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BIANCHI TYPE – III DARK ENERGY COSMOLOGICAL MODEL IN f*(R)* THEORY OF GRAVITATION

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ABSTRACT

In this paper we have used different f(R) action, coupled to two scalar fields in order to obtain a new Bianchi type – III cosmological model in f(R)theory of Gravity. We have derived the standard cosmological quantities and compared them with the respective cosmological quantities in General Relativity.

Keywords: *Equation of State,f(R)-Gravity,Bianchi Type – III Model, Dynamical Parameters*

INTRODUCTION

In modern cosmology the concept of cosmic microwave background (CMB) is most important. Its theoretical aspects play an important role. Standard model of cosmology is based on the inflation theory as well as theoretical aspects of cosmic microwave background. These fundamental concepts are expressed in several recent text books. The standard model of cosmology is mathematically treated by the Bianchi type - III model. This model is consistent with the early and current state universe. It has been observed that the universe is homogeneous and isotropic in the large scale structure [9]. We find that some standard cosmological modelsare based on general relativity, which are unable to explain; like unisotropy or the accelerated expansion of the universe. Therefore, some believe that the standard model cosmology should be replaced by other types, based on alternative theories of gravity [11-25]. *f(R)*theory of gravity [1-6] is one of them. In this theory the commonEinstein-Hilbert action

$$S_{E-H}=\frac{1}{16\pi G}\int d^4x\sqrt{-g}\,(R-2\Lambda)+\int d^4x\sqrt{-g}\,L_m \qquad (1.1)$$

is replaced by

$$S_{f(R)}=\frac{1}{16\pi G}\int d^4x\sqrt{-g}\,\big(f(R)-2\Lambda\big)+\int d^4x\sqrt{-g}\,L_m \qquad (1.2)$$

Where$f$(R) is a function of space-time Ricci scalar curvature R and L_m is the matter Lagrangian.
Now, byvarying the action (1.2) with respect to the space-time metric $g_{\mu\nu}$, we get the corresponding field equations as

$$f'(R)R_{\mu\nu}-\frac{1}{2}f(R)g_{\mu\nu}-\nabla_\mu\nabla_\nu f'(R)+g_{\mu\nu}\,\Box f'(R)+g_{\mu\nu}\Lambda=8\pi G T_{\mu\nu} \qquad (1.3)$$

where $f'(R)=\frac{df(R)}{dR}$, $\Box\equiv\nabla^\mu\nabla_\mu$, ∇_μ is the covariant derivative, $T_{\mu\nu}$ is the standard matter energy-momentum tensor derived from the LagrangianL_m.These are the fourth order partial differential equations in the metric tensor $g_{\mu\nu}$.

BIANCHI TYPE –III COSMOLOGICAL MODEL COUPLED TO SCALAR FIELDS IN STANDARD COSMOLOGY

We introduce the following relation as a substitution for relation (1.2):

$$S=\frac{1}{16\pi G}\int d^4x\sqrt{-g}\,\big[G(\varphi)R+F(\psi)-2\Lambda\big]+\int d^4x\sqrt{-g}\,L_m \qquad (2.1)$$

Here $\varphi\equiv\varphi(R)$ and $\psi\equiv\psi(R)$ the consequent field equations would be [18]

$$\big[G(\varphi)+RG'(\varphi)+F'(\psi)\big]R_{\mu\nu}-\frac{1}{2}g_{\mu\nu}\big[RG(\varphi)+F(\psi)-2\Lambda\big]-\nabla_\mu\nabla_\nu\big[G(\varphi)+RG'(\varphi)+F'(\psi)\big]+g_{\mu\nu}\,\Box\big[G(\varphi)+RG'(\varphi)+F'(\psi)\big]=8\pi G T_{\mu\nu} \qquad (2.2)$$

where the prime stands for differentiation with respect to R.

The dynamics of standard cosmology come from the Bianchi type– III model and its geometric interpretations of space-time, using the line element

$$ds^2=dt^2-A^2dx^2-B^2e^{-2ax}dy^2-C^2dz^2 \qquad (2.3)$$

in which A,B and C are the functions of the cosmic time$t$only and ‘a’ is non-zero constant.
According to this model, we have a homogeneous isotropic distribution of matter/energy, forming the energy-momentum tensor of the perfect fluid.

$$T_{\mu\nu}=(\rho+p)U\otimes U+g_{\mu\nu}p \qquad (2.4)$$

here, ρ is the energy density and p is the pressure of the cosmic fluid. Also U_μ is the 4-velocity vector.

According to the field equations, we can derive

$$8\pi GT_{00}=8\pi G\rho=\left[G(\varphi)+RG(\varphi)F'(\psi)\right]R_{00}-\frac{1}{2}g_{00}\left[RG(\varphi)+F(\psi)-2\Lambda\right]$$
$$-\partial_0\partial_0\left[G(\varphi)+RG'(\varphi)+F'(\psi)\right]$$
$$+g_{00}\left\{g^{00}\partial_0\partial_0\left[G(\varphi)+RG'(\varphi)+F'(\psi)\right]-\left(\Gamma_{11}^0+\Gamma_{22}^0+\Gamma_{33}^0\right)\partial_0\left[RG(\varphi)+F(\psi)-2\Lambda\right]\right\}$$

(2.5a)

and

$$8\pi GT_{11}=8\pi Gp=\left[G(\varphi)+RG(\varphi)+F'(\psi)\right]R_{11}-\frac{1}{2}g_{11}\left[RG(\varphi)+F(\psi)-2\Lambda\right]$$
$$-\Gamma_{11}^0\partial_0\left[G(\varphi)+RG'(\varphi)+F'(\psi)\right]$$
$$+g_{11}\left\{g^{00}\partial_0\partial_0\left[G(\varphi)+RG'(\varphi)+F'(\psi)\right]-\left(\Gamma_{11}^0+\Gamma_{22}^0+\Gamma_{33}^0\right)\partial_0\left[RG(\varphi)+F(\psi)-2\Lambda\right]\right\}$$

(2.5b)

Using equation (2.3) in (2.5), we get

$$8\pi G\rho=\left[G+R\frac{dG}{d\varphi}\frac{d\varphi}{dR}+\frac{dF}{d\psi}\frac{d\psi}{dR}\right]R_{00}-\frac{1}{2}\left[RG+F-2\Lambda\right]$$
$$+\left(\Gamma_{11}^0+\Gamma_{22}^0+\Gamma_{33}^0\right)\left\{2\frac{dG}{d\varphi}\varphi'\dot{R}+R\left[\left(\frac{dG}{d\varphi}\right)^{\cdot}\varphi'+\frac{dG}{d\varphi}\dot{\varphi}'\right]+\left(\frac{dF}{d\psi}\right)^{\cdot}\psi'+\frac{dF}{d\psi}\dot{\psi}'\right\}$$

(2.6a)

$$8\pi Gp=\left[G+R\frac{dG}{d\varphi}\frac{d\varphi}{dR}+\frac{dF}{d\psi}\frac{d\psi}{dR}\right]R_{11}+\frac{1}{2}A^2\left[RG+F-2\Lambda\right]$$
$$+\left(-2A^2\right)\left[\left(\frac{dG}{d\varphi}\right)^{\cdot}\varphi'\dot{R}+\frac{dG}{d\varphi}\dot{\varphi}'\dot{R}+\frac{dG}{d\varphi}\ddot{R}\right]-A^2\left\{\dot{R}\left[\left(\frac{dG}{d\varphi}\right)^{\cdot}\varphi'+\frac{dG}{d\varphi}\dot{\varphi}'\right]+R\left[\left(\frac{dG}{d\varphi}\right)^{\cdot\cdot}\varphi'+2\left(\frac{dG}{d\varphi}\right)^{\cdot}\varphi'+\frac{dG}{d\varphi}\ddot{\varphi}'\right]\right\}$$
$$-A^2\left[\left(\frac{dF}{d\psi}\right)^{\cdot\cdot}+2\left(\frac{dF}{d\psi}\right)^{\cdot}\dot{\psi}'+\frac{dF}{d\psi}\ddot{\psi}'\right]+A^2\left(\Gamma_{11}^0+\Gamma_{22}^0+\Gamma_{33}^0\right)\left[2\frac{dG}{d\varphi}\varphi'\dot{R}+R\left(\left(\frac{dG}{d\varphi}\right)^{\cdot}\varphi'+\frac{dG}{d\varphi}\dot{\varphi}'\right)+\left(\frac{dF}{d\psi}\right)^{\cdot}\psi'+\frac{dF}{d\psi}\dot{\psi}'\right]$$

(2.6b)

The dot stands for differentiation with respect to cosmic time t. These values will be derived explicitly, when we consider

$$R_{00}=\frac{\ddot{A}}{A}+\frac{\ddot{B}}{B}+\frac{\ddot{C}}{C}$$
$$R_{11}=-\left(A\ddot{A}+\frac{A\dot{A}\dot{B}}{B}+\frac{A\dot{A}\dot{C}}{C}\right)+a^2 \qquad (2.7)$$
$$R=2\left(\frac{\ddot{A}}{A}+\frac{\ddot{B}}{B}+\frac{\ddot{C}}{C}+\frac{\dot{A}\dot{B}}{AB}+\frac{\dot{B}\dot{C}}{BC}+\frac{\dot{C}\dot{A}}{CA}-\frac{a^2}{A^2}\right)$$

And

$$\Gamma_{11}^0=A\dot{A}$$
$$\Gamma_{22}^0=B\dot{B}e^{-2ax}$$
$$\Gamma_{33}^0=C\dot{C}$$

DYNAMICAL PROPERTIES FOR DEFINITE SCALAR POTENTIALS IN BIANCHI TYPE-III

Now let us [18]

$$G(\varphi)\equiv G(R)\doteq R$$

$$F(\psi)\equiv F\left(\frac{1}{R}\right)\doteq\frac{1}{R} \qquad (3.1)$$

Using (3.1) in (2.6), while considering the values in (2.7), we obtain

$$8\pi G\rho=\left[4(\alpha)-\frac{1}{4}(\alpha)^{-2}\right]\left(\frac{\ddot{A}}{A}+\frac{\ddot{B}}{B}+\frac{\ddot{C}}{C}\right)-2(\alpha)^2-\frac{1}{4}(\alpha)^{-1}+\Lambda$$
$$-\left(A\dot{A}+B\dot{B}e^{-2ax}+C\dot{C}\right)\left[4(\beta)+\frac{1}{2}(\alpha)^{-3}(\beta)\right]$$

(3.2a)

and

$$8\pi Gp=\left[4(\alpha)-\frac{1}{4}(\alpha)^{-2}\right]\left(-A\ddot{A}-\frac{A\dot{A}\dot{B}}{B}-\frac{A\dot{A}\dot{C}}{C}+a^2\right)+A^2\left[2(\alpha)^2+\frac{1}{4}(\alpha)^{-1}+\Lambda\right]$$
$$+A^2\left\{2(\beta)+\frac{1}{2}(\alpha)^{-3}(\beta)-4(\gamma)+\frac{3}{2}(\alpha)^{-4}(\beta)^2+\frac{1}{2}(\alpha)^{-3}(\gamma)+\left(A\dot{A}+B\dot{B}e^{-2ax}+C\dot{C}\right)\left[4(\beta)+\frac{1}{2}(\alpha)^{-3}(\beta)\right]\right\}$$

(3.2b)

Where,

$$\alpha=\left[\frac{\ddot{A}}{A}+\frac{\ddot{B}}{B}+\frac{\ddot{C}}{C}+\frac{\dot{A}\dot{B}}{AB}+\frac{\dot{B}\dot{C}}{BC}+\frac{\dot{C}\dot{A}}{CA}-\frac{a^2}{A^2}\right] \qquad (3.3)$$

$$\beta=\frac{A^{(3)}}{A}-\frac{\dot{A}\ddot{A}}{A^2}+\frac{B^{(3)}}{B}-\frac{\dot{B}\ddot{B}}{B^2}+\frac{C^{(3)}}{C}-\frac{\dot{C}\ddot{C}}{C^2}+\left(\frac{\dot{A}\ddot{B}}{AB}+\frac{\ddot{A}\dot{B}}{AB}-\frac{\dot{A}\dot{B}^2}{AB^2}-\frac{\dot{A}^2\dot{B}}{A^2B}\right)+\left(\frac{\dot{B}\ddot{C}}{BC}+\frac{\ddot{B}\dot{C}}{BC}-\frac{\dot{B}\dot{C}^2}{BC^2}-\frac{\dot{B}^2\dot{C}}{B^2C}\right)$$
$$+\left(\frac{\dot{C}\ddot{A}}{CA}+\frac{\ddot{C}\dot{A}}{CA}-\frac{\dot{C}\dot{A}^2}{CA^2}-\frac{\dot{C}^2\dot{A}}{C^2A}\right)+2a^2\frac{\dot{A}}{A^3}$$

(3.4)

and

$$\gamma=\frac{A^{(4)}}{A}-2\frac{A^{(3)}\dot{A}}{A^2}-\frac{\ddot{A}^2}{A^2}+2\frac{\dot{A}^2\ddot{A}}{A^3}+\frac{B^{(4)}}{B}-2\frac{B^{(3)}\dot{B}}{B^2}-\frac{\ddot{B}^2}{B^2}+2\frac{\dot{B}^2\ddot{B}}{B^3}+\frac{C^{(4)}}{C}-2\frac{C^{(3)}\dot{C}}{C^2}-\frac{\ddot{C}^2}{C^2}+2\frac{\dot{C}^2\ddot{C}}{C^3}$$
$$+\left(\frac{\dot{A}B^{(3)}}{AB}+\frac{\ddot{A}\ddot{B}}{AB}-\frac{\dot{A}\dot{B}\ddot{B}}{AB^2}-\frac{\dot{A}^2\ddot{B}}{A^2B}\right)+\left(\frac{\ddot{A}\ddot{B}}{AB}+\frac{A^{(3)}\dot{B}}{AB}-\frac{\ddot{A}\dot{B}^2}{AB^2}-\frac{\dot{A}\ddot{A}\dot{B}}{A^2B}\right)-\left(2\frac{\dot{A}\dot{B}\ddot{B}}{AB^2}+\frac{\ddot{A}\dot{B}^2}{AB^2}-2\frac{\dot{A}\dot{B}^3}{AB^3}-\frac{\dot{A}^2\dot{B}^2}{A^2B^2}\right)$$
$$-\left(\frac{\dot{A}^2\ddot{B}}{A^2B}+2\frac{\dot{A}\ddot{A}\dot{B}}{A^2B}-\frac{\dot{A}^2\dot{B}^2}{A^2B^2}-2\frac{\dot{A}^3\dot{B}}{A^3B}\right)+\left(\frac{\dot{B}C^{(3)}}{BC}+\frac{\ddot{B}\ddot{C}}{BC}-\frac{\dot{B}\dot{C}\ddot{C}}{BC^2}-\frac{\dot{B}^2\ddot{C}}{B^2C}\right)+\left(\frac{\ddot{B}\ddot{C}}{BC}+\frac{B^{(3)}\dot{C}}{BC}-\frac{\ddot{B}\dot{C}^2}{BC^2}-\frac{\dot{B}\ddot{B}\dot{C}}{B^2C}\right)$$
$$-\left(2\frac{\dot{B}\dot{C}\ddot{C}}{BC^2}+\frac{\ddot{B}\dot{C}^2}{BC^2}-2\frac{\dot{B}\dot{C}^3}{BC^3}-\frac{\dot{B}^2\dot{C}^2}{B^2C^2}\right)-\left(\frac{\dot{B}^2\ddot{C}}{B^2C}+2\frac{\dot{B}\ddot{B}\dot{C}}{B^2C}-\frac{\dot{B}^2\dot{C}^2}{B^2C^2}-2\frac{\dot{B}^3\dot{C}}{B^3C}\right)$$
$$+\left(\frac{\dot{C}A^{(3)}}{CA}+\frac{\ddot{C}\ddot{A}}{CA}-\frac{\dot{C}\dot{A}\ddot{A}}{CA^2}-\frac{\dot{C}^2\ddot{A}}{C^2A}\right)+\left(\frac{\ddot{C}\ddot{A}}{CA}+\frac{C^{(3)}\dot{A}}{CA}-\frac{\ddot{C}\dot{A}^2}{CA^2}-\frac{\dot{C}\ddot{C}\dot{A}}{C^2A}\right)-\left(2\frac{\dot{C}\dot{A}\ddot{A}}{CA^2}+\frac{\ddot{C}\dot{A}^2}{CA^2}-2\frac{\dot{C}\dot{A}^3}{CA^3}-\frac{\dot{C}^2\dot{A}^2}{C^2A^2}\right)$$
$$-\left(\frac{\dot{C}^2\ddot{A}}{C^2A}+2\frac{\dot{C}\ddot{C}\dot{A}}{C^2A}-\frac{\dot{C}^2\dot{A}^2}{C^2A^2}-2\frac{\dot{C}^3\dot{A}}{C^3A}\right)+2a^2\left(\frac{\ddot{A}}{A^3}-3\frac{\dot{A}^2}{A^4}\right)$$

(3.5)

THE MODEL TO DETERMINE EoS

According to general relativity, the energy deposit of universe could be derived from

$$R_j^i-\frac{1}{2}R\delta_j^i+\Lambda=8\pi GT_j^i \qquad (4.1)$$

For which the Bianchi-III model implies that

$$\frac{\dot{A}\dot{B}}{AB}+\frac{\dot{B}\dot{C}}{BC}+\frac{\dot{C}\dot{A}}{CA}-\frac{a^2}{A^2}=-\rho \qquad (4.2)$$

Also the same procedure for the fluid pressure p, results in

$$\frac{\ddot{B}}{B}+\frac{\ddot{C}}{C}+\frac{\dot{B}\dot{C}}{BC}=p \tag{4.3}$$

$$\frac{\ddot{A}}{A}+\frac{\ddot{C}}{C}+\frac{\dot{A}\dot{C}}{AC}=p \tag{4.4}$$

$$\frac{\ddot{A}}{A}+\frac{\ddot{B}}{B}+\frac{\dot{A}\dot{B}}{AB}-\frac{a^2}{A^2}=p \tag{4.5}$$

And

$$\frac{\dot{A}}{A}-\frac{\dot{B}}{B}=0 \tag{4.6}$$

When $8\pi G=1$ *and* $\Lambda=0$.

Above equation (4.6) implies

$$A=B \tag{4.7}$$

Using above equation the field equations (4.2) to (4.5) implies

$$\frac{\ddot{A}}{A}+\frac{\ddot{C}}{C}+\frac{\dot{A}\dot{C}}{AC}=p \tag{4.8}$$

$$2\frac{\ddot{A}}{A}+\left(\frac{\dot{A}}{A}\right)^2-\frac{a^2}{A^2}=p \tag{4.9}$$

And

$$\left(\frac{\dot{A}}{A}\right)^2+2\frac{\dot{A}\dot{C}}{AC}-\frac{a^2}{A^2}=-\rho \tag{4.10}$$

The field equations (4.8) to (4.10) are a system of three non-linear differential equations with four unknowns A, C, ρ, p.

Hence in order to solve the system completely we assume physical condition that shear scalar σ is proportional to scalar expansion θ, which gives the following relation between metric function as

$$C=A^n \tag{4.11}$$

where $n\neq 1, n.>1$, is an arbitrary constant.

Equating equation (4.8) andequation (4.9), we have

$$\frac{\ddot{A}}{A}-\frac{\ddot{C}}{C}+\left(\frac{\dot{A}}{A}\right)^2-\frac{\dot{A}\dot{C}}{AC}-\frac{a^2}{A^2}=0 \tag{4.12}$$

Usingequation(4.11) inequation(4.12), we get

$$A\ddot{A}+(1+n)\dot{A}^2=\frac{a^2}{(1-n)} \tag{4.13}$$

Let us consider

$\dot{A}=g(A)$,

$$\ddot{A}=gg^* \text{ where } g^*=\frac{dg}{dA} \tag{4.14}$$

With the help of equation (4.14), equation (4.13) reduces to

$$2gg^*+2(n+1)\frac{g^2}{A}=2\frac{a^2}{(1-n)A} \tag{4.15}$$

Solving equation (4.15) and on integration, we get

$$A^{(2n+2)}g^2=2\frac{a^2}{(1-n)}\frac{A^{(2n+2)}}{(2n+2)}+k_1 \tag{4.16}$$

Where k_1 is the constant of integration.

But $g=\dot{A}$ and $g^2=\dot{A}^2$ (4.17)

Using equation (4.17) inequation (4.16), we get

$$\frac{A^{(1+n)}dA}{\sqrt{\frac{a^2}{(1-n^2)}A^{(2n+2)}+k_1}}=dt \tag{4.18}$$

To get determinate solution, we take $k_1=0$

$$\left[\frac{a^2}{(1-n^2)}\right]^{-\frac{1}{2}}dA=dt \tag{4.19}$$

On integration,

$$A=(t+k_2)\left[\frac{a^2}{(1-n^2)}\right]^{\frac{1}{2}} \tag{4.20}$$

Where k_2 is the constant of integration.

Using equation (4.7) and equation (4.11), we obtain the scale factors *A,B and C* as

$$A=k_3(t+k_2) \tag{4.21}$$

$$B=k_3(t+k_2) \tag{4.22}$$

And

$$C=k_4(t+k_2)^n \tag{4.23}$$

Where,

$$k_3=\left[\frac{a^2}{(1-n^2)}\right]^{\frac{1}{2}} \text{ and } k_4=k_3{}^n$$

Using equations (4.21) and (4.23) in equation (4.10), we obtain the energy density (ρ) as

$$\rho=k_5(t+k_2)^{-2} \tag{4.24}$$

Using equations (4.21) and (4.23) in equation (4.9), we obtain the pressure (p) as

$$p=k_6(t+k_2)^{-2} \tag{4.25}$$

From equation (4.24) and equation (4.25), we can write

$$\rho=p \tag{4.26}$$

Also we know that the EoS could be derived from

$$\omega=\frac{p}{\rho} \tag{4.27}$$

Which implies $\omega=$ ***constant*** (4.28)

CALIBRATING THE ENERGY DENSITY AND THE FLUID PRESSURE USINGF(R) EQUATIONS

Using equation (4.7), equation (4.21) and equation (4.23) in equations (3.3), (3.4) and (3.5) we get

$$\alpha = N_1 (t + k_2)^{-2} \tag{5.1}$$

$$\beta = N_2 (t + k_2)^{-3} \tag{5.2}$$

$$\gamma = N_3 (t + k_2)^{-4} \tag{5.3}$$

Where $N_{1,} N_2 and N_3$ are constant terms.

Using equations (5.1), (5.2) and (5.3) in equations (3.2a),(3.2b) while considering $8\pi G = 1$ and $\Lambda = 0$, we obtain energy density and fluid pressure in terms of *f(R)* gravity

$$\rho = \frac{4n(n-1)N_1}{(t+k_2)^4} - \frac{n(n-1)}{4N_1^2(t+k_2)^2} - \frac{2N_1^2}{(t+k_2)^4} - \frac{1}{4N_1(t+k_2)} - \left[k_3^2(t+k_2)\left(1+e^{-2ax}\right)+k_4^2 n(t+k_2)^{2n-1}\right]\left[\frac{4N_2}{(t+k_2)^3}+\frac{N_2}{2N_1^3(t+k_2)^2}\right]$$

(5.4)

$$p = \frac{-4k_3^2(n+1)}{(t+k_2)^2} + \frac{4a^2N_1}{(t+k_2)^2} + \frac{k_3^2(n+1)}{4N_1^2} - \frac{a^2}{4N_1^2} + \frac{2k_3^2N_1^2}{(t+k_2)^2} + \frac{k_3^2(t+k_2)}{4N_1} + \frac{2k_3^2N_2}{(t+k_2)} + \frac{k_3^2N_2}{2N_1^3} - \frac{4k_3^2N_3}{(t+k_2)^2} + \frac{3k_3^2N_2^2}{2N_1^4(t+k_2)^2} - \frac{k_3^2N_3}{2N_1^3(t+k_2)} + \left[k_3^2(t+k_2)\left(1+e^{-2ax}\right)+k_4^2 n(t+k_2)^{2n-1}\right]\left[\frac{4k_3^2N_2}{(t+k_2)}+\frac{k_3^2N_2}{2N_1^3}\right]$$

(5.5)

Using equations (5.4) and (5.5), the EoS $\left(\omega = \frac{p}{\rho}\right)$ could be derived in *f*(R) Gravity

It's like

$$\omega = \frac{p}{\rho} = \frac{1}{t^2}\frac{t^4}{1} = t^2 \tag{5.6}$$

PHYSICAL BEHAVIOR OF THE MODEL

The Hubble parameter H is defined by

$$H = \frac{\dot{V}}{V} \tag{6.1}$$

Where $V^3 = ABCe^{ax}$ and

$$V = K_7 e^{\frac{ax}{3}} (t + k_2)^{\frac{(2+n)}{3}} \tag{6.2}$$

The deceleration parameter q is

$$q = -\frac{V\ddot{V}}{\dot{V}^2} \tag{6.3}$$

The scalar of expansion

$$\theta = 3\frac{\dot{V}}{V} \tag{6.4}$$

And the dynamical parameters are the shear σ defined by

$$\sigma^2 = \frac{1}{12}\left\{\left[\frac{g_{11,0}}{g_{11}} - \frac{g_{22,0}}{g_{22}}\right]^2 + \left[\frac{g_{22,0}}{g_{22}} - \frac{g_{33,0}}{g_{33}}\right]^2 + \left[\frac{g_{33,0}}{g_{33}} - \frac{g_{11,0}}{g_{11}}\right]^2\right\} \tag{6.5}$$

For our model, these parameters are

$$H = \frac{(2+n)}{3(t+k_2)}, \qquad q = \frac{(1-n)}{(2+n)} \tag{6.6}$$

$$\theta = \frac{(2+n)}{(t+k_2)} \text{ and } \sigma^2 = \frac{2(n^2-2n+1)}{3(t+k_2)^2}$$

CONCLUSION

We consideredBianchi type –III cosmological modelin *f*(R) theory, determined field equations and some physical properties had been studied. Then we derived the EoS and we observed that it remain constant. Having the resultant field equations in the standard cosmological model, we derived the energy density and the fluid pressure in our model, which were specified for definite interpretations of the scalar fields. Here we must declare that, if cosmic time t goes on increasing continuously and after a very long time, energy density ρ and fluid pressure p will vanished.

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FUZZY UNBALANCED TRANSPORTATION PROBLEM BY USING MONTE CARLO METHOD

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ABSTRACT

In this article we consider fuzzy unbalanced transportation problem by using triangular fuzzy number. We find the initial solution by using fuzzy matrix minima method. The main objective of this paper is to find optimal solution to given unbalanced transportation problem using Monte Carlo Method i.e. by using triangular fuzzy random number. In general, transportation problems are solved with the assumptions that unit cost of transportation from each source to each destination, supply of the product at each source and demand at each destination are specified in a exact way i.e., in crisp environment. But in practice, many times we face the problem of incompleteness uncertain data, this is due to lack of knowledge about the considered system or changing nature of the world, the parameters of the transportation problem are not always exactly known and stable. Therefore we used the fuzzy logic to solve transportation problem. Fuzzy logic & techniques has been widely used in many areas such as engineering, business, mathematics, psychology, management, medicine and image processing and pattern recognition.

Keyword:*Unbalance, Random Number, Monte Carlo Method.*

INTRODUCTION

Transportation problem which has been used to solve different type of real life problems and generally studied in operation research field. Fuzzy logic deals with degrees of truth rather than the usual true or false (1 or 0) on which the modern computer technology is based. Fuzzy Set Theory gives the formalization of approximate reasoning, and preserves the original information contents of imprecision. Hitchcock (L 1941) first time developed the basic transportation problem. Appa(M 1973) discussed different method of the transportation problem. Prof.Zadeh (Z. L. A 1965)father of fuzzy mathematics introduced the concept of fuzzy numbers.Saad& Abbas (S. O. A 2003)discussed an algorithm for solving the transportation problems in fuzzyenvironment. Das &Baruah(K 2007) proposed Vogel's approximation method to find the fuzzyinitial basic feasible solution of fuzzy transportation problems in which all the parameters arerepresented by triangular fuzzy numbers. Basirzadeh (H 2011) used the classical algorithms tofind the fuzzy optimal solution of fully fuzzy transportation problems by transforming the fuzzyparameters into crisp parameters. Kaur& Kumar (K. A. A 2011)proposeda new method for the fuzzy transportation problems using ranking function.Deepika Rani, T R Gulati&Amit Kumar (Deepika Rani 2014) developed method for unbalanced transportation problems in fuzzy environment. Ali Ebrahimnejad (Ebrahimnejad 2014)used the values of transportation costs are represented by generalized trapezoidal fuzzy numbers and the values of supply and demand of products are represented by real numbers. Here we concluded that once the ranking function is chosen, the FTPis converted into crisp one, which is easily solved by the standardtransportation algorithms.

This paper is organized as follows. In section 2, the triangular membership function isdefined. In the next section, the general transportation problem with fuzzy triangularnumbers is discussed. This is followed by the solution of transportation problem using fuzzy triangular numbers in section 4. Section 5 illustrates the solution of transportation problem through a numerical example and Matlabprogramme is given. Finally, in section 7 conclusions are given.

Preliminaries:

Fuzzy set: A fuzzy set is defined by $\{(x, \mu_A(x)): x \in A, \mu_A(x) \in [0,1]\}$. In the pair $(x, \mu_A(x))$,the first element x belong to the classical set A, the second element $\mu_A(x)$, belong to the interval[0, 1], called Membership function.

Normality:A fuzzy set is called **normal** if its core is nonempty. In other words, there is at least one point $x \in X$with $\mu_A(x) = 1$.

Fuzzy Number: A fuzzy set on R must possess at least the following three properties to qualifyas a fuzzy number,

(i) A must be a normal fuzzy set;

(ii) α must be closed interval for every α∈ [0, 1]

(iii) The support of α, must be bounded

Triangular Fuzzy Number:A triangular fuzzy number A or simply triangular number represented with three points as follows(a1, aM, a2) holds the following conditions

$(i)\ a1\ to\ aM\ is\ increasing\ function$

$(ii)\ \ aM\ to\ a2\ is\ decreasing\ function$

$(iii)\ a1\ \le aM \le a2$.

This representation is interpreted as membership functions

$$\mu_A(x) = \begin{cases} \frac{x-a1}{aM-a1} & a1 \le x \le aM \\ \frac{x-a2}{aM-a2} & aM \le x \le a2 \\ 0 & otherwise \end{cases}$$

where [a1; a2] is the supporting interval and the point (aM; 1) is the peak.

Tabular Representation: Suppose there are *m* factories and *n* warehouses then transportation problem is usually represented in tabular form

Table 1 Tabular Representation of Crisp Transportation Problem

Destina-tion Origin	D1	D2	D3		Dn	Supply
O1	C_{11}	C_{12}	C_{13}	------	C_{1n}	A1
O2	C_{21}	C_{22}	C_{23}	------	C_{2n}	A2
O3	C_{31}	C_{32}	C_{33}	------	C_{3n}	A3
.	⋮					⋮
Om	C_{m1}	C_{m2}	C_{m3}	------	C_{mn}	Am
Demand	B1	B2	B3	------	Bn	$\sum_{i=1}^{n} Bi = \sum_{j=1}^{m} Aj$

Basic feasible solution: A feasible solution to a*m*-origin and *n*- destination problem is said to be basic if the number of positive allocation are *m* + *n* -1.

Theorem: There always exists an optimal solution to a balanced transportation problem.

MATRIX MINIMA METHOD

The initial basic feasible solution obtained by this method usually gives a lower beginning cost.

Step 1: Start with the lowest cost entry in the cell and allocate as much as possible.

Step 2: Move to the next lowest cost cell and make an allocation in the view of the remaining capacity and requirement of its row and column. In case there is tie for lowest cost cell during any allocation we can exercise our judgment and we arbitrarily choose cell for allocation.

Step 3: Above procedure repeated till all row and column requirements are satisfied.

UNBALANCED TRANSPORTATION PROBLEM

A transportation problem is said to unbalanced if total supply at sources is not equal to the total demand of the destinations.

There are two cases in unbalanced T.P.

Case (1): Supply exceeds demand:

In this case the total capacity of sources is greater than the total requirement of the destination i.e. in this case $\sum_{i=1}^{m} a_i > \sum_{j=1}^{n} b_j$

To make such problems balanced we add dummy row or dummy source in transportation table with zero transportation cost.

Case (2):Demand exceeds supply:

In this case the total demand of destination is greater than the total capacity of the destination i.e. in this case $\sum_{i=1}^{m} a_i < \sum_{j=1}^{n} b_j$

To make such problems balanced we add dummy column in transportation table with zero transportation cost.

TRANSPORTATION PROBLEM INTO CRISP LINEAR PROGRAMMING PROBLEM

Let there be *m* origins, i^{th} origin possessing A_i units (see table 1) of a certain product, whereas there are *n* destinations with destination on *j* requiring B_j units. Let C_{ij} be the cost of shipping one unit product from i^{th} origin to j^{th} destination and 'X_{ij}' be the amount to be shipped from i^{th} origin to j^{th} destination. Here we assume that $\sum A_i \ge \sum B_j$ *i= 1,2,..,m* and *j*= 1,2,...,*n*.

LPP formulation of above transportation problem is given below

$Min\ Z = \sum_{i=1}^{m} \sum_{j=1}^{n} X_{ij} C_{ij}$ (Objective function)

Subject to

$\sum_{j=1}^{n} x_{ij} \leq A_i$ for $i = 1,2,\ldots,m$

$\sum_{i=1}^{m} x_{ij} \geq B_j$ for $j = 1,2,\ldots,n$

The problem is to determine non negative values of X_{ij} satisfying both availability constraints.

TRANSPORTATION PROBLEM INTO FUZZY LINEAR PROGRAMMING PROBLEM

Let there be m origins, i^{th} origin possessing $\overline{A_i}$ units (see table 2) of a certain product, whereas there are n destinations with destination on j requiring $\overline{B_j}$ (see table 2) units. Let $\overline{C_{ij}}$ be the cost of shipping one unit product from ith origin to j^{th} destination and '$\overline{X_{ij}}$' be the amount to be shipped from i^{th} origin to j^{th} destination. Here we assume that $\sum \overline{A_i} \geq \sum \overline{B_j}$ $i= 1,2,..,m$ and $j= 1,2,...,n$. (see table 2)

LPP formulation of above transportation problem is given below

Min $z = \sum_{i=1}^{m} \sum_{j=1}^{n} \overline{X_{ij} C_{ij}}$ (objective function)

Subject to

$\sum_{j=1}^{n} \overline{X_{ij}} \leq \overline{A_i}$ for $i= 1, 2,\ldots, m$

$\sum_{i=1}^{m} \overline{X_{ij}} \geq \overline{B_j}$ for $j = 1, 2,\ldots, n$

where $\overline{A_i}$, $\overline{B_j}$, $\overline{C_{ij}}$, $\overline{X_{ij}}$ are all fuzzy triangular number.

Table 2 Tabular Representation of fuzzy Transportation Problem By Using triangular Fuzzy number

Destination / Origin	D1	D2	D3	-------	Dn	Supply
O1	$[C_{11}-d, C_{11}, C_{11}+d]$	$[C_{12}-d, C_{12}, C_{12}+d]$	$[C_{13}-d, C_{13}, C_{13}+d]$	-------	$[C_{1n}-d, C_{1n}, C_{1n}+d]$	$[a_1-d, a_1, a_1+d]$
O2	$[C_{21}-d, C_{21}, C_{21}+d]$	$[C_{22}-d, C_{22}, C_{22}+d]$	$[C_{23}-d, C_{23}, C_{123}+d]$	-------	$[C_{2n}-d, C_{2n}, C_{2n}+d]$	$[a_2-d, a_2, a_2+d]$
O3	$[C_{31}-d, C_{31}, C_{31}+d]$	$[C_{32}-d, C_{32}, C_{32}+d]$	$[C_{33}-d, C_{33}, C_{33}+d]$	-------	$[C_{3n}-d, C_{3n}, C_{3n}+d]$	$[a_3-d, a_3, a_3+d]$
⋮	⋮	⋮	⋮	⋮	⋮	⋮
Om	$[C_{m1}-d, C_{m1}, C_{m1}+d]$	$[C_{m2}-d, C_{m2}, C_{m2}+d]$	$[C_{m3}-d, C_{m3}, C_{m3}+d]$	-------	$[C_{mn}-d, C_{mn}, C_{mn}+d]$	$[a_m-d, a_m, a_m+d]$
Demand	$[b_1-d, b_1, b_1+d]$	$[b_2-d, b_2, b_2+d]$	$[b_3-d, b_3, b_3+d]$	-------	[bn-d,bn,bn+d]	$\sum_{i=1}^{n}[bi-d, bi, bi+d] - \sum_{j=1}^{m}[ai-d, ai, ai-d] = [-k, 0, k]$

MONTE CARLO METHOD

Monte Carlo Method gives approximate solution to fuzzy optimization problem. It is a numerical method that makes use of random number to solve mathematical problem for which an analytical solution is not known; that is trough random number experiment on computer. To compare two random triangular fuzzy number say $\bar{X} = (x_1/x_2/x_3)$ and $\bar{Y} = (y_1/y_2/y_3)$ we find here α cut say Xα and Yα. If each α cut Xα is less than or equal to each α-cut of Yα (α>0.5) then we can say that fuzzy number $\bar{X} \leq \bar{Y}$.

RANDOM NUMBER

Monte Carlo Method is deals with use of random number. We use Matlab function r = rand() to generate random number in the interval [0,1], then by using function (b-a)*r + a we can generate random number in any interval [a,b]. By using sort and reshape function of Matlab we can convert these random numbers into fuzzy triangular numbers.

INTERVAL CONTAINING SOLUTION

Range of interval is very important because exact selection of this interval will make Monte Carlo Method more efficient. If interval is too large then too many of random number rejected and if it is very small then we can miss optimum solution. Suppose there are m equation in $n(x_1,x_2,\ldots x_n)$ variable then put n-1 variable equal to zero find value of x_1 similarly find the values of $x_2,x_3,\ldots,x_n$ by equating ni1 variable equal to zero. Finally to obtain upper bound take maximum of x_1, x_2 ...x_n.

Numerical Example:

Consider the following unbalanced transportation problem having four destinations and three origins.

Table 3 Crisp Unbalance Transportation Problem

Destination / Origin	D1	D2	Supply
O1	40 (2)	70	2
O2	60 **(1)**	30 (1)	3
Demand	3	1	4 / 5

We convert the above unbalance transportation problem into balance by adding one column

Destination / Origin	D1	D2	D3	Supply
O1	40 (2)	70	0	2
O2	60 **(1)**	30 **(1)**	0 **(1)**	3
Demand	3	1	1	5

Minimum Transportation cost is 170

Destination / Origin	D1	D2	D3	Supply
O1	[39,40,41] **(1,2,3)**	[69,70,71]	[-1,0,1]	[1,2,3]
O2	[59,60,61] **(0.5,1,1.5)**	[29,30,31] **(0.5,1,1.5)**	[-1,0,1] **(0.5,1,1.5)**	[2,3,4]
Demand	[2,3,1]	[0.5,1,1.5]	[0.5,1,1.5]	

Table 5 Fuzzy Transportation Problem

[39,80,123]+[29,60,91.5]+[14,30,46]+[-1.5,0,1.5]=[80.5,170,262]
Minimum Transportation Costis ***170.83*** *approximately.*

FUZZY MONTE CARLO METHOD

Step I - Fuzzy Linear Programming Problem:

Min $z = (39/40/41)\overline{x1} + (69/70/71)\overline{x2} + (59/60/61)\overline{x4} + (29/30/31)\overline{x5}$

Subject to

$\overline{x1} + \overline{x2} \leq (1/2/3)$

$\overline{x3} + \overline{x4} \leq (2/3/4)$

$\overline{x1} + \overline{x3} \geq (2/3/4)$

$\overline{x2} + \overline{x4} \geq (0.5/1/1.5)$

Where $\overline{x1}, \overline{x2}, \overline{x3}, \overline{x4} \geq 0$

MatlabProgramme:

```
clc
r1=rand(9999,1);
'Enter interval a & b'
a=input('');
b=input('');
x=(b-a)*r3+a;
for i= 1:3333
for j= 1:3333
for p= 1:3333
for q= 1:3333
X1=[x(i,1) x(i,2) x(i,3)]+[x(j,1) x(j,2) x(j,3)];
X2=[x(i,1) x(i,2) x(i,3)]+[x(p,1) x(p,2) x(p,3)];
X3=[x(p,1) x(p,2) x(p,3)]+[x(q,1) x(q,2) x(q,3)];
X4=[x(q,1) x(q,2) x(q,3)]+[x(j,1) x(j,2) x(j,3)];
a3=min([a1*x(i,1),a1*x(i,2),a1*b1*x(i,1),b1*x(i,2),b1*x(i,3),c1*x(i,1),c1*x(i,2),c1*x(i,3)]);
b3=b1*x(i,2);
c3=max([a1*x(i,1),a1*x(i,2),a1*x(i,3),b1*x(i,1),b1*b1*x(i,3),c1*x(i,1),c1*x(i,2),c1*x(i,3)]);
s1=[a3  b3  c3];
   a1=69;
   b1=70;
   c1=71;
a5=min([a1*x(p,1),a1*x(p,2),a1*x(p,3),b1*b1*x(p,3),c1*x(p,1),c1*x(p,2),c1*x(p,3)]);
b5=b1*x(p,2);
c5=max([a1*x(p,1),a1*x(p,2),a1*x(p,3),b1*x(p,1),b1*x(p,2),b1*x(p,3),c1*x(p,1),c1*x(p,2),c1*x(p,3)]);
s3=[a5  b5  c5];
   a1=29;
   b1=30;
   c1=31;
a6=min([a1*x(q,1),a1*x(q,2),a1*x(q,3),b1*x(q,1),b1*x(q,2),b1*x(q,3),c1*x(q,1),c1*x(q,2),c1*x(q,3)]);
b6=b1*x(q,2);
s4=[a6  b6  c6];
s=s1+s2+s3+s4
X11=[x(i,1) x(i,2) x(i,3)]
X12=[x(j,1) x(j,2) x(j,3)]
X13=[x(p,1) x(p,2) x(p,3)]
X14=[x(q,1) x(q,2) x(q,3)]
end
```

Solution:

Minimum Transportation Cost :(**41.9392 170.9264 290.6067)**

X11 =(0.2589 0.9843 1.4900)
X12 =(0.2436 0.8853 1.4612)
X13 =(0.1275 0.6675 1.3045)
X14 =(0.2589 0.9843 1.4900)

CONCLUSION AND FUTURE WORK

In this articlewe discussed a method of fuzzy unbalancedtransportation problem by using Monte Carlo Method i.e by takingrandom triangular fuzzy number. In this method, through a numerical example we can conclude that Monte Carlo method gives best approximate solution to given fuzzy transportation problem. In future; we want to extend our work doing more research by using trapezoidal fuzzy number.

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HUMAN COMPUTER SHAKUNTALA DEVI AND HER CONTRIBUTION IN MATHEMATICS

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ABSTRACT

The aim of this article is to exhibit the talents of an extra-ordinary Indian mathematician Shakuntala Devi and her contribution in mathematics. The mathematician Shakuntala Devi is well known for her quickest and fastest calculations and hence confers upon the name 'Human Computer'. Many countries have invited Shakuntala Devi to demonstrate her extaordinary talent. She won many awards in her seventy-fouryears lifespan
Today she is acclaimed as an accomplished mathematician.

INTRODUCTION

Shakuntala Devi was born on 4th November 1939 in Bangalore. She was an extraordinary Indian mathematician and calculating prodigy. By age six to eight she demonstrated her calculation and memorization abilities in various states. Shakuntala Devi was not only a mathematician but also she was a number juggler. She is well known for her quickest and fastest calculations and hence confers upon the name human computer. She had amazing computing capabilities and had beaten pre modern computers in number games. Shakuntala Devi has got fame when big IT companies like Infosys started including her mathematical problemsin their interviewing steps.

PERFORMANCE

Shakuntala Devi travelled the world demonstrating her arithmetic talents. Shakuntala Devi gave her performances in England, Hong-Kong, Japan, ShriLanka, Italy, Canada, Russia, France, Spain, Indonesia, Malaysia etc

Shakuntala Devi performed her first major show at Mysore University. She displayed her mathematical prowess by solving Arithmetical problems, mental maths questions.

Shakuntala Devi asked for date and birth year of members of audience and within one or two seconds she pinpointed the day of the week on which they were born.

In one of her performances Devi astounded. Famous magician Ricky-Jay by easily extracting roots of nine and ten digit numbers.

She would look at the number on a blackboard preferred as 900342865. Then finding the brokenness of 900,342,865 and rattle of the exact answer. In her demonstration Devi calculated the cube root of 616298775and seventh root of 170859375 within few seconds.

In 1977 at southern Methodist university in Dallas Devi calculated the 23rd root of 201-digit number in 50 seconds where the most powerful

Computer at that time took exactly 62 seconds and received a standing ovation from an audience of erudite mathematicians.

On June 18, 1980 at Imperial college London. She demonstrated the multiplicationof two13 digit numbers.

76863369, 774870*2,465, 099,745,779 and correctly answered as 18947, 668, 177.995.426, 462,773,730 in 20 seconds. This event was recorded in the 1982 Guinness book of records.

Once she was on Europe tour during an interview on BBC,she was given a complicated mathematical calculation which she solved within seconds but her answer was right, the interviewer and his team of mathematics experts re-examined their calculations for several minutes and finally they were wrong and Devi was correct. This incident spread like wild fire, across the world and Devi got the name 'Human Computer'.

BEST WORK

Someof best known of Shakuntala Devi are there which are very useful to all mathematical lovers.

1) Figuring: The Joy of Numbers
2) Puzzles to Puzzle you- This is a book as one of the best reads for people who want to excel in the field of mathematics and master the secrets of the subject.
3) Book of Numbers

4) In the wonderland of Numbers
5) Mathability: Awaken the math Genius in your child.
6) Super Memory: It can be yours
7) Astrology for you.
8) Perfect Murder.

AWARDS

Afew privileged awards which Devi received are

- Distinguished woman of the year in 1969
- Ramanujan mathematical genius award in 1988.
- Lifetime Achievement award for all her mathematical skills ,Mumbai in 2013

TRIVIA

- This famous Indian mathematician never attended school in her younger days but grew up to become one of the greatest mathematician and authored a number of bookson mathematics.
- In Rome a calculating machine found one of her answers to be wrong but after rechecking the answer, the solution given by computer was proven wrong and hers was established as right.
- Because of her fast, practical and efficient approach towards solving a problem Devi became a mathematics magician and a genius. She stood as a role model and made mathematics an interesting subject for many students.
- Lastly she was suffering from respiratory, heart and kidney problems and admitted to hospital, Bengaluru in April 2013. She took her last breath on 21 April 2013.

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STRANGE QUARK MATTER ATTACHED TO COSMIC STRING IN $f(R,T)$ GRAVITY

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ABSTRACT

In this paper we investigate some features of homogeneous Bianchi type VI_0cosmological model with strange quark matter attached to cosmic string in $f(R,T)$ theory of gravity. Using exact solution of the field equation (Considering the adhocrelation between metric potential $A=\frac{B}{C}$), it is found that energy density of the model approaches to bag constant in positive way at $t\to\infty$ i.e. $\rho\to B_c$. Also some physical and kinematical parameters are discussed in detail.

Keywords:Bianchi type VI_0 model, strange quark matter, cosmic string, $f(R,T)$ gravity.

INTRODUCTION

Modified theories of gravity endow with an alternative approach to studying an accelerated expansion of the universe. Various modified gravity theories have been proposed which provides a successful gravitational alternatives these include $f(R)$ [1,2], $f(T)$ [3,8], $f(R,T)$ [9,14]. Among the various modifications of Einstein's theory, $f(R,T)$ theory of gravity is attracting more and more attention in last decades, in this theory the Gravitational Lagrangian is given by an arbitrary function of the Ricci scalar (R) and trace of the stress energy tensor (T).Recently, Rao and Neelima [15] have obtained Bianchi type-VI_0 perfect fluid model in this theory. Chandel and Ram [16] generated new classes of solutions of field equations starting from known solutions for an anisotropic Bianchi type-*III* cosmological model with perfect fluid in the same theory of gravity. Chaubey et al. [17] has obtained a new class of Bianchi type cosmological models in $f(R,T)$ gravity. Sahoo et al. [18] investigated an axially symmetric space-time in the presence of a perfect fluid source in $f(R,T)$ gravity. While, Sharif and Zubair [19] found that the picture of thermodynamicalequilibrium is not feasible in $f(R,T)$ gravity even if we specify the energy density and pressure of dark components thus the non-equilibrium treatment is used to study the laws of thermodynamics. Katore et al. [20] investigated some cosmological model with dark energy source in $f(R,T)$ gravity. Recently, Chirde and Shekh [21] investigate non-static planesymmetric space-time filled with dark energy within the frame work of same modified gravity. UsingHybrid Expansion Law Bhoyar et al. [22] discussed non-static plane symmetric cosmologicalmodel with magnetized anisotropic dark energy in $f(R,T)$ gravity.Very recently,Chirde and Shekh [14] look into plane symmetric dark energy cosmological models in the form of wet dark fluid along with well-knownastrophysical phenomena, namely the look-back time, proper distance,the luminosity distance and angular diameter distance in the midst of red-shiftin the same gravity using power-law and exponentialvolumetric expansion.

The symmetry of the universe is broken spontaneously during the phase transitions, leading to the formation of topologically stable defects i.e. cosmic strings, domain walls, monopoles and textures.Among all these, string theory is a powerful implement to depict the early phase of universe. The presence of cosmic strings result into anisotropy in the space-time. The existence of strings in the early universe gives rise to the density fluctuations which lead to the formation of galaxies. In this model, quarks are taken as degenerate Fermi gas, which exists only in a region space endowed with a vacuum energy density B_c (called as the bag constant). Assuming quarks are non-reacting, we have quark pressure

$$p_q=\frac{1}{3}\rho_q, \tag{1.1}$$

where ρ_q is the quark energy density.

The total energy density is

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$$\rho = \rho_q + B_c \tag{1.2}$$

and the total pressure is

$$p = p_q - B_c \, . \tag{1.3}$$

According to Alcock*et al.*[24] and Haensel*et al.*[25], some neutron stars could actually be strange stars, built of strange matter. The study of charged strange quark matter in the spherically symmetric space-time admitting conformal motion has been done by Mak and Harko[26]. Yilmaz [27] has studied 5-D Kaluza-Klein cosmological models with quark matter attached to the strings and domain walls. Katore[28] obtained FRW cosmological model with strange quark matter attached to cosmic string. Chirde&Rahate[29] have obtained Bianchi type-V isotropic cosmological model attached to cosmic strings with strange quark matter.

With these motivations, in this paper, we have obtained Bianchi type-VI$_0$ model with strange quark matter attached to cosmic strings. This paper is organized as section [2] deals with the field equations of $f(R,T)$ gravity.Section [3] contains Metric, field equations and Kinematical parameters. In section 4, we find the solution of field equations, and the last section [5] is devoted to concluding remark.

FIELD EQUATIONS IN $f(R,T)$ GRAVITY

$f(R,T)$ gravity is the generalization of General Relativity (GR). In this theory, the field equations are derived from a variation, Hilbert-Einstein type principle which is given as

$$S=\frac{1}{16\pi}\int\sqrt{-g}\, f(R,T)\, d^4x+\int\sqrt{-g}\, L_m d^4x \, , \tag{2.1}$$

where $f(R,T)$ is an arbitrary function of the Ricci scalar (R) and traceof the stress energy tensor (T) of the matter T_{ij} ($T = g^{ij}T_{ij}$). L_m is the matter Lagrangian density.

The stress energy tensor of matter is defined as

$$T_{ij} = \frac{2}{\sqrt{-g}} \frac{\delta(\sqrt{-g}L_m)}{\delta g^{ij}} \, . \tag{2.2}$$

Assuming that the Lagrangian density L_m of matter depends only on the metric tensor components g_{ij} and not on its derivatives, equation (2.2) leads to

$$T_{ij} = g_{ij}L_m - \frac{\delta(L_m)}{\delta g^{ij}} \, . \tag{2.3}$$

Varying the action S with respect to the metric tensor components g_{ij}, the gravitational field equations of $f(R,T)$ gravity are obtained as

$$f_R(R,T)R_{ij}-\frac{1}{2}f(R,T)\, g_{ij}+f_R(R,T)\left(g_{ij}\nabla^i\nabla_i-\nabla_i\nabla_j\right)=8\pi T_{ij}-f_T(R,T)\, T_{ij}-f_T(R,T)\, \Theta_{ij} \, , \tag{2.4}$$

with $f_R = \dfrac{\delta f(R,T)}{\delta R}, f_T = \dfrac{\delta f(R,T)}{\delta T}$

$\Theta_{ij} = g^{\alpha\beta}\dfrac{\delta T_{\alpha\beta}}{\delta g^{ij}}$ and ∇_i is the covariant derivative.

The contraction of equation (2.4) yields

$$f_R(R,T)R+3\Pi f_R(R,T)-2f(R,T)=\left(8\pi-f_T(R,T)\right)T-f_T(R,T)\Theta$$

with $\Theta = g^{ij}\Theta_{ij}$. (2.5)

Equation (2.5) gives a relation between Ricci scalar and the trace of energy momentum tensor.

Using matter Lagrangian L_m the stress energy tensor of the matter is given by

$$T_{ij} = (p+\rho)u_i u_j - p g_{ij} \, , \tag{2.6}$$

where $u^i = (0,0,0,1)$ denotes the four velocity vector in co-moving coordinates which satisfies the condition $u^i u_i = 1$. ρ and p is energy density and pressure of the fluid respectively.

The variation of stress energy of perfect fluid has the following expression

$$\Theta_{ij} = -2T_{ij} - p g_{ij} \, . \tag{2.7}$$

On the physical nature of the matter field, the field equations also depend through the tensor Θ_{ij}.

Several theoretical models corresponding to different matter contributions for $f(R,T)$ gravity are possible. However, Harko et al. [9] gave three classes of these models

$$f(R,T) = \begin{cases} R + 2f(T) \\ f_1(R) + f_2(T) \\ f_1(R) + f_2(R) f_3(T) \end{cases} . \tag{2.8}$$

In this paper, we have focused to the first class $f(R,T) = R + 2f(T)$, where $f(T)$ is an arbitrary function of tress energy tensor of the form $f(T) = \mu T$ where μ is constant. For this choice the gravitational field equations of $f(R,T)$ gravity becomes

$$R_{ij}-\frac{1}{2}Rg_{ij}=8\pi T_{ij}-2f'(T)\, T_{ij}-2f'(T)\, \Theta_{ij}+f(T)\, g_{ij} \, , \tag{2.9}$$

where the prime denotes differentiation with respect to the argument. If the matter source is a perfect fluid then the field equations (in view of Eq. (2.7)) becomes

$$R_{ij}-\frac{1}{2}Rg_{ij}=8\pi T_{ij}+2f'(T)T_{ij}+[2pf'(T)+f(T)]g_{ij}\,. \qquad (2.10)$$

METRIC, FIELD EQUATIONS AND KINEMATICAL PARAMETERS

We consider a homogeneous Bianchi type-VI_0 space-time in the form

$$ds^2 = dt^2 - A^2dx^2 - B^2 e^{-2mx} dy^2 - C^2 e^{2mx} dz^2 \,, \qquad (3.1)$$

where the metric functions A, B and C are functions of cosmic time 't' only and m is a constant.

The energy momentum tensor for string cloud (Letelier 1983) is given by

$$T_{ij} = \rho u_i u_j - \rho_s x_i x_j \,. \qquad (3.2)$$

Here ρ is the rest energy density for the cloud of strings with particles attached to them and ρ_s is the string tension density. They are related by

$$\rho = \rho_p + \rho_s \,, \qquad (3.3)$$

where ρ_p is the particle energy density. The different vibrational modes of the string represent the different types of particles, because these different modes are seen as different masses or spins. Therefore, here we will take quarks instead of particles in the string cloud. Hence we consider strange quark matter energy density instead of particle energy density in the string cloud. In this case from equation (3.3), we get

$$\rho = \rho_q + \rho_s + B_c \,. \qquad (3.4)$$

From equations (3.2) and (3.4), we have energy momentum tensor for strange quark matter attached to the string cloud [27] as

$$T_{ij} = (\rho_q + \rho_s + B_c)u_i u_j - \rho_s x_i x_j \,, \qquad (3.5)$$

where u_i is the four velocity of the particles and x_i is the unit space like vector representing the direction of the string.

We have u_i and x_i satisfying conditions

$$u_i u^i = -x_i x^i = 1 \text{ and } u^i x_i = 0 \,. \qquad (3.6)$$

We have taken the direction of string along x-axis. The components of energy momentum tensor are

$$T_1^1 = T_2^2 = 0, T_3^3 = \rho_s, T_4^4 = \rho, T_1^4 = 0. \qquad (3.7)$$

In co-moving coordinate system, the Einstein's field equations (2.10) for the metric (3.1) with the help of (3.7), take the form

$$\frac{\ddot{B}}{B}+\frac{\ddot{C}}{C}+\frac{\dot{B}\dot{C}}{BC}+\frac{m^2}{A^2} = -2\mu p-(\rho+\rho_s)\,, \qquad (3.8)$$

$$\frac{\ddot{A}}{A}+\frac{\ddot{C}}{C}+\frac{\dot{A}\dot{C}}{AC}-\frac{m^2}{A^2} = -2\mu p-(\rho+\rho_s)\,, \qquad (3.9)$$

$$\frac{\ddot{B}}{B}+\frac{\ddot{A}}{A}+\frac{\dot{A}\dot{B}}{AB}-\frac{m^2}{A^2} = -2\mu p-(\rho+\rho_s)\,, \qquad (3.10)$$

$$\frac{\dot{A}\dot{B}}{AB}+\frac{\dot{A}\dot{C}}{AC}+\frac{\dot{B}\dot{C}}{BC}-\frac{m^2}{A^2} = (8\pi+2\mu)\rho-2\mu p-(\rho+\rho_s)\,, \qquad (3.11)$$

$$\frac{h^2}{A^2}\left(\frac{\dot{C}}{C}-\frac{\dot{B}}{B}\right)=0\,, \qquad (3.12)$$

where the overhead dot (.) denotes ordinary differentiation with respect to 't'.

To discuss the kinematics of the universe, we need to define some kinematical parameters of the universe which has a great importance in cosmology.

Spatial volume and the scale factor for the metric (3.1) are

$$V = a^3 = ABC \,. \qquad (3.13)$$

The mean Hubble parameter, which expresses the volumetric expansion rate of the universe, given as

$$H = \frac{1}{3}\frac{\dot{V}}{V} = \frac{1}{3}\left(\frac{\dot{A}}{A}+\frac{\dot{B}}{B}+\frac{\dot{C}}{C}\right). \qquad (3.14)$$

Another important dimensionless kinematical quantity is the mean deceleration parameter q, which tells whether the universe exhibits accelerating volumetric expansion or not is

$$q = -1 + \frac{d}{dt}\left(\frac{1}{H}\right), \qquad (3.15)$$

for $-1 \le q < 0$, $q > 0$ and $q = 0$ the universe exhibit accelerating volumetric expansion, decelerating volumetric expansion and expansion with constant-rate respectively.

To discuss whether the universe either approach isotropy or not, we define an anisotropy parameter of the expansion as

$$A_m = \frac{1}{3}\sum_{i=1}^{3}\left(\frac{\Delta H_i^2}{H}\right)^2 . \qquad (3.16)$$

The scalar expansion and shear scalar are defined as

$$\theta = \frac{\dot{A}}{A}+\frac{\dot{B}}{B}+\frac{\dot{C}}{C}\,, \qquad (3.17)$$

$$\sigma^2 = \frac{1}{2}\left(\sum_{i=1}^{3}H_i^2 - \frac{1}{3}\theta^2\right), \qquad (3.18)$$

where $\Delta H_i = H_i - H$.

SOLUTION OF THE FIELD EQUATIONS

From equations (2.9) and (2.10), we have

$$\frac{\ddot{B}}{B}-\frac{\ddot{C}}{C}+\frac{\dot{A}}{A}\left(\frac{\dot{B}}{B}-\frac{\dot{C}}{C}\right)=0. \qquad (4.1)$$

We assume the relation between metric potential, which was assumed by Roy and Prasad [30] for solving differential equation of Bianchi type VI_0 metric.

$$A=\frac{B}{C}. \qquad (4.2)$$

Using equation (4.2) in equation (4.1), we get

$$\frac{\ddot{B}}{B}-\frac{\ddot{C}}{C}+\frac{\dot{B}^2}{B^2}+\frac{\dot{C}^2}{C^2}-2\frac{\dot{B}\dot{C}}{BC}=0. \qquad (4.3)$$

Assume the adhoc relation

$$\frac{\ddot{C}}{C}=0. \qquad (4.4)$$

Equation (4.4) yield

$C=mt+d$,

where $m>0$, $d\geq 0$ are constant of integration. Many such solutions previously obtained by Hajj Broutros[31], Ram and Singh[32] and Katore*et al.*[33].

Without loss of generality we take $m=1$, $d=0$.

Above equation reduces to

$$C=t. \qquad (4.5)$$

Making use of equation (4.5) in equation (4.3), we get

$$\frac{\ddot{B}}{B}+\frac{\dot{B}^2}{B^2}+\frac{m^2}{t^2}-\frac{2m}{t}\frac{\dot{B}}{B}=0. \qquad (4.6)$$

Let us assume $f=B^2$. (4.7)

Using equation (4.6) and (4.7), we obtain

$$\ddot{f}-\frac{2}{t}\dot{f}+\frac{2}{t^2}f=0. \qquad (4.8)$$

An equation (4.8) read as

$$t^2\frac{d^2f}{dt^2}-2t\frac{df}{dt}+2f=0, \qquad (4.9)$$

Equation (4.9) gives us

$$f=B^2=c_1t+c_2t^2, \qquad (4.10)$$

where c_1 and c_2 are constant of integration.

The metric potentials are obtained as

$$A=\left(c_2+\frac{c_1}{t}\right),$$

(4.11)

$$C=t. \qquad (4.12)$$

The metric potentials B, C are increasing function of time whereas A is decreasing function of time. As $t\to 0$, $A\to\infty$, B and C approaches to zeroi.e. there is no initial singularity at big bang for $B$and C. As $t\to\infty, B, C\to\infty, A\to const.$ which is consistent with recent observations.

PHYSICAL PARAMETERS

The string energy density of the Universe is

$$\rho=\frac{1}{k^2}\left\{\frac{\left(3c_1+2c_1c_2t+2c_2^2t^2\right)}{\left(c_1t+c_2t^2\right)^2}-\frac{2}{t^2}\right\}. \qquad (4.13)$$

The string tension density is

$$\rho_s=\frac{-1}{k^2}\left\{\frac{\left(c_1^2+c_1c_2t+2c_1c_2t^2+2c_2^2t^3\right)}{\left(c_1t+c_2t^2\right)^2}-\frac{2m^2t}{\left(c_1+c_2t\right)}\right\}. \qquad (4.14)$$

The string particle density of the Universe is

$$\rho_p=\frac{1}{k^2}\left\{\frac{\left(3c_1+3c_1c_2t+2(c_1+c_2)c_2t^2+2c_2^2t^3\right)}{\left(c_1t+c_2t^2\right)^2}+\frac{2}{t^2}+\frac{2m^2t}{\left(c_1+c_2t\right)}\right\}. \qquad (4.15)$$

Quark energy density of the Universe is

$$\rho_q=\frac{1}{k^2}\left\{\frac{\left(3c_1+2c_1c_2t+2c_2^2t^2\right)}{\left(c_1t+c_2t^2\right)^2}+\frac{2}{t^2}\right\}-B_c \qquad (4.16)$$

Quark pressure of the Universe is

$$p_q=\frac{1}{3k^2}\left\{\frac{\left(3c_1+2c_1c_2t+2c_2^2t^2\right)}{\left(c_1t+c_2t^2\right)^2}+\frac{2}{t^2}\right\}-\frac{B_c}{3} \qquad (4.17)$$

The behavior of Quark energy density and Quark pressure of the Universe is same as that of quark matter, except that it is shifted by the bag constant as shown in the right side of the equations (4.16) and (4.17).The side view of energy density and pressure for quark and strange quark matter are identical except for the additional bag constant. For energy density of strange quark we add the bag constant. From equations (4.16) and (4.17), one can notice that, $p_q\to -B_c$ when $t\to\infty$, negative pressure due to the Dark Energy in the context of accelerated expansion of the universe

KINEMATICAL PARAMETERS

The physical parameters such as Spatial volume (V), expansion scalar (θ), mean anisotropic parameter (Δ), shear scalar (σ) and deceleration parameter (q) respectively of the model becomes

Spatial volume,

$$V=t\sqrt{\left(c_1^2+2c_1c_2t+c_2^2t^2\right)}, \qquad (4.18)$$

Spatial volume of the Universe starts with zero value at $t\to 0$ and with the increase of time it

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always expands. Thus, inflation is possible in this model. This shows that the Universe starts evolving with zero volume and expands with time *t*. The behavior is shown in the figure (i).

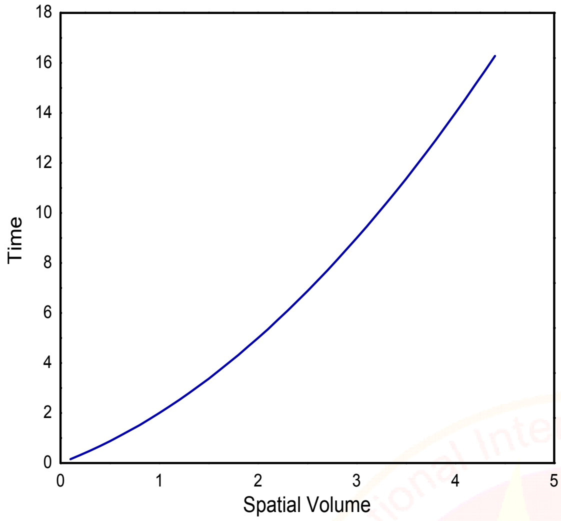

Figure (i): The behavior of Spatial volume versus time with the appropriate choice of constants.

Expansion scalar,

$$\theta = \frac{\dot{V}}{V} = \frac{c_2 t}{\left(c_1 t + c_2 t^2\right)} + \frac{2}{t}, \qquad (4.19)$$

The scalar expansion is the functions of time and decreases as t increases and approaches null at later time. This suggested that at initial stage of the Universe, the expansion of the model is much more faster and then slow down for later time this shows that the evolution of the Universe starts with infinite rate and with the expansion it declines (see figure (ii)).

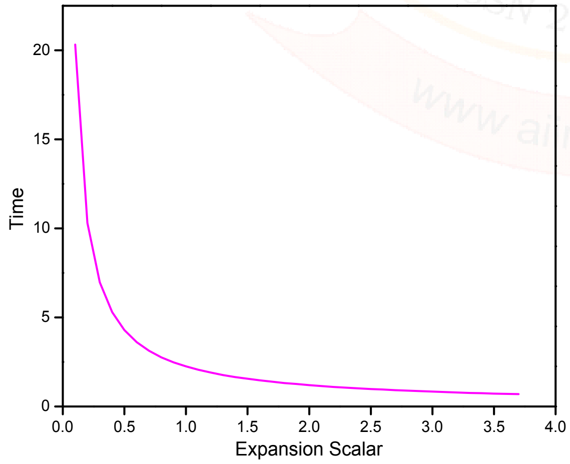

Figure (ii): The behavior of Expansion Scalar versus time with the appropriate choice of constants.

Mean anisotropic parameter,

$$A_m = \frac{1}{3H^2}\sum_{i=1}^{3}\left(H_i - H\right)^2 = 1 + \frac{27c_1^2 + c_1\left(54c_2 - 12c_1\right)t + 6c_2\left(c_2 - 4c_1\right)t^2 + 12c_2^2 t^3}{2\left(c_1 t + 2c_2 t + 2c_1\right)^2}, \qquad (4.20)$$

From the equation (4.20), it is clear that mean anisotropic parameter is function of time and at initial when $t \to 0$, mean anisotropic parameter is infinitely large while at $t \to \infty$, it is approaches to constant quantity i.e. 1.

Deceleration parameter,

$$q = \frac{d}{dt}\left(\frac{1}{H}\right) - 1 = \frac{2\left((c_1 - 1)c_1 - (c_1 - 2c_2 + 12c_1c_2)t + 3c_2(c_1 + 6c_2)t^2\right)}{\left(c_1 + 2c_2\right) t + 2c_1}. \qquad (4.22)$$

Equation (4.22), represents the deceleration parameter. It is observed that the deceleration parameter is function of time t and it is depend on the constants c_1 and c_2. The graphical behavior of deceleration parameter (see figure (iii)) shows that for any value of the constants, it shows signature Philippine i.e. negative to positive value, hence the Universe shows initially accelerating and with the increase of time it is decelerating.

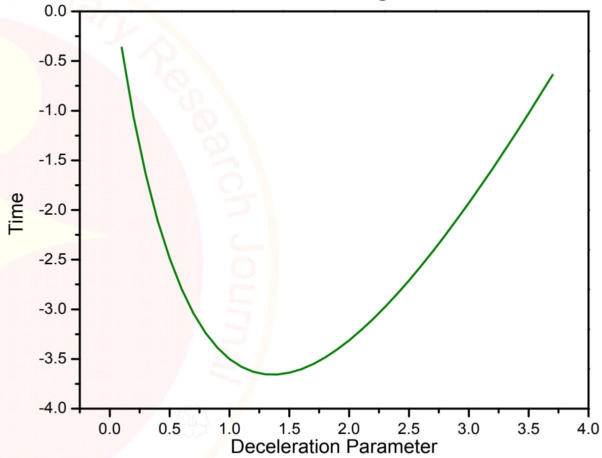

Figure (iii): The behavior of Deceleration Parameter versus time with the appropriate choice of constants.

CONCLUSION

In the investigationof homogeneous Bianchi type VI_0cosmological model with strange quark matter attached to cosmic string in $f(R,T)$ gravity it is observed that,

- The Universe starts evolving with zero volume and expands with time *t*. The expansion of the model is much more faster and then slow down for later time this shows that the evolution of the Universe starts with infinite rate and with the expansion it declines.
- The mean anisotropic parameter is infinitely large while at $t \to \infty$, it is approaches to constant quantity i.e. 1.
- The deceleration parameter shows signature Philippine (i.e. negative to positive value) for any value of the constants, it shows, the

Universe shows initially accelerating and with the increase of time it is decelerating.

- The energy density and pressure for quark and strange quark matter are identical except for the additional bag constant. For energy density of strange quark we add the bag constant and one can notice that, $p_q \rightarrow -B_c$ when $t \rightarrow \infty$, negative pressure due to the Dark Energy in the context of accelerated expansion of the universe.

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GAUSSION IN THE EXTENDED FRACTIONAL FOURIER TRANSFORM

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ABSTRACT

The extended fractional Fourier transform is the generalization of fractional Fourier transform with two more parameters. In this paper, we have proposed Gaussion of the extended fractional Fourier transform domain.

Key words: *Extended fractional Fourier transform, fractional Fourier transform and Gaussion.*

INTRODUCTION

As a generalization of the classical Fourier transform (FT), the fractional Fourier transform (FrFT) has received much attention in recent years. Namias [4] had introduced it and since then it has been applied in several areas, including optics, quantum mechanics and signal processing [1, 5, 6], its relationship with the Fourier transform can be found [7].

The generalization of the fractional Fourier transform, which is known as extended fractional Fourier transform (EFrFT) introduced by Juanwen Hua et. al. [3] (with two more parameters a and b) as,

$$F_{a,b}^{\alpha}[f(t)](u) = F_{a,b}^{\alpha}(u)$$

$$= \int_{-\infty}^{\infty} e^{i\pi[(a^2t^2+b^2u^2)cot\alpha - 2abtucsc\alpha]} f(t)dt \quad (1.1)$$

The Gaussion of fractional Fourier transform introduced by C. Capus and K. Brown [2] in 2003 is,

$$F_\alpha(u_\alpha) = \frac{\sqrt{2\pi}A_\alpha}{\sqrt{\left(\frac{1}{\sigma_t^2} - icot\varphi\right)}} \exp\left(\frac{1}{2}iu_\alpha^2 cot\varphi\right) exp\left[-\frac{1}{2}\frac{u_\alpha^2}{\left(\frac{1}{\sigma_t^2} - icot\varphi\right)sin^2\varphi}\right]$$

where the Gaussion of Fourier transform $F(u) = \frac{1}{\sqrt{2\pi}}\exp\left(-\frac{1}{2}u^2\sigma_t^2\right)$

and the Gaussion with zero mean and standard deviation σ is,

$$f(t) = \frac{1}{\sqrt{2\pi\sigma^2}}\exp\left(-\frac{t^2}{2\sigma^2}\right) \quad (1.2)$$

In this paper we have extended Gaussion formula to extended fractional Fourier transform

GAUSSION IN EXTENDED FRACTIONAL FOURIER TRANSFORM

By (1.1)and (1.2) extended fractional Fourier transform of the Gaussion gives,

$$F_{a,b}^{\alpha}(u) = \int_{-\infty}^{\infty} e^{i\pi[(a^2t^2+b^2u^2)cot\alpha - 2abtucsc\alpha]} \frac{1}{\sqrt{2\pi\sigma^2}} exp\left(-\frac{t^2}{2\sigma^2}\right)dt$$

$$= \frac{1}{\sqrt{2\pi\sigma^2}} exp(i\pi b^2u^2cot\alpha) \int_{-\infty}^{\infty} exp[i\pi a^2t^2cot\alpha - 2i\pi abtucsc\alpha]\, exp\left(-\frac{t^2}{2\sigma^2}\right)dt$$

$$= \frac{1}{\sqrt{2\pi\sigma^2}} exp(i\pi b^2u^2cot\alpha) \int_{-\infty}^{\infty} exp\left[-\frac{1}{2}\left(-2i\pi a^2t^2cot\alpha + 4i\pi abtucsc\alpha + \frac{t^2}{\sigma^2}\right)\right]dt$$

$$= \frac{1}{\sqrt{2\pi\sigma^2}} exp(i\pi b^2u^2cot\alpha) \int_{-\infty}^{\infty} exp\left[-\frac{1}{2}\left(\left(\frac{1}{\sigma^2} - 2i\pi a^2cot\alpha\right)t^2 + 4i\pi abtucsc\alpha\right)\right]dt$$

$$= \frac{1}{\sqrt{2\pi\sigma^2}} exp(i\pi b^2u^2cot\alpha) \int_{-\infty}^{\infty} exp\left[-\frac{1}{2}\left(\left(\sqrt{\left(\frac{1}{\sigma^2} - 2i\pi a^2cot\alpha\right)}\, t + \frac{2i\pi abucsc\alpha}{\sqrt{\frac{1}{\sigma^2} - 2i\pi a^2cot\alpha}}\right)^2 + \left(\frac{2i\pi abucsc\alpha}{\sqrt{\frac{1}{\sigma^2} - 2i\pi a^2cot\alpha}}\right)^2\right)\right]dt$$

$$= \frac{1}{\sqrt{2\pi\sigma^2}} exp(i\pi b^2u^2cot\alpha) exp\left(-\frac{2\pi^2a^2b^2u^2csc^2\alpha}{\left(\frac{1}{\sigma^2} - 2i\pi a^2cot\alpha\right)}\right)$$

$$\times \int_{-\infty}^{\infty} exp\left[-\frac{1}{2}\left(\sqrt{\left(\frac{1}{\sigma^2}-2i\pi a^2 cot\alpha\right)}\, t + \frac{2i\pi abucsc\alpha}{\sqrt{\frac{1}{\sigma^2}-2i\pi a^2 cot\alpha}}\right)^2\right] dt \quad (2.1)$$

Let $z = \sqrt{\left(\frac{1}{\sigma^2}-2i\pi a^2 cot\alpha\right)}\, t + \frac{2i\pi abucsc\alpha}{\sqrt{\frac{1}{\sigma^2}-2i\pi a^2 cot\alpha}}$

Then $dz = \sqrt{\left(\frac{1}{\sigma^2}-2i\pi a^2 cot\alpha\right)}\ dt$

Therefore $dt = \frac{dz}{\sqrt{\frac{1}{\sigma^2}-2i\pi a^2 cot\alpha}}$

Therefore (2.1) will be

$$F^{\alpha}_{a,b}(u) = \frac{1}{\sqrt{2\pi\sigma^2}\sqrt{\frac{1}{\sigma^2}-2i\pi a^2 cot\alpha}} exp(i\pi b^2u^2 cot\alpha).\, exp\left(-\frac{2\pi^2a^2b^2u^2csc^2\alpha}{\left(\frac{1}{\sigma^2}-2i\pi a^2 cot\alpha\right)}\right)$$

$$\times \int_{-\infty}^{\infty} exp\left(-\frac{z^2}{2}\right) dz \quad (2.2)$$

The standard definition of the Gaussion gives,

$$\frac{1}{\sqrt{2\pi}}\int exp\left(-\frac{z^2}{2}\right) dz = 1.0 \quad (2.3)$$

Therefore by (2.3), (2.2) gives,

$$F^{\alpha}_{a,b}(u) = \frac{\sqrt{2\pi}}{\sqrt{2\pi\sigma^2}\sqrt{\frac{1}{\sigma^2}-2i\pi a^2 cot\alpha}} exp(i\pi b^2u^2 cot\alpha).\, exp\left(-\frac{2\pi^2a^2b^2u^2csc^2\alpha}{\left(\frac{1}{\sigma^2}-2i\pi a^2 cot\alpha\right)}\right)$$

$$= \frac{\sqrt{\sigma^2}}{\sqrt{\sigma^2}\sqrt{1-2i\pi\sigma^2a^2 cot\alpha}} exp(i\pi b^2u^2 cot\alpha).\, exp\left(-\frac{2\pi^2a^2b^2\sigma^2u^2csc^2\alpha}{(1-2i\pi\sigma^2a^2 cot\alpha)}\right)$$

$$= \frac{1}{\sqrt{1-2i\pi\sigma^2a^2 cot\alpha}} exp(i\pi b^2u^2 cot\alpha).\, exp\left(-\frac{2\pi^2a^2b^2\sigma^2u^2csc^2\alpha}{(1-2i\pi\sigma^2a^2 cot\alpha)}\right)$$

CONCLUSION

In this paper we are extended the Gaussion formula in to the extended fractional Fourier transform domain.

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BIANCHI TYPE I WITH STRANGE QUARK MATTER ATTACHED TO STRING CLOUD IN BIMETRIC THEORY

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ABSTRACT

In this paper, we investigate bianchi type I cosmological model with strange quark matter attached to the string cloud in Rosen's(1973) bimetric theory. Some physical and geometrical properties are also discussed. It is shown that bianchi type I cosmological model do not exist in case of strange quark matter attached to the string cloud in bimetric theory. Hence only vacuum model can be obtained.

Keywords: *Bianchi type-I space time, quark matter, bimetric theory.*

INRODUCTION

The bimetric theory proposed by Rosen [1] refers to a class of modified Einstein's theories of gravity, in which two metric tensors are used. These two metric tensors are the Riemannian metric tensor g_{ij} and the background flat space-time metric tensor f_{ij}. The background flat space-time metric tensor f_{ij} refers to inertial forces. The metric tensor g_{ij} describes the Riemannian geometry of a curved space-time which plays the same role as given in the Einstein's general theory of relativity. The background metric tensor f_{ij} refers to the geometry of empty (free from matter and radiation) universe and hence describes a space-time of constant curvature. This metric tensor has no direct physical significance but appears in the field equations. Moreover, the bimetric theory also satisfies the covariance and equivalence principles. The theory agrees with the present observational facts pertaining to general relativity.

The field equations of bimetric theory of gravitation proposed by Rosen [1] are

$$N_j^i - \frac{1}{2} N\delta_j^i = -8\Pi k T_j^i \tag{1}$$

where

$$N_j^i = \frac{1}{2} f^{ab} (g^{hi} g_{hj|a})_{|b}$$

and

$N = N_j^i$, $k = \sqrt{\frac{g}{f}}$ together with $g = \det(g_{ij})$ and $f = \det(f_{ij})$

The vertical bar (|) indicates covariance differentiation with respect to f_{ij} and T_j^i is the energy–momentum tensor of the matter field.

Several aspects of bimetric theory of gravitation have been studied by various researchers

Reddy et al [2] have established the non-existence of axially symmetric cosmological model with domain walls and cosmic string. Bali and Pradhan [3] have investigated Bianchi type-III string cosmological model with time-dependent bulk viscosity. Rao et al[4] have studied Bianchi type-I string cosmological models in bimetric theory of gravitation. Yavuz et al. [5] and Yilmaz [6,7] have studied 5-D Kaluza-Klein cosmological models with quark matter attached to the string cloud and domain walls. Sahoo et al.[8] have studied bianchi type cosmic string models coupled with Maxwell fields in this theory. Letelier [9] has solved Einstein field equations for a cloud of massive strings and obtained cosmological models in Bianchi type-I and Kantowaski-Sachs space-time. Itoh [10], Bodmar [11] have formed two ways for creation of strange quark matter. One is thequarkhadron phase transition in the early universe and another is the conversion of neutronstars into strange ones at ultrahigh density. In strong interaction theories it is supposed that breaking of physical vacuum takes place inside hadrons to form quark bag model. As a result vacuum energy densities inside and outside a hadron become essentially different, and the vacuum pressure on the bag wall equilibrates the pressure of quarks, thus stabilizing the system. Sahoo [12] has discussed inhomogeneous plane symmetric string cosmological models in bimetric theory of gravitation. Katore and Rane [13] have investigated Bianchi type-III magnetized cosmological model when the field of gravitation is governed by either a perfect fluid or a cosmic string in bimetric theory of gravitation. Khadekar et al.[14] have confined their work to the quarks matters which attached to the topological defects in general relativity. Dey et al. [15] have obtained new sets of EOSs for strange matter based on a model of interquark potential which has the following features: (a) asymptotic freedom, (b) confinement at zero baryon density and deconfinement at high baryon density, (c) chiral symmetry restoration and (d) gives stable uncharged β-stable strange matter. In quantum field theories, broken symmetries are restored at high enough temperatures. One of the interesting consequences of the first order phase transition from quark phase to hadron phase in the early universe is the formation of strange quark matter and it has been attracting much interest (Witten [16],Fahri and Jaffe [17]). Mak and Harko [18] have discussed the cylindrically space time admitting conformal motion for a charged strange quark matter attached to string cloud. Sanjay Oli [19], Pradhan et al[20], Mahanta et al [21], Singh and Sharma [22] , Ozel et al [23], Namrata et al [24] are some of the authors who have studied various aspects of strange quark matter attached to string cloud in general theory of relativity. Alcock et al.[25] and Haensel et al. [26] examined that if the hypothesis of the quark matter is true, then some of neutrons stars could actually be strange stars built entirely of strange matter. Adhav et al. [27,28] have discussed string cloud and domain walls with quark matter in n-dimensional Kaluza-Klein cosmological model in general relativity and strange quark matter attached to string cloud in Bianchi type-III space time in general relativity. Melvin[29] suggested, in the cosmological solution for dust and electromagnetic field, that during the evolution of the Universe, the matter was in highly ionized state and smoothly coupled with electromagnetic field and consequently formed a neutral matter as a result of the expansion of the Universe. Hence, in string dust Universe the presence of magnetic field is not unrealistic. Katore et al [30] have obtained cosmological model with strange quark matter attached to cosmic string for axially symmetric space-time in general relativity. Jain et al.[31] have studied axially symmetric space-time with wet dark fluid in bimetric theory.Rao and Sireesha [32,33] have studied axially symmetric and Bianchi type II, VIII and XI space-time with strange quark matter attached to string cloud, respectively, in the Brans-Dicke theory of gravitation.

In this study, we will attach strange quark matter to the string cloud. It is plausible to attach strange quark matter to the string cloud. A quark–gluon plasma (QGP) or quark soup is a phase of quantum chromo dynamics (QCD) which exists at extremely high temperature and/or density. This phase consists of (almost) free quarks and gluons, which are several of the basic building blocks of matter. Experiments at CERN's Super Proton Synchrotron (SPS) first tried to create the QGP in the 1980s and 1990s: the results led CERN to announce indirect evidence for a "new state of matter" in 2000. Current experiments at Brookhaven National Laboratory's Relativistic Heavy Ion Collider (RHIC) are continuing this effort.

Strange quark matter is modeled with an equation of state based on the phenomenological bag model of quark matter, in which quark confinement is described by an energy term proportional to the volume. In this model, quarks are through as degenerate Fermi gas, which exists only in a region of space endowed with a vacuum energy density Bc (called as the bag constant). In the framework of this model, the quark matter is composed of massless u and d quarks, massive s quarks and electrons. In the simplified version of the bag model, it is assumed that quarks are massless and non-interacting.

Therefore, we have quark pressure

$$p_q = \frac{\rho_q}{3} \tag{2}$$

Where ρ_q is the quark energy density.

The total energy density is

$$\rho = \rho_q + Bc \tag{3}$$

But the total pressure is

$$p = p_q - Bc \tag{4}$$

Sahoo [34] has shown that the spherically symmetric cosmological model did not exist in Rosen's bimetric theory of gravitation when the source of gravitation was either perfect fluid or massive string whereas the model did exist in scalar meson field. Recently, Kandalkar and Samdurkar [35] have discussed Bianchi type-I cosmological model with strange quark matter attached to string cloud in self creation theory. In this paper, motivated by above discussions ,we studied Bianchi type-I cosmological model with strange quark matter attached to string cloud in biometric theory.

METRIC AND FIELD EQUATIONS

We consider Bianchi type-I metric of the form

$$ds^2 = -dt^2 + A^2dx^2 + B^2dy^2 + C^2dz^2 \quad (5)$$

Where A, B and C are functions of cosmic time t only.

The background flat space-time corresponding to the metric (5) is

$$d\sigma^2 = -dt^2 + dx^2 + dy^2 + dz^2 \quad (6)$$

The energy momentum tensor for string cloud (Letelier [36]) is given by

$$T_j^i = \rho U^i U_j - \rho_s X^i X_j \quad (7)$$

Here ρ is the rest energy density for the cloud of strings with particles attached to them and ρ_s is the string tension density. They are related by

$$\rho = \rho_p + \rho_s \quad (8)$$

Where ρ_p is the particle energy density. We know that string is free to vibrate.

The different vibrational models of the string represent different types of particles because these different models are seen as different masses or spins. Therefore, here we will take quarks instead of particles in the string cloud. Hence we consider quark matter energy density instead of particle energy density in the string cloud.

In this case from (8), we get

$$\rho = \rho_p + \rho_s + B_c \quad (9)$$

From (8) and (9), we have energy momentum tensor for strange quark matter attached to the string cloud as (Yavuz et al. [5])

$$T_j^i = (\rho_p + \rho_s + B_c)U^i U_j - \rho_s X^i X_j \quad (10)$$

Where U^i is the four velocity of the particles and X^i is the unit space like vector representing the direction of string. We have U^i and X^i with satisfying conditions:

$$U^i U_i = -1, \quad U^i X_i = 0, \quad X^i X_i = 1 \quad (11)$$

We have taken the direction of string along z-axes. Then the components of energy momentum tensor are

$$T_1^1 = 0 = T_1^1 \quad T_3^3 = -\rho_s \quad T_4^4 = -\rho \quad (12)$$

The Rosen's field equations (1) for the metric (5) and (6) can be written as

$$\left(\frac{A_4}{A}\right)_4 - \left(\frac{B_4}{B}\right)_4 - \left(\frac{C_4}{C}\right)_4 = 0 \quad (13)$$

$$\left(\frac{A_4}{A}\right)_4 - \left(\frac{B_4}{B}\right)_4 + \left(\frac{C_4}{C}\right)_4 = 0 \quad (14)$$

$$\left(\frac{A_4}{A}\right)_4 + \left(\frac{B_4}{B}\right)_4 - \left(\frac{C_4}{C}\right)_4 = 16\pi k\rho_S \quad (15)$$

$$\left(\frac{A_4}{A}\right)_4 + \left(\frac{B_4}{B}\right)_4 + \left(\frac{C_4}{C}\right)_4 = 16\pi k\rho \quad (16)$$

where the suffixes 4 following an unknown function denotes an ordinary differentiation with respect to time t respectively.

The functional dependence of the metric together with (13) and (14) imply

$$\left(\frac{C_4}{C}\right)_4 = 0 \quad (17)$$

Which immediately yields

$$C(t) = \exp(c_1 t) \quad \text{for some constant } c_1$$

Without loss of generality, by taking c_1 = 1, we have $C(t) = \exp(t)$

Now the field equations (13) to (16) reduces to

$$\left(\frac{A_4}{A}\right)_4 - \left(\frac{B_4}{B}\right)_4 = 0 \quad (18)$$

$$\left(\frac{A_4}{A}\right)_4 + \left(\frac{B_4}{B}\right)_4 = 16\pi k\rho_S \quad (19)$$

$$\left(\frac{A_4}{A}\right)_4 + \left(\frac{B_4}{B}\right)_4 = 16\pi k\rho \quad (20)$$

From (19)-(20) , we get,

$$\rho_s - \rho = 0 \quad (21)$$

For reality condition to hold we need $\rho_s > 0$ and $\rho > 0$

Equation (21) gives us,

$$\rho_s = 0 = \rho \quad (22)$$

Equation (22) shows that there is no contribution from strange quark matter to Bianchi type-I model in bimetric relativity.

From (18)-(22),

$$\left(\frac{B_4}{B}\right)_4 = 0 \quad (23)$$

Above equation yields,

$$B = \exp(b_1 t)$$

Hence Bianchi type-I vacuum model in bimetric relativity can be expressed, after a proper choice of coordinates and constants , in the form

$$ds^2 = -dt^2 + e^{2a_1t}dx^2 + e^{2b_1t}dy^2 + e^{2c_1t}dz^2 \quad (24)$$

SOME PHYSICAL PROPERTIES OF THE MODEL

The physical quantities which plays an important role in cosmology are spatial volume V^3, the expansion scalar, shear scalar, decelerating parameter q , which have the following expression for the model (24) as given below:

Spatial Volume: V^3

$$V^3 = ABC = 3\exp(lt)$$

Expansion Scalar θ

$$\theta = 3H = l$$

The directional hubble parameter that express the expansion rates of the universe along the direction of and x,y and z axes can be defined as,

$$H_1 = \frac{A_4}{A}, \quad H_2 = \frac{B_4}{B}, \quad H_3 = \frac{C_4}{C}$$

Thus the mean Hubble parameter, which expresses the volumetric expansion rate of the universe for the model(24) is

$$H = \frac{\theta}{3} = \frac{1}{3}\left(\frac{A_4}{A} + \frac{B_4}{B} + \frac{C_4}{C}\right) \qquad H = \frac{l}{3}$$

An important quantity q, the deceleration parameter is given by

$$q = -\frac{V_{44}V}{V_4^{\,2}} = -1$$

The role of deceleration parameter q seems to specify the expansion of the universe. In last decades, the standard cosmological model favoured a presently matter-dominated universe expanding in a decelerated fashion. The sign of q indicates whether the model inflates or not. The positive value of deceleration parameter q indicates that the model decelerates in a standard way and negative value indicates that model accelerates.

But the recent observation seems to be a negative value of this parameter which shows that the model inflates in present case.

Shear Scalar :

$$\sigma^2 = \frac{1}{3}(H_1 - H_3)^2$$

$$\sigma^2 = \frac{1}{3}(a_1 - c_1)^2$$

It is observed that, hubble parameter H, the scalar expansion θ and shear scalar σ^2 has constant values and as $\frac{\sigma}{\theta}$ = constant the model is not isotropic for large values of t that means it is anisotropic.

CONCLUSION

Here we have studied bianchi type I cosmological model with strange quark matter attached to string cloud in bimetric theory. We have shown that bianchi type I cosmological model do not exist in Rosens(1973) biometric theory of gravitations in presence of strange quark matter attached to cloud of string. We obtained a vaccum model which is free from singularity and reduces to a flat space time t=0.

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COEXISTENCE BETWEEN ELECTROMAGNETIC WAVES AND PLANE GRAVITATIONAL WAVES IN GENERAL RELATIVITY

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ABSTRACT

In this paper we have explored the coexistence between electromagnetic waves and plane gravitational waves by solving Einstein-Maxwell equation in space-time metric used by K.B.Lal and Shafiullah [Ann. De Mathematica pura ed. Applicata V.126, p. 285. 1980] in general relativity. The deterministic solution is obtained by considering two cases $F_{ij}(Z)$ *is transverse electromagnetic wave and the four potential* $K_i = K_i(Z)$. *The results were obtained purely in Mathematical form.*

Keyword: *General relativity, plane gravitational waves, electromagnetic waves etc.*

INTRODUCTION

The pioneer mathematical work on plane gravitational waves, which has been brilliantly, put forward by H. Takeno [1, 2] forms the cornerstone for investigations on plane waves. He propounded a rigorous discussion on $(z-t)$ and (t/z)-types of plane gravitational waves, and defined various terms by formulating a meaningful mathematical version and obtained numerous results and found out the solutions of plane gravitational waves of the field equations in general relativity. A general case of "plane" gravitational waves is represented by the metric both for weak field approximation and for exact solutions of Einstein field equations. Plane gravitational waves in general relativity in higher dimension have been studied by number of authors viz. Extension of Takeno's work to higher dimension was further carried out by Adhav and Karade [4] by reformulating Takeno's definition of plane gravitational waves in four dimensional space-time to five and six dimensional space-time and obtained the line elements for both $Z=(z-t)$ and $Z=(t/z)$-type plane gravitational waves. Bhoyar et al [9] by using suitable transformation investigated $Z=(t/z)$-type metric having plane symmetry in the sense of Taub A.H. [6]. Furthermore In general relativity, the coexistence of electromagnetic waves with plane gravitational waves for $Z=(z-t)-type$ in four, five and six dimensional, are mathematically exposed by Takeno, Ambatkar et.al [3] , Pawar et.al [7] respectively. In this paper using the work of S.W. Bhaware, et.al [8] extended to explore the co-existence between electromagnetic waves with plane gravitational waves in generalized space time deduced by K.B.Lal and Shafiullah [3]. The paper is organized as follows: The metric and field equations of general relativity is presented in section 2,Maxwell equations are presented in section 3,section 4 represents the non-vanishing components of , the curvature tensor and Ricci tensor . Section 5 relates the solutions of field equations.

METRIC AND FIELD EQUATIONS OF GENERAL RELATIVITY

Let us consider the space-time metric used by K.B.Lal and Shafiullah[3] i.e

$$ds^2=-(1-A)dx^2-(1+A)dy^2-Cdz^2+Cdt^2+2Bdxdy, \qquad (1)$$

where A, B, C are functions of $Z=(z-t)$.

The field equations with electromagnetic field without matter in general relativity is given by

$$R_{ij}=-8\pi E_{ij}, \qquad (2)$$

where R_{ij} is the Ricci tensor and E_{ij} is the electromagnetic energy tensor which is defined by

$$E_{ij}=\frac{1}{4}g_{ij}F_{kl}F^{kl}-F_{ik}F_{jl}g^{kl}, \qquad (3)$$

where F_{ij} is the antisymmetric field tensor and g_{ij} is the fundamental tensor of sp ace-time.

The antisymmetric field tensor F_{ij} satisfies the following generalized Maxwell equations

$$F_{ij,k}+F_{jk,i}+F_{ki,j}=0, \qquad (4)$$

and $$F^{ij}_{;j}=J^{\mu} \qquad (5)$$

where J^{μ} is the charge current four vectors and $(i,j,k,\mu)=1,2,3,4$. Here a semicolon (;) and a comma (,) followed by indices denote covariant and partial derivatives respectively. Here we consider pure radiation field only, hence we assume that the charge current four vectors is identically zero. Hence equation (5) becomes

$$F^{ij}_{;j}=0. \tag{6}$$

Here semicolon (;) the covariant derivative, we assumed that either Maxwell tensor F_{ij} is a function of $Z=z-t$ or the four potentials K_i which are the functions of Z in the co-ordinate system expect for any gauge transformation.

THE MAXWELL EQUATIONS

$$curlE_l=-\frac{\partial H}{\partial t},\quad divH=0 \tag{7}$$

$$curl\,H=-\frac{\partial E_i}{\partial t},\quad divE_l=0 \tag{8}$$

Where the electric field intensity

$$E_i=-\nabla\phi-(\partial\phi/\partial t)$$

The magnetic field intensity,

$$H=\nabla\times A, \tag{9}$$

And $A=(A_x,A_y,A_z)$, ϕ denote vector potential and scalar potential field respectively, the operator ∇ is defined as

$$\nabla=\left(\frac{\partial}{\partial x},\frac{\partial}{\partial y},\frac{\partial}{\partial z}\right)$$

In four dimensional space-time, the velocity of light c=1 and

$$K=(-A_x,-A_y,-A_z,\phi) \tag{10}$$

The above Maxwell equations are re written as,

$$E_l=E_xi+E_yj+E_zk \tag{11}$$

$$H=H_xi+H_yj+H_zk \tag{12}$$

Here i,j,k are unit vectors along X,Y,Z axes respectively .

THE CURVATURE TENSOR & RICCI TENSOR

From equation (1), the components of fundamental tensor g_{ij} and contravarient tensor g^{ij} are as follows

$$[g_{ij}]=\begin{bmatrix} A-1 & B & 0 & 0\\ B & -1-A & 0 & 0\\ 0 & 0 & -C & 0\\ 0 & 0 & 0 & C\end{bmatrix}$$

$$[g^{ij}]=\begin{bmatrix} \frac{A+1}{-m} & \frac{B}{-m} & 0 & 0\\ \frac{B}{-m} & \frac{1-A}{-m} & 0 & 0\\ 0 & 0 & -\frac{1}{C} & 0\\ 0 & 0 & 0 & \frac{1}{C}\end{bmatrix} \tag{13}$$

The components of curvature tensor are easily obtained & the non-vanishing components of the curvature tensor are as follows

$$R_{1313}=-R_{1314}=R_{1414}=-\frac{\bar{\bar{A}}}{2}+\mu^2(A-1)-\psi^2(A+1)+2\mu\psi B+\frac{\bar{A}\bar{C}}{2C}$$

$$R_{1323}=-R_{1324}=-R_{1423}=R_{1424}=-\frac{\bar{\bar{B}}}{2}+\mu\lambda(A-1)+B(\psi\lambda+\mu\phi)-\psi\phi(A+1)+\frac{\bar{B}\bar{C}}{2C}$$

$$R_{2323}=-R_{2324}=R_{2424}=\frac{\bar{\bar{A}}}{2}+\lambda^2(A-1)+2B\lambda\phi-\phi^2(A+1)-\frac{\bar{A}\bar{C}}{2C}. \tag{14}$$

Here dash (-) over a letter denotes the derivative with respect to Z. The non-zero components of curvature tensor shows that space-time is non-flat.

Now $R_{ij}=g^{rp}R_{rijp}$

The non-vanishing components of Ricci tensor are as follows

$$R_{33}=-R_{34}=R_{44}=\frac{1}{m}[(1+A)u+2Bv+(1-A)w]=N \tag{15}$$

Hence the solution of field equation $R_{ij}=0$ in empty region is equivalent to the solution of $N=0$.

SOLUTION OF EINSTEIN-MAXWELL EQUATIONS

By considering the propagation of $(z-t)-type$ waves along the positive direction of z-axis, we obtained the solution of field equation (2), (4), and (5). Two cases are considered for obtaining the solutions

Case I: $F_{ij}(Z)$ is transverse electromagnetic wave.

The electric and magnetic components of F_{ij} along the direction of propagation (i.e. z-direction) vanish and hence

$$E_{lz}=H_z=o$$
$$F_{ij}=K_{j,i}-K_{i,j} \tag{16}$$

From equation (14), (15), (16) and (17) , we have

$$E_x = F_{14}\ ,\ E_y = F_{24}\ ,\ E_z = F_{34}$$

$$H_z = F_{12}$$

Since $E_{lz} = H_z = 0$, implies

$$F_{34} = F_{12} = 0 \tag{17}$$

We take equivalent form of equation (4) as

$$\frac{\partial F_{ij}}{\partial x^k} + \frac{\partial F_{jk}}{\partial x^i} + \frac{\partial F_{ki}}{\partial x^j} = 0 \tag{18}$$

This equation gives

$$F_{14} = \sigma \quad , \quad F_{31} = \sigma + C_1$$

$$F_{23} = \rho \quad , \quad F_{24} = -\rho + C_2 \tag{19}$$

Where σ, ρ are arbitrary functions of Z and C_1, C_2 are constant.

We have $\quad F^{kl} = g^{ik} g^{jl} F_{ij}$

The non-vanishing components of F^{ij} are

$$\left.\begin{aligned}
F^{13} &= -\frac{1}{mc}\{(1+A)(\sigma+C_1) - \beta\rho\} \\
F^{14} &= -\frac{1}{mc}\{(1+A)\sigma + \beta(-\rho+C_2)\} \\
F^{23} &= -\frac{1}{mc}\{\beta(\sigma+C_1) - (1-A)\rho\} \\
F^{24} &= -\frac{1}{mc}\{\beta\sigma + (1-A)(-\rho+C_2)\}
\end{aligned}\right\} \tag{20}$$

From equation (9) and (10)

$$F_{kl}F^{kl} = -\frac{2}{mc}\left\{\begin{matrix}\sigma\left[(1+A)\sigma+\beta(-\rho+C_2\right]+(-\sigma-C_1)\left[(1+A)(\sigma+C_1)-\beta\rho\right]+ \\ \rho\left[\beta(\sigma+C_1)-(1-A)\rho\right]+(-\rho+C_2)\left[\beta\rho+(1-A)(-\rho+C_2)\right]\end{matrix}\right\} = \alpha \tag{21}$$

The non-zero components of the electromagnetic energy tensor are as follows,

$$\left.\begin{aligned}
E_{11} &= \frac{(A-1)\alpha}{4} + \frac{C_1}{C}(2\sigma + C_1) \\
E_{12} &= \frac{\beta\alpha}{4} - \frac{C_1}{C}(C_2\sigma + C_1\rho) \\
E_{22} &= \frac{(-A-1)\alpha}{4} + \frac{C_2}{C}(2\rho - C_2) \\
E_{33} &= \frac{-C\alpha}{4} + \frac{1}{m}[(\sigma+C_1)^2(1+A) - 2\beta\rho(\sigma+C_1) + \rho^2(1-A)] \\
E_{34} &= \frac{1}{m}[-\sigma(\sigma+C_1)(1+A) + (\sigma+C_1)\left(\rho-C_2\right)\beta + \rho\left(-\rho+C_2\right)(1-A)] \\
E_{44} &= \frac{C\alpha}{4} + \frac{1}{m}[\sigma^2(1+A) + 2\beta\sigma(-\rho+C_2) + (-\rho+C_2)^2(1-A)]
\end{aligned}\right\} \tag{22}$$

It is observed that

$$E_{33} = -E_{34} = E_{44} \tag{23}$$

And equation (22) and (23) give

$$C_1 = C_2 = 0$$

Using these constants in equations in (19) and (22) we have

$$F_{14} = -F_{13} = \sigma, F_{23} = -F_{24} = -\rho \tag{24}$$

$$\left.\begin{aligned}
F^{13} = F^{14} &= -\frac{1}{mC}[\sigma(1+A) - \rho\beta] \\
F^{23} = F^{24} &= -\frac{1}{mC}[\sigma\beta - \rho(1-A)]
\end{aligned}\right\} \tag{25}$$

$$F_{kl}F^{kl} = \alpha = 0 \tag{26}$$

With these values equation (23) becomes

$$E_{33} = -E_{34} = E_{44} = \frac{1}{m}[\sigma^2(1+A) - 2\beta\sigma\rho + \rho^2(1-A)]$$

And other $E_{ij} = 0$ (27)

Hence from equation (15) and (26) imply

$$N = -\frac{8\pi}{m}[\sigma^2(1+A) - 2\beta\sigma\rho + \rho^2(1-A)]$$

From equation (6), we have

$$\Gamma^j_{1j} = \Gamma^j_{2j} = 0 \ \text{ and } \ \Gamma^j_{3j} = -\Gamma^j_{4j} \tag{28}$$

From equation (25) and (28), we have

$$F^{ij}_{;j} = \frac{\partial F^{ij}}{\partial x^j} + F^{kj}\Gamma^i_{kj} + F^{ik}\Gamma^j_{ki} = 0 \tag{29}$$

Case II: The four potential $K_i = K_i(Z)$ are given below,

Using $F_{ij} = K_{j;i} - K_{i;j}$, we have

$$F_{11} = F_{12} = F_{22} = F_{33} = F_{44} = 0 \ ,F_{13} = -F_{14} = -\sigma \ ,F_{23} = -F_{24} = \rho, F_{34} = \eta \tag{30}$$

Where $\rho = -\overline{K_2}, \sigma = \overline{K_1}, \eta = \overline{K_4} + \overline{K_3}$ and ρ, σ, η are functions of Z .

Using $F^{kl} = g^{ik} g^{jl} F_{ij}$, we have

$$F^{13} = F^{14} = \frac{-1}{mC}[\sigma(1+A) - \beta\rho] \ ,F^{23} = F^{24} = \frac{-1}{mC}[\beta\sigma - \rho(1-A)] \ ,F^{34} = -\frac{\eta}{C^2} \tag{31}$$

And $F^{11} = F^{12} = F^{22} = F^{33} = F^{44} = 0$ (32)

Hence $F^{ij}F_{ij} = -\dfrac{2\eta^2}{C^2}$ (33)

The non-vanishing components of electromagnetic energy tensors are as follows

$$E_{13} = -E_{14} = -\frac{\sigma\eta}{C}, E_{23} = -E_{24} = \frac{\rho\eta}{C}$$

$$E_{12} = -\frac{\beta\eta^2}{2c^2}, E_{11} = \frac{(1-A)\eta^2}{2C^2}, E_{22} = \frac{(1+A)\eta^2}{2C^2}$$

$$E_{33} = \frac{\sigma}{m}[\sigma(1+A)-\rho\beta]-\frac{\rho}{m}[\sigma\beta-\rho(1-A)]-\frac{\eta^2}{2C}$$

$$E_{34} = \frac{\sigma}{m}[\sigma(1+A)-\rho\beta]-\frac{\rho}{m}[\sigma\beta-\rho(1-A)]$$

$$E_{44}=\frac{\sigma}{m}[\sigma(1+A)-\rho\beta]-\frac{\rho}{m}[\sigma\beta-\rho(1-A)]+\frac{\eta^2}{2C} \quad (34)$$

Then for $E_{a\alpha} = 0,(a=1,2;\alpha=3,4)$ we have following two cases:

Case- I: When $\eta = 0$, in this case, F_{ij} becomes equation (24), i.e. reduces Case II to Case I.

Case-II: When $\eta \neq 0, \sigma = \rho = 0$, In this case

$$E_{ab} = -(\frac{\eta^2}{2C^2})g_{ab} \neq 0,(a,b=1,2)$$

which contracts $E_{ab} = 0$, hence it cannot reduce to Case I.

CONCLUSIONS

In this paper the coexistence of plane gravitational waves with electromagnetic waves in a generalized space-time is established.

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KANTOWSKI-SACH BOUNCING COSMOLOGICAL MODEL WITH VISCOUS FLUIDS

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ABSTRACT

The bounce in viscous fluid cosmology with inhomogeneous viscous fluids in Kantowski space-time has been investigated by considering different forms of scale factor. The general features of the fluids which realize them and the possibility to have an acceleration after the bounce have been discussed.

Keywords: *Kantowski-SachSpace Time, Viscous Fluid, Energy Conditions*

INTRODUCTION

Observational evidence point towards an accelerated expansion of the universe. The astrophysical observations of the SN_eIa (Perlmutter*et al.*1999), cosmic microwave Radiation (Bennet*et al.* 2003; Spergel*et al.*2003), X-ray (Allen *et al.*2004), are the main evidences for the cosmic acceleration. For this acceleration expansion of the universe a new energy with negative pressure is driven which is commonly known as dark energy (DE). (Peebles and Ratra 2003). Dark energy is major component in energy field of the universe (Ade *et al.* 2013). The dark energy which is responsible for accelerated expansion of the universe has been captured a vast range of recherché in astrophysics. But till now the nature of dark energy is a challenging problem in theoretical physics.

The observations also indicate that the fluids in the universe is not a perfect fluids (Jaffe *et al.* 2005) and the viscosity plays role in the evolution of the universe (Brevik and Gorbunova 2005, Brevik*et al* 2005, Cataldo*et al.* 2005). Several interesting cosmological solutions with a variety of features obtain by considering the contain of the universe different from standard matter. Among them, the bounce, solutions (where the contraction is followed by an expansion at a finite time) are quite interesting (Novello and Bergliatta 2008, Battefeld and Peter 2015). In the matter bounce scenarios the initial contraction of the universe is in matter dominated stage, after that a universe without initial singularity appears leading to an expanding universe. In the context of bouncing cosmology, inclusion of viscosity Broadens the applicability of the considered theory.

Many different aspects of bounce cosmology have been analyzed in the literature (Belinsky*et al.* 1970). For BKL instability; Khoury*et al.* (2001) for the Ekpyrotic scenario, Piao*et al.* (2004), Liu etc (2013) for the conformation of the bounce universe with planck observation. (Bamba*et al.* 2014) have investigated bounce solutions in the framework of modified gravity and massive bi-gravity.

The aim of this work is to investigate the bounce cosmology induced by inhomogeneous viscous fluids in Kantowski-Sach space time. We will discuss different bounce solutions and the features of the related viscous fluids, taking into account the necessity to have a cosmic (inflationary) acceleration after the bounce. In particular, we are interested in the relation between bounce and singular solutions and in the corresponding relation between the viscous fluids realizing such a scenario.

The paper is organized as follows. In section 2, the formalism of inhomogeneous viscous fluid in Kantowski-Sach universe is presented. In section 3, we will analyze the bounce solutions in fluids cosmology. In section 4, the same investigations will be carried out for the bounce solutions, conclusions and remarks are given in section 5.

METRIC AND FIELD EQUATIONS

Kantowski-Sach space time is considered in the form

$$ds^2 = dt^2 - A^2 dr^2 - B^2\left(d\theta^2 + \sin^2\theta d\phi^2\right), \quad (1)$$

where A and B are scale factors and are functions of cosmic time t.

The energy-momentum tensor for the viscous fluid is given by

$$T_{ij} = \rho u_i u_j + p(u_i u_j - g_{ij}) \ , \quad (2)$$

where u_i are the co-moving four velocity vectors, ρ is the energy density and g_{ij} is the metric tensor.

The fluid in the universe is inhomogeneous viscous fluid with equation of state (Nojjiri and Odintsov 2005, 2006; Capozzielloet *al.* 2006)

$$p = \gamma(\rho)\rho - B(a, H, \dot{H}, ...) , \quad (3)$$

where the equation of state parameter γ may depend on ρ and bulk viscosity B is a general function of a, H and its derivatives. a is the average scale factor.

Using equations (2) and (3), the energy-momentum tensor for the viscous fluid is

$$T_{ij} = \rho u_i u_j + (\gamma(\rho)\rho + B(\rho, H, \dot{H}, ...))(u_i u_j - g_{ij}) . \quad (4)$$

The Einstein's field equations in general theory of gravitation are,

$$R^i_j - \frac{1}{2} R g^i_j = -T^i_j \ . \quad (5)$$

With the help of equation (4), the field equations (5) for the metric (1) are

$$2\frac{\dot{A}\dot{B}}{AB} + \frac{\dot{B}^2}{B^2} + \frac{1}{B^2} = \rho \ , \quad (6)$$

$$2\frac{\ddot{B}}{B} + \frac{\dot{B}^2}{B^2} + \frac{1}{B^2} = -p \ , \quad (7)$$

$$\frac{\ddot{A}}{A} + \frac{\ddot{B}}{B} + \frac{\dot{A}\dot{B}}{AB} = -p \ , \quad (8)$$

where an overhead dot $\left(\dot{} \right)$ represents differentiation with respect to *t*.

The energy-conservation equation, which is the consequence of the field equations (5)is given by,

$$T^{ij}_{;j} = 0 ,$$

where,

$$T^{ij}_{;j} = \frac{1}{\sqrt{-g}} \frac{\partial}{\partial x^j} \left(T^{ij} \sqrt{-g} \right) + T^{jk} \Gamma^i_{jk}$$

which simplifies to

$$\dot{\rho} + 3H(\rho + p) = 0 \ . \quad (9)$$

Using equation (3), equation (9) reduces to

$$\dot{\rho} + 3H(1 + \gamma(\rho))\rho = 3HB(\rho, a, H, \dot{H}......) \quad (10)$$

From the thermodynamic point of view, for positive entropy change in an irreversible process, the bulk viscosity must be a positive quantity (Brevik&Gorbunov 2005; Brevik&Gorbunov*et al.* 2006). The cosmological parameter Ω is defined as:

$$\Omega = 1 + \frac{1}{a^2 H^2} \ . \quad (11)$$

The quantity Ω in general may be different from(1).

By a bouncing universe, we mean a universe that undergoes a collapse, attains a minimum and then subsequently expands. For a successful bounce in Kantowski–Sachmodel, during contraction phase $a(t)$ is decreasing i.e. $(\dot{a}(t) < 0)$ and then in the expanding phase, the scale factor is increasing i.e. $(\dot{a}(t) > 0)$. At the bounce point i.e. at $t = t_b$, the minimal necessary condition is

i) $\dot{a}(t_b) = 0$ and

ii) $\ddot{a}(t) > 0$ for $t \in (t_b - \in, t_b) \cup (t_b, t_b + \in)$, for small $\in > 0$.

For non-singular bounce $a(t_b) \neq 0$. These conditions may not be sufficient for a non-singular bounce.

The bounce behaviour of cosmological model is also realized using energy conditions as mentioned in Paris&Visser (1999); Singh &Chaubey*et al.* 2016). In terms of (3) and(4), energy conditions can be stated as:

Null Energy Condition (NEC) is satisfied when $\rho + p \geq 0$.

Weak Energy Condition (WEC) is satisfied when $\rho \geq 0$ and $\rho + p \geq 0$.

Dominant Energy Condition (DEC) is satisfied when $\rho \geq |p|$.

Strong Energy Condition (SEC) is satisfied when $\rho + p \geq 0$ and $\rho + 3p \geq 0$ It is clear that, violation of NEC will lead to a violation of other energy conditions. (i.e. SEC) realizing the bounce.

SOLUTION OF FIELD EQUATIONS

The field equations (6) to (8) are a system of three highly nonlinear differential equations in four unknowns A, B, ρ and γ. The system is thus initially undetermined. We need one extra condition for solving the field equations completely. We assume that the scalar expansion (θ) is proportional to shear (σ). This condition leads to

$$\frac{1}{\sqrt{3}}\left(\frac{\dot{A}}{A}-\frac{\dot{B}}{B}\right)=\alpha_0\left(\frac{\dot{A}}{A}+2\frac{\dot{B}}{B}\right),$$

which yields

Above equation after integration reduces to

$$A=\eta(B)^m,$$

where η is an integration constant.

Here, for simplicity and without loss generality, we assume that $\eta = 1$.

Hence, we have

$$A=(B)^m,(m\neq 1), \qquad (12)$$

Collins *et al.* have pointed out that for spatially homogenous metric, thenormal congruence to the homogenous expansion satisfies that the condition $\frac{\sigma}{\theta}$ is constant (Collins 1980).

CASE I : FLUID MODEL WITH $a(t)=\sqrt{a_0^2+\beta^2t^2}$:

The bouncing cosmological model has been obtained by choosing the average scale factor $a(t)$ of the form (Paris & Viiser,1999)

$$a(t)=\sqrt{a_0^2+\beta^2t^2}, \qquad (13)$$

where a_0, β are non-zero positive constants.

The above scale factor is the temporal analogue of the toy model traversable wormhole (Morris & Thorne 1988). One may get phenomenological quintom bouncing model with proper renormalization of a_0,β (Cai*et al.* 2007).

The Hubble parameter is given by

$$H(t)=\frac{\dot{a}}{a}=\frac{\beta^2t}{a_0^2+\beta^2t^2}. \qquad (14)$$

In terms of geometrical quantities, we have

$$\frac{\ddot{a}}{a}=\dot{H}+H^2=\frac{(\beta a_0)^2}{(a_0^2+\beta^2t^2)^2}. \qquad (15)$$

For the metric (1), the average scale factor is given by

$$a(t)=(AB^2)^{\frac{1}{3}}, \qquad (16)$$

From the equations (13)and(16), we have

$$AB^2=\left(a_0^2+\beta^2t^2\right)^{\frac{3}{2}}. \qquad (17)$$

Using equation (12), it reduces to

$$B=\left(a_0^2+\beta^2t^2\right)^{\frac{3}{2(m+2)}}. \qquad (18)$$

Using equation(18), equation (12) leads to

$$A=\left(a_0^2+\beta^2t^2\right)^{\frac{3m}{2(m+2)}}. \qquad (19)$$

With the help of equations (18)and(19), the metric (1) becomes

$$ds^2=dt^2-(a_0^2+\beta^2t^2)^{\frac{3m}{m+2}}dr^2-(a_0^2+\beta^2t^2)^{\frac{3}{m+2}}(d\theta^2+\sin^2\theta d\phi^2). \qquad (20)$$

Equation(20) represents Kantowski-Sach bouncing cosmological model with the viscous fluid in general theory of relativity.

4.1 SOME PHYSICAL PROPERTIES OF THE MODEL

For the cosmological model (20), the physical quantities such as spatial volume V, Hubble parameter H, expansion scalar θ, mean anisotropy A_m,shear scalar σ^2, energy density ρ are obtained as follows:

The spatial volume is in the form

$$V=a^3=(a_0^2+\beta^2t^2)^{\frac{3}{2}}. \qquad (21)$$

The Hubble parameter is

$$H=\frac{1}{3}\left(\frac{\dot{A}}{A}+2\frac{\dot{B}}{B}\right)=\frac{\beta^2t}{a_0^2+\beta^2t^2}. \qquad (22)$$

The expansion scalar is

$$\theta=3H=\frac{3\beta^2t}{a_0^2+\beta^2t^2}. \qquad (23)$$

The mean anisotropy parameter A_m is

$$A_m=\frac{2(m-1)^2}{(m+2)^2}=const.\neq 0, \quad \text{for } m\neq 1. \qquad (24)$$

The shear scalar is

$$\sigma^2=\frac{3(m-1)^2\beta^4t^2}{(m+2)^2(a_0^2+\beta^2t^2)^2}. \qquad (25)$$

It is observed that

$$\lim_{t\to\infty}\frac{\sigma^2}{\theta^2}=\frac{1}{3}\frac{(m-1)^2}{(m+2)^2}\neq 0, \quad \text{for } m\neq 1. \qquad (26)$$

The mean anisotropy parameter A_m and $\lim_{t\to\infty}\frac{\sigma^2}{\theta^2}\neq 0$ is constant. Hence the model is anisotropic throughout the evolution of the universe, except at $m=1$ (i.e. the model does not approach isotropy).

The matter-energy density is given by

$$\rho=\frac{9(m+2)\beta^4t^2}{(m+2)^2(a_0{}^2+\beta^2t^2)^2}+\frac{1}{(a_0{}^2+\beta^2t^2)^{\frac{3}{m+2}}}\ , \quad (27)$$

$$\rho+p=\frac{6(5m+1)\beta^4t^2}{(m+2)^2(a_0{}^2+\beta^2t^2)^2}-\frac{6\beta^2}{(m+2)(a_0{}^2+\beta^2t^2)}\ , \quad (28)$$

$$\rho-p=2\left[\frac{9}{(m+2)}(a_0^2+\beta^2t^2)^{-2}-\frac{6\beta^4t^2}{(m+2)}(a_0^2+\beta^2t^2)^{-2}+(a_0^2+\beta^2t^2)^{\frac{-3}{(m+2)}}\right] \quad (29)$$

$$\rho+3p=\frac{54m\beta^4t^2}{(m+2)^2(a_0^2+\beta^2t^2)^2}-\frac{18\beta^2}{(m+2)(a_0^2+\beta^2t^2)}-\frac{2}{(a_0^2+\beta^2t^2)^{\frac{3}{m+2}}} \quad (30)$$

The cosmological parameter for the closed universe takes the form,

$$\Omega=1+\frac{1}{a^2H^2},$$

$$\Omega=1+\frac{1}{\beta^2}+\frac{a_0{}^2}{\beta^4t^2}. \quad (31)$$

The bulk viscosity is

$$B(a,H,\dot{H}......)=3H\zeta. \quad (32)$$

In this specific case, equation(3), takes the form

$$p=-\rho+3H\zeta\ . \quad (33)$$

From equation (28), we have

$$3H\zeta=\frac{6(5\,m+1)\,H^2}{(m+2)^2}-\frac{6\beta^2}{(m+2)a^3}$$

Dividing by $3H$

$$\zeta(H,a)=\frac{2(5m+1)H}{(m+2)^2}-\frac{2\beta^2}{(m+2)Ha^2}. \quad (34)$$

In equation (33), When the scale factor becomes large, $\zeta(H)\approx\frac{2(5m+1)H}{(m+2)^2}$ and then we can treat it as a fluid with a bulk viscosity of $o(H)$. Therefore, with $\zeta(H,a)$, we can recognize bouncing universe with the scale factor (13).

In another example, we take $\gamma(\rho)=\gamma$ (constant) and $B(\rho,a,H,\dot{H}......)=4H\zeta$ with $\zeta=\in\rho$, where $\in$ is a constant.

From equation (9), we have

$$\dot{\rho}=-3H(\rho+p)$$

Using equation (3), we get

$$\dot{\rho}=-3H\left(\gamma(\rho)\rho-\mathrm{B}(\mathrm{a},\mathrm{H},\dot{\mathrm{H}},.....)\right)$$

Since, $\zeta=\in\rho$ and $B(a,H,\dot{H},.......)=3H\zeta$, we have

$$\rho=\frac{a_1}{(a_0{}^2+\beta^2t^2)^{\frac{3(1+\gamma-\in)}{2}}}$$

where, a_1 is a constant of integration.

Also, from equation (3) we get

$$p=\gamma(\rho)\rho-B(a,H,\dot{H},.......)$$

Using $\gamma(\rho)=\gamma=$Constant,and $B(a,H,\dot{H},.......)=3H\zeta$ we get

$$p=(\gamma-3H\in)\rho. \quad (35)$$

The scenario with $\gamma=$ constant, $\zeta=\in\rho$ the energy density of the bouncing universe will decrease with increasing time (provided, $(1+\gamma>\in)$) and also the bulk viscosity. For the large time t, p will become negative.

Fig. 5.1 represents the plots of time versus (a) Average scale factor (b) Hubble parameter (c) Energy density (ρ) (d) $\rho+p$ (e) $\rho-p$ (f) $\rho+3p$

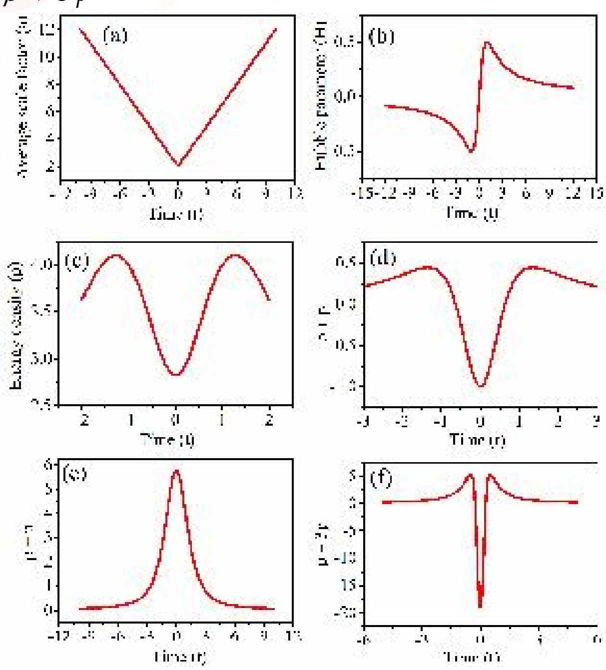

Fig. 4.1 Plots of time versus (a) Average scale factor (b) Hubble parameter (c) Energy density (ρ) (d) $\rho+p$ (e) $\rho-p$ (f) $\rho+3p$

DISCUSSION

Fig. (4.1) (a) is the plot of time versus average scale factor. It is seen that, during contraction phase, the average scale factor $a(t)$ is decreasing (i.e. $\dot{a}(t)<0$) and then in the expanding phase $a(t)$ is increasing (i.e. $\dot{a}(t)>0$). Hence, the minimal necessary conditions (i) and (ii) for the bounce at time $t=0$ are satisfied (Singh &Chaubey 2016).

(i) $\dot{a}(t)=0$ at $t=0$

and (ii) at $t=0$, $\ddot{a}(t)>0$ for $t\in(0-\in,0)\cup(0,0+\in)$, where $\in$ is very small.

Fig. (4.1) (b) is the plot of time versus Hubble parameter. At $t=0$, we get $H=0$ and $a(0)=a_0$ with $\dot{H}(t)>0$ in small neighborhoodof $t=0$, provided $a_0>\beta t$. Thus it satisfies the necessary condition of bounce (Singh*et al.* 2015a, 2015b). After the bounce, the universe expands in an accelerated way.

To realize the bounce in our model, let we obtain the values of ρ, $\rho+p$, $\rho-p$ and $\rho+3p$ for $m=2$.

$$\rho=(2.25)\beta^4t^2(a_0{}^2+\beta^2t^2)^{-2}+(a_0{}^2+\beta^2t^2)^{-\frac{3}{4}},$$

$$\rho+p=(4.12)\beta^4t^2(a_0^2+\beta^2t^2)^{-2}-(1.5)\beta^2(a_0^2+\beta^2t^2)^{-1},$$

$$\rho-p=(4.8)(a_0^2+\beta^2t^2)^{-2}-3\beta^4t^2(a_0^2+\beta^2t^2)^{-2}+2(a_0^2+\beta^2t^2)^{-(0.75)},$$

$$\rho+3p=(6.75)\beta^4t^2(a_0^2+\beta^2t^2)^{-2}-(4.5)\beta^2(a_0^2+\beta^2t^2)^{-1}-2(a_0^2+\beta^2t^2)^{-(0.75)}.$$

From Fig. (5.1) (c), (d), (e) and (f) are the plots of time versus energy density (ρ), $\rho+p$, $\rho-p$ and $\rho+3p$. It is observed that WEC, NEC and DEC energy conditions are satisfied at $t=0$ but SEC is violated at $t=0$. Hence, the bounce is realized in our model at $m=2$.

5. CASE II : FLUID MODEL WITH SCALE FACTOR $a(t)=a_1(e^{\alpha t}+e^{-\alpha t})$

The bouncing cosmological model has been obtained by choosing the average scale factor *a(t)* of the form (Bamba*et al.*2014)

$$a(t)=a_1(e^{\alpha t}+e^{-\alpha t}), \tag{36}$$

where the a_0,β are non-zero positive constants.

The Hubble parameter is given by

$$H(t)=\frac{\dot{a}}{a}=\frac{\alpha(e^{\alpha t}-e^{-\alpha t})}{(e^{\alpha t}+e^{-\alpha t})}. \tag{37}$$

For the metric(1), the average scale factor is given by

$$a(t)=(AB^2)^{\frac{1}{3}}. \tag{38}$$

From the equations (36) and (38) we have

$$AB^2=a_1^3(e^{\alpha t}+e^{-\alpha t})^3 \tag{39}$$

With the help of equation(12), equation (39) reduces to

$$B=a_1{}^{\frac{3}{m+2}}(e^{\alpha t}+e^{-\alpha t})^{\frac{3}{m+2}}. \tag{40}$$

With the help of equation (40), equation (12) leads to

$$A=a_1{}^{\frac{3m}{m+2}}(e^{\alpha t}+e^{-\alpha t})^{\frac{3m}{m+2}}. \tag{41}$$

With the help of equations (40) and (41), the metric (1) can be written as

$$ds^2=dt^2-a_1^{\frac{6m}{m+2}}(e^{\alpha t}+e^{-\alpha t})^{\frac{6m}{m+2}}dr^2-a_1^{\frac{6}{m+2}}(e^{\alpha t}+e^{-\alpha t})^{\frac{6}{m+2}}(d\theta^2+\sin^2\theta d\phi^2) \tag{42}$$

The equation(42)represents Kantowski-Sachs cosmological model with viscous fluid in general theory of relativity.

5.1 SOME PHYSICAL PROPERTIES OF THE MODEL :

For the cosmological model (42), the physical quantity such as spatial volume V, Hubble parameter H, expansion scalar θ, mean anisotropy A_m, shear scalar σ^2 energy density ρ, are obtained as follows.

The spatial volume is in the form

$$V=a_1^3(e^{\alpha t}+e^{-\alpha t})^3. \tag{43}$$

The Hubble parameter is

$$H=\frac{1}{3}\left(\frac{\dot{A}}{A}+2\frac{\dot{B}}{B}\right)=\frac{\alpha(e^{\alpha t}-e^{-\alpha t})}{(e^{\alpha t}+e^{-\alpha t})}. \tag{44}$$

The expansion scalar is given by

$$\theta=3H=\frac{3\alpha(e^{\alpha t}-e^{-\alpha t})}{(e^{\alpha t}+e^{-\alpha t})}. \tag{45}$$

The mean anisotropy parameter is given by

$$A_m = \frac{2(m-1)^2}{(m+2)^2} = \text{constant} \neq 0 \text{ , for } m \neq 1. \quad (46)$$

The shear scalar is

$$\sigma^2 = \frac{3\alpha^2(m-1)^2}{(m+2)^2}\frac{(e^{\alpha t}-e^{-\alpha t})^2}{(e^{\alpha t}+e^{-\alpha t})^2}. \quad (47)$$

It is observed that

$$\lim_{t\to\infty}\frac{\sigma^2}{\theta^2} = \frac{1}{3}\frac{(m-1)^2}{(m+2)^2} = \text{ constant} \neq 0 \text{ , for } m \neq 1. \quad (48)$$

The mean anisotropy parameter A_m is constant and $\lim_{t\to\infty}\frac{\sigma^2}{\theta^2} \neq 0$ is also constant. Hence the model is anisotropic throughout the evolution of the universe, except at $m=1$ (i.e. the model does not approach isotropy).

The matter-energy density is given by

$$\rho = \frac{9\alpha^2(2m+1)}{(m+2)^2}\frac{(e^{\alpha t}-e^{-\alpha t})^2}{(e^{\alpha t}+e^{-\alpha t})^2} + a_1^{\frac{-6}{(m+2)^2}}(e^{\alpha t}+e^{-\alpha t})^{\frac{-6}{m+2}}, \quad (49)$$

$$\rho + p = \frac{6\alpha^2(4m-1)}{(m+2)^2}\frac{(e^{\alpha t}-e^{-\alpha t})^2}{(e^{\alpha t}+e^{-\alpha t})^2} - \frac{6\alpha^2}{(m+2)}, \quad (50)$$

$$\rho - p = 2\left[\frac{6\alpha^2}{(m+2)}\frac{(e^{\alpha t}-e^{-\alpha t})^2}{(e^{\alpha t}+e^{-\alpha t})^2} + \frac{3\alpha^2}{(m+2)} + a_1^{\frac{-6}{(m+2)}}(e^{\alpha t}-e^{-\alpha t})^{\frac{-6}{(m+2)}}\right] \quad (51)$$

$$\rho + 3p = \frac{36\alpha^2(m-1)}{(m+2)^2}\frac{(e^{\alpha t}-e^{-\alpha t})^2}{(e^{\alpha t}+e^{-\alpha t})^2} - \frac{18\alpha^2}{(m+2)} - 2a_1^{\frac{-6}{(m+2)}}(e^{\alpha t}+e^{-\alpha t})^{\frac{-6}{m+2}} \quad (52)$$

Fig. 5.1 represents the plots of time versus (a) Average scale factor (b) Hubble parameter (c) Energy density (ρ) (d) $\rho+p$ (e) $\rho-p$ (f) $\rho+3p$.

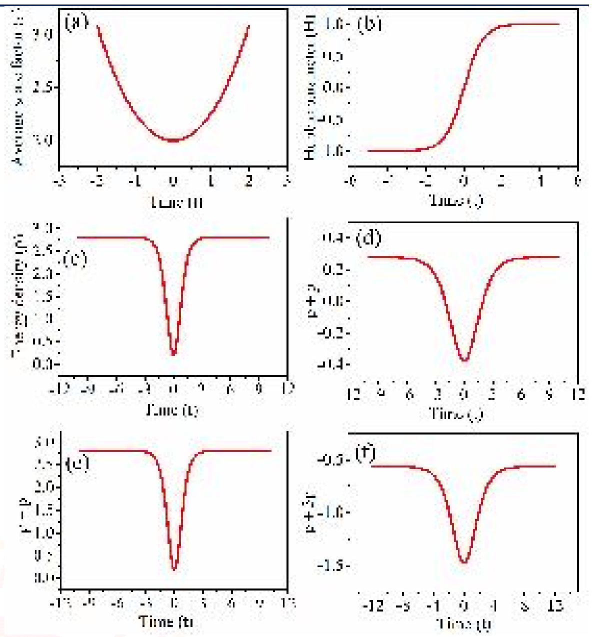

Fig. 5.1 Plots of time versus (a) Average scale factor (b) Hubble parameter (c) Energy density (ρ) (d) $\rho+p$ (e) $\rho-p$ (f) $\rho+3p$.

The cosmological parameter for the closed universe takes the form:

$$\Omega = 1 + \frac{1}{a^2H^2}$$

$$\Omega = 1 + \frac{1}{a_1^2\alpha^2(e^{\alpha t}+e^{-\alpha t})^2}. \quad (53)$$

Discussion : Fig. (5.1) (a) is the plot of time versus average scale factor. It is seen that, during contraction phase, the average scale factor $a(t)$ is decreasing (i.e. $\dot{a}(t)<0$) and then in the expanding phase $a(t)$ is increasing (i.e. $\dot{a}(t)>0$). Hence, the minimal necessary conditions (i) and (ii) for the bounce at time $t=0$ are satisfied (Singh*et al.* 2016).

(i) $\dot{a}(t)=0$ at $t=0$

and (ii) at $t=0$, $\ddot{a}(t)>0$ for $t \in (0-\in, 0) \cup (0, 0+\in)$, where $\in$ is very small.

Fig. (5.1) (b) is the plot of time versus Hubble parameter. At the time $t=0$, $H=0$ and $a(0)=2a_1$ with $\dot{H}(t)>0$ in small neighborhood of $t=0$. Therefore, the above scale factor satisfies necessary conditions for a non-singular bounce. With the above scale factor, we have $\ddot{a}>0$ before and after the bounce (Singh *et al.* 2015 , 2015).

From Fig. (5.2) (c), (d), (e) and (f) are the plots of time versus energy density (ρ), $\rho+p$, $\rho-p$ and $\rho+3p$. To realize the bounce in our model, let we obtain the values of ρ, $\rho+p$, $\rho-p$ and $\rho+3p$ for $m=2$.

$$\rho=(2.81)\alpha^2\frac{(e^{\alpha t}-e^{-\alpha t})^2}{(e^{\alpha t}+e^{-\alpha t})^2}+a_1^{-(0.37)}(e^{\alpha t}+e^{-\alpha t})^{-(1.5)},$$

$$\rho+p=(2.62)\alpha^2\frac{(e^{\alpha t}-e^{-\alpha t})^2}{(e^{\alpha t}+e^{-\alpha t})^2}-(1.5)\alpha^2,$$

$$\rho-p=3\alpha^2\frac{(e^{\alpha t}-e^{-\alpha t})^2}{(e^{\alpha t}+e^{-\alpha t})^2}+(1.5)\alpha^2+2a_1^{-(1.5)}(e^{\alpha t}+e^{-\alpha t})^{-(1.5)},$$

$$\rho+3p=(2.25)\alpha^2\frac{(e^{\alpha t}-e^{-\alpha t})^2}{(e^{\alpha t}+e^{-\alpha t})^2}-(4.5)\alpha^2-2a_1^{-(1.5)}(e^{\alpha t}+e^{-\alpha t})^{-(1.5)}.$$

It is observed that WEC, NEC and DEC energy conditions are satisfied at $t=0$ but SEC is violated at $t=0$. Hence, the bounce is realized in our model at $m=2$.

As an example of viscous fluid realizing bounce scenario, we take $\gamma=-1$ and bulk viscosity is given by

$B(a,H,\dot{H}......)=3H\zeta$, ($\zeta$ being coefficient of bulk viscosity), we have

$$p=-\rho+3H\zeta, \qquad (54)$$

From equation (50), we have

$$3H\zeta=\rho+p$$

$$=\frac{6(4m-1)H^2}{(m+2)^2}-\frac{6\alpha^2}{(m+2)}$$

Dividing by *3H*

$$\zeta(H)=\frac{2(4m-1)H}{(m+2)^2}-\frac{2\alpha^2}{(m+2)H}. \qquad (55)$$

As another example, we take $\gamma(\rho)=\gamma$ (constant) and $B(a,H,\dot{H}......)=3H\zeta$ with $\zeta=\in\rho$, where $\in$ is a constant.

From equation (9), we have

$$\dot{\rho}+3H(\rho+p)=0$$

$$\dot{\rho}=-3H(\rho+p).$$

Using equation (3) we get,

$$\dot{\rho}=-3H(\rho+p)$$

$$=-3H(\gamma(\rho)\rho-B(a,H,\dot{H},.......))$$

Since, $\zeta=\in\rho$ and $B(a,H,\dot{H},.......)=3H\zeta$, we have

$$\Rightarrow \quad \dot{\rho}=3H\rho(\in-(1+\gamma))$$

$$\Rightarrow \quad \frac{\dot{\rho}}{\rho}=-3H(1+\gamma-\in).$$

Using equation (37), we get

$$\frac{\dot{\rho}}{\rho}=-3\left(\frac{\alpha(e^{\alpha t}-e^{-\alpha t})}{(e^{\alpha t}+e^{-\alpha t})}\right)(1+\gamma-\in).$$

Integrating with respect to t

$$\rho=\frac{\rho_0}{(e^{\alpha t}+e^{-\alpha t})^{3(1+\gamma-\in)}}, \qquad (56)$$

where, ρ_0 is a constant.

Also, from equation (3) we get

$$p=\gamma(\rho)\rho-B(a,H,\dot{H},.......). \qquad (57)$$

Using $\gamma(\rho)=\gamma=$ Constant and $B(a,H,\dot{H},.......)=3H\zeta$, we get $p=(\gamma-3H\in)\rho$.

Therefore, the scenario with $\gamma=$ constant, $\zeta=\in\rho$, the energy density of bouncing universe will decrease with increasing time (provided $1+\gamma>\in$).

CONCLUSIONS

Kantowski-Sach cosmological has been investigated with viscous fluid by considering two specific forms of the scale factors proposed by Molina-Parris and Visser, and Bamba*et al.* In both the cosmological models, it is realized that there is existence of bounce at point $t=0$.

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EXISTENCE AND UNIQUENESS OF FRACTIONAL DIFFERENTIAL EQUATIONS WITH BOUNDARY VALUE CONDITION.

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ABSTRACT

In this paper, the existence and uniqueness of solutions of Caputo Fractional Differential Equations with boundary value condition is investigated. We apply comparison result due to Vasundhara Devi to develop monotone iterative technique for the problem instead of fixed point method and obtain th existence and uniqueness of solution of the problem. Recently LinLiLv et.al.[OpusculuMathematica, Vol.31,No.4,2011] established existence and uniqueness results of solutions by virtue of fractional calculus and fixed point method under some weak conditions.Our method is different we apply monotone iterative technique instead of fixed point theory.

Keywords: *Fractional Differential Equation,Upper and Lower solutions, Boundary Value Problem(BVP).*

INTRODUCTION

Fractional Calculus is the field of mathematical analysis which deals with the investigation and applications of integrals and derivatives of arbitrary order[6].It is as old as differential calculus. Abel who is the first use the fractional derivative[2]. During the second half of the twentieth century, considerable amount of research in fractional calculus was published in engineering literature.Indeed ,recent advances of fractional calculus are dominated by modern examples of applications in differential and integral equations ,physics,signal processing,fluid flows, viscoelasticity, mathematical biology, and electrochemistry, solute transport, dynamical processes in self similar and porous structures, diffusive transport a kin to diffusions, Material viscoelasticity theory, electromagnetic theory, dynamical systems,optics and signal processing, bio-sciences, economics, geology, astrophysics, probabality and statistics, chemical physics[2,10,5,2,7].

In this paper, we investigate using the monotone iterative technique the existence and uniqueness of solutions of Caputo Fractional Differential Equations with boundary value condition. We consider the following fractional differential equations.

PRELIMINARIES

Consider the following boundary value problem for fractional differential equations

$$\mathrm{D}_*^\alpha x(t) = f(t,x(t)),\ \ 0<\alpha<1\ ,t\in J=[0,T] \quad (1)$$

$$ax(0)+bx(T)=c$$

Where $f \in C[\mathrm{J}X\mathbb{R},\mathbb{R}]$ and $f(t,x(t))$nondecreasing in $x(t)$, uniformly in t, . D_*^α *is the Caputo fractional derivative of order α and a,b,c are real constant with $a+b\neq 0$.*

Definition 1[5] The Riemann-Liouville fractional integral of order α (0< α <1) is defined as

$$\mathrm{I}_t^\alpha x(t) = \frac{1}{\Gamma(\alpha)}\int_0^t (t-s)^{\alpha-1}x(s)ds \quad (2)$$

Definition 2[5] The Caputo fractional derivative of order α (0< α <1) is defined as

$$\mathrm{D}_*^\alpha x(t) = \frac{1}{\Gamma(n-\alpha)}\int_0^t (t-s)^{n-\alpha-1}x^{(n)}(s)ds \quad (3)$$

***Lemma* 1**[8] *A function $x \in C(J,R)$ is a solution of the fractional integral equations*

$$x(t) = \frac{1}{\Gamma(\alpha)}\int_0^t (t-s)^{\alpha-1}f(s,x(s))ds - \frac{1}{a+b}\left[\frac{b}{\Gamma(\alpha)}\int_0^T (T-s)^{\alpha-1}f(s,x(s))ds - c\right]$$

If and only if $x(t)$ is a solution of the of the following fractional BVP

$$\mathrm{D}_*^\alpha x(t) = f(t),\ \ 0<\alpha<1\ \ t\in J=[0,T] \quad (4)$$

$$ax(0)+bx(T)=c$$

***Lemma* 2** [9] *A function $x \in C(J,R)$ is a solution of the fractional integral equations*

$$x(t) = \frac{1}{\Gamma(\alpha)}\int_0^t (t-s)^{\alpha-1} f(s,x(s))ds - \frac{1}{a+b}\left[\frac{b}{\Gamma(\alpha)}\int_0^T (T-s)^{\alpha-1} f(s,x(s))ds - c\right]$$

If and only if x is a solution of the of the fractional BVP(1).

Remark (1) *[Linearity property] The Caputo fractional derivative operator is linear*

$$D_*^\alpha[\lambda x_1(t) + \mu x_2(t)] = \lambda D_*^\alpha x_1(t) + \mu D_*^\alpha x_2(t)$$

Definition 3. *A pair of functions $u(t)$and $v(t)$in $C(J,R)$ are called lower and upper solutions of the nonlinear BVP (1) if*

$$D_*^\alpha u(t) \le f(t,u(t)),\ \ au(0) + bu(T) = c \quad on\ J$$
$$D_*^\alpha v(t) \ge f(t,v(t)),\ \ av(0) + bv(T) = c \quad on\ J$$

Theorem 3. *The linear fractional BVP*

$$D_*^\alpha x(t) = f(t),\ \ 0 < \alpha < 1 \quad , \quad t \in J = [0,T]$$
$$ax(0) + bx(T) = c$$

has unique solution.

Proof: Let $x_1(t)$ and $x_2(t)$ be two solutions of (4). Then , we have

$$D_*^\alpha x_1(t) = f(t) ax_1(0) + bx_1(T) = c$$
$$D_*^\alpha x_2(t) = f(t) ax_2(0) + bx_2(T) = c$$

Hence, by linearity property of Caputo fractional derivative Remark(1) , we have

$$D_t^\alpha(x_1(t) - x_2(t)) = f(t) - f(t) = 0$$

and $ax_1(0) + bx_1(T) - (ax_2(0) + bx_2(T)) = c - c = 0$

$$ax_1(0) + bx_1(T) = ax_2(0) + bx_2(T)$$

This implies that

$x_1(t) - x_2(t) = k$ *where k is a constant . Let* $k = 0$

$$x_1(t) - x_2(t) = 0$$
$$x_1(t) = x_2(t)$$

This completes the proof.

3. Existence and Uniqueness Result:

Theorem 4: *[Existence Theorem] Assumethat*

(i) $f(t,x(t))$ *in* $C(J \times R, R)$ *is monotone nondecreasing in x for each t.*

(ii) $u_0(t)$ *and* $v_0(t)$ *in* $C(J,R)$*are lower and upper solutions of (1)Such that* $u_0(t) \le v_0(t)$ *on J.*

(iii)function $f(t,x(t))$ *satisfy Lipschiz condition,* $|f(t,u) - f(t,v)| \le L|u-v|$ *,* $L \ge 0$.

Proof: *Define the sequences as follows*

$$D_*^\alpha u_{n+1}(t) = f(t,u_n(t)),\ \ au_n(0) + bu_n(T) = c \quad (5)$$
$$D_*^\alpha v_{n+1}(t) = f(t,v_n(t)),\quad av_n(0) + bv_n(T) = c$$

It follows that there exists unique solutions $u_{n+1}(t)$ *and* $v_{n+1}(t)$*for the above equations. Putting* $n = 0$ *in (5) the existence of solution of* $u_1(t)$*and*$v_1(t)$*is clear. Next show that*

$$u_0(t) \le u_1(t) \le v_1(t) \le v_0(t)$$

Setting $p(t) = u_1(t) - u_0(t)$ *we have*

$$D_*^\alpha p(t) = D_*^\alpha u_1(t) - D_*^\alpha u_0(t) \ge 0 \ and p(t) \ge 0$$

Hence $u_1(t) \le u_0(t)$ *. Similarly we prove* $v_1(t) \le v_0(t)$ *and* $u_1(t) \le v_1(t)$.

Thus $u_0(t) \le u_1(t) \le v_1(t) \le v_0(t)$.

Assume that for some $k > 1$, $u_{k-1}(t) \le u_k(t) \le v_k(t) \le v_{k-1}(t)$.

We claim that $u_k(t) \le u_{k+1}(t) \le v_{k+1}(t) \le v_k(t)$ *on J.*

To prove this, set $p(t) = u_{k+1}(t) - u_k(t)$*, Since* $f(t,u(t))$ *is nondecreasing in u, we have*

$$D_*^\alpha p(t) = D_*^\alpha u_{k+1}(t) - D_*^\alpha u_k(t) \ge 0 \ and\ p(0) \ge 0.$$

Hence $p(t) \ge 0$ *implies that* $u_{k+1}(t) \ge u_k(t)$*. Similarly, we can prove that* $v_{k+1}(t) \ge u_{k+1}(t)$

Using corresponding fractional Volterra integral equations.

$$u_{n+1}(t) = \frac{1}{\Gamma(\alpha)}\int_0^t (t-s)^{\alpha-1} f(s,u_{n+1}(s))ds - \frac{1}{a+b}\left[\frac{b}{\Gamma(\alpha)}\int_0^T (T-s)^{\alpha-1} f(s,u_{n+1}(s))ds - c\right] \quad (6)$$

$$v_{n+1}(t) = \frac{1}{\Gamma(\alpha)}\int_0^t (t-s)^{\alpha-1} f(s,v_{n+1}(s))ds - \frac{1}{a+b}\left[\frac{b}{\Gamma(\alpha)}\int_0^T (T-s)^{\alpha-1} f(s,v_{n+1}(s))ds - c\right]$$

It follows that $u(t)$*and* $v(t)$ *are solutions of* (5).

Next, we claim that $u(t)$*and* $v(t)$*are minimal and maximal solution of* (1).

Let $x(t)$ *be any solution of* (2.1) *different from* $u(t)$*and* $v(t)$*, so t□at t□ere exists k such that*

$$u_k(t) \le x_k(t) \le v_k(t) on J.$$

and set $p(t) = x_k(t) - u_{k+1}(t)$ *, so that*

$$D_*^\alpha p(t) = D_*^\alpha x_k(t) - D_*^\alpha u_{k+1}(t) \ge M(x_k(t) - u_{k+1}(t)) \ge Mp(t) \ and\ p(t) \ge 0$$

Thus $x_k(t) \ge u_{k+1}(t) on J$*. Since* $x_0(t) \ge u_0(t)$ *on J, by mathematical induction it follows that* $x_k(t) \ge u_k(t)$ *. Similarly, we can prove* $v_k(t) \ge x_k(t)$ *for all k on J.*

Thus $u_k(t) \le x_k(t) \le v_k(t)$*on J. Taking* limit *as* $n \to \infty$*, it follows that*

$$u(t) \le x(t) \le v(t) on J.$$

Theorem 5. *[Uniqueness Theorem] Assume that*

(i) $f(t,x(t))$ *in* $C(J \times R, R)$*is monotone nondecreasing in x for each t.*

(ii) $u_0(t)$ *and* $v_0(t)$ *in* $C(J,R)$*are lower and upper soluions of (1)Such that*$u_0(t) \le v_0(t)$ *on J.*

(iii)function $f(t,x(t))$ *satisfy Lipschiz condition,* $|f(t,u) - f(t,v)| \le L|u-v|$ *,* $L \ge 0$.

$(iv) \lim_{n\to\infty} \|v_n(t) - u_n(t)\| = 0$, *where the norm is defined by* $\|f\| = \int_0^t |f(s)|ds$.

Then the solution of (1) is unique.

Proof: *Since* $u(t) \le v(t)$ *it is sufficent to prove* that $u(t) \ge v(t)$

Consider $p(t) = u(t) - v(t)$

$$D_*^\alpha p(t) = D_*^\alpha u(t) - D_*^\alpha v(t) \ge M\big(u(t) - v(t)\big) \ge Mp(t) \text{ and } p(0) \ge 0.$$

Thus $p(t) \ge 0$ *implies* that $u(t) \ge v(t)$. *Hence* $u(t) \ge v(t)$ *is the unique solution of* (1) *on* J.

This completes the proof.

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AN INTEGRAL TRANSFORM APPROACH FOR SOLVING AXISYMMETRIC HEAT CONDUCTIONPROBLEMIN A THIN DISK FOR AN INFINITE ELLIPTICAL DOMAIN

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ABSTRACT

The aim of the present paper is to solve the boundary value problem with the axisymmetric temperature field to elliptical disc subjected to the activity of an internal heat source. The temperature distribution is resolute by the heat conduction differential equation and its corresponding boundary conditions by employing an incipient integral transform technique involving elliptical coordinate.The aforesaid solution is further verified by comparing them to the circumscribing case of a circle as a special kind of ellipse.

Keywords: *Elliptical disk, temperature distribution,Integral transform, Mathieu functions.*

INTRODUCTION

Heat conduction problems with Dirichlet-type boundary conditions frequently occur in engineering and technology applications.Such examples include the dip-forming process in metallurgy, the surface rewetting during loss-of-coolant accidents, the contact resistance between solids, etc. In the heat conduction analysis of these problems, the conventional integral transform method cannot be applied to elliptical structures. It may be due to the complexity of the problem or the subsisting methodologies, availability of closed-form solutions is limited. Nonetheless, numerical solutions are preferred and prevalent in practice, due to either non-availability or mathematical complexity of the corresponding exact solutions.Rather, limited utilisation of analytical solutions should mustn't diminish their merit over numerical ones; since exact solutions, if available, provide an insight into the governing physics of the quandary, that is often missing in any numerical solution. Moreover, analysing closed-form solutions to obtain optimal design options for any particular application of interest is relatively simpler of most recent literature, some authors have undertaken the work on variant boundary conditions, which can be summarised as given below.Han and Hasebe [1] used Green's function of a point heat source for a mechanical mixed boundary value problem of an infinite plane with an arbitrary hole, for which zero-displacement and traction-free boundary conditions are prescribed at its boundary. By employing the mapping technique and complex variable method, an exact solution including a hyper-geometrical function is obtained. In another paper, they [2] derived the Green's function for the bending problem of a thin plate with an elliptical hole under a bending heat source.Sato [3] used Mathieu functions to study the bending of a clamped as well as simply-supported elliptical plate undergoing the combined action of uniform lateral load over its entire surface and normal in-plane force distributed in its central plane. Very recently Bhad et al. [4-6] and Dhakate et al.[7] investigated the thermoelastic problems on an elliptical plate in which internal heat sources are generated within the solid, with compounded effect due to sectional heating and boundary conditions of the Dirichlet type based on the theory of integral transformations. Though finite transform involving Mathieu function and modified Mathieu functions has been already discussed by Bhad et al. [4-6], Dhakate et al.[7] and Gupta [8], in which notations used are those as given by Mclachlan [9]. However, till date, nobody has studied any heat conduction problem for elliptical disc using triple integral equations in elliptical coordinates. The aim of this paper is to supply this deficiency. In the first section of this investigation boundary value problem relating to elliptical disk in which interior heat sources are engendered within the solid having boundary conditions of the Dirichlet type has been discussed in detail and the next section is a transition to a circular disk has been derived. In Appendixpart, an incipient integral transform technique is developed which is nothing but a generalization of the transforms defined in Gupta [10] and the results can be deduced by specializing the coefficients and parameters involved therein. The prosperity of this research mainly lies on the incipient mathematical procedures which present a much more straightforward approach for optimization of the design in terms of material usage and performance in engineering problem, concretely in the tenaciousness of thermoelastic behaviour in ellipticalstructures engaged as pressure vessels, furnaces, etc.

FORMULATION OF THE PROBLEM

Consider a thin elliptical domain occupying the space $D=\{(\xi,\eta,z)\in R^3 : 0\le\xi<\infty,\ 0<\eta<2\pi,$ $-\ell/2<z<\ell/2\}$ defined by thetransformation $\xi+i\eta=\cosh^{-1}[(x+iy)/c],\ z=z$ with $2c$ as the distance between their common foci, as shown in Fig. 1. The elliptical coordinates (ξ,η,z) are related to the rectangular cartesian coordinates (x,y,z) by

$$x=c\cosh\xi\cos\eta,\ y=c\sinh\xi\sin\eta,\ z=z \tag{1}$$

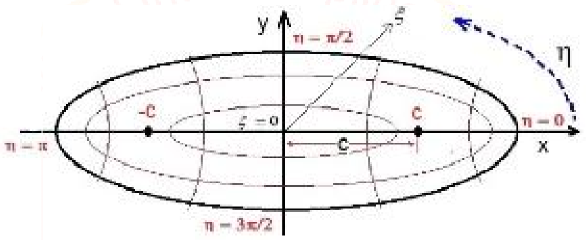

Fig. 1. Elliptical plate configuration

Here the curves $\xi=$constant and $\eta=$constant form orthogonal system of confocal ellipses and hyperbolas, with the common foci being the points $(\pm c,0)$.The scale factor can be calculated as

$$h^2=2/[c^2(\cosh 2\xi-\cos 2\eta)]. \tag{2}$$

2.1 Governing equation of heat conduction

The boundary value problem of heat conduction equation of a homogeneous isotropic solid is given as

$$\frac{d}{dt}T(\xi,\eta,z,t)=\kappa\left\{h^2\left(\frac{\partial^2}{\partial\xi^2}+\frac{\partial^2}{\partial\eta^2}\right)+\frac{\partial^2}{\partial z^2}\right\}T(\xi,\eta,z,t)+Q(\xi,\eta,z,t) \tag{3}$$

in the medium $0\le\xi<\infty,\ 0<\eta<2\pi,\ -\ell/2<z<\ell/2,\ 0<t<\infty$ under the initial conditions with the prescribed initial temperature at $t=0$ as

$$T(\xi,\eta,z,0)=T_0(\xi,\eta,z) \tag{4}$$

subjected to the zeroconditionsat infinity

$$\lim_{\xi\to\infty}T(\xi,\eta,z,t)=0,\ \lim_{z\to\pm\ell/2}T(\xi,\eta,z,t)=0 \tag{5}$$

in which $T=T(\xi,\eta,z,t)$ is the temperature field on the elliptical domain, $\kappa=\lambda/\rho C_v$ representing thermal diffusivity in which λ is the thermal conductivity of the material, ρ is the density and C_v is the calorific capacity.

SOLUTION TO THE PROBLEM

Now, by using the new integral transform in Eq. (A4) [refer Appendix for detail] the differential equation using boundary conditions (5) is transformed to

$$\frac{\partial \bar{T}}{\partial t} = -\kappa \hbar^2 u_3^2 \sinh^2 u \, \bar{T}(u,v,\zeta) + \bar{Q}(u,v,\zeta,t) \tag{6}$$

This differential equation (6) under the boundary condition (4) can be solved by applying Laplace's transformed from which results

$$\bar{\bar{T}}(u,v,\zeta,s) = \frac{\bar{T}_0 + \bar{\bar{Q}}(u,v,\zeta,s)}{s + \kappa \hbar^2 u_3^2 \sinh^2 u} \tag{7}$$

Now applying the Laplace inversion theorems to the equation (7), one yield

$$\bar{T}(u,v,\zeta,t) = T_0 \exp[(-\kappa \hbar^2 u_3^2 \sinh^2 u)t] + \int_0^t \exp[(\kappa \hbar^2 u_3^2 \sinh^2 u)\tau] \, \bar{Q}(u,v,\zeta,t-\tau)\, d\tau \tag{8}$$

Finally applying the inversion theorems of the transforms defined by equations (A5), we find the temperature field as

$$\begin{aligned} T(\xi,\eta,z,t) = {} & \frac{\hbar^2}{\ell(2\pi)^2} \sum \int_0^\infty \int_0^\infty \int_0^{2\pi} \{T_0 \exp[(-\kappa \hbar^2 u_3^2 \sinh^2 u)t] + \int_0^t \exp[(\kappa \hbar^2 u_3^2 \sinh^2 u)\tau] \\ & \times \bar{Q}(u,v,\zeta,t-\tau)\, d\tau\} [\exp(-ih\hbar) \sinh u (\cos h\, \xi \cos\eta \cos v \\ & + \sinh\xi \sin\eta \sin v)](\cosh 2\xi - \cos 2\eta) \exp[i(n\mu_3 \zeta)]\, du\, dv\, d\zeta \end{aligned} \tag{9}$$

The function given in Eq. (9) represents the temperature at every instance and at all point ofthe thinelliptical platewitha finite height when there are conditions of heat contour acting on surfaces $\xi = 0$, $\xi = \infty$, $z = -\ell/2$, $z = \ell/2$, and when on the faces $\eta = 0$, $\eta = 2\pi$ the temperatures are reached.

TRANSITION TO CIRCULAR DISK

Putting

$x = h\cosh\xi \cos\eta = r\cos\alpha$, $y = h\sinh\xi \sin\eta = r\sin\alpha$, $z = z$

then

$r = h(\cosh^2 \xi - \sin^2 \eta)^{1/2}$, $\tan\alpha = \tanh\xi \tan\eta$

and

$$\exp(\pm ih\hbar) \sinh u (\cos h\, \xi \cos\eta \cos v + \sinh\xi \sin\eta \sin v)] \exp[-i(\mu_3 z)]$$

$$= \exp(\pm i2k)(\cos h\,^2 \xi - \sin^2 \eta)^{1/2} \cos(v-\alpha) \exp[-i(\mu_3 z)]$$

Making use of the identity defined in Mclachlan [11], one yield

$$\exp(\pm iZ_1)\cos(v-\alpha) = J_0(Z_1) + 2\sum_{m=1}^{\infty} (\pm i)^m \cos m(v-\alpha) J_m(Z_1) \tag{10}$$

where

$Z_1 = 2k(\cosh^2 \xi - \sin^2 \eta)^{1/2}, 2k = h\hbar \sinh u.$

Substituting Eq. (10) in Eqs. (A4) and (A5), one obtains

$$\begin{aligned} \bar{f}(u,v,\zeta) = {} & \frac{h^2}{2} \int_0^\infty \int_0^{2\pi} \int_{-\ell/2}^{+\ell/2} f(\xi,\eta,z) \left[J_0(Z_1') + 2\sum_{m=1}^{\infty} (i)^m \cos m(\eta - \alpha') J_m(Z_1') \right] \\ & \times (\cos h\, 2\xi - \cos 2\eta) \exp[-i(n\mu_3 z)]\, d\xi\, d\eta\, dz \end{aligned} \tag{11}$$

and

$$f(\xi,\eta,z)=\frac{\hbar^2}{\ell(2\pi)^2}\sum_{n=0}^{\infty}\int_0^{\infty}\int_0^{2\pi}\bar{f}(u,v,\zeta)\left[J_0(Z_1)+2\sum_{m=1}^{\infty}(-i)^m J_m(Z_1)\cos m(v-\alpha)\right] \times\cosh u\sinh u\exp[i(n\mu_3\zeta)]\,du\,dv\,d\zeta \quad (12)$$

where

$Z_1' = 2k(\cosh^2\xi-\sin^2\upsilon)^{1/2}, \tan\alpha' = t\tanh\xi\tan v.$

Now, the elliptical coordinates can bedegenerated into a circularcoordinateof radius, if $\xi\to\infty$, $u\to\infty$, $h\to 0$, $\hbar\to 0$ respectively. Then $h^2\cosh 2\xi d\xi\to 2r\,dr$, $\hbar\cosh u\to\hbar\sinh u\to$ $p J_m(Z_1)\to p J_m(Z_1')\to J_m(pr)$ and if we assume $f(\xi,\eta,z)\to\phi(r,z)\exp(im\theta)$, then Eq. (A4) and (A5) degenerate into

$$\left.\begin{aligned}\bar{\phi}(p,z)&=\int_0^{\infty} r\phi(r,z)J_m(pr)\,dr\\ \phi(r,z)&=\int_0^{\infty} r\bar{\phi}(p,z)J_m(pr)\,dp\end{aligned}\right\}\quad(13)$$

The aforementioned result agrees with the well-known result of m^{th} order Hankel transform.

Finally,if we assume $T(\xi,\eta,z,t)\to T(r,\theta,z,t)\to\phi(r,z,t)\exp(im\theta)$, one yield the temperature in circular disk as

$$T(r,\theta,z,t)=\left\{\frac{1}{\ell(2\pi)^2}\sum_0^{\infty}\int_0^{\infty}\int_0^{2\pi}\{T_0\exp[-\kappa u_3^2J_m^2(pa)t]+\int_0^t\exp[\kappa u_3^2J_m^2(pa)\tau]\times\bar{Q}(u,v,\zeta,t-\tau)\,d\tau\}\left[J_0(Z_1)+2\sum_{m=1}^{\infty}(-i)^m J_m(Z_1)\cos m(v-\alpha)\right]\times\cosh u\sinh u\exp[i(n\mu_3\zeta)]\,du\,dv\,d\zeta\right\}\exp(im\theta)\quad(14)$$

APPENDIX

The transformation and its essential property

The double-integral complex infiniteFourier transform in the $x-$and $y-$direction is coupled with a complex finiteFourier transform in the $z-$coordinate as a function $f(x,y,z)$ is defined by the improper integral [12] as

$$(2\pi)^2\ell\,\bar{f}(\mu_1,\mu_2,n\mu_3)=\int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty}\int_{-\ell/2}^{+\ell/2} f(x,y,z)\,\exp[-i(\mu_1x+\mu_2y+n\mu_3z)]\,dx\,dy\,dz \quad (A1)$$

in which the integration is performed over the entire three-dimensional space $-\infty\le x\le\infty, -\infty\le y\le\infty,$ $-\ell/2\le z\le\ell/2$. If the Fouriertransform $\bar{f}(\mu_1,\mu_2,n\mu_3)$ is also absolutely integrable, then the original function $f(x,y,z)$ can be recovered as the integral

$$f(x,y,z)=\sum_{n=0}^{+\infty}\int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty}\bar{f}(\mu_1,\mu_2,n\mu_3)\exp[i(\mu_1x+\mu_2y+n\mu_3z)]\,d\mu_1\,d\mu_2 \quad (A2)$$

provided

$\int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty}\int_{-\ell/2}^{+\ell/2} \left|f(x,y,z)\right| dx\,dy\,dz$ and $\sum_{n=0}^{+\infty}\int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty} \left|\bar{f}(\mu_1,\mu_2,n\mu_3)\right| d\mu_1\,d\mu_2$ exists.

We canevaluate this integral by taking a system of ellipticalcoordinates (ξ,η,z) as

$$\left.\begin{aligned} &x = h\cosh\xi\cos\eta,\ y = h\sinh\xi\sin\eta,\ z = z;\\ &\mu_1 = \hbar\sinh u\cos v,\ \mu_2 = \hbar\sinh u\sin v,\ \mu_3 = \zeta \end{aligned}\right\} \quad \text{(A3)}$$

Putting Eq. (A3) in Eqs. (A1)-(A2) transforms into

$$\begin{aligned} \bar{f}(u,v,\zeta) = \frac{h^2}{2}\int_0^{\infty}\int_0^{2\pi}\int_{-\ell/2}^{+\ell/2} & f(\xi,\eta,z)[\exp ih\hbar\sinh u(\cos h\,\xi\cos\eta\cos v \\ & + \sinh\xi\sin\eta\sin v)](\cos h\,2\xi - \cos 2\eta)\exp[-i(n\mu_3 z)]\,d\xi\,d\eta\,dz \end{aligned} \quad \text{(A4)}$$

$$\begin{aligned} f(\xi,\eta,z) = \frac{\hbar^2}{\ell(2\pi)^2}\sum_{n=0}^{\infty}\int_0^{\infty}\int_0^{2\pi} & \bar{f}(u,v,\zeta)[\exp(-ih\hbar)\sinh u(\cos h\,\xi\cos\eta\cos v \\ & + \sinh\xi\sin\eta\sin v)](\cos h\,2\xi - \cos 2\eta)\exp[i(n\mu_3\zeta)]\,du\,dv\,d\zeta \end{aligned} \quad \text{(A5)}$$

provided $\bar{f}(u,v,\zeta)$ and $f(\xi,\eta,z)$ be such that

$\int_0^{\infty}\int_0^{2\pi}\int_{-\ell/2}^{+\ell/2} \left|f(\xi,\eta,z)\right|\left|\cos h\,2\xi - \cos 2\eta\right| d\xi\,d\eta\,dz$ and $\sum_{n=0}^{+\infty}\int_0^{\infty}\int_0^{2\pi} \left|\bar{f}(u,v,\zeta)\right| du\,dv\,d\zeta$

should exist. Obviously

$$\begin{aligned} \left|\bar{f}(u,v,\zeta)\right| &= \frac{h^2}{2}\int_0^{\infty}\int_0^{2\pi}\int_{-\ell/2}^{+\ell/2} f(\xi,\eta,z)[\exp ih\hbar\sinh u(\cos h\,\xi\cos\eta\cos v \\ &\quad + \sinh\xi\sin\eta\sin v)](\cos h\,2\xi - \cos 2\eta)\exp[-i(\mu_3 z)]\left|d\xi\,d\eta\,dz\right| \\ &\le \frac{h^2}{2}\int_0^{\infty}\int_0^{2\pi}\int_{-\ell/2}^{+\ell/2} \left|f(\xi,\eta,z)\right|\left|\cos h\,2\xi - \cos 2\eta\right| d\xi\,d\eta\,dz \end{aligned} \quad \text{(A6)}$$

If the integral on the right-hand side of Eq. (A6) exists then the integral of the left-hand side of the Eq. (A6) exist. It indicatesthat $\left|f(\xi,\eta,z)\right|\left|\cos h\,2\xi - \cos 2\eta\right|$ should be bounded within the range defined, thus $\bar{f}(u,v,\zeta)$ should be bounded. For convenience the transform pair in Eqs. (A4)-(A5) can be written as

$$\bar{f}(u,v,\zeta) = T\{f(\xi,\eta,z)\},\ f(\xi,\eta,z) = T^{-1}\{\bar{f}(u,v,\zeta)\}. \quad \text{(A7)}$$

In solving the boundary value problems,we assume $\chi(\xi,\eta,z)$ be a continuous and twice differentiable function with respect to variables (ξ,η,z), such that

$$\left.\begin{aligned} &\left[\chi\frac{\partial f}{\partial\xi} - f\frac{\partial f}{\partial\eta}\right]_0^{\infty} = 0 \text{ and} \left[\chi\frac{\partial f}{\partial\eta} - f\frac{\partial f}{\partial\eta}\right]_0^{2\pi} = 0 \\ &\frac{\partial^2 f}{\partial\xi^2} + \frac{\partial^2 f}{\partial\eta^2} + 2k^2(\cosh 2\xi - \cos 2\eta)\chi = 0 \\ &\left[\frac{\partial^2 f}{\partial\xi^2}\right]_{z=-\ell/2}^{z=\ell/2} = 0 \end{aligned}\right\} \quad \text{(A8)}$$

in which

$$\chi(\xi,\eta,z) = \exp i h \hbar \sinh u\,(\cosh h\,\xi \cos\eta \cos v + \sinh\xi \sin\eta \sin v)\exp[-i(\mu_3 z)] \quad \text{(A9)}$$

and

$$4k^2 = h^2\hbar^2 \sinh^2 u \quad \text{(A10)}$$

Thus the differential property of transformusing the properties (A8) can be defined as

$$\int_0^{\infty}\int_0^{2\pi}\int_{-\ell/2}^{\ell/2}\left\{h^2\left(\frac{\partial^2}{\partial\xi^2}+\frac{\partial^2}{\partial\eta^2}\right)+\frac{\partial^2}{\partial z^2}\right\}f(\xi,\eta,z)\,d\xi\,d\eta\,dz = -\hbar^2 u_3^2 \sinh^2 u\ \bar{f}(u,v,\zeta). \quad \text{(A11)}$$

CONCLUSION

The proposed analytical solution of temperature distribution problem in an elliptic region was dealt in an elliptical coordinates system with the presence of a source of internal heat. The incipient integral transform defined in (A7) is nothing but a generalization of the transforms defined in [10] and the results can be deduced by specializing the coefficients and parameters involved therein. The analytical technique proposed here is relatively straightforward and widely applicable compared to the methods proposed by other researchers. The advantage of this approach is its generality and its mathematical power to handle different types of mechanical and thermal boundary conditions during significant deflection under thermal loading.

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A STUDY OF CRIME STATISTICS IN AMRAVATI CITY. (WITH SPECIAL REFERENCE TO CRIME STATISTICS OF 10 POLICE STATIONS IN AMRAVATI CITY DURING YEAR 2013 TO 2015)

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ABSTRACT

This research paper provides an overview of patterns in crime data between 2013 and 2015, with a particular focus on the recorded crime in 10 police stations in Amravati city. This paper also explores the statistical relationship between selected crime patterns (Murder, Robbery, kidnapped, Molest, Theft, Rape, Hurt and Burglary) and various macro-level demographic and economic changes. Analysis is based on police reported crime data at various police stations in Amravati city.

In general, results indicate that throughout the study period crime rate in Amravati city is increased, especially among young offenders. At the macro-level, different types of crime are influenced by different social and economic factors such as shifts in inflation , shifts in the age composition of the population, shifts in alcohol consumption and unemployment rates.

Key words :- *Crime data, Graphical representation, Descriptive statistics, ANOVA, Crime rate.*

INTRODUCTION

In almost every period of western civilization, the inexorable increase in crime has been lamented in the corridors of power, the media, and the public. Haunted by recollections of a previous golden age, pundits have used crime statistics, research, and the almost daily barrage of media stories as a basis to conjecture about the changing nature and scope of crime, including dire predictions for the future.

In the uncivilized society no person was said to be safe from attacks to his person for property by any other person. The person attested either a succumbed or over-powered his opponent. A tooth for a tooth, an eye for an eye, a life for a life was the rule or long. With the advancement of time, the injured person agrees to accept compensation, instead of killing his adversary. For a long time the function of setting the term remained with the parties themselves, but gradually this function came to be perform by the state. In India the criminal jurisprudence came in to existence from the time of menu. Menu has recognized assault, theft, robbery, and false evidence, and slander, criminal breach of trust, cheating, adultery and rape.

Different lows came into existence in the reins of different rulers. When the Britishers came in to India the adopted a different set of lows which was based on British pattern, but it was not uniform throughout India. Different regulations were pass prescribing practice and procedure to be followed in 1834 the first Indian low commission was constituted to investigate in to jurisdiction, powers and rules of the existing court as well as police establishment and into the low in operation in British India. The Indian penal code was drafted by the first Indian low commission under the president ship of Macaulay and was submitted to the Governor-General of India in council in 1837. It was circulated to the judges and low advisors of the crown. In 1845, another commission was appointed to review the code. This commission submitted its report in two parts, one in 1846 and the other in 1847. The code was revised according to the report of the commission but it never saw the light of the day.

The present study provides an overview of patterns in crime data between 2013 and 2015, with a particular focus on the recorded crime in 10 police stations in Amravati city. This paper also explores the statistical relationship between selected crime patterns (Murder ,Robbery ,kidnapped ,Molest ,Theft ,Rape ,Hurt and Burglary) and various demographic and economic changes in study area. Statistical Analysis is based on police reported crime data at various police stations in Amravati city.

MATERIAL AND METHODS

Research Methodology is a plan, structure and strategy of Investigation conceived so as to control. In the present study researcher has adopted Descriptive Research.

- **Sources of data**

There are two sources of data viz. Primary Data and Secondary Data. The primary data was not collected because it is not possible to collect crime data using primary data collection techniques. Reason for selecting secondary data is to analyze the recent trend. Secondary Data is collected from the FIR records of 10 police stations in Amravati city of year 2013 to 2015. Also some periodicals & reference books are utilized for collecting this data.

- **Sample and sample size**

Sample is the true representation of the population, by studying the behavior of the sample we can predict the behavior of the population. For the present study the sample size is decided according to availability of data at various police stations in urban area of Amravati region.

- **Method of sampling**

It indicates how sample units are selected. For this project Chronological data using Random Probability Sampling is collected.

- **Statistical techniques used**

After the data collection, data was tabulated, analyzed and interpreted to reach the conclusion, Following techniques are used;
Various Bar Graph,
Pie charts,
Testing of hypothesis, ANOVA etc.

RESULT AND DISCUSSIONS

The secondary information collected about total number of crimes reported in 10 police stations in Amravati city is summarized in the table-1.

Year	Police stations									
	Frezarpura	Bhatkuli	Badnera	Nandgao Peth	Walgao	Nagpuri Gate	Gadge nagar	Rajapeth	City Kotwali	kholapuri Gate
2013	84	51	63	53	58	62	57	52	49	48
2014	47	49	47	46	46	48	86	45	51	53
2015	54	52	61	57	45	58	53	62	42	53

Table-1(Source - Compiled by Researcher)

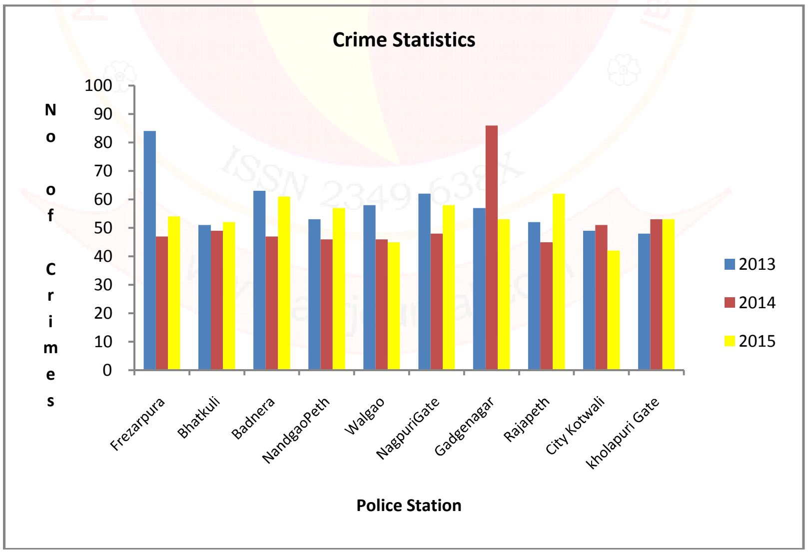

Chart-1(Source - Compiled by Researcher)

Result:-

From the above Table/chart it is clear that The total number of crimes reported at various police stations ranges between 40-90 during study period. Maximum number of crimes(86) are reported at Gadge nagar police station in 2014 where as minimum number of crimes(45) are reported at Rajapeth police station during same period.

Testing of hypothesis:

To analyze the variation in average number of crimes during study period i.e. year 2013 -2015 at 10 police stations in Amravati city, one way ANOVA i.e. F- test is used.
In one way ANOVA our aim is to test whether, the average effects of all the treatments are equal or

not. So, in this case we set up the null hypothesis as,

H_0: there is no significant differences between treatments i.e. average number of crimes reported during study period (2013-2015) are equal.

Vs.

Source of variation	Sum of Square	Degree of freedom	Mean sum of square	Fcal
Treatment	S.S.T. =88.6	K-1=2	St² = SST/K-1 = 44.3	
Error	S.S.E. =2822.6	N-K=28	Se² = SSE/N –K = 100.81	Fcal = St²/ Se² = 0.44
Total	T.S.S. =2911.2	N-1=29	St² = TSS/N-1 = 100.39	

Table-2(Source - Compiled by Researcher)

Where, Total no. of observations = N= 30, No. of treatments = k = 3

T.S.S. = Total Sum of Square = R.S.S. -C.F.

R.S.S. = Raw Sum of Square = ΣΣ Yij^2 , C.F.=Correction Factor= G^2/N

S.S.T. =Sum of Square of Treatment =Σ(Ti2/ni)-C.F , St² = SST/K-1,Se² = SSE/N –K.

Ftab for (2.28) d.f. and 5% level of significance is 3.34.

Fcal < Ftab.

Accept H_0.

Result:-

So, here we conclude that there is no significant difference between treatments i.e. average number of crimes done during study period (2013-2015) are almost equal.

Crime Rate

Crime rate describes the no. of crimes reported to law enforcement agencies for every 1,00,000 persons within a population. A crime rate is calculated by dividing the no. of reported crimes by the total population, then the result is multiplied by 1,00,000.

$$\text{Crime Rate} = \frac{\textit{The no.of reported crime}}{\textit{Total population}}$$

The crime rate for the 10 police station in Amravati city region for year 2013-2015 is calculated using above formula,

H_1: There is difference between at least two treatments or treatment effect i.e. average number of crimes reported during study period (2013-2015) are not equal..

To test the above hypothesis F- test is used, the ANOVA table of one way classification is given as,

Year	Reported Crime	Total Population	Crime Rate
2013	577	1037287	55.63
2014	518	1037287	49.94
2015	537	1037287	51.77

Table-3(Source - Compiled by Researcher)

Result:-

The crime rate for year 2014 is minimum where as for 2013 it is maximum.

(Total population is as per 2011 census)

CONCLUSION

On the basis Crime summery of 10 police station in Amravati city region for year 2013-2015 following conclusions are made, we observe that in year 2013 the total number of crimes are 577, year 2014 the total number of crimes are 518 and year 2015 the total number of crimes are 537. Total number of crimes in year 2014 are decreased as compared to year 2013 and again they are increased in year 2015 as compared to year 2014. In year 2014, total number of crimes are decreased as compared to year 2013 but only molest crimes are decreased on the other hand. The crimes like theft crimes are increased in 2014 compared to 2013.

In year 2015, total number of crimes are increased as compared to year 2014 but only Theft are increased where as the crimes like kidnapping are decreased in year 2015 are compared to year 2014.In year 2014 total number crimes are minimum as compared to year 2013 and 2015. Finally, from one way ANOVA we conclude that the average number crimes reported in FIR of 10 police stations in Amravati city during year 2013 to 2015 are almost equal. The crime rate for year 2014 is minimum where as for 2013 it is maximum.

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MAGNETIZED AXIALLY SYMMETRIC COSMOLOGICAL MODEL IN $f(R,T)$ THEORY OF GRAVITATION

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ABSTRACT

In this paper we have investigated the axially symmetric cosmological model in f(R , T) theory of gravitation with the functional form $f(R,T) = R + 2T$ in presence of electromagnetism. We get the isotropy at any cosmic time t, by converting the vector potential in the constant form.

Key words: *Axially symmetric universe, Electromagnetic Field, $f(R,T)$ theory of gravity.*

INTRODUCTION

The modified theory $f(R,T)$ theory of gravitation is proposed by Harko T. et al [7,8] where R is the curvature scalar and T is the trace of energy momentum tensor. Basically, two kinds of alternative reasons of accelerated expansion of the universe have been proposed for this unexpected observational phenomenon. One is Dark energy (DE) which has negative pressure and which induces a late-time accelerating cosmic expansion. The other is the modified gravity, which originate from the idea that the general relativity is incorrect in the cosmic scale and therefore need to be modified. In order to explain the nature of the DE and accelerated expansion, a variety of theoretical models have been proposed in literature. There are several modified gravity theories like $f(R)$ gravity formulated by Nojiri and Odintsov [5,6]. The idea of introducing additional terms of the Ricci scalar to the Einstein-Hilbert action did not begin years ago with the $f(R)$ theory of gravity paper by Carroll [4]. He explained the presence of a late time cosmic acceleration of the universe in f(R) theory of gravity. In $f(R,T)$ theory of gravity, cosmic acceleration may result not only due to geometrical contribution to the total cosmic energy density but it is also depends on matter contents. Many authors have investigated different problem within the scope of $f(R,T)$ theory. Bijan Saha [9] has studied the interacting scalar and electromagnetic fields in Bianchi type I universe. Our interest is to explore the role of scalar and electromagnetic field played in the amended $f(R,T)$ of gravity in other Bianchi types or other metric universe. In this paper we consider auxiliary symmetric metric universe.

GRAVITATIONAL FIELD EQUATIONS OF F (R, T) GRAVITY

The action of theory of gravitation is as follows

$$S = \int f(R,T)\sqrt{-g}\,d^4x + \int L_m\sqrt{-g}\,dx^4 , \qquad (2.1)$$

where L_m are Lagrangian and other symbols have their usual meaning in Riemannian geometry.
Energy Momentum Tensor is given by

$$T_{ij} = 2\frac{\partial L_m}{\partial g^{ij}} - L_m g_{ij} , \qquad (2.2)$$

Varying the action (2.1) with respect to metric tensor g^{ij} yields

$$\delta S = \frac{1}{2x}\int\left\{ f_R(R,T)\frac{\partial R}{\partial g^{ij}} + f_T(R,T)\frac{\partial T}{\partial g^{ij}} + \frac{f(R,T)}{\sqrt{-g}}\frac{\partial\sqrt{-g}}{\partial g^{ij}} + \frac{2x}{\sqrt{-g}}\frac{\partial\left(L_m\sqrt{-g}\right)}{\delta g^{ij}}\right\}\sqrt{-g}\,d^4x , \qquad (2.3)$$

Here we define

$$\theta_{ij} = g^{\alpha\beta}\frac{\partial T_{\alpha\beta}}{\partial g^{ij}} \text{ and } \frac{\partial g^{mn}}{\partial g^{ij}} = \delta_i^m\delta_j^n , \qquad (2.4)$$

Considering $\delta s = 0$ from equation (2.3) upon integration we obtain

$$f_R(R,T)R_{ij} - \frac{1}{2}f(R,T)g_{ij} + \left(g_{ij}\nabla^i\nabla_j - \nabla_i\nabla_j\right)f_R(R,T) = xT_{ij} - f_T(R,T)\left[T_{ij} + \theta_{ij}\right] , \qquad (2.5)$$

Taking trace of equation (2.5) we get

$$\nabla^i\nabla_j f_R(R,T) = \frac{2}{3}f(R,T) - \frac{1}{3}f_R(R,T)R + \frac{1}{3}xT - \frac{1}{3}f_R(R,T)[T+\theta] , \qquad (2.6)$$

We assume that the function $f(R,T)$ given by Harko [2011]

$$f(R,T) = R + 2f(T)$$

We choose the particular case $f(T)=T$ that particular case the function $f(R,T)=R+2f(t)=R+2T$

In this case we follows the notation $f_R(R,T)=\frac{\partial f(R,T)}{\partial R}=1$ and $f_T(R,T)=\frac{\partial f(R,T)}{\partial T}=2$

$$R_{ij}-\frac{1}{2}f(R+2T)g_{ij}=xT_{ij}-2[T_{ij}+\theta_{ij}], \qquad (2.7)$$

From equation (2.6) we write

$$R+2T=2\theta-xT, \qquad (2.8)$$

Inserting equation (2.8) in equation (2.7) we obtain the field equation as

$$R^i_j=x\left[T^i_j-\frac{1}{2}Tg^i_j\right]-2[T^i_j+\theta^i_j]+\theta g^i_j, \qquad (2.9)$$

Varying the equation (2.2) with respect to metric tensor g^{ij} we get,

$$T_{\alpha\beta}=2\frac{\partial L_m}{\partial g^{\alpha\beta}}-L_m g_{\alpha\beta}, \qquad (2.10)$$

But term (2.2)

$$\frac{\partial L_m}{\partial g^{ij}}=\frac{1}{2}\left[T_{ij}+L_m g_{ij}\right]=2\frac{\partial^2 L_m}{\partial g^{ij}\delta g^{\alpha\beta}}-L_m\frac{\partial g_{\alpha\beta}}{\partial g^{ij}}-\frac{1}{2}g_{\alpha\beta}T_{ij}-\frac{1}{2}L_m g_{\alpha\beta}g_{ij}, \qquad (2.11)$$

But $\frac{\partial g_{\alpha\beta}}{\partial g^{ij}}=-g_{\alpha i}g_{\beta j}$

Inserting the above value in (2.11), we obtain

$$\frac{\partial T_{\alpha\beta}}{\partial g^{ij}}=2\frac{\partial^2 L_m}{g^{ij}\partial g^{\alpha\beta}}+g_{\alpha i}g_{\beta j}L_m-\frac{1}{2}g_{\alpha\beta}L_m-\frac{1}{2}g_{\alpha\beta}g_{ij}T_{ij}, \qquad (2.12)$$

Using the equations (2.2),(2.4) and (2.12) we obtain

$$\theta_{ij}=-T_{ij}+2\left[g^{\alpha\beta}\frac{\partial^2 L_m}{\partial g^{ij}\partial g^{\alpha\beta}}-\frac{\partial L_m}{\partial g^{ij}}\right], \qquad (2.13)$$

MATTER FIELD LAGRANGIAN: THE ELECTROMAGNETIC FIELD TENSOR IS GIVEN BY

$$L_m=-\frac{1}{16\pi}F_{ab}F^{ab}=-\frac{1}{16\pi}F_{ab}g^{ca}g^{db}F_{cd}, \qquad (3.1)$$

From (2.2), we have

$$T^i_j=\frac{1}{4\pi}F^{\mu}_{m}F^{m}_{j}-\frac{1}{16\pi}F_{mn}F^{mn}g^{\mu}_{i}, \qquad (3.2)$$

From equation (2.13) we get

$$\theta_{ij}=-T_{ij}, \qquad (3.3)$$

From the equations (3.2) and (3.3) after contraction field we obtain.

$$\theta=-g^{ij}T_{ij}=-T=0, \qquad (3.4)$$

THE METRIC AND FIELD EQUATIONS

We consider the axially symmetric in the form

$$ds^2=dt^2-A^2(dx^2+f^2(x)d\phi^2)-B^2dz^2, \qquad (4.1)$$

where A and B are functions of time t and f is a function of coordinate x only.

Electromagnetic Maxwell field tensor F_{ij} is given by

$$F_{ij}=\frac{\partial A_i}{\partial x^j}-\frac{\partial A_j}{\partial x^i},$$

(4.2)

To achieve the capability with non-static space time (4.1), we assume electromagnetic vector potential in the form

$$V_i=\left[\lambda(x)v_1(t) \quad v_2(t),\ v_3(t)\ \ v_4(t)\right], \qquad (4.3)$$

From equations (4.2) and (4.3) yields

$$F_{14}=\lambda\dot{v}_1 \qquad F_{24}=\dot{v}_2 \qquad F_{34}=\dot{v}_3,$$

(4.4)

We deduce easily

$$F_{ij}F^{ij}=-2\left[\frac{\lambda\dot{v}_1^2}{A^2}+\frac{\dot{v}_2^2}{Af^2}+\frac{\dot{v}_3^2}{B^2}\right], \qquad (4.5)$$

Noting (4.3) we deduce the nonzero components of the energy momentum tensor of material fields as follows

$$T^1_1=\frac{1}{4\pi}\left[\frac{\lambda^2\dot{v}_1^2}{A^2}-\frac{\lambda^2\dot{v}_2^2}{2A^2}-\frac{\dot{v}_3^2}{2A^2f^2}-\frac{\dot{v}_3^2}{2B^2}\right], \qquad (4.6a)$$

$$T^2_2=\frac{1}{4\pi}\left[-\frac{\lambda^2\dot{v}_1^2}{2A^2}+\frac{\dot{v}_2^2}{2A^2f^2}-\frac{\dot{v}_3^2}{2B^2}\right], \qquad (4.6b)$$

$$T^3_3=\frac{1}{4\pi}\left[-\frac{\lambda^2\dot{v}_1^2}{2A^2}+\frac{\dot{v}_2^2}{2A^2f^2}+\frac{\dot{v}_3^2}{2B^2}\right], \qquad (4.6c)$$

$$T^2_2=\frac{1}{4\pi}\left[\frac{\lambda^2\dot{v}_1^2}{2A^2}+\frac{\dot{v}_2^2}{2A^2f^2}+\frac{\dot{v}_3^2}{2B^2}\right], \qquad (4.6d)$$

From equations (3.2) and (4.6a,b,c,d) we can deduced the components of energy tensor as follows

$$T^i_i=0, \qquad (4.7)$$

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Following [Saha Bian] variation of Lagrangian L_m with respect to electromagnetic field gives

$$\frac{\partial}{\partial x^j}\left(\sqrt{-g}F^{ij}\right)=0,$$

$$\left(\frac{\dot v_1}{v_1}\right)^{\cdot}+\frac{\dot v_1^2}{v_1^2}+\frac{\dot v_1}{v_1}\left[\frac{\dot B}{B}\right]=0, \qquad (4.8a)$$

$$\left(\frac{\dot v_2}{v_2}\right)^{\cdot}+\frac{\dot v_2^2}{v_2^2}+\frac{\dot v_2}{v_2}\left[\frac{\dot B}{B}\right]=0,$$

(4.8b)

$$\left(\frac{\dot v_3}{v_3}\right)^{\cdot}+\frac{\dot v_3^2}{v_3^2}+\frac{\dot v_3}{v_3}\left[2\frac{\dot A}{A}-\frac{\dot B}{B}\right]=0, \qquad (4.8c)$$

$f\dot\lambda+\lambda\dot f \Rightarrow \lambda f=k_1$, where k_1 is constant of integration (4.8d)

Since for the space time (4.1) we get $R_2^1=0$, $R_3^1=0, R_3^2=0$ and from (2.9) we have

$$T_2^1=0=\dot v_1\dot v_2 \qquad T_3^1=0=\dot v_1\dot v_3$$

$$T_3^2=0=\dot v_2\dot v_3, \qquad (4.9)$$

From equation (4.9) we can rewrite it as

$$\frac{\dot v_1}{v_1}=\frac{\dot v_2}{v_2}=\frac{\dot v_3}{v_2}=0, \qquad (4.10)$$

$\frac{\dot v_1}{v_1}=\frac{\dot v_2}{v_2}=\frac{\dot v_3}{v_2}=\frac{\dot g}{g}$, where g is some unknown function (4.11)

Integrating (4.11) we get

$$v_1=gk_2 \quad v_2=gk_3 \quad v_3=gk_4, \qquad (4.12)$$

Inserting (4.11) in (4.10) we get

$$\left(\frac{\dot g}{g}\right)^2=\left(\frac{\dot g}{g}\right)^2=\left(\frac{\dot g}{g}\right)^2=0, \qquad (4.13)$$

From equations (4.8 a.b.c.d),(4.11) and (4.12) we get

$$\left(\frac{\dot g}{g}\right)^{\cdot}+\frac{\dot g^2}{g^2}+\frac{\dot g}{g}\left[\frac{\dot B}{B}\right]=0, \qquad (4.14a)$$

$$\left(\frac{\dot g}{g}\right)^{\cdot}+\frac{\dot g^2}{g^2}+\frac{\dot g}{g}\left[2\frac{\dot A}{A}-\frac{\dot B}{B}\right]=0, \qquad (4.14b)$$

From equations(4.14 a b) we get

$$\frac{\dot A}{A}=\frac{\dot B}{B}, \qquad (4.15)$$

Integrating $A=k_5B$, where k_5 is integration constant. (4.16)

The field equation (3.2) for the metric (4.1) with help of equations (4.11) to (4.16) can be written as

$$\frac{\dot A^2}{A^2}+\frac{\ddot A}{A}+\frac{\dot A\dot B}{AB}-\frac{1}{B^2}\frac{f''}{f}=0, \qquad (4.17a)$$

$$\frac{\dot A^2}{A^2}+\frac{\ddot A}{A}+\frac{\dot A\dot B}{AB}-\frac{1}{A^2}\frac{f''}{f}=0, \qquad (4.17b)$$

$$\frac{\ddot B}{B}+2\frac{\dot B\dot A}{BA}=0, \qquad (4.17c)$$

$$2\frac{\ddot A}{A}+\frac{\ddot B}{B}=0, \qquad (4.17d)$$

From equations (4.15) and (4.17c) we get.

$$\frac{\ddot B}{B}+2\frac{\dot B^2}{B^2}=0, \qquad (4.18)$$

Upon integration which reduced to

$$B=\left(3k_6t+k_7\right)^{\frac{1}{3}}, \qquad (4.19)$$

where $k_6\neq 0$ and k_7 are constants of integration.

From equations (4.16) and (4.18) we obtain

$$A=\left(3k_8t+k_9\right)^{\frac{1}{3}}, \qquad (4.20)$$

where $k_8\neq 0$ and k_9 are constants of integration.

From equations (4.20) and (4.18) we obtain

$$\dot A=3\left(3k_8t+k_9\right)^{-\frac{2}{3}}k_8 \text{ and } \dot B=3\left(3k_7t+k_8\right)^{-\frac{2k}{3}}k_6 \qquad (4.21)$$

From equations (4.18),(4.20) and (4.21) we obtain

$$\frac{\dot A}{A}=\frac{k_8}{(3k_8t+k_9)}, \qquad (4.22)$$

$$\frac{\dot B}{B}=\frac{k_6}{(3k_6t+k_7)}, \qquad (4.23)$$

From equations (4.15) we get

$$\frac{k_8}{(3k_8t+k_9)}=\frac{k_6}{(3k_6t+k_7)} \qquad (4.24)$$

This implies that $k_6=K_8$ and $K_7=k_9$,

Let $k_6=K_8=d_1$ and $K_7=k_9=d_2$,

$$A=B=\left(3d_1t+d_2\right)^{\frac{1}{3}}, \qquad (4.25)$$

Using equations (4.15) and (4.16) reduces to

$$f''=0$$

Integrating we get

$$f(x)=k_{10}+k_{11} \qquad (4.26)$$

Again From equation (4.8d) we get

$$\lambda(x) = \frac{k_1}{k_{10}x + k_{11}}, \quad (4.27)$$

From equation (4.16) we get $\frac{\dot{g}}{g} = 0$,

Upon Integrating $g = c$,where c constant of Integration (4.28)

From (4.15) and (4.28) we have

$v_1 = c = k_{10}$ $v_2 = c = k_{11}$ $v_3 = c = k_{11}$ v_4 is a undetermined (4.29)

where k 's is a constant.

Adjusting the constants in (4.29) and the vector potential assume that the following form $v_i = [k, k, k, v_4]$

From equation (4.25) and line element (4.1) reduces to

$$ds^2 = dt^2 - (3d_1t + d_2)^{\frac{2}{3}}[(dx^2 + (k_{10}x + k_{11})^2(d\phi^2) - dz^2]. \quad (4.30)$$

CONCLUSION

In this paper, we have investigated axially symmetric cosmological model with electromagnetic field in particular case of $f(R,T)$ theory of gravitation $f(R,T) = R + T$. The model which is obtained in (4.30) gives solution of the axially symmetric universe with algebraic volumetric expansion of universe. We get isotropy at any cosmic time t. The metric functions admits constants value at early time of the universe (t tends to zero) and after that the metric function start increasing with increasing in cosmic time and finally diverge to infinity as time tend to infinity .This shows that the universe expand and approaches to infinite volume. It is also interesting to note that the investigated model is from singularity and observed that $f(x)$ and $\lambda(x)$ are reciprocal of each other.

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APPLICATIONS OF LAPLACE-WEIERSTRASS TRANSFORM

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ABSTRACT

In this paper we present the application of Laplace-Weierstrass transform for solving Partial differential equation. We have defined new operator $\wedge_{t,y}$ *and find Laplace-Weierstrass transform of* $\wedge^{n}_{t,y}$. *We also derived Ramanujan's formula for Laplace-Weierstrass transform.*

Keywords: *Laplace transform, Weierstrass transform, Laplace-weierstrass transform, Ramanujan's formula.*

INTRODUCTION

Integral transforms are valuable for the simplification that they bring about, the dealing with differential equations subject to particular boundary conditions. The Laplace transform is a widely used integral transform with many applications in physics and engineering and it is really just a shortcut for complex calculations. Many authors studied on various integral transforms separately. However there is much scope in extending double transformation to a certain class of generalized functions. Khairnar S. M., Choudhary M. S., Bhosale B. N. *et.al.* worked double transform and their applications. Motivated by above work we defined a new transform like Laplace-Weierstrass transform and studied its applications to some particular types of differential equations.

The subject of this research work arises from the confluence of the two mathematical disciplines, the theory of integral transformations and the theory of generalized functions. The theory and applications of the generalized Laplace-Weierstrass has been an active research area in the past.

Bhosale [1] gives the application of generalized fractional Fourier transform for solving particular type of partial differential equation. Khairnar *et.al.* [2] Studied bilateral Laplace-Mellin integral transform and its applications. The Laplace-Weierstrass transform of $f(t,y)$ defined in [3, 4] is as follows

$$LW\{f(t,y)\} = \frac{1}{\sqrt{4\pi}} \int_0^\infty \int_0^\infty e^{-st-\frac{(x-y)^2}{4}} f(t,y)\,dt\,dy$$

Pathak [5] discussed integral transformation of generalized functions and its applications. Sharma [7] developed generalized Fourier-Laplace transform and differential equation.

This paper is planned as follows:

New differential operator $\wedge_{t,y}$ is introduced in section [II]. Solution of Partial differential equation is obtained in section [III]. And Ramanujan's formula derived in last section

APPLICATION OF LAPLACE-WEIERSTRASS TRANSFORM BY DEFINING NEW OPERATOR

2.1 The kernel of Laplace-Weierstrass transform is

$$K(t,y,s,x) = e^{-st-\frac{(x-y)^2}{4}}$$

$$D_t\, D_y\, K(t,y,s,x) = D_t\, D_y \left\{ e^{-st-\frac{(x-y)^2}{4}} \right\}$$

$$= (-s)\frac{(x-y)}{2} K(t,y,s,x) \qquad (2.1)$$

We construct an operator

$$\wedge_{t,y} = D_t\, D_y - \frac{s(x-y)}{2}$$

$$\text{where } D_t = \frac{d}{dt},\; D_y = \frac{d}{dy}$$

$$\wedge_{t,y} K(t,y,s,x) = \left[D_t\, D_y - \frac{s(x-y)}{2}\right] K(t,y,s,x)$$

$$= D_t\, D_y K(t,y,s,x) - \frac{s(x-y)}{2} K(t,y,s,x)$$

$$= P_0\, K(t,y,s,x)$$

Where $P_0 = (-s)(x-y)$ is polynomial.

Continuing in this way, we get

$$\wedge_{t,y}^2 K(t,y,s,x) = (P_0)^2 K(t,y,s,x)$$

$$\wedge_{t,y}^3 K(t,y,s,x) = (P_0)^3 K(t,y,s,x)$$

$$\wedge_{t,y}^4 K(t,y,s,x) = (P_0)^4 K(t,y,s,x)$$

And so on

$$\wedge_{t,y}^n K(t,y,s,x) = (-s)^n (x-y)^n K(t,y,s,x)$$

$$= (P_0)^n K(t,y,s,x)$$

Since the operator $\wedge_{t,y}^n K(t,y,s,x) = (-s)^n (x-y)^n K(t,y,s,x)$ is obviously linear and continuous, we have

$$LW\{\wedge_{t,y}^n [f(t,y)]\} = \frac{1}{\sqrt{4\pi}} \left\langle \wedge_{t,y}^n [f(t,y)], K(t,y,s,x) \right\rangle$$

$$= \frac{1}{\sqrt{4\pi}} \left\langle f(t,y), (-s)^n (x-y)^n K(t,y,s,x) \right\rangle$$

Therefore, we have

$$LW\{\wedge_{t,y}^n [f(t,y)]\}$$

$$= \frac{1}{\sqrt{4\pi}} \left\langle f(t,y), (P_0)^n K(t,y,s,x) \right\rangle$$

APPLICATION OF LAPLACE-WEIERSTRASS TRANSFORMS TO SOLVE DIFFERENTIAL EQUATION.

The preceding theory can be used to developed on operational calculus for the operator D_t and D_y.

We have,

$$LW\ \{D_t^k\ D_y^l\ f(t,y)\}$$

$$= \frac{1}{\sqrt{4\pi}} \left\langle D_t^k\ D_y^l\ f(t,y), e^{-st-\frac{(x-y)^2}{4}} \right\rangle$$

$$= \frac{1}{\sqrt{4\pi}} \left\langle (-s)^k e^{-st-\frac{(x-y)^2}{4}} P_l(x-y), f(t,y) \right\rangle \quad (3.1)$$

We illustrate the application of the distributional Laplace-Weierstrass transform to the solution of the partial differential equation by considering the equation with a generalized initial condition.

Let us determine a generalized function $u(t,y,z)$ on the domain $\{(t,y,z): 0<t<\infty,\ 0<y<\infty, 0<z<\infty\}$ which satisfies the differential equation;

$$a\frac{\partial u}{\partial t} = by^2 \frac{\partial^2 u}{\partial y^2} + cy\frac{\partial u}{\partial y} + \frac{\partial^2 u}{\partial z^2} \quad (3.2)$$

with the following boundary conditions

i) As $z \to 0^+, u(t,y,z)$ converges in D' to a generalized function $f(t,y) \in LW'$.

ii) As $z \to 1, u(t,y,z)$ converges in D' to a generalized function $f(t,y) \in LW'$.

Applying the Laplace-Weiestrass transform to equation (3.2) with respect to t and y and using equation (3.1), we get

$$\therefore \frac{\partial^2 \bar{U}}{\partial z^2} = as\bar{U} - by^2 P_2(x-y)\bar{U} - cyP_1(x-y)\bar{U}$$

$$\therefore \frac{\partial^2 \bar{U}}{\partial z^2} = P(s,x)\bar{U}$$

where $P(s,x) = as - by^2 P_2(x-y) - cyP_1(x-y)$

$$\therefore \bar{U} = A(s,x)e^{-\sqrt{P(s,x)}z} + B(s,x)e^{+\sqrt{P(s,x)}z} \quad (3.3)$$

where $A(s,x)$ and $B(s,x)$ are the unknown generalized function which do not depend on z.

In view of boundary conditions (i) and (ii), we get

$$F(s,x) = A(s,x) + B(s,x) \quad (3.4)$$

and

$$G(s,x) = A(s,x)e^{-\sqrt{P(s,x)}} + B(s,x)\, e^{+\sqrt{P(s,x)}} \quad (3.5)$$

Solving above two equations simultaneously,

$$A(s,x) = \frac{G(s,x) - F(s,x)e^{+\sqrt{P(s,x)}}}{e^{-\sqrt{P(s,x)}} - e^{+\sqrt{P(s,x)}}} \quad (3.6)$$

and

$$B(s,x) = \frac{F(s,x)e^{-\sqrt{P(s,x)}} - G(s,x)}{e^{-\sqrt{P(s,x)}} - e^{+\sqrt{P(s,x)}}} \quad (3.7)$$

where $F(s,x) = \frac{1}{\sqrt{4\pi}} \left\langle e^{-st-\frac{(x-y)^2}{4}}, f(t,y) \right\rangle$,

$G(s,x) = \frac{1}{\sqrt{4\pi}} \left\langle e^{-st-\frac{(x-y)^2}{4}}, g(t,y) \right\rangle$ and

$$P(s,x) = as - by^2 P_2(x-y) - cyP_1(x-y)$$

Putting the values of $A(s,x)$ and $B(s,x)$ in equation (3.3), we get

$$\bar{U} = \frac{G(s,x) - F(s,x)e^{+\sqrt{P(s,x)}}}{e^{-\sqrt{P(s,x)}} - e^{+\sqrt{P(s,x)}}} e^{-\sqrt{P(s,x)}z} + \frac{F(s,x)e^{-\sqrt{P(s,x)}} - G(s,x)}{e^{-\sqrt{P(s,x)}} - e^{+\sqrt{P(s,x)}}} e^{+\sqrt{P(s,x)}z} \qquad (3.8)$$

Furthermore $A(s,x)e^{-\sqrt{P(s,x)}}$ and $B(s,x)e^{+\sqrt{P(s,x)}z}$ are smooth functions of s and x for each $z > 0$. Therefore we can apply the inverse Laplace-Weierstrass transform to get,

$$u(t,y,z) = \frac{-1}{4\pi\sqrt{\pi}} \int_0^\infty \int_0^\infty e^{st + \frac{(x-y)^2}{4}} \bar{U}\, ds\, dx,$$

where $\bar{U}$ is as in (3.8)

IRAMANUJAN'S FORMULA

If $C_q(n) = \sum_{\substack{a=1 \\ (a,q)=1}}^{q} e^{2\pi \frac{a}{q} n}$, where $(a,q) = 1$ means that 'a' only takes on values coprime to 'q'

then $\frac{1}{\sqrt{4\pi}} \int_0^\infty \int_0^\infty e^{-ast - \frac{(x-y)^2}{4}} f(t,y) \sum_{\substack{a=1 \\ (a,q)=1}}^{q} e^{2\pi i \frac{a}{q} t} dt\, dy$

$$= \frac{1}{\sqrt{4\pi}} \int_0^\infty e^{\frac{-(x-y)^2}{4}} \left[\int_0^\infty C_{\left(\frac{2\pi i q}{2\pi i - sq}\right)}(t) f(t,y) dt \right] dy$$

Proof:-

$$\frac{1}{\sqrt{4\pi}} \int_0^\infty \int_0^\infty e^{-ast - \frac{(x-y)^2}{4}} f(t,y) \sum_{\substack{a=1 \\ (a,q)=1}}^{q} e^{2\pi \frac{a}{q} t} dt\, dy$$

$$= \frac{1}{\sqrt{4\pi}} \int_0^\infty e^{\frac{-(x-y)^2}{4}} \left[\int_0^\infty \sum_{\substack{a=1 \\ (a,q)=1}}^{q} e^{-ast + 2\pi i \frac{a}{q} t} f(t,y) dt \right] dy$$

$$= \frac{1}{\sqrt{4\pi}} \int_0^\infty e^{\frac{-(x-y)^2}{4}} \left[\int_0^\infty \sum_{\substack{a=1 \\ (a,q)=1}}^{q} e^{2\pi i a \left(\frac{1}{q} - \frac{s}{2\pi i} \right) t} f(t,y) dt \right] dy$$

$$= \frac{1}{\sqrt{4\pi}} \int_0^\infty e^{\frac{-(x-y)^2}{4}} \left[\int_0^\infty C_{\left(\frac{2\pi i q}{2\pi i - sq}\right)}(t) f(t,y) dt \right] dy$$

CONCLUSION

We have defined new operator $\wedge_{t,y}$ and find Laplace-Weierstrass transform of $\wedge_{t,y}^{n}$.

We have obtained solution of Partial differential equation. We have also derived Ramanujan's formula by using Laplace-Weierstrass transform.

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TRANSIENT THERMOELASTIC PROBLEM IN A THIN RECTANGULAR PLATE

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ABSTRACT

In this paper, we consider a thin rectangular plate and discus the thermoelastic problem. In order to obtain the solution of the governing equation, which is a partial differential equation, the following procedures of analysis have been adopted.

- *Normalizing of the governing partial differential equation subject to appropriate initial, boundary conditions.*
- *Taking the finite Fourier,inverse Fourier and Laplace transform with inverse Laplace of the resulting equation with respect to time.*

The solution and expressions of the temperature, stressfunction, displacement and stress components are obtained in terms of Bessel's function, and the results are illustrated numerically and graphically.

Key words: *Thin rectangular plate, transient quasi-static thermal stress, Fourier transform, Laplace transform, Inverse Fourier and Laplace transform.*

INTRODUCTION

Tanigawa Y., Ishihara M., Morishita H., and Kawamura R. [7] have studied theoretical analysis of two dimensional thermoelastoplastic bending deformation of plate subjected to partially distributed heat supply. YoshinobuTanigawa and YasuoKomatsubara [9] have discussed thermal stress analysis of a rectangular plate and its thermal stress intensity factor for compressive stress field. Ishihara M., Tanigawa Y., Kawamura R. and Noda N. [3] have studied theoretical analysis of residual stress by removing the heat supply. Further, Vihak V.M., Yuzvyak M.Y. and Yasinkij A.V. [8] have investigated the solution of the plane thermo-elasticity problem for a rectangular domain. Adams R.J. and Bert C.W. [1] have determined thermoelastic vibration of a laminated rectangular plate subjected to a thermal shock.

A consistent effort in the past has been made by numerous workers to study various aspects of thermal stresses in different bodies.N W Khobragade and PayaHiranwarl[12] have studied Thermal Deflection of a thick clamped rectangular plate .SunitaPatil and Kirshana Prasad[13] have discussed Some steady state themoelastic problem of rectangular plate.

The aim of this study is to investigate transient problem of Quasi-static thermal stresses in a rectangular plate occupying the space $-a \le x \le a$, $-b \le y \le b$ has been determined.

The solution and expressions of the temperature, stress function, displacement and stress components are obtained in terms of Bessel's function and the results are illustrated numerically and graphically

The results obtained may be useful in solving engineering problems, particularly for industrial machines subjected to heating such as the main shaft of a lathe, turbines and the rolls of the rolling mill.

STATEMENT OF HEAT CONDUCTION PROBLEM

Consider a thin rectangle plate occupying the space D : $-a \le x \le a$, $-b \le y \le b$. Initially the temperature of plate is kept at zero. The differential equation governing transient temperature distribution T(x,y,t) in rectangular plate is

$$\frac{\partial^2 T}{\partial x^2}+\frac{\partial^2 T}{\partial y^2}=\frac{1}{K}.\frac{\partial T}{\partial t}$$

$$-a \le x \le a,\ -b \le y \le b,\ t > 0 \quad (1)$$

subject to the initial boundary conditions as

$$T(x,y,t)_{t=0}=0 \quad (2)$$

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$$\left(\frac{\partial T}{\partial x}\right)_{x=\pm a} = 0 \qquad (3)$$

$$\left(\frac{\partial T}{\partial y}\right)_{y=-b} = 0 \qquad (4)$$

$$T(x, y, t)_{y=\xi} = -f(x) \quad -b \le \xi \le b \qquad (5)$$

where T, K are the temperature change and thermal diffusivity. The Airy's stress function U satisfies the equation as in [9]

$$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)^2 U = -\alpha E\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)T \qquad (6)$$

where α and E are the linear coefficients of the thermal expansion and Young's modulus of elasticity of the materials of the rectangular plate respectively.

The displacement components U_x and U_y in the x and y direction represented in the integral form and the stress components in terms of U are given by

$$U_x = \int\left(\frac{1}{E}\left(\frac{\partial^2 U}{\partial y^2} - \nu\frac{\partial^2 U}{\partial x^2}\right) + \alpha T\right).dx \quad (7)$$

$$U_y = \int\left(\frac{1}{E}\left(\frac{\partial^2 U}{\partial x^2} - \nu\frac{\partial^2 U}{\partial y^2}\right) + \alpha T\right).dy \quad (8)$$

$$\sigma_{xx} = \frac{\partial^2 U}{\partial y^2} \qquad (9)$$

$$\sigma_{yy} = \frac{\partial^2 U}{\partial x^2} \qquad (10)$$

$$\text{and } \sigma_{xy} = \frac{\partial^2 U}{\partial x \partial y} \qquad (11)$$

where ν is the Poisson's ratio of the material of the plate.

The equation (1) to (11) constitutes the mathematical formulations of the problem under consideration.

SOLUTION OF THE HEAT CONDUCTION PROBLEM DETERMINATION OF TEMPERATURESTRESS FUNCTION, DISPLACEMENT COMPONENTAND STRESS COMPONENTS

On applying finite Fourier and Laplace transform to the equation (1) to (5) and then using their inversions, one obtains the expression of the temperature distribution, stress function and displacement respectively as,

$$T(x, y, t) = \sum_{n,p=1}^{\infty} \frac{\dfrac{-2\xi_p.\cos\xi_p(y+b)}{(\xi+b)\sin(\xi_p(\xi+b))}\dfrac{\bar{f}(\xi_n)}{(\xi_n^2+\xi_p^2)}.}{\dfrac{K_0(\xi_n, x)}{Nx}.G(m,n,t)} \quad (13)$$

$$U(x,y,t) = -2\alpha E \sum_{n,p=1}^{\infty} \frac{\dfrac{\xi_p.\cos\xi_p(y+b)}{(\xi+b)\sin(\xi_p(\xi+b))}\dfrac{\bar{f}(\xi_n)}{(\xi_n^2+\xi_p^2)^2}.}{\dfrac{K_0(\xi_n,x)}{Nx}.G(m,n,t)} \quad (14)$$

$$U_x = -2\alpha(1+\nu) \sum_{n,p=1}^{\infty} \frac{\dfrac{\xi_n\xi_p.\cos\xi_p(y+b)}{(\xi+b)\sin(\xi_p(\xi+b))}\dfrac{\bar{f}(\xi_n)}{(\xi_n^2+\xi_p^2)^2}.}{\dfrac{\sin\xi_n(x+a)}{Nx}.G(m,n,t)} \quad (15)$$

$$U_y = -2\alpha(1+\nu) \sum_{n,p=1}^{\infty} \frac{\dfrac{\xi_p^2.\sin\xi_p(y+b)}{(\xi+b)\sin(\xi_p(\xi+b))}\dfrac{\bar{f}(\xi_n)}{(\xi_n^2+\xi_p^2)^2}.}{\dfrac{K_0(\xi_n,x)}{Nx}.G(m,n,t)} \quad (16)$$

$$\sigma_{xx} = 2\alpha E \sum_{n,p=1}^{\infty} \frac{\dfrac{\xi_p^3.\cos\xi_p(y+b)}{(\xi+b)\sin(\xi_p(\xi+b))}\dfrac{\bar{f}(\xi_n)}{(\xi_n^2+\xi_p^2)^2}.}{\dfrac{K_0(\xi_n,x)}{Nx}.G(m,n,t)} \quad (17)$$

$$\sigma_{yy} = 2\alpha E \sum_{n,p=1}^{\infty} \frac{\dfrac{\xi_n^2\xi_p.\cos\xi_p(y+b)}{(\xi+b)\sin(\xi_p(\xi+b))}\dfrac{\bar{f}(\xi_n)}{(\xi_n^2+\xi_p^2)^2}.}{\dfrac{K_0(\xi_n,x)}{Nx}.G(m,n,t)} \quad (18)$$

$$\sigma_{xy} = -2\alpha E \sum_{n,p=1}^{\infty} \frac{\dfrac{\xi_n\xi_p^2.\sin\xi_p(y+b)}{(\xi+b)\sin(\xi_p(\xi+b))}\dfrac{\bar{f}(\xi_n)}{(\xi_n^2+\xi_p^2)^2}.}{\dfrac{\sin\xi_n(x+a)}{Nx}.G(m,n,t)} \quad (19)$$

where

$$G(m,n,t) = \left[1 - \exp\left(-K\left(\xi_n^2 + \xi_p^2\right)t\right)\right]$$

ξ_n is the Fourier transform parameter and Kernal $K_0(\xi_n.x)$ defined as,

$$K_0(\xi_n, x) = \frac{R_0(\xi_n, x)}{\sqrt{N_x}}$$

$$R_0(\xi_n, x) = \cos\xi_n(x+a)$$

$$\frac{1}{\sqrt{N_x}} = \frac{2}{a}$$

where ξ_n is the positive root of the transcendental equation.

$$\sin 2\xi_n x = 0$$

4 Special caseand Numerical results

$$\text{Set } f(x) = ax - \frac{x^2}{2} \qquad (20)$$

Applying the finite Fourier transform to the equation (20) one obtains

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$$\overline{f}(\xi_n) = \int_{-a}^{a} \left(ax - \frac{x^2}{2} \right) \cos \xi_n (x+a).dx \quad (21)$$

For finding out the solution of transient quasi-static thermal stress, steel (SN50C) has been taken as the material of the plate having the following properties:

$\xi_1 = 1.309$ $\xi_2 = 3.927$ $\xi_3 = 4.971$ $\xi_4 = 6.021$ $\xi_5 = 8.115$
$\xi_6 = 10.21$ $\xi_7 = 13.352$ $\xi_8 = 15.97$ $\xi_9 = 17.017$ $\xi_{10} = 19.111$
$\alpha = 11.0 \times 10^{-6}\,K^{-1}$ $\nu = 0.281$ $c = 0.03$ $a = 2$ $b = 1$
$t = 90$ $x = 5$ $y = 0.1, 0.2 \ldots 0.6$

$\delta = -2\alpha E \beta = -2\alpha(1+\nu)$ $\gamma = 2\alpha E$ $K = 15.9 \times 10^{-6}\ m^2 s^{-1}$ $E = 215$ GPa

$$T(x,y,t) = \sum_{n,p=1}^{\infty} \frac{-2\xi_p . \cos \xi_p (y+b)}{(\xi+b) \sin(\xi_p(\xi+b))} . \frac{K_0(\xi_n, x)}{Nx(\xi_n^2 + \xi_p^2)} . G(m,n,t) \int_{-a}^{a} \left(ax - \frac{x^2}{2} \right) \cos \xi_n (x+a).dx \; 111111 \quad (22)$$

$$U(x,y,t)/\delta = -2\alpha E \sum_{n,p=1}^{\infty} \frac{\xi_p . \cos \xi_p (y+b)}{(\xi+b) \sin(\xi_p(\xi+b))} . \frac{K_0(\xi_n, x)}{Nx(\xi_n^2 + \xi_p^2)^2} . G(m,n,t) \int_{-a}^{a} \left(ax - \frac{x^2}{2} \right) \cos \xi_n (x+a).dx \quad (23)$$

$$U_x/\beta = -2\alpha(1+\nu) \sum_{n,p=1}^{\infty} \frac{\xi_n \xi_p . \cos \xi_p (y+b)}{(\xi+b) \sin(\xi_p(\xi+b))} . \frac{\sin \xi_n (x+a)}{Nx(\xi_n^2 + \xi_p^2)^2} . G(m,n,t) \int_{-a}^{a} \left(ax - \frac{x^2}{2} \right) \cos \xi_n (x+a).dx \quad (24)$$

$$U_y/\beta = -2\alpha(1+\nu) \sum_{n,p=1}^{\infty} \frac{\xi_p^2 . \sin \xi_p (y+b)}{(\xi+b) \sin(\xi_p(\xi+b))} . \frac{K_0(\xi_n, x)}{Nx(\xi_n^2 + \xi_p^2)^2} . G(m,n,t) \int_{-a}^{a} \left(ax - \frac{x^2}{2} \right) \cos \xi_n (x+a).dx \quad (25)$$

$$\sigma_{xx}/\gamma = 2\alpha E \sum_{n,p=1}^{\infty} \frac{\xi_p^3 . \cos \xi_p (y+b)}{(\xi+b) \sin(\xi_p(\xi+b))} . \frac{K_0(\xi_n, x)}{Nx(\xi_n^2 + \xi_p^2)^2} . G(m,n,t) \int_{-a}^{a} \left(ax - \frac{x^2}{2} \right) \cos \xi_n (x+a).dx \quad (26)$$

$$\sigma_{yy}/\gamma = 2\alpha E \sum_{n,p=1}^{\infty} \frac{\xi_n^2 \xi_p . \cos \xi_p (y+b)}{(\xi+b) \sin(\xi_p(\xi+b))} . \frac{K_0(\xi_n, x)}{Nx(\xi_n^2 + \xi_p^2)^2} . G(m,n,t) \int_{-a}^{a} \left(ax - \frac{x^2}{2} \right) \cos \xi_n (x+a).dx \quad (27)$$

$$\sigma_{xy}/\gamma = -2\alpha E \sum_{n,p=1}^{\infty} \frac{\xi_n \xi_p^2 . \sin \xi_p (y+b)}{(\xi+b) \sin(\xi_p(\xi+b))} . \frac{\sin \xi_n (x+a)}{Nx(\xi_n^2 + \xi_p^2)^2} . G(m,n,t) \int_{-a}^{a} \left(ax - \frac{x^2}{2} \right) \cos \xi_n (x+a).dx \quad (28)$$

where

$$G(m,n,t) = \left[1 - \exp\left(-K(\xi_n^2 + \xi_p^2)t\right)\right]$$

5 GRAPHS

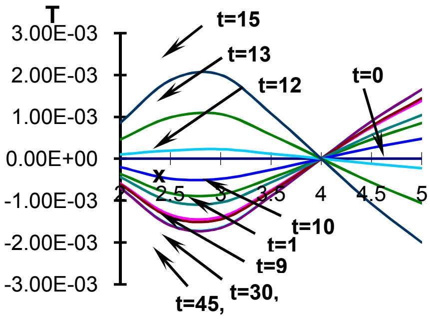

Fig. 1 : Temperature distribution T versus x at t = 15, 30, …, 15for fixed y = 0.05

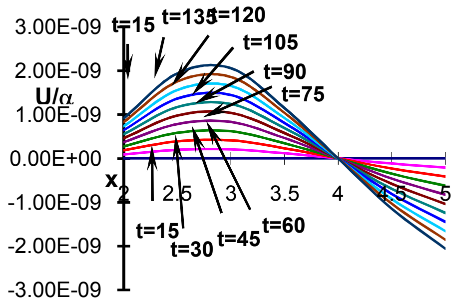

Fig. 2 : Stress function U/α versus x at t = 15, 30, …, 15for fixed y = 0.05

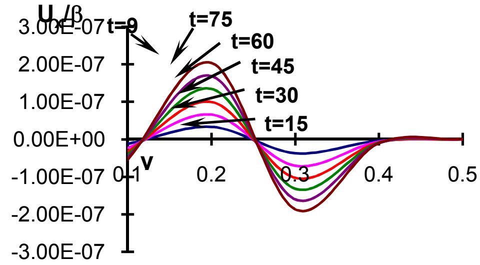

Fig. 3 : Displacement Component U_x/β versus y at t = 15, 30, …, 90for fixed x = 3

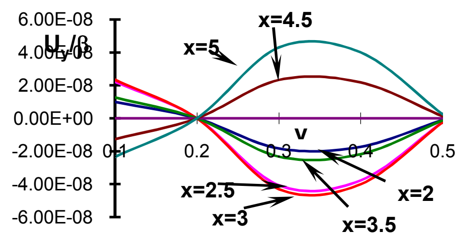

Fig. 4 : Displacement Component U_y/β versus y at x =2,2.5,…5for fixed t = 15

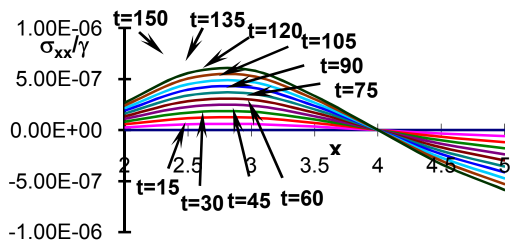

Fig.5 : Stresses component σ_{yy}/γ versus x at t = 15, 30, …, 150for fixed y = 0.5

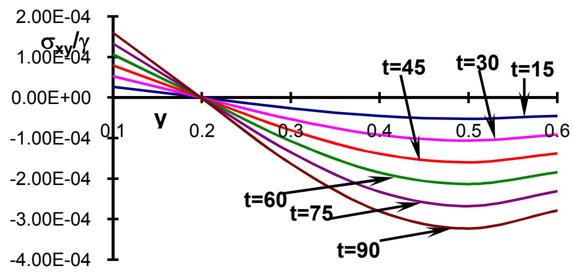

Fig. 6 : Stresses component σ_{xy}/γ versus y at t = 15, 30, …, 90for fixed x = 3

DISCUSSION

In this paper, equations (22) through (28) have been calculated on our observations using MathCAD, graphs have been plotted accordingly as per the results obtained, and conclusions are being drawn.

Initially the temperature of the rectangular plate has been determined by using the conditions given in the problem and applying finite Fourier and Laplace transform and its inverse. Thus, the value of stress function of the material of the plate is found using temperature T, linear coefficients of the thermal expansion α Young's modulus of elasticity E, and Poisson's ratio of the material v. Finally, the displacement component has been arrived at using the stress function; and lastly, the stress component in terms of U has been found.

Now, thermal diffusivity and thermal conductivity are two important thermal properties that enter the differential equation of heat conduction. Therefore, accuracy of the value chosen for these properties affects the accuracy of the results in heat-conduction problems. In isotropic rectangular plate the change of temperature does not lead to any change in shear angles, except the stress and strain of the plate. These properties are clearly reflected in the above plotted graphs.

In this problem of inverse transient quasi-static thermal stress in thin rectangular plate, the condition that has been given, is that, its base is subjected to heat flux and initially the temperature of the plate has been kept at zero. Here, we have considered steel plate (SN50C) as the metal, and hence the graph shows a particular pattern resembling the properties of steel plate (SN50C).

Thus the following conclusion can be drawn:

1. The temperature distribution increases as the time increases, and is at its optimum at time t = 150 for different values of t versus x, for

fixed y = 0.05; and each line coincides at x = 4. (refer fig. 1).

2. Stress function increases as the time increases, for different values of t versus x, for fixed y = 0.05; and each line coincides at x = 4. (refer fig. 2).
3. Displacement component rapidly increases as time t increases for fixed value of x versus y and coincides at y = 0.5 (refer Fig.3).
4. Displacement component is optimum at x = 3 (refer Fig.4), after which it starts declining at different value of x versus y for fixed time t = 15.All lines coincide at y = 0.5.
5. A reverse pattern in the graph obtained in stress component σ_{xx} and σ_{xy} (Fig. 5 &6) due to its negative sign.

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MATTER SYMMETRIES OF EINSTEIN-ROSEN SPACE-TIME IN GENERAL RELATIVITY

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ABSTRACT

In this paper we investigate matter symmetries or collineations (MC)of cylindrically symmetric Einstein-Rosen metric. These have been examined for both cases when energy-momentum tensor is degenerate and when it is non-degenerate.It is shown that non-degenerate energy-momentum tensor gives finite dimensional matter symmetries whereas in most of the cases degenerate energy-momentum tensor gives infinite dimensional MC. There exist one interesting case when the energy-momentum tensor is degenerate but MC is finite dimensional. It is interesting to note that if we take inheriting factor, matter symmetries enhance to matter inheritance symmetries or collineations(MIC) which already available in the literature. We apply different constraint conditions on the energy-momentum tensor in each case.

Keywords *: Matter Symmetries, Cylindrically Symmetric Einstein-Rosen metric.*

INTRODUCTION

In general relativity,space-time symmetries play an important role to recognize the relationship between geometry and matter exhibited by Einstein's Field Equations (EFE's). These EFE's are highly non-linear and their rigorous solution needs some assumptions in form of other conditions or constraints. There are many methods available to apply some assumption on space-time metric. These assumptions must satisfy certain rules one of them is they must be consistent geometric structure of metric and symmetry group of space-time. Such assumptions are known as symmetries or collineations.In the different types of symmetry,isometries are most widely studied in Einstein relativity theory. Homothetic motions, Ricci collineations, mattercollineations, conformal Ricci collineations, matter inheritance collineations are few examples of these symmetries.It is very well known that two unlike symmetries are not equivalent. For instance a Killing vector is a matter symmetry or Ricci symmetry but its reverse does not hold. Symmetries have been classified through their relative properness [1,2].These symmetries arise in the solution of Einstein field equations (EFEs),

$$G_{ij} \equiv R_{ij} - \frac{1}{2} R g_{ij} = \chi T_{ij} \,, \qquad (1)$$

whereR_{ij} is Ricci tensor components, T_{ij} is matter (energy-momentum) tensor components, $R = R_{ij} g^{ij}$ is the curvature scalar, and χ is gravitational constant($\chi = 1$). Here we have assumed cosmological constant $\Lambda = 0$. The exact solution of Einstein's field equations (1) in general relativity can be obtained by means of these symmetries (collinetaions). The geometrical symmetries which are defined by a relation in the form of equation

$\mathcal{L}_X \mathcal{B} = C$,

where $\mathcal{L}$ is the Lie derivative operator, $X^i$is the symmetry or collineation vector,$\mathcal{B}$is any one of the quantities like g_{ij}, Γ^i_{jk}, R_{ij}, $R^i_{jkl}$and C is a any tensor with the same index symmetries as$\mathcal{B}$. One can obtain any symmetry by providing particular forms of $\mathcal{B}$ and$C$.For example, if we take $\mathcal{B}_{ij} = R_{ij}$ and $C_{ij} = 2\psi R_{ij}$ the symmetry vector X^i is called as Ricci inheritance symmetry and Ricci symmetry if$C_{ij} = 0$. Matter inheritance symmetry can be expressed if $\mathcal{B}_{ij} = T_{ij}$ and $C_{ij} = 2\psi T_{ij}$ and it reduces to matter symmetry if $C_{ij} = 0$.

Some authors, Carot*et al*[3] have put forward matter symmetry in EFE's which related to the matter content of the metric represented by energy-momentum tensor and they further have revealed the symmetry inheritance problem in solving the exact solution of EFE's which reflects certain symmetries of space-time metric.Duggal [4,5] has discussed curvature inheritance symmetry in general relativity. Sharif [6] have studied matter inheritance symmetry for degenerate and non-degenerate cases in spherically symmetric static space-time. Oliver and Davis [7,8] explained necessary and sufficient condition for matter space-time to give Ricci Collineation. Geometric symmetry properties as discussed above can be simplified if these are imposed on metric tensor. Such symmetry properties are expressed as isometryorKilling vector fields. These Killing vector fields give conservation laws[9,10]. In the past two decades, there has been much interest in study of space-time symmetries likeRicci symmetry, matter symmetry, proper homothetic vector field [11-20].

A vector field Y on Lorentzian manifold M is said to generate matter symmetry or collineation[21] if the Lie derivative of T_{ij} along Y is given by

$$\mathcal{L}_Y T_{ij} = 0\,, \qquad (2)$$

where$\mathcal{L}$ is the lie derivative operator, Y^i is the symmetry or collineation vector. Above equation (2) can also be written in component form as

$$T_{ij,k}Y^k + T_{ik}Y_{,j}^{\ k} + T_{kj}Y_{,i}^{\ k} = 0\,. \qquad (i,j,k = 0,1,2,3) \qquad (3)$$

In this paper, we investigate matter symmetry or collineation in cylindrically symmetric Einstein-Rosen space-time. Matter symmetry, as a symmetry property of the energy-momentum tensor T_{ij}, are considered for the cases of degenerate and non-degenerate in Einsten-Rosen metric. It is observed that non-degenerate energy-momentum tensor gives finite dimensional matter symmetry or collineation (MC)whereas in most of the cases degenerate energy-momentum tensor gives infinite dimensional MC. There exist one interesting case when the energy-momentum tensor is degenerate, then MC is finite dimensional. We impose different constraint conditions on the energy-momentum tensor (T_{ij}) in each case.

MATTER SYMMETRIES OR COLLINEATIONSEQUATIONS

The most general form of cylindrically symmetric Einstein-Rosen metric is given as

$$ds^2 = e^{2\alpha-2\beta}(dt^2 - d\varrho^2) - \varrho^2 e^{-2\beta} d\psi^2 - e^{2\beta} dz^2, \qquad (4)$$

whereαandβ are the functions of t only.

Here, Ricci Scalar is given by

$$R = 2e^{2\beta-2\alpha}\left(\ddot{\alpha} - \ddot{\beta} + \dot{\beta}^2\right). \qquad (5)$$

The non-vanishing components of energy-momentum tenser are

$$T_{00} = \dot{\beta}^2,$$
$$T_{11} = T_{00}\,,$$
$$T_{22} = \varrho^2 e^{-2\alpha}\left(\ddot{\alpha} + \dot{\beta}^2\right),$$
$$T_{33} = -e^{-2\alpha+4\beta}\left(2\ddot{\beta} - \ddot{\alpha} - \dot{\beta}^2\right). \qquad (6)$$

The MC equations (2) in expanded form is given as

$$T_{00,0}Y^0 + 2T_{00}Y^0{}_{,0} = 0\,, \qquad (7)$$
$$T_{00}Y_{,1}{}^0 + T_{00}Y_{,0}{}^1 = 0, \qquad (8)$$
$$T_{00}\,Y^0{}_{,2} + T_{22}\,Y^2{}_{,0} = 0, \qquad (9)$$
$$T_{00}\,Y^0{}_{,3} + T_{33}\,Y^3{}_{,0} = 0, \qquad (10)$$
$$T_{00,0}\,Y^0 + 2T_{00}\,Y^1{}_{,1} = 0, \qquad (11)$$
$$T_{00}\,Y^1{}_{,2} + T_{22}\,Y^2{}_{,1} = 0, \qquad (12)$$
$$T_{00}\,Y^1{}_{,3} + T_{33}\,Y^3{}_{,1} = 0, \qquad (13)$$
$$T_{22,0}Y^0 + T_{22,1}Y^1 + 2T_{22}Y^2{}_{,2} = 0, \qquad (14)$$
$$T_{22}Y^2{}_{,3} + T_{33}\,Y^3{}_{,2} = 0, \qquad (15)$$
$$T_{33,0}\,Y^0 + 2T_{33}\,Y^3{}_{,3} = 0\,. \qquad (16)$$

where comma denotes the partial derivatives and indices 0, 1, 2, 3 corresponds to variables t, ϱ, ψ, z respectively.

2.1. Matter Symmetries or Collineations (MC) For Degenerate Case

Case I

When all $T_{aa}$are zero then every vector in equ.(7)-(16) is MC.

Case II

When one T_{aa} is zero. In this case we have following sub-cases

i) $T_{00} = 0$ $T_{22} \neq 0$ $T_{33} \neq 0$

ii) $T_{22} = 0$ $T_{00} \neq 0$ $T_{33} \neq 0$

iii) $T_{33} = 0$ $T_{00} \neq 0$ $T_{22} \neq 0$

For sub-case**II** (i),using equations (7)-(16), we have following MC equations

$$T_{22}Y^2{}_{,0} = 0,\ T_{33}Y^3{}_{,0} = 0\,, \qquad (17)$$
$$T_{22}Y^2{}_{,1} = 0,\ T_{33}Y^3{}_{,1} = 0\,, \qquad (18)$$
$$T_{22,0}Y^0 + T_{22,1}Y^1 + 2T_{22}Y^2{}_{,2} = 0, \qquad (19)$$
$$T_{22}Y^2{}_{,3} + T_{33}Y^3{}_{,2} = 0\,, \qquad (20)$$
$$T_{33,0}Y^0 + 2T_{33}Y^3{}_{,3} = 0. \qquad (21)$$

Now,using equations (17)-(18), we have

$$Y^2 = f(\psi, z),$$
$$Y^3 = g(\psi, z).$$

We arrive at solutions using (19)-(21)

$$Y^0 = 0\,,$$
$$Y^1 = c_1\,,$$
$$Y^2 = -\frac{T_{22,1}c_1}{2\,T_{22}}\psi + c_2\,,$$
$$Y^3 = c_3.$$

For sub-case **II** (ii), we have following constraint equations

$Y^0{}_{,0} - Y^1{}_{,1} = 0,$ (22)
$Y^0{}_{,1} + Y^1{}_{,0} = 0,$ (23)
$T_{00}Y^0{}_{,3} + T_{33}Y^3{}_{,0} = 0\,,$ (24)
$T_{00}Y^1{}_{,3} + T_{33}Y^3{}_{,1} = 0,$ (25)
$T_{33,0}Y^0 + 2T_{33}Y^3{}_{,3} = 0,$ (26)
$Y^0{}_{,2} = 0,\ Y^1{}_{,2} = 0,\ Y^3{}_{,2} = 0.$ (27)

To solve above equations we assume, $Y^1 = A(t)B(\varrho)$ and using equations (22) and (23), we get

$\frac{\ddot{A}}{A} = \frac{B''}{B} = 0.$ (28)

Then equation (28) yields

$Y^1 = c_1 t\varrho + c_2 t + c_3\varrho + c_4.$ (29)

Now, using (25), (26) and(29), we have

$Y^0 = 0\,,$
$Y^2 = Y^2(t,\varrho,\psi,z),$
$Y^3 = c_5.$ (30)

Now, for sub-case **II**(iii) we have the following solutions

$Y^0 = 0,$
$Y^1 = c_1,$
$Y^2 = -\frac{\psi T_{22,1}}{2\,T_{22}}c_2 + c_3,$
$Y^3 = Y^3(t,\varrho,\psi,z).$

Case III

When two T_{aa} is zero. In this case we have following sub-cases

i) $T_{33} \neq 0$ $\quad T_{00} = 0 = T_{22}$
ii) $T_{22} \neq 0$ $\quad T_{00} = 0 = T_{33}$
iii) $T_{00} \neq 0$ $\quad T_{22} = 0 = T_{33}$.

For sub-case **III**(i), MC equations (7)-(16) become

$T_{33}Y^3{}_{,a} = 0, (a = 0,1,2)$ (31)
$T_{33,0}Y^0 + 2T_{33}Y^3{}_{,3} = 0.$ (32)

Equations (31) and (32) yield

$Y^0 = c_1\,,$
$Y^3 = -\frac{z\,T_{33,0}}{2\,T_{33}}c_1 + c_2,$
$Y^1 = Y^1(t,\varrho,\psi,z),$
$Y^2 = Y^2(t,\varrho,\psi,z).$

By applying above procedure we have solutions for sub-case **III** (ii) as

$Y^0 = c_1\,,$
$Y^1 = c_2\,,$
$Y^2 = -\left(\frac{T_{22,1}c_2 + T_{22,0}c_1}{2\,T_{22}}\right)\psi + c_3,$
$Y^3 = Y^3(t,\varrho,\psi,z).$

Now, MC equations for sub-case **III** (iii) are

$Y^0{}_{,0} - Y^1{}_{,1} = 0,$ (33)
$Y^0{}_{,1} + Y^1{}_{,0} = 0,$ (34)
$Y^0{}_{,2} = 0,\ Y^0{}_{,3} = 0,\ Y^1{}_{,2} = 0,\ Y^1{}_{,3} = 0.$ (35)

Then we have solutions,

$Y^0 = c_1,$
$Y^1 = c_2,$
$Y^2 = Y^2(t,\varrho,\psi,z),$
$Y^3 = Y^3(t,\varrho,\psi,z).$

2.2. Matter Symmetries or Collineations(MC) For Non-Degenerate Case

We discuss non-degenerate case when $T_{00} \neq 0, T_{22} \neq 0, T_{33} \neq 0$.

Therefore, we consider equations (7)-(16) as given below

$T_{00}\left(Y^0{}_{,0} - Y^1{}_{,1}\right) = 0,$ (36)
$T_{00}\left(Y^0{}_{,1} + Y^1{}_{,0}\right) = 0,$ (37)
$T_{00}\,Y^0{}_{,2} + T_{22}\,Y^2{}_{,0} = 0,$ (38)
$T_{00}\,Y^0{}_{,3} + T_{33}\,Y^3{}_{,0} = 0,$ (39)
$T_{00}\,Y^1{}_{,2} + T_{22}\,Y^2{}_{,1} = 0,$ (40)
$T_{00}\,Y^1{}_{,3} + T_{33}\,Y^3{}_{,1} = 0,$ (41)
$T_{22,0}Y^0 + T_{22,1}Y^1 + 2T_{22}Y^2{}_{,2} = 0\,,$ (42)
$T_{22}\,Y^2{}_{,3} + T_{33}\,Y^3{}_{,2} = 0,$ (43)
$T_{33,0}Y^0 + 2T_{33}Y^3{}_{,3} = 0.$ (44)

Now, using (36) and (37), we get

$Y^1{}_{,00} = -Y^1{}_{,11}\,.$ (45)

Let, $Y^1 = A(t)B(\varrho)$ and substitute in equation (45), we get

$Y^1 = c_1 t\varrho + c_2 t + c_3\varrho + c_4.$ (46)

Now, using (37), (41), (43) and (44), we have

$Y^0 = -\frac{c_1\varrho^2}{2} - c_2\varrho + A_3(\psi,z),$ (47)
$Y^2 = -\frac{T_{33}}{T_{22}}\int A_{1,2}dz + A_2(\psi,\varrho),$ (48)
$Y^3 = A_1(\psi,z),$ (49)

Now, substitute equations (46)-(49) back in (38)-(40) and (42) with constraint conditions

$T_{22} = \alpha \neq 0, T_{33} = \beta \neq 0$ whichyields

$A_1 = c_5 z + c_6,$
$A_2 = z\psi + c_7,$
$A_3 = c_8$ where α, β and $c_i (i = 1,2,3,4,5,6,7,8)$ are constants.

CONCLUSION

In the classification of Einstein-Rosen space-time according to their energy-momentum tensor, we find ten matter symmetries or collineations (MC's) equations. We have solved these equations for degenerate case (section 2.1) where $det(T_{ab}) = 0$ as well as for non-degenerate case (section 2.2) when $det(T_{ab}) \neq 0$. From these equations we obtained different constraint conditions on energy-momentum tensor. If we solve these constraint conditions we can have new class of rigorous solutions of Einstein's field equations. It is observed from section (2.1) that when energy-momentum tensor is degenerate, then matter symmetries equations admit infinite dimensional MC'sexcept case II-(i). In this case, we have three MC'salthough energy-momentum tensor is degenerate. However innon-degenerate case, we have obtained eight MCs.

In this paper, we have explained a detail classification of matter symmetries equations for the Einstein-Rosen space-time in accordance with energy-momentum tensor. After solving equations (2) for the space-time (3), we haveten matter symmetries (collineations) equations. Using these MC equations, we have shown that if the energy-momentum tensor is degenerate, then we found single case where matter symmetry is finite dimensional.

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QUALITATIVE ANALYSIS OF IMPERFECT FLUID WITH DIAGONAL COSMOLOGICAL MODELS IN $f(T)$ GRAVITY

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ABSTRACT

In this article, we considered the bulk viscous fluid in the formalism of modified gravity in which the general form of a gravitational action is $f(T)$ function, where T is the torsion scalar within the frame of flat FRW space time. The cosmological model dominated by bulk viscous matter with total bulk viscous coefficient expressed as a linear combination of the velocity and acceleration of the expansion of the universe in such a way that $\xi = \xi_0 + \xi_1 \frac{\dot{a}}{a} + \xi_2 \frac{\ddot{a}}{\dot{a}}$, where ξ_0, ξ_1 and ξ_2 are constants. We take $p = (\gamma - 1)\rho$, where $0 \le \gamma \le 2$ as an equation of state for perfect fluid. The exact solutions to the corresponding field equations are obtained towards the particular choice of $f(T) = gT + hT^s$. Also some geometrical and physical aspects of the models are discussed.

Keywords: *$f(T)$ gravity, Bulk viscous fluid, Acceleration of universe.*

INTRODUCTION

In recent times, the modified gravity has come to be one of the most popular candidates to understand the indication of dark energy. In modified gravity, the origin of dark energy is identified as a modification of gravity. In literature, a number of modified theories have been discussed to explain early and late time expansion of the universe. In modified theories one modifies the laws of gravity so that the late time accelerated expansion of the universe is realized without recourse to an explicit dark energy matter component. One of the simplest modified gravity models is $f(R)$ gravity in which the 4-dimensional action is given by some general function $f(R)$ of the Ricci scalar R. Viable $f(R)$ gravity models show the unification of early-time inflation and late time acceleration. In the same gravity the explanation of cosmic acceleration is obtained just by introducing the term $1/R$, which is essential at small curvatures. $f(R)$ Gravity is equivalent to scalar-tensor theory of gravity that is incompatible with solar system tests of General Relativity also within this gravity dust matter and dark energy phases can be achieved [1-3]. Subsequently, several authors ([4-8]) investigated $f(R)$ theory of gravity from different aspects.

Another modification of general relativity, so called the $f(R,T)$ gravity, where the gravitational Lagrangian is given by an arbitrary function of the curvature scalar R and T is the torsion scalar. The $f(R,T)$ gravity model depends on a source term, representing the variation of the matter stress-energy tensor with respect to the metric. The general expression for this source term is obtained as a function of the matter Lagrangian L_m. Therefore, the different choice of Lm would generate a specific set of field equations. This modified theory possessing some interesting results which are relevant in theoretical cosmology and astrophysics. Some authors like Rao & Neelima [9], Sharif & Zubair [10], Sahoo et al.[11] and Chirde & Shekh [12-14], Bhoyar et al. [15-16] for instance, have investigated numerous aspects of modified gravity models that show the unification of early time inflation and late time acceleration.

Another alternative approach dealing with the acceleration problem of the universe is changing the gravity law through the modification of action in general relativity (GR). This modification gives $f(T)$ gravity. In the present investigation, we focus on the $f(T)$ gravity as it is the best to account for the present accelerating expansion due to Weitzenbock connection is used instead of the

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curvature defined via the Levi-Civita connection in GR.

$f(T)$ GRAVITY FORMALISM

For a general space-time metric, we can define the line element as

$$dS^2 = g_{\mu\nu} dx^\mu dx^\nu . \qquad (2.1)$$

This line element can be converted to the Minkowski's description of the transformation called tetrad, as follows

$$dS^2 = g_{\mu\nu} dx^\mu dx^\nu = \eta_{ij}\theta^i\theta^j , \qquad (2.2)$$

$$dx^\mu = e_i^\mu \theta^i, \quad \theta^i = e_\mu^i dx^\mu , \qquad (2.3)$$

where η_{ij} is a metric on Minkowski space-time and $\eta_{ij} = diag\,[1,-1,-1,-1]$ and $e_i^\mu e_\nu^i = \delta_\nu^\mu$ or $e_i^\mu e_\mu^j = \delta_i^j$. The root of metric determinant is given by $\sqrt{-g} = \det[e_\mu^i] = e$. For a manifold in which the Riemann tensor part without the torsion terms is null (contribution of the Levi-Civita connection) and only the non-zero torsion terms exist, the Weitzenbocks connection components are defined as

$$\Gamma^\alpha_{\mu\nu} = e_i^\alpha \partial_\nu e_\mu^i = -e_\mu^i \partial_\nu e_i^\alpha . \qquad (2.4)$$

which has a zero curvature but nonzero torsion. Through the connection, we can define the components of the torsion tensors as

$$T^\alpha{}_{\mu\nu} = \Gamma^\alpha{}_{\nu\mu} - \Gamma^\alpha{}_{\mu\nu} = e^\alpha{}_i(\partial_\mu e^i{}_\nu - \partial_\nu e^i{}_\mu), \qquad (2.5)$$

The difference between the Levi-Civita and Weitzenbock connections is a space-time tensor, and is known as the contorsion tensor:

$$K^{\mu\nu}{}_\alpha = -\frac{1}{2}\left(T^{\mu\nu}{}_\alpha - T^{\nu\mu}{}_\alpha - T_\alpha{}^{\mu\nu}\right). \qquad (2.6)$$

For facilitating the description of the Lagrangian and the equations of motion, we can define another tensor $S_\alpha^{\mu\nu}$ from the components of the torsion and contorsion tensors, as

$$S_\alpha^{\mu\nu} = \left(\frac{1}{2}\right)\left(K^{\mu\nu}{}_\alpha + \delta_\alpha^\mu T^{\beta\nu}{}_\beta - \delta_\alpha^\nu T_\beta^{\beta\mu}\right). \qquad (2.7)$$

The torsion scalar T is

$$T = T^\alpha{}_{\mu\nu}\, S_\alpha{}^{\mu\nu} . \qquad (2.8)$$

Now, we define the action by generalizing the TG i.e. $f(T)$ theory as

$$S = \int [T + f(T) + L_{matter}]\, e\, d^4x \;. \qquad (2.9)$$

Here, $f(T)$ denotes an algebraic function of the torsion scalar T. Making the functional variation of the action (2.9) with respect to the tetrads, we get the following equations of motion

$$S_\mu^{\nu\rho}\partial_\rho T f_{TT} + \left[e^{-1} e_\mu^i \partial_\rho\left(e e_i^\alpha S_\alpha^{\nu\rho}\right) + T^\alpha{}_{\lambda\mu} S_\alpha^{\nu\lambda}\right]\left(1+f_T\right) + \frac{1}{4}\delta_\mu^\nu (T+f) = 4\pi G T_\mu^\nu , \qquad (2.10)$$

where $T_\mu^{\,\nu}$ is the energy momentum tensor, $f_T = df(T)/dT$.

The field equation (2.10) is written in terms of the tetrad and partial derivatives and appears very different from Einstein's equations.

Recently, some interesting $f(T)$ models have been explored by different authors. Chirde and Shekh [17-18] deliberated a spatially homogeneous and isotropic model in the context of $f(T)$ gravity with thermodynamic aspects and anisotropic background for one-dimensional cosmic string in $f(T)$ gravity also Chirde and Shekh [19] discussed Accelerating universe, Dark energy and Exponential $f(T)$ gravity. Jamil Amir and Yussouf [20] construct of $f(T)$ models within the Kantowski-Sachs universe using the conservation equation and equation of state parameter, which represents the different phases of the universe. Stability of accelerating universe with linear equation of state in $f(T)$ gravity using hybrid expansion law investigated by Bhoyar et al. [21].

The bulk viscous fluid is the unique viscous effect capable to modify the background dynamics in a homogeneous and isotropic universe. It has been known that, perfect fluid with bulk viscosity can produce acceleration without the help of a cosmological constant or some scalar field. This idea was extended to explain the late time acceleration of the universe. The effects of viscosity terms depending on the Hubble parameter and its derivatives in the dark energy equation of state. In particular, that a viscous fluid (or, equivalently, one with an inhomogeneous (imperfect) equation of state) is perfectly able to produce a Little Rip cosmology as a purely viscosity effect. The bulk viscosity is the most favorable phenomenon, compatible with the symmetry requirements of the homogeneous and isotropic universe.

METRIC, FIELD EQUATIONS AND KINEMATICAL PARAMETERS

We consider the spatially homogeneous and isotropic Friedman-Robertson-Walker (FRW) line element of the form

$$ds^2 = dt^2 - a^2(t)\left[\frac{dr^2}{1-kr^2} + r^2 d\Omega^2\right], \quad (3.1)$$

where $d\Omega^2 = d\theta^2 + \sin^2\theta d\phi^2$. The angle θ and ϕ are the usual azimuthally and polar angles of spherical coordinates, with $0 \le \theta \le \pi$ and $0 \le \phi \le 2\pi$. The coordinates (t, r, θ, ϕ) are called commoving coordinates. This means that the coordinate system follows the expansion of space, so that the space coordinates of objects which do not move with respect to the background remain the same. The homogeneity of the universe fixes a special frame of reference, the cosmic rest frame given by the above coordinate system. Also k is a constant representing the curvature of the space. The case of $k=1$ corresponds to closed universe, flat universe obtained from $k=0$ and the case of $k=-1$ corresponds to open universe. In view of above universe in this work we deliberate on the flat universe take after $k=0$ with infinite radius.

Now we define some kinematical parameters for the FRW cosmological model which are important in cosmological observations.

The spatial volume,

$$V = a^3. \quad (3.2)$$

The generalized mean Hubble parameter,

$$H = \frac{\dot{a}}{a}. \quad (3.3)$$

The mean anisotropy parameter,

$$A_m = \frac{1}{3}\sum_{i=1}^{3}\left(\frac{H_i - H}{H}\right)^2. \quad (3.4)$$

The expansion scalar and shear scalar,

$$\theta = u^{\mu}_{;\mu} = \frac{\dot{A}}{A} + \frac{\dot{B}}{B} + \frac{\dot{C}}{C} = 3H, \quad (3.5)$$

$$\sigma^2 = \frac{3}{2}H^2 A_m. \quad (3.6)$$

As the effect of Bulk viscosity is very important in cosmology, since it plays a superior role in success of an accelerated expansion of the universe which is known as inflationary phase. There are many circumstances in the evolution of the universe like neutrinos decouple from the cosmic fluid at the time of formation of galaxies in which bulk viscosity could arise.

The energy momentum tensor T^i_j for bulk viscous fluid distribution is taken as

$$T^i_j = (\bar{p} + \rho)u^i u_j + \bar{p} g^i_j. \quad (3.7)$$

Together with commoving co-ordinates

$$u^i = (0,0,0,1) \text{ and} \quad (3.8)$$

$$u^i u_i = -1, \; \bar{p} = p - \xi u^i_{;i} = p - 3\xi H, \quad (3.9)$$

Where u^i is the 4-velocity vector of the cosmic fluid, $\bar{p}$, p and ρ are the effective pressure, isotropic pressure and energy density of the matter respectively, ξ is the coefficient of bulk viscosity which is a function of time *t*.

The components of the energy momentum tensor are, $T_{4i} = 0$ and. Therefore the total effect of bulk viscosity is to reduce the pressure *p* of the perfect fluid by an amount $\xi\theta$, so that the effective pressure of the viscous fluid turns out to be $\bar{p} = (p - \xi\theta)$.

We can choose the equation of state in the following form

$$p = (\gamma - 1)\rho, \quad (3.10)$$

where γ is a constant known as the equation of state parameter for perfect fluid lying in the range

$$0 \le \gamma \le 2. \quad (3.11)$$

The cosmological model dominated by bulk viscous matter with total bulk viscous coefficient expressed as a linear combination of the velocity and acceleration (general form of bulk viscous coefficient) of the expansion of the universe in such a way that

$$\xi = \xi_0 + \xi_1\frac{\dot{a}}{a} + \xi_2\frac{\ddot{a}}{\dot{a}}, \quad (3.12)$$

where ξ_0, ξ_1 and ξ_2 are constants.

Equation (3.12) can be expressed as

$$\xi = \xi_0 + \xi_1 H + \xi_2\left(\frac{\dot{H}}{H} + H\right), \quad (3.13)$$

In this paper we consider ξ_0, ξ_1 and ξ_2 all are non zero, so that the total bulk viscous parameter ξ depending on both the velocity and acceleration of the expansion of the universe.

From the equation of motion (3.10), the Friedman equation for the viscous fluid of stress energy tensor (3.7) can be written 0as

$$\frac{\dot{a}}{a}\dot{T}f_{TT}+\left\{\frac{\ddot{a}}{a}+2\frac{\dot{a}^2}{a^2}\right\}(1+f_T)+\frac{1}{4}(T+f)=(-4\pi)\bar{p}\,, \qquad (3.14)$$

$$3(1+f_T)\frac{\dot{a}^2}{a^2}+\frac{1}{4}(T+f)=(4\pi)\rho\,, \qquad (3.15)$$

$$-6\frac{\dot{a}^2}{a^2}=T\,. \qquad (3.16)$$

The overhead dot represents the differentiation with respect to time *t*.

SOME WELL-RECOGNIZED $f(T)$MODELS AND THEIR STABILITY WITH CASE OF LINEAR $f(T)$ GRAVITY

In this case we substitute $g=1$ and $h=0$, in $f(T)=gT+hT^s$ we get the model $f(T)=T$.

Using equation (3.3), and (3.7) the set of field equations (3.14) to (3.16) can be expressed as

$$H^2(3+\dot{H})+\dot{H}(2-3H^2)=4\pi\bar{p}\,, \qquad (4.1)$$

$$3H^2=4\pi\rho\,, \qquad (4.2)$$

$$-6H^2=T\,. \qquad (4.3)$$

Field Equation and Their Solutions:

For substantially significant model, Hubble parameter and deceleration parameter are the most important observational quantities in cosmology. During 1960s and 1970s, red shift magnitude test draw very categorical conclusions. The deceleration parameter lies between *0* and 1, thus it was claimed that the universe is decelerating. Berman and Gomide have proposed a law of variation for Hubble parameter that yields a constant value of deceleration parameter and get value $q\geq -1$, but $-1\leq q\leq 0$ correspond to accelerating expansion. According to the recent theoretical analysis of SNe-Ia, LSS, and CMB, the Universe is spatially flat and has a phase transition i.e. past deceleration to recent acceleration. So, In order to match the results with this observation, many authors have define different types of solutions (corresponds to deceleration parameter and scale factor).

Model- I:

Consider a special form of DP which is linear in time with a negative slope as,

$$q=-\frac{\ddot{a}a}{\dot{a}^2}=-1+\frac{\alpha}{1+a^\alpha}\,, \qquad (4.4)$$

where $\alpha>0$ is a constant and a is mean scale factor of the universe.

From equation (4.4), we observed that when $a=0$, $q=\alpha-1>0$, $q=0$ for $a^\alpha=\alpha-1$, and for $a^\alpha>\alpha-1, q<0$. We assume that $a=0$ for $t=0$ therefore, the universe begins with a decelerating expansion and the expansion changes from past decelerating phase to recent accelerating one. This cosmological scenario is in agreement with theoretical observations.

After solving (3.16), one can obtain the scale factor of the form as

$$a=\left(e^{\alpha kt}-1\right)^{\frac{1}{\alpha}}. \qquad (4.5)$$

For the mean scale factor (4.5), we get the value of the DP as

$$q=\frac{\alpha}{e^{\alpha kt}}-1\,. \qquad (4.6)$$

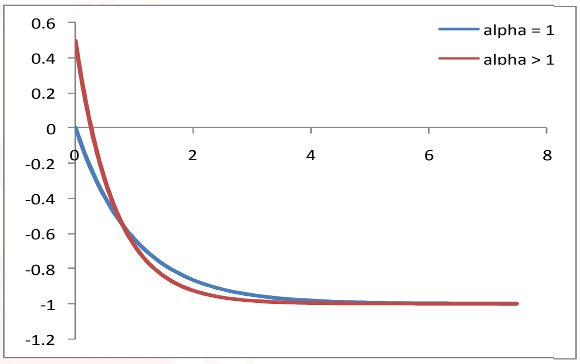

Figure: Behavior of deceleration parameter versus time t.

Equation (4.6) designates that the DP comes out to be a time dependent. At initial epoch $(t=0)$ when universe start to expand, $q=\alpha-1(>0)$ for $\alpha>1$, the sign of q becomes positive which correspond to the standard decelerating expansion, with the expansion of the universe the sign of q become negative which correspond to the standard accelerating expansion. This scenario is consistent with recent theatrical observations (see fig.)

The Torsion scalar T becomes

$$T=-6k^2\left\{\frac{1}{\left(1-e^{-\alpha kt}\right)^2}\right\}. \qquad (4.7)$$

The spatial volume becomes

$$V=\left(e^{\alpha kt}-1\right)^{\frac{3}{\alpha}} \qquad .$$

(4.8)

The mean Hubble parameter and the expansion scalar comes out to be

$$H=\frac{k}{\left(1-e^{-\alpha kt}\right)}. \qquad (4.9)$$

$$\theta=\frac{3k}{\left(1-e^{-\alpha kt}\right)}, \qquad (4.10)$$

The mean anisotropy parameter and shear scalar are given by

$$\Delta=0, \qquad (4.11)$$

$$\sigma^2=0. \qquad (4.12)$$

The spatial volume of the universe starts with big bang at $t=0$ and with the increase of time it always expand, when $t=\infty$ then spatial volume $V\to\infty$. Hubble's parameter, expansion scalar and shear scalar initially all are infinitely large but with the expansion of the universe these parameters are decreases.

Energy density is

$$\rho=\frac{3k^2}{4\pi}\left\{\frac{1}{1-e^{-\alpha kt}}\right\}^2. \qquad (4.13)$$

Viscous pressure is

$$\bar{p}=\frac{k^2}{4\pi}\left\{\frac{(3-2\alpha e^{-\alpha kt})}{(1-e^{-\alpha kt})^2}+\frac{\alpha(3e^{-\alpha kt}-1)}{(1-e^{-\alpha kt})^4}\right\}. \qquad (4.14)$$

Bulk viscous coefficient

$$\xi=\xi_0+\frac{k(\xi_1+\xi_2)}{(1-e^{-\alpha kt})}-\frac{\alpha\xi_2 ke^{-\alpha kt}}{(1-e^{-\alpha kt})} \qquad (4.15)$$

Model –II:

Chirde and Shekh [13] offered the DP, which is linear in time with a negative slope as,

$$q=-\frac{\ddot{a}a}{\dot{a}^2}=-1+\frac{d}{dt}\left(\frac{1}{H}\right), \qquad (4.16)$$

this equation can be integrated to give the average scale factor as

$$a=\exp\int\frac{dt}{\left[\int(1+q)dt+\gamma\right]}, \qquad (4.17)$$

where γ be the arbitrary constant.

For the possible explicit determination of a, we have to integrate above equation (4.17). Depending on the choice for the values of deceleration parameter q, there are two different ways to integrate

(i) According to Berman q is taken to be a constant either positive or negative which provides an explicit function of R and

(ii) According to new law q is taken to vary with cosmic time for an explicit determination of R which leads to a possible choice of q as

$$q=-\frac{\alpha}{t^2}+(\beta-1), \qquad (4.18)$$

which is the main ansatz of the paper. Here $\alpha>0$ is a parameter having the dimension of square of time and β is a dimensionless constant.

Obviously, the different values of α and β will give rise to different models. $\beta\geq1$ corresponds to a decelerating model, for $0<\beta<1$ it corresponds to standard accelerating model.

Equation (4.18) can be integrated to give the time variation of the scale factor as

$$a=\exp\left\{\frac{1}{\beta}\int\left(\frac{tdt}{t^2+t\frac{\delta}{\beta}+\frac{\alpha}{\beta}}\right)\right\}, \qquad (4.19)$$

The integral appearing in (4.19) cannot be evaluated for arbitrary values of the constants. Setting $\delta=0$ in (4.19) and integrating we obtain the average scale factor as

$$a=\left(t^2+\frac{\alpha}{\beta}\right)^{1/2\beta}, \qquad (4.20)$$

The Torsion scalar (T) and spatial volume (V) becomes

$$T=\frac{-6}{\beta^2}\left\{\frac{t^2}{\left(t^2+\frac{\alpha}{\beta}\right)^2}\right\}, \qquad (4.21)$$

$$V=\left(t^2+\frac{\alpha}{\beta}\right)^{3/2\beta}. \qquad (4.22)$$

The mean Hubble parameter (H)

$$H=\frac{t}{\beta\left(t^2+\frac{\alpha}{\beta}\right)} \qquad (4.23)$$

The expansion scalar (θ) turn out to be

$$\theta=\frac{3t}{\beta\left(t^2+\frac{\alpha}{\beta}\right)} \qquad (4.24)$$

The mean anisotropy parameter (A_m)

$$A_m=0 \qquad (4.25)$$

Shear scalar (σ^2) are given by

$$\sigma^2 = 0. \tag{4.26}$$

Since, at an initial stage $t = 0$ the spatial volume is constant, mean Hubble parameter and the expansion scalar are infinite. This shows that the evolution of the universe starts with constant volume and the rate of expansion is infinite. As t increases, the spatial volume increases but the expansion scalar decreases. Hence, the rate of expansion of the universe decreases as the time increases. When $t \to \infty$, the spatial volume becomes infinitely large but the expansion stops and shear becomes zero. The ration of θ/σ tends to constant, thus the model behave anisotropically and matter is dynamically negligible near the origin.

Energy density is

$$\rho = \frac{3}{4\pi\beta^2}\frac{t^2}{\left(t^2+\frac{\alpha}{\beta}\right)^2}. \tag{4.27}$$

Viscous pressure is

$$\bar{p} = \frac{3t^2+2\beta}{\beta\left(t^2+\frac{\alpha}{\beta}\right)} - \frac{2t^2(1+2\beta^2)}{\beta^3\left(t^2+\frac{\alpha}{\beta}\right)^2} + \frac{2t^4}{\beta^3\left(t^2+\frac{\alpha}{\beta}\right)^3}. \tag{4.28}$$

Bulk viscous coefficient

$$\xi = (\xi_0 + \xi_2 t) + \frac{(\xi_1 - \beta\xi_2 + 1)t}{\beta\left(t^2+\frac{\alpha}{\beta}\right)}. \tag{4.29}$$

Model-III:

We consider the value of the average scale factor corresponding to the model of the universe as

$$a = te^t. \tag{4.30}$$

For the mean scale factor (4.30), we get the value of the deceleration parameter as

$$q = -1 + \frac{1}{(t+1)^2}. \tag{4.31}$$

The Torsion scalar T becomes

$$T = -6\left\{1+\frac{1}{t}\right\}^2, \tag{4.32}$$

The spatial volume (V) becomes

$$V = t\ e^{3t} \tag{4.33}$$

The mean Hubble parameter (H)

$$H = \left(1+\frac{1}{t}\right) \tag{4.34}$$

The expansion scalar (θ) turn out to be

$$\theta = 3\left(1+\frac{1}{t}\right), \tag{4.35}$$

The mean anisotropy parameter (A_m)

$$A_m = 0 \tag{4.36}$$

Shear scalar (σ^2) are given by

$$\sigma^2 = 0. \tag{4.37}$$

It is observed that at initial time $t=0$ the spatial volume vanishes and expands exponentially as time increases and becomes infinitely large at $t=\infty$. The mean anisotropy parameter is independent on time t and constant throughout the evolution of the universe from early to infinite expansion but shear scalar is time dependent and decreases with time (i.e. large at $t=0$ and constant at $t=\infty$). This shows that the universe expands with time but the rate of expansion decrease to constant value, which shows that the universe starts evolving with an infinite rate of expansion.

Energy density is

$$\rho = \frac{3}{4\pi}\left(1+\frac{1}{t}\right)^2. \tag{4.38}$$

Viscous pressure is

$$\bar{p} = \frac{1}{4\pi}\left\{\left(3+\frac{2}{t^2}\right)\left(1+\frac{1}{t}\right)^2 - \frac{2}{t^2}\right\}. \tag{4.39}$$

Bulk viscous coefficient

$$\xi = \xi_0 + \xi_1\left(1+\frac{1}{t}\right) + \xi_2\left(\frac{t+2}{t+1}\right). \tag{4.40}$$

CONCLUSIONS

In this article, I have investigated cosmological model dominated by bulk viscous matter with total bulk viscous coefficient expressed as a linear combination of the velocity and acceleration of the expansion of the universe in the formalism of modified gravity in which the general form of a gravitational action is a function of linear and quadratic form of $f(T)$ functions. In both the models the kinematical parameters such as Spatial volume and average scale factor are the functions of time and increases as time increases whereas the other kinematical parameters like expansion scalar, Hubble's parameter both are also the function of time and decreases with time and at infinite time it converges to zero. Also, it interesting to note that in both models anisotropic parameter and shear scalar both are null Hence the model is isotropic in nature. The energy density of the models is decreasing function of time whereas the isotropic bulk viscous pressure is an increasing as expansion of the Universe.

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DOMINATIONS OF HYDRODYNAMIC MODEL BASED ON AN IDEAL FLUID FOR FLAT FRW MODEL

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ABSTRACT

In this investigation we discussed the performance between Equation of State parameter (EoS) parameter for an ideal fluid and Hydrodynamic fluid with some consequences of FRW model. According to the recent observations of SNe-Ia supernova indicate that the expansion of the universe is accelerating due to an unknown form of energy which has large negative pressure known as Dark Energy. The dark energy is characterized by an Equation of State parameter $\omega = \frac{p}{\rho}$ *where* p *and* ρ *are the pressure and energy density of an ideal fluid.*

Keywords: *FRW model, Hydrodynamic, EoS parameter.*

INTRODUCTION

In this paper, we study a variety of fluid dynamics models as they arise in diverse application domains. This analysis allows us to investigate and provide insights to dynamic phenomena that arise in a variety of systems that share similar characteristics. Although,the Plasma Physics and Cosmology are two well-established fields of TheoreticalPhysics, the formulation of hydro and Magneto-hydrodynamics in space-time is a relatively new development.

One of the most important properties of FRW models is, as predicated by the inflation, theflatness, which agrees with observed cosmic microwave background radiation. Even through theuniverse on large scale, appears homogeneous and isotropic at the present time, there is noobservational data that guarantee in an epoch prior to the recombination. In the early universe thesorts of matter fields are uncertain. The existence of anisotropy at early times is a naturalphenomenon to investigate, as an attempt to clarify among other things, the local anisotropiesthat we observe today in galaxies, cluster and super clusters so at early time it appearsappropriate to suppose a geometry that is more general than just the isotropy and homogeneousFRW geometry. Thorne and Macdonald [1] gave a particularly good review of it. Other important works are due to Evans and Hawley [2], Sloan and Smarr[3], Zhang [4], Holcomb and Tajima [5], and later Holcomb [6]. Holcomb and Tajima [6] investigated linearized equations of motion for free photons, longitudinal and transverse oscillations, and Alfven waves in a plasma at an ultrarelativistic temperature in a radiation-dominated FriedmannRobertson Walker (FRW) universe. In many astrophysical situations, the background space-time is neither pure ‘‘dust’’ nor pure radiation, but some kind of mixture of them. Also the temperature involved may be neither ultrarelativistic nor nonrelativistic. So it appears worthwhile to investigate the magnetohydrodynamicsphenomena in a more general background metric andwith a more general adiabatic equation of state for theplasma. In an attempt to extend the work of Holcomb andTajima for a more general background with the metric componentsbeing an arbitrary power function of time, Motivated by the situations discussed in above, in this paper we investigate the performance between EoS parameter for an ideal fluid and Hydrodynamic fluid with some consequences of FRW model. The outlines of the paper is as follows: Section 2, we provide the metric and field equations. Section 3, devotes to Hydrodynamic models. In section 4 we have provide the physical and kinematical properties of the model and finally in section 5 contains concluding remarks.

METRIC AND FIELD EQUATIONS

We consider the spatially homogeneous and isotropic Friedmann-Robertrson-Walker (FRW) line element of the form

$$ds^2 = dt^2 - R^2(t)\left[\frac{dr^2}{1-Kr^2} + r^2(d\theta^2 + \sin^2\theta\, d\Phi^2)\right],$$

(1)

where the angle θ and ϕ are the usual azimuthal and polar angles of spherical coordinates, with $0 \le \theta \le \pi$ and $0 \le \phi \le 2\pi$. The coordinates (t, r, θ, ϕ) are called commoving coordinates. This means that the coordinate system follows the expansion of space, so that the space coordinates of objects which do not move with respect to the background remain the same. The homogeneity of the universe fixes a special frame of reference, the cosmic rest framegiven by the above coordinate system. Also k is a constant representing the curvature of the space. The case of $k = 1$ corresponds to closed universe, flat universe obtained from $k = 0$ and the case of $k = -1$ corresponds to open universe. In view of above universe in this work we deliberate on the flat universe take after $k = 0$ with infinite radius. $R(t)$ represents the radius of the universe and the signature of the metric is $(+,-,-,-)$.

The energy momentum tensor for the source is

$$T_{ij} = (p+\rho)U_i U^j - p g_{ij}, \qquad (2)$$

together with

$$U_i U^i = 1, \qquad (3)$$

where U^i is the four velocity vector of the distribution, ρ is the energy density, p is the pressure,

Using equation (2) the components of T_i^j are as follows

$$T_1^1 = (\rho + p)U_1 U^1 - p\delta_1^1$$
$$= 0 - p$$
$$= -p.$$

Similarly $T_2^2 = T_3^3 = -p$, $T_4^4 = \rho$.

Therefore $T_1^1 = T_2^2 = T_3^3 = -p$ and $T_4^4 = \rho$. (4)

Also

$$T = T_1^1 + T_2^2 + T_3^3 + T_4^4$$
$$= \rho - 3p. \qquad (5)$$

The field equation for gravitation is

$$R_{ij} - \frac{1}{2}R g_{ij} = -8\pi T_{ij}, \qquad (6)$$

In the co-moving coordinate system the equation (6) for the metric (1), with the help of equation (4) take the form

$$2\dot{H} + 2H^2 + KH^{\frac{2}{m}} = -(8\pi)p, \qquad (7)$$

$$3H^2 + 3KH^{\frac{2}{m}} = (8\pi)\rho, \qquad (8)$$

HYDRODYNAMIC MODEL

We have liberty to make some assumptions, since we have more unknowns with lesser number of field equations to determine them. For the complete determination of these unknowns, we use a special law of variation of Hubble parameter, proposed by Berman (1983) as

$$H = DR^{-m}, \qquad (9)$$

where D and $m\ (\neq 0)$ are constants and

$$H = \frac{\dot{R}}{R}. \qquad (10)$$

Solving equation (9), we get

$$R(t) = (at+b)^{\frac{1}{m}}, \qquad (11)$$

where $a \neq 0$ and b are the constants of integration.

PHYSICAL AND KINEMATICAL PROPERTIES OF MODEL

In this section we discussed some kinematical and physical parameters of the model

A. KINEMATICAL PARAMETERS

The spatial volume,

$$V = (at+b)^{\frac{3}{m}}. \qquad (12)$$

In our investigations we observed that the spatial volume V of the universe starts with big bang at $t \to 0$ and with the increase of time t it is always expands and increases, when $t \to \infty$ then spatial volume $V \to \infty$.

The scalar expansion,

$$\theta = \frac{3a}{m(at+b)}. \qquad (13)$$

The generalized Hubble parameter,

$$H = \frac{a}{m(at+b)}. \qquad (14)$$

From the equation (13) and (14) it is observed that the expansion scalar and the generalized Hubble parameter are the functions of cosmic time and the relation between them is $(H, \theta) \propto (1/t)$. This shows that the universe is expanding with the increase of cosmic time but the rate of expansion decrease to constant value which shows that the universe starts evolving with zero volume at initial epoch with an infinite rate of expansion.

The deceleration parameter,

$$q = -1 + m. \qquad (15)$$

The sign of deceleration parameter shows that whether the model inflates or not. The negative sign of q indicates inflation and positive sign indicates deceleration. Also, recent observations of type Ia supernovae, expose that the present universe is accelerating and the value of deceleration parameter lies on some place in the range $-1 \le q \le 0$.

B. PHYSICAL PARAMETERS

Energy Density of Model

$$\rho = \left(\frac{1}{8\pi}\right)\left(\frac{2a^2}{m(at+b)^2} - \frac{2a^2}{m^2(at+b)^2} - \frac{k\left(\frac{a}{m}\right)^{\frac{2}{m}}}{(at+b)^{\frac{2}{m}}}\right) \qquad (16)$$

In this model, we observe that at the initial epoch t = 0 the energy density is a decreasing function of time and attain a small constant value but vanishes at later times.

Pressure of model

$$p = \left(\frac{1}{8\pi}\right)\left(\frac{3a^2}{m^2(at+b)^2} + \frac{3k\left(\frac{a}{m}\right)^{\frac{2}{m}}}{(at+b)^{\frac{2}{m}}}\right). \qquad (17)$$

EoS parameterfor an Ideal fluid

$$\omega = \frac{p}{\rho} = \frac{\left(\frac{3a^2}{m^2(at+b)^2} + \frac{3k\left(\frac{a}{m}\right)^{\frac{2}{m}}}{(at+b)^{\frac{2}{m}}}\right)}{\left(\frac{2a^2}{m(at+b)^2} - \frac{2a^2}{m^2(at+b)^2} - \frac{k\left(\frac{a}{m}\right)^{\frac{2}{m}}}{(at+b)^{\frac{2}{m}}}\right)}. \qquad (18)$$

Above equation represents the EoS parameter for an ideal fluid which is a function of time t. At the initial stage when the universe start to accelerate for small and whole interval of time the EoS parameter of the universe having value $\omega > 0$ (i.e. 1.5)which shows only matter dominated era i.e. our derive model with an ideal fluid is fully occupying the real matter and there is no chance other matters like DE etc.

EoS parameter for Hydrodynamic fluid

$$\omega = -1 + \frac{1}{3}\frac{\left(\frac{4a^2}{m} - \frac{4a^2}{m^2} - \frac{2k\left(\frac{a}{m}\right)^{\frac{2}{m}}(at+b)^{\frac{1}{m}}}{m}\right)}{\left(\frac{-2a^2}{m} + \frac{2a^2}{m^2} + k\left(\frac{a}{m}\right)^{\frac{2}{m}}(at+b)^{\frac{-1}{m}}\right)}. \qquad (19)$$

Above equation (19) represents the EoS parameter for Hydrodynamic fluidwhich is a function of time t. At the initial stage when the universe start to accelerate for whole interval of time the EoS parameter of the universe having value $\omega < 0$ (i.e. -1.7)which shows only dark energy dominated era i.e. our derive model with Hydrodynamic fluid is fully occupying the Dark energy and there is no chance real matter.

Note that the time-dependent EoS parameter for an ideal fluid which is contrast with EoS parameter of hydrodynamic fluid, can justify the transition from the one regime to another (quintessence, phantom regime) as indicated by recent observations (Larson et al. 2011; Komatsu et al. 2011).

CONCLUSIONS

In this work, we investigate the performance between EoS parameter for an ideal fluid and Hydrodynamic fluid with some consequences of spatially homogeneous and isotropic flat Friedman Robertson Walker (FRW) cosmological model with perfect fluid. We find the solution of the field equations using constant deceleration parameter which yields the negative value of deceleration parameter. We found that the spatial volume is constant at $t \to 0$ and it expands exponentially as t increase and becomes infinitely large as $t \to \infty$. Also, we observe that the expansion scalar start with constant value at $t \to 0$ and then rapidly decreases up to a certain value after some finite time. The deceleration parameter $q$is negative and obtained a constant value -1, this range of deceleration parameter resembles with the observations of Type-Ia supernova, CMB rediations. The model with an ideal fluid is fully occupying the real matter and there is no chance of other matters.

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DYNAMICS OF APPARENT HORIZON FORMATION IN HIGHER DIMENSIONAL SPACE-TIMES

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ABSTRACT

We study the dynamics of apparent horizon formation in Four, five and six dimensional space-times. We have chosen dust model for this study. It is found that if one applies the same type of initial data to all higher dimensional space-times, then the time interval $t_{ah}(r)-t_s(0)$ *decreases with the increase in the dimensions of the space-times. In the present work we have given yet another method to investigate the nature of singularity arising in six dimensional space-time.*

Keywords: *Cosmic censorship, naked singularity, gravitational collapse.*

INTRODUCTION

The final outcome of gravitational collapse of a star is an issue of great interest from the perspective of the gravitation theory as well as its possible astrophysical implications [1,2].

When there is a continual collapse without any final equilibrium for the cloud, a black hole may form where the super-dense region of the matter is hidden away from the outside observer within an event horizon of gravity or depending on the nature of the initial data and the possible evolutions, a naked singularity could result as the end state of such collapse.

A crucial aspect of the gravitational collapse of a compact object is the choice of initial data, after the star has exhausted its nuclear fuel. It is well known that if the mass of the remnant cloud is large enough, gravitational collapse will ensue. At the time when the gravitational collapse starts, one of the sets of initial quantities is density, pressure, etc, which completely describes the state of matter distribution. Another set of initial data has to be in the form of the distribution of initial velocities of the cloud toward the center. These two sets of initial data for the collapse would actually arise as the end product of the process of the star exhausting its nuclear fuel.

Our purpose here is to analyze from such a perspective the role of initial data towards determining the final fate of a gravitational collapsing cloud. The behavior and evolution of the apparent horizon in the course of gravitational collapse, gives insight into the casual structure near the central singularity. In the present paper we workout the evolution of the apparent horizon for the marginally bound case, $f(r)=0$. This helps us to understand why some initial data lead to a naked singularity while others would produce a black hole as the end product of collapse.

The structure of this paper is as follows:

In section 2, we give yet another method to investigate the nature of singularity in six dimensional space-time.

In section 3, we discuss the dynamics of the apparent horizon in higher dimensional space-times.

Finally we conclude the chapter by some concluding remarks in section 4.

NAKED SINGULARITY IN SIX DIMENSIONAL SPACE-TIME

In comoving coordinates $(t,r,\theta_1,\theta_2,\theta_3,\theta_4)$, the six dimensional T-B-L model is given by [3, 4]

$$ds^2 = dt^2 - \frac{R'^2}{1+f}dr^2$$

$$-R^2\left(d\theta_1^2+\sin^2\theta_1 d\theta_2^2+\sin^2\theta_1\sin^2\theta_2 d\theta_3^2+\sin^2\theta_1\sin^2\theta_2\sin^2\theta_3 d\theta_4^2\right) \qquad (1)$$

where $R(t,r)$ is the area radius at time t of the shell having the commoving coordinate r. A prime denotes a partial derivative with respect to r. The energy-momentum tensor of dust has only one non-zero component

$$T_0^0 = \varepsilon(t,r), \qquad (2)$$

which is the energy density.

The Einstein equation for the collapsing cloud is given by

$$\dot{R}^2 = f(r) + \frac{F(r)}{R^3}. \qquad (3)$$

In the present work we consider the marginally bound collapse.
Hence we shall take

$$f(r)=0. \tag{4}$$

Hence equation (3) becomes

i.e.

$$R^{3/2}dR=-\sqrt{F}dt \tag{5}$$

i.e.

$$\frac{2}{5}R^{5/2}=-\sqrt{F}\;t+c\cdot \tag{6}$$

Using at $t=0,\ R'=r$, we get

$$\frac{2}{5}R^{5/2}=\frac{2}{5}r^{5/2}-\sqrt{F}\;t \tag{7}$$

i.e. $R^{5/2}=r^{5/2}-\frac{5}{2}\sqrt{F}\;t$ (8)

i.e.

$$R=\left(r^{5/2}-\frac{5}{2}\sqrt{F}\;t\right)^{2/5}. \tag{9}$$

At $R=0,\ \ t=t_c$, this gives

$$\frac{5}{2}\sqrt{F}\;t_c=r^{5/2} \tag{10}$$

i.e. $t_c=\frac{2}{5}\frac{r^{5/2}}{\sqrt{F}}$. (11)

Also $F(r)$ becomes fixed once initial density distribution $\varepsilon(0,r)=\rho(r)$ is given.
i.e.

$$F(r)=\frac{1}{2}\int f(r)\,r^4\,dr\;\cdot \tag{12}$$

Hence $F(r)$ has the interpretation of being twice the mass to the interior of the shell labeled r. If the initial density $\rho(r)$ has a series expansion [5]

$$\rho(r)=\rho_0+\rho_1 r+\frac{1}{2!}\rho_2 r^2+\frac{1}{3!}\rho_3 r^3+\cdots\cdots, \tag{13}$$

near the center $r=0$, then resulting series expansion for the mass function $F(r)$ is

$$F(r)=F_0 r^5+F_1 r^6+\cdots\cdots\cdots\cdots+F_n r^{n+5}. \tag{14}$$

Now using equation (12) we can have

$$t_c=\frac{2}{5}\frac{r^{5/2}}{\sqrt{F_0 r^5+F_1 r^6+---+F_n r^{n+5}}} \tag{15}$$

$$=\frac{2}{5\sqrt{F_0}}. \tag{16}$$

Also

$$t_c=\frac{2}{5}\frac{r^{5/2}}{\sqrt{F_0 r^5+F_1 r^6+-----F_n r^{n+5}}} \tag{17}$$

$$=\frac{2}{5\sqrt{F_0}}\frac{1}{\sqrt{1+\frac{F_1}{F_0}r+\frac{F_2}{F_0}r^2+-----+\frac{F_n}{F_0}r^n}} \tag{18}$$

$$\frac{dR}{dt}=\frac{-\sqrt{F}}{R^{3/2}}$$

$$=\frac{2}{5\sqrt{F_0}}\frac{1}{\sqrt{1+\frac{F_n}{F_0}r^n}} \tag{19}$$

$$=\frac{2}{5\sqrt{F_0}}\left(1+\frac{F_n}{F_0}r^n\right)^{-1/2} \tag{20}$$

$$=\frac{2}{5\sqrt{F_0}}\left(1-\frac{F_n}{2F_0}r^n\right) \tag{21}$$

$$=\frac{2}{5\sqrt{F_0}}-\frac{F_n}{5F_0^{3/2}}r^n, \tag{22}$$

where we have expanded $F(r)$ approximately and F_n is the first non-vanishing term beyond F_0 in the expansion of $F(r)$.
We wish to investigate whether the singularity at $t=t_0,\ \ r=0$ is naked. That is whether there are one or more outgoing null geodesics, which terminate in the past at the central singularity. We restrict our attention to radial null geodesics.
Let us start by assuming that one or more such geodesics
exist and then checking whether this assumption is correct. Let us
take the geodesic to have the form

$$t=t_0+ar^{\alpha},\qquad a>0, \tag{23}$$

to leading order in the $t-r-$ plane.
In order for this geodesic to lie in the space-time, we conclude by
comparing with equation (22) that $\alpha\geq n$, and in addition if $\alpha=n$ then

$$a<-\frac{F_n}{5F_0^{3/2}}. \tag{24}$$

As is evident from equation (1) of metric, an outgoing null geodesic must satisfy the equation

$$\frac{dt}{dr}=R'. \tag{25}$$

In order to calculate R' near $r=0$, we first write the solution (9) with only the leading term F_n retained in $F(r)$ in equation (14). This gives

$$R = \left(r^{5/2} - \frac{5}{2}\sqrt{F}\ t \right)^{2/5} \tag{26}$$

$$= \left(r^{5/2} - \frac{5}{2}\sqrt{F_0 r^5 + F_n r^{n+5}}\ t \right)^{2/5} \tag{27}$$

$$= \left[r^{5/2} - \frac{5}{2} r^{5/2}\sqrt{F_0}\left(1 + \frac{F_n r^n}{F_0}\right)^{1/2} t \right]^{2/5} \tag{28}$$

$$= \left[r^{5/2} - \frac{5}{2} r^{5/2}\sqrt{F_0}\left(1 + \frac{F_n r^n}{2F_0}\right) t \right]^{2/5} \tag{29}$$

$$= \left[r^{5/2} - \frac{5}{2} r^{5/2}\sqrt{F_0}\ t - \frac{5}{4}\frac{F_n t}{\sqrt{F_0}} r^{n+\frac{5}{2}} \right]^{2/5} \tag{30}$$

Hence differentiating this equation with respect to r, we get

$$R' = \frac{2}{5}\left[r^{5/2} - \frac{5}{2} r^{5/2}\sqrt{F_0}\ t - \frac{5}{4}\frac{F_n t}{\sqrt{F_0}} r^{n+\frac{5}{2}} \right]^{-3/5} .$$

$$\left[\frac{5}{2} r^{3/2} - \frac{5}{2}\frac{5}{2} r^{3/2}\sqrt{F_0}\ t - \frac{5}{4}\left(n+\frac{5}{2}\right)\frac{F_n t}{\sqrt{F_0}} r^{n+\frac{3}{2}} \right] \tag{31}$$

$$= \frac{\left[1 - \frac{5}{2}\sqrt{F_0}\ t - \frac{1}{2}\left(n+\frac{5}{2}\right)\frac{F_n t}{\sqrt{F_0}} r^n \right]}{\left[1 - \frac{5}{2}\sqrt{F_0}\ t - \frac{5}{4}\frac{F_n t}{\sqrt{F_0}} r^n \right]^{3/5}} . \tag{32}$$

Substituting $t = t_0 + ar^{\alpha}$, we get

$$R' = \frac{\left[1 - \frac{5}{2}\sqrt{F_0}\left(t_0 + ar^{\alpha}\right) - \frac{1}{2}\left(n+\frac{5}{2}\right)\frac{F_n\left(t_0 + ar^{\alpha}\right)}{\sqrt{F_0}} r^n \right]}{\left[1 - \frac{5}{2}\sqrt{F_0}\left(t_0 + ar^{\alpha}\right) - \frac{5}{4}\frac{F_n\left(t_0 + ar^{\alpha}\right)}{\sqrt{F_0}} r^n \right]^{3/5}} \tag{33}$$

$$= \frac{\left[1 - \frac{5}{2}\sqrt{F_0}\, t_0 - \frac{5}{2}\sqrt{F_0}\ ar^{\alpha} - \left(\frac{2n+5}{4}\right)\frac{F_n t_0}{\sqrt{F_0}} r^n - \left(\frac{2n+5}{4}\right)\frac{F_n a}{\sqrt{F_0}} r^{n+\alpha} \right]}{\left[1 - \frac{5}{2}\sqrt{F_0}\ t_0 - \frac{5}{2}\sqrt{F_0}\ ar^{\alpha} - \frac{5}{4}\frac{F_n t_0}{\sqrt{F_0}} r^n - \frac{5}{4}\frac{F_n}{\sqrt{F_0}} ar^{n+\alpha} \right]^{3/5}} \tag{34}$$

Along the assumed geodesic, t is given by equation (23).

Substituting this in R' and equating the resulting R' to $\frac{dt}{dr} = \alpha\, a\, r^{\alpha-1}$ gives

$$\alpha\, a\, r^{\alpha-1} = \frac{-\left(\frac{2n+5}{4}\right)\frac{F_n}{\sqrt{F_0}}\frac{2}{5\sqrt{F_0}} r^n}{\left(-\frac{5}{4}\frac{F_n}{\sqrt{F_0}}\frac{2}{5\sqrt{F_0}} r^n\right)^{3/5}} \tag{35}$$

$$= \frac{\left(\frac{2n+5}{5}\right)\left(-\frac{F_n}{2F_0}\right) r^n}{\left(-\frac{F_n}{2F_0} r^n\right)^{3/5}} \tag{36}$$

$$= \left(\frac{2n+5}{5}\right)\left(-\frac{F_n}{2F_0}\right)^{2/5} r^{2n/5} . \tag{37}$$

This is the key equation.

If it admits a self-consistent solution then the singularity will be naked (that is at least one outgoing null geodesic will terminate at the singularity), otherwise not. We have simplified this equation by putting in the requirement mentioned earlier, that $\alpha \geq n$.

By comparing ,we get when $n = 1$,

$$\alpha = \frac{2+5}{5} = \frac{7}{5} \quad i.e.\ \alpha > n ,$$

whereas when $n = 2$,

$$\alpha = \frac{4+5}{5} = \frac{9}{5} \quad i.e.\ \alpha < n .$$

Hence singularity is naked for $n = 1$ i.e. for the models $\rho_1 < 0$,there is at least one outgoing geodesic given by (23) which terminates in the central singularity in the past.

For $n = 2$, we get $\alpha < n$, indicating singularity is not naked, which means gravitational collapse would convert into a black hole.

Thus we have shown that in six dimensional dust collapse singularity is naked if the first non-vanishing derivative of density ρ_1 is negative. If $\rho_1 = 0$ and $\rho_2 \neq 0$, the singularity is covered. Thus in six dimensional gravitational collapse, only the first derivative of density plays the role in deciding the nature of the singularity. These results are in agreement with results in reference [3].

DYNAMICS OF APPARENT HORIZONS IN HIGHER-DIMENSIONAL SPACE-TIMES

In $(N+2)$- dimensional space-times, the apparent horizon (AH) is defined as N-dimensional surface whose outgoing null geodesic congruence has zero expansion. The formation of the apparent horizon implies the existence of the event horizon outside of it, if the null energy condition is satisfied. Although the black hole is usually defined by event horizon, the apparent horizon is also of interest since the apparent horizon is a good indicator for the black hole formation.

The process of trapped surface formation in gravitational collapse is also central to black hole physics. The role of such a trapping within the framework of Einstein's theory of gravitation was highlighted by Oppenheimer, Snyder [6] within the context of continual collapse of a massive cloud. They studied the collapse of pressure less dust model using general relativity and showed that it leads to the formation of an event horizon and a black hole as the collapse end state, assuming the spatial density distribution within the star was strictly homogeneous, that is $\rho = \rho(t)$.

At the latter stages of collapse an apparent horizon develops, which is the boundary of the trapped region. Our purpose here is to investigate gravitational collapse from such a perspective and we construct a class of dust models collapsing solutions for the Einstein equations, where the trapped surface formation could be delayed or avoided during the collapse.

Let us consider the metric for (N+2)-dimensional space-time with spherical symmetry [3,4]

$$ds^2 = -dt^2 + \frac{R'^2}{1+f(r)} + R^2 d\Omega^2 , \qquad (38)$$

where

$$d\Omega^2 = d\theta_1^2 + \sin^2\theta_1 d\theta_2^2 + \sin^2\theta_1 \sin^2\theta_2 d\theta_3^2 + - - - - $$
$$- - - + \sin^2\theta_1 \sin^2\theta_2 - - - - \sin^2\theta_{N-1} d\theta_N^2 . \qquad (39)$$

is the metric on N-sphere.

The energy-momentum tensor for dust has the form

$$T_{ab} = \varepsilon(t,r)\, \delta_a^t \delta_b^t , \qquad (40)$$

where $u_a = \delta_a^t$ is the (N+2)-dimensional velocity and R is the area radius at time t of the shell having commoving coordinate r.

The Einstein equations for the collapsing cloud are

$$\varepsilon(r,t) = \frac{NF'}{2R^N R'} , \qquad (41)$$

and

$$\dot{R}^2 = \frac{F(r)}{R^{N-1}} + f(r). \qquad (42)$$

For simplicity, we consider the marginally bound case $f(r) = 0$.

We consider the initial density profile [5]

$$\rho(r) = \rho_0 + \rho_1 r + \frac{\rho_2 r^2}{2!} + \frac{\rho_3 r^3}{3!} + \cdots . \qquad (43)$$

It follows from equation (41) that

$$F(r) = \frac{2}{N}\int \rho(r) r^N \, dr \qquad (44)$$

$$F_0 r^{N+1} + F_1 r^{N+2} + F_2 r^{N+3} + \cdots , \qquad (45)$$

where

$$F_n = \frac{2}{N} \frac{\rho_n}{n!(N+1+n)} . \qquad (46)$$

Since we are considering the collapse case, we should have $\dot{R} < 0$, this gives

$$\dot{R} = \frac{-\sqrt{F(r)}}{R^{(N-1)/2}} . \qquad (47)$$

Integrating above equation we get

$$R^{(N+1)/2} = r^{(N+1)/2} - \frac{(N+1)}{2}\sqrt{F}\; t , \qquad (48)$$

where we have used the freedom in scaling of the comoving coordinate r to set up $R(0,r) = r$ at the starting epoch of the collapse. We consider $t_s(r)$ as the time at which area radius R becomes zero. Hence the above equation yields

$$t_s(r) = \left(\frac{2}{N+1}\right)\frac{r^{(N+1)/2}}{\sqrt{F}} . \qquad (49)$$

Physically $t_s(r)$ is the commoving time at which the shell of matter labeled by r becomes singular. As the density increases unboundedly, trapped surfaces have to form within the collapsing cloud. The outermost boundary of these trapped surfaces is known as apparent horizon.

In (N+2)-dimensional space-time, it follows from equation (47) that the apparent horizon is given by

$$R(t_{ah}(r),\ r) = F^{1/(N-1)} , \qquad (50)$$

where $t_{ah}(r)$ is the time at which apparent horizon forms.

Inserting R from above equation into equation (47), we get

$$t_{ah}(r) = \left(\frac{2}{N+1}\right)\frac{r^{(N+1)/2}}{\sqrt{F}} - \frac{2}{N+1} F^{1/(N-1)} . \qquad (51)$$

Equation (51) determines the behavior of apparent horizon in the vicinity of the central singularity in (N+2)-dimensional space-time**.**

We consider the following cases one by one:

Case 1: - Let us consider N =2 i.e. 4-dimensional space-time

Putting N =2, equation (51) gives

$$t_{ah}(r) = \frac{2}{3}\frac{r^{3/2}}{\sqrt{F}} - \frac{2}{3}\sqrt{F(r)}. \qquad (52)$$

If at $r = 0$, the first non-vanishing derivative of density is the n[th] one, then using equations (14) and (45), we get to the leading order

$$t_{ah}(r) = \frac{2}{3\sqrt{F_0}} - \frac{F_n r^n}{3F_0^{3/2}} - \frac{2}{3}F_0 r^3 \qquad (53)$$

$$= t_s(0) - \frac{F_n r^n}{3F_0^{3/2}} - \frac{2}{3}F_0 r^3. \qquad (54)$$

This equation helps us to understand the evolution of the apparent horizon for inhomogeneous density profile. If the first non-vanishing derivative of the density at the center is either ρ_1 or ρ_2, then naked singularity occurs because in this case we get $t_{ah}(0) = t_s(0) < t_{ah}(r)$. i.e. central singularity will form before the formation of apparent horizon. If the apparent horizon forms after the formation of central singularity, then it cannot cover the singularity and hence singularity remains naked. Next if the first non-vanishing derivative is ρ_3 then we get

$$t_{ah}(r) > t_s(0) \quad \text{if} \quad \xi = \frac{F_3}{F_0^{5/2}} < -2,$$

and

$$t_{ah}(r) < t_s(0) \quad \text{if} \quad \xi > -2.$$

But it is shown in reference [5, 7, 8] that the singularity is naked for $\xi < -25.9504$ and covered if ξ is greater than this number. This means that there is a range $-25.9504 < \xi < -2$ in which the singularity is not naked, even though the center gets trapped before its neighborhood. The apparent horizon is absent until the formation of singularity but the singularity is not naked.

We call the interval [-25.9504, -2] as trapped interval. Because this is the interval for the values of ξ in which even though apparent horizon is absent, singularity is not naked.

Case 2: - $N = 3$

For $N = 3$, the metric (38) becomes five dimensional and equation (51) yields

$$t_{ah}(r) = \frac{1}{2}\frac{r^2}{\sqrt{F}} - \frac{1}{2}F^{1/2}. \qquad (55)$$

Using equations (14) and (45) we get to the leading order

$$t_{ah}(r) = \frac{1}{2\sqrt{F_0}} - \frac{1}{2}\frac{F_n}{F_0^{3/2}} - \frac{1}{2}F_0^{1/2} \qquad (56)$$

$$= t_s(0) - \frac{F_n}{2F_0^{3/2}} - \frac{1}{2}F_0^{1/2}, \qquad (57)$$

where $t_s(0)$ is the time at which central singularity forms and it is given by

$$t_s(0) = \frac{1}{2\sqrt{F_0}}. \qquad (58)$$

It follows from equation (57) that when the first non-vanishing derivative of density is ρ_1, then we get $t_s(0) < t_{ah}(r)$, hence singularity is naked. But if the first non-vanishing derivative of density is ρ_2, then we get

$$t_s(0) < t_{ah}(r) \text{ if } \xi = \frac{F_2}{F_0^2} < -2.$$

But it is shown in references [9,10,3] that in this case central singularity is naked if

$$\xi = \frac{F_2}{F_0^2} < -2.2.18033,$$

which means there is an interval [-22.18033, -2] in which central singularity is formed earlier than apparent horizon still then it is not naked.

Case 3: - For $N = 4$, space-time (38) becomes six dimensional.

$$t_{ah}(r) = t_s(0) - \frac{F_n r^n}{5F_0^{3/2}} - \frac{2}{5}F_0^{1/3} r^{5/3}. \qquad (59)$$

It follows from equation (59) that when the first non-vanishing derivative of density is ρ_1 then the singularity is naked and if the first non-vanishing derivative of density is ρ_2 then the singularity is always covered. In other words if the first non-vanishing derivative of density is ρ_1 then the central singularity will form before the formation of apparent horizon. On the other hand if the first non-vanishing derivative of density is ρ_2 then the apparent horizon will form before the formation of central singularity, hence singularity will not be naked in this case.

CONCLUDING REMARK

In the present paper we have analyzed the dynamics of apparent horizons in four, five and six dimensional space-times. As the collapse evolves, if the trapped surfaces form well in advance to the formation of singularity, then the singularity will be covered. On the other hand, if the trapped surface formation is sufficiently delayed during the collapse then the singularity may be naked. The apparent horizon is the outermost boundary of the trapped surfaces. It is found that if one applies the same type of initial data to all dimensional space-times, then the time interval $t_{ah}(r)-t_s(0)$ decreases with the increase in the dimensions of the space-times, which can be associated with the decrease in the naked singularity spectrum in the gravitational collapse.

Further in the present paper we have given yet another method to investigate the nature of the singularity in six dimensional dust collapse. We have found that the singularity is naked when the first non-vanishing derivative of density is ρ_1 only. If the first non-vanishing derivative of density is greater than two then the singularity is not naked. Our results are in agreement with the previous results [11,3].

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EFFECT OF FRACTIONAL ORDER UNDER DIFFERENT CONDITIONS FOR 0 < q < 0.5

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ABSTRACT

The impulse response characteristics are related to the location of poles of F(s). In this paper, we discuss impulse response of $\{1/(s^2+as+b)^q\}$ *for different fractional values of q where* $0 < q < 0.5$ *under different conditions* $a^2-4b=0$; $a^2-4b>0$; $a^2-4b<0$ *where* $a, b>0$. *The different characters of the impulse response are shown in numerical examples. The numbers of figures are presented to explain the concepts.*

Keywords:- *Transfer Function; Impulse response;Mat-lab.*

INTRODUCTION

The transfer function G(s) is given by

$$G(s)=\frac{L_o}{L_i} \tag{1}$$

where L denotes the Laplace transform. The frequency response function and the transfer function are interchangeable by the substitution $s=j\omega$ [1].

The frequency response function $G(j\omega)$ is

$$G(j\omega)=\frac{F_0}{F_i} \tag{2}$$

where F denotes the Fourier transform.

TF has been used in many applications. One important application among them is monitoring the mechanical integrity of transformer windings (during testing and while in service).Mechanical deformation arise mainly due to short circuit forces, unskilled handling and rough transportation. Information related to winding deformation is embedded in the TF. Hence the first step should ensure accurate diagnosis, a correct interpretation of TF[2]. TF can be used to describe a variety of filter or to express solution of linear differential equation accurately [3]. The TF of system is analyzed and response curves are simulated [4].The location of poles and zeros gives idea regarding response characteristics of a system. Transfer function is mainly used in control system and signal processing. If poles are in LHP, the system is stable; if poles are in RHP, the system is unstable and poles on imaginary axis then system is marginally stable or limitedly stable [5, 6, 7].

FRACTIONAL CALCULUS

Fractional calculus is a part of mathematics dealing with derivative of arbitrary order. The fractional order integral of integrable function f(t)with $r\in\Re_+$.Thus the uniform formula of fractional order integral is defined as follows:

$${}_0D_t^{-q}x(t)=D^{-q}x(t)=\frac{1}{\Gamma(q)}\int_0^t(t-u)^{q-1}x(u)\,du \tag{3}$$

where q > 0 , f(t) is an arbitrary integrable function [8,9,10]

The Laplace transform is a fundamental tool in systems and control engineering, so Laplace transform for the defined fractional order operators are given below. Laplace transforms for fractional – order integral operator is:[11]

$$L\{D^{-q}f(t)\}=s^{-q}F(s) \tag{4}$$

IMPULSE RESPONSE ANALYSIS

Impulse signals and their responses are commonly used in control systems analysis and design.

The inverse Laplace transform of

$$F(s)=\frac{1}{(s^2+as+b)^q} \tag{5}$$

is derived by using the complex integral

$$f(t)=\Gamma(1-q)\,t^{q-1}e^{pt}\,\frac{\sin(q\pi)}{\Gamma(q)}=\frac{t^{q-1}e^{pt}}{\Gamma(q)} \tag{6}$$

(i) When $a^2-4b=0$; then $f(t)=\frac{t^{2q-1}e^{-at/2}}{\Gamma(2q)}$ where $p=-a/2$; (7)

(ii) When $a^2 - 4b < 0; then$

$$f(t) = \frac{e^{s_2 t}}{\Gamma(q)} \, {}_0D_t^{-q}\left[t^{q-1} e^{(s_1 - s_2)t}\right] \le \frac{t^{2q-1} e^{-at/2}}{\Gamma(2q)} \quad \text{where} \qquad (8)$$

$$s_1, s_2 = (-a \mp i\sqrt{4b - a^2})/2 \;\; p = -a/2;$$

(iii) When $a^2 - 4b > 0$; *then*

$$f(t) = \frac{e^{s_2 t}}{\Gamma(q)} \, {}_0D_t^{-q}\left[t^{q-1} e^{(s_1 - s_2)t}\right] \le \frac{t^{2q-1} e^{s_2 t}}{\Gamma(2q)} \quad \text{where}$$

$$s_1, s_2 = (-a \mp \sqrt{a^2 - 4b})/2 \qquad (9)$$

[9,10,12]

Theorem 1: For $\boldsymbol{F(s) = \frac{1}{(s^2+as+b)^q}}$, When both of the poles lie in the open LHP, $\lim_{t\to\infty} f(t) = 0$ with $q > 0$;

(ii) When both the poles lie on the imaginary axis, $f_1(t)$ has damped oscillation with $0 < q < 1$; has undamped oscillation with $q = 1$; and has diverging oscillation with $q > 1$;.

(iii) When both of the poles lie in the open RHP, $\lim_{t\to\infty} f_1(t) = \infty$ with $q > 0$ [11,13,14]

Numerical example 1: To observe the impulse response under different conditions $a^2 - 4b = 0$; $a^2 - 4b > 0$; $a^2 - 4b < 0$ for the lowest positive values of $a, b \ge 0$ for q = 0.2, 0.4 (i) When a1 = 2, b1 = 1; (ii) When a2 = 3, b2 = 2; (iii) When a3 =1, b3 =1 and the impulse response of $F(s) = \frac{1}{(s^2 + as + b)^q}$ is demonstrated in Fig. 1 - Fig.2 respectively.

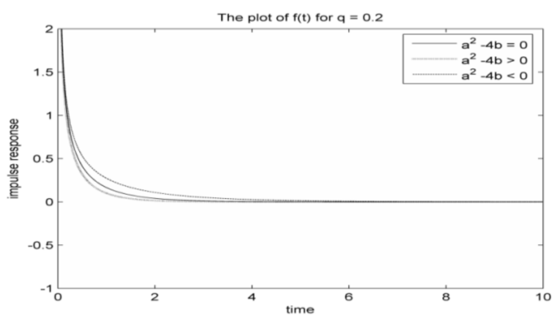

Fig.1. Impulse response of Numerical 1 for q = 0.2

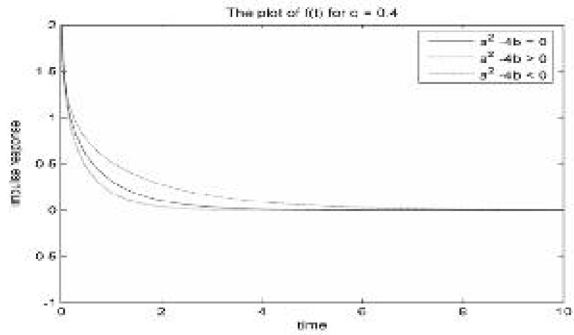

Fig.2. Impulse response of Numerical 1 for q = 0.4

Impulse response for above two conditions tends to zero as time tends to infinity for different values of q. For q = 0.2 & q = 0.4, the curve are nearly same type . For both values of q in $a^2 - 4b > 0$ condition, the curve tends to zero in less time as compared to other two conditions. At $a^2 - 4b < 0$ condition, the curve tends to zero in more time as compaired to other two conditions. As q value increases, impulse response goes down.

Numerical example 2: To observe the impulse response under different conditions $a^2 - 4b = 0$; $a^2 - 4b > 0$; $a^2 - 4b < 0$ on increasing values of $a, b \ge 0$ for q = 0.2 and 0.4 (iv) When a4 = 4, b4 = 4; (v) When a5 = 4, b5 = 3; (vi) When a6 = 2, b6 = 2 and the impulse response of is demonstrated in Fig. 3 - Fig.4 respectively.

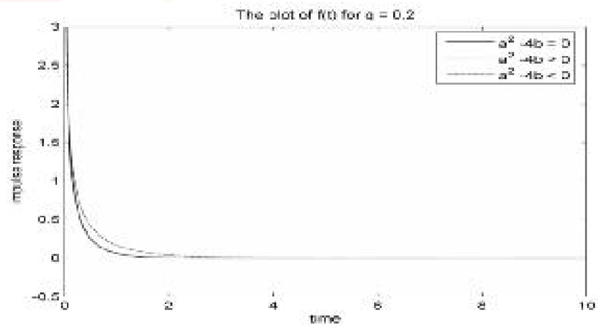

Fig.3. Impulse response of Numerical 2 for q = 0.2

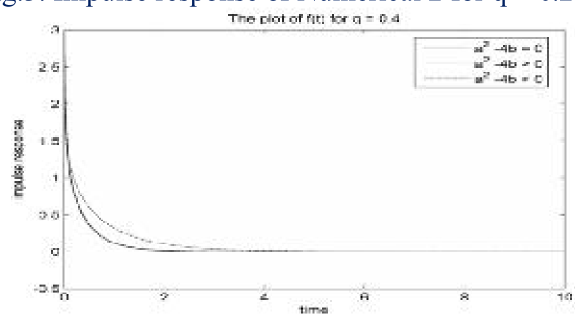

Fig.4. Impulse response of Numerical 2 for q = 0.4

Impulse response for above two conditions tends to zero as time tends to infinity for different values of q. For q = 0.2 & q = 0.4, the curve are nearly same type . For both values of q in $a^2 - 4b < 0$ condition, the curve tends to zero in more time as compaired to other two conditions.

Numerical example 3: To observe the impulse response under different conditions $a^2 - 4b = 0$; $a^2 - 4b > 0$; $a^2 - 4b < 0$ again on increasing values of $a, b \geq 0$ for q = 0.2, 0.4 (vii) When a7 = 6, b7 = 9; (viii) When a8 = 5, b8 = 4; (ix) When a9 = 3, b9 = 3 and the impulse response of $F(s) = \frac{1}{(s^2 + as + b)^q}$ is demonstrated in Fig. 5 - Fig.6 respectively.

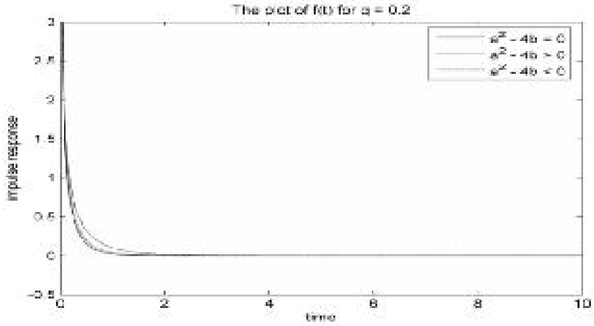

Fig.5. Impulse response of Numerical 3 for q = 0.2

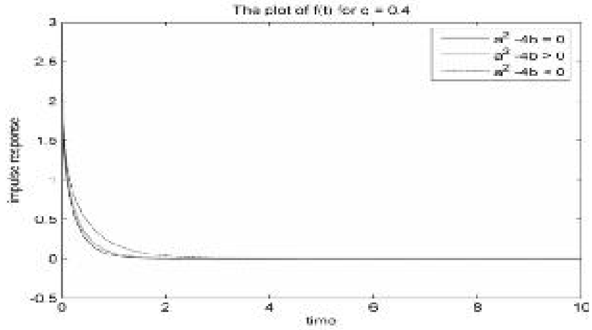

Fig.6. Impulse response of Numerical 3 for q = 0.4

Impulse response for above two conditions tends to zero as time tends to infinity for different values of q. For q = 0.2 & q = 0.4, the curve are nearly same type . For both values of q in $a^2 - 4b < 0$ condition, the curve tends to zero in more time as compaired to other two conditions. As on incresing value of q, impulse response with respect to time decreses.

CONCLUSIONS

Impulse response for above three conditions tends to zero as time tends to infinity for different values of q and a,b. As on incresing value of a, b; time for impulse response tends to zero decreses but for in $a^2 - 4b < 0$ condition, the curve tends to zero in more time as compaired to other two conditions for all q values as well as for all a, b values.
As on increasing value of a & b, the impulse response at t = 0 goes on increasing for 0 < q < 0.5.

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ANALYTICAL BEHAVIOUR OF DISTRIBUTIONAL TWO DIMENSIONAL FOURIER-LAPLACE TRANSFORM

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ABSTRACT

In the literature there are several integral transforms and each are suitable for different type of differential equations. The two dimensional Fourier Transform is one of the most fundamental advances in scientific computing, Mathematical and Statistics problems. On the same lines two dimensional Laplace transform is applied as a frequency-domain tool for analysis and synthesis of communication systems.

In this paper, the aim is to study the possible extension of two dimensional Fourier-Laplace transform in the distributional sense. For this purpose, some testing function spaces by using Gelfand-Shilov technique are developed in order to discuss analytical behaviour of distributional two dimensional Fourier-Laplace transform.

Keywords: *Fourier Transform, Laplace Transform, Two Dimensional Fourier-Laplace Transform, Generalized function.*

INTRODUCTION

Integral transforms are widely used in various fields. The application of the Fourier transform (FT) to nuclear magnetic resonance spectroscopy and its extension to multiple dimensions has radically altered modern chemistry and medical science; NMR imaging and the determination of the structure of proteins in solution are two important advances that would be either impossible or orders of magnitude more difficult without the Fourier transform [1].

Similarly, Laplace transform method was used to obtain the explicit solution of a certain kind of ordinary differential equations with fractional derivatives and to construct the solution of linear non-homogeneous fractional order differential equations. By using Laplace transform, one can also find the exact solution of time fractional partial differential equation and some fractional order integral and integro-differential equations [2]. Moreover system of partial differential equations related to telegraph equation is solved by using the double transformation [3].

On studying the vast applications of these Fourier transform and Laplace transform we developed new transform i.e. two dimensional Fourier-Laplace transform and this may give remarkable and extra ordinary applications in various fields of science and engineering. The main aim of this paper is to discuss the analytical behavior of distributional two dimensional Fourier-Laplace transform for this purpose here is the necessity to describe some testing function spaces and which are as follows:

1.1. The Space $FL_{a,b,c,d,\alpha}$ (S_α-type space):

Let I be the open set in $R_+ \times R_+$ and E_+ denotes the class of infinitely differentiable function defined on I, the space $FL_{a,b,c,d,\alpha}$ is given by,

$$FL_{a,b,c,d,\alpha} = \{\phi : \phi \in E_+ / \gamma_{a,b,c,d,k,r,q,m,l,n}\left[\phi(t,z,x,y)\right]$$
$$= \sup_{I_1}\left|t^k z^r K_{a,b}(x) R_{c,d}(y) D_t^l D_x^q D_z^n D_y^m \left[\phi(t,z,x,y)\right]\right| \le C_{l,q,n,m} A^k k^{k\alpha} B^r r^{r\alpha}\right\}$$

where the constants A, B and $C_{l,q,n,m}$ depend on the testing function ϕ.

1.2. The Space $FL^{\beta}_{a,b,c,d,\alpha}$ (S^{β}_{α}-type space):

It is given by,

$$FL^{\beta}_{a,b,c,d,\alpha} = \{\phi : \phi \in E_+ / \rho_{a,b,c,d,k,r,q,m,l,n}\left[\phi(t,z,x,y)\right]$$
$$= \sup_{I_1}\left|t^k z^r K_{a,b}(x) R_{c,d}(y) D_t^l D_x^q D_z^n D_y^m \left[\phi(t,z,x,y)\right]\right| \le CA^k k^{k\alpha} B^r r^{r\alpha} G^l l^{l\beta} H^n n^{n\beta}\Big\}$$

where the constants A, B, G, H and C depend on the testing function ϕ.

1.3. The space $FL_{a,b,c,d,\gamma}$ (S_γ -type space):

This space is given by,

$$FL_{a,b,c,d,\gamma} = \{\phi : \phi \in E_+ / \xi_{a,b,c,d,k,r,q,m,l,n}\left[\phi(t,z,x,y)\right]$$
$$= \sup_{I_1}\left|t^k z^r K_{a,b}(x) R_{c,d}(y) D_t^l D_x^q D_z^n D_y^m \left[\phi(t,z,x,y)\right]\right| \le C_{k,r,l,n} A^q q^{q\gamma} B^m m^{m\gamma}\Big\}$$

where the constants A, B and $C_{k,r,l,n}$ depend on the testing function ϕ.

In the present paper, two dimensional Fourier-Laplace transform is generalized in distributional sense and discuss its analytical behaviour as given. The plan of the paper is as follows: In section 2, definition of two dimensional Fourier-Laplace transform is given. Definition of Distributional generalized two dimensional Fourier-Laplace transform is given in section 3. In section 4 we have proved Analyticity theorem. Lastly we conclude the paper.

The notations and terminology as per A. H. Zemanian [4], [5].

2. Definitions

The Two Dimensional Fourier-Laplace transform with parameters $s, u, p, v,$ of $f(t,z,x,y)$ is denoted by $FL\{f(t,z,x,y)\} = F(s,u,p,v)$ performs a linear operation, given by the integral transform,

$$FL\{f(t,z,x,y)\} = F(s,u,p,v) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\int_{0}^{\infty}\int_{0}^{\infty} f(t,z,x,y) K(s,u,p,v)\, dtdzdxdy \tag{2.1}$$

where the kernel $K(s,u,p,v) = e^{-i\{(st+uz)-i(px+vy)\}}$

3. Distributional Generalized Two Dimensional Fourier-Laplace Transform (2DFLT)

For $f(t,z,x,y) \in FL^*_{a,b,c,d,\alpha}$, where $FL^*_{a,b,c,d,\alpha}$ is the dual space of $FL_{a,b,c,d,\alpha}$. It contains all distributions of compact support. The distributional two dimensional Fourier-Laplace transform is a function of $f(t,z,x,y)$ is defined as,

$$FL\{f(t,z,x,y)\} = F(s,u,p,v) = \langle f(t,z,x,y), \phi(t,z,x,y,s,u,p,v)\rangle, \tag{3.1}$$

where $\phi(t,z,x,y,s,u,p,v) = e^{-i\{(st+uz)-i(px+vy)\}}$ and for each fixed $t(0<t<\infty)$, $z(0<z<\infty)$, $x(0<x<\infty)$ and $y(0<y<\infty)$. Also $s>0$, $u>0$, $p>0$ and $v>0$. The right hand side of (3.1) has a sense as an application of $f(t,z,x,y) \in FL^*_{a,b,c,d,\alpha}$ to $\phi(t,z,x,y,s,u,p,v) \in FL_{a,b,c,d,\alpha}$.

4. Analyticity Theorem

Let $f(t,z,x,y) \in FL^*_{a,b,c,d,\alpha}$ and its two dimensional Fourier-Laplace transform $F(s,u,p,v)$ is defined by $FL\{f(t,z,x,y)\} = F(s,u,p,v) = \left\langle f(t,z,x,y), e^{-i\{(st+uz)-i(px+vy)\}}\right\rangle$.

Then $F(s,u,p,v)$ is analytic for some fixed $s>0$, $u>0$, $p>0$, $v>0$,

$$\frac{\partial}{\partial s}\frac{\partial}{\partial u}F(s,u,p,v) = \left\langle f(t,z,x,y), \frac{\partial}{\partial s}\frac{\partial}{\partial u}\phi(t,z,x,y,s,u,p,v)\right\rangle \tag{4.1}$$

and $\frac{\partial}{\partial p}\frac{\partial}{\partial v}F(s,u,p,v)=\left\langle f(t,z,x,y),\frac{\partial}{\partial p}\frac{\partial}{\partial v}\phi(t,z,x,y,s,u,p,v)\right\rangle$ (4.2)

where $\phi(t,z,x,y,s,u,p,v)=e^{-i\{(st+uz)-i(px+vy)\}}$.

Proof: Let $s,\ u,$ and $p,\ v$ be an arbitrary but fixed. Choose the real positive numbers $a_1,\ b_1$ and r such that $\sigma_1<a_1<s-r<s+r<b_1<\sigma_2$. Also let Δs be a complex increment such that $0<|\Delta s|<r$.

For $\Delta s\neq 0$, we write

$$\frac{F(s+\Delta s,u,p,v)-F(s,u,p,v)}{\Delta s}-\left\langle f(t,z,x,y),\frac{\partial}{\partial s}e^{-i\{(st+uz)-i(px+vy)\}}\right\rangle$$

$$=\frac{1}{\Delta s}\left\{\left\langle f(t,z,x,y),e^{-i\{[(s+\Delta s)t+uz]-i(px+vy)\}}\right\rangle-\left\langle f(t,z,x,y),e^{-i\{(st+uz)-i(px+vy)\}}\right\rangle\right\}$$

$$-\left\langle f(t,z,x,y),\frac{\partial}{\partial s}e^{-i\{(st+uz)-i(px+vy)\}}\right\rangle$$

$$=\frac{1}{\Delta s}\left\{\left\langle f(t,z,x,y),e^{-i\{uz-i(px+vy)\}}\left[e^{-i(s+\Delta s)t}-e^{-ist}\right]\right\rangle\right\}-\left\langle f(t,z,x,y),\frac{\partial}{\partial s}e^{-i\{(st+uz)-i(px+vy)\}}\right\rangle$$

$$=\left\langle f(t,z,x,y),\frac{e^{-i\{uz-i(px+vy)\}}}{\Delta s}\left[e^{-i(s+\Delta s)t}-e^{-ist}\right]-\frac{\partial}{\partial s}e^{-i\{(st+uz)-i(px+vy)\}}\right\rangle$$

$$=\left\langle f(t,z,x,y),\psi_{\Delta s}(t,z,x,y)\right\rangle \tag{4.3}$$

where $\psi_{\Delta s}(t,z,x,y)=\frac{e^{-i\{uz-i(px+vy)\}}}{\Delta s}\left[e^{-i(s+\Delta s)t}-e^{-ist}\right]-\frac{\partial}{\partial s}e^{-i\{(st+uz)-i(px+vy)\}}$

To prove $\psi_{\Delta s}(t,z,x,y)\in FL_{a,b,c,d,\alpha}$, we shall show that as $|\Delta s|\to 0$, $\psi_{\Delta s}(t,z,x,y)$ converges in $FL_{a,b,c,d,\alpha}$ to zero.

To proceed, let C denotes the circle with centre at s and radius r_1, where $0<r<r_1<\min(s-a_1,b_1-s)$.

We may interchange differentiation on s with differentiation on t and by using Cauchy's integral formula,

$$(-D_t)^l\psi_{\Delta s}(t,z,x,y)=\frac{e^{-i\{uz-i(px+vy)\}}}{\Delta s}\left[(-i)^l(s+\Delta s)^l e^{-i(s+\Delta s)t}-(-i)^l(s)^l e^{-ist}\right]$$

$$-\frac{\partial}{\partial s}(-is)^l e^{-i\{(st+uz)-i(px+vy)\}}$$

Now applying Cauchy's integral formula,

$$(-D_t)^l\psi_{\Delta s}(t,z,x,y)=\frac{(-i)^l e^{-i\{uz-i(px+vy)\}}}{\Delta s}\left\{\frac{1}{2\pi i}\int_C\left[\frac{\xi^l e^{-i\xi t}}{\xi-s-\Delta s}-\frac{\xi^l e^{-i\xi t}}{\xi-s}\right]d\xi\right\}$$

$$-(-i)^l e^{-i\{uz-i(px+vy)\}}.\frac{1}{2\pi i}\int_C\frac{\xi^l e^{-i\xi t}}{(\xi-s)^2}d\xi$$

$$=\frac{e^{-i\{uz-i(px+vy)\}}}{2\pi i\Delta s}\int_C\left[\frac{1}{\xi-s-\Delta s}-\frac{1}{\xi-s}\right](-i)^l\xi^l e^{-i\xi t}d\xi-(-i)^l e^{-i\{uz-i(px+vy)\}}.\frac{1}{2\pi i}\int_C\frac{\xi^l e^{-i\xi t}}{(\xi-s)^2}d\xi$$

$$= \frac{e^{-i\{uz-i(px+vy)\}}}{2\pi i \Delta s} \int_C \left[\frac{\xi - s - \xi + s + \Delta s}{(\xi - s - \Delta s)(\xi - s)} \right] (-i)^l \xi^l e^{-i\xi t} d\xi - (-i)^l e^{-i\{uz-i(px+vy)\}} \cdot \frac{1}{2\pi i} \int_C \frac{\xi^l e^{-i\xi t}}{(\xi - s)^2} d\xi$$

$$= \frac{e^{-i\{uz-i(px+vy)\}}}{2\pi i} \int_C \left[\frac{1}{(\xi - s - \Delta s)(\xi - s)} - \frac{1}{(\xi - s)^2} \right] (-i\xi)^l e^{-i\xi t} d\xi$$

$$= \frac{e^{-i\{uz-i(px+vy)\}}}{2\pi i} \int_C \left[\frac{\xi - s - \xi + s + \Delta s}{(\xi - s - \Delta s)(\xi - s)^2} \right] (-i\xi)^l e^{-i\xi t} d\xi$$

$$= \frac{e^{-i\{uz-i(px+vy)\}} \Delta s}{2\pi i} \int_C \frac{(-i\xi)^l e^{-i\xi t}}{(\xi - s - \Delta s)(\xi - s)^2} d\xi$$

$$D_t^l D_z^n \psi_{\Delta s, \Delta u}(t,z,x,y) = \frac{(-iu)^n e^{-i\{uz-i(px+vy)\}} \Delta s}{2\pi i} \int_C \frac{(-i\xi)^l e^{-i\xi t}}{(\xi - s - \Delta s)(\xi - s)^2} d\xi$$

Now for all $\xi \in C$ and $-\infty < t < \infty$, $\sup_{I_1} \left| t^k z^r K_{a,b}(x) R_{c,d}(y) u^n e^{-i\{uz-i(px+vy)\}} \right| \le K$,

Where K is a constant independent of ξ and t. Moreover, $|\xi - s - \Delta s| > r_1 - r > 0$ and $|\xi - s| = r_1$, $C_1 = \max\left\{ |\xi|^l, \xi \in C \right\}$, consequently

$$\sup_{I_1} \left| t^k z^r K_{a,b}(x) R_{c,d}(y) D_t^l D_z^n \psi_{\Delta s, \Delta u}(t,z,x,y) \right|$$

$$= \sup_{I_1} \left| t^k z^r K_{a,b}(x) R_{c,d}(y) \frac{(-iu)^n e^{-i\{uz-i(px+vy)\}} \Delta s}{2\pi i} \int_C \left[\frac{(-i\xi)^l e^{-i\xi t}}{(\xi - s - \Delta s)(\xi - s)^2} \right] d\xi \right|$$

$$\le \sup_{I_1} \left| t^k z^r K_{a,b}(x) R_{c,d}(y) \frac{(u)^n e^{-i\{uz-i(px+vy)\}}}{2\pi} \right| |\Delta s| \int_C \frac{|\xi|^l \left| e^{-i\xi t} \right|}{|\xi - s - \Delta s| |\xi - s|^2} |d\xi|$$

$$\le \frac{|\Delta s|}{2\pi} \int_C \frac{K C_1}{(r_1 - r) r_1^2} |d\xi|$$

$$\le \frac{|\Delta s|}{2\pi} \int_C \frac{C_2}{(r_1 - r) r_1^2} |d\xi|, \quad \text{where } C_2 = K C_1$$

$$\le \frac{|\Delta s| C_2}{2\pi (r_1 - r) r_1^2} 2\pi r_1,$$

$$\le \frac{|\Delta s| C_2}{(r_1 - r) r_1}.$$

The right hand side is independent of t and converges to zero as $|\Delta s| \to 0$. This shows that $\psi_{\Delta s, \Delta u}(t,z,x,y)$ converges to zero.

Now, let s, u, and p, v be an arbitrary but fixed points. Choose the real positive numbers a_2, b_2 and h such that $\sigma_1 < a_2 < \operatorname{Re} p - h < \operatorname{Re} p + h < b_2 < \sigma_2$. Also let Δp be a complex increment such that $0 < |\Delta p| < h$.

For $\Delta p \neq 0$, we write

$$\frac{F(s,u,p+\Delta p,v) - F(s,u,p,v)}{\Delta p} - \left\langle f(t,z,x,y), \frac{\partial}{\partial p} e^{-i\{(st+uz)-i(px+vy)\}} \right\rangle$$

$$= \frac{1}{\Delta p}\left\{\left\langle f(t,z,x,y), e^{-i\{(st+uz)-i((p+\Delta p)x+vy)\}}\right\rangle - \left\langle f(t,z,x,y), e^{-i\{(st+uz)-i(px+vy)\}}\right\rangle\right\}$$

$$-\left\langle f(t,z,x,y), \frac{\partial}{\partial p} e^{-i\{(st+uz)-i(px+vy)\}}\right\rangle$$

$$= \frac{1}{\Delta p}\left\{\left\langle f(t,z,x,y), e^{-i\{(st+uz)-ivy\}}\left[e^{-(p+\Delta p)x} - e^{-px}\right]\right\rangle\right\} - \left\langle f(t,z,x,y), \frac{\partial}{\partial p} e^{-i\{(st+uz)-i(px+vy)\}}\right\rangle$$

$$= \left\langle f(t,z,x,y), \frac{e^{-i\{(st+uz)-ivy\}}}{\Delta p}\left[e^{-(p+\Delta p)x} - e^{-px}\right] - \frac{\partial}{\partial p} e^{-i\{(st+uz)-i(px+vy)\}}\right\rangle$$

$$= \left\langle f(t,z,x,y), \psi_{\Delta p}(t,z,x,y)\right\rangle \qquad (4.4)$$

where $\psi_{\Delta p}(t,z,x,y) = \frac{e^{-i\{(st+uz)-ivy\}}}{\Delta p}\left[e^{-(p+\Delta p)x} - e^{-px}\right] - \frac{\partial}{\partial p} e^{-i\{(st+uz)-i(px+vy)\}}$

To prove $\psi_{\Delta p}(t,z,x,y) \in FL_{a,b,c,d,\alpha}$, we shall show that as $|\Delta p| \to 0$, $\psi_{\Delta p}(t,z,x,y)$ converges in $FL_{a,b,c,d,\alpha}$ to zero.

To proceed, let C_1 denotes the circle with centre at p and radius h_1, where $0 < r < h_1 < \min(p - a_2, b_2 - p)$. We may interchange differentiation on p with differentiation on x and by using Cauchy's integral formula,

$$(-D_x)^q \psi_{\Delta p}(t,z,x,y) = \frac{e^{-i\{(st+uz)-ivy\}}}{\Delta p}\left[(p+\Delta p)^q e^{-(p+\Delta p)x} - (p)^q e^{-px}\right]$$

$$-\frac{\partial}{\partial p}(p)^q e^{-i\{(st+uz)-i(px+vy)\}}$$

Now applying Cauchy's integral formula, we get

$$(-D_x)^q \psi_{\Delta p}(t,z,x,y) = \frac{e^{-i\{(st+uz)-ivy\}}}{\Delta p}\left\{\frac{1}{2\pi i}\int_C \left[\frac{\xi^q e^{-\xi x}}{\xi - p - \Delta p} - \frac{\xi^q e^{-\xi x}}{\xi - p}\right] d\xi\right\}$$

$$-e^{-i\{(st+uz)-ivy\}} . \frac{1}{2\pi i}\int_C \frac{\xi^q e^{-\xi x}}{(\xi - p)^2} d\xi$$

$$= \frac{e^{-i\{(st+uz)-ivy\}}}{2\pi i \Delta p}\int_C \left[\frac{1}{\xi - p - \Delta p} - \frac{1}{\xi - p}\right]\xi^q e^{-\xi x} d\xi - e^{-i\{(st+uz)-ivy\}} . \frac{1}{2\pi i}\int_C \frac{\xi^q e^{-\xi x}}{(\xi - p)^2} d\xi$$

$$=\frac{e^{-i\{(st+uz)-ivy\}}}{2\pi i\Delta p}\int_C\left[\frac{\xi-p-\xi+p+\Delta p}{(\xi-p-\Delta p)(\xi-p)}\right]\xi^q e^{-\xi x}d\xi - e^{-i\{(st+uz)-ivy\}}\cdot\frac{1}{2\pi i}\int_C\frac{\xi^q e^{-\xi x}}{(\xi-p)^2}d\xi$$

$$=\frac{e^{-i\{(st+uz)-ivy\}}}{2\pi i}\int_C\left[\frac{1}{(\xi-p-\Delta p)(\xi-p)}-\frac{1}{(\xi-p)^2}\right](\xi)^q e^{-\xi x}d\xi$$

$$=\frac{e^{-i\{(st+uz)-ivy\}}}{2\pi i}\int_C\left[\frac{\xi-p-\xi+p+\Delta p}{(\xi-p-\Delta p)(\xi-p)^2}\right](\xi)^q e^{-\xi x}d\xi$$

$$=\frac{e^{-i\{(st+uz)-ivy\}}\Delta p}{2\pi i}\int_C\frac{(\xi)^q e^{-\xi x}}{(\xi-p-\Delta p)(\xi-p)^2}d\xi$$

$$D_x^q D_y^m \psi_{\Delta p,\Delta v}(t,z,x,y)=\frac{(-v)^m e^{-i\{(st+uz)-ivy\}}\Delta p}{2\pi i}\int_C\frac{(\xi)^q e^{-\xi x}}{(\xi-p-\Delta p)(\xi-p)^2}d\xi$$

Now for all $\xi\in C$ and $0<x<\infty$, $\sup_{I_1}\left|t^k z^r K_{a,b}(x)R_{c,d}(y)(v)^m e^{-i\{(st+uz)-ivy\}}\right|\le K$, where K is a constant independent of ξ and x. Moreover, $|\xi-p-\Delta p|>h_1-h>0$ and $|\xi-p|=h_1$, $C_1=\max\left\{|\xi|^q,\xi\in C\right\}$, consequently

$$\sup_{I_1}\left|t^k z^r K_{a,b}(x)R_{c,d}(y)D_x^q D_y^m\psi_{\Delta p,\Delta v}(t,z,x,y)\right|$$

$$=\sup_{I_1}\left|t^k z^r K_{a,b}(x)R_{c,d}(y)\frac{(-v)^m e^{-i\{(st+uz)-ivy\}}\Delta p}{2\pi i}\int_C\left[\frac{(\xi)^q e^{-\xi x}}{(\xi-p-\Delta p)(\xi-p)^2}\right]d\xi\right|$$

$$\le\sup_{I_1}\left|t^k z^r K_{a,b}(x)R_{c,d}(y)\frac{(v)^m e^{-i\{(st+uz)-ivy\}}}{2\pi}\right||\Delta p|\int_C\frac{|\xi|^q\left|e^{-\xi x}\right|}{|\xi-p-\Delta p||\xi-p|^2}|d\xi|$$

$$\le\frac{|\Delta p|}{2\pi}\int_C\frac{KC_1}{(h_1-h)h_1^2}|d\xi|$$

$$\le\frac{|\Delta p|}{2\pi}\int_C\frac{C_2}{(h_1-h)h_1^2}|d\xi|,\quad \text{where } C_2=KC_1$$

$$\le\frac{|\Delta p|C_2}{2\pi(h_1-h)h_1^2}2\pi h_1,$$

$$\le\frac{|\Delta p|C_2}{(h_1-h)h_1}.$$

The right hand side is independent of x and converges to zero as $|\Delta p|\to 0$. This shows that $\psi_{\Delta p,\Delta v}(t,z,x,y)$ converges to zero in $FL_{a,b,c,d,\alpha}$ as $|\Delta p|\to 0$, which end the proof.

CONCLUSIONS

In the present work Distributional Fourier-Laplace Transform is extended in two dimensions. Some testing function spaces are developed. Also, Analytical behaviour of two dimensional Fourier-Laplace transform is presented.

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HYPERSURFACE-HOMOGENOUS MINIMALLY INTERACTING HOLOGRAPHIC DARK ENERGY COSMOLOGICAL MODEL IN SAEZ-BALLESTER THEORY OF GRAVITATION

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ABSTRACT

Homogeneous-Hypersurface cosmological model is investigated in scalar tensor theory of gravitation proposed by Saez-Ballester, when universe is filled with minimally interacting fields; matter and holographic dark energy components. The solution of the field equations is obtained using the physical condition that the shear scalar is proportional to the expansion scalar. The physical behavior of the model is also discussed.

Keywords: *Homogeneous-Hypersurface space-time, Holographic Dark energy, Saez-Ballester theory.*

INTRODUCTION

In the last few decades, there has been considerable interest in studying alternative theories of gravitation, the most important among them being scalar-tensor theories proposed by Lyra [1], Brans and Dicke [2], Nordvedt [3], Wagoner [4], Rose [5], Dun [6], Sáez and Ballester [7], Barber [8], La and Steinhardt [9] are some most important among them. Subsequently, Saez and Ballester [7] have developed a new scalar-tensor theory of gravitation in which the metric is coupled with a dimensionless scalar field in a simple manner. This coupling gives a satisfactory description of weak fields. In spite of the dimensionless character of the scalar field an antigravity regime appears. This theory suggests a possible way to solve the missing matter problem in non-flat FRW cosmologies. In earlier literature, cosmological models within the framework of Sáez-Ballester scalar-tensor theory of gravitation, have been studied by several relativists and obtained the solutions in Sáez-Ballester scalar-tensor theory of gravitation in different context [10-34] .

The recent cosmological observations of Type Ia supernovae (SNeIa) (Riess et al. [35]; Perlmutter et al. [36]) indicate that the universe is currently accelerating. The most accepted interpretation in context of Einstein's general relativity is that this phase is driven by an unknown component called dark energy. Wilkinson Microwave Anisotropy Probe (WMAP) measures that dark energy, dark matter and baryonic matter occupies 73%, 23% and 4% respectively, of the energy-mass content of the universe. Cosmological constant with time dependent equation of state $w=-1$ is the simplest candidate of dark energy. Some other dynamical dark energy models with time dependent equation of state to explain accelerated expansion are quintessence, phantom, quintom , tachyon, dilaton with interacting dark energy models like holographic and agegraphic models. In recent years, holographic dark energy (HDE) models have received considerable attention to describe dark energy cosmological models. Several aspects of holographic dark energy have been investigated by Cohen et al. [37] ,Hsu [38], Gao et al. [39].Granda and Olivers [40] proposed a holographic density of the form $\rho_{DE} \approx \left(\alpha_1 H^2 + \beta_1 \dot{H}\right)$ where H is the Hubble parameter and α_1, β_1 are constants which must satisfy the restrictions imposed by the current observational data. Minimally interacting holographic dark energy models in Bianchi space-time with constant deceleration parameter have been discussed by Sarkar and Mahanta [41-42] while Sarkar [43-45] obtained holographic dark energy models in Bianchi space-times with linearly varying deceleration parameter in general relativity. Discussion on minimally interacting holographic Bianchi type V dark energy models in Sáez-Ballester and Brans-Dicke scalar- tensor theories of gravitation have been done by Kiran et al. [46-47] . Adhav et al. [48] investigated interacting holographic dark energy models in Bianchi space-times. Umadevi and Ramesh [49] obtained minimally interacting Bianchi type III holographic dark energy models in Brans–Dicke theory with the help of constant deceleration parameter while Kiran et al. [50] and Reddy et al.

[51] investigated Bianchi type III holographic dark energy models in Brans–Dicke and Sáez-Ballester theories of gravitation using a linearly varying deceleration parameter proposed by Akarsu and Dereli [52]. Kantowski-Sachs cosmological model has been discussed by Ghate and Patil [53] in the scalar- tensor theory of gravitation proposed by Saez-Ballester when the source for energy momentum tensor is minimally interacting holographic dark energy. Raju et al. [54] have discussed five dimensional spherically symmetric minimally interacting holographic dark energy model in Saez-Ballester scalar-tensor theory of gravitation.

In this paper, Hypersurface – Homogenous metric has considered when universe is filled with minimally interacting fields: matter and holographic dark energy components in the scalar tensor theory of gravitation proposed by Saez-Ballester. This work is organized as follows: In Section 2, the model and field equations have been presented. The field equations have been solved by applying special form of deceleration parameter in Section 3. The physical and geometrical behavior of the model has been obtained in Section 4. In the last Section 5, discussion and concluding remarks have been expressed.

METRIC AND FIELD EQUATIONS

Stewart and Ellis [55] investigated general solutions of Einstein's field equations for a perfect fluid distribution satisfying a barotropic equation of state for the Hypersurface-homogeneous space time. The Hypersurface-homogeneous space time is of the form

$$ds^2=dt^2-A^2(t)dx^2-B^2(t)(dy^2+\Sigma^2(y,K)dz^2), \tag{1}$$

where A *and* B are the cosmic scale functions and $\sum(y,K)=\sin y\,,\,y\,,\sinh y$ for $K=1,0,-1$ respectively.

Hajj-Boutros [56] developed a method to find exact solutions of field equations in case of the metric (1) in presence of perfect fluid and obtained exact solutions of the field equations which add to the rare solutions not satisfying the barotropic equation of state. Katore and Shaikh [57] studied the exact solutions of the field equations for Hypersurface-homogeneous space time under the assumption on the anisotropy of the fluid (dark energy), which are obtained for exponential and power-law volumetric expansions in a scalar-tensor theory of gravitation. Katore and Shaikh [58] presented a class of solutions of Einstein's field equations describing two-fluid models of the universe in Hypersurface-Homogenous space time. Evolution of Hypersurface-Homogenous cosmological models is studied by Shaikh A.Y.[59] in the presence of dark energy (DE) from a wet dark fluid (WDF) in $f(R,T)$ theory. A spatially homogeneous and anisotropic Hypersurface-Homogenous cosmological model when the source for energy momentum tensor is a bulk viscous fluid containing one dimensional cosmic string in $f(R,T)$ gravity, using Hybrid Expansion Law which exhibits a transition of the universe from decelerating phase to the present accelerating phase has been investigated by Shaikh,A.Y.[60]. The exact solutions of the field equations with respect to hypersurface-homogeneous Universe filled with perfect fluid in the framework of $f(R,T)$ theory is derived by Shaikh and Katore [61].Shaikh and Wankhade [62] investigated Hypersurface-Homogeneous cosmological model in $f(R,T)$ theory of gravity with a term Λ.

The field equations for the combined scalar and tensor fields, in Saez-Ballester theory, are

$$R_{ij}-\frac{1}{2}g_{ij}R-\omega\phi^n\left(\phi_{,i}\phi_{,j}-\frac{1}{2}g_{ij}\phi_{,k}\phi^{,k}\right)=\left(T_{ij}+\overline{T}_{ij}\right)\ , \tag{2}$$

where R_{ij} is the Ricci tensor, R is the Ricci scalar, ω and n are arbitrary dimensionless constants and $8\pi G=c=1$ in the relativistic units.

The energy-momentum tensor for matter and the holographic dark energy are defined as

$$T_{ij}=\rho_m u_i u_j$$

$$\text{and}\ \overline{T}_{ij}=(\rho_\lambda+p_\lambda)u_i u_j+g_{ij}p_\lambda, \tag{3}$$

where ρ_m,ρ_λ are the energy densities of matter and the holographic dark energy and p_λ is the pressure of holographic dark energy.

The Scalar field ϕ satisfies the equation

$$2\phi^n\phi^{i}_{;i}+n\phi^{n-1}\phi_{,k}\phi^{,k}=0\,. \tag{4}$$

Also the energy conservation equation is

$$T^{ij}_{;i}+\overline{T}^{ij}_{;i}=0\,. \tag{5}$$

In a co-moving coordinate system, the field equations (2), for the metric (1), using equation (3) be given by

$$\frac{2\ddot{B}}{B}+\frac{\dot{B}^2}{B^2}+\frac{K}{B^2}-\frac{\omega}{2}\phi^n\dot{\phi}^2=-p_\lambda, \tag{6}$$

$$\frac{\ddot{A}}{A}+\frac{\ddot{B}}{B}+\frac{\dot{A}}{A}\frac{\dot{B}}{B}-\frac{\omega}{2}\phi^n\dot{\phi}^2=-p_\lambda, \tag{7}$$

$$2\frac{\dot{A}}{A}\frac{\dot{B}}{B}+\frac{\dot{B}^2}{B^2}+\frac{K}{B^2}+\frac{\omega}{2}\phi^n\dot{\phi}^2=(\rho_m+\rho_\lambda), \quad (8)$$

$$\ddot{\phi}+\dot{\phi}\left(\frac{\dot{A}}{A}+2\frac{\dot{B}}{B}\right)+\frac{n}{2}\frac{\dot{\phi}^2}{\phi}=0, \quad (9)$$

where a dot denotes a derivative with respect to the cosmic time t.

Using barotropic equation of state

$$p_\lambda = w\rho_\lambda, \quad (10)$$

where w is EoS parameter.

We can write the conservation equation (5) for the matter and dark energy as

$$\dot{\rho}_m+\rho_m\left(\frac{\dot{A}}{A}+2\frac{\dot{B}}{B}\right)+\dot{\rho}_\lambda+\left(\frac{\dot{A}}{A}+2\frac{\dot{B}}{B}\right)(1+w)\rho_\lambda=0. \quad (11).$$

SOLUTION OF THE FIELD EQUATIONS

The field equations (6) -(9) are a system of four highly non-linear differential equations in seven unknowns $A, B, \phi, w, p_\lambda, \rho_\lambda, \rho_m$. The system is thus initially undetermined. Thus there is a need of three extra physical conditions to solve the field equations completely.

Firstly, considering the minimally interacting matter and holographic dark energy components . Hence both components conserve separately so that we have

$$\dot{\rho}_m+\rho_m\left(\frac{\dot{A}}{A}+2\frac{\dot{B}}{B}\right)=0, \quad (12)$$

and $$\dot{\rho}_\lambda+\left(\frac{\dot{A}}{A}+2\frac{\dot{B}}{B}\right)(1+w)\rho_\lambda=0, \quad (13)$$

where $$w=\frac{p_\lambda}{\rho_\lambda}. \quad (14)$$

Secondly , the expansion scalar (θ) is proportional to the shear scalar (σ) , which leads to

$$A = B^m \quad, m \neq 1. \quad (15)$$

Collins et. al.[63] discussed the physical significance of this condition for perfect fluid and barotropic EoS in a more general case .Many researchers [64-72] use above condition to find the exact solutions of cosmological models.

Berman proposed [73] the solutions to the field equations by applying a law of variation for Hubble's parameter in FRW models and that yields a constant value of deceleration parameter (DP). Cunha and Lima [74] favors recent acceleration and past deceleration with high degree of statistical confidence level by analyzing three SNe type Ia samples. Singh and Debnath [75], Adhav et al. [76] has defined a special form of deceleration parameter defined by

$$q=-\frac{\ddot{a}a}{\dot{a}^2}=-1+\frac{\alpha}{1+a^\alpha}, \quad (16)$$

where $\alpha > 0$, is a constant and a is mean scale factor of the universe.

Thus, a model of universe which begins with a decelerating expansion and evolves into a late time accelerating universe which is in agreement with SNe Ia astronomical observations .

After solving (16) one can obtain the mean Hubble parameter H as

$$H=\frac{\dot{a}}{a}=k(1+a^{-\alpha}), \quad (17)$$

where k is a constant of integration.

On integrating equation (17), the mean scale factor is obtain as

$$a=(e^{k\alpha t}-1)^{\frac{1}{\alpha}}. \quad (18)$$

For the metric (1), the scale factor a is given by

$$a=(AB^2)^{\frac{1}{3}}. \quad (19)$$

Using equations (18) and (19), it yields

$$(e^{\alpha kt}-1)^{\frac{3}{\alpha}}=AB^2. \quad (20)$$

Using equations (15) and (20), the metric potentials are obtained as

$$A=(e^{\alpha kt}-1)^{\frac{3m}{\alpha(m+2)}}, \quad (21)$$

$$B=(e^{\alpha kt}-1)^{\frac{3}{\alpha(m+2)}}. \quad (22)$$

Using equations (21) and (22), the metric (1) takes the form

$$ds^2=dt^2-(e^{\alpha kt}-1)^{\frac{6m}{\alpha(m+2)}}(t)dx^2-(e^{\alpha kt}-1)^{\frac{6}{\alpha(m+2)}}(dy^2+\Sigma^2(y,K)dz^2) \quad (23)$$

Equation (23) represents Homogenous - Hypersurface minimally interacting holographic dark energy cosmological model with special form of deceleration parameter in Saez- Ballester theory of gravitation.

PHYSICAL PROPERTIES OF THE MODEL

It is well known that one can study the behavior of the physical and kinematical parameters either by observing the analytical expressions or by graphical representation. The physical quantities of observational interest in cosmology are spatial volume V, mean Hubble parameter H, the expansion scalar θ , the mean anisotropy parameter A_m , the shear scalar σ^2 and the deceleration parameter q .

Using equations (19),(21) and (22), the spatial volume V of the universe is given by

$$V=(e^{k\alpha t}-1)^{\frac{3}{\alpha}}. \qquad (24)$$

The Mean Hubble parameter H is given by

$$H=\frac{1}{3}\left(\frac{\dot{A}}{A}+2\frac{\dot{B}}{B}\right)=\frac{ke^{\alpha kt}}{e^{\alpha kt}-1}. \qquad (25)$$

The expansion scalar is given by

$$\theta=3H=\frac{3ke^{\alpha kt}}{e^{\alpha kt}-1}. \qquad (26)$$

The mean anisotropic parameter is defined by

$$A_m=\frac{1}{3}\sum_{i=1}^{3}\left(\frac{\Delta H_i}{H}\right)^2=\frac{2(m-1)^2}{(m+2)^2}, \qquad (27)$$

where H_i (i = 1, 2, 3) along directions of x, y and z axes which are the directional Hubble parameters .

The shear scalar is defined and given by

$$\sigma^2=\frac{3}{2}A_mH^2=\frac{3k^2(m-1)^2}{(m+2)^2}\frac{e^{2\alpha kt}}{(e^{\alpha kt}-1)^2}. \qquad (28)$$

The gauge function i.e. scalar field is given by

$$\phi=\phi_0 c^{\frac{\alpha_1}{3}}\left(e^{\alpha kt}-1\right)^{\frac{-\alpha_1}{\alpha}}. \qquad (29)$$

The matter energy density is given by

$$\rho_m=c_1\left(e^{\alpha kt}-1\right)^{\frac{-3}{\alpha}}. \qquad (30)$$

The holographic energy density is given by

$$\rho_\lambda=\left\{\begin{array}{l}\frac{9k^2}{(m+2)^2}(2m+1)e^{2\alpha kt}(e^{-\alpha kt}-1)^{-2}+K(e^{-\alpha kt}-1)^{\frac{-6}{\alpha(m+2)}}\\+\frac{\omega}{2}\phi_0^{n+2}\alpha_1^2k^2e^{2\alpha kt}(e^{\alpha kt}-1)^{\frac{\alpha_1(n-2)-2\alpha}{\alpha}}\\-c_1\left(e^{\alpha kt}-1\right)^{\frac{-3}{\alpha}}\end{array}\right\} \qquad (31)$$

The holographic pressure is given by

$$p_\lambda=\left\{\begin{array}{l}\frac{3k^2}{(m+2)}\left(2\alpha-\frac{9}{m+2}\right)e^{2\alpha kt}(e^{-\alpha kt}-1)^{-2}-(e^{\alpha kt}-1)^{\frac{-6}{\alpha(m+2)}}\\-K\frac{6k^3}{(m+2)}e^{\alpha kt}(e^{\alpha kt}-1)^{-1}+\frac{\omega}{2}\phi_0^{n+2}\alpha_1^2k^2e^{2\alpha kt}(e^{\alpha kt}-1)^{\frac{\alpha_1(n-2)-2\alpha}{\alpha}}\end{array}\right\}.\qquad (32)$$

The Eos parameter w is given by

$$w=\frac{p_\lambda}{\rho_\lambda}=\frac{\left\{\begin{array}{l}\frac{3k^2}{(m+2)}\left(2\alpha-\frac{9}{m+2}\right)e^{2\alpha kt}(e^{-\alpha kt}-1)^{-2}-(e^{\alpha kt}-1)^{\frac{-6}{\alpha(m+2)}}\\-K\frac{6k^3}{(m+2)}e^{\alpha kt}(e^{\alpha kt}-1)^{-1}+\frac{\omega}{2}\phi_0^{n+2}\alpha_1^2k^2e^{2\alpha kt}(e^{\alpha kt}-1)^{\frac{\alpha_1(n-2)-2\alpha}{\alpha}}\end{array}\right\}}{\left\{\begin{array}{l}\frac{9k^2}{(m+2)^2}(2m+1)e^{2\alpha kt}(e^{-\alpha kt}-1)^{-2}+K(e^{-\alpha kt}-1)^{\frac{-6}{\alpha(m+2)}}\\+\frac{\omega}{2}\phi_0^{n+2}\alpha_1^2k^2e^{2\alpha kt}(e^{\alpha kt}-1)^{\frac{\alpha_1(n-2)-2\alpha}{\alpha}}\\-c_1\left(e^{\alpha kt}-1\right)^{\frac{-3}{\alpha}}\end{array}\right\}}. \qquad (33)$$

The matter density parameter Ω_m and holographic dark energy density parameter Ω_λ are given by

$$\Omega_m=\frac{\rho_m}{3H^2}=\frac{c_1\left(e^{\alpha kt}-1\right)^{\frac{-3}{\alpha}}}{3k^2e^{2\alpha kt}\left(e^{\alpha kt}-1\right)^{-2}}. \qquad (34)$$

$$\Omega_\lambda=\frac{\rho_\lambda}{3H^2}=\frac{\left\{\begin{array}{l}\frac{9k^2}{(m+2)^2}(2m+1)e^{2\alpha kt}(e^{-\alpha kt}-1)^{-2}+K(e^{-\alpha kt}-1)^{\frac{-6}{\alpha(m+2)}}\\+\frac{\omega}{2}\phi_0^{n+2}\alpha_1^2k^2e^{2\alpha kt}(e^{\alpha kt}-1)^{\frac{\alpha_1(n-2)-2\alpha}{\alpha}}\\-c_1\left(e^{\alpha kt}-1\right)^{\frac{-3}{\alpha}}\end{array}\right\}}{3k^2e^{2\alpha kt}\left(e^{\alpha kt}-1\right)^{-2}}. \qquad (35)$$

The overall density parameter as

$$\Omega=\Omega_m+\Omega_\lambda=\frac{c_1\left(e^{\alpha kt}-1\right)^{\frac{-3}{\alpha}}}{3k^2e^{2\alpha kt}\left(e^{\alpha kt}-1\right)^{-2}}+\frac{\left\{\begin{array}{l}\frac{9k^2}{(m+2)^2}(2m+1)e^{2\alpha kt}(e^{-\alpha kt}-1)^{-2}+K(e^{-\alpha kt}-1)^{\frac{-6}{\alpha(m+2)}}\\+\frac{\omega}{2}\phi_0^{n+2}\alpha_1^2k^2e^{2\alpha kt}(e^{\alpha kt}-1)^{\frac{\alpha_1(n-2)-2\alpha}{\alpha}}\\-c_1\left(e^{\alpha kt}-1\right)^{\frac{-3}{\alpha}}\end{array}\right\}}{3k^2e^{2\alpha kt}\left(e^{\alpha kt}-1\right)^{-2}} \qquad (36)$$

The coincidence parameter $r=\frac{\rho_m}{\rho_\lambda}$ i.e. the ratio of energy densities of matter and holographic dark energy is given by

$$r=\frac{c_1\left(e^{\alpha kt}-1\right)^{\frac{-3}{\alpha}}}{\left\{\begin{array}{l}\frac{9k^2}{(m+2)^2}(2m+1)e^{2\alpha kt}(e^{-\alpha kt}-1)^{-2}+K(e^{-\alpha kt}-1)^{\frac{-6}{\alpha(m+2)}}\\+\frac{\omega}{2}\phi_0^{n+2}\alpha_1^2k^2e^{2\alpha kt}(e^{\alpha kt}-1)^{\frac{\alpha_1(n-2)-2\alpha}{\alpha}}\\-c_1\left(e^{\alpha kt}-1\right)^{\frac{-3}{\alpha}}\end{array}\right\}}. \qquad (37)$$

DISCUSSION AND CONCLUSION

In this paper, Homogenous-Hypersurface universe filled with two minimally interacting fluids, matter and holographic dark energy components in the scalar tensor theory of gravitation proposed by Saez and Ballester [7] has been investigated. The field equations of the theory are solved by using the fact that the scalar expansion of the space time is proportional to the shear scalar.

The spatial volume V vanishes at $t=0$. It expands exponentially as t increases and becomes infinitely large as $t \to \infty$ shown in fig. (1). From equations (21) and (22), the spatial scale factors are not zero for any value of t and hence the model does not have singularity. From fig. (2), it is observed that the expansion scalar starts with infinite value at $t=0$ and then rapidly becomes constant after some finite time. The average anisotropic parameter remains constant throughout the evolution of the universe and it becomes zero when $m=1$ so that the universe becomes isotropic. Thus it can be interpreted that our universe is anisotropic throughout the entire life except at m = 1. The shear scalar $\sigma \to \infty$ as time $t \to 0$ and decreases to null as time increases as shown in fig (3).

It is observed that in early phase of universe, the value of deceleration parameter is positive while as $t \to \infty$, the value of $q=-1$ as shown in fig (4). Hence the universe has a decelerated expansion in the past and accelerated expansion at present which is in good agreement with the recent observations of SN Ia. It follows that in our derived model, one can choose values of deceleration parameter consistent with observations.

Figure (5) depicts the variation of energy density due to matter and holographic dark energy respectively, as a representative case with appropriate choice of constants of integration and other physical parameters using reasonably well known situations. From figure (5), it is concluded that energy density of ordinary matter and holographic dark energy are decreasing functions of time. The energy density decrease as the universe expands. The plot of energy density verses time indicates that the model starts with infinite density and as time increases the energy density tends to zero which resembles with the results of Das and Sultana [80].

It is also observed that the EoS parameter is function of cosmic time t only . It may be seen that the universe evolves through the dust ($w=0$) and radiating $\left(w=\frac{1}{3}\right)$ universes and then crosses phantom divided line $(w=-1)$ to attain a constant value, ultimately, in the phantom region ($w<-1$) . The time dependent of the EoS parameter allows it to transit form $w>-1$ to $w<-1$. The SN Ia data suggests that $-1.67<w<-0.62$ [77] while the limit imposed on ω by a combination of SN Ia data (with CMB anisotropy) and galaxy clustering statistics is $-1.33<w<-0.79$ [78] . Fig. (6), clearly shows that w evolves within a range, which is in nice agreement with SN Ia and CMB observations. This shows that the universe is initially dominated by matter and then dominated by dark energy which resembles with Reddy et. al. [79] .

Figure (7) shows the graphical representation of overall energy density with cosmic time. The black line shows that at present day the total energy density is positive and tends to 1 for the entire life. It is observed that the total energy density parameter is varying at the initial epoch, later they approach to constant value as time increases. Since our model predicts a flat universe for large times and present-day universe is very close to flat. Hence derived model is also compatible with observational results which are consistent with the results of Rao et. al. [81].

It is observed that coincidence parameter r at an initial epoch i.e very early stage of evolution varies, but after some finite time it converges to a constant value and remains constant throughout the evolution which resembles with Adhav et. al. [82]. Thus there is no coincidence problem in special form of deceleration parameter which matches with the observations as we now live in the stationary coincidence state of the universe.

Thus our holographic dark energy model represents the accelerated expansion of the universe and is consistent with current observational data.

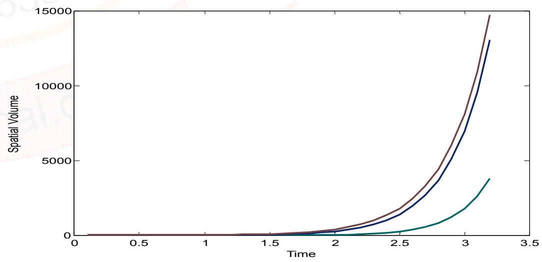

Fig. No.1: Spatial Volume vs time. (for $\alpha = 0.5,1,2$)

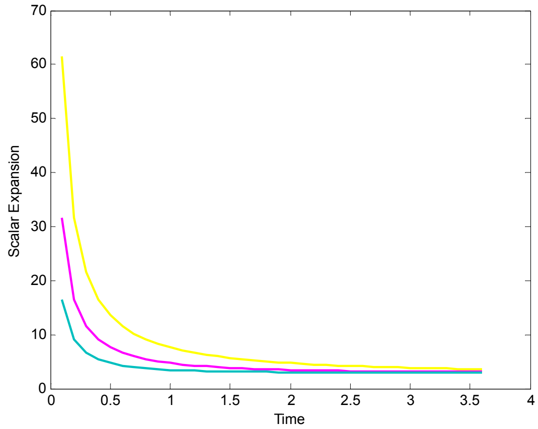

Fig. No.2: Scalar Expansion vs time. (for $\alpha = 0.5,1,2$).

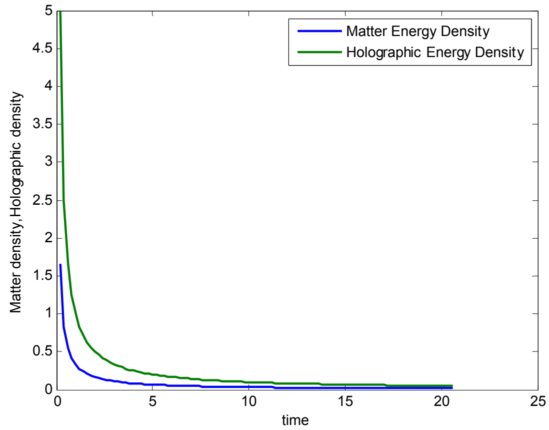

Fig.No. 5. Matter energy density and Holographic energy density vs time.

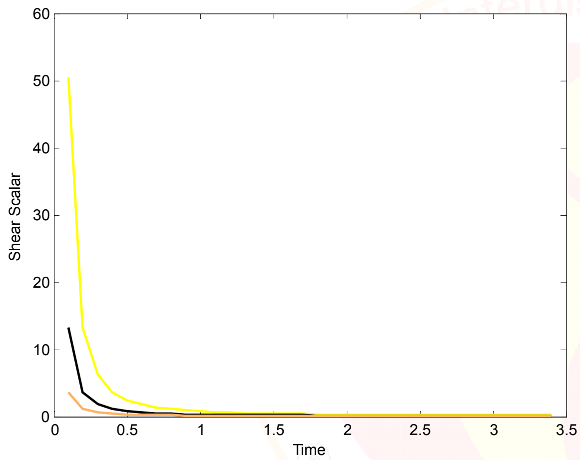

Fig. No.3: Shear Scalar vs time. (for $\alpha = 0.5,1,2$)

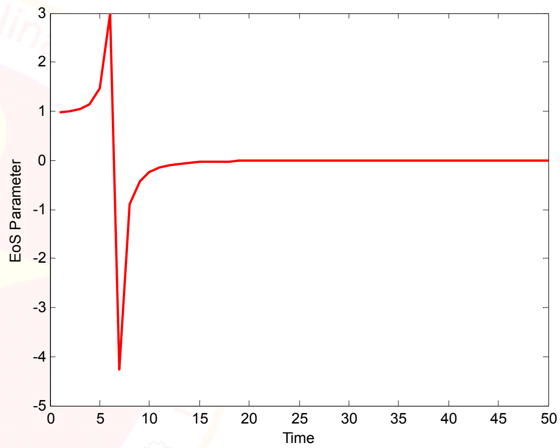

Fig. No. 6 EoS parameter vs time.

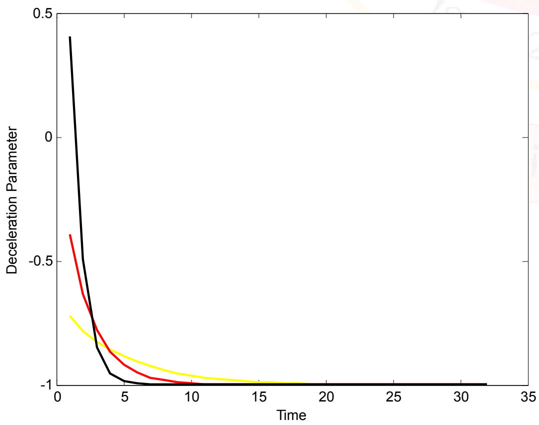

Fig. No.4: Deceleration Parameter vs time. (for $\alpha = 0.5,1,2$)

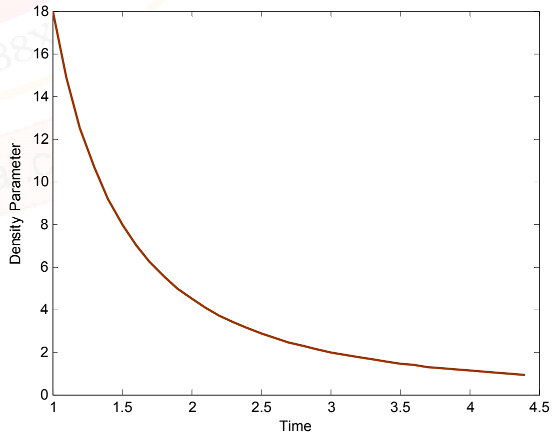

Fig. No.7. Density Parameter vs time.

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BIANCHI TYPE-VI_0 ANISOTROPIC DARK ENERGY MODELS WITH ELECTROMAGNETIC FIELD IN LYRA'S GEOMETRY

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ABSTRACT

In this article we have studied the Bianchi type-VI_0 anisotropic dark energy cosmological models filled with electromagnetic field in Lyra geometry. The Einstein field equations have been solved exactly by using the special law of variation for Hubble's parameter proposed by Berman (1983). Some physical and kinematical properties of the models are also discussed.

Keywords. *Bianchi type-VI_0 universe, anisotropic dark energy, Electoromagnetic field, Lyra Geometry.*

INTRODUCTION

The astronomical observation of SN Ia (Riess [1], Perlmutter [2]), galaxy redshift survey (Fedli [3]), cosmic microwave background radiation (CMBR) data (Caldwell [4], Huang [5]) convincingly suggest that the rate of expansion of our universe is positive, i.e. we live in an accelerating expanding universe. The most surprising and counterintuitive result coming from these observations is the fact that only ~ 4% of the total energy density of universe is in the form of baryonic matter, ~ 24% is non-baryonic matter and almost ~ 72% is completely unknown component with negative pressure. In the literature, the component with negative pressure is named as dark energy (DE) that produces repulsive force which gives rise to the current accelerating expansion of universe.

The Einstein [6] in 1916 proposed his theory of general relativity (GR) which provides a geometrical description of gravitation. Many physicists attempted to generalize the idea of geometrizing the gravitation to include a geometrical description of electromagnetism. One of the first attempts was made by Weyl [7] who proposed a more general theory by formulating a new kind of gauge theory involving metric tensor to geometrize gravitation and electromagnetism. But Weyl theory was criticized due to non-integrability of length of vector under parallel displacement.

Later, Lyra [8] suggested a modification of Riemannian geometry by introducing a gauge function into the structure less manifold which removes the non-integrability condition. This modified geometry is known as Lyra geometry. Subsequently, Sen [9] formulated a new scalar-tensor theory of gravitation and constructed an analogue of the Einstein's field equations based on Lyra geometry. He investigated that the static model with finite density in Lyra manifold is similar to the static model in Einstein's general relativity. Halford [10] has shown that the constant displacement vector field β in Lyra geometry plays the role of cosmological constant Λ in general relativity. He has also shown that the scalar-tensor treatment based in Lyra geometry predicts the same effects, within observational limits, as in Einstein's theory (Halford [11]). Katore et al. [12] studied the Einstein Rosen Bulk viscous cosmological model with bulk viscosity and zero-mass scalar field in Lyra's geometry. Ghate [13], Asagar and Ansari [14, 15], Das and Sarma [16] studied the Bianchi type-V string cosmological model in Lyra's geometry with dark energy. SubbaRao [17] studied the Kantowski-Sachs cosmological model in Lyra's geometry in presence of bulk viscous string cosmological fluid and Sahu et al. [18] studied the Bianchi type-III cosmological model in Lyra's geometry.

There are many candidates of dark energy, among which magnetized (DE) is recently have been studied by many authors. The large scale magnetic fields can be detected by observing their effects on the CMB radiation. These fields enhance anisotropies in the CMB, since the expansion rate will be different depending on the directions of the field lines [19, 20]. Sharif and Zubair [21, 22], Katore et al. [23], Ghate and Sontakke [24] studied some cosmological model in presence of magnetized anisotropic dark energy.

Sharif [22] has investigated the effect of electromagnetic field on the dynamics of Bianchi type-VI_0 universe with anisotropic DE. Motivated by the above investigations, here we take up the study of Bianchi type-VI_0 anisotropic DE filled with electromagnetic field in the framework of Lyra geometry. The Einstein field equations have been solved exactly by using the special law of variation for Hubble's parameter. This paper is outlined as follows: In section **2**, the metric and the Lyra's field equations are described. Section **3** is devoted to the solution of the field equations. In section **3.1**, we have obtained the solution of field equations for exponential volumetric expansion model and discussed its physical properties. Section **3.2**, is the solution of field equations for power-law volumetric expansion model with its physical properties. In section **4** we discuss the physical properties of models and section **5** contains some concluding remarks.

2. Metric and basic equations

The spatially homogeneous and anisotropic Bianchi type-VI_0 space-time is given by

$$ds^2 = dt^2 - A^2dx^2 - B^2e^{2mx}dy^2 - C^2e^{-2mx}dz^2 ,$$

where *A, B* and *C* are functions of time *t* only.

The Energy momentum tensors for dark matter and HDE, are respectively given by

$$T_i^{j(em)} = \bar{\mu}\left[|h|^2\left(u_iu^j - 1/2\delta_i^j\right) - h_ih^j\right],$$

where u^j is the four-velocity vector satisfying $g_{ij}u^iu^j = 1$.

$\bar{\mu}$ is the magnetic permeability and h_i is the four-magnetic flux given by

$$h_i = \frac{\sqrt{-g}}{2\bar{\mu}}\varepsilon_{ijkl}F^{kl}u^j,\ (i,j,k,l = 0,1,2,3),$$

where ε_{ijkl} is the Levi-Civita tensor, F^{kl} is the electromagnetic field tensor and $|h|^2 = h_jh^j$. We assume that the magnetic field is due to an electric current produced along x-axis and hence it is in *yz*-plane. In co-moving co-ordinates $u^i = (1,0,0,0)$ and hence Eq. (3) gives $h_1 \neq 0, h_0 = h_2 = h_3 = 0$. Using these values in Eq. (3), it follows that $F_{12} = F_{13} = 0, F_{23} \neq 0$.

The electric and magnetic field in terms of field tensor are defined as [26]

$$E_i = F_{ij}u^j, B_i = \frac{1}{2}\varepsilon_{ijk}F^{jk}.$$

By Ohm's law, we have

$$h_{ij}J^j = \sigma F_{ij}u^j,$$

where $h_{ij} = g_{ij} + u_iu_j$ is the projector tensor orthogonal to u^i, σ is the conductivity and J^i is the four current density. In the magnetohydrodynamic limit, conductivity takes infinitely large value while current remains finite so that $E_i \to 0$ [26]. Consequently, Eq.(4) leads to $F_{01} = F_{02} = F_{03} = 0$. Thus the only non-vanishing component of electromagnetic field tensor F_{ij} is F_{23}.

The Maxwell's equations

$$F_{ij;k} + F_{jk;i} + F_{ki;j} = 0, F^{ij}_{;k} = 0$$

are satisfied by

$$F_{23} = K = Constant.$$

From Eq.(3), it follows that

$$h_1 = \frac{AK}{\bar{\mu}BC}, |h|^2 = \frac{K^2}{\bar{\mu}^2B^2C^2}. \quad (1)$$

Using Eq. (8) in Eq. (2), we obtain

$$T_0^{0(em)} = \frac{K^2}{2\bar{\mu}^2B^2C^2} = T_1^{1(em)} = -T_2^{2(em)} = -T_3^{3(em)}.$$

Thus, we have (2)

$$T_i^{j(em)} = diag\left[\frac{K^2}{2\bar{\mu}^2B^2C^2}, \frac{K^2}{2\bar{\mu}^2B^2C^2}, -\frac{K^2}{2\bar{\mu}^2B^2C^2}, -\frac{K^2}{2\bar{\mu}^2B^2C^2}\right]. \quad (9)$$

The energy-momentum tensor for anisotropic DE is given by

$$T_j^i = diag[\rho, -p_x, -p_y, -p_z]$$
$$= diag[1, -\omega_x, -\omega_y, -\omega_z]\rho \quad (3)$$
$$= diag[1, -(\omega+\delta), -\omega, -(\omega+\gamma)]\rho.$$

Here ρ is the energy density, p_x, p_y and p_z are pressures and ω_x, ω_y and ω_z are directional EoS parameters in the direction of *x, y* and *z* axes respectively. Whereas ω is deviation free EoS parameter and δ and γ are the deviations from ω on x and z axes respectively.

The Einstein's modified field equation in normal gauge for Lyra's manifold obtain by Sen [9] is given by

$$R_{ij} - \frac{1}{2}Rg_{ij} - \Lambda g_{ij} + \frac{3}{2}\phi_i\phi_j - \frac{3}{4}g_{ij}\phi_k\phi^k = 8\pi\left(T_{ij} + T_{ij}^{(em)}\right), \quad (11)$$

(4)

where ϕ_i is the displacement vector defined as $\phi_i = (0,0,0,\beta(t))$.

In a co-moving co-ordinate system, the modified Einstein field Eq. (11) for Bianchi type-VI$_0$ space-time with the help of Eq. (2) are

$$\frac{\dot{A}\dot{B}}{AB}+\frac{\dot{B}\dot{C}}{BC}+\frac{\dot{A}\dot{C}}{AC}-\frac{m^2}{A^2}-\frac{3}{4}\beta^2 = 8\pi\rho+\frac{4\pi k^2}{\bar{\mu}B^2C^2}+\Lambda, \quad (12)$$

$$\frac{\ddot{B}}{B}+\frac{\ddot{C}}{C}+\frac{\dot{B}\dot{C}}{BC}+\frac{m^2}{A^2}+\frac{3}{4}\beta^2 = -8\pi(\omega+\delta)\rho+\frac{4\pi k^2}{\bar{\mu}B^2C^2}+\Lambda, \quad (13)$$

$$\frac{\ddot{A}}{A}+\frac{\ddot{C}}{C}+\frac{\dot{A}\dot{C}}{AC}-\frac{m^2}{A^2}+\frac{3}{4}\beta^2 = -8\pi\omega\rho-\frac{4\pi k^2}{\bar{\mu}B^2C^2}+\Lambda, \quad (14)$$

$$\frac{\ddot{A}}{A}+\frac{\ddot{B}}{B}+\frac{\dot{A}\dot{B}}{AB}-\frac{m^2}{A^2}+\frac{3}{4}\beta^2 = -8\pi(\omega+\gamma)\rho-\frac{4\pi k^2}{\bar{\mu}B^2C^2}+\Lambda, \quad (15)$$

$$m\left(\frac{\dot{B}}{B}-\frac{\dot{C}}{C}\right)=0, \quad (16)$$

where the overhead dot denotes derivative with respect to cosmic time t.

The conservation of right hand side of Eq. (11) leads to

$$\left(R_i^j-\frac{1}{2}Rg_i^j\right)_{;j}+\frac{3}{2}\left(\phi_i\phi^j\right)_{;j}-\frac{3}{4}\left(g_i^j\phi_k\phi^k\right)_{;j}=0. \quad (17)$$

Eq. (17) reduced to

$$\frac{3}{2}\phi_i\left[\frac{\partial\phi^j}{\partial x^j}+\phi^l\Gamma_{lj}^j\right]+\frac{3}{2}\phi^j\left[\frac{\partial\phi_i}{\partial x^j}-\phi_l\Gamma_{ij}^l\right]-\frac{3}{4}g_i^j\phi_k\left[\frac{\partial\phi^k}{\partial x^j}+\phi^l\Gamma_{lj}^k\right]$$
$$-\frac{3}{4}g_i^j\phi^k\left[\frac{\partial\phi_k}{\partial x^j}-\phi_l\Gamma_{kj}^l\right]=0, \quad (18)$$

which leads to

$$\frac{3}{2}\beta\dot{\beta}+\frac{3}{2}\beta^2\left(\frac{\dot{A}}{A}+\frac{\dot{B}}{B}+\frac{\dot{C}}{C}\right)=0. \quad (19)$$

Integrating Eq. (16), we obtain

$$B=k_1C, \quad (20)$$

where k_1 is constant of integration.

Subtracting Eq. (15) from (14) and using Eq. (20), we obtain

$$\gamma=0. \quad (21)$$

Using Eqs. (20) and (21), field equations (12)-(16), reduced to

$$2\frac{\dot{A}\dot{B}}{AB}+\frac{\dot{B}^2}{B^2}-\frac{m^2}{A^2}-\frac{3}{4}\beta^2=8\pi\rho+\frac{4\pi k^2}{\bar{\mu}B^2C^2}+\Lambda, \quad (22)$$

$$2\frac{\ddot{B}}{B}+\frac{\dot{B}^2}{B^2}+\frac{m^2}{A^2}+\frac{3}{4}\beta^2=-8\pi(\omega+\delta)\rho+\frac{4\pi k^2}{\bar{\mu}B^2C^2}+\Lambda, \quad (23)$$

$$\frac{\ddot{A}}{A}+\frac{\ddot{B}}{B}+\frac{\dot{A}\dot{B}}{AB}-\frac{m^2}{A^2}+\frac{3}{4}\beta^2=-8\pi\omega\rho-\frac{4\pi k^2}{\bar{\mu}B^2C^2}+\Lambda. \quad (24)$$

Some physical and geometrical parameters

The average scale factor is given by

$$a=(ABC)^{1/3}=\left(k_1AB^2\right)^{1/3}. \quad (25)$$

The spatial volume (V) is defined as

$$V=a^3=k_1AB^2. \quad (26)$$

The generalized mean Hubble parameter *(H)* is given by

$$H=\frac{\dot{a}}{a}=\frac{1}{3}\left(\frac{\dot{A}}{A}+\frac{2\dot{B}}{B}\right). \quad (27)$$

The scalar expansion (θ), shear scalar (σ) and anisotropy parameter (Δ) are defined as

$$\theta=3H=\left(\frac{\dot{A}}{A}+\frac{2\dot{B}}{B}\right), \quad (28)$$

$$\sigma^2=\frac{1}{2}\left(\sum_{i=1}^{3}H_i^2-3H^2\right), \quad (29)$$

$$\Delta=\frac{1}{3}\sum_{i=1}^{3}\left(\frac{H_i-H}{H}\right)^2. \quad (30)$$

SOLUTIONS OF FIELD EQUATIONS

We have initially six variables and three linearly independent equations (4)-(6). The system is thus initially undetermined and we need additional constraint to solve it. In order to solve the field equations, we use the special law of variation for Hubble's parameter proposed by Berman[25].We consider that the mean Hubble parameter (H) is related to the scale factor (a) by the relation

$$H=la^{-n}=l\left(k_1AB^2\right)^{-n/3}, \quad (31)$$

where $l>0$ and $n\geq 0$ are constants.

The deceleration parameter q is defined as

$$q=-\frac{\ddot{a}}{aH^2}. \quad (32)$$

Using Eqs. (26) and (31), we obtain

$$\dot{a}=la^{-n+1} \quad (33)$$

and

$$\ddot{a}=-l^2(n-1)a^{-2n+1}. \quad (34)$$

Using Eqs. (32), (33), we obtain

$$q=n-1, \text{ for } n\neq 0 \quad (35)$$

and $$q=-1, \text{ for } n=0. \quad (36)$$

Eqs. (26) and (31) we obtain two different volumetric expansion laws

$$V = k_2 e^{3lt}, \qquad n = 0 \tag{37}$$

$$V = \left(nlt + c\right)^{3/n}, \qquad n \neq 0 \tag{38}$$

Using Eq. (30), we can find the most general form of anisotropic parameter for the expansion for Bianchi type-VI_0 anisotropic fluid and electromagnetic field in the form

$$\varDelta = \frac{2}{9H^2}\left(H_x - H_y\right)^2, \tag{39}$$

where $H_x - H_y$ is the difference between the expansion rates on x and y axes which can be found using the field equations.

Subtracting Eq. (24) from (23), we obtain

$$\frac{\dot{A}}{A} - \frac{\dot{B}}{B} = \frac{d}{V} + \frac{1}{V}\int\left(8\pi\delta\rho + \frac{2m^2}{A^2} - \frac{8\pi k^2}{k_1^2\bar{\mu}B^4}\right)Vdt, \tag{40}$$

where d is constant of integration.

Using Eq. (40) in Eq. (39), we obtain the anisotropic parameter as

$$\Delta = \frac{2}{9H^2}\left[d + \int\left(8\pi\delta\rho + \frac{2m^2}{A^2} - \frac{8\pi k^2}{k_1^2\bar{\mu}B^4}\right)Vdt\right]^2 V^{-2}. \tag{41}$$

The anisotropy parameter in presence of isotropic fluid can be obtain by choosing $\delta = 0$, which gives

$$\Delta = \frac{2}{9H^2}\left[d + \int\left(\frac{2m^2}{A^2} - \frac{8\pi k^2}{k_1^2\bar{\mu}B^4}\right)Vdt\right]^2 V^{-2}. \tag{42}$$

We choose the value of δ so that the integrand in the above equation vanishes

$$\delta = -\frac{m^2}{4\pi\rho A^2} + \frac{k^2}{k_1^2\bar{\mu}\rho B^4}. \tag{43}$$

The corresponding energy-momentum tensor for anisotropic DE is obtained as

$$T_i^{j(em)} = diag\left[1, -\left(\omega - \frac{m^2}{4\pi\rho A^2} + \frac{k^2}{k_1^2\bar{\mu}\rho B^4}\right), -\omega, -\omega\right]\rho. \tag{44}$$

The anisotropy parameter of the expansion reduces to

$$\varDelta = \frac{2}{9}\frac{d^2}{H^2}V^{-2}. \tag{45}$$

The difference between the directional Hubble parameters is

$$H_x - H_y = \frac{d}{V}. \tag{46}$$

Using Eqs (22) and (30), the energy density is obtained as

$$\rho = \frac{1}{8\pi}\left[3H^2\left(1 - \frac{\varDelta}{2}\right) - \frac{m^2}{A^2} - \Lambda - \frac{4\pi k^2}{k_1^2\bar{\mu}B^4}\right]. \tag{47}$$

This equation shows that the anisotropy of expansion, cosmological constant and electromagnetic field reduce the energy density ρ of anisotropic DE.

3.1 Model for $n = 0$ (Exponential volumetric Expansion Model)

The spatial volume of the universe V is given by

$$V = k_2 e^{3lt}, \tag{48}$$

where k_2 is constant of integration.

Using Eqs. (48) and (46) and solving Eqs. (22) to (24), the scale factors are given by

$$A = k_3 e^{lt - \frac{2}{9}\frac{d}{lk_2}e^{-3lt}}, \tag{49}$$

$$B = \left(\frac{k_2}{k_1k_3}\right)^{\frac{1}{2}} e^{lt + \frac{1}{9}\frac{d}{lk_2}e^{-3lt}}, \tag{50}$$

$$C = \left(\frac{k_1k_2}{k_3}\right)^{\frac{1}{2}} e^{lt + \frac{1}{9}\frac{d}{lk_2}e^{-3lt}}, \tag{51}$$

where k_1, k_2 and k_3 are constants of integration.

The directional and mean Huble parameters are given by

$$H_x = l + \frac{2}{3}\frac{d}{k_2}e^{-3lt}, \tag{52}$$

$$H_y = H_z = l + \frac{2}{3}\frac{d}{k_2}e^{-3lt}, \tag{53}$$

$$H = l. \tag{54}$$

The scalar expansion (θ), shear scalar (σ) and anisotropy parameter ($\varDelta$) are given by

$$\theta = 3l, \tag{55}$$

$$\sigma^2 = \frac{1}{3}\frac{d^2}{k_2^2}e^{-6lt}, \tag{56}$$

$$\varDelta = \frac{2}{9}\frac{d^2}{l^2k_2^2}e^{-6lt}. \tag{57}$$

Using Eq. (19), the gauge function is given by

$$\beta = \beta_0 e^{-3lt}, \tag{58}$$

where β_0 is contant of integration.

Using Eqs. (47), the energy density for matter is given by

$$\rho = \frac{1}{8\pi}\left\{3l^2 - \Lambda - \frac{1}{3}\frac{d^2}{k_2^2}e^{-6lt} - \frac{m^2}{k_3^2}e^{-2lt + \frac{4}{9}\frac{d}{lk_2}e^{-3lt}} - \frac{4\pi k^2}{\bar{\mu}}\left(\frac{k_3^2}{k_2^2}\right)e^{-4lt - \frac{4}{9}\frac{d}{lk_2}e^{-3lt}}\right\}. \tag{59}$$

Using Eqs. (24), the EoS parameter ω_D of dark fluid is given by

$$\omega=\frac{\left\{9k_2^2k_3^2l^2+d^2k_3^2e^{-6lt}-3\Lambda k_2^2k_3^2-3k_2^2m^2e^{-2lt+\frac{4}{9}\frac{d}{lk_2}e^{-3lt}}+\frac{9}{4}k_2^2k_3^2\beta^2+\frac{12\pi k_3^4k^2}{\bar{\mu}}e^{-4lt-\frac{4}{9}\frac{d}{lk_2}e^{-3lt}}\right\}}{\left\{d^2k_3^2e^{-6lt}+3\Lambda k_2^2k_3^2-9k_2^2k_3^2l^2+3m^2k_2^2e^{-2lt+\frac{4}{9}\frac{d}{lk_2}e^{-3lt}}-\frac{9}{4}k_2^2k_3^2\beta^2+\frac{12\pi k_3^4k^2}{\bar{\mu}}e^{-4lt-\frac{4}{9}\frac{d}{lk_2}e^{-3lt}}\right\}} \quad (60)$$

The deviation δ in EoS parameter along x-axis is given by

$$\delta=\frac{\left\{6k_2^2m^2e^{-2lt+\frac{4}{9}\frac{d}{lk_2}e^{-3lt}}+\frac{24\pi k_3^4k^2}{\bar{\mu}}e^{-4lt-\frac{4}{9}\frac{d}{lk_2}e^{-3lt}}\right\}}{\left\{d^2k_3^2e^{-6lt}+3\Lambda k_2^2k_3^2-9k_2^2k_3^2l^2+3m^2k_2^2e^{-2lt+\frac{4}{9}\frac{d}{lk_2}e^{-3lt}}+\frac{9}{4}k_2^2k_3^2\beta^2+\frac{12\pi k_3^4k^2}{\bar{\mu}}e^{-4lt-\frac{4}{9}\frac{d}{lk_2}e^{-3lt}}\right\}}. \quad (61)$$

3.2 Model for $n \neq 0$ (Power-Law volumetric Expansion model)

Using Eq. (38), the initial time of the universe is given by

$$t_* = -c/nl \qquad for \qquad n \neq 0. \qquad (62)$$

We define a cosmic time t' as

$$t' = nlt + c \qquad (63)$$

such that the initial time turns out to be zero, i.e. $t'=0$. For this value of cosmic time, we can re-define the Bianchi model in the form

$$ds^2=(nl)^{-2}dt'^2-A^2(t')dx^2-B^2(t')e^{2mx}dy^2-C^2(t')e^{-2mx}dz^2 \qquad (64)$$

The corresponding volume of the universe V is given by

$$V = t'^{\frac{3}{n}}.$$

(65)

Using Eq. (65) and solving Eqs. (22) to (24), the scale factors are given by

$$A(t') = k_3t'^{\frac{1}{n}}e^{\frac{2}{3}\frac{nd}{n-3}t'^{1-\frac{3}{n}}}, \qquad (66)$$

$$C(t')=\left(\frac{k_1k_2}{k_3}\right)^{\frac{1}{2}}t'^{\frac{1}{n}}e^{-\frac{1}{3}\frac{nd}{n-3}t'^{1-\frac{3}{n}}}. \qquad (68)$$

The directional and mean Huble parameters are given by

$$H_x = \frac{1}{nt'}+\frac{2d}{3}t'^{-\frac{3}{n}}, \qquad (69)$$

$$H_y = H_z = \frac{1}{nt'}-\frac{d}{3}t'^{-\frac{3}{n}}, \qquad (70)$$

$$H = (nt')^{-1}. \qquad (71)$$

The scalar expansion (θ), shear scalar (σ) and anisotropy parameter (Δ) are given by

$$\theta = \frac{3}{nt'}, \qquad (72)$$

$$\sigma^2 = \frac{1}{3}d^2t'^{-\frac{6}{n}}, \qquad (73)$$

$$\Delta = \frac{2}{9}n^2d^2t'^{2-\frac{6}{n}}. \qquad (74)$$

Using Eq. (19), the gauge function is given by

where β_0 is contant of integration.

Using Eqs. (47), the energy density for matter is given by

$$\rho(t')=\frac{1}{8\pi}\left\{3(nt')^{-2}-\Lambda-\frac{1}{3}d^2t'^{-\frac{6}{n}}-\frac{m^2}{k_3^2}t'^{-\frac{2}{n}}e^{-\frac{4nd}{3n-3}t'^{1-\frac{3}{n}}}-\frac{4\pi k^2}{\bar{\mu}}\left(\frac{k_3^2}{k_2^2}\right)t'^{-\frac{4}{n}}e^{-\frac{4nd}{3n-3}t'^{1-\frac{3}{n}}}\right\} \quad (76)$$

Using Eqs. (24), the EoS parameter ω_D of dark fluid is given by

$$\omega(t')=\frac{\left\{\left(9(nt')^{-2}-3\Lambda-d^2t'^{-\frac{6}{n}}-6(nt'^2)^{-1}+\frac{9}{4}\beta^2\right)k_2^2k_3^2+3t'^{-\frac{4}{n}}e^{-\frac{4nd}{3n-3}t'^{1-\frac{3}{n}}}\left(\frac{4\pi k_3^4k^2}{\bar{\mu}}-m^2k_2^2t'^{\frac{2}{n}}e^{-\frac{8nd}{3n-3}t'^{1-\frac{3}{n}}}\right)\right\}}{\left\{\left(d^2t'^{-\frac{6}{n}}+3\Lambda-9(nt')^{-2}+\frac{9}{4}\beta^2\right)k_2^2k_3^2+3t'^{-\frac{4}{n}}e^{-\frac{4nd}{3n-3}t'^{1-\frac{3}{n}}}\left(\frac{4\pi k_3^4k^2}{\bar{\mu}}+m^2k_2^2t'^{\frac{2}{n}}e^{-\frac{8nd}{3n-3}t'^{1-\frac{3}{n}}}\right)\right\}}.$$

(77)

The deviation δ in EoS parameter along x-axis is given by

$$\delta(t')=\frac{\left\{6t'^{-\frac{4}{n}}e^{-\frac{4nd}{3n-3}t'^{1-\frac{3}{n}}}\left(\frac{4\pi k_3^4k^2}{\bar{\mu}}+m^2k_2^2t'^{\frac{2}{n}}e^{-\frac{8nd}{3n-3}t'^{1-\frac{3}{n}}}\right)\right\}}{\left\{\left(d^2t'^{-\frac{6}{n}}+3\Lambda-9(nt')^{-2}+\frac{9}{4}\beta^2\right)k_2^2k_3^2+3t'^{-\frac{4}{n}}e^{-\frac{4nd}{3n-3}t'^{1-\frac{3}{n}}}\left(\frac{4\pi k_3^4k^2}{\bar{\mu}}+m^2k_2^2t'^{\frac{2}{n}}e^{-\frac{8nd}{3n-3}t'^{1-\frac{3}{n}}}\right)\right\}}$$

. (78)

DISCUSSIONS

The physical and kinematical properties of models are as follows

i) Displacement vector β:

From Eqs. (58) and (75), it is observed that displacement vector (β) is a decreasing function of time for both exponential expansion and volumetric expansion models.

ii) Scale factors:

The scale factors $A(t), B(t), C(t)$ are finite at $t=0$ which indicate that, exponential expansion model has no initial singularity where as these diverge for later times of the universe. For volumetric expansion model if $n>3, d>0$ then $A'(t)$ takes infinitely large value while $B'(t)$ and $C'(t)$ vanish as $t'\rightarrow\infty$ (pancake type singularity). If $n>3, d<0$ then $A'(t)$ decreases to zero whereas $B'(t)$ and $C'(t)$ increases as $t'\rightarrow\infty$ (Cigar type singularity).

iii) Expansion scalar θ:

From Eqs. (55) and (72), it is observed that, for model $n=0$ (i.e. exponential volumetric expansion model) the expansion scalar θ is constant throughout the evolution of the universe and $dH/dt = 0$, which implies that greater the value of Hubble's parameter faster the rate of expansion of universe. Whereas for model $n\neq 0$ (i.e. power law volumetric expansion model) the expansion scalar θ is infinite at initial epoch and it tends to zero for later time.

iv) Spatial volume *V*:

The spatial volume is finite at $t=0$ and expand exponentially with increase in time for $n=0$ whereas for power law volumetric expansion model $V=0$ at $t'=0$ and $V\rightarrow\infty$ as $t'\rightarrow\infty$.

v) The anisotropy parameter Δ:

The anisotropy parameter Δ is finite for earlier time and it decreases with time and becomes zero as $t\rightarrow\infty$. This shows that anisotropy of expansion is not supported by the anisotropic DE and electromagnetism in exponential expansion model. For power law volumetric expansion model the anisotropy parameter depends on the value of *n*. $\Delta\rightarrow 0$ as $t'\rightarrow\infty$ and it diverges as $t'\rightarrow 0$ for $n<3$ and vice versa for $n>3$ and it remains constant for $n=3$.

vi) **The EoS parameter ω_Λ:**

The EoS parameter ω_Λ for model $n=0$ is varies in phantom region $(\omega_\Lambda<-1)$, increases rapidly and attains the value $(\omega_\Lambda=-1)$ after some finite time *t*. i.e. our model approaches to ΛCDM model after some finite time. The ΛCDM models are best candidate for describing the cosmological evolution of the universe, whereas the EoS parameter for model $n\neq 0$ is starts from quintessence region then passes into phantom region and then it tends to *-1* as $t'\rightarrow\infty$.

vii) Deviation parameter δ:

For model $n=0$, the deviation parameter δ increases from negative values towards zero and $\delta\rightarrow 0$ as $t\rightarrow\infty$. Thus the isotropic fluid becomes isotropic for the later times of the universe. For $n\neq 0$, we observe that magnetic field may increase anisotropic behavior of the DE because δ decreases with increase in time and $\delta\rightarrow 0$ as $t\rightarrow\infty$. Thus the isotropy of the DE vanishes in presence of magnetic field for later time of the universe with negative cosmological constant.

CONCLUSION

In this paper, we have studied the Bianchi type-VI$_0$ anisotropic dark energy models filled with electromagnetic field in Lyra geometry. The exact solutions of Einstein field equations have been obtained by using the special law of variation for Hubble's parameter. The physical parameters such as Hubble parameter, anisotropic parameter, expansion scalar, spatial volume, and the EoS parameter of anisotropic DE are discussed in detail. It is found that if the displacement vector $\beta\rightarrow 0$, the Lyra geometry tends to the results of Sharif [22] in GR in all respects.

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PLANE SYMMETRIC UNIVERSE WITH INTERACTING DARK MATTER AND HOLOGRAPHIC DARK ENERGY

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ABSTRACT

Here in this paper we present a plane symmetric universe filled with interacting dark matter and Holographic dark energy. Solution of Einstein field equation is obtained by using condition that shear scalar is proportional to expansion scalar. The Statefinder diagnostic pair i.e. $\{r,s\}$ is adopted to distinguish our dark energy models from other existing dark energy models. The physical and geometrical feature of the model is also discussed.

Keywords: *Plane symmetric universe, Interacting dark matter, Holographic dark energy, Statefinder parameters, Coincidence parameter.*

INTRODUCTION

Universe is expanding in an accelerating manner and this has been evidenced by recent observations of Type Ia Supernovae team (Riess et al.1998; Permutter et al. 1999), CMB (Bennett et al. 2003; Spergel et al 2003) and WMAP data (Tegmark et al. 2004a, 2004b) . Two dark energy components known as CDM (the pressureless cold dark matter) and DE (dark energy with negative pressure) are importuned to explain these observations. The acceleration of the distance Type Ia Supernovae has been caused by DE, which contributes $\Omega_{DE} \sim 0.7$. The theoretical interpretation of the galactic rotation curve and large scale structure formation have been given by CDM (Cold dark matter), which provides $\Omega_{DE} \sim 0.7$. To satisfy the present value of dark energy, the cosmological constant (Λ) should be extremely fine-tuned. Which is the simplest component for dark energy having equation of state ate $\omega = -1$ and is favored by the present observational data. (Weinberg 1989; Carroll 2001; Peebles and Ratra 2003; Padmanabhan 2003)

This unknown dark sector of the energy context of the universe has been describe by different models, starting from the inclusion of exotic component in the context of general relativity to the modification of the gravitational theory itself , such as a quintessence (Wetterich 1988; Ratra and Peebles 1988), K-essence (Chiba et al. 2000; Armendariz-Picon et al. 2000; Armendariz-Picon et al. 2001), tachyon field (Sen 2002; Padmanabhan and Chaudhury 2002), phantom field (Caldwell 2002; Nojiri and Odinsstov 2003a, 2003b), the dark energy models including Chaplygin gas (Kamenshchik, et al. 2001; Bento et al. 2002), quintom (Elizalde, et al. 2004). Cosmic acceleration is a challenge for modern cosmology in split of these attempts. Early deceleration and late time acceleration with different dark energy cosmologies (isotropic) have been reviewed by Bamba et al. (2012). Among these f(R) gravity, f(R,T) gravity, f(T) gravity, Scalar field theory, holographic dark energy, coupled dark energy and ΛCDM cosmological model representing the accelerating expansion with quintessence phantom nature in detail along with cosmography tests have been studied by them.

According to some basic quantum gravitational principle, the nature of dark energy can also be studied, for example holographic dark energy principle. According to this principle, the degree of freedom in a bounded system should be finite, and does not scale by its volume but with its boundary era (Susskind 1995). Cohen et al.(1999) discovered that for a system with ultra violate (short distance) cutoff scale Λ and infrared (long distance) cutoff scale L without decaying into, a black hole, the quantum vacuum energy should be less than or equal to the mass of a black hole, ($i.e.$ $L^3\rho_\Lambda \le LM_p^2$). Here ρ_Λ is the vacuum energy density and $M_p = (8\Pi G)^{-1/2}$ is the reduced plank mass. With the help of this idea in cosmology, one can take L which satisfies this inequality with ρ_Λ and DE density. Another alternative to the solution of the DE problem is considered as holographic principle. Hooft (1993) put forwarded this principle in the context of black hole physics firstly. According to the holographic principle, the entropy of a system scale not with its volume but with its surface area (Li 2004). In the cosmological context, a new version of the holographic principle proposed by Fishler and Susskind (1998) viz at any time during cosmological evolution, the gravitational entropy within a closed surface should not be always larger than the principle entropy that passes through the past light cone of that surface. A relation between the holographic DE density ρ_Λ and Hubble parameter H proposed from holographic principle in context of the DE problems. To present accelerated expansion of the universe, the relation $\rho_\Lambda = H^2$ does not contribute. A Holographic density of the form $\rho_\Lambda \cong \alpha H^2 + \beta H$, where H is the Hubble parameter and α, β are constant which must satisfy the restriction imposed by the current observational data was proposed by Granda and Olivers (2008). Also Granda and Olivers (2009) discussed the correspondence between this holographic DE model with one of the tachyon, quintessence, k-essence and dialton DE models in the flat FRW universe.

For reconstruction of the holographic scalar field models of dark energy, numbers of works have been done. Reddy et al. (2016) have investigated Bianchi type VI_0 universe filled with matter and holographic dark energy in scalar tensor theory by using hybrid law. Also Sarkar and Mahanta (2013a, 2013b) have studied minimally interacting holographic dark energy model in bianchi space-time with linearly varying deceleration parameter. Recently Sarkar (2014a, 2014b, 2014c) have investigated holographic dark energy model in Bianchi space time with linearly varying deceleration parameter in general relativity. Adhav et al. (2014, 2015) have investigated interacting dark matter and holographic dark energy in Bianchi type I and V by applying special law of variation of Hubble parameter that gives constant value of deceleration parameter. Also, Adhav et al. (2014a, 2014b) have investigated plane symmetric cosmological model with interacting dark matter and holographic dark energy using exponential volumetric expansion and special form of deceleration parameter. Some interacting models can help to understand the coincident problem by assuming possible interaction between dark matter and dark energy due to unknown nature of dark matter and dark energy. The current observations such as the SNIa data and CMB are compatible with the proposal of interacting dark energy. (Guo et al. 2007)

Motivated by the preceding work, in this paper we will discuss Plane symmetric universe filled with interacting dark matter and holographic dark energy in theory of gravitation. Some physical and kinematical properties of the models are also discussed.

METRIC AND FIELD EQUATIONS

We consider the plane symmetric metric in the form as

$$ds^2 = dt^2 - A^2(dx^2 + dy^2) - B^2 dz^2 , \quad (1)$$

where A and B are the scale factors and functions of the cosmic time t only .

The Einstein's field equations are ($8\pi G = 1$ and $c = 1$)

$$R_{ij} - \frac{1}{2} g_{ij} R = -({}^m T_{ij} + {}^\Lambda T_{ij}), \quad (2)$$

Where ${}^m T_{ij} = \rho_m \, u_i \, u_j$ and

$${}^\Lambda T_{ij} = (\rho_\Lambda + p_\Lambda) u_i u_j + g_{ij} p_\Lambda , \quad (3)$$

are matter tensor for dark matter (pressureless i.e. $w_m = 0$) and holographic dark energy respectively. Here ρ_m is the energy density of dark matter and ρ_Λ and p_Λ are the energy density and pressure of holographic dark energy.

The Einstein's field equations (2) for metric (1) with the help of equations (3) can be written as

$$\frac{\ddot{A}}{A} + \frac{\ddot{B}}{B} + \frac{\dot{A}\dot{B}}{AB} = -p_\Lambda , \quad (4)$$

$$\frac{2\ddot{A}}{A} + \frac{\dot{A}^2}{A^2} = -p_\Lambda , \quad (5)$$

$$\frac{\dot{A}^2}{A^2} + \frac{2\dot{A}\dot{B}}{AB} = \rho_\Lambda + \rho_m , \quad (6)$$

where overhead dot $(\dot{})$ represents derivative with respect to time *t*.

Further we assume that the interaction between two perfect fluid, dark matter (pressureless) and holographic dark energy. We consider exchange of energy between these components in such matter that continuity equation for holographic dark energy and dark matters are given by;

$$\dot{\rho}_m + \left(\frac{\dot{V}}{V}\right)\rho_m = Q \quad , \tag{7}$$

$$\dot{\rho}_\Lambda + \left(\frac{\dot{V}}{V}\right)(1+w_\Lambda)\rho_\Lambda = -Q \quad , \tag{8}$$

Equation of state parameter (EoS) for holographic dark energy is given by $w_\Lambda = \frac{p_\Lambda}{\rho_\Lambda}$.

The quantity $Q > 0$ denotes the interaction between the dark energy components. Wetterich (1988) introduced models featuring an interacting matter-dark energy and first used by Horvat (2004) alongside the holographic dark energy. Although this expression for interacting term may looks purely phenomenological. Continuity equation (7) and (8) imply that the interacting term (Q) should be proportional to a quantity with unit of inverse time i.e. $Q \propto 1/t$. This occurred due to choosing H and Q term and is motivated purely by mathematical simplicity. To Form energy density any combination of dark matter and dark energy can be expressed phenomenological in form such as (Amendola et al.2007, Guo et al. 2007).

$$Q = 3b^2 H\rho_m = b^2 \frac{\dot{V}}{V}\rho_m , \tag{9}$$

where b^2 is coupling constant. To avoid the coincidence problem, Cai and Wang (2005) considered same relation for interacting phantom dark energy and dark matter.

$$\rho_m = \rho_0 V^{(b^2-1)}, \tag{10}$$

where $\rho_0 > 0$ is a real constant of integration.

Using equations (9) and (10), we get the interacting term as

$$Q = 3\,\rho_0 b^2 H V^{(b^2-1)}. \tag{11}$$

3. Cosmological Solutions:

In order to find solutions of the field equations (4)-(6), we assume that the expansion scalar (θ) in the model is proportional to the shear scalar (σ). This condition gives

$$A = B^m , \tag{12}$$

where $m > 1$ is constant.

Subtracting equation (4) from equation (5) we obtain,

$$\frac{\ddot{B}}{B} + \frac{\dot{B}^2}{B^2} - \frac{\dot{A}\dot{B}}{AB} - \frac{\ddot{A}}{A} - = 0 . \tag{13}$$

Using equation (12) in the equation (13) and then on integrating, we obtain the value of scale factors as

$$A = (c_1 t + c_2)^{\frac{1}{2m+1}} \quad , \tag{14}$$

$$B = (2m+1)^{\frac{m}{2m+1}}(c_1 t + c_2)^{\frac{m}{2m+1}} , \tag{15}$$

where $c_1 > 0$ and c_2 are real constants of integration.

The volume scale factor V is defined and obtained as,

$$V = A^2 B = (2m+1)(c_1 t + c_2). \tag{16}$$

Mean Hubble parameter defined and obtained as,

$$H = \frac{1}{3}\frac{\dot{V}}{V} = \frac{c_1}{3(c_1 t + c_2)} \tag{17}$$

Using equation (16) in equations (10) and (11), we get energy density of dark matter and interacting term as,

$$\rho_m = \rho_0 (2m+1)^{(b^2-1)}(c_1 t + c_2)^{(b^2-1)} \tag{18}$$

$$Q = b^2 c_1 \rho_0 (2m+1)^{(b^2-1)}(c_1 t + c_2)^{(b^2-2)}. \tag{19}$$

Using equations (14), (15) and (18) in the equation (6), we obtain the energy density of holographic dark energy as,

$$\rho_\Lambda = \frac{c_1^2(m^2+2m)}{(2m+1)^2(c_1 t + c_2)^2} - \rho_0(2m+1)^{(b^2-1)}(c_1 t + c_2)^{(b^2-1)} \tag{20}$$

Using equations (14), (15) in the linear combination of equations (4-6), we obtain the pressure of holographic dark energy as,

$$p_\Lambda = \frac{c_1^2(m^2+2m)}{(2m+1)^2(c_1 t + c_2)^2} . \tag{21}$$

The EoS parameter of holographic dark energy is given by,

$$w_\Lambda = \frac{p_\Lambda}{\rho_\Lambda}$$

$$w_\Lambda = \frac{\dfrac{c_1^2(m^2+2m)}{(2m+1)^2(c_1 t + c_2)^2}}{\dfrac{c_1^2(m^2+2m)}{(2m+1)^2(c_1 t + c_2)^2} - \rho_0(2m+1)^{(b^2-1)}(c_1 t + c_2)^{(b^2-1)}} \tag{22}$$

The coincidence parameter is the ratio of two energies density i.e. the ratio of dark matter energy density to the dark energy density is given by,

$$\bar{r} = \frac{\rho_m}{\rho_\Lambda}$$

$$\bar{r} = \frac{\rho_0(2m+1)^{(b^2-1)}(c_1t+c_2)^{(b^2-1)}}{\frac{c_1^2(m^2+2m)}{(2m+1)^2(c_1t+c_2)^2} - \rho_0(2m+1)^{(b^2-1)}(c_1t+c_2)^{(b^2-1)}}. \quad (23)$$

4. Statefinder Diagnostic:

To explain the cosmic acceleration, most of the models are put forward to find a way to distinguish the various contenders in a model independent manner is very desirable. A cosmological diagnostic pair $\{r, s\}$, so called Statefinder was put forward by Sahni et al. (2003) it is defined as

$$r = \frac{\dddot{a}}{aH^3}, \qquad s = \frac{r-1}{3(q-1/2)};$$

to discriminate among various form of dark energy. Here q is a deceleration parameter and H is Hubble parameter. As Statefinder parameter derived from cosmic scalar factor a(H), therefore these are geometrical and are dimensionless. Information about dark energy in a model independent way is given by this Statefinder parameter, so geometrical variable are universal. As Statefinder depends upon the expansion factor and metric describing space time, it is "geometrical diagnostic". The well known geometrical parameter like the Hubble parameter and deceleration parameter are also generalized by this pair. Equation of state of dark energy and its first time derivative is algebraically related to Statefinder parameter. To characterize primarily flat universe $(k = 0)$ models with dark matter (dust) and dark energy, statefinder parameter were introduced. The Statefinder pair $\{1,1\}$ represents standard cold dark matter model containing no radiation, where Einstein static universe corresponds to pair $\{-\infty, \infty\}$. A cosmological constant having fixed equation of state $\omega = -1$ and fixed Newton's gravitational constant have been represented by the pair $\{1,0\}$. Various dark energy candidates including holographic dark energy, quintessence, interacting dark energy, agegraphic dark energy, tachyon and so on analyzed by statefinder parameter.

$$r = 10 \text{ and } s = \frac{r}{5}.$$

5. Discussion & Conclusion:

In this paper we have discussed plane symmetric cosmological model in presence of interacting dark matter and holographic dark energy. In the holographic interacting dark energy model by employing the apparent horizon as the IR cutoff (Pavon and Zimdahl 2005), it was argued that an equation of state of dark energy $w_\Lambda < 0$ is necessarily accompanied by the decay of the dark energy component into pressureless dark matter ($b^2 > 0$). In this model, there is no Big-Ban type of initial singularity as $t \to 0, v \to$ constant and $t \to \infty, v \to \infty$ and universe expand as time increases.

For Fig.1, at $t \to 0, \omega_\Lambda \to \infty$, as time increases ω_Λ starts from phantom region and for some finite time, it reaches to $\omega_\Lambda = -1$ (cosmological constant), which indicate the model reduces to Λ CDM after some finite time then it goes into the quintessence region ($-1 < \omega_\Lambda < -\frac{1}{3}$). The $\wedge$CDM model or the model that reduces to $\wedge$CDM are serves as a standard model in cosmology and which resemble with present universe; it had been indicated by the three year WMAP data (spergel et al. 2003), the SDSS data (Eisenstein et al. 2005) and the SNeIa data (Riess et al. 2004; Asteir et al. 2006). The Fig. 2 shows the evolving trajectory in the *s-r* plane for the corresponding model in order to distinguish our model with those of other DE models. There is coincidence problem in our model despite of taking interaction and by taking any particular values of the constants as shown in Fig. 3. We hope that the future high precision observations will be capable of determining these cosmological parameters and consequently explore the nature of DE.

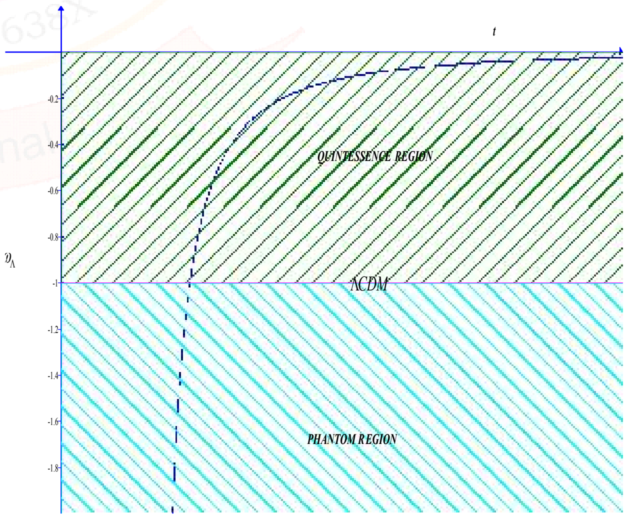

Fig.1:Evolution of EoS parameter (w_Λ).

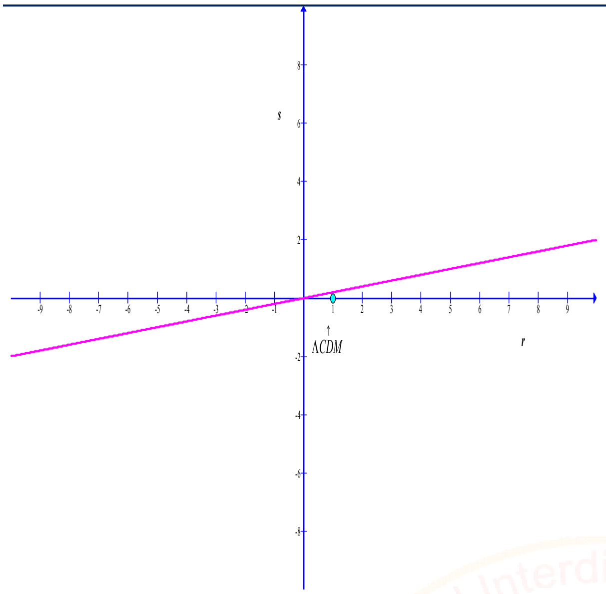

Fig.2- Statefinder parameters s v/s r .

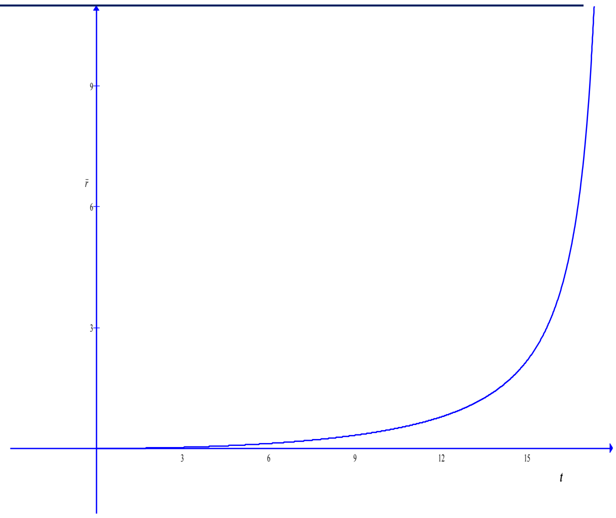

Fig.3: Coincidence parameter

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DISCRETE INITIAL BOUNDARY VALUE PROBLEMS AND APPLICATIONS

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ABSTRACT

The aim of the paper is to study a system of finite difference equations corresponding to the weakly coupled nonlinear parabolic system with nonlinear boundary conditions in a bounded domain . Method of upper – lower solutions and monotone iteration process are studied. We develop new iteration scheme. Discrete initial boundary value problems are studied by applying the method of upper lower solutions, existence comparison and uniqueness of solutions

Keywords: *Diffusion convection system, Initial boundary value Problem, Upper lower solution, Iteration scheme, Existence and uniqueness results .*

Subject Classification: ***MSC****; 65N06,65N12,65N22,65H10, 65 F10*

INTRODUCTION

The finite difference method is one of the powerful and well developed numerical method employed in the study of differential equations. The stability and convergence of this method for parabolic differential equation is discussed in [3].the coupled system of partial differential equation are well studied by many researchers for both continuous problems [1,2,5] as well as discrete problems[1,4,5]. Pao [5,6] studied the weakly coupled system of reaction diffusion convection equation. We generalize the result recently obtained by Pao [6] for discrete problems foe weakly coupled system with linear boundary conditions in two ways .on one hand new iteration scheme is developed which is similar to the iteration scheme for algebraic system and monotone convergent sequence are constructed by choosing suitable initial iteration which leads to existence-comparison as well as uniqueness results and on the other hand the results are obtained with nonlinear boundary conditions, under new iteration scheme .

The out line of the paper is as ; The formulation of the system of finite difference equations corresponding to the weakly coupled system of parabolic equations with nonlinear boundary conditions by implicit method and the development of new iteration scheme for the construction of two monotone convergent sequences when both reaction and boundary functions are quasi-monotone non-decreasing . In the last existence-comparison as well as uniqueness of the solution of the system under consideration are studied.

Classification : MSC; 65N06,65N12,65N22,65H10, 65 F10

Keywords : Reaction diffusion convection system, Initial boundary value Problem ,Upper-lower solution, Iteration scheme, Existence and uniqueness theorems.

2. Upper-lower solutions

Consider the following initial boundary value problem [IBVP] for weakly coupled Nonlinear parabolic system

$$u_t - L^{(1)}[u] = f^{(1)}(x,t,u,v) \text{ in } D_T \qquad (2.1)$$

$$vt - L^{(2)}[v] = f^{(2)}(x,t,u,v) \quad \text{in } D_T$$

With nonlinear boundary conditions

$$\frac{\partial u}{\partial v} + B^{(1)}u = g^{(1)}(x,t,u,v) \qquad \text{on } S_T$$

$$\frac{\partial u}{\partial v} + B^{[2]}u = g^{[2]}(x,t,u,v) \qquad \text{on } S_T \qquad (2.2)$$

And initial conditions

$$u(x,0) = \psi^{(1)}(x) \quad \text{in } \Omega$$

$$u(x,0) = \psi^{[2]}(x) \quad \text{in } \Omega$$

where Ω is a bounded domain in $R^P(p = 1,2,\ldots)$ with boundary $\partial\Omega$ and

$$D_T = \Omega \times (0,T], \qquad S_T = \partial\,\Omega \times (0,T], T > 0$$

$$L^{(1)} \equiv D^{(l)}(x,t)\nabla^2 + b^{(l)}(x,t)\,.\nabla$$

$$D^{(l)}(x,t) > 0 \; on \; D_T\,, B^{(l)}(x) \geq on \; \partial\,\Omega \; for \; l = 1,2.$$

The function $f^{(1)}$, $g^{(1)}$, $\psi^{(1)}, l = 1,2$ are all Holder continues on their respective domains of their definitions.

Now we convert the continuous IBVP (2.1) – (2.3) into the discrete problems. Therefore, we introduce the following notations. Let $L = (i_1, i_2, \dots i_p)$ be a multiple index with $i_v = 0,12, \dots M_v + 1$ and (x_i, t_n) be an arbitrary mesh point in Λ_p where $x_i = (x_{i1}, x_{i1}, \dots x_{ip})$ be an arbitrary mesh point in Ω_p *and* M_v is the total number of interior mesh points in the x_{iv} co-ordinate direction. Denote by $\Omega_p, \overline{\Omega_p}, \partial\Omega_p, \Lambda_p$ and S_p the sets of mesh points in $\Omega, \overline{\Omega}, \partial\,\Omega$, $\Omega \times (0,T]$ and $\partial\,\Omega \times (0,T]$ respectively and $\overline{\Lambda_p}$ the set of all mesh points in $\overline{\Omega} \times (0,T]$ where $\overline{\Omega}$ is the Closure of Ω. Let (i,n)be used to represent the mesh point (x_i, t_n). Set

$$u_{i,n} \equiv u\,(x_i, t_n), v_{i,n} \equiv v(x_i, t_n)\,, f^{(l)}(u_{i,n}, v_{i,n}) \equiv f^{(l)}(x_i, t_n, u_{i,n}, v_{i,n})$$

$$D_{i,n}^{(l)} \equiv D^{(l)}(x_i, t_n), b_{i,n}^{(l)} \equiv b^{(l)}(x_i, t_n), g^{(l)}(u_{i,n}, v_{i,n}) \equiv g^{(l)}(x_i, t_n, u_{i,n}, v_{i,n}),$$

$$\psi_i^{(l)} \equiv \psi^{(l)}(x_i)\; l = 1,2. \textit{and}\; u_{i,0} \equiv u\,(x_{i,0}), v_{i,0} \equiv v\,(x_{i,0})$$

Let $k_n = t_n - t_{n-1}$ be the nth time increment for $n = 1,2,3 \dots N$and h_v be the spatial increment in the $x_{i,v}$ coordinate direction. Let $e_v = (0, \dots, 1 \dots, 0)$ be the unit vector in R^p, where constant 1 appears in the V^{th} component and zero elsewhere.

The standard first and second order difference approximation are

$$u\,(x_i, t_n) = 2h_v^{-1}[\,u\,(x_i{+}h_v e_v, t_n) - u\,(x_i{-}h_v e_v, t_n)] \tag{2.3}$$

$$\Delta^{(v)} u\,(x_i, t_n) = h_v^{-2}[\,u\,(x_i{+}h_v e_v, t_n) - 2u\,(x_i, t_n) + u\,(x_i{-}h_v e_v, t_n)]$$

Respectively (for details see[1.6]. also note that $k_n{}^{-1}(u_{i,n} - u_{i,n-1})$ is the backward approximation for u_t.Using these notations, the continues IBVP(2.1)-(2.3) is transformed to following discrete initial boundary value problem

$$k_n^{-1}(u_{i,n} - u_{i,n-1}) - L^{(1)}[u_{i,n}] = f^{(1)}(u_{i,n}, v_{i,n})$$

$$k_n^{-1}(u_{i,n} - u_{i,n-1}) - L^{(2)}[u_{i,n}] = f^{(2)}(u_{i,n}, v_{i,n})$$

$$B^{(1)}[u_{i,n}] = g^{(1)}(u_{i,n}, v_{i,n})$$

$$B^{(2)}[u_{i,n}] = g^{(2)}(u_{i,n}, v_{i,n})$$

$$u_{i,0} = \psi_i^{(1)}$$

$$i \in \Omega_p \tag{2.6}$$

$$v_{i,0} = \psi_i^{(2)}$$

Where for $l = 1,2$.

$$L^{(l)}[w_{i,n}] \equiv \sum_{v=1}^{p} (D_{i,n}^{(l)}\, \Delta^{(v)} w_{i,n} + b_{i,n}^{(l)}\, \delta_{i,n}^{(v)} w_{i,n})$$

$$B^{(l)}[w_{i,n}] \equiv |x_i - \hat{x}_i|^{-1}[w(x_i, t_n) - w(\hat{x}_i, t_n)] + \beta^{(l)}(x_i,) w(x_i, t_n) \tag{2.8}$$

In the above boundary approximation (2.8) , $\hat{x}_i$ is suitable point in Ω_p and $|\, x_i - \hat{x}_i\,|$is the distance between x_i and $\hat{x}_i$.Here boundary surface is assumed to be parallel to the coordinate planes. Now we define quasimonotone nondecreasing functions.

Definition: A function $(f^{(1)}, f^{(2)})$,is said to be quasi monotonic decreasing in $J \subset R^2$ if

$$\frac{\partial}{\partial v} f^{(1)} \geq 0 \qquad , \frac{\partial}{\partial u} f^{(2)} \geq 0, \quad \textit{for}\; (u, v) \in J$$

Note the Quasimonotone nondecreasing property of boundary function $(g^{(1)}, g^{(2)})$, can be defined in the same way.

The definition of upper- lower solutions for the coupled finite difference system (2.4)-(2.6) depends on both the quasimonotone nondecreasing property of reaction function $(f^{(1)}, f^{(2)})$ and boundary function $(g^{(1)}, g^{(2)})$ in a sector defined below.

Definition 2.2: Let $(\tilde{u}_{i,n}, \tilde{v}_{i,n})$ and $(\hat{u}_{i,n}, \hat{v}_{i,n})$ be any two function in $\overline{\Lambda_p}$ with $(\tilde{u}_{i,n}, \tilde{v}_{i,n}) \geq (\hat{u}_{i,n}, \hat{v}_{i,n})$ then we define the sector $S_{i,n}$ as

$$S_{i,n} = \{\, (u_{i,n}, v_{i,n}) \in \overline{\Lambda_p} : (\hat{u}_{i,n}, \hat{v}_{i,n}) \leq (u_{i,n}, v_{i,n}) \leq (\tilde{u}_{i,n}, \tilde{v}_{i,n})\,\}$$

Where inequalities for vector functionare both component wise as well as point wise.

Definition 2.3: Two functions $(\tilde{u}_{i,n}, \tilde{v}_{i,n}), (\hat{u}_{i,n}, \hat{v}_{i,n})$ in $\overline{\Lambda_p}$ with

$$(\tilde{u}_{i,n}, \tilde{v}_{i,n}) \geq (\hat{u}_{i,n}, \hat{v}_{i,n}) \quad (i,n)\; in\; \Lambda_p \tag{2.4}$$

Are called ordered upper – lower solutions for the system (2.4) - (2.6) if they satify the following inequalities

$$k_n^{-1}(\tilde{u}_{i,n} - \tilde{u}_{i,n-1}) - L^{(1)}[\tilde{u}_{i,n}] \geq f^{(1)}(\tilde{u}_{i,n}, \tilde{v}_{i,n}) \quad (i,n)\; in\; S_p \tag{2.5}$$

$$k_n^{-1}(\tilde{v}_{i,n} - \tilde{v}_{i,n-1}) - L^{(2)}[\tilde{v}_{i,n}] \geq f^{(2)}(\tilde{u}_{i,n}, \tilde{v}_{i,n})$$

$$k_n^{-1}(\hat{u}_{i,n} - \hat{u}_{i,n-1}) - L^{(1)}[\hat{u}_{i,n}] \leq f^{(1)}(\hat{u}_{i,n}, \hat{v}_{i,n}) \qquad (i,n) \in \Lambda_p$$
$$k_n^{-1}(\hat{v}_{i,n} - \hat{v}_{i,n-1}) - L^{(2)}[\hat{u}_{i,n}] \leq f^{(2)}(\hat{u}_{i,n}, \hat{v}_{i,n})$$
(2.9)

$$B^{(1)}[\tilde{u}_{i,n}] \geq g^{(1)}(\tilde{u}_{i,n}, \tilde{v}_{i,n})$$
$$B^{(2)}[\tilde{v}_{i,n}] = g^{(2)}(\tilde{u}_{i,n}, \tilde{v}_{i,n})$$
$$B^{(1)}[\hat{u}_{i,n}] \leq g^{(1)}(\hat{u}_{i,n}, \hat{v}_{i,n}) \qquad (i,n) \in S_p$$
$$B^{(2)}[\hat{v}_{i,n}] = g^{(2)}(\hat{u}_{i,n}, \hat{v}_{i,n})$$
(2.10)

$$\tilde{u}_{i,0} \geq \psi_i^{(1)} \geq \hat{u}_{i,0}$$
$i \in \Omega_p$
$$\tilde{v}_{i,0} \geq \psi_i^{(2)} \geq \hat{v}_{i,0}$$

3 .Monotone iteration scheme:

We concider $(f^{(1)}, f^{(2)})$ and $(g^{(1)}, g^{(2)})$, as quasimonotone nondecreasing function in the sector $S_{i,n}$.therefore ,there exixts nonnegative function$\gamma_{i,n}^{(1)}, \gamma_{i,n}^{(2)}, \sigma_{i,n}^{(1)}$ and $\sigma_{i,n}^{(2)}$ such that for any pair $(u_{i,n}, v_{i,n})$ and $(u'_{i,n}, v'_{i,n})$ in the sector $S_{i,n}$ formed from the ordered upper-lower solutions, the functions $f^{(l)}$, $g^{(l)}, l = 1,2.$ satisfy the following one side Lipchitz condition, which ensure the exixtance of solutions of the discrete IBVP (2.4) –(2.6).

$$f^{(1)}(u_{i,n}, v_{i,n}) - f^{(1)}(u'_{i,n}, v_{i,n}) \geq -\gamma_{i,n}^{(1)}(u_{i,n} - u'_{i,n}) \; when \; u_{i,n} \geq u'_{i,n}$$
$$f^{(2)}(u_{i,n}, v_{i,n}) - f^{(2)}(u_{i,n}, v'_{i,n}) \geq -\gamma_{i,n}^{(2)}(v_{i,n} - v'_{i,n}) \; when \; v_{i,n} \geq v'_{i,n}$$
$$g^{(1)}(u_{i,n}, v_{i,n}) - g^{(1)}(u'_{i,n}, v_{i,n}) \geq -\sigma_{i,n}^{(1)}(u_{i,n} - u'_{i,n}) \; when \; u_{i,n} \geq u'_{i,n}$$
$$g^{(2)}(u_{i,n}, v_{i,n}) - g^{(2)}(u_{i,n}, v'_{i,n}) \geq -\sigma_{i,n}^{(2)}(v_{i,n} - v'_{i,n}) \; when \; v_{i,n} \geq v'_{i,n} \qquad (3.1)$$

Let

$$F^{(1)}(u_{i,n}, v_{i,n}) = \gamma_{i,n}^{(1)} u_{i,n} + f^{(1)}(u_{i,n}, v_{i,n})$$
$$F^{(2)}(u_{i,n}, v_{i,n}) = \gamma_{i,n}^{(2)} v_{i,n} + f^{(2)}(u_{i,n}, v_{i,n}) \qquad (3.2)$$
$$G^{(1)}(u_{i,n}, v_{i,n}) = \sigma_{i,n}^{(1)} u_{i,n} + f^{(1)}(u_{i,n}, v_{i,n})$$
$$G^{(2)}(u_{i,n}, v_{i,n}) = \sigma_{i,n}^{(2)} v_{i,n} + g^{(1)}(u_{i,n}, v_{i,n})$$

Now we start from the suitable initial iteration $\left(u_{i,n}^{(0)}, v_{i,n}^{(0)}\right)$ as either $(\tilde{u}_{i,n}, \tilde{v}_{i,n})$ or $(\hat{u}_{i,n}, \hat{v}_{i,n})$ and construct a sequence $\{u_{i,n}^{(m)}, v_{i,n}^{(m)}\}$ from the following iteration process.

Iteration process.

$$k_n^{-1}(u_{i,n}^{(m)} - u_{i,n-1}^{(m)}) - L^{(1)}[u_{i,n}^{(m)}] + \gamma_{i,n}^{(1)} u_{i,n}^{(m)} = F^{(1)}(u_{i,n}^{(m-1)}, v_{i,n}^{(m-1)}) \qquad (3.3)$$
$$B^{(1)}\left[u_{i,n}^{(m)}\right] + \sigma_{i,n}^{(1)} u_{i,n}^{(m)} = G^{(1)}\left(u_{i,n}^{(m-1)}, v_{i,n}^{(m-1)}\right)$$
$$u_{i,0}^{(m)} = \psi_i^{(1)}$$
$$k_n^{-1}\left(v_{i,n}^{(m)} - v_{i,n-1}^{(m)}\right) - L^{(2)}\left[v_{i,n}^{(m)}\right] + \gamma_{i,n}^{(2)} v_{i,n}^{(m)} = G^{(1)}\left(u_{i,n}^{(m)}, v_{i,n}^{(m-1)}\right)$$

$$B^{(2)}\left[v_{i,n}^{(m)}\right] + \sigma_{i,n}^{(12)} u2_{i,n}^{(m)} = G^{(2)}\left(u_{i,n}^{(m)}, v_{i,n}^{(m-1)}\right)$$
$$v_{i,0}^{(m)} = \psi_i^{(2)}$$

Where $m = 1,2 \ldots$

For each $m = 1,2 \ldots$ the above system consist of two linear finite difference parabolic problems. So the sequence constructed from the above iteration process are well defined. Define

$$\mathcal{L}^{(1)}[u_{i,n}] \equiv k_n^{-1}(u_{i,n} - u_{i,n-1}) - L^{(1)}[u_{i,n}] + \gamma_{i,n}^{(1)} u_{i,n}$$
$$\mathcal{L}^{(2)}[u_{i,n}] \equiv k_n^{-1}(u_{i,n} - u_{i,n-1}) - L^{(2)}[u_{i,n}] + \gamma_{i,n}^{(2)} u_{i,n}$$
$$\mathfrak{B}^{(1)}[u_{i,n}] \equiv B^{(1)}\left[u_{i,n}^{(m)}\right] + \sigma_{i,n}^{(1)} u_{i,n}$$
$$\mathfrak{B}^{(2)}[v_{i,n}] \equiv B^{(2)}\left[v_{i,n}^{(m)}\right] + \sigma_{i,n}^{(2)} v_{i,n}$$

We choose $(\tilde{u}_{i,n}, \tilde{v}_{i,n})$ and $(\hat{u}_{i,n}, \hat{v}_{i,n})$ as initial iteration and obtain the sequences of iteration by splitting the above iteration process in to the following sub- iteration process $A_1 - A_4$.

Sub – iteration process A_1

$$\mathcal{L}^{(1)}\left[\bar{u}_{i,n}^{(m)}\right] = \gamma_{i,n}^{(1)} \bar{u}_{i,n}^{(m-1)} + f^{(1)}\left(\bar{u}_{i,n}^{(m-1)}, \bar{v}_{i,n}^{(m-1)}\right)$$

$$\mathfrak{B}^{(1)}\left[\ \bar{u}_{i,n}^{(m)}\ \right] = \sigma_{i,n}^{(1)}\ \bar{u}_{i,n}^{(m-1)} + f^{(1)}\left(\bar{u}_{i,n}^{(m-1)}, \bar{v}_{i,n}^{(m-1)}\right)$$

$$\bar{u}_{i,0}^{(m)} = \psi_i^{(1)} \text{ Where } m = 1,2 \ldots$$

Sub – iteration process A_2.

$$\mathcal{L}^{(2)}\left[\ \bar{v}_{i,n}^{(m)}\right] = \gamma_{i,n}^{(2)}\ \bar{u}_{i,n}^{(m-1)} + f^{(2)}\left(\bar{u}_{i,n}^{(m-1)}, \bar{v}_{i,n}^{(m-1)}\right)$$

$$\mathfrak{B}^{(2)}\left[\bar{v}_{i,n}^{(m)}\right] = \sigma_{i,n}^{(2)}\bar{v}_{i,n}^{(m-1)} + f^{(2)}\left(\bar{u}_{i,n}^{(m)}, \bar{v}_{i,n}^{(m-1)}\right)$$

(3.4)

$$\bar{v}_{i,0}^{(m)} = \psi_i^{(2)} \text{ Where } m = 1,2 \ldots$$

Sub – iteration process A_3.

$$\mathcal{L}^{(1)}\left[\underline{u}_{i,n}^{(m)}\right] = \gamma_{i,n}^{(1)}\ \underline{u}_{i,n}^{(m-1)} + f^{(1)}\left(\underline{u}_{i,n}^{(m-1)}, \underline{v}_{i,n}^{(m-1)}\right)$$

$$\mathfrak{B}^{(1)}\left[\underline{u}_{i,n}^{(m)}\right] = \sigma_{i,n}^{(1)}\underline{u}_{i,n}^{(m-1)} + f^{(1)}\left(\underline{u}_{i,n}^{(m-1)}, \underline{v}_{i,n}^{(m-1)}\right)$$

$$\underline{u}_{i,0}^{(m)} = \psi_i^{(1)} \text{ Where } m = 1,2 \ldots$$

Sub – iteration process A_4.

$$\mathcal{L}^{(2)}\left[\underline{v}_{i,n}^{(m)}\right] = \gamma_{i,n}^{(2)}\ \underline{v}_{i,n}^{(m-1)} + f^{(2)}\left(\underline{u}_{i,n}^{(m-1)}, \underline{v}_{i,n}^{(m-1)}\right)$$

$$\mathfrak{B}^{(2)}\left[\underline{v}_{i,n}^{(m)}\right] = \sigma_{i,n}^{(2)}\underline{v}_{i,n}^{(m-1)} + f^{(2)}\left(\underline{u}_{i,n}^{(m)}, \underline{v}_{i,n}^{(m-1)}\right)$$

$$\underline{u}_{i,0}^{(m)} = \psi_i^{(2)} \text{ Where } m = 1,2 \ldots$$

We start$\left(\bar{u}_{i,n}^{(0)}, \bar{u}_{i,n}^{(0)}\right) = \left(\tilde{u}_{i,n}, \tilde{v}_{i,n}\right)$ with as initial iteration in the sub-iteration process A_1. for $m = 1$ and obtain $\bar{u}_{i,n}^{(1)}$ then we use this value in the sub- iteration process A_2. for $m = 1$ and obtain $\bar{v}_{i,n}^{(1)}$.in this way we obtain the first iteration $\left(\bar{u}_{i,n}^{(1)}, \bar{v}_{i,n}^{(1)}\right)$. Then using $\left(\bar{u}_{i,n}^{(1)}, \bar{v}_{i,n}^{(1)}\right)$ as initial iteration we find the next iteration $\left(\bar{u}_{i,n}^{(2)}, \bar{v}_{i,n}^{(2)}\right)$ as above from the sub- iteration process A_1 and A_2 $m = 2$ and so on.We denote the sequence of these iteration by $\{\bar{u}_{i,n}^{(m)}, \bar{v}_{i,n}^{(m)}\}$.

Now we start with $\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right) = \left(\hat{u}_{i,n}, \hat{v}_{i,n}\right)$ as initial iteration in the sub –iteration process A_3 for $m = 1$ and obtain$\underline{u}_{i,n}^{(1)}$thus we obtain the first iteration$(\underline{u}_{i,n}^{(1)}, \underline{v}_{i,n}^{(1)})$ .using this iteratin as initial iteatration we obtain the next iteration$(\underline{u}_{i,n}^{(2)}, \underline{v}_{i,n}^{(2)})$ as above from sub – iteration process A_3 and A_4 for $m = 2$ and so on. We denote the sequence of these iteration by$\{\bar{u}_{i,n}^{(m)}, \bar{v}_{i,n}^{(m)}\}$.

To prove monotone property of these sequence we required the monotone property of the functions $F^{(l)}, G^{(l)}, l = 1,2$.as well as positivity result . The monotone property and positivity results are proved in [3,8] and [6], we state without proof these results as lemma 3.1 And lemma 3.2 respectively.

LEMMA 3.1 suppose $\left(u_{i,n}, v_{i,n}\right)$ and $\left(u'_{i,n}, v'_{i,n}\right)$ are two functions in $S_{i,n}$such that $\left(u_{i,n}, v_{i,n}\right) \geq \left(u'_{i,n}, v'_{i,n}\right)$ and suppose that Lipchitz condition (3.1)

Holds .if $(f^{(1)}, f^{(2)})$ and $(g^{(1)}, g^{(2)})$are quasimonotone non decreasing in $S_{i,n}$ then

$$F^{(1)}\left(u_{i,n}, v_{i,n}\right) \geq F^{(1)}\left(u'_{i,n}, v'_{i,n}\right)$$
$$F^{(2)}\left(u_{i,n}, v_{i,n}\right) \geq F^{(2)}\left(u'_{i,n}, v'_{i,n}\right)$$
$$G^{(1)}\left(u_{i,n}, v_{i,n}\right) \geq G^{(1)}\left(u'_{i,n}, v'_{i,n}\right)$$
$$G^{(2)}\left(u_{i,n}, v_{i,n}\right) \geq G^{(2)}\left(u'_{i,n}, v'_{i,n}\right)$$

Lemma 3.2 let $w_{i,n}$ be function defined in $\overline{\Lambda_p}$ such that

$$L\left[w_{i,n}\right] + C_{i,n}w_{i,n} \geq 0 \ \ (i,n) \in \Lambda_p$$
$$B\left[w_{i,n}\right] \geq 0 (i,n) \in S_p$$
$$w_{i,n} \geq 0 \ i \in \Lambda_p$$

Where $C_{i,n} \geq 0$. then $w_{i,n} \geq 0\ i \in \overline{\Lambda_p}$.

Lemma 3.3 let $(f^{(1)}, f^{(2)})$ and $(g^{(1)}, g^{(2)})$be quasimonotone nondecreasing $C^1 - functions$ in $S_{i,n}$.

Then the sequence $\{\bar{u}_{i,n}^{(m)}, \bar{v}_{i,n}^{(m)}\}$ and $\{\underline{u}_{i,n}^{(m)}, \underline{v}_{i,n}^{(m)}\}$obtained from the iteration process (3.3) with initial iterations$\left(\bar{u}_{i,n}^{(m)}, \bar{u}_{i,n}^{(m)}\right) = \left(\tilde{u}_{i,n}, \tilde{v}_{i,n}\right)$ and $\left(\underline{u}_{i,n}^{(m)}, \underline{v}_{i,n}^{(m)}\right) = \left(\hat{u}_{i,n}, \hat{v}_{i,n}\right)$ respctively posses the monotone property

$$\left(\underline{u}_{i,n}^{(m-1)}, \underline{v}_{i,n}^{(m-1)}\right) \leq \left(\underline{u}_{i,n}^{(m)}, \underline{v}_{i,n}^{(m)}\right) \leq \left(\bar{u}_{i,n}^{(m)}, \bar{u}_{i,n}^{(m)}\right) \leq \left(\bar{u}_{i,n}^{(m-1)}, \bar{v}_{i,n}^{(m-1)}\right), \quad (i,n) \in \overline{\Lambda_p} \qquad (3.5)$$

Where $m =$ 1,2, ...

Proof .

$$\text{Let } w_{i,n} = \bar{u}_{i,n}^{(0)} - \bar{u}_{i,n}^{(1)} = \tilde{u}_{i,n} - \bar{u}_{i,n}^{(1)}$$
$$z_{i,n} = \bar{v}_{i,n}^{(0)} - \bar{v}_{i,n}^{(1)} = \tilde{v}_{i,n} - \bar{v}_{i,n}^{(1)}$$

Then by (2.9),(2.10),(3.2), iteration process (3.3 and (3.4))

$$\mathcal{L}^{(1)}\left[w_{i,n}\right] = \mathcal{L}^{(1)}\left[\tilde{u}_{i,n}\right] - F^{(1)}\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right)$$

$$= k_n^{-1}(\tilde{u}_{i,n} - \tilde{u}_{i,n-1}) - L^{(1)}[\tilde{u}_{i,n}] - f^{(1)}\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right) \geq 0$$

$$\mathcal{B}^{(1)}[w_{i,n}] = \mathcal{B}^{(1)}[\tilde{u}_{i,n}] - G^{(1)}(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)})$$
$$= B^{(1)}[\tilde{u}_{i,n}] - g^{(1)}\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right) \geq 0$$

By (2.11) and iteration process (3.3)

$$w_{i,0} = \bar{u}_{i,n}^{(0)} - \bar{u}_{i,n}^{(1)} = \tilde{u}_{i,0} - \psi_i^{(1)} \geq 0$$

By lemma 3.2, $w_{i,n} \geq 0$. This gives $\bar{u}_{i,n}^{(0)} \geq \bar{u}_{i,n}^{(1)}$.

Now by (2.9),(2.10),(3.2),iteration process (3.3) and (3.4),

$$\mathcal{L}^{(2)}[z_{i,n}] = \mathcal{L}^{(2)}[\tilde{v}_{i,n}] - F^{(2)}(\bar{u}_{i,n}^{(1)}, \bar{v}_{i,n}^{(0)})$$
$$= k_n^{-1}(\tilde{v}_{i,n} - \tilde{v}_{i,n-1}) - L^{(2)}[\tilde{v}_{i,n}] - f^{(2)}\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right)$$
$$= k_n^{-1}(\tilde{v}_{i,n} - \tilde{v}_{i,n-1}) - L^{(2)}[\tilde{v}_{i,n}] - f^{(2)}\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right) + f^{(2)}\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right) - f^{(2)}\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right)$$
$$\geq f^{(2)}\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right) - f^{(2)}\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right)$$

≥ 0 ($\because f^{(2)}$ *i squasimonotone decreasing and* $\bar{u}_{i,n}^{(0)} \geq \bar{u}_{i,n}^{(1)}$)

$$\mathcal{B}^{(2)}[z_{i,n}] = \mathcal{B}^{(2)}[\tilde{v}_{i,n}] - G^{(2)}(\bar{u}_{i,n}^{(1)}, \bar{v}_{i,n}^{(0)})$$
$$= B^{(2)}[\tilde{v}_{i,n}] - g^{(2)}(\bar{u}_{i,n}^{(1)}, \bar{v}_{i,n}^{(0)})$$
$$= B^{(2)}[\tilde{v}_{i,n}] - g^{(2)}\left(\bar{u}_{i,n}^{(1)}, \bar{v}_{i,n}^{(0)}\right) + g^{(2)}\left(\bar{u}_{i,n}^{(1)}, \bar{v}_{i,n}^{(0)}\right) - g^{(2)}\left(\bar{u}_{i,n}^{(1)}, \bar{v}_{i,n}^{(0)}\right)$$
$$\geq g^{(2)}\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right) - g^{(2)}\left(\bar{u}_{i,n}^{(1)}, \bar{v}_{i,n}^{(0)}\right)$$

≥ 0 ($\because g^{(2)}$ *i squasimonotone decreasing and* $\bar{u}_{i,n}^{(0)} \geq \bar{u}_{i,n}^{(1)}$)

By (2.11) and iteration process (3.3)

$$z_{i,0} = \bar{v}_{i,n}^{(0)} - \bar{v}_{i,n}^{(1)} = \tilde{v}_{i,0} - \psi_i^{(2)} \geq 0$$

It follows from lemma 3.2 that $z_{i,n} \geq 0$ *in* $\overline{\Lambda_p}$, *which gives* $\bar{v}_{i,n}^{(0)} \geq \bar{v}_{i,n}^{(1)}$. thus we get $\left(\bar{u}_{i,n}^{(1)}, \bar{v}_{i,n}^{(1)}\right) \leq (\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)})$

Similarly letting $w_{i,n} = \underline{u}_{i,n}^{(0)} - \underline{u}_{i,n}^{(0)} = \underline{u}_{i,n}^{(1)} - \hat{u}_{i,n}$

$$z_{i,n} = \underline{v}_{i,n}^{(0)} - \underline{v}_{i,n}^{(0)} = \underline{v}_{i,n}^{(1)} - \hat{v}_{i,n}$$

We obtain $\left(\underline{u}_{i,n}^{(1)}, \underline{v}_{i,n}^{(1)}\right) \geq (\underline{u}_{i,n}^{(0)}, \underline{v}_{i,n}^{(0)})$.

Now let

$$w_{i,n}^{(1)} = \bar{u}_{i,n}^{(1)} - \underline{u}_{i,n}^{(1)}$$
$$z_{i,n}^{(1)} = \bar{v}_{i,n}^{(1)} - \underline{v}_{i,n}^{(1)}$$

Then by iteration process (3.3) and lemma 3.1

$$\mathcal{L}^{(1)}\left[w_{i,n}^{(1)}\right] = \mathcal{L}^{(1)}\left[\bar{u}_{i,n}^{(1)}\right] - \mathcal{L}^{(1)}\left[\underline{u}_{i,n}^{(1)}\right]$$
$$= F^{(1)}\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right) - F^{(1)}\left(\underline{u}_{i,n}^{(1)}, \underline{v}_{i,n}^{(1)}\right) \geq 0$$
$$\mathcal{B}^{(1)}\left[w_{i,n}^{(1)}\right] = \mathcal{B}^{(1)}\left[\bar{u}_{i,n}^{(1)}\right] - \mathcal{B}^{(1)}\left[\underline{u}_{i,n}^{(1)}\right]$$
$$= G^{(1)}\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right) - G^{(1)}\left(\underline{u}_{i,n}^{(1)}, \underline{v}_{i,n}^{(1)}\right) \geq 0$$

By iteration process(3.3) $w_{i,0}^{(1)} = \bar{u}_{i,0}^{(1)} - \underline{u}_{i,0}^{(1)} = \psi_i^{(1)} - \psi_i^{(1)} = 0$

From lemma 3.2, it shows that

$$w_{i,n}^{(1)} \geq 0 \text{ on } \overline{\Lambda_p}. \textit{It leads to}$$
$$\bar{u}_{i,n}^{(1)} \geq \underline{u}_{i,n}^{(1)}$$

Again by iteration process (3.3) and lemma 3.1,

$$\mathcal{L}^{(2)}\left[z_{i,n}^{(1)}\right] = \mathcal{L}^{(2)}\left[\bar{v}_{i,n}^{(1)}\right] - \mathcal{L}^{(2)}\left[\underline{v}_{i,n}^{(1)}\right]$$
$$= F^{(2)}\left(\bar{u}_{i,n}^{(1)}, \bar{v}_{i,n}^{(0)}\right) - F^{(2)}\left(\underline{u}_{i,n}^{(1)}, \underline{v}_{i,n}^{(0)}\right) \geq 0$$
$$\mathcal{B}^{(2)}\left[z_{i,n}^{(1)}\right] = \mathcal{B}^{(2)}\left[\bar{v}_{i,n}^{(1)}\right] - \mathcal{B}^{(2)}\left[\underline{u}_{i,n}^{(1)}\right]$$
$$= G^{(2)}\left(\bar{u}_{i,n}^{(1)}, \bar{v}_{i,n}^{(0)}\right) - G^{(2)}\left(\underline{u}_{i,n}^{(1)}, \underline{v}_{i,n}^{(1)}\right) \geq 0$$

By iteration process (3.3)

$$z_{i,0}^{(1)} = \bar{v}_{i,0}^{(1)} - \underline{v}_{i,0}^{(1)} = \psi_i^{(2)} - \psi_i^{(2)} = 0$$

Using Lemma 3.2we get $z_{i,n}^{(1)} \geq 0$ *on* $\overline{\Lambda_p}$,which gives $\bar{v}_{i,n}^{(1)} \geq \underline{u}_{i,n}^{(1)}$

Thus we get $\left(\bar{u}_{i,n}^{(1)}, \bar{v}_{i,n}^{(1)}\right) \geq (\underline{u}_{i,n}^{(1)}, \underline{v}_{i,n}^{(1)})$

The above conclusion show that $\left(\underline{u}_{i,n}^{(0)}, \underline{v}_{i,n}^{(0)}\right) \leq \left(\underline{u}_{i,n}^{(1)}, \underline{v}_{i,n}^{(1)}\right) \leq \left(\bar{u}_{i,n}^{(1)}, \bar{v}_{i,n}^{(1)}\right) \leq \left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right)$

Assume that (3.5) holds for some integer m .suppose that

$$w_{i,n}^{(m)} = \bar{u}_{i,n}^{(m)} - \underline{u}_{i,n}^{(m+1)} \text{ and } z_{i,n}^{(m)} = \bar{v}_{i,n}^{(m)} - \underline{v}_{i,n}^{(m+1)}.$$

Then by iteration process (3.3) and lemma 3.1

$$\mathcal{L}^{(1)}\left[w_{i,n}^{(m)}\right] = F^{(1)}\left(\bar{u}_{i,n}^{(m-1)}, \bar{v}_{i,n}^{(m-1)}\right) - F^{(1)}\left(\underline{u}_{i,n}^{(m)}, \underline{v}_{i,n}^{(m)}\right) \geq 0$$
$$\mathcal{B}^{(1)}\left[w_{i,n}^{(m)}\right] = G^{(1)}\left(\bar{u}_{i,n}^{(m-1)}, \bar{v}_{i,n}^{(m-1)}\right) - G^{(1)}\left(\underline{u}_{i,n}^{(m)}, \underline{v}_{i,n}^{(m)}\right) \geq 0$$
$$w_{i,0}^{(m)} = \bar{u}_{i,0}^{m} - \underline{u}_{i,0}^{(m-1)} = \psi_i^{(1)} - \psi_i^{(1)} = 0$$

By lemma 3.2, it leads ti the conclusion $w_{i,0}^{(m)} \geq 0$, $\bar{u}_{i,n}^{(m)} \geq \bar{u}_{i,n}^{(m+1)}$

$$\mathcal{L}^{(2)}\left[z_{i,n}^{(m)}\right] = F^{(2)}\left(\bar{u}_{i,n}^{(m)}, \bar{v}_{i,n}^{(m-1)}\right) - F^{(2)}\left(\bar{u}_{i,n}^{(m+1)}, \bar{v}_{i,n}^{(m)}\right) \geq 0$$

$$\mathcal{B}^{(2)}\left[z_{i,n}^{(m)}\right] = G^{(2)}\left(\bar{u}_{i,n}^{(m)}, \bar{v}_{i,n}^{(m-1)}\right) - G^{(2)}\left(\bar{u}_{i,n}^{(m+1)}, \bar{v}_{i,n}^{(m)}\right) \geq 0$$

$$z_{i,0}^{(m)} = \bar{u}_{i,0}^{(m)} - \bar{u}_{i,0}^{(m-1)} = \psi_i^{(2)} - \psi_i^{(2)} = 0$$

Again by Lemma 3.2, $z_{i,n}^{(m)} \geq 0$ *i.e.* $\bar{v}_{i,n}^{(m)} \geq \bar{v}_{i,n}^{(m+1)}$

So $(\bar{u}_{i,n}^{(m+1)}, \bar{v}_{i,n}^{(m+1)}) \leq (\bar{u}_{i,n}^{(m)}, \bar{v}_{i,n}^{(m)})$

A similar argument gives $\left(\underline{u}_{i,n}^{(m+1)}, \underline{v}_{i,n}^{(m+1)}\right) \geq \left(\underline{u}_{i,n}^{(m)}, \underline{v}_{i,n}^{(m)}\right)$

By induction principal the result (3.5) follows for all m. this complete the proof. The results in Lemma 3.3 shows that

$$lim\left(\bar{u}_{i,n}^{(m)}, \bar{v}_{i,n}^{(m)}\right) = (\bar{u}_{i,n}, \bar{u}_{i,n}) \quad \text{as } m \to \infty,$$

(3.6) $$lim\left(\underline{u}_{i,n}^{(m)}, \underline{v}_{i,n}^{(m)}\right) = (\underline{u}_{i,n}, \underline{v}_{i,n}) \quad \text{as } m \to \infty,$$

Exits in $\overline{\Lambda_p}$ .Taking $m \to \infty$ in the iteration process (3.3) implies that both $(\bar{u}_{i,n}, \bar{u}_{i,n})$ And $(\underline{u}_{i,n}, \underline{v}_{i,n})$. Are solutions of the discrete IBVP(2.4) – (2.6). These two solutions may not be equal. They are equal if for $(u_{i,n}, v_{i,n}), (u'_{i,n}, v'_{i,n})$ in the sector $S_{i,n}$ with $(u_{i,n}, v_{i,n}) \geq (u'_{i,n}, v'_{i,n})$; functions $(f^{(1)}, f^{(2)})$ and $(g^{(1)}, g^{(2)})$satisfy the folloeing one sides Lipchitz conditions:

$$f^{(1)}(u_{i,n}, v_{i,n}) - f^{(1)}(u'_{i,n}, v_{i,n}) \leq \gamma_{i,n}^{(11)}(u_{i,n} - u'_{i,n}) + \gamma_{i,n}^{(11)}(u_{i,n} - u'_{i,n})$$

$$f^{(2)}(u_{i,n}, v_{i,n}) - f^{(2)}(u_{i,n}, v'_{i,n}) \leq \gamma_{i,n}^{(21)}(u_{i,n} - u'_{i,n}) + \gamma_{i,n}^{(22)}(u_{i,n} - u'_{i,n})$$

$$g^{(1)}(u_{i,n}, v_{i,n}) - g^{(1)}(u'_{i,n}, v_{i,n}) \leq \sigma_{i,n}^{(11)}(u_{i,n} - u'_{i,n}) + \sigma_{i,n}^{(12)}(u_{i,n} - u'_{i,n})$$

$$g^{(2)}(u_{i,n}, v_{i,n}) - g^{(2)}(u_{i,n}, v'_{i,n}) \leq \sigma_{i,n}^{(21)}(u_{i,n} - u'_{i,n}) + \sigma_{i,n}^{(22)}(u_{i,n} - u'_{i,n})$$

Where the function $\gamma_{i,n}^{(11)}, \gamma_{i,n}^{(21)}, \sigma_{i,n}^{(11)}, \sigma_{i,n}^{(21)}$ for $l = 1,2$ are given by

$$\gamma^{(11)} = max\left\{\frac{\partial}{\partial u} f^{(1)} ; (i,n) \in \overline{\Lambda_p}, (u_{i,n}, v_{i,n}) \in S_{i,n}\right\}$$

$$\gamma^{(12)} = max\left\{\left|\frac{\partial}{\partial v} f^{(1)}\right| ; (i,n) \in \overline{\Lambda_p}, (u_{i,n}, v_{i,n}) \in S_{i,n}\right\}$$

$$\gamma^{(21)} = max\left\{\left|\frac{\partial}{\partial u} f^{(2)}\right| ; (i,n) \in \overline{\Lambda_p}, (u_{i,n}, v_{i,n}) \in S_{i,n}\right\}$$

$$\gamma^{(22)} = max\left\{\frac{\partial}{\partial v} f^{(2)} ; (i,n) \in \overline{\Lambda_p}, (u_{i,n}, v_{i,n}) \in S_{i,n}\right\}$$

$$\sigma^{(11)} = max\left\{\frac{\partial}{\partial u} g^{(1)} ; (i,n) \in S_p , (u_{i,n}, v_{i,n}) \in S_{i,n}\right\}$$

$$\sigma^{(12)} = max\left\{\left|\frac{\partial}{\partial v} g^{(1)}\right| ; (i,n) \in S_p , (u_{i,n}, v_{i,n}) \in S_{i,n}\right\}$$

$$\sigma^{(21)} = max\left\{\left|\frac{\partial}{\partial u} g^{(2)}\right| ; (i,n) \in S_p , (u_{i,n}, v_{i,n}) \in S_{i,n}\right\}$$

$$\sigma^{(22)} = max\left\{\frac{\partial}{\partial u} g^{(2)} ; (i,n) \in S_p , (u_{i,n}, v_{i,n}) \in S_{i,n}\right\}$$

From (3.8) it is clear that $\gamma^{(12)} \geq 0, \gamma^{(12)} \geq 0, \sigma^{(12)} \geq 0, \sigma^{(21)} \geq 0$.

The conditions in(3.1 and (3.7) leads to the following results.

4. Existence-comparison and uniqueness results

In this section, we prove existence-comparison and uniqueness of the solution for the discrete IBVP (2.4) – (2.6)

Theorem 4.1. Suppose that both $(f^{(1)}, f^{(2)})$ *and* $(g^{(1)}, g^{(2)})$ are quasimontone non- decreasing C^1- functions in the sector $S_{i,n}$ and satisfies Lipschitz conditions(3.1), (3.7)

.

Suppose pairs of functions $(\tilde{u}_{i,n}, \tilde{v}_{i,n})$ and $(\hat{u}_{i,n}, \hat{v}_{i,n})$ are ordered upper-lower solutions of the IBYP (2.4) – (2.6).

Then the sequences $\left\{\overline{u}_{i,n}^{(m)}, \overline{v}_{i,n}^{(m)}\right\}$, $\left\{\underline{u}_{i,n}^{(m)}, \underline{v}_{i,n}^{(m)}\right\}$ Obtained from the iteration process

(3.3) with initial iterations $\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right) = (\tilde{u}_{i,n}, \tilde{v}_{i,n})$ and $\left(\bar{u}_{i,n}^{(0)}, \bar{v}_{i,n}^{(0)}\right) = (\hat{u}_{i,n}, \hat{v}_{i,n})$ converge monotonically from above and below respectively to the solutions $(\bar{u}_{i,n}, \bar{v}_{i,n})$ and $(\underline{u}_{i,n}, \underline{v}_{i,n})$ of the discrete IBVP (2.4) – (2.6). Moreover

$$(\hat{u}_{i,n}, \hat{v}_{i,n}) \le (\underline{u}_{i,n}, \underline{v}_{i,n}) \le (\bar{u}_{i,n}, \bar{v}_{i,n}) \le (\tilde{u}_{i,n}, \tilde{v}_{i,n}), (i,n) \in \overline{\Lambda_p} \quad (4.1)$$

If, in addition

$$k_n^{-1} > max\{\gamma^{(11)} + \gamma^{(21)} + \sigma^{(11)} + \sigma^{(21)}, \gamma^{(12)} + \gamma^{(22)} + \sigma^{(12)} + \sigma^{(22)}\} \quad (4.2)$$

then $(\bar{u}_{i,n}, \bar{v}_{i,n}) = (\underline{u}_{i,n}, \underline{v}_{i,n})$, *is the unique solution of the discrete initial boundary value problem* (2.4) – (2.6) *in* $S_{i,n}$.

Proof . It is seen from the Lemma 3.3, that the limits $(\bar{u}_{i,n}, \bar{v}_{i,n})$ and $(\underline{u}_{i,n}, \underline{v}_{i,n})$ in (3.6) are solutions of the discrete IBVP. (2.4) – (2.6) . Clearly they satisfy the relation (4.1)

Now we show that $(\bar{u}_{i,n}, \bar{v}_{i,n}) = (\underline{u}_{i,n}, \underline{v}_{i,n})$ in $\overline{\Lambda_p}$. Let $k_n = k$ be constant time step for n =1,2,…, n_1 where $1 \le n_1 \le N$ and let α be a fixed number such that

$$\gamma^{(11)} + \gamma^{(21)} + \sigma^{(21)} + \sigma^{(21)} < \alpha < k^{-1} \quad (4.3)$$

and $\gamma^{(12)} + \gamma^{(22)} + \sigma^{(12)} + \sigma^{(22)} < \alpha < k^{-1}$

Clearly, existence of such a α follows from [4.2].

Let

$$U_{i,n} = (1 - ak)^{t_n/k}(\bar{u}_{i,n}, - \underline{u}_{i,n})$$

$$V_{i,n} = (1 - ak)^{t_n/k}(\bar{v}_{i,n}, - \underline{v}_{i,n}) \quad (4.4)$$

for $n = 1,2, \ldots, n_1$.

Then observe that $U_{i,n} \ge 0, V_{i,n} \ge 0$ *and*

$$(\bar{u}_{i,n}, - \underline{u}_{i,n}) - (\bar{u}_{i,n-1} - \underline{u}_{i,n-1}) = (1 - ak)^{t_n/k}[U_{i,n} - (1 - ak)U_{i,n-1}]$$

$$(\bar{v}_{i,n}, - \underline{v}_{i,n}) - (\bar{v}_{i,n1,} - \underline{v}_{i,n-1}) = (1 - ak)^{t_n/k}[V_{i,n} - (1 - ak)V_{i,n-1}] \quad (4.5)$$

By (2.4), (3.7) *amd* $k_n = k,$ *we* □*ave*

$$k_n^{-1}[(\bar{u}_{i,n}, - \underline{u}_{i,n}) - (\bar{u}_{i,n\,1} - \underline{u}_{i,n-1})] - L^{(1)}[\bar{u}_{i,n}, - \underline{u}_{i,n}] = f^{(1)}(\bar{u}_{i,n}, \bar{v}_{i,n}) - f^{(1)}(\underline{u}_{i,n}, \underline{v}_{i,n}) \quad (4.6)$$

$$\le \gamma^{(11)}(\bar{u}_{i,n}, - \underline{u}_{i,n}) + \gamma^{(12)}(\bar{v}_{i,n1,} - \underline{v}_{i,n-1})$$

and

$$k_n^{-1}[(\bar{v}_{i,n}, - \underline{v}_{i,n}) - (\bar{v}_{i,n1,} - \underline{v}_{i,n-1})] - L^{(2)}(\bar{v}_{i,n}, - \underline{v}_{i,n}) = f^{(2)}(\bar{u}_{i,n}, \bar{v}_{i,n}) - f^{(2)}(\underline{u}_{i,n}, \underline{v}_{i,n})$$

$$\le \gamma^{(21)}(\bar{u}_{i,n}, - \underline{u}_{i,n}) + \gamma^{(22)}(\bar{v}_{i,n1,} - \underline{v}_{i,n-1}) \quad (4.7)$$

Multiplying (4.6)*and* (4.7) by $(1 - ak)t_n/k$ and using (4.4) and (4.5) , it gives

$$k^{-1}[U_{i,n} - (1 - ak)U_{i,n-1}] - L^{(1)}[U_{i,n}] \le \gamma^{(11)}U_{i,n} + \gamma^{(12)}V_{i,n} \quad (4.8)$$

$$k^{-1}[V_{i,n}-(1 - ak)V_{i,n-1}] - L^{(2)}[V_{i,n}] \le \gamma^{(21)}U_{i,n} + \gamma^{(22)}V_{i,n} \quad (4.9)$$

Also

$$B^{(1)}[U_{i,n}] = (1 - ak)^{t_n/k}B^{(1)}[\bar{u}_{i,n}, - \underline{u}_{i,n}]$$
$$= (1 - ak)^{t_n/k}(B^{(1)}[\bar{u}_{i,n,}] - B^{(1)}[\underline{u}_{i,n}])$$
$$= (1 - ak)^{t_n/k}[g^{(1)}(\bar{u}_{i,n}, \bar{v}_{i,n}) - g^{(1)}(\underline{u}_{i,n}, \underline{v}_{i,n})]$$
$$\le (1 - ak)^{t_n/k}\left[\sigma^{(11)}(\bar{u}_{i,n} - \underline{u}_{i,n}) + \sigma^{(12)}(\bar{v}_{i,n} - \underline{v}_{i,n})\right]$$

Thus

$$B^{(1)}[U_{i,n}] \le \sigma^{(11)}U_{i,n} + \sigma^{(12)}V_{i,n} \quad (4.10)$$

On similar line, we get

$$B^{(2)}[V_{i,n}] \le \sigma^{(21)}U_{i,n} + \sigma^{(22)}V_{i,n} \quad (4.11)$$

Clearly

$$U_{i,0} = (1 - ak)^{t_n/k}\left[\bar{u}_{i,0} - \underline{u}_{i,0}\right] = (1 - ak)^{t_n/k}\left[\psi_i^{(1)} - \psi_i^{(1)}\right] = 0$$

$$V_{i,0} = (1 - ak)^{t_n/k}\left[\bar{v}_{i,0} - \underline{v}_{i,0}\right] = (1 - ak)^{t_n/k}\left[\psi_i^{(2)} - \psi_i^{(2)}\right] = 0 \quad (4.12)$$

Let (i', n') *and* $(i", n")$ be in $\overline{\Lambda}_p = \{(i,n); i \in \overline{\Omega}_p, n = 1,2, \ldots, n_1\}$ such that

$$U_{i',n'} = Max\{U_{i,n;}(i,n); i \in \overline{\Lambda}_p\} = ||U||_1$$
$$V_{i'',n''} = Max\{V_{i,n;}(i,n); i \in \overline{\Lambda}_p\} = ||V||_1 \quad (4.13)$$

By initial condition (4.12); $i', i" \in \overline{\Omega}_p$ and $n' \ne 0, n'' \ne 0$ *unless* $||U||_1 = ||V||_1 = 0$

Using n_1 as the initial time step and considering $k_{n=} k \; for \; n = n_1 + 1, \ldots, n_2$ where $n_1 + 1 \leq n_2 \leq$ N

The same reasoning gives

$$(\bar{u}_{i,n}, \bar{v}_{i,n}) = (\underline{u}_{i,n}, \underline{v}_{i,n}) for \; n = n_1 + 1_{n1} + 2, \ldots, n_2.$$

Continuing the same procedure leads to $(\bar{u}_{i,n}, \bar{v}_{i,n})$=$(\underline{u}_{i,n}, \underline{v}_{i,n})$ for n= 1,2 , . . .,N.

Next to prove uniqueness, let $(u^*_{i,n} v^*_{i,n})$ be any other solution of the discrete problem(2.4) − (2.6)

in $S_{i,n}$. Lemma 3.3 implies that $(\bar{u}_{i,n}, \bar{v}_{i,n}), (\underline{u}_{i,n}, \underline{v}_{i,n})$ given in (3.6) are solutions of the discrete problem(2.4) − (2.6), then considering $(\tilde{u}_{i,n}, \tilde{v}_{i,n})$ and $(u^*_{i,n} v^*_{i,n})$ as pair of ordered upper- lower solutions, we have

$$(\tilde{u}_{i,n}, \tilde{v}_{i,n}) \geq (u^*_{i,n} v^*_{i,n})$$

Next considering $(u^*_{i,n} v^*_{i,n}), (\hat{u}_{i,n}, \hat{v}_{i,n})$ as pair of ordered upper- lower solutions, we have

$$(u^*_{i,n} v^*_{i,n}) \geq (\hat{u}_{i,n}, \hat{v}_{i,n})$$

This shows that the solution $(u^*_{i,n} v^*_{i,n})$ in $S_{i,n}$, satisfy

$$(\underline{u}_{i,n}, \underline{v}_{i,n}) \leq (u^*_{i,n} v^*_{i,n}) \leq (\bar{u}_{i,n}, \bar{v}_{i,n})$$

Since $(\underline{u}_{i,n}, \underline{v}_{i,n}) = (\bar{u}_{i,n}, \bar{v}_{i,n})$ this implies that $(\underline{u}_{i,n}, \underline{v}_{i,n}) = (\bar{u}_{i,n}, \bar{v}_{i,n}) = (u^*_{i,n} v^*_{i,n})$This completes the proof .

CONCLUSIONS

Discrete initial boundary value problems are studied by applying the method of upper lower solutions. We developed the results of existence comparison and uniqueness of solutions .We conclude that these results also develop by the integro parabolic initial boundary value problems.

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COSMOLOGICAL MODELS FOR PERFECT FLUID WITH CONSTANT DECELERATION PARAMETER IN $f(R,T)$ THEORY OF GRAVITY

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ABSTRACT

This paper deals with the physical behavior of an LRS Bianchi type I cosmological model in the framework of the $f(R,T)$ theory of gravity in the presence of the perfect fluid. To solve the field equations, we assumed a special law of variation of Hubble's parameter proposed by Berman [Nuovo Cimento 74 B, 182, 1983]. Some physical and geometrical properties of the models are also discussed.

Keywords:- $f(R,T)$ *Theory of gravity, perfect fluid, cosmological parameters.*

INTRODUCTION

In recent years, there has been a lot of interest in alternative theories of gravitation. In view of the late time acceleration of the universe and the existence of the dark matter and dark energy, very recently, modified theories of gravity have been developed.

Harko (2007) , Ferraro (2007), and Felice (2010) discussed the modified theories of gravity such as $f(R)$ and $f(R,T)$. Noteworthy amongst them are $f(R)$ theory of gravity formulated by Nojiri and Odintsov (2003a) and $f(R,T)$ theory of gravity proposed by Harko et al. (2011).

Harko et al. (2011) developed $f(R,T)$ modified theory of gravity, where the gravitational Lagrangian is given by an arbitrary function of the Ricci scalar R and the trace T of the energy-momentum tensor. It is to be noted that the dependence of T may be induced by exotic imperfect fluid or quantum effects. They have obtained the gravitational field equations in the metric formalism, as well as, the equations of motion of test particles, which follows from the covariant divergence of the stress-energy tensor. They have derived some particular models corresponding to specific choices of function $f(R,T)$. They have also demonstrated the possibility of reconstruction of arbitrary FRW cosmologies by an appropriate choice of the function $f(R,T)$.

Eardley et al. (1979), Multamaki et al. (2006), Chiba et al. (2007), and Nojiri et al. (2007, 2011) are some of the authors who have investigated different aspects of $f(R)$ gravity models showing the consistency of early time inflation and late time acceleration. Samanta, Shriram et al., Chaubey and Shukla, Reddy et al., Shamir et al., Samanta et al., Sharif et al., Pradhan et al., Yadav and Yadav investigated Cosmological models with dark energy in the $f(R,T)$ theory of gravity.

LRS Bianchi type-I cosmological model in $f(R,T)$ gravity using the same assumption of law of variation for the Hubble parameter proposed by Bermann (1983) has been obtained by Adhav (2012). Kaluza-Klein cosmological model in the presence of perfect fluid source and Bianchi type III cosmological model in $f(R,T)$ gravity using the assumption of law of variation for the Hubble parameter proposed by Bermann, have been investigated by Reddy et. al. (2012a, 2012b). Chaubey and Shukla (2013) have obtained a new class of Bianchi cosmological models in $f(R,T)$ gravity. Reddy and Shanti Kumar (2013) have presented some anisotropic cosmological models in this theory. Recently Rao and Neelima (2013) have discussed perfect fluid Einstein-Rosen universe in $f(R,T)$ gravity. LRS Bianchi type-I cosmological model filled with perfect fluid source in $f(R,T)$ gravity have been studied by D D Pawar et al. (2014). A new class of cosmological models using the special form of the average scale factor is derived by Abdussattar and Prajapati (2011) and Pawar et al. (2014). Exact solution of Bianchi type-I cosmological model in $f(R,T)$ gravity have been obtained by Shamir et al. (2015). Cosmological models filled with a perfect fluid source in the $f(R,T)$ theory of gravity has been studied by Pawar et al. (2015).

In section (2), we have derived the metric and Field equations for the LRS Bianchi type I in

$f(R,T)$ gravity. In Section (3), we have obtained solutions of the field equations for two cases.
In section (4), we study the LRS Bianchi type I cosmological model used by Abdussattar et al. (2011) with perfect fluid matter source in $f(R,T)$ theory of gravity, by assuming the spatial law of variation of Hubble's has been discussed. Some physical and geometrical parameters of the model have been discussed. Section 5, included conclusion.

THE METRIC AND FIELD EQUATIONS

We consider the LRS Bianchi type I metric given by

$$ds^2 = dt^2 - a^2\left\{dx^2 + dy^2 + \left(1+\beta\int\frac{dt}{a^3}\right)^2 dz^2\right\} \quad (1)$$

where a is function of cosmic time t and β is $\oplus ve$ is constant.
We have assumed the stress energy tensor of the matter as a perfect fluid, given by

$$T_{ij} = (\rho + p)u_i u_j - pg_{ij} \quad (2)$$

where $g_{ij}u_i u^j = 1$, $u^i = (1,0,0,0)$ is the four velocity vector.
Now by assuming the arbitrary function $f(R,T)$ given by Harko et al. as

$$f(R,T) = R + 2f(T) \quad (3)$$

where R is the Ricci scalar and T is the trace of stress energy tensor.
Thus the field equations in the framework of the $f(R,T)$ theory of gravity are given by

$$R_{ij} - \frac{1}{2}Rg_{ij} = 8\pi T_{ij} + 2f'T_{ij} + \left[2pf'[T] + f(T)\right]g_{ij} \quad (4)$$

We choose the function $f(T)$ of the trace of the energy tensor of the matter source so that

$$f(T) = \lambda T \quad (5)$$

where λ is constant.
By assuming the co-moving coordinate system, the field equations for the metric (1) with the equations (2),(3), and (5) can be written as

$$2\frac{a_{44}}{a} + \frac{{a_4}^2}{a^2} = (8\pi + 3\lambda)p - \lambda\rho \quad (6)$$

$$2\frac{a_{44}}{a} + \frac{{a_4}^2}{a^2} = (8\pi + 3\lambda)p - \lambda\rho \quad (7)$$

$$2\frac{a_{44}}{a} + \frac{{a_4}^2}{a^2} = (8\pi + 3\lambda)p - \lambda\rho \quad (8)$$

$$\frac{3{a_4}^2}{a^2} + 2\frac{\beta a_4}{a^4\left(1+\beta\int\frac{dt}{a^3}\right)} = \lambda p - (8\pi + 3\lambda)\rho \quad (9)$$

The above system of equation reduces to the form

$$2\frac{a_{44}}{a} + \frac{{a_4}^2}{a^2} = (8\pi + 3\lambda)p - \lambda\rho \quad (10)$$

$$\frac{3{a_4}^2}{a^2} + 2\frac{\beta a_4}{a^4\left(1+\beta\int\frac{dt}{a^3}\right)} = \lambda p - (8\pi + 3\lambda)\rho$$

(11)
where suffix 4 indicates the differentiation with respect to time.
The deceleration parameter (q), Mean Hubble parameter (H) Scalar expansion(θ), shear scalar (σ) and the average anisotropy parameter (A_m) are defined as

$$q = -\frac{RR_{44}}{{R_4}^2} \quad (12)$$

$$H = \frac{1}{3}\sum_{i=1}^{3} H_i \quad (13)$$

$$\theta = 3H \quad (14)$$

$$A_m = \frac{1}{3}\sum_{i=1}^{3}\left(\frac{\Delta H_i}{H}\right)^2 \quad (15)$$

$$\sigma^2 = \frac{3}{2}A_m H^2 \quad (16)$$

3. Solutions of The Field Equations:

Equations (8) and (9) contains 3 unknowns a, p, ρ. Therefore in order to obtain a deterministic solution we need one more additional condition.
Finally, we constrain the system of equations with a law of variation for the average Hubble's parameter that yields a constant value of deceleration parameter such types of relation has already been considered by Berman et al. (1988) for solving FRW models. Later on many authors Singh et al., Singh and Baghel have studied flat FRW and Bianchi type models by using the special law of Hubble parameter that yields constant value of deceleration parameter.
The average scale factor of Bianchi type metric is given by

$$R = \left[a^3 \left(1 + \beta \int \frac{dt}{a^3} \right) \right]^{\frac{1}{3}} \tag{17}$$

The directional Hubble parameter in the direction of x, y and z axes, respectively, for new class of Bianchi type metric are

$$H_x = \frac{a_4}{a} = H_y, H_z = \frac{a_4}{a} + \frac{\beta}{a^3\left(1 + \beta \int \frac{dt}{a^3}\right)} \tag{18}$$

The mean Hubble parameter H is defined as

$$H = \frac{1}{3}\left(H_x + H_y + H_z\right) \tag{19}$$

The proper volume V is defined as

$$V = \sqrt{-g} = a^3 \left(1 + \beta \int \frac{dt}{a^3} \right) \tag{20}$$

From equations (17) – (20), we obtain

$$H = \frac{1}{3}\frac{V_4}{V} = \frac{R_4}{R} = \frac{1}{3}\left(\frac{3a_4}{a} + \frac{\beta}{a^3\left(1 + \beta \int \frac{dt}{a^3}\right)} \right) \tag{21}$$

According to Thorne , the observations of the velocity red-shift relation for extragalactic sources suggest that Hubble expansion of the universe is isotropic within about 30% range approximately (Kantowski and Sachs , Kristian and sachs) and red-shift studies place the limit $\frac{\sigma}{H} \le 0.3$, on the ratio of shear σ to Hubble H in the neighborhood of our galaxy today. Collins et al. discussed the physical significance of this condition for perfect fluid and barotropic EoS in a more general case. In many papers (Sarif Zubair, Yadav and Yadav), this condition is proposed to find the exact solutions of cosmological models.

We have the line element (Eqn. (1)) is completely characterized by Hubble's parameter H. Therefore, let us consider that mean Hubble parameter H is related to average scale factor R by the relation.

$$H = k_1 R^{-s} \tag{22}$$

Where, $k_1 (> 0)$ and $s (\ge 0)$ are constants.

An important observational quantity is the deceleration parameter q, which is defined as

$$q = \frac{-RR_{44}}{{R_4}^2} \tag{23}$$

From equations (21) and (22), we have

$$R_4 = k_1 R^{-s+1} \tag{24}$$

$$R_{44} = -{k_1}^2 (s-1) R^{-2s+1} \tag{25}$$

From equations (21), (22), (23), we get constant values for the deceleration parameter for the mean scale factor as

$$q = s - 1, \text{ for } s \neq 0 \tag{26}$$

$$q = -1 \text{ , for } s = 0 \tag{27}$$

The sign of q indicates whether the model accelerates or not. The positive sign of q $(i.e., s > 1)$ corresponds to standard decelerating models, whereas the negative of $-1 \le q < 0$ for $s = 1$ indicates acceleration and for corresponds to expansion with constant velocity. It is remarkable to mention here that though the current observations of SN Ia and CMBR favor accelerating models i.e. $q < 0$.

Using equation (22), we obtain the law of average scale factor as

$$R = (Dt + c_1)^{\frac{1}{s}}, \quad \text{for } s \neq 0 \tag{28}$$

And

$$R = c_2 e^{k_1 t}, \quad \text{for } s = 0 \tag{29}$$

Where c_1 are c_2 constants of integration.

Case (i): Model for $s \neq 0$

Comparing equations (17) and (28), we obtain

$$a = T^{\frac{1}{s}} e^{mT^{\frac{s-3}{s}}} \tag{30}$$

And
$$\left(1 + \beta \int \frac{dt}{a^3}\right) = e^{-3mT^{\frac{s-3}{s}}} \tag{31}$$

Where
$$T = (Dt + c_1 \Rightarrow R = T^{\frac{1}{s}} \tag{32}$$

$$m = \frac{\beta s}{3(3-s)D}, s \neq 3 \tag{33}$$

Using equations (30) and (31), the metric given by equation (1) takes the form

$$ds^2 = dT^2 - T^{\frac{2}{s}} e^{2mT^{\frac{s-3}{s}}}\left(dx^2 + dy^2\right) - T^{\frac{2}{s}} e^{-4mT^{\frac{s-3}{s}}} dz^2 \tag{34}$$

Case (ii): Model for $s = 0$

Comparing equations (17) and (29), we obtain

$$a = Te^{mT^{-3}} \tag{35}$$

And
$$\left(1 + \beta \int \frac{dt}{a^3}\right) = e^{-3mT^{-3}} \tag{36}$$

Where
$$T = e^{k_1 t} \Rightarrow R = T \tag{37}$$

$$m = \frac{\beta}{9k_1} \tag{38}$$

Using equations (35) and (36), the metric given by equation (1) takes the form

$$ds^2 = \frac{dT^2}{T^2} - T^2 e^{2mT^{-3}}\left(dx^2 + dy^2\right) - T^2 e^{-4mT^{-3}} dz^2 \quad (39)$$

4. Some Physical Parameters:

In this section, we investigated some physical properties of the model obtained in the previous section i.e. model for $s \neq 0$ and $s = 0$.

Case (i): Model for $s \neq 0$

Equation (34) represent the LRS Bianchi type I cosmological model with perfect fluid source in the framework of the theory of gravity. The following physical parameters helped us to discuss the physical properties of the cosmological model (34) and (39).

The volume of the model (34) is given by

$$V = \sqrt{-g} = T^{\frac{3}{s}} \quad (40)$$

The directional Hubble's parameter H_x, H_y, H_z of the model (34) are respectively given by

$$H_x = H_y = \frac{D}{s}\left[\frac{1}{T} + \frac{m(s-3)}{T^{\frac{3}{s}}}\right] \quad (41)$$

$$H_z = \frac{D}{s}\left[\frac{1}{T} + \frac{2m(3-s)}{T^{\frac{3}{s}}}\right] \quad (42)$$

The mean Hubble parameter of the model (34) is given by

$$H = \frac{D}{sT} \quad (43)$$

The scalar expansion of the model (34) is

$$\theta = \frac{3D}{sT} \quad (44)$$

The scalar expansion is three times of the Hubble's parameter.

The mean anisotropy parameter of model is

$$A_m = \frac{2m^2(s-3)^2}{T^{\frac{2(3-s)}{s}}} \quad (45)$$

The shear scalar of the model (34) is

$$\sigma^2 = \frac{3m^2(s-3)^2 D^2}{s^2 T^{\frac{6}{s}}} \quad (46)$$

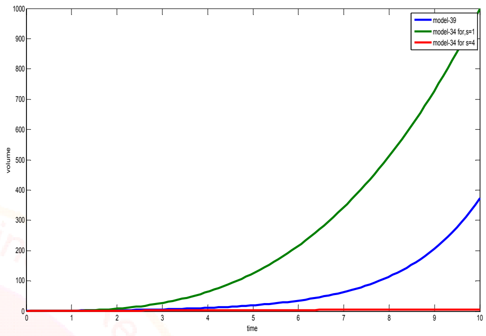
The pressure and the total energy density of perfect fluid for model (34) are given by

$$p = \frac{\beta^2}{3T^{\frac{6}{s}}}\left\{\frac{(8\pi+4\lambda)}{\left[(8\pi+3\lambda)^2-\lambda^2\right]}\right\} + \frac{D^2}{s^2T^2}\left\{\frac{(8\pi+3\lambda)(3-2s)-3\lambda}{\left[(8\pi+3\lambda)^2-\lambda^2\right]}\right\} \quad (47)$$

$$\rho = \frac{\beta^2}{3T^{\frac{6}{s}}}\left\{\frac{(8\pi+4\lambda)}{\left[(8\pi+3\lambda)^2-\lambda^2\right]}\right\} + \frac{D^2}{s^2T^2}\left\{\frac{(3-2s)\lambda-3(8\pi+3\lambda)}{\left[(8\pi+3\lambda)^2-\lambda^2\right]}\right\} \quad (48)$$

The volume of the model (39) is given by

$$V = \sqrt{-g} = T \quad (49)$$



The directional Hubble's parameter H_x, H_y, H_z of the model (39) are respectively given by

$$H_x = H_y = k_1\left[1 - \frac{3m}{T^3}\right] \quad (50)$$

$$H_z = k_1\left[1 + \frac{6m}{T^3}\right] \quad (51)$$

The mean Hubble parameter of the model (39) is given by

$$H = k_1 \quad (52)$$

The scalar expansion of the model (39) is

$$\theta = 3k_1 \quad (53)$$

The scalar expansion is three times of the Hubble's parameter.

The mean anisotropy parameter of model is

$$A_m = \frac{18m^2}{T^6} \quad (54)$$

The shear scalar of the model (39) is

$$\sigma^2 = \frac{27m^2k_1^2}{T^6} \quad (55)$$

The pressure and the total energy density of perfect fluid for model (34) are given by

$$p = \frac{4\beta^2}{3T^6}\left\{\frac{(2\pi+\lambda)}{\left[(8\pi+3\lambda)^2-\lambda^2\right]}\right\} + \frac{6k_1^2(4\pi+\lambda)}{\left[(8\pi+3\lambda)^2-\lambda^2\right]} - \frac{4\beta\lambda k_1}{T^3\left[(8\pi+3\lambda)^2-\lambda^2\right]} \quad (56)$$

$$\rho = \frac{4\beta^2}{3T^6}\left\{\frac{(2\pi+\lambda)}{\left[(8\pi+3\lambda)^2-\lambda^2\right]}\right\} - \frac{6k_1^2(4\pi+\lambda)}{\left[(8\pi+3\lambda)^2-\lambda^2\right]} + \frac{4\beta(8\pi+3\lambda)k_1}{T^3\left[(8\pi+3\lambda)^2-\lambda^2\right]} \quad (57)$$

CONCLUSION

The model (34) and (39) have a singularity at $T=0$. It can be observed that in both cases, volume vanishes when $T=0$ and increases with increase of T and becomes infinitely large for $T \to 0$. Hence the universe is expanding with time. Also it can be observed that pressure and energy density are functions of time and both diverges for $T=0$ and vanishes for large value of T.In both cases, the anisotropy parameter and shear scalar are function of time. In both cases, the anisotropy parameter and shear scalar are inversely varies as time. In case (i) models are anisotropy except $s \neq 3$ and in case (ii) the models are anisotropy. Thus the universe starts with an infinite rate of expansion and measure of anisotropy. It can, also be observed that, for model (34), shear tends to zero faster than the expansion for $s<6$ and the expansion tends to zero faster than the shear $s>6$. For model (34) expansion scalar is function of time but for model (39) expansion is constant.

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INVERSE THERMOELASTIC HEAT CONDUCTION PROBLEM IN AN ELLIPTICAL THIN ANNULAR PLATE

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ABSTRACT

In this paper an exact solution is found for the inverse thermoelastic problem in an elliptical disc, under thermal boundary conditions that are subjected to arbitrary initial temperature on the upper face at zero temperature and lower face thermally insulated . The method of integral transformation technique is used to generate an exact solution of heat conduction equation in which sources are generated according to the linear function of the temperature. Furthermore the study is extended to find its associated thermal stresses. The numerical results obtained are accurate enough for practical purposes.

Keywords: *Transit Response, Elliptical Cylinder, Temperature Distribution, Thermal Stress, Integral Transform*

INTRODUCTION

The determination of temperature of a heating medium, the heat flux on the boundary surface of the solids when the conditions of the displacement and stresses are known at some point of the solid under certain consideration. Choubey [1] discussed the temperature distribution with radiation type boundary conditions in hollow elliptic cylinder. The governing equations and its suitable solution using the DR algorithm to analysis the large deflection in isotropic rectangular Mindlin plates is briefly outlined by Turvey and Osman [2] . The Biswas and Datta [3,4] have obtained a solution of large deflection based on the total strain energy concept devised by Berger. Sitar et al. [5] determined large deflection using Euler–Bernoulli and large displacement theory, and solved numerically by Runge–Kutta–Fehlberg integration and Newton method. The nonlinear bending analysis of clamped circular plates by the Newton-Raphson method has been studied by Altekin [6]. Bhad [15] investigated the thermoelastic problems on an elliptical plate in which interior heat sources are generated within the solid, with compounded effect due to sectional heating and boundary conditions of the Dirichlet type. The analysis is based on the small-deflection theory of the elliptical plate and performed in the elliptical coordinate system.

2. Formulation of the problem

The thermoelastic problem of an elliptical disc subjected to radiation type boundary conditions on the outside and inside surfaces can be rigorously analyzed by introducing the elliptical coordinates (ξ,η), which are related to the rectangular coordinates (x, y) by the relation

$$x = c\cosh\xi\cos\eta,\quad y = c\sinh\xi\sin\eta,\quad z = z \tag{1}$$

where$c$ is the semi-focal length. From the above equations, one obtains a group of confocal ellipses and hyperbolas with the common foci for various values of ξandη, respectively.

2.1 Transient Heat ConductionAnalysis

The governing equation of heat conduction with internal heat source, the initial condition and boundary conditions in elliptical cylindrical coordinates are given, respectively as

$$h^2\left[\theta(\xi,\eta,t)_{,\xi\xi}+\theta(\xi,\eta,t)_{,\eta\eta}\right]+\Theta(\xi,\eta,t,\theta)=\frac{1}{\kappa}\theta(\xi,\eta,t)_{,t} \tag{1}$$

subjected to boundary conditions

$$\theta(\xi,\eta,\tau)= f(\xi,\eta)\ \text{(Unknown)} \tag{2}$$

$$\theta(\xi,\eta,t)=0 \text{ at } \xi=\xi_o \tag{3}$$

$$\partial_\xi\theta(\xi,\eta,t)=0 \text{ at } \xi=\xi_i \tag{4}$$

$$\theta(\xi,\eta,0)= g(\xi,\eta) \text{ at } t=0 \tag{5}$$

where $\theta(\xi,\eta,t)$ is the temperature function, $\Theta(\xi,\eta,t,\theta)$ is the source function for the problem, $k_i\ (i=1,2)$ are radiation coefficients, $\kappa=\lambda/\rho C$ represents thermal diffusivity in which λ being the thermal conductivity of the material, ρ is the density and C is the calorific capacity, assumed to be constant.

We assume heat source functions as the superposition of the simpler function [9]

$$\Theta(\xi,\eta,t,\theta) = \Phi(\xi,\eta,t) + \psi(t)\,\theta(\xi,\eta,t) \quad (6)$$

and

$$T(\xi,\eta,t) = \theta(\xi,\eta,t)\exp\left[-\int_0^t \psi(\zeta)d\zeta\right],\ \chi(\xi,\eta,t) = \Phi(\xi,\eta,t)\exp\left[-\int_0^t \psi(\zeta)d\zeta\right] \quad (7)$$

Substituting equations (6) and (7) in the heat conduction equation (1), we obtain

$$h^2(\partial_{,\xi\xi}+\partial_{,\eta\eta})T(\xi,\eta,t) + \chi(\xi,\eta,t) = T(\xi,\eta,t)_{,t}/\kappa \quad (8)$$

For the sake of brevity, we consider

$\chi(\xi,\eta,t) = \exp(-\omega t)\,\delta(\xi-\xi_0)\,\delta(\eta-2\pi)$,

$\xi_i \le \xi_0 \le \xi_o,\ 0 \le \eta_0 \le 2\pi,\ \omega > 0$ (9)

The equations (2) to (9) constitute the mathematical formulation for temperature change within elliptical disc with internal heat source under consideration.

2.2 Associated thermal stress problem

The medium is defined by, $\xi_i \le \xi \le \xi_o$, $0 \le \eta \le 2\pi$, and compiling various boundary conditions in elliptical coordinate are defined to determine the influence of the thermal boundary conditions on the thermal stresses. The potential function ϕ for such a system satisfies the equation as

$$h^2(\partial_{,\xi\xi}+\partial_{,\eta\eta})\phi = \frac{1+\upsilon}{1-\upsilon}\alpha_t\theta \quad (10)$$

Where υ denotes the Poisson's ratio, α_t the co-efficient of linear expansion.

The component of the stresses [11] are represented by the use of the stress function ϕ are given as

$$\left.\begin{aligned}
(1/h^4)\bar{\sigma}_{\xi\xi} &= -2G(c^2/2)[(\cosh 2\xi-\cos 2\eta)\phi_{,\eta\eta}+\sinh 2\xi\,\phi_{,\xi}-\sin 2\eta\,\phi_{,\eta}],\\
(1/h^4)\bar{\sigma}_{\eta\eta} &= -2G(c^2/2)[(\cosh 2\xi-\cos 2\eta)\phi_{,\xi\xi}-\sinh 2\xi\,\phi_{,\xi}+\sin 2\eta\,\phi_{,\eta}],\\
(1/h^4)\bar{\sigma}_{\xi\eta} &= -2G(c^2/2)[-(\cosh 2\xi-\cos 2\eta)\phi_{,\xi\eta}+\sin 2\xi\,\phi_{,\eta}+\sinh 2\eta\,\phi_{,\xi}]
\end{aligned}\right\} \quad (11)$$

It is to be noted that the condition that boundary of the plate should be stress-free is yet to be satisfied. To this end, we find the complementary stresses $\bar{\bar{\sigma}}_{ij}$ satisfying the following relations

$$\bar{\sigma}_{\xi\xi}+\bar{\bar{\sigma}}_{\xi\xi}=0,\quad \bar{\sigma}_{\xi\eta}+\bar{\bar{\sigma}}_{\xi\eta}=0 \ \textbf{on}\ \xi=\xi_0 \quad (12)$$

To solve the isothermal elastic problem, let us make use of the Airy stress-function ψ which satisfies the Biharmonic equation

$$h^2(\partial_{,\xi\xi}+\partial_{,\eta\eta})\psi = 0 \quad (13)$$

Then the complementary stresses are given by

$$\left.\begin{aligned}
(1/h^4)\bar{\bar{\sigma}}_{\xi\xi} &= (c^2/2)[(\cosh 2\xi-\cos 2\eta)\chi_{,\eta\eta}+\sinh 2\xi\,\chi_{,\xi}-\sin 2\eta\,\chi_{,\eta}],\\
(1/h^4)\bar{\bar{\sigma}}_{\eta\eta} &= (c^2/2)[(\cosh 2\xi-\cos 2\eta)\chi_{,\xi\xi}-\sinh 2\xi\,\chi_{,\xi}+\sin 2\eta\,\chi_{,\eta}],\\
(1/h^4)\bar{\bar{\sigma}}_{\xi\eta} &= (c^2/2)[-(\cosh 2\xi-\cos 2\eta)\chi_{,\xi\eta}+\sin 2\xi\,\chi_{,\eta}+\sinh 2\eta\,\chi_{,\xi}]
\end{aligned}\right\} \quad (14)$$

Thus, the final stresses can be represented as

$$\left.\begin{aligned}
\sigma_{\xi\xi} &= \bar{\sigma}_{\xi\xi}+\bar{\bar{\sigma}}_{\xi\xi}\\
\sigma_{\eta\eta} &= \bar{\sigma}_{\eta\eta}+\bar{\bar{\sigma}}_{\eta\eta}\\
\sigma_{\xi\eta} &= \bar{\sigma}_{\xi\eta}+\bar{\bar{\sigma}}_{\xi\eta}
\end{aligned}\right\} \quad (15)$$

The equations (1) to (12) constitute the mathematical formulation of the problem under consideration.

3. Solution for the Problem

3.1 Transient Heat Conduction Analysis

In order to solve fundamental differential equation (8), we firstly introduce the extendedintegral transformationof order $n$and$m$ over the variableξandηas given in equation (17)-(18) and Laplace transform and its essential inverse Laplace transform for time domain as given in equation (16)

$$F(s) = \int_0^\infty \exp(-st)\,f(t)dt \quad (16)$$

$$\bar{f}(q_{n,m}) = \int_{\xi_i}^{\xi_o}\int_0^{2\pi} f(\xi,\eta)(\cosh 2\xi-\cos 2\eta)\,Ce_{2n}(\xi,q_{2n,m})ce_{2n}(\eta,q_{2n,m})d\xi\,d\eta \quad (17)$$

Inversion theorem of (16) is

$$f(\xi,\eta) = \sum_{n=0}^{\infty}\sum_{m=1}^{\infty}\bar{f}(q_{n,m})Be_{2n}(\xi,q_{2n,m})ce_{2n}(\eta,q_{2n,m})/C_{n,m} \quad (18)$$

$$C_{n,m} = \pi\int_0^{\xi_0} B^2 e_{2n,m}(\xi,q_{2n,m})[\cosh 2\xi-\Theta_{2n,m}]d\xi$$

where s has its usual meaning, $q_{2n,m}$ is a root of the transcendental equation

$$Ce_{2n}(\xi_o,q_{2n,m})Fe'y_{2n}(\xi_i,q_{2n,m}) - Fey_{2n}(\xi_o,q_{2n,m})Ce'_{2n}(\xi_i,q_{2n,m}) = 0 \quad (19)$$

Using equations (8),(9),(16), (17) and(18) one obtains the expression for temperature satisfying the boundary conditions (2)-(5) as

$$T(\xi,\eta,t)=\sum_{n=0}^{\infty}\sum_{m=1}^{\infty}\{\Omega_{2n,m}(\xi_0,2\pi)\exp(-\omega t)-\exp(-\kappa\alpha_{2n,m}^2 t)[\Omega_{2n,m}(\xi_0,2\pi) -(\kappa\alpha_{2n,m}^2-\omega)\bar{g}(q_{2n,m})]\}Be_{2n}(\xi,q_{2n,m})ce_{2n}(\eta,q_{2n,m})/(\kappa\alpha_{2n,m}^2-\omega)C_{2n,m} \tag{20}$$

where

$$\Omega_{2n,m}(\xi_0,2\pi)=\kappa Be_{2n}(\xi_0,q_{2n,m})ce_{2n}(2\pi,q_{2n,m})(\cosh 2\xi_0-1)$$

Taking into account the equation (1) and (7) ,the temperature distribution can be obtained as

$$\theta(\xi,\eta,t)=\sum_{n=0}^{\infty}\sum_{m=1}^{\infty}\{\Omega_{2n,m}(\xi_0,2\pi)\exp(-\omega t)-\exp(-\kappa\alpha_{2n,m}^2 t) \times[\Omega_{2n,m}(\xi_0,2\pi)-(\kappa\alpha_{2n,m}^2-\omega)\bar{g}(q_{2n,m})]\}\exp[\int_0^t\psi(\xi)d\xi] \times Be_{2n}(\xi,q_{2n,m})ce_{2n}(\eta,q_{2n,m})/(\kappa\alpha_{2n,m}^2-\omega)C_{2n,m} \tag{21}$$

The unknown temperature is obtained by taking equation (2) into consideration

$$f(\xi,\eta)=\sum_{n=0}^{\infty}\sum_{m=1}^{\infty}\{\Omega_{2n,m}(\xi_0,2\pi)\exp(-\omega\tau)-\exp(-\kappa\alpha_{2n,m}^2\tau) \times[\Omega_{2n,m}(\xi_0,2\pi)-(\kappa\alpha_{2n,m}^2-\omega)\bar{g}(q_{2n,m})]\}\exp[\int_0^t\psi(\xi)d\xi] \times Be_{2n}(\xi,q_{2n,m})ce_{2n}(\eta,q_{2n,m})/(\kappa\alpha_{2n,m}^2-\omega)C_{2n,m} \tag{22}$$

3.2 Thermoelastic Solution

The potential function $\phi(\xi,\eta,t)$ is obtained by using equations (10) and (21) as,

$$\phi=-\frac{(1+\upsilon)\alpha_t}{1-\upsilon}\sum_{n=0}^{\infty}\sum_{m=1}^{\infty}\{\Omega_{2n,m}(\xi_0,2\pi)\exp(-\omega t)-\exp(-\kappa\alpha_{2n,m}^2 t) \times[\Omega_{2n,m}(\xi_0,2\pi)-(\kappa\alpha_{2n,m}^2-\omega)\bar{g}(q_{2n,m})]\}\exp[\int_0^t\psi(\xi)d\xi] \times Be_{2n}(\xi,q_{2n,m})ce_{2n}(\eta,q_{2n,m})/[\alpha_{2n,m}^2(\kappa\alpha_{2n,m}^2-\omega)C_{2n,m}] \tag{23}$$

One yields the component of the stresses by using equations (11) and (23) as

$$\bar{\sigma}_{\xi\xi}=-\frac{Gc^2h^4(1+\upsilon)\alpha_t}{1-\upsilon}\sum_{n=0}^{\infty}\sum_{m=1}^{\infty}\{\Omega_{2n,m}(\xi_0,2\pi)\exp(-\omega t)-\exp(-\kappa\alpha_{2n,m}^2 t) \times[\Omega_{2n,m}(\xi_0,2\pi)-(\kappa\alpha_{2n,m}^2-\omega)\bar{g}(q_{2n,m})]\}\exp[\int_0^t\psi(\zeta)d\zeta] \times[(\cosh 2\xi-\cos 2\eta)Be_{2n}(\xi,q_{2n,m})ce''_{2n}(\eta,q_{2n,m}) +\sinh 2\xi\, Be'_{2n}(\xi,q_{2n,m})ce_{2n}(\eta,q_{2n,m})-\sin 2\eta\, Be_{2n}(\xi,q_{2n,m}) \times ce'_{2n}(\eta,q_{2n,m})]/[\alpha_{2n,m}^2(\kappa\alpha_{2n,m}^2-\omega)C_{2n,m}] \tag{24}$$

$$\begin{aligned}\bar{\sigma}_{\eta\eta} =& -\frac{Gc^2h^4(1+\upsilon)\alpha_t}{1-\upsilon}\sum_{n=0}^{\infty}\sum_{m=1}^{\infty}\{\Omega_{2n,m}(\xi_0,2\pi)\exp(-\omega t) - \exp(-\kappa\alpha_{2n,m}^2 t)\\ &\times[\Omega_{2n,m}(\xi_0,2\pi)-(\kappa\alpha_{2n,m}^2-\omega)\bar{g}(q_{2n,m})]\}\exp[\int_0^t\psi(\zeta)d\zeta]\\ &\times[(\cosh 2\xi-\cos 2\eta)\,Be''_{2n}(\xi,q_{2n,m})ce_{2n}(\eta,q_{2n,m})\\ &-\sinh 2\xi\;Be'_{2n}(\xi,q_{2n,m})ce_{2n}(\eta,q_{2n,m})+\sin 2\eta\,Ce_{2n}(\xi,q_{2n,m})\\ &\times ce'_{2n}(\eta,q_{2n,m})]/[\alpha_{2n,m}^2(\kappa\alpha_{2n,m}^2-\omega)C_{2n,m}]\end{aligned} \tag{25}$$

$$\begin{aligned}\bar{\sigma}_{\xi\eta} =& \frac{Gc^2h^4(1+\upsilon)\alpha_t}{1-\upsilon}\sum_{n=0}^{\infty}\sum_{m=1}^{\infty}\{\Omega_{2n,m}(\xi_0,2\pi)\exp(-\omega t) - \exp(-\kappa\alpha_{2n,m}^2 t)\\ &\times[\Omega_{2n,m}(\xi_0,2\pi)-(\kappa\alpha_{2n,m}^2-\omega)\bar{g}(q_{2n,m})]\}\exp[\int_0^t\psi(\zeta)d\zeta]\\ &\times[(\cosh 2\xi-\cos 2\eta)\,Be'_{2n}(\xi,q_{2n,m})ce'_{2n}(\eta,q_{2n,m})\\ &-\sinh 2\xi\;Be_{2n}(\xi,q_{2n,m})ce'_{2n}(\eta,q_{2n,m})-\sin 2\eta\,Be'_{2n}(\xi,q_{2n,m})\\ &\times ce_{2n}(\eta,q_{2n,m})]/[\alpha_{2n,m}^2(\kappa\alpha_{2n,m}^2-\omega)C_{2n,m}]\end{aligned} \tag{26}$$

Assuming Airy's stress function $\psi(\xi,\eta,t)$ which satisfies equations (13) as

$$\begin{aligned}\psi(\xi,\eta,t) =& \sum_{n=0}^{\infty}\sum_{m=1}^{\infty}[A_{n,m}Ce_{2n}(\xi,q_{2n,m})Fe'y_{2n}(\xi_i,q_{2n,m})\\ &-B_{2n,m}Fey_{2n}(\xi,q_{2n,m})Ce'_{2n}(\xi_i,q_{2n,m})]ce_{2n}(\eta,q_{2n,m})\end{aligned} \tag{27}$$

where $A_{n,m}$ and $B_{n,m}$ are the constants to be determined using equations (12), (13) and (14) as given below

$$\begin{aligned}A_{n,m} =& \frac{Gc^2h^4(1+\upsilon)\alpha_t}{(1-\upsilon)[\alpha_{2n,m}^2(\kappa\alpha_{2n,m}^2-\omega)C_{2n,m}]}\Omega_{2n,m}(\xi_0,2\pi)\exp(-\omega t) - \exp(-\kappa\alpha_{2n,m}^2 t)\\ &\times[\Omega_{2n,m}(\xi_0,2\pi)-(\kappa\alpha_{2n,m}^2-\omega)\bar{g}(q_{2n,m})]\}\exp[\int_0^t\psi(\zeta)d\zeta]\\ &\times\langle ce_{2n}(\eta,q_{2n,m})\,\mathrm{Sin}[2\eta]Ce'_{2n}(\xi_o,q_{2n,m})+\{Ce_{2n}(\xi_o,q_{2n,m})\mathrm{Sinh}2\xi_o+(\cos 2\eta\\ &-\cosh 2\xi_0)Ce'_{2n}(\xi_o,q_{2n,m})\}ce'_{2n}(\eta,q_{2n,m})\rangle[ce_{2n}(\eta,q_{2n,m})Ce''_{2n}(\xi_o,q_{2n,m})\\ &-Ce_{2n}(\xi_o,q_{2n,m})ce''_{2n}(\eta,q_{2n,m})]/\langle c^2h^4Ce'_{2n}(\xi_o,q_{2n,m})\\ &\times\{-ce_{2n}(\eta,q_{2n,m})ce'_{2n}(\eta,q_{2n,m})\{Fey_{2n}(\xi_o,q_{2n,m})\\ &\times[(\mathrm{Cos}2\eta+\mathrm{Cosh}2\xi_0)Ce'_{2n}(\xi_o,q_{2n,m})+\mathrm{Sinh2b}\,Ce''_{2n}(\xi_0,q_{2n,m})]\\ &-Ce_{2n}(\xi_o,q_{2n,m})[(\mathrm{Cos}2\eta+\mathrm{Cosh2b})Fey'_{2n}(\xi_0,q_{2n,m})+\mathrm{Sinh2b}\,Fey''_{2n}(\xi_0,q_{2n,m})]\}\}\rangle\end{aligned}$$

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$$
\begin{aligned}
B_{n,m} = {} & \frac{Gc^2h^4(1+\upsilon)\alpha_t}{(1-\upsilon)[\alpha_{2n,m}^2(\kappa\alpha_{2n,m}^2-\omega)C_{2n,m}]}\{\Omega_{2n,m}(\xi_0,2\pi)\exp(-\omega t)-\exp(-\kappa\alpha_{2n,m}^2 t) \\
& \times[\Omega_{2n,m}(\xi_0,2\pi)-(\kappa\alpha_{2n,m}^2-\omega)\bar{g}(q_{2n,m})]\}\exp[\int_0^t\psi(\zeta)d\zeta] \\
& \times\{-Ce_{2n}(\xi_0,q_{2n,m})ce'_{2n}(\eta,q_{2n,m})[Fey_{2n}(\xi_0,q_{2n,m})\sinh\xi_0 \\
& +(\cos 2\eta-\cosh\xi_0)Fey'_{2n}(\xi_0,q_{2n,m})ce''_{2n}(\eta,q_{2n,m}) \\
& +(ce_{2n}(\eta,q_{2n,m})]^2\sin 2\eta Ce'_{2n}(\xi_0,q_{2n,m})Fey''_{2n}(\xi_o,q_{2n,m}) \\
& +ce_{2n}(\eta,q_{2n,m})[-(\cos 2\eta+\cosh\xi_0)Fey_{2n}(\xi_0,q_{2n,m})Ce'_{2n}(\xi_o,q_{2n,m})ce'_{2n}(\eta,q_{2n,m}) \\
& +Ce_{2n}(\xi_o,q_{2n,m})Fey'_{2n}(\xi_o,q_{2n,m})[(\mathrm{Cos}\,2\eta+\mathrm{Cosh}\,\xi_o)ce'_{2n}(\eta,q_{2n,m}) \\
& -\sin 2\eta ce''_{2n}(\eta,q_{2n,m})]+[Ce_{2n}(\xi_i,q_{2n,m})\sinh\xi_o+(\cos 2\eta \\
& -\cosh\xi_o)Ce'_{2n}(\xi_o,q_{2n,m})]ce'_{2n}(\eta,q_{2n,m})Fey''_{2n}(\xi_o,q_{2n,m})]]\}/\{c^2h^4\,ce_{2n}(\eta,q_{2n,m}) \\
& \times ce'_{2n}(\eta,q_{2n,m})Fey'_{2n}(\xi_0,q_{2n,m})[-Fey_{2n}(\xi_0,q_{2n,m})[(\cos 2\eta+\cosh\xi_0)Ce'_{2n}(\xi_0,q_{2n,m}) \\
& +\sinh\xi_0 Ce''_{2n}(\xi_0,q_{2n,m})]+Ce_{2n}(\xi_0,q_{2n,m})[(\cos 2\eta \\
& +\cosh\xi_0)Fey'_{2n}(\xi_i,q_{2n,m})+\sinh\xi_0 Fey''_{2n}(\xi_0,q_{2n,m}]]\}
\end{aligned}
$$

On substituting these constants in equation (14), one obtains the complementary stresses. The final stress can be then obtained by using relation (15). Due to lengthy calculations of the complementary as well as final stresses, theauthor deliberately avoid here to write but have taken into consideration while graphical analysis.

4. Numerical Results, Discussion and Remarks

For the sake of simplicity of calculation, we introduce the following dimensionless values

$$
\left.\begin{array}{l}
\bar{\xi}_o=\xi_o/a_o,\ \bar{\xi}_i=\xi_i/\xi_i,\ e=c/a_o,\ \bar{\ell}^2=\ell^2a_o^2,\ \tau=\kappa t/\xi_o^2, \\
\bar{\theta}(\xi,\eta,t)=\theta(\xi,\eta,t)/\theta_k,(\bar{\theta}_i,\bar{\theta}_o)=(\theta_i,\theta_o)/\theta_k\ \ (k=i,o), \\
\bar{\phi}(\xi,\eta,t)=\phi(\xi,\eta,t)/E\alpha_t\theta_k\xi_o^2,\sigma^*_{ij}=\sigma_{ij}/E\alpha_t\theta_k\ \ (i,j=\xi,\eta)
\end{array}\right\} \quad (28)
$$

Here E stands for Young's modulus, α_t for Thermal expansion coefficient, respectively.

Then, setting

$$\psi(\zeta)=-\zeta^2,\ T_0=0 \quad (29)$$

$$\Rightarrow \int_0^t\psi(\zeta)d\zeta=-t^3/3,\ \bar{T}_0^*=0 \quad (30)$$

Substituting the value of equation (30) in equations(21), (23) - (27), one obtained the expressions for the temperature, displacement and stresses respectively. The 1 Aluminum metal is considered to carry the numerical calculations which have the parameters ξ_o =2 cm, ξi =1 cm, l=2.00 cm, Modulus of Elasticity$E$= 6.9 × 10^6N/cm^2, Shear modulus G= 2.7 × 10N/cm^2, Poisson ratioυ = 0.281, Thermal expansion coefficient, α_t= 25.5× 10^{-6}cm/cm-^{0}C, Thermal diffusivityκ= 0.86 cm^2/sec, Thermal conductivityλ = 0.48 calsec^{-1}/cm ^{0}C with $q_{n,m}$ = 0.0986, 0.3947, 0.8882, 1.5791, 2.4674, 3.5530, 4.8361, 6.3165, 7.9943, 9.8696, 11.9422, 14.2122, 16.6796, 19.3444, 22.2066, 25.2661, 28.5231, 31.9775, 35.6292, 39.4784are the positive & real roots of the transcendental equation (A7). The foregoing analysis are performed by setting the radiation coefficients constants, $k_i = 0.86\ (i=1,2)$ so as to obtain considerable mathematical simplicities.In order to examine the influence of uniform heating on the disc, we performed the numerical calculation for various timevarying from *t=0,0.1,0.2,0.3,….* and numerical calculations are depicted in the following figures with the help of MATHEMATICAsoftware.For the sake of brevity, discussion of these effects is omitted here and graphical illustration is investigated for thermoelastic responseforan elliptical disc considering interior heat generation. Figs. 2–8encapsulate the numerical analysis of dimensionless temperature, displacement and stresses of elliptical disc due to interior heat generation within the disc, under thermal boundary condition that are subjected to arbitrary initial temperature on the upper and lower face at zero temperature As shown in

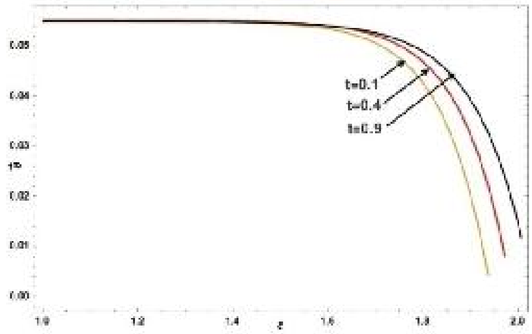

Fig.2: Temperature distribution versus ξ at η=90^0 for different values of time

Fig. 2, there is an effect of temperature along radial direction and is greatest in a steady & initial state due to initial conditions but starts falling with time. From Fig.3, it can be seen that the temperature changes on the heated surface decreases when along the angular direction. The nature of the temperature is found to be periodic.

The variation of displacement in the radial direction is shown in Fig.4. It can be seen from Fig.4 that the displacement increases along the radial direction illustrating the temperature effect on displacement of the disc. Fig. 5 represents the periodic nature of displacement and vanishing on 180^0, 360^0 and so on. The variation of normal stresses $\sigma^*_{\xi\xi}$, $\sigma^*_{\eta\eta}$, and $\sigma^*_{\xi\eta}$ is shown in Figs.6, 7 and 8, respectively.

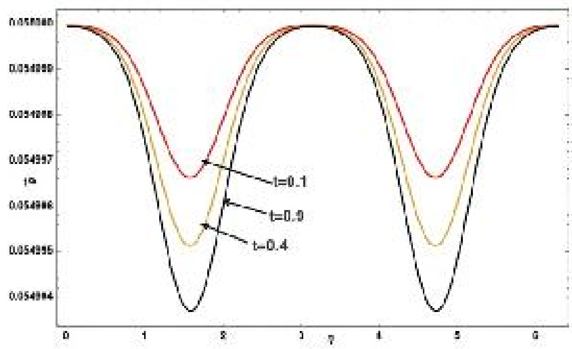

Fig.3: Temperature distribution versus η at ξ=1.4 for different values of time.

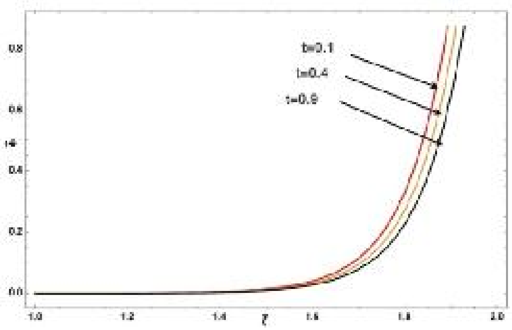

Fig.4: Displacement Potential versus ξ at η=90^0 for different values of time.

From Fig. 6, the large compressive stress satisfying the condition given in equation (12) occurs on the inner heated surface and the tensile stress occurs on the inner surface which drops along the radial direction. From Fig. 7 the maximum tensile stress occurs while heating inside the core of the plate which follows traction free property for circumferential stress. From Fig.8, the maximum tensile stress occurs during uniform heating inside the core of the disc which follows assumed traction free property.

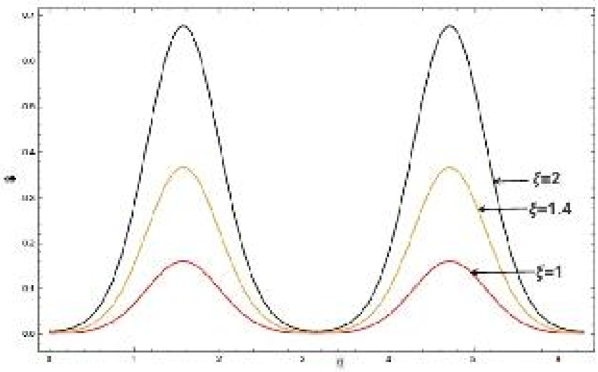

Fig.5: Displacement Potential versus η at t=0.5 for different values of ξ

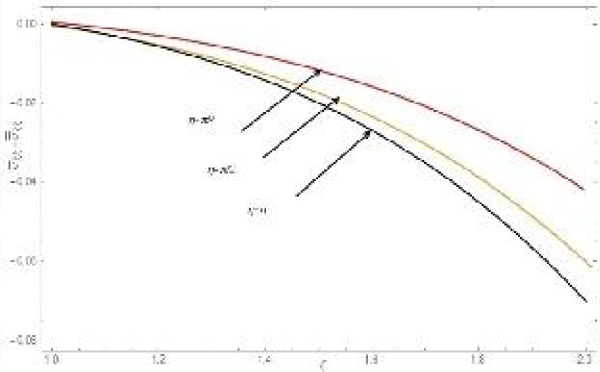

Fig.6: $\sigma^*_{\xi\xi} = \bar{\sigma}_{\xi\xi} + \bar{\bar{\sigma}}_{\xi\xi}$ versus ξ at t=0.5 for different values of η

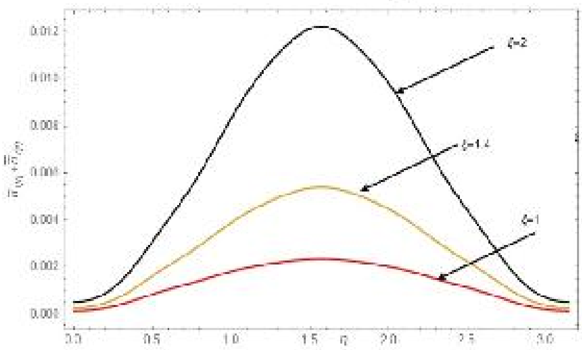

Fig.7: $\sigma_{\eta\eta} = \bar{\sigma}_{\eta\eta} + \bar{\bar{\sigma}}_{\eta\eta}$ versus η at t=0.5 for different values of ξ

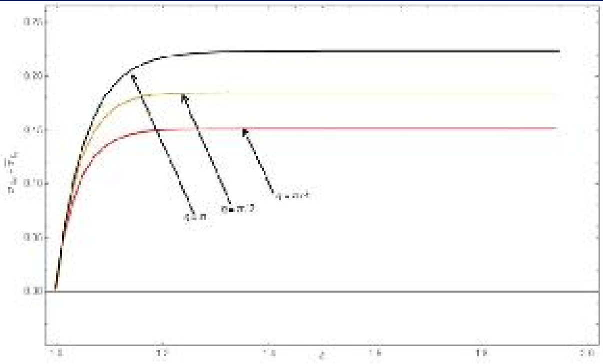

Fig.8: $\sigma_{\xi\eta} = \overline{\sigma}_{\xi\eta} + \overline{\overline{\sigma}}_{\xi\eta}$ *versus* $\xi\eta$ *at t=0.5 for different values of* η

CONCLUSION

The proposed operational method explains heat conduction and its associated thermal stresses with heat generation in the elliptical coordinate system. The analysis of non-stationary three-dimensional equation of heat conduction is investigated with the integral transformation method as when there are conditions of dirichlet type contour acting on the object under consideration. The advantage of this method is its generality and its mathematical power to handle different types of mechanical and thermal boundary conditions.

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CHARACTERIZATION OF UNIFORMLY CONTINUOUS PSEUDO METRIC SPACES

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ABSTRACT

A pseudo metric space (X,d) is called a uniformly continuous if every continuous real valued function on (X,d) is uniformly continuous. In this paper we obtain the characterizations of uniformly continuous pseudo metric spaces in terms of distance between two disjoint closed sets. The precise results are as follows.

Theorem A: *Suppose (X,d) is a pseudo metric space. Then (X,d) is uniformly continuous space if and only if $\bar{A} \cap \bar{B} = \emptyset \Rightarrow d(A,B) > 0$.*

Theorem B: *Pseudo metric space (X,d) is uniformly continuous if and only if $\bar{A} \cap \bar{B} = \emptyset \Rightarrow \exists\, \alpha > 0$ such that $S_\propto(A) \cap S_\propto(B) = \emptyset$.*

We also obtain the sufficient condition for a pseudo metric space to be uniformly continuous. It is proved that

Theorem C: *If (X,d) is a pseudo metric space such that for any two disjoint closed sets at least one is compact, then (X,d) is uniformly continuous space.*

Keywords: *Uniformly continuous space, Uniformly continuous function, Pseudo Metric Space.*

INTRODUCTION

Let X be a pseudo metric space with pseudo metric d. Let A be any non empty subset of a pseudo metric space X. Then $S_\alpha(A) = \{ x \in X : d(x,y) < \alpha$ for some $y \in A\}$, where α is any positive real number. Also for any A, B subsets of X, we shall denote by $d(A,B)$, the distance between two sets A and B i.e. $d(A,B) = \inf\{d(a,b) : a \in A \text{ and } b \in B\}$.

Firstly we show that in a pseudo metric space the distance between two sets is equal to the distance between their closures.

Lemma1: Let (X,d) be a pseudo metric space. Suppose $A, B \subset X$ then $d(A,B) = d(\bar{A},\bar{B})$.

Proof: As $A \subseteq \bar{A}$ and $B \subseteq \bar{B}$ then

$$d(A,B) = \inf\{d(a,b) : a \in A \text{ and } b \in B\}$$
$$\geq \inf\{d(a,b) : a \in \bar{A} \text{ and } b \in \bar{B}\}$$
$$= d(\bar{A},\bar{B})$$

i.e. $d(A,B) \geq d(\bar{A},\bar{B})$. …………..(1)

Now we show that $d(A,B) \leq d(\bar{A},\bar{B})$.

Let $\varepsilon > 0$ be given.

Then $\exists\, a \in \bar{A}\ \&\ b \in \bar{B}$ such that $d(\bar{A},\bar{B}) \leq d(a,b) < d(\bar{A},\bar{B}) + \frac{\varepsilon}{3}$ ……………..(2)

Since $a \in \bar{A}\ \&\ b \in \bar{B}$, $\exists\, a' \in A\ \&\ b' \in B$ such that $d(a,a') < \frac{\varepsilon}{3}$ and $d(b,b') < \frac{\varepsilon}{3}$.

$$\therefore\ d(A,B) \leq d(a',b')$$
$$\leq d(a',a) + d(a,b) + d(b,b')$$
$$< \frac{\varepsilon}{3} + d(\bar{A},\bar{B}) + \frac{\varepsilon}{3} + \frac{\varepsilon}{3} \qquad \text{from (2)}$$
$$= d(\bar{A},\bar{B}) + \varepsilon$$

i.e. $d(A,B) < d(\bar{A},\bar{B}) + \varepsilon$

Since $\varepsilon > 0$ is arbitrary, $d(A,B) \leq d(\bar{A},\bar{B})$ ……….(3)

From (1) and (3) we get $d(A,B) = d(\bar{A},\bar{B})$.

Theorem 2: Let (X,d) be a pseudo metric space. Suppose $A, B \subset X$. Then $d(\bar{A},\bar{B}) > 0$ if and only if $\exists\, \alpha > 0$ such that $S_\alpha(A) \cap S_\alpha(B) = \emptyset$.

Proof: Suppose $d(\bar{A},\bar{B}) > 0$. i.e. $inf\{d(x,y) : x \in \bar{A} \text{ and } y \in \bar{B}\} > 0$.

Put $d(\bar{A},\bar{B}) = r > 0$. Take $\alpha = \frac{r}{2}$.

We show that $S_\alpha(A) \cap S_\alpha(B) = \emptyset$.

Suppose, $S_\alpha(A) \cap S_\alpha(B) \neq \emptyset$. Then $\exists\, z \in S_\alpha(A) \cap S_\alpha(B)$

i.e. $z \in S_\alpha(A)$ and $z \in S_\alpha(B)$.

Thus there are $a \in A$ and $b \in B$ such that $d(z,a) < \alpha$ and $d(z,b) < \alpha$.

$\therefore\ d(a,b) \leq d(a,z) + d(z,b) < 2\alpha = r$.

i.e. $d(a,b) < r = d(\bar{A},\bar{B})$ where $a \in \bar{A}$ and $b \in \bar{B}$.

This gives contradiction. Thus $S_\alpha(A) \cap S_\alpha(B) = \emptyset$.

Converse: Suppose $\exists\, \alpha > 0$ such that $S_\alpha(A) \cap S_\alpha(B) = \emptyset$. We show that $d(\bar{A},\bar{B}) > 0$.

Suppose this is not true. i.e. $d(\bar{A},\bar{B}) = 0$.

i.e. $inf\{d(a,b) : a \in \bar{A}, b \in \bar{B}\} = 0$.
Thus for each $\varepsilon > 0$, $\exists\, a \in \bar{A}$ & $b \in \bar{B}$ such that $d(a,b) < \varepsilon$
$\therefore$ for each $n \in \mathbb{N}, \exists\, a_n \in \bar{A}$ and $b_n \in \bar{B}$ such that $d(a_n, b_n) < \frac{1}{n}$.
Now since $a_n \in \bar{A}$ there is c_n in A such that $d(a_n, c_n) < \frac{1}{n}$ and since $b_n \in \bar{B}$ there is d_n in B such that $d(b_n, d_n) < \frac{1}{n}$.

$$\therefore d(c_n, d_n) \le d(c_n, a_n) + d(a_n, b_n) + d(b_n, d_n) < \frac{1}{n} + \frac{1}{n} + \frac{1}{n} = \frac{3}{n} \to 0 \quad \text{as } n \to \infty$$

Since by assumption there is $\alpha > 0$ such that $S_\alpha(A) \cap S_\alpha(B) = \emptyset$, choose a positive integer N such that $\frac{3}{N} < \alpha$. For this N, $d(c_N, d_N) < \frac{3}{N} < \alpha$.
Thus $d_N \in B, C_N \in A, d_N \in S_\alpha(B)$ and $d_N \in S_\alpha(A)$.
Thus $d_N \in S_\alpha(A) \cap S_\alpha(B)$. i.e. $S_\alpha(A) \cap S_\alpha(B) \neq \emptyset$.
This gives contradiction.
$\therefore$ Our assumption that $d(\bar{A}, \bar{B}) = 0$ is wrong and hence $\square(\bar{\square}, \bar{\square}) > 0$.
For the proof of the following theorem we require the Efremovic lemma as follows.

Lemma 3:
Efremovic lemma:
Let (x_n) and (y_n) be sequences in a metric space (X, d) such that for each n, $d(x_n, y_n) > \varepsilon$. Then there is an infinite set E of positive integers such that
$D_d(\{x_n, n \in E\}, \{\{y_n, n \in E\}) \ge \frac{\varepsilon}{4}$.
This is the lemma 3.3.1, p. 92[1].

Theorem 4:
Suppose (X, d) is a pseudo metric space. Then (X, d) is uniformly continuous space if and only if $\bar{A} \cap \bar{B} = \emptyset \Rightarrow d(A, B) > 0$.
Proof: Suppose pseudo metric space (X, d) is uniformly continuous.
We show that when $A, B \subset X$ satisfy $\bar{A} \cap \bar{B} = \emptyset$ then $d(A, B) > 0$.
By using lemma1 and theorem 2, it is enough to show that when $A, B \subset X$ satisfy $\bar{A} \cap \bar{B} = \emptyset$ then $\exists\, \alpha > 0$ such that $S_\propto(A) \cap S_\propto(B) = \emptyset$.
Let $A, B \subset X$ satisfy $\bar{A} \cap \bar{B} = \emptyset$.
Suppose $\forall\, \alpha > 0, S_\propto(A) \cap S_\propto(B) \neq \emptyset$.
Thus for each $n \in \mathbb{N}$, $S_{\frac{1}{n}}(A) \cap S_{\frac{1}{n}}(B) \neq \emptyset$ and hence for each n, $\exists\, z_n \in S_{\frac{1}{n}}(A) \cap S_{\frac{1}{n}}(B)$
$\therefore$ we get a sequence $\{z_n\}$ such that $z_n \in S_{\frac{1}{n}}(A) \cap S_{\frac{1}{n}}(B)$ $\forall$ n.

Now for each n, $z_n \in S_{\frac{1}{n}}(A) \Rightarrow \exists\, x_n \in A$ such that $d(z_n, x_n) < \frac{1}{n}$.
Similarly, $z_n \in S_{\frac{1}{n}}(B) \Rightarrow \exists\, y_n \in B$ such that $d(z_n, y_n) < \frac{1}{n}$

$$\therefore d(x_n, y_n) \le d(x_n, z_n) + d(z_n, y_n) < \frac{1}{n} + \frac{1}{n} = \frac{2}{n}$$

Now we define a function $f: X \to \mathbb{R}$ as $f(x) = \frac{d(x,\bar{A})}{d(x,\bar{A}) + d(x,\bar{B})}$, $x \in X$ ....(1)
Here for each n, $x_n \in A \Rightarrow x_n \in \bar{A}$
$\therefore d(x_n, \bar{A}) = 0 \Rightarrow f(x_n) = 0 \;\; \forall n$.
Also $y_n \in B \Rightarrow y_n \in \bar{B}$.
$\therefore d(y_n, \bar{B}) = 0$
$\Rightarrow f(y_n) = \frac{d(y_n, \bar{A})}{d(y_n, \bar{A}) + d(y_n, \bar{B})} = \frac{d(y_n, \bar{A})}{d(y_n, \bar{A})} = 1$ i.e. $\forall n, f(y_n) = 1$.
The function f defined in (1) is continuous on X.
Since (X, d) is uniformly continuous, the function f is also uniformly continuous.
i.e. for each $\varepsilon > 0, \exists\, \delta > 0$ such that $d(x, y) < \delta \Rightarrow |f(x) - f(y)| < \varepsilon$.
Now for $\varepsilon = \frac{1}{2}$ $\exists\, \delta > 0$ such that $d(x, y) < \delta \Rightarrow |f(x) - f(y)| < \varepsilon$
Choose $n_0 \in \mathbb{N}$ for which $\frac{2}{n_0} < \delta$
then $d(x_{n_0}, y_{n_0}) < \frac{2}{n_0} < \delta$
but $|f(x_n) - f(y_n)| = |0 - 1| = 1 > \varepsilon$
$\Rightarrow f$ is not uniformly continuous.
i.e. a continuous function $f: X \to \mathbb{R}$ is not uniformly continuous.
This gives contradiction. Thus our assumption is wrong and hence when $A, B \subset X$ satisfy $\bar{A} \cap \bar{B} = \emptyset$ then $\exists\, \alpha > 0$ such that $S_\propto(A) \cap S_\propto(B) = \emptyset$.
Converse: Suppose $A, B \subset X$ with $\bar{A} \cap \bar{B} = \emptyset \Rightarrow d(A, B) > 0$.
We show that pseudo metric space (X, d) is uniformly continuous.
Suppose the mapping $f: X \to \mathbb{R}$ is continuous but not uniformly continuous.
i.e. $\exists\, \varepsilon > 0$ such that $\forall\, \delta > 0$, $\exists\, x_\delta, y_\delta \in X$, $d(x_\delta, y_\delta) < \delta$ but $|f(x_\delta) - f(y_\delta)| \ge \varepsilon$ ....(2)
Thus $\forall n \in \mathbb{N}, \exists\, x_n, y_n \in X$, $d(x_n, y_n) < \frac{1}{n}$ but $|f(x_n) - f(y_n)| \ge \varepsilon$ ....(3)
i.e. there exists sequences $\{x_n\}$ and $\{y_n\}$ in X with $d(x_n, y_n) < \frac{1}{n}$
but $|f(x_n) - f(y_n)| \ge \varepsilon \;\; \forall\, n$.
By lemma3, for the sequences $\{f(x_n)\}$ and $\{f(y_n)\}$ in $\mathbb{R}$ there exists subsequences

$\{f(x_{n_k})\}$ and $\{f(y_{n_k})\}$ respectively such that
$|f(x_{n_k}) - f(y_{n_l})| \geq \frac{\varepsilon}{4} \quad \forall\, k, l \geq 1.$
……….(4)

Denote $A = \{x_{n_k} : k \geq 1\}$ and $B = \{y_{n_l} : l \geq 1\}$.
Then $A \cap B = \emptyset$.
Now we show that $\bar{A} \cap \bar{B} = \emptyset$.
Suppose $x \in \bar{A} \cap \bar{B}$ then $x \in \bar{A}$ and $x \in \bar{B}$.
As f is continuous at a point x there exists $\delta' > 0$ such that
$d(x, y) < \delta' \Rightarrow |f(x) - f(y)| < \frac{\varepsilon}{8}$.
As $x \in \bar{A}$ and $x \in \bar{B}$ thus for δ' neighborhood of x there exist $x_{n_k} \in A$ and $y_{n_l} \in B$ such that $d(x_{n_k}, x) < \delta'$ and $d(y_{n_l}, x) < \delta'$.
$\Rightarrow |f(x_{n_k}) - f(x)| < \frac{\varepsilon}{8}$ and $|f(y_{n_l}) - f(x)| < \frac{\varepsilon}{8}$.
$\Rightarrow |f(x_{n_k}) - f(y_{n_l})| < \frac{\varepsilon}{4}$.
This gives contradiction to (4) and hence $\bar{A} \cap \bar{B} = \emptyset$.
Then by hypothesis, $d(A, B) > 0$. …………….(5)
But $d(A, B) = \inf\{d(x, y) : x \in A, y \in B\}$
$= \inf\{d(x_{n_k}, y_{n_l}) : x_{n_k} \in A, y_{n_l} \in B\}$
$\leq d(x_{n_k}, y_{n_k})$
$< \frac{1}{n_k} \to 0$ as $k \to \infty$
i.e. $d(A, B) = 0$ gives contradiction to (5).
Hence our assumption that "f is not uniformly continuous" is wrong.
Thus f is uniformly continuous.
Combining above lemma and theorem we get the characterization of uniformly continuous pseudo metric spaces.

Theorem 5:
Pseudo metric space (X, d) is uniformly continuous if and only if
$\bar{A} \cap \bar{B} = \emptyset \Rightarrow \exists\, \alpha > 0$ such that $S_\alpha(A) \cap S_\alpha(B) = \emptyset$.

Theorem 6:
Let X be a topological space. Consider the following conditions on X.
a] Every infinite subset of X has an ω-accumulation point.
b] Every sequence in X has a cluster point.
c] For each sequence in X there is a subsequence converging to a point of X.
d] The space X is compact.
These conditions are related as follows.
For all spaces [a] is equivalent to [b] and [d] implies [a].
If X satisfies the first axiom of countability, then [a], [b] and [c] are equivalent.
If X satisfies the second axiom of countability, then all four conditions are equivalent.
If X is pseudo metric space, then each of the four conditions implies that X satisfies the second axiom of countability and all four are equivalent.
This is the theorem 5, p. 138[2].
By using the above theorem, the following theorem gives the sufficient condition for (X, d) to be uniformly continuous space.

Theorem 7
If (X, d) is a pseudo metric space such that for any two disjoint closed sets at least one is compact, then (X, d) is uniformly continuous space.
Proof: We show that (X, d) is uniformly continuous space. By above theorem 5, it is enough to show that $\bar{A} \cap \bar{B} = \emptyset \Rightarrow \exists\, \alpha > 0$ such that $S_\alpha(A) \cap S_\alpha(B) = \emptyset$.
Suppose this is not true. i.e. $\bar{A} \cap \bar{B} = \emptyset$ but for any $\alpha > 0$, $S_\alpha(A) \cap S_\alpha(B) \neq \emptyset$.
$\bar{A} \cap \bar{B} = \emptyset$. Then by hypothesis at least one of them is compact. Suppose $\bar{A}$ is compact.
For any $\alpha > 0$, $S_\alpha(A) \cap S_\alpha(B) \neq \emptyset$. Thus for each $n \in \mathbb{N}$, $S_{\frac{1}{n}}(A) \cap S_{\frac{1}{n}}(B) \neq \emptyset$.
So we may choose a point $z_n \in S_{\frac{1}{n}}(A) \cap S_{\frac{1}{n}}(B) \quad \forall\, n \in \mathbb{N}$.
Thus we get a sequence $\{z_n\}$ such that $z_n \in S_{\frac{1}{n}}(A) \cap S_{\frac{1}{n}}(B) \quad \forall\, n$.
Now for each n, $z_n \in S_{\frac{1}{n}}(A)$ and $z_n \in S_{\frac{1}{n}}(B)$
$\Rightarrow \forall\, n$, $\exists\, a_n \in A$ & $b_n \in B$ such that $d(z_n, a_n) < \frac{1}{n}$ and $d(z_n, b_n) < \frac{1}{n}$
i.e. $d(z_n, a_n) \to 0$ and $d(z_n, b_n) \to 0$ as $n \to \infty$
Now $\bar{A}$ is compact thus it is sequentially compact by theorem 6. Hence there exists a subsequence $\{a_{n_k}\}$ in A converges to some $a \in \bar{A}$. i.e. $a_{n_k} \to a$
$\Rightarrow d(a_{n_k}, a) \to 0$ as $k \to \infty$.
Now we show that $b_{n_k} \to a$.
Let $\varepsilon > 0$ be given.
As $a_{n_k} \to a$ there exist $N_1 > 0$ such that $\forall\, k \geq N_1$, $d(a_{n_k}, a) < \frac{\varepsilon}{3}$.
Also, $d(a_n, z_n) \to 0$ as $n \to \infty$
$\Rightarrow \exists\, N_2 > 0$ such that $\forall\, k \geq N_2$, $d(a_{n_k}, z_{n_k}) < \frac{\varepsilon}{3}$.
Take $N = \max(N_1, N_2)$ then $\forall\, k \geq N$,
$d(z_{n_k}, a) \leq d(z_{n_k}, a_{n_k}) + d(a_{n_k}, a)$
$< \frac{\varepsilon}{3} + \frac{\varepsilon}{3} = \frac{2\varepsilon}{3}$

Also $d(b_n, z_n) \to 0$ as $n \to \infty$
$\Rightarrow$ for the above $\varepsilon > 0$, $\exists\ N_3 > 0$ such that $\forall\ k \geq N_3,\ d(b_{n_k}, z_{n_k}) < \frac{\varepsilon}{3}$.
Take $M = max\ (N, N_3)$ then $\forall\ k \geq M$,
$$d\left(b_{n_k}, a\right) \leq d\left(b_{n_k}, z_{n_k}\right) + d\left(z_{n_k}, a\right)$$
$$< \frac{\varepsilon}{3} + \frac{2\varepsilon}{3} = \varepsilon$$
i.e. $b_{n_k} \to a$ as $k \to \infty$.
But $\{b_{n_k}\}$ is a sequence in $\bar{B}$ and $\bar{B}$ is closed. Thus $a \in \bar{B}$ and therefore $a \in \bar{A} \cap \bar{B}$.
Hence $\bar{A} \cap \bar{B} \neq \emptyset$. This gives a contradiction. Thus our assumption is wrong.
Hence $\exists\ \alpha > 0$ such that $S_\propto(A) \cap S_\propto(B) = \emptyset$.

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FOURIER SERIES, FOURIER TRANSFORM AND BOEHMIAN SPACE

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ABSTRACT

The topic of this paper is an introduction to Fourier series, Fourier Transform and Boehmian space. Paper deals with the meaning of Fourier series and representation along with general and complex form. The paper gives a brief overview of Fourier Transform. Some of the properties of Fourier Transform are also stated.The paper also includes an introduction of Boehmian Space. A few applications of Fourier analysis have been stated.

Key wards: *Fourier series, Fourier Transform, Boehmian Space*

INTRODUCTION

Suppose $f: R \to R$ is a function. Then f is said to be a periodic function if there exist a positive constant p such that f(x+p) = f(x), for all values of x. Here p is called the period of the function.

If p is a period of the function f then 2p, 3p, 4p etc. are also periods.

i.e. f(x) = f(x+p) = f(x+2p) = …=

eg. sinx, cosx are periodic functions with period 2π. sinnx, cosnx are periodic functions with period $\frac{2\pi}{n}$ also 2π.

Note that if the functions f and g are periodic with period p then $f \pm g, f.g$ are also periodic with same period.

A series is the addition of the terms of a sequence. The series

$$\frac{a_0}{2} + a_1 \cos x + a_2 cos2x + a_3 cos3x + \cdots b_1 sinx + b_2 sin2x + b_3 sin3x + \cdots$$

written in the form $\frac{a_0}{2} + \sum_{n=1}^{\infty}(a_n\, cosnx + b_n sinnx)$; is known as trigonometric series ,where a_i and b_i are constants.

DEFINITION

The function f(x) represented by f(x) = $\frac{a_0}{2} + \sum_{n=1}^{\infty}(a_n cosnx + b_n\, sinnx) \ldots\ldots\ldots (1)$ is a periodic function of period2π. The series is called the Fourier series of function f(x) and a_0, a_n, b_n are called Fourier coefficients.

Advantages of Fourier series : whether any function it is continuous or discontinuous can be expanded in a series of sines and cosines of multiples of the variables.

If we consider f(x) to be any function defined on [c, c+2π]. It can be expressed as Fourier series if (i) f(x) is finite, single valued and integrable. (ii) f(x) has finite number of discontinuities (iii) f(x) has finite number of extremum (maxima and minima). These conditions are called Dirichlet conditions, which are sufficient conditions for convergence of Fourier series.

Fourier series f(x) converges to (a) f(x) at each point of continuity (b) If a function f(x) is discontinuous at some point x_0 then f(x) converges to $\frac{1}{2}\left[\lim_{x\to x_0^-} f(x) + \lim_{x\to x_0^+} f(x)\right]$ i.e. it gives arithmetic mean of the 'right hand' and 'left hand' limits. Fourier series of a discontinuous function is not uniformly convergent at all points.

THE EVALUATION OF COEFFICIENTS

The coefficients a_0, a_n, b_n in the Fourier series are obtained by the formulae

$$\mathbf{a_0} = \frac{1}{\pi}\int_c^{c+2\pi} f(x)dx\,,$$

$$\mathbf{a_n} = \frac{1}{\pi}\int_c^{c+2\pi} f(x)cosnx\, dx\,,$$

$$\mathbf{b_n} = \frac{1}{\pi}\int_c^{c+2\pi} f(x)sinnx\, dx.$$

GENERALISATION

A generalized form of Fourier series of function having period 2L i.e. in the interval [c, c+2L] is

$$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty}\left(a_n \cos\left(\frac{n\pi x}{L}\right) + b_n \sin\left(\frac{n\pi x}{L}\right)\right).$$

Thus, we can define a Fourier series of the function in the interval [0,2L],[0,2π],[-L,L],[-π, π].

HALF RANGE SERIES

A series which involves only sine terms or cosine terms only. If the function f(x) is even then the coefficient b_n will be zero as the integral will be an odd function within the interval (-L, L)

And the series will be f(x) = $\frac{a_0}{2} + \sum_{n=1}^{\infty}(a_n \cos\frac{n\pi x}{L})$. This is called the Half Range cosine Series and if the function f(x) is an odd function then the coefficients a_0 and a_n will be both zero.

The series will be then $f(x) = \sum_{n=1}^{\infty}(b_n \sin\left(\frac{n\pi x}{L}\right))$. This is called the Half Range sine Series.

COMPLEX FORM OF FOURIER SERIES

Consider Fourier series of function with period 2L

$$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty}(a_n \cos\left(\frac{n\pi x}{L}\right) + b_n \sin\left(\frac{n\pi x}{L}\right))$$

We know that $\cos x = \frac{e^{ix}+e^{-ix}}{2}$ and $\sin x = \frac{e^{ix}-e^{-ix}}{2i}$ Taking these values in f(x) we will get

$$f(x) = c_0 + \sum_{n=1}^{\infty} c_n e^{in\pi x/L} + \sum_{n=1}^{\infty} c_{-n} e^{-in\pi x/L}$$

; where $c_n = \frac{1}{2}(a_n - ib_n)$, $c_{-n} = \frac{1}{2}(a_n + ib_n)$, so that we have $c_0 = \frac{a_0}{2} = \frac{1}{2L}\int_0^{2L} f(x)dx$, $c_n = \frac{1}{2L}\int_0^{2L} f(x)e^{-in\pi x/L}\, dx$, $c_{-n} = \frac{1}{2L}\int_0^{2L} f(x)e^{in\pi x/L}\, dx$.

Thus, Fourier series shows how to write any periodic function into a sum of sinusoids. (A physical phenomenon described by the sine or the cosine function called a Simple Harmonic Oscillations or Sinusoidal.)

FOURIER TRANSFORM

The Fourier transform decomposes any function into sum of sinusoidal functions. The Fourier transform is the extension of re-writing any non-periodic function into a sum of sinusoidal. The Fourier transform has practical applications in the field of science and engineering.

Definition- The Fourier transform of a function f(x) is defined as

$F\{f(x)\} = F(s) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} f(x)e^{isx}\, dx$ …… (1); s is called parameter of the transform.

Now, f(x) can be obtained from F(s) by $f(x) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{\infty} F(s)e^{-isx}\, dx$ ………… (2); called as inverse Fourier transform. Sometimes we call this as an inversion formula for (1).

Equation (1) and (2) form a Fourier pair, f(x) and F(s).

PROPERTIES OF FOURIER TRANSFORM

1. Linearity property:- If F(s) and G(s) are the Fourier transforms of f(x) and g(x) respectively then F{c_1f(x)+c_2g(x)}= c_1F(s)+c_2G(s) ; c_1 and c_2 are constants.
2. Change of scale property:- If F(s) is the Fourier transform of f(x) then
$$F\{f(ax)\} = \frac{1}{a}F\left(\frac{s}{a}\right), a \neq 0$$

3 Shifting property:- If F(s) is the Fourier transform of f(x) then $F\{f(x-a)\} = e^{ias}F(s)$.

4 Modulation property:- If F(s) is the Fourier transform of f(x) then

$$F\{f(x)cosax\} = \frac{1}{2}[F(s+a) + f(s-a)]$$

Proof: We know that $F\{f(x)\} = F(s) = \int_{-\infty}^{\infty} e^{isx} f(x)dx$

$$F\{f(x)cosax\} = \int_{-\infty}^{\infty} e^{isx} f(x)cosax\, dx$$

$$= \int_{-\infty}^{\infty} e^{isx} f(x)[\frac{e^{iax}+e^{-iax}}{2}]\, dx$$

$$= \frac{1}{2}\int_{-\infty}^{\infty} e^{i(s+a)x} f(x)dx + \frac{1}{2}\int_{-\infty}^{\infty} e^{i(s-a)x} f(x)dx$$
$$= \frac{1}{2}[F(s+a) + f(s-a)].$$

DIRICHLET CONDITIONS FOR FOURIER TRANSFORM

A non-periodic function f(x) is such that

(i) f(x) is absolutely integrable i.e. $\int_{-\infty}^{\infty}|f(x)|\, dx$ exists.

(ii) f(x) has only finite number of extrema in any finite interval.

(iii) f(x) has only a finite number of discontinuities in any finite interval, then

f(x) converges at all points of continuity of f(x), and at points of discontinuity of f(x) the integral converges to the average of the left hand and the right hand limit of f(x) at that point. These conditions are called Dirichlet conditions.

BOEHMIAN SPACE

The integral transforms of generalized functions are studied by Zemanian. His idea is to construct testing function spaces which contain appropriate Kernel of integral transforms and extend it to the dual of corresponding testing function spaces. Boehmian has become an active and important part of theory of generalized integral transforms. Here the general construction of Boehmian which is algebraic is given in which each element has a Fourier transform.

GENERAL CONSTRUCTION OF BOEHMIANS

The structure necessary for the construction of Boehmians [4], [5] consists of

1. A group X and a commutative semi-group (Y,*)
2. An operator $\Theta : X \times Y \to X$ such that
   $X \Theta (v_1 * v_2) = (x \Theta v_1) \Theta v2, \forall x \in X$ & $v_1, v_2 \in Y$
3. A collection $\Delta \subset Y^N$ such that
   I. $\forall (v_n), (\sigma_n) \in \Delta$, we have $(v_n * \sigma_n) \in \Delta$.
   ii. If $x \Theta v_n = y \Theta v_n$ then $x = y$; where $x, y \in X$, $(v_n) \in \Delta$, $n \in N$

The set Δ is called the set of all delta sequences.

Let $A = \{(x_n, v_n) / x_n \in X, (v_n) \in \Delta, x_n \Theta v_m = x_m \Theta v_n \ \forall m, n \in N\}$

Then we say that $(x_n, v_n) \sim (y_n, \sigma_n)$ if there are $(x_n, v_n), (y_n, \sigma_n) \in A$ such that

$$Xn \Theta \sigma_m = y_m \Theta v_n, \forall m, n \in N.$$

The relation $\sim$ is an equivalence relation in A. The space of equivalence classes in A is called the space of Boehmians; denoted by BH. Each element of BH is called as a Boehmian.

The **convergence** δ and Δ of BH is defined as-

1. $(h_n) \in BH$ is said to be δ-convergent to $h \in BH$;denoted by $h_n \xrightarrow{\delta} h$ as $n \to \infty$, if there exists a delta sequence (v_n) such that $(h_n \Theta v_n), (h \Theta v_n) \in X$, and $(h_n \Theta v_k) \to (h \Theta v_k)$ in X as $n \to \infty, \forall k, n \in N$
2. $(h_n) \in BH$ is said to be Δ convergent to $h \in BH$; denoted by $h_n \xrightarrow{\Delta} h$ as $n \to \infty$
   If there exists a $(v_n) \in \Delta$ such that $(h_n - h) \Theta v_n \in X, \forall n \in N$, and $(h_n - h) \Theta v_n \to 0$ in X as $n \to \infty$.

Al-Omari [4] has given construction of Boehmian space with two notion of convergence. Instead of usual convolution product Mellin type convolution is used, and constructed a Lebesgue integrable Boehmian space. Boehmian space is defined by taking group as linear space G and semi-group S as subspace of G.

APPLICATIONS

Fourier analysis is very effective mathematical device to use in practical applications in the field of science and engineering. A few examples are conduction of heat, tranverse vibration of string, oscillations of an elastic beam, transmission lines, image processing, signal processing. The integral transforms are used to solve the boundary value problems, the choice of transform depends on the boundary conditions.

DISCUSSION AND CONCLUSION

This paper thus, gives a brief overview of Fourier analysis which deals with Fourier series. A description of Fourier series along with complex form, evaluation of its coefficients and some properties are discussed. The paper included the idea of Fourier transform which is useful to the extension of any periodic and non-periodic function. A general construction of Boehmian space which is the recent active to study the integral transforms is also introduced. Boehmian space has applications in mathematical physics and applied mathematics.

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COMPARISON OF MELLIN AND LAPLACE-MELLIN TRANSFORM USING MATLAB

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ABSTRACT

There are many integral transformations including the Laplace transform, Fourier transform, Hankel transform, which are widely used to solve various problems in mathematics, science and engineering. In Contrast to this transform that were introduced to solve engineering problem, Mellin transform arose in a mathematical context which can be obtained from Laplace or Fourier by certain changes of variables. The paper deals with the Mellin transform method and Laplace-Mellin transform method for the calculation of Cauchy type differential equation and compare using Matlab. Also illustrate the application of this method to electromagnetic problems.

Keywords: *Laplace Transform, Mellin Transform, Laplace-Mellin Transform, Cauchy differential Equation.*

INTRODUCTION

Historically, the concept of an integral transform originated from the celebrated Fourier integral formula. The importance of integral transforms is that they provide powerful operational methods for solving initial value problems and initial-boundary value problems for linear differential and integral equations [1-5]. Although, Mellin (1854–1933) presented an elaborate discussion of his transform and its inversion formula, it was G. Bernhard Riemann (1826–1866) who first recognized the Mellin transform and its inversion formula in his famous memoir on prime numbers [7].

The Cauchy-Euler differential equation is not developed by the application of the Laplace transformation, in order to study such problems with an integral transformation directly we need a different kernel function. A transformation which is closely connected with the Laplace and Fourier transformations is the Mellin transformation [13]. Mellin transformation is essential in problems involving dilations. Thus, it is not surprising that it has come to play a dominant role in the development of analytical studies of wideband signals [6]. Laplace-Mellin transform method is also useful for the solution of differential equation [8-15].

In this paper first we start by recalling the definition of Laplace, Mellin transform and some important properties of Mellintransform..Then we discuss about the Laplace-Mellin transform. And the applications will illustrate the control system problems.

Generalities on the Transformation

In this section we define the Laplace, Mellin transform and recall some of its main properties.

BI-LATERAL LAPLACE TRANSFORM

If *f(t)* is a function defined for all *t*, its Laplace transform is an integral of a function *f (t)* from *t* = – ∞ to ∞.It is a function of $s\bar{F}(s)$, and is denoted by $L\{f(t)\}$; thus

$$\overline{F}(s) = L\{f(t)\} = \int_{-\infty}^{\infty} e^{-st} f(t)\,dt \qquad (1)$$

Provided that the integral exists,'s' is a parameter which may be real or complex number.

MELLIN TRANSFORM

Let f be a complex-valued function defined over (0, ∞) and continuous in (0, ∞).The Mellin transform is defined as

$$M\{f(t)\} = \int_{0}^{\infty} f(t)\, t^{s-1}\,dt \qquad (2)$$

2.3 Basic Operational Properties of Mellin transforms

We recall some important properties

1) Scaling property

$$M\{f(at\} = a^{-s}\overline{f}(s), a > 0 \qquad (3)$$

2)Shifting Property

$M\left\{t^{a} f(t)\right\} = \overline{f}(s+a)$ and

$$M\left\{f\left(t^{a}\right)\right\} = \frac{1}{a}\overline{f}\left(\frac{s}{a}\right) \qquad (4)$$

3)Mellin Transforms of Derivatives

In general,

$$M\left\{t^{n} f^{(n)}(t)\right\} = (-1)^{n} \frac{\Gamma(s+1)}{\Gamma s}\overline{f}(s) \qquad (5)$$

4) Mellin Transforms of Differential operators:

$$M\left[\left(t\frac{d}{dt}\right)^{2} f(t)\right] = M\left[t^{2} f''(t) + tf'(t)\right]$$

$$= (-1)^{2} s^{2}\overline{f}(s) \qquad (6)$$

In general,

$$M\left[\left(t\frac{d}{dt}\right)^{n} f(t)\right] = (-1)^{n} s^{n}\overline{f}(s) \qquad (7)$$

Theorem1: If $f(t) = e^{-nt}$ $, n > 0$ then

$$M\left\{e^{-nt}\right\} = \frac{\Gamma s}{n^{s}}$$

Proof: By definition of Mellin transform,

$$M\left\{e^{-nt}\right\} = \int_{0}^{\infty} e^{-nt} t^{s-1} dt$$

By putting $nt = x$, $dt = \frac{dx}{n}, t = 0 \ then \ x = 0$ and

$t = \infty \ then \ x = \infty$

we get,

$$M\left\{e^{-nt}\right\} = \int_{0}^{\infty} e^{-x}\left(\frac{x}{n}\right)^{s-1}\frac{dx}{n} = \frac{1}{n^{s}}\int_{0}^{\infty} e^{-x} x^{s-1} dx$$

$$\frac{1}{n^{s}}\Gamma s = \frac{\Gamma s}{n^{s}} \qquad (8)$$

Theorem 2: Find the Mellin transform of $cost$ and $sint$

Proof : We have (using above result)

$$M\left\{e^{-it}\right\} = \frac{\Gamma s}{i^{s}}, \qquad s = 0,1,2\ldots\ldots$$

$$M(cost - isint) = \Gamma s\left(\cos\frac{s\pi}{2} - isin\frac{s\pi}{2}\right) \qquad (9)$$

Equating real and imaginary parts,

$$M(cost) = \Gamma s\left(\cos\frac{s\pi}{2}\right),$$

$$M(sint) = \Gamma s\left(\sin\frac{s\pi}{2}\right) \qquad (10)$$

Theorem 3: $\sin(\beta \ln t) = \frac{\beta}{s^{2}+\beta^{2}}$

Proof: We know, $\sin(\beta \ln t) = \frac{1}{2i}\left(e^{i\beta \ln t} - e^{-i\beta \ln t}\right)$

$$= \frac{1}{2i}\left(t^{i\beta} - t^{-i\beta}\right)$$

On transforming we get,

$$= \frac{1}{2i}\left(\frac{-1}{s+i\beta} + \frac{1}{s-i\beta}\right) = \frac{\beta}{s^{2}+\beta^{2}} \qquad (11)$$

Theorem 4: Find the Mellin transform of $t^{-a} = \frac{-1}{s-a}$

$$M\{t^{-a}\} = \int_{0}^{\infty} t^{-a} t^{s-1} \mathrm{dt} = \left[\frac{t^{s-a}}{s-a}\right]_{0}^{\infty} = \frac{-1}{s-a} \qquad (12)$$

2.4 Laplace –Mellin Transform

Combination of double Bi-Lateral Laplace transforms is denoted and defined by

$$L^{2}\left[f(x,z),s,r\right] = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-(sx+rz)} f(x,z)\, dxdz$$

$$= \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-sx} e^{-rz} f(x,z)\, dxdz$$

$$= \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-sx}\left(e^{z}\right)^{-r} f(x,z)\, dxdz$$

Provided the integral exists, *r> 0* and *s> 0* are parameters.

By using change of variable $z = -\log y$ in above equation, we get the Laplace- Mellin transform relation.

$$L^{2}M\left[f(x,y),s,r\right] = \int_{-\infty}^{\infty}\int_{0}^{\infty} e^{-sx} y^{r-1} f(x,y)\, dxdy \quad (13)$$

2.5 Important Properties of Laplace-Mellin transforms:

1) Laplace-Mellin transform holds the linearity.

2) Scaling Property:

$$L^{2}M\left[f(Ax,By),s,r\right] = \int_{-\infty}^{\infty}\int_{0}^{\infty} e^{-s\theta/A}\left(\frac{\varnothing}{B}\right)^{r-1} f(\theta,\varnothing)\frac{d\theta}{A}\frac{d\varnothing}{B}$$

$$= \frac{1}{AB^{r}}\int_{-\infty}^{\infty}\int_{0}^{\infty} e^{-\theta s/A}\varnothing^{r-1} f(\theta,\varnothing)\, d\theta d\varnothing$$

$$= \frac{1}{AB^{r}} L^{2}M\left[f(\theta,\varnothing),\frac{s}{A},r\right] \qquad (14)$$

3) Power property:

$$L^2M\left[f\left(x,y^a\right),s,r\right]=\int_{-\infty}^{\infty}\int_{0}^{\infty}e^{-sx}\left(\varnothing\right)^{\frac{1}{m}(r-1)}f\left(x,\varnothing\right)dx\frac{1}{m}\varnothing^{\left(\frac{1}{m}-1\right)}d\varnothing$$

$$=\frac{1}{m}\int_{-\infty}^{\infty}\int_{0}^{\infty}e^{-sx}\left(\varnothing\right)^{\frac{r}{m}-1}f\left(x,\varnothing\right)dxd\varnothing$$

$$=\frac{1}{m}L^2M\left[f\left(x,\varnothing\right),s,\frac{r}{m}\right] \qquad (15)$$

4) Shifting Property:

$$L^2M\left[e^{ax}f\left(x,y\right),s,r\right]=\int_{-\infty}^{\infty}\int_{0}^{\infty}e^{ax}e^{-sx}y^{r-1}f\left(x,y\right)dxdy$$

$$=L^2M\left[f\left(x,y\right),s-a,r\right] \qquad (16)$$

5) Derivative Property:

$$L^2M\left[yf'\left(x,y\right),s,r\right]=\int_{-\infty}^{\infty}\int_{0}^{\infty}e^{-sx}y^{r}f'\left(x,y\right)dxdy$$

Using Integration by parts, we get

$$=\left(-1\right)rL^2M\left[f\left(x,y\right),s,r\right]+\left(-1\right)^2k ,$$

$$\left[Where \quad k=\int_{-\infty}^{\infty}e^{-sx}f\left(x,\infty\right)dx\right] \qquad (17)$$

$$L^2M\left[y^2f''\left(x,y\right),s,r\right]=\int_{-\infty}^{\infty}\int_{0}^{\infty}e^{-sx}y^{r+1}f''\left(x,y\right)dxdy$$

$$=\left(-1\right)^2r\left(r+1\right)L^2M\left[f\left(x,y\right),s,r\right]+\left(-1\right)^3\left(r+1\right)k \qquad (18)$$

In general,

$$L^2M\left[y^nf^n\left(x,y\right),s,r\right]=\left(-1\right)^nr\left(r+1\right)\ldots\left(r+n-1\right)L^2M\left[f\left(x,y\right),s,r\right]$$
$$+\left(-1\right)^{n+1}\left(r+1\right)\ldots\left(r+n-1\right)k$$
(19)

APPLICATIONS

Example 1: Following figure has integrator and decision servo-mechanism. Find the driving voltage of the network having charge $q\left(t\right)=\frac{1}{t}+\frac{1}{t^2}$ with varying resistance $R=\frac{R_0}{t^2}$ and capacitance $C=\frac{t^2}{C_0}$.

Given differential equation is:

$$V\left(t\right)=Ri\left(t\right)+\mathbf{L}\frac{d}{dt}i\left(t\right)+\frac{1}{C}\int_0^t i\left(t\right)dt$$

Or $V\left(t\right)=\mathbf{L}\frac{d^2q}{dt^2}+R\frac{dq}{dt}+\frac{1}{C}q \qquad (20)$

Put $R=\frac{R_0}{t}C=\frac{t^2}{C_0}$ and multiplying by t^2 on both sides,we get

$$t^2V\left(t\right)=\mathbf{L}t^2\frac{d^2q}{dt^2}+R_0t\frac{dq}{dt}+C_0q \qquad (21)$$

Using Mellin transformation and formulae

$$V\left(s+2\right)=\left[\mathbf{L}s^2-R_0s+C_0\right]Q\left(s\right) \qquad (22)$$

$$q\left(t\right)=\frac{1}{t}+\frac{1}{t^2}$$

$$Q\left(s\right)=\frac{-1}{s-1}-\frac{1}{s-2} \qquad (23)$$

Equation (22) becomes,

$$V\left(s+2\right)=\frac{\left(s^2+as+b\right)\left(-2s+3\right)}{\left(s-1\right)\left(s-2\right)}$$

Using Mellin inverse transformation we get,

$$t^2v\left(t\right)=-\mathbf{L}\left(a+b+1\right)t^{-1}-\mathbf{L}\left(2a+b+4\right)t^{-2}$$

$$v\left(t\right)=\frac{-\mathbf{L}}{t^4}\left[t\left(a+b+1\right)+\left(2a+b+4\right)\right] \qquad (24)$$

Example2: Find an Euler-Cauchy type Network having Charge q(t) response to voltage v(t)

Where, $q\left(t\right)=\frac{1}{\beta}t^{-\alpha}\sin\sin\left(\beta\ln t\right)$ and $v\left(t\right)=\delta\left(t-1\right)$ is an impulse.

Transforming we get,

$$Q\left(s\right)=\frac{1}{\beta}\frac{\beta}{s^2-2s\alpha+\alpha^2+\beta^2} \qquad (25)$$

And $V\left(s\right)=1$

$$T\left(s\right)=\frac{V\left(s\right)}{Q\left(s\right)}=s^2-2s\alpha+\alpha^2+\beta^2$$

$$1=Q\left(s\right)\left(s^2-2s\alpha+\alpha^2+\beta^2\right) \qquad (26)$$

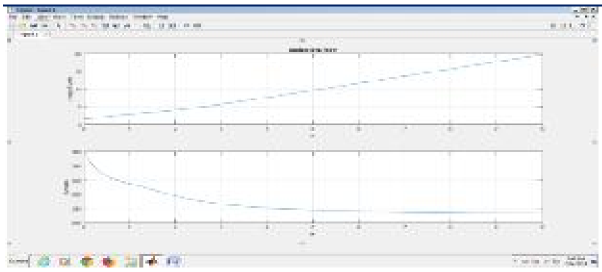
Taking inverse transform we get,

$$\delta\left(t-1\right)=t^2\frac{d^2q}{dt^2}-2\alpha t\frac{dq}{dt}+\left(\alpha^2+\beta^2\right)q \qquad (27)$$

This is the required differential equation which determines the network.

If $\mathbf{L}=1, R_0=-2\alpha$, $C_0=\alpha^2+\beta^2$ then we get the same form as above.

Graphical Representation by Matlab:



For zero voltage, Laplace- Mellin transform of equation is,

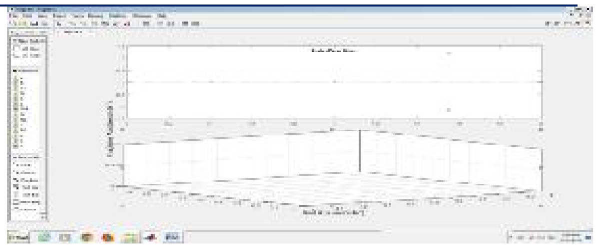
$$\mathbf{L}r(r+1)L^2M[f(x,y),s,r]-(r+1)k+R_0(-r)L^2M[f(x,y),s,r]+K$$
$$+C_0L^2M[f(x,y),s,r]=0 \qquad (28)$$

Since the voltage is constant.

$$L^2M[f(x,y),s,r]=\frac{rk}{\mathbf{L}r(r+1)-R_0r+C_0}$$
$$=\frac{rk}{\mathbf{L}[r^2+ra+b]}, \qquad (29)$$

Where, $a=\left(1-\frac{R_0}{\mathbf{L}}\right), b=\frac{C_0}{\mathbf{L}}$

Graphical Representation by Matlab:



CONCLUSION

Once the fundamental principle have been mastered, one quickly clear that the method is extremely capacious, often yielding closed-form expressions very laborious to come up with other methods or to deduce from the regular tables of integrals. The Mellin contribution gives a conspicuous place to the theory of analytic functions and relies essentially on Cauchy's theorem. Mellin, Laplace-Mellin transform method solved the Cauchy type differential equation where single Laplace is not worked. In electrical engineering it is common place to deal only with the Laplace, Fourier transform method.

In this paper we show how the Laplace-Mellin transform is useful to electrical engineering and show that the LaplaceMellin transform technique provides a useful framework for system analysis. Also compare Mellin and Laplace-Mellin transform graphically with Matlab.

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BIANCHI TYPE-III HOLOGRAPHIC DARK ENERGY COSMOLOGICAL MODELS IN SCALE COVARIANT THEORY OF GRAVITATION

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ABSTRACT

In this paper, we have investigated the Bianchi Type-III holographic dark energy cosmological models in scale-covariant theory of gravitation. Exact solutions of the field equations are obtained by using volumetric exponential expansion, power law expansion and special law for Hubble's parameter. The physical parameters of the models are also discussed.

Keywords: *- Bianchi type-III, holographic dark energy, Scale covariant theory.*

INTRODUCTION

In the recent years, many researchers have shown a lot of interest in alternative theories of gravitation. Alternative theories of gravitation are playing a vital role in modern cosmology. Note worthy among them are Brans and Dicke,[1] Nordtvedt,[2] Ross,[3] Dunn,[4] Saez and Ballester,[5] scalar-tensor theories of gravitation. Canuto *et al.*[6] formulated the scale covariant theory of gravitation by associating the mathematical operation of scale transformation with the physics using different dynamical systems to measure space-time distances.[7] A Scale-Covariant theory gives the theoretical and a sensible framework to discuss the possible variation of the gravitational constant G without compromising the validity of general relativity.[8,9] An important feature of this theory is that no independent equation for the gauge function ϕ exists, and therefore it cannot be determined within the theory. This theory measures physical quantities in atomic units whereas Einstein's theory measures it in gravitational units. The relation between the metric tensors in two systems of units is given by

$$\bar{g}_{ij} = \phi^2\left(x^k\right)g_{ij}, \tag{1}$$

where the Latin indices take the values 1,2,3,4. Overhead bar denotes gravitational units and unbar denotes atomic units. In a general formulation, the guage scalar function $\phi\left(0<\phi<\infty\right)$ is a function of all space-time coordinates.

The field equations in the scale covariant theory with zero cosmological constant are given by

$$R_{ij} - \frac{1}{2}Rg_{ij} + f_{ij}(\phi) = -8\pi G(\phi)T_{ij}, \tag{2}$$

where

$$\phi^2 f_{ij} = 2\phi\phi_{i;j} - 4\phi_{,i}\,\phi_{,j} - g_{ij}\left(\phi\phi^{;k}_{;k} - \phi^{,k}\phi_{,k}\right), \tag{3}$$

R_{ij} is the Ricci Tensor, R is the Ricci scalar, G is the gravitational constant and T_{ij} is the energy momentum tensor of matter distribution, semicolon denotes covariant derivative and comma denotes ordinary derivative with respect to x^k. The possibilities considered for the gauge scalar function are

$$\phi(t) = \left(\frac{t}{t_0}\right)^{\epsilon}, \tag{4}$$

Where $\epsilon = \pm 1, \pm\frac{1}{2}$ and t_0 is a constant.

The form

$$\phi \approx t^{\frac{1}{2}} \tag{5}$$

is the most favored for the observations.[10]

Recent experimental data such as type Ia supernova,[11,12] suggests that the universe is accelerating and expanding. The mysterious energy known as 'Dark Energy' is responsible for this accelerated expansion of the universe. It is believed that 96 percent of the universe consists of dark energy and dark matter.[13] The alternative theories are extensively studied to explain the acceleration of the universe. Many researchers are taking interest in the investigation of the cosmological models in alternative theories of gravity. Rao and Santhi[14] have investigated

Bianchi type II, VIII and IX perfect fluid cosmological models in Brans-Dicke theory of gravitation. Naidu *et al.*[15] have discussed Kantowski-Sachs anisotropic dark energy cosmological model in the framework of scale covariant theory of gravitation. Katore *et al.*[16] have investigated magnetized anisotropic dark energy cosmological models in scale covariant theory of gravitation. Reddy and Lakshmi[17] have obtained Bianchi type V bulk viscous string cosmological model in scale covariant theory of gravitation.

Motivated by the above work, we have studied Bianchi Type-III holographic dark energy cosmological models in scale-covariant theory of gravitation. Section 2 deals with the metric and the field equations. In section 3, we have obtained the model I by using volumetric exponential expansion law. Section 4 deals Model II obtained by using volumetric power law expansion. Section 5 deals with the conclusion.

METRIC AND FIELD EQUATIONS

We consider spatially homogeneous and anisotropic Bianchi Type-III metric in the form

$$ds^2 = dt^2 - A^2dx^2 - B^2e^{-2x}dy^2 - C^2dz^2, \quad (6)$$

where *A, B* and *C* are the functions of cosmic time *t* only.

We consider the energy momentum tensors for matter and holographic energy are defined as

$$T_{ij} = \rho_m u_i u_j,$$
$$\overline{T}_{ij} = (\rho_\lambda + p_\lambda)u_i u_j - p_\lambda g_{ij}, \quad (7)$$

where ρ_m and ρ_λ are the energy densities of matter and holographic dark energy and p_λ is the pressure of holographic dark energy.

The energy conservation equation is

$$T^{ij}_{;j} + \overline{T}^{ij}_{;j} = 0$$

The field equations are given by

$$\frac{\ddot{B}}{B}+\frac{\ddot{C}}{C}+\frac{\dot{B}\dot{C}}{BC}+\frac{\ddot{\phi}}{\phi}+\frac{\dot{\phi}}{\phi}\left(\frac{\dot{B}}{B}-\frac{\dot{A}}{A}+\frac{\dot{C}}{C}\right)-\frac{\dot{\phi}^2}{\phi^2}=-8\pi G(\phi)\,p_\lambda, \quad (8)$$

$$\frac{\ddot{A}}{A}+\frac{\ddot{C}}{C}+\frac{\dot{A}\dot{C}}{AC}+\frac{\ddot{\phi}}{\phi}+\frac{\dot{\phi}}{\phi}\left(\frac{\dot{A}}{A}-\frac{\dot{B}}{B}+\frac{\dot{C}}{C}\right)-\frac{\dot{\phi}^2}{\phi^2}=-8\pi G(\phi)\,p_\lambda, \quad (9)$$

$$\frac{\ddot{A}}{A}+\frac{\ddot{B}}{B}+\frac{\dot{A}\dot{B}}{AB}-\frac{1}{A^2}+\frac{\ddot{\phi}}{\phi}+\frac{\dot{\phi}}{\phi}\left(\frac{\dot{A}}{A}+\frac{\dot{B}}{B}-\frac{\dot{C}}{C}\right)-\frac{\dot{\phi}^2}{\phi^2}=-8\pi G(\phi)\,p_\lambda, \quad (10)$$

$$\frac{\dot{A}\dot{B}}{AB}+\frac{\dot{B}\dot{C}}{BC}+\frac{\dot{A}\dot{C}}{AC}-\frac{1}{A^2}-\frac{\ddot{\phi}}{\phi}+\frac{\dot{\phi}}{\phi}\left(\frac{\dot{A}}{A}+\frac{\dot{B}}{B}+\frac{\dot{C}}{C}\right)+\frac{3\dot{\phi}^2}{\phi^2}=8\pi G(\phi)(\rho_m+\rho_\lambda), \quad (11)$$

$$\frac{\dot{A}}{A}-\frac{\dot{B}}{B}=0, \quad (12)$$

where the overdot denotes the differentiation with respect to *t*.

Equation (12) gives

$$A = B. \quad (13)$$

Using equation (13), equations (8)-(11) reduces to

$$\frac{\ddot{B}}{B}+\frac{\ddot{C}}{C}+\frac{\dot{B}\dot{C}}{BC}+\frac{\ddot{\phi}}{\phi}+\frac{\dot{\phi}}{\phi}\left(\frac{\dot{C}}{C}\right)-\frac{\dot{\phi}^2}{\phi^2}=-8\pi G(\phi)\,p_\lambda, \quad (14)$$

$$2\frac{\ddot{B}}{B}+\frac{\dot{B}^2}{B^2}-\frac{1}{B^2}+\frac{\ddot{\phi}}{\phi}+\frac{\dot{\phi}}{\phi}\left(2\frac{\dot{B}}{B}-\frac{\dot{C}}{C}\right)-\frac{\dot{\phi}^2}{\phi^2}=-8\pi G(\phi)\,p_\lambda, \quad (15)$$

$$\frac{\dot{B}^2}{B^2}+2\frac{\dot{B}\dot{C}}{BC}+-\frac{1}{B^2}-\frac{\ddot{\phi}}{\phi}+\frac{\dot{\phi}}{\phi}\left(2\frac{\dot{B}}{B}+\frac{\dot{C}}{C}\right)+\frac{3\dot{\phi}^2}{\phi^2}=8\pi G(\phi)(\rho_m+\rho_\lambda), \quad (16)$$

The field equations (14)-(16) are the system of three linearly independent equations with four unknown parameters, thus an extra equation is needed to solve the system completely. For this purpose, we assume the relation between the metric potentials given by physical condition that shear scalar is proportional to expansion scalar

$$C = B^n. \quad (17)$$

Also, we have used two different volumetric expansion laws, i.e., volumetric exponential expansion law and volumetric power law expansion are respectively given by

$$V = c_1e^{3mt}, \quad (18)$$

$$V = c_1t^{3k} \quad (19)$$

where c_1, m and k are positive constants.

MODEL I: VOLUMETRIC EXPONENTIAL EXPANSION LAW

Using equations (14), (15) and (18), we obtain the scale factors as follows

$$A = B = (c_1d_1)^{\frac{1}{3}}e^{mt-\frac{k_1}{9mc_1}.e^{-3mt}}, \quad (20)$$

$$C = (c_1d_1)^{\frac{n}{3}}e^{nmt-\frac{nk_1}{9mc_1}.e^{-3mt}}, \quad (21)$$

where c_1, d_1 and k_1 are constants of integration.

From equations (20) and (21), it is observed that the scale factors are non-zero at *t =0* and starts increasing with time. They diverge to infinity for $t \to \infty$. Thus the model is well consistent with the Big Bang model of the universe.

From equations (20) and (21), the metric (6) can be rewritten as

$$ds^2 = dt^2 - \left((c_1d_1)^{\frac{1}{3}}e^{mt-\frac{k_1}{9mc_1}.e^{-3mt}}\right)^2 dx^2 - \left((c_1d_1)^{\frac{1}{3}}e^{mt-\frac{k_1}{9mc_1}.e^{-3mt}}\right)^2 e^{-2x}dy^2 - \left((c_1d_1)^{\frac{n}{3}}e^{nmt-\frac{nk_1}{9mc_1}.e^{-3mt}}\right)^2 dz^2 \quad (22)$$

The Hubble parameter of the model is

$$H = m. \tag{23}$$

Expansion Scalar is

$$\theta = 3m. \tag{24}$$

Deceleration Parameter is given by

$$q = \frac{d}{dt}\left(\frac{1}{H}\right) - 1 = -1. \tag{25}$$

Mean Anisotropy Parameter is

$$A_m = \frac{(n-1)^2}{3} + \frac{(2+n^2)k_1^2}{27m^2c_1^2}e^{-6mt} + \frac{2(n-1)k_1}{9mc_1}e^{-3mt}. \tag{26}$$

Shear Scalar is

$$\sigma^2 = \frac{(n-1)^2m^2}{2} + \frac{(2+n^2)k_1^2}{18c_1^2}e^{-6mt} + \frac{(n-1)k_1m}{3c_1}e^{-3mt}. \tag{27}$$

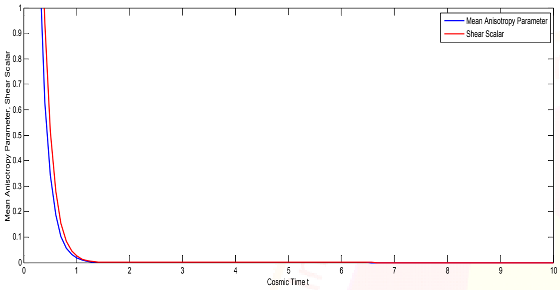

Fig 1: Plot Mean Anisotropy Parameter (A_m) and Shear Scalar (σ^2) versus cosmic time t .

Equations (23) and (24) imply that the Hubble parameter and expansion scalar are constant. Hence the rate of expansion of the universe is constant. In this model the deceleration parameter is -1 which indicates that the universe is accelerating. From Fig 1, we see that the mean anisotropy parameter and shear scalar are the decreasing functions of time *t*, i.e., they decreases exponentially as the time *t* increases and tend to zero at late time *t*. Thus the universe approaches isotropy at large time. These results are consistent with the recent cosmological observations.

MODEL II: VOLUMETRIC POWER LAW EXPANSION

Using equations (14), (15) and (19), we obtain the scale factors as follows

$$A = B = (c_1 d_1)^{\frac{1}{3}} t^k e^{\frac{k_2}{3c_1(1-3k)}t^{1-3k}}, \tag{28}$$

$$C = \left(\frac{c_1}{d_1^2}\right)^{\frac{1}{4}} t^k e^{-\frac{2k_2}{3c_1(1-3k)}t^{1-3k}}, \tag{29}$$

where c_1, d_1 and k are the constants.

From equations (28) and (29), the metric (6) can be rewritten as

$$ds^2 = dt^2 - \left((c_1d_1)^{\frac{1}{3}} t^k e^{\frac{k_2}{3c_1(1-3k)}t^{1-3k}}\right)^2 dx^2 - \left((c_1d_1)^{\frac{1}{3}} t^k e^{\frac{k_2}{3c_1(1-3k)}t^{1-3k}}\right)^2 e^{-2x} dy^2 - \left(\left(\frac{c_1}{d_1^2}\right)^{\frac{1}{4}} t^k e^{-\frac{2k_2}{3c_1(1-3k)}t^{1-3k}}\right)^2 dz^2 \tag{30}$$

From equations (28) and (29) and (30), it is observed that the scale factors are increasing functions of time *t*. They turns out to be zero at $t = 0$ and diverge to infinity as $t \to \infty$. The model has singularity at $t = 0$.

The Hubble Parameter of the model is

$$H = \frac{k}{t}. \tag{31}$$

Expansion Scalar is

$$\theta = \frac{3k}{t}. \tag{32}$$

Mean Anisotropy Parameter

$$A_m = \frac{8k_2}{27k^2c_1^2}t^{2-6k}. \tag{33}$$

Shear Scalar is

$$\sigma^2 = \frac{4k_2^2}{9c_1^2}t^{-6k}. \tag{34}$$

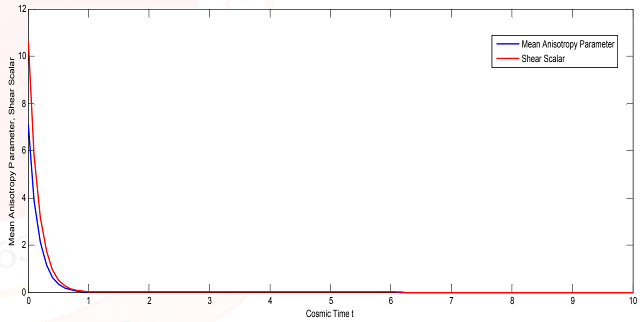

Fig 2: Plot of Mean Anisotropy Parameter (A_m) and Shear Scalar (σ^2) versus Cosmic Time *t*

Equations (31) and (32) show that the Hubble parameter and expansion scalar are constant. Hence universe is expanding at constant rate. From Fig 2, we observe that the mean anisotropy parameter and shear scalar are the decreasing functions of time *t*, i.e., they decreases exponentially as the time *t* increases and tend to zero at late time *t*, i.e., the universe tends to isotropy at large time.

MODEL III

In this case, we consider the special law of variation for Hubble's parameter, defined by

$$q = -\frac{a\ddot{a}}{\dot{a}^2} = \text{constant}, \qquad (35)$$

where q is the deceleration parameter such that $1+q>0$. The universe decelerates if $q>0$ and accelerates if $q<0$.

Integrating equation (35) yields

$$a(t) = (ct+d)^{\frac{1}{1+q}}, \qquad (36)$$

where c and d are constants of integration and $c \neq 0$.

From equations (22) and (46), we get

$$A = B = (ct+d)^{\frac{3}{(1+q)(n+2)}}, \qquad (37)$$

$$C = (ct+d)^{\frac{3n}{(1+q)(n+2)}}. \qquad (38)$$

By choosing suitable values of constants (i.e. $c=1$ and $d=0$), we can rewrite the metric (6) as

$$ds^2 = dt^2 - \left(t^{\frac{3}{(1+q)(n+2)}}\right)^2 dx^2 - \left(t^{\frac{3}{(1+q)(n+2)}}\right)^2 e^{-2x} dy^2 - \left(t^{\frac{3n}{(1+q)(n+2)}}\right)^2 dz^2. \qquad (39)$$

The spatial volume is given by

$$V = t^{\frac{3}{1+q}}. \qquad (40)$$

The Hubble Parameter is

$$H = \frac{1}{(1+q)\,t}. \qquad (41)$$

Expansion Scale is obtained as

$$\theta = \frac{3}{(1+q)\,t}. \qquad (42)$$

CONCLUSION

In this paper, we have studied the Bianchi Type-III cosmological model in the framework of the scale covariant theory of gravitation proposed by Canuto *et al.*[6] in the presence of bulk viscous string fluid. We have presented three madels. In model I, we have considered the volumetric exponential expansion law and it is observed that the model is well consistent with the Big Bang model of the universe. The model is accelerating and the rate of expansion of the model is uniform throughout the evolution of the universe. In model II the solutions are obtained by considering the volumetric power law expansion. It is observed that the model has initial singularity. Whereas the third model is obtained by using the special law of variation for Hubble's parameter proposed by Bermann.[36] From the results, it is observed that the spatial volume increases with time. The Hubble parameter and expansion scalar are decreasing functions of time and approaches zero at large time.

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RANDOM FIXED POINT THEOREM FOR WEAKLY CONTRACTIVE MAPPINGS

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ABSTRACT

In this paper, we prove the common random fixed point theorem and its uniqueness for a pair of random mappings for weakly contractive mapping under generalized altering distance function .

Keywords:*Polish space, Random fixed point theorem, Weakly contractive mappings.*

INTRODUCTION

Random fixed point theorems are generalization of classical fixed point theory and its applications are directly yields the existence of random solution. Here ,we discuss the common random fixed point theorem and its uniqueness for a pair of random mappings for weakly contractive mapping under altering distance function .

AUXILIARY RESULTS

Definition1. A function ϕ : $[0,\infty)$ $\rightarrow$ $[0,\infty)$ is called a *D*-function if it is a continuous and monotone non-decreasing function satisfying $\phi(0) = 0$.

Commonly *D*- functions are $\phi(r) = kr$ and $\Psi(r) = \frac{Lr}{K+r}$. The *D*- functions ϕ and Ψ are respectively used in the fixed point theory for linear and nonlinear contraction mappings in metric spaces..

In fact, Alber and Guerre-Delabriere [2] assumed an additional condition on $\lim_{t\to[0,\infty)} \phi(t)$ ϕ .But Rhoades [9] obtained the result noted in following theorem without using this particular assumption.

Theorem 1.(Rhoades [9]) IfT : X $\rightarrow$ X is a - weakly contractive mapping, where (X,d) is a complete metric space, then T has a unique fixed point.

Definition2. A self mapping *T* of a metric space *(X, d)* is said to be weakly contractive with respect to a self mapping *S*: *X*$\rightarrow$*X,* if for each *x,y* € *X such that ,*

$$d(Tx,Ty)\leq d(Sx,Sy) - \Psi(d(Sx,Sy)),\text{where } \Psi : [0,\infty) \rightarrow [0,\infty)$$ is a continuous and non-decreasing function.

Beg and Abbas [4] proved a generalization of Rhoades [9] for a pair of mappings with weakly contractive and further generalized by Azam and Shakeel [3]. Combining the generalization of Banach contraction principle given by Khan[8] and the generalization given by Rhoades [9], Dutta and Choudhury [7] obtained a result which is further extended by Abbas and Khan [1]. Choudhury [6] also proved similar type of works for generalized *D*-functions. Also,Beg [5] obtained random version of these results in convex separable complete metric spaces.

EXISTENCE RESULTS

Let *(X,d)* be a polish space and (Ω ,A)be a measurable space. A function $\xi:\Omega\rightarrow X$ is said to be a measurable if for any open subsets B of *X*, $\xi^{-1}(B)\in A$.

A mapping $S:\Omega\times X\rightarrow$ is said to be a random map if and only if for each fixed $x\in X$, the mapping $S(.,x):\Omega -$ is measurable. A random map $S:\Omega\times X$ is continuous if for each $\omega\in\Omega$., the mapping S(Ω , ·) : *X* $\rightarrow$ *X* is continuous. A measurable mapping $\xi:\Omega\rightarrow X$ is a random fixed point of the random map $S:\Omega\times X\rightarrow X$ if and only if S $(\omega,\ \zeta\ (\omega))=\xi\ (\omega)$ for each $\omega\in\Omega$.

Definition 3. A measurable mapping $\xi:\Omega\rightarrow K,$ is said to be a random common fixed point of random operators $R:\Omega \text{ x } K\rightarrow K$, $S:\Omega \text{ x } K\rightarrow K$ and $T:\Omega \text{ x } K\rightarrow$ if for each $\omega\in\Omega$,

$\xi(\omega)=R(\omega,\xi(\omega))=S($

In [6], Choudhury introduced the concept of a generalized altering distance function for three variables. In the following we generalized this notion for five variables.

Definition4..A function $\phi:[0,\infty)\to$ is said to be a generalized D-altering distancefunction if thefollowing conditions are satisfied:

(i) ϕ is continuous,

(ii) ϕ is monotone increasing for every variables, and

(iii) ϕ (x_1,x_2,x_3,x_4) = 0 if and only if $x_1,x_2,x_3,x_4=($.

MAIN RESULT

Our main result for random common fixed point theorem is

Theorem 2.Let X be a separable metric space and K be a nonempty Polish subspace of X. Let $R,S,T:\Omega\times K\to K$ be continuous self maps satisfying for each $\omega\in\Omega$ and $x,y\in K$, Such that

$$\psi(d(R(\omega,x),R(\omega,y)))\le\phi_1(d(x(\omega),y(\omega)),d(x$$
$$d(x(\omega),S(\omega,y)),d(y(\omega),S(\omega$$
$$-\phi_2\left(d(x(\omega),y(\omega)),d(x(\omega),T(\omega,x\right.$$
$$d(x(\omega),T(\omega,y)),d(y(\omega),T(\omega \qquad (1)$$

where ϕ_i (i=1,2) aregeneralized D-functions and the function ψ isdefined by ϕ_i (x,x,x,x,x) .Then there exists a measurable mapping $\xi:\Omega\to K$ Such that $\xi(\omega)=R(\omega,\xi(\omega))=S(\omega,\xi(\omega$.

Proof: Let $\xi_0:\Omega\to K$ be a measurable but fixed mapping in *K,* we get

$\xi_1(\omega)=R(\omega,\xi_0(\omega))$ and $=\xi_{:}$

Similarly, we get

$\xi_3(\omega)=T(\omega,\xi_2(\omega))$ and $=\xi_{.}$

Inductively, we construct a sequence of measurable maps $\{\xi_n\}$ from Ω to *K* such that

$$\xi_{2n+1}(\omega)=R(\omega,\xi_{2n}(\omega)),$$
$$\xi_{2n+2}(\omega)=S(\omega,\xi_{2n+1}(\omega))$$

And $\xi_{2n+3}(\omega)=T(\omega,\xi_{2n+2}(\omega))$ (2)

Since R , S and*T* are continuous, hence $\{\xi_n\}$ is a measurable sequence. First we will prove that

$$d(\xi_n(\omega),\xi_{n+1}(\omega))\le d$$

Consider, the following estimate:

$$\psi(d(\xi_{2n+1}(\omega),\xi_{2n+2}(\omega))$$
$$\le\psi(d(R(\omega,\xi_{2n}(\omega)),S($$
$$\le\phi_1(d(\xi_{2n}(\omega),\xi_{2n+1}(\omega)),d(\xi_{2n}(\omega),$$
$$d(\xi_{2n}(\omega),S(\omega,\xi_{2n+1}(\omega))),d($$
$$-\phi_2(d(\xi_{2n}(\omega),\xi_{2n+1}(\omega)),d(\xi_{2n}(\omega),R(\omega,$$
$$d(\xi_{2n}(\omega),S(\omega,\xi_{2n+1}(\omega))),$$
$$=\phi_1(d(\xi_{2n}(\omega),\xi_{2n+1}(\omega)),d(\xi_{2n}(\omega),$$
$$d(\xi_{2n}(\omega),\xi_{2n+2}(\omega)),d(\xi$$
$$-\phi_2(d(\xi_{2n}(\omega),\xi_{2n+1}(\omega)),d(\xi_{2n}(\omega),$$
$$d(\xi_{2n}(\omega),\xi_{2n+2}(\omega)),d(\xi \qquad (3)$$
$$\le\phi_1(d(\xi_{2n}(\omega),\xi_{2n+1}(\omega))$$
$$d(\xi_{2n}(\omega),\xi_{2n+1}(\omega))+d($$
$$-\phi_2(d(\xi_{2n}(\omega),\xi_{2n+1}(\omega))$$
$$d(\xi_{2n}(\omega),\xi_{2n+1}(\omega))+d($$

If

$$d(\xi_{2n+1}(\omega),\xi_{2n+2}(\omega))>$$

Then,

$$\psi(d(\xi_{2n+1}(\omega),\xi_{2n+2}(\omega)))<\phi_1(d(\xi_{2n-1}($$
$$d(\xi_{2n+1}(\omega),\xi_{2n+2}(\omega)),d(\qquad (4)$$
$$=\psi(d(\xi_{2n+1}(\omega),\xi_{2n+2}(\omega$$

which is a contradiction. Since ϕ_1 is monotone increasing for all variables and

$$\phi_2[d(\xi_{2n+1}(\omega),\xi_{2n+2}(\omega))$$

whenever

$$d(\xi_{2n+1}(\omega),\xi_{2n+2}(\omega))$$

So, we have

$$d(\xi_{2n+1}(\omega),\xi_{2n+2}(\omega))\le \qquad (5)$$

for all n = 0, 1, ... Putting $x=\xi_{2n}(\omega),y=\xi_{2n-1}(\omega)$

$$\psi(d(\xi_{2n}(\omega),\xi_{2n-1}(\omega))$$
$$=\psi(d(R(\omega,\xi_{2n-1}(\omega)),d$$
$$\le\phi_1(d(\xi_{2n-1}(\omega),\xi_{2n}(\omega)),d(\xi_{2n-1}(\omega),R(\omega,$$
$$d(\xi_{2n-1}(\omega),S(\omega,\xi_{2n}(\omega))),d($$

$$-\phi_2(d(\xi_{2n-1}(\omega),\xi_{2n}(\omega)),d(\xi_{2n-1}(\omega),R(\omega,\xi_{2n-1}$$
$$d(\xi_{2n-1}(\omega),S(\omega,\xi_{2n}(\omega))),d(\xi_{2n}(\omega$$
$$=\phi_1(d(\xi_{2n-1}(\omega),\xi_{2n}(\omega)),d(\xi_{2n-1}(\omega$$
$$d(\xi_{2n-1}(\omega),\xi_{2n+1}(\omega)),d(\xi_{2n}(\omega)$$
$$-\phi_2(d(\xi_{2n-1}(\omega),\xi_{2n}(\omega)),d(\xi_{2n-1}(\omega)),$$
$$d(\xi_{2n-1}(\omega),\xi_{2n+1}(\omega)),d(\xi_{2n}(\omega) \qquad (6)$$

By similar arguments, we have

$$d(\xi_{2n+2}(\omega),\xi_{2n+3}(\omega))\le d(\xi_{2n+} \qquad (7)$$

for all $n \in$ N. From (5) and (7) we obtain

$$d(\xi_{2n+1}(\omega),\xi_{2n+2}(\omega))\le d(\xi_{2n} \qquad (8)$$

for all $n \in$ N. From (3) and (8), we have for all integers $n \geq 0$

$$\psi(d(\xi_{2n+1}(\omega),\xi_{2n+2}(\omega)))\le\phi_1(d(\xi_{2n,}\xi_{n+1}(\omega))),-$$

or, equivalently,

$$\phi_2(d(\xi_{n+1}(\omega),\xi_{2n+2}(\omega)))\le\phi_1(d(\xi_n(\omega),\xi_{n-1}(\omega))$$

.

Summing up from (8), we obtain

$$\sum_{n=0}^{\infty}\phi(d(\xi_{n+1}(\omega),\xi_{n+2}(\omega)))\le\phi_1(d(\xi$$

This implies,

$$\phi_2(d(\xi_n(\omega),\xi_{n+1}(\omega))),\rightarrow 0 \text{ as} \qquad (9)$$

Again, from (8), the sequence $\{d(\xi_n(\omega),\xi_{n+1}(\omega))\}$ is monotone non-increasing and bounded. Hence there exists a real number $r(\omega)\geq 0$ such that,

$$\lim_{n\to\infty} d(\xi_n(\omega),\xi_{n+1}(\omega))=r(\omega)$$

Then, by continuity of ϕ, from (9), we obtain ϕ_2 (r(ω))) = 0 which imphes that by the property of function ϕ, , we have $r(\omega)$ = 0. Thus,

$$\lim_{n\to\infty} d(\xi_n(\omega),\xi_{n+1}(\omega))=0 \qquad (10)$$

Now we claim that {$\xi_n(\omega)$} is a Cauchy sequence in *K*. If possible, let {$\xi_n(\omega)$} is not a Cauchy sequence then there exists ε > 0 for which we can find subsequences

{$\xi_{n_i}(\omega)$} and $\xi_{m_i}(\omega)$} with n > m_i >*i* such that

$$d(\xi_{m_i}(\omega),\xi_{ni}(\omega))<\varepsilon \qquad (11)$$

Further we can choose n_i corresponding m_i in such a way that it is smallest integer with $n_i > m_i$ satisfying

$$d(\xi_{m_i},\xi_{ni-1}(\omega))<\varepsilon \qquad (12)$$

Using (11), (12) and the triangle inequality, we have

$$\varepsilon \le d(\xi_{mi}(\omega),\xi_{ni}(\omega))$$
$$\le d(\xi_{m_i}(\omega),\xi_{n_i-1}(\omega))+ \qquad (13)$$
$$\varepsilon + d(\xi_{ni-1}(\omega),\xi_{ni}(\omega))$$

Letting $i\rightarrow\infty$ and using (10),

$$\lim_{n\to\infty} d(\xi_{mi}(\omega),\xi_{ni}(\omega))= \qquad (14)$$

Again, from the triangle inequality we get

$$d(\xi_{m_i}(\omega),\xi_{n_i}(\omega))\le d(\xi_{m_i}(\omega),\xi$$
$$+d(\xi_{n_i-1}(\omega),\xi_{n_i}(\omega)) \qquad (15)$$
$$d(\xi_{m_i-1}(\omega),\xi_{n_i-1}(\omega))\le d(\xi_{m_i-1}(\omega$$
$$+d(\xi_{n_i}(\omega),\xi_{n_i-1}(\omega))$$

Letting $i\rightarrow\infty$ and using the inequalities (10) and (14), we obtain

$$\lim_{n\to\infty} d(\xi_{m_i-1}(\omega),\xi_{n_i-1}(\omega) \qquad (16)$$

Setting $x=\xi_{m_i}(\omega)$ and $y=\xi_{n_i}(\omega)$ in (1), we obtain

$$\psi(d(\xi_{m_i-1}(\omega),\xi_{n_i-1}(\omega))$$
$$=\psi(d(R(\omega,\xi_{m_i}(\omega)),S($$
$$\le\phi_1((d(\xi_{m_i}(\omega),\xi_{n_i}(\omega)),d(\xi_{m_i}(\omega),R(\omega, \qquad (17)$$
$$d(\xi_{m_i}(\omega),S(\omega,\xi_{n_i}(\omega))),d$$
$$-\phi_2((d(\xi_{m_i}(\omega),\xi_{n_i}(\omega)),d(\xi_{m_i}(\omega),R(\omega$$
$$d(\xi_{m_i}(\omega),S(\omega,\xi_{n_i}(\omega))),d$$

Letting $i\rightarrow\infty$ in (17) and using the inequalities (2), (11) and (12), we obtain

$$\psi(\varepsilon)\le \lim_{i\to\infty}\psi(d(R(\omega,$$
$$\le \lim_{i\to\infty}\phi_1(d(\xi_{m_i}(\omega),\xi_{n_i}(\omega)),d(\xi_{m_i}(\omega),R(\omega$$
$$d(\xi_{m_i}(\omega),S(\omega,\xi_{n_i}(\omega))),$$

$$-\lim_{i\to\infty} \phi_2(d(\xi_{m_i}(\omega),\xi_{n_i}(\omega)),d(\xi_{m_i}(\omega),R(\omega,\xi_{n}$$

$$d(\xi_{m_i}(\omega),S(\omega,\xi_{n_i}(\omega))),d(\xi_{n_i}($$

$$=\lim_{i\to\infty} \phi_1(d(\xi_{m_i}(\omega),\xi_{n_i}(\omega)),d(\xi_{m_i}(\omega),\xi_{n_i-1}($$

$$d(\xi_{m_i}(\omega),\xi_{ni+1}(\omega)),d(\xi_{ni}(\omega),\xi$$

$$-\lim_{i\to\infty} \phi_2(d(\xi_{m_i}(\omega),\xi_{n_i}(\omega)),d(\xi_{m_i}(\omega),\xi_{m_i-1}(\omega))$$

$$d(\xi_{m_i}(\omega),\xi_{n_i+1}(\omega)),d(\xi_{n_i}(\omega),\xi \tag{18}$$

Using inequalities (10), (12) and (14), we have

$\psi(\varepsilon)\le\phi_1(\varepsilon,0,0,0,0)-\phi_2(\varepsilon,0$

Since ϕ_1 is monotone increasing in its variables and by the property ϕ_2 that $\phi(t_1,t_2,t_3,t_4,t_5)=0$ if and only if

Thus we arrive at a contradiction as $\varepsilon > 0$.

Hence $\{\xi_{n_i}(\omega)\}$ is Cauchy sequence in *K*, there exists $\xi:\Omega\to K$ such that $\xi_{n_i}(\quad \to\xi(\omega)$ for all $\omega\in\Omega$. We show that $\xi(\omega)$ is random common fixed point of *S* and R.

$$R(\omega,\xi(\omega)) = \lim_{i\to\infty} R(\omega,\xi_{2n}(\omega)) = \lim_{i-}$$

Similarly, we can prove $S(\omega,\xi(\omega)) =$ and $T(\omega,\xi(\omega)) = \xi(\omega)$ .Hence,

$R(\omega,\xi(\omega))=S(\omega,\xi(\omega))=T($

and consequently $\xi(\omega)$ is common fixed point of $R(\omega),S(\omega)$ *and* $T(\omega)$ *i.e..*

Finally, we prove the uniqueness of the common random fixed point ξ ofR , S and *T.* Let $\xi(\omega)$ and $\zeta(\omega)$ be two random fixed points ofR , S and *T* i.e.

$R(\omega,\xi(\omega)) = \xi(\omega)) =$

and

$T(\omega,\xi(\omega)) = \xi(\omega) =$ F

for each $\omega\in\Omega$ Using inequality*(1),* we have

$$\psi(d(\xi(\omega),\zeta(\omega)))=\psi(d(I$$

$$\le\phi_1(d(\xi(\omega),\xi(\omega)),d(\xi(\omega),R(\omega,$$

$$d(\xi(\omega),R(\omega,\xi(\omega))),d($$

$$-\phi_2(d(\xi(\omega),\xi(\omega)),d(\xi(\omega),R(\omega$$

$$d(\xi(\omega),R(\omega,\xi(\omega))),d(\tag{19}$$

$$\le\phi_1(d(\xi(\omega),\zeta(\omega)),0,0,d(\xi($$

$$-\phi_2(d(\xi(\omega),\zeta(\omega)),0,0,d(\xi($$

$$\angle\phi_1(d(\xi(\omega),\zeta(\omega))$$

which is possible only when $\xi(\omega)=\zeta(\omega)$ since ϕ_1 is monotone increasing in all its variables and $\phi(t_1,t_2,t_3,t_4,t_5)\le 0$ if at least one of t_1,t_2,t_3,t_4,t_5 is nonzero. Hence, $\xi(\omega$ is the unique random common fixed point of R , S and T i.e., $R(\omega,\xi,(\omega))=\xi(\omega)=S($ for all $\omega\in\Omega$.

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ALMOST SEMI-REGULAR MODULES

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ABSTRACT

A right R-module M_R is called small injective if every homomorphism from a small right ideal to M_R can be extended to an R-homomorphism from R_R to M_R. A ring R is semi-regular if R/J(R) is regular and idempotent lift modulo J(R). In this paper we generalized some properties of MQ-injective and AMQ-injective modules with $l_R(X)$ and $r_R(X)$, X is non-empty subset of R.

$S = \mathrm{End}_R(M)$, *M is called almost semi-regular if, for any* $a^n \in M$ *there exists an S-module decomposition* $l_M r_R(a^n) = P \oplus Q$ *such that* $P \subseteq S_{a^n}$ *and* $Q \cap S_{a^n} << M$. *A ring R is said to be right almost semi-regular if R_R is almost semi-regular.*

Keyword: *P-injective, QM-injective, AMQ-injective, local, Semi-local, minjective module, regular, semi-simple, almost semi-regular, Von-Neumann regular and I- semi-regular.*

INTRODUCTION

A right R-module M is called GP-injective if for any $0 \neq a \in R$, there exists $n \geq 1$ such that $a^n \neq 0$ and $l_M r_R(a^n) = Ma^n$. Many authors investigate some properties of ring whose simple right R-module is GMP-injective. A right R module M is AGP-injective if for any $a \in J(R)$, there exists an S- sub module X_a of M such that $l_M r_R(a) = Ma \oplus X_a$ .A ring R is called right AGP-injective module if R_R is an AGP-injective module. AQM-injective ring need not be right GP-injective. AQM-injective rings are the proper generalization of PS-injective rings and QM-injective rings. There are many similarities between QM-injective rings and APS-injective rings.

A ring R is said to be regular for any $x \in R$ there exists $y \in R$ such that $x = xyx$. A ring R is said to be semi regular if and only if R/J(R) is regular and idempotent lift modulo J(R). A ring R is called almost semi-regular if R/J(R) is Von-Neumann regular and idempotent lift modulo J(R), equivalently if, for any $a^n \in R$ there exists $e^2 = e \in Ra^n$ such that $a^n(1-e^2) \in J(R)$ .An element m is called I- semi-regular if there exists a decomposition $M = P \oplus Q$, where P is projective, $P \subseteq Rm$ and $Rm \cap Q = IM$.M is called I-semi-regular module if every element of M is I-semi-regular. R is called I-semi-regular if ${}_RR$ is an I-semi-regular module. Note that I-semi-regular ring are left- right symmetric and R is semi-regular if and only if R is J(R)-semi-regular. An R module M is called an I-semi-perfect module if for every submodule U of M, there is a decomposition $M = A \oplus B$ such that A is projective $A \subseteq U$ and $U \cap B \subseteq IM$. A ring R is called I-semi-perfect if ${}_RR$ is an I-semi-perfect module. R is semi-perfect if and only if r is J(R)- semi-perfect [11].

DEFINITION

Let M be a right R-module. $S = \mathrm{End}_R(M)$. The module M is called almost generalized principally small injective module in short (AGP-S-injective) if for any $a \in J(R)$, there exists $n \geq 0$ and left sub module X_a^n of M such that $l_M r_R(a^n) = Ma^n \oplus X_{a^n}$ as left S-modules[11]. If R_R is an AGP-S-injective module, then we call R is a right AGP-S-injective ring.

Lemma: Let M_R be the right R-module with $S = End_R(M_R)$. and let $m^n R$ be a simple sub module of M_R, $m \in M$.

1) if $Hom_R(m^n R, M) = S \oplus Y$ as left S-module, then $l_M r_R(m^n) = Sm^n \oplus X$ as left S-module, where $X = \{f(m^n) : f \in Y\}$.

2) If $l_M r_R(m^n) = Sm^n \oplus X$ for some $X \subseteq M$ as left S-modules, then

$Hom_R(m^nR,M) = S \oplus Y$ as left S-modules, where $Y = \{f \in Hom_R(m^nR,M) : f(m^n) \in X\}$.

3) Sm^n is a direct summand of $l_m r_R(m^n)$ as left S-modules if and only if S is a direct summand of $Hom_R(m^nR,M)$ as left S-modules.

Proof: The map $\theta : Hom_R(m^nR,M) \to l_M r_R(m^n)$ defined by $\theta(f) = f(m^n)$ where $f \in Hom_R(m^n,R)$. it is clear θ is an S-monomorphism. For $t \in l_M R_R(m^n)$, the map $g : m^nR \to M$ define by $g(m^n r) = tr \ \forall r \in R$. Since $r_R(t) \supset r_R(m^n)$, then $tr_1 = tr_2 \Rightarrow t(r_1 - r_2) = 0 \Rightarrow r_1 - r_2 \in r_R(t)$, since $t \in l_M R_R(m^n) \Rightarrow m^n(r_1 - r_2) = 0 \Rightarrow m^n r_1 - m^n r_2 = 0$ $\Rightarrow m^n r_1 = m^n r_2 \Rightarrow g(m^n r_1) = g(m^n r_2)$. This shows that g is well-defined, it is homomorphism. Then $g(\theta) = g(m^n) = t$. so θ is an S-isomorphism. Let $sm^n \in Sm^n$. Since $sm^n \in l_M r_R(m^n)$, therefore there exists $\varphi \in Hom_R(m^nR,M)$ such that $\theta(\varphi) = sm^n$, so $\varphi(m^n) = sm^n$. The map $\hat{\varphi} : M \to M$ define by $\hat{\varphi}(t) = st, \ \forall \ t \in M$. It is clear that $\hat{\varphi}$ is an R-homomorphism and as an extension of φ. Then $sm^n = \hat{\varphi}(m^n) = \theta(\hat{\varphi})$. This shows that $Sm^2 \subseteq \theta(S)$. other inclusion is clear. Then $Sm^2 = \theta(S)$ and $X = \theta(Y) = \{f(m^n) = f \in Y\}$.//

Corollary: Let M_R be a right R-module with $S = End(M_R)$, and let m^nR be a simple submodule of M, m ∈M. Then $l_M r_R(m^n) = Sm^n$ if and only if every R-homomorphism from m^nR to M can be extended to an endomorphism of M.

Theorem: Let M_R be GAMQ-injective module with $S = End(M_R)$. Then $Soc(M_R) \subseteq r_M(J(S))$.

Proof: Let m^nR be a simple. Suppose $am^n \neq 0$ for some $a \in J(S)$. The map $\rho : m^nR \to am^nR$ defined by $\rho(m^n r) = am^n r, \ \forall r \in R$. Since m^nR is simple and $\ker \rho = 0$, so ρ is R-epimorphism and am^nR is a simple R-module. Note that $r_R(am^n) = r_R(m^n)$ because $r_R(m^n)$ is maximal. Since M_R is GAMQ-injective, there exists a left S-module X_{am^n} such that $l_M r_R(am^n) = Sam^n \oplus X_{am^n}$. Thus $l_M r_R(m^n) = Sam^n \oplus X_{am^n}$. we write $m^n = bam^n + x$, where $b \in S, x \in X_{am^n}$. So $(1-ba)m^n = x \in X_{am^n}$. Thus $m = (1-ba)^{-1}x \in X_{am^n}$. This shows that $am^n \in Sam^n \cap X_{am^n}$, a contradiction.//

Corollary: Let R be a right mininjective ring. Then $Soc(R_R) \subseteq r_R(J(R))$.

Proof: [15]

Corollary: Let M_R be an GAMQ-injective module. If S is semi-local, then $Soc(M_R) \subseteq Soc(_S M)$.

Proof: [5]

Theorem: Let M_R be GAMQ-injective module with $S = End(M_R)$. If $a \in S$, and m^nR is simple, m ∈M. Then there exists a left S-module X_{am^n} of M such that $l_S(\ker a \cap m^nR) = (X_{am^n} : m^n)t + Sa$ and $(X_{am^n} : m^n)t \cap Sa \subset l_S(m^n)$, where $(X_{am^n} : m^n)t = \{x \in s : xm^n \in X_{am^n}\}$.

Proof: If $am^n = 0 \Rightarrow m^nR \in \ker a$, so result is clear taking $X_0 = 0$. If $am^n \neq 0$, then for any $x \in l_S(\ker a \cap m^nR)$. we have $r_R(am^n) \subseteq r_R(xm^n)$, so $xm^n \in l_M r_R(xm^n) \subset l_M r_R(am^n)$. Since m^nR is a simple. Thus $l_M r_R(m^n) = Sam^n \oplus X_{am^n}$. we write $xm^n = sam^n + y$, where $s \in S, y \in X_{am^n}$. Thus $(x - sa)m^n = y \in X_{am^n}$. So $x - sa \in \{X_{am^n} : a\}t + Sa$.

Conversely; It is clear that $Sa \subseteq l_S(\ker a \cap m^nR)$. Let $y \in \{X_{am^n} : m^n\}t$. Then $ym^n \in X_{am^n} \subseteq l_M r_R(am^n)$. If $m^n r \in \ker a \cap m^nR \Rightarrow am^n r = 0$ and so $ym^n r = 0$. Hence $y \in l_S(\ker a \cap m^nR)$. This shows that $\{X_{am^n} : m^n\}t \subseteq l_S(\ker a \bigcap m^n R)$. If $sa \in \{X_{am^n} : m^n)t \bigcap Sa$, Then $sam^n \in Sam^n \bigcap X_{am^n} = 0$. Hence $sa \in l_S(m^n)$. //

Theorem: Let M_R be GAMQ-injective module with $S = End(M_R)$. Then $J(S) \subseteq \Delta$.

Proof: Let $a \in J(S)$. If $a \notin \Delta$, then $\ker a \bigcap m^n R = 0$ for some simple submodule $m^n R$ of M, m $\in$M. So $am^n \neq 0$. The map $\rho : m^n R \to am^n R$ defined by $\rho(m^n r) = am^n r,\ \forall\, r \in R$. Since $\ker a \bigcap m^n R = 0$, so ρ is R-epimorphism and $\ker \rho = 0$, Thus $am^n R$ is a simple R-submodule of M and $r_R(am^n) = r_R(m^n)$. Note $m^n \in l_M r_R(m^n) = l_M r_R(am^n) = S(am^n) \oplus X_{am^n}$, so we write $m^n = sam^n + x$, where $s \in S, x \in X_{am^n}$. Then $am^n = asam^n + ax$, $(1-as)am^n = ax \in Sam^n \bigcap X_{am^n} = 0$. Since $a \in J(S)$, $1-as$ is invertible, therefore $am^n = 0$, a contradiction.//

Define $\hat{\Delta} = \{x \in R : r_R(x) \bigcap k^n R \neq 0$ for any simple right ideal $k^n R$ of R$\}$

Corollary: Let R be an Generalized almost mininjective ring, then $J(R) \subseteq \hat{\Delta}$.

Lemma: Let M_R be GAMQ-injective module with $S = End(M_R)$. If $a \notin \Delta$, then the inclusion $\ker a \subset \ker(a - ata)$ is strict for some $t \in S$.

Proof: If $a \notin \Delta$, then $\ker a \bigcap m^n R = 0$ for some simple submodule $m^n R$ of M. Thus $am^n R$ is a simple R-submodule of M and $r_R(am^n) = r_R(m^n)$, so $l_M r_R(am^n) = S(am^n) \oplus X_{am^n}$ as left s-modules because M_R is GAMQ-injective module. We write $m^n = sam^n + x$, where $s \in S, x \in X_{am^n}$. Then $am^n = asam^n + ax$, $(1-as)am^n = ax \in Sam^n \bigcap X_{am^n} = 0$. i.e. $(a - asa)m^n = 0$. Therefore the inclusion $\ker a \subset \ker(a - asa)$ is strict.//

Theorem: Let M_R be GAMQ-injective module with $S = End(M_R)$, and $\ker(a_1) \subseteq \ker(a_1 a_2) \subseteq \ker(a_1 a_2 a_3) \subseteq \ldots$ satisfies the ascending conditions for any sequence $a_1, a_2, a_3, \ldots \in S$, Then S/Δ is regular.

Proof: [1]

ALMOST SEMI-REGULAR

A ring R is said to be regular for any x $\in$ R there exists y $\in$ R such that x = xyx. A ring R is said to be semi regular if and only if R/J(R) is regular and idempotent lift modulo J(R). A ring R is called almost semi-regular if R/J(R) is Von-Neumann regular and idempotent lift modulo J(R), equivalently if, for any $a^n \in R$ there exists $e^2 = e \in Ra^n$ such that $a^n(1-e^2) \in J(R)$. An element m is called I- semi-regular if there exists a decomposition M = P $\oplus$ Q, where P is projective, P $\subseteq$ Rm and Rm $\cap$ Q = IM.M is called I-semi-regular module if every element of M is I-semi-regular. R is called I-semi-regular if $_R R$ is an I-semi-regular module. Note that I-semi-regular ring are left- right symmetric and R is semi-regular if and only if R is J(R)-semi-regular. An R module M is called an I-semi-perfect module if for every submodule U of M, there is a decomposition M = A $\oplus$ B such that A is projective A $\subseteq$ U and U $\cap$ B $\subseteq$ IM. A ring R is called I-semi-perfect if $_R R$ is an I-semi-perfect module. R is semi-perfect if and only if r is J(R)- semi-perfect [11].

Let M be a right R-module and $S = End_R(M)$, M is called almost semi-regular if, for any $a^n \in M$ there exists an S-module decomposition $l_M r_R(a^n) = P \oplus Q$ such that $P \subseteq S_{a^n}$ and $Q \bigcap S_{a^n} << M$. A ring R is said to be right almost semi-regular if R_R is almost semi-regular.

Lemma.4.1. Let I be an ideal of the ring R. The following conditions are equivalent for right ideal K of R;

i) $e^2 = e \in K$ with $(1-e)K \subseteq I$.

ii) $e^2 = e \in K$ with $K \bigcap (1-e)R \subseteq I$.

iii) $K = eR \oplus S$ where $e^2 = e$ and $S \subset I$.

Proof: [14].

Proposition.4.2. If R is almost semi-regular, then R is the right AGP-injective if and only if R is right AGPS-injective.

Proof: i) Necessary condition is obvious

ii) Sufficient condition; Let R is AGPS-injective and since R is a almost semi-regular, foe any $a^n \in R$, $Ra^n = Re \oplus Rb^n$, where $e^2 = e \in R$ and $b^n \in J(R)$ by definition, $l_R r_R(b^n)$ $= Rb^n \oplus X_{b^n}$ for some left ideal $X_{b^n} \in R$. Then $Ra^n \oplus Rb^n = Re \oplus Rb^n \oplus X_{b^n}$ $= l_R(1-e) \oplus l_R r_R(b^n) = l_R r_R(Re \oplus Rb^n)$ $= l_R r_R(Ra^n) = l_R r_R(a^n)$. So R is AGP-injective. //

Example: A ring R is almost semi-regular but not AGPS-injective. Let $R = \begin{bmatrix} Z_2 & Z_2 \\ 0 & Z_2 \end{bmatrix}$ is upper triangular matrix, where $\mathbf{Z_2}$ is a ring if integers mod **Z.** Then $J(R) = \begin{bmatrix} 0 & Z_2 \\ 0 & 0 \end{bmatrix}$ and $Z(R_R) = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ by the theorem (..) R is not AGPS-injective, but $R/J(R) \cong \begin{bmatrix} Z_2 & 0 \\ 0 & Z_2 \end{bmatrix}$ is Von-Neumann regular and any idempotent of R/J(R) can lifted to R, so R is almost semi-regular.

Corollary4.3. If R is almost semi-perfect and right AGPS-injective ring, then $R = R_1 \times R_2$, where R_1 is semi-simple and every simple right ideal of R_2 is nilpotent.

Proposition.4.5. Let U be an ideal of a ring R. If R is right almost generalized i-semi-regular and there exists $e^2 = e \in R$ such that $r_R(a^n) = r_R(e)$ for any $a^2 \in R$, and R is a GI-semi-regular.

Proof: Let R be right almost GI-semi-regular-injective module and there exists $e^2 = e \in R$ such that $r_R(a^n) = r_R(e)$ for any $a^2 \in R$. Let, there exists a decomposition $l_M r_R(a^n) = P \oplus Q$ such that $P \subseteq Ra^n$ and $Q \cap Ra^n \subseteq U$ as left ideal. Since $r_R(a^n) = r_R(e^2) = r_R(e)$ for some $e^2 = e \in R$, $Re = P \oplus Q$ and $a^n = a^n e$. Let $e = p + q$ where $p = ra^n \in P$ and $q \in Q$. Then $a^n = ra^n$ $= a^n ra^n + a^n q$ and $ra^n = ra^n ra^n + ra^n q$. Since $ra^n = ra^n ra^n = ra^n q \in P \cap Q = 0$. Therefore ra^n is an idempotent. Also we have $a^n(1 - ra^n) = a^n - a^n ra^n = a^n q \in Q \cap Ra^n \subset U$. Hence R is a GI-semi-regular. //

Corollary.4.6. If $l_M r_R(a^n) = 0$ is summand of R for any $a^n \in R$, and R is right almost GI-semi-regular for an ideal U, Then R is GI-semi-regular.

Proof: [11].

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KALUZA-KLEIN COSMOLOGICAL MODEL IN SAEZ-BALLESTER THEORY OF GRAVITATION

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ABSTRACT

In this paper, we have obtained the field equations in the presence of perfect fluid source distribution in Saez and Ballester theory of gravitation (Phy. Lett. 113,1985,467) with the aid of n-dimensional Kaluza-klein space time. Exact cosmological model is presented with the help $p = \gamma\rho$. *Also some physical and kinematical properties of the model are discussed.*

Key words: *PerfectFluid, Saez-Ballester theory, Kaluz ~a-klein .*

INTRODUCTION

In recent year there has been considerable interest in scalar–tensor theories of gravitation proposed by Brans and Dicke(1961), Nordtvedt (1970), Lyra(1951),Sen and Dunn(1971) and Saez and Ballester(1985). Brans-Dicke theory includes a long range scalar field interacting equally with all forms of matter (with the exception of electromagnetism) while in Saez-Ballester scalar-tensor theory the metric is coupled with a dimensionless scalar field in a simple manner. This coupling gives a satisfactory description of the weak fields.

The field equations given by Saez and Ballester(1985) for the combined
Scalar and tensor fields are

$$G_{ij} - \omega\phi^n\left(\phi_{,i}\phi_{,j} - \frac{1}{2}g_{ij}\phi_{,k}\phi^{,k}\right) = -8\pi T_{ij} \quad (1)$$

$$2\phi^n\phi^i_{;i} + n\phi^{n-1}\phi_{,k}\phi^{,k} = 0 \quad (2)$$

Where $G_{ij} = R_{ij} - \frac{1}{2}Rg_{ij}$ is the Einstein tensor, R_{ij} is the Ricci tensor, R is the scalar curvature, n an arbitrary constant , ω is a dimensionless coupling constant and T_{ij} is the matter energy-momentum tensor. Here comma and semicolon denote partial and covariant differentiation respectively.

The equation of motion

$$T^{ij}_{;j} = 0, \quad (3)$$

is a consequence of field equation (1) and (2).

A detailed discussion of Saez - Ballester and string cosmological model is contained in the work of Singh and Agrawal (1991). Shri Ram and Tiwari (1998). Reddy and Venkateswara Rao(2001), D.R.K. Reddy, CH,C.S.V.V.RMurthy, R. Venkateswarlu(2006), K.S. Adhav, A.S.Nimkar, R.L.Naidu (2007) and K.S.Adhav, V.G.mete, A.S.Nimkar and A.M.Pund (2008).

The purpose of the present work is to obtained Kaluza-klein cosmological model in a scalar tensor theory of gravitation proposed by Saez and Ballester in presence of a perfect fluid. Some physical and kinematical properties of the cosmological models are also discussed.

METRIC AND FIELD EQUATIONS

We consider the n-dimensional Kaluza Klein space time in the form

$$ds^2 = -dt^2 + a^2\sum_{i=1}^{n-2} dx_i^{\,2} + b^2 dx_{n-1}^{\,2}, \quad (4)$$

where a and b are the functions of time *'t'* only.

The energy momentum tensor for Perfect Fluid is

$$T_{ij} = (\rho + p)u_i u_j + pg_{ij}, \quad (5)$$

where p and ρ *is proper pressure and energy density of the fluid resp.*

Using the co moving coordinate system, the non-vanishing components T^i_j can be obtained as

$$T^0_0 = -\rho \quad T^1_1 = T^2_2 = ------ = T^{n-2}_{n-2} = T^{n-1}_{n-1} = p \quad (6)$$

With the help of equations (5) and (6), field equations (1),(2) and (3) for the metric (4) can be written as

$$\left(\frac{n^2-5n+6}{2}\right)\left(\frac{\dot{a}}{a}\right)^2+(n-2)\frac{\dot{a}\dot{b}}{ab}-\frac{\omega}{2}\phi^n\phi_0^2=\rho \quad (7)$$

$$(n-3)\frac{\ddot{a}}{a}+\frac{\ddot{b}}{b}+\left(\frac{n^2-7n+12}{2}\right)\left(\frac{\dot{a}}{a}\right)^2+(n-3)\frac{\dot{a}\dot{b}}{ab}+\frac{\omega}{2}\phi^n\phi_0^2=-p \quad (8)$$

$$(n-2)\frac{\ddot{a}}{a}+\left(\frac{n^2-5n+6}{2}\right)\left(\frac{\dot{a}}{a}\right)^2+\frac{\omega}{2}\phi^2\phi_0^2=-p \quad (9)$$

$$\frac{\phi_{00}}{\phi_0}+\left[(n-2)\frac{\dot{a}}{a}+\frac{\dot{b}}{b}\right]-\frac{n}{2}\frac{\phi_0^{\,2}}{\phi}=0 \quad (10)$$

$$\dot{\rho}+(n-2)(\rho+p)\frac{\dot{a}}{a}+(\rho+p))\frac{\dot{b}}{b}=0$$

(11)

Here over head dot denotes differentiation with respect to t .

SOLUTIONS OF THE MODEL

The field equations (7) to (10) are four independent equations in five unknown a,b,ϕ,ρ and p. Hence to get a determinate solutions one has to assume a physical or mathematical condition. In the literature, we have equation of state for perfect fluid model.

i.e. $p=\gamma\rho$.

here also above set of equations (7) to (10) are highly non linear therefore, we have to assume the relation between metric coefficients *a* and *b*,

$$\text{i. e.}\quad b=\mu a^n \quad (12)$$

using equation (11) for $\gamma=1$ and (12), the field equations (7) to (10) admit the exact solution

$$a=K_4(k_2t+k_3)^{\frac{1}{K_1+1}}, \quad (13)$$

$$\text{And}\quad b=k_5(k_2t+k_3)^{\frac{n}{k_1+1}}, \quad (14)$$

where, $k_4=(k_1+1)^{\frac{1}{k_1+1}}$, $k_5=k_4^n$

$$\phi=k_9\left[\frac{1}{k_7}\int\frac{k_6}{(k_2t+k_3)^{\frac{2n-2}{k_1+1}}}dt+k_8\right]^{\frac{2}{2-n}}$$

where $k_9=\left(\frac{2-n}{2}\right)^{\frac{2}{2-n}}$

Using equation (13) & (14) the equation (4) becomes

$$ds^2=-dt^2+(K_4(k_2t+k_3)^{\frac{1}{K_1+1}})\sum_{i=1}^{n-2}dx_i^{\,2}+k_5(k_2t+k_3)^{\frac{n}{k_1+1}}dx_{n-1}^{\,2}$$

After a suitable choice of coordinates and constant of integration, the above model can be written as

$$ds^2=-\frac{dT^2}{k_2^{\,2}}+k_4^{\,2}(T)^{\frac{2}{k_1+1}}\sum_{i=1}^{n-2}dx_i^{\,2}+k_5^{\,2}(T)^{\frac{2n}{k_1+1}}dx_{n-1}^2, \quad (15)$$

SOME PHYSICAL AND KINEMATICAL PARAMETERS FOR THE MODEL :-

The model (15) represents an exact cosmological model in the frame

Work of Saez-Ballester theory of gravitation.

The physical quantities that are important in cosmology are proper volume , expansion scalar , shear scalar. They have the following expression for the model (15) :

$$\text{Proper Volume } V^3=\sqrt{-g}=k_9T^{\frac{2n-2}{k_1+1}} \quad (16)$$

$$\text{ExpansionScalar}(\theta)=\frac{2k_2(n-1)}{3(k_1+1)}\frac{1}{T} \quad (17)$$

$$\text{Shearscalar}(\sigma^2)=\frac{2(n-1)^3k_2^2}{27(k_1+1)^2}\frac{1}{T^2} \quad (18)$$

$$\text{Deceleration parameter }(q)==+ve \quad (19)$$

Case II: $\gamma=1$

$$\text{ie..}\quad p=\rho \quad (20)$$

In this case, again similar result is obtained and value of

$$p=\rho=\frac{c_4}{(k_2t+k_3)^{c_3}} \quad (21)$$

Some physical and kinematical parameters for the model (15) are

$$\text{ProperVolume}\,V^3=\sqrt{-g}=k_8(T)^{\frac{2(n-i)}{k_1+1}}$$

$$k_8=(k_4)^{n-2}_{k_5} \quad (22)$$

$$\text{ExpansionScalar}(\theta)=\left(\frac{2n-2}{3}\right)\left(\frac{k_2}{k_1+1}\right)\frac{1}{T}$$

Shearscalar $\left(\sigma^2\right)=k_9\dfrac{1}{T^2}$ (23)

Deceleration parameter $\left(q\right) == +ve$

The model (15) has no initial singularity, while the energy density and pressure are zero. For the model (15), the expansion scalar θ and shear scalar σ^2 tends to zero as $T \to \infty$. The positive values of the deceleration parameter indicates that the model decelerates in the standard way.

Also, since $\lim\limits_{T\to\infty}\left(\dfrac{\sigma}{\theta}\right) \neq 0$

The model does not approach isotropy for large values of *T*.

CONCLUSION

In this paper, we have studied n-dimensional Kaluza-Klein cosmological model in the presence of perfect fluid in Saez-Ballester scalar tensor theory of gravitation. For solving the field equations we have assumed the relation between metric coefficients and equation of state. The cosmological model, thus obtained are free from initial singularities and they are expanding, anisotropic, shearing, non rotating and decelerate in standard way. Also, we find all the physical quantities like pressure and density.

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PLANE SYMMETRIC UNIVERSE FILLED WITH SCALAR FIELD COUPLED WITH ELECTROMAGNETIC FIELDS IN $f(R,T)$ THEORY OF GRAVITATION

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ABSTRACT

In $f(R,T)$ theory of gravity, we have studied the interacting scalar and electromagnetic fields in plane symmetric universe, by considering the general cases $f(R,T)=f_1(R)+\lambda f_2(T)$, $f(R,T)=f_1(R)f_2(T)$ and $f(R)$ theory and its particular cases $f(R,T)=R+\lambda T$, $f(R,T)=RT$, $f(R)=R$. It is observe that, even though the cases of $f(R,T)$ are distinct, the convergent, non-singular and isotropic solution of metric functions can be evolved in each case along with the components of vector potential, corresponding to suitable integrable function.

Keywords: *Plane symmetric universe, Scalar field, electromagnetic field, $f(R,T)$ theory of gravity, isotropy*
AMS Subject Classification: *83C, 83F, 85A*

INTRODUCTION

Cosmological data from wide range of source have indicated that our universe is undergoing an accelerating expansion [1-5]. To explain this fact, two alternative theories are proposed: one concept of dark energy and other the amendment of general relativity leading to $f(R)$ and $f(R,T)$ theories [6-8] where R stands for Ricci scalar $R=g^{ij}R_{ij}$, R_{ij} being Ricci tensor $T=g^{ij}T_{ij}$,T_{ij} being energy momentum tensor derived from Lagrangian. The field equations of $f(R,T)$ theories due to Harko [8] are deduced by varying the action

$$s=\int f(R,T)\sqrt{-g}d^4x+\int L_m\sqrt{-g}d^4x \qquad (1.1)$$

Where L_m is lagrangian and the other symbols have their usual meaning. Energy momentum tensor is given by

$$T_{ij}=L_m g_{ij}-2\frac{\delta L_m}{\delta g^{ij}} \qquad (1.2)$$

Varying the action (1.1) with respect to g^{ij} which yields as

$$\delta s=\frac{1}{2\chi}\int\left\{f(R,T)\frac{\delta R}{\delta g^{ij}}+f_T(R,T)\frac{\delta T}{\delta g^{ij}}+\frac{f(R,T)}{\sqrt{-g}}\frac{\delta(\sqrt{-g})}{\delta g^{ij}}+\frac{2\chi}{\sqrt{-g}}\left(\frac{\delta(L_m\sqrt{-g})}{\delta g^{ij}}\right)\right\}\sqrt{-g}\,d^4x \qquad (1.3)$$

Here we define $\theta_{ij}=g^{\alpha\beta}\frac{\delta T_{\alpha\beta}}{\delta g^{ij}}$ (1.4) By defining the generalized kronecker symbol $\frac{\delta g^{\alpha\beta}}{\delta g^{ij}}=\delta_i^\alpha\delta_j^\beta$ we can reduce

$$\frac{\delta g^{\alpha\beta}}{\delta g^{ij}}T_{\alpha\beta}=\delta_i^\alpha\delta_j^\beta T_{\alpha\beta}$$

$$=g^{p\alpha}g_{pi}g^{q\beta}g_{qj}T_{\alpha\beta}=T_{ij}$$

Using above equations we can write

$$\frac{\delta T}{\delta g^{ij}}=\frac{\delta(g^{\alpha\beta}T_{\alpha\beta})}{\delta g^{ij}}=\frac{\delta g^{\alpha\beta}}{\delta g^{ij}}T_{\alpha\beta}+g^{\alpha\beta}\frac{\delta T_{\alpha\beta}}{\delta g^{ij}}=T_{ij}+\theta_{ij}$$

integrating (1.3) we can obtain

$$f_R(R,T)R_{ij}-\frac{1}{2}f(R,T)g_{ij}+\left(g_{ij}\Box-\nabla_i\nabla_j\right)f_R(R,T)=\chi T_j-f_T(R,T)\left[T_{ij}+\theta_{ij}\right] \qquad (1.5)$$

This can be further written as

$$f_R(R,T)G_{ij}+\frac{1}{2}[f_R(R,T)R-f(R,T)]g_{ij}+g_{ij}\Box f_R(R,T)-\nabla_i\nabla_j f_R(R,T)=\chi T_{ij}-f_T(R,T)\left[T_{ij}+\theta_{ij}\right] \qquad (1.6)$$

where $G_{ij}=R_{ij}-\frac{1}{2}Rg_{ij}$

Taking trace of (1.5) we obtain

$$\Box f_R(R,T)=\frac{2}{3}f(R,T)-\frac{1}{3}f_R(R,T)R+\frac{\chi}{3}T-\frac{1}{3}f_T(R,T)[T+\theta] \qquad (1.7)$$

Inserting (1.7) in (1.6) we can reorganized in the form

$$G_j^\mu=\frac{1}{f_R(R,T)}\left[g^{i\mu}\nabla_i\nabla_j f_R(R,T)\right]-\frac{1}{6f_R(R,T)}[f_R(R,T)R+f(R,T)]g_j^\mu+\frac{\chi}{f_R(R,T)}\left[T_j^\mu-\frac{1}{3}Tg_j^\mu\right]+\frac{1}{3}\frac{f_T(R,T)}{f_R(R,T)}[T+\theta]g_j^\mu-\frac{f_T(R,T)}{f_R(R,T)}\left[T_j^\mu+\theta_j^\mu\right] \qquad (1.8)$$

Let us now calculate the tensor θ_{ij} .Varying (1.2) with respect to metric tensor g^{ij} and using the definition (1.4) we obtain

$$\theta_{ij}=-T_{ij}+2\left[\frac{\delta L_m}{\delta g^{ij}}-g^{\alpha\beta}\frac{\delta^2L_m}{\delta g^{ij}\delta g^{\alpha\beta}}\right] \qquad (1.9)$$

With this background, in this paper we discover the plane symmetric space-time with interacting scalar field with electromagnetic one.

2. Matter field Lagrangian L_m

The electromagnetic field tensor is given by

$$F_{ij} = \frac{\partial V_i}{\partial x^j} - \frac{\partial V_j}{\partial x^i},$$

where V_i is electromagnetic four potential.

The aforesaid the matter Lagrangian can be expressed as in [9]

$$L_m = \left[\frac{1}{4} F_{\eta\tau} F^{\eta\tau} - \frac{1}{2} \varphi_{,\eta} \varphi^{,\eta} \psi\right] \qquad (2.1)$$

where $\psi = \psi(I), \quad I = V_i V^i$

The function ψ characterizes the interaction between the scalar φ and electromagnetic field [10].

Then energy momentum tensor in (1.2) can conveniently be expressed in the mixed form.

$$T_j^\mu = \left(F_\alpha^\mu F_j^\alpha + \frac{1}{4} g_j^\mu F_{\alpha\beta} F^{\alpha\beta}\right) - \left[\frac{1}{2}\psi g_j^\mu - \dot{\psi} V^\mu V_j\right] \varphi_{,\eta} \varphi^{,\eta} + \psi \varphi^{,\mu} \varphi_{,j} \qquad (2.2)$$

Similarly from (1.9) we can have tensor θ_j^i as

$$\theta_j^i = -T_j^i - (\psi - I\dot{\psi}) \varphi^{,i} \varphi_{,j} + I\ddot{\psi} \varphi_{,\eta} \varphi^{,\eta} V^i V_j \qquad (2.3)$$

Then the equations (2.2) and (2.3), after contraction yield

$$T = -(\psi - I\dot{\psi}) \varphi_{,\eta} \varphi^{,\eta} \qquad (2.4)$$

$$\theta = I^2 \ddot{\psi} \varphi_{,\eta} \varphi^{,\eta} \qquad (2.5)$$

3. Plane symmetric space-time

We consider the plane symmetric space-time specified by

$$ds^2 = dt^2 - A^2(dx^2 + dy^2) - B^2 dz^2 \qquad (3.1)$$

where A and B are function of t alone

The non-vanishing components of Einstein tensors are

$$G_1^1 = -\frac{\ddot{A}}{A} - \frac{\ddot{B}}{B} - \frac{\dot{A}\dot{B}}{AB}, \quad G_2^2 = -\frac{\ddot{A}}{A} - \frac{\ddot{B}}{B} - \frac{\dot{A}\dot{B}}{AB}, \quad G_3^3 = -2\frac{\ddot{A}}{A} - \left(\frac{\dot{A}}{A}\right)^2$$

$$G_4^4 = -\left(\frac{\dot{A}}{A}\right)^2 - 2\frac{\dot{A}\dot{B}}{AB}$$

Electromagnetic field tensor F_{ij}

To achieve the compatibility with the non-static space time (3.1), we assume the electromagnetic vector potential in the form

$$V_i = [V_1(t), V_2(t), V_3(t), V_4(t)] \qquad (3.2)$$

Then we can deduce easily the following

$$I = V_i V^i = -\left[\frac{{V_1}^2}{A^2} + \frac{{V_2}^2}{A^2} + \frac{{V_3}^2}{B^2} - {V_4}^2\right] \qquad (3.3)$$

$$F_{14} = \dot{V}_1, F_{24} = \dot{V}_2, F_{34} = \dot{V}_3 \qquad (3.4)$$

$$F_{ij} F^{ij} = -2\left[\frac{{\dot{V}_1}^2}{A^2} + \frac{{\dot{V}_2}^2}{A^2} + \frac{{\dot{V}_3}^2}{B^2}\right] \qquad (3.5)$$

$$\varphi_i \varphi^i = \dot{\varphi}^2 \qquad (3.6)$$

With these quantities at our disposal the components of energy momentum tensors from 9 (2.2) becomes

$$T_1^1 = \frac{1}{2}\frac{{\dot{V}_1}^2}{A^2} - \frac{1}{2}\frac{{\dot{V}_2}^2}{A^2} - \frac{1}{2}\frac{{\dot{V}_3}^2}{B^2} - \frac{1}{2}\psi\dot{\varphi}^2 - \dot{\psi}\dot{\varphi}^2 \frac{{V_1}^2}{A^2} \qquad (3.7a)$$

$$T_2^1 = \frac{\dot{V}_1 \dot{V}_2}{A^2} - \dot{\psi}\dot{\varphi}^2 \frac{v_1 V_2}{A^2} \qquad (3.7b)$$

$$T_3^1 = \frac{\dot{V}_1 \dot{V}_3}{A^2} - \dot{\psi}\dot{\varphi}^2 \frac{V_1 V_3}{A^2} \qquad (3.7c)$$

$$T_2^2 = -\frac{1}{2}\frac{{\dot{V}_1}^2}{A^2} + \frac{1}{2}\frac{{\dot{V}_2}^2}{A^2} - \frac{1}{2}\frac{{\dot{V}_3}^2}{B^2} - \frac{1}{2}\psi\dot{\varphi}^2 - \dot{\psi}\dot{\varphi}^2 \frac{{V_2}^2}{A^2} \qquad (3.7d)$$

$$T_3^2 = \frac{\dot{V}_2 \dot{V}_3}{A^2} - \dot{\psi}\dot{\varphi}^2 \frac{V_2 V_3}{A^2} \qquad (3.7e)$$

$$T_3^3 = -\frac{1}{2}\frac{{\dot{V}_1}^2}{A^2} - \frac{1}{2}\frac{{\dot{V}_2}^2}{A^2} + \frac{1}{2}\frac{{\dot{V}_3}^2}{B^2} - \frac{1}{2}\psi\dot{\varphi}^2 - \dot{\psi}\dot{\varphi}^2 \frac{{V_3}^2}{B^2} \qquad (3.7f)$$

$$T_4^4 = \frac{1}{2}\frac{{\dot{V}_1}^2}{A^2} + \frac{1}{2}\frac{{\dot{V}_2}^2}{A^2} + \frac{1}{2}\frac{{\dot{V}_3}^2}{B^2} + \frac{1}{2}\psi\dot{\varphi}^2 + \dot{\psi}\dot{\varphi}^2 {V_4}^2 \qquad (3.7g)$$

$$T = -(\psi - I\dot{\psi})\dot{\varphi}^2 \qquad (3.7h)$$

Similarly the components of tensors θ_j^μ from (2.3) assume the values

$$\theta_1^1 = -T_1^1 - I\ddot{\psi}\dot{\varphi}^2 \frac{{V_1}^2}{A^2} \qquad (3.8a)$$

$$\theta_2^1 = -T_2^1 - I\ddot{\psi}\dot{\varphi}^2 \frac{V_1 V_2}{A^2} \qquad (3.8b)$$

$$\theta_3^1 = -T_3^1 - I\ddot{\psi}\dot{\varphi}^2 \frac{V_1 V_3}{A^2} \qquad (3.8c)$$

$$\theta_2^2 = -T_2^2 - I\ddot{\psi}\dot{\varphi}^2 \frac{{V_2}^2}{A^2} \qquad (3.8d)$$

$$\theta_3^2 = -T_3^2 - I\ddot{\psi}\dot{\varphi}^2 \frac{V_2 V_3}{A^2} \qquad (3.8e)$$

$$\theta_3^3 = -T_3^3 - I\ddot{\psi}\dot{\varphi}^2 \frac{{V_3}^2}{B^2} \qquad (3.8f)$$

$$\theta_4^4 = -T_4^4 - (\psi - I\dot{\psi}) + I\ddot{\psi}\dot{\varphi}^2 {V_4}^2 \qquad (3.8g)$$

$$\theta = I^2 \ddot{\psi}\dot{\varphi}^2 \qquad (3.8h)$$

Variation of Lagrangian in (2.1) with respect to electromagnetic field as in [9] gives

$$\frac{1}{\sqrt{-g}}\frac{\partial}{\partial x^j}\left(\sqrt{-g} F^{ij}\right) - (\varphi_{,j}\varphi^{,j})\dot{\psi} V^i = 0$$

where $\dot{\psi} = \frac{\partial \psi}{\partial I}$

for i=1,j=4 $\Rightarrow \left(\frac{\dot{V}_1}{V_1}\right)^{\cdot} + \frac{{\dot{V}_1}^2}{{V_1}^2} + \frac{\dot{V}_1}{V_1}\left[\frac{\dot{B}}{B}\right] - \dot{\psi}\dot{\varphi}^2 = 0$ (3.9a)

for i=2, j=4 $\Rightarrow \left(\frac{\dot{V}_2}{V_2}\right)^{\cdot} + \frac{{\dot{V}_2}^2}{{V_2}^2} + \frac{\dot{V}_2}{V_2}\left[\frac{\dot{B}}{B}\right] - \dot{\psi}\dot{\varphi}^2 = 0$ (3.9b)

for i=3,j=4 $\Rightarrow \left(\frac{\dot{V}_3}{V_3}\right)^{\cdot} + \frac{{\dot{V}_3}^2}{{V_3}^2} + \frac{\dot{V}_3}{V_3}\left[2\frac{\dot{A}}{A} - \frac{\dot{B}}{B}\right] - \dot{\psi}\dot{\varphi}^2 = 0$ (3.9c)

for i=4, j=4 $\Rightarrow \quad V_4 = 0$ (3.9d)

Since the expression of the Einstein tensor in (1.8) is complicated, the solution of the Einstein's field equation in general cannot be obtained. With this reality we take recourse to the particular cases of the function $f(R, T)$ and there upon try to obtain the solution.

4. Sub case $f(R, T) = f_1(R) + \lambda f_2(T)$

Here we follow the notations

$f_R(R,T) = \frac{\partial f(R,T)}{\partial R} = \dot{f}_1(R)$, $f_T(R,T) = \frac{\partial f(R,T)}{\partial T} = \lambda \dot{f}_2(T)$

Then (1.8) reduces to the form

$$G_j^\mu = \frac{1}{\dot{f}_1(R)}\left[g^{i\mu}\nabla_i\nabla_j \dot{f}_1(R)\right] - \frac{1}{6\dot{f}_1(R)}\left[\dot{f}_1(R)R + f_1(R) + \lambda f_2(T)\right]g_j^\mu + \frac{\chi}{\dot{f}_1(R)}\left[T_j^\mu - \frac{1}{3}Tg_j^\mu\right] + \frac{\lambda}{3}\frac{\dot{f}_2(T)}{\dot{f}_1(R)}[T+\theta]g_j^\mu - \frac{\lambda \dot{f}_2(T)}{\dot{f}_1(R)}\left[T_j^\mu + \theta_j^\mu\right] \quad (4.1)$$

Since for the space-time (3.1) $G_2^1 = 0, G_3^1 = 0, G_3^2 = 0$, by using (3.7) and (3.8), the field equations (4.1) yield

$$\frac{\dot{V}_1}{V_1}\frac{\dot{V}_2}{V_2} = \dot{\psi}\dot{\varphi}^2 - \frac{\lambda}{\chi}\dot{f}_2(T)I\ddot{\psi}\dot{\varphi}^2 \quad (4.2a)$$

$$\frac{\dot{V}_1}{V_1}\frac{\dot{V}_3}{V_3} = \dot{\psi}\dot{\varphi}^2 - \frac{\lambda}{\chi}\dot{f}_2(T)I\ddot{\psi}\dot{\varphi}^2 \quad (4.2b)$$

$$\frac{\dot{V}_2}{V_2}\frac{\dot{V}_3}{V_3} = \dot{\psi}\dot{\varphi}^2 - \frac{\lambda}{\chi}\dot{f}_2(T)I\ddot{\psi}\dot{\varphi}^2 \quad (4.2c)$$

From (4.2) we can write

$$\frac{\dot{V}_1}{V_1}\frac{\dot{V}_2}{V_2} = \frac{\dot{V}_2}{V_2}\frac{\dot{}_3}{V_3} = \frac{\dot{V}_1}{V_1}\frac{\dot{V}_3}{V_3} = \dot{\psi}\dot{\varphi}^2 - \frac{\lambda}{\chi}\dot{f}_2(T)I\ddot{\psi}\dot{\varphi}^2 \quad (4.3)$$

Further we can rewrite it as

$$\frac{\dot{V}_1}{V_1} = \frac{\dot{V}_2}{V_2} = \frac{\dot{V}_3}{V_3} \equiv \frac{\dot{h}_1}{h_1}, \text{ say} \quad (4.4)$$

where h_1 some unknown function of t

Inserting (4.4) in (4.3) we obtain

$$\left(\frac{\dot{h}_1}{h_1}\right)^2 = \left(\frac{\dot{h}_1}{h_1}\right)^2 = \left(\frac{\dot{h}_1}{h_1}\right)^2 = \dot{\psi}\dot{\varphi}^2 - \frac{\lambda}{\chi}\dot{f}_2(T)I\ddot{\psi}\dot{\varphi}^2 \quad (4.5)$$

Integrating (4.4) we obtain

$$V_1 = k_1 h_1, \quad V_2 = k_2 h_1, \quad V_3 = k_3 h_1 \quad (4.6)$$

where k_1, k_2, k_3 are constants of integration.

Now our plan is to express the components of T_j^i in (3.7) in terms of T_4^4. For this we consider the expression

$$\frac{\dot{V_1}^2}{A^2} + \frac{\dot{V_2}^2}{A^2} + \frac{\dot{V_3}^2}{B^2} = \left[\frac{V_1^2}{A^2} + \frac{V_2^2}{A^2} + \frac{V_3^2}{B^2}\right]\left(\frac{\dot{h}_1}{h_1}\right)^2 \text{ by (4.4)}$$

$$= -I\left(\frac{\dot{h}_1}{h_1}\right)^2 \text{ by (3.3) and (3.9d)} \quad = \frac{\lambda}{\chi}\dot{f}_2(T)I^2\ddot{\psi}\dot{\varphi}^2 - I\dot{\psi}\dot{\varphi}^2 \text{ by (4.5)} \quad (4.7)$$

We attempt to express the components of T_j^i in (3.7) in terms of T_4^4 by using (4.4), (4.5) and (4.7)

$$T_4^4 = \frac{1}{2}\psi\dot{\varphi}^2 - \frac{1}{2}I\dot{\psi}\dot{\varphi}^2 + \frac{1}{2}\frac{\lambda}{\chi}\dot{f}_2(T)I^2\ddot{\psi}\dot{\varphi}^2 \quad (4.8a)$$

$$T_1^1 = -T_4^4 - \frac{\lambda}{\chi}\dot{f}_2(T)I\ddot{\psi}\dot{\varphi}^2\frac{V_1^2}{A^2} \quad (4.8b)$$

$$T_2^2 = -T_4^4 - \frac{\lambda}{\chi}\dot{f}_2(T)I\ddot{\psi}\dot{\varphi}^2\frac{V_2^2}{A^2} \quad (4.8c)$$

$$T_3^3 = -T_4^4 - \frac{\lambda}{\chi}\dot{f}_2(T)I\ddot{\psi}\dot{\varphi}^2\frac{V_3^2}{B^2} \quad (4.8d)$$

$$T = -(\psi - I\dot{\psi})\dot{\varphi}^2 \quad (4.8e)$$

In view of the expression of G_1^1, G_2^2, G_3^3 from (4.1) we deduce

$$-\frac{\ddot{A}}{A} - \frac{\ddot{B}}{B} - \frac{\dot{A}\dot{B}}{AB} = -\frac{\dot{A}}{A}\frac{\ddot{f}_1(R)}{\dot{f}_1(R)}\frac{dR}{dt} - \frac{1}{6\dot{f}_1(R)}\left[\dot{f}_1(R)R + f_1(R) + \lambda f_2(T)\right] + \frac{\chi}{\dot{c}_1(R)}\left[T_1^1 - \frac{1}{3}T\right] + \frac{\lambda}{3}\frac{\dot{f}_2(T)}{\dot{f}_1(R)}[T+\theta] - \frac{\lambda \dot{f}_2(T)}{\dot{f}_1(R)}[T_1^1 + \theta_1^1] \quad (4.9a)$$

$$-\frac{\ddot{A}}{A} - \frac{\ddot{B}}{B} - \frac{\dot{A}\dot{B}}{AB} = -\frac{\dot{A}}{A}\frac{\ddot{f}_1(R)}{\dot{f}_1(R)}\frac{dR}{dt} - \frac{1}{6\dot{f}_1(R)}\left[\dot{f}_1(R)R + f_1(R) + \lambda f_2(T)\right] + \frac{\chi}{\dot{f}_1(R)}\left[T_2^2 - \frac{1}{3}T\right] + \frac{\lambda}{3}\frac{\dot{f}_2(T)}{\dot{f}_1(R)}[T+\theta] - \frac{\lambda \dot{f}_2(T)}{\dot{f}_1(R)}[T_2^2 + \theta_2^2] \quad (4.9b)$$

$$-2\frac{\ddot{A}}{A} - \left(\frac{\dot{A}}{A}\right)^2 = -\frac{\dot{B}}{B}\frac{\ddot{f}_1(R)}{\dot{D}_1(R)}\frac{dR}{dt} - \frac{1}{6\dot{f}_1(R)}\left[\dot{f}_1(R)R + f_1(R) + \lambda f_2(T)\right] + \frac{\chi}{\dot{f}_1(R)}\left[T_3^3 - \frac{1}{3}T\right] + \frac{\lambda}{3}\frac{\dot{f}_2(T)}{\dot{f}_1(R)}[T+\theta] - \frac{\lambda \dot{f}_2(T)}{\dot{f}_1(R)}[T_3^3 + \theta_3^3] \quad (4.9c)$$

Subtracting (4.9b) from (4.9a), (4.9c) from (4.9b) and (4.9a) from (4.9c) we get

$$\frac{\ddot{A}}{A} - \frac{\ddot{B}}{B} + \frac{\dot{A}}{A}\left[\frac{\dot{A}}{A} - \frac{\dot{B}}{B}\right] + \left(\frac{\dot{A}}{A} - \frac{\dot{B}}{B}\right)\frac{\ddot{f}_1(R)}{\dot{f}_1(R)}\frac{dR}{dt} = \frac{\chi}{\dot{f}_1(R)}[T_2^2 - T_3^3] + \frac{\lambda \dot{f}_2(T)}{\dot{f}_1(R)}[(T_3^3 + \theta_3^3) - (T_2^2 + \theta_2^2)] \quad (4.10a)$$

$$\frac{\ddot{B}}{B} - \frac{\ddot{A}}{A} + \frac{\dot{A}}{A}\left[\frac{\dot{B}}{B} - \frac{\dot{A}}{A}\right] + \left(\frac{\dot{B}}{B} - \frac{\dot{A}}{A}\right)\frac{\ddot{f}_1(R)}{\dot{f}_1(R)}\frac{dR}{dt} = \frac{\chi}{\dot{f}_1(R)}[T_3^3 - T_1^1] + \frac{\lambda \dot{f}_2(T)}{\dot{f}_1(R)}[(T_1^1 + \theta_1^1) - (T_3^3 + \theta_3^3)] \quad (4.10b)$$

Using (4.8) and (3.8) the equation (4.10) reduces to

$$\frac{\ddot{A}}{A} - \frac{\ddot{B}}{B} + \frac{\dot{A}}{A}\left[\frac{\dot{A}}{A} - \frac{\dot{B}}{B}\right] + \left(\frac{\dot{A}}{A} - \frac{\dot{B}}{B}\right)\frac{\ddot{f}_1(R)}{\dot{f}_1(R)}\frac{dR}{dt} = 0 \quad (4.11a)$$

$$\frac{\ddot{B}}{B} - \frac{\ddot{A}}{A} + \frac{\dot{A}}{A}\left[\frac{\dot{B}}{B} - \frac{\dot{A}}{A}\right] + \left(\frac{\dot{B}}{B} - \frac{\dot{A}}{A}\right)\frac{\ddot{f}_1(R)}{\dot{f}_1(R)}\frac{dR}{dt} = 0 \quad (4.11b)$$

Upon Integration of the equations (4.11) we obtain

$$\frac{A}{B} = k_5 exp\left\{k_4 \int \frac{1}{A^2 B \dot{f}_1(R)}dt\right\} \quad (4.12a)$$

$$\frac{B}{A} = k_7 exp\left\{k_6 \int \frac{1}{A^2 B \dot{f}_1(R)}dt\right\} \quad (4.12b)$$

The equations in (4.12) can be reformulated explicitly as follows

$$A = (A^2B)^{\frac{1}{3}} k_9 exp\left\{k_8 \int \frac{1}{A^2 B \dot{f}_1(R)}dt\right\} \quad (4.13a)$$

$$B = (A^2B)^{\frac{1}{3}} k_{11} exp\left\{k_{10} \int \frac{1}{A^2 B \dot{f}_1(R)}dt\right\} \quad (4.13b)$$

Where k_4 to k_{11} are constants of integration subject to the condition $k_5 k_7 = 1$ and $k_4 + k_6 = 0$

Using (4.4) we can write the equations (3.9) as

$$\left(\frac{\dot{h}_1}{h_1}\right)^{\cdot} + \frac{\dot{h_1}^2}{h_1^2} + \frac{\dot{h}_1}{h_1}\left[\frac{\dot{B}}{B}\right] - \dot{\psi}\dot{\varphi}^2 = 0 \quad (4.14a)$$

$$\left(\frac{\dot{h}_1}{h_1}\right)^{\cdot} + \frac{\dot{h_1}^2}{h_1^2} + \frac{\dot{h}_1}{h_1}\left[\frac{\dot{B}}{B}\right] - \dot{\psi}\dot{\varphi}^2 = 0 \quad (4.14b)$$

$$\left(\frac{\dot{h}_1}{h_1}\right)^{\cdot} + \frac{\dot{h_1}^2}{h_1^2} + \frac{\dot{h}_1}{h_1}\left[2\frac{\dot{A}}{A} - \frac{\dot{B}}{B}\right] - \dot{\psi}\dot{\varphi}^2 = 0 \quad (4.14c)$$

These equations further imply

$$\frac{\dot{A}}{A} = \frac{\dot{B}}{B} \quad (4.15)$$

Inserting (4.15) in (4.14) we get

$$\left(\frac{\dot{h}_1}{h_1}\right)^{\cdot} + \frac{\dot{h}_1{}^2}{h_1{}^2} + \frac{\dot{h}_1}{h_1}\left[\frac{\dot{B}}{B}\right] - \dot{\psi}\dot{\varphi}^2 = 0 \qquad (4.16)$$

But from (4.5) we have

$$\dot{\psi}\dot{\varphi}^2 = \left(\frac{\dot{h}_1}{h_1}\right)^2 + \frac{\lambda}{\chi}\dot{f}_2(T)I\ddot{\psi}\dot{\varphi}^2 \qquad (4.17)$$

Inserting (4.17) in (4.16) we obtain

$$\left(\frac{\dot{h}_1}{h_1}\right)^{\cdot} + \frac{\dot{h}_1}{h_1}\left[\frac{\dot{B}}{B}\right] = \frac{\lambda}{\chi}\dot{f}_2(T)I\ddot{\psi}\dot{\varphi}^2 \qquad (4.18)$$

If we confine to the linearity of ψ i.e. ($\psi = k_{12}I + k_{13}$) then equation (4.18) has perfect solution

$$h_1 = k_{15}exp\left\{k_{14}\int \frac{1}{B}dt\right\} \qquad (4.19)$$

With the help of (4.19) the equation (4.6) convert in to

$$V_1 = k_{16}exp\left\{k_{14}\int \frac{1}{B}dt\right\} \qquad (4.20a)$$

$$V_2 = k_{17}exp\left\{k_{14}\int \frac{1}{B}dt\right\} \qquad (4.20b)$$

$$V_3 = k_{18}exp\left\{k_{14}\int \frac{1}{B}dt\right\} \qquad (4.20c)$$

where k_{12} to k_{18} are constants of integration.

5. Sub case $f(R,T) = f_1(R)f_2(T)$

In this case we follow the notations

$$f_R(R,T) = \frac{\partial f(R,T)}{\partial R} = \dot{f}_1(R)f_2(T) \quad ,$$

$$f_T(R,T) = \frac{\partial f(R,T)}{\partial T} = f_1(R)\dot{f}_2(T)$$

Then the field equation (1.8) reduces to

$$G^i_j = \frac{1}{\dot{f}_1(R)f_2(T)}\left[g^{im}\nabla_m\nabla_j\dot{f}_1(R)f_2(T)\right] - \frac{1}{6\dot{f}_1(R)f_2(T)}\left[\dot{f}_1(R)f_2(T)R + f_1(R)f_2(T)\right]g^i_j + \frac{\chi}{\dot{f}_1(R)f_2(T)}\left[T^i_j - \frac{1}{3}Tg^i_j\right] + \frac{1}{3}\frac{f_1(R)\dot{f}_2(T)}{\dot{f}_1(R)f_2(T)}[T+\theta]g^i_j - \frac{f_1(R)\dot{f}_2(T)}{\dot{f}_1(R)f_2(T)}\left[T^i_j + \theta^i_j\right] \qquad (5.1)$$

We consider the vanishing components of Einstein tensor G^1_2, G^1_3, G^2_3 from (5.1) and by using (3.7) and (3.8) we have

$$\frac{\dot{V}_1\dot{V}_2}{V_1V_2} = \dot{\psi}\dot{\varphi}^2 - \frac{f_1(R)\dot{f}_2(T)}{\chi}I\ddot{\psi}\dot{\varphi}^2 \qquad (5.2a)$$

$$\frac{\dot{V}_1\dot{V}_3}{V_1V_3} = \dot{\psi}\dot{\varphi}^2 - \frac{f_1(R)\dot{f}_2(T)}{\chi}I\ddot{\psi}\dot{\varphi}^2 \qquad (5.2b)$$

$$\frac{\dot{V}_2\dot{V}_3}{V_2V_3} = \dot{\psi}\dot{\varphi}^2 - \frac{f_1(R)\dot{f}_2(T)}{\chi}I\ddot{\psi}\dot{\varphi}^2 \qquad (5.2c)$$

From (5.2) we can write it as

$$\frac{\dot{V}_1\dot{V}_2}{V_1V_2} = \frac{\dot{V}_2\dot{V}_3}{V_2V_3} = \frac{\dot{V}_1\dot{V}_2}{V_1V_2} = \dot{\psi}\dot{\varphi}^2 - \frac{f_1(R)\dot{f}_2(T)}{\chi}I\ddot{\psi}\dot{\varphi}^2 \qquad (5.3)$$

or $\frac{\dot{V}_1}{V_1} = \frac{\dot{V}_2}{V_2} = \frac{\dot{V}_2}{V_2} \equiv \frac{\dot{h}_7}{h_7}$, say (5.4)

where h_7 is some unknown function of t.

Inserting (5.4) in (5.3) we get

$$\left(\frac{\dot{h}_7}{h_7}\right)^2 = \left(\frac{\dot{h}_7}{h_7}\right)^2 = \left(\frac{\dot{h}_7}{h_7}\right)^2 = \dot{\psi}\dot{\varphi}^2 - \frac{f_1(R)\dot{f}_2(T)}{\chi}I\ddot{\psi}\dot{\varphi}^2 \qquad (5.5)$$

Integrating (5.4) with respect to t we get

$$V_1 = m_1h_7 \qquad V_2 = m_2h_7 \qquad V_3 = m_3h_7 \quad (5.6)$$

where m_1, m_2, m_3 are constants of integration

Now our plan is to express the components of T^i_j in (3.7) in terms of T^4_4. For this we consider the expression

$$\frac{\dot{V}_1{}^2}{A^2} + \frac{\dot{V}_2{}^2}{A^2} + \frac{\dot{V}_3{}^2}{B^2} = \left[\frac{V_1{}^2}{A^2} + \frac{V_2{}^2}{A^2} + \frac{V_3{}^2}{B^2}\right]\left(\frac{\dot{h}_7}{h_7}\right)^2 \quad \text{by (5.4)}$$

$$= -I\left(\frac{\dot{h}_7}{h_7}\right)^2 \quad \text{by (3.3) and (3.9d)}$$

$$= \frac{f_1(R)\dot{f}_2(T)}{\chi}I^2\ddot{\psi}\dot{\varphi}^2 - I\dot{\psi}\dot{\varphi}^2 \quad \text{by (5.5)} \qquad (5.7)$$

We attempt to express the components of T^i_j in (3.7) in terms of T^4_4 by using (5.4), (5.5) and (5.7)

$$T^4_4 = \frac{1}{2}\psi\dot{\varphi}^2 - \frac{1}{2}I\dot{\psi}\dot{\varphi}^2 + \frac{1}{2}\frac{f_1(R)\dot{f}_2(T)}{\chi}I^2\ddot{\psi}\dot{\varphi}^2 \quad (5.8a)$$

$$T^1_1 = -T^4_4 - \frac{f_1(R)\dot{f}_2(T)}{\chi}I\ddot{\psi}\dot{\varphi}^2\frac{V_1{}^2}{A^2} \qquad (5.8b)$$

$$T^1_2 = -\frac{f_1(R)\dot{f}_2(T)}{\chi}I\ddot{\psi}\dot{\varphi}^2\frac{V_1V_2}{A^2} \qquad (5.8c)$$

$$T^1_3 = -\frac{f_1(R)\dot{f}_2(T)}{\chi}I\ddot{\psi}\dot{\varphi}^2\frac{V_1V_3}{A^2} \qquad (5.8d)$$

$$T^2_2 = -T^4_4 - \frac{f_1(R)\dot{f}_2(T)}{\chi}I\ddot{\psi}\dot{\varphi}^2\frac{V_2{}^2}{A^2} \qquad (5.8e)$$

$$T^2_3 = -\frac{f_1(R)\dot{f}_2(T)}{\chi}I\ddot{\psi}\dot{\varphi}^2\frac{V_2V_3}{A^2} \qquad (5.8f)$$

$$T^3_3 = -T^4_4 - \frac{f_1(R)\dot{f}_2(T)}{\chi}I\ddot{\psi}\dot{\varphi}^2\frac{V_3{}^2}{B^2} \qquad (5.8g)$$

$$T = -(\psi - I\dot{\psi})\dot{\varphi}^2 \qquad (5.8h)$$

We consider the non-vanishing components of Einstein tensor G^1_1, G^2_2, G^3_3 from (5.1)

$$-\frac{\ddot{A}}{A} - \frac{\ddot{B}}{B} - \frac{\dot{A}\dot{B}}{AB} = -\frac{\dot{A}}{A}\left[\frac{\ddot{f}_1(R)}{\dot{f}_1(R)}\frac{dR}{dt} + \frac{\dot{f}_2(T)}{f_2(T)}\frac{dT}{dt}\right] - \frac{1}{6\dot{f}_1(R)f_2(T)}\left[\dot{f}_1(R)f_2(T)R + f_1(R)f_2(T)\right] + \frac{\chi}{\dot{f}_1(R)f_2(T)}\left[T^1_1 - \frac{1}{3}T\right] + \frac{1}{3}\frac{f_1(R)\dot{f}_2(T)}{\dot{f}_1(R)f_2(T)}[T+\theta] - \frac{f_1(R)\dot{f}_2(T)}{\dot{f}_1(R)f_2(T)}[T^1_1 + \theta^1_1] \qquad (5.9a)$$

$$-\frac{\ddot{A}}{A} - \frac{\ddot{B}}{B} - \frac{\dot{A}\dot{B}}{AB} = -\frac{\dot{A}}{A}\left[\frac{\ddot{f}_1(R)}{\dot{f}_1(R)}\frac{dR}{dt} + \frac{\dot{f}_2(T)}{f_2(T)}\frac{dT}{dt}\right] - \frac{1}{6\dot{f}_1(R)f_2(T)}\left[\dot{f}_1(R)f_2(T)R + f_1(R)f_2(T)\right] + \frac{\chi}{\dot{f}_1(R)f_2(T)}\left[T^2_2 - \frac{1}{3}T\right] + \frac{1}{3}\frac{f_1(R)\dot{f}_2(T)}{\dot{f}_1(R)f_2(T)}[T+\theta] - \frac{f_1(R)\dot{f}_2(T)}{\dot{f}_1(R)f_2(T)}[T^2_2 + \theta^2_2] \qquad (5.9b)$$

$$-2\frac{\ddot{A}}{A} - \left(\frac{\dot{A}}{A}\right)^2 = -\frac{\dot{B}}{B}\left[\frac{\ddot{f}_1(R)}{\dot{f}_1(R)}\frac{dR}{dt} + \frac{\dot{f}_2(T)}{f_2(T)}\frac{dT}{dt}\right] - \frac{1}{6\dot{f}_1(R)f_2(T)}\left[\dot{f}_1(R)f_2(T)R + f_1(R)f_2(T)\right] +$$

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$$\frac{\chi}{\dot{f}_1(R)f_2(T)}\left[T_3^3 - \frac{1}{3}T\right] +$$
$$\frac{1}{3}\frac{f_1(R)\dot{f}_2(T)}{\dot{f}_1(R)f_2(T)}[T+\theta] - \frac{f_1(R)\dot{f}_2(T)}{\dot{f}_1(R)f_2(T)}[T_3^3 + \theta_3^3] \quad (5.9c)$$

Subtracting (5.9c) from (5.9b) and (5.9a) from (5.9c) we obtain

$$\frac{\ddot{A}}{A} - \frac{\ddot{B}}{B} + \frac{\dot{A}}{A}\left[\frac{\dot{A}}{A} - \frac{\dot{B}}{B}\right] + \left[\frac{\dot{A}}{A} - \frac{\dot{B}}{B}\right]\left[\frac{\ddot{f}_1(R)}{\dot{f}_1(R)}\frac{dR}{dt} + \frac{\dot{f}_2(T)}{f_2(T)}\frac{dT}{dt}\right] = \frac{\chi}{\dot{f}_1(R)f_2(T)}[T_2^2 - T_3^3] + \frac{f_1(R)\dot{f}_2(T)}{\dot{f}_1(R)f_2(T)}[(T_3^3+\theta_3^3) - (T_2^2+\theta_2^2)] \quad (5.10a)$$

$$\frac{\ddot{B}}{B} - \frac{\ddot{A}}{A} + \frac{\dot{A}}{A}\left[\frac{\dot{B}}{B} - \frac{\dot{A}}{A}\right] + \left[\frac{\dot{B}}{B} - \frac{\dot{A}}{A}\right]\left[\frac{\ddot{f}_1(R)}{\dot{f}_1(R)}\frac{dR}{dt} + \frac{\dot{f}_2(T)}{f_2(T)}\frac{dT}{dt}\right] = \frac{\chi}{\dot{f}_1(R)f_2(T)}[T_3^3 - T_1^1] + \frac{f_1(R)\dot{f}_2(T)}{\dot{f}_1(R)f_2(T)}[(T_1^1+\theta_1^1) - (T_3^3+\theta_3^3)] \quad (5.10b)$$

By using (5.8) and (3.8) the equations (5.10) reduces to

$$\frac{\ddot{A}}{A} - \frac{\ddot{B}}{B} + \frac{\dot{A}}{A}\left[\frac{\dot{A}}{A} - \frac{\dot{B}}{B}\right] + \left[\frac{\dot{A}}{A} - \frac{\dot{B}}{B}\right]\left[\frac{\ddot{f}_1(R)}{\dot{f}_1(R)}\frac{dR}{dt} + \frac{\dot{f}_2(T)}{f_2(T)}\frac{dT}{dt}\right] = 0 \quad (5.11a)$$
$$\frac{\ddot{B}}{B} - \frac{\ddot{A}}{A} + \frac{\dot{A}}{A}\left[\frac{\dot{B}}{B} - \frac{\dot{A}}{A}\right] + \left[\frac{\dot{B}}{B} - \frac{\dot{A}}{A}\right]\left[\frac{\ddot{f}_1(R)}{\dot{f}_1(R)}\frac{dR}{dt} + \frac{\dot{f}_2(T)}{f_2(T)}\frac{dT}{dt}\right] = 0 \quad (5.11b)$$

Upon integration of the equations (5.11) with respect to t, they yield

$$\frac{A}{B} = m_5 exp\left\{m_4\int\frac{1}{A^2B\dot{f}_1(R)f_2(T)}dt\right\} \quad (5.12a)$$
$$\frac{B}{A} = m_7 exp\left\{m_6\int\frac{1}{A^2B\dot{f}_1(R)f_2(T)}dt\right\} \quad (5.12b)$$

From (5.12) we can express explicitly the values of A, B as

$$A = (A^2B)^{\frac{1}{3}}m_8 exp\left\{m_9\int\frac{1}{A^2B\dot{f}_1(R)f_2(T)}dt\right\} \quad (5.13a)$$
$$B = (A^2B)^{\frac{1}{3}}m_{10} exp\left\{m_{11}\int\frac{1}{A^2B\dot{f}_1(R)f_2(T)}dt\right\} \quad (5.13b)$$

where $m's$ are constants of integration such that $m_5m_7 = 1$ and $m_4 + m_6 = 0$

Adjusting the constants in (4.13) and (5.13), the line element (3.1) assumes an isotropic form and hence we generalize the result in the form of the following theorem.

Theorem 1: In the $f(R,T)$ theory of gravity, the Plane symmetric space-time filled with scalar field coupled with electromagnetic field, admits isotropy for the functional form $f(R,T) = f_1(R) + \lambda f_2(T)$ and $f(R,T) = f_1(R)f_2(T)$

With the help of (5.4) we can write the equation (3.9) as

$$\left(\frac{\dot{h}_7}{h_7}\right)^{\cdot} + \frac{\dot{h}_7^{\ 2}}{h_7^{\ 2}} + \frac{\dot{h}_7}{h_7}\left[\frac{\dot{B}}{B}\right] = \dot{\psi}\dot{\varphi}^2 \quad (5.14a)$$
$$\left(\frac{\dot{h}_7}{h_7}\right)^{\cdot} + \frac{\dot{h}_7^{\ 2}}{h_7^{\ 2}} + \frac{\dot{h}_7}{h_7}\left[\frac{\dot{B}}{B}\right] = \dot{\psi}\dot{\varphi}^2 \quad (5.14b)$$
$$\left(\frac{\dot{h}_7}{h_7}\right)^{\cdot} + \frac{\dot{h}_7^{\ 2}}{h_7^{\ 2}} + \frac{\dot{h}_7}{h_7}\left[2\frac{\dot{A}}{A} - \frac{\dot{B}}{B}\right] = \dot{\psi}\dot{\varphi}^2 \quad (5.14c)$$

Equating the equations in (5.14) we can write

$$\frac{\dot{B}}{B} = 2\frac{\dot{A}}{A} - \frac{\dot{B}}{B}$$
$$\text{Or } \frac{\dot{A}}{A} = \frac{\dot{B}}{B} \quad (5.15)$$

Inserting (5.15) in (5.14) we get

$$\left(\frac{\dot{h}_7}{h_7}\right)^{\cdot} + \frac{\dot{h}_7^{\ 2}}{h_7^{\ 2}} + \frac{\dot{h}_7}{h_7}\left[\frac{\dot{B}}{B}\right] = \dot{\psi}\dot{\varphi}^2 \quad (5.16)$$

But from (5.5) we have

$$\dot{\psi}\dot{\varphi}^2 = \frac{\dot{h}_7^{\ 2}}{h_7^{\ 2}} + \frac{f_1(R)\dot{f}_2(T)}{\chi}I\ddot{\psi}\dot{\varphi}^2 \quad (5.17)$$

Inserting (5.17) in (5.16) we obtain

$$\left(\frac{\dot{h}_7}{h_7}\right)^{\cdot} + \frac{\dot{h}_7}{h_7}\left[\frac{\dot{B}}{B}\right] = \frac{f_1(R)\dot{f}_2(T)}{\chi}I\ddot{\psi}\dot{\varphi}^2 \quad (5.18)$$

If we confine to linearity of the function ψ i.e. $\psi = m_{12}I + m_{13}$ or $\ddot{\psi} = 0$ then equation (5.18) has perfect solution

$$h_7 = m_{15}\, exp\left\{m_{14}\int\frac{1}{B}dt\right\} \quad (5.19)$$

With the help of (5.19) the equations (5.6) convert in to

$$V_1 = m_{16} exp\left\{m_{14}\int\frac{1}{B}dt\right\} \quad (5.20a)$$
$$V_2 = m_{17} exp\left\{m_{14}\int\frac{1}{B}dt\right\} \quad (5.20b)$$
$$V_3 = m_{18} exp\left\{m_{14}\int\frac{1}{B}dt\right\} \quad (5.20c)$$

where $m's$ are constant of integration.

Adjusting the constants in (4.20) and (5.20) the vector potential assume the form

$$V_i = [V_1, V_1, V_1, 0]$$

Hence we generalize the result in the form of following theorem

Theorem 2: In the $f(R,T)$ theorem of gravity the Plane symmetric space-time filled with scalar field coupled with electromagnetic field admits the vector potential $V_i = [V_1, V_1, V_1, 0]$ for the functional form $f(R,T) = f_1(R) + \lambda f_2(T)$ and $f(R,T) = f_1(R)f_2(T)$

6. Sub case $f(R,T) = f(R)$

In this case we follow the notations

$$f_R(R,T) = \frac{\partial f(R,T)}{\partial R} = \dot{f}(R)\,, \quad f_T(R,T) = \frac{\partial f(R,T)}{\partial T} = 0$$

The field equations (1.5) reduces to

$$G_j^i = \frac{1}{\dot{f}(R)}\left[g^{im}\nabla_m\nabla_j\dot{f}(R)\right] - \frac{1}{6\dot{f}(R)}\left[\dot{f}(R)R + f(R)\right]g_j^i + \frac{\chi}{\dot{f}(R)}\left[T_j^i - \frac{1}{3}Tg_j^i\right] \quad (6.1)$$

The computation for this case easily follows from those of the earlier case (section 4) by mere substitution *of* $f_1(R) = f(R)$ and $f_2(T) = 0$ or $\lambda = 0$

We get the result as follows

$$A = (A^2B)^{\frac{1}{3}}k_{26} exp\left\{k_{27}\int\frac{1}{A^2B\dot{f}(R)}dt\right\} \quad (6.2a)$$

$$B = (A^2B)^{\frac{1}{3}}k_{28}exp\left\{k_{29}\int\frac{1}{A^2B\dot{f}(R)}dt\right\} \quad (6.2b)$$

where $k's$ are constant of integration.

$$V_1 = k_{32}exp\left\{k_{30}\int\frac{1}{B}dt\right\} \quad (6.3a)$$

$$V_2 = k_{33}exp\left\{k_{30}\int\frac{1}{B}dt\right\} \quad (6.3b)$$

$$V_3 = k_{34}exp\left\{k_{30}\int\frac{1}{B}dt\right\} \quad (6.3c)$$

where $k's$ are constants of integration.

From sections 4, 5 and 6 we observe that the result remains intact for $f(R,T) = f_1(R) + \lambda f_2(T)$, $f(R,T) = f_1(R)f_2(T)$ and $f(R,T) = f(R)$, differ in constants of integration only. Hence the equations (6.2) and (6.3) admit theorems 1 and 2.

7. Sub case $f(R,T) = R + \lambda T$

In this case we follow the notations

$$f_R(R,T) = \frac{\partial f(R,T)}{\partial R} = 1 \quad , \quad f_T(R,T) = \frac{\partial f(R,T)}{\partial T} = \lambda$$

Then the equation (1.5) reduces to

$$G_j^i = \chi\, T_j^i - \lambda[T_j^i + \theta_j^i] + \frac{1}{2}\lambda T g_j^i \quad (7.1)$$

The consideration of this sub case follows from (section 4) by mere substitution of

$f_1(R) = R$ and $f_2(T) = T$

We get the result as follows

$$A = (A^2B)^{\frac{1}{3}}l_8 exp\left\{l_9\int\frac{1}{A^2B}dt\right\} \quad (7.2a)$$

$$B = (A^2B)^{\frac{1}{3}}l_{10}exp\left\{l_{11}\int\frac{1}{A^2B}dt\right\} \quad (7.2b)$$

where $l's$ are constants of integration.

$$V_1 = l_{16}exp\left\{l_{14}\int\frac{1}{B}dt\right\} \quad (7.3a)$$

$$V_2 = l_{17}exp\left\{l_{14}\int\frac{1}{B}dt\right\} \quad (7.3b)$$

$$V_3 = l_{18}exp\left\{l_{14}\int\frac{1}{B}dt\right\} \quad (7.3c)$$

where $l's$ are constants of integration.

From section 4, 5 and 7 we observe that the result remain intact for $f(R,T) = f_1(R) + \lambda f_2(T)$, $f(R,T) = f_1(R)f_2(T)$ and $f(R,T) = R + \lambda T$, only differ in constant of integration only. Hence the equations (7.2) and (7.3) admits theorem 1and 2.

8. Consideration of particular case $f(R,T) = f(R) = R$

In this case we follow the notations

$$f_R(R,T) = \frac{\partial f(R,T)}{\partial R} = 1 \quad \text{and} \quad f_T(R,T) = \frac{\partial f(R,T)}{\partial T} = 0$$

Then equation (1.5) reduces to

$$G_j^i = \chi T_j^i \quad (8.1)$$

The computation for this case easily follows from (section 7) by mere substitution of $\lambda = 0$

We get the result as follows

$$A = (A^2B)^{\frac{1}{3}}l_{26}exp\left\{l_{27}\int\frac{1}{A^2B}dt\right\} \quad (8.2a)$$

$$B = (A^2B)^{\frac{1}{3}}l_{28}exp\left\{l_{29}\int\frac{1}{A^2B}dt\right\} \quad (8.2b)$$

where $l's$ are constants of integration.

$$V_1 = l_{32}exp\left\{l_{30}\int\frac{1}{B}dt\right\} \quad (8.3a)$$

$$V_2 = l_{33}exp\left\{l_{30}\int\frac{1}{B}\,t\right\} \quad (8.3b)$$

$$V_3 = l_{34}exp\left\{l_{30}\int\frac{1}{B}dt\right\} \quad (8.3c)$$

where $l's$ are constants of integration.

From section4, 5 and 8 we observe that the result remain intact for $f(R,T) = f_1(R) + \lambda f_2(T)$, $f(R,T) = f_1(R)f_2(T)$ and $f(R,T) = R$, only differ in constant of integration only. Hence the equations (8.2) and (8.3) admits theorem 1 and 2.

9. Sub case $f(R,T) = RT$

In this case we follow the notations $f_R(R,T) = \frac{\partial f(R,T)}{\partial R} = T$, $f_T(R,T) = \frac{\partial f(R,T)}{\partial T} = R$

Then the field equations (1.8) reduces to

$$G_j^i = \frac{1}{T}[g^{im}\nabla_m\nabla_j T] - \frac{R}{3}g_j^i + \frac{\chi}{T}\left[T_j^i - \frac{1}{3}Tg_j^i\right] + \frac{R}{3T}[T+\theta]g_j^i - \frac{R}{T}[T_j^i + \theta_j^i] \quad (9.1)$$

We get the result as follows

$$A = (A^2B)^{\frac{1}{3}}n_8 exp\left\{n_9\int\frac{1}{A^2BT}dt\right\} \quad (9.2a)$$

$$B = (A^2B)^{\frac{1}{3}}n_{10}exp\left\{n_{11}\int\frac{1}{A^2BT}dt\right\} \quad (9.2b)$$

where $n's$ are constant of integration.

$$V_1 = n_{16}exp\left\{n_{14}\int\frac{1}{B}dt\right\} \quad (9.3a)$$

$$V_2 = n_{17}exp\left\{n_{14}\int\frac{1}{B}dt\right\} \quad (9.3b)$$

$$V_3 = n_{18}exp\left\{n_{14}\int\frac{1}{B}dt\right\} \quad (9.3c)$$

where $n's$ are constants of integration.

From section4, 5 and 9 we observe that the result remain intact for $f(R,T) = f_1(R) + \lambda f_2(T)$, $f(R,T) = f_1(R)f_2(T)$ and $(R,T) = RT$, only differ in constant of integration only. Hence the equations (9.2) and (9.3) admits theorem 1 and 2.

CONCLUSION

i) In the present paper we have considered sub cases of $f(R,T)$ theory of gravity models$f(R,T) = f_1(R) + \lambda f_2(T)$, $f(R,T) = f(R)$, $f(R,T) = R + \lambda T$, $f(R,T) = R$, $f(R,T) = f_1(R)f_2(T)$, $f(R,T) = RT$ in plane symmetric metric. We have derived the gravitational field equations corresponding to the

general and particular cases of $f(R,T)$ theory of gravity.
ii) It is observed that, even though the cases of $f(R,T)$ theory are distinct, the convergent, non-singular, isotropic solutions can be evolved in each case along with the components vector potential.
iii) From finding of the $f(R,T)$ and $f(R)$ theory, general and particular cases, in this paper we believe firmly that the results of $f(R,T)$ and $f(R)$ depends on only R and not on T
iv) From different cases of $f(R,T)$ we observe that the results remain intact only differ in constants of integration.

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FUZZY CLASSIFICATION OF PERISHABILITY

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ABSTRACT

Agricultural produce includes food-grains, vegetables & fruits. Among these vegetables & fruits are the most perishable items which need different marketing strategy as well as financial strategy. In the case of marketing of perishable agricultural produces. A scenario in perishable food supply chain management modelling and optimisation approach focusing on loss minimization along supply chain is presented based on real market data treated with analysis based on fuzzy logic. In this paper Fuzzy classification of perishability is defined.

Key Words *: fuzzy questionnaires, perishable food Supply chains.*

INTRODUCTION

Agricultural produce includes food-grains, vegetables & fruits. Among these vegetables & fruits are the most perishable items which need different marketing strategy as well as financial strategy.
Yavatmal is an agricultural city in the state of Maharashtra, located in Vidarbha region in central India. The objectives of the present study will be to survey the retail vegetable market & fruit market in order to know the ways of costing & selling the perishable items & how they accounts for loss due to perishable nature of items. The scope of the present study will be restricted to Yavatmal town only.

LITERATURE REVIEW

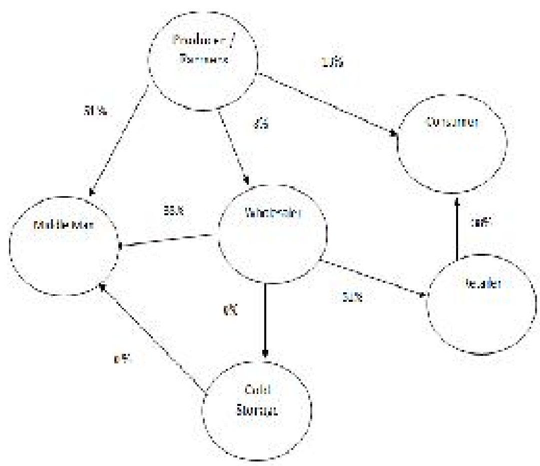
Supply Chain Management (SCM), currently a popular topic in research literature, breaches the boundaries of many academic disciplines. Food supply chains (FSC) are distinct from other product supply chains. The fundamental difference between FSC and other supply chains is the continuous and significant change in the quality of food products throughout the entire supply chain until the points of final consumption [1] [2]. In addition, FSC is complex as compared to other supply chains due to the perishable nature of the produce, high fluctuations in demand and prices, increasing consumer concerns for food safety [3] [4] [5] [6] and dependence on climate conditions [6].
Perishability of vegetables and fruits introduce a lot of uncertainity into the quality of the goods as they are shipped . Measuring perishability itself is a problem and it can be handled only with fuzzy classification. High, Moderate and Non perishable could be the classes, to consider.
Decision making under uncertain environment is critical to food transshipment. A producer has to decide 'how much' through {Direct Market, Whole sale Market, Self-storage} as strategic alternatives when goods are to be moved, to optimize his income.

CONSUMER

Consumer has to decide how much to purchase atone go, and how to arrange for preservation during the time the product is with him, so that there is not wastage/ spoilage.
Our preliminary investigations lead to the design of following supply chain.

THE SUPPLY CHAIN

<u>From our finding the Supply chain representing the scenario looks like this: (7)</u>



Considering this scenario in this research paper we present Impact of experience on the profit of producer, wholesaler and retailer .

In this paper we will discuss how perishability is a fuzzy attribute, and how the fuzzy classification converts the CRISP supply chain into a fuzzy-Supply chain.

RESEARCH METHODOLOGY

Primary Data collection The data were collected from

a. producers, i.e. farmer (32) b. Wholesalers (17),

b. retailer (32) and d. Consumers (50) of vegetable & fruits,

in the Yavatmal township.

Questionnaire properly designed in Marathi language, was used (See Appendix I)

Sampling Method: cluster type of sampling is taken for this project.

Secondary data : Collected from PanjabraoKrishiVidyapith Research Centre at Yavatmal, related books & from Internet. The data is collected from 36 producer, 17 wholsellers, 32 retailers and 50 consumers of vegetable and fruits.

The factors included in the questionnaire :- Questionnaire given in Appendix-I constituted of sections -

A -Personnel information.

B -Opinion about important related factors relating to many factors of agriculture as a profession & practice.

RESULTS & DISCUSSION

Description about scale

The stakeholders were supposed to answer or award scores the range of0 to 1

Fuzzy scale

0% Corresponds with 0	60% Corresponds with 0.6
10% Corresponds with 0.1	70% Corresponds with 0.7
20% Corresponds with 0.2	80% Corresponds with 0.8
30% Corresponds with 0.3	90% Corresponds with 0.9
40% Corresponds with 0.4	100% Corresponds with 1
50% Corresponds with 0.5	

Now the set U={Producer, wholesaler, retailer} every member of the set will have great of membership to great experience, moderate experience and no experience this is not possible with crisp set where each member will have either experience or not experience.

N={ person giving nil importance }

A={person giving 10% to 40% importance}

B={person giving 60% to 90% importance }

C={person giving 100% importance}

$F: U \rightarrow [0,1]$

$F(x) = 0 \quad x \in N$

$= 0.4 \quad x \in A$

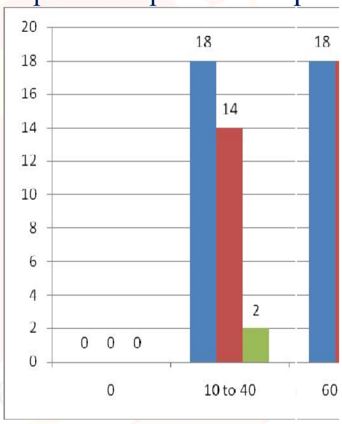
$= 0.7 \quad x \in B$

$= 1 \quad x \in C$

Producer				***Retailer***				***Whole seller***		
Q 1.4 Experience				Q 1.6				Q 1.4		
0	**0.1 To 0.4**	**0.6 to 0.9**	**100**	**0**	**0.1 To 0.4**	**0.6 to 0.9**	**100**	**0**	**0.1 To 0.4**	**0.6 to 0.9**
0	**18**	**18**	**0**	0	14	18	0	0	2	15
0	**50**	**50**	**0**	**0**	**43.75**	**56.25**	**0**	**0**	**11.76**	**88.24**

	P Q 1.4	R Q 1.6	W Q 1.4
0	0	0	0
10 to 40	18	14	2
60 to 90	18	18	15
100	0	0	0

Impact of experience on profit of supply chain



Fuzzy classification of perishability:
One look at the opinion of customers shows that, the customer expects the vegetables to last for

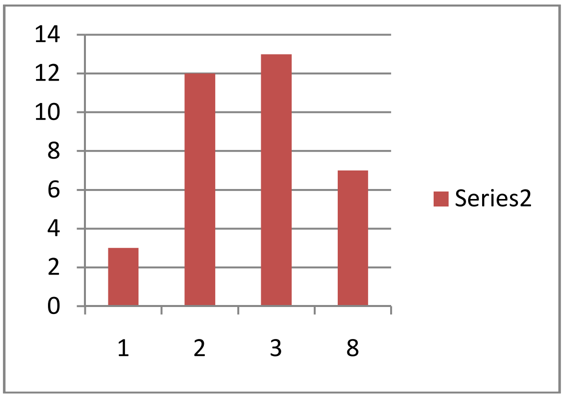


Fig: Customers Perspective of Perishability

Days	Frequency	It is clear that most customers assume natuaral storage life as 2-3 days, very few like only 1 days storage, a considerable number require nearly 8 days storage. The fuzzy classification function can be
1	3	Highly-Perishable = 0 for x < 1; = 1 for x > 1
2	12	{ stay good for only one day} Moderate-Perishable = 0 for x < 1; = 0.5 for 2<x 3; = 1 for x > 3
3	13	{stay good up to three days} Low-Perishable = 0 for x <8
8	7	= 1 for x > 8 { this class stays good upto 7days , or can be stored with help of domestic refrigeration}

We can see that this perspective gets translated into attitude of the producer in deciding whether to send the goods for {Direct marketing, ColdStore-and then-Market, Sell_to_WholeSaler }

Each of the channel is a marketing channel . The Supply chain shows that the produce goes into three types of classes as indicated in the three braches at the top of the Supply Chain. There are many more such fuzzy-aspects which conver the SC into fuzzy.

CONCLUSION

Its seems that the wholesaler gives most importance to the experience, in camparison with retailer & producer.

The consumer perspective is that storage-life of 2-3 days is the popular requirement.

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EQUIVALENT CONDITIONS FOR A COMPACTNESS IN PSEUDO METRIC SPACE

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ABSTRACT

In this paper we obtain equivalent conditions for compactness in pseudo metric spaces. It is proved that the following conditions are equivalent for a complete pseudo metric space.
01: A(X) is dense in C(X).
02: For any two normally separable closed sets at least one is compact.
03: For any two disjoint closed sets at least one is compact.
04: (X,d) is compact space.

Key words: *Pre compactness, AMS 54 E15.*

INTRODUCTION

For a topological space X, let C(X) be the set of all real valued continuous functions on X and A(X) be the set of all continuous real valued functions f such that f is constant outside a compact subset of X.

We say that A(X) is dense in C(X) if for any $\in > 0 \;\; and\, f \;\in C(X)$, there is a function $g \in A(X)$ such that $|f(x) - g(x)| < \in$ for all $x \in X$.

Remark: - If A(X) is dense in C(X), then every $f C(X)$ is bounded.

Definition: - **Pre compact**:- A pseudo metric space (X,d) is said to be pre compact if for every $\in > 0$ there exists a finite set $\{x_1, x_2, \ldots, x_n\}$ Such that for every $x \in X$ there is x_i , $1 \leq i \leq n$ with $d(x, x_i) < \epsilon$.

Normally separable closed sets:- The closed sets C_1 and C_2 are called normally separable if there exists a continuous real valued function f on X which takes the value 0 on C_1 and 1 on C_2.

Theorem 01: - Suppose (X,d) is a pseudo metric space. If A(X) is dense in C(X) then for any two normally separable closed sets at least one is compact.

Proof:- Suppose A(X) is dense in C(X) and F_1, F_2 are any two normally separable closed sets such that none of them is compact. Choose $f \in C(X)$ such that f: X→ [0,1] with $f(F_1)= 0$ and $f(F_2) = 1$. Since A(X) is dense in C(X), for this f and ϵ = ¼ there exists $g(x) \in A(X)$ such that $|f(x) - g(x)| < 1/4$ for all $x \in X$.

Suppose g(x)= c outside the compact set K of X .Then $F_1 \not\subseteq K$ because $F_1 \subseteq K$ implies that F_1 is compact. Similarly $F_2 \not\subseteq K$. Thus $F_1 \cap K^c \neq \emptyset$ and $F_2 \cap K^c \neq \emptyset$. Suppose $x \in F_1 \cap K^c$ and $y \in F_2 \cap K^c$ .Then g(x) =c, f(x) = 0, g(y) = c and f(y) = 1 i.e, $|f(x) - g(x)| = |c| < \frac{1}{4}$ i.e $-\frac{1}{4} < c < \frac{1}{4}$ and $|f(y) - g(y)| = |1 - c| < \frac{1}{4}$ $\Rightarrow 1 - \frac{1}{4} < c < 1 + \frac{1}{4}$ i.e $\frac{3}{4} < c < \frac{5}{4}$

This gives the contradiction and the theorem is proved.

Theorem 02: - Suppose (X,d) is a pseudometric space if for any two normally separable closed sets at least one is compact then for any two disjoint closed sets at least one is compact.

Proof: - Let C_1 and C_2 be disjoint closed sets. We have to prove that at least one is compact, since X is pseudo metric space, it is normal and hence by using Urysohn's lemma there is a continuous function f on X to [0,1] such that f is zero on C_1 and one on C_2 i.e. C_1 and C_2 are normally separable closed sets. By assumption at least one of them is compact. Thus the theorem is proved.

Theorem 03: - If (X,d) is a pseudo metric space such that for any two disjoint closed sets at least one is compact then (X,d) is pre compact space.

Proof: - Suppose (X,d) is not pre compact. Thus there is $\in > 0$ such that for every finite set F, $X \not\subseteq \cup_{x \in F} S_\in(x)$. If $x_1 \in X$, Since $X \neq S_\in(x_1)$, there is $x_2 \in X$ such that $x_2 \notin S_\in(x_1)$. Since $X \neq S_\in(x_1) \cup S_\in(x_2)$, there is $x_3 \in X$ such that $x_3 \notin S_\in(x_1) \cup S_\in(x_2)$.Thus we have a sequence $\{x_n\} \subset X$ such that $d(x_m, x_n) \geq \in$, for $n \neq m$. Now we construct two disjoint closed sets such that none of them is compact. Let $F_1 = \overline{\{x_1, x_3, x_5 \ldots\}, , \ldots\}}$, $F_2 = \overline{\{x_2, x_4, x_6 \ldots\}}$. If $x \in F_1 \cap F_2$, then $x \in F_1$ *and* $x \in F_2$.Thus there will be x_{2n+1} and x_{2m} such that $d(x_{2n+1}, x) < \in/4$ and $d(x_{2m}, x) < \in/4$ i.e.$d(x_{2n+1}, x_{2m}) < \in/2$ which is contradiction to d $(x_p, x_q) \geq \in$ for $p \neq q$. Hence F_1, F_2 are disjoint sets. Being closers F_1, F_2 are closed sets also.

Now we show that F_1 and F_2 are not compact. Since in a pseudo metric space a set is compact if and only if it is sequentially compact it is enough to verify that F_1, F_2 are not sequentially compact . But $\{x_{2n+1}, n> 1\} \subset F_1$ cannot have a convergent subsequence as it cannot have a Cauchy sub sequence. Similarly $\{ x_{2m}, n> 1\} \subset F_2$ cannot have a Cauchy subsequence. Thus F_1 and F_2 are not compact. This proves the theorem.

Theorem 04 : - If (X,d) is complete pseudo metric space and for any two disjoint closed sets at least one is compact then (X,d) is compact space.

Proof: By the theorem 02 (X,d) is precompact and since (X,d) is also complete, (X,d) is compact space.

Theorem05 : - Suppose (X,d) is compact space then A(X) is dense in C(X)

Proof: Since X is compact space, C(X) = A(X) and hence A(X) is dense in C(X).

Theorem 06: - If (X,d) is complete pseudo metric space then the following are equivalent.

01: A(X) is dense in C(X).

02: For any two normally separable closed sets at least one is compact.

03: For any two disjoint closed sets at least one is compact.

04: (X,d) is compact space.

Proof: 01) ⇒ 02) follows from theorem 01.

02) ⇒ 03) follows from theorem 02.

03) ⇒ 04 follows from theorem 03 and 04

04) ⇒ 01) follows from theorem 05

Remark:- It is known that every compact uniform space is uniformly continuous space. Since all the conditions 01,02,03,04 are equivalent, it follows that each of these conditions implies that the space is uniformly continuous space.

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INVESTIGATION UNDER DC GLOW DISCHARGE SPECTROMETRY

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ABSTRACT

Phenomenon of discharge of electricity through the study of property of ionized gases has proved to be fruitful for the investigation. The dc glow discharge spectrometry is the most essential part of the electrical and spectral emission studies of the molecules, atoms and ions in the interface of solid and liquid. We measured the intensity of radiation emitted by dc glow discharge as a function of discharge current for the different electrolytes along with V-I characteristics. The voltage-ampere characteristics during a glow discharge in the atmospheric pressure gas using an electrolytic solution as the anode and metal electrode like tungsten as a cathode were carried out. Under the study of glow discharges of various elements, a monochromatic light at various wavelengths generated. Few species shows a change in the color of the glow when discharge current increased. We investigated negative resistance of solutions. This behavior investigated as tunneling behavior of electrolytic solution using DC glow discharge.

Keywords: *glow discharge, interface, radiation intensity, tunneling.*

INTRODUCTION

Electrical and spectral characterization of the glow discharge [1-7] of the material helps in studying the chemical composition of the material. The elements in the material may be excited in the plasma [8] produced between liquid and solid interface. The neutral atoms, ionized atoms and molecules are excited and they emit characteristic spectrum and hence atomic, ionic or molecular species may be identified. Spectral study of the glow discharge [3,4,7,9] of the material helps in studying the chemical composition of the material. The solid liquid junction is formed when current is passed through the junction; a plasma film is generated along the interfaces between solid and liquid. The plasma pressure is very near to the atmospheric pressure [10,11,12]. [The plasma parameters in DC glow discharge may be generated by a current source [13].] The method is very low cost and quick results may be obtained and therefore has wide applications.

When electric discharge is passed to a conducting solution from an electrode, which is placed in the gas space above the liquid surface, reactions take place in the liquid phase and the process is referred to as “Glow Discharge Electrolysis (GDE)”. The dc glow discharge continues to be the subject of spectroscopic research [15] and analytical method development. Glow discharges [14] are used for a variety of technological, physical and analytical applications, ranging from plasma etching and deposition systems in the micro-electronics industry, to lasers or even plasma monitors. Traditionally [14] dc-glow discharge optical emission spectroscopy is mainly applied in the materials sciences where it is used for bulk and surface analysis, pellets containing the adsorbed liquid and direct analysis of the liquid samples by use of adequate sample introduction techniques. Liquids can be analyzed directly at atmospheric pressures, when applying the atmospheric electrolyte cathode glow discharge cell approach with detection by emission spectroscopy as described by Cserfalvi and Mezei [3].

MATERIAL AND METHODS

The experimental arrangement used for the investigation of dc glow discharge is simple and. It is inexpensive arrangement and it is very much cost effective. It consists of tungsten electrode of length 40 mm and diameter 3mm fused in glass capillary tube and suspended axially in a hollow slotted stainless steel cylinder, of length 6 cm and internal diameter 2.54 cm. The stainless steel cylinder served as another electrode i.e. anode in the glow discharge. The suspended end of tungsten rod was carefully rounded. The tungsten electrode can be used as cathode by connecting it to the dc power supply of 700 V capacity having 1.5 A current capacity. In this arrangement the hallow cylinder was dipped in a electrolytic aqueous solution taken in a glass beaker. The depth of immersion of the tungsten electrode in electrolyte solution could be adjusted with the help of micrometer adjustable stand. By using this arrangement the tip of tungsten electrode could be just brought in touch with the upper surface of the solution or the distance between the solution surface and the electrode may be adjusted. In this way the solution itself acts as another electrode.

The different 28 electrolytic solutions have been taken for investigation using the glow discharge system. With the help of the above-mentioned experimental arrangement the following properties may be studied.

RESULT AND DISCUSSIONS

Variation of electrolytic current with the applied dc-voltage during glow discharge in atmospheric pressure gas using 28 electrolytic solutions as the anode and cathode were carried out. The colors emitted on the glow are observed and listed in table 1. As an example we consider the electrolytic aqueous solution of 0.5N Cd(NO3)2.4H2O as the anode, the electrolytic process leading to a luminescent glow is best depicted by the standard voltage-current curve as shown in figure 1. The curve may be divided in to several regions and its behavior may be studied.

In the region AB the curve is almost linear, the Ohms law is satisfied and conventional electrolysis found with tiny bubbles of gas around both material electrodes-tungsten electrode and stainless steel electrode. At the voltage corresponding to point B in curve, a smooth evolution of gas bubbles is disturbed and layer of steam is seen at the tungsten cathode. In the region between B and C, the pointer of voltmeter and ammeter widely fluctuates. In this region the characteristics like current passing through the electrode and voltage applied found as unstable.

The behavior of region BC, CD and DE can be explained as follows. Because of increase in the applied dc voltage, the rate of gas evolution is increased with the formation of large size gas bubbles at a fast rate.

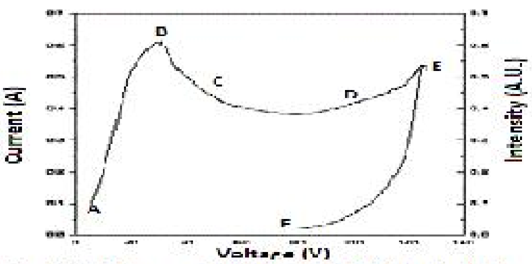

Fig.1: V- I Characteristics of 0.5N Electrolytic Solution of Cd(NO3)2.4H2O

Sr. No	Electrolytic Solution	Colour of glow when solution used as	
		Anode	Cathode
1	0.5N NaOH	Yellow	Yellow
2	0.5N KOH	Lavender	Lavender
3	0.25 N LiNO3	Reddish	Reddish
4	0.1N Pb(NO3)2	Bluish	Bluish
5	0.5N MgSO4	Green	Orange
6	0.5N CuCl2.2H2O	Green	White
7	0.05N AgNO3	Pale Green	Yellow
8	0.5N NaCl	Yellow	Yellow
9	0.5N KNO3	Lavendor	Lavender
10	0.5N CaCl2	Orange	Pink

Table 1: Colour of Discharge Glow

This decreases the rate of migration of the ions and charge transfer process at the electrodes. When voltage is further increased more fluctuations are obtained in both voltage and current readings with fall in current. This unstable decreased current is shown by line BC. In the neighborhood of point C it is found that fluctuation rate decreases and now hissing sound occurs. When the applied dc voltage reaches to the point C, there is intermittent sparking. The formation of gas bubbles around the tungsten electrode has now stopped. After increasing the applied dc-voltage to a still higher value the formation of movable thin vapor film around the tungsten cathode takes place, which at times produces the vortex motion and visible glow spark of greenish-blue color is found in the gap between cathode and solution phase. Due to vortex motion, electrolyte periodically touches to the tungsten cathode surface. This produces local heating at the tungsten cathode surface and visible glow spark of bluish-green color. Due to the local heating process there produces the vapor jet and nearby liquid molecules tried to take its place. The region CD of V- I characteristics shows this situation. Thus the region B to C represents the negative slope as seen in the curve. When the electrolyte current decreases to the corresponding point D, the violent gas evolution stops and slope of the curve changes sign from negative to positive. After the point D, with the applied dc voltages the current starts increasing and thereby producing a stable superheated insulating layer around the cathode (tungsten electrode). At this situation a continuous bluish-green glow is developed at the cathode surface. For a further increase in applied dc voltage, the intensity of the glow increases continuously with the increase in current also as shown in figure 1. Thus the region beyond D i.e. along DE appears to be true glow discharge. This happens due to the discharge of accumulated ions through the insulating layer. This situation produces intense glow of bluish-green color and it sometimes can be pictured as corona discharge. Thus under the observation, it is quite obvious that the superheated insulating layer around the cathode is the governing factor responsible for the bluish-green glow.

Tunnel Behavior Under V-I Characteristics of DC-glow Discharge

The discharge parameter like V-I characteristics of dc-glow discharge between the solid and liquid interfaces behaves like that of Tunnel diode. This has been investigated under the observation of V-I characteristics of aqueous solution of different concentrations. The energy band diagrams of cathode type and anode type (plasma band) materials as shown in figure 2. (a, b and c) can be used to explain the Tunneling phenomenon.

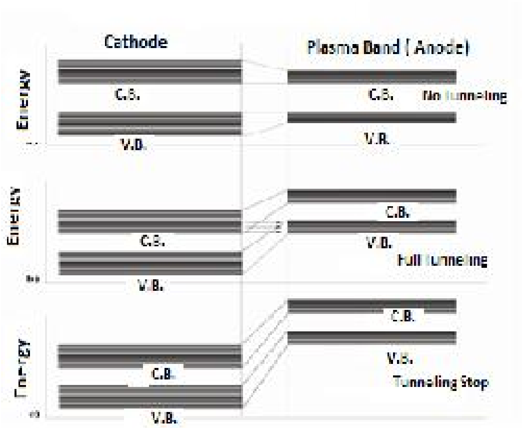

Fig 2 : Energy band diagram for Tunneling phenomenon

When the cathode type material (tungsten electrode) is joined, the energy band diagram under no bias condition becomes as shown in figure 2. (a). The junction barrier produces only a rough alignment of the two materials and their respective valence and conduction bands, hence no tunneling occurs. Initially when a lower voltage in equal step is applied, the energy band diagram become as shown in figure 2. (b). Due to the downward movement of the cathode region, the anode region valence band becomes exactly aligned with the cathode region conduction band. At this stage, electrons tunneling takes place as shown in figure and it 54

For this investigation taking the example of V-I characteristics for aqueous solution of 0.5 N KOH by dc glow discharge as shown in figure 3. With initially gradually increasing dc-voltage, the significant electrolyte current rises to its peak value say Ip and the corresponding applied voltage reaches to a value say Vp (at point B).

When applied voltage is increased to a value greater than Vp, the electrolyte discharge current starts decreasing till it achieves its minimum value called valley current Iv corresponding to valley voltage Vv (at point D). For the voltages greater than Vv current starts increasing again as in any ordinary junction diode.

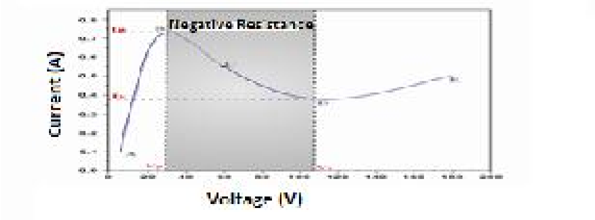

Fig.3: Tunnel Behavior Under V -I Characteristics of 0.5 N KOH Electrolytic Solution

In a similar way to negative resistance of the Tunnel diode it is seen from the figure in the region between peak point B and valley point D that the electrolyte current decreases with increase in the applied voltage. This behavior of the characteristics is similar to the electrolytic cell possesses negative resistance in this region. In fact this contributes the most useful property of the diode. Instead of absorbing power a negative resistance produces power.

Table 2 Tunnel behavior of electrolytic solution by dc glow discharge

Sr.No.	Electrolytic solution	Ip/Iv ratio	Negative resistance Rn = - dV/ dI
1	0.5N FeSO4	1.937	-191.907
2	0.5 N CdSO4	1.645	-141.35
3	0.5 N KCl	1.4366	-175.0067
4	0.5 N NiSO4	1.1872	-862.42
5	0.25 N COCl2	1.471	-111.55
6	0.25 N TiO2	1.4759	-316.96
7	0.5N AlCl3	1.5	-250
8	0.5N (NH4)2SO4	1.43	-159.168
9	0.5N KOH	1.9375	-230.88
10	0.5N KNO3	1.7179	-211.739

Ip/Iv ratio is almost as important factor at the point of view of the negative resistance of electrolyte. It determines the depth of the negative resistance. By adopting the same procedure we investigate the V-I characteristic of twenty seven solutions. Further we obtain the characteristics like Ip, Iv and Ip/Iv ratio with negative resistance dV/ dI for all the solutions and the results are tabulated in table 2..

Another point worth noting is that this resistance increases as we go from point B to D because as applied voltage is increased current keeps decreasing which means that negative resistance of electrolytic cell keeps increasing.

Thus the resistance offered by the electrolyte within the negative-resistance section of its characteristic (shown in figure as shaded) during glow discharge is the reciprocal of the slope of V-I characteristic in this region. Thus the negative resistance Rn = -dV/dI in the region BD. Its value depends on the composition of electrolyte (aqueous solution), current and voltage.

Ip/Iv ratio is almost as important factor at the point of view of the negative resistance of electrolyte. It determines the depth of the negative resistance. By adopting the same procedure we investigate the V-I characteristic of twenty seven solutions. Further we obtain the characteristics like Ip, Iv and Ip/Iv ratio with negative resistance dV/ dI for all the solutions and the results are tabulated in table 2.

CONCLUSION

DC Glow discharge using a solution as the anode and the metallic electrode as the cathode for the investigation of phenomenon of spectrometry shows that, a sensitive and inexpensive technique and very much cost for the elemental analysis of electrolytic solutions.

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SYNTHESIS AND ANTIBACTERIAL STUDY OF POLYETHELENE MICROPARTICLES

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ABSTRACT

Polyethylene microspheres (microparticles) were prepared using a modified chemical route. The prepared powder samples were characterized using scanning electron microscopy which shows that the concentration of polyglycolic acid decreased the agglomeration and increased the degree of sphericity of the polyethylene microspheres.Antibacterial study with encapsulation of drug Tetracycline was done and found that the prepared microparticles are shows good antibacterial effects in drug delivery process.

Keywords: *Polyethelene microparticles, polyglycolic acid, Drug carrier, Antibacterial.*

INTRODUCTION

The theory that polymers could be used as drug carriers to provide the controlled release of drug(s) is now well established. Biodegradable polymers are extensively employed in controlled-release drug delivery devices because of their abundant source, lack of toxicity, high tissue compatibility and they are the possible means of delivering drugs by several routes of administration. Micro-encapsulation (micro-particulate delivery system) wasone of the promising drug delivery system, which delivers thedrugs in a controlled rate over a period of time [1]. (Kumaret al., 2011). The use of controlled-release formulations to deliveranti-bacterial to the site of infection has recently gained interest. In order to develop a controlled drug delivery system,the micro-particulate system is developed having a polymerwhether natural or synthetic judiciously combined enclosedwith a drug in such a way that the active agent is released fromthe material in a pre-designed manner.

Various methods are available for the administrationof drugs, including intravenous, intradermal, sub-coetaneous, oral (e.g., inhalation), transdermal (topical),transmucosal, and rectal administrations. The oral andtransdermal methods are the simplest routes of drugadministration. However, for the oral method, thereis a risk of drug decomposition by the digestiveorgans, whereas when transdermal methods are used, theadsorption efficiency of a drug is generally low. Theinjection method results in a high adsorption efficiency,which is an early effect of the pharmacological actionsof the injected drug, and there is no risk of drug decomposition by the digestive organs. However, because themethod can result in pain at the injection site, it isdifficult to administer injection-based drugs to patientswith belonephobia. In recent years, there has been agrowing interest in the pulmonary route of drug administration because pulmonary administration is simple,shows the effects of the pharmacological action of thedrug early on, and has no risk of drug decomposition [2–4]. Pulmonary administration is a method thatworks via the lungs. Among the several types of drugcarriers, including liposomes [5,6], micelles [7–10], andgels [11–13], polymeric “particles” are suitable for pulmonary drug administration [14]. In this method, the drug incorporated particle is aspirated into the lungand decomposed via transcytosis, and then the drugis absorbed into the body. The drug-absorption efficiency is high because the lungs have relatively largesurface areas, thin alveolar epithelial cells, and significant blood capillaries.

The antimicrobial agent in liquid form has the inherentproblem of residual toxicity. This problem could beresolved if the antimicrobial agent could be immobilizedon a substrate surface. Methods of immobilizing antimicrobialagents on various substrate surfaces havebeen widely studied[1]. Among the surface functionalizationtechniques, polymer brushes from surface-initiatedpolymerizations have been widely used to tailor thesurface properties of substrates, such as wettability,[2-4],biocompatibility,[5-6], corrosion resistance,[7] and antibacterialeffect.[8-9]. The advantage of covalently tetheredpolymer brushes over other surface modification methods (e.g., self-assembled monolayers) is their mechanicaland chemical robustness, coupled with a high degree ofsynthetic flexibility toward the introduction of a widevariety of functional groups.

The microspheres have the advantages of large specificsurface area, ease of dispersion, ease of packing (inpack column applications), and ease of recovery andhandling (in comparison to nano- or submicron spheres).Furthermore, polymer microspheres of fairly uniformsizes can be readily prepared via suspension or emulsionpolymerization. They have been widely used as absorbents, affinity bioseparators, and drug and enzymecarriers.[15] In the present work, we report on a simpleprocess for the preparation of polymer microsphereswith permanent antimicrobial surfaces.

EXPERIMENTAL

The details of the preparation technique is given in our previous article,[16].The constituents that were used for the preparation ofthe polyethylene micro particles are provided in Table 1.Small pieces of polyethylene were placed in a beakercontaining 40 ml of xylene with a small amount ofglycolic acid. Then, the solution was stirred using a magnetic stirrer at 100◦C until the powder form of PLGAwas obtained. Sample powders with different concentrations of glycolic acid (0.3, 3, 5, 7 g) were prepared usingthis technique. After the synthesis, the powder sampleswere characterized at room temperature. Fig. 1 showsthe adopted synthesis method for the preparation of thepolyethylene micro particles.The morphology and spherical shape of the prepared particles were observed using scanning electronmicroscopy (SEM, JSM-6700F). The Fourier transforms infrared spectra between 450 and 1500 cm^{-1}wereobtained at room temperature with a Perkin ElmerSpectrum 400 FTIR spectrometer. Differential scanningcalorimetry was performed using a DSC-Q20 V24.11(heating rate: 50◦C/min; gas flow: air).

Table 1. Constituents used for the preparation of the polyethylene micro particles.

Xylene	40 ml
Polyethylene	4 bags (wt. of one bag = 1.601 g)
Glycolic acid	Varying concentrations (0.3, 3, 5, and 7 g)

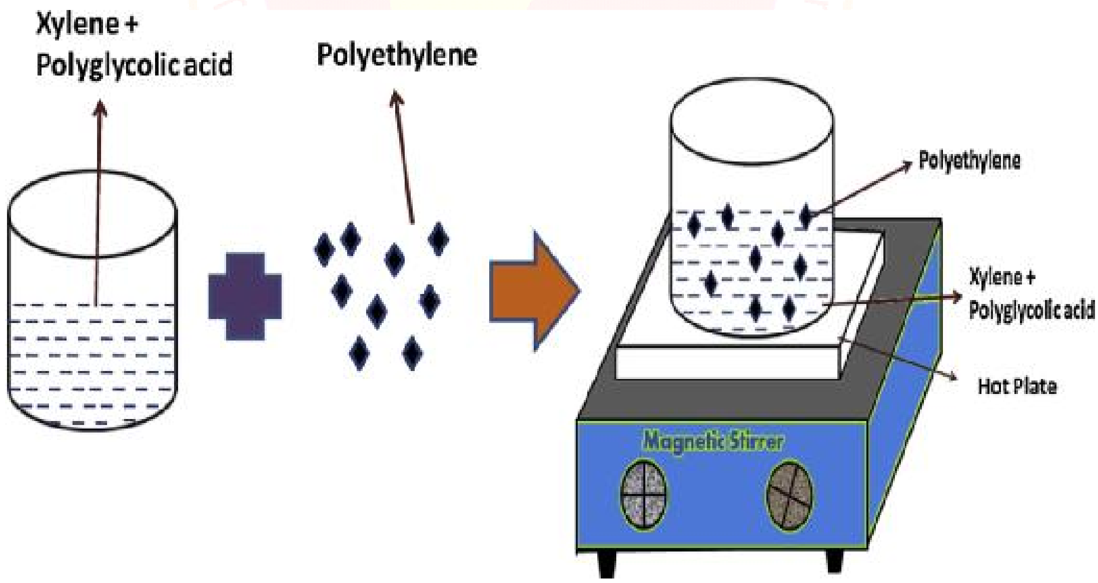

Fig. 1. Synthesis method used for the preparation of the polyethylene micro particles.

RESULTS AND DISCUSSION

3.1. Surface morphology of the polyethyleneparticles

The SEM micrographs of the prepared materials atdifferent concentrations of glycolic acid are shown inFig. 2. The polyethylene micro particle sizes increased ata concentration of glycolic acid from 3 μm to 9 μm. Themicro particles agglomerated when a lower concentrationof acid was used. Additionally, when lower concentrations of glycolic acid were used, the polyethylenemicro particles were not completely spherical. However,when 5 or 7 g were used, a high degree of sphericityand agglomeration of a few of the micro particles wasobserved.

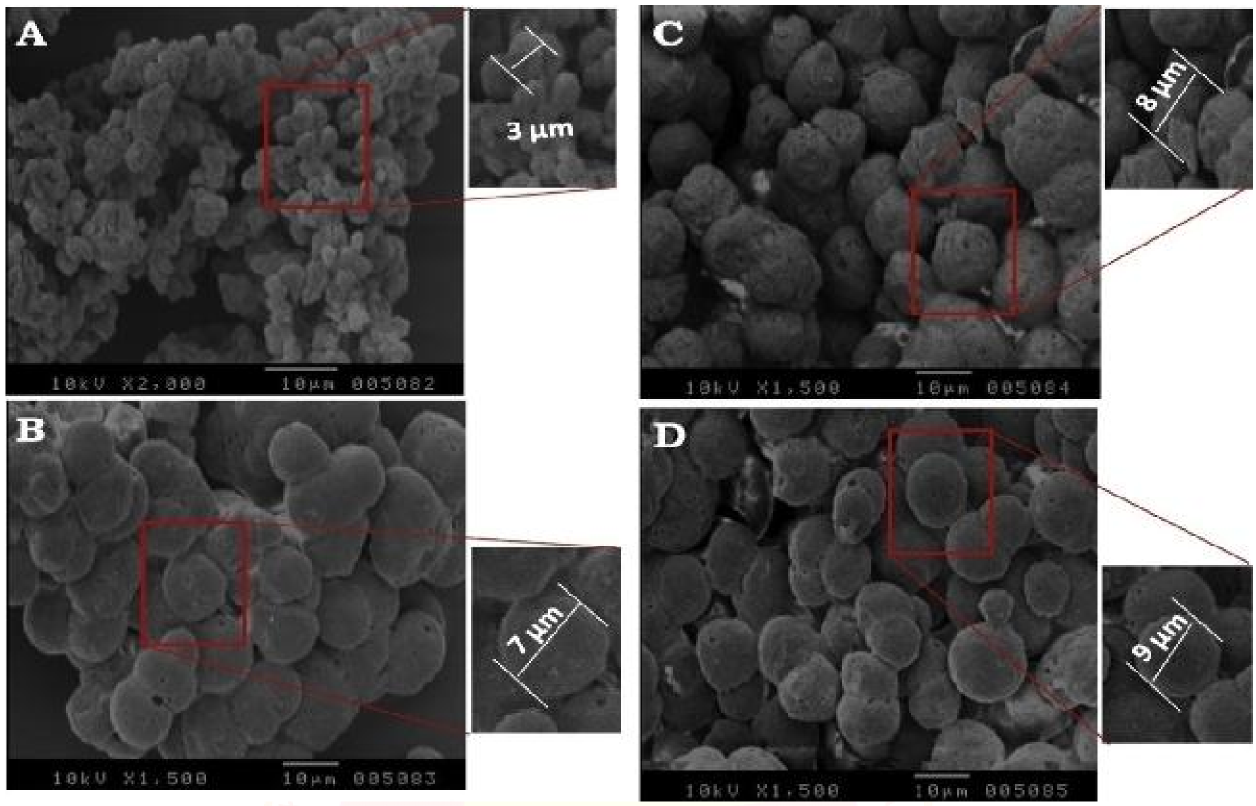

Fig. 2. SEM images of the polyethylene micro particles prepared using different concentrations of glycolic acid: (A) 0.3 g, (B) 3 g, (C) 5 g, and (D)7 g.

3.2. Antimicrobial studies

The purpose of antibacterial studies was to find out drugrelease from formulations and its efficacy to inhibit the growthof microorganisms.The antibacterialpotency of the drug needs to be tested as the desiredminimum inhibitory concentration (MIC) has to be achieved.Thus selected microsphere formulations along with pure drug Tetracycline was tested for the antibacterial activity. Each Sample dissolved in DMSO 70% + Acetone 30% about 1000 ppmand antibacterial disc of 6mm &15 µl samples for each disc were used for this antibacterial study.Incubation period for all organisms and Petri plates at 37^{0}C for 24 h. The results obtained are summarized in below given table. 2.

	***Escherichia coli*-ATCC-14948 (Gram Negative)**				**Propionibacterium acnes -ATCC-1951 (Gram Positive)**			
Sample Code	**AB**	**SP**	**ABSP**	**CL**	**AB**	**SP**	**ABSP**	**CL**
A	25	00	25	00	28	00	28	00
B	27	00	27	00	28	00	28	00
C	25	00	25	00	27	00	27	00
D	26	10.5±0.2	26	00	29	00	29	00

CONCLUSIONS

Polyethylene microspheres were successfully pre-pared using a modified chemical synthesis technique.The scanning electron microscopy images show that fora lower concentration of polyglycolic acid, the poly-ethylene microspheres agglomerate with a lower degreeof sphericity. However, for a higher concentration, theagglomeration becomes lower, and the particle size anddegree of sphericity of the microspheres increases. Antibacterial study with encapsulation of drug Tetracycline was done and found that the prepared micro particles are shows good antibacterial effects in drug delivery process.

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PHYSICS AND DERMATOLOGY BRIDGED BY LIGHT SOURCES IN PHOTOTHERAPY.

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ABSTRACT

The light has healing power this fact is known to man from ancient times. The research related to medically important light sources and its use in the treatment of skin diseases is referred as phototherapy. While studying the light sources and their utility in dermatology one has to consider the interaction of light with human skin. As the technology advanced new light sources became available. There is a wide range of skin disorders which can be treated successfully with the help of light. The therapeutic use of light in treating skin disorders like vitiligo is proven by clinical case studies and reports. The clinically important light sources and their application in the field of dermatology is discussed here.

Keywords : *Phototherapy, Laser, Dermatology, Intense Pulsed light, Light emitting diode (LED)*

INTRODUCTION

The manmade light sources had a long journey from heating filament based incandescent lamp to laser and LED. These light sources are categorized as per the working principle, radiation power, wavelength of radiation and utility in various fields. There are many type of phototherapy units available as on date. The light has tremendous importance for human life as well as plants and animals. The invention of laser in 1960 was a landmark. Immediately after its invention, utility'of laser in the field of medical science was proposed by the researchers. A whole new field of phototherapy with lot of potential was introduced.

METHOD AND MATERIALS

In case of laser different gain media have been used to create a variety of radiation with different properties. In general, lasers fall into 1 of 4 categories: gas discharge, diode, dye, and solid-state lasers.[1] A gas discharge laser is the simplest laser, whereby a gas is excited by an electric discharge and the excited particles of gas create the laser beam, The excimer laser is a specific type of gas discharge laser in which a noble gas is mixed with halogen and high-current pulses are used to generate excited dimers, hence the term *excimer*. The wavelength of radiation is 308 nm and it is found to be suitable for treatment of vitiligo and psoriasis.

Solid-state lasers are most often used as phototherapy tools in dermatology. These devices utilize a conducting medium (eg, garnet, sapphire, ruby) doped with trivalent rare-earth ions or transition metal ions (eg, neodymium, ytterbium, erbium, titanium, chromium). This process is a relatively reliable and flexible methodology for generating stable lasers, thus explaining its widespread use. Additionally, these solid-state lasers are particularly amenable to modifications (eg, Q-switching).Quality switching (known as Q-switching) is a method used to generate a shorter burst of a higher-power laser output.[2]

Intense pulsed technology is a highly versatile, safe, and effective modality for the treatment of vascular and pigmented lesions. Epidermal and dermal atrophy associated with photoaging, as well as acne, rosacea, actinic keratoses, and nonmelanoma skin cancers. The biological efficacy of various wavelength distributions evolved the range of IPL technology. With regard to different wavelength filters, pulse durations, pulse frequencies, and cooling modalities to protect from side effects. The end result will be a widening domain of IPL's clinical applications and indications. It will be incumbent on clinicians who use these devices with regularity for such new and emerging indications to report their clinical experiences in order to sustain our continued understanding of the technology's long-term safety and efficacy profile. [3]

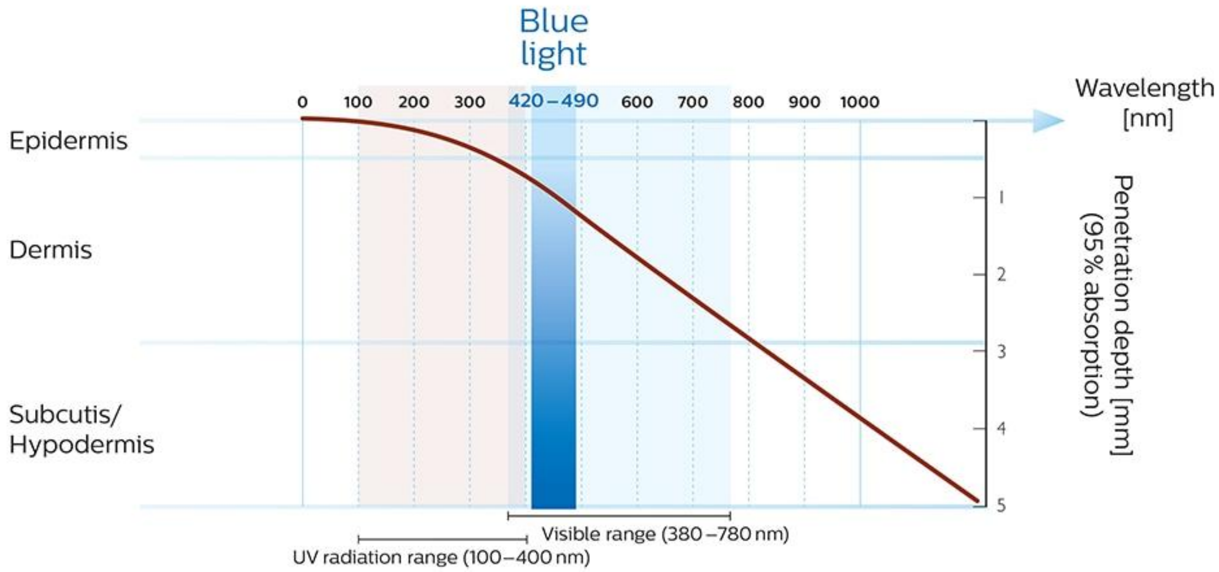

Fig. 1 Penetration depth in skin for different wavelengths. This figure is retrieved from www.philips.co.uk

Blue Light 470 nm (visible spectrum) can penetrate into follicle,destroy acne-causing bacteria and removes redness and irritation.Blue light has a wavelength of 400–490 nm and is part of the light spectrum that is visible to the human eye. Blue light does not contain any UV-radiation and penetrates deeply into the skin. It is known that blue light has positive effects on the human body. LEDs are known for their energy efficiency, compact design and stability. The combination – blue LEDs – is a promising and powerful tool for medical applications. Research shows that LEDs used for medical treatments require special features that exceed those of conventional LEDs, including high intensities and tailored adjustments such as pulsed LED light. With blue LEDs optimized specifically for health applications, patients receive the benefits of phototherapy through the gentle, natural process-inducing characteristics of LED light in the visible blue spectrum.[4]

Recently, there are multiple home optical devices available on the market. These devices have been approved for the treatment of acne, scars, hair removal, and wrinkles using intense pulsed light, light-emitting diode, heat, infrared, low-level light therapy, and laser. Although studies on home devices are limited.Home optical devices are mostly used without medical practitioner supervision. As home devices usually deliver less energy per session than with professional treatments. Patients may use home devices without disclosure to their physician and it is important as healthcare professionals to be aware of the existence of these devices, how to use the devices properly. New research endeavors are being completed to explore the use of home devices for the treatment of chronic inflammatory diseases such as psoriasis.[5]

DISCUSSION

Light sources are useful in the treatment of vitiligo, removal of tattoos, treatment of port wine stain, removal of skin tumors, external ulcers, and warts. Light sources are also useful in ophthalmogy for cornea repair or correction; retina repair. New trend of cosmetic and aesthetic application of light is set up. In aesthetics or cosmetic clinics light is used for hair reduction, skin rejuvenation.

Powerful light sources like laser beam are used in oncology for tumor ablation. Photodynamic therapy is a methodology in which photochemicals are used along with light treatment. The Psoralen with ultra violet A (PUVA) theapy is clinically used at many places prior to narrowband ultra violet B (NBUVB).

Light emitting diode LED are neither a laser nor IPL. Through a process of thermolysis lasers and IPL selectively destroy a specific target. LED’s have a much lower energy output and stimulate biological tissue by supporting collagen synthesis, repair, circulation, support the reduction of inflammation and the appearance of some pigment. LED’s do not destroy tissue. A light therapy unit functions with LED diodes (not to be confused with a diode laser). LEDs can emit pure wavelengths between 400 nm and 700 nm (visible light). After 700 nm the energy moves out of the visible range and into more heat producing thermal effects onto the skin.

Biological effects of various wavelengths can be listed as follows. LED green light 525 nm (visible spectrum) can penetrate to dermal capillary beds, decrease melanin production and regulating the soothing effects. Yellow light 590 nm (visible spectrum) is absorbed by body fluids. It effects lymph and blood circulatory systems and promotes wound healing. It also reduces inflammation.Red Light 640 nm (visible spectrum) is also helpful to reduce inflammation. It is absorbed by all tissues, specifically in dermis. It possesses the most regenerative properties.

CONCLUSION

In the medical field laser, Intense Pulsed Light and even Light Emitting Diodes which is a Non-laser are used now a days for treatment. We have studied the use of light in dermatology as a part of our research work. The physics and dermatology are bridged by the sources of light used in phototherapy. Though the phototherapy is a little bit expensive therapy as on date. Research in this field will make low cost units available to patients and affordable treatment facilities is definitely the need of time.

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ADVANCES IN TECHNOLOGY FOR VITILIGO TREATMENT WITH PHOTOTHERAPY

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ABSTRACT

It is a well known fact that ultraviolet light in the range of 308 nm to 311 nm (NBUVB) is worldwide accepted phototherapy standard for the treatment of vitiligo. The research in this field has published many clinical study reports approving the efficacy and suitability of NBUVB. The advances in technology for vitiligo treatment suggested excimer laser as the best treatment tool. Vitiligo is cosmetically disfiguring disease in which white patches appear on any part of the skin. These patches are due to destruction of melanocytes which produce melanin the chemical that gives colour to skin. The excimer laser itself is costly unit requiring special installation and power requirements. Recently excimer lamps are introduced. These lamps have same therapeutic results. The recent developments and advantages of new technology are discussed here.

Keywords : *Excimer laser, Excimer lamp, Pototherapy, Vitiligo, NBUVB*

INTRODUCTION

The molecule of XeCl is used in producing UVB with 308 nm wavelength which is found to be useful in accelerating melanin formation activity. The UVB units are available in various shapes and sizes to cover entire body surface or targetting to a small skin area like fingers or toes. The depigmented skin showing white patch can be repigmented to achieve normal skin colour. Primarily Mercury lamps were popular though they were not much ecofriendly. With the inert gases lamps focus was shifted to various application areas. Initially XeCl mix gas was used as a lasing medium and excimer laser were launched but with advances in technology made it possible to develop excimer lamp.

MATERIALS AND METHODS

Xenon monochloride (XeCl) is an excimer which is used in excimer lasers emitting near ultraviolet light at 308 nm. It is most commonly used in medicine. At least two gases must be used to generate exciplexes: a halogen donor and a rare gas. However, not all rare gas halide molecules lead to the development of lasers; some may not even exist. Multiple molecules and applications have been developed.[1]

In a case study by Korean team who compared the clinical efficacy of a short-term intervention of 308-nm excimer laser with that of narrow-band UVB (NBUVB) phototherapy for vitiligo patients to see the early response. Twenty-three symmetrically patterned patches of vitiligo on 8 patients were selected. Vitiligo patches on one side of the body were treated 2 times per week for a maximum of 20 treatments with the excimer laser, and NBUVB phototherapy was used on patches on the other side. They used a 308-nm excimer laser with a self-contained gas system of Xe-Cl (Photomedex®, Carlsbad, CA, U.S.A.). Output is initiated by a foot switch and consists of a train of short pulses with a pulse-width of 30 nanoseconds, delivered through a fiber optic hand piece. It is operated at 3 mJ per pulse with pulse repetition of up to 200 Hz. The laser allows fixed fluences to be delivered, from 100 mJ/cm^2 to a maximum dose of 2,100 mJ/cm^2, in 50 mJ/cm^{2}increments. Additional fluences can be delivered by pressing the foot switch. The NBUVB phototherapy unit (Waldmann Co., Germany) contains a bank of 48 fluorescent tubes (TL-100W/01, Phillips, Eindhoven, The Netherlands) with peak emission at 311 to 312 nm.[3]

In another case study by Goldinger et al. tried the combination therapy for two months i.e. 24 treatments (8 weeks), nine patients were evaluated. Eight patients showed evidence of repigmentation on both body sides, with no significant difference between the body side treated with calcipotriol and excimer laser and the side treated with excimer laser alone. The mean repigmentation rate was 22.4% (1-37%).The addition of calcipotriol ointment to 308-nm xenon chloride excimer laser phototherapy does not significantly enhance its efficacy. Small additive effects must be investigated in a larger trial.[4]

Eszter Baltas MD and his team used XeCl and they found that the 308-nm xenon chloride (XeCl) excimer laser was effective in inducing repigmentation in one patient with localized vitiligo. The aim of this study was to expand our observation on the therapeutic efficacy and safety of the 308-nm XeCl laser for the treatment of vitiligo.[5]

A group from japan studied that the rate of repigmentation continued to increase with the number of treatments up to 20 sessions, and then showed plateaus between 20 to 30 sessions. On the other hand, the lesions in acral and joint areas showed the worst responses throughout the treatment sessions. Our findings extend previous observations that the 308-nm excimer laser is an effective treatment option for patients with vitiligo. However, further studies will be needed to determine the optimal dosing and administration method, especially for acral and joint areas.[6]

In India very few excimer laser units are available. Maharshi Vitiligo Centre having branches at Indore(MP), Mumbai (Maharashtra), Ahmadabad (Gujrat) and Delhi have Excimer laser unit shown in Fig.1. It is supplied by RA Medical systems USA. Most studies of vitiligo treatment with phototherapy set a 75% repigmentation rate as cosmetically acceptable, and are able to achieve it in 12.5 to 75% of patients after one year of treatment.[9] By comparison, other studies have found a 43% improvement with narrow band UVB therapy.[10]

Recently in 2016 Exciplex an excimer lamp shown in Fig.1 is manufactured by an Australian company Clarteis was launched Annual Conference of The Association of Cutaneous Surgeons of India 2016.(ACSICON 2016) held at Mahabaleshwar. We have studied the efficacy of this lamp at Darpan Skin care clinic, Akola for the treatment of vitiligo. The results obtained are quite satisfactory.

Fig. 1 Images and technical details from www.ramed.com USA

CONCLUSION

The excimer lamp is a cost effective alternative to excimer laser. Technology has achieved success in terms of not only results but cost (4 times less than laser), weight (50 times less than laser), and portability. The patients who could not approach to the clinics at city can avail treatment facility in their respective town or village. The excimer lamps can fit inside a briefcase and have no consumable parts. The spot size and power ratings are similar to laser unit. The heating time is not required for the lamp. There are many manufacturers worldwide so competitive prices will make the phototherapy an affordable treatment. Home phototherapy will gain popularity in coming days and Indian patients will prefer using this technology for vitiligo treatment.

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DEVELOPMENT OF PTH-PEO POLYMER COMPOSITE AS CO_2 GAS SENSOR

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ABSTRACT

A new active layer for CO_2 sensing based on semiconducting Polythiophene-Polyethylene Ox ide Composite was synthesized by in situ chemical oxidative polymerization method. PTh-PEO Polymer Composite films were characterized through scanning electron microscopy (SEM). PTh-PEO polymer composite doped with LiCl was prepared by screen-printing method on Cladophora substrate followed by Al_2O_3 layer as a sensor. The sensors were used for CO_2 gas sensing detection at room temperature. Dynamic and static sensing response of both pure and doped sensor was studied. Sensitivity of sensors at different a concentration (ppm) of CO_2 gas were measured. The variation of sensitivity with CO_2 gas concentration is found to be linear. The reproducibility and stability for both sensors was good.

Keywords: *Polythiophene, Polymer Composite, Sensing response, CO_2 Gas*

INTRODUCTION

Now a day the demand for CO_2 sensors is high because of their potential uses in a broad range of applications, including consumer, industrial, and agricultural applications. It is important to monitor atmospheric CO_2 concentration to understand its impact on climate change. Conducting polymers and their derivatives has been used as the active layers of gas sensors since early 1980s. In comparison with most of the commercially available sensors, based usually on metal oxides and operated at high temperatures, the sensors made of conducting polymers have many improved characteristics. They have high sensitivities and short response time; especially, these features are ensured at room temperature. Conducting polymers have been widely studied for the development of chemical sensors [1].

Gas sensors based on conducting polymers offer high sensitivities and fast response towards a range of target gases at ambient temperature [2]. The most commonly applied polymers for gas sensing applications have been based on polypyrrole (PPy), polyaniline (PAN), polythiophene (PTh) and their derivatives [3]. Among those conducting polymers, Polythiophene has received great attention over the past few years, because it is one of the most environmentally and thermally stable material in the group of conducting polymers [4, 5].In the present paper, sensor films of PTh- PEO polymer composite doped with LiCl were prepared by screen-printing method on Cladophora substrate. Surface morphology was investigated via SEM. The sensing response of films for different concentration of CO_2 gas was investigated.

EXPERIMENTAL

PTh-PEO polymer composite doped with Lithium Chloride (LiCl) was synthesized at room temperature (303 K) by chemical oxidative method[6]. Anhydrous $FeCl_3$ was used as a oxidizing agent. A solution of PEO was first prepared in methanol by stirring for 6 hours and kept over a night. Appropriate amount of Anhydrous $FeCl_3$ and LiCl were added and stirred for 15 minutes. When monomer thiophene was added drop by drop to the solution, a dark brown homogeneous solution was obtained. The obtained solution of PTh-PEO polymer composite was screen printed on initially prepared Cladophora substrate followed by Al_2O_3 layer. Al_2O_3 layer acts as an insulator. Cladophora substrate provides the nano structure in which PTh-PEO molecules embedded. This will increase the sensing response. For resistance measurement, electrical contacts of conducting silver paint were screen printed on the adjacent sides of Cladophora paper as shown in fig.1. The electrical resistance was measured by using voltage drop method adopted by Yawale et al [7].

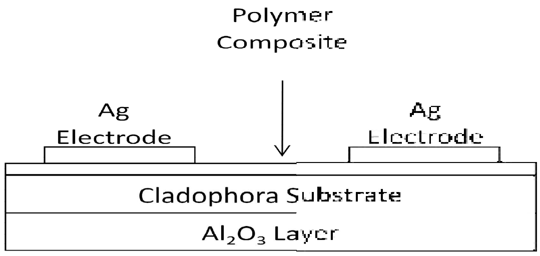

Fig.1: Structure of Polymer Composite Sensor

RESULTS AND DISCUSSION

Figure 2. (a) and (b). Its shows the surface morphology of pure PTh-PEO polymer composite and doped with LiCl. In which the randomly distributed cluster of particles and voids are observed. The average size of the particles is varied from 5 µm to 20 µm as shown in Fig. 2(a). The large number of grains which leading to high porosity and large effective surface area available for adsorption of gas species. The large nnmber of non-uniform voids, bigger and flat patches also seen in the micrograph of doped PTh-PEO composite film Fig.2 (b). The size of voids varies from ~ 200 nm to 2µm. which increase the sensing response of Doped PTh-PEO sensor

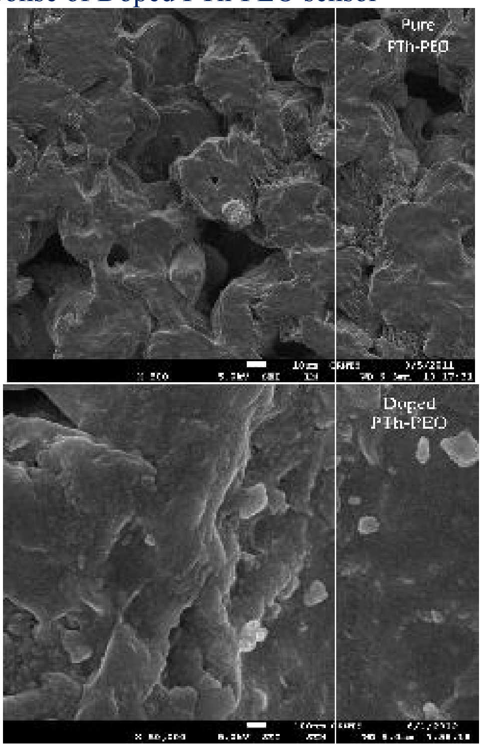

Fig. 2: SEM image of (a) pure PTh-PEO and (b) doped PTh-PEO polymer composite with LiCl.

The sensitivity is the device characteristics of a variation in electrical property of the sensing material under gas exposure and it can be defined as

if $R_g > R_a$ $$S = \frac{R_g - R_a}{R_a}$$

or $$S = \frac{R_a - R_g}{R_a}$$ *if* $R_a > R_g$

Where R_a is the resistance of sensor in air and R_g is the resistance in presence of gas, respectively.

All the PTh-PEO sensor samples were studied for detection of CO_2 gas. The resistance of pure and doped PTh-PEO sensors increases with CO_2 gas concentration. A typical plot of sensitivity verses concentration (ppm) of CO_2 gas for pure and doped PTh-PEO polymer composite is shown in Figure 3. Initially the sensitivity of both polymer sensor increases linearly and after certain time it becomes constant. The possible mechanism for CO_2 gas detection in polymer is based on reactions that occur at the sensor surface, resulting in a change in concentration of adsorbed oxygen. At lower temperature (<150°C), oxygen adsorption at the surface is mainly in the form of O_2. Oxygen ions adsorb onto the surface of material removes electrons from the bulk and create a potential barrier that limits electron movement and resistivity. When exposed to an oxidizing gas such as CO_2 then it is chemisorbed on bridging oxygen atoms with the formation of a surface carbonate [8], subsequently increasing the barrier height and the resistivity.Fig.4 shows that the sensitivity of doped PTh-PEO was higher than pure PTh-PEO sensor. The maximum sensitivity value of pure and doped PTh-PEO sensor was found to be 0.36 and 0.47 respectively.

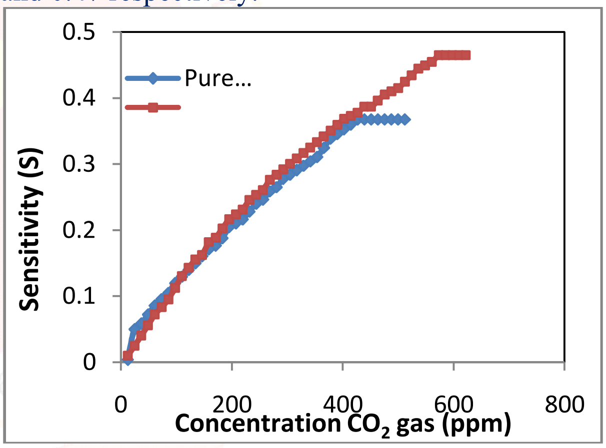

Fig. 3: Sensing Response of Polymer composite as a function of CO_2 gas Concentration at room temperature

As stability is defined as the change of sensor resistance with time. This shows that stability of PTh-PEO sensor doped with LiCl is higher than other PTh-PEO sensor.

The static sensing response of pure and doped PTh-PEO sensor was studied for 150 ppm of CO_2 gas concentration and sensitivity versus time characteristics is plotted as shown in figure 4.

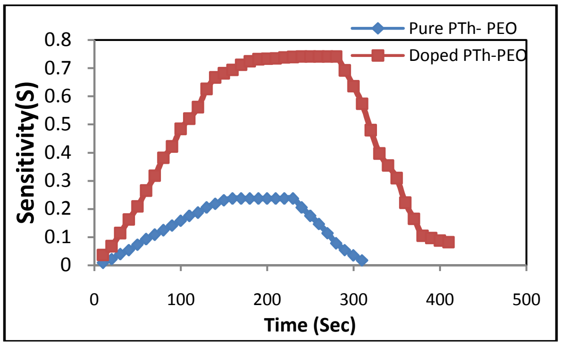

Fig.4: Static Response of Polymer composite as a function of time at room temperature

The response (τ_{res}) and recovery (τ_{rec}) time are two important parameters to characterize a sensor. The response time is defined as the time taken to reach 90% of the response when ppm of gas is changed. The recovery time is defined as the time taken to reach 90% of the recovery when gas is turned off. The response and recovery time of pure PTh-PEO polymer composite sensor were slightly higher than those of doped PTh-PEO sensor which was good agreement with the results reported by other researchers [9]. Hence doped PTh-PEO sensor shows good sensitivity and sensing response than pure PTh-PEO sensor.

The dynamic response of Pure and doped PTh-PEO sensor for 150, 300 and 450 ppm CO_2 gas concentration at room temperature are shown in Fig.5. It is clearly seen that the sensitivity of both sensor increases gradually with concentration of CO_2 gas (ppm).

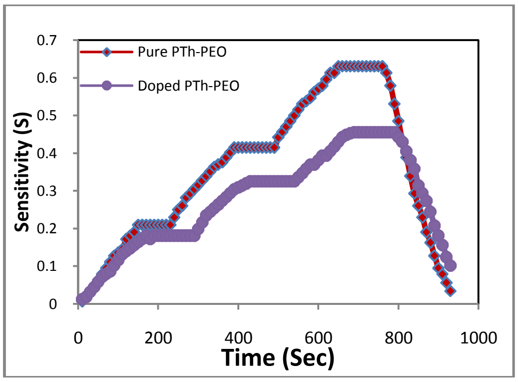

Figure 5: Dynamic Response of Polymer composite as a function of time

Static and dynamic sensing study suggested that Pure and doped PTh-PEO sensor was a good sensing element in the detection of CO_2. By removal with dry air, the response of Pure and doped PTh-PEO sensor can be near-completely recovered, indicating the quick desorption of gas molecules from the sensor layer and the good reproducibility PTh-PEO sensor.

CONCLUSION

In this paper, PTh-PEO polymer composite doped with LiCl were selected as sensitive material for carbon dioxide (CO_2) gas detection at room temperature. Moreover pure and doped PTh-PEO polymer composite were fabricated successfully by screen-printing method on Cladophora substrate as CO_2 gas sensors. The resistance of Pure and doped PTh-PEO sensor was found to be increased in presence of different concentration of CO_2 (ppm) gas. The maximum sensitivity of pure and doped PTh-PEO sensor was found to be 0.36 and 0.47 respectively. Dynamic and static sensing response of both pure and doped PTh-PEO sensor, clearly shows that the response and recovery time of pure PTh-PEO sensor were slightly higher than doped PTh-PEO sensor. Hence doped PTh-PEO sensor shows good sensitivity and sensing response than pure PTh-PEO sensor. Similarly Step response of both the sensors exhibit better reproducibility.

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DIELECTRIC STUDY OF FOOD PRESERVATIVE POTASSIUM META -BISULPHATE (KMS) USING TIME DOMAIN REFLECTOMETRY (TDR) TECHNIQUE

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ABSTRACT

Preservatives help to delay the microbial growth. These preservatives may alter the electrical properties of the foodstuff. Therefore, it is necessary to study the electrical properties of preservatives. The present work deals with the dielectric study of Potassium Meta -Bisulphate using Time Domain Reflectometry (TDR). Electrical conductivity and Dielectric constant are studied with the TDR technique. A low frequency TDR was developed in the laboratory. Aqueous solution of Potassium Meta –Bisulphate was prepared with freshly collected distilled water. Nine different (0.01 – 0.1) molar concentrations are kept at three different temperatures (35°C, 45°C and 55°C). It was found that the electrical conductivity increases with increase in the concentration as well as temperature. Dielectric constant increases as increase in concentration but very small decrease was observed in the dielectric constant with the increase in temperature.

***Key words**: Electrical Conductivity, Dielectric Constant, Potassium Meta–Bisulphate, temperature, Time Domain Reflectometry*

INTRODUCTION

Excess use of preservatives or additives is harmful to human body. Potassium Meta-Bisulphate is used as a food additive, also known as E224[1]. It is restricted in use and may cause allergic reactions in some sensitive persons [2].
The impedance and conductance of the system are the main parameters for electrochemical signal analysis. This seems to indicate that the scientific community has chosen impedance spectroscopy to characterize a large number of electrochemical systems [3, 4, 5, 6].
Impedance spectroscopy is traditionally used in monitoring corrosion [7] and electro-deposition processes in the coating and characterization assessment of many kinds of sensors and semiconductors [8, 9]. Its application in biotechnology for the characterization of cell cultures [10] has, however, been notably expanded in the last decade. The impedance has been applied in the field of microbiology as a means of detecting and quantifying pathogenic bacteria [11, 12].
Impedance spectroscopy is a powerful tool for a fast bio-molecule diagnosis and for analysis in cell cultures [13, 14]. Its superiority over other laboratory techniques lies in that it uses a small signal, thus minimizing the alterations of the properties of the medium, in other words, applied stimulation does not alter the equilibrium conditions of the system. The signal applied to the samples makes it possible to link the properties of the liquid or solid being studied with the variations or changes obtained in its characteristic impedance. This is due to the physical structure of the material, the chemical processes occurring in it, or a combination of both. Consequently, electrochemical impedance spectroscopy is a non-destructive technique providing robust measurements.[15]
IS have been made in the biological area, such as studies of polarization across cell membrane and of animal and plant tissues [16, 17, 18, 19, 20]. The analysis techniques of IS are not limited to electrical immittance but apply as well to measurements of mechanical [21] and acoustic [22] immittance.

MATERIAL AND METHOD

We have developed an instrument for measurement of impedance based on time domain technique. A low frequency TDR of the Bandwidth 25MHz to 200MHz. Maximum real time sampling rate is 200MHz to 1GHz and 5ns rise time was developed. The experimental setup consists of sampling oscilloscope DS1000 [23], TDR module, a transmission line, and sample cell.. The co-axial transmission line with characteristic impedance of 50 ohm was used for study. Different types of probes (sample cell) were designed and tested for the accurate measurement.
Various samples of different molar concentrations of freshly collected distilled water and Potassium

Meta–Bisulphate were prepared. Electrical Conductivity and Dielectric Constant were calculated with the help of TDR.

RESULT AND DISCUSSION

Table: Electrical Conductivity and Dielectric Constant of aqueous solution of Potassium Metabisulphite

Temp.	**35 °C**		**45 °C**		**55 °C**	
Molar Conc.	**EC**	**DC**	**EC**	**DC**	**EC**	**DC**
0.01	3936	91.73	4636	89.92	5581	88.13
0.02	6780	125.21	7903	131.66	9025	118.92
0.03	9322	156.68	10286	142.76	11224	140.50
0.04	10393	207.76	11231	218.84	12276	196.97
0.05	11231	235.99	12448	238.92	13012	230.20
0.06	13090	247.79	13754	247.79	14379	244.81
0.07	13177	259.88	14038	250.79	14379	247.79
0.08	13741	281.72	14379	253.80	14722	250.79
0.1	14371	297.86	15027	288.12	15680	266.03

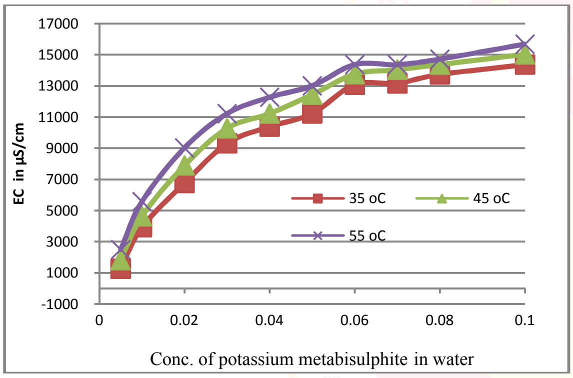

Fig 1: Electrical conductivity

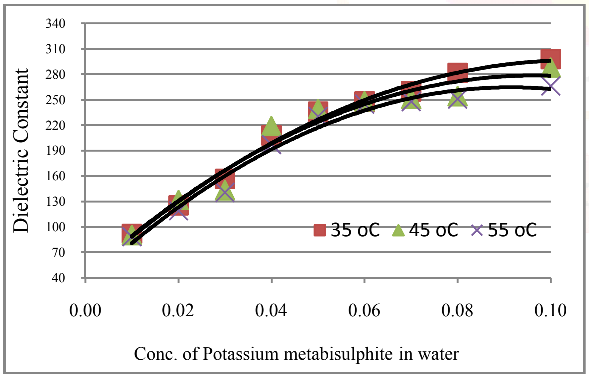

Fig 2: Dielectric Constant

Electrical Conductivity of sodium metabisulphite in distilled water increases with increase in concentration as well as temperature of the solution. It indicates that conductivity is directly proportional to the concentration and temperature. Graph shows that fast raise from 0.01 to 0.04 molar concentrations.

The dielectric constant of potassium meta-bisulphate increases with increase in molar concentration. There is remarkable increase in dielectric constant from 91 to 297 at 35 °C. Same type of change is observed for 45 and 55 °C.

Temperature also affects the value of Dielectric constant. Graph shows decease in dielectric constant as temperature increases i.e. Dielectric constant is inversely proportional to the temperature.

CONCLUSION

The developed TDR unit using digital storage oscilloscope, pulse generator, coaxial transmission line and sensor probe works successfully for the measurement of electrical parameters, dielectric Constant and Electrical Conductivity of preservatives. The parameter value changes with change in temperature well as molar concentrations. This indicates the change in properties of solution with temperature and concentrations. This helps to decide the food preservation strategy.

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ELECTRICAL INVESTGATION OF POLYTHIOPHENE–POLY (VINYL ACETATE) COMPOSITE

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ABSTRACT

Polythiophene (PTP) and poly (vinyl acetate) (PVAc) composite films were prepared by chemical oxidativepolymerization method with $ZnCl_2$ as an oxidant, in methanol at room temperature. Their dc conductivitiesas a function of temperature (313–358 K) were measured. An attempt has been made toinvestigate the effect of temperature and concentration of zinc chloride oxidant on the conductivityof polythiophene–poly (vinyl acetate) composite films. For fixed wt% of PVAc, the dc electrical conductivityof the film initially increases with the molar concentration of $ZnCl_2$ and then decreases with the furtherincrease in the concentration of $ZnCl_2$. The temperature dependence of conductivity showedArrhenius behavior. The Nyquist plot of Z' vs. Z" was plotted for frequency range 100 Hz–200 kHz and temperaturerange of 313–358 K. These plots consist of semicircles for higher temperatures. This suggests Debye typerelaxation mechanism. The equivalent circuit consists of parallel combination of bulk resistance R_B andbulk capacitance C_B. The bulk resistance R_B of the samples decreased with increase in temperature.

Key words: *Polythiophene, dc electrical conductivity, conducting polymer, structure, synthesis.*

INTRODUCTION

The first conducting plastics were discovered by accident at the Plastics Research Laboratory of BASF in Germany. They were attempting the oxidative coupling of aromatic compounds. When they made polyphenylene and polythiophene they found that they showed electrical conductivities of up to 0.1 s cm^{-1}. Since then other conducting polymers have been discovered.

Since1976, a number of conducting polymers, namely polypyrrole, polythiophene, and polyaniline, have become the focus of much study. The importance of conducting polymers is exemplified by awarding Nobel Prize for the discovery and development of conducting polymers. This was particularly exciting because it created a new field of research and a number of opportunities on the boundary between chemistry and physics.

Conducting polymers, also sometimes called conjugated conducting polymers, have high electrical conductivity. Conjugated polymers have received a great deal of attention in the last decade due to their potential applications in optoelectronic devices such as organic light-photovoltaic cells [1], emitting diodes (LEDs) [2], photovoltaic cells [2] and photo transistors [3] gas sensors [4]. A wide range of conjugated polymer systems and their derivatives have been developed, such as poly (1, 4-phenylenevinylene) (PPV) [5, 6], poly (p-phenylene) (PPP) [7], polyfluorene (PF) [8] and polythiophenes (PT) [9-11]. Among these polymers polythiophenes are being regarded as one of the most promising materials because of their good thermal and chemical stability, as well as excellent electronic and optical properties [12-15]. Many composites of polythiophene have been reported using various matrices of conventional polymers such as PTP-PolyN-Vinylcarbazole[16], PTP-Polyimide[17], PTP-Polyfuran[18].

The world of conducting polymers [CPs] has been established asan important branch of materials science owing to many opportunitiesfor applications in electronics and photonics. Among thewide variety of organic conducting polymers, the polyheterocycleshave received more attention due to their high conductivity, environmentalstability and simple preparation procedure [19–21]. In 1977, it was discovered that the conductivity of polyacetylene[PA] could be increased by 13 order of magnitude by doping it withvarious donor (alkali metals) or acceptor (halogens, AsF5) speciesto give n-type or p-type semiconductors and conductors [22]. Since then a number of other organic polymers have been investigated extensively, synthesized and evaluated as conductors upon doping: polypyrrole, PPY [23], polythiophene, PTP [24], poly(p-phenylene), PPP [25], polyaniline, PANI [26], and many others [27].

EXPERIMENTAL
SAMPLE PREPARATION

Polythiophene was synthesized at room temperature (303 K) by mixingmonomer thiophene (Sd fine chemicals, AR grade) with solutionsof $ZnCl_2$ and polyvinyl acetate(PVAc) (AR grade) in methanol (AR grade) solvent. A solution ofPVAc was first prepared in methanol. The composition of the solutionwas PVAc:methanol = 10:90 (wt% ratio). The molar concentrationof $ZnCl_2$ in this solution was changed from 0.1 M to 1.2 M. Foreach molar concentration of FeCl3, wt% quantity of thiophene was keptconstant at 0.4 ml. Thus, such films were prepared for differentmolar concentration viz. 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1and 1.2 M of $ZnCl_2$. When monomer thiophene was added to the solutionof PVAc–methanol– $ZnCl_2$ a homogeneous solutionwas obtained. The solution was then poured on a chemicallycleaned optically plane glass plate, to prepare the composite films.The thiophene polymerization progresses because the evaporationof the solvent increases the oxidation potential of cast solution.After evaporation of the solvent, the transparent thin films wereformed which were then washed with water to remove the excessof $ZnCl_2$. The optimization of the composite films for PVAc:methanol= 10:90 (wt% ratio), prepared with different molar concentrationof the oxidizing agent $ZnCl_2$,was done with respect toconductivity σ, at 323 K.

DC CONDUCTIVITY MEASUREMENT

DC electrical conductivity of the samples was measured in thetemperature range of 313–358 K using Ohms law. A dc regulated power supply having a Pico ammeter with a resolution of 1 pAand a voltmeter having a resolution of 0.01 V was used for themeasurement. The thickness of the films was measured with dogmaticmicrometer (Japan), having a least count of 0.001 mm.

IMPEDANCE MEASUREMENT

Impedance measurements were performed by using a WayneKerr (Model 4230) LCR meter, in the frequency range 100 Hz to200 KHz, in the temperature range 313–358 K. The amplitude ofthe bias voltage was selected as 0.25 V for the whole frequencyrange.

TG–DTA CHARACTERIZATION

The film samples were characterized by using thermogravimetric-differential thermal analysis (TG-DTA) technique. The thermalstudies of the films were carried out under Ar atmosphere with aheating rate of 10^0C/min on a Perkin–Elmer (Diamond model)thermal analyzer in the range of room temperature to 400 ^{0}C.

RESULTS AND DISCUSSION

The variation of dc conductivity with molar concentration of$ZnCl_2$ for 10 wt% PTP–PVAc composite films at various temperatures is presentedin Fig. 1.

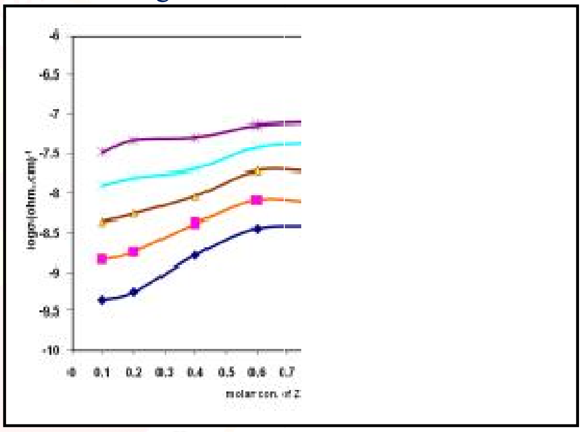

Fig.1- Variation of conductivity with different molar concentration of $ZnCl_2$ at various temperatures.

It is observed that initially as the molar concentration of $ZnCl_2$ increases, conductivity also increases, and it became maximum at 1.0 M $ZnCl_2$. To optimize the system the dc conductivity variation is plotted against $ZnCl_2$ (M) concentration which is shown in fig 1. The nature of the curves for all the temperature is found to be same. The conductivity is found to be maximum for 1M of $ZnCl_2$ sample. The room temperature conductivity is found to be of the order of 2x 10^{-8} $(ohm.m)^{-1}$. The temperature variation of conductivity for different samples of $ZnCl_2$ doping is depicted in fig2. The plot of log σ Vs 1/T shows almost linear behavior within the studied temperature range. The resistance of the sample decreases with increase in temperature and follows Arrhenius behavior.

Fig.2 shows the temperature dependence of conductivity as a plot of log of conductivity versus 1000/T, for different molar concentration of $ZnCl_2$.

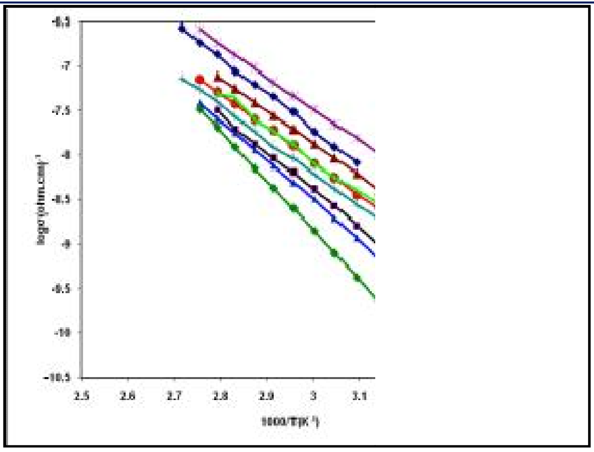

Fig.2-Plot of Variation of dc conductivity with temperature for different molar concentration of $ZnCl_2$ in PTh-PVAc films.

It is observed that as the temperature increases conductivity also increases due to increase in mobility of charge carriers and the charge carrier hop among the conducting domains. Also, for lower molar concentration of $ZnCl_2$, barrier of PVAc affect the mobility and it requires higher activation energy (excitation energy) to hop, so the resistance rises and conductivity decreases. It is clearly observed from the graph that as molar concentration of $ZnCl_2$ increases the curve shifted upwards indicates the increase in conductivity. It is due to reduction in barriers of PVAc. All the curves are linear. It is known that, in common with other amorphous semiconductors or polymers the temperature dependence of conductivity obey Arrhenius relation

Impedance data taken over wide range of frequency at different temperatures and obtained the Nyquist diagram. Nyquist diagrams for various molar concentration of $ZnCl_2$ and various wt. % of thiophene is as shown in fig.3

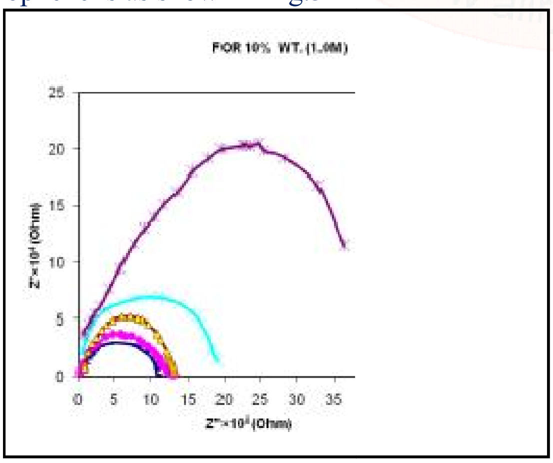

Fig.3:Nyquist plots Z' versus Z"at various temperature for PTh-PV composite with $ZnCl_2$ - 1.0M.

The Impedance data at room temperature do not take the sharp shape of semicircle in the Nyquist plot, which having certain slope, suggesting the some type of insulating behaviour of composite at room temperature.

It is observed that with increasing the temperature the slope of lines decreases and they deviates towards realZ' axis and at temperature above 50^0C, a semicircle could be traced, indicating increase in the conductivity of the sample. The semicircle diameter gives the electrical resistivity of the sample at the specified temperature and the maximum value corresponds to the relaxation frequency,

$f_r = 1 / 2\pi RC$ ------------------------------(1)

Initially at low temperature, when the sample resistance is too high, a small portion of the impedance dispersion profile can be detected in the measured frequency range and thus making data analysis impossible. Since the impedance measurements performed for all the samples at 318 K did not present the complete semicircle.

For higher temperature we get semicircular plots. It provides the information about the nature of dielectric relaxation. As the Nyquist plots are single semicircle with the centre located on the Z" axis, relaxation process is pure monodispersive Debye process. For polydispersive relaxation, these argand plane plots are close to circular arcs with end points on the real axis and the center below this. The comlex impedance in such situations is known to be described by Cole-Cole formalism. Above figures shows full semicircle, suggests that the relaxation to be Debye type.

From these semicircles values of bulk resistance (R_b) and bulk capacitance (C_b) can be calculated at various temperatures. These values are given in table 1.

Table1:- Values of bulk resistance (R_b) and bulk capacitance (C_b) of optimized 1.0M concentration of $ZnCl_2$ sample at various temperature.

S. No.	Temperature(K)	Relaxation Frequency (KHz)	Bulk resistance R_b(kΩ)	Bulk Capacitance C_b (nF)	2Л$f_rR_bC_b$
01	313	1.5	36.36	2.9	0.99
02	323	10	18.92	0.84	0.99
03	333	20	12.73	0.62	0.99
04	343	40	12.97	0.31	1.0
05	353	5	10.57	3.01	0.99

From above table it appears that values of 2Л$f_rR_bC_b$ are found to be nearly equal to 1, which supports classical Debye formalism. As the impedance plane polts are semicircular, it's equivalent electrical circuit is a parallel combination of Rb and Cb at different temperatures are given in table1.

For the conducting polymer composites prepared by mixing conducting particles, the conductivity of the composite is insensitive to initial mixing, although it rises dramatically as the so called percolation threshold is reached. Further increase in molar concentration of $ZnCl_2$, the conductivity decreases. This may due to lack of conjugation. Overloading the monomer concentration may disturb the conjugation, which play an important role in conduction. Thus the conductivity decreases at higher molar concentration of $ZnCl_2$.

Frequency dependance of a real part of impedance Z' (Zsinθ) at different temperature for optimised PTh-PVAc composite samples 1.0 M of $ZnCl_2$ are shown in figure 4.

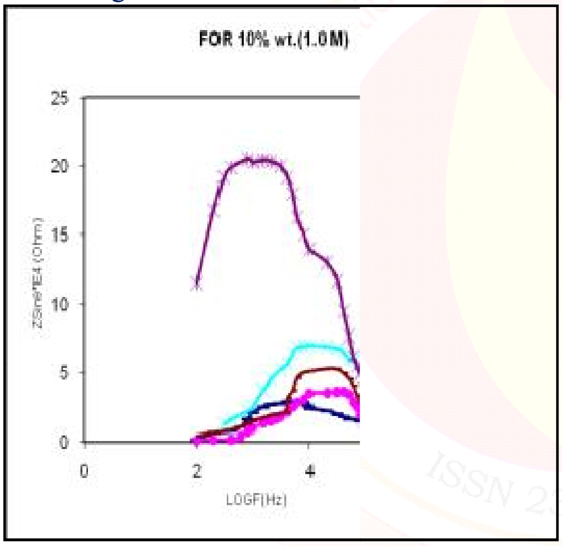

Fig.4:Z'(Zsinθ) versus frequency at various temperature for PTh-PVAc composite with $ZnCl_2$-1.0M (Optimised sample).

The relaxation times (τ) were calculated from the frequency at which Z'_{max} is observed. The frequency of maximum Z', called relaxation frequency (f_r).

Relaxation frequency (f_r) shifts to higher values with increasing temperature indicating the increasing loss in the samples.

The variation of frequency with temperature is as shown in fig.5 for various molar concentration of $ZnCl_2$.

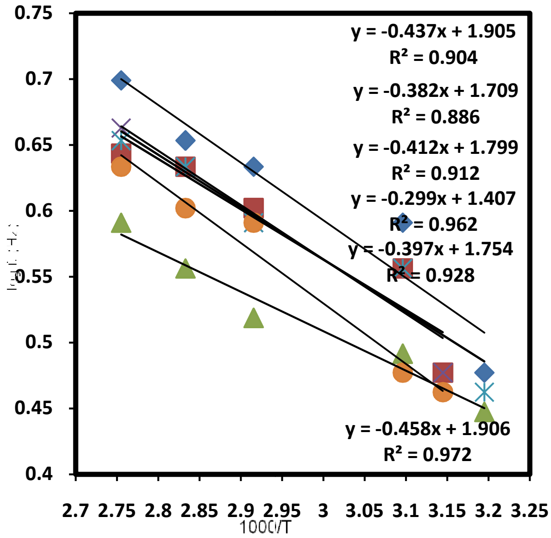

Fig.5:- Logf$_r$ versus 1000/T plot for PTh-PVAc composite for various molar concentration of $ZnCl_2$.

The relaxation frequency (f_r) Vs. 1/T plots obey Arrhenius relation given by;

$f_r = f_0 \exp(-E_g / kT)$

where f_0 is the pre-exponential factor, k is Boltzmann's constant, T is absolute temperature and E_g is the activation energy can be calculated from slope. The nature of log f_r versus 1000/T plot is linear.

CONCLUSION

PTP–PVAc composites were synthesized by oxidative (chemical)polymerization of thiophene using different concentration of$ZnCl_2$. The composites were characterized by electrical and thermalmethods. The conductivity of the composites can be tuned by varyingthe concentration of dopant $ZnCl_2$. It has been observed that thePTP–PVAc composites, synthesized with 1.0 M of $ZnCl_2$, showed amaximum conductivity at 323 K. The low values of conductivitymay come from the contribution of ionic conductivity. The initial increasein conductivity with $ZnCl_2$ concentration may be due to increasein strength of the oxidizing agent, which increases the rateof polymerization. Further the conductivity decreases with increasein $ZnCl_2$ concentration, because increasing $ZnCl_2$ concentration maystiffen the polymer chains due to the formation of polymer salt complex.PTP in PTP–PVAc composite helps to enhance the ionic transport.The value ofbulk resistance R_B decreases with increase in temperature.

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SYNTHESIS OF CuO MODIFIED NANOCRYSTALLINE CR_2O_3

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ABSTRACT

Nanocrystalline Cr_2O_3 was successfully synthesized by co-precipitatipon method. Synthesized Cr_2O_3 was examined with the help of X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM) and energy dispersive X-ray (EDX) spectroscopy. Thick films of pure Cr_2O_3 were prepared by screen-printing technique. The surfaces of these films were modified by dipping them into a 0.01M aqueous solution of cupric chloride ($CuCl_2$) for different intervals of time, followed by firing at 550 ^0C for 30 min. The firing resulted in the oxidation of the $CuCl_2$ additive into. CuO i.e Cu0 modified Cr_2O_3 thick films.

Keywords: *Chromium Oxide; Nanocrystalline; X-ray diffraction; Thick films; CuO.*

INTRODUCTION

Chromium oxide (Cr_2O_3) is one of the widely studied transition metal oxide because of to its wide band gap (~3.3 eV) [1]. Cr_2O_3 is an intrinsic semiconductor at high temperature (>1000ºC), whereas extrinsic p-type semiconductor at lower temperatures [2,3]. This kind of p-type wide band gap oxide semiconductors may be a good candidate for numerous applications.

Different preparation techniques for synthesis of Cr_2O_3 nanoparticles have been reported in the literature. For most of the techniques, highly explosive reactants, more complex processes, environmentally sensitive, more expensive reaction apparatus and higher calcination temperature is required. Moreover, most of methods produced a nonhomogenous particle size distribution, highly agglomerated and low yields. Among them, co-precipitation is considered as a cost effective and a less time consuming route. This technique can be used for the production of high purity nanocrystalline Cr_2O_3 on large scale.

So, the aim of the present work is to prepare nanocrystalline Cr_2O_3 by co-precipitation route to investigate the effect of CuO modification on structural and morphological behaviour of Cr_2O_3 based thick films fabricated by screen printing technique.

EXPERIMENTAL

2.1. Synthesis of nanocrystalline Cr_2O_3

In present work 25.50gm $Cu(NO_3)_3 \cdot 9H_2O$ was dissolved in 50 ml double distilled water and then kept on magnetic stirrer at 80^{0}C for 1 h, a transparent solution was formed. In this solution ammonia was added drop wise until a precipitated of pH 9 was formed. After ageing at room temperature for overnight the Chromium hydroxide was recovered by filteration, washing with double distilled water and drying at 110^{0}C for 24 h. Cr_2O_3 nanomaterial was obtained by calcinig Chromium hydroxide at 600^{0}C for 5 h. The synthesized Cr_2O_3 nanostructure product was used for further study.

2.2. Preparation of thick films

Thick films of Cr_2O_3 nanostructure were prepared by using screen printing technique. In this process, paste was formulated by mixing the synthesized Cr_2O_3 nanostructure with ethyl cellulose (a temporary binder) in mixture of three organic solvents. The ratio of inorganic to organic part was kept as 75:25 in formulating the pastes. The ready pastes were screen printed on a glass substrate in desired patterns. The films prepared were fired at 500^{0}C for 12 h. Prepared thick films termed as pure Cr_2O_3 thick films.

2.3. CuO modified Cr_2O_3 thick films

Surface of pure Cr_2O_3 thick films were modified by dipping them into 0.01M aqueous solution of $CuCl_2$ (99%ARgrade, Merck) for different intervals of time (3, 6, 9 min.). Dipped thick films were dried under IR lamp for 1 h. Dried thick films were fired at 500^{0}C for 30 min. The $CuCl_2$ dispersed on the film surface was oxidised to CuO in firing process and sensor elements with different mass % of CuO on the surface of Cr_2O_3

thick films were obtained. These surface modified thick films are termed as CuO modified Cr_2O_3 thick films.

RESULTS AND DISCUSSION

3.1. X-ray diffraction studies

Fig. 1 shows X-ray diffraction (XRD) patterns of synthesized Cr_2O_3 powder samples, the observed peaks are matching well with JCPDS data of Cr_2O_3. The characteristic peaks observed in the spectrum are higher in intensity which indicates that the as-synthesized samples are of good crystalline nature. The average crystallite size (D) was estimated from

the Debye–Scherrer's equation: $D = 0.9\ \lambda / \beta \cos \theta$; where λ is the wavelength of X-rays (1.54056 Å), β is the FWHM, θ is the diffraction angle at which the full width at half maximum (FWHM) measured.

The average crystallite size of the synthesized Cr_2O_3 nanoparticles was measured from XRD patterns using Scherrer equation and was found to be ~23 nm.

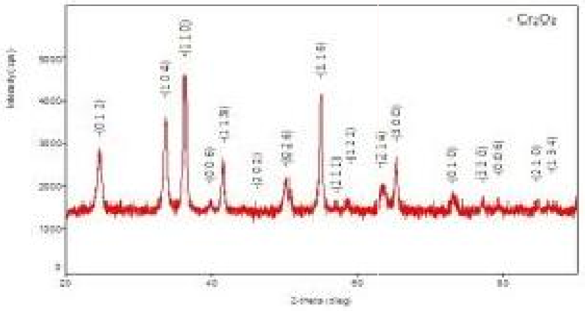
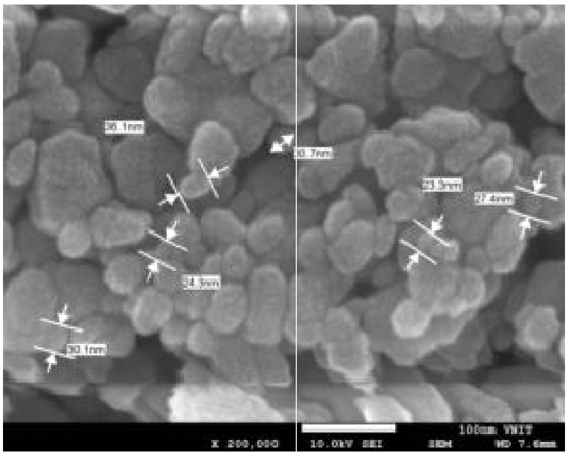
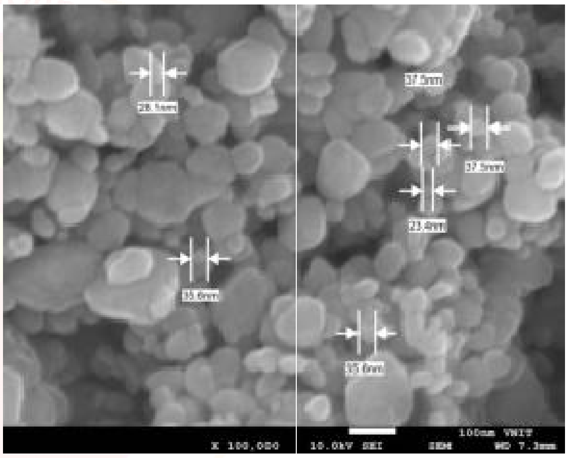


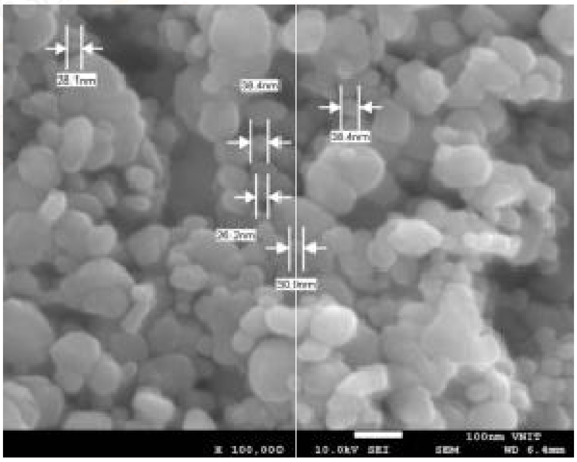
Fig. 1: X-ray diffraction pattern of Cr_2O_3 powder sample calcinated at 600 ^{0}C.



(a)



(b)

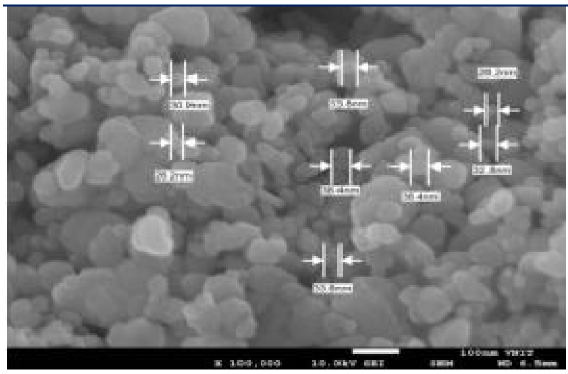


(c)

3.2. Scanning electron microscopic study

Fig. 2 (a-d) shows typical FE-SEM images of the pure and CuO modified Cr_2O_3 thick films prepared by screen printing technique. It can be seen from Fig. 2 (a) that the pure Cr_2O_3 nanoparticles were nearly uniform spherical shapes and very small particles in evidently dispersed without large agglomerates. Fig. 2 (b-d) depicts the microstructure of

CuO modified film for 3 min., 6 min. and 9 min., respectively, consist of particles with smaller size and shape associated with the Cr_2O_3 grains. Moreover, it can be seen that there is decrease in the agglomerations with the increase in the content of Cu. The average grain size of the fabricated thick films is observed to be in the range of 24 nm to 32 nm.



(d)

Fig. 2: FE-SEM microstructures for (a) Cr_2O_3 nanoparticles (b) CuO modified Cr_2O_3 thick films (3 min.) (c) CuO modified Cr_2O_3 thick films (6 min.) (d) CuO modified Cr_2O_3 thick films (9 min.).

CONCLUSIONS

In this paper, nanocrystalline Cr_2O_3 has been successfully prepared by co-precipitation method. The average crystallite size of as-prepared Cr_2O_3 has been estimated to be ~23 nm. The as-prepared nanoparticles are high purity, composition and produced with minimal agglomeration. The crystallite sizes calculated from XRD data show good agreement with those particle sizes obtained by FE-SEM. The morphological characterization of pure and CuO modified Cr_2O_3 thick films reveals that there is decrease in the agglomerations with the increase in the content of Cu.

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LASER TRANSITION AS A FUNCTION OF TIME FOR DIFFERENT INITIAL INVERSION DENSITIES

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ABSTRACT

We have computed normalized inversion density of the laser transition as a function of time for different initial inversion densities of the transition. The time is taken as initial time when the discharge pulse is fired. The behavior of inversion density has been studied for initial inversion density from 0.1 through 1.If the pumping pulse is longer enough. However, as the pumping pulse width increases the electrical efficiency of laser system decreases because the lower laser state gets more and more populated reducing the population density. In case of 3371 A ultra violet pulsed nitrogen laser the inversion time is measured by Steinvall and Anvary.

Keywords: *glow discharge, interface, radiation intensity, emission*

INTRODUCTION

In order to increase the laser pulse peak power and pulse width, the knowledge about the inversion time is very much essential. In case of CVL the pumping pulse produces the inversion favorable for the stimulated emission. In the CVL discharge the upper state must be excited with the high excitation rate by the electron impact excitation within a very short interval of time. A high voltage and high current discharge pulse having narrow' pulse width passed through the copper-helium or copper-neon mixture produces high inversion density [24]. After the production of the inversion the stimulated emission and spontaneous emission together destroy the population inversion produced by the pumping pulse. After a typical time interval the inversion becomes zero and then after some time it becomes negative. The laser medium favors amplification as long as the population inversion is present. When the inversion becomes negative it starts absorbing the radiation consequently reducing the laser beam intensity and energy. The time interval within which the population inversion produced by the exciting pulse becomes zero may be called as inversion time.

The inversion time is determined together by the shape of the pumping pulse, the temperature of the electrons in the pumping pulse, the fluorescence life time of the laser state, density of lower laser state and the flux of the stimulating radiation.

POPULATION AND DEPOPULATION OF THE LASER STATES

It has been extensively discussed that the laser states are dominantly populated by the electron collisions. The excitation rate would depend upon the electron density, copper density and electron impact excitation rate. The laser states are also excited by the cascading processes. The energy states of copper atoms lying above the laser levels are excited with low excitation rate coefficient. Moreover, the higher states are coupled to the other states also reducing the excitation rate of the laser states. Thus, the contribution of the cascading processes to the excitation of the laser states is negligible. The computation of the inversion density, the electron collision de-excitation of the laser states may be considered as negligible. Thus, in absence of the stimulated emission of the radiation the rate governing the density of the upper laser state is expressed as

$$\frac{dN_u}{dt} = \frac{-N_u}{\tau_u} \qquad (1)$$

having the solution

$$N_u(t) = N_u(0)\exp(-t/\tau_u) \qquad (2)$$

where, N_u (0) is the population of the upper laser state at time t = 0 (i.e. when the discharge pulse is fired), τ_u is the fluorescence life time of the upper laser state. The energy states of the copper atom are radiatively coupled to the state having radiative decay life time 40 nsec. In fact, the state decays only to populate the lower laser state. Thus, the decay of the upper laser state and the population of the lower laser state takes place according to the equation 6.2.

The lower laser state has fluorescence life time of about 700 nsec, which is longer than 40 nsec, the fluorescence life time of the upper laser state. Thus, the decay of lower state may be assumed to be negligible as compared to that of upper laser state. Hence the population of the lower laser state at time t after firing the exciting pulse (for t << 700nsec) may be expressed as

$N_l(t) = N_l(0) + N_u(0) \exp(-t/\tau_u)$ (3)

Subtracting equation 7.3 from 7.2 and dividing the resulting equation by a factor $N_u(0) + N_l(0)$, we get,

$n(t) = [1 + n(t_i)] \exp(-t/\tau_u)$ (4)

where

$$n(t) = \frac{N_u(t) - N_l(t)}{N_u(t) + N_l(t)}$$

Normalized inversion density at time t

.

$$n(t_i) = \frac{N_u(0) - N_l(0)}{N_u(0) + N_l(0)}$$

Normalized inversion density

The equation (4) gives the normalized inversion density at time t. At a time t = 0, the first term in the equation is equal to $1 + n(t_i)$ and the normalized inversion density is equal to the initial inversion density $n(t_i)$. As time advances the first term decreases and after a time t_n called as inversion time, the first term becomes +1 i. e. the inversion density becomes zero. A time after inversion time t_n the first term become more than 1 and the inversion becomes negative. After time t_n the laser medium starts absorbing the radiation reducing the Intensity of the laser output beam. The electrical energy deposited into the laser medium at time t later than the inversion time t is wasted.

The inversion time t_n may be obtained by putting n(t)= 0 and $t = t_n$ in equation (4) Rearranging the resulting equation we get,

$t_n = \tau_u \ln[1+n(t_i)]$ (5)

The inversion time is a function of the fluorescence life time and the normalized initial inversion density. In the CVL for 5106°A, the increase in initial inversion density increases the inversion time. The normalized initial inversion density varies from 0 through 1. This shows that when· exciting pulse is very narrow the inversion time is maximum which is

$\tau_u \ln 2$.

In case of transversely excited lasers the exciting pulse is narrow and the excitation of the laser states during the formation of the laser pulse may be very less. However, when the excitation of the laser medium is long enough and the rate equation for the upper laser state may not be written as equation (3) The excitation due to electron impact during the laser formation must be taken in to consideration. Thus, the rate of the change of the population of the upper state is written as,

$$\frac{dN_u(t)}{dt} = -\frac{N_u(t)}{\tau_u} + R_{gu} N_g N_e \qquad (6)$$

If the term R_{gu} N_g-N_e is slowly varying as compared to the first term, the equation (6) has solution.

$N_u(t) = N_u(O) \exp(-t/tu)+C1$ (7)

where, C1 is constant whose value depending upon the pump pulse characteristics. Further, the wider pump pulse increases the value of N_l (0) by a constant factor. The new value of the population of the lower state may also be denoted by $N_l(0)$. Using the value of the $N_u(t)$ given by the equation (7), the value of inversion time may be obtained and it is expressed as

$t_{nl} = T_c \ln [n(t_i) + 1]/K$ (8)

where,

$K = 1 - C_1/[N_u(0) + N_l(0)]$

When the pump pulse is narrow the value of constant C, goes to zero and the constant K tends to unity. Under this condition the equation (8) reduces to (5)

The discharge pulse width dependents upon several parameters like charging voltage, gas pressure in the discharge tube, pulse repetition rate, temperature of the gas in the tube, distance between the electrodes, size and shape of the electrodes, material of the electrode etc. In fact the discharge pulse parameters like pulse shape, pulse height and the heating of the plasma electrons during discharge pulse may be studied as a function of the above parameters. The inductance of the pulse forming line also plays vital role in the determination of the pulse parameters.

A flat plate double Blumelein pulse forming circuit is used in transversely excited laser[6-10]. The pumping pulse is very narrow and the discharge electron cool down to a value where excitation rate coefficient is very small. In nitrogen laser discharge the pumping pulse electrons cool down to about 1.5eV from 14eV within fraction of a nanosecond. The pulse for CVL excited by transverse discharge should have same properties. The excitation rate coefficient at

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electron temperature 1.5eV is times less than that at its 14eV. Thus it may be assumed that the discharge pulse is very narrow and the inversion time is computed using equation (5)

In the longitudinal electrical field pumping, the separation between the laser electrodes is more than that in transverse electric field configuration system. The increase in the separation between electrodes increases pulse length of the discharge current decreasing the pulse height. Consequently the electron density is also reduced resulting in less output power and electrical efficiency. The electrical efficiency of the transverse electric field configuration system in general is more as the energy of the discharge pulse is condensed in the narrow current pulse.

The expression (5) and (8) are the expression for the inversion time, where there is only spontaneous decay of the laser levels. However, this is not always the situation as there may come a stimulated emission. After the onset of stimulated emission the rate of decay of population inversion increases resulting in the shortening of inversion time. The expression for the inversion time give maximum possible value of time for which the inversion can persist in the laser medium. The formation of the laser pulse starts after the firing of the discharge pulse by spontaneous emission of radiation from the laser state. The pulse grows in amplitude as there is high inversion density in the medium. The amplitude of the pulse grows as long as there is inversion density in the medium. When major part of the density is exhausted by stimulated and spontaneous emission, the pulse height goes on decreasing with high rate. The process of amplification of radiation terminates at time $t = t_{nl}$. At later time $t > t_{nl}$ the population inversion becomes negative and medium starts absorbing the radiation. Hence zero intensity laser pulse width Δt_p at most is equal to the inversion lifetime t_{nl}. The condition can be written mathematically as

$$\Delta t_p < t_{nl} \qquad \text{-------- (9)}$$

POPULATION INVERSION DENSITY OF THE TRANSITION

The inversion density plays very vital role in the determination of the output power and pulse width of the output laser. The inversion density produced by the discharge pulse before initiation of building of the oscillations is called as the initial inversion density. Later on the inversion density is destroyed together by spontaneous and stimulated emission. The figure (1) shows the decay of the inversion density by the process of spontaneous emission. When the stimulated emission is switched on the inversion density in the discharge is destroyed faster than that destroyed by the spontaneous emission. The destruction rate of the inversion density by the stimulated emission is determined by the photon flux at the laser wavelength and the Einstien's coefficient.

RESULTS AND DISCUSSION

The behavior of inversion density has been studied for initial inversion density from 0.1 through 1. The results are displayed in figure (1) All the curve shows decay of the population inversion density. The inversion time of the transition $^2P_{3/2}$ $^2D_{5/2}$ of copper atom is computed using equation (8) and the results are displayed in figure (2) The curves are obtained for values of K varying from 0.1 through 1. The increase in the length of the pumping pulse has great influence on the inversion time of the transition. It is noticeable that the inversion time can be as long as 120 nsec. Thus the computations for the CVL also should give the reliable values of the inversion time. In CVL systems and UV nitrogen laser the pulse width of the output pulses lies between 5 and 40 nsec.

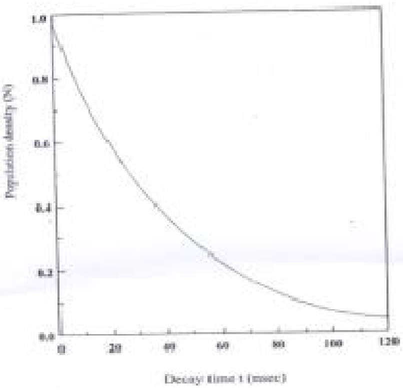

Fig:1 Decay of population inversion of $^2P_{32}$ energy state of copper atom

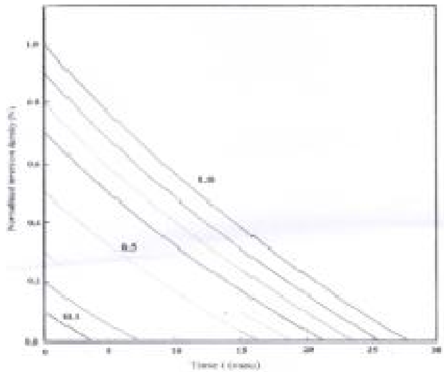

Fig: 2 Decay of normalized inversion density for $^2P_{3/2} \rightarrow {}^2D_{5/2}$ transition of copper atom

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ACOUSTICAL STUDY OF TERNARY LIQUID MIXTIRES OF BENZENE + TRIMETYHYL AMINE +ACETIC ACID AND BENZENE + TRIETYHYL AMINE +ACETIC ACID AT DIFFERENT TEMPERATURES

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ABSTRACT

Various thermodynamic and acoustical parameters such as adiabatic Compressibility (β_a), Free length (L_f) and Specific Acoustical Impedance(Z) were calculated. The ultrasonic velocity, viscosity and density of ternary liquid mixtures of different compositions have been made at different temperatures in the ternary liquid mixtures of benzene + tri-methylamine + acetic acid and benzene + tri-ethylamine + acetic acid at different temperature. The results were explained in terms of dipole-dipole interactions and hydrogen bon formation between acetic acid and tri-ethylamine.

***Key Words**: Carboxylic acids, tri-methyl amine, molecular interactions, Ternary liquid mixtures, Ultrasonic study. Free length, acoustical impedance*

INTRODUCTION

The molecules in a liquid are so close together that the various interactions such as Vander Waal's forces, electronic fields and ionic interactions assume considerable significance. Because these factors are not easy to evaluate, it is expedient to heavily rely on experimental information in characterizing liquids. The data may be classified according to the equilibrium and non-equilibrium conditions of the fluid. The consideration of collection of thermodynamic properties makes up the first category, while the second involves the transport phenomenon.

Of the several physical properties of liquids which can be employed to study the various molecular interactions prevailing therein, we have chosen density, viscosity and ultrasonic velocity to derive the various parameters

Following liquid systems were taken for investigations:

System I: Benzene +Tri-ethyl amine (TEA) + Acetic Acid

System II: Benzene +Tri-methyl amine (TMA) + Acetic Acid

Temperatures: 303K, 308 K, 313 K

MATERIALS

1.Carboxylic Acids:

A carboxylic acid is organic component that contain carboxyl group COOH. Carboxylic acids occur widely in nature and include amino acids and acetic acid (as vinegar).They play very important role in life processes. They are also very important in food industry and medical science. When carboxylic group is deprotonated its conjugate base forms carboxylate anion. The carboxylate ions are stabilized and this increased stability makes carboxylic acids more acidic than alcohols. In functional group COOH, a carbon forms double bond to one oxygen forming a carbonyl group and single bond to other oxygen atom forming a hydroxyl group (or OH in case of formic acid). The carboxylic acids are highly polar organic compounds .the polarity results from the presence of strongly polarized carbonyl group(C=O) group and hydroxyl group (OH). Recalling that oxygen is relatively electronegative atom and when covalently bounded to carbon atom and particularly hydrogen a strong dipole is created

2: Amines

Amines are organic derivatives of ammonia, NH3, in which one or more of the three H's is replaced by a carbon group. Amines are abundant in nature. They are a major component of proteins ,enzymes and nucleic acids. Amines are classified as primary (1°), secondary (2°), or tertiary (3°), depending on how many carbon groups are connected to the nitrogen atom. They smell fishy and can form hydrogen bond to each other. They are used in detecting adulteration of urea in dairy industry. The nitrogen is less electronegative than oxygen so that N-H bond is not quite as polar as O-H bond. They are a major component of proteins and enzyme, nucleic acids and alkaloid drugs. The study of physical properties can be used to study the nature of the molecular interactions

SAMPLE PREPARATION AND MEASUREMENT

In the present investigation density, viscosity and ultrasonic velocity are measured for ternary liquid mixtures containing Benzene + Tri-methyl amine + Acetic acid and Benzene + Tri-ethyl amine + Acetic acid at four different temperatures 303K, 308Kand 313K. The chemicals were of AR grade obtained from Merc, Mumbai with purity of 99.5% . Samples of different concentrations were prepared by mixing the component liquids in volume proportion. Every time 28 ml was prepared for measurement of density, viscosity and ultrasonic velocity.

The density measurements were made by using electronic monopan balance supplied by CONTECH with accuracy of 0.0001 gm and specific gravity bottle of 10ml capacity. The density bottle was filled with the sample mixture and then immersed up to the neck in thermostatic bath for five minutes. After that it was wiped out from outside, cooled up to room temperature and weighed using monopan balance.

For viscosity measurements Ostwald viscometer was filled with given liquid and was immersed into constant temperature water bath for about 5 minutes to acquire the desired constant temperature. The time't' for liquid to go from mark A to lower mark B was recorded, with a stop watch of accuracy.

The sound velocity was measured by using ultrasonic multiple frequency interferometer supplied by Mittal enterprises New Delhi working at 3 MHz (Model No. M815)

In order to keep the temperature of the mixture the temperature controlled water bath was used. The density bottle and viscometer were immersed in bath for 10 minutes to attain the desired temperature. In order to keep the temperature of the mixture constant the constant temperature water bath supplied by BIOTECNICS INDIA with accuracy of 0.5 ^{o}C was used. The hot water of the bath was circulated through the metal Jacket of the cell of the interferometer.

RESULTS AND DISCUSSIONS

Tables for System-I (Benzene + Tri-ethyl amine + Acetic acid)

Mole Fraction Of Tri-ethyl amine	Density (ρ) (gmcm^{-3}		Velocity (U) (m/s)	Molar volume (V) (cm^3/mole)	Adiabatic compre. (βa) (cm^2/dyne)	Free length (Lf) (A^o)	Available Volume (Va) (cm^3/mole)	Specific acoustical impedance (Z) (dyne s cm^{-3})
0.3902	0.8428	0.4745	1171.5	103.367	8.65E-11	0.5867	27.68	987.33
0.3097	0.8801	0.7129	1197.0	94.300	7.93E-11	0.5619	23.75	1053.44
0.2403	0.9263	1.1614	1232.4	85.752	7.11E-11	0.5320	19.70	1141.60
0.1799	0.9769	1.9015	1305.6	78.137	6.00E-11	0.4890	14.38	1275.49
0.1267	1.0029	2.0839	1321.8	73.399	5.71E-11	0.4767	12.76	1325.61
0.0797	1.0010	1.5639	1271.4	71.125	6.18E-11	0.4960	14.61	1272.70
0.0377	1.0042	1.4719	1204.5	68.760	6.86E-11	0.5228	17.00	1209.51
0.0000	1.0004	0.6560	1147.5	67.089	7.59E-11	0.5498	18.97	1147.93

Table no.1 (Temp.303K)

Mole Fraction Of Tri-ethyl amine	Density (ρ) (gmcm^{-3}		Velocity (U) (m/s)	Molar volume (V) (cm^3/mole)	Adiabatic compre. (βa) (cm^2/dyne)	Free length (Lf) (A^o)	Available Volume (Va) (cm^3/mole)	Specific acoustical impedance (Z) (dyne s cm^{-3})
0.3894	0.8381	0.4446	1135.2	80.5765	9.26E-11	0.6120	23.4075	951.41
0.2219	0.8854	0.6778	1173.0	67.2603	8.21E-11	0.5762	17.9501	1038.61
0.1756	0.9242	1.0542	1215.9	62.9035	7.32E-11	0.5441	15.1008	1123.71
0.1338	0.9764	1.5267	1275.9	58.2256	6.29E-11	0.5045	11.7943	1245.75
0.0958	0.9959	1.6982	1310.1	55.9132	5.85E-11	0.4865	10.1308	1304.69
0.0611	0.9983	1.3546	1250.7	54.7083	6.40E-11	0.5089	11.9435	1248.60
0.0293	0.9972	1.1929	1185.0	53.7926	7.14E-11	0.5375	13.9525	1181.63
0.0000	0.9926	0.6213	1128.9	53.1332	7.91E-11	0.5655	15.6444	1120.57

Table no. 2 (Temp.308K)

Mole Fraction Of Tri-ethyl amine	Density (ρ) (gmcm^{-3}		Velocity (U) (m/s)	Molar volume (V) (cm^3/mole)	Adiabatic compre. (βa) (cm^2/dyne)	Free length (Lf) (A^o)	Available Volume (Va) (cm^3/mole)	Specific acoustical impedance (Z) (dyne s cm^{-3})
0.3901	0.8286	0.4057	1131.6	105.136	9.43E-11	0.6233	30.7788	937.61
0.3094	0.8830	0.5910	1157.7	93.9696	8.45E-11	0.5902	25.9767	1022.23
0.2400	0.9212	0.9399	1194.9	86.2018	7.60E-11	0.5598	21.8252	1100.73
0.1795	0.9718	1.4212	1263.3	78.5194	6.45E-11	0.5155	16.5234	1227.68
0.1264	0.9919	1.5001	1291.2	74.1792	6.05E-11	0.4992	14.3166	1280.79
0.0794	0.9968	1.5565	1236.3	71.3966	6.56E-11	0.5201	16.2293	1232.37
0.0376	0.9919	0.9895	1161.6	69.5864	7.47E-11	0.5549	19.0667	1152.15
0	0.9907	0.5633	1109.1	67.7214	8.21E-11	0.5816	20.7778	1098.80

Table no. 3 (Temp.313K)

Tables for System- II (Benzene + Tri-methyl amine + Acetic acid)

Mole Fraction Of Tri-mythyl amine	Density (ρ) (gmcm^{-3}		Velocity (U) (m/s)	Molar volume (V) (cm^3/mole)	Adiabatic compre. (βa) (cm^2/dyne)	Free length (Lf) (A^o)	Available Volume (Va) (cm^3/mole)	Specific acoustical impedance (Z) (dyne s cm^{-3})
0.5807	0.9544	1.6214	1219.2	70.2781	7.05E-11	0.5298	16.7262	1163.66
0.4927	1.0051	2.7295	1380.0	66.7438	5.22E-11	0.4561	9.1773	1387.01
0.4064	1.0195	3.4360	1270.8	65.8049	6.07E-11	0.4918	13.5393	1295.58
0.3219	1.0826	3.2979	1262.1	61.9751	5.80E-11	0.4805	13.0884	1366.34
0.2391	1.0310	2.9334	1253.4	65.0844	6.17E-11	0.4958	14.0989	1292.20
0.1578	1.0515	2.7201	1221.3	63.8170	6.38E-11	0.5038	15.1047	1284.22
0.0781	1.0313	1.2552	1195.8	65.0704	6.78E-11	0.5196	16.4384	1233.28
0.0000	1.0004	0.6560	1147.5	67.0895	7.59E-11	0.5498	18.9738	1147.93

Table no. 4 (Temp.303K)

Mole Fraction Of Tri-mythyl amine	Density (ρ) (gmcm^{-3}		Velocity (U) (m/s)	Molar volume (V) (cm^3/mole)	Adiabatic compre. (βa) (cm^2/dyne)	Free length (Lf) (A^o)	Available Volume (Va) (cm^3/mole)	Specific acoustical impedance (Z) (dyne s cm^{-3})
0.5813	0.9378	1.2870	1208.1	71.5098	7.31E-11	0.5436	17.5154	1133.00
0.4936	0.9852	1.8477	1222.2	68.0817	6.79E-11	0.5243	16.0758	1204.14
0.4075	1.0292	3.1115	1245.3	65.1839	6.27E-11	0.5034	14.4505	1281.65
0.3229	1.0691	2.8015	1244.4	62.7622	6.04E-11	0.4943	13.9489	1330.35
0.2400	1.0252	2.6043	1233.0	65.4582	6.42E-11	0.5094	15.0145	1264.07
0.1585	1.0499	2.5342	1198.5	63.9289	6.63E-11	0.5179	16.0422	1258.29
0.0786	1.0265	1.1984	1176.9	65.3965	7.03E-11	0.5334	17.2933	1208.06
0.0000	0.9926	0.6213	1128.9	67.6367	7.91E-11	0.5655	19.9148	1120.57

Table no. 5 (Temp.308K)

Mole Fraction Of Tri-mythyl amine	Density (ρ) (gmcm^{-3}		Velocity (U) (m/s)	Molar volume (V) (cm^3/mole)	Adiabatic compre. (βa) (cm^2/dyne)	Free length (Lf) (A^o)	Available Volume (Va) (cm^3/mole)	Specific acoustical impedance (Z) (dyne s cm^{-3})
0.5812	0.9317	0.9598	1207.2	71.9862	7.37E-11	0.5510	17.6726	1124.706
0.4930	0.9848	1.6855	1265.1	68.1062	6.34E-11	0.5114	14.2555	1245.868
0.4066	1.0306	2.8532	1228.2	65.0862	6.43E-11	0.5149	15.1244	1265.723
0.3219	1.0674	2.5407	1218.9	62.8405	6.31E-11	0.5098	14.9678	1301.101
0.2390	1.0227	1.9211	1213.8	65.5928	6.64E-11	0.5230	15.8325	1241.358
0.1577	1.0496	2.1684	1182.3	63.9139	6.82E-11	0.5300	16.6855	1240.97
0.0781	0.9092	0.9725	1148.4	73.7896	8.34E-11	0.5863	20.8271	1044.118
0.0000	0.9907	0.5633	1109.1	67.7214	8.21E-11	0.5816	20.7778	1098.799

Table no. 6 (Temp.313K)

Discussion on the basis of Adiabatic Compressibility (βa):

From the values of ρ, η, u adiabatic compressibility has been calculated. Fig 1 (a) and Fig 1(b) show that adiabatic compressibility is complementary to velocity. Compressibility decreases with mole fraction of tri-ethylamine, reaches a minimum value and then increases again, the maxima in the velocity and minima in the compressibility curves occur at or very near the some mole fraction of in both system I & system II . The variation of adiabatic compressibility with concentration shows a minimum at some intermediate concentration range. This minimum in adiabatic compressibility curves can be explained as below-

Assuming the spherical cage model the consideration of thermodynamics and statistical mechanics Hild banand et al (1962) gave the formula for free volume

$V_f = 4/3\ \pi K\ R^3/V^2\ 1/\alpha^3\ \beta_i^3$

Where, V_f - Free Volume ,α - Coefficient of volume expansion and K – Constant depending upon geometry of packing

Further, $\beta_i = \gamma\beta_a$

Where, γ - Ratio of Specific heats and β_a – Adiabatic compressibility

Then, $V_f = 4/3\ \pi K\ R^3/V^2\ 1/\alpha^3\ (\gamma\beta_a)^3$

If this relation holds good for mixtures decrease in β_a indicates decrease in free volume (V_f) assuming the rest of the quantities to remain sensibly unchanged.

The decrease of adiabatic compressibility β_a would mean a decrease in free volume V_f. The decrease in free volume can be caused by closer packing of the molecules, which may be due to complex formation between the constituents of the mixture. This complexation may primarily be due to donor acids & acceptor amines as constituents of the mixture with benzene as inert solvent. The proton (H+) donor acids are in readiness to accept the proton. This intercomponent binding leads to the complexation in the mixtures. It therefore appears that the experimental observation satisfactorily explain the molecular interaction in ternary system in present investigation. Such type of observation was made by J.B.Thakare and P.J.Thakare 1[6]. As the temperature increases compressibility increases in both system.

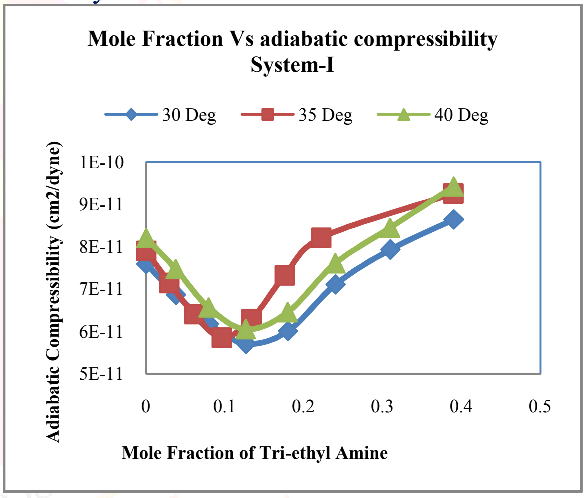

Fig.1(a)

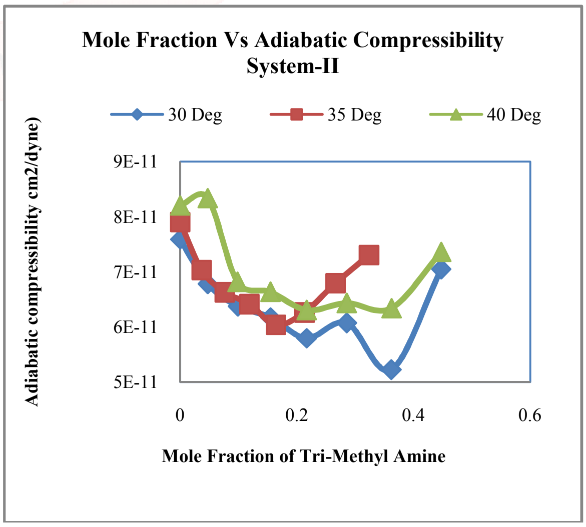

Fig. 1(b)

Discussion on the basis Free length (L_f)

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In tables (1-6) the values of free length are given at 303K, 308K & 313K for system I and system II. The plots of the free length versus mole fraction at various temperatures are shown graphically in fig3 2(a) and 2(b). Free length decreases up to certain mole fraction attains minima and again increases with mole fraction. It is clear that intermolecular free length depends upon intermolecular attractive & repulsive forces 2[7]. Eyring and Kincared3[8] have proposed that free length is predominating factor in determining the variation of ultrasonic velocity of solutions. Free length decreases with concentration of Tri-ethylamine and Tri-methylamine at all temperatures. This suggests the presence of strong solute solvent interactions. Decrease in intermolecular free length in system leads to positive deviation in sound velocity4[9]. This indicates the molecules are closer in the system. P. J. Thakare and J.B.Thakare 5[10] also observed such molecular interaction. The decreasing trend may be due to stronger interactions and increasing trend in L_f may be due to weaker interaction i. e. As the mole fraction of Tri-ethylamine and Tri-methylamine in system I and system II have larger values and mole fraction of acetic acid have smaller values L_f shows increasing trend that indicates weak interactions and when mole fraction of tri-ethylamine is equal to mole fraction of acetic acid it attains minima i.e. Strong interactions take place. Adiabatic compressibility and free length have inverse behavior of velocity with mole fraction. It has been observed as the increase in the free length leads to decrease in the ultrasonic velocity and increase in the compressibility. As the temperature increased free length increased. This is because of thermal agitation of molecules at higher temperature.

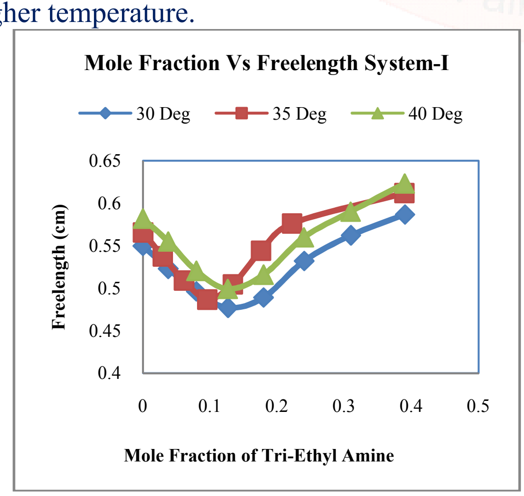

Fig. 2(a)

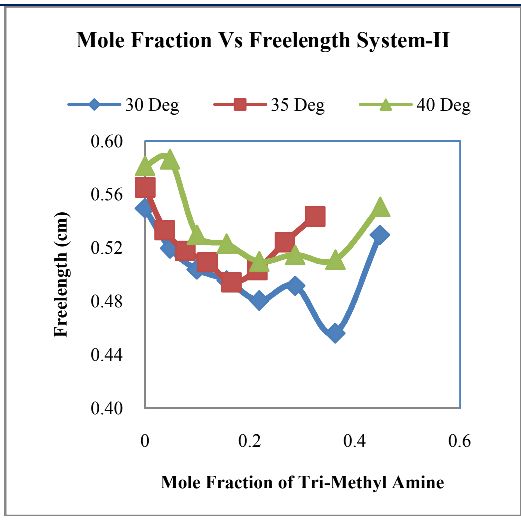

Fig. 2(b)

Discussion on the basis Specific Acoustical Impedance (Z) :

It is significant to measure acoustic impedance as it directly indicates the pressure velocity changes at a particular point in the nodal plane of the liquid mixtures. Acoustic impedance is read as one of the parameters to ascertain the formation of a heterogeneous molecular complex in liquid mixtures. Acoustic impedance is dependent on both material and its geometry and is complicated. The fact that the velocity & pressure are not necessarily in phase but exhibits efficient transfer of sound energy fraction point to point and therefore serves further to describe solvent behavior in altogether different perspective6[11].

It is seen from Fig 3(a) and Fig 3(b) that acoustic impedance (Z) increases with increasing concentration in both system I and system II. It becomes maximum and again decreases. This is found to be in agreement with the theoretical requirements as the value of ultrasonic velocity increases with increase of concentration and decreases again with concentration of solute. The increase of Z value with mole fraction solute can be attributed to the effective interactions. Such type of findings were also observed by P.J.Thakare et al7,8[12]13in liquid mixture of alcohol,formic acid and tri-ethyl amine There is decrease in Z values with increase in temperature for both systems, which is in accordance with decrease in U values with increase in temperature.

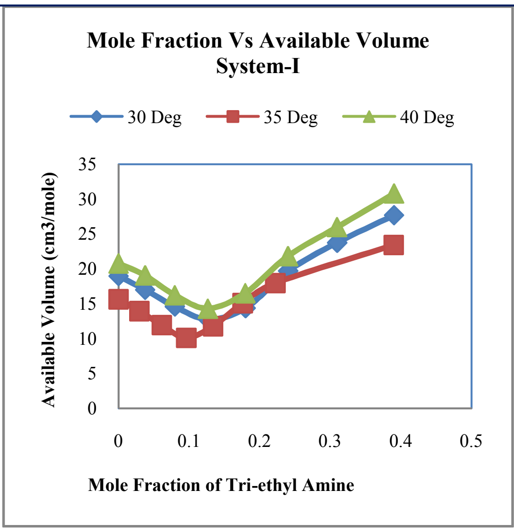

Fig. 3(a)

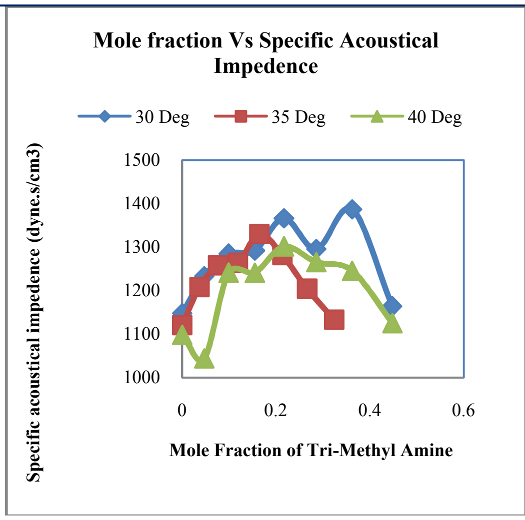

Fig. 3(b)

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STUDY OF MOLECULAR COMPLEXES OF VEGETABLE OIL (BIODIESEL) WITH ALCOHOL USING DIELECTRIC AND OTHERS MEASUREMENTS

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ABSTRACT

Variation of dielectric constant (€), density (ρ), viscosity (□), refractive index (n) of binary liquid mixture of GuizotiaAbyssinica(Niger oil) + methanol, GuizotiaAbyssinica(Niger oil) + ethanol , Palmarosa oil + methanol and Palmarosa oil+ ethanol with the their different weight fraction at constant temperature 313K. The excess dielectric constant and Nissan parameter are evaluated from the observations which are indicates the possibilities of molecular interaction .The nature and physic-chemical behavior of liquid mixture are also studied. The extent of interaction and the complex formation of liquid mixtures are also studied.

Key words: *Molecular interaction, dielectric Viscosity, Refractive index*

INTRODUCTION

According to Indian scenario the demand of petroleum product like biodiesel is increasing day by day hence there is need to find solution. The use of edible oil to produce biodiesel in India is not feasible in view of big gap in demand and supply of such a oil. Under Indian condition only non-edible oil can be used as biodiesel which are used in appreciable quantity and can be grown in large scale on non-cropped marginal lands and waste lands. Non-edible oils like jatropa, Karajan and mahua contain 30% or more oil in their seed, fruit or nut. India has more than 300 species of trees, which produce oil in their seed/kernel, have been identified and listed . Biodiesel has become more attractive because of its environmental benefits and fact that it is made up of renewable sources.

Biodiesel is one of the important renewable energy sources used in many countries in world. It is a renewable alternative fuel that can be produced from vegetable oils or animals fats. It has many advantages over petroleum diesel fuel. It is a nontoxic together with having lower carbon monoxide levels and low hydrocarbon emission and being a biodegradable, renewable fuel . It can act both as substitute and additive to diesel fuel. European Union has set an objective to replace 5 per cent of total motor fuel consumption with biodiesel by 2005. US department of energy estimated that up to 50 percent of diesel fuel could be replaced with biodiesel. Importance of biodiesel increasing due to (i) Increasing petroleum prices, (ii) Limited fossil fuel reserves, and (iii) Environmental benefits of biodiesel . Different methods used for production of biodiesel are,

(i) Direct use/blending
(ii) Micro-emulsion
(iii) Pyrolysis, and
(iv) Transesterification

Vegetable oil can be directly used as diesel without any changes to engine. Vegetable oil as fuel is its high viscosity which leads to problems in the long run[1].

Dielectric study is very much useful for characterizing the physic-chemical behaviour of liquids mixtures and measurement are used to study molecular interactions in the liquids.[1] Various approaches have been made to study experimentally the physical properties of pure liquids, solutions and mixtures using a variety of technique and use the data to infer the nature and strength of intermolecular interactions on the other hand a variety of empirical interaction potential have been used to calculate and predict the physic-chemical properties using the perturbation approach. Structural rearrangements subsequent to disturbances in electronic configurations of molecules of liquids are covered under the dielectric measurements cover the physic-chemical properties which are susceptible to the various interactions occurring in the liquids and their mixtures on various counts. A sudden change in the physical properties of liquid mixtures has been attributed to the molecular complex formation between the constituents of the mixtures. The commonly used physical properties include dielectric constants, viscosity, refractive index etc. Mulay et al[2] (1987) observed that the peak at the equimolar concentration between dielectric constants versus mole fraction curve for the systems was due to the complex formation between the two constituents of the mixtures . SolimoHoracioet al[3] (1974) predicted the existence of intermolecular complexes by viscosity and density measurements. Rattan et al[4] (1987) reported molecular interaction of binary mixtures from viscosity measurements. This difficulty is overcome by dielectric constant measurements of interacting solutes mixed in variable proportions which are simpler, cheaper, readily available and reasonably accurate technique.

AIM OF PRESENT WORK

Various approaches have been made to study the experimentally the physical properties of pure liquids, solutions and mixtures using a variety of technique and use the data to infer the nature and strength of intermolecular interactions. Dielectric constant have contributed a good deal in the study of molecular interaction in liquid. The useful wavelength range of ultrasonic extends its ability to study weak and very weak interaction. In addition the dielectric are directly related to a large number of molecules and thermodynamic properties.Keeping this in view an attempt is made in this study to understand the role of various factors such as hydrogen bonding, donor acceptor capabilities, etc. On the overall interactions among the molecules. These effects are expected to yield information on the existence.

Nature of present work

a) The density and dielectric constant are measured at constant temp. of pure alcohol (methanol, ethanol) and edible oil (Guizotiaabyssinica,), also with non-edible oil (palmarosa oil)

b) Non-edible and edible oils mixed with ethanol and methanol at different volume proportion at constant temperature 313K and measured dielectric constant and density of solution, determines whether or not the complex action takes place.

EXPERIMENAL SETT-UP

Measurements of dielectric constant.

1) For Capacitance Measurement *:* The cylindrical condenser consisting of an outer hallow cylinder of length ‘3.73’cm. and inner diameter ‘2.04’ cm. is used. The inner solid cylinder is of the same length but of diameter ‘1.61’ cm. Both of them provided with electrodes for electrical connection. The two cylinder are fitted co-axially with glass rod as spacers. Both the cylinder are silver plated. The correction for the glass spacers is incorporated in the measurement through correction factor ‘X’. The double wall chamber is Newton’s cooling law apparatus and is polished bright on outside, to reduce heat exchanges. The entire assembly was properly electrically shielded. The dimension of the double walled chamber height ‘13’ cm. inner diameter ‘7.46’cm. and the outerdiameter11.65’ cm.

2) Dielectric constants of experimental samples:

LCR,Q meter supplied by RADART has been used in the present work to measure the capacitances form which the dielectric constant can be evaluated capacitances value for 1 pf. to 1 KHz internal oscillator.

The cylindrical condenser was completely immersed in the sample liquid mixture maintained at constant temperature 313k. By selecting proper range of capacitance, the bridge is balanced, and capacitance reading C2 is noted on the dial. Knowing capacitance C1 with air as dielectric, and correction factor x, the value of the dielectric constant of the sample mixture is given by.

3) **Viscosity Measurement:**

The sample solutions employed in dielectric are also used to measure viscosity of each sample. The graph between viscosity and relative concentrations detects complex formation in the form of sudden change. Viscosity measurements will be made with Ostwald’s viscometer. Viscometer was calibrated with double distilled water.

The viscosity of the liquid is given by well-known relation,

$\eta_1 = (t_1\rho_{1} / t_2\rho_{2})\, \eta_2$ Where

η_1- Viscosity of liquid mixture t_1- time required for liquid mixture to cross from mark A to mark B of viscometer.

ρ_1- density of liquid.

η_2- viscosity of water

t_2 - time required for double distilled water to cross from mark A to B of viscometer

ρ_2 - density of double distilled water

4) **Refractive Index Measurement:**

The Refractive index of liquid samples measured by Abbe refractometer provided by Vishal Scientific Industries, Delhi. The accuracy of measurement is 0.001 by direct reading and 0.0001by estimation.

6) **Density Measurement**

The density measurements were made by standard measuring technique.In present study density (ρ), dielectric constant (Є), viscosity (□),and refractive index (n) were measured experimentally for the binary system namelyGuizotiaAbyssinica(Niger oil) + methanol, GuizotiaAbyssinica(Niger oil) + ethanol , Palmarosa oil + methanol and Palmarosa oil+ ethanol mixtures at constant temperature 313K. From measured data, change in dielectric constant (ΔЄ) been computed and the results are analysed in the light of molecular interactions in the binary mixtures.

Table No. 1 Temp 313k

Liquid/Oil	ρ g/cm^3	□ Dyne sec/cm^2	R.I.(μ)	□
GuizotiaAbyssinica	1.16257	28.0394	1.471	59.75
Palmarosa	0.9027	2.3062	1.480	91
Ethanol	0.72349	1.1810	1.420	173.5
Methanol	1.0116	0.4954	1.450	196

Table No. 2GuizotiaAbyssinica (A) + Ethanol (B) Temp=313k

W_A	ρ_{AB} g/cm^3	□ Dyne sec/cm^2	μ_{AB}	ϵ_{AB}	Δ□	□^{E}
0.0977	0.9946	1.0147	1.451	47.25	-	
0.2961	1.0011	5.8834	1.452	62.25	15	4.8687
0.5066	1.0631	7.289	1.463	48.5	-13.75	1.4056
0.7151	1.111	11.4262	1.467	16	-32.5	4.1372
0.8996	1.1363	18.3644	1.468	63.5	47.5	6.9382
1	1.1625	28.0394	1.471	59.75	-3.75	9.675

Table No. 3GuizotiaAbyssinica (A) + Methanol (B) Temp=313k

W_A	ρ_{AB} g/cm^3	□ Dyne sec/cm^2	μ_{AB}	ϵ_{AB}	Δ□	□^{E}
0.1325	0.9867	0.4671	0.461	27.25		
0.3722	0.9932	9.1446	0.467	4.75	-22.5	8.6795
0.595	1.039	13.3284	0.467	29.75	25	4.1838
0.7818	1.0886	13.7388	0.469	12.25	-17.5	0.4104
0.9339	1.0082	23.2063	0.47	13.5	1.25	9.4675
0.9414	1.0025	28.0394	0.471	59.75	46.25	4.8331

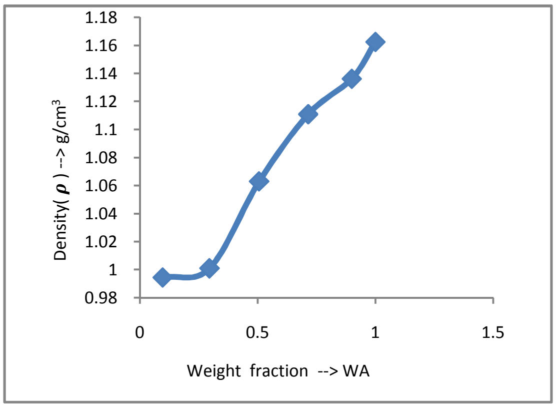
Table No. 4Palmarosa oil (A) + Ethanol (B) Temp=313k

W_A	ρ_{AB} g/cm^3	□ Dyne sec/cm^2	μ_{AB}	ϵ_{AB}	Δ□	□^{E}
0.1075	1.0973	1.8933	1.454	27.25		-
0.3029	1.0206	1.6891	1.468	14.75	-12.5	-0.2042
0.5086	1.0472	2.6869	1.46	23.5	8.75	0.0266
0.8958	1.0784	2.8497	1.467	61	37.5	0.0312
0.9069	1.0957	2.97	1.465	1	-60	0.0173
1	0.9027	3.3463	1.468	59.75	58.75	-0.193

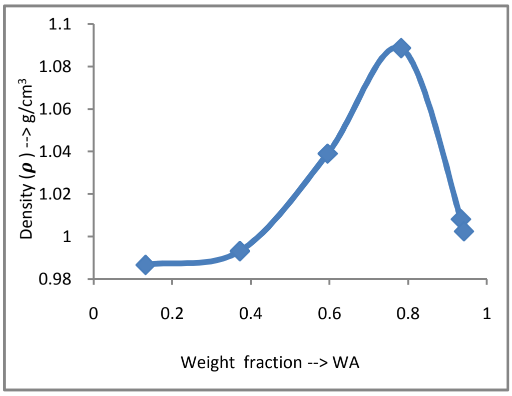
Table No. 5 Palmarosa oil(A) + Methanol (B) Temp=313k

W_A	ρ_{AB} g/cm^3	□ Dyne sec/cm^2	μ_{AB}	ϵ_{AB}	Δ□	□^{E}
0.1075	1.0973	0.0717	1.454	2.25	-	
0.3029	1.0206	1.1579	1.46	7.25	5	1.0862
0.5086	1.0472	1.0513	1.465	3.5	-3.75	-0.1066
0.8958	1.0784	1.9395	1.474	2.25	-1.25	0.8882
0.9069	1.0957	2.3062	1.475	18.5	16.25	0.3667
1	0.9027	3.0855	1.48	91	72.5	0.7793

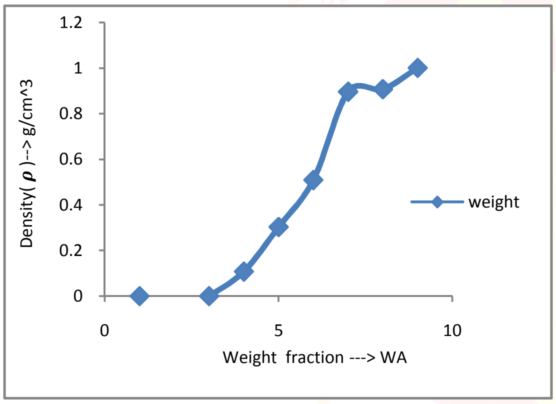
1) For density : Guizotia abyssinica (A) + Ethanol (B)



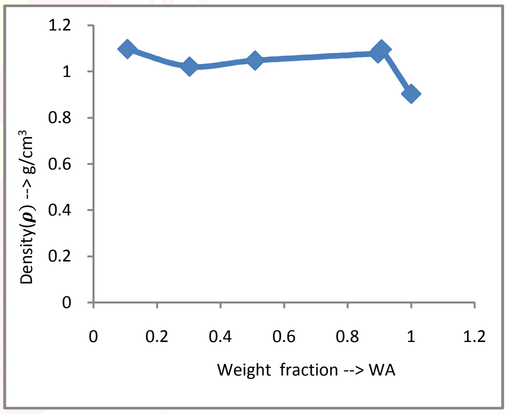
Guizotia abyssinica (A) + Methenol (B)



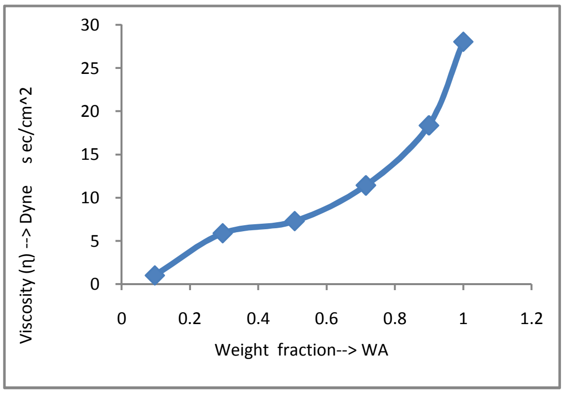
Palmarosa oil (A)+ Ethanol (B)



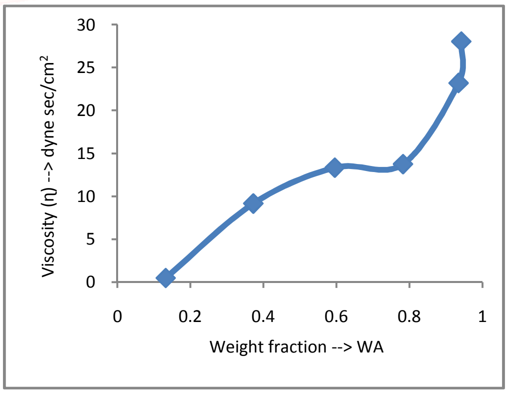
Palmarosa oil (A)+ Ethanol (B)



2) Viscosity : Guizotia abyssinica (A) + Ethanol (B)

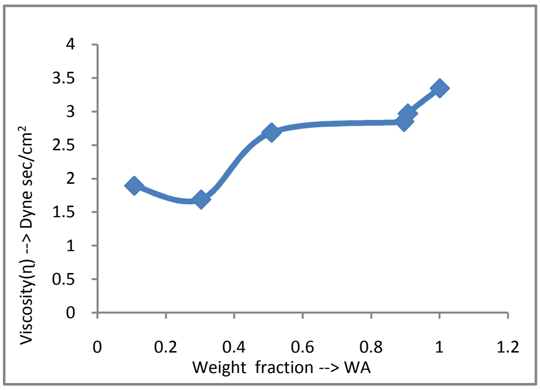


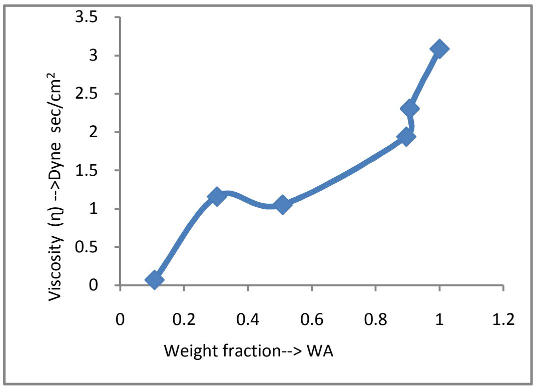
Guizotia abyssinica (A) + Methenol (B)



Palmarosa oil (A)+ Ethanol (B)

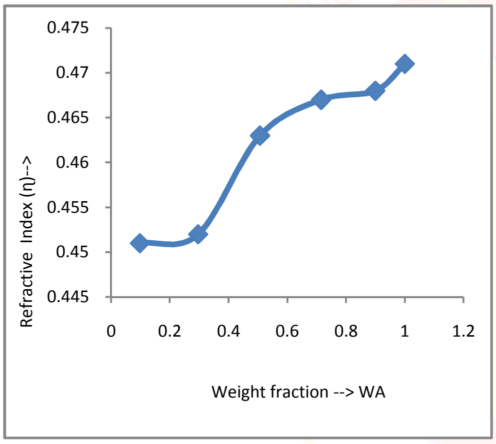
Palmarosa oil (A)+ Ethanol (B)

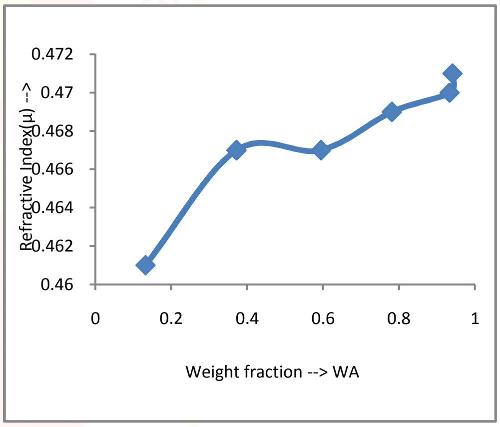




3) Refractive Index : Guizotia abyssinica (A) + Ethanol (B)

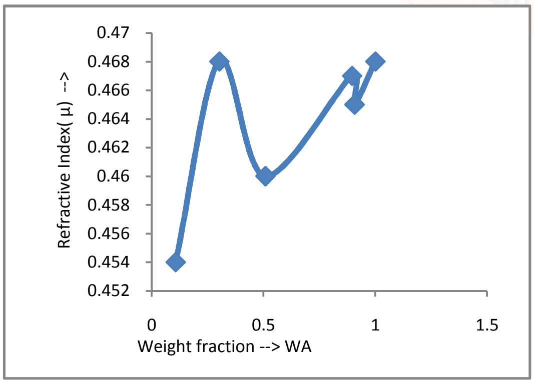
Guizotia abyssinica (A) + Methanol (B)

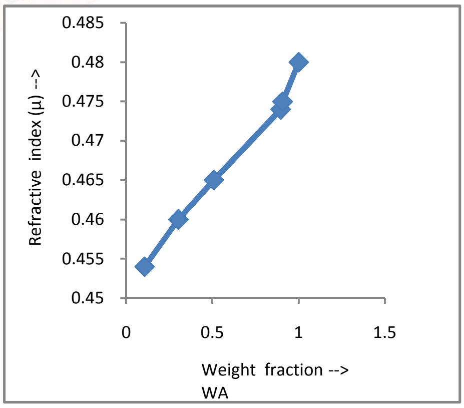




Palmarosa oil (A)+ Ethanol (B)

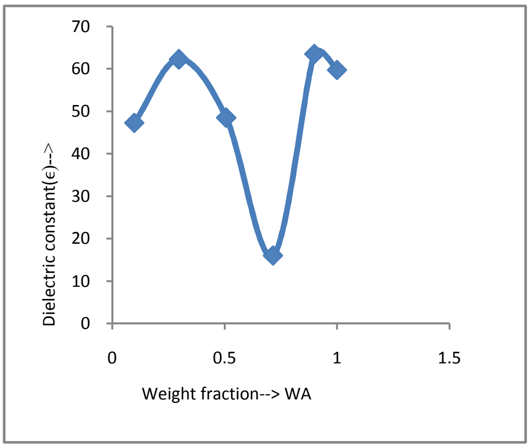
Palmarosa oil (A)+ Ethanol (B)



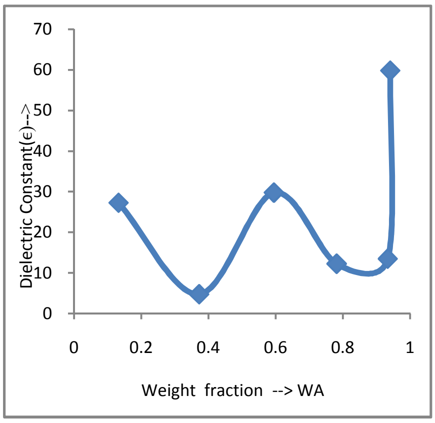


Dielectric Constant : Guizotia abyssinica (A) + Ethanol (B)

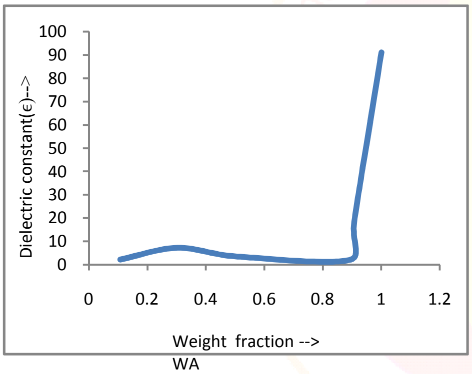
Guizotia abyssinica (A) + Methanol (B)



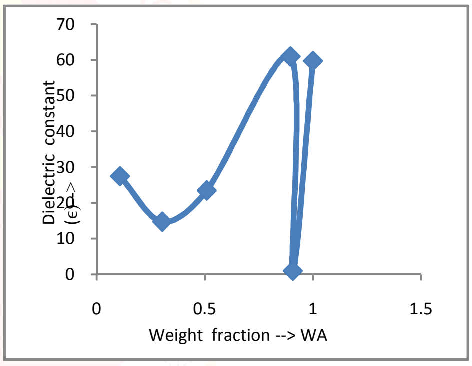
Palmarosa oil (A)+ Ethanol (B)



Palmarosa oil (A)+ Ethanol (B)

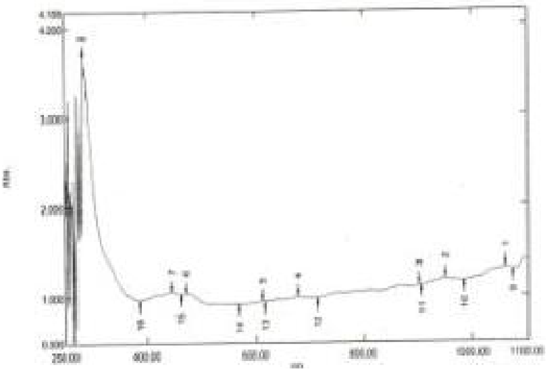
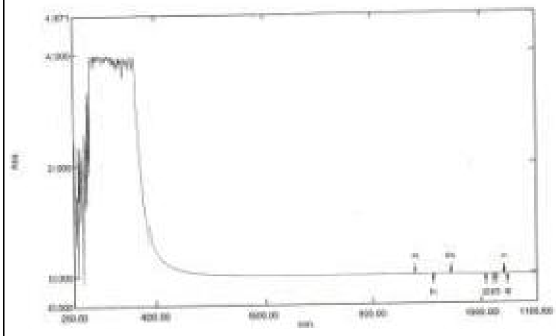
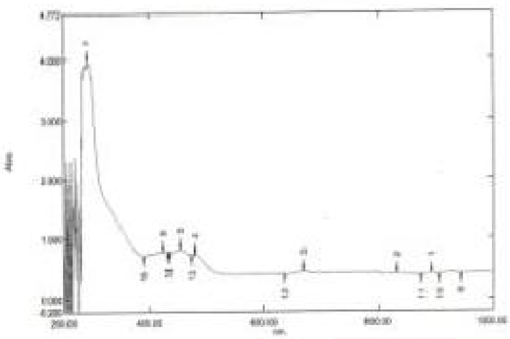
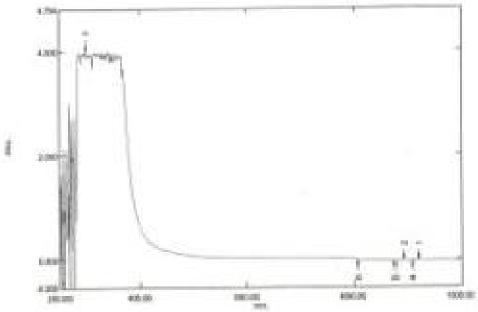


Jigani Oil + Methanol (1:1)

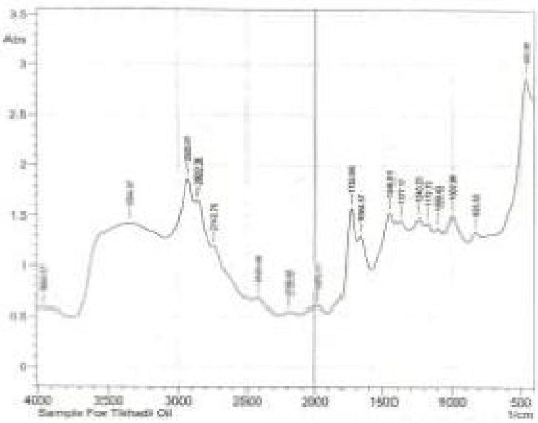
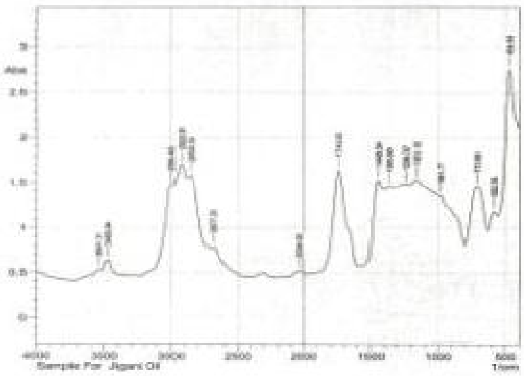


Tikhadi Oil + Methanol (1:1)

UV Spectrum Report

	
Jigani Oil + Methanol (1:1)	**Tikhadi Oil + Methanol (1:1)**
	

IR Spectrum Report

Tikhadi Oil	**Jigani Oil**
	

RESULT AND DISCUSSION

The density (***ρ***), dielectric constant (□), viscosity (□) and refractive index (n) of Vegetable oil with Ethanol and Methanol at different concentration at 313Ktemperature are as shown in the Table No. 1, 2,3,4,5. The corresponding graphs are plotted against Weight Fraction of oils are as shown in graph no.1 to 5.

Complex formation is solution which is detected by studying physical properties of the solution and noting a deviation from ideal maxima or minima or there may be same abrupt change in the physical properties density(***ρ***),dielectric constant[5] (□),viscosity[6](□) and refractive index[7] (n), absorption of infrared are ultraviolet radiation , dipole moment[8] etc. The dipole moment of molecule of a substance influences its dielectric constant.

The formation of hydrogen bond in the two liquid leads to an increased polarity of the bond A-H (proton donor) and hence a large dielectric constant. It provide valuable information regarding the formation of molecular comlex[9].

This suggested that the oils contains more free fatty acids (FFA), In first step of esterification with alcohol to produce methyl ester by lowering the acid value, this is supported to decrease density and viscosity with the decreasing oil concentration and increasing alcoholic concentration at temp 313K. This improve the quality of biodiesel and efficiency of Biodiesel engine.

The dielectric constant (□) of GuizotiaAbysinnica with Ethanol and Methanol are varied non linearly with the increase in weight fraction of oil.

It gives sudden changes at 1:1 concentration which suggest a strong intermolecular interaction.

The density and viscosity of palmarosa oil with Ethanol and Methanol are then increases with increase in weight fraction oil compare to GuizotiaAbyssinica oil but, the dielectric constant □ suddenly increases at specific concentration above 50% of oil[1]. This is also supported to produces stronger molecular interaction in solutions.

The variation of dielectric constant is non-linear at low concentration of oil but prominent changes to 1:1 or equimolar concentration. This attributed to formation of hydrogen bonded complex.

The change in dielectric constant (Δ□) which is a measures of extent of complex formation in sample or molecular association[10]. All graph shown a non-linear variation and more at higher concentration of oils in alcohols.

The excess viscosity (□^{E}) is more in GuizotiaAbyssinica oil and Palmarosa oil with Ethanol and Methanol suggests more stronger interaction of molecules.

IR AND UV SPECTRUM

GuizotiaAbyssinica oil (Jigani, Niger oil) contains more ester (liq) and very less contains of free fatty acid. Neglects in IR spectrum absorption frequency spectrum shows very strong peak for ester group at 1743cm^{-1}.

A sharp peak at 3740 cm^{-1} in IR spectrum due to OH group of a small amount of carbonyl OH group. A broad bending for Carbonillic OH is observed at 2677cm^{-1}-2950cm^{-1}.

Palmarosa (Tikhadi oil) contains a more amount of free fatty acid which reflects in IR spectrum by a large hump in the region of 3610cm^{-1}-3100 cm^{-1} due to intermolecular hydrogen bonding of free acid. Ester peak is observed at 1736cm^{-1}.

The UV spectra GuizotiaAbyssinica in 1:1 ratio methanol shows a strong and broad absorption band from 282nm-390nm. This supported the oil contains unsaturated acid residue in large amount.

From above spectrum shows that Jigani has a allopathic and my cornizal association effective genotypes and possibility of in bio fertilizers.

CONCLUSION

Abrupt changes of dielectric constant (□) of Vegetable oils with Alcohol at 1:1 concentration indicates the stronger molecular attraction or complex formation at 313K GuizotiaAbyssinica oil seeds are rich sources in both macro and micro minerals contain high proportion of fibrous hull and their phosphorous is mostly present in the form of phytate. Great role in combating malnutrition

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STUDY OF INTERNAL PRESSURE OF BINARY MIXTURE OF BENZONITRILE AND NN-DYMETHYLACETAMIDE AT DIFFERENT TEMPERATURES

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ABSTRACT

There are many studies have been developed to derive the nature of intermolecular interaction in different materials but the Ultrasonic studies have always played an important role in liquid and their mixtures.Internal pressure (π_i) is one of the parameters which is thermodynamically well-defined and can be used to describe the macroscopic result of molecular interaction, the nature and degree of molecular interaction occurring in the binary mixture. Considering the importance of physico-chemical properties of the liquids the study on the binary mixture of N-NDimethyl acetamide and benzonitrile is carried out.

The measured ultrasonic velocity (υ), density and evaluated adiabatic compressibility (β), molecular free length (L_f), coefficient of viscosity, free volume (V_f) and internal pressure (π_i) are plotted at different temperatures.The non-linearity of the curve indicates existence of an intermolecular association between the components of the mixture. The measurements of excess values of the above parameters are also carried out and the results are plotted. The data confirms the existence of interaction between the components of the binary mixture.

***Keywords**: internal pressure, molecular interaction, ultrasonic study, free length, compressibility*

INTRODUCTION

As a result of importance of molecular interactions in many fields of study thevarious physical methods have been developed for its investigations. Some of them are Infrared study, Raman Effect, Nuclear magnetic resonance, Dielectric constant, ultraviolet and ultrasonic methods. But in all of the ultrasonic technique has played an important role due to its simplicity and accuracy. The ultrasonic velocity measurements with density and coefficient of viscosity at different concentrations and different temperature are carried out for the better understanding of the physical and chemical properties and the inter-molecular interactions between the molecules of the mixture[1-5]. Mainly the ultrasonic velocity is very sensitive to molecular structuresand therefore used for investigations of liquid mixtures. It helps to understand the nature of molecular associations in pure and binary mixtures of the liquids at different concentration and temperature[6-8]. It is of more interest to discuss the same in terms of excess parameters rather than actual values, in order to understand the nature of molecular interactions between the components of the liquid mixtures.

The liquid NN-Dimethyl acetamide (NNDMA) is used for many organic reactions and industrial applications. It can be applied as a solvent for the manufacturing of films, acrylic fibers, X-ray contrast media, and cellophane. Similarly the liquid Benzonitrile is also very important in many pharmaceutical and industrial applications[9-10].

The measurements of the ultrasonic velocity, density and viscosity for the pure NNDMA, benzonitrile and their binary mixtures at different temperatureswere carried out for the evaluation of the other parameters such as adiabatic compressibility (β_α), free length (L_f), free volume (V_f), internal pressure (π_i) with the excess values of all these parameters to understand molecular interactionsbetween the different components of the mixtures.

EXPERIMENTAL

The liquids NNDMA and Benzonitrile commercially perchased are of excel grade (99-99.5%) purity used here without further purification. The binary mixtures for different range of composition were prepared and kept in a special airtight glass bottles to avoid air contact and were used within 24 hours of its preparation. The measurements of ultrasonic velocities were carried out on single crystal multi frequency ultrasonic interferometer operating at 1MHz (M-81). The constant temperature of the liquid inside the interferometer cell was maintained by circulating water through the outer jacket through electronically controlled thermostat. Accuracy of measurement of ultrasonic velocity was within ±0.01m/s and the temperature of the test liquids during measurement were maintained within an accuracy of ±0.1^{0}C. The densities of the binary mixtures & pure liquids were measured using 25ml specific gravity bottle and a sensitive mono pan balance (K-Roy, K-12 classic) within ±0.1mg accuracy. The viscosity of the liquids and their mixtures were measured using the viscometer. The experimentally measured ultrasonic velocity (υ) in ms^{-1}, density (ρ) in kgm^{-3} and viscosity (η) in Nsm^{-2} are used to evaluate various thermo dynamical parameters and their excess valuesby using standard relations.

RESULT AND DISCUSSION

The binary mixtures are prepared with the addition of increasing concentration of liquid NNDMA in the liquid Benzonitrile. The density values are seen to be decreasing with the concentration of NNDMA in binary mixture at different temperatures. The values of ultrasonic velocity and viscosity shows increase with the increase in concentration of NNDMA but decreases with increasing temperature of the binary mixture.

The plots of different parameters (fig.1) shows that the ultrasonic velocity increases with the increase in concentration of NNDMA in the binary mixture, adiabatic compressibility increases but non linearly. As the intermolecular free length depends upon intermolecular attractive and repulsive forces[11], it is observed that Free length (L_f) also seen to be having similar relation with the concentration as that of compressibility. The values of free volume (V_f) shows increasing trend but after 0.5 molar concentration.

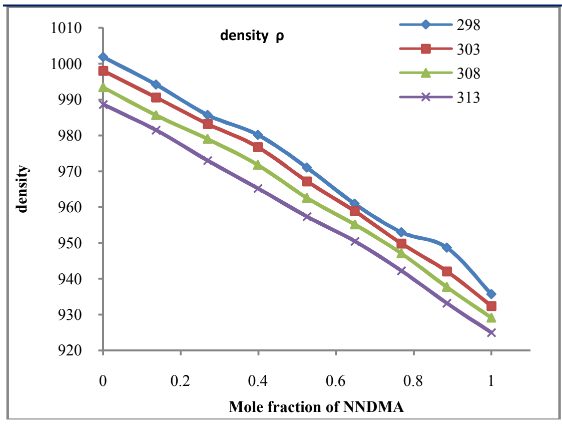
The internal pressure (π_i) is seen to be increasing upto 0.6 concentration and then decreases with increasing concentration of NNDMA in the mixture.The increase in the values of free length with increasing concentration can be concluded as there is significant interaction between the molecules of the two liquids[12]. The increasing free length with the increase in concentration of NNDMA in the binary mixture suggests the dispersive interaction between the molecules, which may be concluded as due to the increasing magnitude of the interaction. The non linear variation in the above parameters is an indication of existence of interaction between the components of the mixture[13-17]

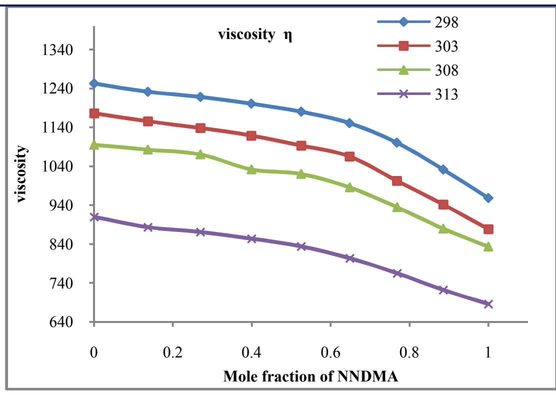
The viscosity values showing decreasing trend is the indication of decreasing frictional resistive force may be due to a change in effective molecular area of the components by the cohesive or adhesive forces or relative random velocity between the components of the mixture.

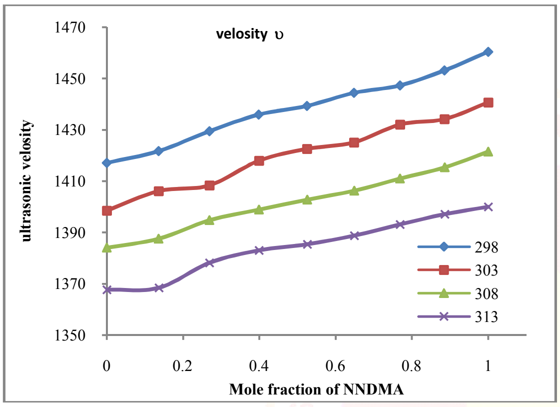
It is essential to study the excess parameters in order to determine the extent and presence of molecular interaction between the components[18-19]. The excess compressibility and free length are negative but non linear for all concentrations and all temperature. The excess internal pressure is positive indicating dispersive interaction exists between the components of the mixture. This is the indication of the presence of strong attractive or repulsive forces between the different components of the mixture. The close perusal of the excess values conform the existence of interaction between the different components of the mixture. The sign of excess free length plays a vital role in assessing compactness due to molecular interaction through dipole-dipole interaction[20-21].

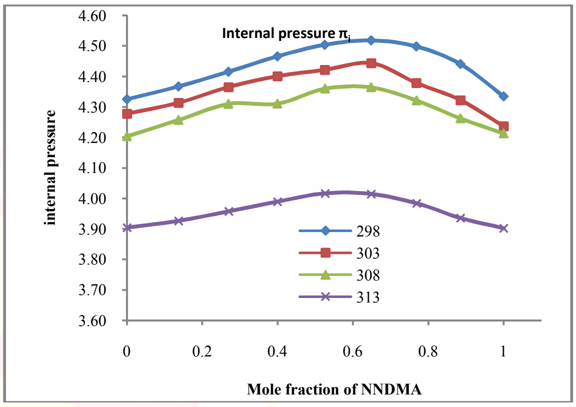
CONCLUSION

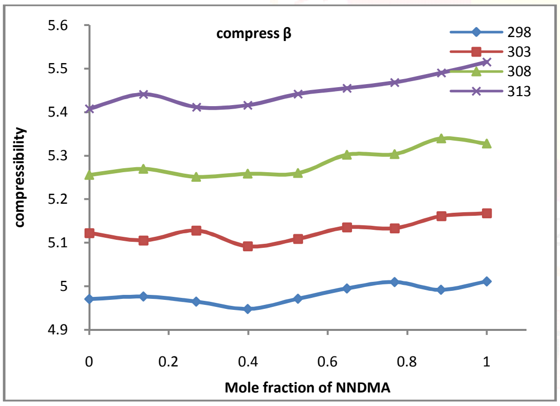
All the plots of different parameters obtained from the present study shows the non linear variation for the binary mixture of NNDMA in the Benzonitrile for entire range of concentration and temperature, which indicates there exists intermolecular interaction between the different components of the mixture. The negative values of excess compressibility (β_α^E), excess free length (L_f^E), and excess free volume (V_f^E) and positive excess internal pressure (π_i^E) indicates the existence of the intermolecular interaction between the different molecules of the mixture and the interaction is more at 298 and 303K temperature. The negative excess values seen in these parameters confirm the presence of strong dispersive interaction between the components of molecule in the mixture.

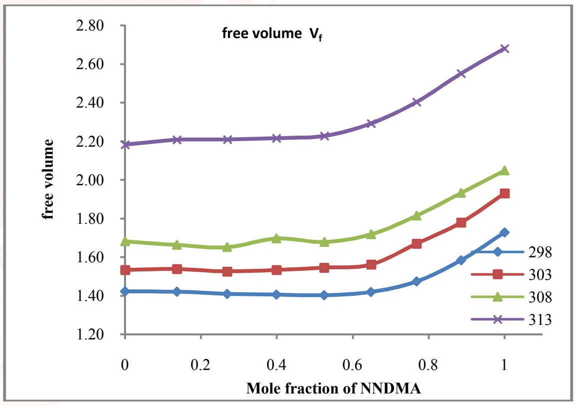

density ρ
density
Mole fraction of NNDMA
298
303
308
313

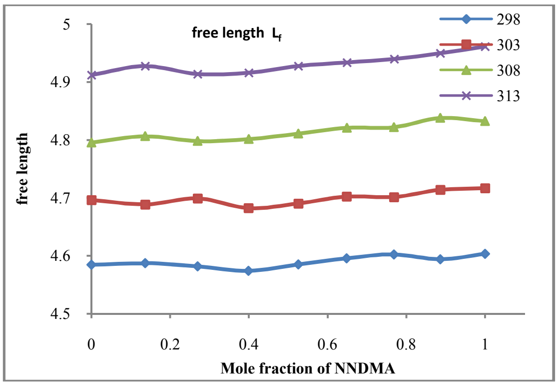

viscosity η
viscosity
Mole fraction of NNDMA
298
303
308
313

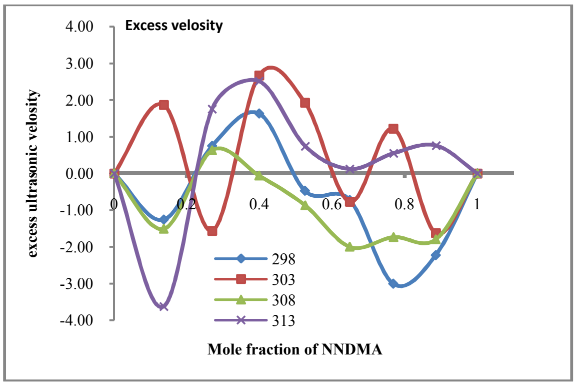

velocity υ
ultrasonic velocity
Mole fraction of NNDMA
298
303
308
313


Internal pressure π_i
internal pressure
Mole fraction of NNDMA
298
303
308
313


compress β
compressibility
Mole fraction of NNDMA
298
303
308
313


free volume V_f
free volume
Mole fraction of NNDMA
298
303
308
313


free length L_f
free length
Mole fraction of NNDMA
298
303
308
313


Excess velocity
excess ultrasonic velocity
Mole fraction of NNDMA
298
303
308
313

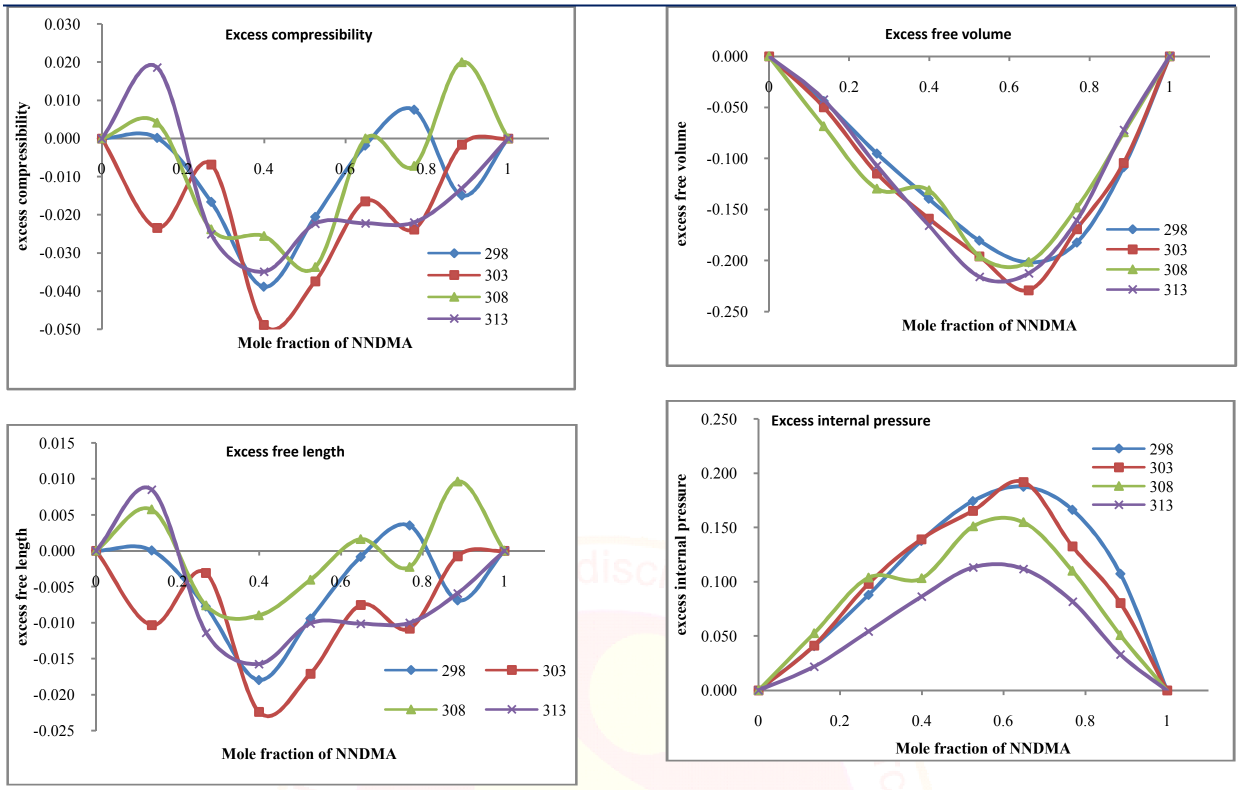


Figure 01:- Plots of ultrasonic velocity, viscosity, adiabatic compressibility (□ free length (L_f), free volume (V_f) and internal pressure (□$_i$) and their excess values, for N,N-dimethylacetamide + Benzonitrile mixture at different temperature.

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STUDY OF THERMO-ACOUSTICAL PARAMETERS OF BINARY LIQUID MIXTURES OF ANILINE WITH PYRIDINE AND ACETOPHENONE WITH PYRIDINE

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ABSTRACT

Liquids are the important entity which is to be used in almost all activities of living and material science. Thus it is needed to be characterise.There are various methods to do the characterisation. The Ultrasonic methods having its application towards the characterization of materials,provides simple way of analysis of liquid properties.Here the two binary systems (1) acetophenone and pyridine and (2) aniline and pyridine are studied to investigate the different ultrasonic parametersat different temperatures.
Here the density, ultrasonic velocity and coefficient of viscosity measured for these binary mixtures shows increasing trend with the increase in concentration of acetophenone in the mixture of pyridine.The internal pressure of both the binary mixtureis found to be increasing with the corresponding increase in concentration of the acetophenone or aniline in their binary mixtures.The excess values of the above parameters such as, excess velocity υ^E, excess adiabatic compressibility $\beta_\alpha{}^E$, excess free length L_f^E, excess free volume V_f^E and excess internal pressure $\pi_i{}^E$ are also evaluated and the results are plotted. The data confirms the existence of interaction in the binary mixtures.

Keywords: *Inter-Molecular interaction, free volume, ultrasonic velocity, internal pressure, excess parameters*

INTRODUCTION

Due to the importance of liquids in every field of study the researchers are motivated to investigate the behavior of liquid molecule. The knowledge of the molecular behavior is very important for the application of that liquid or mixture in pure and applied fields of study, such as biological, automobile, pharmaceutical, chemical, industrial, and other research areas. It is well known fact that in spite of many other studies used to understand the nature of intermolecular interaction the Ultrasonic studies have played an important role.Due to the dependence of ultrasonic velocity on the bonding forces, it provides directly the knowledge about the nature of intermolecular interactions occurring between the components of the liquids and their mixtures.

The liquids acetophenone, aniline and pyridine are very useful liquids as they have wide applications in different areas of studies of human importance[1-7]such as bio-medical, chemical and pharmaceuticals. These liquids & their mixtures are of great interest to organic chemists to know about the typesand nature of bonds.

In order to understand the nature of molecular interactions between the components of the liquid mixtures, the different ultrasonic parameters are to be discussed in terms of their excess values rather than actual.

METHODS AND MEASUREMENTS

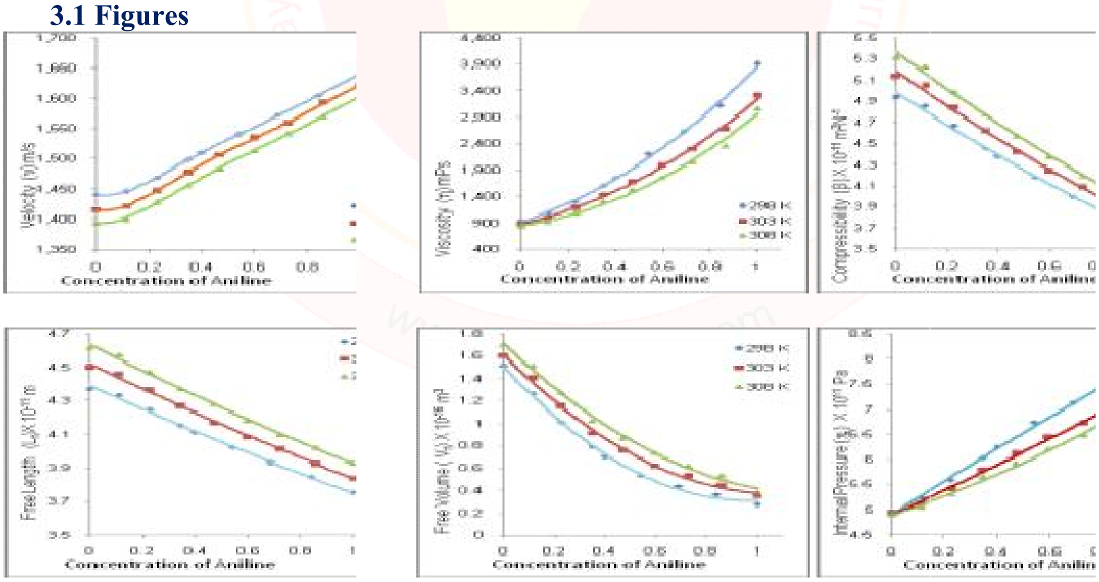
The chemicals used here Pyridine, Acetophenone and Aniline with purity of 99-99.5% of AR grade were obtained commercially and used without any further purification. The first binary mixturewas prepared by adding the liquidacetophenonein the liquid pyridine and second binary mixture was prepared by the addition of aniline in the liquid pyridine for different mole fraction and stored in specially designed containers to avoid any air contact. All the mixtures prepared were utilized within the 24 hours of their preparation. The measurements of Ultrasonic velocities (υ) for different concentrations of binary mixtures were carried out by using Ultrasonic Interferometer at 1MHz (Mittal enterprises- model M-81). The densities were measured using specific gravity bottle and mono pan balance. And the coefficients of viscosities were measured using the suspended level viscometer. The density (ρ), ultrasonic velocity (υ) and coefficient of viscosity (η) are used to evaluate various parameters and their excess values by standard relations.

RESULT AND DISCUSSION

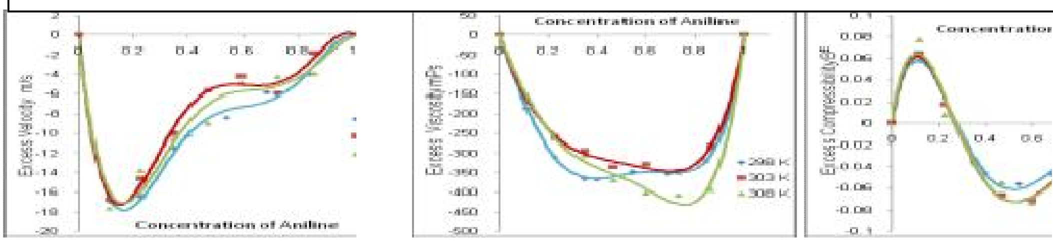
The binary mixtures under investigation wereprepared by decreasing the molar concentration of the liquid pyridine inacetophenone and similarly the second binary system was also prepared by decreasing the molar concentration of the liquid pyridine inaniline. As the density of acetophenoneandaniline is more than the density of pyridine any increase in the concentration of acetophenone or aniline in their respective mixtures increases the density of the binary mixture. The value of ultrasonic velocity (υ) and coefficient of viscosity (η), increases in both binary mixtures with the increase in concentration of acetophenoneand aniline in theirrespective mixtures. The adiabatic compressibility (β_α), Free length (L_f) and free volume shows the opposite trend at the three temperatures 298, 303and 308K. The increasing trend in coefficient of viscosity is the indication of existence of frictional resistive forces that may be due to a change in effective molecular area by the cohesive or adhesive forces. The intermolecular free length depends upon intermolecular attractive and repulsive force[12-16]. The decrease in free length is responsible for the decrease in free volume which ultimately increases the internal pressure of the system, this result is confirmed from the plots of these parameters (figure 01-06). The decrease in the values of free length and free volume can be concluded as there is significant interaction between the two liquids in both the cases. This suggests the close packing of the molecules.

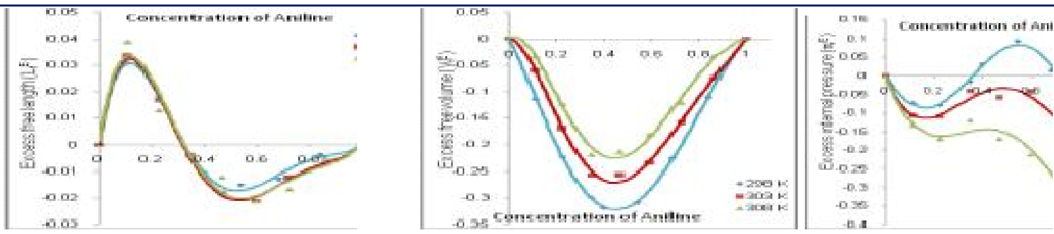
The extent of deviation & sign of excess values of the thermo dynamical parameters depends on the strength of interaction between moleculesfig. 07 to 12. The excess velocity is seen to be negative which can be concluded as the making and breaking of the structure[17, 18]. The excess values of coefficient of viscosity and excess free volume are observed to be negative, which indicates the presence of strong interaction between the components of the mixture. The sign of excess free length plays a vital role in assessing compactness due to molecular interaction through dipole-dipole interaction the increase in compactness enhances structure making and excess free length tends to negative values. Excess compressibility and free length are negative indicates the weak and strong interactions are prevailing in the present binary mixtures[19,20].

3.1 Figures

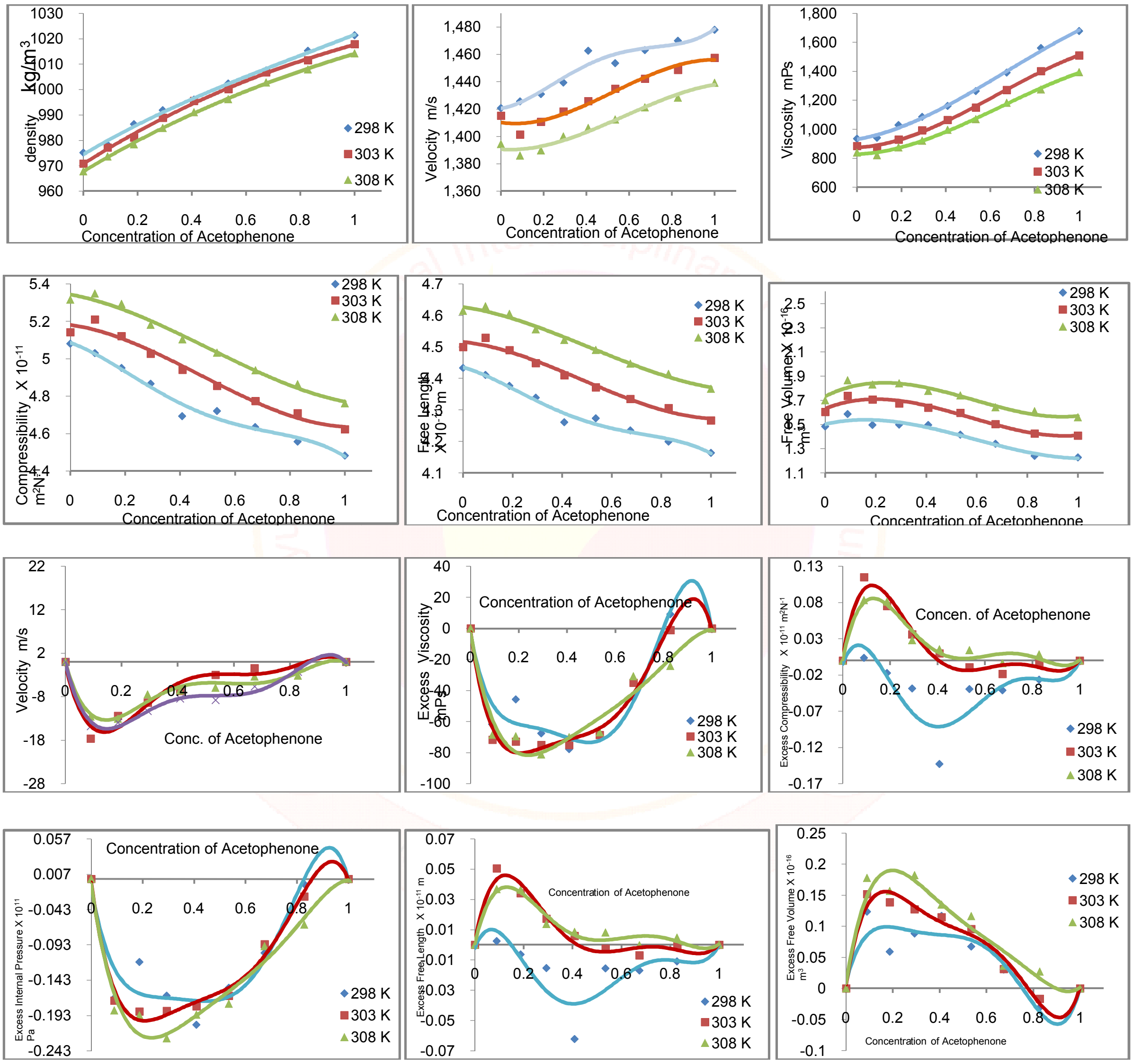


Graphs: (01 to 06) Plots of ultrasonic velocity, viscosity, adiabatic compressibility, free length, free volume and internal pressure for varying concentration ofaniline in pyridine at 298, 303 and 308 K temperatures.





Graphs: (07 to 12) -Plots of excess values of ultrasonic velocity, viscosity, adiabatic compressibility, free length, free volume and internal pressure for varying concentration of aniline in pyridine at 298, 303 and 308 K temperatures.



Graphs: (13 to 24) -Plots of ultrasonic velocity, viscosity, adiabatic compressibility, free length, free volume and internal pressure and their excess values for varying concentration of acetophenone in pyridine at 298, 303 and 308

CONCLUSION

In the binary mixtures (acetophenone and aniline with Pyridine), the increase in ultrasonic velocity, density, coefficient of viscosity and internal pressure and the decrease in adiabatic compressibility, intermolecular free length and free volume confirms the existence of intermolecular interaction between the different components of the mixture. The negative excess values of ultrasonic velocity (υ^E), viscosity (η^E), free volume (V_f^E) and the excess compressibility (β_α^E) and excess free length (L_f^E) having non linearity but more negative excess internal pressure (π_i^E) in the binary mixture at temperatures

298, 303, 308K confirms the presence of strong dispersive interaction between the components of molecule. The non-linear variation of all the parameters indicates existence of dipole-dipole interaction between the different molecules of the compounds in the mixture.

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CURRENT STATUS OF DIRECT DARK MATTER DETECTION EXPERIMENTS

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ABSTRACT

Much like ordinary matter, dark matter might consist of elementary particles, and weakly interacting massive particles are one of the prime suspects. During the past decade, the sensitivity of experiments trying to directly detect them has improved by three to four orders of magnitude, but solid evidence for their existence is yet to come. We overview the recent progress in direct dark matter detection experiments and discuss future directions.

Direct detection experiments are designed to detect the nuclear recoil in the scattering of galactic WIMPs off target nuclei. The signal rate depends on the local density and velocity distribution of WIMPs in the Milky Way (astrophysical inputs with non-negligible systematic uncertainties), the WIMP mass, and the interaction cross-section of the target nuclei. Most theoretical models predict that this cross-section is smaller than 10^{-42} cm^2 for nearly all possible WIMP masses, yielding an extremely low signal rate, which in turn requires an extraordinarily low background environment for detection. To suppress the background produced by cosmic rays, all the direct detection experiments are located in deep underground laboratories. The residual background also includes neutrons and gamma rays from the environment and detectors. Passive shielding and, in some cases, active veto are required to suppress the external background, and high-purity detector components are a must to minimize the more dangerous internal backgrounds. The ultimate irreducible background comes from solar and atmospheric neutrinos. The uncertainty in neutrino-nucleus coherent scattering eventually limits the sensitivity of the direct detection experiments

Keywords: *WIMP, Milky Way, Neutrino, Detection*

INTRODUCTION

Another popular particle dark matter candidate is the axion, an extremely light bosonic particle originally introduced to explain the so-called charge-parity (CP) symmetry in the strong interaction. The extremely small coupling of axions to electromagnetic radiation and regular matter (such as electrons and nucleons) would allow them to be detected in ground experiments. However, no positive signals have shown up so far. WIMPs, on the other hand, have finite weak coupling with regular matter. They could be detected via their elastic scattering off matter (direct detection), in high-energy collisions (collider searches), or via their annihilation into normal particle-antiparticle pairs (indirect detection). In recent years, significant experimental progress has been made in the direct detection of WIMPs, which is the focus of this short review.

For a WIMP mass between 1 and 1,000 GeV, the typical elastic recoil energy of an atomic nucleus ranges from 1 to 100 keV (for a large nucleus, the smaller the WIMP mass, the lower the mean recoil energy and vice versa), which is the primary signal in direct detection. WIMPs can in principle scatter off electrons, but the re-coil energy would be suppressed further by the electron mass and hence would require a more sensitive detection technology. The nuclear recoil energy can be converted into thermal motion (phonons), ionization, or scintillation photons through the Coulomb field of the charged nucleus.

METHODOLOGY

Experiments that simultaneously detect two types of signals are typically more powerful in differentiating nuclear recoil signals against electron recoil backgrounds from radioactivity. Other features of the signals, such as the timing shape, can sometimes also be used for background discriminations. To compare the results from different experiments, the standard assumption is that WIMPs scatter coherently and elastically o all nucleons in the nucleus, and the interaction has neither nuclear spin nor a proton-neutron dependence. To date, apart from a few controversial claims, no solid WIMP signal has been observed in a direct detection experiment.

However, these placed tight constraints on various theoretical models. Figure 1 summarizes the current leading direct detection limits on spin-independent WIMP-nucleon cross-section versus the mass of the WIMPs. Overlaid in the figure are the WIMP search sensitivity limited by the neutrino background, and the representative minimal super symmetric model contours (2σ) constrained by Run 1 at the Large Hadron Collider. In what follows, we review some of the progress made by a few representative experiments.

Detectors made of noble liquids are spearheading WIMP searches in the ~100 GeV/c^2 mass range. The so called dual-phase XENON10 collaboration, have developed into the state-of-the-art detection technology and have been pushing the elastic spin-independent WIMP-nucleon scattering sensitivity in a wide range of WIMP masses above 5 GeV/c^2. Natural xenon does not have long-lived radioactive isotopes, except for 136Xe, whose double-beta decay has a negligible contribution to the current generation of experiments. Liquid-xenon targets allow for a relatively straightforward scaling-up to large monolithic detectors. In a liquid-xenon time-projection chamber, with two arrays of photomultiplier tubes located at its top and bottom and with a large electrical field across the liquid-gas interface, the prompt scintillation photons can be detected along with the electroluminescence in the gas, produced by the ionization electrons drifted to and extracted from the liquid surface. This technique provides excellent vertex reconstruction, enabling a powerful target fiducialization and a good discrimination between the nuclear recoil signals and the electron recoil background.

At present, there is a tight ongoing race between a few xenon experiments. LUX, a 250-kg xenon experiment, located in the Sanford Underground Research Facility (SURF) [29], USA, started taking physics data in 2013, and recently concluded in May 2016. By combining the 95 live days of data taken in 2013 and another 332 live days of data taken from 2014 to 2016, the collaboration reported a minimum of 1:1 x 10^{-46} cm^2 upper limit at a WIMP mass of 50 GeV/c^2 on the WIMP-nucleon cross-section. This is the strongest reported limit to date. The best published WIMP search limit is set by the half-ton scale PandaX-II experiment located in the JinPing underground Laboratory (CJPL) in China. This is also the largest running dual-phase xenon detector in the world. The results were obtained with an exposure of 3:3 x 10^4 kg-day, with an unprecedented background level of 2x10^{-3} events kg^{-1} d^{-1} keV^{-1} within the electron equivalent energy region between 1.3 and 8.7 keV. The lowest limit for the cross-section was set at 2:5 x 10^{-46} cm^2 at a WIMP mass of 40 GeV/c^2. PandaX-II will continue data taking until 2018. The XENON100 experiment located in the Gran Sasso National Laboratory (LNGS) in Italy recently reported their final WIMP results using a total of 477 live days of data with a limit of 1:1 x 10^{-45} cm^2 at 50 GeV/c^2. For these detectors at the hundreds-kilogram level, the background due to uniformly distributed sources such as ^{85}Kr, ^{222}Rn and ^{220}Rn already becomes prominent, and the effective suppression of such a background for the next generation of experiments is under intensive research and development. Looking into the near future, the XENON1T experiment, the successor of XENON100, is commissioning its dual-phase detector with a 2-ton liquid-xenon target. The minimum projected sensitivity on the WIMP-nucleon cross-section can reach 2:0 x 10^{-47} cm^2 at 50 GeV/c^2 with an exposure of 2.2 ton-year. The upgrade experiment XENONnT, with a 6.5-ton liquid-xenon target, is in planning. The successor of LUX, LZ, will contain a 7-ton liquid-xenon target, and is expected to start operation in 2020 to achieve a sensitivity of 3 x 10^{-48} cm^2 at 40 GeV/c^2 with 1,000 live days of data. In China, a future 4-ton scale experiment, PandaX-4T, and its follow-up PandaX-30T are planned in the second phase of CJPL. Another future large direct detection project, DARWIN, is aiming at a target mass up to 40-ton.

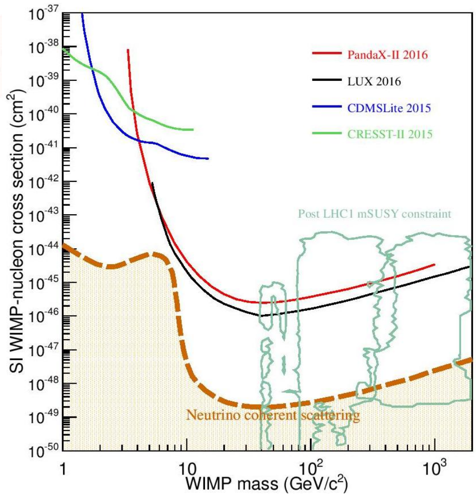

Fig. 1: Upper limits on the spin-independent (SI) WIMP-nucleon scattering cross-section set by current leading experiments. The limit curves are

from PandaX-II, LUX, SuperCDMS (CDMSLite) and CRESST-II.

The XMASS experiment, in the Kamiokamine in Japan, uses an alternative single-phase liquid-xenon detector to search for WIMPs by detecting only the scintillation photons. The detector has an approximately spherical shape with a nearly 4 photodetector coverage. One major challenge for such a detector is to correctly reconstruct event vertices to have an unambiguous fiducial volume selection. After discovering a significant background from the photodetectors, which could `leak' into the central region due to mis-reconstruction, the photodetector array was replaced and the experiment resumed data taking in 2014. The next stage for XMASS is XMASS 1.5, a detector with 5 tons of xenon in the full volume. The projected sensitivity will reach 10^{-46} cm^2 for 100 GeV/c^2 WIMPs.

Argon is another type of noble element widely used in direct detection experiments with a primary focus on the high-mass WIMPs. In comparison to xenon, due to its low cost, even a few hundred-ton future detector is foreseeable. The DarkSide-50 experiment located in LNGS is running a dual-phase argon detector. The first physical result of DarkSide-50 with atmospheric argon was reported in 2015. It demonstrated excellent pulse shape discrimination of the background electron recoil events. For detectors using natural argon, ^{39}Ar is an irreducible long-lived cosmogenic background. To tame this background, DarkSide collaboration pioneered the underground argon extraction and showed that the ^{39}Ar levels can be reduced by a factor of 1.4 x 10^3. At the next stage, DarkSide-20k, a detector with 20-ton of argon, is expected to reach a sensitivity of 9 x 10^{-48} cm^2 at 1 TeV/c^2 with a 100 ton-year exposure. DEAP-3600 at SNOLAB in Sud-bury, Canada is another argon-based experiment with a 1-ton target. It is operating in the single-liquid phase by detecting scintillation photons. Pulseshape discrimination will be used to identify the electron recoil background, which from a smaller prototype detector has been proven to have less than 2.7 x 10^{-8} background contamination. Presently, DEAP-3600 is being commissioned. Like DarkSide, DEAP-3600 aims to eventually use underground argon extraction to suppress ^{39}Ar. The projected sensitivity on the spin-independent WIMP-nucleon scattering cross-section can reach 10^{-46} cm^2 for WIMP masses of 100 GeV/c^2 with a 3 ton-year exposure.

An important frontier is the search for lighter WIMPs in the range of a few GeV/c^2 which would produce a lower recoil energy. Aside from the standard background issues common to all direct searches, a key issue in such experiments is the operation of the detectors at a very low threshold, hundreds of eV or lower. The Super-CDMS experiment located in the Soudan mine in Minnesota, USA uses cryogenic semiconductor detectors, armed with the so-called interleaved Z-sensitive ionization phonon (iZIP) technique to detect both the phonon and ionization signals at a low temperature of ~ 40-50 mK. The technology provides a factor of greater than 106 rejection of the electron recoil background relative to the nuclear recoil background. The collaboration published results in 2014 with 15 iZIP modules, each with a mass of 0.6 kg. To reach a lower threshold, one of the iZIP detectors was operated with a relatively high bias voltage (HV) to convert the ionization signal into phonons, which reached an electron recoil threshold of 56 eV. With a 70 kg-day exposure, the experiment set the leading limits published on low-mass WIMPs between 1.6 and 5.5 GeV/c^2. The CDEX experiment located in CJPL used point-contact germanium detectors operating at liquid nitrogen temperature. These detectors have also the advantage of a low threshold and a good rejection power to surface background, and hence are suitable for low-mass WIMP searches. The first stage CDEX-I experiment was completed with a 915-g detector at 475 eV threshold with final exposure of 335.6 kg-days. With no sign of unusual events, the CDEX-I results challenged the WIMP interpretation of the event excess from the CoGENT experiment which pioneered the technology. An improved 1-kg CDEX detector with an even lower threshold is currently taking data.

The DAMIC experiment is another direct dark matter search at SNOLAB. It uses high-resistivity charge-coupled detectors (silicon) to record both the amplitude and position of the ionization signal created by the nuclear recoil. The experiment is particularly sensitive to WIMPs with low mass in the range 1~20 GeV/c^2. Results from the 0.6 kg-day exposure data taken in 2016 provided an upper limit for the elastic spin-independent WIMP-nucleon cross-section below 10^{-39} cm^2 for WIMPs with masses larger than 3 GeV/c^2.

Another low-mass WIMP search experiment is CRESST, located in LNGS. CRESST uses $CaWO_4$ crystal modules operated at an extremely low temperature (10 mK) to detect both thermal excitations and scintillations resulting from the nuclear recoils. The CRESST-II experiment, which concluded in 2015, is currently leading the exclusion limit below a mass of 1.5 GeV/c^2, and has extended below 1 GeV/c^2 for the first time.

DISCUSSION

Most of the projects discussed above have planned upgrades to improve their sensitivities,. At the next stage SuperCDMS will be moved to SNOLAB, and it is projected to start operation in 2020. With an exposure of 100 kg-year of Ge and 14.4 kg-year of Si with mixed iZIP and HV mode, the SuperCDMS experiment is anticipated to approach the ultimate neutrino background for WIMP masses in the range between 0.5 and 7 GeV/c^2. Also at SNOLAB, the upgraded DAMIC100 experiment with 100 g of target mass is upcoming. In China, the CDEX-10 with a total target mass of 10 kg is being prepared with an improved low-energy threshold. At LNGS, the newly designed CRESST-III experiment started commissioning in June 2016, and a low threshold below 100 eV is expected. In fact, such lower threshold experiments are opening up new opportunities to detect sub-GeV WIMPs via the very low energy electron recoil signals in addition to the nuclear recoil signals. Besides existing technologies, new experimental concepts are being discussed and developed.

Despite the heated competition in searching for signs of spin-independent (scalar) WIMP-nucleon scattering, WIMPs could well carry spin and interact with nucleons through spin-dependent interactions. At SNOLAB, the PICO experiment is looking for spin-dependent WIMPs signals with the bubble chamber technique. In such superheated liquid detectors, only nuclear recoil events with large enough stopping power can produce nucleation to critically sized bubbles, which can then be photographed. Currently, PICO is operating two chambers. One is called PICO-2L with 2.9 kg of C_3F_8. Another one, PICO-60, is the largest bubble chamber used in dark matter search to date, and was filled with 36.8 kg of CF_3I in run 1 and C_3F_8 in run 2. Due to the odd number of protons in 19F and the fact that the last unpaired proton dominates the overall spin of 19F, PICO has excellent sensitivity to spin-dependent WIMP-proton scattering. In fact, the most recent result of PICO-2L provided the most stringent direct detection constraints on such cross-sections for WIMP masses of less than 50 GeV/c^2. The leading experiments searching for the WIMP-neutron interaction are again using liquid xenon, relying on the fact that two of its natural isotopes, ^{129}Xe and ^{131}Xe, carry odd numbers of neutrons. The lowest published cross-section limit is 9.4 x 10^{-41} cm^2 at 33 GeV/c^2 from the LUX collaboration with a total of 1:14 x 10^4 kg-day exposure. More recently, the PandaX-II experiment reported a record limit of 4:1 x 10^{-41} cm^2 at 40 GeV/c^2 in a preprint. The current limits set on spin-dependent WIMP-nucleon scattering cross-sections by different experiments are shown in Fig. 2 (proton) and Fig. 3 (neutron).

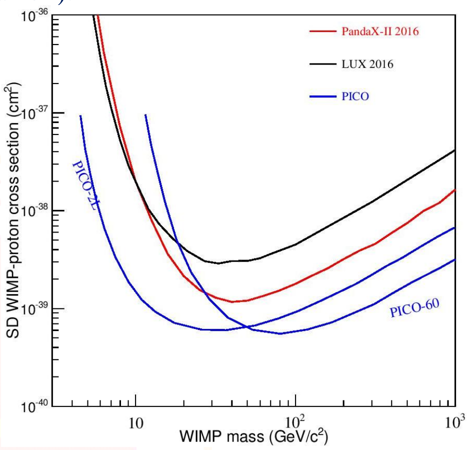

Fig. 2: Upper limits on the spin-dependent (SD) WIMP-proton scattering cross-section set by different experiments. The limit curves are from LUX [62], PandaX-II [63], and PICO [60, 61].

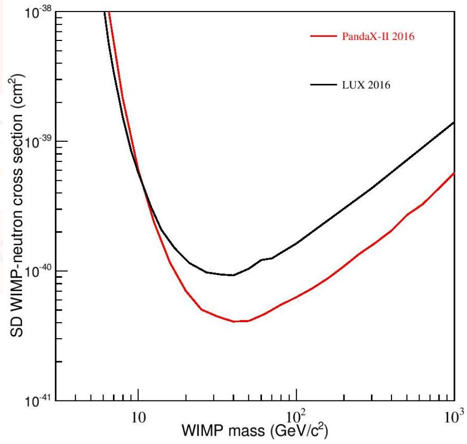

Fig. 3: Upper limits on the spin-dependent WIMP-neutron scattering cross-section set by different xenon-based experiments. Limit curves from LUX [62] and PandaX-II [63].

Finally, to prove the astrophysical nature of the WIMPs requires measurements of the angular correlation between the recoil signals and the galactic rotation. Relevant experimental techniques can also be applied to further reject both electron and nuclear recoil backgrounds, or even break the ultimate neutrino background limit. Active research and development is being pursued globally in the direction of solid and gaseous detectors, to demonstrate their ability to identify recoil tracks and the scalability to a significant target mass.

CONCLUSION

To summarize, we presented a non-exhaustive survey of the recent progress in direct detection WIMP experiments. Although there has been no solid evidence of a real event yet, the currently operating experiments are expected to enhance their search sensitivity, and may have the opportunity to first detect a real WIMP signal. In the next decade or so, future experiments are planning to push the search sensitivity in spin-independent WIMP-nucleon interaction to the irreducible neutrino background in almost the entire WIMP range. The present status and future reach of this very competitive field is illustrated in Fig. 4. Should a future observation be made in one experiment, a robust discovery would require confirmation from other experiments, preferably with different experimental techniques and different target materials, as well as cross checks from indirect and collider searches (for example, see SUSY contours from Figs 1 and 4). This calls strongly for a worldwide multifaceted programme for dark matter detection. Finally, one cannot ignore the importance of those null searches which have been setting tighter constraints to many theoretical models and which may eventually direct us on a completely different path towards understanding this mysterious component of our Universe.

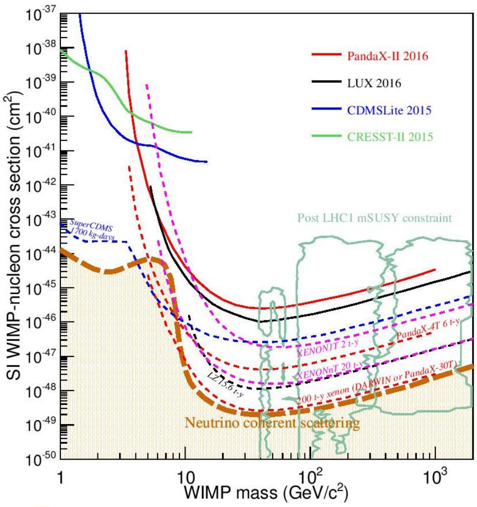

Fig. 4: The projected sensitivity (dashed curves) on the spin-independent WIMP-nucleon cross-sections of a selected number of upcoming and planned direct detection experiments, including XENON1T [34], PandaX-4T, XENONnT [34], LZ [35], DARWIN [36] or PandaX-30T, and SuperCDMS [56]. Currently leading limits in Fig. 1 (see legend), the neutrino 'floor' [20], and the post-LHC-Run1 minimal-SUSY allowed contours [21] are overlaid in solid curves for comparison. The different crossings of the experimental sensitivities and the neutrino floor at around a few GeV/c^2 are primarily due to different threshold assumptions.

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POLYANILINE THIN FILM SYNTHESIS AND CHARACTERIZATION BY A NOVEL ELECTROCHEMICAL POLYMERIZATION TECHNIQUE.

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ABSTRACT

In the present work , electrochemical behavior of polyaniline (PANI) thin films which is synthesized by galvanostatic technique on platinum substrate as working electrode in three electrode system. During deposition of PANI, various process parameters Viz. concentration of dopant, time of deposition and applied current density were optimized. Surface morphology was characterized by Scanning probe technique Viz. Atomic Force Microscopy (AFM) which confirms the deposition of thin films and chemical composition verified by Fourier Infra Red (FTIR) Spectroscopy.

Keywords: *Polyaniline Thin films, galvanostatic technique, surface modification. Atomic Force Microscopy, Fourier Infra Red Spectroscopy.*

INTRODUCTION

In this era world is going to developed due to liberalization, Privatization and globalization which can produce adverse effect on flora and fauna. So it is very important to nurture the nature for our future. Therefore scientists were attracted towards the Conducting polymers which can play a vital role to monitor the environment due to its ease of synthesis, low power consumption, tunable conductivity [1 - 5]. conducting polymer synthesized by chemical oxidative polymerization techniques [6, 7] which require large amount of times to carry out the reaction with the help of oxidizing agent but it is helpful to synthesize the thick film as well as an interfacial polymerization technique is utilize to produced composite film of polyaniline with the help of oxidizing agent which is quite tedious to carry out [8]. PANI films synthesize by electrochemical polymerization techniques [9, 10].

In present work, keeping the idea of one step electrochemical polymerization technique by lower applied current density, PANI thin film synthesize and deposited on platinum working electrode (vs Ag/AgCl reference electrode) and topographical image PANI thin film is recorded by Atomic Force Microscopy (Park XE 7). The electrochemical characterization performed by utilizing CH 600C electrochemical work station. A three electrode cell containing platinum plates of dimensions 20 * 10 *0.5 mm3 were used as working & counter electrodes and saturated Ag/AgCl used as reference electrode. In the preparation of electrolyte, aniline monomer distilled once prior to used and stored in cold environment were purchase from Sigma Aldrich. The reagent used as hydrochloric acid (HCl) of laboratory grade. In the electrolyte preparation 1 M of HCl is added drop wise with continuous stirring in 0.1 M of aniline for half an hour. This solution is used for electrochemical deposition of PANI thin films on platinum working electrode at room temperature.

RESULT AND DISCUSSION

PANI thin films synthesized by galvanostatic electrochemical polymerization technique by applying constant current density of 0.0417 mA/cm2 for 20 minutes to introduced PANI nuclei on to the platinum working electrode, at this current density effective potential at working electrode at which anodic peak potential remains at 0.77 v (vs Ag/AgCl reference electrode). After anodic peak there is a decrease in potential which confirms a uniform polymerized mass of PANI deposited on platinum working electrode. In the process of deposition, first the oligomers with smaller in size are deposited on the working electrode which acts as a seeds and help to deposited PANI polymers on the platinum working electrode. The modification in the topographic surface of the substrate after deposition of PANI thin film on working electrode is confirmed by Atomic Force Microscopy (AFM).

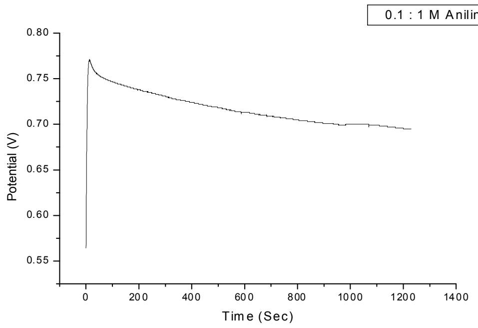

Fig.1: Chronopotentiogram of 0.1 : 1 M aniline/HCL thin film.

The modification in the topographic surface of the substrate after deposition of PANI thin film on working electrode was confirmed by Atomic Force Microscopy (AFM).

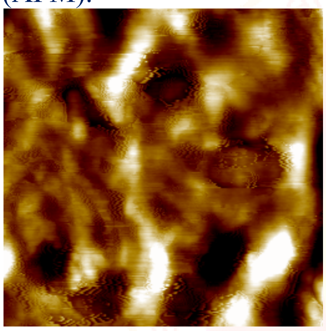

Fig. 2: Surface morphology of PANI thin film by AFM.

The chemical compositions of polyaniline were analyzed by FTIR Spectroscopy. The peak near 3500 cm^{-1} is attributed to stretching mode N-H band. The peak near 3000 cm-1 and 1500 cm^{-1} attributed to C-H sp^3 , stretch and C=C stretch for benzenoid group and the peak near 1250 cm^{-1} attributed for stretch quinonoid unit of polyaniline and below 1000 cm^{-1} attributed C-H band.

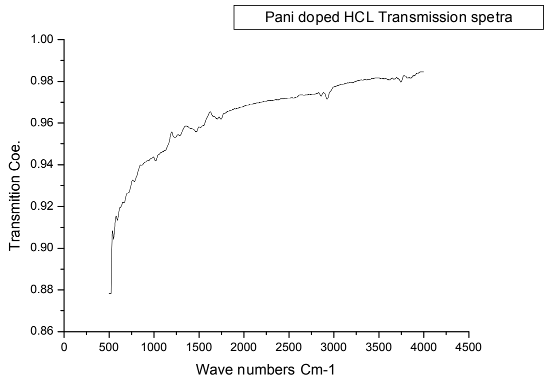

Fig.3 : FTIR spectrum of polyaniline.

CONCLUSION

One step novel electrochemical polymerization technique is utilized to synthesis and characterization of PANI thin film on platinum working electrode at room temperature. A chronopotentiogram is recorded which required less reaction time with lower applied current density as well as do not require any oxidant compare to the chemical oxidative polymerization technique. Surface morphology of deposited PANI thin film was studied by Atomic Force Microscopy, which confirms the deposition of PANI thin film on the working electrode due to roughness of topographic image. Chemical composition of PANI thin film is verified by FTIR Spectroscopy.

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FLUORESCENCE LIFETIME IMAGING-A NEW &NOVEL MODALITY FOR THE DETECTION & DIAGNOSIS OF BREAST CANCER

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ABSTRACT

Cancer is going to become a leading cause of death in the twenty first century. It is a morbid phenomenon caused by uncontrolled cell division, growth and differentiation. The normal cell division is a regulated phenomenon guided by the functional units of DNA molecules, called genes. The life of the normal cells also regulated. It grows, becomes old, and dies automatically after its programmed function is accomplished. But cancer cells are immortal. They do not die automatically. The horrific side effects inflicted by conventional therapy often leave patients partially or severely debilitated, and set the stage for deadly secondary diseases. For those people suffering from cancer the dangerous mix of chemotherapy and surgery not only failed to cure the cancer, but destroyed their remaining quality of life. The laser treatment has the potential to destroy primary breast tumors but for some women to whom X- ray mammography is not suitable, a new and novel modality such as "fluorescence lifetime imaging" is used as a potential tool for the detection and diagnosis of breast cancer. In this technique, the contrast for the diseased tissue is provided by a change in lifetime of fluorescent contrast agents such as porphyrins or some of the newly synthesized lifetime sensitive dyes.

Keywords: *Mammography, Fluorescence lifetime imaging (FLIM), Porphyrins, chemotherapy.*

INTRODUCTION

In recent years there has been much interest in the use of optical diagnostics in cancer detection. Early diagnosis of cancer affords early intervention and greatest chance of cure. The laser treatment has the potential to destroy primary breast tumors but for some women to whom X-ray mammography is not suitable, a new and novel modality such as "fluorescence lifetime imaging" is used as a potential tool for the detection and diagnosis of breast cancer. In this technique, the contrast for the diseased tissue is provided by a change in lifetime of fluorescent contrast agents such as porphyrins or some of the newly synthesized lifetime sensitive dyes. Fluorescence lifetime imaging (FLIM) is a novel imaging technique that generates image contrast between different states of tissue due to differences in fluorescence decay rates.

RESULTS AND DISCUSSIONS

Time-resolved techniques, such as fluorescence lifetime imaging (FLIM), add a further dimension to fluorescence data by analyzing the temporal properties of the fluorescence. FLIM is an imaging technique that measures the rate of decay ('lifetime') of fluorescence at each point in the image after pulsed laser excitation and plots the distribution of fluorescence 'lifetime' values. FLIM provides more reliable quantitative data than steady-state intensity imaging. Fluorescence typically decays over a period of picoseconds to nanoseconds after an excitation pulse and the rate of this decay (or lifetime) depends not only on the fluorophores present but also on their surrounding microenvironment. Fluorescence decay profiles are therefore sensitive to both the composition and the function of tissue. For simple fluorescence decay profiles, the data can be accurately fitted to a mono-exponential decay model. For more complex decay profiles, such as those often observed from tissue AF, it is possible to fit such data to a mono-exponential decay model and obtain an apparent (effective) fluorescence lifetime value. Alternatively, the data can be fitted to a more complex model such as a stretched exponential decay profile, which corresponds to a continuous distribution of fluorophore lifetimes at each pixel that may be represented by a mean lifetime. This study uses multi-photon fluorescence lifetime imaging (FLIM) to characterize the fluorescence lifetime of normal and neo-plastic epithelial tissues in vivo. Multi-photon FLIM is a promising tool for the study and diagnosis of cancer in vivo because it non-invasively provides chemically specific information about tissue fluorophores and fluorophore microenvironment, and it is independent of fluorescence intensity. This technique exploits the intrinsic fluorescence of molecules already present in tissue, such as the metabolic coenzyme reduced nicotinamide adenine dinucleotide (NADH), thus obviating the need for exogenous contrast agents Multiphoton microscopy can generate high resolution, three-dimensional fluorescence images deep within tissue while maintaining tissue viability, thus allowing for the visualization of cellular and sub-cellular structures. Our group has previously shown that multi-photon microscopy of epithelial tissues reveals statistically significant differences in tissue morphology and endogenous fluorescence intensity between normal, pre-cancerous and cancerous tissues (Skala et al., Cancer Res, 2004 in review). The current study provides an additional layer of functional information by characterizing changes in the fluorescence lifetimes and relative abundance of fluorophores in normal and pre-cancerous epithelial tissues.

The development of non-invasive, biomedical optical imaging from frequency-domain photon migration (FDPM) measurements of near-infrared (NIR) light propagation depends upon (i) the measurements of optical signal on the boundary of tissues and (ii) the numerical techniques enabling the reconstruction of interior optical properties from such measurements. From the mapping of interior optical properties, it is envisioned that diseased tissues can be identified and diagnosed based upon the differences in absorption and scattering properties. Briefly, FDPM consists of launching intensity-modulated light at the air-tissue interface and detecting the phase-delay and amplitude attenuation at another point distant from the incident point source. In the Purdue Photon Migration Laboratory (PPML), we have developed rapid multi-pixel methods for acquiring large data sets of phase-delay and amplitude attenuation across a tissue surface for use in an inversion algorithm in order to perform image reconstruction. In addition, since we have found that the endogenous contrast offered by absorption and scattering may be insufficient for biomedical imaging, we have invented a method for inducing contrast using fluorescent contrast agents. Algorithm development for biomedical fluorescence lifetime imaging was conducted under USAMRMC support. Using fluorescent agents, we have shown that the inverse problem may be better posed and that bio-diagnostic information can be obtained from assessing the fluorescent decay kinetics within the tissue.

CONCLUSIONS

In Fluorescence lifetime imaging (FLIM) study, we used fixed but unstained tissue sections which revealed statistically significant differences in the fluorescence lifetimes of benign and malignant tissues. Whereas this was the first FLIM study to be conducted that directly compared benign versus malignant breast tissue, the effects of sample fixation are likely to significantly alter fluorescence lifetimes compared with that of unfixed tissue. When recording the fluorescence lifetimes of metabolites related to cellular metabolism, it is clearly preferable to use viable cells and tissues.

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INORGANIC COMBUSTION SYNTHESIS, STRUCTURE AND LUMINESCENCE PROPERTIES OF (CA, MG) AL_2SIO_8: EU^{2+} (CMAS) PHOSPHORS

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ABSTRACT

The present manuscript report, synthesis of Eu^{2+} doped metal alumino silicates $MAl_2Si_2O_8$ (M=Ca,Mg) blue phosphors by a novel solution combustion technique. It also accounts an effort to improve the efficiency, stability against high temperature and long life time when excited by ultra & vacuum ultraviolet radiation (UV/VUV) in Lighting & display devices. Crystal structure and particle morphology of prepared $MAl_2Si_2O_8$ (M=Ca, Mg) material were studied by XRD and FE-SEM. Photoluminescence spectra obtained under UV/VUV excitation, shows emission band moved gradually to a longer wavelength of 435 nm with increasing Mg concentration which enhance performance of these compounds in harsh environment of vacuum tubes found suitable to employ as blue components LED Lighting & PDP display.

Keywords: *Combustion synthesis, photoluminescence, phosphors.*

INTRODUCTION

The recent developments in the lighting and display devices need efficient phosphors, in a modern usage of Lightning W-LEDs & plasma display panel (PDPs) is the distinguish technique to fabricate and developed a large screen flat panel display, high definition television (HDTV) and mercury free lamps [1-2].These devices required blue phosphor, but these have some series issue such as low efficiency and degradation [3-4]. One possibility for overcoming the degradation problems is to replace host crystals with other stable compounds.

In this context silicate materials are reported as promising host candidates for the PDP phosphors with various crystal structures and high chemical stability and activated with rare earth ions [5-7]. As a progressive research we optimized and synthesized these materials by solution combustion technique, which is simple, time saving, operating at low temperature and rapid prototype, moreover intermixing of precursors at atomic level is another feature of this technique. Crystal structure and Photoluminescence properties were discussed upon UV/VUV excitation.

2. COMBUSTION SYNTHESIS OF EU^{2+}ACTIVATED (CA,MG)$AL_2SI_2O_8$

The samples were prepared by a novel solution combustion technique [7-12] .The starting ingredients $Ca(NO_3)_2$, $Mg(NO_3)_2$, $Al(NO_3)_3$ $CO(NH_2)_2$,NH_4NO_3 (AR Loba chem.) and SiO_2,$Eu(NO_3)_3$ (IRE Ltd.) were used. The stoichiometric amounts of the ingredients require were calculated by using coefficients of multiplier in balanced inorganic chemical reaction described in equation (1). Ingredients were thoroughly mixed in an agate mortar with addition of little amount of double distilled water then transferred in to a china basin. The China basin was introduced in to preheated muffle furnace maintained at 550°C. The solution boils, froths and ignites to burn with flame and obtained a voluminous, foamy powder. Following the combustion the resulting fine powders were annealed in strong reducing atmosphere provided by well activated burning charcoal at temperature 550 °C for about 3 hour and suddenly cooled to room temperature.

$$(0.95\times0.50)Ca(NO3)_2+(0.95\times0.50)Mg(NO_3)_2 +2Al(NO_3)_3+ SiO_2+ 0.05Eu(NO_3)_3 \xrightarrow[550^oC]{\textbf{(reduced)}} [Ca,Mg]Al_2SiO_8{:}Eu^{2+}+\text{Gaseous } (H_2O\uparrow,NH_3\uparrow \text{and } NOx\uparrow) \quad .....(1)$$

3. XRD ANALYSIS AND CRYSTAL STRUCTURE OF CMAS:EU^{2+}

The powder XRD pattern of prepared samples of host lattice of $MAl_2Si_2O_8{:}Eu^{2+}$, (M=Ca-Mg) shown in figure 1, and matched with JCPDS pattern of $[Ca,Mg]Al_2SiO_8$ (ICDD Card no.00-19-0239).It contain two phases trigonal which is more compatible for reduced Eu^{2+} ion and resists oxidization than phase occurred in monoclinic. The crystal structure of infinite two-dimensional hexagonal sheets consisting of two layers of

$(Al,Si)O_4$ tetrahedra. CMAS has a space group P1 with cell parameters, a= 8.17A°, b=12.87A°, c =13.18 A°, α=93.17°, β=115.91°, γ=91.19° [13]. As shown in CMAS has an infinite three-dimensional silicon–oxygen frame work and the Ca atom has six or seven closely lying oxygen neighbors at distance between 2.28 and 2.82 A°, that is, due to its rigid structure and unlimited framework of silicon–oxygen and aluminum–oxygen around Eu^{2+} ions shown in Fig.2, Eu^{2+} ions were protected from outer oxidizing atmosphere during the baking process, since the structure acts as a shield against oxidation environment [14].

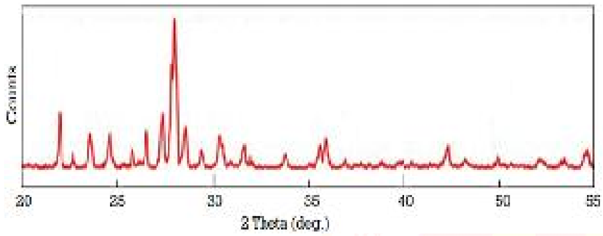

Fig.1 XRD pattern of $[Ca,Mg]Al_2SiO_8$ (ICDD Card no.00-19-0239)

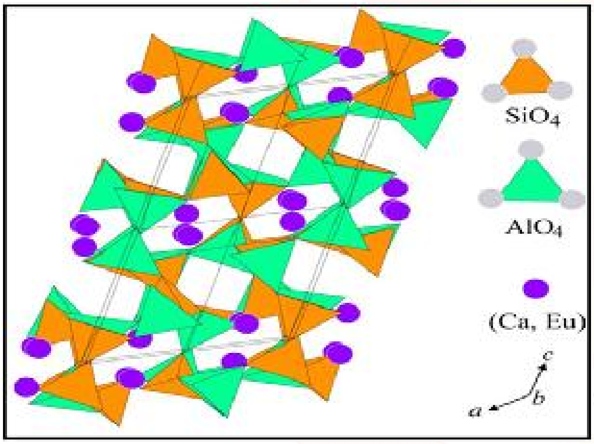

Fig.2 Crystal structure of CMAS:Eu^{2+}phosphor

SURFACE MORPHOLOGY

The morphology of the phosphor particles were studied by using **Hitachi model S-4800 type-2 FE-SEM.** The SEM images of $(Ca,Mg)Al_2Si_2O_8:Eu^{2+}$ prepared under identical conditions are shown in Fig. 3. flossy, hallow agglomarizations and morphology and some agglomerations are observed. The average size of particles is about 5μm better for high energy VUV absorption and emission from exterior surface of phosphor particles.

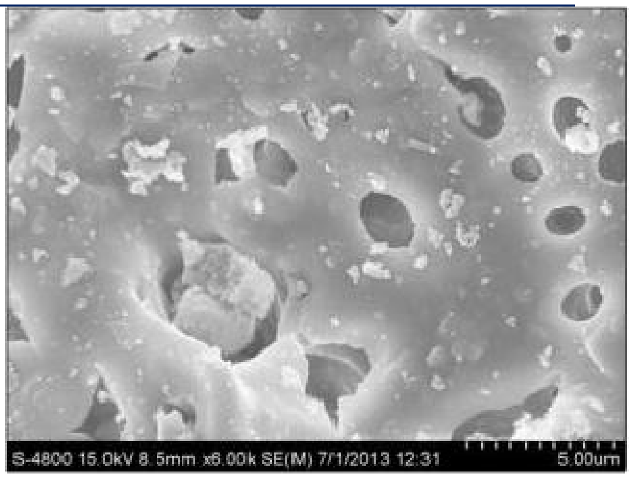

Fig. 3 FE-SEM micrograph of $[Ca,Mg]Al_2SiO_8$: Eu^{2+}

RESULTS & DISCUSSION

It is found that the addition of Mg in to $(Ca_{1-x}, Mg_x)Al_2SiO_4:Eu^{2+}$ changes its crystal structure significantly and the CIE color coordinate of the resulting emission shifted to longer wavelength(deep blue colour) with increasing Mg concentration [15]. Fig.4 and 5 shows emission obtained at 455nm at 325 nm of UV excitation and 147 nm of VUV excitation relative PL intensity and dominant wavelength of optimized Mg concentration. It may be attributed to some changes in the crystal field around Eu^{2+} with addition of Mg since the 5d electrons of Eu^{2+} are split by the crystal field changes. Although the 4f electrons of Eu^{2+} are not affected the crystal field easily due to the shielding of thee electrons in the outer shell. Its emission band moved gradually to a longer wavelength of 435 nm with increasing Mg concentration, while PL intensity decreases significantly.

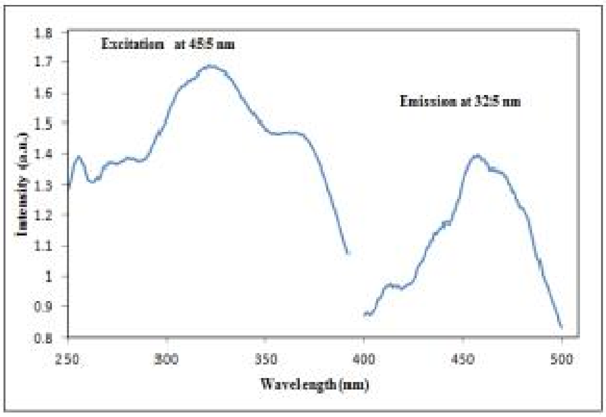

Fig.4 Excitation & Emission Spectra of $[Ca_{0.50},Mg_{0.50}]_{0.95}Al_2SiO_8:Eu^{2+}$ under UV light.

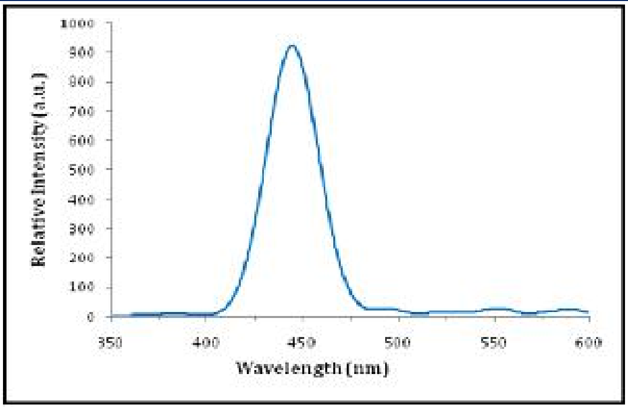

Fig.5 Emission Spectra of $[Ca_{0.50},Mg_{0.50}]_{0.95}Al_2SiO_8:Eu^{2+}$ under VUV light.

CONCLUSION

Novel route of solution combustion synthesis was successfully employed for synthesis of silicate host phosphor. The optimized concentration of Mg in to $(Ca_{1-x}, Mg_x)Al_2SiO_4:Eu^{2+}$ around Eu^{2+} ions with addition of Mg since the 5d electrons of Eu^{2+} are split by the crystal field changes. Its emission band moved gradually to a longer wavelength of 450 nm with increasing Mg concentration, while PL intensity decreases significantly. Photoluminescence emission under 235 UV and 147 nm of VUV excitation suggest that these materials can be employ in solid state lighting and blue PDP phosphors.

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OSL PROPERTIES OF LI2B4O7: AG PHOSPHOR FOR RADIATION DOSIMETRY

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ABSTRACT

The sample of Li2B4O7: Ag was successfully synthesized by using solid state reaction and synthesis method which is low cost, low temperature method and it not required any other atmospheres for synthesis. The X-ray powder diffraction, photoluminescence (PL) emission & excitation spectra and optically stimulated luminescence (OSL) were measured. X-Ray diffraction (XRD) and Scanning electron microscopy (SEM) techniques have been used to confirm the formation of material in the micro size. PL emission spectra of Li2B4O7: Ag phosphors show the broad band around 180-300 nm. Also the concentration quenching phenomenon was studied for the Li2B4O7: Ag phosphor for different concentrations of Ag. OSL sensitivity of prepared phosphor was determined along with its fading with time. Effective atomic number (Zeff) of prepared phosphors near about human tissue hence this phosphor could be helpful in radiation dosimetry applications.

***Keywords** : Dosimetry, Phosphor, Quenching, etc.*

INTRODUCTION

Radiation dosimeter is a device that measures exposure to ionizing radiation. It has two main uses: for human radiation protection and for the measurement of dose in medical and industrial processes [1].

In the present scientific world, ionizing radiations have been found very useful in engineering, medicine, science and technology. Professionals used them at every walk of life. In all the applications like personnel dosimetry, environmental monitoring, space dosimetry, etc., the exact amount of absorption of radiation energy in the exposed material is important factor to get the desired results. The better use can be achieved mostly by accurate determination of energy absorbed from the radiation field and the possible distribution of this absorbed energy within the material. Measurements of these quantities form the basis of radiation dosimetry and systems used for this purpose are referred as dosimeters.

- ✓ The radiation monitoring could be effective only when the radiation dosimetry is accurate.
- ✓ Internal dosimetry due to the ingestion or inhalation of radioactive materials relies on a variety of physiological or imaging techniques. External dosimetry, due to irradiation from an external source is based on measurements with a dosimeter.
- ✓ The nuclear energy is clean and efficient alternative over traditional methods of power generation worldwide. Number of nuclear plants is increasing every year.
- ✓ Dosimetry is used extensively for radiation protection and is routinely applied to occupational radiation workers, where irradiation is expected, but regulatory levels must not be exceeded.
- ✓ Radiation processing using high-doses presents significant advantages in industry (water purification, organic polymer materials crosslinking and pasteurization), medicine (radio-sterlization), agriculture (disinfections, inhibition of sprouting).
- ✓ Other significant areas are medical dosimetry, where the required treatment absorbed dose and any collateral absorbed dose is monitored. Medical dosimetry is the calculation of absorbed dose and optimization of dose delivery in radiation therapy.
- ✓ Environmental Dosimetry is used where it is likely that the environment will generate a significant radiation dose. An example of this is radon monitoring.

Optically stimulated luminescence (OSL) is the phenomenon of emission of light from a solid which has been previously exposed to ionizing radiation under conditions of increasing temperature

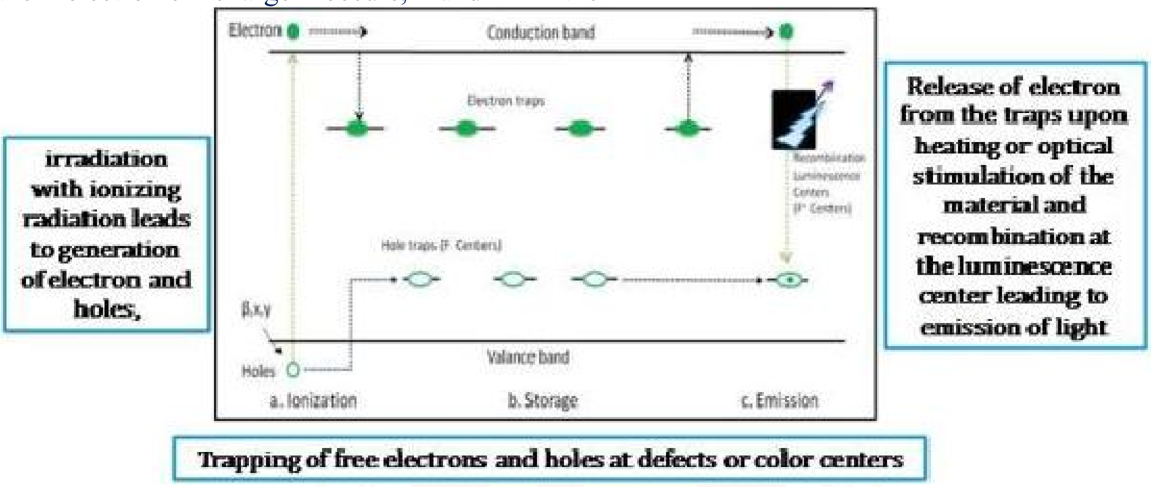
Phenomenon of OSL is described as follows

a. The absorption of energy from an ionizing radiation source by an insulating or semiconducting material causes the excitation of free electrons and holes and subsequent trapping of these electronic species at defects (trapping states) or metastable states within the material.

b. The subsequent absorption of external energy by the metastable trapped charge results in the stimulated relaxation of the system back to its equilibrium condition.

c. During the relaxation process recombination of the electronic charge occurs, and if the recombination is radiative, luminescence is emitted.

Figure 1. Represent schematic representation of Optically stimulated luminescence phenomena in an insulating or semiconducting material.



Requirements of good OSL materials

The important requirements of a material to be good OSL phosphor are listed below

- Tissue equivalence (effective atomic number (Z_{eff}) = 7.4).
- Sufficiently high sensitivity and accuracy.
- Linearity of dose response over a wide range (µGy – few Gy).
- Dose rate independence of the response.
- Negligible fading.
- Emission spectra preferably in the range 300–425 nm.
- Minimum Detectable Dose (MDD) in the (µGy) range
- Low cost of preparation.

Applications of OSL phosphor

The applications of the phenomenon of TL/OSL to the measurement of dose have progressed a great deal since the initial work by Daniels and Colleagues (1953). Several Optical and thermo luminescent phosphors are now used routinely in many dosimetric applications for environmental monitoring, personnel dosimetry and medical applications.

Personnel monitoring: Measurement or assessment of radiation dose delivered to personnel during their occupational exposure.

Environmental dosimetry: To determine the environmental radiation doses absorbed by archaeological and geological materials in efforts to date those materials.

Space dosimetry: The space radiation field to which the astronauts are exposed originates from three primary sources: galactic cosmic rays (GCR), solar particle events (SPEs) and charged particles trapped in the Earth's magnetic field (Earth's Radiation Belts, ERB).

Medical dosimetry: To help the medical physicist for treatment of their patients.

Literature Survey

The some of the phosphor materials developed over many decades and their dosimetric properties are summarized in table 1.

Sr. No.	Materials	Zeff	Glow peak Temp	TL emission Wavelength	Fading	Sensitivity
1.	LiF:Mg,Ti (TLD-100) [2]	8.2	200°C	400 nm	5% in 3 months	1
2.	LiF:Mg,Cu, P (TLD-100H) [3]	8.2	210°C	400 nm	5% in 3 months	25
3.	$Li_2B_4O_7$:Cu [4]	7.4	178°C	368 nm	11% in 3months	2
4.	$Li_2B_4O_7$:Cu,In [5]	7.4	210°C	368 nm	6% in 3 months	0.7

5.	$Li_2B_4O_7$:Cu,In, Ag [5]	7.4	190°C	368 nm	10% in 3months	2
6.	$Li_2B_4O_7$:Cu,Ag,P [6]	7.4	179-248°C	370 nm	<10% in 3months	5
7.	$Li_2B_4O_7$:Mn [7]	7.4	220°C	605 nm	4% in 1 month	5
8.	LiB_3O_5:Al [8]	7.34	218°C	520 nm	<5% in 1 month	0.5
9.	(TLD-900) [9]	15.3	220-240°C	480,570nm	1% in 2 Months	40
10.	$CaSO_4$:Tm [10]	15.3	220°C	450 nm	1 - 2% in 2 Months	40
11.	$CaSO_4$:Tm/Dy, Ag [11]	15.3	350 - 370°C	445, 480, 570 nm	<1% in 1months	40
12.	CaF_2:Dy [12]	16.3	240°C	480, 570 nm	5% in 2 months	50
13.	CaF_2:Mn [13]	16.3	280°C	500 nm	16% in 2 weeks	10
14.	$BaSO_4$:Eu [14]	46.9	230°C	380 nm	40% in 40 days	100
15.	$SrSO_4$:Eu [15]	30.3	210°C	380 nm	15% in 30 days	>40
16.	Mg_2SiO_4:Tb [16]	11	200°C	540 nm	Very less	>40
17.	BeO [17,18]	7.1	180 - 200°C	330 - 340 nm	10% in 3months	1
18.	Al_2O_3:C [19]	10.2	180°C	420 nm	21% in 3 Months	40-60
19.	$LiCaBO_3$:Tm [20]	18.6	233°C	455 nm	15% in 1 month	3
20.	$LiMgBO_3$:Tb [21]	10.2	250°C	544 nm	negligible	4
21.	MgB_4O_7:Dy, Na [22]	8.55	190°C	480, 570 nm	8% in 3 month	6
22.	ZnB_2O_4:Dy [23]	22.5	200°C	480, 570 nm	-	-
23.	SrB_6O_{10}:Tb [24]	31.8	210°C	542 nm	-	-
24.	BaB_4O_7:Dy	52.1	345°C	480, 570 nm	-	-
25.	BaB_4O_7:Ce	52.1	250°C	-	-	1.8

MATERIALS AND METHODS

We have prepared borate phosphors by using Solid State Reaction. A brief description of preferred method is as follows.

The solid-state reaction is the conventional as it was widely used during first half of the last century, for the synthesis of multielement ceramic powders. In this method, fine powders of the individual component oxides ⁄ carbonates / nitrates are first mixed, milled and calcined at elevated temperatures. Sometimes the production of such oxides may require repeated grinding and calcining steps in order to achieve the desired phase. Relatively high temperatures are required for solid-state reactions; typically around 1200°C because of limited diffusion during calcinations, and this can result in decomposition of the ceramic product. The particle size of product prepared by this method is large for display applications; therefore the powders must be ground into a finer powder. Particle size reduction by milling can introduce chemical impurities into the product. It is well known that mechanical crushing creates lattice defects, which in turn, reduce the radiant efficiency of the phosphor. Preparation of single-phase materials is difficult by solid-state reaction method. Hence homogeneous doping at low activator concentration (2 mol %) has always been delicate i.e. product is inhomogeneous. Carefully controlled addition of dopant is important in this synthesis.

Disadvantages of solid-state reaction:

- Coarse grain size, powder agglomerates having non-homogeneous properties due to limited diffusion lengths.
- Repeated cycles of heating and cooling followed after crushing the material in

between these cycles.

- This added processing time as well as chemical impurity during crushing.
- Preparation of single-phase compound is difficult by the conventional solid-state method. Hence, doping a low concentration (of the order of 1%) of activator has always been delicate.
- Formation of large particles with low surface area and hence mechanical particle size reduction is required which introduces impurities and defects.

The polycrystalline $Li_2B_4O_7$: Ag phosphor was successfully synthesized by using a solid-state method. The raw materials Lithium Nitrate ($Li(NO_3)$), Boric acid (H_3BO_3), Silver Nitrate ($AgNO_3$) were used. The starting materials in stoichiometric amounts were mixed thoroughly in china clay basins and small amount of acetone were added. The detail of molar ratio of constituent used for phosphor synthesis was given in Table 4. The obtained mixture was heated at100 °C for 1h, 200 °C for 1h, 400 °C for 2h, 600 °C for 2h and 700 °C for1h between 2 intermediate regrinding and sample was quenched at room temperature.

Table 2 gives the reactions involved in the synthesis of the $Li_2B_4O_7$ phosphor.

Product	Corresponding reaction with balanced molar ratios of Precursors
$Li_2B_4O_7$: Ag^{2+}	$(2\text{-}x)LiNO_3 + 4H_3BO_3 + xAgNO_3$ (In stock solution for 1gm = 100ml) = $Li_{(2-x)}B_4O_7$: xAg^{2+} + gaseous product (H_2O and NO_2) (x=0.001, 0.002, 0.005, 0.01, 0.02)

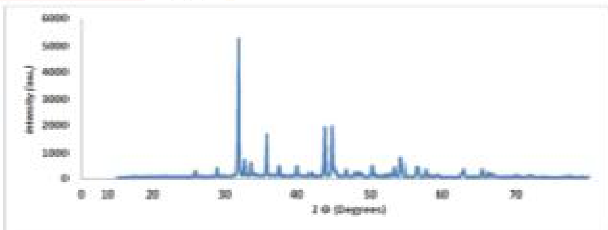
RESULTS AND DISCUSSION

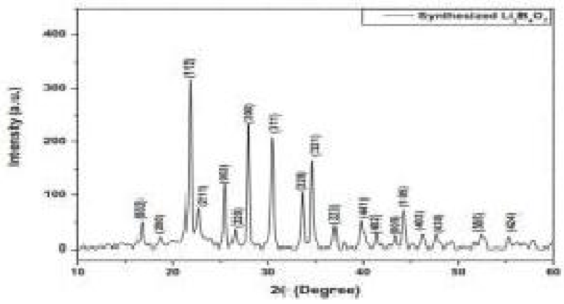
3.1 Introduction

Lithium borate ($Li_2B_4O_7$) is a low Zeff, tissue equivalent material that is commonly used for medical dosimetry using the Optically stimulated luminescence (OSL) technique. In the present work, the polycrystalline lithium borate have been synthesized by using solid state method for the first time in the laboratory. X-Ray diffraction (XRD) and Scanning electron microscopy (SEM) techniques have been used to confirm the formation of material in the sub micron range. The OSL properties of synthesized $Li_2B_4O_7$ phosphor, irradiated to UV light have been examined in this study that includes OSL sensitivity. These results may be helpful in the development of tissue equivalent TL detectors best suited for wide range of radiation exposures [25].

3.2 X-ray Diffration Data

The structure of the as-prepared samples were analyzed by Rigaku Miniflex X-ray diffractometer, using monochromatic CuKα_1 (□ = 1.5405 Å) radiation in the 2ϴ range of 10-70. The XRD pattern of synthesized compound with hkl values is shown in Figure 2. The results for hkl values were obtained by matching the peaks with the standard data available (JCPDS card No. 84-2191). After fitting the data with the powder X-ray data analysis system, it has been found that the compound exhibits tetragonal structure having lattice parameters a=b= 9.566 Å, c= 10.445 A and α=β=γ=90° [25].





2θ	θ (in degree)	θ (in radian)	Sin θ (θ in degree)	Sin θ (θ in radian)	Sin^2 θ (θ in radian)	Sin^2 θ / Sin^2 θmin	(Sin^2 θ / Sin^2 $θ_{min}$)*3	$h^2+k^2+l^2$	hkl
21.00	10.5	0.1831	-0.8796	0.1821	0.0331	0.7111	2.1334	3	111
25.62	12.81	0.2234	0.2412	0.2216	0.0491	1.0526	3.1580	5	210
32.37	16.185	0.2823	-0.4591	0.2786	0.0776	1.6637	4.9913	6	211
34.91	17.455	0.3044	-0.9845	0.2998	0.0898	1.9267	5.7801	8	220
44.89	22.445	0.3915	-0.4384	0.3816	0.1456	3.1215	9.3647	11	311

3.3 Scanning Electron Microscopy (SEM)

Figure 3 presentes the SEM result of prepared $Li_2B_4O_7$: Ag phosphor studied using Zeiss Scanning Electron Microscope. SEM results confirms the surface morphology at 5.32 Kx magnification which concludes that the particle size of prepared phosphor is around 2-10 µm range. Also the image shows that there is presence of non-uniform agglomeration, the particles are very well separated from each other in some area and somewhere they are agglomerated.

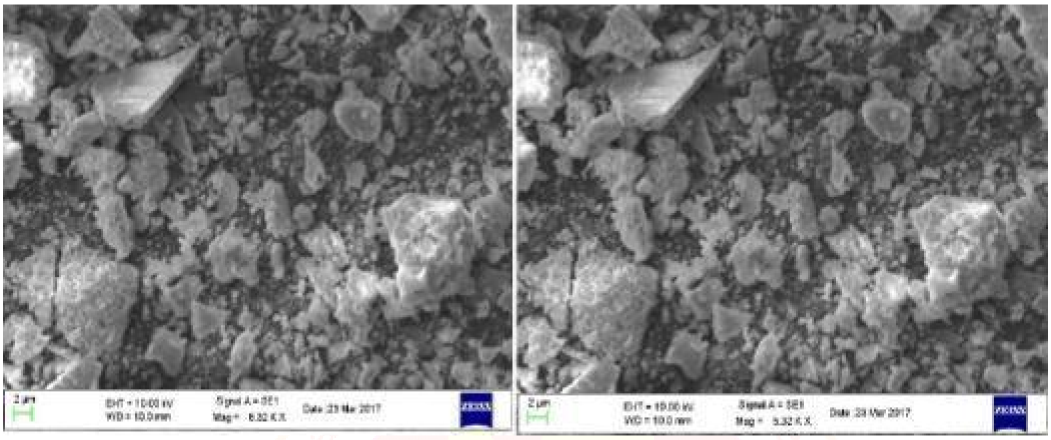


Figure 3. SEM image of $Li_2B_4O_7$: Ag phosphor

3.4 Photoluminescence (PL)

Figure 4(a) shows the excitation and emission spectra of phosphors $Li_2B_4O_7$: Ag. The excitation spectra were monitored at 207 nm and emission spectra were monitored at 261 nm. The excitation spectra shows broad band at 200-250 nm whereas the emission consists of broad spectra peaking at 261 nm of Ag. It is clear from figure 4(b) that the PL intensity increases with increase in the concentration of Ag up to the 0.01 % concentration and the concentration quenching phenomenon is observer after the 0.01 concentration.

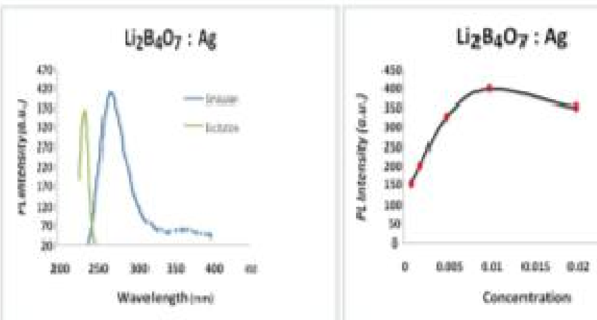


Figure 4 (a) and (b) showing excitation emission spectra and the concentration quenching in $Li_2B_4O_7$: Ag

3.5 OSL Results

The OSL properties of the prepared phosphor were studied. It is found that $Li_2B_4O_7$: Ag phosphor provides excellent OSL intensity as shown in the figure 5.

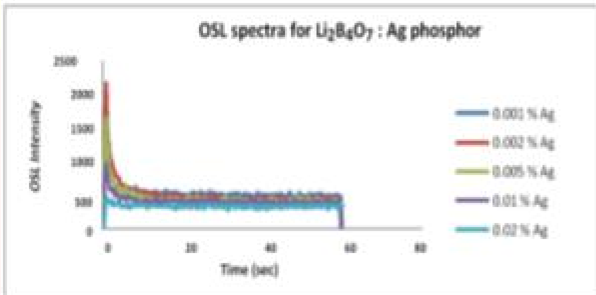


Figure 5. OSL spectra for $Li_2B_4O_7$: Ag phosphor

The optimum OSL intensity is monitored for 0.002 % concentration of Ag. $Li_2B_4O_7$: Ag and LMP TB both the phosphors were exposed to UV light of 254 nm for 30 min. On comparison of OSL intensity of $Li_2B_4O_7$: Ag with the standard LMP TB phosphor shows that the prepared phosphor is 4.82 time more sensitive than the standard one. The comparison of prepared phosphor with standard one is shown in figure 6.

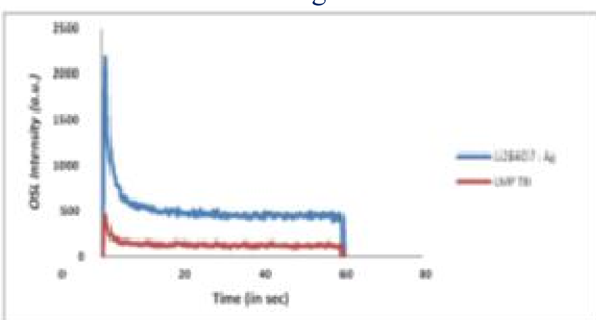


Figure 6. Comparison of OSL intensity of prepared phosphor with standard one

3.6 Fading Response of $Li_2B_4O_7$: Ag

The sample with highest OSL intensity irradiated to a UV light of 254 nm wavelength have been studied for fading by recording OSL intensity with increasing time. The results of fading of synthesized microcrystalline $Li_2B_4O_7$ doped with Ag are presented in Figure 7.

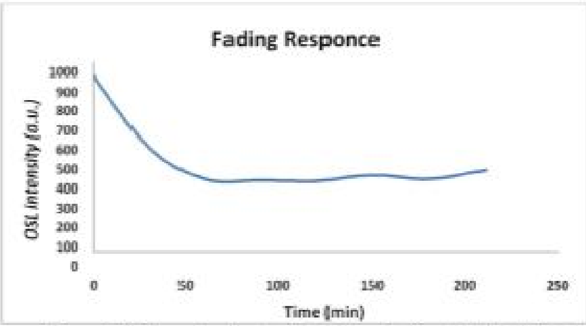


Figure 7. Fading of synthesized $Li_2B_4O_7$: Ag (Doped with 0.002%)

CONCLUSIONS

The sample of $Li_2B_4O_7$: Ag phosphor was successfully synthesized by using solid state reaction. The phase purity is confirmed with the help of X-Ray diffraction (XRD) data and also the values of miler indices hkl were calculated for the prepared phosphor. The surface morphology of prepared material was studied using Scanning electron microscopy (SEM) techniques and the average particle size is found to be 2-10 µm. PL spectra of $Li_2B_4O_7$: Ag shows the excitation and emission peaks at 207 nm and 271 nm respectively. The concentration quenching is observed at 0.01 % concentration of Ag. The prepared phosphor $Li_2B_4O_7$: Ag was found to be 4.82 times more OSL sensitive than the standard phosphor LMP TB. The fading of signal with time was studied for highest sensitive $Li_2B_4O_7$: Ag. The effective atomic number of prepared phosphor is 7.4 whereas that of the standard phosphor is around 11. Hence, the $Li_2B_4O_7$:Ag could be the promising phosphor for personnel monitoring applications.

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SPECTROSCOPIC AND SURFACE MORPHOLOGICAL STUDY OF POLY (STYRENE)/ POLY (VINYL ACETATE) COMPOSITE THIN FILMS

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ABSTRACT

The objective of this study is to illustrate the synthesized pure Poly (styrene) and pure Poly (vinyl acetate) also composite films with Salicylic acid (SA) as dopant by Isothermal evaporation technique; spectroscopic and surface morphological studies of these composite films have been investigated. The effect of PS content on PVAc blends was observed by Fourier transform infrared (FT-IR), X-ray diffraction (XRD) and Scanning electron microscopy (SEM). Significant changes in FTIR, XRD and SEM analysis are observed which reveals an interactions between the two polymers and PS/PVAc blends had good or certain miscibility. XRD graph shows some changes in the intensity peak. SEM micrographs attribute all experimental results.

Keywords: *Polystyrene (PS), Polyvinyl acetate (PVAc), Isothermal Evaporation Technique, FTIR, XRD, SEM.*

1. INTRODUCTION

Polymers have been applied successfully in fields such as adhesion, biomaterials, protective coatings, friction and wear, composites, microelectronic devices, and thin-film technology. They have excellent bulk physical and chemical properties. They are inexpensive and easy to process. For these reasons, surface modification techniques and addition of dopant which can transform these inexpensive materials into highly valuable finished products have become an important part of the plastics and many other industries. Also blending involves physical mixing of polymers and allows one to create a new material having some of the desired properties of each component. Moreover, blending and addition of dopant of different existing polymers is of considerable importance as an alternative to graft copolymerization and the very high cost to develop new homopolymers. This field has become economically very important [1-3].

2. MATERIAL AND EXPERIMENTAL

All chemicals were of analytical grade. Poly (styrene) and Poly (vinyl acetate) was supplied by SIGMA –ALDRICH, Co., 3050 spruce street, St. Louis. MO 63103 USA 314-771-5765.Salicylic Acid by (Sd fine- chem. Limited, Mumbai) and Tetrahydrofuran (THF-E-Merck India Ltd., Mumbai) is being used as a solvent for polyblending process. In the present work, thin films were prepared by isothermal evaporation technique.

2.1. PREPARATION OF THIN FILMS

2.1.1. PREPARATION OF PURE PS AND PURE PVAC THIN FILMS

Poly styrene (PS) was dissolved in tetrahydrofuran (THF) and continued stirring was performed for one hour before casting of film on plane glass plate in mercury pool; dry the film for 5-6 hrs in air. During this period due to evaporation process, THF was evaporated. Further thin film from glass plate was removed and washed it by distilled water. Furthermore, put this film in vacuum chamber at 50^0 C for 1-2 hrs to remove moisture on casted thin films. Finally we get pure PS thin film isothermal evaporation technique. Same procedure was followed for casting of pure PVAc thin films by isothermal evaporation technique.

2.1.2. PREPARATION OF POLYBLENDS

Poly (styrene) and poly (vinyl acetate) were dissolved in THF simultaneously. Stirring was continued for one hour before deposition of film. Total concentration of the polymeric mixture in solvent was kept 5%. Film of polymer blends was prepared by isothermal evaporation technique.

2.1.3. ADDITION SALICYLIC ACID AS DOPANT

The 10 % of Salicylic acid (dopant) means 0.05 gm was taken and dissolved in the mixture of PS-PVAc solutions. After attainment homogenous solution, the above mentioned 2.1.1 procedure was repeated to prepare the film.

2.2. MEASUREMENTS AND CHARACTERIZATIONS

Thickness of the films plays vital role in structural and electrical properties of the films. There are different methods (techniques) for the measurement of the film thickness. Thicknesses of all the samples were measured by using Digital micrometer (Digimatic outside Micrometer) supplied by Mitutoyo Corporation Japan. Its measuring range is 0 to 25 mm with resolution. 0.001mm, instrumental error (at 20 ^{0}C) is + 2□m and operating temperature range is 5^{0}C to 40^{0}C. It has digital display (6 digit and minus sign) for clear read out. From optimization study four samples from a series were selected for further study. List of optimized samples along with their wt %, sample codes and thicknesses are given in table I

Table I: Sample code and thickness of pure PS, pure PVAc and PS-PVAc composite films doped with Salicylic acid

Sr. No	Sample description	Sample code	Thickness
1	Pure PS	S_1	0.073 mm
2	Pure PVAc	S_2	0.024 mm
3	05:95PS-PVAc	S_3	0.041 mm
4	PS(05)-PVAc(95): SA (10)	S_4	0.040 mm

Ultraviolet (UV) absorption spectra of the films were carried out at room temperature. FT-IR measurements were carried out using Bruker Model: Vertex 70 (Made in Germany). This equipment has wide wave number range (50 cm to 15,000 cm^{-1}). So it can be recorded in transmission as well as reflecting geometry with high resolution scale 0.5cm^{-1}.The FT-IR spectra of all samples are in the range of 700-3800 cm^{-1}.

X-ray diffraction is a characterization technique that can be useful for analyzing the lattice structure of a material. It provides information for structure, phases and other structural parameters such as average grain size, crystallinity and crystal defects. In the present work, X-Ray Diffraction (XRD) of the samples was obtained using system Bruker D8 Advance XRD from UGC-DAE Consortium for Scientific Research, Indore. For surface structure analysis as well as to find out dislocation which is present in samples; we had done Scanning electron micrograph at Department of Physics, RTM Nagpur University by using system Model:XL-30, Make: Philips.

3. RESULTS AND DISCUSSION

3.1. FT-IR SPECTROSCOPIC ANALYSIS

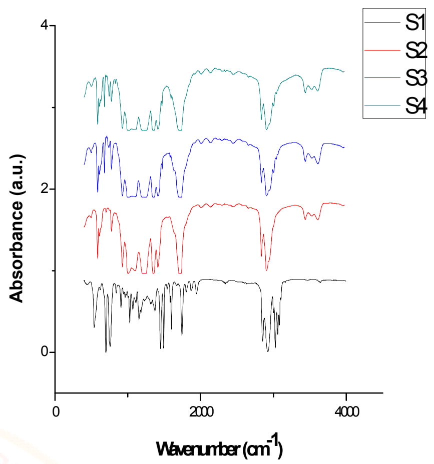


Fig. 1: Comparative FTIR Spectra of S_1, S_2, S_3 and S_4.

Fourier transform infrared (FTIR) spectroscopy is one of the widely used optical methods to study the interaction of electromagnetic radiation in the infrared region with chemical compounds [4]. Figure 1 represents comparative FTIR Spectra of S_1, S_2, S_3 and S_4 samples.

Pure PS consists of alternating methylene and methane groups. However, each repeat unit in PS contains a pendant benzene ring. The spectrum of pure PS is shown in Figure 1. The main PS characterizing bands are observed. The methylene (CH_2) asymmetric and symmetric stretching bands are observed at 2924 and 2852cm $^{-1}$. There is a group of aromatic C–H stretches around 3026cm^{-1} and benzene ring modes are found at 1600 and 1491 cm $^{-1}$. The out-of-plane C–H bending mode of the aromaticring is shown at 756cm^{-1}and the ring-bending vibrational band appears at 698cm^{-1}[5]. These last two bands confirm that PS contains a monosubstituted benzene ring.

Figure 1 depicts the FT-IR absorpti on spectra in the range 4000–400cm^{-1} of all synsthesied films. For pure PVAc, the vibrational bands observed at 2927 and 2854cm^{-1} are ascribed to O–CH_3 (ester group) asymmetric stretching and symmetric stretching vibrations, respectively. The intense band at around 1736cm $^{-1}$ represents the C=O stretching band of an unconjugated ester. At 1373cm^{-1}, a prominent band is evident, here the CH_3 (C=O) group strongly absorbs acetate esters; these acetate esters show a corresponding weak band at 629cm^{-1}. The strong band at 1243cm $^{-1}$ and the band at 1122cm^{-1} are ascribed to C–O–C symmetric stretching and C–O stretching vibrations, respectively. Also the peak at 947cm^{-1} is ascribed to CH bending vibrations and there is a significant band at 606 cm^{-1} which is assumed to be linked to CH $_3$ (C=O) group [6-8].

For all films, a triple split band appearance is identified at 3465, 3535 and 3637cm^{-1} as shown in Figure 1. This is the C–H stretching band, typical C–H stretching being usually present as a distinctively large band above 3000cm $^{-1}$. Some bands are disappeared in the blends and the intensity of some bands was changed. All results data suggest that homogeneous polymer composites are formed over all the blend compositions.

From Figure 1 revel that band at 2924 cm^{-1} and 2856 cm^{-1} shows presence of salicylic acid.

3.2. X-RAY DIFFRACTION ANALYSIS

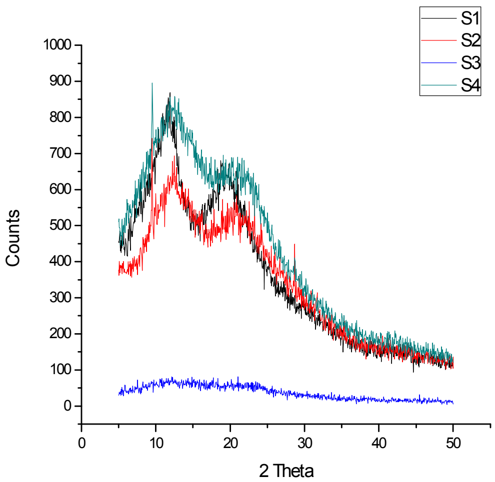
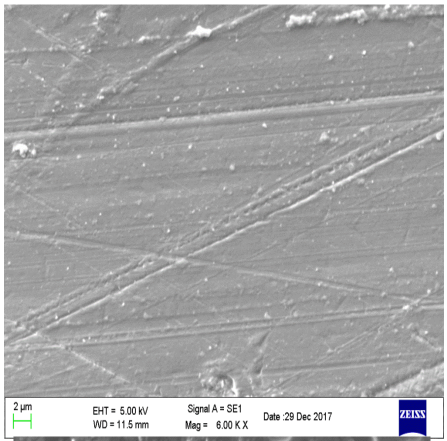


Fig. 2: Comparative XRD pattern S_1, S_2, S_3 and S_4.

Figure 2 represents X-ray diffraction patterns for the comparative study of S_1, S_2, S_3 and S_4 films. The XRD patterns of samples were recorded in terms of 2□ in the range of 5–50^0 at room temperature. The measurement of XRD diffraction scans of the polymer blends is also used as a criterion to determine its miscibility. The broad hump and noisy peaks in XRD patterns reveled predominantly the amorphous nature of the samples. The intensity of characteristic peaks increased with addition of dopant [9-11].

3.3. SCANNING ELECTRON MICROSCOPY

This is the technique that used to analyze the miscibility of two or more solid phases. For S_1, S_2, S_3 and S_4 films; the SEM studies were carried and micrograph images are presented in the following Figure 3 (a-d).



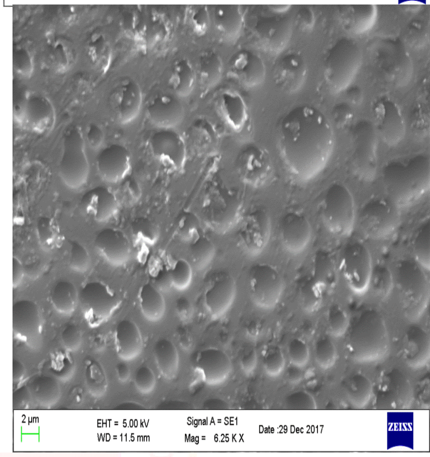
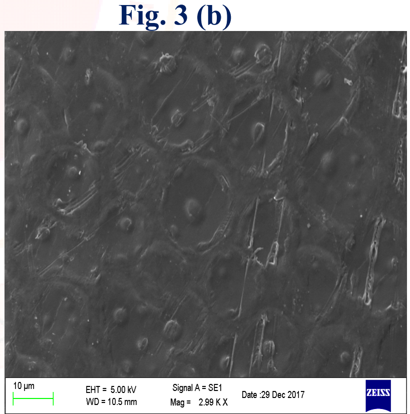


Fig. 3 (a)

Fig. 3 (b)



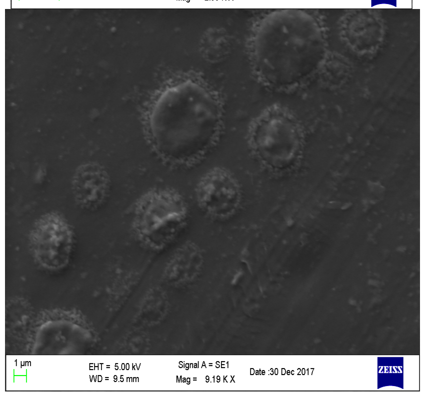


Fig. 3 (c)

Fig. 3 (d)

Fig. 3: SEM micrograph images of S_1, S_2, S_3 and S_4.

In S_1 and S_2 samples only one type of monomers are present which attributes in FTIR results. Some fracture over surface of S_1 and S_2 samples occurred. These homogenous structures show miscibility of pure PS and pure PVAc in THF solvent.

In case of S_3 and S_4 sample the scanning electron micrographs shows dislocation on surfaces which confirm unambiguously, the homogeneity of these blends and can be seen as proof of their miscibility [12]. This type of homogenous structure is necessary to ensure the good mechanical properties of the blends. In agreement with S_3 and S_4 samples FTIR and XRD results revels the above. Also, in the experimental observation these samples have exhibited high interfacial tension between the components.

The SEM image of a S_4 sample Figure 3(d) reveals the salicylic acid (SA) particles around PS particles. The SA particles are more over not uniformly dispersed in the PS: PVAc matrix, which is due to the poor compatibility between PS and PVAc phase and the tendency of the SA particles to coalesce during mixing [13].

4. CONCLUSIONS

It was found that Pure PS show maximum thickness among other samples. In short, we were successfully synthesized the Pure PS, Pure PVAc and composite PS-PVAc with dopant Salicylic acid (SA) films. The FTIR spectrum analysis allows us to conclude that successful formation of PS in the presence of PVAc and characteristic peaks increased with addition of Salicylic acid. The prepared films show amorphous nature observed from XRD patterns. SEM images of all samples revels FTIR and XRD's results. These films have potential of application in electronic and thermal devices.

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STUDY OF STRUCTURAL PROPERTIES AND GROWTH PARAMETERS $Cd_{1-x}Zn_xS$ THIN FILMS

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ABSTRACT

The cadmium Zinc Sulphide (CdZnS) is a ternary compound having the wide band gap window material used for the solar cells applications. These materials possess the band gap between CdS and ZnS. The simple and inexpensive CBD technique is used to obtain $Cd_{1-X}Zn_XS$ thin films by varying Zn content. The variations of Zn content on structural properties were investigated by xrd. Thickness and grain size of the film have been studied on the basis of growth parameters. The xrd analysis suggests that as deposited $Cd_{1-x}Zn_xS$ films have Zinkosite crystal structure. The qualitative analysis results, peak list, Structure parameters, Lattice constant and crystal structure results shows that obtained film is polycrystalline in nature with some amorphous phase. The thickness of the film decreases with increase in the Zn content. The grain size decreases as the Zn content increases. The reduction in grain size improves the quality of the film which is useful for the photovoltaic application

Keywords: Chemical Bath Deposition, CdZnS, XRD, Magnetic Stirrer, pH, Molarities

1. INTRODUCTION

The cadmium Zinc Sulphide (CdZnS) is the wide band gap window material used for the solar cells applications. These materials possess the band gap between CdS and ZnS. The band gap energy of CdS is 2.42eV and that of ZnS is 3.66 eV. The CdZnS is a ternary compound belonging to II – IV group of periodic table is a promising alternative window for the CdS and ZnS [1-5]. There are various techniques used for the preparation of the $Cd_{1-x}Zn_xS$ thin film. These techniques are Chemical Bath Deposition (CBD), Chemical Vapour Deposition, Vacuum evaporation, spray pyrolysis, molecular beam epitaxy (MBE), electro deposition, screen printing, sol-gel etc. Among these techniques the CBD technique is the simple, inexpensive, large area deposition, low temperature and simple equipment. Therefore this technique is suitable for the manufacturer for the photovoltaic application [6-8]. In the present study, $Cd_{1-X}Zn_XS$ thin films by varying Zn content were prepared using CBD technique. The variations of Zn content on structural properties were investigated by xrd. Thickness and grain size of the film have been studied on the basis of growth parameters [9 10].

2. EXPERIMENTAL DETAIL

For various zinc concentration(x = 0, 0.2, 0.4, 0.6, 0.8 & 1) the $Cd_{1-x}Zn_xS$ thin films were prepared by CBD technique on the glass substrate. The $CdSO_4$, $ZnSO_4$ and thiourea were used as a starting material as Cd^{+2}, Zn^{+2} , S^{-2} ion sources, The molarities of the $CdSO_4$ were taken on the basis of the morality of the $ZnSO_4$ by keeping the molarities of thiourea constant. For controlling the Cd^{+2} and Zn^{+2} ion densities the triethanolamine (TEA) were used as a complexing agents. An alkaline solution of ammonia was used to adjust the pH of the reaction mixture. The entire chemical used was of analytical reagent grade. The pH of the solution depends on the temperature and was adjusted by controlling the temperature. The process involving a controllable chemical reaction at low rate. The stiochiometry constant for any ratio between anions and cations was also maintained[11-15].

The experimental arrangement consist of special substrate holders which is attached to motor having the constant speed of 60 r. p. m. The temperature of the chemical bath was adjusted with hot plate and temperature controller. (71 ± 2^0C) while magnetic stirrer is utilized to promote ion- by- ion heterogeneous growth on the substrate. The pH was adjusted between 9 and 10 for different deposition time (15 to 90 min.) After deposition the substrate were removed from chemical bath and cleaned in double distilled water [16-20].

3. RESULT AND DISCUSSION

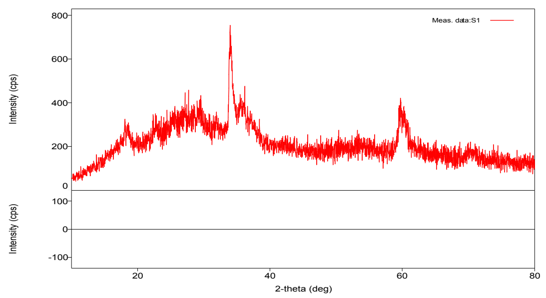

Figure 1: XRD of $Cd_{1-x}Zn_xS$ thin film.

The $Cd_{1-x}Zn_xS$ thin film was characterized by the XRD technique. The zinc ions concentration was varied by keeping all other parameter constant. The figure 1 shows the X- ray diffraction pattern of $Cd_{1-x}Zn_xS$ thin film. The xrd analysis suggest that as deposited $Cd_{1-x}Zn_xS$ films have Zinkosite crystal structure with the xrd peaks corresponding to (110), (101), (200), (111), (201), (301), (202), (310) and (131). The qualitative analysis results, peak list, Structure parameters, Lattice constant and crystal structure results are tabulated in tables 1, 2,3,4,5 and 6[21-23].

Table 1: Qualitative analysis result of $Cd_{1-x}Zn_xS$ thin film.

Phase name	Formula	DB card number
ZnY6Si2S14	S14 Si2 Y6 Zn	4302810
Zinkosite	O4 S Zn	9009831
Phase name	Formula	DB card number
ZnY6Si2S14	S14 Si2 Y6 Zn	4302810
Zinkosite	O4 S Zn	9009831

Table 2: Peak List of $Cd_{1-x}Zn_xS$ thin film.

No.	2theta(deg)	D (ang.)	Height (cps)	FWHM(deg)	Grain Size (nm)	Lattice Strain
1	29.0	3.08	49	5.5	1.56	0.0928
2	33.92	2.640	240	0.53	16.36	0.0076
3	35.89	2.500	86	3.45	2.53	0.0456
4	60.03	1.539	130	1.31	7.32	0.0099
5	70.26	1.338	26	1.6	6.34	0.0099

Table 3: Structure Parameter of $Cd_{1-x}Zn_xS$ thin film.

Data set name	Phase Name	Element	x	Y	z
S1	ZnY6Si2S14	Y	0.22	0.35	0.06
S1	ZnY6Si2S14	Zn	0.00	0.00	0.20
S1	ZnY6Si2S14	Si	0.33	0.66	0.64
S1	ZnY6Si2S14	S	0.33	0.66	0.277
S1	ZnY6Si2S14	S	091	0.15	0.03
S1	ZnY6Si2S14	S	0.47	0.58	0.79
S1	Zinkosite	Zn	0.00	0.00	0.00
S1	Zinkosite	S	0.18	0.25	0.46
S1	Zinkosite	O	0.12	0.25	0.76
S1	Zinkosite	O	0.35	0.250	0.45
S1	Zinkosite	O	0.1267	0.06	0.32

Table 4: Lattice Constant of $Cd_{1-x}Zn_xS$ thin film.

Data name	a(A)	b(A)	c(A)	alpha	beta	gamma
S1	9.7571	9.7571	5.6400	90	90	120
S1	8.5600	6.7460	4.7740	90	90	90
Phase name	a(A)	b(A)	c(A)	alpha	beta	gamma
ZnY6Si2S14	9.7571	9.7571	5.64	90	90	120
Zinkosite	8.5600	6.7460	4.7740	90	90	90

Table 5: Crystal structure result of $Cd_{1-x}Zn_xS$ thin film.

Phase name	Formula	DB card number
ZnY6Si2S14	S14 Si2 Y6 Zn	4302810
Zinkosite	O4 S Zn	9009831

Table 6: Structure determination of $Cd_{1-x}Zn_xS$ thin film.

Phase name	Atomic coords	Of indep. reflns
ZnY6Si2S14	Fractional coords	112
Zinkosite	Fractional coords	91

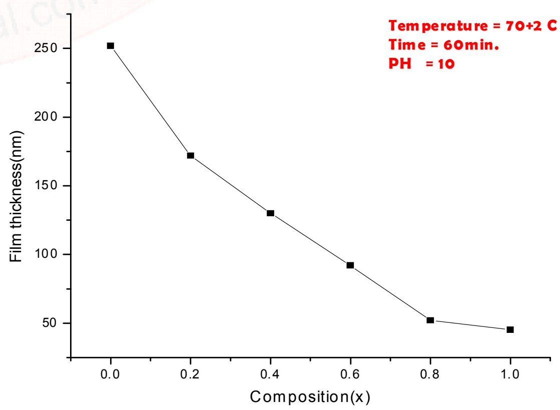

Figure 2: Graph between the composition parameter (x) with film thickness.

3.1. EFFECT OF COMPOSITION PARAMETER ON THE FILM THICKNESS

The $Cd_{1-x}Zn_xS$ thin films were prepared by varying the composition parameter (x) i.e. Zn content by keeping all other parameters constant throughout the experiment. The value of Zn content was taken to be i. e. x = 0, 0.2, 0.4, 0.6, 0.8 &1. It is observed that the thickness of the film decreases with increase in the value of x for the constant deposition temperature $70\pm{}^{0}C$, constant pH = 10 and constant deposition time of 60 minute as shown in figure 2[24-25]

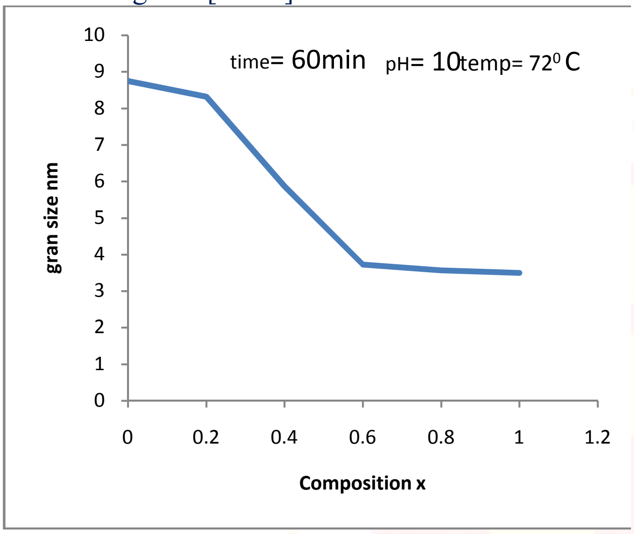

Figure 3: Graph between the composition parameters with grain size.

3.2 EFFECT OF COMPOSITION PARAMETER ON GRAIN SIZE

The X- ray diffraction pattern of the film obtained for various composition were studied for measuring the grain size by using the Debye – Sherrer`s formula. Variations in grain size with the composition parameter (x) were observed from the figure 3. It is observed that the grain size decreases as the Zn content increases. From this it can be conclude that reduction in grain size improves the quality of the film which is useful for the photovoltaic application [26].

CONCLUSION

The xrd analysis suggest that as deposited $Cd_{1-x}Zn_xS$ films have Zinkosite crystal structure with the xrd peaks corresponding to (110), (101), (200), (111), (201), (301), (202), (310) and (131). The qualitative analysis results, peak list, Structure parameters, Lattice constant and crystal structure results shows that obtained film is polycrystalline in nature with some amorphous phase having D. B. number4302810 and 9009831. The thickness of the film decreases with increase in the value of x for the constant deposition temperature $70\pm{}^{0}C$, constant pH = 10 and constant deposition time of 60 minute. The grain size decreases as the Zn content increases. From this it can be conclude that reduction in grain size improves the quality of the film which is useful for the photovoltaic application

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SECOND HARMONIC GENERATION IN KDP SINGLE CRYSTAL

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ABSTRACT

Potassium dihydrogen phosphate (KDP) is an excellent inorganic nonlinear optical material with different device applications. In the present work, single crystal of pure KDP crystal has been grown from the aqueous solution by slow evaporation technique. KDP crystal is a suitable nonlinear material for second Harmonic generation. UV-visible studies suggest that the crystal is suitable for nonlinear applications. During the growth it has been observed that the low evaporation rate gives good quality crystals, avoiding temperature fluctuation during stirring and for long time magnetic stirring gives good quality crystals with lesser defects. We synthesized KDP single crystal this crystal possess high optical and structural perfection that make it possible to produce elements for doubling and tripling of laser radiation frequency.

Keywords: *UV-Visible spectra, transparency, SHG efficiency and second harmonic generation, low evaporation rate and single crystal, etc.*

INTRODUCTION

Crystals are the pillars of modern technology. Without crystals, there would be no photonic industry, no fiber optic communications, which depend on materials crystals such as semiconductors, superconductors, transducers, radiation detectors, solid state lasers, nonlinear optics and crystalline films for microelectronics and computer industries. Crystal growth is an inter-disciplinary subject covering physics, chemistry, material science, chemical engineering, metallurgy, and crystallography etc. In the past few decades, there has been a growing interest on crystal growth processes, particularly in view of the increasing demand of materials for technological applications [1]. Atomic arrays that are periodic in three dimensions with repeated distances are called single crystals. It is clearly more difficult to prepare single crystal than poly crystalline material and extra efforts are justified because of the outstanding advantages of the single crystals [2]. The chief advantages of the single crystals are the anisotropy, uniformity of composition and the absence of boundaries between the grains, which are inevitably present in polycrystalline materials. Hence in order to achieve high performance from the device, good quality single crystals are needed. Growth of single crystals and their characterization towards device fabrication have assumed great impetus due to their importance for both academic as well as applied research. In order to see the second order effects that are atomic nonlinear polarization, which cause a doubling in the frequency of the incident light, the incident light must be an intense and coherent, like laser. KDP is a crystal that exhibits these nonlinear polarization properties and cheap to produce.

Nonlinear optical crystals are very important for laser frequency conversion [3], KDP (potassium dihydrogen phosphate) is suitable for higher harmonic generation to the huge laser systems for the fusion experiments because KDP crystals are good quality crystals, colorless transparent crystals having high value damage threshold. In present work the pure KDP single acrystal is grown in laboratory using slow evaporation technique and different characterizations are carried out. In order to study the second harmonic generation effect in a crystal, three steps are to be considered. The first is related to the characterization of the second order nonlinearity. The second consists in determination the direction of phase matching i.e. the orientation of crystal with respect to the fundamental beam and conversion efficiency, considering the experimental conditions (beam size and power of incoming beam).

We will consider here the second harmonic generation in KDP crystal for the conversion process 1064nm to 532nm. The crystal is a negative uniaxial. The KDP belongs to the symmetric group 42m, characterized by a $\chi^{(2)}$ tensor in which only three terms are non zero. Tensor is defined in the Cartesian frame of reference using the crystallographic axes.

1.1 Type I phase matching achievement in KDP crystal

In uniaxial crystal, the extraordinary refractive index varies with the angle Θ between the optical axis and the direction of wave vector (k$^{-)}$. If the refractive index variation due to this birefringence is greater than the one due to dispersion, it is then possible to fulfill the phase matching condition.

1.2 Conversion efficiency

1.3 When the conversion efficiency becomes important, it is then false to assume that the fundamental wave will not be depleted through its propagation in the nonlinear crystal. The efficiency directly proportional to the second order nonlinear coefficient and length of nonlinear crystal and inversely with the wave length of the pump wave.

1.4 Damage threshold of KDP single crystal

The laser induced breakdown in the crystals caused by various physical processes such as electron avalanche, multiphoton absorption, photo ionization for the transparent materials whereas in case of high absorbing materials, the damage threshold is mainly due to the temperature rise, which leads to strain- induced fracture.[10, 11]. It also depends on the specific properties of material, pulse width and wavelength of laser used. LDT is perhaps most accurately specified in terms of pulse fluency for long pulse laser, this kind of laser have pulse durations in the nanoseconds to microseconds range, with repetition rates typically ranging from about 1 to 100HZ. Because the time between pulses is so large, (milliseconds), the irradiated material is able to thermally relax- as a result damage is generally not heat induced, but rather caused by nearly instantaneous optical field effects. Usually damage results from surface or volume imperfections in the material and the associated irregular optical filed properties near these sites, rather than catastrophic destruction of fundamental material structure[12].the different dopants like amino acids and alkali metals can increase the specific heat of KDP crystals and hence the damage threshold of crystals. Azarov et al.[13] reported that the damage threshold was influenced by the dislocation in the KDP crystal, and the crystal with many dislocations presented low damage threshold. On the other hand, Nwkirk et al.[14] showed no direct relation between the dislocation in KDP crystals and damage threshold. Nisshida et al.[15] used KDP samples with dislocations in which the organic impurities seemed to play the role in causing bulk laser damage. The mechanical hardness of the materials also plays a vital role in LDT of the crystals grown in different crystallographic orientations. Optical damage in dielectric materials (NLO materials) may severely affect the performance of high power laser systems as well as the efficiency of the optical devices. Hence, high damage threshold is a significant parameter for NLO crystals.

GROWTH OF PURE KDP

Figure1. Pure KDP single crystals

Single crystal of pure KDP was grown by slow evaporation of the saturated aqueous solution at room temperature. Analytical grade samples of Potassium dihydrogen phosphate with double distilled water was used for the growth of single crystals. A solution of potassium dihydrogen phosphate was preparing using water as solvent. The pH of the solution was 4. The solution is stirred for one hour at 40^0C using magnetic stirrer. The solution was then filtered and allowed to evaporate in a constant temperature bath at 32 ^{0}Ctemperature. After a period of fourteen days transparent colorless single crystals of pure KDP were harvested. The grown crystals are found to be transparent and they are of good optical quality. ADP and KDP crystals belong to the same family, and they have the same structure. KDP crystals could be changed into ADP crystal if K^+ is substituted by NH_4. A lot of data about the study on ADP crystal are piled up, and from them we know that with the change of P^H value and increasing super saturation, the growth rates along z and x axes accelerate rapidly. However the rate along x-axis is obviously slower than that along c-axis. When, the pH reaches 3.8, the rate along c-axis remains stable at a certain value, but the growth along x-axis stops. This phenomenon has been paid attention to for a long time. Mullin [7] believed that it resulted from the increase of H^+ in solution. Because H^+ appears around the prism faces in the form of H_3O^+, it brings a diluents effect to influence the diffusion of solute to prism faces and this will result in the slower growth of the prism faces. Zhong Weizhuo, YuXiling and Luo Haosu et al. also believed that hydration molecules can bring a diluents effect to tetragonal pyramid faces. When, the pH value is quite low, the tetragonal pyramid faces maintained the fast growth rate.

Evidently it is not appropriate to interpret the diffusion of solute to interfaces with diluents effect. And it is easier for us to explain the differences in the growth rates of prism faces and pyramid faces in relation to pH value, because pH values in solution affect the bonding ability of $[H_2PO_4]^-$ unit to each face.

The combination of growth units to prism faces mainly depends on the hydrogen bonds. When pH value declines, H^+ ions concentrate around the interfaces and growth unit $[H_2PO_4]^-$ resulting a difficulty of combining to prism faces. However the situation changes to the pyramid faces. Because of O^{2-} at the vertex of tetrahedral $[H_2PO_4]^-$ is bound with K^+ and angle nearly normal to the pyramid faces $88^0 4^/$. The tetragonal pyramid faces can maintain certain growth rates if the concentration of H^+ is high enough. Only when the pH value declines does the rate decelerate. In solutions with different super saturation, growth units can assemble into different sizes of growth units, n $[H_2PO_4]^-$. In the boundary layers, the growth units have showed the characteristics of short range order as that in crystal. The stability of combination of growth units varies with their size and also varies with combining ability on crystal surfaces.

In glycine doped KDP crystals that is the hydrogen bonded crystals, we observed the sufficient growth along x-axis and c-axis. Good quality, mechanical strong and optically good quality single crystals are obtained. The favorable structure of growth units varies with the conditions of crystal growth. So, the rates of combination of growth units varies with the crystal surfaces, and this is the reason why the morphologies are various for the same crystal under different growth conditions. Improved quality of crystals was obtained with the increasing the duration of stirring due the change of kinetics of the solution.

CHARACTERIZATIONS

The grown crystals have been characterized for FTIR study. The FTIR spectra of the crystals have been recorded on Shimadzu spectrometer and SHG efficiency has been measured by Kurtz and Perry method [6]. The transparency of the crystals in the range 200 nm to 800 nm has been studied by using UV-1700 Shimadzu spectrometer. The powder XRD pattern of the grown crystal is recorded. The results have been discussed below.

RESULTS AND DISCUSSION VISIBLE SPECTROSCOPY

Fig2. Shows that the UV-Visible spectrum of pure crystal. For optical applications, the crystal should be highly transparent in the considerable region of wavelength [8]. The good transmission of the crystal in the entire visible region suggests its suitability for second harmonic generation devices [9]. The UV-visible spectral analysis shows that the crystals are transparent in the entire visible region. The absence of absorption and excellent transmission in entire visible region makes this crystal a good candidate of the opt-electronic applications [8-9]. Figure2 shows the UV-Visible spectrum of pure KDP crystal

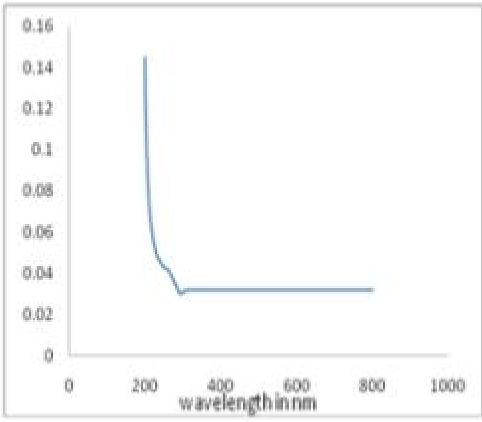

Figure2. UV-Visible spectrum of KDP Crystal

SHG MEASUREMENTS

The SHG intensity of the samples were tested by the modified version of the powder technique developed by Kurtz and Perry in 1968 using Quanta Ray Spectra Physics model: Prolab 170 Nd: YAG 10ns laser with a pulse repetition rate of 10HZ working at 1064nm at the department of Inorganic Physical Chemistry, Indian Institute of Science Bangalore. The energy per pulse is 4.4mj. The SHG was confirmed by the emission green radiation (ג = 532nm) which was finally detected by a photomultiplier tube and displayed on the oscilloscope. Measured powder SHG efficiency of pure ADP is 123mV and for KDP 71mV.

CONCLUSIONS

Transparent, colorless crystals of pure KDP single crystals were grown by slow evaporation technique at 32^0C. The absorption spectra reveals that grown crystals have better optical transparency and have sufficient transmission in UV- visible and IR regions.The lower cut-off wavelength is found to be 200nm. It has been observed that enhanced transparency is better for good NLO efficiency and also the indication of good quality crystal with good laser induced damage threshold.

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STUDY OF ACOUSTICAL PROPERTIES OF TERNARY LIQUID MIXTURES OF ALCOHOL, FORMIC ACID AND TRI-ETHYLAMINE AT THREE DIFFERENT TEMPERATURES

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ABSTRACT

The density, viscosity and ultrasonic velocity of ternary liquid mixtures of Alcohol + Tri-ethylamine (TEA) + Formic acid have been measured at three different temperatures 303, 308 and 313K. From these measured values adiabatic compressibility and freelength have been calculated. The nature of molecular interactions between component molecules is investigated through above parameters. The experimental results are used to interpret the molecular interactions in ternary liquid mixture. The non linearity and wave like nature indicates presence of intermolecular interaction between the components of mixture. The results are discussed in terms of hydrogen bonding and complexation between donor acids and acceptor amines.

Keywords *molecular interactions, adiabatic compressibility, freelength, ternary liquid mixtures.*

INTRODUCTION

Acoustical parameters are important to understand different kinds of association, the molecular packing, molecular motion and various types of intermolecular interactions and their strength. The variation in acoustic properties with temperature provides additional information regarding the binary and ternary system. The measurements of ultrasonic velocity and acoustical parameters with change in mole fraction give an insight in to the molecular process. Due to industrial applications this type of study has much importance[1]. Generally due to the presence molecular interaction the variation of acoustical and other properties is nonlinear. The study of molecular interaction inorganic mixture having an alcohol as one component is of particular interest since alcohols are strongly self associated liquids with three-dimensional network of hydrogen bonds[2] and can be associated with any other group having same degree of polar attraction[3]. However there are only few references on the acoustical studies on mixtures of carboxylic acids and amines with alcohols solvent. This is mainly because higher carboxylic acids are not completely miscible in water[4].

THEORY

The adiabatic compressibility is the fractional decrease of volume per unit increase of pressure, when no heat flows in or out. These changes are related to the compressibility of the medium by thermodynamic relation;

$$U^2 = \left(\frac{\partial P}{\partial \rho}\right)_s$$

So that

$$\frac{1}{U^2} = \rho.[1/\rho\left(\frac{\partial \rho}{\partial P}\right)_s] = \rho.\beta_a$$

and then

$$\beta_a = 1/(U^2 \rho) \qquad (1)$$

Where, 'ρ' stands for density of liquid and 'β_a'is adiabatic compressibility. Thus, from experimental measurement of 'U' and 'ρ' we can calculate adiabatic compressibility.

The increase or decrease in free length shows weakening and strengthening of intermolecular attraction. As the ultrasonic velocity increases due to the increase in concentration, the interaction free length has to decrease and vice-versa. It is related to ultrasonic velocity and density as; [29]

$$L_f = K/U.\rho\ ½ \qquad (2)$$

EXPERIMENTAL WORK:

In the present work density was measured by using density bottle (corning made certified 10 ml). Stopper is used in order to avoid evaporation of chemicals. Weight of bottle was taken by monopan balance(model no. K15) supplied by K-Roy and Company, Varanasi. Its capacity is 100 gm with sensitivity of 0.01 mg. For the measurement of viscosity Ostwald viscometer was used. During measurement prepared sample was poured in to the viscometer and the time taken by the liquid sample to fall down from higher mark to lower mark. The liquids used for the work were of BDH AR grade. For the present work the chemicals used viz. Tri-ethylamine(TEA), Ethyl alcohol and Formic acid were procured SD fine Mumbai and from E Merk chemicals Ltd India. Samples of different concentration were prepared by mixing the component liquids in volume proportion. Every time 28ml of mixture was prepared for measurement of density, viscosity and ultrasonic velocity. The volume of alcohol which is used as solvent is kept constant while that of other two was varied. In the present work ultrasonic velocity was measured by ultrasonic interferometer. A crystal controlled interferometer, model No. M8 15 supplied by Mittal enterprises, New Delhi, was used for determination of ultrasonic velocity. Measurements are made at frequency 2 MHz.

OBSERVATION TABLE

System – Alcohol + Tri-Ethylamine + Formic Acid.

At 303k

Mole Fraction of Formic Acid	Density ρ (gm/cm^3)	Viscosity η (Cp)	Velocity v (Cm/s)	Adiabatic Compressibility β_a (cm^2/dyne) X 10^{-11}	Freelength L_f Cm X 10^{-9}
0.0000	0.9104	1.8136	130800	6.42	5.06
0.1230	0.9675	2.1959	145920	4.85	4.40
0.2294	0.9846	1.9290	142830	4.98	4.45
0.3223	1.0027	1.6823	137550	5.27	4.58
0.4042	1.0104	1.3997	131700	5.71	4.77
0.4769	1.0239	1.1973	126450	6.11	4.93
0.5418	1.0365	1.0623	122100	6.47	5.08
0.6002	1.0494	0.8552	119700	6.65	5.15

At 308k

Mole Fraction of Formic Acid	Density ρ (gm/cm^3)	Viscosity η (Cp)	Velocity v (Cm/s)	Adiabatic Compressibility β_a (cm^2/dyne) X 10^{-11}	Freelength L_f Cm X 10^{-9}
0.0000	0.9122	1.5337	129000	6.59	5.16
0.1232	0.9648	1.9535	145710	4.88	4.44
0.2297	0.9807	1.6695	141510	5.09	4.54
0.3227	0.9967	1.5045	135840	5.44	4.69
0.4047	1.0072	1.2808	130740	5.81	4.85
0.4773	1.0172	1.1016	125520	6.24	5.02
0.5423	1.0305	0.9611	120840	6.65	5.18
0.6006	1.0456	0.9110	118020	6.87	5.27

At 313k

Mole Fraction of Formic Acid	Density ρ (gm/cm^3)	Viscosity η (Cp)	Velocity v (Cm/s)	Adiabatic Compressibility β_a (cm^2/dyne) X 10^{-11}	Freelength L_f Cm X 10^{-9}
0.0000	0.9060	1.3674	126600	6.89	5.33
0.1233	0.9622	1.7431	144090	5.01	4.54
0.2298	0.9777	1.4730	139440	5.26	4.66
0.3228	0.9934	1.2986	135210	5.51	4.76
0.4047	1.0043	1.1169	129060	5.98	4.96
0.4774	1.0166	0.9585	123960	6.40	5.14
0.5423	1.0285	0.8103	114240	7.45	5.54
0.6006	1.0409	0.6691	117480	6.96	5.36

RESULTS AND DISCUSSION

From these graphs it is observed that the density in the present ternary systems increases with mole fraction of carboxylic acid. The increasing trend of density reveals that the addition of components makes the system more compact thereby revealing the attractive type interactions between components. Molecular association leads to change in apparent molecular volume as well as mass and hence density changes accordingly[5]. That is, increase in the density is accompanied with the increase in the velocity, which is the basic property of liquids[6].

According to Kauzma and Eyring[7], the viscosity of a mixture should be strongly dependent on the entropy of the mixture, which in turn is related to the liquid structure and consequently with molecular interactions between the components of the mixtures. The non-linear variation in the viscosity of the mixture suggests the presence of interactions between the component molecules. In the present investigation viscosity values shows increasing trend in the beginning and decreasing trend on higher mole fraction of carboxylic acid. The maximum in viscosity observed at intermediate concentrations. Further, it is observed that viscosity decreases with temperature, this may be due to more spacing between the molecules. Similar results are fond by S P Poongothai et al[8] and Kolhe R K et al[9].

Nature of ultrasonic velocity curves is convex upwards. In general, ultrasonic velocity increases with mole fraction of carboxylic acids attains maximum and decreases again. It should be noted that velocity curves are nonlinear. This type of behaviour of velocity confirms the existence of molecular interactions between the components of liquid mixture. The increase in ultrasonic velocity may be attributed to the cohesion of component molecules[10]. At the maxima both the mole fractions of amines and acids are nearly same. Hence complexation takes place. This complexation may primarily be due to the donor acids and acceptor amines as constituent in the mixture with alcohol as solvent.

The values of adiabatic compressibility have been used to explain the molecular interactions in the ternary system in the present investigation. The minimum compressibility indicates the more bond strength and maximum compressibility indicates the poor bond strength between the molecules. Similar results in some liquid mixtures were also reported by researchers Whiba Kerboub et al[11] and Arvinthraj M et al[12].

Variation of free length is the direct consequence of variation in the molecular forces in the mixture which in turn depends on the experimental density as well as the temperatures of the mixture. Eyring and Kincard[13] have proposed that it is dependent on the interaction between the molecules and is a measure of the strength of the interaction present in the component molecules. Decrease in freelength with increase in ultrasonic velocity in the present investigation strengthens the molecular association between the unlike molecules through hydrogen bonding[14].

CONCLUSION

In this work we have measured ultrasonic velocity, viscosity, adiabatic compressibility, freelength at three different temperatures 303k, 308k and 313k of different concentration of system Alcohol + Triethylamine + Formic acid. All the observations from the present study leads to conclude that the non linear variation of all the parameters measured for ternary liquid mixture indicates existence of interaction between the different molecules of the compounds in the mixture. For the observed molecular interactions hydrogen bond formations are responsible for the interaction in the liquid mixture.

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COMPLEX DIELECTRIC STUDY ON CHEMICALLY ENGINEERED CONDUCTING POLYTHIOPHENE

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ABSTRACT

This research article is intended to examine the real and imaginary part of dielectric constants of conducting polythiophene (PTh) as-synthesized through chemical oxidative polymerization method in aqueous solution. The surface morphology of as-synthesized optimized sample was analyzed through Field Effect Scanning Electron Microscopy (FE-SEM) technique. An attempt has been made to explore the effect of frequencies on real and imaginary part of dielectric constants by using ac impedance analyser in the frequency and temperature ranges 20 Hz-1 MHz and 303-393 K respectively. The decrease in dielectric constant with frequency is attributed to polar nature of the material.

Key words: *Chemical polymerization; Polythiophene; FE-SEM; Dielectric constant.*

INTRODUCTION

In recent years, the field of conducting polymers has attracted the interest of many researchers. The conjugated aromatic polymers like polythiophene (PTh), polypyrrole (PPy), polyindole (PIn) are the most promising conducting polymers [1-3]. These polymers have interesting physiocochemical properties and are novel materials for optoelectronic technology. Such conducting polymers are generally prepared via chemical or electrochemical polymerization methods. The chemical oxidative polymerization of thiophene is very important as it is a more feasible route for producing polythiophene on a large scale [4-6].
PThs show sufficient stability for practical applications as compared with many other π-conjugated polymers and have a special importance due to their electrical properties, environmental stability in doped and undoped states, non-linear optical properties, and highly reversible redox switching [7]. Therefore, PThs have become probably the most widely studied of all conjugated polyheterocycles. Titanium (Ti)-doped PTh was synthesized by a chemical route using titanium chloride as oxidant. The synthesized composites were used for fabrication of photovoltaic (PV) cells with indium tin oxide/Ti-doped PTh/aluminum architecture [8]. PTh was chemically synthesized, doped with $FeCl_3$ for different time durations and analyzed by using different characterizing techniques [9]. The complex dielectric properties of PVP:$KBrO_4$ complexed polymer were studied and shows that the ionic conductivity increased with the increase of salt concentration as well as temperature [10].
In the present work, we carried out the polymerization of thiophene using anhydrous $FeCl_3$ as an oxidizing agent to prepare conducting polythiophene via the chemical oxidative polymerization route. The optimized sample was characterized by FE-SEM technique. The effect of frequency on real and imaginary part of dielectric constants at different temperature were explore for as-synthesized conducting PTh samples.

2. EXPERIMENTAL

Thiophene monomers, anhydrous iron (III) chloride ($FeCl_3$), and hydrogen peroxide (H_2O_2) from SD Fine Chemicals (AR-grade) were employed in the current study. The thiophene monomer was used as received for synthesis of PTh without further purification. The sample was synthesized at room temperature (303 K) by mixing thiophene with $FeCl_3$ in deionised water. H_2O_2 was used to enhance the rate of reaction and conjointly yield [11]. During this approach, different samples of PTh were synthesized by chemical oxidative polymerization technique by varying the stoichiometric ratios of thiophene and $FeCl_3$ as 90:10, 80:20, 70:30, 60:40 and 50:50 Wt. %.
To examine the effect of frequency on the real and imaginary part of dielectric constant, the samples were made in the form of pellets, polished and conducting silver paste was deposited on both sides. The area of the pellet was taken to be an area exposed to the electrode surface. The effect of frequency on the real and imaginary part of

dielectric constant of the samples were obtained over a temperature range from 303-393 K.

3. RESULTS AND DISCUSSION

The morphology and structural features of the material report from FE-SEM (JEOL JSM-6360). The surface morphology of optimized PTh powder sample with stoichiometric ratio of thiophene and $FeCl_3$ as (70:30) Wt. % was analyzed by FE-SEM and the micrograph is displayed in Figure 1. The FE-SEM micrograph reveals a Cauliflower like structure, but some fibrils are also present. The nature of particles has irregular in structure which reflects definite amorphous morphology. The micrograph depicts the presence of aggregation up to some extent as well as an agglomeration of particles [12].

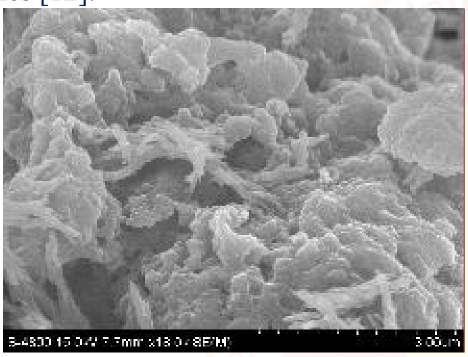

Fig. 1. FE-SEM micrograph of optimized sample of PTh.

The complex dielectric constant of a system is defined as

$\varepsilon^* = \varepsilon' - j\varepsilon''$

where ε' is the real part of dielectric constant (dielectric permittivity) and ε'' is the imaginary part of dielectric constant (dielectric loss). Both real and imaginary part of the complex dielectric constant ε^* are of particular significance in ion conducting polymers.

Figure 2 shows the frequency dependence plots of real part of dielectric constant ε' for PTh with different stoichiometric ratios of thiophene and $FeCl_3$ as 90:10, 80:20, 70:30, 60:40 and 50:50 Wt. %. at various temperatures. From the plot, it is clear that at a particular temperature the value of ε' decreases with increase in frequency that is the contribution from charge carriers towards the dielectric constant decreases with increase in frequency and attains a constant limiting value, which is not related to the hopping dynamics of mobile ions and may be due to the effect of rapid polarization process occurring in the samples. The high value of ε' in low-frequency region is a bulk phenomenon, which may be due to the presence of metallic or blocking electrodes which do not permit the mobile ions to transfer into the external circuit that is charge accumulation at the electrode-sample interface, as a result mobile ions pile up near the electrodes and give a large bulk polarization in the materials. In the high frequency region, at low temperatures, the well-known non-Debye behavior is observed. The observed frequency dependence of ε' for other compositions shows similar nature [13, 14].

The variation of frequency dependence real part of dielectric constant with temperature is different for nonpolar and polar polymers. In general, for nonpolar polymers, the ε' increases with temperature. The behaviour of the ε' in the present investigations is typical of polar dielectric, where dipole orientation is facilitated by the increased temperature resulting in increased real part of dielectric constant.

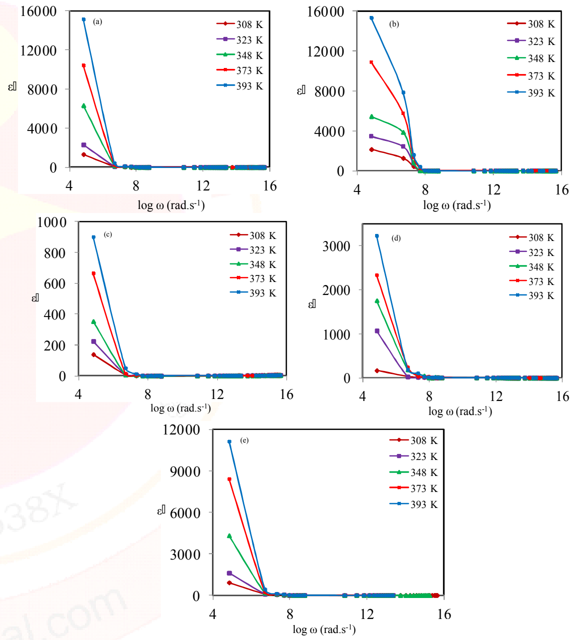

Fig. 2. Frequency dependence plot of real part of dielectric constant (ε') for the samples of PTh.

Figure 3 shows the frequency dependence plots of imaginary part of dielectric constant ε'' at various temperatures for PTh with different stoichiometric ratios of thiophene and $FeCl_3$ as 90:10, 80:20, 70:30, 60:40 and 50:50 Wt. %. In this figure it is observed that the loss factor ε'' exhibit the loss peak in the high frequency region. This behaviour indicates that the polarization of the samples obeys the Debye model [15]. Here, we have found that the temperature dependence of dielectric relaxation peak ω_m obeys a simple Arrhenius formula, $\omega_m = \omega_{m0}\exp(-E/kT)$, with the same activation energy as dc conductivity.

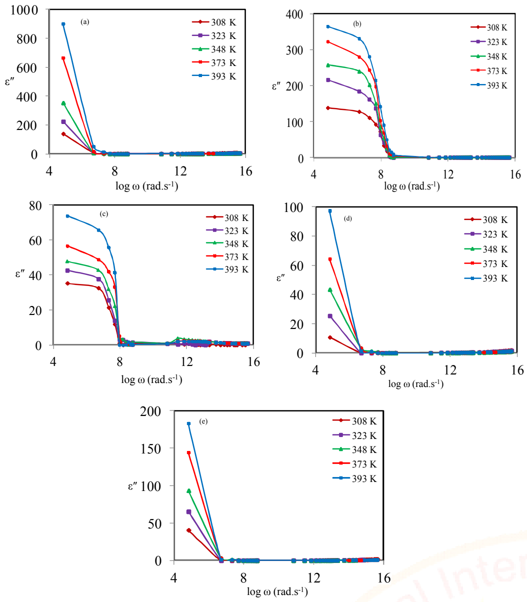

Fig. 3. Frequency dependence plot of imaginary part of dielectric constant (ε″) for the samples of PTh.

4. CONCLUSIONS

In the summary of present work, we have successfully made an attempt for one pot chemical synthesis of PTh using $FeCl_3$ as an oxidant at room temperature in aquoues solution. The amorphous nature of as-synthesized optimized sample was confirmed through FE-SEM analysis. The complex dielectric constant of as-synthesized materials were studied by using ac impedance analyser in the frequency and temperature ranges 20 Hz-1MHz and 303-393 K respectively. The dielectric constant of the sample decreases with the increase in frequency and increases with increase in temperature. This behavior can be ascribed to the fact that at low frequencies, dielectric constant is the result of contribution of several kinds of polarizations as deformational (electronic, ionic) as well as relaxation (orientational and interfacial). When the frequency is increased, the electric dipoles cannot follow the field which leads to the decrease of orientational polarization. The decrease in dielectric constant with frequency is attributed to polar nature of the material.

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THE STUDY AND INVESTIGATION OF MOLECULAR INTERACTION AND ACOUSTICAL PARAMETERS IN BENZENE-TOLUENE MIXTURE USING ULTRASONIC INTERFEROMETER

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ABSTRACT

The acoustical parameters for two binary liquid mixture namely Benzene and Toluene have been determined at 303 K temperature. The acoustical parameters such as adiabatic compressibility $\boldsymbol{\beta_s}$, the free length of interaction $\boldsymbol{L_f}$, interaction parameter χ and also excess parameters such as excess velocity $\boldsymbol{u^E}$, excess compressibility $\boldsymbol{\beta_s}^{\boldsymbol{E}}$ and excess free length $\boldsymbol{L_f^E}$ are computed from measured velocity and density values. The molecular interaction existing between component molecules has been found out. The hydrogen bonding and dipole – induced dipole interaction has been out from variation of ultrasonic velocity with mole fraction of mixed compounds.

Keywords: *Ultrasonic velocity, molecular interaction, acoustical parameters, adiabatic compressibility, free length, dipole-induced dipole interaction.*

1. INTRODUCTION

The study of propagation of ultrasonic waves in liquid systems and solids is now well established as an effective means of examining certain physical properties of the materials. It is particularly well adapted to examining changes in such physical properties at the macro level. The data obtained from ultrasonic propagation parameters in liquid mixtures and solutions viz., ultrasonic velocity and attenuation, and their variation with concentration of one of the components, helps to understand the nature of molecular interactions in the mixtures. Owing to high sensitivity to very low population densities at high energy states, ultrasonic methods have been preferred, and are reported to be complementary to the other techniques like dielectric relaxation, infrared spectroscopy, nuclear magnetic resonance, etc. The study of physiochemical behavior and molecular interactions in liquid mixtures is of considerable importance and a number of experimental techniques have been used to investigate the interactions between the components of binary liquid mixtures. In recent years, the measurement of ultrasonic velocity has been extensively applied in understanding the nature of molecular systems, physicochemical behavior and molecular interactions in liquid mixtures . Rout and Chakravortty studied the molecular interactions in binary mixtures of acetyl acetone with isoamyl alcohol, benzene and carbon tetrachloride at 30, 35, 40 and 45 ^oC showed that due to dipole-induced dipole interactions between unlike molecules, a relatively stronger interaction is present in the mixtures of toluene and benzene system than in the other two systems [1]. Ultrasonic velocity studies of in binary liquid mixtures of nibbenzene with several alcohols at 25 and 30% showed that strong dipole-dipole interactions are present in the liquid discussed extensive application of isentropic compressibility of liquid mixtures in characterizing molecular association, dissociation and complex formation[2,3]. This chapter deals with the experimental study of ultrasonic velocity, density in a few binary organic liquid mixtures at different temperatures. Organic solvents can be classified on the basis of their structure and dielectric constants. On the basis of structure they are classified as aliphatic and aromatics. Aliphatic has an open chain structure and aromatics have a closed chain structure. Polar solvents are those having high dielectric constants, which produce effects on reaction rates that are different those produced by non-polar solvents (having very low dielectric constants) [4]. There are important difference between protic solvents- solvents containing hydrogen that is attached to oxygen or nitrogen and hence acidic enough to form hydrogen bonds-and aprotic solvents which do not contain acidic hydrogen and in which all hydrogen are bonded to carbon . Methyl ethyl ketone, nitrobenzene, chlorobenzene and bromobenzene are polar aprotic solvents while benzene and toluene are non-polar aprotic solvents. When discussing solvent effects, it is important to distinguish between the macroscopic effects of the solvent and effects that depend upon the details of the structure. An important example is the dielectric constant, which is a measure of the availability of the bulk material to increase the capacitance of condenser. In terms of structure,

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dielectric constant is a function of both the permanent dipole moments of the molecule and its polarizability. Polarizability refers to the distortion of molecule's electron density. Dielectric constant increases with both dipole moment and polarizability. The dielectric constant of a solvent is a good indicator of the ability of the solvent to accommodate separation of charges [5, 6]. . Ultrasonic studies are also extensively used in the combinational analysis of organic molecules [7]. Several empirical and semi-empirical formulae have been developed correlating velocity and attenuation with other molecular parameters, The acoustical parameter for binary liquid mixture namely toluene-benzene have been determined at a temperature. the acoustical parameters such as the adiabatic compressibility , the free length of interaction , interaction parameter χ and also excess parameters such as excess velocity , excess compressibility and excess free length ,are computed for system from the measured ultrasonic velocity and density values, The extent of interactions existing between component molecules has been found out. In Benzene-acetone system there are strong dipole-induced dipole interactions. Ultrasonic velocity measurements have been employed extensively to detect and assess weak and strong molecular interactions in binary and ternary mixtures, because mixed solvents find practical applications in many chemical and industrial processes. To meet the need of applications, ultrasonic velocity measurements are generally carried out at different temperatures. The present investigation is carried out to study molecular interactions in the binary liquid mixture of toluene-benzene in particular temperature. This chapter deals with a detailed study of ultrasonic velocity in binary liquid mixture of toluene and benzene as a common component.

(2) MATERIALS AND METHODS

High purity Toluene and benzene binary mixtures are prepared by mixing appropriate volumes of the liquid components in the standard flask with airtight caps and the mass measurements are performed on high precision digital balance with an accuracy of ±1 mg. The accuracy in the measurement of density is the order of ±0.01. The required properties are measured for freshly prepared solutions. The ultrasonic velocity is measured with an uncertainty of ±0.3% using a single crystal ultrasonic interferometer operating at 2 MHz (model F81), which is calibrated with water and benzene. In order to minimize the error of measurements, several maxima of ultrasonic velocity are allowed to pass and their number 'n' is counted. All maxima recorded with highest swing of the needle on the micrometer scale of the interferometer. The total distance, 'd' moved by the reflector of the interferometer cell is given by

$d = n\lambda/2$ ……………… (1)

Where λ is wavelength of ultrasonic wave. The Frequency of the interferometer crystal is accurately known (2MHz) & using λ from equation (1), the ultrasonic velocity u m/s is calculated by the relation:

$u = \nu \lambda$ ……………….. (2)

Employing the measured values of velocity (u), density (ρ) some acoustical & allied parameters can be computed through the following expressions: diabatic (isentropic) compressibility; $\boldsymbol{\beta_s} = 1/u^2\rho$ Acousticimpedance-$Z = u\rho$

Free Length; $L_{f} = K$

Where K is temperature dependent constant. [Value, $(93.875+0.375T)*10^{-8}$]

Interaction parameter;

$X = (u_{exp}^2/ \quad)-1$ Where , = +

is ideal mixing velocity

(4) Result and Discussion: According to theory of ultrasonic waves in medium we were find out the ultrasonic velocity and related acoustical parameters. they are in table (a).

a) Computed values of acoustical parameters at 303K temperature for benzene-toluene.

Mole fraction (Toluene)	Mole fraction (Benzene)	Velocity (u) m/s	Density (ρ) Kg/	Adiabatic compressibility (κ) $10^{-10}N^{-1}m^2$	Acoustic impedance (Z) Kg	Free length ( )	Interaction parameter (χ)
1	0	1283	848	7.164	1.080	0.555	0.008629
0.8846	0.1153	1282	828	7.348	1.061	0.562	0.007057
0.7731	0.2268	1275	832	7.394	1.060	0.564	-0.00391
0.6652	0.3347	1268	864	7.1990	1.095	0.556	-0.01482
0.5609	0.4390	1265	856	7.300	1.082	0.560	-0.01947
0.4599	0.5400	1260	844	7.463	1.063	0.566	-0.02721
0.3622	0.6377	1258	860	7.348	1.081	0.562	-0.0303
0.2674	0.7325	1256	848	7.475	1.065	0.567	-0.03338
0.1755	0.8244	1255	852	7.452	1.068	0.566	-0.03491
0.0864	0.9135	1255	848	7.487	1.064	0.567	-0.03491

0	1	1272	844	7.323	1.073	0.561	-0.00859

B) GRAPH ANALYSIS

The experimental values of the ultrasonic velocity in benzene-toluene mixtures at are plotted against the mole fraction of Toluene in Fig (1) and mole fraction of Benzene in Fig. (2). the velocity in pure toluene differs from that in pure benzene only by 11 m/s at 30°C. When both the liquids are mixed, the velocity of the system is almost constant is the benzene-rich region. As the composition becomes toluene-rich, the velocity increases gradually. The non linear variation of velocity indicates the induced dipole-dipole interaction in binary liquid mixture of non polar benzene and non polar toluene.

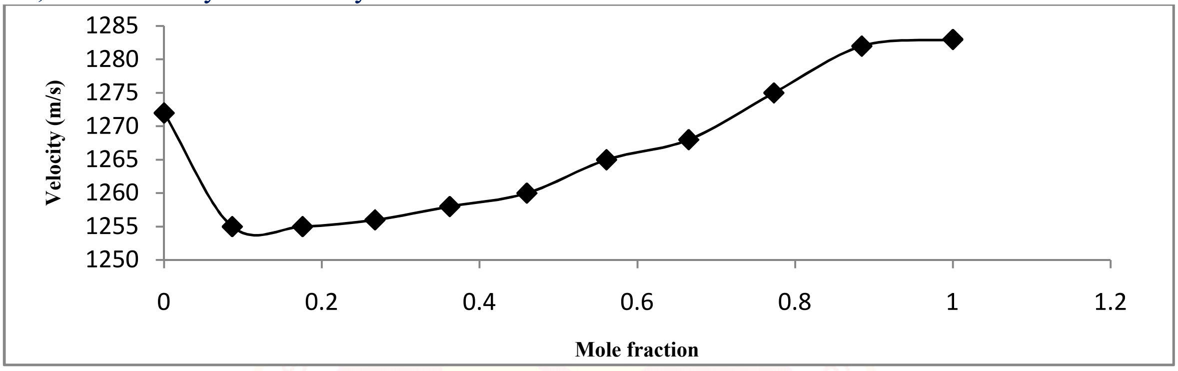

Fig.(1) Plot of Ultrasonic velocity versus mole fraction of Toluene.

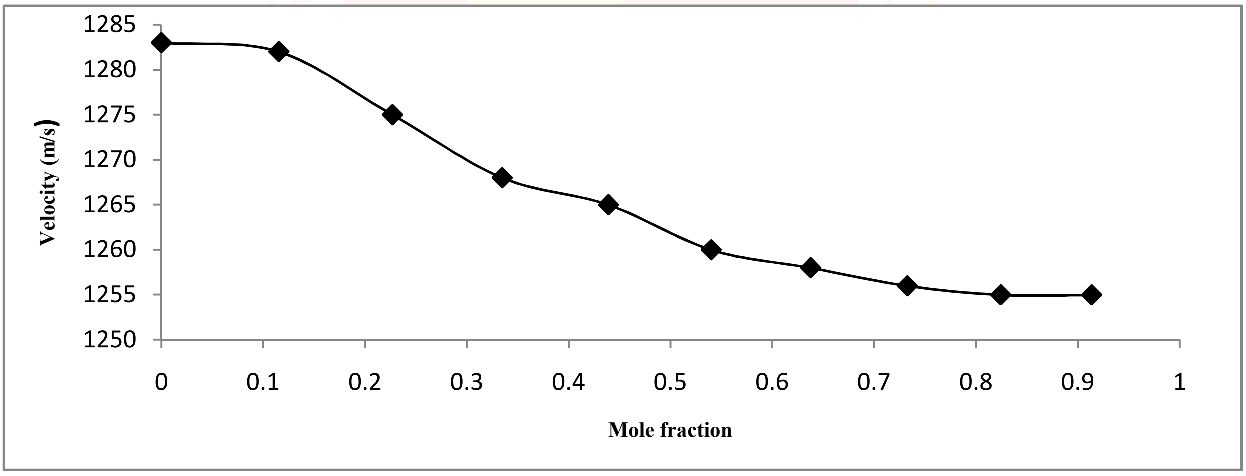

Fig.(2) Plot of Ultrasonic velocity versus mole fraction of Benzene.

Fig.(3) shows the complex variation of the adiabatic compressibility against mole fraction of toluene, the adiabatic compressibility decreases in toluene rich region, The plots of ultrasonic velocity and adiabatic compressibility versus composition of the mixtures have shown maximum in velocity and minimum in compressibility. A result minimum in compressibility in these mixtures indicates complex formation through hydrogen bonding and also indicated that molecules are not compactly arranged, so strong dipole- induce dipole interaction. But Fig (4) shows exactly opposite result at benzene rich region. The velocity is minimum and compressibility is maximum, this result indicates that at benzene rich region dissociation is weak and arrangement of molecules are compact, so weak dipole- induce dipole interaction. The adiabatic compressibility showed discontinuity and order of discontinuity increases in toluene rich region due to dissociation of component. Fig. (3,5) show complex variation of adiabatic compressibility and acoustical impedance. It was shown earlier that specific acoustic impedance and adiabatic compressibility exhibit opposite trend. A similar trend is expected in the corresponding excess functions also.

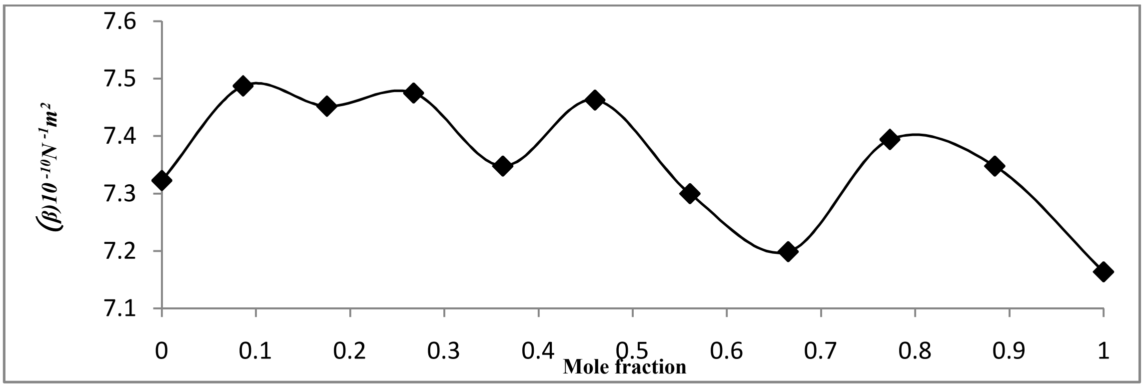

Fig.(3) Plot of Adiabatic compressibility versus mole fraction of Toluene.

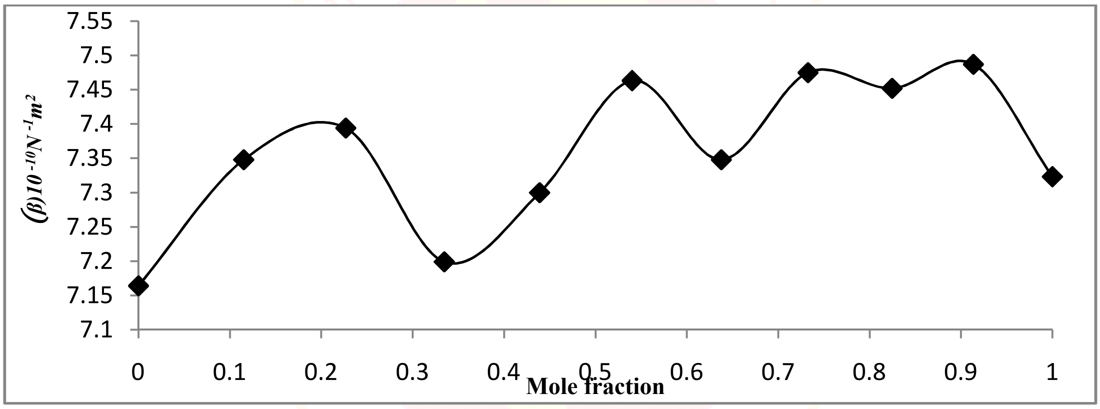

Fig.(4) Plot of Adiabatic compressibility versus mole fraction of Benzene.

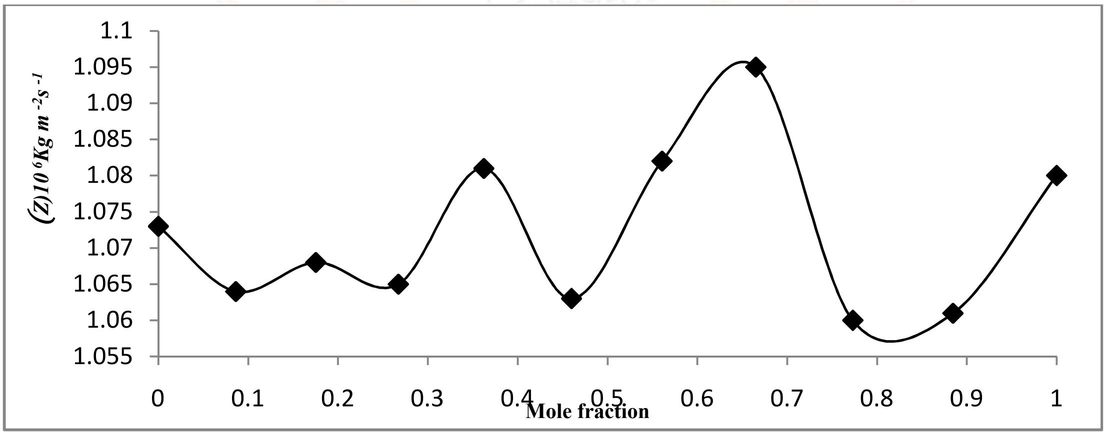

Fig.(5) Plot of Acoustical Impedance versus mole fraction of Toluene.

Fig.(6) shows the direct proportionality between Free length and compressibility i.e. linearity. The intermolecular interaction occurring in the liquid mixtures might result in the decrease of the inter space between molecules and this might lead to a decrease in intermolecular free length, The decrease of intermolecular free length result in a decrease of compressibility and an increase of velocity. The benzene and toluene are non polar components, benzene has zero dipole moment and toluene has 0.45D dipole moment. When the concentration of toluene increases there is dissociation of structure, hence dipole – induced dipole interaction in component molecules. Both component molecules are large so has strong dipole – induced dipole interaction. Due to this, in toluene rich region velocity is maximum and compressibility and free length is minimum, But irregular variation of compressibility and free length there is complex formation of hydrogen bonding at toluene rich region. An analysis of figures (3, 5, and 6) shows the free length of interaction decreases with increase in the mole fraction of toluene like compressibility. Which shows that the strong dipole-induced dipole interaction which makes the system less compressible as evident from the values of adiabatic compressibility.

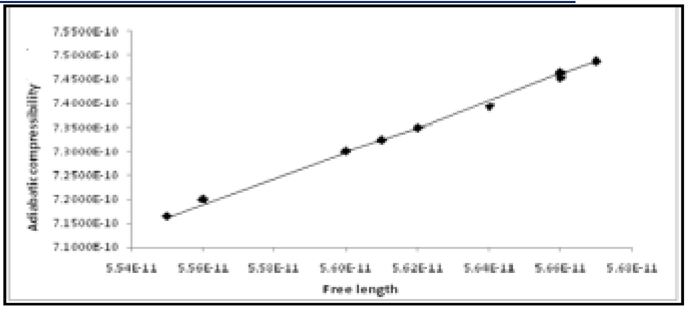

Fig.(6) Plot of Adiabatic compressibility versus Free length.

(5) CONCLUSION

Ultrasonic velocity, density were measured in binary mixtures of toluene and benzene at temperature. Various thermo acoustical parameters were evaluated. An analysis of these results suggests the presence of strong intermolecular interactions resulting from dipole-induced dipole interactions and hyper conjugation in binary mixtures. The study of compressibility, free length, acoustical impedance and excess function showed that there is complex formation of hydrogen bonding and also there are molecular interaction and formation of a charge transfer complex between aromatic compounds.

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THE DEVELOPMENT OF PVA BASED SOLID PROTON CONDUCTING POLYMER ELECTROLYTE

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ABSTRACT

Proton conducting solid polymer electrolyte thin films of PVA: AA complexes were prepared by solution cast technique. The X-ray diffraction (XRD) pattern revealsthebroadening of the peak due to addition of ammonium acetate(AA) is attributed to an increased amorphousnessof polymer complex electrolyte. The typical DTA /TGA curvesshows that the glass transition temperatureTg ofpolymer complexes decreases with an increase in ammoniumacetate salt concentration.Complex Impedance Spectroscopy (CIS) study reveals the semicircular arc is attributed to the migration of protons under external electricfield.These polymer complexes obey the Arrhenius law below and above the glass transition temperature.Thecomposition 80PVA:20AAexhibiting maximumconductivity shows minimum activation energy(Ea).

Keywords: *Solid polymer Electrolyte, XRD, DTA/TGA, Complex impedance spectroscopy*

INTRODUCTION

In the world of today, materials figure extensively as enabling parameters in every system associated with modern technologies and they dominate many sectors such as transport, communication, energy, etc. Furthermore, materials are centre of the growth, prosperity, security, and quality of life of humans since the beginning of history. Our present world of modern devices, machines, computers, automobiles, aircraft, communication equipment and structural products without the new materials and their efficient production would not be possible. Some of the crucial aspects to be taken into account while developing the materials for specific applications are

- The structure and the composition of the material, including the type of atoms
and their arrangement, as viewed over the range of length scales (nano-, micro, meso-, and macro-scale).
- The synthesis and the processing which achieves the particular arrangement of
atoms.
- The properties of the material resulting from the atoms and their arrangement
those make the material interesting or useful.
- The performance of the material, i. e. the measurement of its usefulness in
actual conditions by taking account of economic and social costs and benefits.

Fast ion conductors are solids in which ions are highly mobile. These materials areimportant in the area of solid-state ionics, and are also known as solid electrolytes orsuperionic conductors. Fast ion conductors are used primarily in fuel cells apart from use inbatteries and gas sensors. As solid electrolytes they allow the movement of ions without theneed for a liquid or soft membrane separating the electrodes. The phenomenon relies on thehopping of ions through an otherwise rigid crystal structure.

In fact, fast conduction of protons in the liquid electrolytes is not new butrelatively rare in the solids. Recent interest all over the world in proton conducting solidsis both from the scientific aspect, as materials with novel properties and for their possibleapplications in PEMFC, gas sensors and other electrochemical devices. The performanceof any PEMFC is rated on its shelf life, thermo-chemical stability and current deliveringcapacity. In fact, all these parameters are very much dependent on the functioning of thesolid electrolyte apart from anode and cathode of fuel cells. Particularly, chargetransference ability of PEMFC solely depends on solid electrolytes in terms of optimumproton conductivity.

Alfred Ubbelohdeand Rogers are the first to suggest proton conduction in 1950 [1].

Solid proton conductors in the form of crystalline/amorphous allow the passage of electrical
current through the bulk material exclusively by diffusion of protons, H+. The H+, H3O+,
OH- or NH4 + are the known conducting species of this class.Technologically important proton-conducting solids are usually based on polymerelectrolytes having negatively charged groups attached to the polymer backbone. These polymer electrolytes are rigid and poor proton

conductors unless water is absorbed. Theproton conductivity of hydrated polymer electrolytes dramatically increases with watercontent and reaches values of 10^{-1} – 10^{-2} S cm^{2} [2-9]. The polymer electrolyte fuel cell(PEFC) the first in an operational system was the GE-built 1 kW Gemini power plant [10].Complexes of basic polymers, such as poly(ethylene oxide) (PEO) [10], poly(ethylene imine) (PEI) [21],poly(acrylamide) (PAAM) [11,12], and poly(vinylalchol) (PVA) [24,25], with strong acidshave been shown to possess high proton conductivities both in the dehydrated and hydratedstates [26-31]. These complexes are relatively inexpensive and can be easily processed asthin films for applications such as hydrogen sensors [11], electrochromic displays, and PEFCsystems.Water-soluble polymer, i.e. PVA used in practical applications because of its ease of preparation, excellent chemical and thermal stability along with good mechanical properties.In a comparative study on pure PVA and PVA complexed with ammoniumacetate (CH3COONH4) having different compositions (prepared by solution casttechnique) suggests that the conductivity of the pure PVA is of the order of 10^{-10} S/cm atambient temperature while increases 10^{4} times when complexed with 20% CH_3COONH_4[12]

In general, the charge transfer in solid by motion of protons is the major problem inthe field of proton conduction [12]. A good number of attempts are made in the past and continuing to developthe fast solid proton conducting polymer electrolytes [13].

During the present work, efforts were directed to prepare polymer complexes with different ammonium salt concentration to develop proton conducting polymer electrolyte system and characterized for PEMFC/sensors device applications.

MATERIAL AND METHODS

Poly(vinyl alcohol) (PVA), with a degree of hydrolysis more than 99% and average molecular weight of 146000, was procured from Aldrich, USA. Ammonium acetate (AA/CH3COONH4) was obtained from Merck, India.

In the present study the solution cast technique was used to prepare poly(vinyl alcohol)based polymer electrolytes owing to its simple procedure and inexpensive.The aqueous solutions with desired mole ratios of PVA:AA as (95:5), (94:6), (90:10) (87.5:12.5), (85:15), (80:20), (75:25) and (72.5:27.5) were prepared by dissolving PVA and AA separately in deionized water and then mixing them together. Later, each aqueous solution batch was thoroughly stirred for 8–10 h at 60–70 °C using magnetic stirrer so as to obtain the homogeneous single-phase solution. The homogenous viscous solution thus obtained was then casted on the glass and in the petridish. The casted solution was left for a week in a desiccator covered with perforated aluminum foil to evaporate water slowly at room temperature. The smooth anduniform thin filmswith good mechanical strength were obtained which were transparent to visible light.Solid polymer electrolytes prepared by the solution cast technique were obtained also in the form of thick films of the thickness 0.4 mm. The circular film of diameter 9 mm was punched outfrom the casted polymer films for complex impedance spectroscopy studies.

RESULTS AND DISCUSSION

X-RAY DIFFRACTION

The X-ray diffraction (XRD) patterns of pure PVA along with 20 and 25 mole%AA added PVA films are presented in Fig.1 (a) – (c), respectively. The appearancesof broad peak at 2θ between 18-22º in all the patterns are matching well with thediffraction peak corresponding to pure PVA as (110) reflection. The broad (110) peak inpatterns suggests semicrystalline nature of polymer. Partial crystnallinity of PVA has beenproposed in the literature on the basis of appearance of broad peak in XRD pattern [14].

A close scrutiny of the Fig. (1(a) – (c) reveals the decrease in the relative intensity while
Broadening of the diffraction peak (110) with an increase in AA concentration. Thebroadening of the peak due to addition of AA is attributed to an increased amorphousnessof polymer complex electrolyte. Pandian et al [12] and Hodge et al. [15] have alsoobserved almost similar trends due to addition of AA. In general, broader diffraction peaksuggests more amorphousness and sharp one.

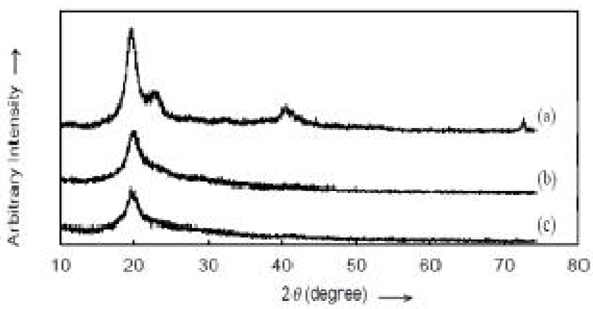


Fig 1 XRD patterns of (a) pure PVA, (b) 80PVA:20AA and (c) 75PVA:25AA.

The values of degree of crystnallinity of thepolymer complexes were determined using Eq. (I) proposed by Alexander[17].

$X_C = I_C / I_T$

whereX_C, I_C and I_T are degree of crystnallinity (crystalline fraction), crystalline and total integrated intensities, respectively. Similar procedure has been used to obtain the values of the degree of crystnallinity of polymer complexes [18]. A comparison of degree of crystnallinity of AA added PVA polymer complexes is given in Table I. Evidently, amorphousness of PVA increases with increase in AA salt content.

Samples	X_C (%)
Pure PVA	43
95PVA:5AA	27
94PVA:6AA	25
90PVA:10AA	23
87.5PVA:12.5AA	20
85PVA:15AA	18
80PVA:20AA	12
75PVA:25AA	09
80PVA:20AA	07

Table 1: Degree of crystnallinity determined from XRD patterns for PVA:AA complexes.

DTA/TGA

The typical DTA and TGA curves for 25 mole% AA (ammonium acetate) doped PVA, the highest conducting one amongst all the samples in this series are depicted in Figs.2.1 and 2.2, respectively. The two distinct endothermic peaks, the onset of first at about 209 ºC and that of second at 233ºC are distinct in Fig. 2.1. The TGA curve shown in Fig.2.2 reveals the negligible weight loss up to about 100 ºC. Further, the rate of weight loss slightly increases thereafter till 200 ºC. Furthermore, a sudden/drastic increase in the weight loss at about 233 ºC is discernable. Since there is no significant change in weight till 233 ºC (Fig2.2), the small exothermic hump in DTA curve at around 178 ºC (Fig.2.1), just before the first endothermic peak, is attributed to the glass transition (*T*g). And endothermic peak with onset at around 209 ºC observed in DTAcurve (Fig.2.1) is assigned to the melting of polymer complex. The prominent endothermic peak at 233 ºC where onset of drastic weight loss (Fig.2.2) observed that coincides with the prominent endothermic peak in DTA thermogram (Fig2.1) is attributed to the boiling/evaporation of water (*T*b). As seen the *T*g of polymer complexes decreases with an increase in AA concentration.

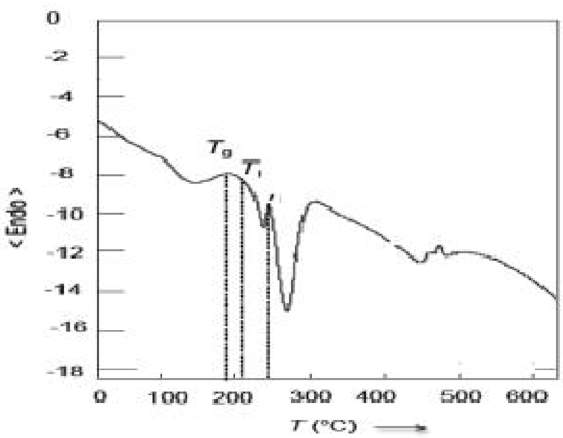


Fig. 2.1 DTA curve for 25 mole% AA doped PVA.

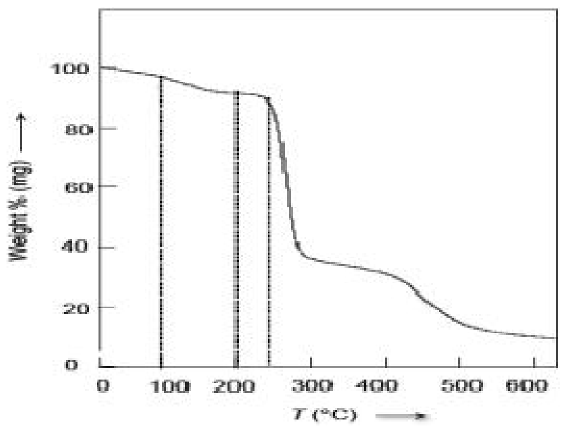


Fig2.2TGA curve for 25 mole% AA doped PVA.

COMPLEX IMPEDANCE SPECTROSCOPY

Typical complex impedance plots of 80PVA:20AA at various temperatures aredepicted in Fig3.1. At each temperature a depressed semicircle passing through theorigin is discernable (Fig.3.1). Further, a semicircular arc in the high frequencyregion followed by an inclined straight line (spike) in the low frequency region is clearly seen. Similar behavior of electrode is reported in literature [19]. A non-linear leastsquares fit (NLSF) is used to obtain the best fit to the experimental data andsubsequently various impedance parameters such as bulk conductivity, relaxation time,etc. The semicircular arc is attributed to the migration of protons under external electricfield. Further, the spike in complex impedance plane is attributed to an electroderesponse. Evidently, (Fig.3.1) the high frequency x-axis intercept of semicircular arcdecreases with an increase in temperature.

Almost similar trend is observed for all compositions under study.

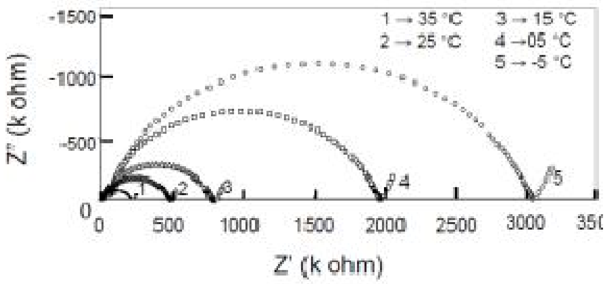
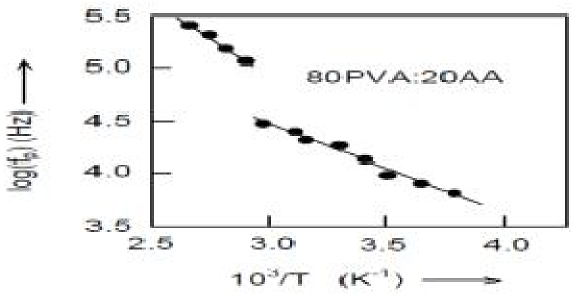
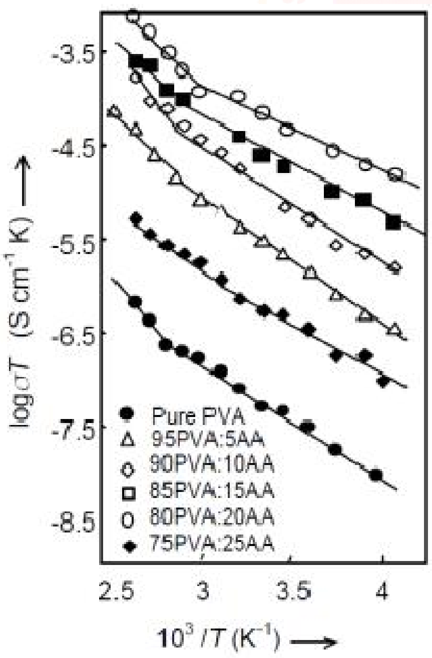


Fig. 3.1: Complex impedance plots at various temperatures for 80PVA:20AA

Since the conductive platinum coating on both the surfaces of electrolyte, in absence of H2, acts as irreversible (blocking) electrode, as expected, spike or inclined straight line appears at low frequency. Appearance of spike suggests the transport of protons through the polymer complex and their accumulation at electrode-electrolyte interface leading to the electrode polarization. The bulk conductivity was obtained from the real axis intercept of the semicircular arc that excludes the electrode polarization as well as conductivity due to displacement current. The decrease in bulk conductivity with rise in temperature implies thermally activated conduction process.The variation of peak frequency *fp* corresponding to the high frequency semicircle in the complex impedance plane as a function of temperature for 80PVA:20AA is depicted in Fig.3.2Arrhenius like behavior is evident.



. Fig 3.2: Variation of peak frequency with temperature**.**



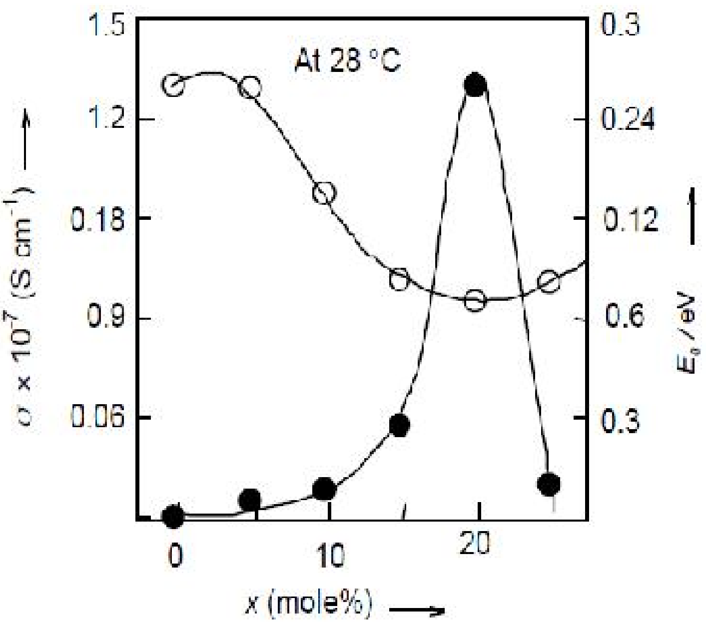


Fig4.1: Arrhenius plots for different concentrations of AA in PVA.

Fig4.2: Variation of conductivity at 28 °C and activation energy with AA concentration in PVA.

IONIC CONDUCTIVITY

The temperature dependent bulk conductivity for pure PVA, 95PVA:5AA,90PVA:10AA, 85PVA:15AA,80PVA:20AA and 75PVA:25AApolymercomplexes were measured over the temperature range from-10 to 100 ºC is depicted inFig.4.1. A close look at thefigure reveals a change in theslope for all polymers belongingto this series. The change in slope approximately coincides with theglass transition temperature (*T*g)obtained from DTA /TGA studies discussed earlier, these polymers obey the Arrhenius law below and above *T*g. The change in slope of Arrhenius plot is, generally, ascribed to the change in conduction mechanism owing to change in phase of the material; and thus correlated with change in the phase (crystal structure).

The variation of conductivity and activation energy the conductivitybelow *T*g initially increases with an addition of AA up to 20 mole% (Fig4.2) and later it decrease with further addition of AA (>20 mol%). Thecomposition 80PVA:20AAexhibiting maximumconductivity shows minimum*E*a.

CONCLUSION

Poly(vinyl alcohol) based polymer electrolytes added with ammonium acetate with different mole ratios were prepared by solution cast technique.The XRDpattern shows broad (110) peak with an increase in AA concentrationwhich suggests semicrystalline nature of polymer. The typical DTA and TGA curves for 25 mole% AA (ammonium acetate) doped PVA, the highest conducting one amongst all the samples in this series shows the negligible weight loss up to about 100 ºC. Typical complex impedance plots of 80PVA:20AA at various temperatures revels the semicircular arc is attributed to the migration of protons under external electric field. The temperature dependent bulk conductivity for pure PVA, 95PVA:5AA, 90PVA:10AA, 85PVA:15AA, 80PVA:20AA and 75PVA:25AA polymer complexes were measured over the temperature range from -10 to 100 ºC the conductivity below *T*g initially increases with an addition of AA up to 20 mole% and later it decrease with further additionof AA (>20 mol%).

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AC ELECTRICAL CONDUCTUVITY OF PEO: PVP: NACLO$_2$ BASED POLYMER ELECTROLYTE

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ABSTRACT

The polymer electrolyte PEO: PVP: NaClO$_2$ was prepared by solution cast technique. Polymers PEO, PVP, NaClO$_2$ were taken separately at three different ratios. Experimental technique such as ac electrical conductivity by impedance spectroscopy of composite films of different compositions were measured at ac voltage (0.5V constant) in the temperature range from room temperature to 333 K at frequencies ranging from 100 Hz to 200 KHz. Here the value of Relaxation time is calculated. The Values of bulk resistance R_b and bulk capacitance C_b of 25 wt % NaClO$_2$ sample at different temperature is evaluated in the table.

Keywords: Polymer electrolyte, Composite,Ac conductivity,Nyquist diagram.

INTRODUCTION

Polymer electrolytes do not leak any harmful chemical and so that they safer than liquid electrolytes.The polymer electrolyte (Solutions) serve as electronic insulators between the anode and cathode but it must be a good ionic conductor. Polymer electrolytes based on PEO complexed with NaClO$_3$, AgNO$_3$ and NaYF$_4$ etc. have been reported [1]-[6]. Also the polymer electrolytes based on PVP complexed with NaClO$_3$ have been prepared [7]-[8]. The polymer electrolyte based on PEO, PVP complexed with NaClO$_3$ were prepared [9].Keeping this view in mind, authors prepared polymer electrolyte based on PEO, PVP complexed with NaClO$_2$ and study their AC electrical properties.

MATERIALS

For the preparation of polymer electrolyte following materials are used:
(PEO) polyethylene oxide (AR grade) was obtained from Across organic (USA), polyvinyl pyrrolidene (PVP) (loba chem.), sodium chlorite (NaClO$_2$) with AR grade and methanol.
Also for preparation of polymer electrolyte cell sodium (Na) metal (GR grade), (I$_2$) Iodine and graphite fine powder (loba chem.) are used.

METHOD OF PREPARATION OF POLYMER ELECTROLYTE

The polymers PEO and PVP were taken separately at different ratio with NaClO$_2$ wt% as (40:50:10) (35:50:15), (30:50:20), (25:50:25), (20:50:30) and (15:50:35). Each mixture dissolved in methanol for making polymer-salt mixture into solution. To obtain the perfect solution of this mixture, the solution was stirred well for 24 hours and powered into a polypropylene dishes. The solution was slowly evaporated at room temperature. Thus, thin film of polymer electrolyte was prepared by solution cast technique. Further these films were crushed into powder form. Now, this powder was processed on the pellet machine having pressure of 6 ton at room temperature into circular shapes. These pallets (polymer electrolyte) are used for measuring AC electrical conductivity .When the concentration of NaClO$_2$ is 25 wt% the conductivity has the maximum value. So this optimized PEO:PVP composite with 25 wt% NaClO$_2$ polymer electrolyte is used for the measurement of ac conductivity .

RESULT AND DISCUSSION
AC ELECTRICAL CONDUCTIVITY

AC conductivity is one of the studies done on solids in order to characterize the bulk resistance of the crystalline sample. Measurement of ac conductivity can be done by different techniques. The currently used technique is the impedance spectroscopy. This study also gives information on electrical properties of materials and their interface with electronically conducting electrodes. The complex impedance spectroscopy measurement of ac conductivity is based on studies made on the measurement of cell impedance/admittance over a range of temperatures and frequencies and analyzing them in complex impedance plane [1, 2]. This is particularly characterized by the measurement and analysis of (impedance), Y (admittance) and plotting of these functions in the complex plane, which is known as Nyquist diagrams.

IMPEDANCE SPECTROSCOPY

Frequency dependence of real part of impedance (Z') at different temperatures for PEO:PVP composite samples with 25 wt% $NaClO_2$ is shown in fig.1.

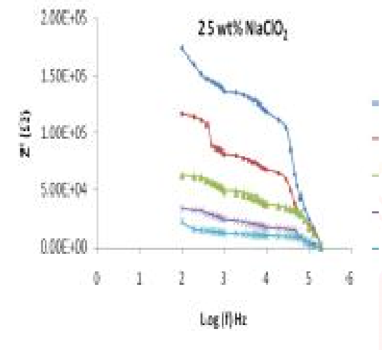

Fig.1 Z' versus frequency at different temperatures for PEO:PVP composite with $NaClO_2$ 25 wt%

It is observed that the magnitude of Z' decreases with increase in both frequency as well as temperature. The Z' values of all temperatures merge above 10 KHz. The curve also display single relaxation process and indicate an increase in ac conductivity with temperature and frequency. Figure 2 shows the variation of the imaginary part of impedance (Z") with frequency at different temperatures for optimized PEO:PVP composite with 25 wt% $NaClO_2$.

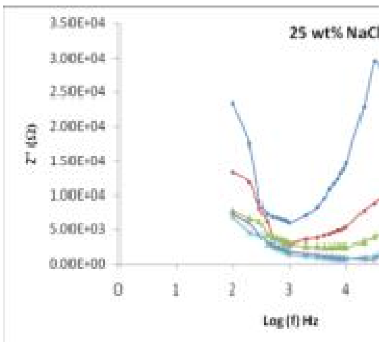

Fig.2 Z"versus frequency at different temperatures for PEO:PVP composite with $NaClO_2$ 25 wt%

The curve shows that the value of Z" initially decreases then increases and again decreases with increase in frequency at lower temperature. It is also observed that the Z" peaks are found to shift towards higher frequency side with the increase in temperature. All these curves are merging at the higher frequency.

The relaxation times (τ) were calculated from the frequency at which Z"max is observed. The frequency for the maximum Z", called relaxation frequency (f). Relaxation frequency (f) shifts to higher values with increasing temperature indicating the increase loss in the sample.

The variation of relaxation frequency with temperature for PEO:PVP composite samples with 25 wt% $NaClO_2$ is shown in fig.3.

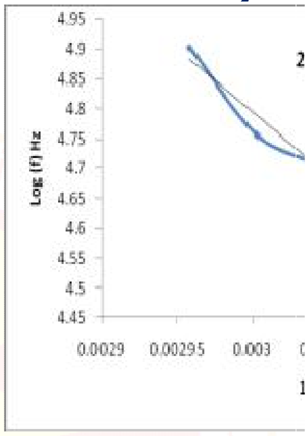

Fig.3 Log (f) versus 1/T plot for PEO:PVP composite with $NaClO_2$ 25 wt%

Above figure shows relaxation frequency obeys the Arrhenius relation given by,

$$f_r = f_0 \exp(-Ea/kT)$$

Where, f_0 is the pre-exponential factor, k is the Boltzmann's constant, T is the absolute temperature and Ea is the activation energy.

Relaxation time at different temperature of PEO:PVP composite sample with 25 wt% $NaClO_2$ is 0.741 x 10^{-11} s.

Impedance data taken over wide range of frequency (10^2 to 10^5 Hz) at different temperatures and obtained the Nyquest diagram. Nyquest diagrams for PEO:PVP composite sample with 25 wt% $NaClO_2$ is shown in figure 4.

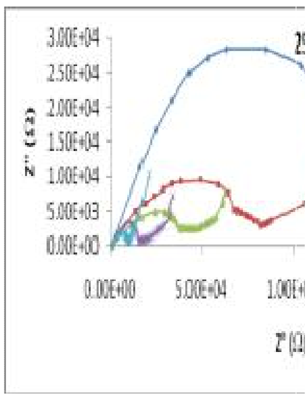

Fig.4 Nyquist diagram for PEO:PVP composite with 25 wt% $NaClO_2$ at different temperatures

From the above fig.4, it is observed that each curve ends with spike (residual tail) which is the characteristics of a blocking double layer capacitance. Sasikala et al [10] have observed such type of results.

Again it is observed that with the increased in temperature slope of the line decreased and deviates towards real axis (Z') which indicate the increased in the conductivity of the sample. The semicircle diameter gives the electrical resistivity of the sample at the specified temperature and the maximum value corresponds to the relaxation frequency, f = 1/2ЛRC. For higher temperature we get semicircle plots. It provides information about the nature of dielectric relaxation. As the Nyquist plots are single semicircle with the center located on Z' axis, relaxation process is pure monodispersive Debye process. For polymer dispersive relaxation, these argand plane plots are close to circular arcs with the end points on the axis of real and the center below this axis. The complexed impedance in such situations is known as Cole-Cole formalism [11].

$$Z^*(\omega) = Z' + IZ'' = \frac{R}{\left(1 + i\omega/\omega_0\right)^{1-\alpha}}$$

Where, α represents the magnitude of the departure of the electrical response from an ideal condition and this can be determined from the location of the center of the Cole-Cole circles. When α goes to zero (1- α → 1), above equation gives rise to the classical Debye's formalism. Figure 4 shows full semicircle i.e. semicircle centered on the abscissa axis (α = 0), suggest that the relaxation to be of Debye type.

From these semicircles values of bulk resistance R_b and bulk capacitance C_b can be calculated for different temperatures. These values are given in the following table.

Table: Values of bulk resistance R_b and bulk capacitance C_b of optimized $NaClO_2$ sample at different temperatures.

Sr. No.	Temperature (K)	Relaxation frequency (kHz)	Bulk resistance (R_b) (MΩ)	Bulk capacitance (C_b) (pF)	$2Лf_rR_bC_b$
1	318	30.77	0.13	39.80	1
2	323	40	0.07	56.90	1
3	328	50	0.04	79.60	1
4	333	57.14	0.01	279	1
5	338	80	0.01	199	1

From above table values of $2Лf_rR_bC_b$ are found to be equal to 1, which supports Classical Debye formalism.

CONCLUSION

From impedance spectroscopy result, it is observed that magnitude of Z'decreases with increase in both frequency as well as temperature. The Z' values of all temperatures merge above 10 KHz. The curve also displays single relaxation process and indicates an increase in ac conductivity with temperature and frequency. From Z" verses frequency curve initially decreases then increases and again decreases with increase in frequency at lower temperature. It is also observed that the Z" peaks are found to shift towards higher frequency side with the increase in temperature. All these curves are merged at the higher frequency. The relaxation times (τ) were calculated from the frequency at which Z"max is observed. The frequency for the maximum Z", called relaxation frequency (f). Relaxation frequency (f) shifts to higher values with increasing temperature indicating the increase loss in the sample. Relaxation times at different temperature of PEO:PVP composite sample with 25 wt% $NaClO_2$ is 0.741×10^{-11} s. From Nyquist diagram, it is observed that with the increase in temperature slope of the line decreased and deviates towards real axis (Z') .From these semicircles values of bulk resistance R_b and bulk capacitance C_b can be calculated for different temperatures. The values of $2Лf_rR_bC_b$ are found to be equal to 1, which supports classical Debye formalism.

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NORMAL VOICE OF A HUMAN BEING DEPENDS ITS OWN HEARING CAPACITY

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ABSTRACT

The human bearing range depends on both the pitch of the sound whether it is low or high. For a person with normal hearing when it comes to pitch the human hearing range starts low at about 20 Hz.As far as loudness is concerned, the normal human can hear any voice starts from 0db to 85db and above it is dangerous for normal human being.This article is all about how normal voice rang of human being is related with his own hearing capacity.It presents normal voice and pitch is totally depends on his own hearing capacity. If persons are more sensitive for hearing, the voice of speaking will be low and vice versa.So article will present voice capacity of normal human being is directly proportional to his hearing capacity.

Keywords *db:decibel , Hz:Hertz*

INTRODUCTION

Normal hearing range of a person varies from 20 Hz to 20,000 Hz it varies from person to person. It also depends on the age of the person. Person may hear less as with his increasing age. As far as the voice of human being confirmed he speaks in a voice which he can hear, human can hear the sound from 0db onward above 85db it is harmful.Sound or voice is a longitudinal mechanism wave of any frequency. Frequency is the number of cycles or complete vibration experiences at each point per unit. The frequency of a sound wave determines its tone and pitch.

OBJECTIVE

1) To know the normal hearing range of human being.
2) To study the sound voice loudness, vibration, frequency of normal speaking.
3) Co-relation of hearing and voice of speaking.

OVERVIEW

The number of vibration that is produced per second is called frequency. Frequency varies from each sound and it is measured in hertz.A sound with a low frequency will have low pitch, such as a human's heartbeat. A sound with high frequency will have high pitch. Human cannot hear the voice of every frequency because each sound has different frequency depends on the frequency of each sound he will determine the voice and speak accordingly.
hear.

EXAMPLES

1) If a person hear less, he always used to speak loudly because he always think that if he can't hear the voice, the person in front of him is also unable to hear his voice.
2) In crowded area normal human will speak loudly, because in such condition he is unable to hear his own voice properly; so many sounds are there which frequently bombard him. So he will speak loudly till he himself can't hear his own voice.
3) In case of a head phone, if a person is hearing a song with head phone and when he starts to speak he will speak in a voice bigger than his normal voice because he is not able to hear his own voice. So he increases his voice volume till he is able to hear it, as a result he speaks in a range above to his normal speaking voice.
4) So it is proven that Normal speaking voice is proportional his own hearing Of human being capacity & vice versa

CONCLUSION & RESULT

From all the above study it can be said that human speaks in a pitch which he can hear if person is very sensitive to hearing he will speak slowly and if the persons hearing capacity is less he will speak loudly. So from the above article it can be clearly said that volume of speaking of normal human being totally depends on his own hearing capacity.

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STUDY OF FREQUENCY ON AC CONDUCTIVITY AND DIELECTRIC CONSTANT ON COMPOSITE POLYMER ELECTROLYTE

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ABSTRACT

Polyvinyl alcohol (PVA), ammonium nitrate (NH_4NO_3) and nanofiller ZrO_2 composite proton conducting polymer electrolyte with different concentration have been prepared by solution cast technique. The FTIR analysis confirms the complex formation of polymer (PVA) with ammonium salt (NH_4NO_3). The ionic conductivity shows that 2 mole % dispersed nanofiller ZrO_2 in (PVA:NH_4NO_3) composite polymer electrolyte has been maximum. The frequency dependence of ac conductivity and dielectric constant have been analysed of composite polymer electrolyte. And frequency dependent ac conductivity follows universal Jonscher's Power law.

Keywords *Composite polymer electrolyte, FTIR, AC electrical conductivity, dielectric constant.*

1. INTRODUCTION

Composite which are made of polymer with nanofiller have been used in electrical and electronic industries. Nanofiller can improve mechanical thermal and electrical (conductivity and permittivity) properties [1]. The conductivity of proton conducting polymer increase due to addition of nanofiller [2]. Polyvinyl alcohol has been particular chemical and physical properties as well as industrial applications [3-4]. Its good flim forming nature, high dielectric strength, good charge storage capacity, and dopant dependent electrical and optical properties. It has carbon chain backbone with hydroxyl group attach to methane carbon [5].

Ammonium salts are very good proton doner. Hema etal studied that the AC electrical conductivity of proton conducting solid polymer electrolyte based on PVA with ammonium salts (NH_4Cl, NH_4Br, NH_4I). It has been found that PVA doped with ammonium iodide have high ionic conductivity and its activation energy is low [6]. G. Hirankumar etal reported that the conductivity of pure PVA is of the order 10^{-10} S/cm at ambient temperature and its value increases 10^4 times when complex with 20 mole% ammonium acetate [7]. So in the present work, to study, AC electrical conductivity of proton conducting composite polymer electrolyte PVA:NH_4NO_3 doped with nanofiller ZrO_2 of different molar ratio.

2. MATERIALS AND EXPERIMENTAL TECHNIQUE

Polyvinyl alcohol with molecular weight 125,000 (AR grade Sd fine), ammonium nitrate (AR grade merck), nanofiller ZrO_2 and deionized distilled water as a solvent have been used to prepare composite polymer electrolyte by solution cast technique. In this method PVA and ammonium nitrate have been dissolved separately in deionized distilled water by mole percent. And this solution mixed together. Then different mole percent of nanofiller ZrO_2 (0,0.5,1.0,1.5,2) in PVA:NH_4NO_3 (80:20) and the solution is stirred well using magnetic stirred, untiled homogenous solution was formed. These homogeneous solution was casted in petri dish and evaporated slowly at room temperature. The flim have been formed with uniformed thickness. AC electrical conductivity have been measured at different temperatures (313K- 353K) at the different frequencies (20Hz to 1MHz) using 4284 LCR meter.

3. RESULT AND DISCUSSIONS

FTIR absorption spectra of pure PVA and PVA: NH_4NO_3 (80:20) as shown in fig 3.1a and 3.1b. The absorption band 3411cm-1 is the vibrational frequency due to OH bond alcohol and phenols in pure PVA. This (OH) band shifts to 3247cm-1 in 80PVA:20 NH_4NO_3. The hydroxyl group shifts towards lower wave number due to addition of ammonium salts is characteristic to an interaction in polymer matrix. The FTIR spectra in pure PVA is clearly seen that the absorption band 2961cm-1 is the vibrational frequency due to asymmetry C-H stretching in fig 3.1a. This C-H band shifts to lower frequency in 80PVA:20 NH_4NO_3 is observed in fig 3.1b respectively. An absorption peak C-O stretching have been shifted to the lower wave number when the addition of ammonium salt in PVA [8]. The absorption band C-H rocking vibration of PVA appears near 840 cm-1 [9-10]. The intensity of other peaks reduced due to addition of ammonium nitrate content in pure PVA. This result shows that the complexation has been occurred between PVA and ammonium nitrate.

3.1. FOURIER TRANSFORM INFRARED SPECTROSCOPY (FTIR)

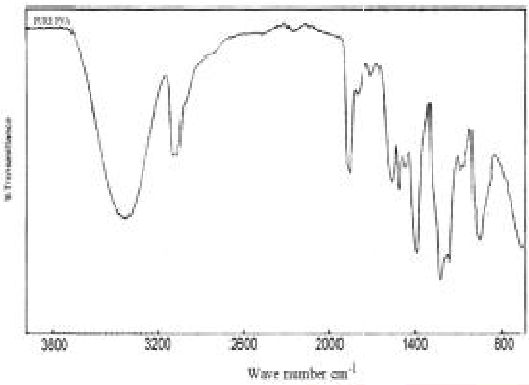

Fig. 3.1a FTIR of Pure PVA

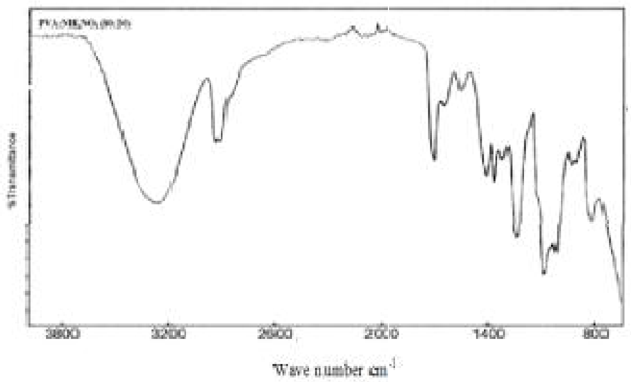

Fig. 3.1b FTIR of PVA: NH_4NO_3 (80:20)

3.2. AC ELECTRICAL CONDUCTIVITY

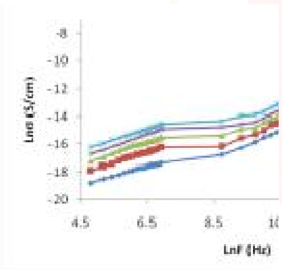

Fig. 3.2a: Variation of conductivity (□$_{ac}$) with Frequency at different temperatures for Pure PVA

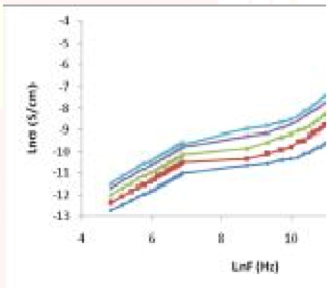

Fig. 3.2b: Variation of conductivity (□$_{ac}$) with Frequency at different Temperatures for PVA: NH_4NO_3 (80:20) with different mole %.

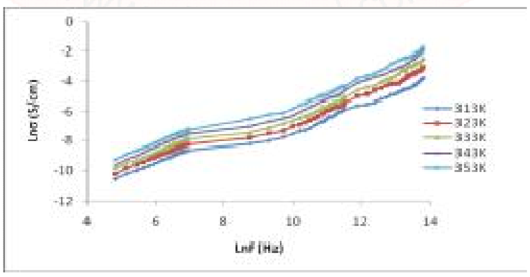

Fig. 3.2 c: Variation of conductivity (□$_{ac}$) with Frequency at different Temperatures for PVA: NH_4NO_3 (80:20): ZrO_2 with 2 mole %

Fig 3.2a, Fig 3.2b, and fig 3.2c shows that the relation between ac conductivity with frequency at Different constant temperatures 313K, 323K, 333K, 343K and 353K. It is seen that the conductivity increases with an increase of frequency in all composition due to more number of free ions. This will increase mobile of charge carrier. In Fig 3.2a,3.2b, 3.2c shows that two region i.e. low and high frequency region.

In low frequency region more and more charge accumulation occurs at electrode- electrolyte interface and to decrease number of mobile ions and conductivity also decreases. Therefore, electrode polarization effect is occurring [11]. The platue region is representing the DC conductivity. In high frequency region, the AC conductivity increases due to high mobility of charge carrier [12], and it is related to the variation of bulk conductivity. It is found that AC conductivity variation with frequency follows the universal Jonscher's power law [13].

3.3. DIELECTRIC CONSTANT

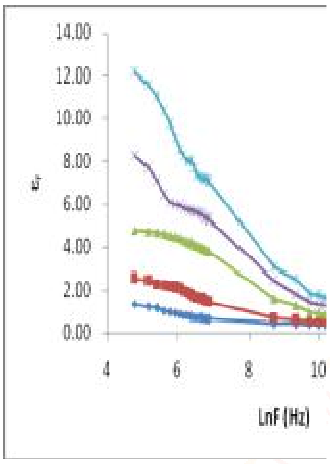

Fig.3.3a: Variation of Dielectric constant (ε_r) with Frequency at different temperatures for Pure PVA

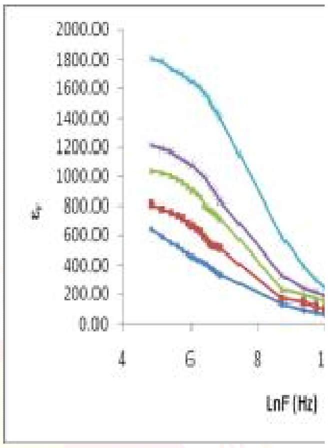

Fig.3.3b: Variation of Dielectric constant (ε_r) with Frequency at different Temperatures for PVA: NH_4NO_3 (80:20) with different mole %.

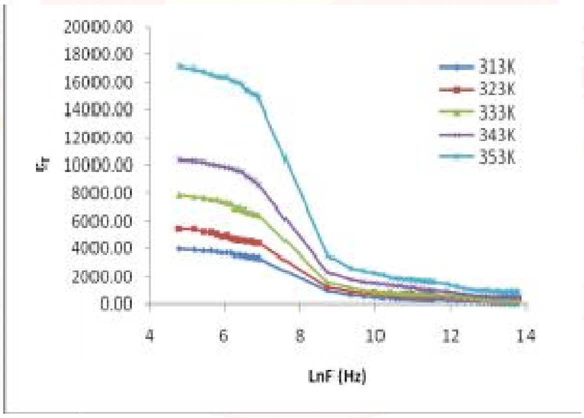

Fig.3.3c: Variation of Dielectric constant (ε_r) with Frequency at different Temperatures for PVA: NH_4NO_3 (80:20): ZrO_2 with 2mole %

The frequency dependent dielectric constant of pure PVA, PVA:NH_4NO_3 (80:20) and PVA:NH_4NO_3 (80:20): ZrO_2 2 mole % as shown in fig 3.3a, 3.3b and 3.3c. It is observed that dielectric constant is high at low frequency. Due to contribution of charge (collection) accumulation at electrode-electrolyte interface. But in high frequency dielectric constant decreases and nearly constant value with increases in frequency. This is due to the dipole not being able to follow apposite of electric field variation at higher frequency [14-15].

4. CONCLUSION

AC electrical conductivity and dielectric constant have been measured with frequency at different temperature, it is found that ac electrical conductivity of film increases with increase in frequency and dielectric constant decreases with increase in frequency. The polymer PVA and ammonium salt NH_4NO_3 complex formation have been confirm from FTIR spectra studies

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EFFECTIVE ATOMIC NUMBER AND MASS ATTENUATION COEFFICIENT OF VANADIUM LEAD BORATE GLASS SYSTEM WITHIN THE ENERGY RANGE OF 0.122-1.330 MEV

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ABSTRACT

Photon attenuation coefficient calculation methods have been widely used to accurately study the properties of Vanadium lead borate such as ($7V_2O_5$-$63PbO$-$30B_2O_3$). In this study, mass attenuation coefficients (μ_m) of these Vanadium lead borate for 0.122-, 0.356-, 0.511-, 0.662-, 0.884-, 1.170, 1.275-, 1.330- MeV photons are determined using the radio-nuclides Co^{57}, Ba^{133}, Cs^{137}, Na^{22}, Mn^{54}, and Co^{60}. NaI (Tl) scintillation detection system. The calculated attenuation coefficient values were then used to determine total atomic cross sections (σ_t), molar extinction coefficients (ε), electronic cross sections (σ_e), effective atomic numbers (Z_{eff}), and effective electron densities (N_{eff}) of the Vanadium lead borate. Theoretical values were calculated based on the XCOM data. Theoretical and experimental values are found to be in a good agreement (error < 5%). The variations of μ_m, σ_t, ε, σ_e, Z_{eff}, and N_{eff} with energy are shown graphically. The values of μ_m, σ_t, ε, σ_e are higher at lower energies, and they decrease sharply as energy increases; by contrast, Z_{eff} and N_{eff} were found to be almost constant.

Keywords: *Mass attenuation coefficient; total atomic and electronic cross sections; effective atomic number; effective electron density; molar extinction coefficient*

1. INTRODUCTION

Mass attenuation coefficients, total atomic and electronic cross sections, molar extinction coefficients, effective atomic numbers, and effective electron densities are critical in applied as well as fundamental science because of their diverse applications in cancer treatment, shielding, gamma-ray fluorescence studies and tomography.

Radiation shielding are used in many area likes medical, technology, agriculture, space technology. There is many radiation interaction investigation data are introduced in scientific,engineering, medical and biologycal application.(Young et al 1987) elements(Goswamiand chaudhari,1973),alloys(Siddappa et al, 1986; El-Kateb et al., 2000)and compounds(Singh et al, 1996; Turgut et al., 2002,2004). Interaction of photons with glasses plays an important role in radiation shielding properties in biology, nuclear technology, and space research as radioactive sources such as Co^{57} (122 keV), Ba^{133} (356 keV), Na^{22} (511 and 1275 keV), Cs^{137} (662 keV), Mn^{54} (840 keV) and Co^{60} (1170 and 1330 keV) are used in radiation studies, radiation sterilization, and industry (Hall, 1978). Related parameters such as total atomic and electronic cross section, effective atomic number and electron density, and molar extinction coefficient can be derived using mass attenuation coefficient.

The studies of radiation shielding glasses have been published by several authors .(N Singh etal., 2006) comparison with concrete has studied on a radiation shielding property of PbO-BaO-B2O3 glass at 511 keV, 662 keV and 1274 keV. It has been shown that PbO-BaO-B2O3 is a better shielding property than concrete at all energy. (J.Kaewkhao et al., 2010). Were observed mass attenuation coefficients (μ_m) and effective atomic number (Zeff) in borate and phosphate glass containing with BaO, PbO and Bi2O3 at energy 662 keV .The result shows that all glass samples are better HVL than ordinary concrete and commercial glass window. Furthermore, higher BaO, PbO and Bi2O3 concentration then effective increase. BaO may be used on x-ray or lower energy level on suitable for use at appropriate energy. (Murat Kurudirek et al.,2010)have compared some lead and non-lead based glass, standard shielding concretes and commercial window glasses in different energy region of 1keV-100 GeV. They confirmed that all glasses are suitable as substitutes for some concretes and commercial window glasses in this energy region. (K. Kirdsiri et al., 2011) have compared the silicate glasses containing with Bi_2O_3, PbO and

BaO on radiation shielding and optical properties. The results showed that Bi_2O_3 and BaO glasses will be a new possibility for a lead-free radiation protecting glass with non-toxicity to our environment.

Z_{eff} and N_{eff} are known values of given medium can be calculated only when Energy absorption. Thus, studies of these parameters of complex molecules are focused on the determination in the energy range 5-1500 keV as these energy range are widely used in biological and medical applications (Hubbell, 1999) via different methods (Murut Kurudirek, 2013, 2014a, 2014b, 2014c, 2015; Midgley, 2004, 2005; Manohara and Hanagodimath, 2007; Demir et al., 2012; Murat Kurudirek and Tayfur Onaran, 2015; Danial Salehi et al., 2015).

In this study, mass attenuation coefficients, total atomic and electronic cross sections, molar extinction coefficients, effective atomic numbers and electron densities of some Vanadium lead borate of 0.122-1.330 MeV are calculated. These values are compared with theoretical values calculated using XCOM program (Berger M.J. and Hubbell J.H., 1987/1999).

2. CALCULATION METHODS

2.1 MASS ATTENUATION COEFFICIENT

A parallel beam of mono-energetic X-ray or γ-photons passing through matter is attenuated due to absorption and scattering. Attenuation due to absorption follows the Beer-Lambert law:

$$I = I_0 e^{-\mu_m X} , \qquad (1)$$

where I_0 and I are un-attenuated and attenuated photon intensities, respectively, X is mass per unit area (g/cm^2), and μ_m is mass attenuation coefficient (cm^2/g) given by the following equation for a compound or mixture of elements (Jackson D. F. and Hawkes D.J., 1981; Hubbell and Seltzer, 1995):

$$(\mu/\rho)_i = \sum_i W_i (\mu/\rho)_i , \qquad (2)$$

where W_i is the weight fraction and $(\mu/\rho)_i$ is the mass attenuation coefficient of the i^{th} constituent element.

Weight fraction is given by

$$W_i = n_i A_i / \sum_j n_i A_j , \qquad (3)$$

where A_j is the atomic weight of i^{th} element and n_i is the number of formula units.

2.2 Total atomic cross section

Total attenuation cross section (σ_t) is given by

$$\sigma_t = \frac{A}{N_A X} \ln(I_o / I) , \qquad (4)$$

where, A is molecular weight and N_A is Avogadro's number (6.02486×10$^{\wedge 23}$).

2.3 Molar Extinction coefficient

Molar Extinction coefficient is determined a by following formula

$$\varepsilon = 0.4343 N_A \sigma_t , \qquad (5)$$

2.4 Electronic cross section

Electronic cross section (σ_e) is given by

$$\sigma_e = \frac{\sigma_t}{\bar{Z}} , \qquad (6)$$

where $\bar{Z}$ is mean atomic number.

2.5 Effective atomic number

Effective atomic number (Z_{eff}) is given by

$$Z_{eff} = \frac{\sum_i W_i f_i A_i (\mu/\rho)_i}{\sum_i f_i (A_j / Z_j)(\mu/\rho)_j} , \qquad (7)$$

where f_i is the mole fraction of each constituent element (provided $\sum_i f_i = 1$) and A_i is the atomic weight. In this study, all the quantities are directly used (Manohara et al., 2008).

2.6 Effective electron density

Effective electron density expressed in the number of electrons per unit mass is closely related to the effective atomic number, and is given by

$$N_{eff} = \left(\frac{N_A}{A_{eff}}\right) * Z_{eff} , \qquad (8)$$

where $A_{eff} = \dfrac{A}{\text{total number of atoms}}$. (9)

3. EXPERIMENTAL DETAILS

The $7V_2O_5$-63PbO-$30B_2O_3$ glass system of sample were prepare with help of melt quenching method. The batch of formulas was weighted to 30 g and melted at 1100 °C in alumina crucible by an electrical furnace. These melts were quenched at room temperature by pouring between stainless steel plates which produces circular shape with top side opened and when filled, a top part was press by top stainless steel plate for circular shape. The quench glass was annealed at 500 °C for 3 hour at room temperature. Geometry set up (Fig. 1). The six radioactive sources, Co^{57} (122 keV), Ba^{133} (356 keV), Na^{22} (511 and 1275 keV), Cs^{137} (662 keV), Mn^{54} (840 keV), and Co^{60} (1170 and 1330 keV), used in this study were obtained from Bhabha Atomic Research Centre, Mumbai, India. Gamma rays emitted by these radioactive sources were collimated and detected by a NaI (Tl) scintillation detector. Signals from the detector (2"×") NaI (Tl) crystal. Stability and reproducibility of the arrangement were checked before and after each set of runs. In order to minimize the effects of small-angle scattering and multiple scattering events on the measured intensity, the transmitted intensity was measured by setting the channels at the full-width half-maximum position of the photo-peak.

Circular shaped Vanadium lead borate ($7V_2O_5$-63PbO-$30B_2O_3$) under investigation were confined in a cylindrical plate.Mass attenuation coefficients (μ/ρ) of all the samples of Vanadium lead borate were calculated from the measured values of unattenuated photon intensity I_0 (without sample) and attenuated photon intensity I (with sample) Eq. (2). The experiments were conducted in an air-conditioned room to avoid possible shifts of the photo-peaks.. The maximum angle of scattering was maintained <30 min by properly adjusting the distance between the detector and source (30cm ≤ d ≤ 50 cm), as the contribution of coherent and incoherent scattering at such angles in the measured cross sections at intermediate energies is negligible (Hubbell, 1999).

$30B_2O_3$).

Fig. 3 Plot of σ_t versus photon energy for Vanadium lead borate ($7V_2O_5$-63PbO-$30B_2O_3$).

Fig. 4 Plots of ε versus photon energy for Vanadium lead borate ($7V_2O_5$-63PbO-$30B_2O_3$).

Fig. 5 Plot of σ_e versus photon energy for Vanadium lead borate ($7V_2O_5$-63PbO-$30B_2O_3$).

Fig. 6 Plot of Z_{eff} versus photon energy for Vanadium lead borate ($7V_2O_5$-63PbO-$30B_2O_3$).

Fig. 7 Plot of N_{eff} versus photon energy for Vanadium lead borate ($7V_2O_5$-63PbO-$30B_2O_3$).

Fig. 8 Plot of N_{eff} versus Z_{eff} for Vanadium lead borate ($7V_2O_5$-63PbO-$30B_2O_3$).

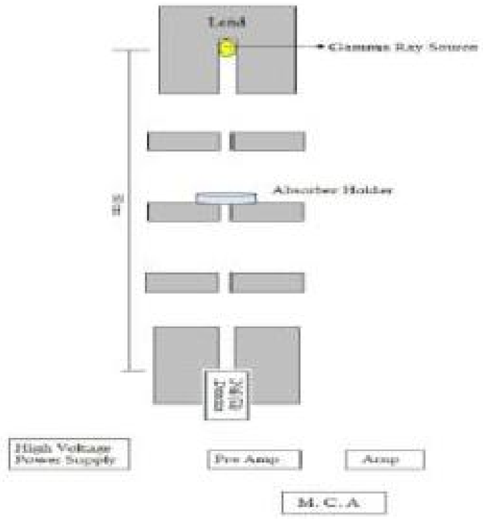

Fig.1 Narrow beam good geometry set up.

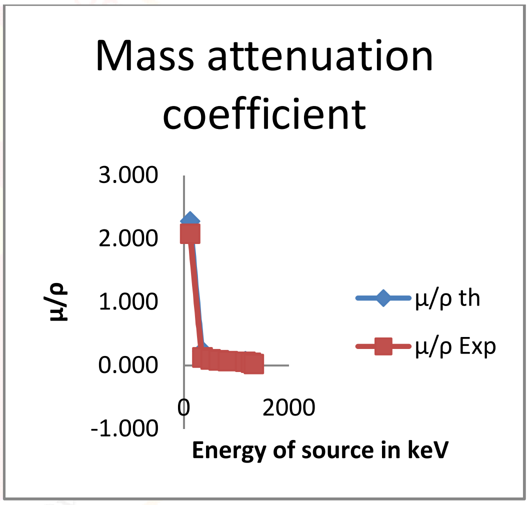

Fig. 2 Typical plot of μ_m versus energy for Vanadium lead borate ($7V_2O_5$-63PbO-$30B_2O_3$).

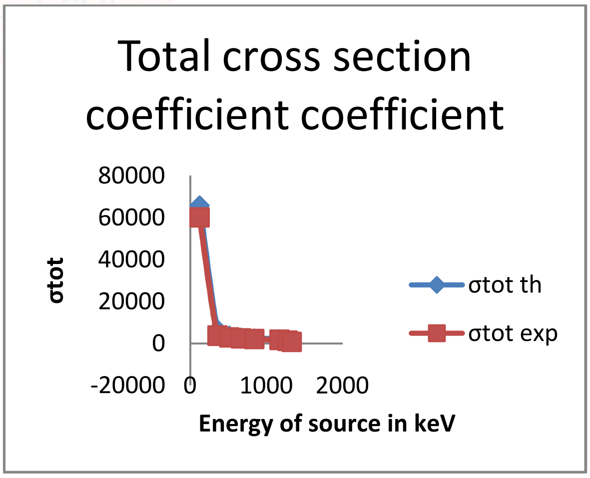

Fig. 3 Typical plot of σ_t versus energy for Vanadium lead borate ($7V_2O_5$-63PbO-$30B_2O_3$).

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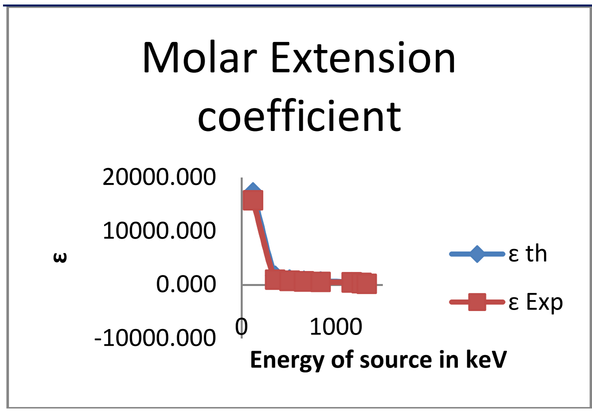

Fig. 4 Typical plot of ε versus energy for Vanadium lead borate ($7V_2O_5$-63PbO-$30B_2O_3$).

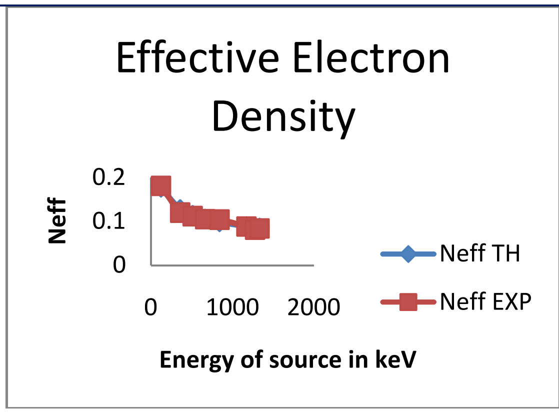

Fig. 7 Typical plot of N_{eff} versus energy for Vanadium lead borate ($7V_2O_5$-63PbO-$30B_2O_3$).

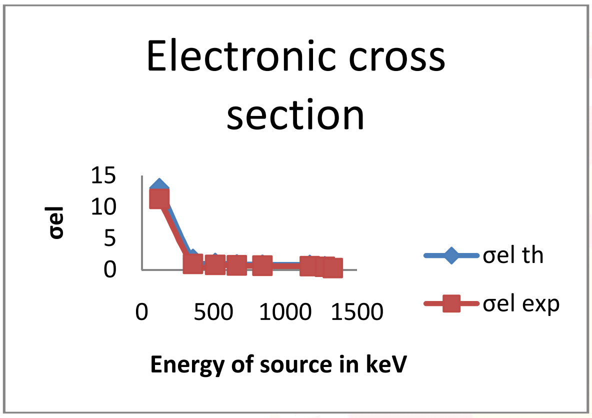

Fig. 5 Typical plot of σ_{el} versus energy for Vanadium lead borate ($7V_2O_5$-63PbO-$30B_2O_3$).

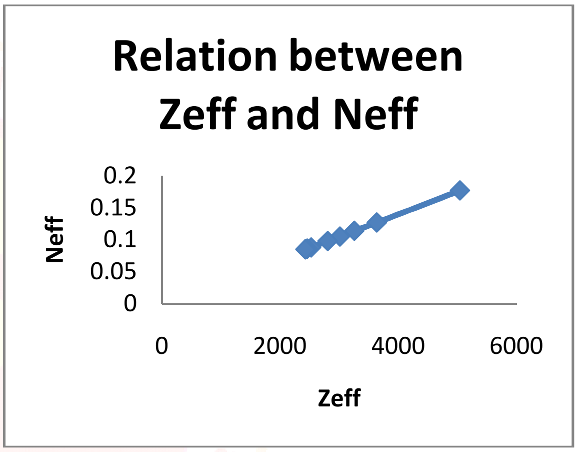

Fig. 8 Typical plot of N_{eff} versus Z_{eff} for Vanadium lead borate ($7V_2O_5$-63PbO-$30B_2O_3$)

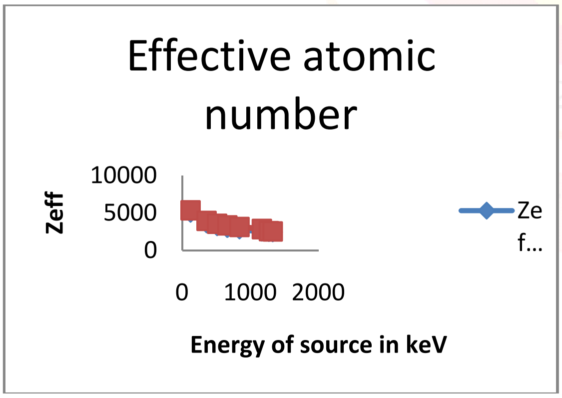

Fig. 6 Typical plot of Z_{eff} versus energy for Vanadium lead borate ($7V_2O_5$-63PbO-$30B_2O_3$).

Table 1 Mass attenuation coefficient of 7V2O5-63PbO-30B2O3

Sr. N.	SOURCE	ENERGY IN KeV	μ/ρ th	μ/ρ Exp
1	Co^{57}	122	2.275	2.078
2	Ba^{133}	356	0.225	0.127
3	Na^{22}	511	0.126	0.097
4	Cs^{137}	662	0.095	0.081
5	Mn^{54}	840	0.081	0.069
6	CO^{60}	1170	0.069	0.057
7	Na^{22}	1275	0.050	0.042
8	CO^{60}	1330	0.039	0.024

Table 2 Total interaction cross section of 7V2O5-63PbO-30B2O3

Sr. No.	source	Energy in KeV	σtot th	σtot exp
1	Co57	122	65789.61	60092.66
2	Ba133	356	6506.665	3672.651
3	Na22	511	3643.732	2805.095
4	Cs137	662	2747.258	2342.399
5	Mn54	840	2342.399	1995.377
6	Co60	1170	1995.377	1648.355
7	Na22	1275	1445.925	1214.577
8	Co60	1330	1127.822	694.0442

Table 3 Total electron cross section of 7V2O5-63PbO-30B2O3

Sr. No.	SOURCE	ENERGY IN KeV	σel th	σel exp
1	Co57	122	13.04758	11.28545
2	Ba133	356	1.790087	0.935863
3	Na22	511	1.120085	0.796215
4	Cs137	662	0.912869	0.705646
5	Mn54	840	0.836055	0.643378
6	CO60	1170	0.791424	0.584263
7	Na22	1275	0.588369	0.474887
8	CO60	1330	0.465093	0.277626

Table 4 Molar extention coefficient of 7V2O5-63PbO-30B2O3

Sr. No.	source	Energy in KeV	□ th	□ Exp
1	Co57	122	17214.490	15723.830
2	Ba133	356	1702.532	960.985
3	Na22	511	953.418	733.980
4	Cs137	662	718.847	612.911
5	Mn54	840	612.911	522.110
6	Co60	1170	522.110	431.308
7	Na22	1275	378.340	317.806
8	Co60	1330	295.106	181.603

Table 5 Effective atomic number 7V2O5-63PbO-30B2O3

Sr. No.	SOURCE	ENERGY IN KeV	Zeff th	Zeff exp
1	Co57	122	5042.283	5324.789
2	Ba133	356	3634.831	3924.348
3	Na22	511	3253.085	3523.039
4	Cs137	662	3009.476	3319.512
5	Mn54	840	2801.728	3101.408
6	CO60	1170	2521.249	2821.253
7	Na22	1275	2457.513	2557.613
8	CO60	1330	2424.938	2499.928

Table 6 Effective electron density of 7V2O5-63PbO-30B2O3

Sr. No.	SOURCE	ENERGY IN KeV	Neff TH	Neff EXP
1	Co57	122	0.177	0.181
2	Ba133	356	0.127	0.12
3	Na22	511	0.114	0.112
4	Cs137	662	0.105	0.105
5	Mn54	840	0.098	0.104
6	CO60	1170	0.088	0.088
7	Na22	1275	0.086	0.081
8	CO60	1330	0.085	0.084

4. RESULTS AND DISCUSSION

The experimental and theoretical values of μ_m (cm^2/g) for Vanadium lead borate studied at 122-, 360-, 511-, 662-, 840-, 1170-, 1275- and 1330-keV photon energies are shown in Table 1**.** The experimental values of μ_m agree with the theoretical values calculated using the XCOM program based on the mixture rule. The total experimental uncertainties of the μ_m values depend on the uncertainties of I_0 (without attenuation), I (after attenuation), measurements of mass thickness values, and counting statistics. The estimated total uncertainty in the measured experimental values of μ_m was found to be in the range of 2-3%. It is clear that all the vanadium Lead borate have almost same behavior. Measured total atomic (σ_t) and electronic cross sections (σ_e) for the Vanadium lead borate studied are displayed in Tables 2 and 3, respectively. The typical plots of σ_t versus E and σ_e versus E for vanadium lead borate are shown in Figures 3 and 5 respectively. The behavior of σ_t and σ_e with photon energies is almost similar to that of μ_m.

Molar extinction coefficients of vanadium lead borate calculated using Eq. (5) are presented in Table 4**.**Effective atomic numbers of composite materials, such as the vanadium lead borate studied, calculated using Eq. (7) are displayed in Table 5. A typical plot of Z_{eff} versus energy is shown in Figure 6. The effective electron densities of the vanadium lead borate studied are shown in Table 6 and the plot of N_{eff} versus energy is shown in Figure 7. A typical plot of N_{eff} versus Z_{eff} is shown in Figure 8. It is evident from the figure Z_{eff} and N_{eff} are almost constant in the energy range studied. The figure also shows a linear relation between Z_{eff} and N_{eff}.

5. CONCLUSION

This study was conducted to obtain information on mass attenuation coefficient, μ_m, and related parameters (σ_t, ε, σ_e, Z_{eff} and N_{eff}) for the chosen vanadium lead borate samples. For the interaction of photons with matter, the values of μ_m depend on the physical and chemical environments of the samples. These values were found to decrease with increasing photon energies. The parameters σ_t, σ_e and ε change similar to μ_m, and it is clear that ε depends totally on the number and nature of atoms. The values of Z_{eff} and N_{eff} in this energy region were found to be almost constant. It is also evident that N_{eff} has a linear relationship with Z_{eff}.

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VARIATION OF DEPOLARIZATION CURRENT IN POLYBLEND WITH DOPING PERCENTAGE

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ABSTRACT

The polyblend films of polyvinyl chloride (PVC) and polymethyl methacrylate (PMMA), in the weight ratio 2:1 were prepared by using 1.0 gm. of PVC and 0.5 gm. of PMMA. Polyaniline (PANI) has been used as a dopant with 0.2% 0.4% 0.6% 0.8% & 1.0% of the total weight of the two polymers. The TSDC studies of doped polyblends of thickness 60μm have been carried out at the various poling fields viz. 10 kV/cm, 15 kV/cm, 20 kV/cm, 25 kV/cm and 30 kV/cm by using constant value of poling temperature (T_p) 353 K. In general it has been observed that the peak TSDC current (I_m) at given poling temperature (T_p) increases with the magnitude of poling field strength. The effect of fields of polarization and constant polarization temperature on TSDC peaks indicates that the polarization in the blend may be due to the charge carrier trapping in the deep traps, which leads to the induced dipole formation. The phenomenon of existence of TSDC peaks has been analyzed and discussed. It is observed that peak depolarization current increases with increase in doping percentage and poling field.

Key words: *Polyblend, TSDC, PANI.*

INTRODUCTION

Thermally stimulated discharge is a technique that has contributed significantly to the current understanding of the charge storage and charge decay processes in electrets. The charge of electrets may be generated by various mechanisms : orientation of permanent dipoles (in polar materials), trapping of charge by structural defects and impurity centers and build-up of charges near heterogeneities such as amorphous crystalline interfaces in semicrystalline materials, and the grain boundaries in polycrystalline materials. Electrets formed by thermal methods are referred to as thermoelectrets. TSDC technique is an efficient tool for findings and developing better electret materials as it reveals, in a short span of time,

the mechanisms responsible for decay of the charge of electret [Sessler]. This technique has also been successfully used to study the various mechanisms involved in electret formation and charge storage phenomenon [Van Turnhout]. Electrets prepared from the polyblend have better charge storage properties and higher polarization that the individual polymers [Pillai *et al*]. TSDC of polymer blend is likely to give valuable information about the molecular interactions and the extent of mixing between the individual components.

TSDC study of Iodine doped polyblends of polystyrene (PS) and polymethyl- methacrylate (PMMA) have been studied by Belsare and Deogaonkar. Burghate *et al.* reported thermally stimulated discharge current (TSDC) and dielectric constant of semiconducting glasses. Sangawar measured the dc electrical conductivity of doped electrets of PS and PMMA. Khare *et al.* measured the thermally stimulated discharge current (TSDC) and electrical conductivity in metal and ethyl cellulose-metal system. Sawarkar *et al.* have studied depolarization study of semiconducting glasses using thermally stimulated discharge. Thermally stimulated discharge conductivity in polymer composite thin films have been studied by Sangawar *et al.* Polarization and depolarization studies in polymethyl methacrylate and polyvinyl pyrrolidone polybend films was reported by Khare *et al.*

Pissis *et al.* reported the electric and dielectric measurements of several conducting polyethylene oxide (PEO) based electrolytes, by using thermally stimulated depolarization current (TSDC) and thermally stimulated polarization current (TSPC). Negau and Negau obtained new results in thermally stimulated discharge current (TSDC) peak above room temperature. The bioelectret state in an amino acid-glycine, has been studied using the thermally stimulated discharge current (TSDC) technique by Mishra *et al*.

The detailed survey of literature revealed that the thermally stimulated discharge technique is extensively applied for the study of polymer thermoelectrets only. However,
work on TSDC measurement is very scant in polyblends doped with polyaniline. Therefore, it has been decided to study the depolarization in PVC- PMMA blend doped with PANI, using thermally stimulated discharge current (TSDC) technique.

THEORY

The polarization in a dielectric is caused by i) orientation of dipoles ii) transference of space charge and iii) injected surface charge from electrodes. If the sample is polarized at a temperature T_p, the polarization will acquire an equilibrium value. According to Perlman *et al*., the discharge current at any time 'i(T)' at absolute temperature T is given by

$$i(T) = A\exp\left[(-E/kT) - \frac{1}{\beta\tau_o}\int_{T_0}^{T}\exp(-E/k\right. \quad (1)$$

Where A is a constant, E is an activation energy, k is the Boltzman constant, T_o is the room temperature and T is the temperature attained by the specimen in time (t) on heating it at a definite linear rate β and τ_o is the characteristics relaxation time given by the expression.

$$\tau = \tau_o \exp(E/kT)$$

Where τ is the relaxation time of dipoles at the temperature T. The relation represented by eq.1 shows a peak at T_m, which has the following relation with τ_o.

$$\tau_o = \left[\frac{kT_m^{\ 2}}{\beta\, E\exp(E/kT_m)}\right] \quad (2)$$

The activation energy E has been calculated using the formula, given by Chirstodoulides as

$$E = [T_1T_2/\,4738\,(T_2\text{-}T_1)] - [T_1/11616]$$ in eV when T is in K

Where T_1 and T_2 denote the temperature at which depolarization current drops to half of its maximum value on the low temperature and high temperature sides respectively.

MEASUREMENT OF THERMALLY STIMULATED DISCHARGE (TSD) CURRENT

Thermoelectret samples were heated at nearly uniform heating rate of 1.25^{O}C/min. This rate of heating was achieved by suitably adjusting the position of the knob of the thermostatic control of the furnace with respect to time and temperature, which would produce equal rise of temperature (5^{o}C) in equal interval (4min.) of time. The discharge (TSDC) current was measured with the sensitive pico ammeter (Model DPA 111 with accuracy $\pm$ 0.2% Scientific Equipment, Roorkee).

RESULTS AND DISCUSSION

The peak depolarization current for various values of pooling fields for different samples are presented in Table 1.

A representative TSDC thermogram for sample blend PVC-PMMA, doped with 0.2% polyaniline (PANI), at various poling fields E 10 kV/cm, 15 kV/cm, 20 kV/cm & 30 kV/cm, poling temperature 353 K, heating rate 1.25^{o}C/min, sample thickness 60µm and poling time is shown in Fig.1. Each of the curves shows a single prominent peak at around 408 K. This current peak (Fig.1) is characterized by following feature.

1. With increasing poling field, the peak shows a linear increasing magnitude (Fig.1), the temperature of peak current remaining almost the same i.e. constant at around 408K.
2. The area under the curve, which is measure of total stored polarization also increased with increasing poling field (Fig.1).

It appears therefore that the magnitude of peak current and the total polarization are liner functions of poling field. This is suggestive of the fact that the current peak is due to dipolar orientation rather than space charge (Anagnostopoulon *et al*,Turnhout and Pillai *et al*).
The linearity between peak depolarization current and polarizing field, suggests uniform polarization
Addition of PMMA to PVC and doping with PANI makes a heterogeneous structure and creates a plasticisation effect. Because of the heterogeneous structure, the charge carriers injected into the bulk by increasing may field pile up at the phase boundaries. The plasticisation causes loosening of the structure and provides greater mobility to charge carriers. This results in increase in peak current.

In the blend PVC-PMMA doped with PANI, of least two or three phases coexist and so discontinuity of structure at such boundaries increases. The carriers may get trapped at the interface of the phase boundary due difference in conductivity of different phases. Dipoles may also originate, due to trapping of both +ve and -ve charge carriers, in deep traps in such a way as to form induced dipoles. Ionization of impurities may also generate trapped charge carriers. These lead to induced dipole polarization in polyblend films.
PMMA (μ = 1.33D), PVC (μ =1.73D) and PANI, all known to be polar in nature, there should already be a contribution of permanent dipoles, to the host material. It may just happen that the dipoles to the polyblend are so constrained by the polarizing field, that they do not orient at all or their contribution to total polarization is almost negligible as compared to the contribution of induced dipoles formed due to trapping of charge carriers during polarization. In such a case the energy requires to disorient the charge carriers and their subsequent release from trapping site, will be higher. This entails higher activation energy. Thus the higher value of activation energy observed in this case points to the induced dipole formation. Such induced dipole formation in polyblends has been observed by Khare *et al.* Also similar results are obtained in all other samples

Fig. 1: Representative TSDC Thermograms of polyaniline (0.2%) doped

PVC-PMMA polyblends.

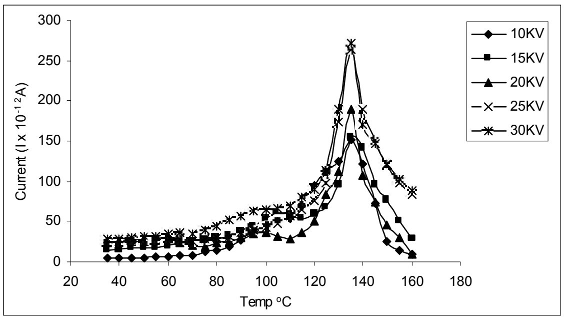

Fig.2: Variation of peak current (I_m) with PANI % for various polarizing fields, Ep = 10, 15, 20, 25 and 30kV/cm

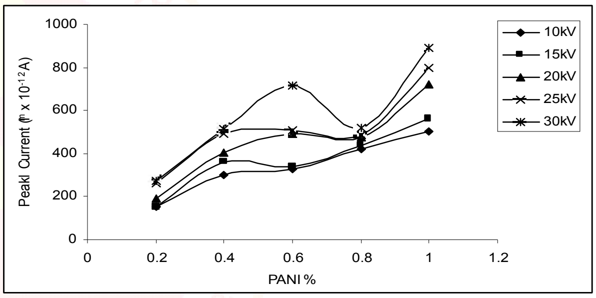

Table No. 1 Peak Depolarization Current in polyaniline doped PVC-PMMA Polymer blend.

Polling field (kV/cm)	Peak Depolarization Current Im (A)				
	0.2% Sample	0.4% Sample	0.6% Sample	0.8% Sample	1.0% Sample
10	151×10^{-12}	212×10^{-12}	327×10^{-12}	420×10^{-12}	505×10^{-12}
15	155×10^{-12}	216×10^{-12}	339×10^{-12}	439×10^{-12}	502×10^{-12}
20	190×10^{-12}	295×10^{-12}	490×10^{-12}	477×10^{-12}	721×10^{-12}
25	264×10^{-12}	340×10^{-12}	506×10^{-12}	489×10^{-12}	797×10^{-12}
30	271×10^{-12}	406×10^{-12}	717×10^{-12}	520×10^{-12}	890×10^{-12}

CONCLUSIONS

1. It is observed that with the increasing poling field the peak shows a linear increase in peak magnitude. However, the peak temperature remains the same.
2. The area under the curve, which is a measure of total stored polarization, also increases linearly with the increasing poling field, as shown in Fig. 1
3. The peak depolarization current increases almost linearly with increasing poling field and with increasing percentage of doping (Fig.2).

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STUDY ELECTRICAL AND OPTICAL PROPERTIES OFPVA-NH_4FSOLID POLYMER ELECTROLYTE

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ABSTRACT

Achievethe high ionic conductivity in the field of polymer for application of batteries, full cell, and super capacitor etcsolid polymer electrolyte are used.To overcome the leakage problem in liquid electrolyte, it is replaced by solid polymer electrolyte. An attempt has been made in this study with polyvinylalcohols (PVA) doped with different percentage of Ammonium fluorides(NH_4F) were prepared by solution casting technique. Here reported optical properties by using UV-Vis Double Beam spectrophotometer in the wavelength range (190-1100) nm and the electrical conductivity of polyvinyl alcohol doped with 15% ammonium fluoride.

Keyword-*optical properties, polyvinyl alcohol, solid polymer electrolyte*

INTRODUCTION

It is important to enhance the ionic conductivity of solid polymer electrolyte and understand the mechanism of ion transport. Solid polymer electrolyte are proficiently significant due to their wide range application in solid state electrochemical devices like batteries, fuel cell, super capacitor, sensors etc. (1-4). Manyresearchershave attracted much attention toward solid polymerelectrolyte due to their ease of handling low cost, high environment stability (5). Electrical and optical properties of polymer can be suitability modified by adding of salt, adding plasticizer to polymer electrolyte, adding inorganic filler, blending of two polymers. In present study, PVA has been chosen as polymer host due to their mechanical strength, excellent film-forming ability, dopant-dependent electrical and optical properties, low cost and high tensile strength (6-7). PVA is semicrystalline material and it contain hydroxyl group attach to methane carbon which can be source of hydrogen bounding. As per literature survey ammonium salt are very good proton donor (8-10). The polymer electrolyte based on polyvinyl alcohol (PVA) based with ammonium fluoride (NH_4F) has been studied with different concentration.

EXPERIMENTAL DETAILS

Polyvinyl alcohol (PVA) supplied by S.D. fine-Chem. and Ammonium Fluoride (NH_4F) supplied by Merck are used in present study.Different composition of Polyvinyl alcohol-Ammonium fluoride (PVA-NH_4F) have been prepared by solution casting method. The appropriate amount of Polyvinyl alcohol (PVA) and ammonium fluoride(NH_4F) was dissolvedseparately in double distill water.These solutionshave been mixed together and stirred well to get homogenous solution. These homogenous solutions were casted on glass plate. The whole assembly was placed in dust free-chamber and allowed to evaporate the solvent slowly in dry atmosphere at room temperature for 4-5 days The thickness of the films was in the range (0.045-0.021) mm It was determined using micrometer at different places in each films and average was taken.

RESULT AND DISCUSSION

TEMPERATURE DEPENDENCE OF I-V CHARACTERISTICS

I-V characteristic of PVA doped with 15% of ammonium fluoride is shown in fig 1. It is reveals that ohmicbehavior in which current density is controlled by thermal bulk generation of charge carriers

TEMPERATURE DEPENDENCE CONDUCTIVITY

The variation of ionic conductivity with absolute temperature over the range of 313 to 353K havingconcentration 5%, 10%, 15% of NH_4F with PVA are shown in fig 2Ionic conductivity increases with increasing temperature due to addition of ammonium fluoride gives rise to protons. Such mobile protons increases with increase ammonium fluoride in polyvinyl alcoholThe variation of electrical conductivity as a function of temperature can be evaluated with the help of Arrhenius equation given below (11).

$\sigma=\sigma_0 \exp(-E_a \backslash KT)$…………… (1)

Whereσ_0 is pre-exponential factor, E_a is activation energy, Tis absolute temperature,and K is Boltzmann constant.

Variation of conductivity with temperature has been explained the segmental motion that result in an increase in free volume of sample hence motion of charge. Thus, the segmental motion either provides the ions to hop from one site to another or provides a pathway for ions to move(12).

CONCENTRATION DEPENDENCE CONDUCTIVITY

Ionic conductivity of polymer electrolyte as a function of ammonium fluoride concentration at different temperature is shown in fig 3 Ionic conductivity increases with increases of salt concentration up to15%, increase in ionic conductivity with increase in salt concentration related to increase the mobile charge carriers

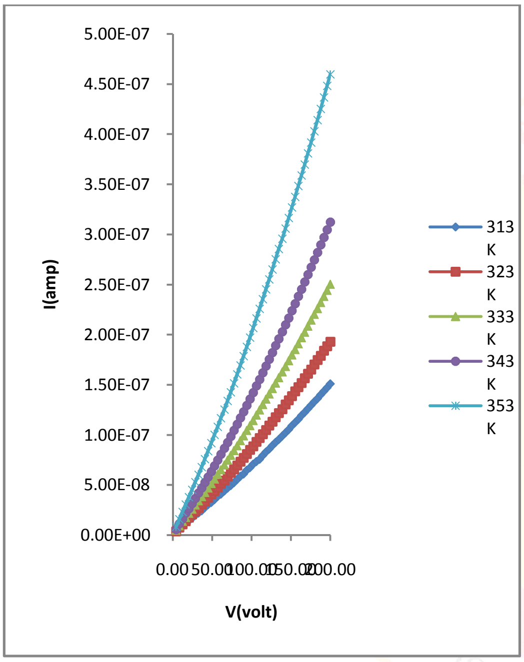

Fig 1.I-V characteristic for 15%PVA-NH_4F

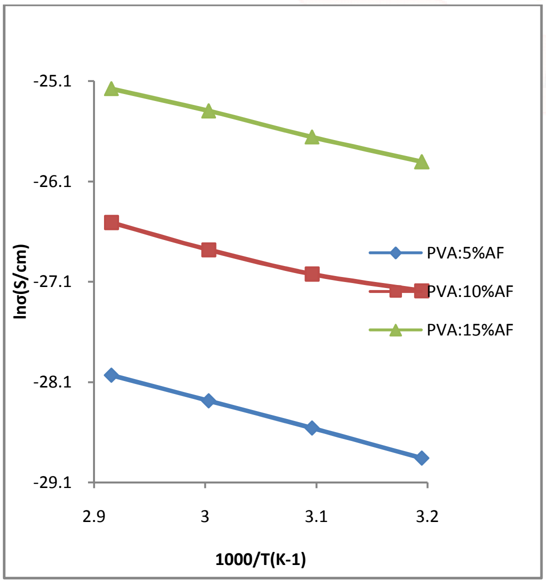

Fig 2.conductivity as function of temperatureat different concentration of PVA-NH_4F

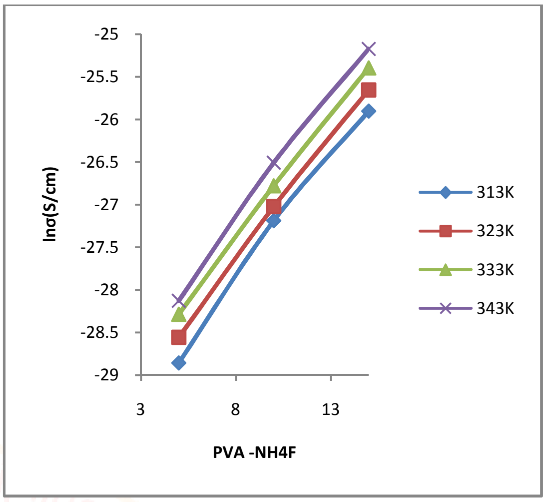

Fig 3.conductivity as function of concentration at different temperature

OPTICAL PROPERTIES

The basic principle behind the UV visible spectroscopic depend on the absorption of photons with energies greater than the band gap energy of carrier which undergoes transition from occupied state in valance band to unoccupied state in conduction band (13-14). The study of optical absorption gives information about band structure of solid. Generally there are two types of optical transition that occur at fundamental edge in solid like insulators/semiconductor such as (a) Direct band gap (b) indirect band gap semiconductor. In direct band gap, the top of valance band and the bottom of the conduction band both lie at the same zero crystal momentum (wave vector). If the bottom of conduction band does not correspond to zero crystal momentum, then it is called indirect band gap semiconductor. In indirect band gap semiconductor, the transition from valance band to conduction band should always be associated with a phonon of the right magnitude of crystal movement.Davis and Shalliday (15) reported that near fundamental band edge, both direct and indirect transitions occur and determine by plotting $\alpha^2$and $\alpha^{1/2}$as function of photon energy (h□).

The Thutupalli and Tomlin (16)reported the relationship based on the analysis for direct and indirect band of semiconductors/insulator respectively

$(h\alpha\square n)^2 = C_1(h\square - E_{gd})$ ------------- (2)

$(h\alpha\square n)^{1/2} = C_2(h\square - E_{gi})$ ------------- (3)

Where h□ is the photon energy, E_{gd} is the direct band gap, E_{gi} is the indirect band gap, n is the refractive index, α is absorption coefficient and C_1, C_2 are constants.

The optical absorbance spectra as a function of wavelength for prepared polymer composite have been recorded by double beam UV Vis spectrophotometer in the wavelengthrange (190-1100) nm.

The optical band gap energies were evaluated from $(\alpha h\upsilon)^2$ verse photon energy (h□) curve is as shown in fig 4.

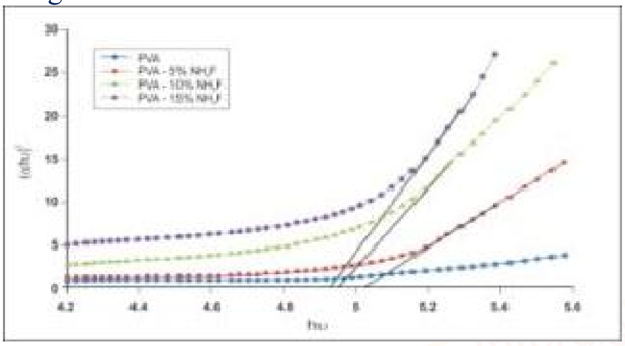

Fig 4.Band gap energy as function of photon energy

The direct optical energy band gap for PVA and PVA doped with ammonium fluriod were determined from the intercept of the extrapolated the linear portion of plot of $(\alpha h\upsilon)^2$on the photon energy axis. The optical band gap decreases from 5.83 eV for pure PVA to 4.98 eV for NH_4F concentration increase up to 15%. The decrease in the optical band gap may be explained on the basis of the fact that the incorporation of small amount of dopant from charge transfer complex in the host matrix (17-18).These charge transfer provides conductivity by providing addition charges this result in decrease of the optical energy gap.

CONCLUSION

The solid polymer electrolyte based on polyvinyl alcohol (PVA) doped with different concentration of Ammonium Fluoride(NH_4F) has been prepared using solution cast technique. Electrical conductivity has been found to be increase with increase in salt concentration attribute to increase ion in host polymer.Temparature dependent conductivity of polymer electrolyte obeys Arrhenius behavior.The optical band gap decreases with increase the ammonium fluoride (NH_4F) concentration up to 15%. The optical band gap decreases due to increase the number of mobile charge carrier into the host polymer.

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INVESTIGATION THE EFFECT OF GLASS FORMER ON DENSITY AND FTIR IN LI^{+} ION CONDUCTING GLASSES

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ABSTRACT

Lithium aluminum borate glasses of composition $40Li_2O$: (60-X) B_2O_3: xAl_2O_3 (where X = 0, 5, 10, 15, 20) were prepared by melt quenching technique and investigated by XRD, DTA, FTIR and density measurement. X ray diffraction and scanning electron microscopy confirmed the nature of sample. The density of glasses was measured by Archenemies principle using benzene as immersion liquid. The study of density and molar volume reported change of structure with increase in mole percent of aluminum. The FTIR analysis revealed that network structures of sample are mainly based on BO_3 and BO_4 unit.

***Keyword**: XRD, FTIR and Density.*

INTRODUCTION

Chemical composition of glasses play important role in determining properties of the glasses. The glass is divided into main categories: network formers, network modifiers and intermediate species, which falls somewhere between network modifier and may be substituted for a network former in the glassy state. Borate is one of the important glass former and has been incorporated in many kind of glasses to attain desired chemical and physical properties. Glasses are receiving considerable attention due to their unique properties like hardness, good strength, transparency and excellent corrosion resistance. X-ray diffraction (XRD), infra-red spectroscopy (IR), differential scanning calorimetric (DSC) studies has been extensively employed over the years to investigate the structure of glasses [1-4]. Borate glasses, in particular, have been the subject of numerous infra-red studies due to their structural peculiarities [5-8]. In pure B_2O_3 glass structure most of the boron is involved in B_3O_6 (boroxol) ring. Addition of modifier breaks boroxol ring and thereby produced BO_3 and BO_4 units [6, 8]. In addition, modifier also changes the physical properties along with structural modifications. Recently, the study of oxide glasses doped with transition metal ions (TMI) has received considerable attention due to their attractive combination of physical and chemical properties. TMI doped borate glasses have application in microelectronics, optical glasses and solid state laser [9-11]. Continued effort for the development of new glassy materials either by doping or by adding TMI, and the study of their novel properties is highly relevant due to their potential applications in various technological fields [12, 13]. It has been reported that density and molar volume changes due to chang in mole percent of Al_2O_3 in lithium borate glasses [14-15].

In this work an attempt has been made to study the effect of glass former on FTIR, molar volume and density of Li^{+} ion conducting glasses.

EXPERIMENTAL

The aluminum lithium borate glasses of composition $40Li_2O$: $(60\text{-}X)B_2O_3$: xAl_2O_3 (where X = 0,5,10,15,20) were prepared by melt quenching technique. The glass samples were prepared for different former ratio by using following formula.

$$\textbf{Former Ratio} = \frac{B_2O_3}{B_2O_3 + Al_2O_3} \qquad \text{....... (1)}$$

The starting material lithium carbonate, boric acid and aluminum oxide of AR grade purchased from Merc laboratory were used. A homogeneous mixture of different composition has melted in ceramic crucible by keeping it into Muffle furnace equipped with digital temperature controller. The materials were melted at 1150^0C for two hours with heating rate 30^0C/min and molted material is quenched in aluminum mould at room temperature (27^0C).The samples were annealed at 200^0C for 2Hrs in hot air oven. The measurements of XRD were carried out by using XPERT PRO DIFFRACTOMETER. Scanning electron microscope of all samples was investigated from Tata Institute of Fundamental Research Mumbai by using ZEISS Ultra SEM instrument. In the present investigation measurement of TG-DTA has been carried out by using instrument NEFZ SCH STA 449F1 from TIFR Mumbai. FTIR of prepared samples were recorded by SHIMADZU FTIR spectrometer IR infinity1/8300 in the range 4000-400cm^{-1} with resolution 4 cm^{-1}.

MEASUREMENT

The density of glass samples have been measured by Archimedes's principle with pure benzene as the immersion fluid. All the measurement were made using K Roy balance. The experiment was repeated five times to get accurate value of density. The density was calculated according to known formula.

$$d_{exp} = \frac{Wa \times d_b}{(Wa - W_b)} \quad \ldots\ldots\ldots\ldots \quad (2)$$

Where, Wa is the weight of sample in air, Wb is the weight of sample benzene and d_b is density of buoyant (benzene) at room temperature.

Molar volume is calculated by the formula.

$$Vm = \frac{M}{d_{exp}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

Where, M is the molecular weight of sample.

RESULTS AND DISCUSSION

1. X- RAY DIFFRACTION (XRD)

The XRD spectra of investigated samples have been found as shown in Fig.1. X – Ray diffraction patterns recorded for all samples show a diffuse scattering over range of angles (2θ from 10˚ to 100˚), which confirms amorphous nature of the samples.

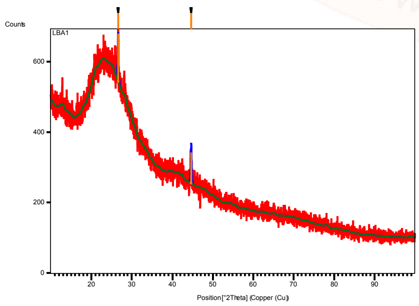

Fig.1. XRD of LBA1 sample

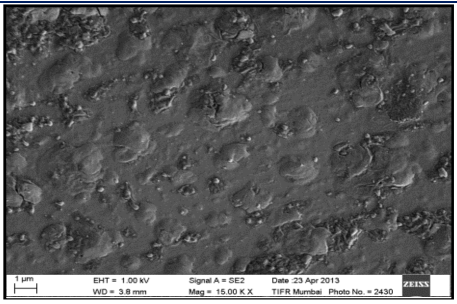

Fig.2. SEM of LBA2 sample

2. SCANNING ELECTRON MICROSCOPY (SEM)

To study the surface morphology, scanning electron microscope results are obtained and are shown in Fig.2. It is clearly visible from the scan that the prepared glasses appear a homogeneous structure of glass flake suggesting highly amorphous phase. The result of XRD and SEM shows that the prepared glasses are amorphous in nature.

In the photograph of SEM, It has been observed that the structure of glass sample is changed and compactness increases due to addition of glass former Al_2O_3, glass converted in to glass ceramics. It reflects the effect of glass former.

3. DENSITY AND MOLAR VOLUME

The variation of density and molar volume with mole percent of Al_2O_3 and former ratio is depicted in Fig.3. It is observed that density of glass increases from 2.28 to 2.58 g cm^{-3} while molar volume decreases from 23.49 to 23.32 cm^3 with increasing modifier content (Li_2O + Al_2O_3) in the glass system. A possible explanation of the general increase in density is due to change in the structure of glass with oxide content, Li_2O and Al_2O_3. It is believed that the presence of Li_2O increases the density of glass due to effect of Li ions which are situated in cavities in the empty space of network. The availability of more oxygen from Li_2O shifts the coordination (BO_3) to (BO_4). Molar volume indicates the spatial distribution of the oxygen in the glass network. The gradually decrease in molar volume can be attributed to closing up of glass structure.

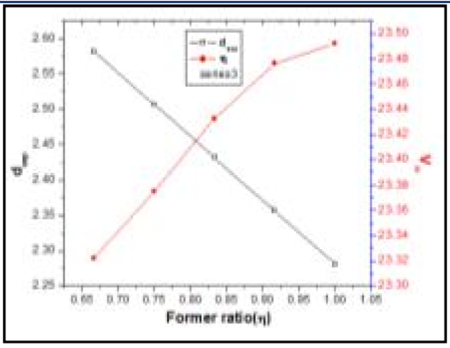

Fig.3: Variation of d_{exp} and Vm against former ratio

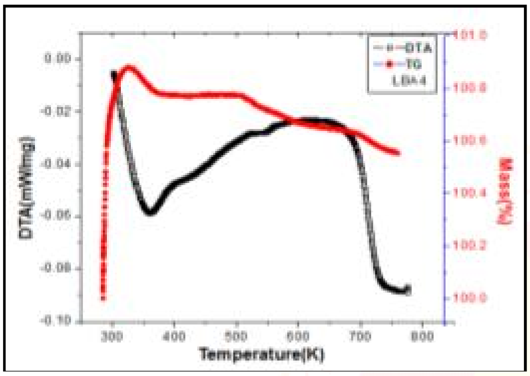

Fig.4 Tg-DTA of glass sample LBA4

4. DIFFERENTIAL THERMAL ANALYSIS

Fig 4 shows Tg-DTA of glass sample. It has been observed that in the series LBA1-LBA5 glass transition temperature is shifted to higher value up to 15 mole percent of Al_2O_3. The reduced glass transition temperature is high for 15 mole percent of Al_2O_3 and it has higher value of ΔTx. It indicates that this sample has higher thermal stability of super-cooled liquid region against crystallization.

5. FOURIER TRANSFORM INFRARED RADIATION (FTIR)

The results have been discussed on the basis of method given by Condrate and Tarte[16-17] by comparing experimental data of the glasses with those of related crystalline compounds. The characteristic curve for B_2O_3, Li_2O and Al_2O_3 were used as reference point in the discussion. The structural analysis of oxide glasses is carried out by using following information [18-19].

Fig.5 shows FTIR spectra of investigated samples. The FTIR absorption bands obtained for the series(LBA1-LBA5) are center at 418cm^{-1},447cm^{-1} 1490 cm^{-1}, 509 cm^{-1}, 700 cm^{-1}, 785 cm^{-1}, 870 cm^{-1}, 900 - 1100 cm^{-1}, 1273cm^{-1}an 1423cm^{-1}.The band observed at 418-447cm^{-1} indicate presence of lithium oxide in the sample. The band appears at 490 cm^{-1} is assigned to symmetrical stretching vibrations of BO_4 unit. The band center at 700 cm^{-1} is attributed to vibration of chain type metaborate group and no noticeable change occurs in the sample.[31] In the range 1200 – 1600 cm^{-1}, we have observed center band at 1273 cm^{-1} and 1423 cm^{-1} which is assigned for the B-O band asymmetric stretching vibration from BO_4 group.

In all samples the weak band appears around from 417 cm^{-1} showing presence of Lithium Oxide and another band appear around 478cm^{-1} which can be due to vibration of Lithium cations. The bands are significantly appears in Al_2O_3 content samples because Al has higher mass than Boron and Al is substituted in the glass structure. In the investigated samples of these series, the band between 490cm^{-1} and 625 cm^{-1} is prominent, which shows that Al_2O_3 enter in the glass network mainly as both It is revealed that in all samples with increasing Al_2O contents the intensity of peak near 1000 cm^{-1} goes on increasing following decrease in the intensity peak near 1500 cm^{-1} which attributes conversion of BO_3 group to BO_4. But change intensity peak is not large, which indicates that increase in BO_4 group is not prominent. In the sample occurs in the region 1200-1600 cm^{-1}, which indicate that there is asymmetric stretching relaxation of B-O band of trigonal BO_3 unit. In all, AlO^{-6}octahedral may be in modifying position as AlO_4 tetrahedral groups. The absorption bands due to AlO_4 or AlO_6 groups are located in the same position as the position of borate group. There is no existence of absorption peak at 806 cm^{-1} indicates the absence of boroxol in our system of glasses hence consists of only BO_3 and BO_4 groups. The band appears above 1600 cm^{-1} that is attributed to presence of water and O-H bond vibrations. For the samples LBA3 and LBA5 shows that some peaks shift to lower wave number, while some glass peaks are more defined and are observed at higher wave number suggesting structural changes in glasses with composition. The shifting of peaks towards lower wave number suggests compactness in glass structure at these compositions. This result may be supported by increase in density with decreasing molar volume.

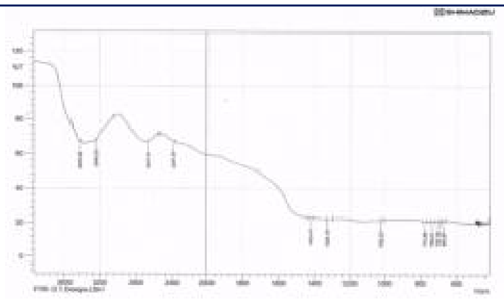

Fig.5 (a) FTIR of sample LBA1

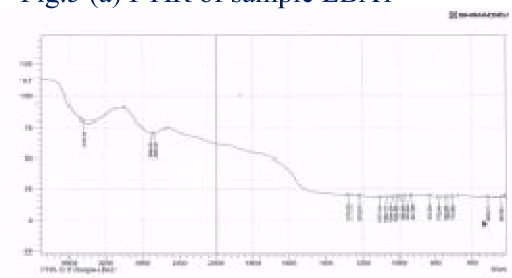

Fig. 5(b) FTIR of Sample LBA2

CONCLUSION

According to the results obtained, it can be concluded that investigated glass samples are composed of glassy phase. The increase in mole percent of Al_2O_3 changes the structure of sample from partial crystalline phase to fully glassy phase. The results of SEM are same as that of XRD results. From FTIR results, it is concluded that Al_2O_3 enters in the glass network as modifier and former. The BO_3 and BO_4 act as network structural group while lithium and aluminum appear in interstitial positions. Formation of BO_3 and BO_4 units with increase in mole percent of Li_2O and Al_2O_3 is also confirmed by FTIR spectroscopic studies. The density of glass increases and molar volume decreases with increase in mole percent of aluminum oxide.

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GAS SENSING TECHNOLOGIES: REVIEW AND CHALLENGES

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ABSTRACT

This paper reviews the descriptions, evaluation, comparison and recent developments in existing gas sensing technologies. A classification of sensing technologies is given, based on the variation of electrical and other properties. Detailed introduction to sensing methods based on electrical variation is discussed. Sensing technology has been widely investigated and utilized for gas detection. Due to the different applicability and inherent limitations of different gas sensing technologies, researchers have been working on different scenarios with enhanced gas sensor calibration. The rapid development of material science and semiconductor technology had a strong effect on gas sensor technology in the past. This trend may be extrapolated to the future; the "More than Moore" principle will be valid in the semiconductor gas sensor field too[19][3].

Keyword: *Metal oxide semiconductor sensor, gas sensing methods; sensing materials; sensitivity; selectivity*

INTRODUCTION

Devices used to the detecting or measuring the chemical or physical quantities in the form of electrical signal are called gas sensors that quantities can be temperature, sound, pressure etc. Day by day the use of sensors significantly increases in human life such as in biomedical and automobile industry. It needs to develop new technologies. Our requirement for good sensors are highly sensitive, low cost and fast response, high reliability and low power consumption. This leads to miniaturized sensors[17].

Gas sensors are used in many industrial, medical, and commercial applications. For example, oxygen sensors are used in the monitoring of combustion engine environment to increase engine performance and reduce emission of green house gases . Ammonia sensors are important for monitoring ambient ammonia concentration since it is related to many environmental issues such as acidification, human health, and climate change through particle formation. In addition to controlling industrial processes and monitoring air quality , CO sensors are also widely used in food and medicine packages as a means of detecting spoilage[12].

Recently, gas sensing, as a typical application in intelligent systems, is receiving increasing attention in both industry and academia. Gas sensing technology has become more significant because of its widespread and common applications in the following areas:

(1) industrial production (e.g., methane detection in mines);
(2) automotive industry (e.g., detection of polluting gases from vehicles);
(3) medical applications (e.g., electronic noses simulating the human olfactory system);
(4) indoor air quality supervision (e.g., detection of carbon monoxide);
(5) environmental studies (e.g., greenhouse gas monitoring).

During the last fifty years, different studies have established various branches of gas sensing technology. Among them, the three major areas that receive the most attention are investigation of different kinds of sensors, research about sensing principles, and fabrication techniques. In this paper current research status and recent developments in the gas sensing field are reported, to discuss potential future interests and topics[19].

Metal oxide semiconductor gas sensors are utilised in a variety of different roles and industries. They are relatively inexpensive compared to other sensing technologies, robust, lightweight, long lasting and benefit from high material sensitivity and quick response times. They have been used extensively to measure and monitor trace amounts of environmentally important gases such as carbon monoxide and nitrogen dioxide.It is highly desirable that metal oxide semiconductor sensors have a large surface area, so as to adsorb as much of the target analyte as possible on the surface, giving a stronger and more measurable response(especially at low concentrations) [6].

Air quality monitoring is becoming a popular application as pollution is an increasing problem in urban areas, directly connected to the increased density of combustion-powered vehicles. Many studies have also demonstrated the close link between urban air pollution and human health. There are different gas sensor technologies that can be used in such devices . Metal-Oxide Semiconductor (MOX) gas sensors are cheap, small in size and lightweight, which is beneficial for their use in pervasive mobile sensing systems for environmental monitoring . Their biggest downsides are problems related to drift and especially their significant energy consumption. This energy is needed to activate the interaction with a certain gas for concentration measurements, and the sensing layer of a MOX gas sensor needs to be heated up for long periods (few minutes). Manufacturer instructions usually propose continuous heating with up to 100 mW power, which is too high for small-size batteries[5].

Classification of Gas Sensing Methods: To evaluate the performance of gas sensing methods or gas sensors, several indicators should be considered:

(1) sensitivity: the minimum value of target gases' volume concentration when they could be detected;

(2) selectivity: the ability of gas sensors to identify a specific gas among a gas mixture;

(3) response time: the period from the time when gas concentration reaches a specific value to that when sensor generates a warning signal;

(4) energy consumption;

(5) reversibility: whether the sensing materials could return to its original state after detection;

(6) adsorptive capacity (also affects sensitivity and selectivity);

(7) fabrication cost.

Besides, gas sensors designed for the market must guarantee the stability of their operation, in other words, they should exhibit a stable and reproducible signal for a period of time. There are several factors leading to gas sensor's instability:

(1) design errors (which should be avoided);

(2) structural changes, such as variations of grain size or grain network;

(3) phase shifts, which usually refers to the segregation of additives doped with sensing materials;

(4) poisoning triggered by chemical reactions;

(5) variation of the surrounding environment.

In order to solve these problems, the following methods could be considered:

(1) using materials with chemical and thermal stability;

(2) optimizing elemental composition and grain size of sensing materials;

(3) utilizing specific technology during surface pretreatment of sensors.

Among those indicators mentionedabove, sensitivity and selectivity are the two main indicators.

GAS SENSOR: BRIEF REVIEW

a. Carbon Nano Tube:

In 1991 the carbon nanotubes discovered by Japanese physicist Sumio Iijima. Researchers later developed single wall carbon nanotube (SWNTs) -based gas sensors which make the great impact on sensor industries. The CNTs have large surface area to volume ratio making it a very sensitive device[7].

Keat Ghee Ong, Kefeng Zeng proposed A Wireless, Passive Carbon Nanotube-Based Gas Sensor, the application of multiwall carbon nanotubes (MWNTs) for remote query detection of carbon dioxide, oxygen, and ammonia based upon the measured changes in MWNT permittivity and conductivity with gas exposure. The transduction platform used in thiswork is a planar, inductor-capacitor resonant-circuit (LC) sensor. A thin layer of gas-sensitive MWNT-SiO composite is placed upon the interdigital capacitor of the LC sensor; as the permittivity and/or conductivity of the adjacent MWNT-SiO composite changes, so does the sensor resonant frequency that remotely monitored through a loop antenna [20]. The passive nature of the LC sensor enables long term monitoring without battery lifetime issues, and the wireless nature of the platform enables long-term gas monitoring from within sealed, opaque containers[12].

In 2015 Narendra Kumar, Ashish Singh Baghel et.al fabricate carbon nanotube (CNTs) based two terminal device for gas sensing applications. Thematerial used for the fabrication of gas sensor is single and multi-walled CNTs powder with the average lengthof 3-10 micro meter. Due to the self-association property of CNTs in suspension, we dis aggregate and uniformlydisperse CNTs to make the device. Author find that Nickel contactdevices showed maxImum conductance andAluminum contact devices showed minimum conductance, copper devices were intermediate of the two. Contact resistance of the device mainly depends on the schottky barrier height. The work function of different metal and the Schottky barrier establishes that the CNT must be p-type with work function value around 6 eV[7].

b. MEMS based sensing:

D. Sparks, R. Smith et.al discussed a new MEMS-based density and binary gas concentration sensor. The micromachined sensor is made using a resonating silicon tube. Gas density and concentration test data over pressure for air, hydrogen, nitrogen, argon, methane, carbon dioxide, sulfur hexafluoride and gas mixtures are presented. The measurement of the density low pressure (101–400 kPa) hydrogen is demonstrated. Coupling binary gas concentration and density measurements of low pressure, light gases like hydrogen and methane opens up new sensing applications like fuel cells, energy management, chemical and semiconductor processing.

This paper examines the use of a resonating micromachined silicon tube for density and binary gas concentration measurements. Special attention is given to light, low pressure gases like hydrogen and nitrogen which have not been measured with conventional metal Coriolis mass flow and density meters due to the high materialdensity and thickness of the metal tubes[11].

Cecilia Occhiuzzi, Amin Rida, Gaetano Marrocco, and Manos Tentzeris proposed RFID Passive Gas Sensor Integrating Carbon Nanotubes, Carbon nanotube (CNT) composites are sensitive to the presence of gases due to their high surface-to-volume ratio and hollow structure that are well suited for gas molecule absorption and storage. Such sensing capability is here integrated with UHF RF identification (RFID) technology to achieve passive and lowcost sensors, remotely readable. CNT film (buckypaper) is used as a localized variable resistive load integrated into a tag antenna, which becomes able to transduce the presence of hazardous gas in the environment, ammonia in this case, into a change of its electromagnetic features. The dynamic range and the hysteresis of the radio sensor are investigated by simulations, equivalent circuits, and articulated experimentations within a true RFID link, providing the proof of concept and some guidelines for tag design[2].

c. Portable gas sensor

In 2016 Michele Magnoy, Vana Jelicic et.al proposed Low-Power Gas Sensing using Single Walled Carbon Nano tubes in Wearable Devices In this paper, author present a two-stage gas sensing concept where novel multiple-Single-Walled Carbon Nanotubes (SWCNT) are proposed as detectors for an energy-hungry metal-oxide (MOX) semiconductor gas sensor. We simulate the system performance combining the low power consumption of SWCNT gas sensors and the more mature MOX sensor to achieve an energy-efficient wearable device able to monitor the air quality continuously while achieving long lifetime. We perform simulations using measured power consumptions for two event-driven scenarios to evaluate the power consumption reduction and lifetime extension in a wearable mobile context. Our results show that the proposed approach prolongs node lifetimes by 30 times compared to adaptive duty-cycling with only MOX gas sensors. We also propose that the nanotube recovery time issue can be overcome by using four single nanotubes on the same chip, which results in an extension of lifetime[5].

In this paper, Author proposed a multiple-SWCNTs gas presensing concept for wearable devices to continuously monitor the air quality and detect quickly dangerous situations in mobile applications. Author presented a sensor wake-up driven approach for energy-efficient gas monitoring which can be used in a wide range of applications. Our approach benefits from the low-power consumption in continuous mode enabled by the SWCNTs and acceptable response time due to multiple-SWCNTs and measurements enabled by the MOX gas sensor. The novel approach proposed with four SWCNTs sensors overcomes the limit of the long recovery time of a single SWCNT without increasing the power consumption. We demonstrated, by simulation, that with four SWCNTs it is possible both significantly to increase the lifetime, allowing longer period where the MOX is off, and to reduce the reactivity time. Simulations using power consumption values of a developed wearable device demonstrates that SWCNTs, despite their technological immaturity, already enable a significant lifetime prolongation of the wearable device, of up to 30 times more than duty cycling approach, depending on the scenario. These results are also promising for several application such as IoT and building monitoring.

d. Metal Oxide Gas Sensor:

DUE TO the easy fabrication, facile operation and relatively high sensitivity, metal oxide semiconductor (MOX) gas sensors have been widely adopted as inflammable and explosive gas alarms, which are working for gases at relatively high concentration of percent per million (ppm) to percentage levels. In recent years, people are aiming at detecting the low concentration gases at sub-ppm levels for health, environment and so on The general method is to improve the gas response of MOX sensing materials such as SnO2, In2 O3, ZnO, etc., by ways such as doping with other elements, surface functionalization, heterojunction,core/shell structure, Micro-Electro-Mechanical System fabrication, and so on[8].

In 2017 Xinyuan Zhou, Ying Wang et.al discussed Amplifying the Signal of Metal Oxide Gas Sensors for Low Concentration Gas Detection In this paper, a widely applicable amplification circuit is designed and fabricated to evidently enhance the signal of the MOX sensors by adding a field effect transistor (FET) into the conventional circuits. By optimizing the FET parameters and the loading resistance, this amplification circuit enables the commercial Figaro TGS2602 toluene sensors response effectively to the highest permissive limit (0.26 ppm) of toluene in indoor air of cars, with the detection limit of ∼0.1 ppm. Furthermore, this circuit can also make the commercial Hanwei MP502 acetone sensors and MQ3 ethanol sensors response to the 1–2-ppm acetone in breath of diabetes and 2-ppm ethanol for fast and effectively drinker driver screening. The mechanism is investigated to be the gate voltage induced resistance change of the FET, with the highest theoretically estimated and experimentally measured magnification factor of 5–6. This FET amplifier can effectively enable the ppm level commercial MOX sensors response to subppm level gases, promising for MOX gas sensor integration andalso for other kind of resistive sensors.This signal amplification circuit shows the advantage in low concentration gas detection in environment and health, which can be readily integrated using the commercial electronics. And this circuit design is also promising in other kind of sensors to extend the detection limit to low concentrations.

George F. Fine, Leon M. Cavanagh et.al in 2010 reported Metal Oxide Semi-Conductor Gas Sensors in Environmental Monitoring, In this review the nature of the gas response and how it is fundamentally linked to surface structure is explored. Synthetic routes to metal oxide semiconductor gas sensors are also discussed and related to their affect on surface structure. An overview of important contributions and recent advances are discussed for the use of metal oxide semiconductor sensors for the detection of a variety of gases—CO, NOx, NH3 and the particularly challenging case of CO2[6].

CONCLUSION

The development of semiconducting metal oxides as gas sensors has accelerated over the past 20 years. Increasingly (as we have briefly shown) these sensors are being used increasingly in the monitoring of environmentally important gases. Metal oxide semiconductor sensors have been shown to be sensitive to a large range of gases, with responses varying with target gas concentration and device operating temperature. These properties can be tailored the specific environment in which the sensor is to be used, by understanding the material science involved. Advances have been made in the understanding of materials chemistry and materials processing such as doping, deposition temperatures, and annealing temperatures. These have been shown to have a profound effect on the material structure and subsequently the gas sensing properties of the sensors.

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SURFACE & DOMAIN ANALYSIS IN TIO_2 DOPED $KNBO_3$ SINGLE CRYSTAL

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ABSTRACT

Synthesis of TiO_2 doped $KNbO_3$ single crystal by flux method is reported here. The effect of TiO_2-doping on phase transition temperatures of $KNbO_3$ single crystals was investigated using dielectric studies. The phase transition temperatures were found to be 240°C and 440°C with small dielectric dispersion due to doping as compared to reported by others. The domain studies were carried out using metallurgical microscope. This study reveals the growth centres for the layer type growth. Also some domain lines piercing the different layers are seen.

Keywords: *TiO_2 doped $KNbO_3$, Single Crystal, Dielectric Study, Surface Study, Domains.*

INTRODUCTION

Lead-free materials are in great demand due to environmental concerns. One of the most important groups of compounds in the study of ferroelectricity and structural phase transitions is perovskite oxides with the general formula ABO_3 [1]. The niobate single crystals are of a great interest for modern technology because of their good electro-optic, nonlinear optic and acousto-optic properties. Among them potassium niobate ($KNbO_3$) is a primary candidate for many applications in the fields of optical signal processing, dynamic holography, and optical frequency conversion [2,3]. It is known to be difficult to grow its bulk single crystals from melt due to KN's incongruent melting and the double solid-state phase transformation properties, such as its cubic structure above 435°C, tetragonal below it, and then at 225°C turning orthorhombic [4]. The $KNbO_3$ is a perovskite type ferroelectric material. The ideal cubic (C) perovskite structure has a general formula ABO_3 which is described as a cubic unit cell with the corners occupied by a large cation ("A", such as Pb, Ba, Ca, K, Na, etc.), the center by a smaller cation ("B", such as Ti, Nb, Mg, Zr,etc.), and oxygen in the face's center. Because of the interest in this material for high frequency, electro optical devices, measurements of its dielectric properties have been performed on $KNbO_3$single crystals as well as pure and doped ceramics[5-9].

The large sized single crystals have been grown successfully in our laboratory using reheating and re-soaking mechanism as reported by Deshmukh & Ingle[10] . The effect of TiO_2- doping on dielectric properties and domains of $KNbO_3$ single crystals have been investigated in this paper.

MATERIALS AND METHODS

The TiO_2 doped $KNbO_3$ single crystals were prepared by the solid state flux method. The starting materials K_2CO_3 (99.99% Merck) and Nb_2O_5 (99.99% Merck) were taken in the molar ratio of 1.2:1 and the dried materials were grounded together in a mortar. The dopant TiO_2 (99.99% 10mg) was added to the mixture of K_2CO_3 and Nb_2O_5.

This mixture was grounded together in theS mortar for 6 hours and placed in a 50 ml platinum crucible covered with a platinum lid. The crucible was heated till 900°C at the rate of 50°C/h. After a temperature of 900°C, the rate of heating was reduced to 20°C/h, till a temperature of 1080°C was reached. The crucible was maintained at this temperature for a period of 24 h. After soaking for 24 h, the homogeneous mixture was then cooled to 840°C at the rate of 20°C /h to allow for crystallization. The material was reheated, to 1000°C, maintained at this temperature for 18 h and slowly cooled to room temperature at the rate of 50°C /h for the complete crystal growth.

An x-ray powder diffraction pattern was recorded for the crystal using X-ray diffractometer with monochromatic Cu Kα radiation at glancing angles 5 and 80°. The samples for dielectric measurements were made by cutting the crystal ~5mm diameter and ~ 2mm thickness. Then the samples were polished and cleaned. The experiments were carried out to determine dielectric constant, conductivity and loss tangent at frequency range up to 200 kHz using Wayne-Kerr LCR meter. Also domain studies were performed on these crystals under powerful metallurgical microscope using reflected light.

results and discussion

The crystalline nature of Fe-doped $KNbO_3$ crystal samples was confirmed by XRPD studies and the results are shown in Figure1. The lattice parameters were calculated using JCPDS data cards and the software's such as Crysfire, Check Cell, Cell 151 etc. The lattice parameters were found to be a = 5.6821 Å, b = 3.9609 Å and c = 5.7064 Å with volume of the unit cell V=128.43 Å^3. The space group found to be PCCA belonging to orthorhombic crystal system. [11]

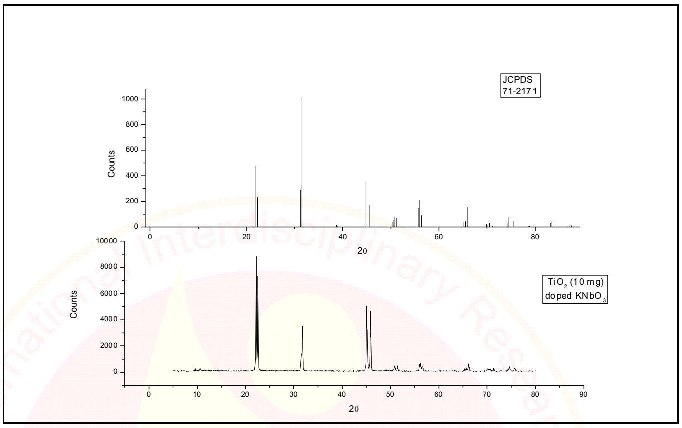

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FIGURE 1. XRPD of TiO_2-doped $KNbO_3$ single crystal.

Dielectric constant variations with respect to temperature were recorded at 1 kHz.

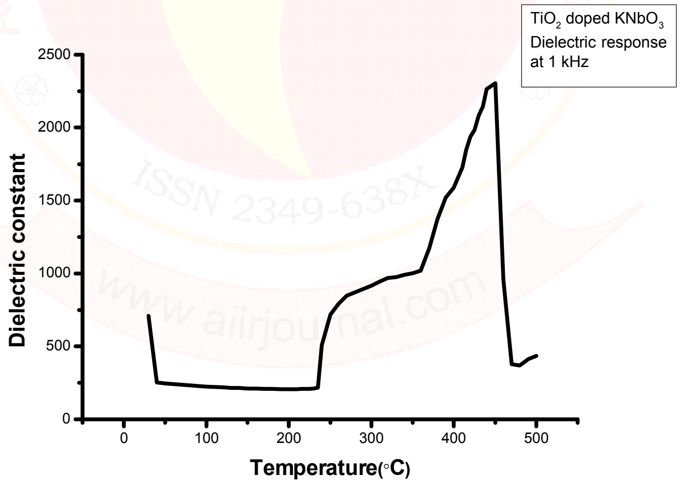

FIGURE 2: Variation of dielectric constant w. r. to temperature for TiO_2-doped $KNbO_3$ single crystal.

From Figure 2, it is clear that dielectric constant shows anomalies at 240^{o}C and 440^{o}C.. These two temperatures may be attributed to structural phase transitions (from orthorhombic to tetragonal and tetragonal to cubic) and the Curie temperature (Tc), where the ferroelectric properties of the material cease to exist. The huge increase in dielectric constant near (Tc) for the present material can be explained by the temperature dependant characteristics of domain wall motion. At low temperature it is difficult for domain to move, so the extrinsic contribution from the domain wall to the dielectric response is small. At high temperature above Tc the ferroelectric phase has translated into paraelectric phase [12].

From Figure 3, it is clear that dielectric constant ε decreases with increasing frequency, indicating dielectric dispersion with frequency. The dielectric dispersion is observed at 27^{o}C with frequency. The dielectric dispersion with frequency shown by the material is due to Maxwell-Wagner [13-14] type interfacial polarization. The large value of dielectric constant at low frequency is attributed to the presence of all types of polarization, whereas at higher frequencies the dominant contribution to dielectric constant is from electronic polarization only.

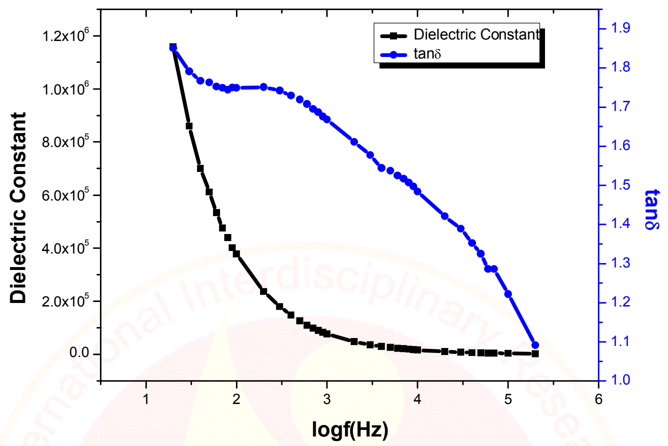

FIGURE 3. Plots of dielectric constant and $\tan\delta$ w.r.to frequency at a 27^{o}C.

Dielectric loss (tan δ) almost decreases linearly with frequency. The physical significance of tan δ is the energy dissipation in the dielectric system which is proportional to the imaginary part (ε") of the dielectric constant.

SURFACE AND DOMAIN ANALYSIS

Domain formation is a very common phenomenon in ferroelectric materials. Domains in single crystals of $KNbO_3$ were extensively studied earlier [15–17]. The domains in ferroelectric crystal can be formed by twinning, when the crystal is subjected to local stresses and internal imperfections

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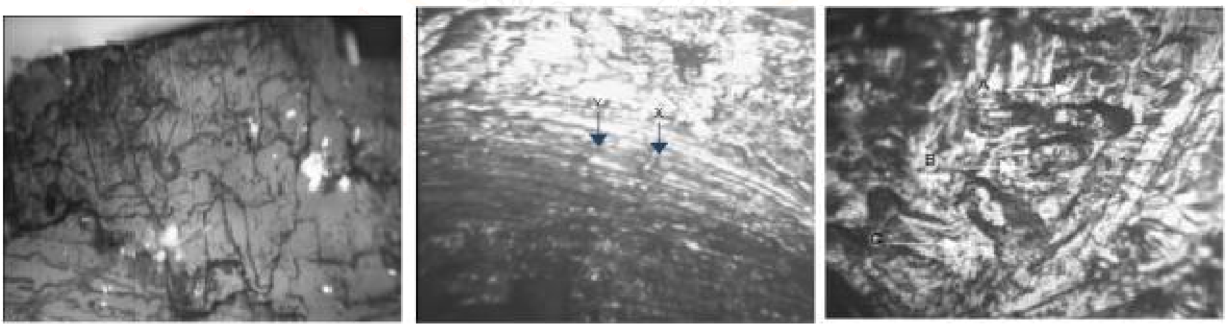

a) b) c)

FIGURE 4(a,b,c): Observation of surface in grown TiO_2 doped $KNbO_3$ single crystals.

Fig. 4 a) shows a photomicrograph of TiO2 (10mg) doped KNbO3 single crystal with 200× magnification. This micrograph shows different growth centres, which are marked by A, B and C. Different layers can be seen to grow from these growth centres. The layer boundaries are not straight but of different shapes and curved. This photograph is an evidence of a typical layer growth in this material. Fig. 4 b) shows another section of TiO_2 (10mg) doped $KNbO_3$ single crystal with 100× magnification. The curved lines are layer boundaries. In this photograph, lines at 'X' and 'Y' are possibly the domain lines on different layers, since there is no change of orientation of lines as there is lateral shift. Possibly these domain lines must have formed at much lower temperature. Fig. 4 c) shows different section of TiO_2 (10mg) doped $KNbO_3$ single crystal with 200× magnification. Fig shows small hillocks marked by A, B and C. Such hillocks usually nucleate in the middle of the layer because of the covalent character of bonding present in the crystal. A natural growth of layer occurs by deposition of atoms or a cluster of atoms at the sites that produce change of entropy. Earlier studies of crystal growth from saturated solutions indicated that a thin but rather dense layer adheres to the external surface of the crystal during growth. It was postulated that atoms or cluster of atoms could move laterally on the absorbed layer until they become permanently fixed on the surface. The loss of atoms from this layer is then instantaneously replaced by other atoms from the surrounding solution. This leads to the growth of crystal by diffusion through the relatively dense absorbed layer. Thus the small structures are formed by a group of atoms diffusing over the crystal surface which are nothing but the hillocks.

conclusions

The single crystals of Fe doped $KNbO_3$ were grown successfully using modified flux melt method. The XRD data confirms single crystal nature of the grown crystals. The obtained crystals are in orthorhombic type of crystalline phase. The lattice parameters were found to be be a = 5.6821 Å, b = 3.9609 Å and c = 5.7064 Å with volume of the unit cell V=128.43 Å^3. The phase transition temperatures were found to be 240^{o}C and 440^{o}C with small thermal dispersion as compared to reported by others. The dielectric dispersion with frequency shown by the material confirms a Maxwell-Wagner type interfacial polarization. Metallurgical reflected microscope study reveals the growth centres for the layer type growth. Also some domain lines piercing the different layers are seen.

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PHOTOVOLTAIC APPLICATION OF ARCHITECTURE DESIGN INDIUM TIN OXIDE/POLYANILINE-ZNO/ALUMINUM

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ABSTRACT

In the present work, we investigated the structural properties, morphological, optical and photovoltaic properties of PANi-ZnO matrix. The architecture design indium tin oxide/polyaniline-ZnO/aluminum was achieved by doctor blead technique. The IV curves for all fabricated cells recorded under the under light illumination (0.0205 Watt/m^2). The 1.5 wt.% ZnO loaded PANi sample shows highest power conversion efficiency of the order of 0.064 %. The main accomplishment of present work is that we extract 0.064% power conversion efficiency from weak light source of incident power 0.0205 Watt/m^2. Such type of photovoltaic devices found great application in Arctic and Antarctica regions.

Keywords: *photovoltaic; indium tin oxide; polyaniline-ZnO*

1. INTRODUCTION

The increasing cost of energy and the environmental impact of energy consumption place extreme pressure on developing world. In this condition, solar energy is the most clean and readily available source of energy. Inspiring from this them, in the present work we planned to investigate the PV properties of ZnO loaded PANi matrix.

Bera et al reported the photoelectrochemical activity of polyaniline hybridized surface defective ZnO nanorods. The absorption spectroscopy of polyaniline hybridized surface defective ZnO nanorods shows significant enhancement in visible absorption [1]. Nguyen et al studied the photoinduced charge transfer within polyaniline-encapsulated quantum dots decorated on graphene. The results of this shows that such materials have great advantage for further applications in optoelectronic devices [2]. Zhu et al investigated the solar cell performance of polyaniline/ZnO nanograss. This work reports the overall light-conversion efficiency enhancement by 60%. This significant value of power conversion efficiency was attributed to the effective charge separation and faster interfacial charge transferring at photoanode [3]. Eskizeybek et al reported the photocatalytic activity for degradation of methylene blue for polyaniline/ZnO nanocomposite. Results of this study indicates that the addition of the ZnO nanoparticles enhance the photocatalytic efficiency [4]. Pandiselvi et al studied the photocatalytic performance of carbon nitride/polyaniline/ZnO ternary heterostructure. This work shows that carbon nitride/polyaniline/ZnO has high-efficient visible photocatalysts characteristics [5]. Wang et al explore the ZnO nanorods and polyaniline nanowires as UV photodetector. The result indicates that the UV photodetector based on ZnO/PANI nanocomposite has good UV photoelectric properties [6].

The present work is focused on the analysis of concentration of ZnO in PANi matrix for PV application. In this context, with typical architecture of PV cell was used to analyze PV properties of ZnO loaded PANi for weak light source of power incident 0.0205 W/m^2.

2. EXPERIMENTAL

The chemicals required for the experimentation in the present work such as aniline monomer, ammonium persulphate and ZnO of AR grade were directly procured from SD fine, India. The oxidative polymerization approch was adopted for the synthesis of PANi. Similarly, for the preparation of ZnO loaded PANi matrix, ex-situ approch was used. For the synthesis of PANi, aniline monomer and ammonium persulphate were taken in molar ratio 1:1 M in beaker under constant magnetic stirring at room temperature (303 K). Different PANi-ZnO matrix were prepared by changing the concentration of ZnO from 0.5-1.5 wt.% with intervel 0.25 wt.%.

The as-obtained PANi-ZnO matrix were characterized by different analytical tools such as X-ray diffraction (XRD), Scanning electron microscopy (SEM), Ultraviolet-visible (UV-VIS), Raman Spectroscopy, Photoluminescence (PL) spectroscopy and Thermo gravimetric-differential thermal analysis (TG-DTA). The XRD patterns of all samples were recorded on Philips PW 1830 using CuK$_\alpha$ radiation of wavelength λ= 1.54 Å. The morphology of samples tested using the JEOL JSM-7500F SEM instrument with an acceleration voltage of 15 kV. The absorption spectroscopy of samples were done through UV-VIS Agilent Cary 60 spectrophotometer. Raman spectra of samples were acquired at room temperature using Bruker Raman spectrometer. The Fluorescence spectra of sample collected using Fluorescence Spectrophotometer (Hitachi F-7500). Thermal analysis of sample was conducted in nitrogen atmosphere using Shimadzu DTG-60h.

For the fabrication of PV cell, ITO was used as transparent electrode and Al as metallic electrode. The ZnO loaded PANi matrix was deposited on ITO plate using doctor blade technique. The IV characteristic of PV cells were mesured at room temperature by using incandescent light bulb radiating light power of 0.0205 Watt/m^2. Different parameters such short circuit current (I_{SC}), open circuit voltage (V_{OC}), fill factor (FF), and power conversion efficiency (η) were determined from IV curve.

3. RESULTS AND DISCUSSION

XRD patterns of pure ZnO, PANi, and 0.5, 0.75, 1, 1.25 and 1.5 wt.% of ZnO loaded PANi matrix is shown in Figure 1(a-g). XRD data shows that ZnO loaded PANi matrix samples have amorphous nature. Only in case of 1.5 wt.% ZnO loaded PANi XRD pattern shows some sharp peaks in pattern. This indicates that at higher concentration of ZnO in PANi matrix can improves the cystallinity index of matrix. The XRD pattern of ZnO (Figure 1 (a)) nanoparticles good agreement with JCPDS file no.36-1451. It shows that ZnO has hexagonal wurtzite ZnO structure (space group C6mc) with lattice a = 3.25 Å and c = 5.2 Å; their ratio c/a ~ 1.60. The average crystallite size was determined using Debye-Scherrer formula,

$$D = \frac{K\lambda}{\beta Cos\theta} \quad (1)$$

where D is average crystallite size (nm), k is shape factor (k=0.89), λ is the wavelength of X-ray source, β is the full width at half maxima, and θ is the diffraction peak angle. The average crystallite size for ZnO nanoparticles was found to be 19.31 nm.

The average chain separation determined for ZnO (0.5-1.5 wt.% with interval 0.25 wt.%) loaded PANi matrix by using the relation,

$$R = \frac{5\lambda}{8Sin\theta} \quad (2)$$

where R is the polymer chain separation in Å, λ is the X-ray wavelength (1.541 Å) and θ is the diffraction angle of prominent peak. The average particle size and average chain separation was determined for ZnO loaded PANi matrix and summarized in Table 1. In Table 1, it is observed that average chain separation has good dependence on ZnO concentration in PANi matrix.

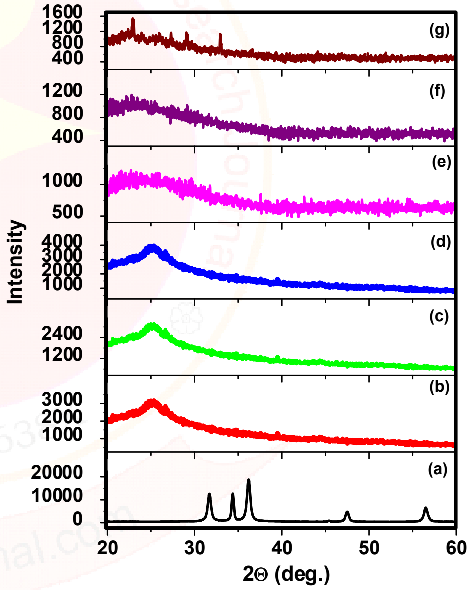

Figure1. XRD patterns of (a) ZnO, (b) PANi, (c) 0.5, (d) 0.75, (e) 1, (f) 1.25 and (g) 1.5 wt% ZnO loaded PANi matrix.

Table 1. Value of average polymer chain separation and particle size for ZnO loaded PANi matrix.

Sample	Average chain separation (Å)	Particle size (nm)
0.5 wt.%	8.28	16.7
0.75 wt.%	20.76	26.3
1 wt.%	0.97	24.1
1.25 wt.%	1.007	21.4
1.5 wt.%	1.030	14.1

Figure 2 (a-e) represents the micrographs of ZnO (0.5-1.5 wt.% with interval 0.25 wt.%) loaded PANi matrix, respectively. SEM images clearly shows that high degree of agglomeration is present in 0.5, 0.75

and 1 wt.% of ZnO loaded PANi matrix (Figure 2 (a-c). The extent of agglomeration is reduced in 1.25 and 1.5 wt.% of samples. Similarly, the SEM images of 1.25 and 1.5 wt.% of samples depicts crystallization. The matrix does not comprises pores on the surface, which indicates the strong interaction exist in crystals [7].

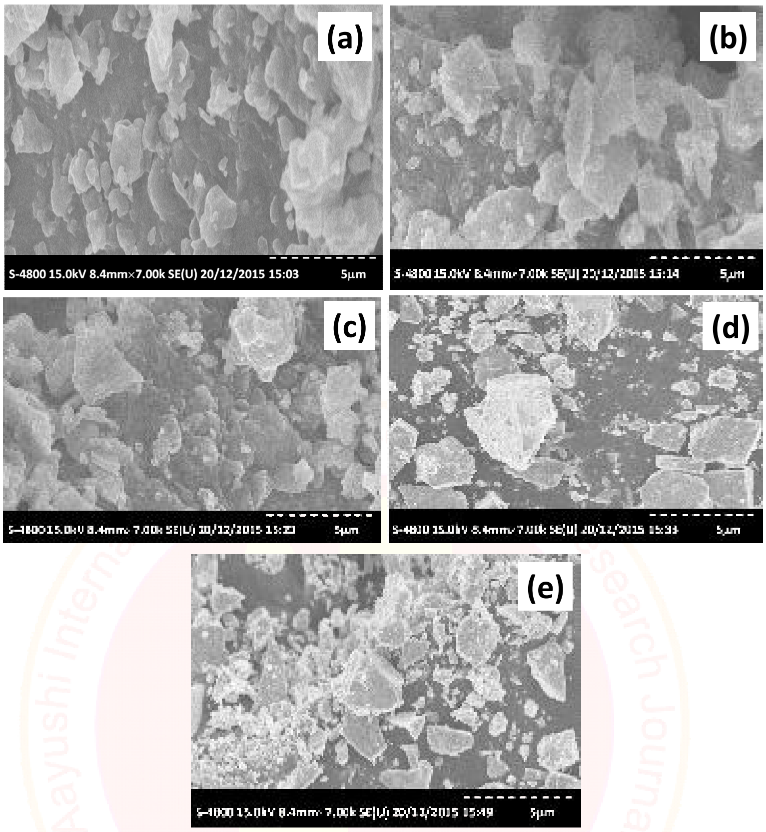

Figure 2. SEM images of (a) 0.5, (b) 0.75, (c) 1, (d) 1.25 and (e) 1.5 wt% ZnO loaded PANi matrix.

The UV-VIS spectrum of ZnO (0.5-1.5 wt.% with interval 0.25 wt.%) loaded PANi matrix recorded at room temperature (303 K) is shown in Figure 3(a-e). With increasing concentration of ZnO in PANi matrix, the sample shows shifting towards the longer wavelength. This phenomenon shows that increasing content of ZnO in PANi matrix, prepares agglomorated regions in the matrix.

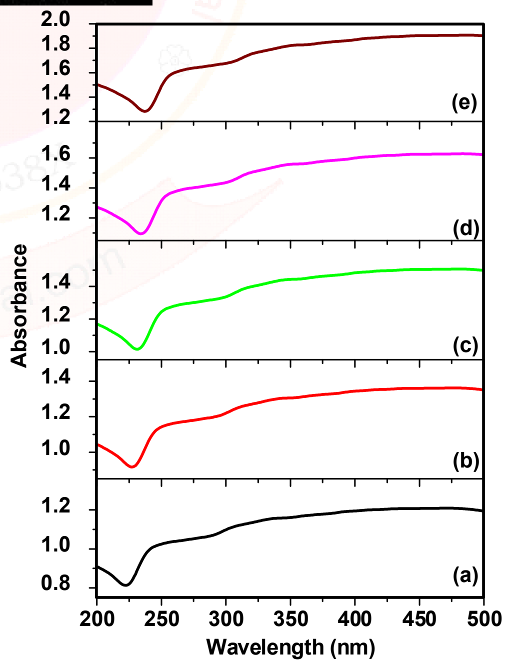

Figure 3. UV-VIS spectra of (a) 0.5, (b) 0.75, (c) 1, (d) 1.25 and (e) 1.5 wt% ZnO loaded PANi matrix.

The optical band gap for ZnO (0.5-1.5 wt.% with interval 0.25 wt.%) loaded PANi matrix is shows

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in Figure 4 (a-e). Theory of optical absorption shows the absorption coefficients α and the photon energy hν for direct allowed transition are related as,

$$\alpha h\upsilon = C(h\upsilon - E_g)^m$$

Where h is Planck's constant, α is absorbance coefficient, C is constant, ν is frequency of photon, Eg is band gap and m is 1/2 for direct band gap semiconductors. By extrapolating straight line to absorption tail portion, we determined optical band gap. From plot of optical band gap, no correlation observed between content of ZnO in PANi matrix and optical band gap. The values of optical band gap ranges between 2.83-3.31 eV.

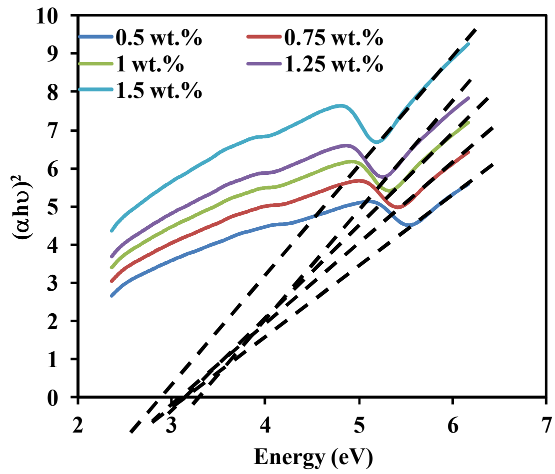

Figure 4. Plot of energy (hν) versus $(\alpha h\nu)^2$ of different wt.% of ZnO loaded PANi matrix.

Raman spectra of ZnO (0.5-1.5 wt.% with interval 0.25 wt.%) loaded PANi matrix is shown in Figure 5 (a-e). A weak peak around 442 cm−1 in the spectra shows characteristics band of hexagonal ZnO, which attributed to the E2(high) non-polar vibration mode [8, 9]. The E1(LO) mode associated with oxygen diffciency, which reflects from ~575 cm−1 band. In ZnO loaded PANI matrix, the peaks appear at ~1165 cm−1, ~1237 cm−1,~1450 and 1605 cm−1, associated with vibrations of C H benzenoid or quinoid stretching, C N benzenoid stretching,C N quinoid stretching and C C quinoid stretching, respectively.

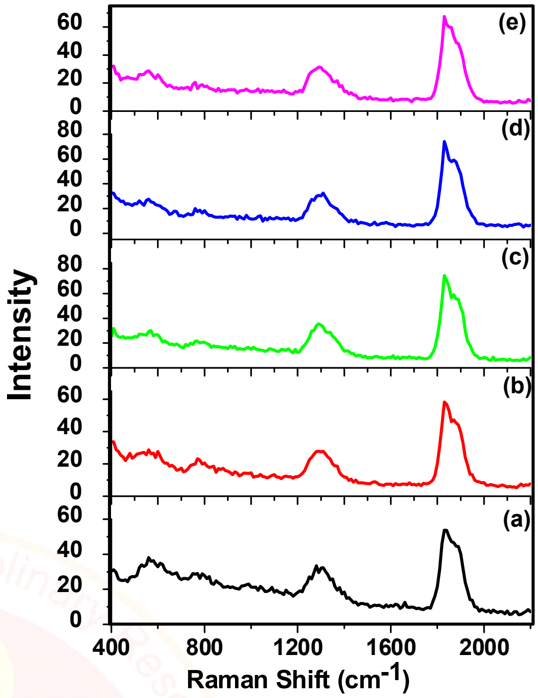

Figure 5. Raman spectra of (a) 0.5, (b) 0.75, (c) 1, (d) 1.25 and (e) 1.5 wt% ZnO loaded PANi matrix.

The PL spectra of ZnO (0.5-1.5 wt.% with interval 0.25 wt.%) loaded PANi matrix is shown in Figure 6 (a-e). The PL spectra of ZnO loaded PANi matrix shows stronger and broader emission in visible region at around 552 nm. This emission in matrix attributed to the recombination of an electron from conduction band edge and a surface fluorescence center situated in the forbidden band [10]. The enhancement in PL intensity not shows dependence on concentration of ZnO in PANi matrix. This may be due to dopant particle of irregular shape and particle size transfer of some energy absorbed by PANI to ZnO particles [11]. The highest PL intensity was observed for 1 wt.% of ZnO loaded PANi matrix.

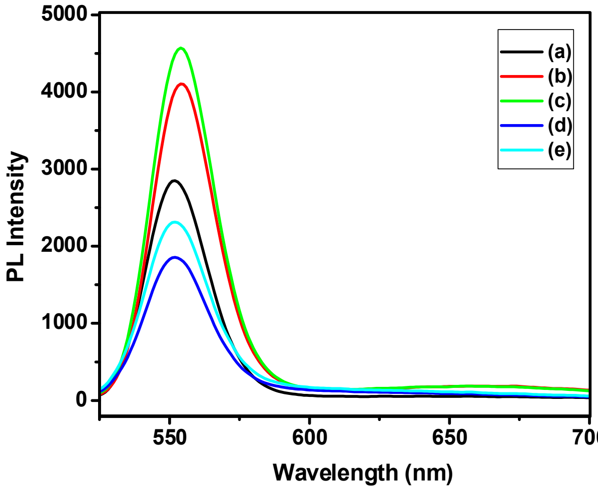

Figure 6. PL spectra of (a) 0.5, (b) 0.75, (c) 1, (d) 1.25 and (e) 1.5 wt% ZnO loaded PANi matrix.

Figure 7 depicts the TG-DTA curve of 1.5 wt.% ZnO-PANi matrix. The significant mass loss of the order of 9.81 % observed up to 375 K. For this mass loss, the endothermic peak associated at 344 K, which indicates the removal of constituted water molecules from PANi-ZnO matrix. Beyond 470 K, matrix another time shows continuous mass loss up to 650 K, which is ascribed to the degradation of polymeric backbone [12].

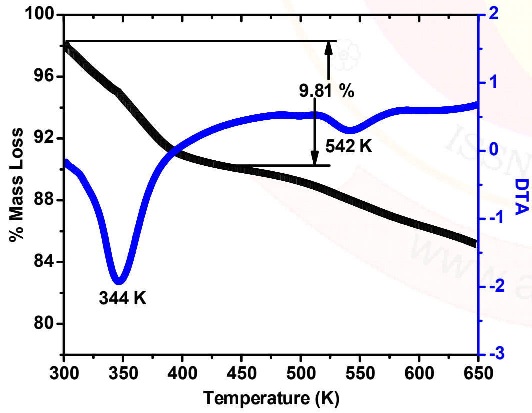

Figure 7. TG-DTA of 1.5 wt% ZnO loaded PANi matrix.IV curves of the ZnO (0.5-1.5 wt.% with interval 0.25 wt.%) loaded PANi matrix based photovoltaic cells is shown in Figure 8. The IV characteristics of all samples recorded under incandescent light bulb radiating light power of 0.0205 Watt/m^2. The separation between light source and PV cell was about 25 cm. Diffrent diode parameters likes open circuit voltage (V_{OC}), short circuit current (I_{SC}), fill factor (FF), and power conversion efficiency (η) measured under these conditions, which were reproduced without any considerable deviation and summarized in Table 2. The fill factor of PV cell computed using relation Eq. (1) [13]:

$$FF = \frac{I_{MAX} \times V_{MAX}}{I_{SC} \times V_{OC}} \quad (1)$$

Whereas, power conversion efficiency (η) of PV cell estimated using the relation Eq. (2) [14],

$$\%\eta = \left(\frac{I_{SC} \times V_{OC} \times FF}{P_{in}} \right) \times 100 \quad (2)$$

The highest value of short-circuit current (I_{SC}) was found to be 138.22 μA for 1.5 wt.% ZnO loaded PANi matrix. Whereas, the maximum value of V_{OC}=204 mV obtained for 1.25 wt.% and 1.5 wt.% ZnO loaded PANi matrix. The highest power conversion efficiency of the order of 0.0640 was obtained for 1.5 wt.% ZnO loaded PANi matrix. This highest value of power conversion efficiency attributed to the morphology of matrix.

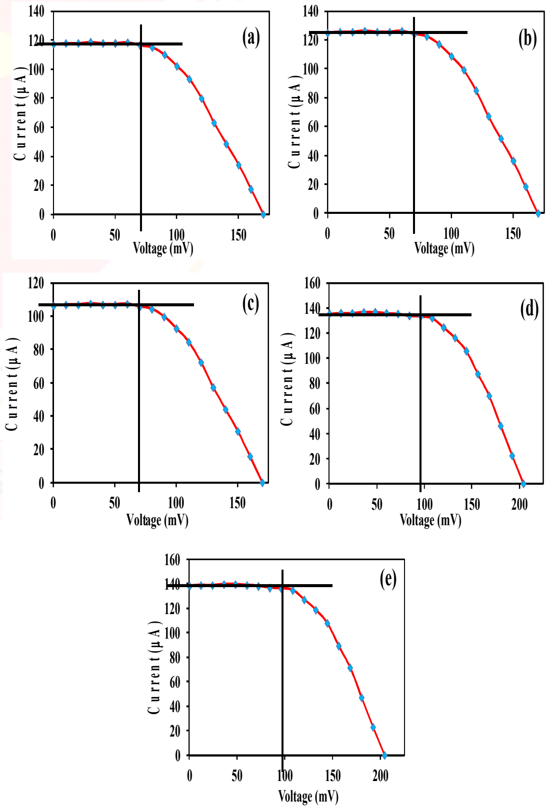

Figure 8. Photovoltaic response of (a) 0.5, (b) 0.75, (c) 1, (d) 1.25 and (e) 1.5 wt% ZnO loaded PANi matrix sandwiched in architecture ITO/PANi-ZnO/Aluminum for incident power 0.0205 W/m^2.

Table 2. The photovoltaic performance of (a) 0.5, (b) 0.75, (c) 1, (d) 1.25 and (e) 1.5 wt% ZnO loaded PANi matrix.

Sample (wt.%)	Imax (μA)	Vmax (mV)	Isc (μA)	Voc (mV)	FF	%η
0.5	116.65	70	117.39	170	0.409	0.0400
0.75	124.21	70	125	170	0.409	0.0426
1	99.69	90	106.33	170	0.496	0.0439
1.25	133.50	96	135.62	204	0.463	0.0628
1.5	136.07	96	138.22	204	0.463	0.0640

Figure 9 (a-e) shows the variation of optical conductivity with wavelength of (a) 0.5, (b) 0.75, (c) 1, (d) 1.25 and (e) 1.5 wt% ZnO loaded PANi matrix, respectively. The optical conductivity values calculated by using Eq. (4),

$$\sigma = \frac{\alpha c n}{4\pi} \quad (4)$$

where α is transmission, c is velocity of light and n is refractive index. The value of refractive index estimated using the Eq. (5),

$$n = \frac{1}{\%T} + \sqrt{\frac{1}{\%T} - 1} \quad (5)$$

where %T is transmission through sample under investigation. It is observed that magnitude of optical conductivity increases with ZnO content in PANi matrix. The highest value of optical conductivity was observed for 1.5 wt.% loaded PANi matrix.

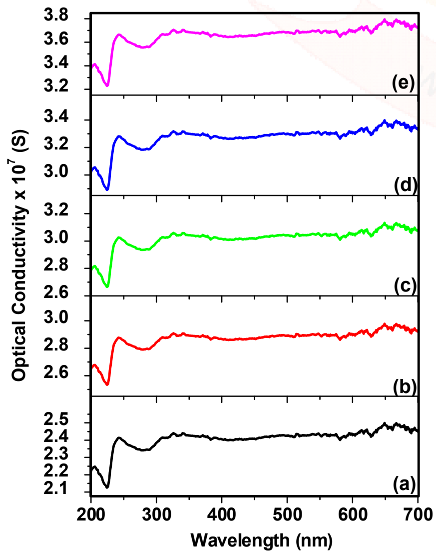

Figure 9. Optical conductivity of (a) 0.5, (b) 0.75, (c) 1, (d) 1.25 and (e) 1.5 wt% ZnO loaded PANi matrix.

IPCE spectrum of sample indicates the lowest energy photon absorbed by material system [15]. Figure 10 (a-e) depicts the variation of %IPCE with wavelength for ZnO (0.5-1.5 wt.% with interval 0.25 wt.%) loaded PANi matrix. The magnitude of %IPCE improves with increasing content of ZnO in PANi matrix. The light-harvesting capacity is result of light-scattering effect. This ability of material can analyze by using SQRT (% IPCE). Inset of Figure 9 shows the variation SQRT (%IPCE) with wavelength. The SQRT (% IPCE) also improves with concentration ZnO in PANi matrix. The %IPCE is determined by using Eq. (3) [16],

$$\%IPCE = \frac{I_{SC}}{P_{in}} \times \frac{1240}{\lambda(nm)} \times 100 \quad (3)$$

Where, I_{SC} is short circuit current, P_{in} is power incident and λ is wavelength.

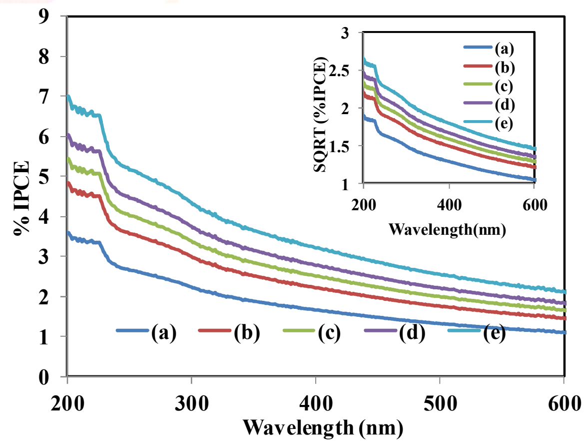

Figure 10. Variation of %IPCE with wavelength in (a) 0.5, (b) 0.75, (c) 1, (d) 1.25 and (e) 1.5 wt% ZnO loaded PANi matrix. Inset shows the variation of SQRT (%IPCE) with wavelength.

CONCLUSIONS

In concluding remarks of present work, with the typical architecture design of PV cell we achieved significant power conversion efficiency from PANi-ZnO matrix with much low power incident 0.0205 Watt/m^2. The power conversion efficiency shows good dependence on content of ZnO in PANi matrix. The power conversation efficiency value ranges between 0.04-0.064 under incandescent light bulb radiating light power of 0.0205 Watt/m^2. Further improvement in power conversion efficiency for PANi-ZnO matrix is possible by controlling over some parameters like thickness of sandwiching material, particle size of dopant and solvent used in the synthesis process.

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OPTIMIZATIONS OF SOFTWARE BLEND BY GENETIC ALGORITHM BASED DECISION SUPPORT SYSTEM IN SENSE OF INTELLIGENT ROUTINE.

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ABSTRACT

The objective of whole concept is based on best utilization of resources available to maximize the profit. This object doesn't focused by any of the software development methodology or pedagogy. Here, through this paper I am trying to achieve the same. Optimization in intelligence sense because such concentration to maximize the profit in software development is done manually as per the trend but here I am trying to achieve the same through generic algorithm based decision support system (DSS). Software blend for profit maximization is one of the important decision making task which involve a lot of experiences and perception. There are many factors of the system develop to develop the software which affects the decision regarding number of modules and its best performance so that the developed software can satisfies the client called software blend. This concept of software blend I am using here to promote the DSS through G.A because in software engineering most of the system analyst does not follow any optimization method attitude for the software blend to maximize the profit by utilizing all the available resources. It is difficult to recognize the optimum blend of software solution which can result in maximum utilization of resources and also maximizing the profit. In some cases blend of software in the form of solution to the existing problem is based on the basis of cost and not on the basis of suitable quality parameters. It follows rapid development speed rather than focusing on strategies for the overall achievements so that we can achieve the benefits of optimization available resources utilization.

There is a need of decision support system to provide assistance throughout the software development life cycle for blending of software solution. This paper deals with the problem of software solution blend. In this paper, a DSS is as knowledge backup to address the above stated problems. The proposed DSS uses Genetic Algorithm as an optimization tool. Here, the sensitivity analysis and what- if analysis features of proposed DSS allows system analyst to achieve the outcomes of variety of combinations of software solution blend.

Keywords: *Software solution blend, Decision Support System, Genetic Algorithm, optimization, profit maximization*

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INTRODUCTION

Software development is an organizational process dealing with various phases of software development life cycle. As per existing trend but here I would like to tress on the concept of profit maximization means same emphasis like to give on profit like other important stages. I would like to newly suggest to system analyst that rather than only concentrating on software development life cycle concepts he should consider the market demand, marketing strategies and current trends, for all software routine lines, at all stages of the software development life cycle including newly introduced i.e. marketing.

This concept suggest to system analyst or the persons playing the role of software project management is to analyze & identify existing trend problems, quantify opportunity size, and determine risks & costs, to make available business cases to senior project manager or higher authorities for decision-making. Once approval is given, project management professionals are responsible for building the right solution for the client in case of special purpose type software and for the user in case of general purpose type software, and associate its sale. One of the important decisions in software project management is related with software solution blend [6]. Software solution blend is a set of various software development lines that a particular company offers for sale. Development line is a set of same software with its different versions, sizes of the organization where it will be implemented, operating systems where it will be installed and tools used to develop content is known as software development line. (Example: Office software suites for Windows, Linux, Android operating system). It can be based on various aspects like problem definition, existing solutions, objectives and budget affordable to client or user. Software project development line is a series of related same software solutions. It is a group of software solutions that are physically similarly in performance, use or features and intended for a similarly in performance, use or features and intended for a similar market.

Now days competitions are cut-throat, there is a need of tool which can help manger to identify software solution blend and software solution line to satisfy client's need and also result in maximization of profit of the company.

Generally, it is found that in many of the company, software solution blend decision is a tedious decision making process which requires lot of experience and insight. There are various parameters which affects the decision regarding software solution blend. Most of the companies do not follow any optimization method approach to identify the optimum blend of software which can result in maximum utilization of resources thereby maximizing the profit. Linear programming and decision theory are some of the tools which can be applied for optimization of software solution blend. Hence, when number software modules and other parameters increases, these tools cannot handle the same problems as it has many constraints and complicated. Genetic Algorithm (GA) can help to solve this problem as it works with a set of potential solutions instead of trying to improve a single solution.[2] The G.A. work with a set of potential solutions instead of trying to improve a single solution. The G.A. doesn't use information obtained directly from the object

VERDICTS

1. Nowadays there is a cut – Throat Competition for survival.
2. Even if linear programming technique of software solution blend is sound but it has not that much approach to generate optimum solution.
3. For the implementation of LPP, analyst needs to have the knowledge of OR and Statistics.
4. it consumes lot of time and need lot of calculations.
5. Software solution blend is mostly decided on the basis of cost and not on the basis of suitable quality parameters.
6. Software solution blend is one of the routine decisions and is based on the experience of system analyst or other higher authorities involve in cost determination.
7. Current trend of software development life cycle has not that much scope to follow mathematical approach for software solution blend.
8. It follows higher production speed rather than focusing on strategies to fully exploits the benefits of optimized resources utilization.
9. The people responsible for the product blend are not aware of the latest tools available for optimization.
10. There is any hardly any tool to analysis system to provide assistance throughout the Project Management for blending of software solutions.

Proposed model:

Decision Support System for software solution blend

There is a need of system which helps project manager or system analyst in decision making regarding software solution blend for software development. The object of this model is to maximize the profit subject to different cost factors involve in software development. The features like compassion analysis and what-if analysis allows the decision maker to see the outcome of different combinations. The problem formulation is stated below.

Here, Objective formula for the optimization is used to

Maximize Profit = $\sum M_i P_j$

Where

M_i- Number of Software Models 1,2,3, …….., i Units.

P_j- Profit gain on each Software models 1, 2, 3,….. j (in Rs/-. units)

Subject to the constraints

i. M_i should not be less than the models required in proposed software solution and clients expectation.
ii. M_i should not be more than the models required in proposed software solution and clients expectation.
iii. $\sum M_i$ should not exceed the capacity of the software development system.

Subject to the condition: M_i and $P_j > 0$.

ASSUMPTIONS

1. Let M1,M2,M3,M4 are four software models in a proposed solution.
2. Let P_1, P_2, P_3, P_4 are the profit earned on software MODELS m_1,m_2,m_3,m_4 respectively
3. Let Demand of M1 =D1, Demand of M2 =D2, Demand of M3 =D3 , Demand of M4=D4
4. Capacity C=(D1+D2+D3+D4)*2
5. Capacity of System development organization is fixed.
6. There is no plan for over time to increase the Capacity of System development organization.
7. All the required resources are sufficient for the development.

Available Data for testing:

Desk 1: Development Plan

Model Cipher	Demand(in unit of time)	Profit (Rs./Model in lacks)
m1	1	1
m2	2	7.5
m3	1	0.50
m4	9	0.25

An Optimization Tool: Genetic Algorithm

The genetic algorithm (G.A.) is used here has following characteristics.

1. The G.A. process is quite simple; it only involves a copy string, partial string exchanges or a string Metamorphosis, all these in random form.[3]
2. Function, of the derivatives, or of any other auxiliary knowledge of the same one.
3. The G.A. applies probabilistic transition rules, not deterministic rules.
4. The G.A. work with the base in the code of variables group (artificial genetic strings) and not with the variables in themselves.
5. The basic genetic algorithm that can be produce acceptable results in many practical problems is composed of three operators.
6. Metamorphosis
7. Crossover
8. Modification

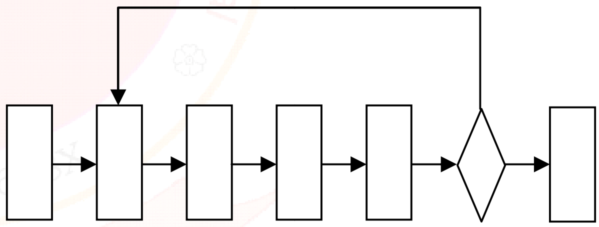
The modification process goal is to allow the genetic information, stored in the good fit ness artificial strings, survive the next generation. The typical case is where the population's string has assigned a value according to its aptitude in the object function. This value has the probability of being chosen as the parent in the reproduction process of a new generation.

The crossover is a process by which a string is divided into segments, which are exchanged with the segments corresponding to another string. With this process to new strings different to those that produce them are generated. It is necessary to clarify that the choice of strings crossed inside those that were choose previously in the reproduction process is random. From the point of view of problem optimization, it is equal to exploitation of an area of the parameters.

As with biological systems the Metamorphosis is manifested with a small change in the genetic string of the individuals in the case of the artificial genetic strings, the Metamorphosis is equal to a change in elementary portion (allele) of the individuals' code. The Metamorphosis takes place with characteristics different to those that the individuals had at the beginning, characteristics that didn't possibly exist in the population. Form the point of view of problem optimization, it is equal to a change of the search area in the parameters. [1]

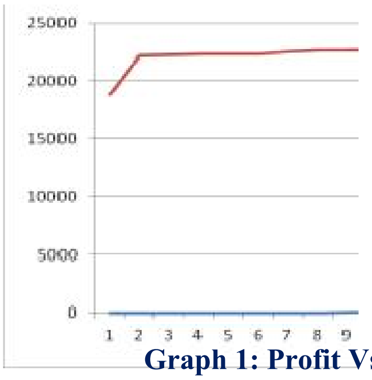
The GA seek their goal recurrently (by generation), evaluating each individual's aptitude in the object function which is in fact the optimization approach.

In this paper GA is used as an optimization tool. In the proposed DSS a population size of 50 was taken. The crossover and Metamorphosis operators were applied in the ratio 95:5. The crossover is of three different type viz. single point, double point and multipoint in the ratio 50:25:25. The implementation of GA for optimization of solution is shown in figure 1.



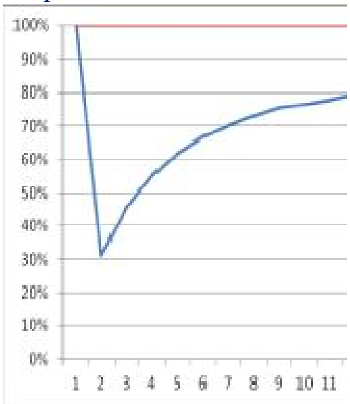
RESULT

Fig. 1 GA Flowchart



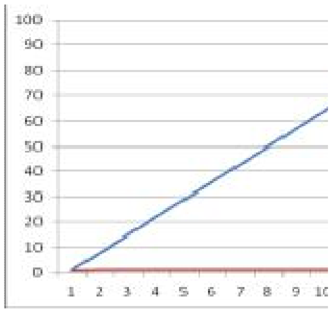
Graph 1: Profit Vs Generations

As shown in the graph, the profit of software solution development blend increases as we apply increase the number of iterations (generations). It also ensures the maximum utilization of available capacity of the plant. The above result is obatined by applying several cycles of GA, Although the solutions obtained is not the optimum but it is much better than the avialble software development blend.



Graph 2: %Gain Vs Generations

As shown in the graph, the percentage gain in the overall profit by applying GA is 20-25% which is quite significant. The improvement is the outcome of few iteration of GA. There is a scope for improvement in the profit as we increase the number of iterations.



The above graph shows that as we move from generation 1 to 2, there is an improvement in the fitness factor it indicates that the solution get better and better as we move ahead. The above graphs show the software development blending ratio.

SOFTWARE PRODUCTS								CAPACITY	PROFIT	GAIN	FITNESS
M1	M2	M3	M4	M5	M6	M7	P8				
1200	1000	850	670	1150	1180	725	915	7690	18826.5	0	0.826884
1200	1000	850	1470	978	1182	774	1046	8500	22186	17.64268	0.974438
1200	1000	850	1478	1150	1002	774	1046	8500	22202	17.65862	0.97514
1904	1007	346	1222	1200	1181	725	915	8500	22263	17.76485	0.97782
1200	1000	850	1470	929	1180	730	1141	8500	22281	17.84453	0.97861
1598	618	903	1407	1153	1180	725	916	8500	22328	17.92951	0.980675
1770	644	705	1407	1153	1180	725	916	8500	22500	18.25353	0.988229
1904	297	850	1399	1223	1180	725	922	8500	22624	18.34914	0.993675
1904	846	369	1407	1153	1180	725	916	8500	22634	18.59878	0.994115
1200	1000	850	1470	815	941	726	1498	8500	22638	19.51239	0.99429
1963	253	903	1407	1153	1180	725	916	8500	22693	20.17104	0.996706
1216	1000	903	1407	1153	473	677	1671	8500	22701	20.22415	0.997057
1201	1000	850	1428	529	1096	725	1671	8500	22728	20.2454	0.998243
1904	840	306	1470	1150	1181	725	924	8500	22768	20.53754	1

Table 2: Obtaining Blending Results.

As shown in the table 2, there is definite improvement in profit without affecting the demand of the products. It is observed that the profit of the software solution blend get increased substantially. It also ensures the maximum utilization of available capacity. The above results are obtained by executing the GA for few runs. As we increase the run, there is possibility to improve the results.

CONCLUSIONS

Software Development Management is an organizational function dealing with the phases like planning, development, implementation, testing and also consider marketing, for all product lines, at all stages of the software development lifecycle. It is observed that the most of the company software solution blending is a day to day decision which requires lot of experience and intuition. There are various parameters which affects the decision regarding the software solution blend. It is proved that with proper application of GA, we can identify the optimum blend of software which can result in maximum utilization of resources thereby maximizing the profit .

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DESIGN OF DATABASE USING GRAPH APPROACH WITH STRATEGIES

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ABSTRACT

Database is not static but rapidly grows in size. These issues include how to allocate data, communication of the system, The coordination among the individual system, distributed transition control and query processing, concurrency control over distributed relation, design of global user interface, design of component system in different physical location, integration of existing database system. Design of database with Strategies using Various Methods. These Methods are concerned with solving the critical problems using Graph for improve the performance of databases.

Keywords:*Database, distributed transition control*

INTRODUCTION

Design of centralized and distributeddatabase is an alternative process that involves developing and refining a database structure based on the information and processing requirement of organization. Initially, a design strategy is significant for designing database. Basically, design strategies have two approaches, top- down and bottom-up.

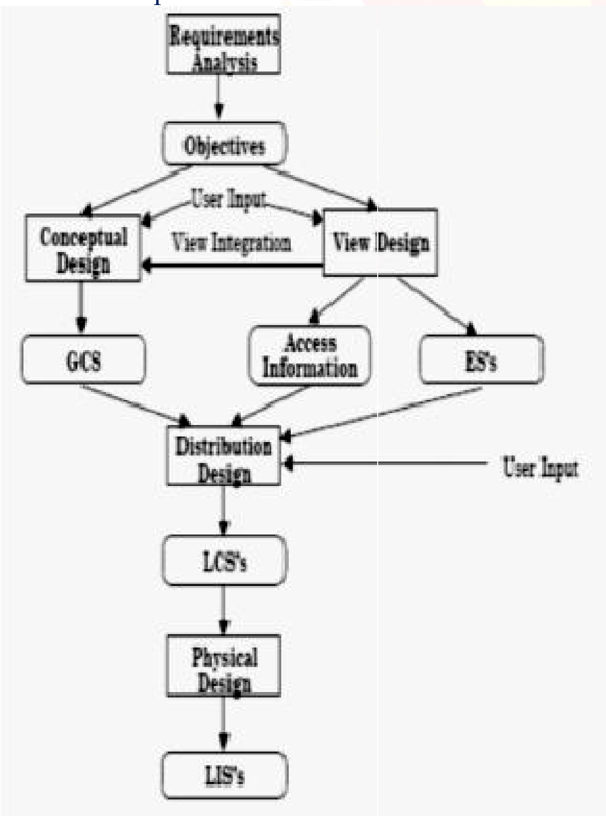

Figure 1: Top-down Design Process

1.1 Top-down approach:-Top-down design process is mostly used in designing system. The process starts from analysis of requirement including study of organisation, defining problems, defining objectives, conditions, scope and limitation. The next steps are conceptual design and view design as per requirement. Entity relationship model is used for conceptual design. The conceptual schema is designed through normalization. It creates abstract data structure to represent real facts. Defining user interface is on the basis of view design. All databases taken together in a distributed database are a virtual view on the basis of conceptual schema. The entity and relationship requirement for all user views should be covered in conceptual schema. The conceptual schema uses defining global conceptual schema. View design activities are input of global conceptual schema and access information collection. Distribution objects need fragmentation and allocation over the system. These aspects use design local conceptual schema. The local conceptual schema maps the physical storage devices. The physical storage device carries out through physical design activity.

1.2Bottom-up approach

The bottom-up approach is convenient when the objective of the design is to integrate existing database system. The bottom-up design starts from local conceptual schema. The next step is gaining local schema into global conceptual schema.

The important aspect of design strategy is integrated multiple database system which is classified according to the autonomy, distribution and heterogeneity of the local systems. The logical

data structure describes global conceptual schema (GCS). The global conceptual schema defines external schemas (ES) in distributed environment. The local internal schemas (LIS) represent physical data organisation on each site. These all are entities as shown in figure 1.
is presented by local internal schema

DESIGN METHODS

These Methods are as follows

2.1Design Goal-oriented Schema:-

Goal-oriented requirements analysis starts high-level goals, which are refined and interrelated to produce a goal model. The goal model captures not a single, but several alternative sets of data requirements, from which a particular one is chosen to generate the conceptual schema for the Biological database-to-be.

2.2Design OMT (Object Modeling Technique):-

The OMT (Object Modeling Technique) method because it integrates a minimal set of concepts shared by several methods. These concepts are sufficient for our project. Moreover, OMT is based on various standards (Entity/ Association, Data flow diagram, State transition diagram) extended to the object paradigm. At last, the OMT graphical representation is expressive enough. A global conceptual schema of a DB managing a research centre documentation.

2.3 Database Designer's Workbench:-

The Database Designer's Workbench (or "Workbench") is a graphics oriented decision-support system to assist with the design of all aspects of a computerized database, from the initial specification of the system's requirements through its final physical structure. It provides a wide variety of design aids, or "tools," for designers to explore many design alternatives and to evaluate them precisely. These tools are presented in a homogeneous, graphically oriented environment that allows a designer to use familiar representations, store incomplete designs, progress smoothly from one design phase to the next, and iterate over previous design stages. The Workbench is therefore a real asset to the database design practitioner, seeking to improve productivity and the quality of design.

2.4 Database Design Based on DFDC :-

Presents, The new method of Database design,on the basis of Data Floating Direction Chart (DFDC). The final design maps relation of database field. DFDC consists of tables and direction lines with formula mark, defined as 2-triples[80]. DFDC = (T,L) where T is collection of tables, L is collection of lines. Table T defined as 2-triples, T = (N,I) where N is the name of tables and I is the set of the item. An item is denoted to be I = (IF, IN) where IF is a keyword flag for item, value for k represents keywords.
A line is denoted to be L= (ST.li, TT.Is, F)
Where ST.li is the source item meaning that the start of this line is the Li item in table ST.li. TT.I_j is the target item, that is, end of this line is the Ij item in the table TT, and F is a formula on the line. T is a table which contains set of items. It also uses functional dependency during design approach

2.5DatabaseDesign on based Star Model:-

Design Database, there are requirement centralized control of Database as well as Integration of system at that time specified the star model.
Star model of Database design is divided into three types: control data, integrated data, and security control.

♦ Control data: by controlling the data, integrated system must provide to create data tables and to\delete data tables. This model can not bring the impact of additions and deletions from Biological database.

♦ Integrated data: this model must be fit to get together data from different government departments

♦Secure access: it is must be field-level security.

PROPOSED METHODOLOGY AND ITS COMPARISON

Its deals with the existing methodology and proposed methodology with respective biological database design, architecture supported to biological database, security model, transaction method and deadlock detection and recovery .

3.1 Database Design Method:-

Design of centralized and distributed database is significant for further performance.

3.2 Design Method with Work branch:-

Various approaches are used for design database. Work branch is one of the ways for this. This way is graphically presented as well as through framework for a model. It is also called graphic-oriented decision, which includes five phases. This way is good for using large database, but it requires more time since complicity increases during designing.

3.3 Design Method with goal oriented:-

This approach is goal-oriented. This concept is useful for analysis of the data as per requirement and to produce goal model. This goal model is a derived model of application domain. Lastly, conceptual scheme is created on basic domain. This is a way to produce absolute database but problem is created when further need arises to extend database. Hence it is not convenient for huge database.

3.4 Design Method with object model technique:-

Another way is object model technique. This technique is used in conceptual design. It is based on various standards (entity / association, data flow diagram, state transition) or objects. The object model technique is perfect for distribution in a technical design. As such, the object linking is difficult to establish.

3.5 Design Method with star model and data floating direction chart:-

One of the methods for design database is star model. This model provides security in terms of centralized control. This model is very useful in government sector and integrated system. This model is used only for secured database design. It is also critical for implementation. The new method is used for design database on the basis of data floating direction chart. This chart design methods, using table links properly. The limitation of this method is that it is only table-based and linking is critical except table-linking.

We have proposed design of database using graph. This method tries to solve problem related to other method. This method achieves scalability as well as dynamic change. It also achieves extend approach easily with accuracy. Itrequires less time for design. It also performs forward linking and backward linking correctly. Hence we have tried to maintain consistency with the help of this method.

DESIGN ISSUE FOR PROPOSED NEW APPROACH

4.1 Requirement of New methodology

Many methods are used to design the centralized and distributed database to serve many aspects. The database designing is one of the methods in object modelling technique. This method shows various objects and it links with other data objects. Therefore, this method is used to design good database, but database should improve performance. Database designing uses objects molding technique with Graph. This method is called design of database using graph.

4.2 Parameters for New Methodology:-

In the design of centralized and distributed database, we have considered aspects, viz: design methods, architecture support, security model, transaction, and deadlock detection and recovery, etc. We have proposed an data object related to databasedesign. This method is focused graphand data object are two parameters in this method. Graph represents flow of data towards proper direction. This Graph is based on object. First, we have to consider data objects and then design Graph. This is a way to use data objects and graph in this method.

4.3 Proposed Methodology:-

Design of database using graphmethod:-

Database consists of data objects. Data objects are construction in the database on the basis of graph. Graph is made of nodes. Here Nodes consider as data objects .Construction of algorithms for design of database on the base of graph. In this algorithms, give input as values of number of Data objects in form of Array. Two values are number of Data objects and Reference key . Number of Data objects and Reference key are represent N and R respectively. These numbers used within Array. Here put-up loop and perform task step by step,Call data object from the [N] sequencely.Create Reference Key of data object and stored in the [R].Selected data object and Adding into the Database. Repeat steps until last data object in array. Finally, get Graph as output.

4.4Design of database using graph method:-

This Algorithm is basically focused on Data object,Reference key and graph. Graph is created by using algorithm as per requirement. First step is choosing the data objects. After this consider Reference keyof Data object which are classified in terms of table as per requirement. These Data object are connected to other data object using Reference key. Finally, Graph is created on basis of Data objects and Reference key .

The Algorithms as follows
// Graph G=(N,R)
// N is number of Data objects.
// R is number of Reference key.
//[N] is Array of data objects.
//[R] is Array of Reference key.
Input (Number of data objects [N])
Output (Graph G)
Begin
Loop
1) Call data object in [N].
2) Create Reference Key.
3) Include Reference Key into [R].
4) Select data object.
5) Add into database.
Repeat until last data object in Array.
Output(G);
End;

CONCLUSION

In the above proposed work, These are the various issues which are considered during the designing of the databases. These issues are concerned with solving the critical problems using Graph for improve the performance ofdatabases.

It is help to improve the performance as well as enhanced the quality of databases, and we can improve the clarity about the database

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CLASSIFICATION BASED MODEL FOR CONTENT EXTRACTION USING WEB CONTENT MINING TECHNIQUES

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ABSTRACT

Abstract—On the Internet, no. of web pages contain several items that cannot be classified as the "informative content". Clients and end users interest is to search for the informative content, and don't interest in non informative content. As a result, the need of Informative Web Content Extraction from web pages becomes important. So extraction of information has become an important task for discovering useful knowledge or information from the Web Pages. Web content extraction is one of the used techniques for extracting the main content from the web pages. The main objective of this paper is to apply the classification model for getting interested item set for performing various operations on web pages. Using classification based model segmentation for content extraction will do only on interest item sets using web content mining techniques.

Keywords: *-content extraction, information extraction, web content mining, web segmentation, Informative content*

INTRODUCTION

World Wide Web is a prosperous source of information for many applications. From the previous several years web expanded openly for sharing a vast amount of information. From World Wide Web, finding and analysis of useful information is key issue for the researcher's. Huge amount of information and rapid growth of information needs various repositories for extracting relevant information. The massive growth and unstructured dynamic nature of web gives difficulties in searching and retrieving useful information for search result. Web pages have billion of unstructured, semi-structured and structured documents with various types of information. The relevance of information depends on the content available on the web pages. Generally a web contains many kinds of information represented in the form of text, image, audio, video, etc. and web pages in the form of headers, content, advertisements, panels of navigation, copyright notices, footers etc [3][4]. This form of information is application specific wherein part of the information is useful for that application and other information become noise for other application. In web content mining some techniques have been used to extract and mine useful knowledge or information from these web pages. The content available on the web is in a variety of forms like structured, semi structured and unstructured, integrated with relevant and irrelevant data. Web pages, besides core contents, consist of other elements, such as banners, navigational elements, copyright information, external links, etc. The information is called noisy or irrelevant content. This noisy content covers more area of web pages and is typically not related to the main subjects of the web pages. This includes information extraction from web pages. In order to achieve this; web pages are processed using web page segmentations algorithms, web content mining methods. Using data mining techniques, retrieving valuable information is called Web mining. Web mining is classified into various sub tasks such as Resource finding, Information selection and pre-processing, Generalization, Analysis and Visualization. The detailed justification about other five sub tasks is given below.

i) *Resource Finding:* The process of retrieving the required data from on-line or offline is called Resource finding. We apply data mining techniques, classification, clustering etc., to extract information.

ii) *Information Selection and Pre-processing:* In the pre-processing phase we deal with web pages representation. The brief explanation of different representations is given below .

• *Binary:* This is called as "Set of words". The relevance or weight of feature is a binary value {0, 1} depending on whether the feature appears in the document or not.

• *Term Frequency (TF):* Each term is assumed to have an importance proportional to the number of times it occurs in the text. The weight of a term t in a document d is given by: W (d; t) = TF (d; t) is the term frequency of the term t in d.

• Latent Semantic Indexing (LSI): Determines clusters of co-occurring keywords so that the query which uses a particular keyword can then retrieve documents perhaps not containing this keyword, but containing other keywords from the same cluster.

iii) *Generalization:* Generalization means Pattern evaluation. We used machine learning or data mining processes to identify general patterns in individual web pages or across multiple sites.

iv) *Analysis:* In the analysis phase accuracy of the retrieved pattern is evaluated using accuracy measures.

v) *Presentation or Visualization:* To decide in which order the discovered knowledge (web pages) has to be presented.

Web page segmentation is a process to divide a Web page into visually and semantically cohesive pieces. Web page segmentation has a no. of benefits and potential Web applications. Web Page segmentation is of extreme importance when information is to be extracted omitting the noise from web pages [4]. A web page needs to be partitioned into blocks such as main content block, navigation block, advertisements, etc. It is practicable to separate these areas automatically for several useful applications. Techniques belonging to the Web Content Mining such as classification and clustering, separation of block of web pages and removal of noisy blocks enable one to produce much better result for extracting useful information. The web page segmentation is a task in which break down the structure of web page into smaller segments, in the segmentation consist of DOM-based segmentation, location based segmentation and vision based segmentation.

LITERATURE REVIEW

EICD (Entropy based informative Content density) is approach developed by Manjusha Annam and G P Sajeev [2] build on Entropy. The Proposed EICD novel method is used for the efficient extraction of web content. The technique utilizes both text density and entropy. The entropy-based analysis is performed for selected features. The key idea of EICD is to utilize the information entropy for representing the knowledge that correlates to the amount of informative content in a page. In EICD, Content Ratio (CR), Page information density (PID) and tag information density (TID) are measured. Page information density (PID) is the number of web pages classified as informative pages in a given set of pages. The probability that the number of tags having informative content to the high text content tags is defined as tag information density. The content Ratio is a measure to define the count of nodes which are high text content threshold condition for different values.

In Algorithm for extraction of core content, pattern matching technique are used [6]. The Pattern matching algorithm for extracting the core content of web pages using Pattern matching approach that transforms the contents of web pages automatically in to plain text form. The algorithm that applies regular expressions identifies the correct pattern for extracting the actual text contents from these web documents. Here present a template independent approach based on patter matching for extraction of core contents from web pages. This approach extracts the data from each web page that are organized as well as formatted XHTML documents. Proposed approach deals with web pages of any size and extracts core contents with efficiency and high accuracy. The algorithm extracts high quality contents with efficiency and accuracy even from short informative content.

Mohammad Mehind Yadollahi and Masoud Asadpour proposed an AWS (Automatic webpage segmentation) technique [7]. AWS, which classifies the main content of a given webpage using a feature set consisting of structural and shallow text features. We benefit DOM tree of web pages for feature extraction. AWS consists of three main steps:Feature Extraction, Feature Selection, Classification.

Hybrid approach Proposed by Madhura R. Kaddu and Dr.R.B.Kulkarni to Extract Informative Content from online web pages [9]. In this the web page is converted into DOM tree and features are extracted. Use this features in the machine leaning method like decision tree classification and dynamic rules are created. By using these rules informative content is extracted from the web pages. Further the rules which are created in the automatic extraction technique used as hand crafted rule for content extraction from the web pages without using machine learning method. Here the informative content like relevant text, images, multimedia are extracted from the web pages and these web pages are taken from the Internet i.e. Online. And also consider dataset for extracting relevant content. The propose work generates effective rules, achieve automaticity and efficiency. In the hybrid approach initially automatic rules are generated by using machine leaning method if rules are not present. Otherwise use the extracted rules to extract informative content from web pages without using ML technique. The important thing into this approach is to learn pattern or rules and use this rules for efficiently extracting the informative content from web pages.

The Debnath S et al proposed four algorithms to identify primary content blocks. First the algorithm segments the web pages into web page blocks by considering different HTML tags. Secondly differentiate the primary content blocks from non-informative content blocks. The algorithm decides whether block B is content or not and also compare block B with stored blocks to decide whether block B is same as stored blocks.

Weka-LibSVM approach proposed by Kevin Joy Dsouza and Zaheed Ahmed Ansari [10].In this presented work classification of multi-domain documents is performed by using weka-LibSVM classifier. Here to transform collected training set and test set documents into term-document matrix (TDM), the vector space model is used. In classifier TDM is used to generate predicted results. The results emerged from weka with its GUI support using TDM have quick response time in classifying the documents.

Priyanka B dastanwala and Vibha Patel proposed a Text mining methods for extracting informative content [11]. Text Mining also referred as the process of deriving information from text. In this approach SVM and LDA method are used for solving problem of content extraction. Data cleaning and reparation, seed words generation, Fuzzy Keyword match methods, LDA method and support vector machine steps are used.

LBDA (Layout based detachment approach) approach proposed by Dr.Anna SaroVijendran and C Deepa[12] . The proposed approach extracts the main content from the web page and removes the irrelevant information like header, footer contents, navigation bars, advertisements and other noisy images. The proposed methodology uses the following techniques: tag tree parsing to get the analysis structure, block acquiring page segmentation method to remove unwanted tags, and data extraction to retrieve the necessary contents. It can eliminate noise and extract the main content blocks from web page effectively and display the essential content to the users. The performance is evaluated based on the following metrics like precision, recall, accuracy, execution time and memory usage. The implementation results obviously show that our proposed LBDA approach is performed better than the existing heuristic approach. In this approach we proposed a novel methodology layout based detachment approach to extract the content from the web pages. Web page content extractions are more vital to retrieve the contents of web pages, particularly in unstructured web.

A Realtime News classification engine for web streaming proposed by Urooj Mohiuddin and Hameeza Ahmed [15] .The idea behind NEWSD is innovative in the sense that it makes the complex process of news classification for multiple activities possible .using classification ,one can classify the news in various categories includingcrime,sports,national,politics,internationa l,entertainment and general activities resp. The final classification results are able to group all the same activities in one set. One or two well know classifiers namely NaiveBayes and J48 are used. NEWSD is beneficial to news searching and classification. It reduces human effort and time by automatically displaying the news.

CLASSIFICATION MODEL

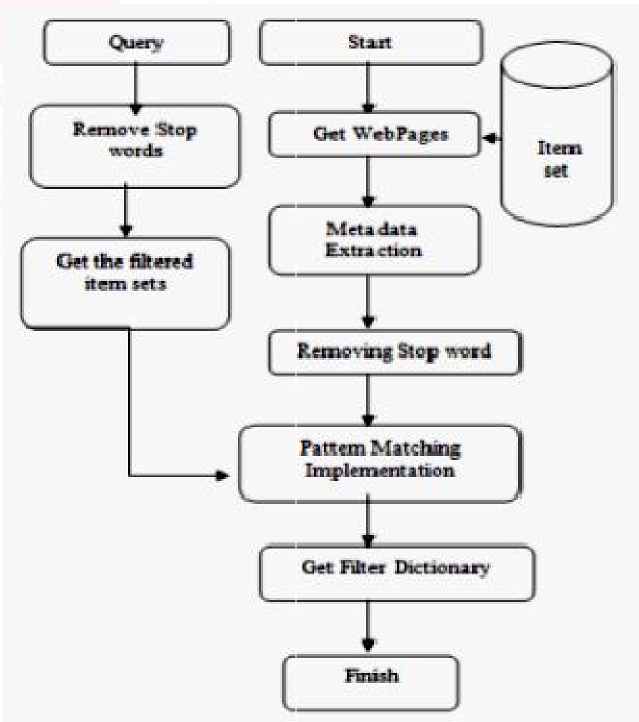

Fig1. Classification Model

Classification is a one of the fundamental task that assigns documents to one or more categories based on its content for web mining applications. Classification is process of a predictive learning function that classifiers a data item into one of several predefined classes. Classification tasks can be divides into two parts: supervised documents classification and unsupervised documents classification. In supervised document classification some external source provides information on the correct classification for documents such as human feedback. In unsupervised classification. Classification done entirely without reference to external information. Fig.1 shows Classification model for content extraction using web content techniques. It defines the system component that provides a plan for content extraction using classification. Training data sets are first filtered to obtain the filtered directory. It is done through preprocessing. Preprocessing involves removing stop words and stemming words from the web pages. The filtered item sets gets from the query word or direct from item sets. After getting the filtered item sets we move to segmentation, DOM tree extraction and pattern matching for content extraction.

In implementation we are proposed an enhance method of information Extraction from web pages by improving mining techniques. Normally in information extraction the segmentation will be done on all item sets but we are putting an interest mining on only certain web Pages which are contain the Meta data related to the keywords. So we will get the interested item sets only on which the operation of extraction and pattern matching will perform which make our system more fast as compared to others.

CONCLUSION

In these papers we give Classification Based Model for Content Extraction Using Web Content Mining Techniques for Extracting informative web content using web content mining techniques. The informative contents like text, images and multimedia are extracted from web pages using the above technique. Content extraction is useful for the human users as they will get the required information in a time efficient manner. In this study, Classification Based Model for Content Extraction used for filtering the data for pattern matching, segmentation and information extraction .on filtered data set web content mining extraction easily done fast as compared to all data items

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BLOWFISH ENCRYPTION ALGORITHM FACILITATE TO SECURE USER DATA OF HYBRID CLOUD IN CLOUD COMPUTING ENVIRONMENT : A STUDY

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ABSTRACT

Cloud computing is a technology which offers different services (like network, server) to the users as you pay on basis. Cloud is free pool of resources [1,2]. Cloud computing has several advantages but apart from this it has to face challenges also. One of the major challenge of cloud computing is security. Security of data plays vital role in cloud computing environment. Data security assures various parameters like integrity of data, confidentiality of data and authentication of data [3]. Now a day's awareness and concern regards to cloud computing and information technology has growing. Most of the data system and processes used data security algorithms to protect cloud data[4]. Hybrid cloud is nothing but integration of two public or private clouds or public, private cloud independently. Resource sharing is one of the advantages of cloud computing while sharing data or transferring data from one cloud to another cloud due to overloading user always wants to security about his data. Symmetric and asymmetric algorithms are used for the security of the data. In this paper researcher presents brief overview on blowfish algorithm a type of symmetric algorithm which emphasis on security of user's data. Blowfish algorithm helps to reduce power consumption in cloud computing. There are various cryptography techniques like DES, Blowfish,RC5, AES, RSA, 3DES , Diffie-Hellman[6,7]. These techniques are used in protecting the data in those applications which are running in a network environment. One more thing should be discussed in this paper is how users data should be secure with minimum cost

Keywords: *Cloud Computing, Blowfish Algorithm, Cloud Security, Hybrid cloud*

INTRODUCTION

Cloud computing is a technology which offers various services to the users as per the requirement. It is not technology but it is a way of delivering computing resources based on the existing technologies like virtualization. Cloud computing is closely linked with IaaS, SaaS and PaaS as service model. It also recommended public, private, hybrid and community cloud ad deliver cloud . One of the benefit of the cloud computing is , it reduces cost of the hardware that have been used by the user at other end. Cloud is nothing but free pool of resources like hardware, software, network and server. As there is no need to install hardware and software at the users end because it is stored somewhere else at another location. Cloud computing assist to access the data from the data center ubiquitously from any location with location independently. Instead of buying the infrastructure or software to run the process and save the bulk of data they just buy as per user requirement on pay basis.

Cloud networks uses various services through minimum utilization of resources to get maximum output. Cloud technology provides a way which requires and utilizes its resources in the best way. [1]

Cloud computing has various advantages over traditional computing which include agility, cost reduction, location and device independency, scalability. Cloud computing has to face the challenge of data security and integrity of the data. Different models and algorithms are proposed to study security issues of the data. The scheme used in the model falls into two categories private and public auditability of the cloud. Private cloud is more efficient than public cloud in terms of security of users' data when data could be share from one cloud to another.

Hybrid cloud is one type of the type of delivery model of cloud computing. The term hybrid cloud is nothing but integration of private and public cloud or community cloud. Resource sharing and resource utilization is one of characteristics of cloud computing in which resources are shared as per users requirement. The process of sharing resources from one cloud to another cloud (from private to public, public to community likewise). When data is transferred or migrate from one cloud to another cloud due to over loading, at the time of migration of data user has concern out its data security and confidentiality of the data. To overcome this problem diverse security algorithms are used in cloud computing environment.

Various cryptography techniques like DES, Blowfish, RC5, AES, RSA, 3DES , Diffie-Hellman[2] are used to provide security to the data. These techniques are fall into two categories according to the symmetric and asymmetric algorithm. These techniques are used in protecting the data in those applications which are running in a network environment. In this research paper, researcher focuses on blowfish encryption algorithm which is used for the protection of the data. Blowfish is type of symmetric algorithm in which only one key is used for encryption and decryption [1,2].

LITERATURE SURVEY

Rachna Arora, Anshu Parashar [1] mentions that today's era demand of cloud is increasing so the security of the cloud and user is on top concern. Hence, proposed algorithms are helpful for today's requirement. Encryption algorithms play an important role in data security on cloud and by comparison of different parameters used in algorithms, it has been found that AES algorithm uses least time to execute cloud data. Blowfish algorithm has least memory requirement. DES algorithm consumes least encrypt-ion time. RSA consumes longest memory size and encryption time.

Shakeeba S. Khan1 , Prof.R.R. Tuteja2[2] focused on Cloud computing which is defined as the set of resources or services offered through the internet to the users on their demand by cloud providers. As each and every organization is moving its data to the cloud, means it uses the storage service provided by the cloud provider. So there is a need to protect that data against unauthorized access, modification or denial of services etc.

Jean Raphael Ngnie Sighom *, Pin Zhang and Lin You [3] , mentions that the Cloud computing is a multi-tenant environment, where resources are shared. Threats can happen from anywhere; inside or outside the shared environment. Deciding whether to migrate sensitive data or keeping it on premise is one of the most important decisions faced by personal users, as well as small and medium-sized enterprises.

Eng. Hashem H. Ramadan, Moussa Adamou Djamilou [4] focused on the security of the data over the cloud storage .cryptographic techniques are used to encrypt and decrypt data. In this research paper researcher proposed security algorithms, which are compatible with each other AES and RSA algorithms. The proposed system that we are designing to use multilevel cryptography, first we are encrypting the data using the AES algorithms and then we are encrypting the output from the first level using RSA algorithms then uploading it over the cloud storage.

Faheem Gul, 2Aaqib Amin, 3 Suhail Ashraf [5] mentions about the cloud security. AES encryption is the fastest method that has the flexibility and scalability and it is easily implemented. On the other hand, the required memory for AES algorithm is less than the Blowfish algorithm. AES algorithm has a very high security level because the 128, 192 or 256-bit key are used in this algorithm. It shows resistance against a variety of attacks such as square attack, key attack, key recovery attack and differential attack. Therefore, AES algorithm is a highly secure encryption method. Data can also protect against future attacks such as smash attacks. AES encryption algorithm has minimal storage space and high performance without any weaknesses and limitations while other symmetric algorithms have some weaknesses and differences in performance and storage space.

Papri Ghosh, Vishal Thakor, Dr. Pravin Bhathawala[6] proposed different encryption algorithms to make cloud data secure, vulnerable and gave concern to security issues, challenges. The comparisons between AES, DES, Blowfish and RSA algorithms are shown. Comparison is done to find the best security algorithm, which has to be used in cloud computing for making cloud data secure which cannot be hacked by attackers. Encryption algorithms play an important role in data security on cloud. Through the comparison, it has been found that 1) AES algorithm uses least time to execute cloud data. 2) Blowfish algorithm has least memory requirement. 3) DES algorithm consumes least encryption time and 4) RSA consumes longest memory size and encryption time.

Akashdeep Bhardwaja*, GVB Subrahmanyamb , Vinay Avasthic , Hanumat Sastryd[7] mentions that Cloud computing is emerging trends in technology industry, public and private enterprise and corporate organizations are either using the Cloud services or in process of moving there but face security, privacy and data theft issues. This makes Cloud security a must to break the acceptance hindrance of the cloud environment. Use of security algorithms and ensuring these are implemented for cloud and needs to be properly utilized in order to ensure end user security. The authors analyzed Symmetric algorithms for different encryption and encoding techniques, found AES to be a good candidate for key encryption and MD5 being faster when encoding.

Omar Mohammed Abdul rahman Abdulkareem1, N. Shanker2 [8] discuss about encryption algorithm and scheme by which data can be protect .Encryption is done by the Blowfish algorithm by this technique the data is encrypted/decrypted fast. In this research paper researcher focus on the system which is used for "Protection the Data of public cloud by encryption of data by applying symmetric key algorithm".
Kishore Kumar1, Dr. M. Gobi2[9] focus on the role of Blowfish & Two fish algorithms that are helpful in addressing the cloud security issues, in which our research would be focusing.
B.Thimma Reddy, K.Bala Chowdappa, S.Raghunath Reddy[10], discuss various cryptographic algorithm like AES,DES,Blowfish and many more can be adopted in cloud computing environment for optimization of data security. Researcher also mention about how to provide security to the data while transmission of data.
Satish Khadke, Sayyed Mustafa and Syed Akhtar[11] discuss the hybrid cloud model and its implementation for providing security to the data . it also make a glance on the autherization of deduplication.
1Eter Basar*, 2Ankur Pan Saikia, 3Dr. L. P. Saiki[12] mention various security issues and challenges of cloud computing.,
Pooja devi,Amit Verma[13] , discuss the workflow of processing of blowfish algorithm in cloud computing environment to provide better security to the data using MD5 method. In this paper researcher also focus on the encryption and decryption of data.
Miss Pulatsya Kanasagara1, Prof. Tushar J Raval2, Prof. Karishma A chaudhary3[14] discuss various data encryption algorithm which are using in cloud computing environment for better enhancement of security

EXISTING ALGORITHM FOR CLOUD SECURITY

There are various security algorithm used in cloud computing environment to secure data stored on cloud. Some of them are discussed as below.

1. Data Encryption Standard (DES) Algorithm

At the encryption site, DES takes a 64-bit plaintext and creates a 64-bit cipher text, at the decryption site, it takes a 64-bit cipher text and creates a 64-bit plaintext, and same 56 bit cipher key is used for both encryption and decryption. The encryption process is made of two permutations (P-boxes), which we call initial and final permutation, and sixteen Feistel rounds each round uses a different 48-bit round key generated from the cipher key according to a predefined algorithm [3].

2. RSA Algorithm

RSA is an algorithm which is used for encryption and decryption of data. It is utilized for public-key cryptography which involves a public key and a private key. The public key can be known to everyone and is used for encrypting messages. Messages encrypted with the public key can only be decrypted using the private key [3,14].

3. AES

AES is a symmetric key encryption algorithm which used 128 bit block and key length of 128-bits. In cloud computing environment user send request to cloud service provider for utilization of resources and cloud service provider offered services as per the requirement of the user. In this process user decides to use cloud services and then migrate data on cloud. It will first encrypt using AES algorithm and then send it to provider. AES has replaced the DES as the 56 bit keys of DES were no longer considered safe[3,14].

4. DIFFIE HELLMAN

DIFFIE HELLMAN algorithm designed to generate a shared secret key for exchanging information confidentially. DH is one of the earliest, practical examples of public key exchange implemented within the field of cryptography and provides the basis for a variety of authenticated protocols[3,14]

5. BLOWFISH

Blowfish is a symmetric-key block cipher, designed in 1993 by Bruce Schneier. This is being used in a huge number of cipher suites and encryption products. One of the strong symmetric key cryptographic algorithms is BLOWFISH. It encrypts 64 bit blocks with a variable length key of 128-448 bits. The objectives of designing blowfish algorithm are as follows:

- Blowfish encryption rate is fast on 32-bit microprocessors.
- It requires less than 5 kb memory for execution.
- For the making of design and implementation simple blowfish algorithm uses only Simple primitive operations such as addition, XOR and table look up.
- It is secure and flexible. Blowfish suits applications where the key remains constant for a long time (e.g. Communications link encryption), but not where the key changes frequently (e.g. Packet Switching)

Since the data is encrypted and decrypted by secret key, using blowfish algorithm encryption method the data over the cloud and secret key encryption/decryption is extremely quick as compare to public key encryption [5].

Implementation of blowfish algorithm in software provides good rate.AES algorithm gives more attention on the standard of encryption. The DES or IDEA can use blowfish as drop-in replacement wherein it takes 32-448 bits of a variable length key for both domestic and exportable uses. This process uses large key-dependent S-boxes and a 16-round Feistel cipher, which resembles CAST-128 in structure where fixed S-boxes are used [6].

SECURITY ISSUES OF HYBRID CLOUD IN CLOUD COMPUTING ENVIRONMENT

Security is one of the most significant aspects in everyday day computing. Cloud computing uses various new technologies and services in our day to day life applications. Cloud provides various services to the customers that will beneficial for them. Apart from the advantages of cloud computing, it has to face many challenges related to the security like data security, trust, expectations and performance issues. In hybrid cloud, due to the problem of overloading, the load may be distributed or transferred amongst other cloud to balanced load[7]. Data may be transferred from one cloud to another it may be either from public to private cloud likewise. Security of data at end user level is one of the crucial aspects in the cloud computing environment. In Cloud computing hybrid cloud has to face various security issues some of them are as follows given in Fig1:

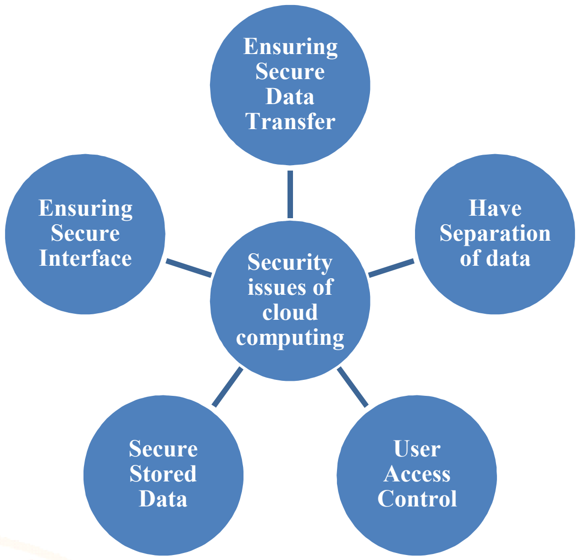
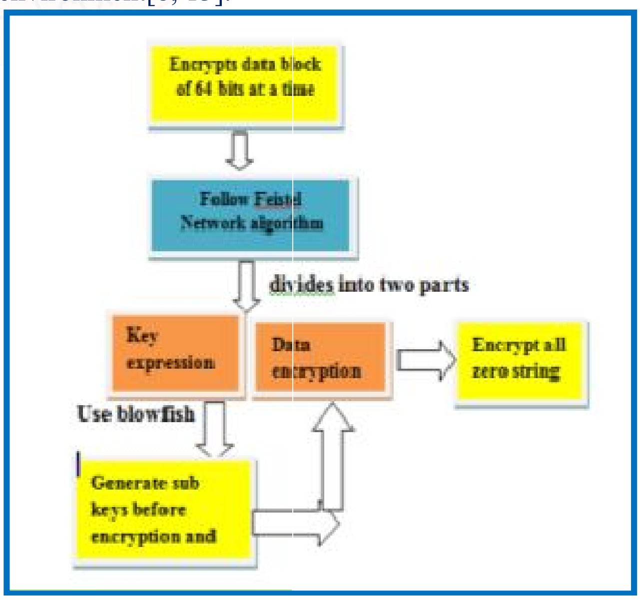


Fig 1: Security Issues of Cloud Computing

Asymmetric and symmetric encryption helps to secure data in cloud computing environment**.** In asymmetric algorithm one key is used for encryption called the Public key and a different but inter related key for Decryption called the Private keys when performing transformation of plain text into cipher text[7,8]. The main asymmetric algorithms are ECC, Diffie-Hellman and RSA. Another type of algorithm is Symmetric algorithm in which a single secret key is shared to encrypt as well as decrypt data. AES, 3DES, RC6 and Blowfish these are symmetric algorithms use for encryption of data.

1. WORKING PRINCIPLE OF BLOWFISH

Fig 2.shows the working flow of blowfish algorithm and Fig 3 illustrates BLOWFISH encryption scheme used in hybrid cloud environment[8, 13].



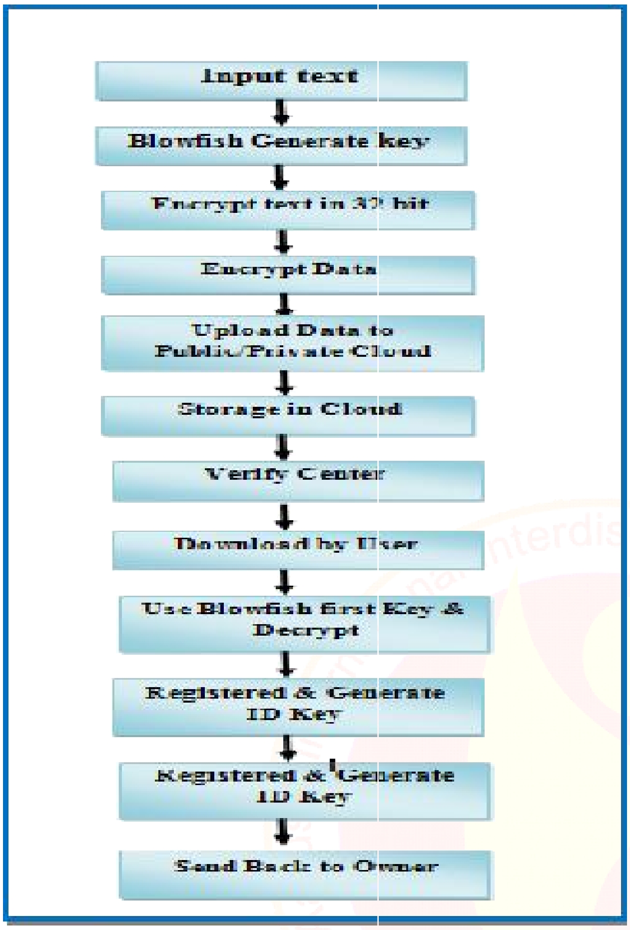


Fig 2: Working Principal of Blowfish

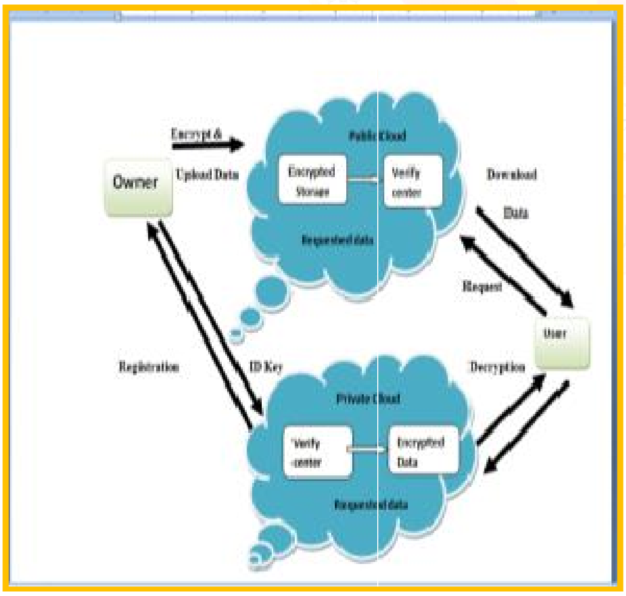


Fig 3 : BLOWFISH Encryption Scheme in Hybrid Cloud

1. **Objective of the Work**

➢ Provide security in hybrid cloud computing environment.
➢ Secure management of virtualized resource using resource provisioning.
➢ Availability, recovery and auditing.
➢ Identification and privacy in computing.
➢ Dynamic data operation security[12].

2. **Data Encryption Algorithm**:

Divide x into two 32-bit halves: xL, xR
For i = 1to 16:
xL = XL XOR Pi
xR = F(XL) XOR xR
Swap XL and xR
Swap XL and xR (Undo the last swap.)
xR = xR XOR P17
xL = xL XOR P18
Recombine xL and xR[14]

3. **Advantages of Blowfish in Cloud Computing Environment**

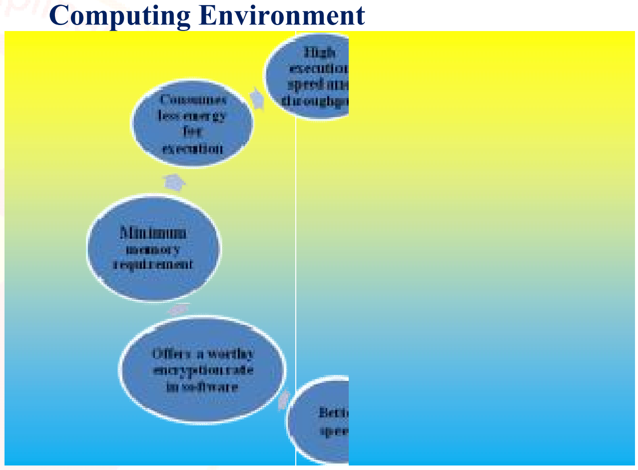


Fig 4 : Advantages of Blowfish

RESULT AND DISCUSSION

Implementation of symmetric Encryption BLOW Fish algorithm in hybrid cloud will help to provide better network security in cloud computing environment as well as it will facilitate user to secure data from cloud. Data migration is one of the issue of cloud computing. In hybrid cloud when data is transmitting from public cloud to private cloud due to overloading at that time the security of data is crucial aspect of cloud . After balancing load blowfish encryption algorithm generate key to encrypt and decrypt data for protection . The following are few benefits of encryption in the cloud environment [9]. The encryption helps to

a. Substantiate the privacy of the institutional data, where the encrypted data used in transmission as well as storage location.
b. It will help to offer Confidence about the data backups regarding safety of the data in cloud environment.

c. It will facilitate to enlarge potential of profits to customers with sensitive or regulated data by maintaining the key by cloud data owner.
d. Help to accomplished secure multi tenancy in cloud computing environment.

CONCLUSION

Cloud computing technology is an emerging technology. The major problem that has to face is security about user's data. In this research paper researcher discussed various security algorithms which will help to secure users data stored on cloud. There are various symmetric and asymmetric encryption algorithms like AES, DES, RSA, Blowfish and Diffie Hellman algorithm. Blowfish algorithm is a symmetric encryption algorithm which generates two keys that will help the user to provide protection to the data that is stored in the cloud. Blowfish encryption method is fast method to encrypt and decrypt the data by secret key[10]. This method use encryption algorithm which is quick as compare to other encryption method like public key method. Blowfish algorithm gives high performance with less through put in cloud computing environment. It will facilitate to secure data in hybrid cloud of cloud computing environment. In hybrid cloud architecture data is secure and for better management of virtualized resources Blowfish algorithm assist to protect data from cloud. By implementation of blowfish in cloud the speed of transformation of data will improve. Data is encrypted and decrypted using only one public key which can be generated using blowfish algorithm to identify data from cloud[11]. In future, more work has to done on implementation of security algorithm at higher level of cloud storage in cloud computing environment for better advancement in security of big size data. **SN 2392]**

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BETTER RESOURCE PROVISIONING AND INTEROPERABILITY USING COMPETENT SERVICE BROKER POLICY IN HYBRID CLOUD

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ABSTRACT

Cloud computing is a providing almost everything in the form of services and so it is called as a service oriented model. Elasticity is provided in terms of resources like storage, bandwidth, computational power etc. Due to immense potential of resource provisioning provided by cloud and huge demand of resources, there has to be effective service broker policies for better utilization of resources in cloud computing. In cloud computing the resources are used by the users as per demand and are paid per use. A broker is a mediator between the client and the cloud service provider and hence the role of broker is very important in cloud environment. Broker also has a significant role in interoperability or intercloud management. The service broker policies route the user to the most suitable data centre in cloud environment. This paper focuses on the effective use of resources by implementing efficient service broker policies for better resource provisioning. We also study the use of hybrid cloud and unleash it's power for a better resource provisioning. We make use of Cloud Analyst Toolkit for experimental study of the broker policies in the cloud computing environment. The paper would be focusing on the QOS attributes like response time and data centre service times for different service broker policies.

Keywords: *Cloud Broker, Resource Provisioning, Service Broker Policy, Cloud Analyst.*

INTRODUCTION

Cloud computing is a pool of resources which can be utilised on demand in a real time environment. Everything is in a form of service in cloud environment. All the resources provided by the cloud can be used as a service which can be accessed by the clients from the remote location. Thus, we can visualize cloud environment to be like client server environment where the cloud acts as a server providing the resources on demand to the clients at real time. The basic principle behind cloud computing is its way of providing the resources to the clients on demand. Due to this nature of cloud environment there is a need for better cloud service providers so that the users get better Quality of service at a low operational cost and hence getting all the facilities like better resource availability, multitenant user access, reliability, scalability etc. All the services are provided in the form of Infrastructure As A Service(IAAS), Software As A Service(SAAS), Platform As A Service(PAAS) and even Network As A Service(NAAS), Security As A Service (SeAAS) etc. The technology governing this service provider capability of cloud environment is called as Virtualization. Virtualization brings in the concept of using virtual machines as an add-on to the physical machines which increases the computational power of the cloud environment. Here multiple virtual machines are available to the user so that no user will have to wait for any type of resource availability.

The process of virtualization involves the efficient distribution of load among the virtual machines so that no virtual machine gets overloaded or under-utilized. This process of effective distribution of work load is called as “load balancing”. The users send the request to the data centre, which data centre would fulfil the given request is decided by the “service broker”. The standardization of this process of balancing by the service broker policy is done in the terms of service broker policy. This paper aims to study the importance of service broker policy with respect to better resource provisioning and thereby enhancing the cloud interoperability. We are

SERVICE BROKER POLICIES

A client or user requests for a service to the cloud which is directed by the broker to the appropriate data centre. Thus service broker plays a very important role in the service model. The request put by the user reaches to the destination through series of steps, the decider being the service broker. The service broker makes use of any one of the available service broker policies to redirect the request to appropriate data centre.

Cloud Users

After the data centre is allocated for resource provisioning the load balancer implements proper load balancing algorithm for redirecting the request to proper virtual machine which can fulfil the request without any under or overloading conditions or otherwise the requests migrates to another suitable virtual machines of cloud data centres. From the above situation we can very well figure out that a service broker plays a very important role in resource provisioning.

The three most frequently used service broker policies are as follows:

1. Closest Data Centre Policy: This type of broker policy can also be called as service proximity based routing. In this service broker policy the broker chooses the nearest data centre for allocation to the user. So, here the only consideration is given to the shortest path of the data centre along with the network latency. This type of broker policy is effective only when the data centres are uniformly distributed the job.
2. Optimal Response Time: This broker policy keeps a account of performance of all data centres and allocates the job to the data centre with best response time. In this type of broker policy either one data centre gets overloaded and while the other is under-utilized.
3. Dynamically reconfigure routing with load balancing: This policy takes into consideration the need of the user and route to the appropriate data centre dynamically. Thus while dynamically routing to the data centre the broker on time decides the need of number of virtual machines and accordingly either increases or decreases them. Along with this the best processing times and current processing times are also taken into consideration.

SIMULATION AND RESULTS

We have made use of Cloud Analyst simulator to study the use of service broker policy for better resource provisioning and interoperability in hybrid cloud. Cloud Analyst is a effective tool which provides a powerful and easy GUI for carrying out necessary simulation for various cloud situations. We modelled a hybrid cloud in cloud analyst and then we compared different service broker policies with respect to different load balancing algorithms thereby calculating the response time in each condition

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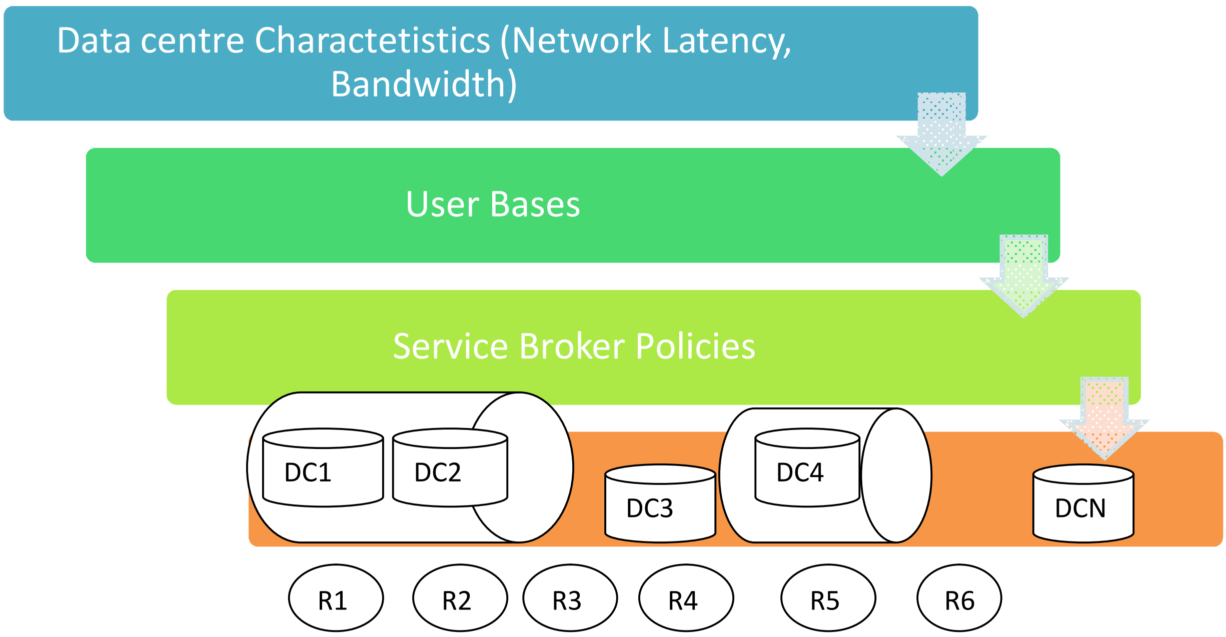

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A CASE STUDY ON ICCS STAFF WHAT SAPP GROUP CHAT ANALYSIS USING BIG DATA SCIENCE

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ABSTRACT

Big Data Science, made a trend and evolution from good old techniques to modern new techniques. In addition, Big data science tools offer a variety of analytical and visualization techniques that produce an efficient graphical view of modern data like WhatsApp group chat, Instagram etc. This paper is attempt to study sentiment analysis of WhatsApp group chat data in which text mining is incorporated to the chat file and the resulted chat text file is further processed with analytical tools that analyze the chat contents and produces a graphical visualization of the word cloud as well as sentiments shared in the group by ICCS staff. Outcome of analysis lies in high stratum of trust opinions compared to other emotions such as anger, fear, disgust, anticipation, joy, positive, sadness, surprise and negative.

Keywords: *Big Data Science , R Code , Whatsapp chat , Text Mining, Sentiment Analysis, Word Cloud .*

INTRODUCTION

In the current stint, due to ease of use, modern features, the usage of WhatsApp has augmented. In 2009, WhatsApp was founded by Brian Action and Jon Koum [1]. WhatsApp user base increased due to the user's ability to interact with others through audio, video calling, texting, and transferring media as well as group chat [1]. In particular, this paper mainly emphasizes on the usage of R statistical software code for text mining , and how it can be used to extract and work with a ICCS staff Whatsapp group chat dataset. R and RStudiois an open-source data analysis programming language and environment [2].It has a wide-ranging user base in academia precisely and is also reinforced by email and web groups.
The dataset of ICCS staff WhatsApp Group chat used for analysis is of 1 Month (Jan 2018) RStudio the most preferred IDE for R is been used to perform exploratory data analysis and visualization for the collected data largely because of its open source nature.

METHODOLOGY AND RESULT DISCUSSION

Different stepstogather relevant data, importing it into RStudioandpackages used in R for text mining analysis toretrieve results.

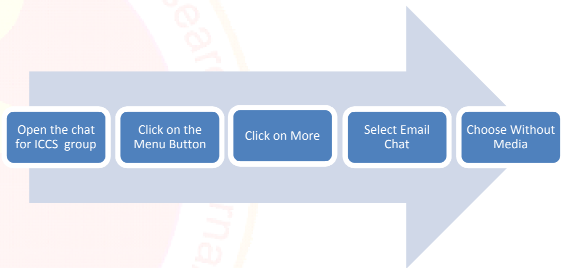

Figure 1 : Steps to gather Whatsapp Group Chat Data

```
library(ggplot2)
library(tm)
library(wordcloud)
library(syuzhet)
texts = readLines("WhatsAppChat.txt")
print(texts)
docs = Corpus(VectorSource(texts))
docs
trans = content_transformer(function(x,pattern)
gsub(pattern," ",x))
docs=tm_map(docs,trans,"/")
docs=tm_map(docs,trans,"@")
docs=tm_map(docs,trans,"\\|")
docs=tm_map(docs,content_transformer(tolowe
r))
docs=tm_map(docs,removeNumbers)
docs=tm_map(docs,removeWords,stopwords("e
nglish"))
docs=tm_map(docs,removePunctuation)
docs=tm_map(docs,stripWhitespace)
```

```
install.packages("SnowballC")
library(SnowballC)
docs=tm_map(docs,stemDocument)
dtm = TermDocumentMatrix(docs)
mat=as.matrix(dtm)
mat
v=sort(rowSums(mat),decreasing =
TRUE)
print(v)
d = data.frame(word=names(v),freq=v)
head(d)
set.seed(1056)
wordcloud(words=d$word,freq=d$freq,
in.freq=1, max.words=200,random.order
=
FALSE,rot.per=0.35,colors=brewer.
pal(8,"Dark2"))
```

Figure 2 : R Code used for Text Mining

1. R-tool has an package termed ggplot, tm, wordcloud ,syuzhet, snowballc which is imported at the start into the R-environment
2. WhatsApp chat text file that is saved in systems local drive is imported into the environment using readLine()
3. Analysis on the emotions are made which produces sentimental values for the chat file
4. Dataframe and colsums are the one that adds additional framework for the analysis produced
5. Data visualization techniques such as boxplotthat is suitable for visualizations of the sentiments is used and this visualization is the final step forexposing analytical result
6. WordCloud is prepared at the end.

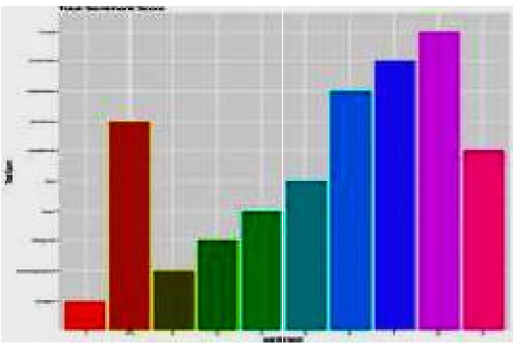

Figure 3 : Sentiment Analysis Graph

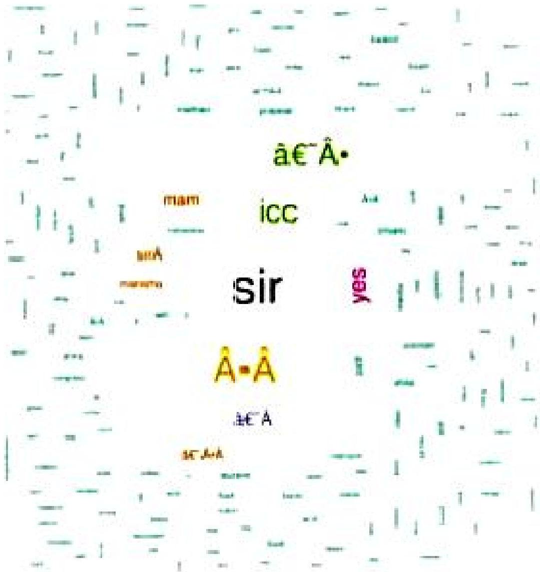

Figure 4 :WordCloud

CONCLUSION

Sentiments plays a fundamental role based on which one can derive conclusion or justifications of any real time scenario like ICCS staff whatsapp group chat . In this paper those sentiments were analyzed using emerging Big Data science that produced a result with higher stratum of trust emotions for the ICCS staff whatsapp group chat that was taken for the analysis. Finally it is stated that since the chats produced positive responses chats can be proceeded with that team or group and as it is emotionally lies on the trust scale the group can be in active state without any reporting on it. This paper focused on the offline analysis of the ICCS staff whatsapp group chat data which was taken between 1 monthperiod of time interval but emotions can be varied as well when time moves in such cases this can be extended to online streaming analysis which is for further enhancemen

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CONTEXTUAL QUERY BASED ON SEGMENTATION & CLUSTERING FOR ACQUIRING RELATED FEATURES IN MEDICAL DIAGNOSIS

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ABSTRACT

Nowadays internet plays an important role in information retrieval but user does not get the desired results from the search engines. Web search engines have a key role in the discovery of relevant information, but this kind of search is usually performed using keywords and the results do not consider the context. This paper describes the use of information extraction techniques applied in previously defined resources in order to suggest the terms to the users and run these expanded terms in web search engines, getting more useful search results, considering the domain context of the required information. The terms most often found in an information resource that is representative of a subject are more likely to also be present in other related documents available in database. The results show that the proposed approach can be used in a corporative environment to help the execution of contextual search activities with good results.

Keywords: *information, engines, context, extraction, terms, documents.*

INTRODUCTION

The web is nowadays one of the main information sources, and information search is an important area in which many advances have been registered. One approach to improve web search results is to consider contextual information. Usually, information about context has been provided through user logs on previous searches or the monitoring of clicks on first results, but different approaches can be used in special environments. In a web based learning environment, existing documents and exchanged messages could provide contextual information. So, the main goal of this work is to provide a contextual web search engine. Contextual search is provided through query expansion using medical documents .The proposed approach makes the context acquisition faster and more dynamic as it considers an automatic approach over text processing of documents.

However, information retrieval is strongly dependent on the context. What a user, who has a specific knowledge and a specific experience, believes as relevant may not be relevant to another user with distinct characteristics and experiences, even if the search expressions used by both of them are the same. This paper presents a proposal to make web searches adaptive to the context of the users, according to their information needs, thus improving query results.

LITERATURE REVIEW

Data mining [11] is a process of nontrivial extraction of implicit, previously unknown, and potentially useful information (such as knowledge rules, constraints, and regularities) from data in databases. In fact, the term "knowledge discovery" is more general than the term "data mining." Data mining is usually viewed as a step towards the process of knowledge discovery, although these two terms are considered as synonyms in the computer literature. The entire life cycle of knowledge discovery includes steps such as data cleaning, data integration, data selections, data transformation, data mining, pattern evaluation, and knowledge presentation.

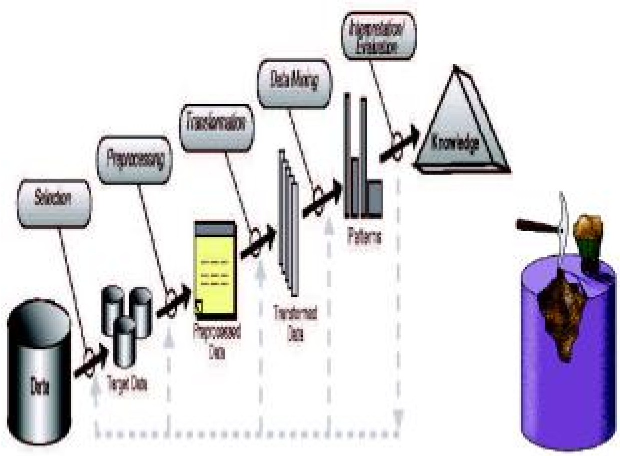

Fig. 1. Life Cycle of knowledge presentation

Data cleaning[11] is to remove noise and inconsistent data. *Data integration* is to combine data from multiple data sources, such as a database and data warehouse. *Data selection* is to retrieve data relevant to the task**.** *Data transformation* is to transform data into appropriate forms. *Data mining* is to apply intelligent methods to extract data patterns. Pattern evaluation is to identify the truly interesting patterns based on some interestingness measures. There are many data mining techniques, such as association rule mining, classification, clustering, sequential pattern mining, etc.

CONTEXT SENSITIVE IR APPROACH

Information retrieval (IR)[18] is a scientific research field concerned with the design of models and techniques for selecting relevant information in response to user queries within a collection (corpus) of documents. Two main steps characterizing an IR process are document indexing and document–query matching. The objective of the indexing stage is to assign to each document in the collection the set of words, terms or concepts expressing the topic(s) or subject matter(s) addressed in the document. The matching stage aims at identifying the most valuable documents that better fit the query. Several and different issues arise from both indexing and matching in IR. In this paper, we are interested particularly in biomedical IR where collections entail medical knowledge and queries cover the information needs of physicians, researchers in the biomedical domain or more generally users of biomedical search tools.
Our context sensitive IR[12][13] approach relies on two main steps detailed below: (1) Conceptual Document Indexing and (2) Context Sensitive Document Retrieval. We integrate them into a biomedical IR process as the combination of the global and local semantic contexts for improving the biomedical IR effectiveness.

QUERY EXPANSION VS DOCUMENT EXPANSION

In order to close the semantic gap between the user's query and documents in the collection, several research works have been focused on applying data smoothing techniques such as document expansion and query expansion on the original document/query. Theoretically, such techniques allow to enhance the semantics of the document/query by bringing the query closer to the relevant documents in the collection. As stated earlier, semantic information can be detected in a global context (usually from a domain knowledge source or an entire collection) or a local context (usually from a sub collection of related top-ranked documents).The principle goal of QE[7] is to increase the search performance by increasing the likelihood of term overlap between a given query and documents that are likely to be relevant to the user query. Current approaches of QE can be subdivided into two main categories: global analysis and local analysis. Global techniques aim to discover word relationships in a large collection (global context) such as Web documents or external knowledge sources like Wordnet , MeSH or UMLS or multiple terminological resources. Local techniques emphasize the analysis of the top-ranked documents (local context) retrieved for a given query in the previous retrieval stage.
Word mismatch is a common problem in information retrieval. Most retrieval systems match documents and queries on a syntactic level, that is, the underlying assumption is that relevant documents contain exactly those terms that a user chooses for the query. However, a relevant document might not contain the query words as given by the user. Query expansion (QE) is intended to address this issue. Other topical terms are located in the corpus or an external resource and are appended to the original query, in the hope of finding documents that do not contain any of the query terms or of re-ranking documents that contain some query terms but have not scored highly.
A disadvantage of QE is the inherent inefficiency of reformulating a query. With the exception of our earlier work , these inefficiencies have largely not been investigated. In this work we proposed improvements to the efficiency of QE by keeping a brief summary of each document in the collection in memory, so that during the expansion process no time-consuming disk accesses need to be made. While some of the methods proposed in this earlier research more or less maintain effectiveness, the process is sped up by roughly two thirds. However, expanding queries using the best of these methods still takes significantly longer than evaluating queries without expansion. Document expansion (DE) as an alternative to QE. In DE, documents are enriched with related terms. Although, while not prohibitively so, there is a significant cost associated with expanding documents, this is undertaken at indexing time, and there is only marginal cost at retrieval time. In

principle it is reasonable to suppose that DE will help resolve the problem of vocabulary mismatch and thus yield benefits like those obtainable with QE. We propose two new corpus-based methods for DE[7].

1. The first method is based on adding terms to documents in a process that is analogous to QE: each document is run as a query and is subsequently augmented by expansion terms.
2. The second method is based on regarding each term in the vocabulary as a query, which is expanded using QE and used to rank documents. The original query term is then added to the top-ranked documents. Our experiments measure the efficiency and effectiveness of QE and DE on several collections and query sets. We find that, on balance, DE leads to improvements in effectiveness, but few of the measured gains are statistically significant; the computational cost at query time is small. In contrast, both standard QE and the efficient QE that we proposed earlier lead to gains in most cases, many of them significant, while the efficient QE is less than twice the cost of querying without expansion. Our experiments were, within the constraints of our resources, reasonably exhaustive. We tested several alternative configurations of DE and explored the parameters, but did not observe useful gains in effectiveness. We conclude that corpus-based DE is unpromising. We did not explore QE to the same extent, yet found effectiveness to consistently improve, and thus believe that further gains in performance may be available.

SYSTEM ARCHITECTURE

3.1 Knowledge base creation

The contextual information must be accessed through the system, so it is necessary to create a connector layer, called the data integration[4], which contains a set of specific software that can read every kind of information available. A domain expert must, from all sources of information available and accessible through the system, select the contents that are good representatives of the subjects that compose the context. Context is modeled with the use of existing resources such as databases, miscellaneous files.

3.2 Extraction of terms

The objective of the Information Extraction module[4] is to identify the main terms of all the contextual information obtained from the Knowledge Base Configuration module, and to provide a list of terms to the search module. Two extractions of terms are executed, one for the most frequently used terms in the context (context extraction), and another for specific terms of each subject identified in context (subject extraction).In both situations, it is necessary to apply some activities of text preparation before the extraction of terms: (i) the Tokenization, the process of breaking a stream of text into words, phrases, symbols and other meaningful elements called tokens, (ii) the removal of stop words, a list of common or general terms that have little value in the text and must not be extracted, and (iii) stemming, the process for reducing inflected (or sometimes derived) words to their base[4].

The extraction of general terms of context is done by calculating the weights of the terms and extracting the n terms with highest weight.

w(i) is the idf (inverse document frequency) factor computed as:

$w(i) = \log2\ N - Nt + 0.5/Nt + 0:5$ [18]

where N is the total number of documents in the collection and Nt is the number of documents containing term t (document frequency).

Similarity measure: Okapi BM25

To measure the similarity of queries to documents, we use Okapi BM25 [7] in all our experiments, where constants k1 and b are set to 1:2 and 0:75 respectively. We set k3 to 0, motivated by the assumption that each term in contemporary queries only occurs once.

Term selection measures

Depending on the expansion method, we use different measures to select terms from a set of candidate terms.

TSV. We use the *term selection value[7]* in our experiments for ranking terms, if not stated otherwise:

$TSVt = (ft/N)\ \ fr,t * (|R|/fr,t)$

where ft is the number of documents in the collection in which term t occurs in, N is the total number of documents in the collection, and fr,t is the number of the |R| top ranked documents in which term t occurs.

The weight calculation is performed with the formula of sublinear term frequency scaling.

$wf\ t,d = 1 + \log tf\ t,d$, if $tf\ t,d > 0$ [4]

0 , otherwise

After the calculation of weights for all de terms, the n terms with highest weight are extracted for each identified subject. The extraction of the specific terms of each subject that is identified in the context requires the application of more information extraction activities. The first step is

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the use of a routine of text segmentation to divide the contents of the contextual information into sentences. The text segmentation is an activity of natural language processing that aims to identify subtopics within a document, defining its limits.

3.3 Searching the terms

The original query can be expanded according to two ways. The first is the automatic expansion, in which the original query is expanded n times, where n is equal to one (context expansion) plus the number of subjects that were identified in the selected context (subject expansion)[4]. Each expanded query is executed on the selected web browser, and the results are presented to the user. The second mode of query expansion is the suggestion of terms, in which all extracted terms are presented as a suggestion. The user has to select the terms of his/her interest that will be incorporated to the original query, performing the query expansion.

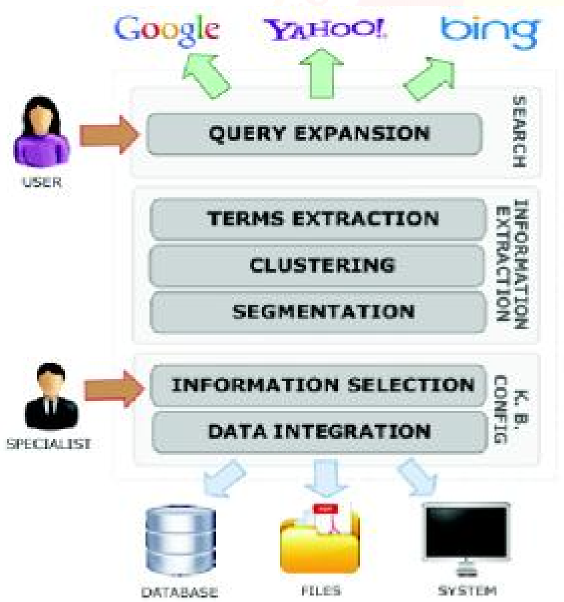

Fig 2. System Architecture

SYSTEM IMPLEMENTATION

4.1 Configuring the System

1. For configuring the system first of all JDK 7 is installed on the machine.

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2. Net Beans 7.4 is installed & JDK is configured in the
   Net Beans for running & compiling java programs.
3. SQL server R2 2008 is installed
4. A new blank project is created in the NetBeans
5. Environment variables are set for libraries of SQL
   Server & JDK

ANALYZING RESULTS

In the automatic expansion mode, in all metrics, the query expansion with general terms of the context and the query expansion with specific terms of the subjects showed better results than those obtained with the original query. In the metric of full precision, an improvement of 76.47% of the cases in at least one of the query expansions was observed, while the original query result only showed better results in 11.76% of cases[4].

The percentage improvement was observed in the comparison of results from the original query with the results of the expanded query with general terms of context (64.71%), and comparing results from the original query with the results of expanded queries with specific terms of subjects (64.71%).In the metrics of search length and correlation rank, improvement in results were also observed, but in smaller proportions than the full precision. Unlike what happened with the automatic expansion, in the mode of suggestion of terms, all metrics showed that the query expansion presented worse results than those obtained with the original query. In the three considered metrics, the differences between the obtained percentages were big, reaching a difference of up to seven times in the case of metric search length (in 47.06% of the case the original query obtained better results against 5.88% of the expanded query)[4][7].

CONCLUSION

The use of information extraction activities in existing resources in databases, archives and information systems can be considered in order to make search results more contextualized and therefore more useful to users

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IMPLEMENTATION OF DRONE FOR SURVEILLANCE OF ISOLATED PLACE FOR SMART CITIES

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ABSTRACT

Surveillance has been always a concern for everyone. In and around city there are so many places which are isolated and require surveillance as many crimes took place at such places. Even manual patrolling is not possible is so many places due to many geographical conditions. As every Government is taking certain steps in surveillance system maximum infrastructure related to this system is available. Using this present infrastructure and small implementation into this will not only improve the surveillance of the isolated places but will remove the manual efforts.

In our study we are using camera attached to drone. This drone will be powered by lithium ion batteries. These batteries will get power from the solar panel attached to the drone. At the time of installation we will fix the center point we call it home point and radius. Using the midpoint algorithm we will calculate the coordinate points of the circular path and on that path the drone will move and will click pictures. These pictures will get compared with the original one if difference occurs will intimate the nearest police station.

Keywords: *Drone surveillance, public security, machine learning*

INTRODUCTION

Surveillance has been always a concern for everyone. In and around city there are so many places which are isolated and require surveillance as many crimes took place at such places. Even manual patrolling is not possible is so many places due to many geographical conditions. As every Government is taking certain steps in surveillance system maximum infrastructure related to this system is available. Using this present infrastructure and small implementation into this will not only improve the surveillance of the isolated places but will remove the manual efforts.

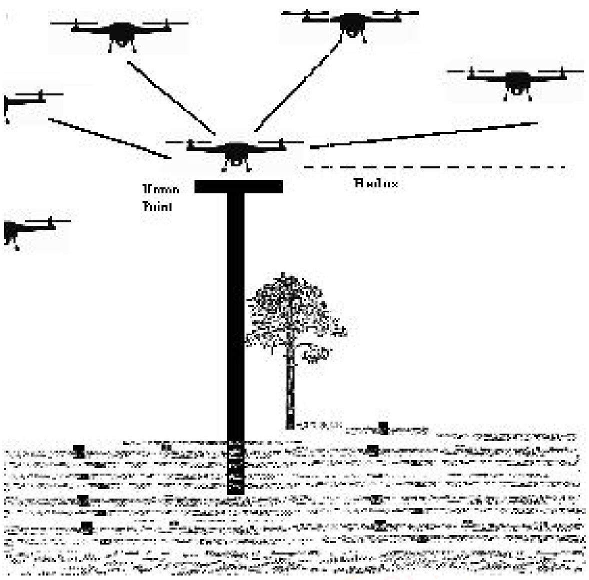
Surveillance system helps in solving many crimes. One benefit of surveillance cameras is they provide you with real time monitoring of your place. It improves the safety of life. It is digitally stored so you can use it and extract the required information from the stored photos. Surveillance of isolated placed now days require constant watch as many crimes are getting planned at certain places.

Our study is to secure the public life safety by automatically observing the cities isolated places using drone system. The data will be sent to the nearest police station. If any unwanted thing observed then that picture can be processed forward to extract additional information.

STEPS FOR INITIAL SETUP REQUIREMENT

1. Identify the area
2. Install a pole on the place consider this place as a home
3. Calculate the radius of area according to requirement. Drone configuration will be according to area to be covered.
4. Take the initial pictures of the isolated place.
5. Save all the pictures for future comparison.
6. Configure the WiFi setup.
7. Configure to the nearest control room (Nearest Police Station)
8. Configure the rest time for drone to save battery life.
9. Start the system according to the configured settings.

These are the one time requirement. Once it is done you can start the process.



DRONE CONFIGURATION

Many of the drones [1] today can be flown from a smartphone app which can be downloaded from Google Play or the Apple Store. The app allows for full control of the drone. Each manufacturer will have their applications such as the Go 4 app from DJI [2].
When we will buy control chip according to your requirement we will get data sheet along with the chip. These instructions help us to control the movements of drone. Readymade software's are also available from the manufacturer's site to program it.
Most flight controllers give you a step by step procedure on what settings to select for your specific drone configuration, including full control over the coordinate values. The drone relies on Wi-Fi and radio signals, gyroscopes, accelerometers, and magnetometers. Taking consideration of all these factors and club it with your requirement and then select the best combination for you setup.
The specialty of our drone is use of lithium ion battery for light weight and use of solar panels to generate power and store it in the lithium ion batteries.

CAMERA CONFIGURATION

There are so many cameras [3] available in the market which gives best performance at the affordable price. The camera will be attached to the drone so it must be light weight and it must have option to communicate to the software through which we will be communicating for image processing.

ROUTING ALGORITHM FOR DRONE

As in our study the drone has to cover a circular path. the path has to be calculated automatically without human intervention . To calculate the coordinate points we have used Mid Point Circle generation algorithm [4] and redesign our algorithm. the drone will start from the home point which is also the center point of the circle and according to the given radius the drone will start flying. When it will reach to the condition radius equals to zero that point is its home point only so it will take a single snap and rest for the while. This rest time is set according to the requirement to save the battery life and charging its battery too using the solar panels.

Algorithm to rotate the drone and click the photos simultaneously

```
midPointCircularPath ( x_centre,  y_centre, r)
{
  Initialize  x = r, y = 0;
  // click the photo on  initial point on the axes
after translation
Move_Drone ( x + x_centre, y + y_centre);
Photo_Click ( x + x_centre, y + y_centre);
  // When radius is zero only a single photo will
be clicked
  if (r > 0)
  {
       Move_Drone( x + x_centre, -y +
       y_centre);
       Photo_Click( x + x_centre, -y + y_centre);
       Move_Drone( y + x_centre, x + y_centre);
    Photo_Click( y + x_centre, x + y_centre);
       Move_Drone( -y + x_centre, x +
y_centre);
       Photo_Click( -y + x_centre, x + y_centre);
  }
  Initialising the value of P
  int P = 1 - r;
  while (x > y)
  {
     y++;
     If Mid-point is inside or on the perimeter
     if (P <= 0)
        P = P + 2*y + 1;
     If Mid-point is outside the perimeter
     else
     {
        x--;
        P = P + 2*y - 2*x + 1;
```

```
        }
        All the perimeter coordinate have already
been clicked
        if (x < y)
            break;
  Clicking on the generated coordinate point and its
reflection in the other octants after translation
            Move_Drone( x + x_centre, y + y_centre);
            Photo_Click( x + x_centre, y + y_centre);
            Move_Drone( -x + x_centre, y +
y_centre);
            Photo_Click( -x + x_centre, y + y_centre);
            Move_Drone( x + x_centre, -y +
y_centre);
            Photo_Click( x + x_centre, -y + y_centre);
            Move_Drone( -x + x_centre, -y +
y_centre);
            Photo_Click( -x + x_centre, -y +
y_centre);
If the generated point is on the line x = y then the
perimeter coordinate points have already been
clicked
        if (x != y)
        {
            Photo_Click( y + x_centre, x + y_centre);
            Photo_Click{ -y + x_centre, x + y_centre);
            Photo_Click( y + x_centre, -x + y_centre);
            Photo_Click(-y + x_centre, -x + y_centre);
        }
    }
}
```

Driver code for Function Calling

```
{
 Obtaining coordinates from starting point
Set radius according to the user requirements;
Call the function until radius become zero
{
midPointCircularPath(homepointx,homepointy,
radius);
radius + radius-1;
}
```

IMAGE COMPARISON

Image comparison can be done using MatLab [5] very effectively. The pseudo code is as below:

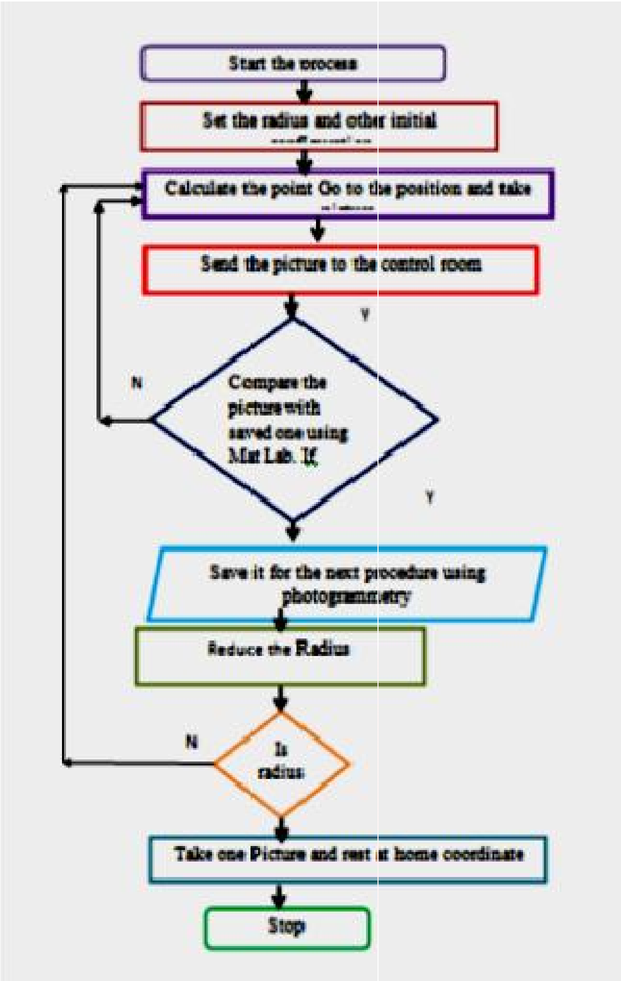
```
% Importing the first image (reference):
Image = imread('image.png');
BW = im2uint8(Image);
[B,L,N,A] = bwboundaries(BW);
% Showing the boundaries:
figure, imshow(BW); hold on;
colors=['b' 'g' 'r' 'c' 'm' 'y'];
for k=1:length(B)
  boundary = B{k};
  cidx = mod(k,length(colors))+1;
  plot(boundary(:,2), boundary(:,1),...
     colors(cidx),'LineWidth',2);
% figure; spy(A);
% Importing the second image:
BW1 = imread('image2.png');
[B1,L1,N1,A1] = bwboundaries(BW1);
% Showing the boundaries:
figure, imshow(BW1); hold on;
colors=['b' 'g' 'r' 'c' 'm' 'y'];
for y=1:length(B1)
  boundary1 = B1{y};
  cidx1 = mod(y,length(colors))+1;
  plot(boundary1(:,2), boundary1(:,1),...
     colors(cidx1),'LineWidth',2);
end
% figure; spy(A1);
% Resizing the second image to match the size of
the first image:
[rowsA colsA RGBA]=size(BW);
[rowsB colsB RGBB]=size(BW1);
C=imresize(BW,[rowsB colsB]);
% Showing the images next to each other:
figure;
imshowpair(BW,C,'diff');
% The following two lines do the same thing that
the function above does:
% K = imabsdiff(BW,C);
% figure, imshow(K,[])
% Showing the images on top of each other in
black and white:
figure;
imshowpair(BW,C,'montage');
% Showing the images on top of each other:
figure;
imshowpair(BW,C,'blend','Scaling','joint');
% K = imabsdiff(BW,C);
% figure, imshow(K,[])
```

First of all make sure the images are scaled, registered, and histogram matched. Then subtract them. If there is difference then that image can be saved for future reference.

USE OF PHOTOGRAMMETRY

Photogrammetry [6] is the science of making measurements from photographs. The output of photogrammetry is typically a map, a drawing or a 3D model of some real-world object or land mass. This method is used to convert images into 3D models. There is much software available which can convert the pictures into 3D model. We are using photogrammetry for those images whose difference is other than zero.

The System Flow Chart



.

CONCLUSION

The present surveillance system implemented in the smart cities is based on CCTV and IP Wireless cameras. They are good option for public places. In an around city there are many isolated places where there is a dearth of crime. In many of the places human patrolling is not possible. Our study can be a good option for such types of surveillance. One time installation and maximum infrastructure is same as that has been used for public place monitoring system. The control room is nearest police station so the single person who is sitting there can watch more than one location. In such a way our study helps in reducing human effort of patrolling such dangerous place. The drone setting is easily possible because of instruction set data sheet and many open source programs are also available who can design the controls according to the user requirements. The study is worth for implementing as per as security is concern

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USE OF CLOUD COMPUTING IN EDUCATION FIELD A REVIEW

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ABSTRACT

In the present scenario, many education institutions are facing the problems with the growing need of IT and infrastructure. Cloud computing which is an emerging technology and which relies on existing technology such as Internet, virtualization, grid computing etc. can be a solution to such problems by providing required infrastructure, software and storage. Resource sharing in a pure plug and play model that dramatically simplifies infrastructure planning is the promise of "cloud computing". The two key advantages of this model are ease of-use and cost-effectiveness.
In this paper a basic research has been carried out to show cloud computing can be introduced in the education field to improve teaching – learning process effectively.The requirement of current demand of infrastructure as well as softwares which is fulfilled by cloud computing and bring a revolution in the field of education.

Keywords: Cloud Computing, e Learning, Saas, IaaS, PaaS

INTRODUCTION

Cloud computing is a complete new technology. It is the development of parallel computing, distributed computinggrid computing, and is the combination and evolution of Virtualization, Utility computing, Software-as-a-Service(SaaS), Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS). cloud computing provides shared resources, software and information through Internet as a PAYGO (Pay-as-you-go) basis. Cloud computing can be a welcomed optioned in the universitiesand educational institutes for higher studies. It gives a betterchoice and flexibility to the IT departments by building multipurpose computational infrastructure once and thenuses it for several purposes for several times. Evolution of cloud computing number of services have migrated from traditional system to the online form. At present many institute are updating their IT infrastructure and data and facing some challenges which can be solved by cloud computing.

CLOUD COMPUTING CHARACTERISTICS AND BENEFITS

Cloud computing boasts several attractive benefits for organizations i.e. business as well as educational and end users. Main benefits of cloud computing are:

- Self-service provisioning: End users can spin up compute resources for almost any type of workload on demand. This eliminates the traditional need for IT administrators to provision and manage compute resources.
- Elasticity: Companies can scale up as computing needs increase and scale down again as demands decrease. This eliminates the need for massive investments in local infrastructure, which may or may not remain active.
- Pay per use: Compute resources are measured at a granular level, enabling users to pay only for the resources and workloads they use.
- Workload resilience: Cloud service providers often implement redundant resources to ensure resilient storage and to keep users' important workloads running -- often across multiple global regions.
- Migration flexibility: Organizations can move certain workloads to or from the cloud -- or to different cloud platforms as desired or automatically for better cost savings or to use new services as they emerge.

TYPES OF CLOUD COMPUTING SERVICES

Cloud Providers offer services that can be grouped into three categories.

1. Software as a Service (SaaS): In this model, a complete application is offered to the customer, as a service on demand. A single instance of the service runs on the cloud & multiple end users are serviced. On the customers side, there is no need for upfront investment in servers or software

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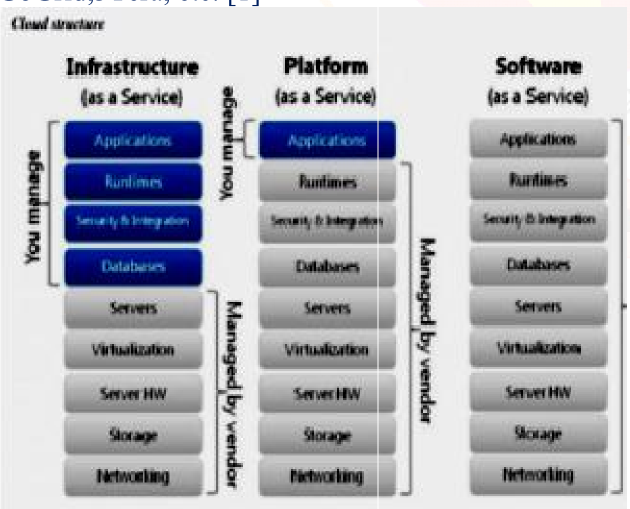
licenses, while for the provider, the costs are lowered, since only a single application needs to be hosted & maintained. By using Saas, big vendors like Microsoft, IBM, Oracle and SalesForce.com offers various educational software and applications in less cost.[3]

2. Platform as a Service (Paas): Here, a layer of software, or development environment is encapsulated & offered as a service, upon which other higher levels of service can be built. The customer has the freedom to build his own applications, which run on the provider's infrastructure. PaaS enables the customer to hire virtual servers, as well as other services required to operate the applications that exist. Further, it ensures that the client design, develop, test, deploy and host applications[2]. PaaS providers offer a predefined combination of OS and application servers, such as LAMP platform (Linux, Apache, MySql and PHP), restricted J2EE, Ruby etc. Google□s App Engine, Force.com, etc are some of the popular PaaS examples.

3. Infrastructure as a Service (Iaas): IaaS provides basic storage and computing capabilities as standardized services over the network. Servers, storage systems, networking equipment, data centre space etc. are pooled and made available to handle workloads. The customer would typically deploy his own software on the infrastructure. Some common examples are Amazon, GoGrid,3Tera, etc. [1]



CLOUD DEPLOYMENT MODELS

The hosting models for cloud represent the different types of cloud environments which are characterized by different sized, access and proprietorship. There are four deployment models are as follows:

Public Cloud: In this type of cloud hosting, the cloud services are provided through a network that is accessible by the public.

Private Cloud:
This is also regarded as an internal cloud. The environment on which the cloud computing platform lies is protected by a firewall that is monitored by the information technology department which belongs to the particular organization and can only be used by the authorized clients only.

Community Cloud:
This denotes a cloud hosting that is mutual and is shared among many organizations with similar interest and requirement of a specific community including trading firms, banks, or gas stations among others. The group of users must have computing apprehensions that are similar.

Hybrid Cloud:
This is an integrated model of cloud computing environment. It may consist of two cloud servers or more, which may either be public, communal or private.

APPLICATIONS OF CLOUD IN EDUCATION

Educational cloud computing services represent a growing variety of useful services available on the internet, and the most innovative and rapidly developing element of technology and education. It also promises to provide multiple services that will be very useful to the students, faculty and staff . Furthermore, these applications are heavily investing in cloud computing as being the future of the academic cloud computing[4] [5]. Some of these applications are Microsoft, Google, IBM, HP, Amazon, Sales force, Amanda and Zamanda.

A. Amazon Cloud Services in Education- Amazon Web:
Amazon offers many cloud services, including: Amazon Elastic Compute Cloud (AmazonEC2): A web service that offers virtual machine and extra CPU cycles for the institutional organization. Amazon Simple Storage Service (Amazon S3): Allows the students, faculty and researchers to store items with alimited size in Amazon's Virtual storage_ Amazon Simple Queue Service (SQS),Amazon Virtual Computing Laboratory (Amazon VCL): [6].

B. Microsoft Education Cloud Computing: The Microsoft software and services strategy are about the power of choice a hybrid model of resources that enables the students and researcher to transfer to the cloud. The Azure Services Platform (ASP), includes services that allow the faculty, students and researchers to establish user identities, manage work flows, execute other functions such as Microsoft's online computing platform [7]

C. Google Applications for Educational Cloud Computing Google App Education (GAE) as a new generation of cloud computing-based Web application

development platform, enables its users such as the faculty, researchers and students and so on, GAE is available at no cost to institutions, universities and education community [8]. Google Apps Education Web-based messaging tools such as Google Mail, Google Talk, Google Sites , Google Video and Google Calendar to the faculty, students and staff for free in addition to productivity and collaboration tools such as Google Docs Package [9][14]

D. IBM Cloud Services to Education: By using the IBM SmartCloud for Education services, schools and higher education institutions can address the significant challenges they face: student achievement, graduation rates, scholarship funding, and demands for IT resources for research.[10].

E. Salesforce.com Cloud Computing In Education: Salesforce is a trusted leader in cloud computing and customer relationship management, as well as a respected pioneer in the educational institutes. As part of these philanthropic efforts, the Salesforce.com Foundation makes its products available at the educational institutes at a big discount.[11]

F. HP Cloud Computing In Education: HP Cloud computing in education is a way to build, operate, and consume IT that makes educational resources such as the student records, knowledge management, faculty collaboration and etc. available on demand. [12].

G. AMANDA And ZMANDA Cloud Computing For Education:

For backup and added Functionality that support fast installation, simplified management, enterprise-class functionality, and low-cost subscription fees.[13].

IMPACTS OF CLOUD COMPUTING ON EDUCATION

Three fundamentally new impacts that must befactored into the educational system:

A. Low – Cost and Free Technology: There has been ahuge growth in low – cost and free technology for social interaction, publishing, collaborating, editing, contentcreation, computing etc., All that needed is a cheap access device and aweb browser, broadband perhaps wireless hotspots.

B. Content Growth : The amount of content is growing at an exponential rate, available to a broad audience and anyone can contribute. Content has traditionally come from limited, relatively "known" channels like textbooks, encyclopedias, newspapers and television. Most content now comes from relatively "unknown" sources through the web. Content can be true, partially true, or false. There is more of all of the above available to us instantaneously.

C. Collaboration : Technology is rapidly improving the ability to communicate and collaborate with others. It is becoming easier to find and cannot with any one in any new and expanding ways; mobile phones, email, instant messaging, social and collaborative software and blogs. Collaboration has been a one – time, relatively static and sequential process.

BENEFITS OF CLOUD COMPUTING FOR INSTITUTIONS AND STUDENTS

There are numerous benefitsin the field of education for institutions and students when the e-learning is implemented with the cloud computing technology[19].

1. *Personalized Learning*: Cloud computing affords opportunities for greater student choice in learning.
2. *Reduced Costs:* Students can use office applications for free without having to purchase, installand keep these applications up to date on their computers. It also provides the facility of Pay per use for someapplications.
3. *Accessibility:* Availability of the services is the most important and desired by the user using the educationcloud.24 X7 is the availability that is needed by this system without failure and anywhere.
4. *No Extra Infrastructure:* The applications can run from cloud through their PC, mobile phones, tablet PC having minimum configuration with internet connectivity
5. *Go Green:* Education cloud will surely reduce the carbon footprint.
6. *User Friendly:* This new facility is user friendly and no need to worry about the complexity. It is easy tounderstand and easy to operate.

7 *Improved performance:*

Since the cloud based e-learning applications have most of the applications and processes in cloud, client machines do not create problems on performance when they are working.

8 *Instant software updates:*

Since the cloud based application, the software's are automatically updated in cloud source. So, always e-learners get updates instantly.

9 *Benefits for students:*

Students can take online courses, attend the online exams, get feedback about the courses from instructors, and send their projects and assignments through online to their teachers. [16]

10 *Benefits for teachers:*

Instructors have the capacity to get ready online tests for understudies, arrangement and make better substance assets for under studies through substance administration, evaluate the tests, homework, tasks taken by understudies, send the input and correspond with understudies through online discussions. [17][15]

Teachers or lecturers can upload their class Tutorials, assignments, and tests on the cloud server which students will be able to access all the teaching material provided by the teachers via Internet using computers and other electronic devices both at home and college.[20]

SOME CHALLENGES

There are several obstacles computing faces before adopted.

1. Security: There are several concerns surrounding the implementation of security in cloud computing and one of them is data privacy. The users do not have control or know where their data is being stored.

2. Performance and Availability: Experiments that are research endeavors computing power. Some of the concerns include how to guarantee such performance from an outside vendor. Availability of services is another related concern in terms of the possibility of massive vendor outages. This is especially true since it may impact student learning or the timely delivery of the research results, which are typically tied to strict timelines.

3. Integration with in house IT and customizability: University IT administrators typically use their own in –house applications with a considerable portion that is customized to their own lab structure. The concern is the transition of such in – house applications to the cloud environment and how much of the customizability will be lost in that process.

4. Cost is another factor that may be introduced by additional vendor relationship management or possibly additional measures that are unique to cloud computing.

5. Interoperability: A universal set of standards and interfaces have not yet been defined, resulting in a significant risk of vendor lock – in.

6. Control: The amount of control that the user has over the cloud environment varies.

7. Latency: All access to be cloud is done via the internet, introducing latency into every communication between the user and the environment.

8. Reliability: Many existing cloud infrastructures leverage commodity hardware that is known to fail unexpectedly.

RISKS OF CLOUD COMPUTING IN EDUCATION

The universities and schools should consider the challenges and risks prior to transferring to the cloud[18][19] . Examples of these risks are:

Cloud Service Failure: Insufficiency of financing and immature markets could guide some cloud providers out of business and any loss or deterioration of service delivery performance, as well as a loss of investment, make the universities and schools to the risk of having to perform their own duties and obligations, thus being exposed to contractual or legal liability to their employees, third parties, the students or even the public.

Compliance Regulations: Due to the increasing number of regulations and need for operational transparency, the educational institutions are increasingly adopting consolidated and consistent sets of compliance controls

Data Privacy: The multi-tenancy, reuse of hardware and software profiles, and resiliency due to the redundant nature of cloud means a greater risk of incomplete or unlock deletion or denial of service attacks on institutions' confidential data.

Assurance to Service Provider: This proposes a dependency on a particular cloud service provider for service preparation, especially when data portability is not supported.

CONCLUSION

The present motto of our country is making india, digital india and equal and quality education to all, the problem of reaching the technology to remote schools and educational institutes therewhere cloud computing plays immense role to improving quality and enormous education for students.

The cloud allows us to access its services for our work anywhere, anytime and share it with anyone with machine independent. In this paper present this cloud computing in the field of education is very beneficial not only to educational institutes but also for students and faculty members for improving the quality of education.

There are some challenges with cloud computing and its use in education but with the time these will be resolved.

As we know that every technology update time to time so in future more secure and some complex softwares would be available. Also for making strong cloud computing Basic cloud computing courses should be arrange as well as teachers and students should be willingly and motivate to use services of cloud computing. It is proposed that universities and other institutions will provide cloud based virtual laboratories for all disciplines.

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INFORMATION SECURITY IN CLOUD COMPUTING

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ABSTRACT

The use of cloud computing is becoming widespread, but systematic study of its managerial implications is lacking.This paper examines cloud computing in the context of other major changes in Information Technology (IT) and explores the revolutionary transformations and challenges it brings to IT management. The paper analyzes study of cloud computing with it's technologies and focus on information security in cloud computing.

Keywords: *Cloud Computing, Characteristics of cloud computing,Technology used in cloud computing and information security in cloud computing*

INTRODUCTION

Cloud computing has been an important term in the world of Information Technology (IT). Cloud computing is a kind of computing which is highly scalable and use virtualized resources that can be shared by the users. Users do not need any background knowledge of the services. A user on the Internet can communicate with many servers at the same time and these servers exchange information among themselves. The concept of cloud computing offers in the IT sector a way to increase IT capacity and add on the fly capabilities without investing in new infrastructure, new training, or licensing new software. There is no need to setup, configure and manage large physical installations of hardware and networks. This technology allows much more efficient computing by centralizing storage, memory, processing and bandwidth. In cloud computing big data tool utilize the big data and provide the solutions. Cloud computing techniques to estimate costs for service dependency and to monitor costs associated with typical scientific applications. Recently, cloud computing has been considered as an emerging model which aims at allowing customers to utilize computational resources and software hosted by service providers. Cloud computing promises to eliminate obstacles due to the management of IT resources and to reduce the cost on infrastructure investments. Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the datacenters that provide those services. The services themselves have long been referred to as Software as a Service (SasS), so we use that term. Providers apply online ordering and payment via browser-based applications for selling Utility Computing and Application Service Providing . Hence, a very important aspect in Cloud Computing is E-commerce applied to the above-mentioned services. Other works introduce the service types infrastructure, platform and software for cloud-based services. Cloud-based infrastructure provides access to virtualized hardware located on the Internet. Figure 1.[1] Cloud Computing and its Service Provider

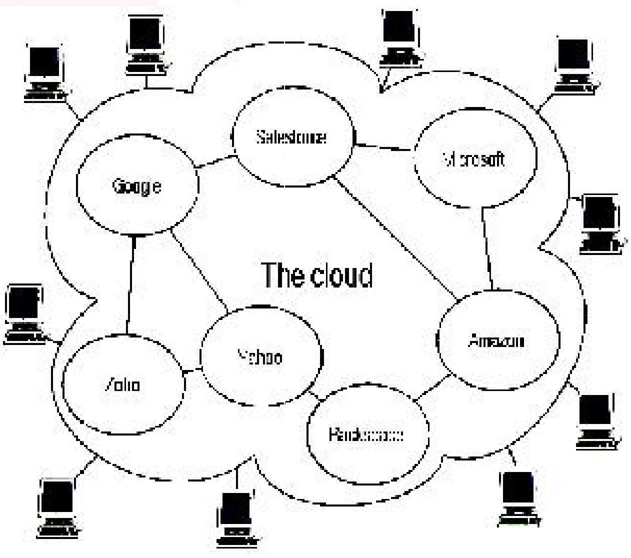

Figure1. CloudComputing an itService Provider

It can be the ability to rent a virtual server, load software on it, turn it on and off at will, or clone it ten times to meet a sudden workload demand. It can be storing and securing immense amounts of data that is accessible only by authorized

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applications and users. the nature of cloud computing and how it builds on established trends while transforming the way that enterprises everywhere build and deploy applications.

DEFINITION OF CLOUD COMPUTING

Cloud computing is a model for enablingconvenient, on-demand network access to a shared pool of configurable computing resources(e.g., networks, servers, storage, applications,and services) that can be rapidly provisionedand released with minimal management effort or service provider interaction.

2.1Essential Characteristics:

1.On-demand self-service. A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service's provider.

2.Broad network access. Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, laptops, and PDAs).

3.Resource pooling. The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, network bandwidth, and virtual machines.

4.Rapid elasticity. Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time.

5.Measured Service. Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported providing transparency for both the provider andconsumer of the utilized service.

TECHNOLOGIES USED IN CLOUD COMPUTING

Cloud computing systems use many technologies of which the programming model, data management, data storage, virtualization are the key technologies:

3.1. Virtualization : Virtualization is a method of deploying computing resources. It separates the different levels of the application system including hardware, software, data, networking, storage and so on, breaks the division among the data center, servers, storage, networking, data and the physical devices, realize dynamic architecture, and achieves the goals of managing centralized and use dynamically the physical resources and virtual resources, improving the flexibility of the system, reducing the cost, improving the service and reducing the risk of management. In computing, virtualization means to create a virtual version of a device or resource, such as a server, storage device, network or even an operating system where the framework divides the resource into one or more execution environments. Even something as simple as partitioning a hard drive is considered virtualization because you take one drive and partition it to create two separate hard drives. Devices, applications and human users are able to interact with the virtual resource as if it were a real single logical resource.

3.2. Distributed Storage : In order to ensure high credibility and economy, cloud computing adopts distributed storage to save data, using redundancy storage to ensure the reliability of stored data and using high credible software to make up the readability of the hardware, therefore providing the cheap and credible mass distributed storage and computing system. The data storage system of cloud computing are Google File System (GFS) and Hadoop Distributed File System (HDFS) which is developed Hadoop team. GFS is a distensible distributed file system. It is used in large and distributed applications which need to access mass data. HDFS is a distributed file system which is applicable to running on commodity hardware. It is very similar to the existing distributed file system, but also with a significant difference.

3.3. Parallel Programming Model : To enable users efficiently to use cloud computing resources and more easily enjoy services that cloud computing adopts Map Reduce programming model, which decomposes the task into multiple subtasks, and through two steps (Map and Reduce) to realize scheduling and allocation in the large-scale node.

Map Reduce is a parallel programming system developed by Google. It puts parallelism and fault tolerance, data distribution, and load balance in a database. Map Reduce system mainly consists of three modules: client, master and worker. The client is responsible for submitting parallel processing assignments composed by the users to master node. Map Reduce is mainly used in mass data processing. One of the features of the task scheduling strategy is scheduling priority the task the node which the data belong.

INFORMATION SECURITY IN CLOUD COMPUTING

The selected literature will now be evaluated on the common issues as enlisted by NIST and CSA guidelines. This evaluation of literature will also help us to identify the areas which are more researched as compared to other issues and which need further research. This will help us in determining recommendations on future work and research

1. Service Traffic Hijacking If an attacker gains access to your credentials, he or she can eavesdrop on your activities and transactions, manipulate data, return modified / false information, and redirect your clients to unwilling sites. Your account or services instances may become a new base for the attacker. From here, they may leverage the power of your reputation to launch subsequent attacks.[2] Countermeasure:- Organizations should look to prohibit the sharing of account credentials between users and services, and they should leverage strong two-factor authentication techniques where possible. Cloud Security Alliance (CSA) has issued an Identity and Access Management Guidance which provides a list of recommended best practices to be governed.[8].

2. Insecure Interfaces and APIs System administrators rely on interfaces and Application Program Interface (API) for cloud provisioning, management, orchestration, and monitoring. Many a times, Organizations and third parties known to build on these interfaces, injecting add-on services to facilitate ease of system administration. Weak interfaces and APIs can expose an organization to such security issues pertaining to confidentiality, integrity, availability, and accountability.Countermeasure: - Organizations specially the providers and orchestration layer developers in the field of Cloud are required to understand the security implications associated with the usage, management, orchestration, and monitoring of cloud services and take necessary steps while developing such interface and APIs.

3. Malicious Insider Attacks. Malicious insiders can be a current or former employee, a contractor, or an outsourced third party who gains access to a network, system, or data for malicious purposes. These attacks are quite prominent for all three service models of Cloud Computing i.e. IaaS, PaaS, SaaS. Even if encryption is implemented and if the keys are not kept with the CSU and are only available at data-usage time, the system is still vulnerable to malicious insider attacks. Countermeasure: Fog computing [9] which is suggested to include user behavior profiling and Decoy Information such as honey pots may be implemented to avoid malicious insider attacks

. 4. Cloud Abuse A legitimate hacker may use cloud servers hosted on same CSP or third party CSP to launch a DDoS attack, propagate malware, botnet etc. Botnets have been used for sending spam, harvesting login credentials, and launching injection attacks against Websites. Botnets can also be used to launch a denial of service attack against the infrastructure of a cloud provider. Hacker may hire cloud services to launch phishing attacks, malware etc. This leads to another challenge for CSP to define what constitutes abuse and to determine the best processes for identify it.[3] Countermeasure: A few solutions has been suggested by researchers such as intrusion prevention system, flitering of Network Traffic, Logging along with some non technical measures such as acceptable use policies, account verification etc.[4] G. Multi Tenancy In Cloud Computing environment, CSP shares infrastructure, platforms, and applications to deliver their services in a scalable way. The threat of shared vulnerabilities exists in all delivery models of cloud computing. [5] Countermeasure:- The Infrastructure at CSP end should be designed and deployed to offer strong isolation properties for a multi-tenant architecture (IaaS), re-deployable platforms (PaaS), or multi-customer applications (SaaS).

5. System Complexity A public cloud computing architecture is a bit complex as compared to in house deployment of the same service. A public cloud architecture like any in house solution may include application deployment, compute infrastructure, storage, supporting middleware, virtualization, third party VMs etc but it may additionally include other management backplanes such as for self-service resource allocation, quota management, metering, data replication and

recovery management etc. Public cloud service itself may be a nested architecture provided by other third party cloud service providers. Therefore the security depends on more complex architecture. Countermeasure: Subscriber of this service should take due diligence of the cloud architecture depending upon his requirement and keep all the aspects in its risk assessment plan.

6. Loss of Control Migrating to a public cloud requires a transfer of control to the cloud provider; your data and other system components that were previously under the client's direct control. This loss of control [6] will affect subscriber's ability to maintain situational awareness, find alternatives, prioritization of tasks best suited to the incident in favor of client's organization. Loss of control differs in three service models (Saas, Paas, Iaas). Countermeasure: Due diligence is must to understand the architecture of the provider solution and risk assessment should be planned accordingly.

7. Virtualization Issues We have discussed so far about multi tenancy, resource pooling etc; to achieve this, Virtualization of compute resources is one of the main building block of Cloud Architecture. Virtualization allows users to create, copy, share, migrate, and roll back virtual machines, which may allow them to run a variety of applications. In Virtualization a second logical layer is added to create Virtual machines. Security becomes more complex due to additional layer and complex interconnectivity [10]. Shared Resources:- Virtual machines hosted on same physical server share CPU, memory, I/O, network etc. Sharing resources between virtual machines may cause security issue amongst different virtual machines. For example, a malicious VM can infer some information about other VMs through shared memory or other shared resources without need of compromising the hypervisor. VM escape, the program running in a virtual machine is able to completely bypass the virtual layer (hypervisor layer), and get access to the host machine. Uncontrolled VM Images:- In virtualization, a VM image is a prepackaged software template containing the configurations files that are used to create new virtual machines. One can either create its own image from scratch, or one can use any image stored in the service provider's repository. An attacker with a valid account can create an image containing malicious code. If another customer uses this image to create VM, the new virtual machine will be infected with the hidden malware. So these images can be the fundamental for overall security of virtualization. Exposed IP Address of VMs:- Network components may also be shared by different clients due to resource pooling. In virtualization, virtual networks are configured either by bridging or routing in virtual switch of hypervisor. This may lead to perform some attacks such as sniffing and spoofing virtual networks. VMs have IP addresses that may be visible to anyone within the cloud and hence the attacker may map the target virtual machine Countermeasure: The issues due to Virtualization may be solved by properly configuring the host/guest interaction. [10] Traditionally firewalls are configured at gateways but for better security countermeasures, the firewalls may be configured near to the virtualization hypervisor.

8. Service Level Agreements An SLA represents the understanding between the cloud subscriber and cloud provider about the expected level of service to be delivered and, in the event that the provider fails to deliver the service at the level specified, the compensation available to the cloud subscriber. Countermeasure:- Exit Clause must be mentioned with proper data transfer, data sanitization, service transition. In case the client wishes to migrate service to any third party service provider, the present Cloud service provider should provide disposition support including data migration, knowledge transfer and integration respectively. M. Incident Response Incident responds means dealing with Information Security incidents in an organized manner. Incident management [7] shall include logging of incident, incident verification, root cause analysis of attacks, containment (restrict effected area of incident), data collection and preservation, problem remediation, and service restoration. Response to an incident should be handled in a way that limits damage and reduces recovery time and costs else it may lead to problems for other customers of same CSP. Countermeasure: The Contract agreement between CSP and CSU must provision procedures incident response and management. The CSP should transparently share the information with its clients during and after the incident.

CONCLUSION

This paper introduces the definition of could computing and its main service offered in IT and other fields, summarizes the characteristics, and focused on the key technologiesof cloud computing.Cloud computing is becoming popular because of its cost and other good number of reasons for its users. At the same time its adoptability may be faster if security aspects are addressed well. Traditional security mechanisms may not work well in cloud environments because it is a complex architecture which is composed of a combination of different complex technologies. New Security techniques are required to be developed so as to meet cloud architecture. An analysis of security has been done on the basis of three popular service models (SPI) of cloud computing

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NANT: AN ANT-COLONY SWARM INTELLIGENCE BASED APPROACH FOR COMMUNICATION NETWORKS

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ABSTRACT

The world around us is becoming increasingly complex every day and changes dynamically. The problems that we face require adaptive and scalable systems that can offer solutions with ever-rising level of autonomy. Traditional approaches are becoming obsolete because they were designed for a simpler world. Therefore, any advancement in understanding and solving of complex problems can have an impact on the entire set of disciplines in engineering, biology, sociology, etc.

In this paper we present a new on-demand routing algorithm for mobile, multi-hop ad-hoc networks. The protocol is based on swarm intelligence and especially on the ant colony based meta heuristic. These approaches try to map the solution capability of swarms to mathematical and engineering problems. The introduced routing protocol is highly adaptive, efficient and scalable. The main goal in the design of the protocol was to reduce the overhead for routing. Swarm Intelligence is a problem-solving behavior that occurs as a result of a multiplicity of interactions between independent components that make up the entire system.

Keywords: *Swarm Intelligence, Hive, Piping, Quorum*

INTRODUCTION

Swarm Intelligence is a problem-solving behavior that occurs as a result of a multiplicity of interactions between independent components that make up the entire system. The algorithms inspired by the cooperative behavior in nature, as in colonies of social insects, rely on artificial swarms of agents and were initially applied to solve the combinatorial optimization problems. Swarm intelligence comes from the biological study of social insect and insight about how they manage to solve complex problems in their daily lives. Research field as swarm systems are examples of behavior based systems. The most common form of communication among social insects is the use of pheromones. Pheromones are chemical signals sent out from one individual to trigger a reaction behavior on the receiving individuals of the same species. The proposed approach can be useful in traveling salesman problem also in optimized way of path finding.

The main problem in mobile ad-hoc networks is still, the finding of a route between the communication end-points, which is aggravated through the node mobility. Ant colony algorithms are a subset of swarm intelligence and consider the ability of simple ants to solve complex problems by cooperation. The interesting point is, that the ants do not need any direct communication for the solution process, instead they communicate by stigmergy. The notion of stigmergy means the indirect communication of individuals through modifying their environment. Several algorithms which are based on ant colony problems were introduced in recent years to solve different problems, e.g. optimization problems.

LITERATURE REVIEW

Joshua Kirby et al.[1] introduced a novel swarming interpolation framework and validated its effectiveness on static fields. Proposed framework can be used to control autonomous mobile sensors into flexible spatial arrangements in order to interpolate values of a field in an unknown region. Sorin Ilie and Costin Badica [2] proposed a framework based on Ant Colony Optimization on a Distributed Architecture (ACODA), for implementation of SI algorithms aimed at solving complex graph search problems. In [3] Jiraporn Kiatwuthiamorn and Arit Thammano proposed an optimization technique based on the ant colonies. Sifat Momen[4] investigates that effects of biasness in brood caring on the performance of the colony, it is observed that a little biasness in brood caring results in a statistically improvement in the performance of the colony. Omid Nezami et al. [5] found the appropriate regions of search space by introducing

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new artificial particles based on historical information.

Imane Fahmy et al. [6] proposed the The Predictive Energy Efficient Bee-inspired Routing algorithm for Mobile Ad-hoc Networks (MANETs). The proposed algorithm was to find the optimal path among a number of potential paths between a certain source-destination pair. Patrick Benavidez et al. [7] investigated the problems related to swarm robots to coordinate their actions to accomplish a given task in multi domain systems and developed protocol which is flexible enough to handle different types of data such as GPS, image, and control commands. John Baras et al. [8] proposed a set of routing algorithms for MANETs based on the swarm intelligence paradigm. It observes that end-to-end delay for swarm based routing is low compared to AODV. However, the good put for these algorithms is lower than for AODV in scenarios with high mobility [10].

ANT SYSTEM ALGORITHM

The ant colony optimization meta-heuristic is a particular class of ant algorithms. Ant algorithms are multi-agent systems, which consist of agents with the behavior of individual ants,

Figure 1: Nest of Ant Colony

The above figure 1 indicates the two circles, the first one in the brown color indicates the source of the ants and the orange circle indicates the destination of ants. Ant Colony Optimization (ACO) is a swarm-based meta heuristic which models the foraging behavior of ant colonies in nature the ants through collaboration can solve complex problems such as finding the shortest path to a food source. This feature can be used to solve the engineering problems that require this kind of optimization. When traversing from one node to another, ants leave pheromone trails on the edges connecting the nodes. The pheromone trails attract other ants that lay more pheromone, which consequently leads to pheromone trail accumulation.

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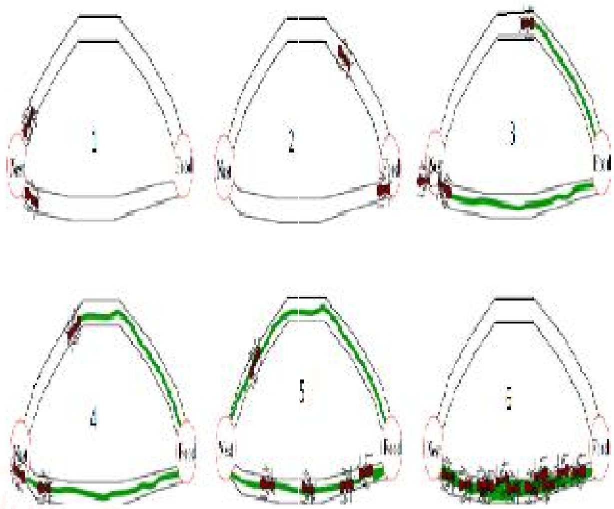

Figure 2: Ants Bridge Experiment

Negative feedback is applied through pheromone evaporation that, importantly, restrains the ants from taking the same route and allows continuous search for better solutions.

SIMULATION ENVIRONMENT

The ANT-Lines model shows the swarm intelligence of ANT colonies. A swarm of tens of thousands can accurately pick the best solution available among dozens of potential choices through self-organizing behavior. The behavior of ants following a leader towards a food source, the leader ant moves towards the food along a random path; after a small delay, the second ant in the line follows the leader by heading directly towards where the leader is located. Each subsequent ant follows the ant ahead of it in the same manner.

Table 1: Simulator Parameters

Simulator Environment	NetLogo-6.0.2
Leader Wiggle Angle	10 Degrees
Start Delay	3 Sec
Number of Ants	[20,40,60,80,100]
Leader Heading	Random

Plots: Even though the leader may take a very circuitous path towards the food, the ant trail, surprisingly, adopts a smooth shape. While it is not yet clear if this model is a biologically accurate model of ant behavior, it is an interesting mathematical exploration of the emergent behavior of a series of agents following each other serially

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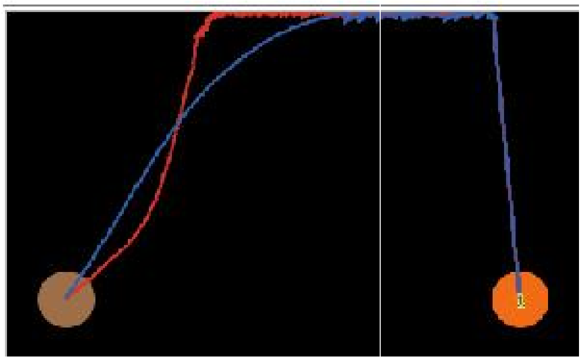

Figure 3: NANT 20

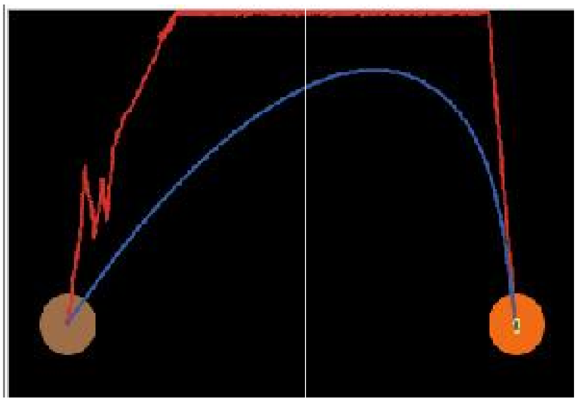

Figure 4: NANT 40

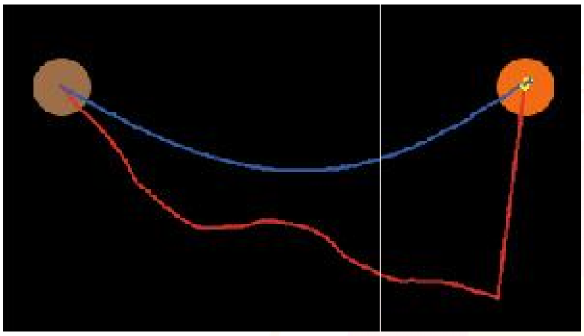

Figure 5: NANT 60

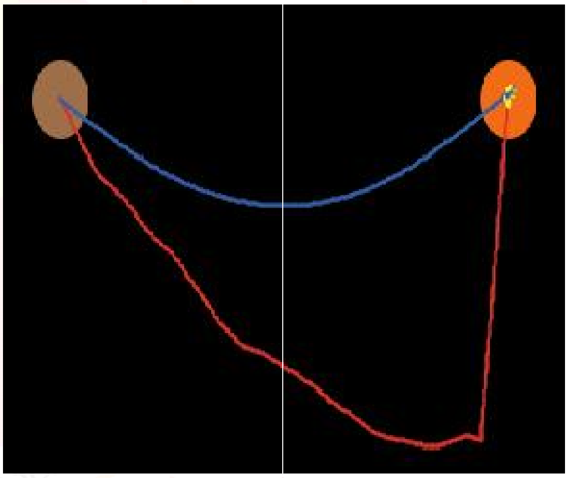

Figure 6: NANT 80

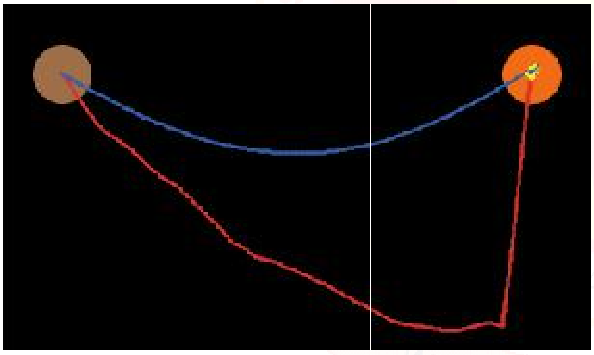

Figure: NANT 100

When the leader ant gets close enough to the food to "smell" it, it stops wiggling and heads directly for the food. The leader ant leaves a red trace as it moves. Each subsequent ant follows the ant ahead of it by heading directly towards it before it takes each step. The follower ants do not leave a trace. The yellow line of ants, however, traces out a curve in the drawing. The last ant to go leaves a blue trace. Hence from the above plots it is confirmed that as the number of ants increases for the foraging the chances for the shortest path is greater.

CONCLUSION

Swarm Intelligence (SI) based ACO algorithms provide interesting solutions to network routing problems. ACO based routing in MANETs will enhance the reliability and efficient packet delivery. They help in reducing control overhead due to their inherent scalable feature. This proves the potentiality of our approach which is problem-type-independent. Finally, it is concluded that the swarm intelligence approach is an effective algorithm to solve different kinds of problems. In this dissertation, the research in Swarm Intelligence focused on two general approaches. One approach was to solve the optimization-like problems using the swarm-based algorithms as tools, and the other approach was to model the multi-agent systems such that they resemble swarms of animals in nature providing them with the ability to autonomously perform a task at hand

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A SYSTEMATIC REVIEW OF BIG DATA

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ABSTRACT

Big data is the term for collecting of data sets so large and complex that it becomes difficult to process using on-hand database system tools or traditional data processing applications. Big data can be structured, unstructured or semi-structured, resulting in incapability of conventional data management methods. Big Data is a data whose scale, diversity, and complexity require new architecture, techniques, algorithms, and analytics to manage it and extract value and hidden knowledge from it. The challenges include capturing, analysis, storage, searching, sharing, visualization, and transferring and privacy violations. This paper aims to analyze some of the Characteristics which can be applied to big data, as well as the opportunities provided by it, and various Big Data Challenges.

Keywords: *Big Data , Volume , Variety , Velocity*

INTRODUCTION

"***Big Data***" is data whose scale, diversity, and complexity require new architecture, techniques, algorithms, and analytics to manage it and extract value and hidden knowledge from it.[1]

Data has always been around and there has always been a need for storage, processing, and management of data, since the beginning of human civilization and human societies. However, the amount and type of data captured, stored, processed, and managed depended then and even now on various factors including the necessity felt by humans, available tools/technologies for storage, processing, management, effort/cost, ability to gain insights into the data, make decisions, and so on.[2]

The term has been in use since the 1990s, with some giving credit to John Mashey for coining or at least making it popular. Big data usually includes data sets with sizes beyond the ability of commonly used software tools to capture, curate, manage, and process data within a tolerable elapsed time. Big Data philosophy encompasses unstructured, semi-structured and structured data, however the main focus is on unstructured data. Big data "size" is a constantly moving target, as of 2012 ranging from a few dozen terabytes to many petabytes of data. Big data requires a set of techniques and technologies with new forms of integration to reveal insights from datasets that are diverse, complex, and of a massive scale.[3]

Processing information like this illustrates why big data has become so important:

- Most data collected now is unstructured and requires different storage and processing tthan that found in traditional relational databases.
- Available computational power is sky-rocketing, meaning there are more opportunities to process big data.
- The Internet has democratized data, steadily increasing the data available while also producing more and more raw data.

It is important to realize that big data comes in many shapes and sizes. It also has many different uses – real-time fraud detection, web display advertising and competitive analysis, call center optimization, social media and sentiment analysis, intelligent traffic management and smart power grids, to name just a few. All of these analytical solutions involve significant (and growing) volumes of both multi-structured and structured data.

Many of these analytical solutions were not possible previously because they were too costly to implement, or because analytical processing technologies were not capable of handling the large volumes of data involved in a timely manner. In some cases, the required data simply did not exist in an electronic form.

CHARACTERISTICS OF 'BIG DATA'

The original three 'V' Dimension Characteristics of Big Data identified in 2001 are in fig 1:

Volume

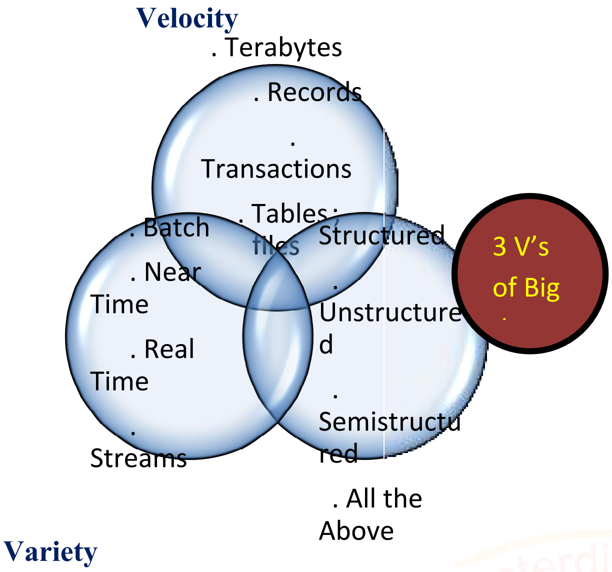

Fig 1: Big Data Identification

1) Volume (amount of data the size of the data set)

Volume Refers to the vast amounts of data generated every second. We are not talking Terabytes but Zettabytes or Brontobytes. If we take all the data generated in the world between the beginning of time and 2008, the same amount of data will soon be generated every minute. This makes most data sets too large to store and analyze using traditional database technology. New big data tools use distributed systems so that we can store and analyze data across databases that are dotted around anywhere in the world.[4]

2) Velocity (speed of data in and out or data in motion)

Velocity Refers to the speed at which new data is generated and the speed at which data moves around. Just think of social media messages going viral in seconds. Technology allows us now to analyze the data while it is being generated (sometimes referred to as in-memory analytics), without ever putting it into databases.

The Velocity is the speed at which the data is created, stored, analyzed and visualized. In the past, when batch processing was common practice, it was normal to receive an update from the database every night or even every week. Computers and servers required substantial time to process the data and update the databases. In the big data era, data is created in real-time or near real-time. With the availability of Internet connected devices, wireless or wired, machines and devices can pass-on their data the moment it is created.

3) Variety (range of data types, domains and sources)

Variety Refers to the different types of data we can now use. In the past we only focused on structured data that neatly fitted into tables or relational databases, such as financial data. In fact, 80% of the world's data is unstructured (text, images, video, voice, etc.) With big data technology we can now analyze and bring together data of different types such as messages, social media conversations, photos, sensor data, video or voice recordings.

In the past, all data that was created was structured data, it neatly fitted in columns and rows but those days are over. Nowadays, 90% of the data that is generated by an organization is unstructured data. Data today comes in many different formats: structured data, semi-structured data, unstructured data and even complex structured data. The wide variety of data requires a different approach as well as different techniques to store all raw data.

There are many different types of data and each of those types of data require different types of analyses or different tools to use. Social media like Facebook posts or Tweets can give different insights, such as sentiment analysis on your brand, while sensory data will give you information about how a product is used and what the mistakes are.It can be structured, semi-structured or unstructured.

Structured data is typically found in tables with columns and rows of data. The intersection of the row and the column in a cell has a value and is given a "key," which it can be referred to in queries. Because there is a direct relationship between the column and the row, these databases are commonly referred to as relational databases. A retail outlet that stores their sales data (name of person, product sold, amount) in an Excel spreadsheet or CSV file is an example of structured data.[5]

Example:

A Product table in a database is an example of Structured Data

Product_id	**Product_name**	**Product_price**
1	Pen	10
2	Paper	5

Semi-structured data also has an organization, but the table structure is removed so the data can be more easily read and manipulated. XML files or

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an RSS feed for a webpage are examples of semi-structured data.[5]

Example: XML file

Example:

<product>
<name>Pen </name>
<price>10</price>
</product>
<product>
<name>Paper </name>
<price>5</price>
</product>

Unstructured data: Unstructured data generally has no organizing structure, and Big Data technologies use different ways to add structure to this data. Typical example of unstructured data is fig 2, a heterogeneous data source containing a combination of simple text files, images, videos etc[5]

Example:

Output returned by 'Google Search'

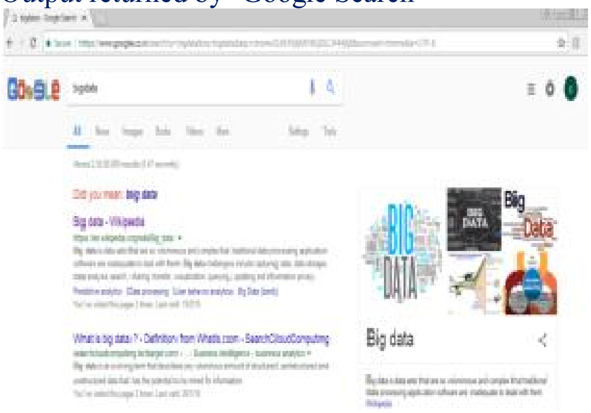

Fig 2.Typical example of unstructured data

THE BIG DATA CHALLENGE:

In addition to buying the right software, recruiting the right talent ranks among the most important investments an organization can make in its big data initiative. Having the right people in place will ensure that the right questions are asked—and that the right insights are extracted from the data that's available. Keep in mind that data scientists, as many refer to those working with big data, are in short supply and are being quickly snapped up by top firms.

Every CIO wants to keep his finger on the pulse of innovations that can transform his company, enhance existing business models and identify potential revenue sources. Enabling this business transformation means adopting the right tools, hiring the right people and—most of all—convincing executive leadership to embrace new models for using existing and brand-new data.

A successful big data initiative, then, can require a significant cultural transformation that's driven by the IT department. Highlight these five advantages of pursuing a big data initiative, though, and your executives are more likely to give you the resources, and the talent, you need to rise to the challenge.[6] In the distributed systems world, "Big Data" started become a major issue in the late 1990□s due to the impact on world-wide Web and a resulting need to index and query its rapidly mushrooming content. Database technology (including parallel databases) was considered for the task, but was found to be neither well-suited nor cost-effective for those purposes. The turn of the millennium then brought further challenges as companies began to use information such as the topology of the We band users□ search histories processing. Itinerants on order commodity to hardware, provide it uses HDFS useful search results, as well as more effectively-targeted advertising to display alongside and fund those results. Google □*scenically* responses to the challenges of Web-scale data management and analysis was simple. To handle the challenge of Web-scale storage, the Google File System (GFS) was created. GFS provides clients with the familiar OS-level byte-stream abstraction, but it does so for extremely large files whose content can span hundreds of machines in shared- nothing clusters created using inexpensive commodity hardware[7].The emerging markets are showing the largest increases in data growth. There are various unwanted big data is generated in the form of images or videos etc in fig 3.

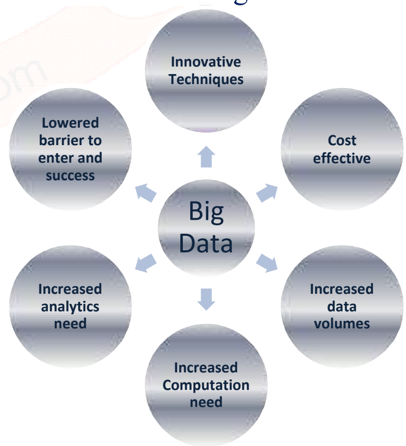

Fig 3 : Architecture of Big data

CONCLUSION

Big data is data that exceeds the processing capacity of conventional database systems. In this paper fundamental concepts about Big Data are presented. This paper described the new concept of Big data, its importance and the existing projects. There is no doubt that the industries are going ablaze with the huge eruption of data. None of the sectors have remained untouched of this drastic change in a decade. Technology has crept inside each business arena and hence, it has become an essential part of every processing unit. Talking about IT industry specifically, software and automation are the bare essential terms and are used in each and every phase of a process cycle .

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ANALYSIS OF RECENT RESEARCH PROGRESS AND ISSUES IN BIG DATA

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ABSTRACT

Big data is the phrase for huge and complex data sets, that it becomes difficult to process this data using traditional data management tools or data processing software's. Big Data refers to data volumes in the range of Exabyte (10^{18}) and beyond. Such volumes exceed the capacity of current on-line storage and processing systems. With characteristics like volume, velocity and variety big data throws challenges to the traditional IT firms. There are many issues with Big Data that demand quality assessment methods. The issues are pertaining to storage and transport, management, and processing. This paper isfocused to analyze most recent advancement on big data networking and big data. After brief summary and analysis, limitations of the proposed mechanism and possible research directions are projected.

Keywords: *Big Data, Hadoop , Map Reduce, Cloud Computing, Benchmark, Mobile Net*

INTRODUCTION

Big data is the term for data sets so large and complicated that it becomes difficult to process using traditional data management tools or processing applications. It is observed that, the size of digital data in2011 is roughly1.8 Zeta bytes (1.8 trillion gigabytes). Means, the supporting networking infrastructure has to manage 50 times more information by year 2020. Specifically, considerations of efficiency, economics and privacy should be carefully planned while including new big data building blocks into existing data and networking infrastructure [1].

In addition to big data challenges induced by traditional data generation, consumption, and analytics at a much larger scale, newly emerged characteristics of big data has shown important trends on mobility of data, faster data access and consumption, as well as ecosystem capabilities [2]. Fig. 1 illustrates a general big data network model with Map Reduce. This paper reveals recent progress on big data, big data networking and relevant topics.

RELATED WORK

This section reveals recent progress and efforts in big data networking. We cover these topics in four categories:

1. Classic big data networking technology,
2. Big data in cloud computing, and
3. Data engineering

There are a number of fresh and interesting big data methodologies reported.Monga [3]introduces their efforts on Software-Defined Networking for big-data science-architectural models in campus environment and more importantly in Wide Area Network. Herodotouet.al.proposed a self-tuning system for big data analytics[9]. He and Yongqianget.al.introducesRCFile as a fast and space-efficient data placement structure in Map Reduce warehouse has been proposed in[10]. An efficient in-network aggregation method for big data applications was introduced in[11], which considerably reduce sizes ofdata transportation. Brunet et.al.reported their method of Gaia Hadoop solution with an emphasis on identifying potential challenges[11]. An interesting application of using big-data for Kinect training was discussedby Budiu et.al.[13].Wang et.al.introduces their efforts of run-time networking programming in big data applications [14]. A recent case study for bursting data in Transportation SDN was introducedby Sadasivarao et.al. [15]. Efforts on optimizing interactions with big data analytics were reportedbyFisheret.al.[16]. Begoliet.al.presented their design principles for efficient knowledge discovery [17]. Radoop, based on Rapid Miner and Hadoop, has attracted attention in data analytics by Prekopcsák et.al.[18]. General considerations for big data architecture and data management has been reported in[19].

Remarkable progress of big data networking has also been reported inthe area ofcloud computing. Agrawal et.al.[18]reported existing and potential future opportunities for bigdata and cloud computing. Resource management and allocation in multi-cluster clouds were introducedby Lakew et.al.[20]. A dataflow-based performance analysis for bigdata cloud, i.e., Hitune, was presentedby Dai et.al.[21]. Interesting case studies onbigdata processing in cloud computing environment was depicted by Ji [22]. Lu et.al. [23]presented their work of a framework for cloud-based large-scale data analytics and visualization; a case study on climate data of various scales were introduced too. A recent online cost-minimization approach was depictedby Zhanget.al.[23]. Specifically for reducing cooling energy cost for big data analytics cloud, a data-central approach was introduced by Kaushiket.al.[25].

In addition to methodologies, there have been a few interesting data engineering efforts reported for big data. Gaoet.al.[26] introduces a big data benchmark project based on open-source data interfaces of web search engines. Laurilaet.al.[27] presents a mobile data collection challenge initiated by Nokia, which represents an important step towards mobile big data networking.

Shekharet.al.[28] reported a spatial big-data challenges intersecting mobility and cloud computing. A recent effort on mining large-scale smart phone and data for personality studies has been presentedby Chittaranjanet.al. [29].From a perspective of big data applications, Silberstein [30] introduced challenges in social applications.

EFFORTS IN CLASSIC BIG DATA NETWORKING

In addition to traditional big data technologies such as Hadoop, MapReduce and NoSQL, possible progresses have been made in the pastyears on big data networking in many other areas. We summarize them into 4 categories: storage and warehouse, data transportation, Software-Defined Networking and big data Analytics.

3.1 Storage and Warehouse:

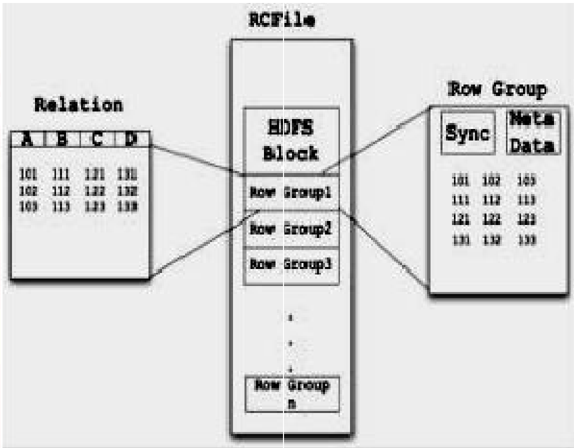
Data storage is the basis for big data networking. Representative technologies are Relational database and Not Only SQL (NoSQL) databases and data warehouse.

An in-depth review on state-of-art database technologies in the area of big data was presentedby Maddenet.al.[3].

Firstly, handling streaming high-rate data in relational models remains as an open problem; and secondly, statistical analysis and machine learningalgorithms for big data need to be more robust and easier to use. And finally but more importantly, an ecosystem - alike mechanism should be built around the devised big data algorithms so that data management and usage canevolve sitting on top of the proposed algorithms.

Another important aspect in big data related database is data placement structures. The authors He andYongqianget.al.[10] argues that traditional data placement structures such as row-stores, column-stores and hybrid-stores are no longer suitable in large data analysis using Map Reduce on distributed systems. Instead, the authors have proposed RC File (Record Columnar File) and its implementation in Hadoop, which meets fast data loading, query processing, efficient storage space utilization, and strong adaptability to dynamic workload patterns. Basic idea of RC File isdefined as in Fig.1.

Fig.1. Architecture ofRCFile.



As in the above figure, tables in HDFS of RCFile have multiple HDFS blocks, and each HDFS block is organized with basic units of row groups and all groups have the same size. This clustering idea enables RC File to more efficientlymanage data rows. Data areas of RC File tables aredivided as sync marker, metadata and table data sections. More importantly,RCFile has adopted RLE (Run Length Encoding) algorithm to compress metadata while using the Gzip compression algorithm for independently column data compression, which takes advantage the columnar storage of data. RCFilehas been selected as the default data placement method in Facebook. Hive and Pig have also adopted it. CurrentlyRCFile does not support arbitrary writings since HDFS currently supports only data writes to the end of files.

Gaia Hadoop by Brunet et.al.[11] has included their batch execution framework with HDFS optimized for task execution. Gaia aims to deal with one Petabyte data in tables consisting eighty billion rows. Although the proposed software and hardware design have been proven to work, heterogeneity among hardware remains as a concern and careful design in this regard should be done.

3.2 Software-Defined Network

Software-Defined Network (SDN) as the critical transportation media of big data also plays a critical role in big data networking. We next reveal progress in this regard.

Mongaet.al.introduces their efforts on Software-Defined Networking for big-data science-architectural models from campus to WAN. To bypass traditional performance hotspots in typical campus network, the authors have built based on the SC11 SCi net Research Sandbox demonstrator with SDN for sake of a scalable architectural approach. The proposed work has been proved simple and more importantly adaptable to network framework[3].

Wang et.al.introduces their efforts of run-time networking programming in big data applications. Specifically, the authors combined SDN controller and optical switching to realize close collaboration of network control and potential applications. Joint optimizations of network performance as well as network utilization have been explored. Analysis shows that, at a relatively small overhead of configurations, the proposed integration offers great potentials for optimizing applications performances. Bursting data transportation is yet another important aspect for SDN data exchanging as it promises smaller transportation delays[14].

A recent case study for bursting data in Transportation SDN was introducedby Sadasivarao et.al.The authors proposed a SDN-enabled optical transportation architecture, whichinterconnects seamlessly within data centers[15].

Inefficient in-network aggregation method, Camdoop, for big data applications was introduced by Costaet.al., which considerably reduce volumes of data transportation. Implementation based onCamCube and direct-connect topology(i.e., servers connected directly to other servers), Camdoop specifically utilize the property that CamCube servers forward traffics to do in-network aggregation. Case studies showed that Camdoop significantly reduces the network traffic while maintaining comparable performances as opposed to a reference of Hadoop and Dryad/DryadLINQ[12].

3.3Analytics

Collection and transportation of big data share a common goal: analyzing the data for insights and better application guidance. We reveal new progress as below for big data analytics.

Dittrichet.al.[8] gives a tutorial on optimizing big data processing efficiency in Hadoop and Map Reduce. A comprehensive comparison between Hadoop Mad Reduce and Parallel DBMS was given[8].

From an architecture perspective, Ferguson et.al.reported their progress for accelerating big data analytics. This work introduces efforts ofIBM in designing their big data platforms to meet the requirement that one new analytical ecosystem can support entire spectrum of big data analytics. The reported technology utilized Hadoop, IBM Smart Analytic System with built-in NoSQL graph store[7].

Starfish byHerodotou et.al.a self-tuning system for big data analytics. The focus of this work is to mitigate the knowledge gap between new users and the sophisticated configurations of Hadoop and its default Map Reduce layer. The basis of Starfish is self-tuning database[9].

Radoop, based on Rapid miner and Hadoop, has attracted attentions in data analytics Prekopcsák et.al. [18]. Integration, development and runtime measurement ona few data transformation tasks have validated feasibility of Radoop for big data analytics with scalable network size and data volumes. Integrationof RapidMiner and Hadoop has enabled Radoopto fully take advantage ofbothsides.

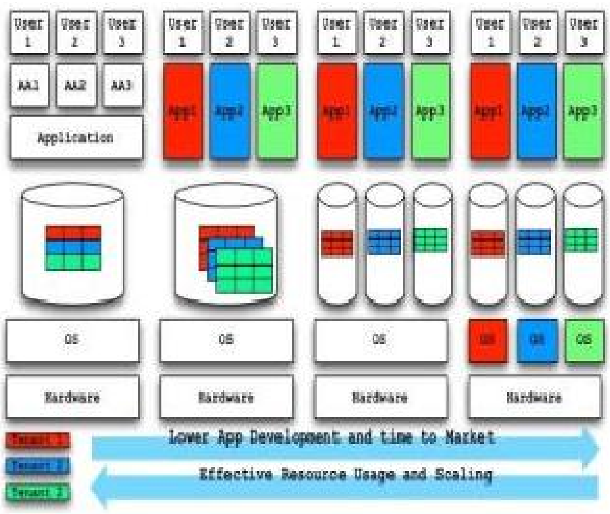
PROGRESS OF BIG DATA IN CLOUD COMPUTING

Cloud computing - an important application environment for big data has attracted remarkable attention from the research community. In this section, we introduce big data research issues and solutions related to Cloud Computing. Specifically, we are interested in the following topics: opportunities and challenges ofbigdata networkinginCloud Computing, cloud resource management ofbigdata, and performance optimization of big data in Cloud Computing.

4.1 Overview and Resource Management

Agrawalet.al. [19] has comprehensively reported existing states and potential future opportunities for big data and cloud computing. Specifically, Agrawal et.al. focused on systems for supporting update heavy applications and ad-hoc analytics and decision support. Multi-tenant systemmodelwithdifferent levelofresource sharing isshowninFig. 3.

Fig.2. Multi-tenant model: left to right, shared table, shared database shared OS and shared hardware.



.
Fig.2shows representative forms of the challengingmulti-tenant mode land trade-offs associated with different forms of sharing. Since models share resources at different levels of abstraction, isolation guarantees cane achieved differently accordingly.Resource management plays fundamental role inbigdata applications in the cloud. We next review important progress in this regard.
A generalintroductionto resource management and allocationinmulti-cluster clouds are introducedbyLakew et.al. [20]. Girolaet.al.introduces virtualizationplanningand cloud computing methods inIBM data center networking. Despite existing efforts taking care of these challenges, anopenquestionremains for making these objectives possible in real-time and scalable fashion.
Specifically for reducing cooling energycost for big data analytics cloud, a data-centric approach was introduced by Kaushik et.al. Instead of relying on thermal-aware computational job placement/migration, the method takes a data-centric approach, which is now popular in big data applications. While reducing cooling energy costs, thermal reliability of servers can beachieved [25].

4.2 Performance Optimization

Performance optimization is yet another classic and important topic in cloud computing because appropriate optimization techniques will provide better application experiences with comparable or even less system resource consumption, compared to non-optimized cases.
A dataflow-based performance analysis tool for big data cloud, i.e., Hitune, was presented in Daiet.al. [21]. Hituneis shown to be effective in assisting users doing Hadoop performance analysis and system parameter tuning. Limitations of existing approaches, such as Hadoop logs and metrics are also compared and discussed. A few interesting case studies on big data processing in cloud computing environment was depicted by Ji, Changqing, et al. [22].
A recent online cost-minimizationalgorithmwas depicted byZhang et.al. [24]. The proposed work specifically focused on real-time cost minimizations for uploading massive and dynamic data onto the cloud.

CONCLUSION

In this work, analysis of efforts dedicated to big data and big data networkingis performed. The progress in fundamental big data technologies such as storage and warehousing, SDN, transportation and analyticsis analyzed. Important aspects of big data networking in cloud computing such as new challenges and opportunities, resource management and performance optimizations were also discussed with independent viewpoints. Last but not the least, important efforts in big data mobile networking, which represent foundations of big data research and promising trends, respectively are also discussed.
Finally, it is observed that though adequarte progress have been made in the area of bigdata and big data networking, but much remains to be done. Almost all proposed approaches are evaluatedat a limited scale, for whichthe reported benchmarkingprojects canact as a helpfulcompensationfor larger-scale evaluations. Moreover, software-oriented studies also need to explore cross-layer, cross-platformtradeoffs and optimizations.

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THE CONCEPT OF 'CLOUD COMPUTING'

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ABSTRACT

In the field of computing, a lot of changes have been observed due to the increased use and popularity of the Internet and the availability of high-speed networks.
Resource sharing in a pure plug and play model that dramatically simplifies infrastructure planning is the promise of "Cloud computing".
Cloud computing is becoming an increasingly popular enterprise model in which computing resources are made available on-demand to the user as needed.
Cloud computing[1] is the development of parallel computing, distributed computing, grid computing and virtualization technologies which define the shape of a new era. Cloud computing is an emerging model of business computing.
The paper aims to provide a means of understanding the model and exploring options available for complementing your technology and infrastructure needs. Also explore some of the basics of cloud computing with the aim of introducing aspects such as:
Realities and risks of the model
Components in the model
Characteristics and Usage of the model.
This work aims to provide the ways to reduce security risk & also promotes the performance of cloud computing

Keywords: *Cloud computing, architecture, Cloud systems, SLA, SaaS, Paas, Iaas, daas, Cloud Service Provider, Cloud computing metaphor.*

INTRODUCTION

The term "Cloud Computing" [2] is everywhere. Simply put, cloud computing is computing based on the Internet. In the past, people would run application or programs from software downloaded on a physical computer or server in their building. Cloud computing allows access from the same kinds of applications through the internet on a virtual server.
It is the new computing example which provides large pool of dynamical scalable and virtual resources as a service on demand. Cloud computing is a complete new technology. It is the development of parallel computing, distributed computing
grid computing, and is the combination and evolution of Virtualization, Utility computing. The main principle of cloud computing representation is to offer computing, storage, and software as a service,(SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS),) or as a utility, Data as a Service(Daas). We just by using the need internet.

Cloud computing metaphor: Cloud is a metaphor[9] to describe web as a space where computing has been pre installed and exist as a service; data, operating systems, applications, storage and processing power exist on the web ready to be shared. the group of networked elements providing services need not be individually addressed or managed by users; instead, the entire provider-managed suite of hardware and software can be thought of as an amorphous cloud.

"Cloud is a parallel and distributed computing system consisting of a collection of inter-connected and virtualized computers based on service-level agreements (SLA) which established through cooperation between the service provider and consumers."

Cloud computing is a computing example, where a large pool of systems are connected in private or public networks which provide dynamically scalable infrastructure for application, data and file storage.

Cloud computing is a practical approach for to experience direct cost benefits and it has the potential to transform a data center from a capital-intensive set up.

The idea is based on a very fundamental principal of reusability of IT capabilities'. The difference is that to bring compared to traditional concepts of "grid computing", "distributed computing", "utility computing", or "autonomic computing".

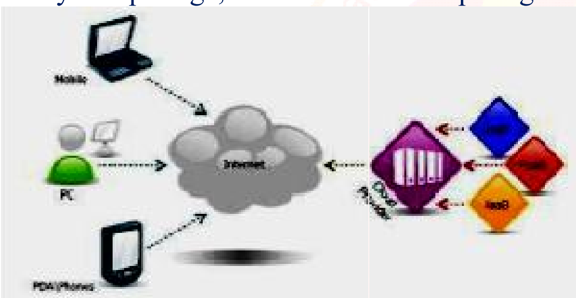
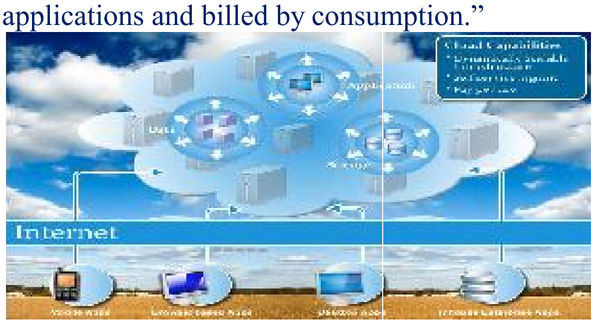


Fig. 1: Cloud computing concept

Fig. 1 shows [8] that how users can connect to the cloud services which are provided by cloud service provider by using any device over the internet. It includes scalable resources in storage, network, and compute & also contain virtualized infrastructure and provide that services to the users.

Forrester defines cloud computing as:

"A pool of abstracted, highly scalable, and managed compute infrastructure capable of hosting end-customer
applications and billed by consumption."



It cuts the operational and capital costs and permits the IT departments to focus on strategic projects instead of keeping the datacenter running. It provides the services on Infrastructure level, Platform level, and Software level, many features such as speed, scalability of resources, parallel processing, to choose another technology at any time to further work like 24/7 availability of services, device and location independent and security etc. Cloud computing has five essential features such as rapid elasticity, measured services, on-demand self-service, resource pooling, and board network access. as shown in Fig. 2.

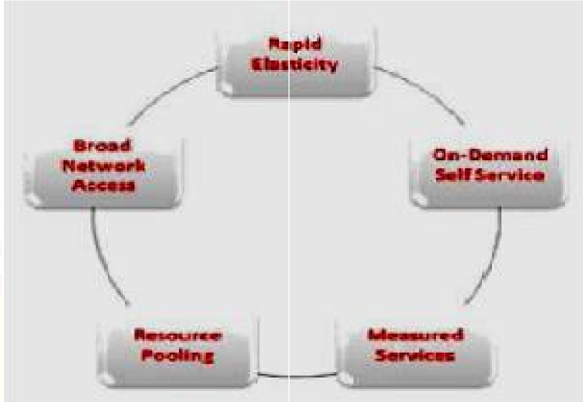


Fig. 2: Five features of cloud computing

CLOUD COMPUTING MODELS

Cloud service Providers [4] following 4 types of Models:-

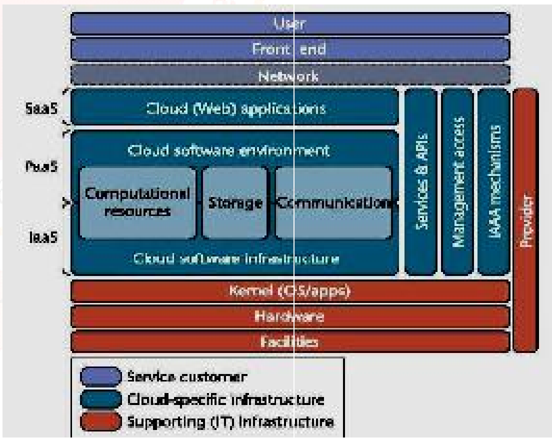


Fig.3: The Cloud reference architecture

Cloud reference architecture [11] that makes the most important security-relevant cloud components explicit and provides an abstract overview of cloud computing for security issue analysis.

1. Software as a Service (SaaS): In this model,[12] a complete application is offered to the customer, as a service on demand. A single instance of the service runs on the cloud & multiple end users are serviced. Today SaaS is offered by companies

such as Googlemail, Salesforce.com, Microsoft, Zoho, etc.

2. Platform as a Service (Paas): a layer of software or development environment is encapsulate & offered as a service, upon which other higher levels of service can be built. In this model The customer has the freedom to build his own applications, which run on the provider□s infrastructure. PaaS providers offer a predefined combination of OS and application servers, such as LAMP platform (Linux, Apache, MySql and PHP), classified J2EE, Ruby etc. Google's App Engine, Force.com, etc

3. Infrastructure as a Service (Iaas): IaaS provides basic storage and computing capabilities as standardized services over the network. The basic strategy of virtualization is to set up independent virtual machines (VM) that are isolated from both the underlying hardware and other VMs. Servers, storage systems, networking equipment, data centre space etc. The customer would typically deploy his own software on the infrastructure. Some common examples are Amazon'EC2, GoGrid, 3 Tera, etc.

DATA AS A SERVICE (DAAS): DAAS

Delivery of virtualized storage on demand becomes a separate Cloud service - data storage service. Notice that DaaS could be seen as a special type IaaS. DaaS allows consumers to pay for what they are actually using rather than the site license for the entire database. In addition to traditional storage interfaces such as RDBMS and file systems.

Some common examples are Amazon S3, Google BigTable, and Apache HBase, etc.

Public, Private & Hybrid Cloud:-

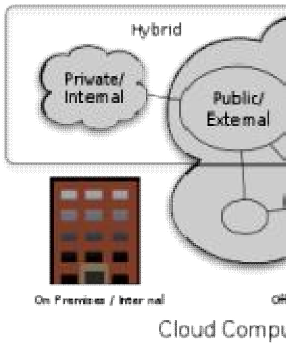


Fig. 3: Types of Cloud Deployment Model

Public Cloud

Public clouds are owned and operated by third parties; they deliver better economies of scale to customers, as the infrastructure costs are spread among a mix of users, giving each individual client an attractive low-cost, "Pay-as-you-go" model. One of the advantages of a Public cloud is that they may be larger than an enterprises cloud, thus providing the ability to scale seamlessly, on demand.

Private Cloud

Private clouds are built exclusively for a single enterprise. They aim of Private Cloud is to address concerns on data security.

There are two variations to a private cloud:-

- On-premise Private Cloud: also known as internal clouds are hosted within one own data center.

- Externally hosted Private Cloud: This type of private cloud is hosted externally with a cloud provider.

Hybrid Cloud

Hybrid Clouds combine both public and private cloud models.. The Hybrid cloud environment is capable of providing on-demand, externally provisioned scale.

Cloud Computing Characteristic:-

1: Dynamic computing infrastructure
2: IT service-centric approach
3: Self-service based usage model
4: Minimally or self-managed platform
5: Consumption-based billing
6. Reduced Cost
7. Increased Storage
8. Flexibility
9. Data Protection
10 Data Recovery and Availability
11. Management Capabilities
12. Disaster Recovery
13. Automatic Software updates
14. Free Capital- expenditure
15. Work from anywhere

16. Document control
17. Security

ADVANTAGES OF CLOUD COMPUTING

(1) Shared Resources:
it shares resources to provide the services to multiple users.
(2) Pay-As-You-Go:
Users only need to pay those resources which are used by them. They can demand for more resources if they required
(3) Better Hardware Management:
It is easy for cloud service provider (CSP)[4] to manage the hardware easily because all computers run the same hardware.

Area of Cloud Computing:
1. Banking
2. Insurance
3. Weather Forecasting
4. Space Exploration
5. Software as a service
6. Platform as a Service
7. Infrastructure- as -a-Service
8. Data-as-a-service

MOTIVATING FACTORS AND CHALLENGES

Cloud systems [15] are not just another form of supply provisioning transportation and in fact, have multiple opportunities from the principles for cloud infrastructures that will enable further types of applications, compact development and provisioning time of different services.

APPLICATIONS

There are a few applications of cloud computing [6] as follows:
1) Cloud computing provides dependable and secure data storage center.
2) Cloud computing can realize data sharing between different equipments.
3) The cloud provides nearly infinite possibility for users to use the internet.
4) Cloud computing does not need high quality equipment for the user and it is easy to use.

Scope:-
Cloud computing is a tremendous innovation in the digital landscape that has changed the way IT solution are delivered and how end-users put them tom use. The cloud computing aspect is growing and will continue to do so.

CONCLUSION

Cloud computing is a new technology of computer network, providing the web services at lower cost comparing to normal technique. It contribute to improve the service in other related technologies like,
Grid Computing, Cluster Computing,
Utility Computing / Automatic Computing
Distributed Computing
With cloud computing, to the interface between service suppliers and multiple groups of service consumers. Cloud services will demand expertise in distributed services, procurement, risk assessment and service negotiation — these are the areas that many enterprises are only modestly equipped to handle.

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USE OF VIRTUALIZATION IN EDUCATIONAL DIGITAL LIBRARY DATA UNDER CLOUD

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ABSTRACT

Now a days cloud computing is the vast growing area in each area due to which we can minimize the required computing resources, minimize the cost and enhance the performance. There is an inventive development in the field of multimedia communication and wireless technology. Cloud computing is fundamentally altering the expectations for how and when computing, storage and networking resources should be allocated and managed. Cloud computing technology came up as a boon for libraries and is offering various opportunities for libraries to connect their services with cloud. We can use cloud computing technology under education system to enhance the quality of education. The emergence and development of cloud computing have a great effect on the development and application of digital library. Libraries may soon be building and managing their own data centers. This model would let libraries maintain more control over the applications and data stores that contain sensitive, private information. In the recent years growth of computer technology contribute to the progress towards the application of the cloud computing. This paper describes architecture, use of cloud computing in libraries and how cloud computing works which helps the use of virtualization using cloud computing in educational digital library data.

Keywords: *Cloud Services; Cloud Platforms; Educational Cloud computing; digital library; Virtualization;*

INTRODUCTION

Fast development of information technology (IT) industry for the last several decades has introduced us with many new terms. Nowadays, we are doing the same tasks but in a flexible, much cheaper, and are in a portable manner, either by using desktop computer or mobile devices to several types of servers tied together to create a so called Cloud Computing System (CCS). Cloud Computing has emerged as a phenomenon that represents the way by which IT services and functionality are charged for and delivered. Cloud computing can be defined as the aggregation of computing as a utility and software as a service [1] where the applications are delivered as services over the Internet and the hardware and systems software in data centers provide those services [2].The new concept of cloud and libraries has generated a new model called cloud libraries. Though the usages of cloud computing may vary with the libraries nature, services and information needs but most common usages of cloud computing with in libraries can be development of digital libraries, corporate cataloging, acquisition, storages and sharing the resources on virtual environment. This Cloud computing technology provides almost everything as service using Internet, and every resource is highly scalable. Resources in cloud computing are provided as service based on data centers. Educational institution is moving towards adopting new developing technology for providing the student new and faster means of resources through which they can adopt the higher level knowledge. Cloud computing might be an area for the educational institution to provide faster and much chipper resources for student with globalization. Cloud computing offers some advantages by allowing user to use infrastructure, platforms and software's provided by the cloud providers at very low cost. Cloud computing brings new types of services and facilities for users to take full advantages of cloud computing. This paper proposed an idea to develop various clouds for educational sectors which help different students and faculty to research on the various subjects globally.

OVERVIEW OF EDUCATION, CLOUD COMPUTING AND DIGITAL LIBRARY

Educational institution consist a large I.T. infrastructure and for managing it requires many services. Student required software for simulation, experimental performance and manipulation of statically data. These software's are high end software and required skilled people to work with, thus rather this software can be installed in the virtualized environment on the clouds data centre. Internet can be medium to provide access to this software with high reliability. Virtualization technology helps creating multiple client nodes for student, these nodes can be easy access through Internet [3].

The basic principle of Cloud Computing is making tasks distributed in large numbers of distributed computers but not in local computers or remote servers. In other words, by collecting large quantities of information and resources stored in personal computers, mobile phones and other equipment. There is a serial of problem in digital library, such as resource independent of each other. Low level of information technology, non-uniform resource form and hardware limitation. In order to solve these problems, it proposes a new digital library platform based on cloud computing, which can provide personal service to different terminal users, such as computer, PC etc. The educational sectors are looking for options which are chipper and more convenient in terms to improve the performance and ranking of the students [4].

CLOUD COMPUTING

Cloud computing is emerging as one of the most important branch for providing seamless application on mobile devices.. Cloud computing is not a new technology that suddenly appeared on the web but it is a new form of computing. It is a web-based processing, whereby shared resources, software and information are provided on demand to computers and other similar devices. Cloud computing can be defined as , ‘‘It refers to both the applications delivered as services over the Internet and the hardware and systems software in the datacenters that provide those services’’ [5]. Cloud computing data centers can be sliced into various servers and virtual machines can be a solution to their problems, and these are easy to access to the computing services on demand. Cloud computing can also be used for research work for various platform [6].Cloud computing has become a significant technology emerging trend, and many experts, researchers and academicians expect that cloud computing will reshape information technology (IT) sector and the IT marketplace in world. With the cloud computing technology, users use a wide variety of devices, including PCs, Laptops, Smart Phones, and PDAs to access different kinds of utility programs, storage, and application development platforms over the Internet, via services offered by cloud computing providers.

This section provides an overview of Cloud computing including definition and service oriented cloud architecture. In overall cloud computing revolves around two things one is Cloud platforms and other is Cloud services.

2.1.1Cloud computing Platforms

Cloud platforms are basically the hosts that provide the required resources to the clients. It is an arrangement for executing software applications in a logically abstract environment comprising of various utility cloud services [7]. Cloud computing is being driven by cloud providers including Amazon, Google, Salesforce and Yahoo as well as traditional vendors including IBM Microsoft and are adopted by different users. Few well-known cloud platforms are,

- Amazon Elastic Cloud Computing (EC2) [8]
- Microsoft Azure[9]
- Hyrax[10]
- Google App Engine[11]
- Force.com[12]

2.1.2 Cloud Services

Cloud services are hosted services. Cloud service [13] is a software system which is responsible providing interoperable machine-to -machine interaction over a network or internet which is further accessed by other cloud computing components ,clients, software or end users directly like,

- Integration (Amazon simple Queue Service)
- Mapping (Google maps, Yahoo! Maps)
- Payments (, Google Checkout)
- Search (Google Custom search)

SERVICES OF CLOUD

Here, we focus on a layered architecture of cloud computing. In cloud computing there are different categories of cloud services. The cloud services are generally classified based on layer concept.

In the upper layer of this paradigm, Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) are stacked. These services delivered to the users in real time via internet.

2.2.1 Software as a Service (SaaS)

It is a model of software deployment whereby the provider licenses an application to the consumers for use as a service on demand. The capability provided to the consumer is to use the provider applications running on a cloud infrastructure. In this service, users can avail the facilities to access and use any software available with cloud vendors.

2.2.2 Platform as a Service (PaaS)

Platform as service helps in generating the computing platforms to run the software and other tools over the internet without managing the software and hardware at the end of user side.The capability provided to the consumer is to deploy onto the cloud infrastructure consumer created or acquired applications created using programming languages and tools supported by the provider. It is the delivery of computing platform and solutions stack as a service.

2.2.3 Infrastructure as a Service (IaaS)

This service comprises a wide range of features, services and resources which support to build a virtual infrastructure for computing. Organizations can be developed entire infrastructure on demand. The capability provided to the consumer is to provision processing, storage, networks and other fundamentals computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications IaaS enables the provision of storage, hardware, servers and networking components. Amazon Web Services, HP,IBM, Google Base are the examples of IaaS.

2.2.4 Data Centers layer

This layer provides the hardware facility and infrastructure for clouds. In data layer, a number of servers are linked with high speed networks to provide services for customers.

CLOUD COMPUTING REALIZATION

The Cloud in cloud computing are categorized in three types they can be used in various services as educational public cloud, educational private cloud and educational hybrid cloud.

3.1. Public clouds

It provides services like application, storage and makes resources available to public through the Internet.

Private clouds

Private cloud is special infrastructure dedicated to a single educational organization for services, resources and data storage.

Hybrid clouds

It is the combination of one or more public and private educational cloud.

The educational sector can be implemented using public cloud, as they are chipper compare to private and hybrid, for some of the institution and university, which carry out the research work in depth, they can use the private and hybrid cloud after undergoing through the various terms. The components used in the architecture as in fig.1.

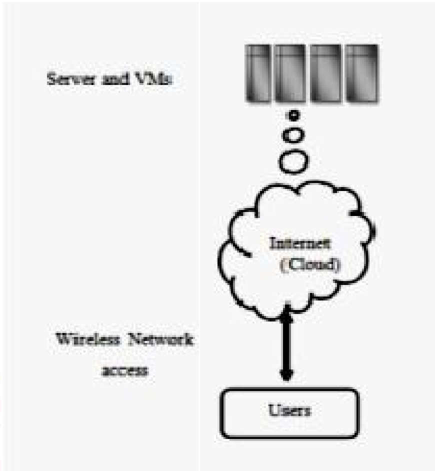

Fig. 1 Architecture for Cloud Computing in Educational Environment

IMPLIMENTATION

The implementation work consists of a thin client which acts as node for the client to access and work with the services provided by the cloud computing model. A thin client is a low configuration computer system which consist hardware only to access information online. Secondly, an application interface is required for working which act as GUI interface through which user can interact with cloud. The user interface will give a dashboard panel and a configuration window which help user to communicate and configure the services. Operating system and network management software are also required, this software are powerful enough to handle the connectivity and to provide a standard bandwidth through which the thin client can communicate with the cloud. The services are provided through Internet, this Internet connectivity and network device layer. Cloud environment is made up of shared resources, these shared resources are none other than the same computing resources which are used for computing, but with a slight change that the shared resources can be located at remote location and accessed using an Internet connection. Better resources management will lead to maximize the usability of cloud resources.

CONCLUSION

Cloud computing is web based processing where by shared resources software and information is provider on demand to computer and other similar devices. It represents an exciting opportunity to bring on-demand applications to digital library data. This technology provides a better used in educational system much more reliable platform for handling computing resources, it appears to the users of high-quality service and high security.. This paper has discussed about introducing cloud computing and virtualization in educational sector in digital libraries. This provides a platform independent of infrastructure with much more flexible model. Thus considering the educational cloud environment proposed model in terms educational sector in digital library will help in making a better model for student with powerful functional capabilities which can be further implemented in the real world cloud computing environment

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A REVIEW ON MOBILE CLOUD COMPUTING AND ITS FUTURE SCOPE

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ABSTRACT

Mobile cloud computing (MCC) is the availability of cloud computing services in a mobile environment. By providing optimal services for mobile users MCC incorporates the elements of mobile networks and cloud computing. In mobile cloud computing, all the data and complicated computing modules can be processed in clouds and mobile devices do not need a powerful configuration like CPU speed, memory capacity etc. However, the mobile devices are facing up with many struggles in their resources (e.g., battery life, storage, and bandwidth) and communications (e.g., privacy, mobility and security). These challenges have great affect in the improvement of service qualities. In this paper, we discuss the overview of mobile cloud computing technology together with the architecture, applications, major characteristics, security issues, advantage and limitation and possibly solution

Keywords: *Mobile cloud computing (MCC) information technology*

INTRODUCTION

In the field of network based computing and applications mobile cloud computing (MCC) has been introduced as a potential technology for mobile services. It is the combination of mobile computing, cloud computing and wireless networks to bring high quality computational resources to network operators, mobile users, and cloud computing providers . MCC is a new platform for combining the mobile devices and cloud computing to create a new infrastructure. In this architecture, cloud performs the heavy lifting of computing-intensive tasks and store large amounts of data. The rapid emergence of mobile computing becomes a powerful trend in the development of information technology. However, the mobile devices in mobile computing are facing many problems in their resources (e.g., battery life, storage, and bandwidth) and communications (e.g., mobility and security) Therefore, different applications based on mobile cloud computing have been developed and served to users, such as Google's Maps ,Gmail and Navigation systems for Mobile, Voice Search, and various applications on an Android platform. The increasing application of mobile computing is evident by the study of Juniper Research, which states that the consumer and enterprise market for cloud-based various mobile applications is $9.5 billion . The main objective behind the cloud computing is the delivery of different services, software and processing capacity over the Internet, increasing storage, reducing cost, automating systems and decoupling of service delivery from underlying technology, and providing flexibility and mobility of information in different purposes. Alternatively, mobile cloud computing can be defined as a combination of mobile web and cloud computing , which is the most popular tool for mobile users to access applications and services on the Internet.

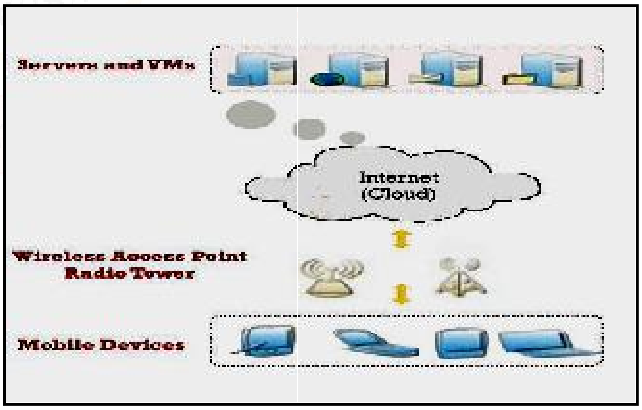

Fig-1: Mobile Cloud Computing

ARCHITECTURE

- Mobile devices are connected to the mobile networks via base stations that establish and control the connections and functional interfaces between the networks and mobile devices.

- Mobile user's requests and information are transmitted to the central processors that are connected to servers providing mobile network services.
- The subscriber's requests are delivered to a cloud through the Internet.
- In the cloud, cloud controllers process the requests to provide mobile users with the corresponding cloud services.

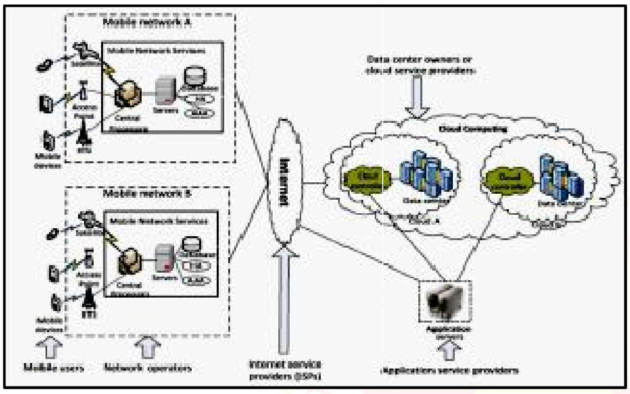

Fig2: Architecture of mobile cloud computing

DIFFERENT FEATURES OF MOBILE CLOUD COMPUTING

Mobile cloud computing provide different facilities like scalability ,mobility, flexibility, virtualization, mobile cloud service connectivity, Multi-tenancy , mobile utility billing etc. The facilities are also shown in details in the given figure.

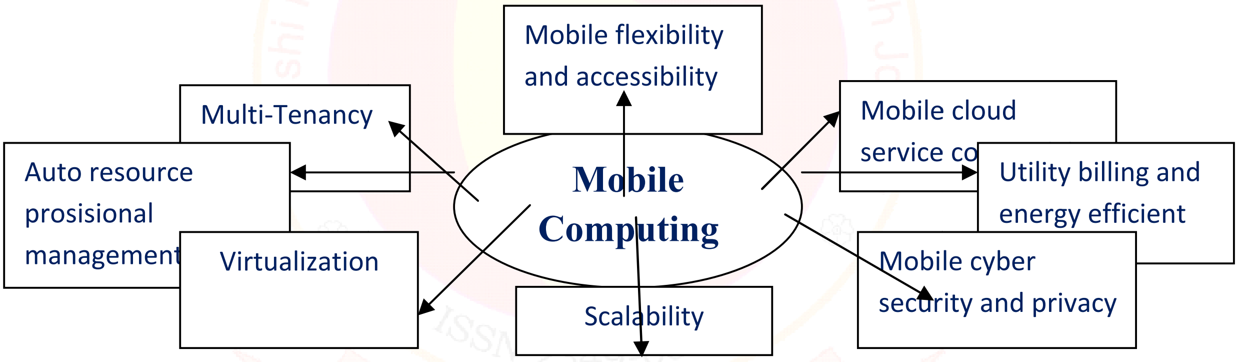

Fig3. Different Features of mobile computing

SECURITY ISSUES IN CLOUD COMPUTING

Platform Security
Each of Fractal's technical threads presents its own security challenges.
For example, the cloud-scale repository
16 Harsha Bhatti
Index Copernicus Value: 3.0 - Articles can be sent to editor@impactjournals.us
Poses problems inherent to multi-tenanted content management, including isolation, sandboxing, scaling, and Usage. Tracking Allowing users access to programmable behaviors introduces many security issues, especially Guaranteeing Safe execution The service runtime must ensure that the intellectual property embodied within both services and Content is protected.

REQUIRED ACTIONS TO MAKE CLOUD SECURE

Intruders would have to be restricted access to the source code, and providers often work hard to provide clean, Unbreakable barriers between customers. Security can differ greatly from application to application, from platform to platform, and from provider to provider, however, Authentication credential management poses another cloud security concern. Artificial Immune System (AIS) in danger theory is a new intelligent problem-solving technique should be incorporated to increase the efficiency of cloud based application. The protected resources are defined as self, while the others (including the intrusion) are defined as non-self. The central idea of the Danger Theory is that the immune system does not respond to non-self but to danger .This is used as a tool to define danger signals on continuously changing parameters. Yet on the whole, the cloud holds must promise for guarantee security over application.

ADVANTAGES OF MOBILE CLOUD COMPUTING

Extending Battery Lifetime

There are several solutions have been proposed to increase the CPU performance and organizes the disk and screen in an intelligent manner to reduce power consumption. In order to fulfill these solutions may require changes in the structure of mobile devices or require advance hardware that results in an increase of cost. But these changes may not be feasible for all mobile devices. In order to execute the large computations and complex processing from resource-limited devices like mobile devices to resourceful machines such as servers in clouds several computations offloading technique is proposed. Mobile cloud computing avoids taking a long application execution time on mobile devices which may results in large amount of power consumption.

Improving Reliability

By storing data or information on clouds is an effective way to increase the reliability whereby the data and application are stored and backed up on a number of computers. Hence the chance of data and application lost on mobile devices is reduced and ultimately reliability is increased. Moreover mobile cloud computing can be designed as a significance and compressive data security model for both service providers and users.

Improving Data Storage Capacity and Processing Power

Data storage capacity is also an important constraint for mobile devices. Mobile cloud computing is developed to enhance the mobile users to store/access the large data on the cloud network through wireless networks. There are several examples which are mostly used i.e. Amazon Simple Storage Service (Amazon S3) to provide file storage on the cloud network.

Dynamic Provisioning

Dynamic provisioning of resources is a flexible way for service providers and mobile users to run their various applications without advanced reservation of resources. Without storing data in mobile device it be stored in cloud and can be accessed dynamically.

Scalability

Due to flexible resource provisioning deployment of mobile applications can be performed. Internet Service providers can easily increase and expand an application and service without or with small constraint on the resource usage.

Multi-tenancy

Internet Service providers i.e. network operator or data center owner can share the resources and costs to provide variety of applications and for large number of users.

Ease of Integration

Multiple types of services from different service providers can be integrated easily through the cloud and Internet to meet the user's requirement.

Fig4:-Advantages of cloud computing

APPLICATIONS OF MOBILE CLOUD COMPUTING

Mobile cloud computing has a large number of application in various fields and a wide range of potential mobile cloud applications have been recognized in the present literature. These applications are fall into different areas including natural language processing, image processing, sharing GPS, sharing Internet access, sensor data applications, crowd computing, querying and multimedia search.

Image Processing

In the authors try to experiment with running GOCR and an optical character recognition (OCR) program on a collection of different mobile devices. A similar scenario is given in . If user/subscriber visit foreign museum, he can't perceive the language written in each object of the museum. He can take picture of the object and using mobile cloud computing can understand the language written over the object.

Natural Language Processing

Language translation is one possible application for mobile cloud computing. Translation is a viable candidate for language processing since different sentences and paragraphs can be translated independently, and this is experimentally explored in using Pangloss- Lite .

Sharing GPS/Internet Data

Through local-area or peer-to-peer networks data can be share among a group of mobile devices that are near each other. It is faster as well as cheaper .

Sensor Data Applications

Now-a-days almost every mobile devices are built with sensors which are used to read data. Some sensors such as GPS, accelerometer, thermo sensor, light sensor, clock and compass may be time stamped and associated with other phone readings. In order to gather precious information in different situation different queries can be executed.

Multimedia Search

Mobile phones may store different types of multimedia content such as videos, photos, and music. To illustrate, Shazam is a music identification service for mobile phones that searches for similar songs in a central database. In mobile cloud, the searching could be executed on the contents of nearby phones easily.

Social Networking

Since sharing different user content is a popular way and we can interact with friends on social networks such as Facebook.

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CONCLUSION

The world of computing is moving away from the on premises IT model, where you keep buying servers, PCs and Software licenses as your business grows. Cloud computing disrupts the conventional model and opens a new IT path for the small-to mid size business: "clouds" of computing power, accessed over the Internet, become your server and your data center. Among the clouds: inexpensive applications that users can access on demand from any location and through a variety of devices. Cloud computing—or as, if you prefer—frees up budget for companies hand-cuffed by IT expenses. Instead of purchasing additional software licenses and hardware for new employees and new locations, businesses can simply open new employee accounts with providers of their cloud based services to expand computing capacity With the workload factoring technology in cloud computing, the hybrid cloud computing model allows enterprise IT systems to adopt a hybrid cloud computing model where a dedicated resource platform runs for hosting application base loads, and a separate and shared resource platform serves trespassing peak load. Given the elastic nature of the cloud infrastructure, it creates a situation where cloud resources are used as an extension of existing infrastructure. It's not an all or nothing decision; companies can ease into the cloud without abandoning established infrastructure and applications. For the future work, extending the hybrid cloud computing model scope to stateful applications such as n-tier web services is a natural and challenging step. Many new problems arise such as session maintenance, service time estimation, and data consistency. We are working on a fast data on demand service and integrating the dynamic web service scaling approach proposed in into our mechanism

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STUDY OF FREQUENCY DOMAIN FILTRATION TECHNIQUES ON VARIOUS TYPES OF IMAGE

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ABSTRACT

This paper presents an outline for the reduction of noise and enhancement of various types of images. Various types of images are used in this paper. We can use CCTV image, Infrared image, satellite image, digital image, X-ray image. A noise is any unwanted signal/pixel that may be added or subtracted during transmission. These unwanted signals/pixels decrease the image quality. To reduce the noise from images, various image filters are used. Generally CCTV images are low resolution. As well as affected with illuminations of light. Here Histogram Equalization, Adaptive Histogram Equalization Techniques and some Filtration techniques is applied to images, for overall face image restoration. Image filtering is a common procedure in digital image processing aiming at the suppression of different type of noises that might have corrupted an image during its acquisition or transmission. This procedure is traditionally performed in the frequency-domain or transform-domain by filtering. In this paper we discuss and analyses the enhancement and filtrations of frequency domain techniques applies on images used for various recognition applications.

Keywords: *CCTV image, Infrared image, satellite image, digital image, X-ray image, Frequency Domain, Histogram Equalization.*

INTRODUCTION

This Paper introduces the frequency domain filtration techniques on the various images. We collected the CCTV image, Infrared image, satellite image, digital image, X-ray image discuss in following sections. The images are low resolution, with noises and bluer so need to remove all these noises and bluer with different filtration techniques. Also improvement of brightness and contrast for face recognition application to improve the recognition rates. Various Face recognition algorithms needs to verify the image databases. In this research area thousands of researchers was works and till continue, the huge amount of literature is available for work here only do the pre-processing techniques on the face images.

An image could be degraded during digitization or during transmission. During digitization or transmission a noise may be included in a digital image from the environment around it. For example, while taking a picture using a camera a noise is added by the camera fault, the image sensor or from the environment where the image is taken[1]. When it is from the camera fault it means if the shutter speed of the camera is too long.

IMAGE ACQUISITION

In this paper, we used the CCTV image, Infrared image, satellite image, digital image, X-ray image for the study of restoration techniques. The fig.1 to fig.5 shows all the images. For the image acquisition we use the two types of CCTV cameras 700 TVL (TV Line) CCTV camera is used for outdoor images and 600 TVL Bullet IR CCTV camera is used for infrared images also. The outdoor images are taken in Corridor of a building with natural light and infrared images taken in

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dark room using the various distances. The subject is standing in front of the CCTV camera with 5 mtr. Distance and head is move from left to right and up to down direction for video shooting. Digital image is taken from camera. Satellite image and X-ray image are taken from internet. Fig.1 shows all the camera use for image acquisition [2].

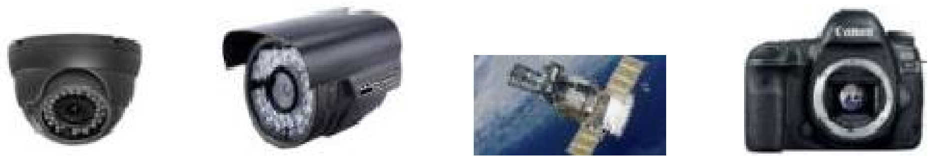


Fig.1 Camera used for image acquisition

FACE IMAGE GRAY SCALE CONVERSION

After resizing images we convert the all RGB images in to the 8 bit gray scale images. The average image intensity level is 0 to 255 [6]. Then we perform enhancement and filtering techniques on the gray scale images. , removing noise from the images. HE is used to display the enhanced output images which are based on the original input image.

IMAGE ENHANCEMENT

An Image is an array (or) matrix, of square of pixels arranged in rows and columns. Pixel is widely used in the term and it is denote the elements of an image [3][4]. Image enhancement is process of images more useful. It is mainly used to improve the quality of images Image enhancement using Spatial domain and frequency domain. In frequency domain idle, Butterworth, Gaussian low pass, high pass filter various techniques is used. In Spatial domain direct manipulation of image pixels [7]. It is a manipulation or changing the image representations and also it is used into many fields such as smooth and sharpening filtering images.

HISTOGRAM EQUALIZATION

Histogram equalization is broadly used in the field of contrast enhancement [2]. Proposed algorithm mainly focuses on the novel extension and also used to utilize histogram equalization. Ultimate goal is present the brightness value. Histogram equalization is significantly introducing the brightness of the image. Different Histogram equalization methods can be used in the images. Each picture is having their own ratio. Measure is calculated with the use gray scale preserved brightness images. Future work is recommended to introduce the new measure which is also used to evaluate the performance.

IMAGE ADJUST

Proposed method is based on extensive experiment [8]. The face images patches at different intensity level. Future work is recommended to improve the accuracy. Proposes a new image enhancement method with it is based on the Non-sub Sampled Contour let Transform (NSCT) [9]. The proposed algorithm enhances the dynamic range of the image. We have proposed a novel algorithm for multi-scale image enhancement based on the NSCT and also the algorithm can be applied to greyscale and both color images.

FREQUENCY DOMAIN ANALYSIS

Till now, all the domains in which we have analyzed a signal, we analyze it with respect to time. But in frequency domain we don't analyze signal with respect to time, but with respect of frequency.

a. **Differences between spatial domain and frequency domain.**

In spatial domain, we deal with images as it is. The value of the pixels of the image change with respect to scene. Whereas in frequency domain, we deal with the rate at which the pixel values are changing in spatial domain.
For simplicity, let's put it this way [11].

b. Spatial domain

Fig.2 Spatial Domain

In simple spatial domain, we directly deal with the image matrix. Whereas in frequency domain, we deal an image like this.

c. Frequency Domain

We first transform the image to its frequency distribution. Then our black box system perform whatever processing it has to performed, and the output of the black box in this case is not an image, but a transformation. After performing inverse transformation, it is converted into an image which is then viewed in spatial domain [12].

It can be pictorially viewed as

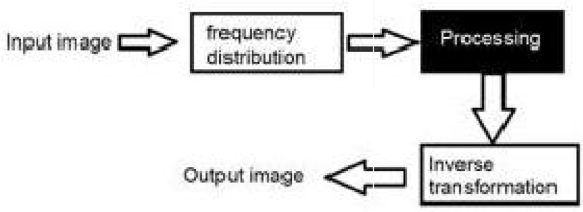


Fig.3 Frequency Domain

d. Transformation.

A signal can be converted from time domain into frequency domain using mathematical operators called transforms. There are many kind of transformation that does this

e. Filters

The concept of filter in frequency domain is same as the concept of a mask in convolution.

After converting an image to frequency domain, some filters are applied in filtering process to perform different kind of processing on an image [13]. The processing include blurring an image, sharpening an image e.t.c.

The common type of filters for these purposes are:

- Gaussian high pass filter
- Gaussian low pass filter
- Butterworth high pass filter
- Butterworth low pass filter

GAUSSIAN LOW PASS FILTER

Gaussian filters are used in image processing because they have a property that their support in the time domain is equal to their support in the frequency domain. This comes about from the Gaussian being its own Fourier Transform. What are the implications of this? Well, if the support of the filter is the same in either domain, that means that the ratio of both supports is 1. As it turns out, this means that Gaussian filters have the 'minimum time-bandwidth product'. [5].The result of Gaussian low pass filter on various types of images is shown in Fig.4.

GAUSSIAN HIGH PASS FILTER

In electronics and signal processing, a **Gaussian filter** is a filter whose impulse response is a Gaussian function (or an approximation to it). Gaussian filters have the properties of having no overshoot to a step function input while minimizing the rise and fall time.

The one-dimensional Gaussian filter has an impulse response given by

$$g(x) = \sqrt{\frac{a}{\pi}} \cdot e^{-a \cdot x^2}$$

and the frequency response is given by (eq.206 Fourier transform)

$$\hat{g}(f) = e^{-\frac{\pi^2 f^2}{a}}$$

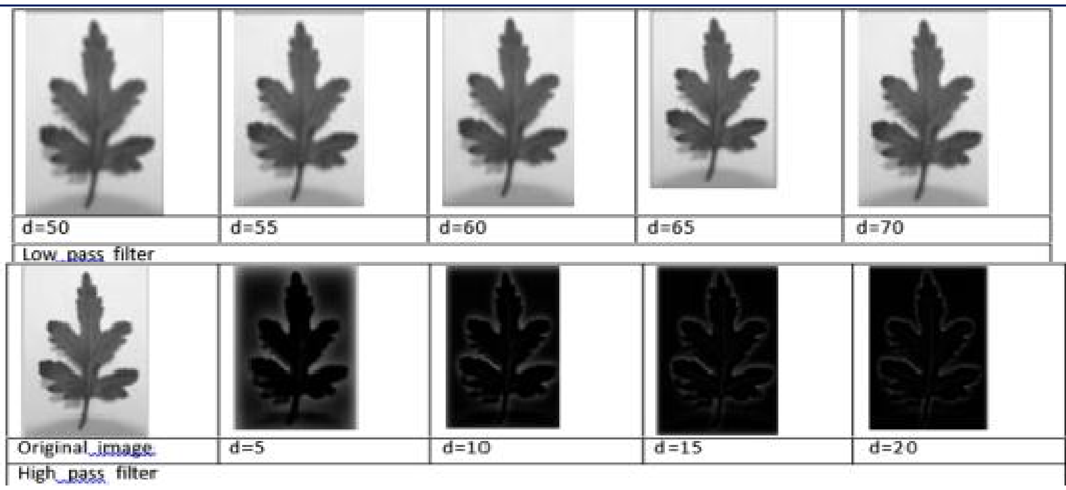
with f the ordinary frequency. These equations can also be expressed with the standard deviation as parameter

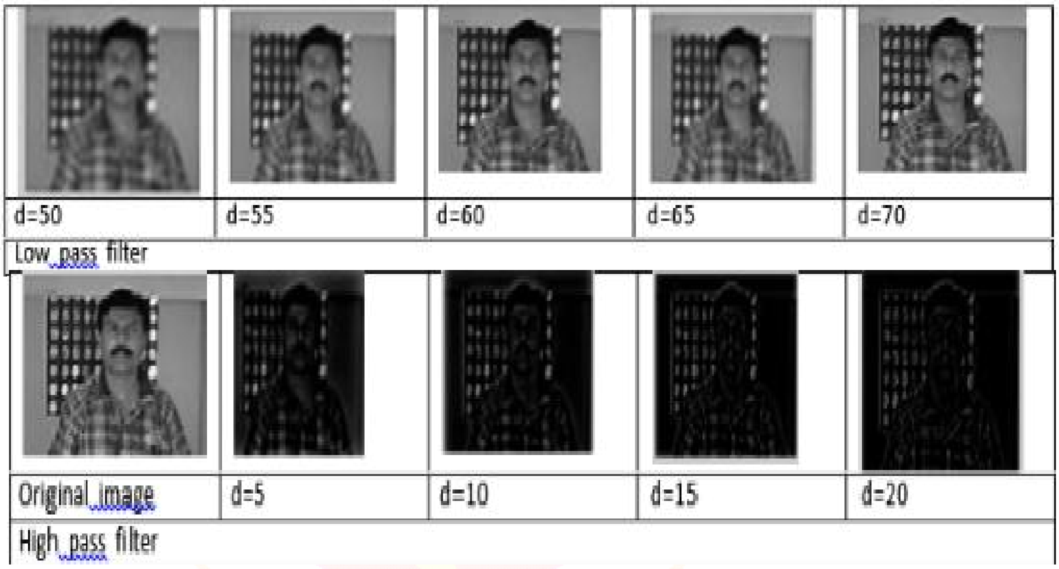
$$g(x) = \frac{1}{\sqrt{2\pi} \cdot \sigma} \cdot e^{-\frac{x^2}{2\sigma^2}}$$

and the frequency response is given by

$$\hat{g}(f) = e^{-\frac{f^2}{2\sigma_f^2}}$$

The result of Gaussian high pass filter on various types of images is shown in Fig.4.


d=50
d=55
d=60
d=65
d=70
Low pass filter
Original image
d=5
d=10
d=15
d=20
High pass filter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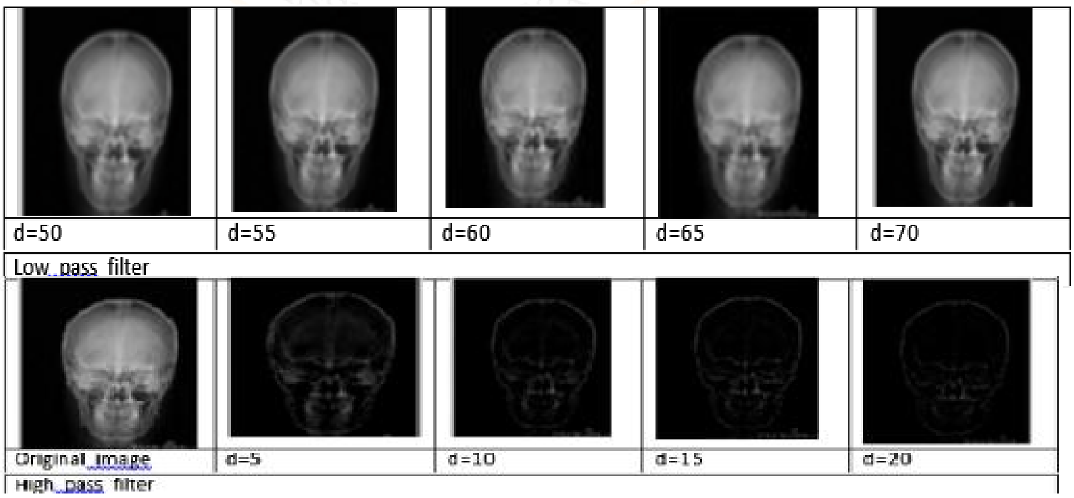
d=65
d=70
Low pass filter
Original image
d=5
d=10
d=15
d=20
High pass filter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d=65
d=70
Low pass filter
Original image
d=5
d=10
d=15
d=20
High pass filter

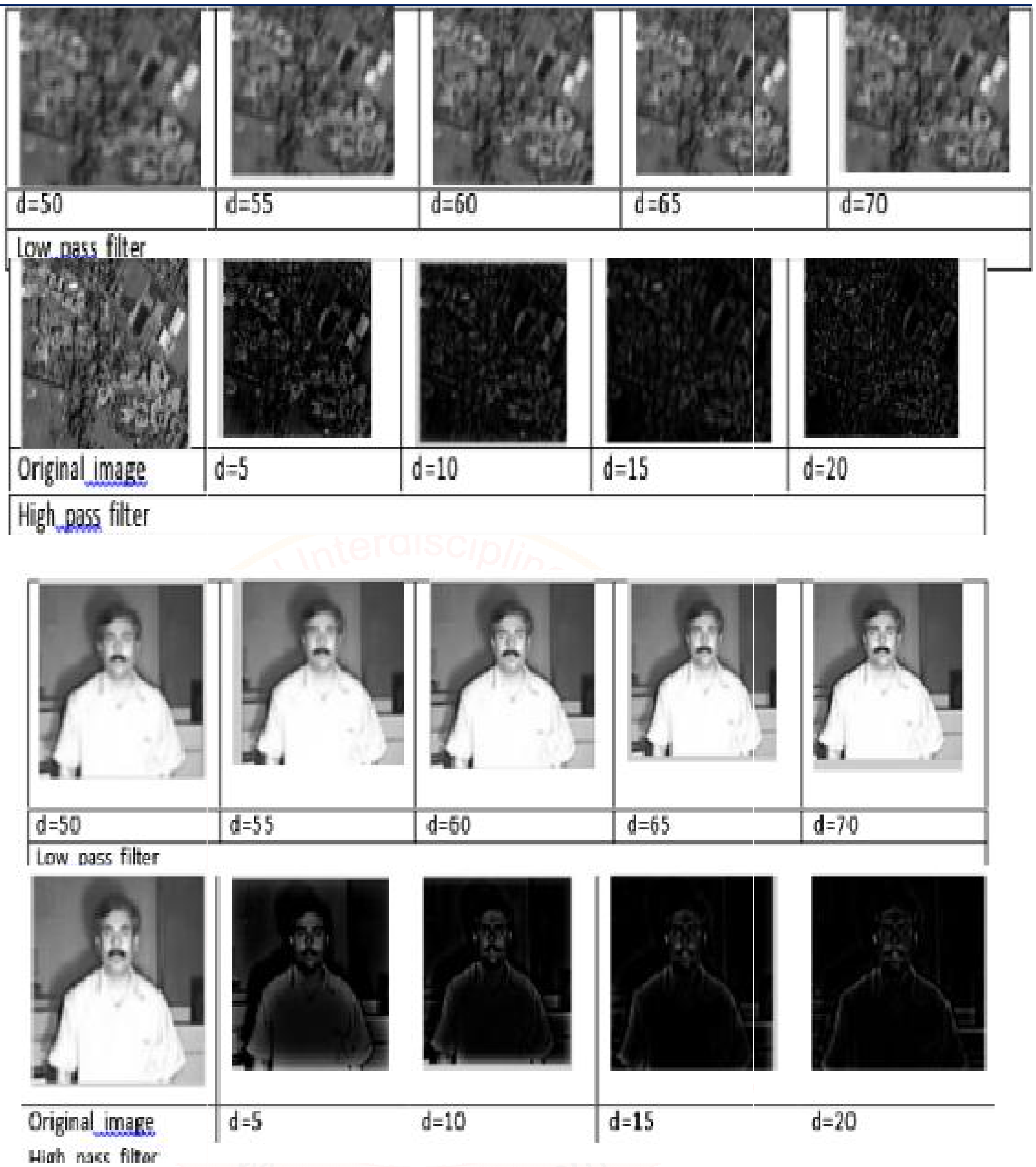


Fig.4 The result of Gaussian high & low pass filter on various types of images.

BUTTERWORTH HIGH PASS FILTER

The **Butterworth filter** is a type of signal processing filter designed to have as flat a frequency response as possible in the pass band. It is also referred to as a **maximally flat magnitude filter**. It was first described in 1930 by the British engineer and physicist Stephen in his paper entitled "On the Theory of Filter Amplifiers".

A simple example of a Butterworth filter is the third-order low-pass design shown in the figure on the right, with $C_2 = 4/3$ F, $R_4 = 1\ \Omega$, $L_1 = 3/2$ H, and $L_3 = 1/2$ H. Taking the impedance of the capacitors C to be $1/Cs$ and the impedance of the inductors L to be Ls, where $s = \sigma + j\omega$ is the complex frequency, the circuit equations yield the transfer function for this device:

$$H(s) - \frac{V_o(s)}{V_i(s)} = \frac{1}{1 - 2s + 2s^2 + s^3}.$$

The magnitude of the frequency response (gain) $G(\omega)$ is given by

$$G^2(\omega) = |H(j\omega)|^2 = \frac{1}{1+\omega^6},$$

and the phase is given by

$$\Phi(\omega) = \arg(H(j\omega)).$$

The result of Butterworth high pass filter on various types of images is shown in Fig.6.

BUTTERWORTH LOW PASS FILTER

Filters are classified according to the functions that they are to perform, in terms of ranges of . We will be dealing with the *low-pass filter*, which has the property that low-frequency excitation signal components down to and including direct current, are transmitted, while high-frequency components, up to and including infinite ones are blocked. The range of low frequencies, which are passed, is called the *pass band* or the *bandwidth* of the filter.� It extends from $\omega=0$ to $\omega=\omega_c$ rad/sec (f_c in Hz). The highest frequency to be transmitted is ω_c, which is also called the *cutoff frequency*. Frequencies above cutoff are prevented from passing through the filter and they constitute the filter *stopband [12]*. The result of Butterworth low pass filter on various types of images is shown in Fig.6.

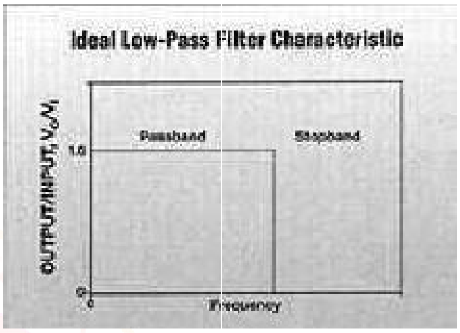
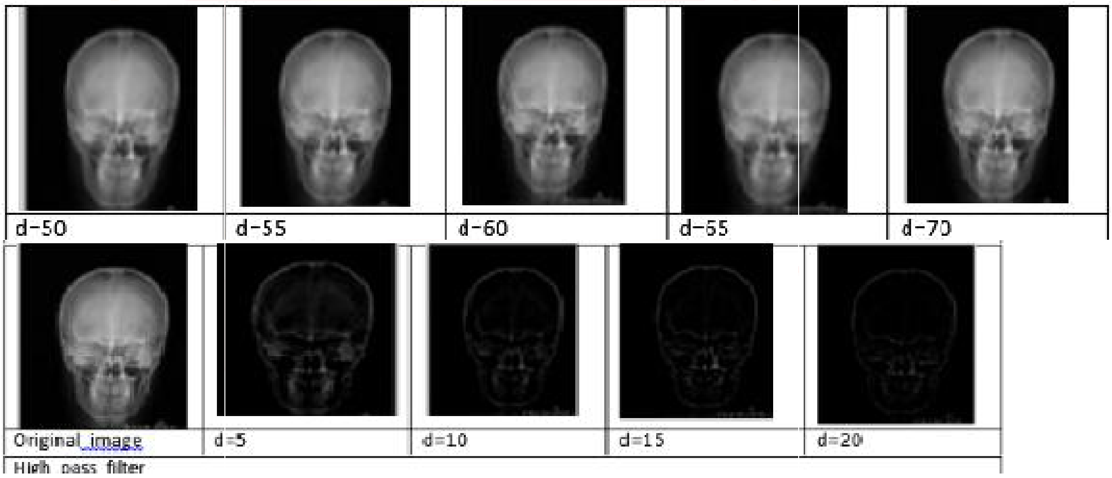
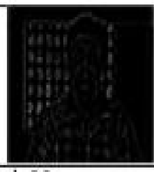
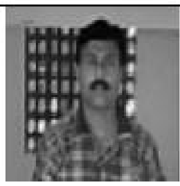
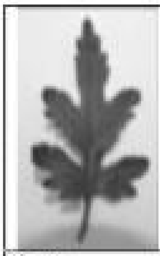
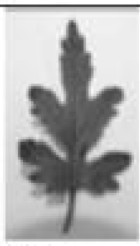
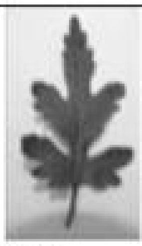
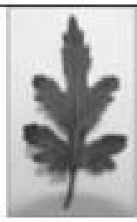
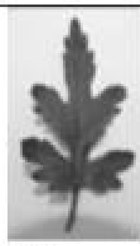


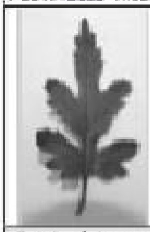
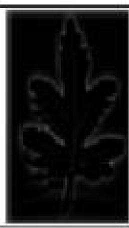
Fig.5 Butterworth low pass filter



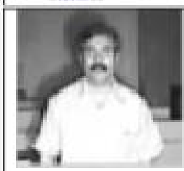
				
Original image	d=5	d=10	d=15	d=20
High pass filter				

				
d=50	d=55	d=60	d=65	d=70

				
d=50	d=55	d=60	d=65	d=70
Low pass filter				

				
Original image	d=5	d=10	d=15	d=20
High pass filter				

				
d=50	d=55	d=60	d=65	d=70
Low pass filter				

				
Original image	d=5	d=10	d=15	d=20
High pass filter				

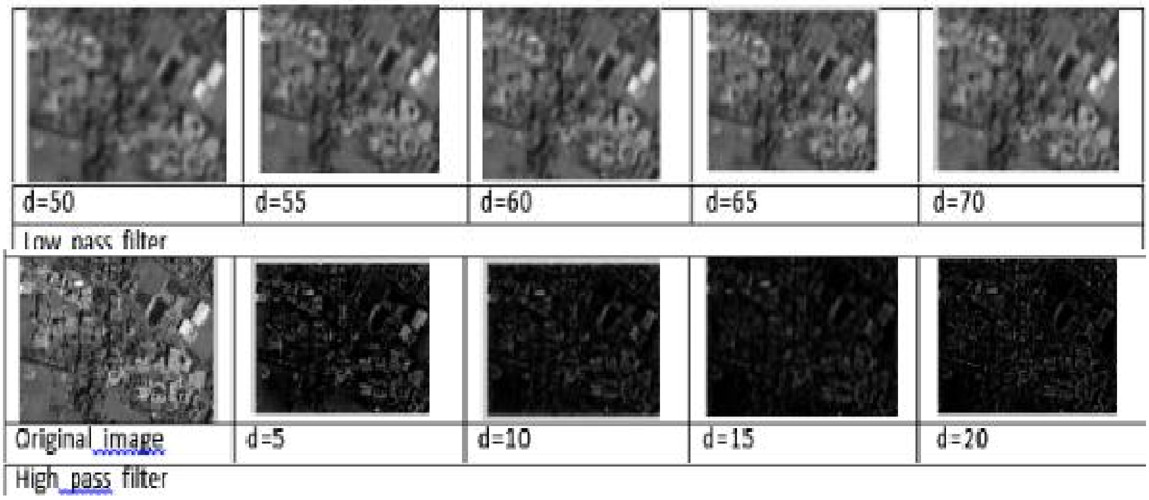


Fig.6 The result of Butterworth high & low pass filter on various types of images.

CONCLUSION

In this paper, described methods for an approach for the filtration operations on various types of images. In this work, we used different types of frequency domain filtration techniques. By applying this technique we decompress the various types of images. In frequency domain filtration technique we used Gaussian lowpass and highpass filter and Butterworth lowpass and highpass filter to decompress the image.
.

In this filtration technique we use different cutoff values to check the result. In Gaussian lowpass filter 70 cutoff value gives the high result and 5 cutoff value give high result for Gaussian highpass filter.In Butterworth lowpass filter 70 cutoff value gives the high result and 5 cutoff value give high result for Butterworth highpass filter.The lowpass filter improves the smoothness of image. The highpass filter improves the sharpness of image

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SCHEDULING ALGORITHMSFORRESOURCE ORGANIZATION-ACLOUDCOMPUTING ENVIRONMENT PERSPECTIVE

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ABSTRACT

Cloud computing is intensifying as the latest platform which is used to provide the user on pay per use basis. The main aim of Cloud Computing is to provide proficient way to remote and geographically dispersed resources. A scheduling algorithm manages the access to these different resources. There are various types of resource scheduling technologies in cloud environment. These are implemented at different levels based on different parameters like cost, performance, resource utilization, time, priority, physical distances, throughput, bandwidth, resource availability etc. In this research paper, various types of resource scheduling algorithms that offer efficient cloud services are studied. Based on the study of different algorithms, a classification of the scheduling algorithms has been presented

Keywords: *Cloudcomputing,schedulingalgorithms,Resourceallocation,Opensource,VirtualMachine*

INTRODUCTION

Cloud computing has come out of developments in the grid computing, virtualization and web technologies. Cloud computing is a scalable distributed computing environment in which a large set of virtualized computing resources, different infrastructures, various development platforms and useful software's are delivered as a service to customers on pay per use manner usually over the Internet[1]. Cloud Computing consists of infrastructure, platforms, and applications. Cloud technology helps business organizations, academic institutions, government organizations in cutting down operational expenses. The significant features of Cloud Computing include lower cost, incremental scalability, reliability and fault-tolerance, service-oriented, utility-based, virtualization and SLA (Service Level Agreement)[2][3].Cloud computing have been used for various areas like education, business, health etc. It is required to have an efficient use of resources by different application areas[4][5].

Cloud computing environments can be fabricated on different system infrastructures like on physically located grids(grid- based), geographically distributed services(service-based), commercial cloud computing infrastructure (business-based) etc. Cloud enables on-demand provisioning of computational resources, in the form of virtual machines (VMs) deployed in a cloud provider's data centre. Cloud computational resources are shared among different cloud customers who pay for the services according to the usage of resource. The allocation of resource and proper scheduling has significant impact on the performance of the system. There are different types of resource scheduling in Cloud Computing that are based on different parameters like cost, performance, resource utilization, time, priority, and physical distances, throughput, bandwidth, and resource availability.

SchedulinginCloudComputing - Schedulingalgorithm isthemethodby which threads, processes or data flows are given access to system resources (e.g. VM, processor time, communications bandwidth). The method of scheduling is very significant in the Cloud Computing environment for proficiently using the scattered resources. The speed, efficiency, utilization of resources in enhanced way depends largely on the type of scheduling algorithm selected. This is typically done to load balance a system effectively or achieve a target quality of service. Scheduling is the process of determining the distribution of the resources between varieties of possible tasks. There are certain factors that scheduler is mainly concerned. These include throughput, latency, turnaround, response time and fairness. Throughput is number of processes that complete their execution per time unit. Latency is a measure of time delay experienced in a system. Turnaround is total time between submission of a process and its completion. Response time can be defined amount of time it takes from when a request was submitted until the first response produced. Fairness is equal CPU time to each process generally according to each process' priority. There are various issues pertaining to scheduling for various systems. The applications require different optimization criteria. In Batch, systems criteria required are throughput and turnaround time.

A brief study has been carried out to study and analyze the working of different scheduling algorithms. Based on this study different selected significant factors are being identified for comparative analysis of the algorithms.

PREVIOUS WORK

Resource provisioning and scheduling of resources is an important feature that affect the performance of networking, parallel, distributed computing and cloud computing. Many scholars have suggested various algorithms for allocating, scheduling and scaling the resources competently in the cloud. These includes first come first serve, min-min max min, ant colony, round robin, earliest dead line first, hybrid heuristic, back tracking, task duplication, genetic algorithm, loss and gain simulated annealing, ant colony , greedy etc. Various modified scheduling algorithms like Improved Genetic Algorithm, Modified ant colony optimization, Extended Min-Min have also been proposed by researchers [6-10][12][15] [16][18][19][24].

Energy-efficient (Green) resource provision policies and scheduling algorithms for cloud computing are proposed. The algorithm uses the prediction in making turning off/on the number of running servers/hosts in order to reduce the idle power consumption [20-22].Scheduling policies in this cloud computing scenario should fulfil the purposes of customer as well as of service providers. Here focus is onparticular problem related toscheduling of consumers' service requests (or applications) on service instances made available by providers taking into account costs incurred by both consumers and providers as the most important factor [11][13] [14][16][31].

There are two major types of workflow scheduling algorithms for grid and cloud workflow management systems. These are best effort and QoS (Quality of Service) constraint based algorithms. Users QoS requirements like deadline and budget havebeen addressed in these existing grid and cloud workflow management systems [30].

Based on the literature review, various Scheduling algorithms as mentioned above have been identified.

3.Schedulingalgorithms:

The efficiency of task scheduling has a direct impact on the performance of the entire cloud environment. Many heuristic scheduling algorithms were used to optimize it. Scheduling in cloud computing environment is performed at various levels like workflow, VM level, task level etc.A detailed explanation of various algorithms is given below. Recently some new modified algorithms have been suggested.

(A) EarliestDeadlineFirst – Earliest Deadline First (EDF) or Least Time to go is a dynamic scheduling algorithm used in real-time operating systems. It places processes in a priority queue. Whenever a scheduling incident occurs (task finishes, new task released, etc.) the queue will be searched for the process closest to its deadline, the found process will be the next to be reserved for execution [8].

(B) Back-trackingAlgorithm– The backtracking algorithm [12] assigns available tasks to the least expensive computing resources. An available task is an unmapped/unscheduled task whose parent tasks have been scheduled. If there is more than one available task, the algorithm assigns the task with the largest computational demand to the fastest resources in its available resource list. The heuristic repeats the procedure until all tasks have been mapped. After each iterative step, the execution time of the current assignment is calculated. If the execution time exceeds the time limitation, the heuristic back tracks the previous step, removes the least expensive resource from its resource list and reassigns tasks with the reduced resource set. If the resource list is empty, the heuristic keeps backtracking to the previous steps, reduces corresponding resource list and reassigns the tasks.

(c) DeadlineDistributionAlgorithm– The deadline distribution algorithm [13] attempts to minimize the cost of completion while meeting the deadline for delivering results. This algorithm divides a workflow and distributes the overall deadline into each task based on their workload and dependencies. It uses synchronization Task Scheduling (STS) for synchronization tasks and Branch Task Scheduling (BTS) for branch partition respectively. Once each task has its own sub-deadline, a local optimal schedule can be generated for each task. If each local schedule guarantees that their task execution can be completed within their sub-deadlines, the whole workflow execution will be completed within the overall deadline. Similarly, the result of the cost minimization solution for each task leads to an optimized cost solution for the entire workflow. Therefore, an optimized workflow schedule can be constructed from all local optimal schedules. The schedule allocates every workflow task to a selected service such that it can meet its assigned sub-deadline at a low execution cost.

(d) GeneticAlgorithm- Genetic algorithms are stochastic search algorithms based on the mechanism of natural selection policy. It starts with a set of initial solution, called initial population, and will produce new solution using genetic operators. The benefit of this method is that, it can handle a large searching space, applicable to complex objective function and can avoid trapping by local optimum solution[18][29].

(e) EMM(ExtendedMin-Min)SchedulingAlgorithm – Algorithm is designed for task scheduling with the main goal to achieve maximum throughput in the group. This algorithm is executed periodically to provide dynamic scheduling in a batch mode. The EMM algorithm extends the original Min-Min algorithm and is more appropriate for instance-intensiveworkflows. Inworkflow systems, resources are needed to perform tasks, and for every resource, it can only be engaged by a task at one time. The resources are allotted to tasks by allocating time slots to selected tasks. When it is decided to schedule a task (i.e. the task of the workflow instance) on resource, it will assign a suitable time slot of this resource to it. Of course, the data dependency and control dependency should be preserved simultaneously. The element in matrix means the estimated execution time for particular task on resource. If its value equals to -1, it means that task cannot be executed on resource. The original values of this matrix are estimated, but can modify the values at runtime according to the history execution record for better estimation later [24].

(f) Compromisedtimecostschedulingalgorithm– S.Pandey et.al. presented a compromised-time-cost scheduling algorithm in which they considered cost-constrained workflows by compromising finishing time and cost with user input [28].

(g) MarketOrientedHierarchicalScheduling- Zhangjun Wu et.al. proposed a market-oriented hierarchical Schedulingstrategy which consists of a service-level scheduling and a task-level scheduling. The servicelevel scheduling deals with the Task-to-Service assignment and the task-level scheduling deals with the optimization of the Task-to-VM assignment in local cloud data centres. It can be used to improve the time and cost simultaneously [32].

OUTCOMEANDCONSIDERATIONS

There are various factors that determine which algorithm is best for Cloud environment for providing efficient services. There are various algorithms used for scheduling cloud computing environment for resource allocation which are based on various factors like cost, throughput, time etc. Various Cloud providers offer paid extra resources to users in an on demand manner. Scheduling algorithms can be categorized according to following criteria like time, cost, energy etc as shown in table-2. Some of the scheduling algorithm can optimize the time span where as other can minimize the cost or energy consumption. So based on the customer or service provider requirements various algorithms can be used for enhancing the efficiency and also to get optimized resource allocation and load balancing depending on various factors.

Table-1
:SchedulingAlgorithmsusedindifferentCloudEnvironment

CloudProvider	OpenSource	Algorithmsusedfor scheduling
Eucalyptus	Yes	GreedyfirstfitandRound Robin
OpenNebula	Yes	Rankmatchmakerscheduling,pre-emptionscheduling
Rack space	Yes	roundrobin,weightedround robin,leastconnections, weightedleastconnection
Nimbus	Yes	VirtualmachineschedulersPBSandSGE
AmazonEC2	No	Xen,swam,genetic
Red Hat	Yes	Breathfirst,Depthfirst
Luna cloud	Yes	Round Robin

Table-2
:FactorBasedGroupingofSchedulingAlgorithms

Time	Cost	Energy/Others(Queue,ranketc.)
Roundrobin	Deadline distribution	Modified Best fit Decreasing
Earliest Dead Line first	Compromised–time cost	Green Scheduling Algorithm
Backtracking	GeneticAlgorithm	FCFS
Modified ant colony optimization	Improved activity based cost	Adaptive Scheduling Algorithm
Extended Min-Min	A Particle Swarm Optimization	---
Market Oriented Hierarchical Scheduling	Improved Genetic Algorithm	---

Compromised time cost	Profit-driven service oriented algorithm	---

CONCLUSION

In Cloud computing environment, varied resources are provided as s ervices in forms of virtual machines. To manage these diverse resources in improved way efficient scheduling and load balancing is required. In this study, an effort is made to study various scheduling . algorithms in cloud computing environment. This classification shall help in selecting the proper class of scheduling algorithms for different types of services as per the necessities of the clients and service providers. Future work will include implementation of various kinds of algorithms using cloud simulator and open source cloud environment

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PATENT - A CHALLENGE

A Comparative Analysis Between Indian and International Patenting Process

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ABSTRACT

Patent is a document containing innovation supplied after filing the application to the government. Patent office which is operated by government carries the process from filing to grant the patent. The invention or ideas which will be commercially adopted can be legally protected through filing the patent. Patent can be granted on the terms related with the innovation and examination of the plagiarism or copyright laws. The lethargic process to examine the patents can prone to plagiarism. Innovators disappointed due to the large processing and examination timing of the patent. It is a failure of those countries where limited number of patents can be filed. This article provides a deep perception of a situation of patent filing and examination process in India and other countries.

Keywords : *Patent, IPO, WIPO, potentially pending application, patent exmination*

INTRODUCTION

Patent can be treated as a property where innovator can sell or any one purchase it. As an developing country like India, many researchers are working on their innovations. As compared with the other countries like China, Indian patent system is somewhat slower. Global Intellectual Property filing has been reached to the new heights. In comparison with other countries, Indian patent processing and examination system is very slow. Now, the time required for the patent application to enter into the examination is 4 years. The prime bottleneck in Research and Development is the unenergetic patent examination process.

The most important activity in research and development is acquiring the Intellectual Property Rights for your innovation.

A new trend comes in practice that researchers publish their research work through journals or presented it in the conferences. If any innovative literature published through journals or conferences, the ideas of innovations can be easily stolen by other researchers or manufacturing industries.

In India, researchers excessively published their research innovations. These innovations cannot be converted into Intellectual Property by them. As compared to the patent examination process between Indian and other countries, Indian patent examination process is very lengthy and disappointing. Therefore, it is act as a bottleneck for "Make in India". Patent offices examine applications and decide whether or not to grant patent rights. Examination processes differ across offices. As per the patent examination scenario in India, the IPO follows the formal examination process.

OVERVIEW OF IP FILING ACTIVITY

Patent filing activity started by writing innovation in the form of patent application. It requires a complete specification along with the claims which defines the innovation clearly. The patent filling process is somewhat typical and need some expert writing presentation skill that is helpful for the patent review and examination. Ones any patent application filed, the innovative idea in the patent can be treated as a property. Therefore, it will be protected across a single country or other countries depending on the type of filing.

In India, a limited number of patent applications can be filed where as per the statistics, other countries can handled large number of patent applications.

APPLICATION PROCESSING TIME

Different countries patent offices carry their own filing and examination process. The normal time to process the patent application caries from 2 to 3 years depending on the protocols of the respected office. The delay of application process depends on the application received and the experts available for the examination of application. Excessive delay in the process tends the system towards severe pending.

Some countries adopted rapid examination technique which is beneficial for the nation as well as every individual researchers. This rapid technique is adopted by China and USA that treat the patent application for substantial examination. The substantive examination process follows a rapid and effective way that determine the innovation is novel nor not, apparent and industrially applicable. It can be executed by arranging several meetings between applicants and examiners. Though, it is a lengthy procedure during the examination, but it is fruitful and helpful to find the genuineness of the application. This process guarantees the final outcome of rapidly. Figure 1 shows the examination time required to process the patent application. In this figure, Indian examination process face more examination time than other countries.

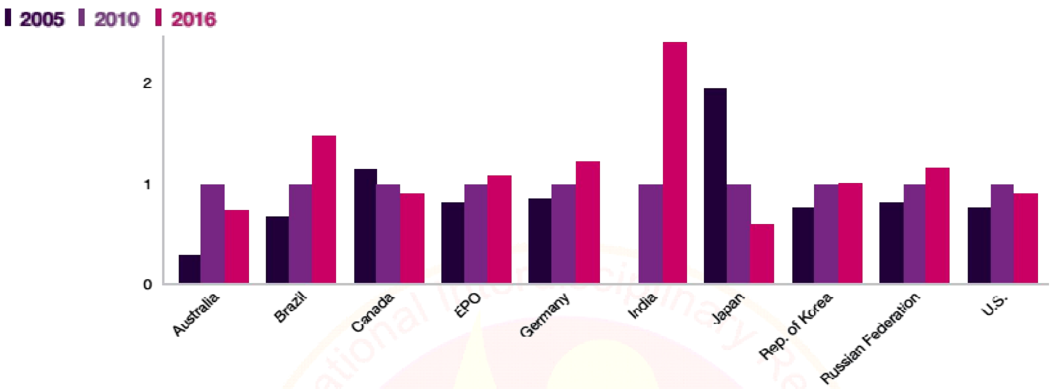

Fig. 1Time required to examination the patent application

EXAMINERS & EXAMINATION CAPACITY

The patent application capacity differs from countries to countries. Some countries are prominent to handle the examination process with extra ordinary payload capacity. This is only because of the more examiners appointed to handle the heavy application traffic. Moreover, the capacity of the patent office to handle incoming patent applications relies on some crucial factors such as outsourcing prior art searches, joint operation between offices. Figure 2. shows the workload per patent examiner. Figure 3. shows the granted, rejected, withdrawn and abandoned patent application. Japan is a country where huge number of patents are granted while in case of India, the granted patents are less and rejection as well as abandoned application increases day by day.

Data on the number of patent examiners consider those working full time and do not take into account other possible workforces provided by outsourcing companies and freelancers. However, examination work undertaken by affiliated institutions is included. At some offices, such as those of Japan and the Republic of Korea, patent examiners also process utility model applications, while in the U.S. patent examiners also deal with plant variety applications. These offices cannot provide breakdowns between patent examination and utility model/plant variety examination. The number of patent examiners at the office of Australia includes hearing staff, who account for a small proportion of the total staff.

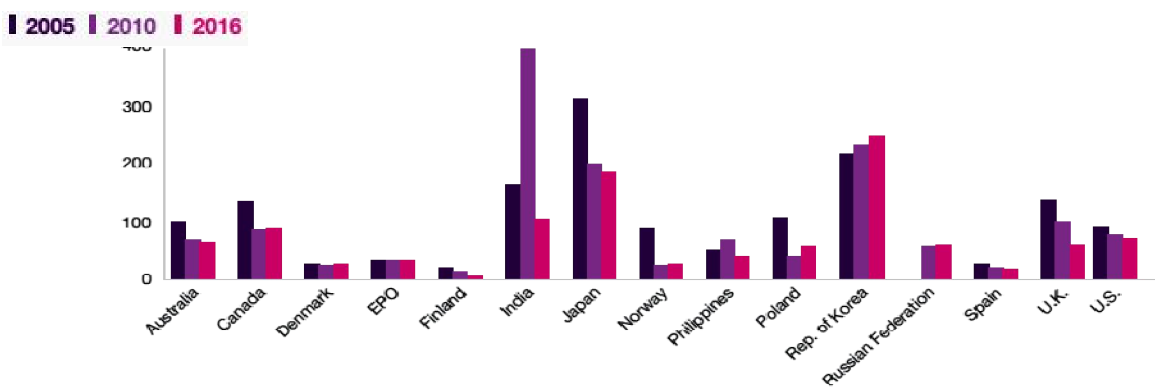

Fig. 2 Workload per patent examiner.

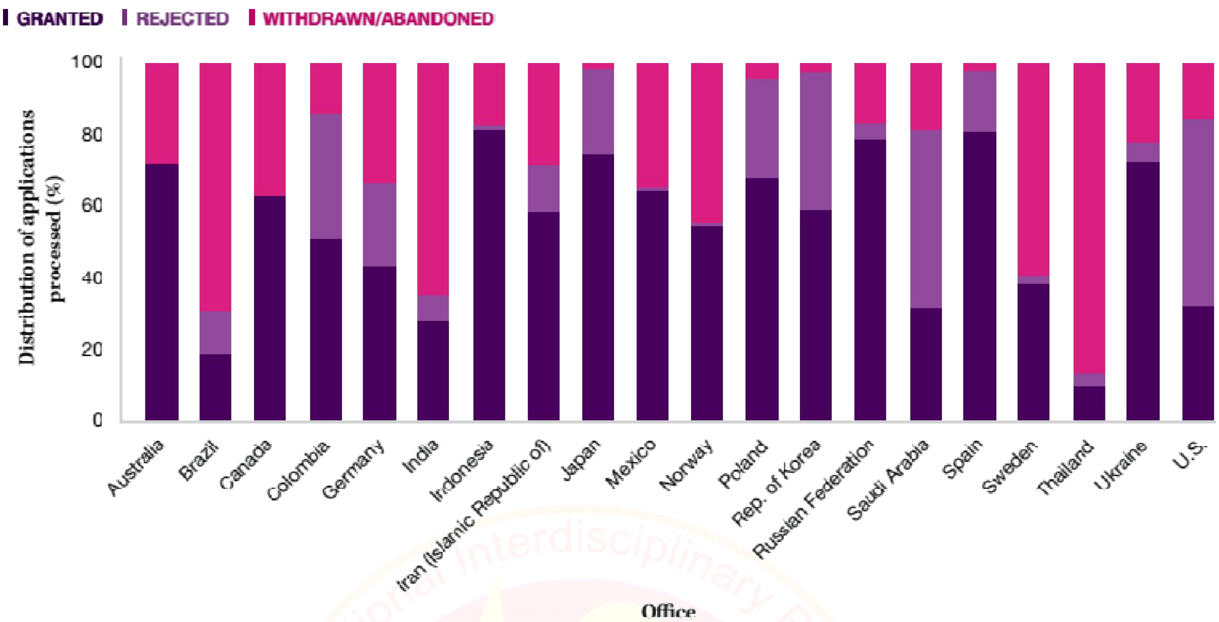

Fig. 3 The granted, rejected, withdrawn and abandoned patent application.

POTENTIAL PENDING APPLICATIONS

Potentially pending applications are the patent applications which are not entered into to the examination process or waiting for the final decision by the examiners at the patent office. It can be potentially pending because of other issue such as the applicants have not requested for the examination. The application pending for the examination can be influence by the tedious and laborious process by the patent office. It may be affected by the lethargic practices or less number of examiners.

The potentially pending application ruined country or researchers. During the pending time, the ideas can be stolen by opponents. They can put another design, framework or improved process to get the benefits. It is one of the malpractices and can be beneficial for the opponents. Some countries take benefits of the potential pending application because if any researcher filed the application in any single country then it cannot be protected at rest of the countries at all. The following figure 4. the average pendency time for the examination of different countries. As shown in the figure 5., India has a highest potential pending application in 2016 as compared to other countries and the large time require to process the patent application.

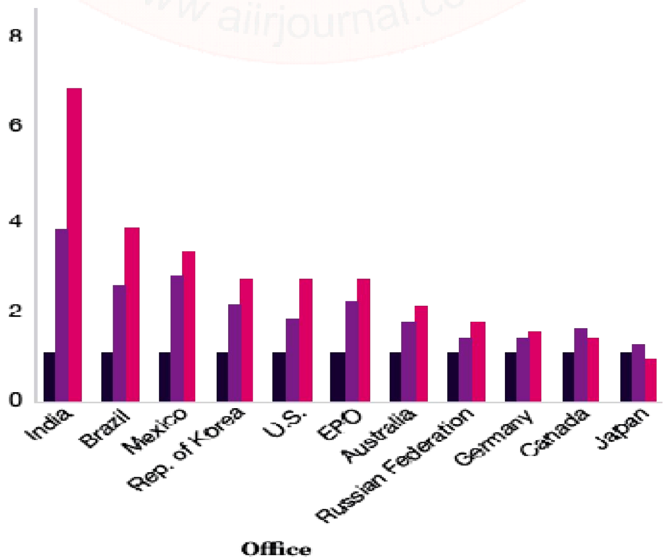

Fig. 4 Potentially pending applications

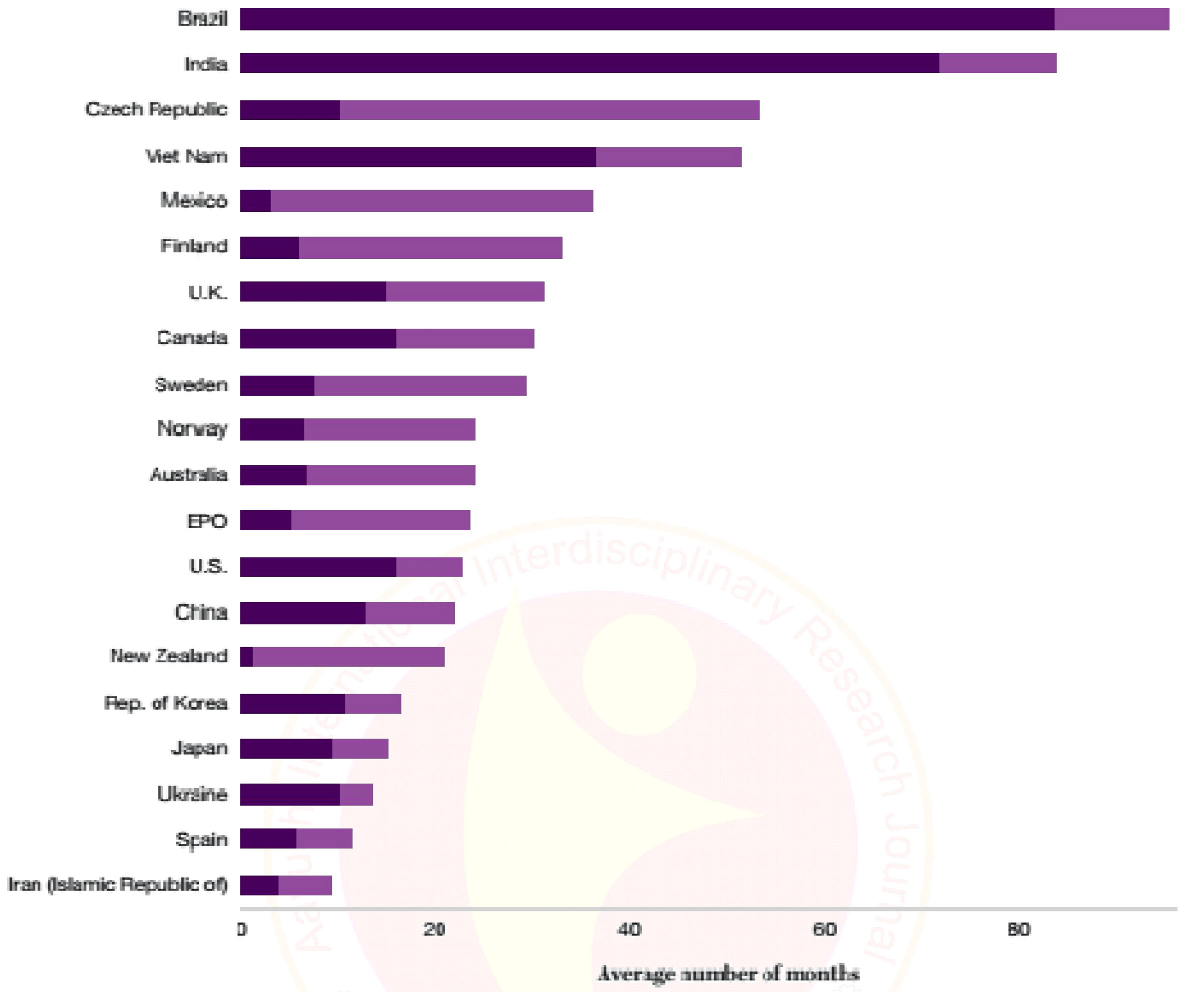

Fig. 5 Average pendency times for first office action and final decision at selected offices

MISFORTUNE

It is an unfortunate state where the patent application gets rejected by the examiner even if it is a genuine innovation. The rejection can happened if the examiner cannot contain satisfactory literature that will be compared against the submitted application. Patent can be rejected during the examination because of the poor defending.

PATENT PLAGIARISM

The term plagiarism refers to the writing contents that replicated from someone's literature and presented in own literature as your own work. Such king of plagiarism can be happened in case of patents also. If any patent is published, then the ideas are viral over the web. These ideas can be easily refurbished and the improved of somewhat differently presented by anyone. It is known as patent plagiarism.

The second thing is the patent plagiarism can be happened in other countries where the protection is not submitted. It will only submitted in single country, therefore it can be plagiarized in other countries. In such cases, the original innovators cannot claim those things.

The trends to publish the innovations in the conferences are now at its extreme position due to the academic requirements. Every academicians or researchers willing to published their work for the betterment of their degrees or academic jobs. But, it is most dangerous and prone to the plagiarism because they leak their ideas and innovations. Their publications are viewed worldwide through the open access journals. Though there are some copyright laws that restricts reproduce the written literature but the innovative ideas can be easily accessible.

Therefore, the patent plagiarism is done in case of the patent delayed by the lengthy examination process.

CONCLUSION

The quantity of patents filed in India is very less as compared to other countries even if they have not potential. The delayed process of patent examination in India is harmful to every innovators as well as for the nation. It will be a bottleneck for the Make in India process. As like China or USA, revolutionary changes should be adopted by Government of India to improve the patent examination process. The rapid examination should be introduced by the government that will benefits the Indian market economically. Due to the lethargic examination process, innovators and researchers disappointed. Some researchers are not in the position to pay the large amount patent process. Because of this, the quality research are not converted into patents that affects the market. If government provides some kind of subsidy in the form of construction of research laboratories or incubation centers then it will helps the students researchers to nurture their researchers ideas.

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MOBILE COMPUTING ISSUES, CHALLENGES AND SOLUTIONS

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ABSTRACT

Mobile Computing plays very important role in the era of information technology. It is a major innovation in the field of data storage and it's security. Storing the data with security issues is a challenging pat of mobile computing. Mobile computing is human-computer interaction by which a computer is expected to be transported during normal usage, which allows for transmission of data, voice and video. Advanced Encryption Standard (AES) as well as the steganographic algorithms such Least Significant Bit insertion algorithm used in mobile computing. It provides security system for mobile computing. This paper presents collaborating encryption technique framework to meet the futures' faster encryption requirements.

Keywords: *Mobile Computing, Issues, Challenges, Solutions, Advanced Encryption Standard (AES) and Steganographic algorithms.*

INTRODUCTION

Mobile computing is human – computer interaction by which a computer is expected to be transported during normal usage, which allows for transmission of data, voice and video. The computers are smaller and bits travel by wireless rather than Ethernet. To improve the work efficiency by accessing the remote data is only possible by the mobile computing but the information security is the prime goal of every organization. Earlier we are willing to work in a mobile fashion. We use the handheld devices such as smart phones, android phone, for needs of users, peoples but the information security of mobile communications is the biggest issue for everyone. This research proposed a framework that contains the encryption, decryption, AES and stenographic algorithm for security.

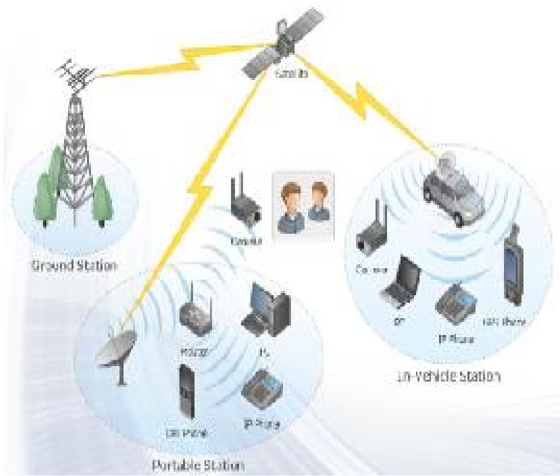

Fig.1: Typical Mobile Computing Environment

LITERATURE REVIEW

"Mobile Computing and Urban Systems: A Literature Review using mobile systems in urban systems is a research subject, which was addressed in the last year by several research projects and research papers. In such a situation and analyzing look at the research work done so far can provide valuable insights". Previous paper presents a three-tier (and two-tier) security mechanism that effectively controls the information security with the security key agreement and exchange protocol. This security system is suitable for the communication channel having low bandwidth. And the structuring distributed algorithms and services for networks with mobile hosts.

Jambhekar, N.D. et. al (2016) proposed the method of integrated crypto steganography approach that resolves the key agreement and transmission issues with the key agreement and exchange protocol. This system introduces a three-tier security protocol that secure the information stored and flows on the mobile network, by providing the trusted third party controlled security key management. The proposed security system is implemented using Matlab and tested on Intel I5 processor. The encryption and decryption operation is carried out and the performance of the proposed system is taken using Matlab. The mobile computing environment requires the rapid encryption and decryption system that keep the sensitive information safe. The proposed method resolves the issues of key transfer between encryption and decryption party that also resolves the security key management issues affected to the mobile computing environment. It can be effective in the encryption load balancing by facilitating the asymmetric key feature and encryption process at server side.

Dharma P. Agrawal, Hongmei Deng, Rajani Poosarla and Sugata Sanyal describes the center for distributed and mobile computing. Mobile computing technology provides anytime and anywhere service to mobile users by combining wireless networking and mobility, which would engender various new applications and services. However, the inherent characteristics of wireless communication and the demand for mobility and portability make mobile computing more vulnerable to various threats than traditional networks. Securing mobile computing is critical to develop viable applications. In this article, the security issues faced by mobile computing technology. It analyzed the various security threats and describes the existing current countermeasures. We have seen that many security solutions have been proposed to securing WLANs, but no one is able to claim that it solves all the security problems, or even most of them. In essence, secure mobile computing would be a long-term ongoing research topic.

Dr. N. D. Jambhekar, proposed the parallel and distributed encryption technique introduced that helps to reduce the confidential data security requirement. It helps to encrypt the parts of data at different locations and merge at a single location. The fully homomorphic encryption technique is a miraculous solution and can support the encrypted search. This can be implemented with the help of the collaborating encryption technique discussed in this paper.

MOBILE COMPUTING SECURITY

3.1. Mobile Computing

Mobile Computing is a distributed wireless computing technology that enables desktop computer users to work outside anywhere from office or home. Mobile computing enabled devices use wireless communication feature makes them accessible and present online on any remote place anywhere anytime. Mobile computing supports two advantageous entities such as mobility and computing are as follows:

Fig.2: Mobile Computing

3.2. Mobility and computing

In my opinion, Mobile IP will be successful in the future as it has several notable features like no geographical limitation, no physical connectivity required, supports security, no modifications for the current IP address. The main factors that influence the need for Mobile IP are

• Mobility Support, increased number of mobile users
• Standardization uses the current IP Protocol
• Inter-Operability, can be used across different service providers
• Alternative Technologies, lack of proper alternatives other than Mobile IP
• IPv4 Availability, limited availability of IPv4 address necessitates the need for Mobile IP
• Improved Security, while registering with the home agent

3.3. Security

Mobile Computing environment can uses static and dynamic servers i.e. cloud servers to store the data. Both client computer and server can maintain the security of this data.

The encryption and decryption algorithm for encryption of data, if the data encrypted by the user then the data is unreadable by the un-authorized people. And decryption is the technique in which data can be decrypted by the user or at the time of searching, the security is required. A mobile communication networks cannot provide the information security therefore, the parties engaged in the data communication handle the security mechanism with the help of security system such as cryptography and steganography.

LIMITATIONS OF MOBILE COMPUTING

4.1. Insufficient Bandwidth. Mobile Internet access is generally slower than direct cable connections, using technologies such as GPRS and

EDGE, and more recently 3G networks. These networks are usually available within range of commercial cell phone towers. Higher speed wireless LANs are inexpensive but have very limited range.

4.2. Security Standards. When working mobile, one is dependent on public networks, requiring careful use of Virtual Private Network (VPN). Security is a major concern while concerning the mobile computing standards on the fleet. One can easily attack the VPN through a huge number of networks interconnected through the line.

4.3. Power consumption. When a power outlet or portable generator is not available, mobile computers must rely entirely on battery power. Combined with the compact size of many mobile devices, this often means unusually expensive batteries must be used to obtain the necessary battery life. Mobile computing should also look into Greener IT ,in such a way that it saves the power or increases the battery life.

4.4. Transmission interferences. Weather, terrain, and the range from the nearest signal point can all interfere with signal reception. Reception in tunnels, some buildings, and rural areas is often poor.

4.5. Potential health hazards. People who use mobile devices while driving are often distracted from driving are thus assumed more likely to be involved in traffic accidents. Cell phones may interfere with sensitive medical devices. There are allegations that cell phone signals may cause health problems.

CHALLENGES

The main objective of mobile cloud computing is to provide a convenient and rapid method for users to access and receive data from the cloud, such convenient and rapid method means accessing cloud computing resources effectively by using mobile devices. The major challenge of mobile cloud computing comes from the characters of mobile devices and wireless networks, as well as their own restriction and limitation, and such challenge makes application designing, programming and deploying on mobile and distributed devices more complicated than on the fixed cloud devices . In mobile cloud computing environment, the limitations of mobile devices, quality of wireless communication, types of application, and support from cloud computing to mobile are all important factors that affect assessing from cloud computing. Table 1 gives an overview of proposed challenges and some solutions about mobile cloud computing.

5.1 Wireless Communication

Generally wireless computers have fewer resources relative to stationary (wired) computers, this is because wireless computers are required to be smaller, lighter and consume less power than stationary computers. Wireless communication is more difficult to implement than wired communication because of the interaction of the surrounding environment with the message signal. Problems caused by the environment include blocked signal paths, echoes and noise. Hence wireless connections are more error prone, have much lower bandwidths, and have frequent spurious disconnections when compared to wired connections. These factors can increase communication latencies due to error control checks, retransmissions, time-out delays and brief disconnections.

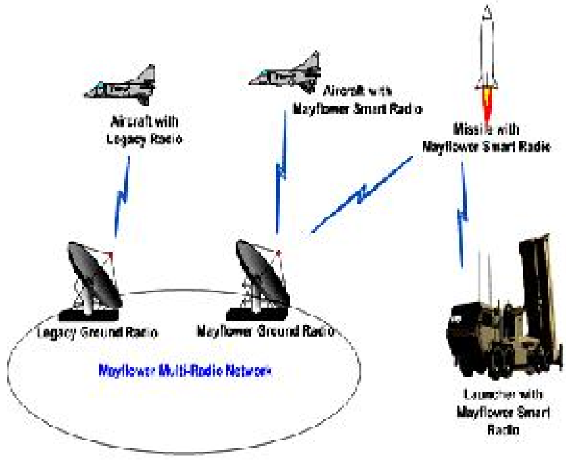

Fig 5.1. Wireless Communication

5.2 Disconnections

Since wireless communication is so susceptible to disconnection, it is of great concern when designing successful mobile computers. Resources can be allocated to handle disconnections more elegantly, or to try and prevent those disconnections from happening. In environments with frequent disconnections it is better for the mobile computer to act as a stand-alone unit rather than a mobile terminal (i.e. splitting the application and the user interface across the network). For wide-area networks, round-trip RPC delays will tend to be expensive in terms of wasted processor clock cycles, hence round-trip latencies and brief disconnections can be made less expensive by operating asynchronously. The advantages of using synchronous systems include a substantially simpler design, implementation and debugging. Whereas the asynchronous model will yield considerably higher performance because the receiver does not block waiting for the requested data. Caching techniques could be used to enhance the performance of weakly-connected and disconnected operation, but preserving cache coherence under weak connectivity can be expensive. The Coda file system solves this problem by maintaining cache coherence at multiple levels of granularity and by the use of callbacks. In the Coda solution, fast cache validation is performed by comparing version stamps maintained by the clients and servers, then preserving the validity through callbacks. This approach provides a trade-off between precision of invalidation for speed of validation.

5.3 Low Bandwidth and Bandwidth Variability

Wireless networks deliver lower bandwidth than wired networks; hence mobile computing designs need to be very concerned about bandwidth consumption. The deliverable bandwidth per user depends on the number of users sharing a cell. The network's capacity can be measured by its bandwidth per cubic meter. This value can be improved in two ways:

- Maintain multiple cells at different frequencies. This technique, although more flexible, is limited by the range of frequencies of the electromagnetic spectrum available for public consumption.
- Limiting transmission ranges so that more cells can fit in a given area. This preferred approach is simpler, reduces power requirements, and may decrease corruption of the signal. It is also known that transceivers covering less area can achieve higher bandwidths. Besides these, techniques such as compression, logging (making large requests out of several short ones), perfecting (guessing which files will be needed soon), and write-back caching can help cope with low bandwidth. System performance can be further enhanced by scheduling communications intelligently. Mobile computing designs must cope with much greater variations in network bandwidth than traditional designs. A good design would be able to adapt to the currently available resources, providing the user with a variable level of quality. As a mobile element leaves the range of one network transceiver it switches to another, and there may also be places where they can access multiple transceivers on different frequencies. Concurrent use of a wired network and a wireless network maybe possible too.

SOLUTIONS

6.1. Collaboration Encryption Techniques to secure mobile computing

The traditional uni-model encryption techniques are not adequate to provide the information over mobile network. If the computing device is in motion and using the mobile network, then the supporting security resources will be unavailable at any instance. The problem of relocation can be resolve effectively by the collaborative encryption techniques with collaboration network. One possible and effective method for the collaborative encryption is to avail the multi-model encryption algorithms works with integrated features as discussed in the proposed method of this paper. When one mobile network handover its security mechanism to another network, the encryption process can also be relocated from network to network without interruption. The servers are interconnected with each other to accept the incoming security request and need of encryption type and avail the same encryption facility from the current location. Figure 6 depicts the cluster with collaborative computing with the help of honeybee network and collaborative encryption for mobile computing network. The cluster network works under the mobile network with independent regulations .The relocation of mobile device from one cluster network to another cannot interrupt the communication links. Other clusters pre-registered the incoming mobile device communication request and the resources are reserved and utilized for its communication.

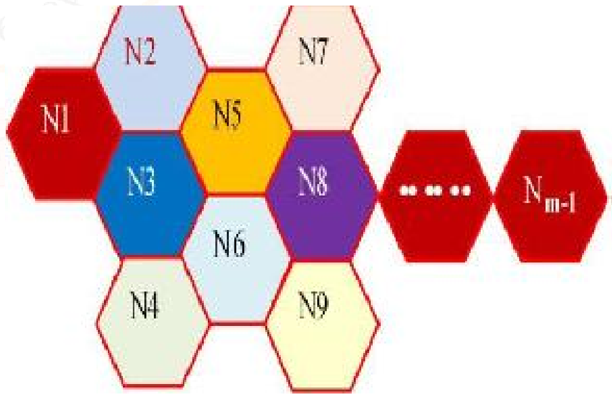

Figure 6. Honeybee Collaborative security network.

6.2 Big Data Security To Mobile Computing

a. **User/Administrator Authentication:** The registered users, guest, administrator authentication requires via preserving the metadata for them. The security is controlled by a software or a hardware base Front End Processor for every cloud big data.

b. **Secured Front End Processors for encrypted search:** Encrypted search is a major essential part of a mobile computing. The software or hardware base front end processors play a great role in maintaining the security across world.
c. **Type dependant security:** Different type of data requires different security mechanism. The well-known cryptographic algorithms such as AES carry out the text data security. While the audio, images and video security is carried out by the various steganographic techniques.
d. **Failure/Leakage Management:** The log based recovery must be maintained for the failure. The Two-Phase-Locking protocol is useful in Big Data leakage management.

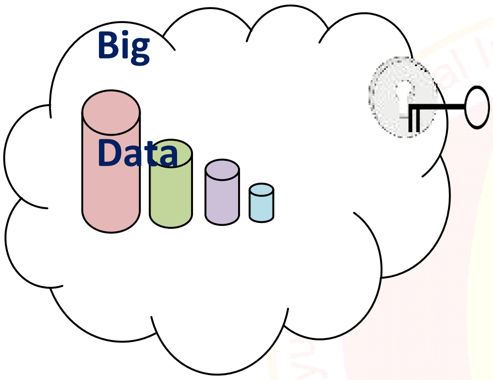

Fig 4.1. Big Data Security

6.3 Encryption

Encryption plays a bigger role in the security of Big Data information. Various encryption techniques are available such as AES, TDES to secure the data.

a. **Real time big data encryption:** The offline encryption is suitable for the small local data. However, the huge online data must be secured by the real time encryption. This can be possible only by capturing the data its source and encrypt. The client encrypts the data and transferred over cloud solves the key management problems.
b. **Parallel/Distributed encryption:** If cloud carries the security work huge data, it is well handled by the parallel and distributed encryption technique. Multiple servers across the different clouds performs the encryption in collaboration.
c. **Encryption Key Management:** A trusted third party plays a great role to maintain the encryption key. If user encrypt the data at its source, the key need not be managed at server. If servers handle the encryption part, the digital certificate technique is useful.
d. **Homomorphic Encryption:** A newer fully homomorphic encryption technique used to merge different parts of encrypted data which supports the encrypted search. The homomorphic encryption plays a role in multiparty encryption in keeping the encrypted data at combining place. The collaborating encryption is helpful for the homomorphic encryption where clients from different places encrypt their own data and store at a single cloud. The query in encrypted form can be searched on that server without understanding the meaning of the ciphertext.

CONCLUSION

he mobile computing with the security mechanism has been discussed in this paper. The encryption and decryption algorithm and steganographic techniques, AES, cryptographic algorithm provides the better solution and security for mobile computing. Encryption technique discussed in this paper facilitates the network users to keep their information and database safe. The proposed method discussed in this paper is an integrated crypto steganography approach that resolves the key agreement and transmission issues with the key agreement and exchange protocol. The proposed method resolves the issues of key transfer between encryption and decryption party that also resolves the security key management issues affected to the mobile computing environment. It can be effective in the encryption load balancing by facilitating the asymmetric key feature and encryption process at server side.

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SURVEY AND ANALYSIS OF BIG DATA TECHNOLOGY FOR CLOUD COMPUTING

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ABSTRACT

With the rapid growth of emerging applications like social network analysis, semantic web analysis, a variety of data to be processed continues to witness a quick increase big data has attracted a lots of attention from academia, industries as well as government this paper introduces several big data processing techniques from system and applications aspects. First, from the view of cloud data management and big data processing mechanisms, we present the key issues of big data processing, including cloud computing platform, cloud architecture, cloud database and data storage scheme. Following the MapReduce parallel processing framework, within introduce MapReduce optimization strategies and applications reported in the literature. Finally we discuss the open issues and challenges, and deeply explore the research direction in the future on big data processing on cloud computing.

Keywords: *Cloud computing, Big data, Data annalistic, data management, big data as a service, big data issues, MapReduce.*

INTRODUCTION

Cloud computing has become an alternative choice for enterprise IT organizations. It can be very cost effective by lowering overall cost for some IT use cases (such as web scale implementation) and applications (such as, backup and disaster recovery.) .As a result, many organizations including enterprise IT companies will increasingly need personal with cloud computing skills in coming years. This course will prepare participants for developing their cloud computing skills MapReduce is a processing technique and a program model for distributed computing based on java. The MapReduce algorithm contains two important tasks, namely Map and Reduce. Map takes a set of data and converts it into another set of data, where individual elements are broken down into tuples (key/value pairs). Secondly, reduce task, which takes the output from a map as an input and combines those data tuples into a smaller set of tuples.

Big data platform is increasingly being used in enterprise in business environment to gain insight into their business operations and provide better service to customers. Enterprises want to uncover operational and business intelligence from the digital data captures during their regular business. In other words, the enterprise IT is building data intensive project/platform on the top of their existing computation-intensive environment. As a result the digital economy will drive enterprises to have more personnel with big data skills. This course will provide an introduction to big data so that participant an take next step in building their skills in big data.

BIG DATA & BIG DATA TECHNOLOGY FOR CLOUD COMPUTING

Big data is data sets that are so voluminous and complex that traditional data processing application software are inadequate to deal with them[2]. Big data challenges include capturing data, data storage, data analysis, search, sharing, transfer, visualization, querying, updating and information privacy. There are five dimensions to big data known as Volume, Variety, Velocity and the recently added Veracity and Value.

Lately, the term "big data" tends to refer to the use of predictive analytics, user behavior analytics, or certain other advanced data analytics methods that extract value from data, and seldom to a particular size of data set[5][6]. "There is little doubt that the quantities of data now available are indeed large, but that’s not the most relevant characteristic of this new data ecosystem." Analysis of data sets can find new correlations to "spot business trends, prevent diseases, combat crime and so on." Scientists, business executives, practitioners of medicine, advertising and governments alike regularly meet difficulties with large data-sets in areas including Internet search, fintech, urban informatics, and business informatics. Scientists encounter limitations in e-Science work, including meteorology, genomics, connectomics, complex physics simulations, biology and environmental research.

Data sets grow rapidly - in part because they are increasingly gathered by cheap and numerous information-sensing Internet of things devices such as mobile devices, aerial (remote sensing), software logs, cameras, microphones, radio-frequency identification (RFID) readers and wireless sensor networks. The world's technological per-capita capacity to store information has roughly doubled every 40 months since the 1980s; as of 2012, every day 2.5 exabytes (2.5×10^{18}) of data are generated. By 2025, IDC predicts there will be 163 zettabytes of data. One question for large enterprises is determining who should own big-data initiatives that affect the entire organization.

Relational database management systems and desktop statistics- and visualization-packages often have difficulty handling big data. The work may require "massively parallel software running on tens, hundreds, or even thousands of servers"[2][5]. What counts as "big data" varies depending on the capabilities of the users and their tools, and expanding capabilities make big data a moving target. "For some organizations, facing hundreds of gigabytes of data for the first time may trigger a need to reconsider data management options. For others, it may take tens or hundreds of terabytes before data size becomes a significant consideration."

CHARACTERISTICS OF BIG DATA

Big data can be described by the following characteristics:

Volume

The quantity of generated and stored data. The size of the data determines the value and potential insight- and whether it can actually be considered big data or not.

Variety

The type and nature of the data. This helps people who analyze it to effectively use the resulting insight.

Velocity

In this context, the speed at which the data is generated and processed to meet the demands and challenges that lie in the path of growth and development.

Variability

Inconsistency of the data set can hamper processes to handle and manage it.

Veracity

The data quality of captured data can vary greatly, affecting the accurate analysis.

Factory work and Cyber-physical systems may have a 6C system:

- Connection (sensor and networks)
- Cloud (computing and data on demand)
- Cyber (model and memory)
- Content/context (meaning and correlation)
- Community (sharing and collaboration)
- Customization (personalization and value)

Data must be processed with advanced tools (analytics and algorithms) to reveal meaningful information. For example, to manage a factory one must consider both visible and invisible issues with various components. Information generation algorithms must detect and address invisible issues such as machine degradation, component wear, etc. on the factory floor.

CLOUD COMPUTING

In Computer science, **cloud computing** describes a type of outsourcing of computer services, similar to the way in which electricity supply is outsourced. Users can simply use it[9]. They do not need to worry where the electricity is from, how it is made, or transported. Every month, they pay for what they consumed.

The idea behind cloud computing is similar: The user can simply use storage, computing power, or specially crafted development environments, without having to worry how these work internally. Cloud computing is usually Internet-based computing. The *cloud* is a metaphor for the Internet based on how the internet is described in computer network diagrams; which means it is an abstraction hiding the complex infrastructure of the internet. It is a style of computing in which IT-related capabilities are provided “as a service”, allowing users to access technology-enabled services from the Internet ("in the cloud") without knowledge of, or control over the technologies behind these servers.

“Cloud Computing is a paradigm in which information is permanently stored in servers on the Internet and cached temporarily on clients that include computers, laptops, handhelds, sensors, etc.[1]”

Cloud computing is a general concept that utilizes software as a service (SaaS), such as Web 2.0 and other technology trends, all of which depend on the Internet for satisfying users' needs. For example, Google Apps provides common business applications online that are accessed from a web browser, while the software and data are stored on the Internet servers.

Cloud computing often uses grid computing, has autonomic characteristics and is billed like utilities, but cloud computing can be seen as a *natural next step* from the *grid-utility model*. Some successful cloud architectures have little or no centralised infrastructure or billing systems including peer-to-peer networks like BitTorrent and Skype.

CHARACTERISTICS

As customers generally do not own the infrastructure or know all details about it, mainly they are accessing or renting, so they can consume resources as a service, and may be paying for what they do not need, instead of what they actually do need to use.[1][2] Many cloud computing providers use the utility computing model which is analogous to how traditional public utilities like electricity are consumed, while others are billed on a subscription basis. By sharing consumable and *"intangible"* computing power between multiple *"tenants"*, utilization rates can be improved (as servers are not left idle) which can reduce costs significantly while increasing the speed of application development.

A side effect of this approach is that "computer capacity rises dramatically" as customers do not have to engineer for peak loads. Adoption has been enabled by "increased high-speed bandwidth" which makes it possible to receive the same response times from centralized infrastructure at other sites.[2]

CLOUD COMPUTING – TYPES OF CLOUD

Cloud computing is usually described in one of two ways. Either based on the cloud location, or on the service that the cloud is offering.

Based on a cloud location, we can classify cloud as:

- public,
- private,
- hybrid
- community cloud

Based on a service that the cloud is offering, we are speaking of either:

- IaaS (Infrastructure-as-a-Service)
- PaaS (Platform-as-a-Service)
- SaaS (Software-as-a-Service)
- or, Storage, Database, Information, Process, Application, Integration, Security, Management, Testing-as-a-service

Previously, we have explained how cloud works. Basically, programs that are needed to run a certain application are now more popularly located on a remote machine, owned by another company. This is done in order not to lose on the quality performance due to processing power of your own computer, to save money on IT support, and yet remain advantageous on the market. These computers that run the applications, store the data, and use a server system, are basically what we call “the cloud”.

When we talk about **public cloud**, we mean that the whole computing infrastructure is located on the premises of a cloud computing company that offers the cloud service. The location remains, thus, separate from the customer and he has no physical control over the infrastructure.

As public clouds use shared resources, they do excel mostly in performance, but are also most vulnerable to various attacks.[3][4]

Private cloud means using a cloud infrastructure (network) solely by one customer/organization. It is not shared with others, yet it is remotely located. If the cloud is externally hosted. The companies have an option of choosing an on-premise private cloud as well, which is more expensive, but they do have a physical control over the infrastructure.

The security and control level is highest while using a private network. Yet, the cost reduction can be minimal, if the company needs to invest in an on-premise cloud infrastructure.[8]

Hybrid cloud, of course, means, using both private and public clouds, depending on their purpose.

For example, public cloud can be used to interact with customers, while keeping their data secured through a private cloud.

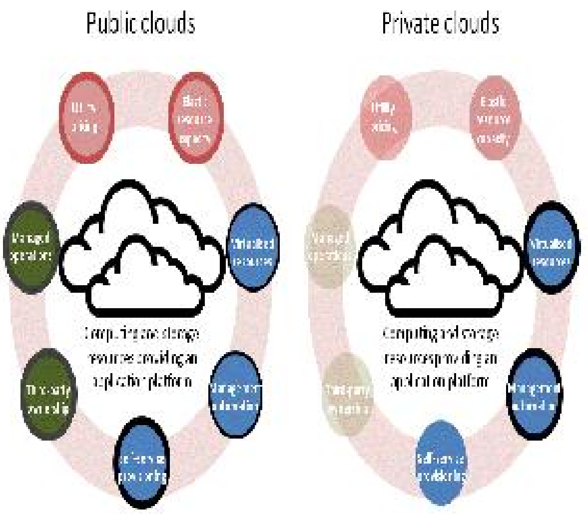
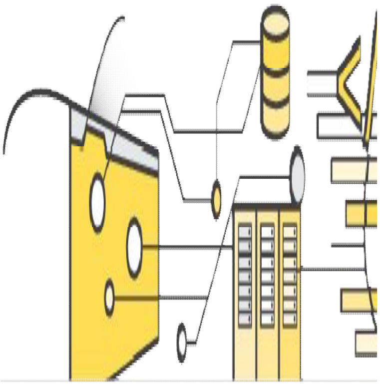


Image 1 – Private vs Public Cloud (Image Source: TalkCloudComputing)

Community cloud implies an infrastructure that is shared between organizations, usually with the shared data and data management concerns. For example, a community cloud can belong to a government of a single country. Community clouds can be located both on and off the premises.

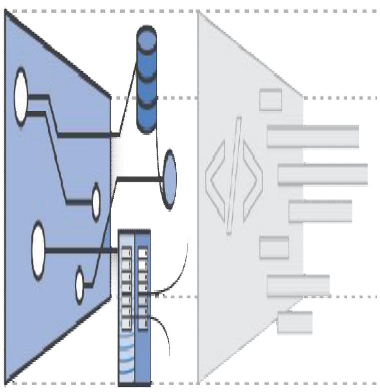
TYPES OF CLOUD COMPUTING

Cloud computing is providing developers and IT departments with the ability to focus on what matters most and avoid undifferentiated work like procurement, maintenance, and capacity planning.[5][6] As cloud computing has grown in popularity, several different models and deployment strategies have emerged to help meet specific needs of different users. Each type of cloud service, and deployment method, provides you with different levels of control, flexibility, and management. Understanding the differences between Infrastructure as a Service, Platform as a Service, and Software as a Service, as well as what deployment strategies you can use, can help you decide what set of services is right for your needs.



A. *Cloud Computing Models*

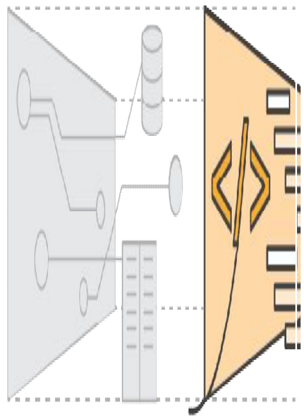
There are three main models for cloud computing. Each model represents a different part of the cloud computing stack.



1)

2) *Infrastructure as a Service (IaaS):*

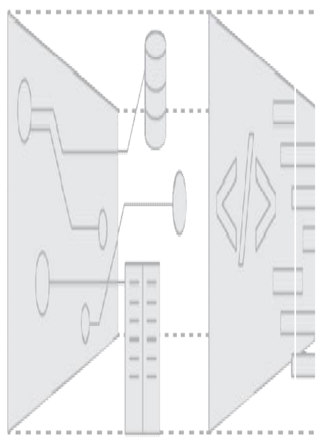
Infrastructure as a Service, sometimes abbreviated as IaaS, contains the basic building blocks for cloud IT and typically provide access to networking features, computers (virtual or on dedicated hardware), and data storage space.[3][4] Infrastructure as a Service provides you with the highest level of flexibility and management control over your IT resources and is most similar to existing IT resources that many IT departments and developers are familiar with today.



3)

4) *Platform as a Service (PaaS):*

Platforms as a service remove the need for organizations to manage the underlying infrastructure (usually hardware and operating systems) and allow you to focus on the deployment and management of your applications.[3][4] This helps you be more efficient as you don't need to worry about resource procurement, capacity planning, software maintenance, patching, or any of the other undifferentiated heavy lifting involved in running your application.



5)

6) *Software as a Service (SaaS):*

Software as a Service provides you with a completed product that is run and managed by the service provider. In most cases, people referring to Software as a Service are referring to end-user applications. With a SaaS offering you do not have to think about how the service is maintained or how the underlying infrastructure is managed; you only need to think about how you will use that particular piece software[4]. A common example of a SaaS application is web-based email where you can send and receive email without having to manage feature additions to the email product or maintaining the servers and operating systems that the email program is running on[4].

CONCLUSION

Cloud computing enables small to medium sized business to implement big data technology with a reduced commitment of company resources. The processing capabilities of the big data model could provide new insights to the business pertaining to performance improvement, decision making support, and innovation in business models, products, and services. Benefits of implementing big data technology through cloud computingare cost savings in hardware and processing, as well as the ability to experiment with big data technology before making a substantial commitment of company res ources. Several models of cloud computing services are available to the businesses to consider,with each model having tradeoffs between the benefit of cost savings and the concerns data security and loss of control.

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A SURVEY ON HANDWRITTEN CHARACTER RECOGNITION TECHNIQUES

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ABSTRACT

Handwritten character recognition is an emerging and a very challenging field of research as the handwritings vary from person to person. Handwriting is an one other such thing that is unique to every individual, which the recent studies on Handwriting analysis have already proved. Handwritten Character Recognition (HCR) has specific domain to apply. Various techniques have been proposed to for character recognition in handwriting recognition system. The proposed system has been implemented using MATLAB successfully. The proposed reorganization system perform quite well yielding higher levels of recognition accuracy compared to the system employing the conventional horizontal and vertical methods of features extraction. In coming days, character recognition system might serve as a key factor to create a paperless environment by digitizing and processing exiting paper documents. An overview of some methodologies and recognition algorithm, particularly recognition methods are presented here. The character recognition methods are listed under two main headings. The "Offline" methods use the static image properties. The offline methods are further divided into four methods, which ate Clustering, Features Extraction, Pattern Matching and Artificial Neural Network. The "Online" are subdivided into K-NN classifier and direction based algorithm. This paper presents a detailed review in the field of Handwritten Character Recognition.

Keywords: *Handwritten Character Recognition, Features Extraction, Clustering, Pattern Matching, Neural Network, ANN.*

INTRODUCTION

Various approaches have been applied in order to accomplish character recognition. The technique by which a computer system can recognize characters and other symbols written by hand in natural handwriting is called handwriting recognition system. Handwriting recognition is classified into offline handwriting recognition and online handwriting recognition [2]. If handwriting is scanned and then understood by the computer, it is called offline handwriting recognition. In case, the handwriting is recognized while writing through touch pad using stylus pen, it is called online handwriting recognition. More precisely Character recognition is the process of detecting and recognizing characters from the input image and converts it into ASCII or other equivalent machine editable form [7][12]. The numbers of applications are License Plate Recognition System, which can be used in parking areas and for highly security premises, Handwriting Recognition System, Identifying Engine Number and Chassis Number, Text Recognition, Form Processing, Bank Check Processing. Every language has different shape and curve of different characters and digits [10]. Several types of analysis, recognition, and interpretation can be associated with handwriting. Handwriting recognition is the task of transforming a language represented in its own spatial form of graphical marks into a symbolic representation [11]. Handwriting interpretation is the task of determining the meaning of a body of handwriting, e.g., a handwritten address. Handwriting data is converted to digital form either by scanning the writing on paper or by writing with a special pen on an electronic surface. The two approaches are distinguished as offline and on-line handwriting, respectively. In the on-line case, the two-dimensional co- ordinates of successive points of the writing as a function of time are stored in order. In the off-line case, only the completed writing is available as an image. Neural Network is self-learning system as one can learn by previous experiments and examples. Artificial Neural Networks are inspired by Biological Neural Network. ANN provides quick classification, flexibility once network trained properly, automatic learning, process system in parallel. ANN is advanced tool that can be used to solve classification and regression. There are various kinds of Neural Networks available. According to applications and their functionality, we can use them. Dynamic Neural Network and Static Neural Network are two different types or Neural Networks. Dynamic Neural Networks deals with nonlinear multivariate behavior and time dependent behavior.

LITERATURE AND REVIEW

1. P. Shankar Rao, J. Aditya intended" In an e-world dominated by the WWW, the design of human computer interfaces based on handwriting is part of tremendous research effort together with speech recognition, language processing and translation to facilitate communication of people with computer networks. From this perspective, any successes or failure in these fields will have a great impact on the evolution of languages.

2. Ms. Harita Dave1, A/Prof. Mitesh Patel tell the proposed system has been implemented using MATLAB successfully. In this paper, we present a handwritten character recognition system in which first of all original image is converted into greyscale image. After that pre-processing steps are applied on that greyscale image. Then individual characters split from word using segmentation. Features are extracted for those characters and multilayer perceptron classifier is used for classification. At last handwritten character is recognized and converted into machine printable form, which will be easier to store and use in future. The result shows that the back propagation network provides good recognition accuracy of more than 70% of handwritten English characters

3. Character Recognition Techniques

Some approaches e a holistic approach, recognizing entire words, while others focus more on recognizing individual characters. Holistic approaches incur more computational cost since there are more models, but have more expressive and discriminative power since the visual cues are gathered over large areas. Character Recognition can be classified according to two important aspects. One is based on type of text has been used: Machine printed and Handwritten. Another is based on manner in which data has been acquired: Online and Offline. Fig. shows the classification of character recognition techniques.

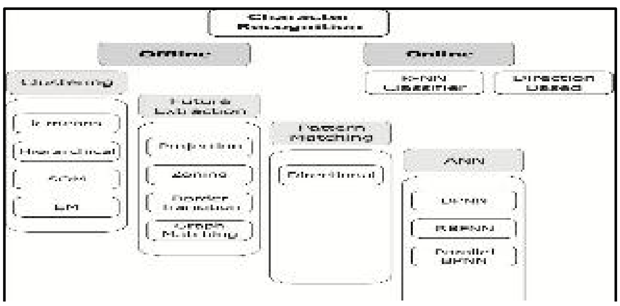

Fig. Types of Character Recognition Techniques

A. OFF-LINE RECOGNITION

The central tasks of off-line handwriting recognition are character recognition and word recognition. Document analysis is the necessary preliminary step in recognition that locates appropriate text when complex, two-dimensional spatial layouts are employed [11]. Different approaches have been proposed to offline recognition that have contributed to the present day efficiency of the technique Off-line recognition operates on pictures generated by an optical scanner. The data is two-dimensional and space-ordered which means that overlapping characters cannot be separated easily. Off-line handwriting recognition involves the automatic conversion of text in an image into letter codes which are usable within computer and text-processing applications. The data obtained by this form is regarded as a static representation of handwriting. Off-line handwriting recognition is comparatively difficult, as different people have different handwriting styles. Considerable numbers of document images have been tested and these algorithms give accurate results on all the tested images, and the algorithms are easy to implement. The four important methods in this category are Clustering, Feature Extraction, Pattern Matching and Artificial Neural Network.

1) Clustering:-

The goal of a clustering analysis is to divide a given set of data or objects into a cluster, which represents subsets or a group. The partition should have two properties. Homogeneity inside clusters: the data, which belongs to one cluster, should be as similar as possible. Heterogeneity between the clusters: the data, which belongs to different clusters, should be as different as possible [13].

1. K-means Algorithm

K-means is a simple unsupervised learning method, which can be used, for data grouping or classification when the number of the clusters is known. Thus, this method works for a fixed set of characters. A variation of K-means is obtained and it is called K-median. Fig. shows two clusters 1 and 2 formed using k-means algorithm according to their centroids.

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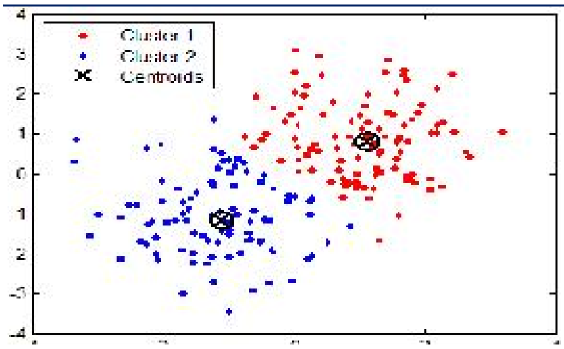

Fig. K-means clustering

2. Hierarchical Algorithms

The hierarchical clustering of documents can be carried out either divisively or agglomerative. Divisive clustering breaks one complete cluster down into smaller pieces. However, divisive algorithm require lesser time than agglomerative algorithms when the size of the database increases.

3. Self Organizing Map (SOM) Algorithm

The self-organizing feature map (SOM) algorithm, developed by Kohonen [3][9], in particular, has been widely used in many different engineering and scientific applications such as image recognition, signal processing, and connectionist natural language processing. In addition, SOM is also widely used in visualization as a dimension (feature) reduction tool. This network contains two layers of nodes - an input layer and a mapping (output) layer in the shape of a two-dimensional grid.

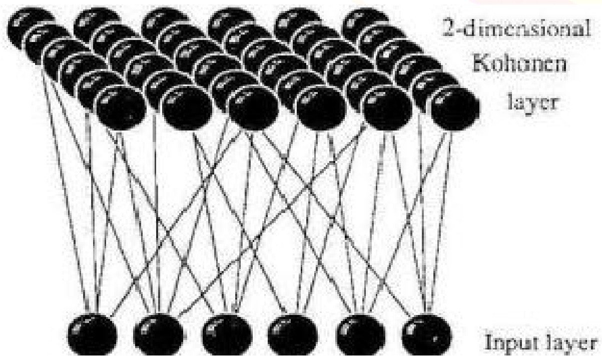

Fig. Kohonen SOM Topology

4. Expectation Maximization (EM) Algorithm

It is used for finding maximum likelihood estimates of parameters in probabilistic models, where the model depends on unobserved latent variables. Expectation maximization (EM) is a well-known algorithm used for clustering in the context of mixture models [9]. EM was proposed by Demster. This method estimates missing parameters of probabilistic models. The algorithm is similar to the K-means procedure in that a set of parameters are re-computed until a desired convergence value is achieved.

2) Feature Extraction

Features play an important role in handwriting recognition systems. Their main goal is to increase the recognition rate by effectively representing the data. Feature extractions covenants with extracting mainly with the necessary information from image pixels depending upon the difficulty to be resolved and the utilized data. Feature extraction is done after the preprocessing phase in character recognition system. For achieving a good performance of handwritten character recognition system one of the essential steps is feature extraction. Feature Extraction is the process of extraction of certain types of information from the given character image. The features which are important for classification are extracted at this stage. It is the strongest part of any character recognition system to get high performance. The character is represented by a features vector, which becomes its identity.

1. Projection Method

In the projection method it compares data through a projection. Black pixel counts are taken along parallel lines through the image area to generate distributions. The direction of projection will be horizontal axis, vertical axis diagonal axis or all of the above.

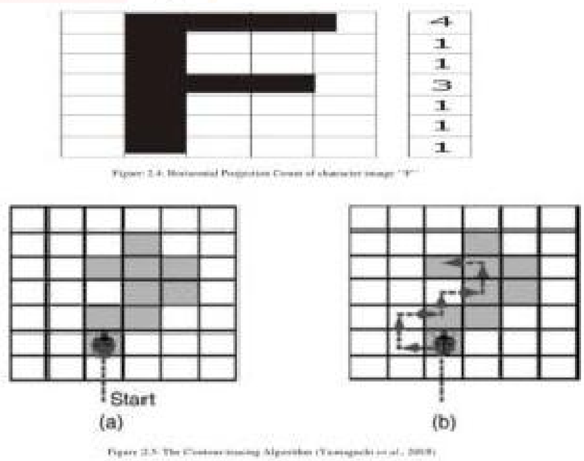

Fig. Projection Method

2. Zoning

Zoning widely used method in character recognition tasks. In this method, the character images are divided into zones of predefined sizes and then features are computed for each of these zones. Zoning obtains local characteristics of an image. Zoning is a method involves the division of the character into smaller fragment of areas (zone)

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[1]. The character image us divided into N×M zones as shown in following figure.

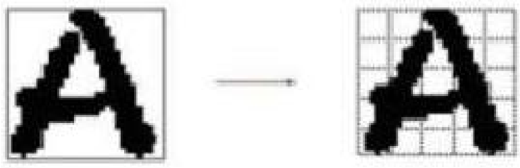

Fig. Zoning

3. Border Transition technique

In border transition technique, it assumes that all the characters are oriented vertically. Each character is divided into four equal quadrants. The scanning and calculation of zero-to-one transition in both vertical and horizontal directions in each division take place.

4. Graph Matching Method

In a graph matching method [6], it uses structural feature of character. It is useful method to change of font or rotation. In this, three features are defined. First, an end point is connected only one pixel which has information of position. A branch point is connected more than three pixels. And a curve point is connected two pixels.

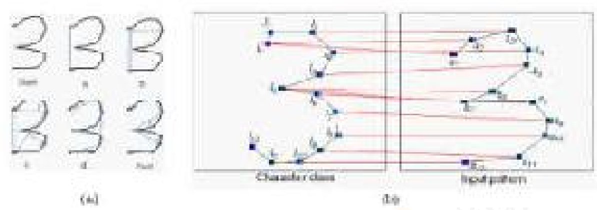

Fig. Graph matching method

3) Pattern Matching

In Pattern Matching, a character is identified by analyzing its shape and comparing its features that distinguish each character. Various handwritten characters from forms or peripheral devices etc. are recognized with the help of various pre-processing and image enhancement techniques. These characters are further more specifically recognized by Pattern matching using Neural Network. Pattern matching can be subdivided into two categories, depending on the type of input patterns: photometric pattern matching and geometric pattern matching.

1. Directional Pattern Matching

The extraction of discriminative features is crucial to the recognition performance of pattern matching. Though sophisticated classification is now available for character recognition, pattern matching still survives for, e.g., coarse classification, and the evaluation of features with pattern matching makes sense for various classifiers.

4) Artificial Neural Network

Artificial Neural Network is Neural Network in AI. ANN has three types of parameters interconnection between layers of neurons, learning process and activation function. Neural networks are ideal for specific types of problems, such as processing stock market data or finding trends in graphical patterns. Neural networks have been used in a variety of different areas to solve a wide range of problems.

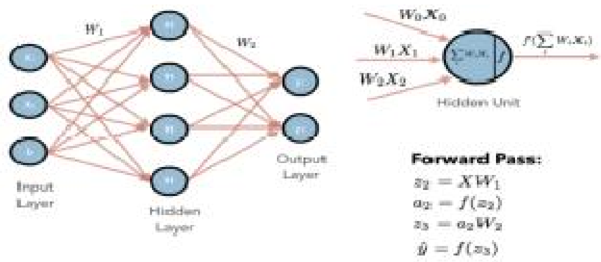

Fig. Artificial Neural Network

1. Back Propagation Neural Network

A Back propagation (BP) network consists of at least three layers of units, an input layer, at least one intermediate hidden layer, and an output layer. [1] When a Back propagation network is cycled, an input pattern is propagated forward to the output units through the intervening input-to-hidden and hidden-to-output weights. Fig. shows the working of BP algorithm.

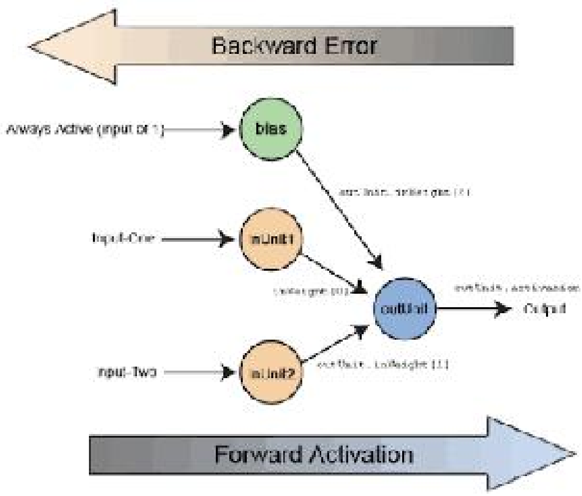

Fig. Working of Back propagation Algorithm

2. RBFNN

As Fig. shows, the RBFNN is composed of an input layer, a concealed layer and an output layer, in which the input layer and the output layer are respectively corresponding to the input vector

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space and classifications [4]. RBFNN has random accuracy of functional approach ability, optimal characteristic of functional approach, and a good constringency.

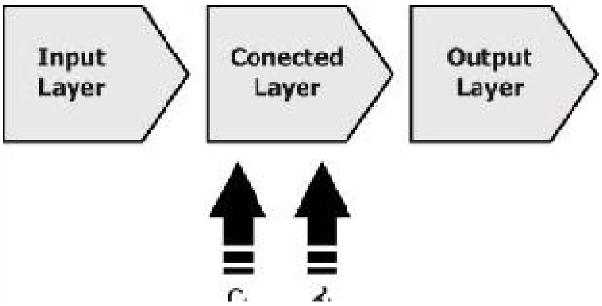

Fig. RBFNN Structure

3. Parallel BP Neural Network

A simple BP neural network consists of three layers: input layer, hidden layer and output layer. Among them the input of the nodes of the input layer are the pixels of character images, the output of the nodes of the output layer are 35 characters (for letter aggregation are 26 letters), and the number of nodes in hidden layer is determined by experiments, usually around the square root of the sum of the number of input nodes and output nodes.

The parallel BP neural network consists of two simple BP neural networks: BP neural networks A and BP neural networks B. In the input layer of neural networks A, the character image is input in a row-first way so that the row spatial information of the character is preserved. And in the input layer of neural networks B, the character image is input in a column-first way so that the column spatial information is preserved. Fig. shows the architecture of the parallel BP neural network.

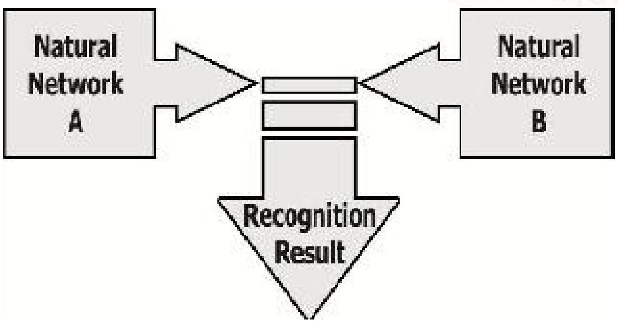

Fig. The Parallel BPNN

B. ON-LINE RECOGNITION

Online handwriting recognition has gained interest due to increase in usage of hand held devices. On-line recognition seems to be a simpler problem since more information is available. A few studies on converted or independent on-line and off-line data suggest superior recognition performance for on-line data [5]. The distinction between on-line and off-line recognition is not as rigid as it may seem.

The challenges posed by the online character recognition system are to increase the recognition accuracy and to reduce the recognition time. Also on-line systems have been designed using spatial representations of the on-line data, or combining on-line and off-line representations by supplementing each on-line data point with a pixel image of its local surroundings. On-line handwriting recognition involves the automatic conversion of text as it is written on a special digitizer or PDA, where a sensor picks up the pen-tip movements as well as pen-up/pen-down switching. That kind of data is known as digital ink and can be regarded as a dynamic representation of handwriting.

1) K-NN Classifier and DTW-Based Dissimilarity Measure

Classification is carried out by evaluating the dissimilarity measures [8] between the preprocessed input character and all the training samples and then applying the nearest neighbor rule. The elastic matching of the character. Its major drawback is that it is computationally heavy, especially with large prototype sets and complicated similarity measures. For similarity measure, it uses DTW measure between two strokes. DTW is an elastic matching technique that gives distance measure between character pairs. A stroke is a sequence of sample points from pen down to pen up events. The distance between strokes is calculated by considering all possible alignments between them, and finding the alignment for which the total distance is minimum using dynamic programming.

2) Direction Based Algorithm

Many online character recognition methods use directional information to recognize a character [8], which assumes that same directional information is generated when written again. For example take only four directions that is right (r), down (d), left (l) and up (u) which helps in modeling strokes using regular expressions. The first stroke of has four different directional variations which can be modeled using regular expression. Ambiguities are resolved using spatial properties. It can be seen that success of the direction-based approach is due to the less directional variations between the similar strokes.

The number of variations depends upon the complexity in writing a stroke.

CONCLUSION

This paper described various techniques for character recognition in handwriting recognition system. The paper discuss in detail all advances in the area of handwritten character recognition. We have proposed an organization of these methods under two basic strategies. It is hoped that this comprehensive discussion will provide insight into the concepts involeved, and perhaps provoke further advances in the area. Handwritten character recognition is more complicated as compare to optical character recognition. This study will be help full to the researchers to make the choice of techniques for character recognition.

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STUDY AND ANALYSIS OF INFORMATION SECURITY SCENARIO IN MOBILE COMPUTING ENVIORMENT

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ABSTRACT

Mobile computing is a computing in which a computing and communication takes place but device is not restricted to a single place. Mobile computing is a form of human computer interaction by which computer is expected to be transported during the Mobile computing must be categorize in to three aspect: mobile communication, mobile hardware, and mobile software. The first aspect addresses communication issues in ad-hoc and infrastructure networks as well as communication properties protocols, and concrete technologies. The second aspect is on the hardware, e.g., mobile devices or device components. The third aspect deals with the Mobile computing is taking a computer and all necessary files and software out into the field. With the rapid growth the wireless mobile communication technology, small devices like PDAs, laptops are able to communicate with the fixed wired network while in motion. Because of its flexibility and provision of providing ubiquitous infrastructure, we need to provide security increases to a great degree. This paper intended to cover the information security scenario arises during working with the mobile computing.

Keywords:*mobile computing, security issues, security, information.*

INTRODUCTION

In the growing decades use of Laptop computers, cell phones, mobile data storage devices, and similar mobile computing and communication devices have become very popular because of their convenience and portability. These devices are used in convenient way and they are highly portable. The concept of mobile computing is derived from the realization that as computing machinery decrease in size and increase in computing power users will demand these machinery to be part of their everyday life, accompanying them in the carrying-out of their everyday tasks. The rapid development of wireless technology in particular mobile computing technology, that's make its devices more popular and interesting by users these days. This paper consists of two parts: the first part will give an overview of mobile computing with a brief history of mobile computing evolution and comparing it with traditional computing, the second part will be about security and security issues in mobile computing, and the final part will about security requirements of mobile computing.

LITERATURE REVIEW

Thpmson hardjono NSW2522, implement the conclusion for future direction for the security in mobile computing. In the paper he proposed security to be a major category for future developments mobile computing. He discussed the issues of security in the context mobility, disconnection and data access methods, presenting a number of potential problems in the security of a mobile computing environment.

Dharma P. Agrawal, Hongmei Deng, Rajani Poosarla and Sugata Sanyal describes the center for distributed and mobile computing. Mobile computing technology provides anytime and anywhere service to mobile users by combining wireless networking and mobility, which would engender various new applications and services. However, the inherent characteristics of wireless communication and the demand for mobility and portability make mobile computing more vulnerable to various threats than traditional networks. Securing mobile computing is critical to develop viable applications. In this article, the security issues faced by mobile computing technology. It analyzed the various security threats and describes the existing current countermeasures. We have seen that many security solutions have been proposed to securing WLANs, but no one is able to claim that it solves all the security problems, or even most of them. In essence, secure mobile computing would be a long-term ongoing research topic.

MOBILE COMPUTING

Mobile computing is a form of human–computer interaction by which a computer is expected to be transported during normal usage. Mobile Computing is a variety of wireless devices that has the mobility to allow people to connect to the internet, providing wireless transmission to access data and information from where ever location they may be. “The concept of mobile computing is derived from the new era in the field of computing machine decreases in size and increases in computing power user will demand these machinery as a bigger part of everyday life. In case of mobile computing there were several differences and in contrast to distributed computing in preciously the mobility and positioning some non field element. In the notable work four categories good future development in mobile computing have been proposed namely mobility, disconnection, data access nodes and scale of operation. In this paper we would like to proposed security as being the fifth part which must interact the first fourth categories.

SECURITY

The most important aspect in the computing is the security. Security must important consideration specially in mobile computing because the mobile user may face many security threats that may not be offer in any other computing. These threats include lose or stolen the private and sensitive data mobile user that store on their devices and it could used by the hackers and other threats. Security principles or aspects of computer systems are related to confidentiality, integrity, availability, vulnerability, non-repudiation, authorization, and anonymity. A mobile computing defined as the capabilities of computing that rely on the existence of distributed systems infrastructure. So it can be considered the mobile computing as an extension of distributed systems, and it could be argued that there is a relation between security issues of mobile computing with other security issues of information systems. Security principles or aspects of computer systems are related to confidentiality, integrity, availability, vulnerability, non-repudiation, authorization, and anonymity which is shown in Fig.

Fig. General Security Aspects

SECURITY ISSUES

Many authors have presented classifications of security issues in communication networks. There are five fundamental goals of security in information system.

I. Confidentiality, preventing unauthorized users from gaining access to critical information of any particular user.

II. Integrity, ensures unauthorized modification, destruction or creation of information cannot take place.

III. Availability, ensuring authorized users getting the access they require.

IV. Legitimate, ensuring that only authorized users have access to services.

V. Accountability, ensuring that the users are held responsible for there security related activities by arranging the user and his/her activities are linked if and when necessary. The way these goals are achieved depends on the security policy adopted by the service Provider.

SECURITY TECHNIQUES AND REQUIREMENT

There are a number of security requirements which valid with security issues relating to distributed systems, such as identification and authentication of trusted people by using authentication mechanisms like passwords, cryptographic techniques, access control by using information and rules of access control, information confidentiality by using mechanisms of 1confidentiality like encryption, information integrity by using integrity mechanisms those provide a verification of integrity checks and availability and prevention of denial of service. That's security requirements which related to traditional computing, but with mobile computing the security requirements have become highly important, especially with regard to data security. One of the most important security measures is maintaining of the latest update of network or mobile elements and their software. There are different security requirements and techniques which valid for both mobile devices and networks, some of them include:

Encryptions: If there is an important information that stored in a mobile device, it should be encrypt this information to save it from unauthorized access by external party or in case if a mobile is stolen. It also contributes to the security aspects of confidentiality and integrity .

Standards: It should ensure that the mobile devices are protected and have a set of requirements like: locking, backups, antivirus software, and a strong password protection .

Network Access Control (NAC) solutions: This is a system used to check which mobile devices trying to connect to the network, that's provide protection of the network from any infections or malicious code that may damage of mobile devices .

Control Access: Control access to functions of mobile computing systems depending on the current location of the user, and there are already some security models which identifies some functions to certain user to access the mobile.

SECURITY SOLUTION

7.1. Collaboration Encryption Techniques to Resolve Security Issues

The traditional uni-model encryption techniques are not adequate to provide the information over mobile network. If the computing device is in motion and using the mobile network, then the supporting security resources will be unavailable at any instance. The problem of relocation can be resolve effectively by the collaborative encryption techniques with collaboration network.

One possible and effective method for the collaborative encryption is to avail the multi-model encryption algorithm works with integrated features as discussed in the proposed method of this paper. When one mobile network handover its security mechanism to another network, the encryption process can also be relocated from network to network without interruption. The servers are interconnected with each other to accept the incoming security request and need of encryption type and avail the same encryption facility from the current location depicts the cluster with collaborative computing with the help of honeybee network and depicts the collaborative encryption for mobile computing network. The cluster network works under the mobile network with independent regulations18. The relocation of mobile device from one cluster network to another cannot interrupt the communication links. Other clusters pre-registered the incoming mobile device communication request and the resources are reserved and utilized for its communication.

7.2. Honeybee Collaborative security network.

Here, the honeybee collaborative security framework contains the resources worked in collaboration. No delay or waiting of resources occurs during relocation from one cluster to another. As depicted in the , the mobile computing machine relocating from one network area to another can suffer from the network loss and tends the system towards insecure way. During unavailability of the network, the current encryption process of the
cryptographic security may be interrupted.

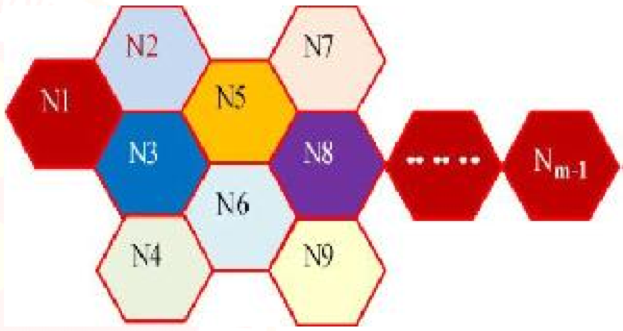

Fig. Honeybee Collaborative security network

7.3. Big Data Security To Mobile Computing

a. **User/Administrator Authentication:** The registered users, guest, administrator authentication requires via preserving the metadata for them. The security is controlled by a software or a hardware base Front End Processor for every cloud big data.

b. **Secured Front End Processors for encrypted search:** Encrypted search is a major essential part of a mobile computing. The software or hardware base front end processors play a great role in maintaining the security across world.

c. **Type dependant security:** Different type of data requires different security mechanism. The well-known cryptographic algorithms such as AES carry out the text data security. While the audio, images and video security is carried out by the various steganographic techniques.

d. **Failure/Leakage Management:** The log based recovery must be maintained for the failure. The Two-Phase-Locking protocol is useful in Big Data leakage management.

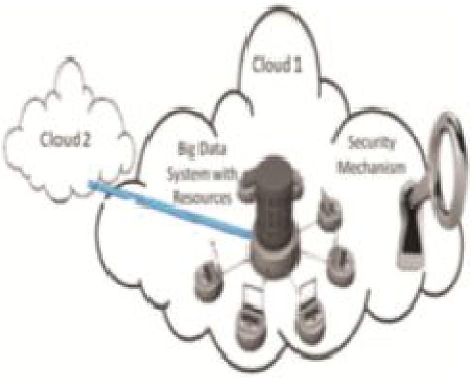

Figure: Security and Privacy challenges in Big Data ecosystem

7.4 Cloud Computing Security :

- **Data Protection;-** Data Security is a crucial element that warrants scrutiny. Enterprises are reluctant to buy an assurance of business data security from vendors. They fear losing data to competition and the data confidentiality of consumers. In the cloud model, Service providers are responsible for maintaining data security and enterprises would have to rely on them. This could potentially put your company to great risk.
- **Data Recovery and Availability*:*** All business applications have service level agreements that are stringently followed. Operational teams play a key role in management of service level agreements and maintenance of applications. In production environments, operational teams support,
- Appropriate clustering and Fail over
- Data Replication
- System monitoring
- Maintenance (Runtime Governance)
- Disaster recovery
- Capacity and performance management
- **Management Capabilities*:*-** There is huge potential to improve on the scalability and load balancing features provided today. The Scaling offerings and maintaining sufficient performance is a challenge, especially for software as a service provider, who must deliver over networks and environments that they do not necessarily control.
- **Regulatory and Compliance Restrictions*:*-** Many industries and countries disallow data or asset transparency. Also, some cloud providers have had outages with disastrous results, so trust remains an issue. In order to meet such requirements, cloud providers need to setup a data center or a storage site exclusively within the country to comply with regulations. Having such an infrastructure may not always be feasible and is a big challenge for cloud providers.
- **Federation and Inter-operability:** IT functions typically automate a contiguous business process -and will thus require service integration among cloud providers.
- **Vendor lock-in and Data Management:** Data ownership in the cloud is not clear cut. Nor is the process by which data is to be reclaimed from cloud provider systems.
- **Technical Issues:** Though, it is true that information and data on the cloud can be accessed anytime and from anywhere at all, there are times when this system can have some serious dysfunction. We should be aware of the fact that this technology is always prone to outages and other technical issues. Even the best cloud service providers run into this kind of trouble, in spite of keeping up high standards of maintenance. Besides, we will need a very good internet connection to be logged onto the server at all times.
- **Prone to Attack:** Storing information in the cloud could make your company vulnerable to external hack attacks and threats. As you are well aware, nothing on the internet is completely secure and hence, there is always the lurking possibility of stealth of sensitive data.

CONCLUSION

Mobile computing is a form of human–computer interaction by which a computer is expected to be transported during normal usage. Mobile Computing is a variety of wireless devices that has the mobility to allow people to connect to the internet, providing wireless transmission to access data and information from where ever location they may be. This paper intended to cover the information security scenario arises during working with the mobile computing. Although, this paper gives us the information about the security, what are the security issues involved in the mobile computing. and what the solution to protect the that issues

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BIG DATA OPPORTUNITIES AND CHALLENGES, TOOLS AND TECHNOLOGIES, HADOOP MAPREDUCE FRAMEWORK

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ABSTRACT

Big data can be defined as data which requires latest technologies other than the traditional tools and techniques to handle it, due to its unstructured nature. Huge volume, various varieties and high velocity create lots of other challenges regarding its management and processing. Due to widespread usage of many computing devices such as smart phones, laptops, wearable computing devices; the data processing over the internet has exceeded more than the modern computers can handle. Due to this high growth rate, the term Big Data is envisaged. However, the fast growth rate of such large data generates numerous challenges, such as data inconsistency and incompleteness, scalability, timeliness, and security. This paper provides a brief introduction to the big data technology and its importance in the contemporary world. This paper addresses various challenges that need to be emphasized to present the full influence of big data. The tools used in Big data technology are also discussed in detail. This paper also discusses the characteristics of Big data and the platform used in Big Data i.e. Hadoop. There are so many areas from which big data is being generated, this paper covered those areas and provide solutions for dealing with that data.

Keywords: Big Data, BIG DATA Opportunities And Challenges, Hadoop, MapReduce, No SQL, Unstructured Nature.

INTRODUCTION

Big Data has gained much attention from the last few years in the IT industry. As we can witness billions of people are connected to internet worldwide, generating large amount of data at the rapid rate. The generation of this large amount of engenders various challenges. Along with Big Data, huge benefits to many organizations, the challenges should also be brought into light. A forecast from International Data Corporation (IDC),

"Big data" word itself describes that it is a huge amount of data, but this is not the complete explanation of big data, if you want to understand it properly. For a complete understanding of big data you have to study all the basic properties of it. The main thing in big data is that it has no structure. This is the main difficulty to deal with it. Big data is beyond the structured data. It is very tough task to manipulate the big data due to its unstructured form.

Big data can be defined with the following properties associated with it:

1.1 Volume

The huge amount is the basic property of big data. These days there is an exponential growth in big data. Data is everywhere and it is generated very fast. Social media, Server logs are generating huge amounts of data on a daily basis.

1.2 Velocity

Velocity is another basic property of big data. This is the speed at which data is generated. Big data is generated very fast now days due to social media and the digital world. Thousands GB's of data is generated everyday over the digital world.

1.3 Variety

Variety is one of the most important properties of big data. The basic identification of big data is based on a variety of data. There are two basic types of data, structured and unstructured. There is also a semi structured data which is an extension of structured data. Unstructured data is difficult to handle with traditional relational database.

So no structure of data is a big challenge in itself. It is a big challenge for the traditional technologies and databases to deal with big data because it completely unstructured. Traditional databases are basically made for structured data.

1.4 Data Value

Data value measures the usefulness of data in making decisions. It has been noted that "the purpose of computing is insight, not numbers". Data science is exploratory and useful in getting to know the data, but "analytic science" encompasses the predictive power of big data.

1.5 *Complexity*

Complexity measures the degree of interconnectedness (possibly very large) and interdependence in big data structures such that a small change (or combination of small changes) in one or a few elements can yield very large changes or a small change that ripple across or cascade through the system and substantially affect its behavior, or no change at all.\

LITERATURE AND REVIEW

1. M. Chen, S. Mao, and Y. Liu,intended" we review the background and state-of-the-art of big data. We first introduce the general background of big data and review related technologies such as could computing, Internet of Things, data centers, and Hadoop. We then focus on the four phases of the valchain of big data, i.e., data generation, data acquisition, data storage, and data analysis. For each phase, we introduce the general background, discuss the technical challenges, and review the latest advances.

2. Stephen Kaisler was tell the" collaborative research effortto begin examining big data issues and challenges. Weidentified some of the major issues in big data storage,management, and processing. We also identified some of the major challenges – going forward – that we believe must be addressed within the next decade \

BIG DATA OVERVIEW

Big Data is a compendium of big datasets that cannot be processed using traditional computing techniques. It is not a technique that can be worked on its own or in isolation; rather it involves many areas of business and technology. Big data involves the data produced by different devices and applications. Some of the sources of Big Data are shown in the figure.

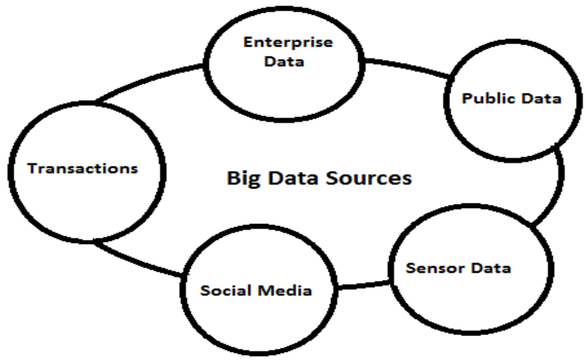

Figure 1. Some Sources of Big Data

3.1.IMPORTANCE OF BIG DATA AND VARIOUS PROJECTS

Big data is different from the data being stored in traditional warehouses. The data stored there first needs to be cleansed, documented and even trusted. Moreover it should fit the basic structure of that warehouse to be stored but this is not the case with Big data it not only handles the data being stored in traditional warehouses but also the data not suitable to be stored in those warehouses. Thus there comes the point of access to mountains of data and better business strategies and decisions as analysis of more data is always better.

A. Sensor Data

Massive amount of sensor data is also a big challenge for Big data. All the industries at present dealing with this large amount of data make use of small portion of it for analysis because of the lack of the storage infrastructure and the analysis techniques. Moreover sensor data is characterized by both data in motion and data at rest. Thus safety, profit and efficiency all require large amount of data to be analyzed for better business insights.

B. Log Storage in IT Industries

IT industries store large amount of data as Logs to deal with the problems which seem to be occurring rarely in order to solve them. But the storage of this data is done for few weeks or so though these logs need to be stored for longer duration because of their value. The Traditional Systems are not able to handle these logs because of their volume, raw and semi structured nature. Moreover these logs go on changing with the s/w and H/w updates occurring. Big data analytics not only does analysis on the whole /large data available to pinpoint the point of failures but also would increase the longevity of the log storage.

C. Social Media

The most use of Big data is for the social media and customer sentiments. Keeping an eye on what the customers are saying about their products helps business organizations to get a kind of customer feedback. This feedback is then used to modify decisions and get more value out of their business

D. Risk Analysis

It becomes important for financial institutions to model data in order to calculate the risk so that it falls under their acceptable thresholds. A lot amount of data is potentially underutilized and should be integrated within the model to determine the risk patterns more accurately.

3.2.VARIOUS BIG DATA PROJECTS

Big Science

1.The Large Hadron Collider (LHC) is the world's largest and highest-energy particle accelerator with the aim of allowing physicists to test the predictions of different theories of particle physics and high-energy physics. The data flow in experiments consists of 25 petabytes (as of 2012) before replication and reaches upto 200 petabytes after replication.

2. The Sloan Digital Sky Survey is a multi-filter imaging and spectroscopic redshift survey using a 2.5-m wide-angle optical telescope at Apache Point Observatory in New Mexico, United States. It is Continuing at a rate of about 200 GB per night and has more than 140 terabytes of information.

3.3 Government

1. The Obama administration project is a big initiative where a Government is trying to find the uses of the big data which eases their tasks somehow and thus reducing the problems faced. It includes 84 different Big data programs which are a part of 6 different departments.

2. The Community Comprehensive National Cyber Security initiated a data center, Utah Data Center (United States NSA and Director of National Intelligence initiative) which stores data in scale of yotta bytes. Its main task is to provide cyber security.

3.4Private Sector

1. Amazon.com handles millions of back-end operations every day, as well as queries from more than half a million third-party sellers. The core technology that keeps Amazon running is Linux-based and as of 2005 they had the world's three largest Linux databases, with capacities of 7.8 TB, 18.5 TB, and 24.7 TB.

2. Walmart is estimated to store about more than 2.5 petabytes of data in order to handle about more than 1 million customer transactions every hour.

3.FICO Falcon Credit Card Fraud Detection System protects 2.1 billion active accounts world-wide.

3.5International Development

Information and Communication Technologies for Development (ICT4D) uses the Information and Communication Technologies (ICTs) for the socioeconomic development, human rights and international development. Big data can make important contributions to international development.

PHASES IN BIG DATA PROCESSING

Before processing Big data it must be recorded from various data generating sources. After recording, it must be filtered and compressed. Only the relevant data should be recorded by means of filters that discard useless information. In order to facilitate this work specialized tools are used such as ETL. ETL tools represent the means in which data actually gets loaded into the warehouse. The figure 3 demonstrates different stages in the process.

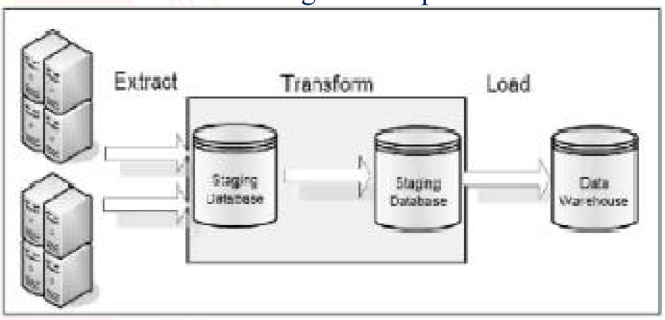

Figure 2. ETL process

SNO	PHASE	DESCRIPTION OF THE PHAS
1	Extraction	In this phase relevant informatio extracted. To make this phase efficient, only the data source has been changed since recent last ET process is considered.
2	Transformation	Data is transformed through various phases The phases are 1. Data analysis; 2. Definition of transformation workflow and mapping rules; 3. Verification; 4. Transformation; and 5. Backflow of cleaned data.
3	Loading	At the last, after the data is in the required format, it is then loa into the data warehouse.

Table 1: Various phases in ETL

BIG DATA OPPORTUNITIES AND CHALLENGES

In the distributed systems world, “Big Data” started become a major issue in the late 1990s due to the impact on world-wide Web and a resulting need to index and query its rapidly mushrooming content. Database technology (including parallel databases) was considered for the task, but was found to be neither well-suited nor cost-effective for those purposes. The turn of the millennium then brought further challenges as companies began to use information such as the topology of the We band users search histories processing. Itinerants on order commodity to hardware, provide it uses HDFS useful search results, as well as more effectively-targeted advertising to display alongside and fund those results. Google *scenically* responses to the challenges of Web-scale data management and analysis was simple. To handle the challenge of Web-scale storage, the Google File System (GFS) was created. GFS provides clients with the familiar OS-level byte-stream abstraction, but it does so for extremely large files whose content can span hundreds of machines in shared-nothing clusters created using inexpensive commodity hardware. To handle the challenge of processing the data in such large files, Google pioneered its Map Reduce programming model and platform. This model, characterized by some as “parallel programming for map dummies”, phase of the job. For applications enabled just needing Google developers to process large collections of data by writing two based record management operations, the HBase store (layered user-defined functions, map and reduce, that the Map Reduce on top of HDFS) is available as a key-value layer in the Hadoop framework applies to the instances (map) and sorted groups of stack. As indicated in the figure, the contents of HBase can instances that share a common key (reduce) –similar to the sort either be directly accessed and manipulated by a client of partitioned parallelism utilized in shared-nothing parallel query processing.

Driven by very similar requirements, software Developers Yahoo!, Facebook, and other large Web companies followed suit. Taking Google’s GFS technical specifications, open-source equivalents were the middle layer of the stack is the Hadoop Map Reduce system, which applies map operations to the data in partitions of an HDFS file, sorts and redistributes the results based on key values in the output data, and then performs reduce operations on the groups of output data

TOOLS AND TECHNIQUES AVAILABLE

There are many techniques available for data management. That includes Google BigTable, Simple DB, Not Only SQL (NoSQL), Data Stream Management System (DSMS), MemcacheDB, and Voldemort. But these traditional approaches are only applicable to traditional data and not Big data as it cannot be stored on a single machine. The Big Data handling techniques and tools include Hadoop, MapReduce, and Big Table. Out of these, Hadoop is one of the most widely used technologies.

The following tools and techniques are available:

5.1.Hadoop

Apache Hadoop is an open source software framework that allows large sets of data to be processed using commodity hardware. Hadoop is designed to run on top of a large cluster of nodes that are connected to form a large distributed system. Hadoop implements a computational paradigm known as MapReduce, which was inspired by an architecture developed by Google to implement its search technology. The MapReduce model runs over a distributed filesystem and the combination allows Hadoop to process a huge amount of data, while at the same time being fault tolerant.

Hadoop is a complex piece of software, which can be a stumbling block for newcomers. In this article we will briefly cover the basics of Hadoop and explain how the various parts and components of Hadoop fit together to provide the functionality that Hadoop offers. We will also take a look at the Map/Reduce model, which is a central piece of Hadoop, and explore how it is being used within Hadoop to break complex data processing tasks into simpler ones.

Hadoop mainly consists of :

- File System (The Hadoop File System)
- Programming Paradigm (Map Reduce)

The other subprojects provide complementary services or they are building on the core to add higher-level abstractions. There exist many problems in dealing with storage of large amount of data. Though the storage capacities of the drives have increased massively but the rate of reading data from them hasn’t shown that considerable improvement. The reading process takes large amount of time and the process of writing is also slower. This time can be reduced by reading from multiple disks at once. Only using one hundredth of a disk may seem wasteful. But if there are one hundred datasets, each of which is one terabyte and providing shared access to them is also a solution.

There occur many problems also with using many pieces of hardware as it increases the chances of failure. This can be avoided by Replication i.e. creating redundant copies of the same data at different devices so that in case of failure the copy of the data is available.

The main problem is of combining the data being read from different devices. Many a methods are available in distributed computing to handle this problem but still it is quite challenging. All the problems discussed are easily handled by Hadoop. The problem of failure is handled by the Hadoop Distributed File System and problem of combining data is handled by Map reduce programming Paradigm. Map Reduce basically reduces the problem of disk reads and writes by providing a programming model dealing in computation with keys and values. Hadoop thus provides: a reliable shared storage and analysis system. The storage is provided by HDFS and analysis by MapReduce.

6.1 Hadoop Components in detail

A.Hadoop Distributed File System: Hadoop comes with a distributed File System called HDFS, which stands for Hadoop Distributed File System. HDFS is a File System designed for storing very large files with streaming data access patterns, running on clusters on commodity hardware. HDFS block size is much larger than that of normal file system i.e. 64 MB by default. The reason for this large size of blocks is to reduce the number of disk seeks. A HDFS cluster has two types of nodes i.e. namenode (the master) and number of datanodes (workers). The name node manages the file system namespace, maintains the file system tree and the metadata for all the files and directories in the tree. The datanode stores and retrieve blocks as per the instructions of clients or the namenode. The data retrieved is reported back to the namenode with lists of blocks that they are storing. Without the namenode it is not possible to access the file. So it becomes very important to make namenode These are areas where HDFS is not a good fit: Low-latency data access, Lots of small file, multiple writers and arbitrary file modifications.

B.*Map reduce*: MapReduce is a computational paradigm designed to process very large sets of data in a distributed fashion. The MapReduce model was developed by Google to implement their search technology, specifically the indexing of web pages. The model is based on the concept of breaking the data processing task into two smaller tasks of mapping and reduction. During the map process, a key-value pair in one domain is mapped to a key-value pair in another pair, where the 'value' can be a single or a list of multiple values. The keys from the mapping process are then aggregated and the values for the same key combined together. This aggregated data is then fed to the reducer (one call per key) and the reducer then processes this data to produce a final value. The list of all final values for all the keys is the result set.

The key issue in breaking a problem into the MapReduce model is that the map and reduce operations can be performed in parallel on different keys, without the results of one operation affecting the other. This independence of results allows the map/reduce tasks to be distributed in parallel to multiple nodes, which can then perform the respective operations independent of each other. The final results are then aggregated together to produce the final result list.

A classic example used to explain the MapReduce model is the "word counting" example. The problem to be solved is to count the occurrence of each word in a set of documents.

CONCLUSION

As there are huge volumes of data that are produced every day, so such large size of data it becomes very challenging to achieve effective processing using the existing traditional techniques Big data is data that exceeds the processing capacity of conventional database systems. In this paper fundamental concepts about Big Data are presented. This paper described the new concept of Big data, its importance and the existing projects. Hadoop tool for Big data is described in detail focusing on the areas where it needs to be improved. Big data can have technology as well as skills to work with. These concepts include Big Data characteristics, challenges and tools and techniques for handling big data

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CHALLENGES OF BIG DATA SECURITY IN CLOUD COMPUTING

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ABSTRACT

The primary goal of information security is to protect the fundamental data that powers our systems and applications. One of them is privacy. As about the cloud computing, security of data are challenged by the cloud based architectures. Cloud computing is mainly associated with big data. This paper is intended to the working and the challenges of the big data security in cloud computing. The traditional information systems does not provide complete security system during the cloud computing. In this paper, we discuss big data security issues for cloud computing. Big data applications are the benefit to organizations, business, and etc. Cloud computing security is developing at a rapid growth with computer security, network security, information security and data privacy. Cloud computing plays a very vital role in protecting data and applications.

Keywords: *Cloud computing, big data, encryption, decryption*

INTRODUCTION

Cloud computing is revolutionizing many of our ecosystems. The adoption of cloud computing is increasingly giving rise to security and privacy considerations relating to facets of cloud computing such as multi-tenancy, trust, loss of control and accountability.

Consequently cloud platforms that handle sensitive information are required to deploy technical measures and organizational safeguards to avoid data protection breakdowns that might result in enormous and costly damages. Data concerning health is the type of sensitive information handled in cloud computing. This paper presents an overview of the research on security and privacy of sensitive data in cloud computing environments..

LITERATURE REVIEW

Dr. Jambhekar N. D. et. al (2016) states the real time encryption for the flowing data over the cloud. This is possible with the help of collaborating servers among cloud to cloud. In that paper, the parallel and distributed encryption technique introduced that helps to reduce the confidential data security requirement which helps to encrypt the parts of data at different locations and merge at a single location .

Ekata Narasimha Inukollu, Sailaja Arsi, and Srinivasa Rao Ravuri states that security is an important aspect for organizations running on these cloud environments. Using proposed approaches, cloud environments can be secured for complex business operations. Ali Gholami and Erwin Laure described several cloud computing key concepts and technologies, such as virtualization, and containers that are presented in the area of cloud security and privacy are based on cloud provider activities, Pearson discusses a range of security and privacy challenges that are raised by cloud computing.

Venkata Narasimha Inukollu proposed in the that Cloud environment is widely used in industry and research aspects; therefore security is an important aspect for organizations running on these cloud environments. Using proposed approaches, cloud environments can be secured for complex business operations.

CLOUD COMPUTING

Cloud computing is an on demand service model for IT provision. Cloud Computing is a technology which depends on sharing of computing resources. In Cloud Computing, the word “Cloud” means “The Internet”, so Cloud Computing means a type of computing in which services are delivered through the Internet. The cloud is a mobile framework that contributes the availability different services and resources with different cloud models. Cloud computing uses networks of a large group of servers with specialized connections to distribute data processing among the servers. Cloud computing plays an important role in mobile computing, collaborating servers and applications without any effort.

Cloud computing architectures have:

- Highly abstracted resources
- Near instant scalability and flexibility
- Near instantaneous provisioning
- Shared resources (hardware, database, memory, etc)
- Service on demand
- Programmatic management

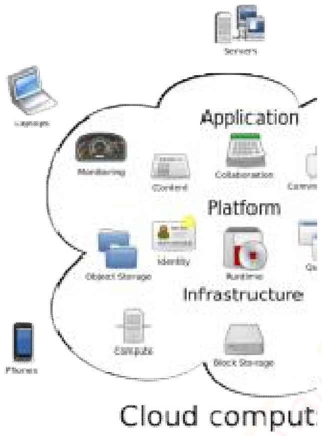

Fig. Cloud Computing

The services provided by different clouds are:
On-demand Self Service - Automatic services available from the cloud to anyone connected to the cloud.
Heterogeneous Platforms - Network access can possible to any type of devices having any platform without cloud-to-cloud surfing.
Resource Sharing - A pool of resources is available on every cloud and scheduled for the connected users while moving from one location to another. Cloud physical resources acts like virtual and are location independent. When the user moves from one cloud to another, these resources are available on every cloud without specifying their locations. These resources include virtual storage, processors, network bandwidth.
Cloud Collaboration - Multiple clouds are working in collaboration to provide the uninterrupted services to the connected users. The movements from one location to another do not affect the mobile computing of the device. The cloud services work in collaboration and available to the user moving from one cloud to another.
Different types of clouds are available –
• ***Private Cloud***- It is an enterprise cloud available for the campus area defined users with internal access to resources and services solely on demand.
• Community cloud- It is a backbone network of clouds shared by multiple organizations, having their limited own policies.
• ***Public Cloud***- The public cloud is accessible to anyone with all the resources and functionalities available to the connected user publicly. Sometimes it is owned by a public organization and the users requested the cloud services on demand.
• ***Hybrid cloud***- More than one type of cloud works in collaboration to provide the services to the users moving from one location to another and without demanding the services from cloud to cloud.

BIG DATA

Big data is an emerging technology that comparatively gain its important and even more than the cloud computing. Big data is a massive set of information comprised of different data type having dissimilar data structure to be stored in multiple locations. Due to the extraordinary monolithic structure, the data can be difficult to organize, store, analyze, and retrieve. Today, the world is moving towards the digital age. Every hard coded paper document will be transformed into digital form. Big data, the software packages provide a rich set of tools and options where an individual could map the entire data landscape across the company.
There are some common characteristics of big data, such as:

a) Big data integrates both structured and unstructured data.
b) Addresses speed and scalability, mobility and security, flexibility and stability.
c) In big data the realization time to information is critical to extract value from various data sources, including mobile devices, radio frequency identification, the web and a growing list of automated sensory technologies

4.1 Big Data Security Challenge

Big data is a massive set of digital information stored on different servers and can be available through the cloud. If data are smaller, it can easily encrypt/decrypt during the transmission and storage. The bigger data suffer from the security problems, hardware offload, operating system and resources management, data acquisition, data analysis and processing workloads, indexing, cataloging, searching, data mining and dissemination. If the data is in text form it is sometimes easier, but if it is audio, images and video data, then it is harder to store and manipulate because of the large size. If data captured by any organization in a few terabytes or petabytes size, it is harder to process by a single machine even by the supercomputer or cluster machines.

Big Data is the word used to describe massive volumes of structured and unstructured data that are so large that it is very difficult to process this data using traditional databases and software technologies. The term "Big Data" is companies who had to query loosely structured very large distributed data.

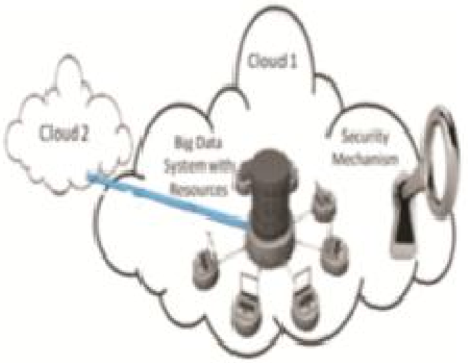

Fig. Big data Security

The three main terms that signify Big Data have the following properties:

a) **Volume**: Many factors contribute towards increasing Volume streaming data and data collected from sensors etc.,

b) **Variety**: Today data comes in all types of formats emails, video, audio, transactions etc.,

c) **Velocity**: This means how fast the data is being produced and how fast the data needs to be processed to meet the demand. The other two dimensions that need to consider with respect to Big Data are Variability and Complexity.

d) **Variability**: Along with the Velocity, the peaks.

e) **Complexity**: Complexity of the data also needs to be considered when the data is coming from multiple sources. The data must be linked, matched, cleansed and transformed into required formats before actual processing.

Technologies today not only support the collection of large amounts of utilizing such data effectively transactions made all over the world with respect to a Bank, Walmart customer transactions, and Facebook users generating social interaction data. When making an attempt to understand the concept of Big Data, the words and "Hadoop" cannot be avoided. Big Data is the word used to describe massive volumes of structured and unstructured data that are so large that it is very difficult to process this data using traditional databases and software technologies. The term "Big Data" is believed to be originated from the Web search companies who had to query loosely structured very large distributed data.

Encrypted Storage

Every organization or an individual trying to save their confidential information over cloud storage. A massive amount of data is captured by the cloud from various resources where it may be a secured encrypted data or plain confidential information. The client computer can
implement the security or the cloud server or both can be engaged to encrypt the data. As the data larger, it is harder to encrypt by a single cloud server and store it.

Encrypted Workload

Workload is the amount of data handle during the encryption process. If the incoming data becomes larger, the encryption workload becomes heavier. The client or server can handle the encryption process. If the client performs the encryption and server becomes free, but the
network traffic suffering due to transfer of large encrypted data. For several security reasons, it is better to encrypt the data at its source i.e. at the client machine. It can resolve the problem of encryption, decryption, key maintenance and transfer.

Decryption

If the cloud server store the data encrypted by clients, then the client machine can handle the part of decryption. Only the work is to transfer the encrypted data towards the client computer.

Encrypted Storage

As the data are bigger, the retrieval is tedious because the indexing, ordering and searching consumes lot of computing and network resources.

Failure and Recovery

The Database Management System (DBMS) uses the ACID properties, for example, Atomicity, Consistency, Isolation, and Durability to work with the transactions. It assures the complete successful transaction processing. If the failure occurs, the log based recovery system is available. In big data cloud computing, the recovery can be implemented by the same log based concept with the implementation of ACID properties. This paper investigates the current security issues of big data and cloud computing and proposed a framework to enhance the security. The essence of big data security is not handled by a single framework, rather it can be efficiently controlled by the collaborating encryption system where the entities engage in this big data security can be collaborating cloud servers working with the client security mechanism

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CLOUD SECURITY ISSUES

Multi tenancy – Multi tenancy refers to sharing physical devices and virtualized resources between multiple independent users. Using this kind of arrangement means that an attacker could be on the same physical machine a s the target. Cloud providers use multi-tenancy features to build infrastructures that can efficiently scale to meet customers' needs, however the sharing of resources means that it can be easier for an attacker to gain access to the target's data.

Loss of control - Loss of control is another potential breach of security that can occur where consumers data, applications, and resources are hosted at the cloud providers owned remises. As the users do not have explicit control over their data, this makes it possible for cloud providers to perform data mining over the users' data, which can lead to security issues. In addition, when the cloud providers backup data at different data centers, the consumers cannot be sure that their data is completely erased everywhere when they delete their data. This has the potential to lead to misuse of the unerased data. In these types of situations where the consumers lose control over their data, they see the cloud provider as a black-box where they cannot directly monitor the resources transparently.

Trust chain in clouds - Trust plays an important role in attracting more consumers by assuring on cloud providers**.** Due to loss of control (as discussed earlier), cloud users rely on the cloud providers using trust mechanisms as an alternative to giving users transparent control over their data and cloud resources. Therefore cloud providers build confidence amongst their customers by assuring them that the provider's operations are certified in compliance with organizational safeguards and standards.

Big data security: Future directions

Throughout this chapter it was possible to present some of the most important security and privacy challenges that affect Big Data projects and their specificities. Although the information security practices, methodologies and tools to ensure the security and privacy of the Big Data ecosystem already exist, the particular characteristics of Big Data make them ineffective if they are not used in an integrated manner.

4.2 BIG DATA SECURITY FRAMEWORK

Data security includes the specific controls and technologies used to enforce information governance. We've broken this out into three sections to cover detection (and prevention) of data migrating to the cloud, protecting data in transit to the cloud and between different providers/environments, and protecting data once it's within the cloud.

Fig. Big data Security Platform

5 SECURITY SOLUTION

Following are the security solutions of Big data,

1.1 Authentication and Authorization

This study identifies a set of categories relevant for authentication and authorization for the cloud focusing on infrastructural organization which include classifications for credentials, and adapt those categories to the cloud context.

1.2 Identity and access management

This solution demonstrates how organizations can outsource authentication and authorization to third-party clouds using an identity management system. E-ID authentication and uniform access to cloud storage service providers is an effort to build identity management systems for authenticating Portuguese citizens using national e-identification cards for cloud storage systems. In this approach, the OAuth protocol is integrated for authorizing the cloud users. The e-ID cards contain PKI certificates that are signed by several levels of governmental departments. A certification authority is responsible for issuing the e-ID cards and verifying them. The e-ID cards enable users for identity-based encryption of data in cloud storage.

1.3 Confidentially, integrity and availability

It is the trusted cloud computing platform. In this approach, all nodes run a trusted virtual machine monitor to isolate and protect virtual machines. Users a regiven access to cloud services through the cloud manager component. The external trusted entity (ETE) is another component that provides a trust coordinator service in order to keep track of the trusted VMs in a cluster. The ETE can be used to attest the security of the VMs.

A TCCP guarantees confidentiality and integrity in data and computation and it also enables users to attest to the cloud service provider to ensure whether the services are secure prior to setting up their VMs. These features are based on the trusted platform module (TPM) chip. The TPM contains a private endorsement key that uniquely identifies the TPM and some cryptographic functions that cannot be altered. In this approach, all nodes run a trusted virtual machine monitor to isolate and protect virtual machines. Users a regiven access to cloud services through the cloud manager component. The external trusted entity (ETE) is another component that provides a trust coordinator service in order to keep track of the trusted VMs in a cluster. The ETE can be used to attest the security of the VMs. A TCCP guarantees confidentiality and integrity in data and computation and it also enables users to attest to the cloud service provider to ensure whether the services are secure prior to setting up their VMs. These features are based on the trusted platform module (TPM) chip. The TPM contains a private endorsement key that uniquely identifies the TPM and some cryptographic functions that cannot be altered.

1.4 Security monitoring and Incident response

Redundancy, automatic healing, and multi-level notifications are other benefits of the proposed solution which are designed to avoid the typical drawbacks of a centralized monitoring system, such as limited scalability, low performance and single point of failure.

CONCLUSION

This paper reviewed several security and privacy issues on big data in the cloud. It described several big data and cloud computing key concepts. Security and privacy factors that affect the activities of cloud providers in relation to the legal processing of consumer data were identified and a review of existing research was conducted to summarize the state-of-the-art in the field. More research challenges in the Big Data area include developing techniques to perform a transparent computations over encrypted data with multiple keys, from multiple sources and multiple users. In terms of research it would be challenging to study and develop ways to delegate limited functions over encrypted data, so that third parties can analyze it. All the aspects related with key management, authorization delegation, management of rights, are topics that require further research in this field. This paper also focuses on the real time encryption for the flowing data over the cloud. This is possible with the help of collaborating servers among cloud to cloud. Major technology variations occur in a few years where traditional encryption techniques not fulfill the security need. In this paper, the parallel and distributed encryption technique introduced that helps to reduce the confidential data security requirement. It helps to encrypt the parts of data at different locations and merge at a single location.

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ARTIFICIAL INTELLIGENCE IN POWER SYSTEMS

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ABSTRACT

A continuous supply of electricity plays a significant role in functioning of daily life. It acts as the basis for the society where everyone is either directly or indirectly involved with power stations. The evolution of the method from tedious mathematical modeling which were derived from operation research to usage of artificial intelligence depicts a boon to the power system. It leads to simplicity and increases the efficiency in control, acquisition of date, planning, scheduling and forecast of the power system. Artificial Intelligence is the science of automating intelligent behavior currently achievable by humans. Artificial Intelligence overcomes difficulty in the old traditional approach. It is used to handle the increasing load demand of electricity. The application of artificial intelligence in power system has been successful in many areas of power system engineering.

Keywords: *- Artificial Intelligence, Power Stations, Power System Engineering.*

INTRODUCTION

POWER SYSTEM

An Electric power system is the network of electrical components that are used to transmit,supply and use electric power for various purposes.Electric power is often expressed as the product of current and voltage. Power systems engineering is a subpart of electrical engineering which handles the production, transportation, distribution and using of power and the electrical devices connected to systems like generators that are used in generation of supply of electricity and many other devices.[1]

ARTIFICIAL INTELLIGENCE

Artificial intelligence defined as theintelligence exhibited by software and machines , for example,computer and robots programs. This term is generally used when things are related to the development of a process or system which are equipped with intellectual thinking,characteristics and features which are possessed by human brain. The human ability of thinking, reasoning, finding the meaning, generalizing, distinguishing, learning from past experience or rectifying their mistakes can be done through AI. Artificial general intelligence (AGI) is the intelligence of an extreme or a weird situation in which a machine or computer which can accomplish any intellectual assignment successfully which a human being can do without the interference of a human being.[1]

Need for AI in power systems: Power system when analyzed by conventional techniques becomes difficult to understandbecause of: (i) Versatile, complex and large amount of information that is used for calculation, learning and diagnosis . (ii) Increase in the computational period, time and accuracy due to extensive and huge system data handling.

The modern power system operates close to the limits due to the ever increasing energy consumption and the extension of currently existing electrical transmission networks and lines. This increase in power demands might not allow it to work with super perfection. This situation requires a less old fashioned approach power system operation and control operation which only possible by continuously checking the system states in a much more detailed and meticulous manner than it was necessary. Sophisticated computer tools are now the primary tools in solving the difficult problems that arise in the areas of power system planning, operation, diagnosis and design. Predominantly Artificial Intelligence has grown in recent years and has been applied to various areas of power systems.[1]

ARTIFICIALINTELLIGENCE TECHNIQUES

1.Artificial Neural Networks (ANN)

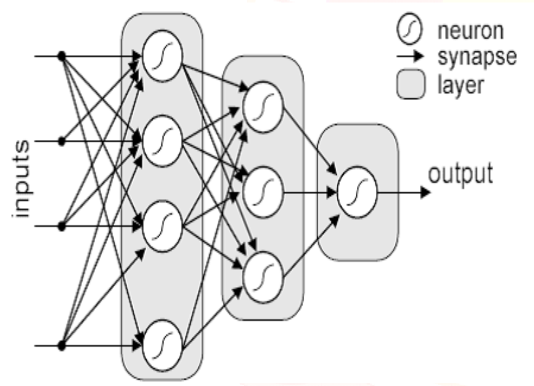
Artificial Neural Networks are the systems which are inspired by biological systems which convert a set of inputs into a set of outputs by a network of neurons, in this case each neuron produces one output as a function of multiple or single inputs. A fundamental neuron can be considered as a processor which makes a simple operation which is non linear of its inputs to produce a single output. To construct computers for solving real world problems of classification of patterns and pattern recognition, the understanding of the working of neurons and the pattern of their interconnection can be used.

They are classified by their architecture: number of layers and topology: connectivity pattern, feed forward or recurrent.[2]

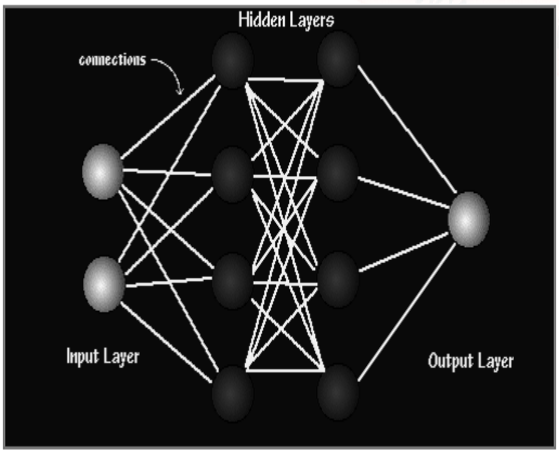
Input Layer: The nodes are input units which distribute this data and information to other units but do not process the data and information.

Hidden Layers: These nodes are not directly evident and visible because they are invisible. The ability to map or classify the nonlinear problems is provided by them. [2]

Output Layer: The nodes are output units, that encrypt the possible values to be allocated to the case under consideration



Architecture of a feed forward ANN



Typical structure of an ANN

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1.1. *Advantages*:

(i) The speed of processing is very fast

(ii) Knowledge of the system model is not as necessary in this case.

(iii) The situations of incomplete data and information, corrupt data is handled here.

(iv) Faults can be handled by this mechanism.

(v) ANNs are super fast with robustness. Ability of the data and adaptability to the data is possessed by them.

(vi) They can generalize. [3][4]

1.2. *Disadvantages*:

(i) Huge dimension.

(ii) Even if the input data are unreasonable ,the output is generated

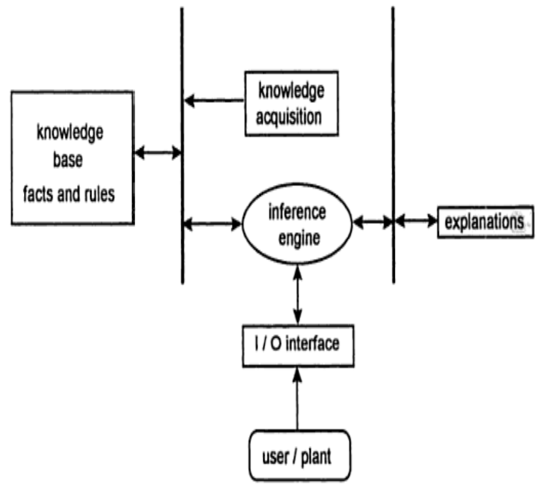
(iii) They are not resizable or modifiable i.e. once an ANN is trained to do certain task, it is difficult to extend for other tasks without making changes to the neural network. [3]

1.3. *Applications*: Power system problems when concerned with encoding of an unspecified non-linear function are apt for ANNs. ANNs can be specifically useful for problems which require quick and precise results, like those in operation which are performed in real time. This is due to the quick response time of the system where they generate result in a very short moment of time after obtaining the set of inputs. [3][4]

1.4. *How ANNs can be used in power systems:*The biological impulse is the basis in which ANN operates and performs biological assessment of the problems which are faced in day to day life. When there is problem in production, transmission and distribution of power at that instance they can be fed to the ANNs due to which a suitable solution can be obtained.Considering the restrictions of a practical transmission and distribution system, the exact values of parameters can be found out. For instance, the approximate values of inductance, capacitance and resistance in a transmission line can be calculated numerically by ANNs which considers various factors like environmental factors, unbalancing conditions, and other potential problems.Also the values of resistance, capacitance and inductance of a transmission line can be supplied as inputs and a combined, normalized value of the parameters can be obtained out of it. In this way skin effect and proximity effect can be reduced to an extent upto which it can can be accepted [3][4]

EXPERT SYSTEMS

An Expert System (ES) obtains the knowledge of a human expert in a specified domain into a form that machine can implement. ES are computer programs which have ability to perform and do something successfully in a particular field. This knowledge is stored separately from the program's part that includes procedure and can be stored in many forms, like rules, D-trees (decision), models, and frames. They are also called as systemsbased on knowledge or rule.[4]



2.1.*Structure of an Expert System*

Advantages:

(i) It is not temporary and consistent.

(ii) It is easily documented.

Disadvantage:

Expert Systems are not able to learn or accept new problems or situations.

2.2.*How expert systems can be used in power systems***:**

Since ES are basically computer programs, the process of writing codes for these programs is simpler than actually calculating and estimating the value of parameters used in process of generation, transmission and distribution. Any changes even after design can be done because they are computer programs. [2]

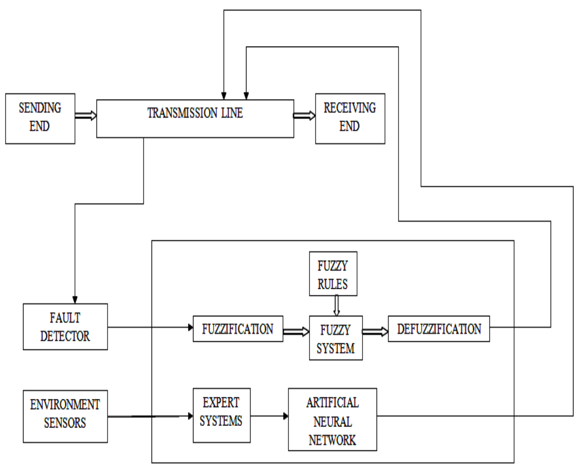
GENETIC ALGORITHMS (GA)

Genetic Algorithm is awayof picking upof a best unit or an element fromset of available options based on the study of natural selection and genetics. Its basic principle is that the fittest element of the solutionhas the highest possibility for survival. GA gives a global technique based on metaphors biologically related to it. The Genetic Algorithm is different from other techniques or methods by:

- Genetic Algorithm uses coding of the variables set instead of the actual variables.
- GA checks out for appropriate points through a population of available solution points and not a single point.
- Genetic Algorithm uses only objective function information.
- It uses only the probability transition laws and not the deterministic laws.
- GA is based on the principle that the most appropriate and the fittest element for a particular solution is more immortal i.e. it has highest chances of survival.[4]

3.1.*How Genetic Algorithms Can Be Used In Power Systems***:**

As genetic algorithms are based on the principle of survival of fittest, many methods can be stated for increasing the efficient use of power system and increasing power output. Out of themethods using GA, the best method which stands among all challenges is chosen as it is the method of survival of fittest. Artificial Neural Networks (ANNs) and Expert systems are used to increase the performance of the line. The environmental sensors sense the conditions of environment and atmosphere and give that as input to the Expert Systems. The ANNs are made to understand the change of values of line parameters over the given ranges based on the environment conditions. After training is completed, network of neural is tested and the performance of trained neural network which is updated is checked upon. If performance is not up to the mark, some changes can be done like differentiating number of layers that are hidden, varying number of neurons in each layer. The processing speed has the relation of directly proportionalityto the number of neurons.[5].



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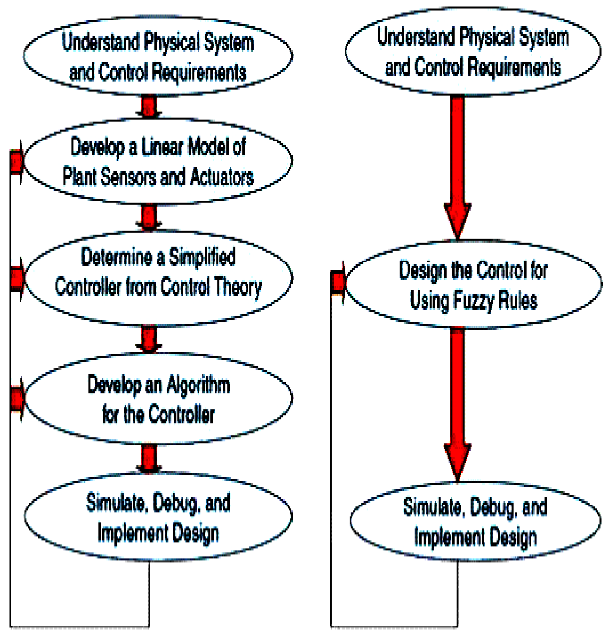
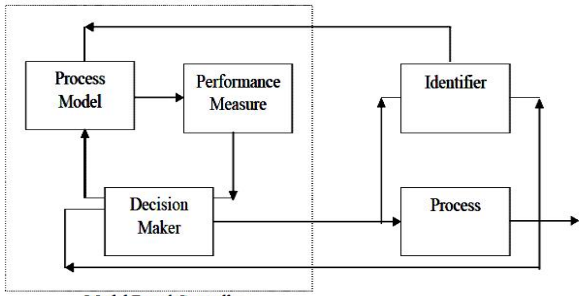
FUZZY LOGIC

The logical systems for standardisation and formalisation of approximate reasoning may be termed as Fuzzy logic or Fuzzy systems. It is the same way when human with their ability to take decisions makes some exact and accurate solutions from certain or even approximate information and data which they have or get from some past experience. The reasoning in fuzzy logic can be compared to the human reasoning. When we use fuzzy logic it can be observed that it is same as the functioning of the human brains. Fuzzification provides superior expressive power, higher generality and an improved capability to model complex problems at low or moderate solution cost. Fuzzy logic allows a particular level of duplication throughout an analysis. Because this ambiguity can specify the information available and reduce the problem complexity and that is the reason why fuzzy logic is useful in many applications. For power systems, fuzzy logic is very suitable in many areas where the available information involves much uncertainty. For example, when a problem involves logical reasoning, but there is chance of applying numerical solutions, other than symbolic inputs and outputs. Fuzzy logic provides the opportunity to convert from numerical to symbolic inputs, and back again for the outputs.[6] [7]



Benefits of using fuzzy logic

4.1. *Fuzzy Logic Controller*Simply explained, it is a fuzzy code which is designed to control something, generally mechanical input. It can be used from a small circuits to large mainframes, It can be considered as a software or hardware model. Adaptive fuzzy controllers learn to control complex process in a much similar fashion as humans tend to do.[7] [9]



Model Based Controller

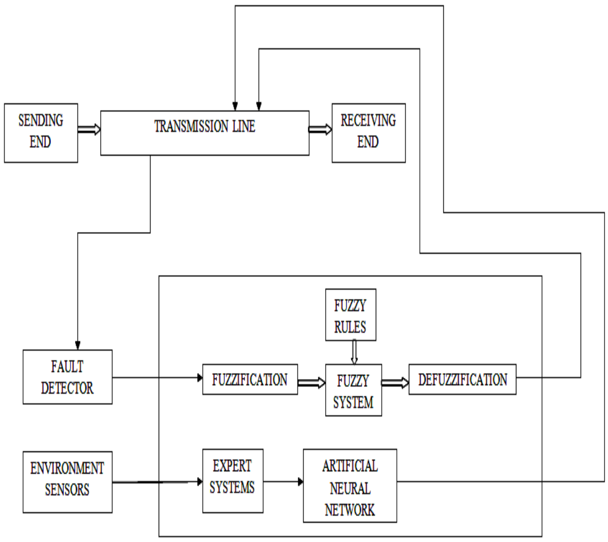
4.2. *Applications*:
(i) Analyzing stability and improvement
(ii) Controlling power systems
(iii) Diagnosing faults
(iv)Assessing security
(v) Load forecasting
(vi) Reactive power planning and its control
(vii) Estimation of states[10]

4.3. *Reactive Power and Voltage Control*:
Fuzzy logic has been applied in the reactive power control with an aim of enhancing the voltage profile of power system.To construct a relation between voltage change and controlling ability of the controlling device there are fuzzy set or system notations which are developed with a use of the change in the voltage and controlling variables.The generator excitation,transformer taps and VAR compensators are the main changing variables.To monitor these control variables and their movement a fuzzy system is formed.[10]

III) Current Application of Ai in Power Systems
Many problems in power systems cannot be solved by old methods and are based on more than onerequirement which may not be used all the time. In these situations, AImethodsare the only alternative. Areas of application of AI in power systems are:
Planning of power system like generation expansion plan, how much reliable the power system is.Control of power system like voltage control, control in its stableness, power flow control, control on the load frequency. Electricity markets like analysis of electricity markets. Power System automation like restoration, management, diagnosis of fault, security of network. Applications of distributedgeneration like

distributed generation planning, control of solar photovoltaic power plant, control on wind turbine plant and energy resources that can be renewed. Application of forecast like short term and long term load forecasting, electricity market forecasting, solar and wind power forecasting.[10]

IV. Practical Application Of Ai Systems In Transmission Line[10]



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V. Comparison Of Ai Techniques In Power System Protection:

Feature	Approach		
	XPS	ANNs	FL
Knowledge used	Expert knowledge in the form of rules, objects, frames, etc.	Information extracted from the training set of cases.	Expert knowledge in the form of protection criteria.
Trouble-shooting and improving a relay	Change of rules required.	Difficult - the internal signals are almost impossible to interpret.	Convenient - the internal signals are understandable and analyzable
Self-learning	Possible.	Natural.	Possible.
Handling unclear cases	Possible.	Natural.	Natural.
Robustness	Not-critical and easy to ensure.	Difficult to ensure.	Not-critical and easy to ensure.
Setting a relay	Convenient.	Large number of simulation required.	Convenient. Both knowledge and simulation are used.
Computations	Extensive.	Dedicated hardware.	Moderate.

[Referred from www.iosrjournals.org]

CONCLUSION:

Reliability is the main feature of power system design and its planning, which was first rated using old approach. Moreover, old techniques don't satisfy the probabilistic essence of power systems. This totally leads to increase in costs. More of research is carried upon to use the current interest AI for power system applications. A lot of research is yet to be carried out to understand full advantages of this upcoming technology for increasing the efficiency of electricity market investment, making efficient system analysis and in general more of power systems which use renewable energy resources for its operation.[8][9]

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BIG DATA MANAGEMENT IN CLOUD COMPUTING

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ABSTRACT

Big data is concern massive amount, complex, growing data set from multiple autonomous sources. It has to deal with large and complex dataset that can be structured, semi-structured or unstructured and will typically not fit into memory to be processed.

The advent of the digital age has led to a rise in different types of data with every passing day. In fact, it is expected that half of the total data will be on the cloud by 2016. This data is complex and needs to be stored, processed and analyzed for information that can be used by organizations. Cloud computing provides an apt platform for big data analytics in view of the storage and computing requirements of the latter. This makes cloud-based analytics a viable research field. However, several issues need to be addressed and risks need to be mitigated before practical applications of this synergistic model can be popularly used. This paper explores the existing research, challenges, open issues and future research direction for this field of study.

Keywords: *Cloud-based Big Data Analytics, Big Data, Big Data Analytics, Big Data Cloud Computing*

INTRODUCTION

In the current era, enormous data is being generated day by day continuously. With the rapid expansion of data, we are moving from the Petabyte to Exabyte and zettabytes age. At the same time, new technologies progressing with high speed make it possible to organize and manipulate the voluminous amounts of data presently being generated. With this trend there exists a greater demand for new data storage and analysis methods. Especially, the real world aspects of extracting knowledge from huge data sets have become utmost important. “Big Data” is the biggest observable fact that has captured the attention of the modern computing industry today since the expansion of Internet globally. Big Data is gaining more popularity today is because of the technological revolutions that have emerged are providing the capability to process data of multiple formats and structures without worrying about the constraints associated with traditional systems and database platforms.

LITERATURE REVIEW

BIG DATA & CLOUD COMPUTING

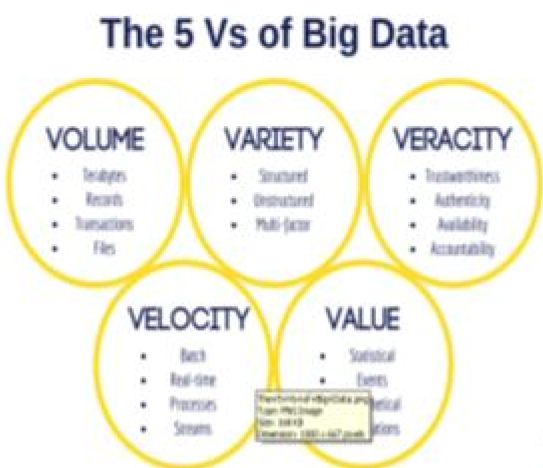
The concept of big data became a major force of innovation across both academics and corporations. The paradigm is viewed as an effort to understand and get proper insights from big datasets (big data analytics), providing summarized information over huge data loads. As such, this paradigm is regarded by corporations as a tool to understand their clients, to get closer to them, find patterns and predict trends. Furthermore, big data is viewed by scientists as a mean to store and process huge scientific datasets. This concept is a hot topic and is expected to continue to grow in popularity in the coming years.

Although big data is mostly associated with the storage of huge loads of data it also concerns ways to process and extract knowledge from it (Hashem et al., 2014). The five different aspects used to describe big data (commonly referred to as the five “V”s) are Volume, Variety, Velocity, Value and Veracity (Sakr & Gaber, 2014):

- *Volume* describes the size of datasets that a big data system deals with. Processing and storing big volumes of data is rather difficult, since it concerns: scalability so that the system can grow; availability, which guarantees access to data and ways to perform operations over it; and bandwidth and performance.
- *Variety* concerns the different types of data from various sources that big data frameworks have to deal with.
- *Velocity* concerns the different rates at which data streams may get in or out the system and provides an abstraction layer so that big data systems can store data independently of the incoming or outgoing rate.
- *Value* concerns the true value of data (i.e., the potential value of the data regarding the

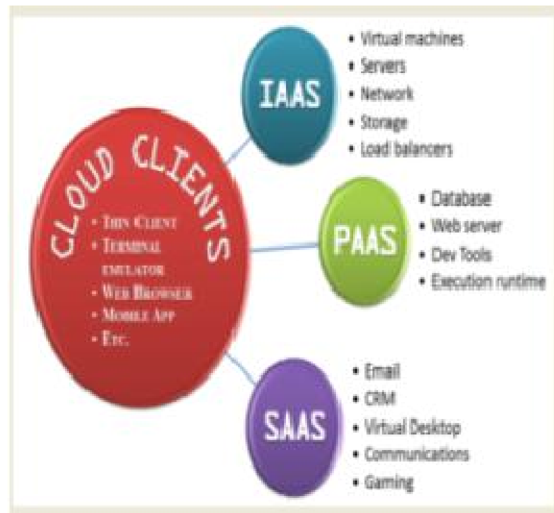
information they contain). Huge amounts of data are worthless unless they provide value.

- *Veracity* refers to the trustworthiness of the data, addressing data confidentiality, integrity, and availability. Organizations need to ensure that data as well as the analyses performed on the data are correct.



Cloud computing is another paradigm which promises theoretically unlimited on-demand services to its users. Cloud's ability to virtualize resources allows abstracting hardware, requiring little interaction with cloud service providers and enabling users to access terabytes of storage, high processing power, and high availability in a *pay-as-you-go* model (González-Martínez et al., 2015). Moreover, it transfers cost and responsibilities from the user to the cloud provider, boosting small enterprises to which getting started in the IT business represents a large endeavour, since the initial IT setup takes a big effort as the company has to consider the total cost of ownership (TCO), including hardware expenses, software licenses, IT personnel and infrastructure maintenance. Cloud computing provides an easy way to get resources on a pay-as-you-go model, offering scalability and availability, meaning that companies can easily negotiate resources with the cloud provider as required. Cloud providers usually offer three different basic services: Infrastructure as a Service (IaaS); Platform as a Service (PaaS); and Software as a Service (SaaS):

- *IaaS* delivers infrastructure, which means storage, processing power, and virtual machines. The cloud provider satisfies the needs of the client by virtualizing resources according to the service level agreements (SLAs);
- *PaaS* is built atop of IaaS and allows users to deploy cloud applications created using the programming and run-time environments supported by the provider. It is at this level that big data DBMS are implemented;
- *SaaS* is one of the most known cloud models and consists of applications running directly in the cloud provider;



These three basic services are closely related: SaaS is developed over PaaS and ultimately PaaS is built atop of IaaS.

From the general cloud services other services such as Database as a Service (DBaaS) (Oracle, 2012), BigData as a Service (BDaaS) and Analytics as a Service (AaaS) arose.

Since the cloud virtualizes resources in an on-demand fashion, it is the most suitable and compliant framework for big data processing, which through hardware virtualization creates a high processing power environment for big data.

BIG DATA IN THE CLOUD

Storing and processing big volumes of data requires scalability, fault tolerance and availability. Cloud computing delivers all these through hardware virtualization. Thus, big data and cloud computing are two compatible concepts as cloud enables big data to be available, scalable and fault tolerant.

Business regard big data as a valuable business opportunity. As such, several new companies such as Cloudera, Hortonworks, Teradata and many others, have started to focus on delivering Big Data as a Service (BDaaS) or DataBase as a Service (DBaaS). Companies such as Google, IBM, Amazon and Microsoft also provide ways for consumers to consume big data on demand. Next, we present two examples, Nokia and RedBus, which discuss the successful use of big data within cloud environments.

2.1 Nokia

Nokia was one of the first companies to understand the advantage of big data in cloud environments (Cloudera, 2012). Several years ago, the company used individual DBMSs to accommodate each application requirement. However, realizing the advantages of integrating data into one application, the company decided to migrate to Hadoop-based systems, integrating data within the same domain, leveraging the use of analytics algorithms to get proper insights over its clients. As Hadoop uses commodity hardware, the cost per terabyte of storage was cheaper than a traditional RDBMS (Cloudera, 2012).

Since Cloudera Distributed Hadoop (CDH) bundles the most popular open source projects in the Apache Hadoop stack into a single, integrated package, with stable and reliable releases, it embodies a great opportunity for implementing Hadoop infrastructures and transferring IT and technical concerns onto the vendors' specialized teams. Nokia regarded Big Data as a Service (BDaaS) as an advantage and trusted Cloudera to deploy a Hadoop environment that copes with its requirements in a short time frame. Hadoop, and in particular CDH, strongly helped Nokia to fulfil their needs (Cloudera, 2012).

2.2 RedBus

RedBus is the largest company in India specialized in online bus ticket and hotel booking. This company wanted to implement a powerful data analysis tool to gain insights over its bus booking service (Kumar, 2006). Its datasets could easily stretch up to 2 terabytes in size. The application would have to be able to analyse booking and inventory data across hundreds of bus operators serving more than 10.000 routes. Furthermore, the company needed to avoid setting up and maintaining a complex in-house infrastructure.

At first, RedBus considered implementing in-house clusters of Hadoop servers to process data. However they soon realized it would take too much time to set up such a solution and that it would require specialized IT teams to maintain such infrastructure. The company then regarded Google bigQuery as the perfect match for their needs, allowing them to:

- Know how many times consumers tried to find an available seat but were unable to do it due bus overload;
- Examine decreases in bookings;
- Quickly identify server problems by analysing data related to server activity;

Moving towards big data brought RedBus business advantages. Google bigQuery armed RedBus with real-time data analysis capabilities at 20% of the cost of maintaining a complex Hadoop infrastructure (Kumar, 2006).

As supported by Nokia and RedBus examples, switching towards big data enables organizations to gain competitive advantage. Additionally, BDaaS provided by big data vendors allows companies to leave the technical details for big data vendors and focus on their core business needs.

BIG DATA ISSUES

Although big data solves many current problems regarding high volumes of data, it is a constantly changing area that is always in development and that still poses some issues. In this section we present some of the issues not yet addressed by big data and cloud computing.

As the amount of data grows at a rapid rate, keeping all data is physically cost-ineffective. Therefore, corporations must be able to create policies to define the life cycle and the expiration date of data (data governance). Moreover, they should define who accesses and with what purpose clients' data is accessed. As data moves to the cloud, security and privacy become a concern that is the subject of broad research.

Big data DBMSs typically deal with lots of data from several sources (variety), and as such heterogeneity is also a problem that is currently under study. Other issues currently being investigated are disaster recovery, how to easily upload data onto the cloud, and Exaflop computing.

Within this section we provide an overview over these problems.

3.1 Security

Cloud computing and big data security is a current and critical research topic (Popović & Hocenski, 2015). This problem becomes an issue to corporations when considering uploading data onto the cloud. Questions such as who is the real owner of the data, where is the data, who has access to it and what kind of permissions they have are hard to describe. Corporations that are planning to do business with a cloud provider should be aware and ask the following questions:

a) Who is the real owner of the data and who has access to it?

The cloud provider's clients pay for a service and upload their data onto the cloud. However, to which one of the two stakeholders does data really belong? Moreover, can the provider use the client's data? What level of access has to it and with what purposes can use it? Can the cloud provider benefit from that data?

In fact, IT teams responsible for maintaining the client's data must have access to data clusters. Therefore, it is in the client's best interest to grant restricted access to data to minimize data access and guarantee that only authorized personal access its data for a valid reason.

These questions seem easy to respond to, although they should be well clarified before hiring a service. Most security issues usually come from inside of the organizations, so it is reasonable that companies analyse all data access policies before closing a contract with a cloud provider.

b) Where is the data?

Sensitive data that is considered legal in one country may be illegal in another country, therefore, for the sake of the client, there should be an agreement upon the location of data, as its data may be considered illegal in some countries and lead to prosecution.

The problems to these questions are based upon agreements (Service Level Agreements – SLAs), however, these must be carefully checked in order to fully understand the roles of each stakeholder and what policies do the SLAs cover and not cover concerning the organization's data. This is typically something that must be well negotiated.

Concerning limiting data accesses, (Tu et al., 2013) and (Popa et al., 2011) came up with an effective way to encrypt data and run analytical queries over encrypted data. This way, data access is no longer a problem since both data and queries are encrypted. Nevertheless, encryption comes with a cost, which often means higher query processing times.

3.2 Privacy

The harvesting of data and the use of analytical tools to mine information raises several privacy concerns. Ensuring data security and protecting privacy has become extremely difficult as information is spread and replicated around the globe. Analytics often mine users' sensitive information such as their medical records, energy consumption, online activity, supermarket records etc. This information is exposed to scrutiny, raising concerns about profiling, discrimination, exclusion and loss of control (Tene & Polonetsky, 2012). Traditionally, organizations used various methods of de-identification (anonymization or encryption of data) to distance data from real identities. Although, in recent years it was proved that even when data is anonymized, it can still be re-identified and attributed to specific individuals (Tene & Polonetsky, 2012). A way to solve this problem was to treat all data as personally identifiable and subject to a regulatory framework. Although, doing so might discourage organizations from using de-identification methods and, therefore, increase privacy and security risks of accessing data.

Privacy and data protection laws are premised on individual control over information and on principles such as data and purpose minimization and limitation. Nevertheless, it is not clear that minimizing information collection is always a practical approach to privacy. Nowadays, the privacy approaches when processing activities seem to be based on user consent and on the data that individuals deliberately provide.

Privacy is undoubtedly an issue that needs further improvement as systems store huge quantities of personal information every day.

CLOUD COMPUTING CHALLENGES/ SECURITY

Data Protection;- Data Security is a crucial element that warrants scrutiny. Enterprises are reluctant to buy an assurance of business data security from vendors. They fear losing data to competition and the data confidentiality of consumers. In the cloud model, Service providers are responsible for maintaining data security and enterprises would have to rely on them. This could potentially put your company to great risk. Hence, you need to make absolutely sure that you choose the most reliable service provider, who will keep you

Data Recovery and Availability :- All business applications have service level agreements that are stringently followed. Operational teams play a key role in management of service level agreements and maintenance of applications. In production environments, operational teams support:

Appropriate clustering and Fail over
Data Replication
System monitoring
Maintenance (Runtime Governance)
Disaster recovery
Capacity and performance management

Management Capabilities:- There is huge potential to improve on the scalability and load balancing features provided today. The Scaling offerings and maintaining sufficient performance is a challenge, especially for software as a service provider, who must deliver over networks and environments that they do not necessarily control.

Regulatory and Compliance Restrictions:- Many industries and countries disallow data or asset transparency. Also, some cloud providers have had outages with disastrous results, so trust remains an issue. In order to meet such requirements, cloud providers need to setup a data center or a storage site exclusively within the country to comply with regulations. Having such an infrastructure may not always be feasible and is a big challenge for cloud providers.

Federation and Interoperability :- IT functions typically automate a contiguous business process - and will thus require service integration among cloud providers.

***Vendor lock-in and Data Management*:** Data ownership in the cloud is not clear cut. Nor is the process by which data is to be reclaimed from cloud provider systems.

Technical Issues:- Though, it is true that information and data on the cloud can be accessed anytime and from anywhere at all, there are times when this system can have some serious dysfunction. We should be aware of the fact that this technology is always prone to outages and other technical issues. Even the best cloud service providers run into this kind of trouble, in spite of keeping up high standards of maintenance. Besides, we will need a very good internet connection to be logged onto the server at all times.

Prone to Attack :- Storing information in the cloud could make your company vulnerable to external hack attacks and threats. As you are well aware, nothing on the internet is completely secure and hence, there is always the lurking possibility of stealth of sensitive data.

CONCLUSION

This is an age of big data and the emergence of this field of study has attracted the attention of many practitioners and researchers. Considering the rate at which data is being created in the digital world, big data analytics and analysis have become all the more relevant. Moreover, most of this data is already on the cloud. Therefore, shifting big data analytics to the cloud framework is a viable option.

The cloud provides many options for the everyday computer user as well as large and small businesses. However, with this increased ease also come drawbacks. We have less control over who has access to our information and little or no knowledge of where it is stored. We also must be aware of the security risks of having data stored on the cloud. Cloud computing is one avenue for this move into the future. It can bring several benefits for libraries and give them a different future

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COMPARATIVEANALYSIS OF CLUSTERING TECHNIQUES BASED ON VALIDITY MEASURES

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ABSTRACT

clustering is one of the important aspects for analyzing patterns, unsupervised learning, text mining, information retrieval and many other domains related to analysis, marketing, and data construction. In recent years a lot of research is made on clustering. In this paper, we are going to study multiple clustering methods used for analysis of text mining for e-commerce data. These techniques will help in finding patterns in the buying behavior of the user as well as their preferences on products. This data will help in marketing and analyze the productivity of a product. The techniques presented will be compared on the basis of Precision, Recall, Fallout, Accuracy and Compactness.

Keywords: *Clustering, Data Mining, Text mining, Precision, Recall, Fallout, Accuracy, Compactness.*

INTRODUCTION

With the developments in technology, it is currently possible to keep large numbers of records in repositories cost-effectively. It is very difficult to see the appropriate documentation from all of these massive series. Text mining is the method of extracting the top quality of information from these large text corpus. There are numerous Text exploration techniques available for dealing with this wide range of records these are for instance facts extraction, clustering, classification, categorization, summarization, concept linkage etcetera. Clustering was a method of grouping a collection of files into significant clusters with highest intra-class similarity and lower inter-class similarity [1]. There are many solutions of clustering including information mining, image processing, economics, bioinformatics, pattern identification etc.

Figure 1 illustrates the methods of Text mining processes which starts with gathering text papers from different sources after that preprocessing are applied to washed or format the data.

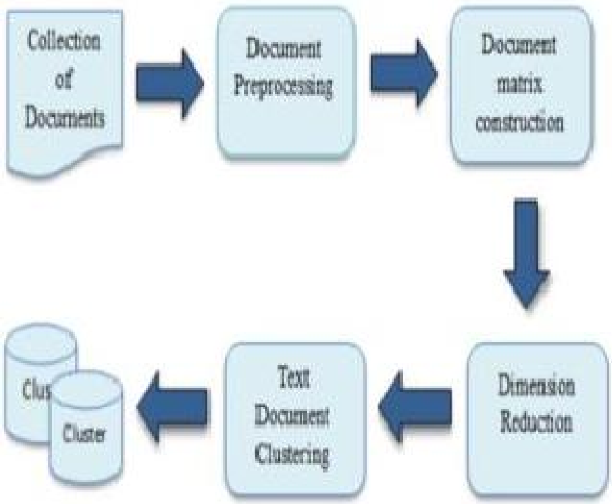


Figure 1: Text mining using clustering stage process.

The process starts with acollection of documents,some of the databases of text documents are available like iris. Once the data is found it is preprocessed. The preprocessing is divided into three stages. In the first stage is the tokenization [1], where the sentences are broken into individual token also known as words. In the second stage stop words like pronoun, articles, prepositions etc. are removed from the data.Lastly, Stemming is done, where the removal of prefix and suffix from the features that is searching for the root word for each word filtering results.

The second step in clustering is making a space model. It contains the word and its weight in the document, for example, V= {d1, d2,…..,dn}. A vector d is represented as d= {w1, w2,….,wn} where wi denotes the term weight. The third step is to reduce thedimensionality of the system this is done to remove the unwanted features from the list of the features extracted and lastly the documents are clustered. In this paper, we are going to learn about various methods used for clustering text data the next section explained a few of the techniques following with its analysis on the basis of various notations and finally the paper is concluded with theconclusion.

TECHNIQUES

In this section of the paper, we are going to learn a few clustering techniques for performance analysis:

A. K-Means

Clustering algorithms are broadly employed for image segmentation and database organization group that is clustering images whose feature vectors are similarly centered on similarity judgmentstandard while separating the dissimilar images. Hierarchical [2] and clustering that is partitional the 2 major sets of clustering algorithms. Hierarchical clustering algorithm finds nested clusters recursively in a choice of agglomerative mode or perhaps in divisive mode. The agglomerative mode is starting from the own cluster`s data point and merging the essential similar couple of clusters successfully to be able to form a cluster hierarchy and mode that is divisive beginning with data points of just one cluster and repeatedly dividing each cluster into thesmaller cluster. Partitional clustering algorithm finds all of the clusters at precisely the same time as a data for partition plus it will not impose hierarchical structure whereas hierarchical clustering algorithm does impose a structure that is hierarchical. In thehierarchical algorithm, theinput is a similarity that is n*n, where n could be thenumber of objects to be clustered. In partitional algorithms, theinputmay bea n*d similarity matrix where n could be the number objects embedded in d-dimensional feature space or perhaps the input may bea similarity complex that is n*n. It ought to be noted that a similarity matrix can be simply produced by a pattern matrix but thederivation of pattern matrix from similarity matrix requires ordination methods such as for example multi-dimensional scaling.

Single-link and complete-link would be the most well-known algorithm that is hierarchical the best, therefore, the most well-knownpartitional algorithm are K-means. K-means is just one of the most widely use clustering algorithm since partitional algorithms are preferred more in pattern recognition as a result of the data that are available. The primary reasons behind its popularity are ease of implementation, efficiency, simplicity and empirical success.

B. K-Medoids Clustering Algorithm:

The final representative objects are called as Medoids in the cluster. It is based on Partitioning aroundMedoidswhich starts by searching a small set of medoidsand updates the set when finds such a medoid which in more efficient that is it improves the total distance of resulting cluster. PAM [2] is very efficient with small data set but gives average results when the datasets are large. It was first introduced by Kaufman and Rousseeuw. The K-Medoids starts with thereal object to represent thecluster. The algorithm starts with selecting k representative object arbitrarily. Then each pair of non-selected items in the list h and the selected item I, which will help in calculating the swapping cost TC_{ih}. For each pair of i and h if the $TC_{ih}$is less than 0 then the value is replaced by h. then assign each non-selected object to the most similar representative object repeat the steps until there is no new addition to the list.

The major disadvantage of Pam is that it is more robust than k-means when there is a presence of noise, extreme means, and outliers as the medoidsare not affected. The PAM doesn't scale well when a large dataset is tested. The complexity of each iteration is O(k(n-k)2).

C. BIRCH:

BIRCH [3] or Balanced Iterative Reducing and Clustering using Hierarchies was introduced by Zhang, Ramakrishnan, and Livny. It incrementally constructs a tree of cluster feature for a hierarchical data structure for multiphase clustering. It contains two phases,

Phase 1: it starts with scanning the DB to build an internal memory CF, it is built so that a multi-level compression of the data is preserved using the inherent clustering structure of data.

Phase 2: A clustering algorithm is applied to leaf nodes to form the cluster.

The main advantage of the algorithm is that it can scale linearly that is I can scan for a good cluster with a single scan and improves the quality of the cluster by again running additional scans. The technique also has a weakness that is it can only handle numeric data and is also sensitive to the order of records. The clustering feature in BIRCH is shown as follows:

Clustering Feature: CF = (N, LS, SS)

N: Number of data points

LS: $\sum_{i=1}^{N} = Xi$
SS: $\sum_{i=1}^{N} = Xi^2$

D. The ROCK Algorithm:

Robust Clustering using linKs or ROCK [3] is one of the clustering algorithm introduced by S. Guha, R. Rastogi& K. Shim in ICDE. The base on which ROCK stands which make it a unique algorithm is that the clustering was done is not based on thedistance between the items of the clusters instead it uses links to measure similarity and proximity. It not only calculates the similarity of the node tested but also calculates the similarity of the neighbors. It is assumed that if two points are closer together if they share some of their neighbors.

The algorithm follows sampling based clustering that is divisions are made and then they are optimized. The algorithm starts by drawing a random sample. Once the sample is drawn it is then sent to a cluster based on the link. Once clustering is done the data in the disk is labeled. It is a bit complex algorithm the computational complexity of the algorithm is

$O(n^2 + n m_m m_n + n^2 \log n)$

To understand the links concept let us take the following example.

Links: # of common neighbors

C1 <a, b, c, d, e>: {a, b, c}, {a, b, d}, {a, b, e}, {a, c, d}, {a, c, e}, {a, d, e}, {b, c, d}, {b, c, e}, {b, d, e}, {c, d, e}

4C2 <a, b, f, g>: {a, b, f}, {a, b, g}, {a, f, g}, {b, f, g}

Let T 1
= {a, b, c}, T 2 = {c, d, e}, T3 = {a, b, f}

link(T 1, T 2) = 4, since they have 4 common neighbors □ {a, c, d}, {a, c, e}, {b, c, d}, {b, c, e}.

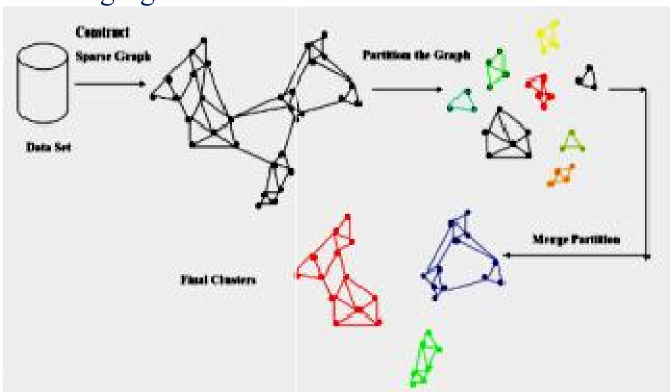
E. CHAMELEON:

This algorithm was proposed by G. Karypis, E.H. Han, and V. Kumar. In this technique, the similarity of the system is based on a dynamic model. Two nodes are merged into a single cluster only when the interconnectivity and closeness (proximity) between them is relatively high within the clusters present. Cure ignores information about theinterconnectivity of the objects, Rock ignores information about the closeness of two clusters. It is also a two-phase algorithm.

Phase 1: Use a graph partitioning algorithm: cluster objects into a large number of relatively small sub-clusters

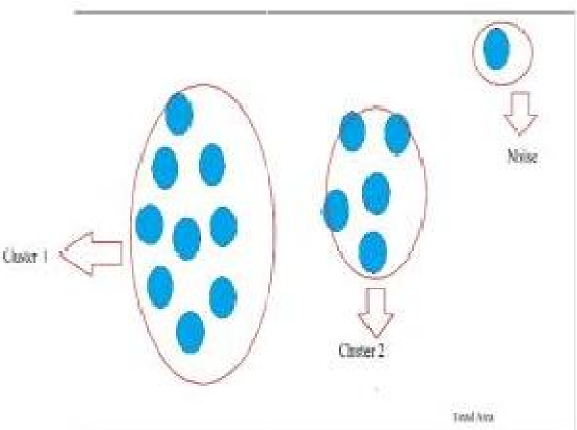
Phase 2. Use an agglomerative hierarchical clustering algorithm: find the genuine clusters by repeatedly combining these sub-clusters

The framework of CHAMELEON is shown in the following figure:



F. Density-Based Spatial Clustering of Applications with Noise:

DBSCAN or Density-Based Spatial Clustering of Applications with Noise is based on thedensity-based notion of a cluster. It means that a cluster is processed as a maximal set of pairs connect with density. In this technique the cluster can be of any arbitrary size with a few outlier as shown in the figure below:



As observed there are two clusters with MinPts = 5 and Eps = 1cm and with one noise/outlier value. The DBSCAN algorithm starts with selecting an arbitrary point p. Once a point is selected we have to retrieve all the points that are density specific that all the points with theless density difference are present in one cluster with respect to Eps and MinPts value. Then if the selected p is a core point the cluster is finished. But if the p is a border point density related points are hard to find and algorithm chooses the next point. This process is continued until all the points are processed. And finally,clusters are formed.

G. Model-Based Clustering:

The fit is achieved by finding similarity between the data and some mathematical model. This technique is based on assumptions. One of the important technique of this type is the Expectation Maximization. This technique is amongst the popular iterative refinement algorithm which is an extension to the traditional K-means algorithm. Each cluster item is given a weight according to the data based on which new means are calculated. The technique starts with an initial estimate of the parameter vector and it iteratively re-scores the patterns against the mixture density produced by the parameter vector. The re-score is used for updating of the parameters and the patterns belonging to clusters are places.

The algorithm starts with initializing random K centers ad iteratively refine the cluster based on the following formula:

$$P(X_i \in C_k) = p(C_k|X_i) = \frac{p(C_k)p(X_i|C_k)}{p(X_i)}$$

And the Maximization is done using the following formula:

$$m_k = \frac{1}{N}\Sigma_{i=1}^{N}\frac{X_i P(X_i \in C_k)}{\Sigma_j P(X_i \in C_j)}.$$

H. CLIQUE:

It was introduced by Agrawal, Gehrke, Gunopulos, Raghavan and is also known as clusteringinQUEst. It automatically identifies subspace of a high dimensional data space that allows better clustering. The clique is a mixture of both density and grid based systems. Therefore it partitions each dimension into the same number of equal length interval also the partitions is made such that an m-dimensional data space into non-overlapping rectangular units. The cluster units are much denser since the fraction of total data points contained in the unit exceeds the input model parameter. The cluster created is a maximal set of connected dense units within a subspace.

The major steps of CLIQUE so the data space is partitioned and find the number of points that lie inside each cell of the partition. Once done we have to identify the subspaces that contain cluster the Apriori technique. To identify the cluster determine the dense units in all subspaces of the interests and also the connected dense units in the interest space. Lastly, we have to generate aminimal description for the clusters, to find the descriptor determine the maximal region that covers the cluster of connected nodes of each other also the minimum cover of each cluster is determined. The major strength of the technique is that it automatically finds subspaces of the highest dimensional clusters. Also, it doesn't get affected by theorder of records or any kind of data distribution. Lastly, the technique can scale linearly. Whereas the weakness of the technique is that the accuracy of the clustering result may be degraded at the expense of simplicity of the method.

PERFORMANCE EVALUATION

There are a few parameters [11] [12] on which the performance of the performance of clustering technique which is explained as follows:

A. Precision:

Accuracy is the portion of the archives recovered that are significant to the client's data. Accuracy considers all recovered records. It can likewise be assessed at a given cut-off rank, considering just the highest outcomes returned by the framework. This measure is ascertained as given beneath:

$$Precision\ P(i,j)\frac{Nij}{Nj}$$

B. Recall:

The recall is the division of the archives that are important to the inquiry that is effectively recovered. In parallel grouping, recall is regularly called affectability. So it can be taken a gander at as the likelihood that a significant record is recovered by the question. It is insignificant to accomplish recall of 100% by giving back all records because of any question. In this way recall alone is insufficient but rather one needs to quantify the quantity of non-pertinent records likewise, for instance by processing the exactness. The recall measure can be figured as takes after.

$$Recall\ R(i,j)\frac{Nij}{Ni}$$

C. Fall-out:

The extent of non-significant archives that are recovered, out of all non-important records is accessible. In twofold order, drop out is firmly identified with specificity and is equivalent to (1-specificity). It can be taken a gander at as the likelihood that a non-significant record is recovered by the inquiry. It is minor to accomplish drop out of 0% by returning zero reports because of any question. It can be measured as given beneath.

$$Fallout = \frac{n - \sum_{i=1}^{n} di}{L - R}$$

D. Accuracy:

Accuracy is the term in which it gauges the level of thevicinity of an amount to the amount's real genuine mark values. As such it is characterized as the quantity of precisely decided information objects of group results rather than the known genuine names separated by the aggregate number of cases in the dataset.

$$Accuracy = \frac{\sum_{i=1}^{k} Mi}{D}$$

E. Compactness:

Compactness is the estimation of normal separation between each combine of information items having a place with a similar bunch. Particularly the individuals from each bunch ought to be as close as could reasonably be expected. Consequently, it is expressed that the lower estimation of the smallness measure has a tendency to be the better bench design.

$$Compactness = \frac{1}{D} \sum_{k=1}^{k} n_k \left(\frac{\sum_{xi,xj \in Ck} d(xi,xj)}{n_k \; (n_k - 1)/2} \right)$$

The table below shows acomparative analysis of the techniques studied based on validity measure. These results are based on IRIS dataset.

Technique Name	Precision	Recall	Fall-out	Accuracy	Compactness
K-Means	0.95-0.98	0.85-0.92	0.85-0.90	0.90-0.95	0.70-0.75
K-Medoids	0.85-0.93	0.70-0.75	0.65-0.70	0.85-0.90	0.75-0.80
Agglomerative Approach	0.80-0.90	0.85-0.90	0.55-0.60	0.75-0.80	0.60-0.65
Divisive Approach	0.65-0.70	0.85-0.90	0.85-0.90	0.85-0.90	0.60-0.65
BIRCH	0.70-0.80	0.80-0.90	0.55-0.60	0.70-0.75	0.60-0.65
ROCK	0.75-0.85	0.80-0.90	0.60-0.65	0.75-0.80	0.65-0.70
CHAMELEON	0.70-0.75	0.80-0.90	0.60-0.70	0.75-0.80	0.60-0.70
DBSCAN	0.75-0.85	0.70-0.80	0.70-0.75	0.80-0.90	0.70-0.80
Modal Based	0.75-0.80	0.75-0.80	0.65-0.70	0.80-0.90	0.70-0.0
CLIQUE	0.85-0.90	0.70-0.80	0.75-0.80	0.80-0.90	0.60-0.70

From the above table, we can observe that K-Means is one of the best algorithmswhich has the best values for precision, recall, fallout, accuracy and compactness. The values also change the type of data input but K-means remains the best.

CONCLUSION

From our research, we find that K-Means technique is better for clustering of data, as it gives better performance in terms of precision, recall and other statistics. Other algorithms might be good for specific applications, but K-Means outperforms them for any general purpose applications. We intend to use K-Means as a base algorithm for our further research. Empty cluster formation is a minor drawback of K-Means, but it can be resolved using Bisecting K-Means, which divides the datasets repeatedly into 2 clusters, and keeps on bisect clustering the larger cluster till the specified clusters are obtained. Thus, bisecting K-Means can also be used for further research.

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AN OVERVIEW ON ROLE OF VARIOUS PROTOCOLSIN ADAPTIVE ROUTING ALGORITHM.

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ABSTRACT

Along with the rapid development of the Internet, the theory and method of routing protocol design has become an important issue in the field of network. The routing algorithm is a major factor in the performance of routing environment. Routing algorithm mainly focuses on routing selection method to ensure the connection between the sender and the receiver during each session is optimal and effective. The purpose of the routing algorithm is to make decisions for the router concerning the best paths for data.We do not directly choose the algorithm that your router uses. Rather, the routing protocol we choose for our network determines which algorithm will use. The routing algorithm cannot be changed. The only way to change it is to change routing protocols.

This paper focus on types of adaptive routing algorithm and adaptive routing protocols their types, working style, advantages, limitation and comparison.

keywords: *Router, routing, routing table, routing protocol, routing algorithm, adaptive routing protocol, Distance Vector Routing Protocols, hops, distance metric, RIP, IGRP, Link State Routing Protocols, BGP, OSPF, IS-IS, IGRP.*

INTRODUCTION

The Internet is made of communication links and packet switching nodes named routers. Routers are equipped with buffers that hold packets during congestion and feed output links with packets during underutilization[1].

Data communication networks generally contain routing tables at each of the nodes of the network. We consider the routing tables at a given node to specify the fraction of traffic for each destination that should travel over each of the outgoing links from the given node [2]. Routing is the process of getting information packets where they need to go. Routing is a surprisingly complicated task, and there are a number of different algorithms used to find the shortest route between two points[3].

A routing protocol uses software and routing algorithms to determine optimal network data transfer and communication paths between network nodes. Routing protocols facilitate router communication and overall network topology understanding.

A routing protocol is also known as a routing policy.[4]

The routing algorithm is stored in the router's memory. The routing algorithm is a major factor in the performance of routing environment. The purpose of the routing algorithm is to make decisions for the router concerning the best paths for data. The router uses the routing algorithm to compute the path that would best serve to transport the data from the source to the destination.

Adaptive routing protocols play an important role in today's networks. Several important benefits that adaptive routing protocols provide. In many networks, dynamic routing protocols are typically used with static routes.[5]

The two major types of routing algorithms are distance vector and link-state. Distance vector algorithms generally use one metric to calculate the lowest cost from source to destination. Link-state protocols use multiple metrics to calculate the shortest distance from a source to a destination one hop at a time.

A variety of parameters need to be investigated before deciding on that. Or investigations should include bandwidth prerequisite, reliability, convergence speed, network architecture and much more.We should know the details of the best routing decision process, and the details behind the operation of the different routing.

DISTANCE VECTOR ROUTING PROTOCOLS

Distance Vector routing protocols base their decisions on the best path to a given destination based on the distance. Distance is usually measured in hops, though the distance metric could be delay, packets lost, or something similar. If the distance metric is hop, then each time a packet goes through a router, a hop is considered to have traversed. The route with the least number of hops to a given network is concluded to be the best route towards that network.

The vector shows the direction to that specific network. Distance vector protocols send their entire routing table to directly connected neighbors. Examples of distance vector protocols include RIP - Routing Information Protocol and IGRP - Interior Gateway Routing Protocol.

In distance vector protocols, each router sends its neighbours a list of all known networks along with its own distance to each one of these networks. Because in software engineering, a list is also called a vector, the list of networks and distances is sometimes called the vector of networks and distances, hence the name distance vector routing protocol.

Distance vector routing protocols do not advertise the entire network topology, and with a distance vector routing protocol, none of the routers in the network knows how the network looks like in its entirety. A router running a distance vector routing protocol only knows its directly connected neighbours, and it knows about the lists of networks these neighbours have advertised, but it does not really know where those networks really are.

a) The Routing Information Protocol (RIP) is one of the oldest distance-vector routing protocols which employ the hop count as a routing metric. RIP prevents routing loops by implementing a limit on the number of hops allowed in a path from source to destination. The largest number of hops allowed for RIP is 15, which limits the size of networks that RIP can support.

RIP implements the split horizon, route poisoning and hold down mechanisms to prevent incorrect routing information from being propagated.

In RIPv1 router broadcast updates with their routing table every 30 seconds. In the early deployments, routing tables were small enough that the traffic was not significant. As networks grew in size, however, it became evident there could be a massive traffic burst every 30 seconds, even if the routers had been initialized at random times.

In most networking environments, RIP is not the preferred choice for routing as its time to converge and scalability are poor compared to EIGRP, OSPF, or IS-IS. However, it is easy to configure, because RIP does not require any parameters unlike other protocols.

RIP uses the User Datagram Protocol (UDP) as its transport protocol, and is assigned the reserved port number 520[6].

The routing metric used by RIP counts the number of routers that need to be passed to reach a destination IP network. The hop count 1 denotes a network that is directly connected to the router. 16 hops denote a network that is unreachable, according to the RIP hop limit [7].

There are three standardized versions of the Routing Information Protocol: RIPv1 and RIPv2 for IPv4, and RIPng for IPv6.

LIMITATIONS

The hop count cannot exceed 15, or routes will be dropped.

Variable Length Subnet Masks are not supported by RIP version 1 (which is obsolete).

RIP has slow convergence and count to infinity problems.

LINK STATE ROUTING PROTOCOLS

Link state protocols are also called **shortest-path-first protocols**. Link state routing protocols have a complete picture of the network topology. Hence they know more about the whole network than any distance vector protocol.

Three separate tables are created on each link state routing enabled router. One table is used to hold details about directly connected neighbors, one is used to hold the topology of the entire internetwork and the last one is used to hold the actual routing table.

In link state routing protocols, each router describes itself and its interfaces to its directly connected objects; these objects can be neighbouring adjacent routers, or they can be directly attached networks. This information is passed unchanged from one router to another, so that in the end, every router knows about every other router, its interfaces and what exactly they connect to. In essence, in link state routing protocols, each router knows the entire network topology down to every single router and every single interconnection, also called the state of a link, hence the name link state routing protocol.

So these protocol types differ in what they know about the network and what information they use to compute the routing table.

Link state routing protocols allow a router to have a complete map of the network, and use specific algorithms to find shortest paths to every object in the network, including destination IP networks.

Both distance vector and link state routing protocols is due to historical reasons: Originally, distance vector protocols were much easier to design and implement in software, and so they were very popular. However, without some clever ideas which haven't been invented until early 90's, they had some drawbacks, especially in terms of how fast they reacted to a change in the network and how they avoided creating a routing loop. In the meantime, another approach to routing protocol design, the link state approach, was developed. Link state protocols are much more complex and require more processing power and memory, but as the resources in routers improved over time, link state routing protocols slowly took over.

B. Open Shortest Path First (OSPF) is a routing protocol for Internet Protocol (IP) networks. It uses a link state routing (LSR) algorithm and falls into the group of interior gateway protocols (IGPs), operating within a single autonomous system (AS). OSPF detects changes in the topology, such as link failures, and converges on a new loop-free routing structure within seconds. It computes the shortest-path tree for each route using a method based on Dijkstra's algorithm. The OSPF routing policies for constructing a route table are governed by link metrics associated with each routing interface. Cost factors may be the distance of a router, data throughput of a link, or link availability and reliability, expressed as simple unit less numbers. This provides a dynamic process of traffic load balancing between routes of equal cost.

OSPF does not use a transport protocol but encapsulates its data directly in IP packets using protocol number 89. OSPF implements its own transport layer error detection and correction functions. OSPF uses multicast addressing for distributing route information within a broadcast domain.

ROUTER RELATIONSHIPS

OSPF supports complex networks with multiple routers, including backup routers, to balance traffic load on multiple links to other subnets. Neighboring routers in the same broadcast domain or at each end of a point-to-point link communicate with each other via the OSPF protocol. Routers form adjacencies when they have detected each other. This detection is initiated when a router identifies itself in a Hello protocol packet. Upon acknowledgment, this establishes a two-way state and the most basic relationship. The routers in an Ethernet or Frame Relay network select a Designated Router (DR) and a Backup Designated Router (BDR) which act as a hub to reduce traffic between routers. OSPF uses both unicast and multicast transmission modes to send "Hello" packets and link state updates.

As a link state routing protocol, OSPF establishes and maintains neighbor relationships for exchanging routing updates with other routers. The neighbor relationship table is called an adjacency database. Two OSPF routers are neighbors if they are members of the same subnet and share the same area ID, subnet mask, timers and authentication.

APPLICATIONS

OSPF was the first widely deployed routing protocol that could converge a network in the low seconds, and guarantee loop-free paths, in contrast, can be tuned for lower overhead in a stable network, the sort more common in ISP than enterprise networks. OSPF can provide better load-sharing on external links than other IGPs.

C.The **IS-IS protocol** is defined as an international standard within the Open Systems Interconnection (OSI) reference design.

IS-IS is a link-state routing protocol, operating by reliably flooding link state information throughout a network of routers. Each IS-IS router independently builds a database of the network's topology, aggregating the flooded network information. Like the OSPF protocol, IS-IS uses Dijkstra's algorithm for computing the best path through the network. Packets are then forwarded, based on the computed ideal path, through the network to the destination.

IS-IS routers build a topological representation of the network. This map indicates the subnets which each IS-IS router can reach, and the lowest-cost (shortest) path to a subnet is used to forward traffic.

IS-IS differs from OSPF in the way that "areas" are defined and routed between. IS-IS routers are designated as being: Level 1 (intra-area); Level 2 (inter area); or Level 1-2 (both). Routing information is exchanged between Level 1 routers and other Level 1 routers of the same area, and

Level 2 routers can only form relationships and exchange information with other Level 2 routers. Level 1-2 routers exchange information with both levels and are used to connect the inter area routers with the intra area routers.

IS-IS also does not require Area 0 (Area Zero) to be the backbone area through which all inter-area traffic must pass. The logical view is that OSPF creates something of a spider web or star topology of many areas all attached directly to Area Zero and IS-IS by contrast creates a logical topology of a backbone of Level 2 routers with branches of Level 1-2 and Level 1 routers forming the individual areas.

D) Interior Gateway Routing Protocol (IGRP)/ Enhanced Interior Gateway Routing Protocol (EIGRP)

Static networks do not implement adaptive routes, opting instead for static or fixed routes. So, if one of the routes is failed, the packet transfer will either fail or the packet has to wait until the route failure is rectified. This proves that the effective implementation of adaptive routes is vital in routing.

An adaptive route is selected based on routing criteria, algorithms and priorities assigned to different network devices[8].

RESULTS AND CONCLUSION

Every routing protocol uses a routing algorithm to facilitate the decision-making process for routers. A routing algorithm is a formula used to calculate the best path between two networks. The algorithm uses information gathered by the routing protocols, known as metrics, to compute the best path. Routers use routing algorithms to find the best route to a destination. Based on how routers gather information about the structure of a network and their analysis of information to specify the best route, we have two major routing algorithms: global routing algorithms and decentralized routing algorithms.

Several protocols are available to facilitate routing via adaptive routes. Some of them are:
Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Intermediate System To Intermediate System (IS-IS), Interior Gateway Routing Protocol (IGRP)/ Enhanced Interior Gateway Routing Protocol (EIGRP)

OSPF is the most popular dynamic routing protocol in use today. It is an open protocol, so . that any router or server operating system can run OSPF. IT is a full-featured routing protocol and can be complex, but it can also scale to any size of network.

EIGRP is a Cisco proprietary protocol. Only Cisco devices run EIGRP. EIGRP is a full-featured routing protocol, similar to OSPF. EIGRP has some great features, but unless you can guarantee that you will always have an all-Cisco network., With EIGRP, the metric used to select the best route is calculated using a formula that takes into account the bandwidth, reliability, load and delay of the link.

RIP is also an open source protocol. RIP is the simplest and easiest routing protocol to configure, but it also has fewer features than OSPF and is limited to routing for a network with fewer than 15 hops. RIP works very well for a small network that doesn't plan on growing large, however. Another great thing about RIP is that it is commonly supported by even small routers and firewalls.And, in a class by itself, there is Border Gateway Protocol (BGP):

BGP (Border Gateway Protocol) is the routing protocol of the Internet. BGP is an Exterior Gateway Protocol (EGP). What that means is that BGP is used by routers that make routing decisions on the Internet. BGP is a path-vector protocol, and it selects the best route, unlike other routing protocols.

Link state protocols send information about directly connected links to all the routers in the network. Examples of Link state routing protocols include OSPF - Open Shortest Path First and IS-IS - Intermediate System to Intermediate System.

There are also routing protocols that are considered to be hybrid in the sense that they use aspects of both distance vector and link state protocols. EIGRP is one of those hybrid routing protocols.

Examples of distance vector protocols include RIP - Routing Information Protocol and IGRP - Interior Gateway Routing Protocol.

Nowadays, we have extremely fine routing protocol implementations from both worlds - **EIGRP** is a state-of-the-art distance vector routing protocol. The fundamental difference between distance vector and link state routing protocols is in the nature of the routing information routers send to each other.

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CRYPTOGRAPHY ENCRYPTION AND COMPRESSION TECHNIQUES

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ABSTRACT

Data is any type of stored digital information. Security is about the protection of assets. Data security refers to protective digital privacy measures that are applied to prevent unauthorized access to computers, personal databases and websites. Cryptography is evergreen and developments. Cryptography protects users by providing functionality for the encryption of data and authentication of other users. Compression is the process of reducing the number of bits or bytes needed to represent a given set of data. It allows saving more data. Cryptography is a popular ways of sending vital information in a secret way. There are many cryptographic techniques available and among them AES is one of the most powerful techniques. The scenario of present day of information security system includes confidentiality, authenticity,integrity, non repudiation.The security of communication is a crucial issue on World Wide Web. It is about confidentiality, integrity, authentication during access or editing of confidential internal documents.

Keywords: *Data Encryption and decryption, Compression, Cryptography Concept, Security, Integrity.*

INTRODUCTION

To secure the data, compression is used because it use less disk space (saves money), more data can be transfer via internet. It increase speed of data transfer from disk to memory. Security goals for data security are Confidential, Authentication, Integrity, and Non-repudiation. Data security delivers data protection across enterprise. Information security is a growing issue among IT organizations of all sizes. To tackle this growing concern, more and more IT firms are moving towards cryptography to protect their valuable information. In addition to above concerns over securing stored data, IT organizations are also facing challenges with ever increasing costs of storage required to make sure that there is enough storage capacity to meet the organization’s current and future demands. Data compression is known for reducing storage and communication costs. It involves transforming data of a given format, called source message to data of a smaller sized format called code word. Data encryption is known for protecting information from eavesdropping. It transforms data of a given format, called plaintext, to another format, called cipher text,using an encryption key. Currently compression and encryption methods are done separately. Cryptography prior to the modern age was effectively synonymous with encryption, the conversion of information from a readable state to apparent nonsense. Modern cryptography is heavily based on mathematical theory and computer science practice; cryptographic algorithms are designed around computational hardness assumptions, making such algorithms hard to break in practice by any adversary. It is theoretically possible to break such a system, but it is infeasible to do so by any known practical means. The growth of cryptographic technology has raised a number of legal issues in the information age. Cryptography's potential for use as a tool for espionage and sedition has led many governments to classify it as a weapon and to limit or even prohibit its use and export.

CRYPTOGRAPHY

The art of cryptography is considered to be born along with the art of writing. As civilizations evolved,human beings got organized in tribes, groups, and kingdoms. This led to the emergence of ideas such as power, battles, supremacy, and politics. These ideas further fueled the natural need of people to communicate secretly with selective recipient which in turn ensured the continuous evolution of cryptography as well. The roots of cryptography are found in Roman and Egyptian civilizations.The importance of information and communication systems for society and the global economy is intensifying with the increasing value and quantity of data that is transmitted and stored on those systems. At the same time those systems and data are also increasingly vulnerable to a variety of threats, such as unauthorized access and use, misappropriation, alteration, and destruction.The hiding of information is called encryption, and when the information is unhidden, it is called decryption. A cipher is used to accomplish the encryption and decryption. Merriam-Webster's Collegiate Dictionary defines cipher as —a method of transforming a text in order to conceal its meaning. The information that is being hidden is called plaintext; once it has been encrypted, it is called cipher text. To hide any data two techniques are mainly used one is Cryptography other is Steganography. In this paper we use Cryptography. Cryptography is the science of protecting data, which provides methods of converting data into unreadable form, so that Valid User can access Information at the Destination. Cryptography is the science of using mathematics to encrypt and decrypt data.

Basic Terminology of Cryptography

Computers are used by millions of people for many purposes. such as banking, shopping, military, student records,etc.. Privacy is a critical issue in many of these applications, how are we need to make sure that an unauthorized parties cannot read or modify messages.

Cryptography is the transformation of readable and understandable data into a form which cannot be understood in order to secure data. Cryptography refers exactly to the methodology of concealing the content of messages, the word cryptography comes from the Greek word "Kryptos", that means hidden, and "graphikos" which means writing. The information that we need to hide, is called plaintext , It's the original text, It could be in a form of characters, numerical data, executable programs, pictures, or any other kind of information, The plaintext for example is the sending of a message in the sender before encryption, or it is the text at the receiver after decryption. The data that will be transmitted is called cipher text , it's a term refers to the string of "meaningless" data, or unclear text that nobody must understand, except the recipients. it is the data that will be transmitted Exactly through network, Many algorithms are used to transform plaintext into cipher text.

Cipher is the algorithm that is used to transform plaintext to cipher text, This method is called encryption, in other words, it's a mechanism of converting readable and understandable data into "meaningless" data. The Key is an input to the encryption algorithm, and this value must be independent of the plaintext, This input is used to transform the plaintext into cipher text, so different keys will yield different cipher text, In the decipher side, the inverse of the key will be used inside the algorithm instead of the key.

COMPUTER SECURITY it's a generic term for a collection of tools designed to protect any data from hackers, theft, corruption, or natural disaster while allowing these data to be available to the users at the same time. The example of these tools is the antivirus program.

Network security refers to any activity designed to protect the usability, integrity, reliability, and safety of data during their transmission on a network, Network security deals with hardware and software. The activity can be one of the following anti-virus and anti-spyware, firewall, Intrusion prevention systems, and Virtual Private Networks.

Internet Security is measures and procedures used to protect data during their transmission over a collection of interconnected networks, while information security is about how to prevent attacks, and to detect attacks on information-based systems.

Cryptography Goals

By using cryptography many goals can be achieved, These goals can be either all achieved at the same time in one application, or only one of them.

These goals are:

1. Confidentiality: it is the most important goal, that ensures that nobody can understand the received message except the one who has the decipher key.

2. AUTHENTICATION: it is the process of proving the identity, that assures the communicating entity is the one that it claimed to be. This means that the user or the system can prove their own identities to other parties who don't have personal knowledge of their identities.

3. DATA INTEGRITY: its ensures that the received message has not been changed in any way from its original form. The data may get modified by an unauthorized entity intentionally or accidently. Integrity service confirms that whether data is intact or not since it was last created, transmitted, or stored by an authorized user. This can be achieved by using hashing at both sides the sender and the recipient in order to create a unique message digest and compare it with the one that received.

4. NON-REPUDIATION: it is mechanism used to prove that the sender really sent this message, and the message was received by the specified party, so the recipient cannot claim that the message was not sent. For example, once an order is placed electronically, a purchaser cannot deny the purchase order, if non-repudiation service was enabled in this transaction.

5. ACCESS CONTROL: it is the process of preventing an unauthorized use of resources. This goal controls who can have access to the resources, If one can access, under which restrictions and conditions the access can be occurred, and what is the permission level of a given access.

DATA ENCRYPTION

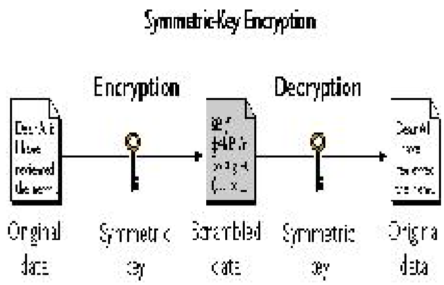
A data encryption is a random string of bits created explicitly for scrambling and unscrambling data. Data encryption is designed with algorithms intended to ensure that every key is unpredictable and unique. Cryptography uses two types of keys: symmetric and asymmetric. Symmetric keys have been around the longest ; they utilize a single key for both the encryption and decryption of the cipher text. This type of key is called a secret key. Secret-key ciphers generally fall into one of two categories: stream ciphers or block ciphers. A block cipher applies a private key and algorithm to a block of data simultaneously, whereas a stream cipher applies the
key and algorithm one bit at a time. Most cryptographic processes use symmetric encryption to encrypt data transmissions but use asymmetric encryption to encrypt and exchange the secret key. Symmetric encryption, also known as private key encryption, uses the same private key for both encryption and decryption. The risk in this system is that if either party loses the key or the key is intercepted, the system is broken and messages cannot be exchanged securely.

DATA DECRYPTION

One of the foremost reasons for implementing an encryption-decryption system is privacy. As information travels over the World Wide Web, it becomes subject to access from unauthorized individuals or organizations. Decryption is the process of taking encoded or encrypted text or other data and converting it back into text that you or the computer can read and understand. This term could be used to describe a method of un-encrypting the data manually or with un-encrypting the data using the proper codes or keys. Encryption is the process of translating plain text data (*plaintext*) into something that appears to be random and meaningless (*ciphertext*). Decryption is the process of converting ciphertext back to plaintext.

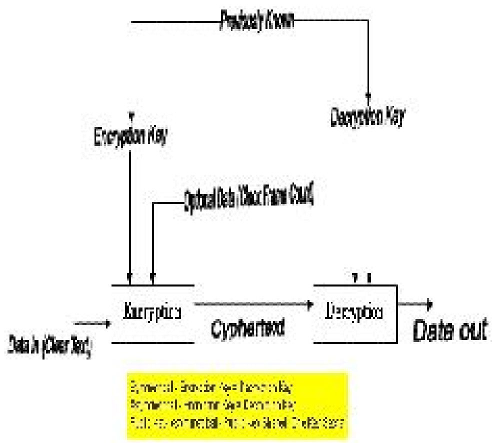
SYMMETRIC KEY CRYPTOGRAPHY

In symmetric key cryptography is also known as private-key cryptography, a secret key may be held by one person or exchanged between the sender and the receiver of a message. If private key cryptography is used to send secret messages between two parties, both the sender and receiver must have a copy of the secret key.



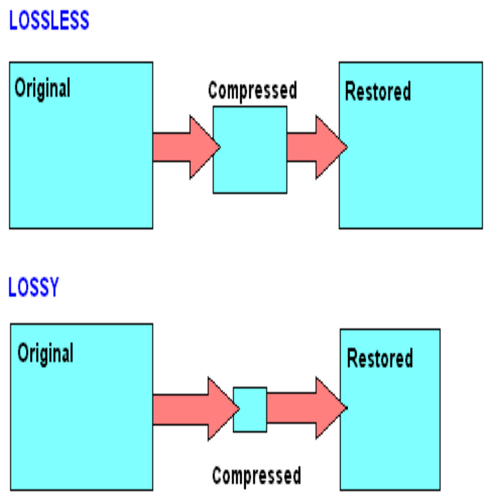
ASYMMETRIC KEY CRYPTOGRAPHY

In the two-key system is also known as the public key system, one key encrypts the information and another, mathematically related key decrypts it. The computer sending an encrypted message uses a chosen private key that is never shared and so is known only to the sender. If a sending computer first encrypts the message with the intended receiver's public key and again with the sender's secret, private key, then the receiving computer may decrypt the message, first using its secret key and then the sender's public key.Using this public-key cryptographic method, the sender and receiver are able to authenticate one another as well as protect the secrecy of the message.



COMPRESSION

Data compression offers an attractive approach for reducing communication costs by using available bandwidth effectively. Compression algorithms reduce the redundancy in data representation to decrease the storage required for that data. Over the last decade there has been an unprecedented explosion in the amount of digital data transmitted via the Internet, representing text, images, video, sound, computer programs etc.Data compression implies sending or storing a smaller number of bits. Compression is the reduction in size of data in order to save space or transmission time. Many methods are used for this purpose, in general these methods can be divided into two broad categories: Lossy and Lossless methods. Lossy Compression generally used for compress an images. In this original data is not identical to compressed data that means there is some loss e.g. Block Truncation Coding, Transform Coding, etc... Lossless Compression used for compress any textual data.



SUMMARY

Cryptography is used to ensure that the contents of a message are confidentiality transmitted and would not be altered. Confidentiality means nobody can understand the received message except the one that has the decipher key, and "data cannot be changed" means the original information would not be changed or modified.

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CLOUD COMPUTING TECHNOLOGY AND ITS IMPACT ON LIBRARIES

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ABSTRACT

Cloud computing and web collaboration are shaping twenty first century libraries and both the developments seem to be behind the newest developments in library services which are driving library automation. This paper discusses some of the basics of cloud computing with the aim of introducing aspects wich as ; challenges and risks of the model, types in the model, advantages nad disadvantages of the model.

Keywords *Cloud computing, cloud Models, Hybrid cloud, Community cloud, Private cloud*

1. INTRODUCTION

Cloud computing and web collaboration are shaping twenty first century libraries and both the developments seem to be behind the newest developments in library services which are driving library automation. This paper discusses some of the basics of cloud computing with the aim of introducing aspects such as: challenges and risks of the model, types in the model, advantages and disadvantages of the model. Cloud computing is not an exception in changing the world. Cloud computing provides us virtually unlimited and on-demand computing resources. The study aims to provide a means of understanding the mode! and exploring options available for complementing the technology and infrastructure needs. It also highlights the libraries in the environment of cloud computing with their challenges security. Cloud Computing, Cloud Models, Hybrid Cloud, Community Cloud, Private Cloud BPl. Introduction Cloud computing is a computing paradigm, where a large pool of systems are connected in private or public networks, to provide dynamically scalable infrastructure for application, data and file storage. In this .technology, information is permanently stored on the internet servers and it can be cached by the users temporarily. The cloud application is created using resources from more than one service and from more a . than one location. It is a subscription-based service where a person can obtain networked storage space and ' computer resources.

2. REVIEW OF LITERATURE.

Padhy and Mahapatra [2012) describes in their study that the basic principle of cloud computing entails the reduction of in-house data centre and

We can understand it with the example of a person's experience with email. If his email - client is rediffmail, yahoomail,Gmail etc, and he want to access his email firstly, he opens the web browser then goes to the email client, and log in. The most important part of the equation is having internet access. His email is not housed on his physical computer; he can access it through an internet connection, and access it anywhere. At any place he can check his email as long as he has access to the internet. His email is different than software installed on his computer, such as a word processing program. When he creates a document using word processing software, that document stays on the device he used to make it unless he physically : moves it. An email client is similar to how cloud computing works. Except instead of accessing just your email,.you can choose what information you have access to within the cloud.

Cloud computing has large prospective for libraries. Libraries may put more and more contents into the cloud. Using cloud computing user would be able to browse a physical shelf of books, CDs or DVDs or choose to take out an item or scan a bar code into his mobile device. All historical and rare documents would be scanned into a comprehensive, easily searchable database and would be accessible to any researcher. Many libraries already have online catalogues and share bibliographic data with OCLC. More frequent online catalogues are linked to consortium that share resources.

the delegation of a portion or all of the information technology infrastructure capability to a third party. Universities and Colleges are the core of innovation through their advanced research and development. Subsequently, Higher Institutions may benefit greatly by harnessing the power of cloud computing, including ccst cutting as well as all the different types of cloud services. They also discusses problems faced with digital library and development efforts to overcome that problem. Sanchati and Kulkarni [2011) found in their study that cloud computing is still in the initial stage now, impacts brought by cloud computing are obvious. With the introduction of cloud computing to 59th ILA International Conference on Managing Libraries in the Changing Information World: From Surviving to Thriving |2014university library, services of libraries will have a new rise in the near future. Services provided by libraries will become more user-centric, more professional and more effective, etc. The cloud computing techniques and methods applied to digital libraries, not only can improve the utilization rate of resources to address the imbalance in development between regions, but also can make more extensive use of cloud computing to our work life. Xiaona [2010) described cloud computing and analyzed the current status of user service models in university libraries. Then he proposed to improve current user service model with cloud computing and forward the bright prospect of user service models based on Cloud Computing.

3. TYPES OF CLOUD COMPUTING

As a home user or small business owner, you will most likely use public cloud services. There are different types of clouds that you can subscribe to depending on your needs.

• Public Cloud- In public cloud a core infrastructure made available to and shared by many. It can be accessed by any subscriber with an internet connection and access to the cloud space. Its applications, storage, and other resources are made available to the general public by a service provider. For example the Internet and Public Switched Telephone Network (PSTN) etc.

• Private Cloud- A private cloud is established for a specific group or organization and limits access to just that group. It is cloud infrastructure operated solely for a single organization, whether managed internally or by a third-party and hosted internally or externally. Infrastructure can be on- or off-premise. It is built exclusively for a single enterprise. There are two variations to a private cloud:•

• On-premise Private Cloudy It is hosted within one's own data center. It is best suited for

• Systems distributed across the net using pre-web technology are harder and more costly to integrate.

applications which require complete control and configurability of the infrastructure and security

• Externally hosted Private Cloud: It is hosted externally with a cloud provider, where the provider facilitates an exclusive cloud environment with full guarantee of privacy. It is best. suited for enterprises that don't prefer a public cloud due to sharing of physical resources. .

Hybrid Cloud- Hybrid cloud is a composition of two or more clouds that remains unique entities but are bound together, offering the benefits of multiple deployment models. It combines both public and private cloud models. In this, service providers can utilize third party cloud providers in a full or partial manner thus increasing the flexibility of computing. Its environment is capable of providing on-demand, externally provisioned scale.• Community Cloud- It shares infrastructure between several organizations from a specific community with common concerns i.e. security, compliance, jurisdiction etc., whether managed internally or by a third-party and hosted internally or externally.

4. CLOUD COMPUTING AND LIBRARIES

Libraries have been using some cloud computing services for over a decade. Online databases are accessed as cloud applications. Large union catalogs can also be defined as cloud applications. The library community can apply the concept of cloud computing to strengthen the power of cooperation and to build a significant, unified presence on the web. This approach to computing can help libraries save time and money while simplifying work flows.

If a person used any of the popular web 2.0 services over the past few years (e.g. Gmail, Wikipedia, Flicker or Twitter), then he already have some experience with cloud computing, since most of these applications are hosted in the large online data centers libraries that are the hallmark of cloud computing, Like water and electricity, a computing cloud is a communally-shared resource that you lease on a metered basis, paying for as little or as much as you need, when you need it. A brief list of potential areas of improvement could include Most library computer systems are built on pre-web technology.59' ILA International Conference on Managing Libraries in the Changing Information World: From Surviving to Thriving|20l4

Information seekers work in common web environments and distributed systems make it difficult to get the library into their workflow.

Benefits of Cloud Computing in Libraries :-

Cloud computing is the most cost efficient method to use, maintain and upgrade. It is available at much cheaper rates.

It allows us to customize our options with great ease. Hence, we can handpick just those services and software applications that we think will best suit our particular library.

This technology is user centric.

It is reliable and saleable and poses privacy concerns.

Since all the data is stored in the cloud, backing it up and restoring the same is relatively much easier than storing the same on a physical device. Hence, this makes the entire process of backup and recovery much simpler than other traditional methods of data storage in the libraries.

Improved resource utilization provides green and clean technology

If any library registers them in the cloud then anyone can access the information anywhere with the availability of internet connection.

Storing information in the cloud gives the unlimited storage capacity. It provides users with immediate access to a broad range of resources and applications hosted in the infrastructure of another organization via a web service interface.

Following effects of cloud computing will probably impact libraries and other sized organizations:

Cost savings:- Cloud computing offers price savings due to economies of scale and the fact that we are only paying for the resources you actually use.

Flexibility and innovation:- Libraries do not have to decide between devoting their limited server resources to the OPAC's overflow traffic and a new mobile web application that one of your colleagues wants to develop. If they are both hosted in the cloud, the resources devoted to each will shrink and expand as traffic rises and drops.

General IT skills:- System librarians have to manage complex projects and evaluate competing vendors on a variety of criteria. Holding vendors accountable is especially important when they manage a significant chunk of our online data and IT infrastructure. Therefore, as long as cloud security remains a significant concern, techies may be called upon to help write binding, enforceable contracts that hold vendors to certain standards with regards to reliability and security of their services.

Data Recovery and Availability :- All business applications have service level agreements that are stringently followed. Operational teams play a key role in management of service level agreements and maintenance of applications. In production environments, operational teams support:

Appropriate clustering and Fail over

Data Replication

System monitoring

Maintenance (Runtime Governance)

Disaster recovery

Capacity and performance management

Cloud OPAC:- Over the past year, more and more vendors have started offering cloud-hosted versions of their products. OCLC joined several other vendors last year when they began offering a cloud-based tool that complement their existing cataloguing tools [e.g. World Cat and First Search).

5. CLOUD COMPUTING CHALLENGES/ SECURITY

• ***Data Protection;-*** Data Security is a crucial element that warrants scrutiny. Enterprises are reluctant to buy an assurance of business data security from vendors. They fear losing data to competition and the data confidentiality of consumers. In the cloud model, Service providers are responsible for maintaining data security and enterprises would have to rely on them. This could potentially put your company to great risk. Hence, you need to make absolutely sure that you choose the most reliable service provider, who will keep you

Management Capabilities:- There is huge potential to improve on the scalability and load balancing features provided today. The Scaling offerings and maintaining sufficient performance is a challenge, especially for software as a service provider, who must deliver over networks and environments that they do not necessarily control.

Regulatory and Compliance Restrictions:- Many industries and countries disallow data or asset transparency. Also, some cloud providers have had outages with disastrous results, so trust remains an issue. In order to meet such requirements, cloud providers need to setup a data center or a storage site exclusively within the country to comply with regulations. Having such an infrastructure may not always be feasible and is a big challenge for cloud providers.

Federation and Interoperability :- IT functions typically automate a contiguous business process - and will thus require service integration among cloud providers.

***Vendor lock-in and Data Management*:** Data ownership in the cloud is not clear cut. Nor is the process by which data is to be reclaimed from cloud provider systems.

Technical Issues:- Though, it is true that information and data on the cloud can be accessed anytime and from anywhere at all, there are times when this system can have some serious dysfunction. We should be aware of the fact that this technology is always prone to outages and other technical issues. Even the best cloud service providers run into this kind of trouble, in spite of keeping up high standards of maintenance. Besides, we will need a very good internet connection to be logged onto the server at all times.

Prone to Attack :- Storing information in the cloud could make your company vulnerable to external hack attacks and threats. As you are well aware, nothing on the internet is completely secure and hence, there is always the lurking possibility of stealth of sensitive data.

6. CONCLUSION

The cloud provides many options for the everyday computer user as well as large and small businesses. However, with this increased ease also come drawbacks. We have less control over who has access to our information and little or no knowledge of where it is stored. We also must be aware of the security risks of having data stored on the cloud. Cloud computing is one avenue for this move into the future. It can bring several benefits for libraries and give them a different future.

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FIDOOP ALGORITHM : DATA HIERARCHY AND PARALLEL MINING OF FREQUENT ITEMSETS USING MAP REDUCE

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ABSTRACT

In Existing parallel mining algorithms are deficient in some of the features like parallelization of sequential code, distribution of data over computers in a cluster and balancing load over cluster of computers. To overcome these problems, FIDoop uses parallel mining algorithms on the basis of I/O overhead, data distribution, storage, scalability, load balancing, automatic parallelization and fault tolerance. FiDoop algorithm uses the ultrametric tree pattern for storage of data. This technique incorporates three MapReduce job to mine the large amount of data conventionally and economically.

In first MapReduce job , it minimizes I/O overhead by scanning the database twice ,all frequent itemsets are discovered.

In second MapReduce job is FIU-tree an improved way to partition a database, which results from clustering transactions, and significantly reduces the search space, it removes infrequent itemstes.

Third MapReduce is most important, it construct small ultrametric trees which is helpful to mine the frequent data conventionally and economically which significantly reduces computing time.

FiDoop algorithm is implemented in Hadoop cluster. For high dimensional data, FiDoop-HD is used, it is an improved version of FiDoop. FiDoop using FIUT and Map Reduce programming model

Key words: *Automatic parallelization, Scalability , Frequent item sets, frequent items ultrametric tree (FUIT), Map Reduce, FiDoop,load balance.*

INTRODUCTION

The existing mining algorithm lacks in some areas like it is expensive to mine the required data, the time required to mine the data is more, it require more storage while processing the data. The existing system uses the FIUT(frequent itemset ultrametric tree), but it lacks some of the features like parallelizing the data. To overcome this problem FiDoop algorithm is introduced.

FiDoop algorithm overcomes these problems. In FiDoop algorithm the data is decomposed and with the help of ultrametric tree the data is stored. With ultrametric tree we can mine our data or we can FIU-tree is a tree structure constructed as follows, the FIU-tree to enhance the efficiency of mining frequent itemsets.

After the root is labeled as null, an itemset p1, p2, . . . , pm of frequent items is inserted as a path connected by edges (p1, p2), (p2, p3), . . . , (pm−1, pm) without repeating nodes, beginning with child p1 of the root and ending with leaf pm in the tree. An FIU-tree is constructed by inserting all itemsets as its paths, each itemset contains the same number of frequent items. Thus, all of the FIU-tree leaves are identical height. Each leaf in the FIU-tree is composed of two fields: named item-name and count. The count of an item-name is the number of transactions containing the itemset that is the sequence in a path ending with the item get our data very easily, we do not have to scan the tree again and again to get our data. FiDoop uses some special scheme to distribute the data over nodes of the cluster. For high-dimentional data, FiDoop-HD is used. The FiDoop has some special features like parallization of sequential data which improve the performance of data mining.

To distribute the data over nodes so that it does not degrade the performance by over loading the data at one node in a cluster.

The three Map Reduce jobs are performed in FiDoop.

FIUT

name. Non leaf nodes in the FIU-tree contains two fields: named item-name and node-link. A node-link is a pointer linking to child nodes in the FIU-tree.

The FIUT algorithm consists of two key phases. The first phase involves two rounds of scanning a database. The first scan generates frequent one-itemsets by computing the support of all items, whereas the second scan results in *k*-itemsets by pruning all infrequent items in each transaction record. Note that, *k* denotes the number of frequent items in a transaction. In phase two, a *k*-FIU-tree is repeatedly constructed by decomposing each *h*-itemset into *k*-itemsets, where $k + 1 \le h \le M$ (M is the maximal value of *k*), and unioning original *k*-itemsets. Then, phase two starts mining all frequent *k*-itemsets based on the leaves of *k*-FIU-tree without recursively traversing the tree. Compared with the FP-growth method, FIUT significantly reduces the computing time and storage space by averting overhead of recursively searching and traversing conditional FP trees.

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MAPREDUCE FRAMEWORK

MapReduce is a promising parallel and scalable programming model for data-intensive applications and scientific analysis. A MapReduce program expresses a large distributed computation as a sequence of parallel operations on datasets of key/value pairs. A MapReduce computation has two phases, namely, the Map and Reduce phases. The Map phase splits the input data into a large number of fragments, which are evenly distributed to Map tasks across the nodes of a cluster to process. Each Map task takes in a key-value pair and then generates a set of intermediate key-value pairs. After the MapReduce runtime system groups and sorts all the intermediate values associated with the same intermediate key, the runtime system delivers the intermediate values to Reduce tasks. Each Reduce task takes in all intermediate pairs associated with a particular key and emits a final set of keyvalue pairs. Both input pairs of Map and the output pairs of Reduce are managed by an underlying distributed file system. MapReduce greatly improves programmability by offering automatic data management, highly scalable, and transparent fault-tolerant processing. Also, MapReduce is running on clusters of cheap commodity servers—an increasingly attractive alternative to expensive computing platforms. Thanks to the aforementioned advantages, MapReduce has been widely adopted by companies like Google, Yahoo, Microsoft, and Facebook.

Hadoop—one of the most popular MapReduce implementations—is running on clusters where Hadoop distributed file system (HDFS) stores data to provide high aggregate I/O bandwidth. At the heart of HDFS is a single Name Node—a master server that manages the file system namespace and regulates access to files. The Hadoop runtime system establishes two processes called Job Tracker and Task Tracker. Job Tracker is responsible for assigning and scheduling tasks; each Task Tracker handles Map or Reduce

FIDOOP

In light of the MapReduce programming model, we design a parallel frequent itemsets mining algorithm called FiDoop. The design goal of FiDoop is to build a mechanism that enables automatic parallelization, data distribution and load balancing for parallel mining of frequent itemsets on large clusters. To facilitate the presentation of FiDoop. Aiming to improve data storage efficiency and to avert building conditional pattern bases, FiDoop incorporates the concept of FIU-tree .

METHODOLOGY

first MapReduce job is responsible for creating all frequent one-itemsets. A transaction database is partitioned into multiple input files stored by the HDFS over data nodes of a Hadoop cluster. Each mapper sequentially reads each transaction from its local input split, where each transaction is stored in the format of pair. Then, mappers compute the frequencies of items and generate local one-itemsets.

Second MapReduce Job: Given frequent one-itemsets generated by the first MapReduce job, the second subsequent MapReduce job applies a second round of scanning on the database to prune infrequent items from each transaction record. The second job marks an itemset as a k-itemset if it contains k frequent items ($2 \leq k \leq M$, where M is the maximal value of k in the pruned transactions).
Third MapReduce Job: The third MapReduce job,a computationally expensive phase is dedicated to: decomposing itemsets; constructing k-FIU trees; mining frequent itemsets. The main goal of each mapper is twofold: 1) To decompose each k-itemset obtained by the second MapReduce job into a list of small-sized sets, where the number of each set is anywhere between 2 to $k - 1$ and 2)to construct an FIU-tree by merging local decomposition results with the same length.

LOAD BALANCE

The *decompose*() function of the third MapReduce job accomplishes the decomposition process. If the length of an itemset is *m*, the time complexity of decomposing the itemset is *O(2m)*. Thus, the decomposition cost is exponentially proportional to the itemset's length. In other words, when the itemset length is going up, the decomposition overhead will dramatically enlarge. The data skewness problem is mainly induced by the decomposition operation, which in turn has a significant performance impact on FiDoop. The first step toward balancing load among data nodes of a Hadoop cluster is to quantitatively measure the total computing load of processing local itemsets. We achieve this first step by developing a workload-balance metric to quantify load balance among the data nodes.

PERFORMANCE ANALYSIS

The efficiency of the system can be analyzed in terms of time taken by the FP-Tree and FIU-Tree algorithms in generating the Frequent Itemsets. We compare the performance of the system with the Fidoop system.

In Table 7.1 shows the time taken to create the Frequent Itemsets of different transactions size. From the Table, it is clear that the amount of time taken to generate frequent itemsetsby FP-Tree algorithm is around 1.5 times slower than the FIU-Tree for the same input.

FP-Growth Tree				FIU- Tree			
S. No	No. of Records	Support Value	Time	S. No	No. of Records	Support Value	Time
1.	10	0.1	10.002	1.	10	0.1	1.31
2.	20	0.1	20.00	2.	20	0.1	2.44
3.	50	0.1	100.05	3.	50	0.1	6.54
4.	100	0.1	212.04	4.	100	0.1	14.98

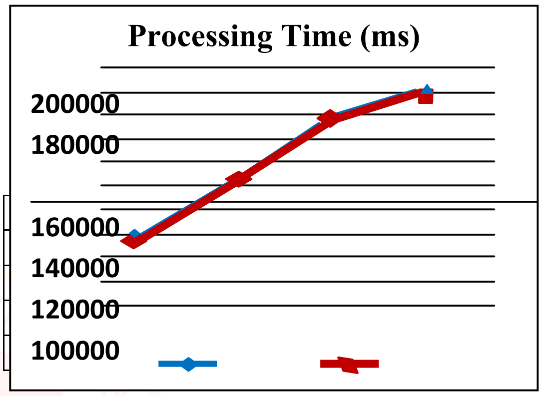
Table :7.1

ADVANTAGES

8.1 Processing time

Processing time is defined as the time it takes to complete a prescribed procedure.

This graph shows the processing time. When compared to the existing method, there is less processing time in the proposed method.



7. CONCLUSION

This paper, proposed the FiDoop based parallel mining of frequent item set using map reduce. To solve the scalability and load balancing challenges in the existing parallel mining algorithms for frequent itemsets,the MapReduce programming model to develop a parallel frequent itemsets mining algorithm called FiDoop. FiDoop incorporates the frequent items ultrametric tree or FIU-tree rather than conventional FP trees, thereby achieving compressed storage and avoiding the necessity to build conditional pattern bases. FiDoop seamlessly integrates three MapReduce jobs to accomplish parallel mining of frequent itemsets.

An important role of the third MapReduce job plays in parallel mining; its mappers independently decompose itemsets whereas its reducers construct small ultrametric trees to be separately mined. We improve the performance of FiDoop by balancing I/O load across data nodes of a cluster. We enhance the execution of FiDoop by adjusting I/O load crosswise over information hubs of a group.

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CYBER LAWS IN INDIA: A REVIEW

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ABSTRACT

The growth of Electronic Commerce has boosted the need for effervescent and effective regulatory mechanisms which would further reinforce the legal infrastructure, so crucial to the success of Electronic Commerce. All these regulatory mechanisms and legal infrastructures come within the domain of Cyber law. Cyber law touches almost all aspects of transactions and activities on and involving the internet, WWW and cyberspace. In the year 2000, the IT Act, launched to define the different aspects of cyber law in the country. It was also an instrument to address the misuse of e-information and subsequent securities which was proposed to be provided to the e-transactions which had tripled and increased its volume in multiple times in India. This paper, analyze the provisions of the IT Act, 2000 and explore into analyzing the different aspects of the recent amendments which has been instrumental in combating the various current trends which are existing in combating cyber-crimes and different legislations in cyber laws.

KEYWORDS: *Cyber law, Cyber crimes, IT Act, 2000, Digital signature,*

INTRODUCTION

From the last decade onwards, the step of India in the Information Technology Sectors has been remarkable. Internet was initially developed as a research and information sharing tool and was in an unregulated manner. As the time passed by it became more transactional with e-business, e-commerce, e-governance and e-procurement etc. Overall Internet usage has seen tremendous growth from 2000. There is great amount of data about individuals and businesses which is available in digital format. The great amount of data about individuals and businesses which is available in digital format therefore technological transactions and entry of India into the unlimited and unbounded cyberspace made it compulsory for the Indian legislature to come up with the laws regarding control of technology in India.

[3]The filing of the documents electronically has been the latest trend in the modern times and this is how the system has changed over a period of time.The virtual world of internet is known as cyberspace and the laws governing this area are known as Cyber laws.cyber law can also be described as that branch of law that deals with legal issues related to use of inter-networked information technology. In short, cyber law is the law governing computers and the internet.

[1]Cyber law encompasses laws relating to –

- Cyber crimes
- Electronic and digital signatures
- Intellectual property
- Data protection and privacy
- In today's highly digitalized world, almost everyone is affected by cyber law. For
- example:
- Almost all transactions in shares are in demat form.
- Almost all companies extensively depend upon their computer networks and keep their valuable data in electronic form.
- Government forms including income tax returns, company law forms etc. are now filled in electronic form.
- Consumers are increasingly using credit cards for shopping.
- Most people are using email, cell phones and SMS messages for communication.
- Even in "non-cyber crime" cases, important evidence is found in computers / cell phones e.g. in cases of divorce, murder, kidnapping, tax evasion, organized crime, terrorist operations, counterfeit currency etc.
- Cyber crime cases such as online banking frauds, online share trading fraud, source code theft, credit card fraud, tax evasion, virus attacks, cyber sabotage, phishing attacks, email hijacking, denial of service, hacking, pornography etc are becoming common.
- Digital signatures and e-contracts are fast replacing conventional methods of transacting business.

INFORMATION TECHNOLOGY ACT, 2000

The IT Act, 2000 consists of 90 sections spread over 13 chapters [Sections 91, 92, 93 and 94 of the principal Act were omitted by the Information Technology (Amendment) Act 2008 and has 2 schedules.[Schedules III and IV were omitted by the Information Technology (Amendment) Act 2008]. [4]The overall net effect of all these notifications is that the IT Act, 2000 has come into operation.

SALIENT FEATURES OF THE INFORMATION TECHNOLOGY (AMENDMENT) ACT, 2008

1. The term 'digital signature' has been replaced with Page **2** of **9**
'electronic signature' to make the Act more technology neutral.
2. A new section has been inserted to define 'communication device' to mean cell phones, personal digital assistance or combination of both or any other device used to communicate, send or transmit any text video, audio or image.
3. A new section has been added to define cyber cafe as any facility from where the access to the internet is offered by any person in the ordinary course of business to the members of the public.
4. New Section to address data protection and privacy -Section 43
5. Body corporate to implement best security practices-Sections 43A &72A

APPLICABILITY AND JURISDICTION OF THE ACT

The Act will apply to the whole of India unless otherwise mentioned. It applies also to any offence or contravention there under committed outside India by any person. If a crime is committed on a computer or computer network in India by a person resident outside India, then can the offence be tried by the Courts in India?

According to Sec.1(2) of Information Technology Act, 2000, the Act extends to the whole of India and also applies to any offence or contravention committed outside India by any person. Further, Sec.75 of the IT Act, 2000 also mentions about the applicability of the Act for any offence or contravention committed outside India. According to this section, the Act will apply to an offence or contravention committed outside India by any person, if the act or conduct constituting the offence or contravention involves a Page **3** of **9** computer, computer system or computer network located in India.

LIABILITY OF BODY CORPORATE TOWARDS SENSITIVE PERSONAL DATA

New amendment was brought in changes in section 43 of IT Act 2000 in which for the fist time any body corporate which deals with sensitive personal information does not have adequate controls resulting in wrongful loss or wrongful gain to any person is liable to pay damages to that person to the tune of five crores. Introduction of virus, manipulating accounts, denial of services etc made punishable Section 66 has been amended to include offences punishable as per section 43 which has also been amended to include offences as listed above; punishment may lead to imprisonment which may extend to three years or with fine which may extend to five lakh rupees or with both. This is a change from earlier position where introduction of virus, manipulating some ones account has been made punishable with imprisonment for the first time.

PHISHING AND SPAM

While this has not been mentioned specifically but this can be interpreted in the provisions mentioned here in section 66 A. Any person who sends, by means of a computer resource or a communication device,— (a) any information that is grossly offensive or has menacing character; or (b) any information which he knows to be false, but for the purpose of causing annoyance, inconvenience, danger, obstruction, insult, injury, criminal intimidation, enmity, hatred or ill will, persistently by making use of such computer resource or a communication device, (c) any electronic mail or electronic mail message for the purpose of causing annoyance or inconvenience or to deceive or to mislead the addressee or recipient about the origin of such messages, shall be punishable with imprisonment for a term which may extend to three years and with fine.

STOLEN COMPUTER RESOURCE OR COMMUNICATION DEVICE

Newly added Section 66B has been introduced to tackle with acts of dishonestly receiving and retaining any stolen computer resource. This has also been made punishable with three years or fine of one lakh rupees or both.

MISUSE OF DIGITAL SIGNATURE

Section 66C. Dishonest use of somebody else□s digital signature has been made punishable with imprisonment which may extend to three years and shall also be liable to fine with may extend to rupees one lakh.

CHEATINGCheating using computer resource has been made punished with imprisonment of either description for a term which may extend to three years and shall also be liable to fine which may extend to one lakh rupee (section 66D)

CYBER TERRORISM

The newly introduced section 66F talks about acts of cyber terror which threatens the unity, integrity or sovereignty of India or strike terror in the people or any section of the people include a. Denial of service of resources in use by nation b. Attempting to penetrate or access a computer resource without authorization or exceeding authorized access c. Introducing or causing to introduce any computer contaminant likely to cause death or injuries to person or damage to or destruction of property or disrupts or knowing that it is likely to cause damage or disruption of supplies or services essential to the life of the community or d. knowingly or intentionally penetrates or accesses a computer resource without authorization or exceeding authorized access, and by means of such conduct obtains access to information, data or computer database that is restricted for reasons for the security of the State or foreign relations, or any restricted information, data or computer database, with reasons to believe that such information, data or computer database so obtained may be used to cause or likely to cause injury to the interests of the sovereignty and integrity of India, the security of the State, friendly relations with foreign States, public order, decency or morality, or in relation to contempt of court, defamation or incitement to an offence, or to the advantage of any foreign nation, group of individuals or otherwise, commits the offence of cyber terrorism. These acts have been made punishable with Imprisonment which may extend to imprisonment for life.

CHILD PORNOGRAPHY

Newly introduced section 67 B attempts to address the issue of child pornography. Through this section it has made the publication or transmission of material in any electronic form which depicts children engaged in sexually explicit act or conduct, any one who creates, facilitates or records these acts and images punishable with imprisonment of five years and fine which may extend up to ten lakhs in first offence and seven years and fine of ten lakhs on subsequent offence.

[5]INTERMEDIARY'S LIABILITY

Intermediaries have been made liable to retain any information in the format that Central government prescribes. (Sections 67C) and are punishable for violation with a punishment of imprisonment of 3 years and fine In case of any act which affects national sovereignty intermediaries are liable to seven years (Section 69(4)).

[11]SURVEILLANCE, INTERCEPTION AND MONITORING

In order to compact cyber terrorism the government has further armed itself with drastic powers Sections 69 of IT Act 2000 amended enhances the scope from the 2000 version to include interception and monitoring. This has been a major change in the section which also empowers government not only to monitor any traffic but also block any site through any intermediary. Any failure on part of the intermediary is punishable by seven years and also fine (Section 69(4)). Earlier the provision did not mention any fine.

[4]COGNIZANCE OF CASES

All cases, which entail punishment of three years or more, have been made cognizable. Offences with three years punishment have also been made bailable (Section 77B). This change though welcome will make sure most cases falling under IT Act will bailable with sole exception of Cyber terrorism cases, cases related to child pornography and violations by intermediaries in some cases.

[7]INVESTIGATIONS OF OFFENCES

One major change has been inclusion of Inspectors as investigating officers for offences defined in this act (section 78). Earlier these investigations were being done only by an officer of the rank of Deputy Superintendent of Police which was a serious limitation mainly because number of officers in this rank is limited. With this change one can look forward to more cases being filed and investigated by police.

[2] DATA PROTECTION AND PRIVACY

The Section 43-A, dealing with compensation for failure to protect data was introduced in the ITAA -2008. As per this Section, where a body corporate is negligent in implementing reasonable security practices and thereby causes wrongful loss or gain to any person, such body corporate shall be liable to pay damages by way of compensation to the person so affected.

Thus the corporate responsibility for data protection is greatly emphasized by inserting Section 43A whereby corporates are under an obligation to ensure adoption of reasonable security practices. Further what is sensitive personal data has since been clarified by the central government vide its Notification dated 11 April 2011. Sensitive personal data or information.- Sensitive personal data or information of a person means such personal information which consists of information relating to;- (i) password; (ii) financial information such as Bank account or credit card or debit card or other payment instrument details ; (iii) physical, physiological and mental health condition; (iv) sexual orientation; (v) medical records and history; (vi) Biometric information; (vii) any detail relating to the above clauses as provided to body corporate for providing service; and Page **6** of **9** (viii) any of the information received under above clauses by body corporate for processing, stored or processed under lawful contract or otherwise: provided that, any information that is freely available or accessible in public domain or furnished under the Right to Information Act, 2005 or any other law for the time being in force shall not be regarded as sensitive personal data or information for the purposes of these rules. Thus the role of top management and the Information Security Department in organizations is very important in ensuring data protection, especially while handling the customers' and other third party data.

Reasonable Security Practices are

1. Site certification
2. Security initiatives
3. Awareness Training
4. Conformance to Standards, certification
5. Policies and adherence to policies
6. Policies like password policy, Access Control, email Policy etc
7. Periodic monitoring and review.

The Information Technology (Reasonable security practices and procedures and sensitive personal data or information) Rules have since been notified by the Government of India, Department of I.T. on 11 April 2011. Any body corporate or a person on its behalf shall be considered to have complied with reasonable security practices and procedures, if they have implemented such security practices and standards and have a comprehensive documented information security programme and information security policies containing managerial, technical, operational and physical security control measures commensurate with the information assets being protected with the nature of business. The International Standard IS/ISO/IEC Page **7** of **9**
27001 on "Information Technology – Security Techniques - Information Security Management System - Requirements" is one such standard referred to in sub rules. In view of these rules not only IT companies but also those in the Banking and Financial, Services Sector especially those with massive computerized operations dealing with public data and depending heavily on technology have to be very careful and sensitive to data privacy.

SOME POINTS

• The Indian Penal Code (as amended by the IT Act) penalizes several cyber crimes. These include forgery of electronic records, cyber frauds, destroying electronic evidence etc.

• Digital Evidence is to be collected and proven in court as per the provisions of the Indian Evidence Act (as amended by the IT Act).

• In case of bank records, the provisions of the Bankers' Book Evidence Act (as amended by the IT Act) are relevant.

• Investigation and adjudication of cyber crimes is done in accordance with the provisions of the Code of Criminal Procedure and the IT Act.

• The Reserve Bank of India Act was also amended by the IT Act.

The Cyber Appellate Tribunal has, for the purposes of discharging its functions under the IT Act, the same powers as are vested in a civil court under the Code of Civil Procedure, 1908. However, is not bound by the procedure laid down by the Code of Civil Procedure, Page **8** of **9.** 1908 but is guided by the principles of natural justice and, subject to the other provisions of this Act and of any rules. The Cyber Appellate Tribunal has powers to regulate its own procedure including the place at which it has its sittings.

CONCLUSION

Today society is more dependent on technology. Technology is always a double-edged sword and can be used for both the purposes – good or bad. For crime-free society,it should be constant effort of rules to keep the crimes lowest. Steganography, Trojan Horse, Scavengingare all technologies are not for crimes, but falling into the wrong hands with a criminal intent who are out to exploit them or misuse them, they come into the range of cyber crime and become punishable offences. Hence, it should be the persistent efforts of rulers and law makers to ensure that technology grows in a healthy manner and is used for legal and ethical business growth and not for committing crimes.

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IMPORTANT WEBSITES

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3. http://cca.gov.in/rw/pages/index.en.do - Controller of Certifying AuthoritiesPage9 of 9 http://deity.gov.in/content/cyber-laws
4. http://www.cyberlawsindia.net

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CYBER SECURITY THREATS IN SOCIAL NETWORK: A SURVEY

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ABSTRACT

Along with the growth of social media, a variety of potential threats to users is also increasing. These kinds of threats often occur because the users accidentally or unknowingly disclose their information or identity on social media. Threats resulted from the disclosure of information are needed to be known so that the users can understand the risks that arise and take precautions. This research was aimed to summarize the potential threats arising from the information disclosure in social media. The research method used was a systematic literature review to explore and summarize the literatures that discuss the specific topic. The research results show that the potential threats are mostly social threats and identity theft.

Keywords: social media, social threat, identity threat, information disclosure, social, networking websites.

1. INTRODUCTION

Social media is an online interaction and communication media that allows the communities forming (Gangopadhyay & Dhar, 2014), content sharing (Guo, 2008), and collaboration (Rouse,2015). Social media are providing interaction channel for their users (Acquisti & Gross, 2006) and appearing as a potentially addictive 'toy' that fills the social vacuum in people's lives and produces the ongoing sensation (Turel & Serenko, 2012). Most users typically use social media for fun and spending time rather than gathering information (Fogel & Nehmad, 2009).Currently, the popular social media are Facebook, Twitter, LinkedIn, Pinterest, Google+, Tumblr, and Instagram (Ebizmba, 2016; Elmaghraby & Losavio, 2014). Facebook, a social media that was built in 2004, is now becoming the most popular social media with 1.5 billion users (Figure 1) and revenue of $3.7 billion per year (Factslides, 2015). Thus a large number of communities have made Facebook as the online 'state' with the densest number of 'residents' even outnumbering the population of China. Along with the growth of Facebook, a variety of threats to users is also increasing (Shullich, 2012; Jones & Soltren, 2005; Acquisti & Gross, 2006). About 122 million Facebook users use fake accounts, and there are 600.000 hacking attacks attempted every day. Other data said that 1 of 3Facebook users feel disappointed, sad, and intimidated after accessing Facebook.

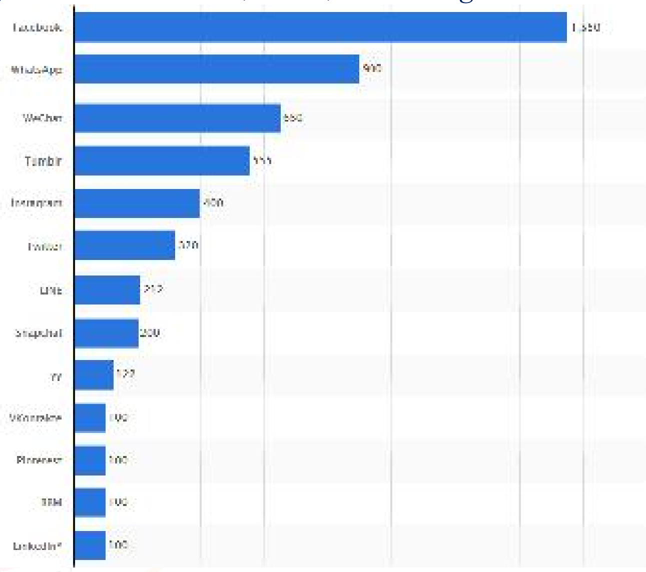

Figure 1 Social Media Active Users in Million per January 2016 (Statista, 2016)

Many threats and dangers are growing in line with the growth of social media (Figure 2). A 14-year-old boy who loved gaming, was groomed online and murdered in 2014 (Moore, 2016). In 2015, a 19-year-old girl had been kidnapped after getting contact with a fake account by promising a job at Amazon (McMillan, 2015). In 2016, a 13-year-old girl had been kidnapped and murdered after getting contact in social media (Riley, 2016). There is also a list of death for trivial matters in social media. A man killed his friend for "poking" his girlfriend, a wife was killed for changing status to single, a man used social media to lure his ex-girlfriend into a death trap, and a 17-year-old girl killed herself after being cyberbullied (Milam, 2016).

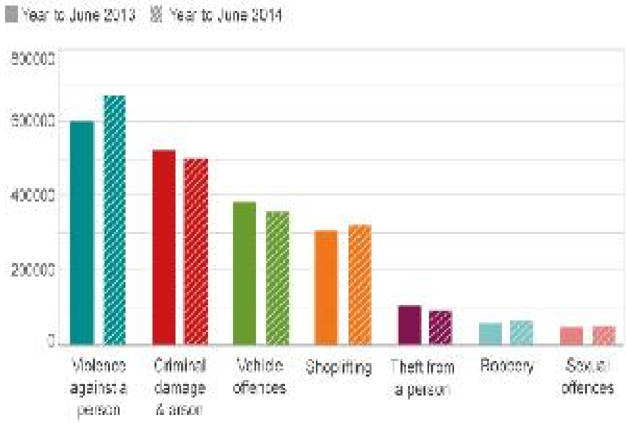

Figure 2 Social Media Crime Reported Statistics (BBC, 2014)

Bishop (2013) and Krasnova *et al.* (2009) divided the potential threats in social media into three categories, namely identity, social, and technology threat. Identity threat is activities of user's information or identity theft. Social threat includes (1) cyberbullying, ridicule or bullying activities that annoy users by either textual or visual, (2) cyber crime, criminal activities that generally lead to fraud or financial theft (Lawstuff, 2015), and (3) sexual predator, sexual crimes in the form of ridiculement, visual, to unwanted sexual act. These threats often occur because the users accidentally or unknowingly disclose their identity information in social media (Christofides *et al*., 2010; Acquisti & Gross, 2006), poorly understood default sharing mechanism, or intentional use of user data by social media provider for marketing purposes (Lucas & Borisov, 2008).

This research is conducted to answer a research question "What are the potential threats arising from information disclosure in social media?". Through systematic literature review (SLR) research method, researchers will explore and summarize journals that discuss the topic. Expected result of this study is to contribute to the community of the potential threats caused by information disclosure in social media, either as precaution or exhortation to the users.[1]

According to the survey of India, incidences of cyber crime shot up drastically in 2015,with 72 percent companies falling prey to online attacks.

A report said that,94 respondents that cyber crime is a major threat faced by organizations.

It is critical for the citizens both co-operate and individuals, to be aware of cyber risk, for this purpose a drive should be undertaken awareness about cyber threats.

OBJECTIVES

- Awareness about threats including in the social networking websites.
- A high risk for security threats.
- Tools for controlling the threats.
- Needs for improvements of social networks.
- new technologies that allow user data portability.
- Analysis and comparision of threats .

2. WORKING OF THREATS IN SOCIAL NETWORK

Social networking has changed the way we interact with friends and associates. While social networks, like Facebook, Twitter, YouTube, FourSquare, and Google+, play a significant role in our lives, they are also a high risk for security threats.

With hundreds of millions of users online, these tools not only attract friends and family wanting to stay in touch, but they also attract people wanting to know about you for the wrong reasons. Be aware of the top five security threats currently out there to help you stay safe online.

2.1 HAVING YOUR IDENTITY STOLEN

Identity thieves gather personal information from social media sites. Even if you have your account on the highest security settings, there are still ways for an identity thief to get your information. Most social network sites have information that is required, such as email address or birthday. It's common for an identity thief to hack an email account by using social information. For example, a common technique to get personal information is by clicking on "forgot password" and trying to recover the information through email. Once the thief has access to your email account, they then have access to all information on your social networking sites.

So what can you do to protect yourself? You don't have to delete all your social profiles or hide from the real world; just take these precautions.

- **Have a strong password**. The stronger your password, the harder it is to guess. Use special characters like symbols and capital letters when creating your password. Also, don't use "common" passwords, like your birthday or your child's name.
- **Be careful with your status updates**. Often, we innocently post status updates that would give an identity thief information they need to steal our identity. For example, you may post "Happy

birthday to my mother!" and then tag her in the post. Likely, your mother's maiden name will be associated with that tag now. A popular security question is "What is your mother's maiden name?" and if you share that online, you run the risks of identity thieves getting the answer to this commonly used question.

- **Don't reveal your location.** You can use a fake location or make one up from another city and state. You may even be able to leave this information blank. Be cautious and never use a city and state where you live.

2.2 GETTING YOUR COMPUTER OR SOCIAL PROFILE HACKED

Hackers love social networking, going right to the source to interject malicious code. The codes hackers use can steal your identity, inject viruses to your computer, and obstruct bank account information, to name a few. Shortened URLs, such as those created on bit.ly, are especially susceptible to hackers. Shortened URLs can trick users into visiting harmful sites where personal information can be compromised because the full URL is not seen.

The best advice is to never click on a link until you are sure of the source. To tell if a link is safe, you can:

- **Hover over the link.** If you hover over a link without clicking, you'll see the full URL in the lower corner of your browser. If this is a website you recognize, go ahead and click.
- **Try a link scanner.** A link scanner is a website that lets you enter the URL of a link you suspect might be suspicious to check for safety. Try URLVoid or MyWOT as possible options.
- **Check shortened links.** A shortened link is popular on sites like Twitter where character length matters. Some shortened link sites include bit.ly, Ow.ly, and TinyURL. Use a service like Sucuri to determine if the real link is secure.

2.3 INADVERTENTLY LETTING STALKERS FIND YOU

When you use social networking sites, you are posting personal information. Once information is posted online, it's no longer private and can fall into the wrong hands. The more you post, the more vulnerable you become to those who may wish to harm you. Even with the highest security settings, friends, associates, and even the brands you "like" on your networking sites, can inadvertently leak information about you. The websites you subscribe to, the apps you download, and the games you play on social networking sites all contain personal information about you. Every time you browse a website, companies can put invisible markers on your computer called cookies. In theory, no two cookies are alike. When you are online, these cookies track your activity as you move from site to site.

To keep sites from tracking your activity, click on the "Do Not Track" feature. Most websites have an option for you to opt out of tracking. You can also clear the cache and cookies on your browser regularly to help prevent any problems.

2.4 LETTING BURGLARS KNOW YOUR WHEREABOUTS

Telling the online world where you're going and when you aren't at home is inviting burglars to your house. Did you know that a run-of-the-mill burglar can break into your home in less than 60 seconds and spend minutes stealing your possessions? By telling the world you are on vacation in Europe, you're letting potential thieves know where you are, how long you'll be gone, and where you live. Burglars are fond of constant updates, especially about your travel plans. You wouldn't stand up in the middle of a crowd and announce you're going on vacation for a week, would you? Of course not, but that's what you do when you post your vacation pictures and plans online.

When you go on vacation:

a) Avoid posting specific travel plans. Never post When, where, or how long you'll be gone.
b) Wait until you are home to post pictures to a vacation album.
c) Use highest privacy control. Only let certain groups, like a family group, view your photos.
d) Be selective with the status updates. You can use an audience-selector dropdown menu on Facebook to choose certain groups to see your status updates.
e) Stay offline. You're on vacation, after all. Relax and forget about the online world for a few days.

2.5 BECOMING OVERCONFIDENT

One of the biggest threats to online security is overconfidence. Whether at home or at work, many users believe as long as they have a firewall and an antivirus installed, there is no threat to security. Many people also believe that they don't have anything worth hacking so there's no need to worry about security. With today's technology, we are more connected to each other than ever before. When you neglect security, you not only put yourself at risk, but others are at risk as well.

To keep yourself and your information safe, pay careful attention to your online activity. Avoid posting information including:

- Travel plans
- Bank account information
- Your full address and birthdate
- Your children's' names, school, and birthdates
- Location information, such as the name of your work place
- Your daily schedule

3. MINIMIZING THE THREATS

There are some techniques used for reduce largest potential issues regarding online security:

Changing the social media settings

Posting photos on facebook while out of town may seem harmless, that is big indication for house is alone. Make sure you change your privacy setting so that not everyone can see your posts. Only direct connections can see.

Utilization of VPN

Virtual private network is just a fancy way to protect my profile when I'm online. By using the free Wi-Fi in coffee shops, hotels and airports more hackers are using simple "man in the middle attacks to tick people into logging onto their fake networks. so, it is for them to steal your information. Using VPN services keep you safe from these hackers when out masking your online presence.

Building self awareness about information disclosure

Users need to be more conscious about the information the reveal through their personal profiles in online social networks. They also have to accurately maintain the profiles through periodical review and necessary modification of the profile contents to ensure appropriate disclosure of information.

Encouraging awareness-raising and educational campaigns

Government should initiate different educational and awareness-raising campaigns to inform the users how to make rational usage of Social Networking Sites as well as to encourage the providers to develop and practice security conscious corporate policies.

Use secured websites

Most secured web browsers use such as google chrome will use show a green icon in the URL for the website is secured.

Setting appropriate defaults

Since most of the users are not aware of the necessity for changing the default privacy preference, it is essential to set the default setting as safe as possible. The SNS service provider also needs to offer user friendly guidelines that help the users to change the privacy settings successfully.

Providing suitable security tools

Tools that will allow the users to remove their accounts as well as edit their own posts on the other people's public notes or comments areas conveniently.

Automated filtering tools for determining the legitimate contents.

Tools for controlling the tagging of images depicting them.

New privacy software such as visualization tools for increasing the utilization of privacy options by providing clear representation of social networks, friend proximity, and availability of profile features.

4. COMPARISION OF SECURITY THREATS

Sr.No.	Social Networking Issues	Overcomes in threats
1	Any social website sharing personal information.	Building self awareness about information disclosure.
2	Social websites exposes profile user location.	Government should initiate different educational campaigns to inform the users.
3	The Internet makes it easy to obtain photos and use the image in anyway the person may choose whether it use for good or bad purposes.	The existing legislation may need to be modified and extended.

5. FUTURE TRENDS OF SOCIAL NETWORKING WEBSITES:

In spite of the development and advanced technologies in social networking websites adjustment, a few are listed as below:

a) A need for more improvements for social networks so that they can allow users to manage their profiles and connecting tools.

b) A need for convergence and integration of social networks and future virtual worlds.

c) Needs for data integration from different networks, i.e. identification of all contents related to specific topic. This needs particular standards and sophisticated technology supported by social networks providers.

d) Many social networks need standard application programming interfaces, so that users can import and export their profiling information by using standard tools. (For example, Facebook and Google have applied new technologies that allow user data portability among social websites, representing a new source of competition among social networking service). We hope that in the near future, one can by single sign-in functionality use over websites, that is, the user IDs are portable to other websites. Moreover, virtual worlds have distinct virtual economies and currency that based on the exchange of virtual goods. Games are one of the newest and most popular online application types on social websites. Here, we have to mention the importance of privacy and security to save users from fraudsters who attempt to steal social networking credentials and online money. Finally, we have to mention that the advances in the social websites and mobile-phone usage will effect on the growing of using mobile social networking by adding more features and application not only to mobiles, but also to social televisions for future chat, email, forums, and videoconferencing.

6. CONCLUSION:

Although social networking websites offer advanced technology of interaction and communication, they also raise new challenges regarding privacy and security issues. In this paper, we briefly described the social networking web sites, summarized their taxonomy, and highlighted the crucial privacy and security issues giving some essential antithreats strategies with the perspective of the future of the social networking websites. We think that the advancement of new technology in general and social websites in particular will bring new security risks that may present opportunities for malicious actors, key loggers, Trojan horses, phishing, spies, viruses and attackers. Information security professionals, government officials and other intelligence agencies must develop new tools that prevent and adapt to the future potential risks and threats. It can also safely manipulate the huge amount of information in the internet and in the social websites as well.

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"COMPARISON AND ANALYSIS OF DIFFERENT CLASSIFICATION TECHNIQUES FOR HEMATOLOGICAL DATA"

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ABSTRACT

Medical professionals need a reliable prediction methodology to diagnose hematological data comments. There are large quantities of information about patients and their medical conditions. Generally, data mining (sometimes called data or knowledge discovery) is the process of analyzing data from different perspectives and summarizing it into useful information. Data mining is one of a number of analytical tools for analyzing data. It allows users to analyze data from many different dimensions or angles, categorize it, and summarize the relationships identified. Classification is an important data mining technique with broad applications. It classifies data of various kinds. Classification is used in every field of our life. Classification is used to classify each item in a set of data into one of predefined set of classes or groups. In this paper we are studying the various Classification algorithms. The thesis main aims to show the comparison of different classification algorithms and find out which algorithm is most suitable for user working on hematological data. To use propose model, new Doctor or patients can predict hematological data Comment also developed a mobile App that can easily diagnosis hematological data comments.

Keywords -Hematological data, Data Mining, J48 Decision tree, Multilayer Perception, Naïve Bayes.

1. INTRODUCTION

Data mining technique is a process of discovering pattern of data. The patterns discovered must be meaningful in that they lead to some advantage. The overall goal of the data mining process is to extract information from a data set and transform it into an understandable data in order to aid user decision making [9]. Data mining is being used in several applications like banking, insurance, hospital and Health informatics. In case of health informatics, Data mining plays a vital role in helping physicians to identify effective treatments, and Patients to receive better and more affordable health services. In hematology laboratory, it has become a powerful tool in managing uncountable laboratory information in order to seek knowledge that is underlying or within any given information. Comparison of Different Classification Techniques for Hematological Data Comment is a challenging and interesting task in medical research area. To find out which classification algorithms is batter it is very difficult to compare different classification algorithms in different dataset.

We studied various journals and articles regarding performance evaluation of Data Mining algorithms on various different tools, some of them are described here. There are related works using data mining techniques to diagnose several types of diseases and phenomena, such as Automated Diagnosis of Thalassemia Based on Data Mining Classifiers, etc. And many other tried to find their own formula. in their paper "Application of Data Mining Methods and Techniques for Diabetes Diagnosis." they provide a comparative analysis of different algorithms. This project aims for mining the relationship in diabetes data for efficient classification. But they need proposed a model that can diagnose diabetes dataset. Naïve Bayes algorithm has been obtained for high probability of hematological data comment. Multilayer perceptron algorithm has been obtained mathematical or computational model for information processing based on a connectionist approach. A comparison with different classification techniques has made with optimal features to show which method is appropriate for hematological data.

2. CLASSIFICATION METHODS

Three candidate classifiers are considered in this study: Decision Tree (J48), Naïve Bayes, and Neural Network (Multilayer Perceptron)

2.1. J48 ALGORITHM

J48 algorithm is called as optimized implementation of the C4.5 or improved version of the C4.5. The output given by J48 is the Decision tree. A Decision tree is same as that of the tree structure having different nodes, such as root node, intermediate nodes and leaf node. Each node in the tree contains a decision and that decision leads to our result as name is decision tree. Decision tree divide the input space of a data set into mutually exclusive areas, where each area having a label, a value or an action to describe or elaborate its data points. Splitting criterion is used in decision tree to calculate which attribute is the best to split that portion tree of the training data that reaches a particular node [1].

2.2. MULTILAYER PERCEPTRON

The single-layer perceptron can only classify linearly separable problems. For non-separable problems it is necessary to use more layers. A Multilayer (feedforward) network has one or more hidden layers whose neurons are called hidden neurons. The Fig.1 illustrates a multilayer network with one input layer, one hidden layer and one output layer.

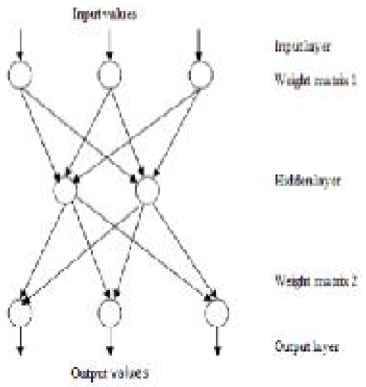

Figure 1: multilayer perceptron

2.3 NAIVE BAYES

Naive Bayes implements the probabilistic Naïve Bayes classifier. Naïve Bayes Simple uses the normal distribution to model numeric attributes. Naïve Bayes can use kernel density estimators, which develop performance if the normality assumption if grossly correct; it can also handle numeric attributes using supervised discretization. Naïve Bayes Updateable is an incremental version that processes one request at a time. It can use a kernel estimator but not discretization [13].

3. ADVANTAGES

- Classification makes statistical analysis possible. It provides Efficient management reporting of data.
- Data only have to be entered once and can be used for multiple purposes. Efficient management of product databases.
- Standardised, automated, direct coupling and/or processing in internal automation. Therefore fewer actions are necessary and faster acting is possible. Time gained and thus savings.
- It predicts accurate results for most of the classification and prediction problems.

4. DISADVANTAGES

- In Naïve bayes the precision algorithm decreases if the amount data is less.
- Also for obtaining the good result it requires very large number of records.
- In Multilayer Perceptron requires high processing time if neural network is large
- Also difficult to know how many neurons and layers are necessary

5. OBJECTIVES

- We publish this paper because we want to compare hematological data.
- for the comparision we use three methods namely J48 Decision tree, Multilayer Perception, Naïve Bayes.
- By using these three methods we compare the performance and accuracy of different classification algorithms.
- In this , we focuses on various classification techniques most frequently used in data mining and compare the performance and the interpretation level of confidence on different classification techniques applied on hospital and health infomatic datasets.

6. CONCLUSION

There are so many benchmarks comparing the performance and accuracy of different classification algorithms but there are still very few experiments carried out on Credit card risk assessment and fraud detection datasets. In this work, we focuses on various classification techniques most frequently used in data mining and compare the performance and the interpretation level of confidence on different classification techniques applied on hospital and health infomatic datasets in order to determine which one is more suitable. From the result we see that time to build the model is less when using j48 and correctly classified instances are more and prediction accuracy is also greater in j48 than the other two. Hence it is concluded that j48 performed better on hospital and Health informatics dataset.

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CLOUD COMPUTING SECURITY ISSUES ANDENCRYPTION TECHNIQUES : A SURVEY

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ABSTRACT

Cloud computing is the latest technology in the modern world. Cloud computing is the present technology in the field of distributed computing. The adoption of this technology is growing day by day because it facilitates the users to utilize the services through making use of shared pool of resources without the installation of any software. Since Cloud computing stores the data and its disseminated resources in the environment, security has become the main obstacle which is hampering the deployment of cloud environments. There are number of users used cloud to store their personal data, so that data storage security is required on the storage media. The major concern of cloud environment is security during upload the data on cloud server. But security is the critical inhibitor that are faced by cloud computing and it makes the use of cloud computing more difficult. To solve these problems, we have some encryption algorithms which provide security to the data stored on cloud. In this paper, an effort is made to review the security problems and the encryption algorithms that provide security to the cloud data.

Keywords: *Cloud computing, Cloud deployment models, Security issues, Encryption techniques*

INTRODUCTION

Cloud computing is the next stage in the Internet's evolution, providing the means through which everything- from computing power to computing infrastructure, applications, business processes to personal collaboration -can be delivered to you as a service wherever and whenever you need.

Cloud computing is a growing technology which has gained significant attention recently from the industry field and academia. It offers services through the internet.User can deploy the services of different software by using cloud computing without buying or installing them on their own computers. It is the logical representation of the internet in the diagrams that's why is called cloud computing. Through cloud computing, users of internet can access services from a cloud as though employing a super computer. Instead of storing data in own devices they could be stored in the cloud making possible to access ubiquitous data.

Figure 1 : Cloud Computing

CLOUD COMPUTING DEPLOYMENT MODELS

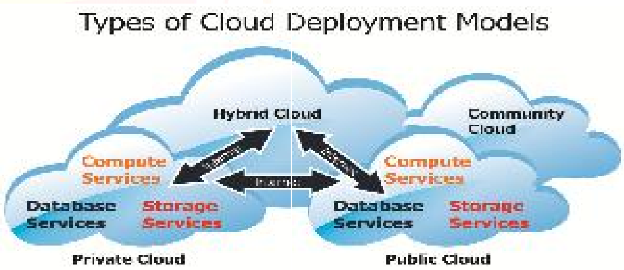

Figure 2: Cloud Computing Deployment Models

The various cloud deployment models are shown in figure 2 given below:

1. *Public Clouds:*In public cloud vendors dynamically allocate resources on a per-user basis through web applications. For example: Drop Box, SkyDrive and Google drive.
2. *Private Clouds:*Due to security and availability issues more and more companies are choosing Private Clouds. It provides more secure platform to the employees and customers of an organization. For example Banks, In banks all the employees and customers can access the bank data which is assigned to them particularly.
3. *Hybrid Cloud:*Hybrid cloud is the combination of the Public cloudand private cloud. In this type of cloud services the internalresources, stays under the control of the customer,

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andexternal resources delivered by a cloud service provider.

4. *Community Cloud:*The community cloud share the infrastructure around several organizations which can be managed and hosted internally or by third party providers.

CLOUD MODELS OR LAYERS

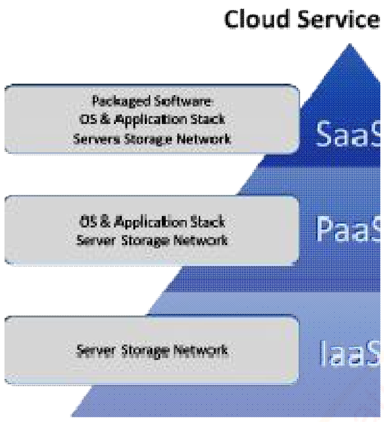

Figure 3: Cloud Models or Layers

The various layers of cloud are shown in figure 3 given below:

1. *SaaS(Software as a service)–* In this companies host applications in the cloud that many users access through internet connections. E.g. Gmail, facebook.
2. *PaaS (Platform as a service)–* Developers can design, build and test applications that run on the cloud provider's infrastructure. E.g. Google app Engine
3. *IaaS (infrastructure as a service)* – This part is basically belong to the admin part or we can say the service provider. In this part the service provider provides the user with the basic infrastructure. Like platform and the end applications which become the interface between users and the cloud.

DATA SECURITY ISSUES IN CLOUD

Securing data is always of vital importance as shown in figure 4 and because of the critical nature of cloud computing and large amounts of complex data it carries, the need is even important. Therefore, data privacy and security are issues that need to be resolved as they are acting as a major obstacle in the adoption of cloud computing services.

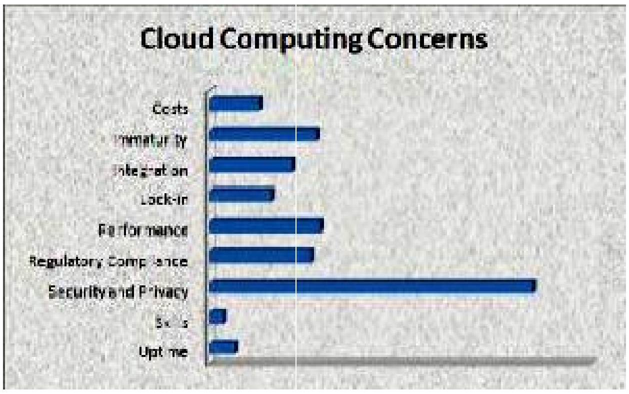

Figure 4: Cloud Computing Concerns

The major security issues with cloud are:-

1. *Privacy and Confidentiality:*
   Once the clients outsource data to the cloud there must be some assurance that data is accessible to only authorized users. The cloud user should be assured that data stored on the cloud will be confidential.
2. *Security and Data integrity:*
   Data security can be provided using various encryption and decryption techniques. With providing the security of the data, cloud service provider should also implement mechanism to monitor integrity of the data at the cloud.
3. *Data Recovery:*
   It is defined as the process of restoring data that has been lost, corrupted or accident.
4. *Trust Issue:*
   Trust is also a major issue in cloud computing. Trust can be in between human to machine, machine to human, human to human, machine to human. Trust is revolving around assurance and confidence. In cloud computing, user stores their data on cloud storage because of trust on cloud. For example people use Gmail server, Yahoo server because they trust on provider.

PROBLEM FORMULATION

Users who put their large data files in the cloud storage servers can relieve the burden of storage and computation. At the same time, it is critically important for users to ensure that their data are being stored correctly and safely. So, users should be equipped with certain security means so that they can make sure that their data is safe. The major concern is the security of data at rest and while moving. So to handle thisproblem it is required that data at both user and server end must be in encrypted form.

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ENCRYPTION TECHNIQUES

1. *Server-side Encryption:* With this option all data is encrypted in storage by the cloud platform itself. Server-side encryption really only protects against a single threat: lost media. It is more a compliance tool than an actual security tool because the cloud administrators have the keys anyway. Server-side encryption offers no protection against cloud administrators.
2. *Client/Agent Encryption:* If you don't trust the storage environment your best option is to encrypt the data before sending it up. In it we turn a shared public resource into a private one by encrypting it while retaining the keys.
3. *Proxy Encryption:* One of the best options for business-scale use of object storage, especially public object storage, is an inline or cloud hosted proxy. There are two main topologies:
   - The proxy resides on your network, and all data access runs through it for encryption and decryption.
   - The proxy runs as a virtual appliance in either a public or private cloud.

METHODOLOGY

Security of data and trust problem has always been a primary and challenging issue in cloud computing. This section describes a methodology as shown in figure 5 to ensure security in cloud computing. The two different approaches used are as follows:-

A. *Extensible Authentication Protocol-CHAP:*EAP stands for Extensible Authentication Protocol. It offers a basic framework for authentication. Many different authentication protocols can be used over it. New authentication protocols can be easily added. EAP works over a secure line. A client may not support all authentication methods so EAP must support authentication method negotiation. It also allows for mutual authentication by running the protocol in both directions. In our purposed model we use Challenge Handshake Authentication Protocol (CHAP) for authentication

B. *Rijndael encryption Algorithm:*The Rijndael is a symmetric block cipher algorithm with key sizes ranging from128, 192, and 256. A symmetric algorithm is one in which the cryptographic keys for encrypting plain text anddecrypting cipher text are the same. There are two types of symmetric encryption algorithms: stream ciphers and blockciphers. Stream ciphers encrypt data each digits separately and individually whereas block cipher algorithms encrypttext in blocks an pad original plain text so that the size it matches the block size. It uses the encryption of 128 bitblocks. Rijndael is an iterated block cipher, the encryption or decryption of a block of data is accomplished by theiteration (a round) of a specific transformation (a round function).

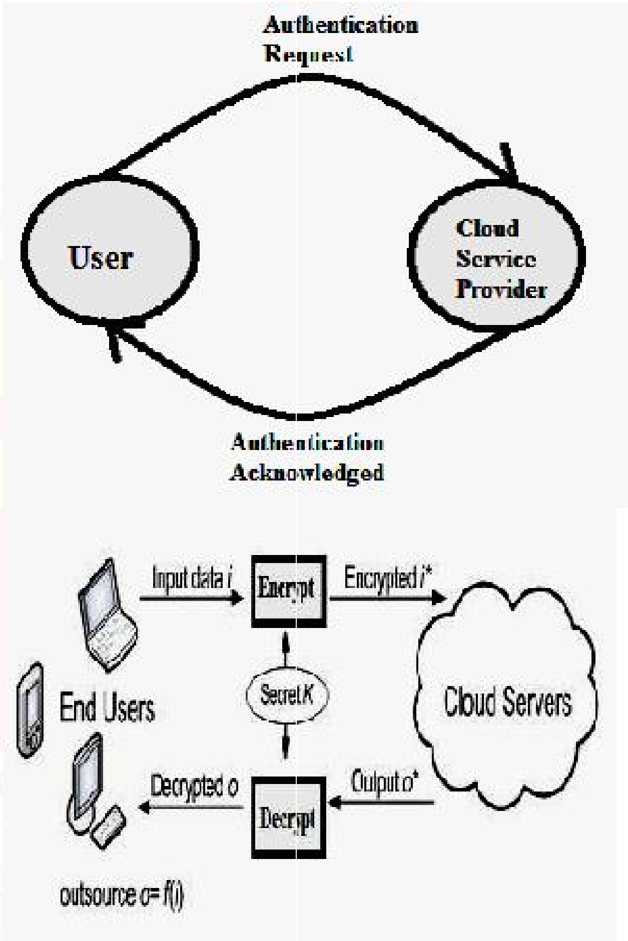

Figure 5: Methodology

The steps of the methodology shown in figure 5 are given below:-

1. User sends the authentication request to the Cloud Service Provider (CSP).
2. CSP checks the authorization using EAP-CHAP and sends the acknowledgement back to the user.
3. User first encrypts his data and then outsources it to the server.
4. When the user downloads his data from CSP, it is received in the encrypted form.
5. To use the data user can decrypt it using same key used for encryption.

CONCLUSION

Cloud computing is relatively a new technology that provides vast benefits to the users. Cloud computing has huge visions, but the security hazards placed in cloud computing approach are directly related to the benefits that it offers. For both the businesses and the hackers or attackers, cloud computing is a great chance and profitable. Security is ainflexible requirement for cloud computing environment. We have presented the various cloud computing security issues and the solutions for this. Although cloud computing has many advantages, there are still many actual problems that need to be solved. The main problem is to maintain the privacy and the confidentiality of the data. Data confidentiality can be achieved by encrypted outsourced content before outsourcing to cloud servers and for privacy it is required that only the authorized user can access the data. Even if some intruder (Unauthorized user) gets access of the data accidentally or intentionally, he will not be able to decrypt it. In my work, I have used Rijndael Encryption algorithm to provide security to the data and EAP-CHAP for authentication purpose .

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ROLE OF CLOUD COMPUTING IN AGRICULTURAL SECTOR FOR ECONOMIC DEVELOPMENT IN THE DEVELOPING COUNTRIES

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ABSTRACT

Cloud computing in agriculture plays an vital role. As in India, giant population lives in villages and smaller towns and they depends upon the agriculture. The agriculture in India essentially depends upon the natural resource. The maximum population is about 70 to 75% depends upon the agricultural sector and the natural income mainly comes from the agricultural sector. Cloud services mainly include built in hardware, software resources, infrastructure and storage depends upon the user demands.

The cloud computing technology in agricultural sector is useful for agriculture connected data bank such as weather, crop, soil, agriculture marketing, fertilizers and pesticides information to the farmers. This paper mainly focus on the role of cloud computing in agriculture field, benefits and challenges in agricultural field and implementation in agricultural sector.

Keywords: *Cloud computing, Agriculture.SaaS, PaaS, Iaas, cloud computing challenges.*

INTRODUCTION

Cloud computing technologies are resolved in various sectors of the developing countries. Maximum people in the rural areas depends on the agriculture, farming and economy of the developing countries exactly depends on the agricultural products. India is the biggest producer of food, grains and other products. But also the agriculture and the related production processes are decentralized followed by the farmer. Due to this the result is accessible between the supply and demand chains of the agricultural products. This directly affects the nation's income as well as the farmer's economic conditions of the country. Cloud computing means the fact in that the user does not know about the service provider and the cloud protect all the formality from them. Cloud computing needs less man power and zero maintenance [1]. Cloud computing provides easiest method to access database through the internet. Amazon web service provides the platform for cloud computing. Cloud computing has three different deployment model such as public, private and hybrid. The cloud computing models such as such as Infrastructure as a service (IaaS), Platform as a service (Paas), Software as a service (SaaS) for providing services [2, 3]. The services provided by the cloud computing is as follows-

(a) Software as a service (SaaS):-

SaaS contains the ICT tools such as web applications and software without purchasing and downloading and installing in a limited machine. In SaaS model any application is hosted as a service supplied to the users across the internet [1,2,3]. SaaS service delivery model, users directly use the application service over the network on the user's demand basis. Eg. Email, Google drive etc.

(b) Platform as a service(PaaS):-

Paas provides the platform for the developers to develop their own based application and tools and run them on the system software and hardware supplied by the other company. It guarantees the possibility of recent platforms and their security [1,2,3]. PaaS service required for the development of software. Eg. Google application engine.

(c) Infrastructure as a service (SaaS):-

IaaS provides the computer infrastructure as a service. IaaS is an instant computing infrastructure manages over the internet. It supports to avoid the complexity of acquiring and managing your own physical servers [1,2,3]. The cloud service provider governs the infrastructure at the time of purchasing, installing and configuring software operating system and application.

LITERATURE SURVEY

Sushil Kumar Choudhary et. al. (2016) in Role of Cloud Computing Technology in Agriculture Fields [1] focuses on the Computing model, cloud service model, deployment model, cloud benefits and challenge of cloud computing in the agriculture field. Also focuses on the cloud computing technology useful for centralized the agricultural associated data bank (Soil-related, weather, Research, Crop, Farmers, Agriculture marketing, fertilizers and pesticide information) in the cloud storage.

Rakesh Patel et. al. (2013) in Application of Cloud Computing in Agricultural Development of Rural India [2] have focused on benefits of cloud computing in the agricultural sector and suggested a cloud agro system and system have some services such as demand supply, communication , E- knowledge sharing , communication devices and research conducting and E- data bank is used for the information storing and contains a crop related data, soil, weather, growth progress monitoring and farmers data etc. Cloud computing is the newly concept and most of the countries are not aware of these concept so it requires a mass awareness

Seena Kalghatgi et. al. (2015) in Review: Using Cloud Computing Technology in Agricultural Development [3] have fussed on the implementation of cloud computing effectively in the developing counties and the usefulness if ICT in the agriculture sector in the economic development of the countries and using SaaS cloud service model a mobile application developed to the farmers guideline.

Radadiya B.L.et. al. (2016) in Cloud Computing and Agriculture [4] focused on delivery of computing recourses over the internet for keeping data on hard drive, cloud computing is the new concept you can store your data securely on the cloud and most of the nations are not aware of implementation of these technology. Also discuss benefits to the agriculture, industries and business and challenges.

Abdulrahman Saidu et. al. (2017) in Application of ICT in Agriculture: Opportunities and Challenges in Developing Countries [5] focused on the role of ICT technology in the developing countries. Also discuss the benefits and problems related to the application of ICT in agriculture.

Neelam Swarnkar in Application Of Cloud Computing Technology For Rural Development [6] have focused on the development of web based application on cloud and improve the knowledge of education, agriculture and healthcare in the rural areas and also design a cloud computing model for e learning.

ENHANCEMENT OF AGRICULTURAL SECTOR OF INDIA

This paper essentially focuses on the concept of fulfillment of cloud computing in Indian agricultural sector for economic development of the developing countries. It contains two parts – the first part monitor and fulfills user requirements for faster approach and other part for storing all the important data in a centralized location of cloud.

(A) Cloud agro system:

This part of the system controls the whole functionalities of the system. The system have online facility service available to all the users from ay part of country available at any time. The cloud agro system has some services such as demand supply, communication, e-knowledge sharing, communication devices and research conducting.

(i) Demand supply:-

It provides the current demand and supply of the agro products in distinct countries in the rural area. It helps the farmers to make the decision of selection of crops.

(ii) Communication:-

Due to this agro system the people in rural area can communicate in different parts of the countries. The literacy rate is less; therefore the system will provide services in their national languages and provide the audio-visual facilities to advertise the information.

(iii) E-knowledge sharing:-

The system provides the online communication facility to the farmers with the help of expert and also attend the online training programs. The system collects all the agricultural related global information to the rural farmers. The farmers can achieve information when they require from the cloud system. And they are aware of recent agro related concept.

(iv) Communication Devices:-

The mostly used communication device is mobile phones, mobile phones can easily access by the farmers. The farmers can access the information from cloud data bank from anywhere, at anytime through this devices. The government also provide the toll free service, the farmers can do miss call to toll free numbers and access the agro related information through mobile phones. They can also achieve information through SMS system.

(v) Research conducting:-

The researcher can extract agricultural data from the e-data bank from anywhere through cloud system in order to contribute the agricultural sector.

(B) E-data bank

The e-data bank is used to store all the agricultural information in the centralized cloud and this information is available to all the users at any time and they can access data from anywhere though the cloud. The main concept of e-data bank is to provide the vital information to the rural farmers in decision making. The e-data bank contains the following data bases such as crop related information, soil information, growth progress monitoring, farmer data and expert consultation.

CROP RELATED INFORMATION

It contains the information related to the different types of crops grown in various regions in India and this will helps the rural farmers in crop related decision making.

(i) **Soil Information:-**

Soil information is the main related decision making. The whole crop depends upon the soil; the nature of the soil is different for different region. Soil testing is also important.

(ii) **Weather information:-**

Data bank stores the weather information and provides the weather forecast to the farmers and it will benefits to the farmers to the selection of crops.

(iii) **Growth progress monitoring:-** It captures the data on crop growth in various region, useful for comparing crop growth region wise and compare it with previous data while importing a picture image.

(iv) **Farmers data**: - The e-data bank captures and stores the farmers data and study and monitor this data in agricultural sector. And also designing the agricultural policies. The whole data is stored on the server and when they require they access from the server at anywhere anytime.

(v) **Expert Consultation:-** Expert provides the solution for common problems occurring to the farmers.

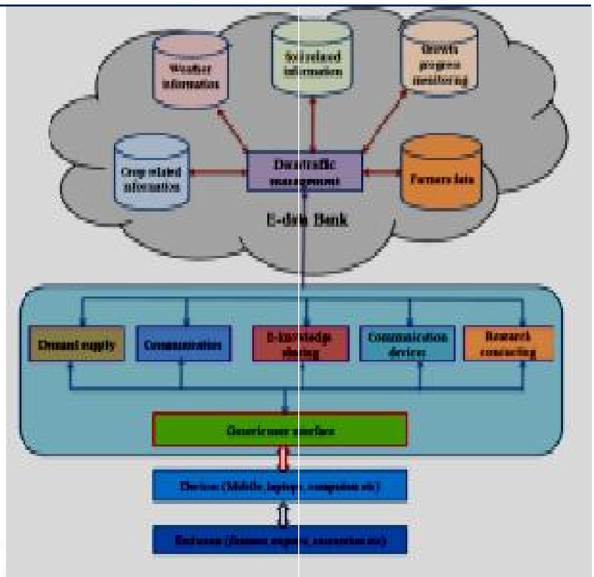

Figure: Cloud Agro System

IMPLEMENTATION IN AGRICULTURAL SECTOR

Cloud computing selecting the global market binding almost all the best sectors, there is nothing completed in Indian agricultural sector. Countries such as China, USA and Africa started implementing in cloud computing in agricultural sector in recent past but still in the potential state and consider the new technology in the developing countries. The key searching in this study is the economy does not play an important role in terms of rapidly of implementation of cloud computing in any sector.

Bhutan is the perfectly digital nation of telecommunication network interconnecting all the twenty districts established in 1998. Bhutan did not take time in achieving IOT importance and started using different key sectors such as ministries and prime organizations. However the Indian agricultural sector committed around 20% of the country's GDP and 65% of the total population is employed by this sector. Bhutan needs to establish a sophisticated city infrastructure a huge amount of investment and lacks of man power. The cloud computing tools can be implemented in agricultural sector with the help of this the impact of doing this project the cost, time and the communication system faster and easier. By guiding information related to agriculture through the cloud and other devices by using internet the farmer can achieve bulky information and the nation's economy is increasing very fast.

BENEFITS OF CLOUD COMPUTING IN AGRICULTURAL SECTOR FOR RURAL AREA

There are some of the benefits of using cloud computing, out of the following seems more suitable for the economic development in the developing countries.

- It promotes the economic condition of nation.
- Encouragement of farmers and researchers.
- It supplies the enhance security to the resources stored in the cloud and maintain by
  - the Service providers.
- The communication system between the global and local users much easier and
- cheapened and will be secured.
- Motivation of farmers and researchers involved more and more into agriculture as any
- Communication system will result adapted.
- The users access the cloud server through personal computer, touch pad or mobile
  - Phones at any location and at any time.
- The data can be available at anytime and anywhere at any location without delay.
- The administration is easy and no need of software license, power supply to run the
- Server.

CHALLENGES OF CLOUD COMPUTING IN AGRICULTURAL SECTOR

- Cloud computing is the progressive tool to take the challenges in rural development and implemented in rural areas.
- To set up a strong network of computing devices with constant internet connection.
- The farmers training technology programs are necessary.
- English language is not well known to all rural people so instead the villages prefer their local languages.
- It requires constant internet connection facility.
- The farmers in rural area do not know about cloud computing technology.
- The farmers data is not secured due to the third party maintenance.
- The hackers can direct attack to the data.

ROLE OF CLOUD COMPUTING FOR RURAL AREA IN AGRICULTURAL FIELD

(i) In cloud storage all the agricultural related information stored and the farmers can access easily these information at anytime and anywhere.
(ii) It improves the agricultural marketing products.
(iii) It manages the agricultural data related soil, weather, land and location centralized decision making system.
(iv) People can directly sell their agricultural product in market directly. Many agent burst in between the retailer and production basically heavy exploitation of the farmers. Due to the use of cloud computing system the farmers can sell their products to the end users directly.

CONCLUSION

Role of cloud computing in agricultural sector plays an important role to provide comprehensive farming. The utilization of current technologies accomplishes the monitoring of agricultural easy and simple. This technology will carry outstanding opportunities to the agricultural development in the developing countries and explicitly have real impact in the overall economic development of the nation. With the help of cloud computing applications, farmers are profits in the context of larger production and decision making process and the market selling is high. Different types of government schemes for the agriculture presented to farming society with the help of cloud computing. The reason for implementing cloud computing is to help to farmers to take decision associated to the crops.

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COMPARITIVE ANALYSIS OF UDP AND SCTP BANDWIDTH OF WI-FI NETWORK IN ANDROID SMARTPHONES

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ABSTRACT

Wireless technology has been available for decades. This technology has been allowed for transferring data efficiently over long distances... The devices in wireless technology can be developed to support communication with higher data rate and security. The smart phones are equipped with Wi-Fi technology The Wi-Fi on smart phones used to fast and possibly free internet access. With increase in number of wireless devices, slows down the internet performance of Wi-Fi network. The main reason of such performance degradation is the channel bandwidth. In this paper the performance analysis of channel bandwidth of UDP and SCTP protocol are considered. In this paper, an overall comparison of UDP and SCTP bandwidth in order to analyze the performance.

***Keywords**: Wi-Fi, Android Smartphone's, UDP, SCTP.*

INTRODUCTION

Wi-Fi is the wireless fidelity which allows an electronic device to communicate over wireless signal. Fidelity gives compatibility between wireless equipment from different manufacturer. Wi-Fi works on physical and data link layer It allows local area network to operate without cables and wiring. It is very much popular for the home and business network It can be used to provide wireless broad band internet access for many devices such as laptops, smart phones, tablets and computers with authentication. It uses radio frequency to transmit and receive data at higher speed frequency with the electromagnetic spectrum associated with radio wave propagation. When an RF current is passing through and antenna an electromagnetic field is created that is able to propagate through space. The transport layer employed one of two protocols, transmission control and user datagram protocol. The choice of transport protocol depends on the requirement of the application in the terms of quality of service. Application that requires reliability in order to delivery of the data. To extend transport layer functionality the new protocol the stream control transmission protocol (SCTP. It offer a point to point connection oriented reliable delivery transport service for application communicating over an IP network. SCTP provides a number of functions that are critical for telephony signal ling transport and at the same for communication SCTP supports for multi-homing and partial ordering. It establishes a session with another SCTP host over multiple interfaces identified by separate IP address. Thus SCTP can benefit applications that require reliable delivery and fast processing of multiple unrelated data stream protocol

WI FI NETWORK

There are multiple standards for wireless n/w available today with varying levels of standardization and interoperability. The IEEE finalized the initial standards for wireless n/w under the title of IECE 802.11. It defines the format and structure of short range signals that provide the Wi-Fi serviceThe original 802.11 standards was released in 1997. It covers several types of wireless media and specifies a 2.4 GHz operating frequency with the data rate of 1 and 2 Mbps. It uses either frequency hopping or direct sequence because of relatively low data rate as compared to Ethernet. In 1999, IEEE published two additional 802.11 standards : 802.11a and 802.11b. The 802.11 operates the physical layer in the 5 MHz radio spectrum with data rate up to 54Mb/s. It covers 50.20 meter range and higher range physical layer as compared to 802.11b. It has less radio frequency interference with other type of devices. However 802.11 are not compatible with 802.11b and 802.11g as with the initial standards 802.11b operates in the 2.4Ghz radio spectrum but it includes 5.5 and 11Mb/s data rates with the range 30m, but it produces more frequency interference. The 802.11 extends the data rate in 2.4 GHz radio frequency band to 50Mbp/s using orthogonal frequency division Multiplexing. It is the combination of 802.11a and IEE 802.11b. It is appeared offering greater performance on the basis of speed and range. Another improved standard called 802.11n has yet to be finalized. It has an additional feature of MIMO (Multiple inputs and multiple outputs). It specifies an operation in the 2.4 Ghz radio spectrum with an data rate 54Mbps to 600Mbps.Following table gives overall idea about Wi-Fi standards

LITERATURE REVIEW

In communication Wired technology playing the very important role from several years but these technology have been drawbacks of using cable, it is very difficult to use for long distance communication. Even also reliability does not occur. Therefore these drawbacks can be overcome by using wireless communication. The wireless communication has been allowed for transferring data over long distance. The advantage of using wireless communication is Reliability of data, greater mobility and possibilities to move devices and connect it freely without utilization of cables. Wireless communication communicates via satellite. The data can transfer with the help of wireless network such Wi-Fi

Wi-Fi is the wireless fidelity which allows an electronic device to communicate over wireless signal. Fidelity gives compatibility between wireless equipment from different manufacturer. Wi-Fi works on physical and data link layer It allows local area network to operate without cables and wiring. It is very much popular for the home and business network . [1,3,5,16,17]

The rapid growth of digital wireless telephony gives rise to an increasing demand for data services as well. This is achieved through the concept of transport layer connection established between different interface pairs at the two end points. During the normal operation SCTP always uses at most one path at the time for communication. [10,12]SCTP is the fundamental member of a family of protocols designed by the SIGTRAN group to allow SS7messages to be transported over an unreliable IP infrastructure. All data transferred between the hosts is encapsulated in SCTP packets. SCTP packet contains a common header and a sequence of structures called 'chunks'.

The Stream Control Transmission Protocol (SCTP is a Transport Layer protocol, serving in a similar role as the popular protocols: UDP. Indeed, it provides some of the same service features of both, ensuring reliable, of messages with congestion control, and preserving data message boundaries similarly to UDP. However, differently to UDP, SCTP offers such advantages as multi-homing and multi-streaming capabilities .referred to as a sequence of bytes, an SCTP stream represents a sequence of messages.Multi-streaming allows data to be partitioned into multiple streams that have the property of being independently delivered to the application at the receiver. This means that the loss of a data chunk that belongs to a certain stream will only affect the delivery within that stream, without affecting the delivery of other streams., congestion avoidance, fast retransmit and fast recovery mechanisms First, the direct dependence of SCTP on the number of bytes acknowledged, rather than the number of acknowledgements received, to increase the congestion window. Secondly, the implicit dependence of SCTP on SACK messages for acknowledging the received data chunks

RESEARCH OBJECTIVE

Following objectives were aimed in writing this paper:

- Measurement of bandwidth of wi-fi Network.
- What is the bandwidth of UDP and SCTP protocol in smartphone (Android 6)?
- Is SCTP better than UDP? How?

BANDWIDTH MEASUREMENT TOOLS

Various tools are available for performance measurement of Wi-Fi network such as Wi-Fi analyzer wireshark, Acrylic Wi-Fi (Windows), AirGrabWiFi Radar (Mac OS X), Cain & Abel (Windows), Homedale (Windows), LizardSystems Wi-Fi Scanner, Wireless NetView , Wireless Diagnostics (Mac OS X Lion and later), SL Speed Test, Wi-Fi Network Analyzer, Wi-Fi Spectrum Analyzer, Wireless Manager and even Wi-Fi Hotspots, InSSIDer, Xirrus Wi-Fi Inspector, Connectify, WeFi, Hotspot Shield,Plug and browse.

These tools can be installed on different operating systems depending on their compatibility. It can run on Windows, Mac OS, Linux, Android The tools which runs on android smartphones are Speedtest.net, 3G 4G WiFi Map &Speedtest, Wifi Analyzer, Network Signal Info, WiFi Expert, WiFi Manager, WiFi Connection Manager [18]. Amongst these tools,iperf tool has been selected for experimental work as this tool runs on the operating systems like windows, linux, Mac OS , Linux, reeBSD, OpenBSD, NetBSD, VxWorks. In this paper Iperf tool is used for experimental analysis.

Iperf tool:

iPerf is used for performance tuning and it measures throughput ,bandwidth and jitter ,data loss in case of UDP tests. There are two components of iperf tool server and client. It is an open source command line tool.

Setup:

The experiment has been carried out on two device having Iperf installed on both devices and is having internet connection through Wi-Fi network. The density of the network is set to zero i.e. only these two devices are connected to internet connection. All experiments have carried out at same distance and place because this was not in scope of this paper. The parameters for the experiment are no. of requests and size of data. There are three cases in which the experiment was carried out viz. unidirectional, bidirectional (sequential and parallel). The device used for this experiment was Android 6 (marshmallow) smart phone.

Following are the different commands used for the experiment of , SCTP and UDP bandwidth measurements:

a) To send data of different size in one direction:
perf –c 192.168.43.144 -u –n 10 (for UDP)
perf –c 192.168.43.144 --sctp –n 10 (for SCTP)

b) To send more no. of requests in one direction:
perf –c 192.168.43.144 -u -r 10 (for UDP)
perf –c 192.168.43.144 --sctp -r 10 (for SCTP)

c) To send data from both directions sequentially:
perf –c 192.168.43.144 -u –d –n 10 (for UDP)
perf –c 192.168.43.144 --sctp –d –n 10 (for SCTP)

d) To send data from both directions parallel:
perf –c 192.168.43.144 --sctp -p -n 10 (for UDP)
perf –c 192.168.43.144 --sctp -p -n 10 (for SCTP)

e) To send no. of requests from both directions sequentially:
perf –c 192.168.43.144 -u –d –r 10(for UDP)
perf –c 192.168.43.144 --sctp –d –r 10 (for SCTP)

f) To send no. of requests from both directions parallel:
perf –c 192.168.43.144 -u –p –r 10 (for UDP)
perf –c 192.168.43.144 --sctp –p –r 10 (for SCTP)

RESULTS AND INTERPRETATION

Case I-a) Unidirectional-Changing the size of data

Size of data (in KB)	UDP		SCTP	
	Client (Mbits/ Sec)	Server (Mbits/ sec)	Client (Mbits/ sec)	Server (Mbits/ sec)
10	1.02	16.0	2.02	14.0
100	1.4	18.7	1.92	13.7
1000	12.5	20.7	1.76	22.7
10000	69.8	69	1.04	56

Table 1 : Bandwidth of UDP and SCTP in android smartphones(unidirectional) w.r.t. size of data

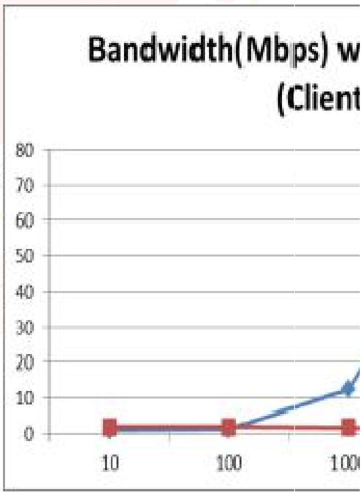

Fig.1: Comparison of client bandwidth in UDP & SCTP unidirectional w.r.t. size of data

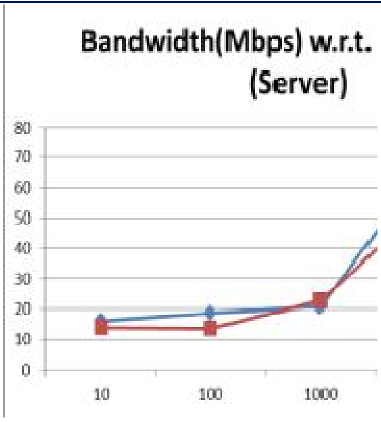

Fig.2: Comparison of Server bandwidth in ,UDP& SCTP unidirectional w.r.t. size of data unidirectional w.r.t. no. of requests

Interpretation:
From the graphs above, it can be observed that SCTP is utilizing less bandwidth, UDP is utilizing more bandwidth.

Case I-b) Unidirectional-Changing the number of requests

No. of Requests	UDP		SCTP	
	Client (Mbits/ Sec)	Server (Mbits/ sec)	Client (Mbits/ sec)	Server (Mbits/ sec)
10	1.06	1.06	2.02	14.0
20	13.7	1.05	1.92	13.7
40	16.9	1.05	20.7	10.25
80	19.2	1.05	20.5	12.5
100	21.2	1.05	20.4	10.25
120	27.4	0.82	22.03	12.05

Table 2 : Bandwidth of UDP and SCTP in android smartphones(unidirectional) w.r.t. no. of request

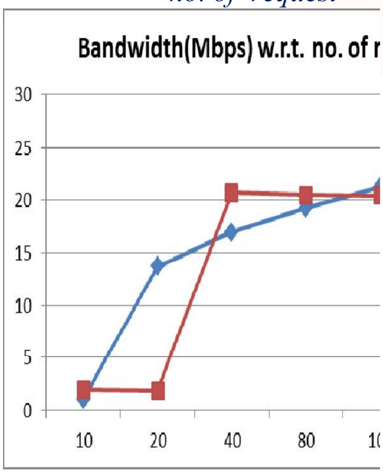

Fig.3: Comparison of client's bandwidth in ,UDP& SCTP unidirectional w.r.t. no. of requests

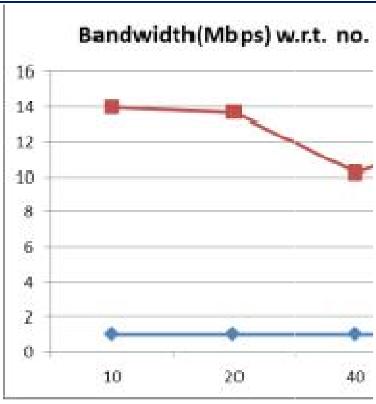

Fig.4: Comparison of Server 's bandwidth in UDP& SCTP unidirectional w.r.t. no. of requests

Interpretation:
From the graphs above, it can be observed that SCTP is utilizing more bandwidth, UDP is utilizing less than SCTP is utilizing more bandwidth.

Case II-a) Bidirectional (Sequential) - Changing the size of data

Size of data (in KB)	UDP		SCTP	
	Client (Mbits/ Sec)	Server (Mbits /sec)	Client (Mbits /sec)	Server (Mbits /sec)
10	1.02	2.50	18.9	6.61
100	0.932	10.03	22.9	6.62
1000	0.936	16.08	20.9	6.68
10000	0.87	18.6	21.09	6.92
100000	1.09	20.01	21.13	6.70

Table 3 : Bandwidth of ,UDP and SCTP in android smartphones(unidirectional) w.r.t. size of data

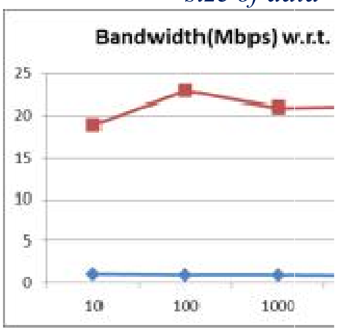

Fig.5 Comparison of client's bandwidth in,UDP& SCTP bidirectional (sequential) w.r.t. size of data

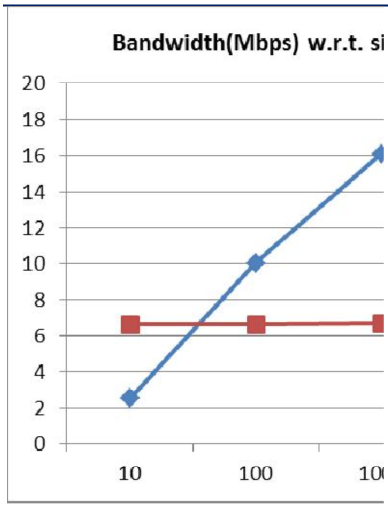

Fig.6: Comparison of Server bandwidth in ,UDP& SCTP bidirectional (sequential) w.r.t. size of data

Interpretation:

From the graphs above, it can be observed that SCTP is utilizing less bandwidth, UDP is utilizing more than SCTP is utilizing more bandwidth

Case II-b) Bidirectional (Sequential)- Changing the number of requests

No. of Requests	UDP		SCTP	
	Client (Mbits/Sec)	Server (Mbits/sec)	Client (Mbits /sec)	Server (Mbits/sec)
10	1.05	1.05	12.03	28.2
20	1.05	1.05	16.08	25.2
40	1.05	1.05	12.06	26.3
80	1.05	1.05	18.03	25.85
100	1.05	1.05	17.09	27.2
120	1.05	1.05	15.06	30.06

Table 4 : Bandwidth of ,UDP and SCTP in android smartphones(unidirectional) w.r.t. no. of request

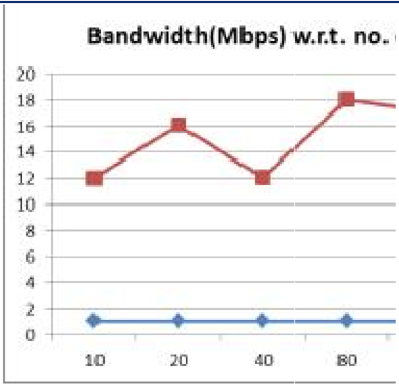

Fig.7 Comparison of client's bandwidth in ,UDP& SCTP bidirectional (sequential) w.r.t..no. of request

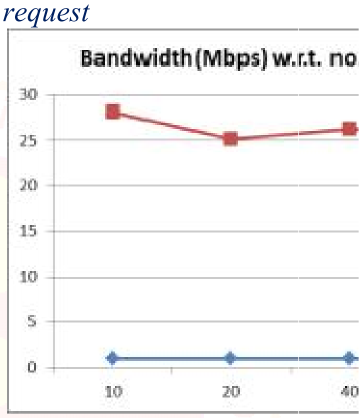

Fig.8: Comparison of Server bandwidth in UDP & SCTP bidirectional (sequential) w.r.t. no. of request

Interpretation:

From the graphs above, it can be observed that SCTP is utilizing less bandwidth, UDP is utilizing more than SCTP is utilizing more bandwidth

Case III-a) Bidirectional (Parallel) - Changing the size of data

Size of data (in KB)	UDP		SCTP	
	Client (Mbits /Sec)	Server (Mbits /sec)	Client (Mbits /sec)	Server (Mbits /sec)
10	3.43	5.61	20.10	3.61
100	3.43	5.62	20.10	3.62
1000	3.46	5.68	16.6	3.68
10000	3.77	5.92	20.7	3.92
100000	4.01	6.67	20.7	3.87

Table 5 : Bandwidth of,UDP and SCTP in android smartphones(unidirectional) w.r.t. size of data

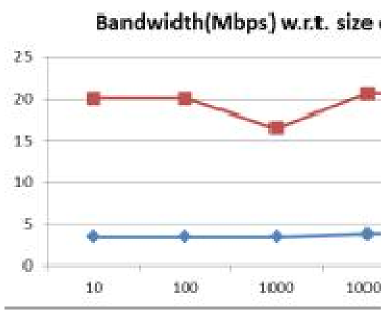

Fig.9 Comparison of client's bandwidth in UDP & SCTP bidirectional (Parallel) w.r.t.. size of data

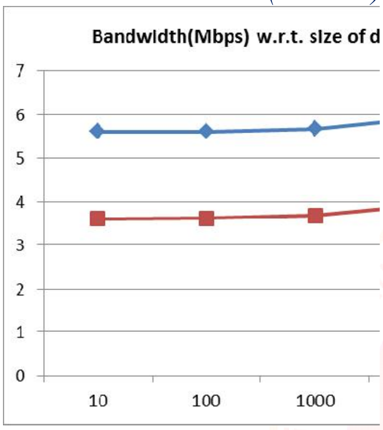

Fig.10 Comparison of Server bandwidth in UDP& SCTP bidirectional (Parallel) w.r.t. size of data

Interpretation:
From the graphs above, it can be observed that SCTP is utilizing less bandwidth, UDP is utilizing more than SCTP is utilizing more bandwidth

Case III-b) Bidirectional (Parallel)-
Changing the number of requests

No. of Requests	UDP		SCTP	
	Client (Mbits/ Sec)	Server (Mbits/ sec)	Client (Mbits/ sec)	Server (Mbits/ sec)
10	2.03	18.2	11.06	2.03
20	6.08	15.2	10.04	2.05
40	12.06	16.3	10.03	2.03
80	21.03	15.85	10.05	2.05
100	27.09	17.2	11.06	2.07
120	34.06	16.2	10.05	2.03

Table 6 : Bandwidth of UDP and SCTP in android smartphones(unidirectional) w.r.t. no. of requests

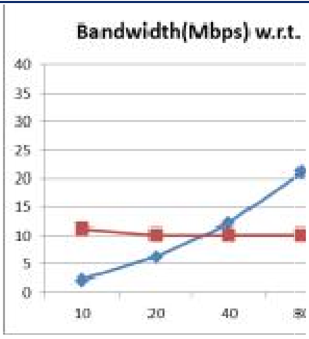

Fig.11 Comparison of client's bandwidth in UDP& SCTP bidirectional (Parallell) w.r.t.. no. of request

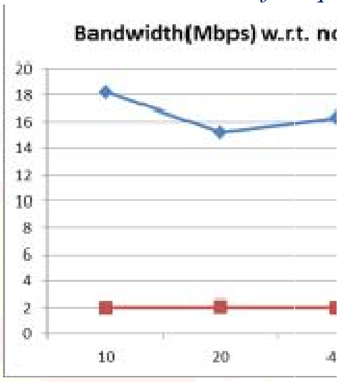

Fig.12 Comparison of Server bandwidth in UDP& SCTP bidirectional (Parallel) w.r.t. no. of request

Interpretation:
From the graphs above, it can be observed that, UDP is utilizing more than SCTP is utilizing more bandwidth than UDP.

Interpretation:
From above values,it can be concluded that when no. of requests and size of each request is less, client and server both gives better performance and with increase in number of request or size of data more bandwidth is utilized.

Analysis of UDP protocol:
Minimum Bandwidth obtained= 0.87Mbits/sec (Client device, size of data = 100 KB)
Maximum Bandwidth obtained= 69.8Mbits/sec (Client device, size of data =10000 KB)
Average Bandwidth obtained= 10.67Mbits/sec

Interpretation:
From above values, it can be concluded that when no. of requests and size of each request is less, client and server both gives better performance and with increase in number of request or size of data more bandwidth is utilized.

Analysis of SCTP protocol:
Minimum Bandwidth obtained= 1.04Mbits/sec (Client device, size of data = 100 KB)
Maximum Bandwidth obtained= 56Mbits/sec (Client device, size of data =10000 KB)

Average Bandwidth obtained= 12.53Mbits/sec

Interpretation:

From above values, it can be concluded that when no. of requests and size of each request is less, client and server both gives better performance and with increase in number of request or size of data more bandwidth is utilized.

Protocol	**UDP**	**SCTP**
Average bandwidth	10.67 Mbits/sec	12.53 Mbits/sec

CONCLUSION

From all the results and graphs, it can be concluded that in both versions Server device is taking constant bandwidth whereas client device is either utilizing less or more bandwidth .Compared UDP, SCTP is a better protocol as for some of the experiments, UDP protocol failed at some values in every test but SCTP didn't get failed at all as the data is sent in terms of chunks, hence sometime differs in bandwidth but the data is sent surely. UDP utilizes least bandwidth but is unreliable protocol

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BIG DATA ANALYTICS FOR REAL ESTATE PREDICTION

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ABSTRACT

There are various parameters that influence the real estate price variations. Most of the modern day bankers and investors are also interested to know the real estate price future change and the various effects of the market on the changes. There are many factors and parameters such as the architectural factors, economic growth, interest rates etc. that leads to the changes in the real estate rates. In this particular model, parameters are taken into consideration in order to predict the future price of the particular estate. The internet acts as a source of data, marketing, business expansion, and various other utilities. The data set will be collected from the internet which will include the required attributes and parameters. By studying the past variations we incorporate an algorithm which is Lasso and Linear Regression Algorithm that will read all necessary data from the dataset- the train set that will develop the pattern of particular real estate, tendencies of the rise or fall of the prices and the test set on which the particular usage pattern developed will be applied in order to obtain the prediction of the real estate price.

Keywords: real estate, price, parameters, algorithm.

INTRODUCTION

Real estate is one of the major aspects that defines the wealth and glory of an individual. In addition, the fluctuations in the real estate's price have an impact on the household's investment and consumption. The modern day investors, bankers and business men are interested in the developments and the future predictions of the real estate. The fluctuation in the prices of real estate also leads to the economic variation of the nation. However, there are too many factors that influence the prediction model. In the existing model, Random forest prediction algorithm has been used in order to come to a final prediction. Since we know that random forest algorithm uses random data set and variable in order to generate multiple decision trees, which are the evaluated and on the basis of majority the final prediction is made. The above model is unorganized and doesn't follow a particular principle. In the proposed model we are using LASSO (Least Absolute Shrinkage and Selection Operator) algorithm and Linear Regression algorithm.

LASSO is type of regression analysis that performs both variable selection (selection of a subset of relevant variables/attribute for the model construction) and regularization in order to improve the prediction accuracy of the model. The computation of lasso solution can be done by standard numeric analysis algorithms. Lasso regression performs L1 regularization, i.e. it adds a factor of sum of absolute value of coefficients in the optimization objective. Thus, lasso regression can be mathematically represented as the following:

Objective = RSS + α * (sum of absolute value of coefficients)

(RSS: Residual sum of squares)

Here, α (alpha) is the parameter which balances the amount of emphasis given to minimizing RSS vs minimizing sum of square of coefficients. α can have various values as follows:

α = 0: Same coefficients as simple linear regression

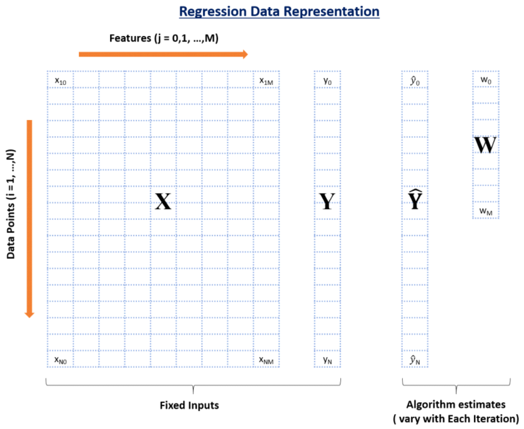
α = ∞: All coefficients zero

0 < α < ∞: coefficients between 0 and that of simple linear regression

To minimize the objective function we add the sum of absolute value of magnitude of weights to RSS.

$$Cost(W) = RSS(W) + \lambda * (\text{sum of absolute value of weights})$$

$$= \sum_{i=1}^{N}\left\{y_i - \sum_{j=0}^{M} w_j x_{ij}\right\}^2 + \lambda \sum_{j=0}^{M} |w_j|$$



In the above graphical representation, you can see there are 4 data elements:

X: the matrix of input features (nrow: N, ncol: M+1)
Y: the actual outcome variable (length:N)
Yhat: these are predicted values of Y (length:N)
W: the weights or the coefficients (length: M+1)

SIMPLE LINEAR REGRESSION is one of the commonly known predictive analysis algorithm. It creates a model of the relationship between two variables by fitting a linear equation to observed data. One of variable is an explanatory variable, and the other is a dependent variable.

Before fitting a linear model to observed dataset, we need to check whether or not there exists a relationship between the two variables of interest. The relationship does not necessarily imply that one variable is responsible for the other, but that there is some significant connection between the two variables.

The objective function also known as the cost that is to be minimized is nothing but the RSS (Residual Sum of Squares), which is nothing but the sum of squared errors of the predicted output in comparison with the actual output.

This can be mathematically as follows:

$$Cost\,(W) = RSS(W) = \sum_{i=1}^{N}\{y_i - \hat{y}_i\}^2 = \sum_{i=1}^{N}\left\{y_i - \sum_{j=0}^{M} w_j\, x_{ij}\right\}^2$$

Where;

$$\hat{y}_i = \sum_{j=0}^{M} w_j \, * \, x_{ij}$$

X: the matrix of input features (nrow: N, ncol: M+1)
Y: the actual outcome variable (length:N)
Yhat: these are predicted values of Y (length:N)
W: the weights or the coefficients (length: M+1)

RELATED WORKS

1) **Big Data Analytics for Program Popularity Prediction in Broadcast TV Industries-** The distinct prediction of program popularity is of great use for content providers, advertisers, and broadcast TV operators. This information can be beneficial for operators in TV program purchasing decisions and can help advertisers formulate reasonable advertisement investment plans. In technical terms, a precise program popularity prediction method can advance and develop the whole broadcasting system, such as the content delivery network strategy. Several prediction models have been proposed based on video-on-demand (VOD) data from YouTube, and Twitter. There are two major algorithms used in this paper; first for dynamic time wrapping they have used K-medoids algorithm for cluster programs with similar popularity. The data used in this algorithm is raw data. The second algorithm used is for prediction model; which is the Random forest algorithm (RF). This algorithm uses random data set and variables to generate multiple decision tree, of which the one with best result is the final prediction.

   Advantages: prediction helps the TV operators to develop well organized plan for advertisements and future investments.

   Disadvantages: require a large quantity of samples and long training time. The selection of the data set is random and unorganized. The is no particular method by which the variables and data set can be selected which makes it very difficult to find out the exact data set or variable that lead to the particular prediction.

2) **Applying Dynamic Bayesian Tree in Property Sales Price Estimation–** In this particular paper, the sales prediction is done with the help of the dynamic Bayesian tree.

   Advantages: The model presented to us has seven different types of algorithms that provides us the price prediction of the particular real estate.

   Disadvantages: This model only uses various methods to provide us the estate price. All the different models generate different graphs and results.

3) **Image-Based Appraisal of Real Estate Properties-** This paper is also related to the real estate price prediction. One of the major factors involved in this is the visual representation of the particular estate. They have used neural network in order to produce the visual representation of the property.
Advantages: The major advantage of this model is that the user can visually see the estate without going to the location which helps them filter out their options.
Disadvantages: In this model, while the user can see the property prior the visit. They only get the knowledge about the visual aspects of the house and not the complete financial and neighborhood information.

4) **Prediction of Real Estate Price Variation Based on Economic Parameters-** In this paper, we can see that the main factors included that affect the real estate prediction are the economic factors. Various economic parameters more or less influence the real estate price variation.
Advantages: This model takes into consideration the macroeconomic parameters that lead to the prediction of the variation in the real estate pricing. They have used back propagation neural network (BPN) and radial basis function neural network (RBF) to develop the nonlinear model for real estate price variation prediction.
Disadvantages: Taking into consideration the various economic factors, the other factors like the architectural factors are not concentrated on much.

5) **Research on prediction methods of Residential real estate price Based on Improved BPNN-** This paper presents a real estate prediction model that takes into consideration the mixed optimizing model based on IPSO-BPNN.
Advantages: This model uses gray correlation theory that optimizes the index value that influences the price and uses IPSO to optimize the definition of original weights and the threshold value.
Disadvantages: This method lags in providing reduced iteration times, output stability, convergence and precision of prediction.

Proposed System

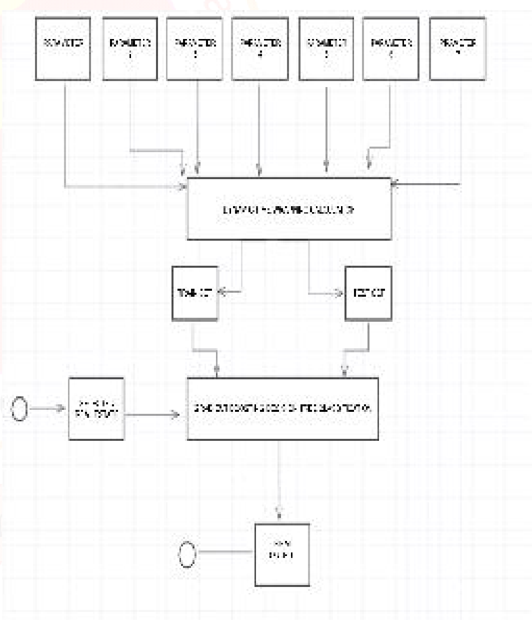
In this project, the data set is collected with includes the parameters such as economic growth, interest rates, property rates, etc. From this data set a particular pattern is generated using Lasso regression algorithm, which is used to predict the final outcome. The whole model consists of three levels.

The first level is the data collection model. It reads the data from the input data set and studies the various attributes and applies Dynamic time wrapping (DTW) to it. This DTW data is then clustered using the algorithm.

The second level is responsible for the pattern generation. The data is the divided into two parts, first the train set and second the test set. After that, the LASSO algorithm and LINEAR REGRESSION is applied to each individual trend. This then is passed on to the gradient boosting decision tree which is a part of third level.

The third level involves the interface of the user. The input from the user is taken is further transferred to the decision tree along with the Lasso model and the regression model to generate the final price prediction of the estate.

BLOCK DIAGRAM



CONCLUSION AND FUTURE ENHANCEMENTS

Hence by using this model which comprises of both Lasso and Linear regression algorithm of prediction we can obtain more organized and principled prediction technique. In this paper, we have analyzed massive user behavior data and presented our improved method to predict the prices of real estate. We applied a dynamic time warping (DTW)-algorithm. The two datasets namely, train set which is studied and the usage pattern is noted, that particular pattern is applied to the test set in order to obtain the predicted price. For future work we can add visual representation of the real estate requested by the user with the help of neural networks, which will help them get a better idea about the property prior to visiting it personally.

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UNDERSTANDING PRACTICAL GREEN MANAGEMENT THOUGH ENERGY EFFICIENCY AWARENESS IN LOOSELY COUPLED COMPUTER ENVIRONMENT OF SRTM UNIVERSITY, NANDED

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ABSTRACT

This paper is summery of the efforts made for green management through reduction in power consumption by computers without affecting work efficiency. The computers are second largest power consumption device in the administration and the number of computers in administration are increasing thereby increasing power consumption. This study was designed to monitor power consumption and to learn more about users' behaviors toward the power management features. A sample space of 121 computers was physically monitored through power meters, awareness workshops were taken and finally actual reduction in power consumption was observed.

Keywords: *Green Management, Power consumption, Computer Efficiency*

INTRODUCTION

Swami Ramanand Teerth Marathwada University, Nanded is a State University in Maharashtra which has spread across four districts, viz, Hingoli, Parbhani, Latur and Nanded, from Marathwada zone. Its head quarter is at Nanded. This headquarter has a main Administrative Building consists of four floors. Every floor has sections like Finance & Accounts, Academics, Administration, Examinations, etc, to cater actual functioning. A significant portion of plug load energy in all sections is used for computers, including desktops, laptops, and related computing devices. Studies like energy audit conducted by the university itself [1] have indicated that beside air conditioners, computers account for more electricity consumption. Every section has minimum 2 to 10 computers, used throughout the day for carrying section related jobs mainly typing, data entry and printing. Computers typically have built in features providing for reduced energy consumption when the computer is not in active use. These features allow the computer to be switched to low power modes automatically. Awareness of these modes could save sizeable amounts of energy, but there are very few people who have such awareness. Hence unattended computers consume more power which obliviously leads to high power bills.

Reduction in power consumption or achieving energy efficiency is always part of green initiatives. The term "green" is polymorphic and many times taken as reduction in power, management of energy, efficiency gaining, optimization, recycling, reuse, etc. All organizations have passive plans for green initiative to reduce power bills. In our view, Computer / IT is the biggest user of energy, primarily because power is a basic requirement for their operations and also because the power supplies in most computers and other hardware are not designed for energy efficiency. In fact, most computers drain more power than they need during normal operations. A typical desktop computer can consume 200-300W of power, leading to consumption of 0.5 to 1 unit per day. Moreover, 50 computers can generate about 10KW of heat requiring extra cooling [5]. This has indirect environmental impacts also. A single desktop computer results in emission of about 220Kg of CO_2 /annum [3]. By using more efficient systems, the level of CO_2 produced by a typical desktop computer could be reduced by 75%. Although office computer use is increasing, no considerable efforts to reduce energy use through improved power management have yet focused or practiced at university's end.

In our overall work, meaning of green has taken as green use or energy efficiency. The green management means work organisation using built in energy efficient equipments and architecture, which has likely less environmental impacts - one unit saved is actually one unit generated. In our view the solution for green management should be easily addressable. We feel that the solutions must be part of the operational management or computing infrastructure. Further, these solutions must take form like technical innovation supporting energy management, tools for re-thinking, tools for re-designing, management restructuring utilities, regulatory compliance, awareness etc.

After observing the truth that, every day, many computers are turned on and left unattended till end of the day, the proper solution form can be awareness i.e., to aware people towards existing power management tools and force them to use. This study took it as a challenge. A proposal, titled escalating opportunities for initiation of green computing in S.R.T.M. University and suggestion of approaches for green management was submitted to the Rajiv Gandhi Science and Technology Commission, Maharashtra State (RGSTC) [2], in the form of a project. This RGSTC Commission has been set up under the act of the state legislature for the purposes of advancement, propagation and promotion of application of science and technology for development. The Commission undertakes programs and projects related to science and technology and its utilization for the benefit of the people. Since, conservation of energy is directly related with environment protection, cost reduction and energy efficiency, the proposal was sanctioned as a pilot study.

The specific focus of the study was more or less like a self enquiry to reduce energy consumption of computers by awareness and training and without affecting work efficiency. The final output was energy efficient computing scenario (a form of green management) and ICT survey as by-product. The key motivations were ,

1. Criteria VII of NAAC - Does the University conduct a green audit of the campus? The answer was no in our case.
2. Energy Audit made by Electrical Department of the University, which was not specific to computers.
3. Number of Computers and peripherals in the university are increasing and their consumption is also increasing.
4. This will be a "lead by example" for other institutions.

WORK PLAN

This work is a collaborative work between schools of the campus and electrical department. The principal author is actual principal investigator of the project where as fifth author is the fellow appointed under the project. The second author has actually helped for measurement of electric consumption. The third and fourth authors have helped for statistical analysis of sample space and behavior analysis of staff respectively.

Many research studies have addressed power management in computers, but no single study can cover all aspects of the considered project [3,4,5,6]. Monitoring alone cannot determine whether power management is operational or not?, which power settings were selected?, or why?. There is a compulsory need to understand how the usage pattern is? Further staff behavior, working style, nature of job done through computer, etc must also be monitored to understand how exactly a computer is used?. The type and make or configuration of the computer being used also matters. More advanced computers consume more power. A survey was undertaken to understand all these aspects. This survey noted down observations of the workplace. Survey also gave us very specific observation regarding distribution of computers in the main administrative building. An ICT survey document was prepared at the end of the project.

Further, subjects and objects in the University were found out for setting experiments. These are

a. Subjects (staff - Clerk, Senior Clerk, Superintendent, Assistant registrar, Deputy Registrar, System Expert, Accountant, Computer Operator, Teacher and other higher authorities) and
b. Objects (Computers: Desktop Computers, Laptop Computers, and Laser Printers).

The survey has also studied type of computer (advanced or typical), usage of computer (continuous or discrete), type of job carried out by subject like typing, data entry, printing, report generation, etc. The survey also understood basic requirements of the object by the subject.

Keeping all these behavior analysis and traditional patterns of computer usage, we went further and purchased digital power meters for actual power consumption measurements. We have also discussed with engineers of electric department of our university regarding understanding power consumption measurement issues. A dedicated research fellow was also appointed to physically measure power consumption.

EXPERIMENTATIONS

The workplace of the SRTMUN is loosely coupled computer environment where computers in the ratio 1:1 are allocated to staff. These computers are inter networked and also have internet access. There is no distributed or parallel computing scenario. University staff simply works on his/her computers and type the matter. The typed matter is printed out and passed for higher approval. There is no central backup facility. There is no use of digital platform to pass on the work. No Client Server paradigm is in place. Staff of a section often do same job repeatedly.

Since computers are maximum stand alone, three power meters were fabricated in special circuit and we went further for usage analysis with respect subjects and objects. Right wing of administrative building was considered as site for investigation as left wing has Examination department (confidential work). Random sampling method was done as the project duration was only one year.

In first phase, 72 samples of subjects were selected for monitoring. Out of 72 computers, 13 computers have power management enabled by default or by the staff who were using them. These 13 computers consumed efficient power and their average efficient consumption was set as a benchmark. Further, computer configuration, computer usage style / behavior were monitored for these selected 72 samples. The behavior monitoring questionnaire is shown in figure 2, below. Analysis regarding knowledge of power management settings was also tested. Power meters were deployed at selected workplaces and actual power consumption was measured. Depending upon usage and work style, week average and month average were calculated. The execution plan was very simple. Three power meters were deployed at three subjects per day. The figure 1 shows deployment of power meters, measuring actual power consumption of the connected computer. Readings for whole day consumption of 72 computers were made likewise which normally took around 6 months. Mean while discussions on the behavior analysis of subjects was carried on.

The second phase dealt with 49 computers likewise. Total 121 computers were analyzed. Power usage is measured in kilowatt hours (kWh).There were some common observations regarding consumption of energy,

1. Maximum numbers of subjects were using computers without software, hardware or power management knowledge. They were unaware of basic settings, basic troubleshooting and other superficial knowledge.
2. Less significant jobs like typing, data entry use modern and latest configured computers leads to more energy consumption.
3. Discrete use of computers without power management knowledge also leads to more energy consumption.
4. Every day, computers are switched on and the staff hops from one place to another, in the administrative hierarchy, for compliance, pendency etc requirements, actually consumes more power. Here computers are kept on throughout the day
5. Staff does not unplug the computers at the end of the day. They simply power off the computers. However, computers are still technically on, consuming power throughout the night. This becomes worst if succeeding day is a routinely off like first & third Saturdays or holiday like Sunday or vacations.
6. Collaborative and distributed processing is missing. Hence everybody does the same job at different places on different configured computers leading to more energy consumption.
7. Lack of advanced architectures like client and servers, thin clients, work specific computers, etc also leads to more power consumption.
8. Lack of scientific data entry knowledge, unavailability of standard perform, redundancy of information, reparation of same work for different cases, etc also leads to more power consumption.
9. Fear of sleep mode and hibernate mode of power management. Only 13 people out of 72 were suing these modes. Other people feel that, when these modes are operations, system goes down pretending restart and they may lose their typed matter. So they are afraid of using sleep and hibernate modes.

After understanding these aspects, we have decided for onsite demonstration on actual power

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management settings. We have physically visited selected samples. Awareness Programs / demonstration programs, section to section, for selected 121 samples were given. Special stickers were created and fixed at work place for easy remembrance of the staff. Leaflet regarding built in power management settings were also circulated so that selected samples can try them out at their own. A typical leaflet is shown in figure 3 below.

Likewise, awareness campaigns were extended to all sections in the main building. Then suing same set of experiments, the reduction in the power usage was calculated. The figure 4 shows such analysis sheet. To cross verify, random visits must be made at selected places to see whether power management is functional or not? These are planned in nearer future and percentage of success will be recorded.

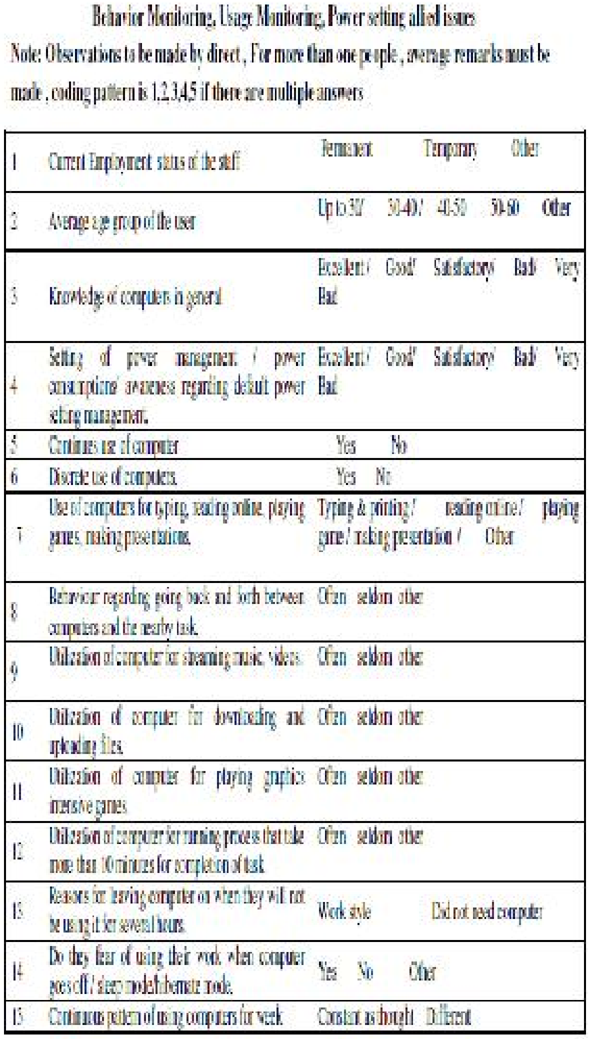
The table 1 shows various configurations of the computers in the sample space. These computers are purchased under various funding agencies like UGC, RUSA, etc. We have also noted their processor type, RAM and type of operating systems installed on them. Advanced processors consume more power. More RAM means more refreshing and means indeed more consumption. Advanced operating systems also lead to more power consumption as they are bulky and we need to mount them on significant portion of RAM [3].

Table 1 : Sample Space at a glance

Sr.No	Machine	Processor			
		I3	I5	I7	Pentium/core 2 due
1	UGC XII Plan	60	09	0	04
2.	RUSA	0	32	14	0
3.	UGC XI Plan	0	0	0	06
4.	UGC XII Plan	0	0	0	06
	Total	60	41	14	16
					121

Figure 1: Power Analyzer

Figure 2: Behavior monitoring questionnire



Behavior Monitoring, Usage Monitoring, Power setting allied issues

Note: Observations to be made by direct , For more than one people , average remarks must be made , coding pattern is 1,2,3,4,5 if there are multiple answers

1	Current Employment status of the staff	Permanent Temporary Other
2	Average age group of the user	Up to 30/ 30-40/ 40-50 50-60 Other
3	Knowledge of computers in general	Excellent/ Good/ Satisfactory/ Bad/ Very Bad
4	Setting of power management / power consumption/ awareness regarding default power setting management.	Excellent/ Good/ Satisfactory/ Bad/ Very Bad
5	Continues use of computer	Yes No
6	Discrete use of computers	Yes No
7	Use of computers for typing, reading online, playing games, making presentations.	Typing & printing / reading online / playing game / making presentation / Other
8	Behaviour regarding going back and forth between computers and the nearby task.	Often seldom other
9	Utilization of computer for streaming music, videos	Often seldom other
10	Utilization of computer for downloading and uploading files.	Often seldom other
11	Utilization of computer for playing graphics intensive games.	Often seldom other
12	Utilization of computer for running process that take more than 10 minutes for completion of task	Often seldom other
13	Reasons for leaving computer on when they will not be using it for several hours.	Work style Did not need computer
14	Do they fear of using their work when computer goes off / sleep mode/hibernate mode.	Yes No Other
15	Continuous pattern of using computers for week	Constant as thought Different

Figure 3 : Awareness stickers / leaflet

Figure 4 : Analysis Sheet

		Observation Sheet								
Subject	Object	Awarness of PM	Voltage(V	Power(w	Current(A	Energy(Wh)	Unit per day	Usage	Units per day after awarness	savings
Accountant	Desktop	N	230	50.1	0.69	3390	0.5	Continious	0.3	0.2
Accountant	Desktop	Y	238	40.9	0.74	3820	0.4	Discrete	0.4	0
Teacher	Desktop	Y	230	12.9	0.07	3990	0.3	Discrete		
Teacher	Desktop	Y	249	20.9	0.19	3880	0.3	Discrete		
Cleark	Desktop	N	243	50.2	0.31	3930	0.4	Discrete	0.3	0.1
System Expert	Desktop	Y	254	22.1	0.15	8240	0.3	Discrete		
Clerk	Desktop	Y	259	30.6	0.29	7280	0.3	Discrete		
Senior Clerk	Desktop	N	210	30.6	0.55	3900	0.4	Continious	0.3	0.1
Clerk	Desktop	N	230	27.8	0.45	3700	0.3	Discrete	0.3	0
Teacher	Desktop	Y	288	20.6	0.39	3590	0.3	Discrete		
System Expert	Desktop	Y	219	21.1	0.21	2670	0.2	Continious		
Operator	Desktop	Y	234	63.2	0.35	3096	0.3	Continious		
Operator	Desktop	Y	238	65	0.41	3120	0.3	Continious		
Operator	Desktop	Y	228	61.2	0.31	3137	0.3	Continious		
Operator	Desktop	Y	237	67.5	0.47	3859	0.3	Continious		

Note : Red color fonts indicated subjects with power management awareness, black colored fonts indicate un-aware subjects

Finally, gain in power saving by deploying power meters at selected workplaces and actual power consumption was measured. Depending upon that, week average and month average was calculated. We then compared it with untrained data to find out actual gain. The University itself got benefited economically in terms of reduced electricity bills without disturbing throughput. As a positive side effect, environmental awareness has been nourished.

PER PC ELECTRICITY USAGE ANALYSIS

1. Existing untrained consumption =0.5 to 0.7 units per day
2. Ideal consumption after awareness = 0.2 to 0.4 units per day
3. Energy saving after awareness = 0.2 to 0.3 units per day
4. Weekly savings (assuming 05 days) = 1 to 1.5 units
5. Monthly saving (assuming 04 weeks) = 4 to 6 units
6. Yearly savings (12 months) = 48 to 72 units per PC

There are 225 PCs in Main Building. Total yearly savings will be around 2700 to 4500 units per year Assuming @10 rupees per unit (as per egareenment), we can project that around Rs.27000 to Rs.45000 could be saved per year on electricity usage by computers. just by awareness & training There are 1000 computers in the campus. Assuming above data, 48 to 72 units could be saved per PC per year. This means, we could save 48000 to 72000 units per year resulting in cost reduction of power bill per annum by Rs.480000 to Rs.720000

CONCLUSION

The work described in this paper represents actual implementation of an energy efficiency and green management study in achieving power reduction through awareness. Much remains to be done through implementation of novel approaches and modern architectures in particular. This study could be a role model for other higher educational organization as a self enquiry for reduction in power consumption without major arrangements.

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A REVIEW ON RECENT TRENDS IN OBJECTIVE QUALITY EVALUATION OF FUSED THERMAL IMAGES FOR CONTEXT ENHANCEMENT

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ABSTRACT

Advancements in digital image processing and nightvision technology with invent of new sensors experiencing the excessive need of effective image quality assessment metric for various image fusion techniques. Different metrics have been formulated for quality measurement of fused thermal image based on subjective or objective assessment. Objective quality assessment techniques are preferred over subjective since they do not involve the complexity in their practical implementation and validation. This paper presents an analysis of different image fusion schemes using statistical evaluation techniques. The project proposes an analytical framework for objective assessment of fused images obtained from various image fusion algorithms. The theme is concentrated on fusion of visible and thermal image under varying conditions. Various metrics are compared to get optimal performance metric for applications like Nightvision.

Keyword: *Image fusion, performance metric, image quality assessment.*

INTRODUCTION

Various methodologies and tools for union of data originating from different sensors take place are termed as data fusion techniques. The main objective of data fusion process is to get information of high quality. Image fusion is the process of combining images acquired from different image sensors into composite image so as to retain relevant information consistent with specific application [1]. The need of determination of optimal information arises when several information sources take an effect simultaneously. The fused image have a more accurate description of the environment and it more useful for human recognition and machine vision. The performance of metric varies with application and context of the fused image. Different metrics can be organized and ranked based on the performance using suitable criteria.

The main aim of image fusion is to integrate complementary and redundant information from multiple images to create a composite that have a better description of the scene than any of the individual source images. Fused image should increase the performance of the image processing tasks [1]. Quantitative analysis provides repeatable, reliable data that can aid in performance tracking and failure analysis [10]. Image quality is an attribute of an image that measures the apparent degradation of information. The need of image quality measurement arises in case of image fusion optimization problems. In general, fusion results are being evaluated by human observer referred as subject. Validation of subjective quality assessment is complicated due to involvement of large number of human observers. This method is costly and time consuming. To overcome such difficulties many objective quality metrics are proposed [9].

Conventional and Advanced Approaches for Quality Evaluation of Fused Images

Conventional and advanced metric can be described separately. This section contains mathematical and statistical details of various quality assessment techniques for fused thermal images

CONVENTIONAL APPROACHES FOR QUALITY EVALUATION

Primitive techniques widely used for practical image quality assessment are described below

1. Entropy (H)

Information content in any information signal can be measured in terms of entropy. Entropy H of fused image F is given by

$$H = -\sum_{m=1}^{n} P(F_m)\, log_2(P(F_m)) \qquad (1)$$

where n is number of grey levels and $P(F_m)$ is the probability of specific level occur in fused image [2]. When fused image has relatively uniform frequency content then it contains maximum entropy. Greater entropy for fused image indicates more information contents than original images.

2. Mean Square Error (MSE)

Input reference image $r(x,y)_{ij}$ and fused image $f(x,y)_{ij}$ are of size $M \times N$ with row and column indices i and j respectively. Mean square error can be calculated by finding the square of the difference between respective pixel values of fused and reference image.

$$MSE = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}|r(x,y)_{ij} - f(x,y)_{ij}|^2 \qquad (2)$$

Mean square error takes positive values irrespective of the amount of contents in reference or fused image [13]. It is accepted widely for its easy optimization. However its performance is degraded for cross artifact measurements [3].

3. Average difference (D_A)

The average difference D_A between fused and reference image is

$$D_A = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}|r(x,y)_{ij} - f(x,y)_{ij}| \qquad (3)$$

4. Maximum difference (D_M)

The maximum difference D_M between fused and reference image is

$$D_M = max\left(\left|r(x,y)_{ij} - f(x,y)_{ij}\right|\right) \qquad (4)$$

5. Normalized Absolute Error (M_{NAE})

Absolute error can be normalized with respect to visible image as

$$M_{NAE} = \frac{\sum_{i=1}^{M}\sum_{j=1}^{N}\left(\left|V_{ij} - T_{ij}\right|\right)}{\sum_{i=1}^{M}\sum_{j=1}^{N}(V_{ij})} \qquad (5)$$

6. Normalized Cross Correlation (M_{NCC})

This measure is also useful when significant mutual information is present between visible V and thermal image T. It is given by

$$M_{NCC} = \frac{\sum_{i=1}^{M}\sum_{j=1}^{N}(V_{ij} * T_{ij})}{\sum_{i=1}^{M}\sum_{j=1}^{N}(V_{ij})^2} \qquad (6)$$

7. Peak Signal to Noise Ratio (PSNR)

$PSNR$ for reference image R and fused image F is calculated on the basis of mean square error (MSE). It is given by

$$PSNR(R,F) = 10\,log_{10}\frac{N^2}{MSE(R,F)} \qquad (7)$$

where N represent maximum number of pixels in an image which takes value 255 for 8 bit greyscale images [4]. $PSNR$ is accepted universally due to its easy mathematical implementation.

RECENT TRENDS FOR QUALITY EVALUATION

Recent metrics for fused image quality assessment is described in the section below.

1. Hossney Metric (I_H)

Both input images are not fused at same level in above technique. This poses the problem regarding metric boundness [6]. Y. Horibe improved the measure through the process of normalization. Normalized mutual information I_{MN}^{FAB} is given by

$$I_{MN}^{FAB}(A,B) = \frac{I_M^{FAB}(A,B)}{\max\{H(A),H(B)\}} \qquad (8)$$

It is observed that error between I_M^{FAB} and I_{MN}^{FAB} increases with source image entropy. Amount of information transferred to fused image from source image can be estimated after normalization [6]. Hossney worked on joint entropies to propose metric shown below

$$I_H = 2\left[\frac{I_M^{FAB}(A,F)}{H(A)+H(F)} + \frac{I_M^{FAB}(B,F)}{H(B)+H(F)}\right] \qquad (9)$$

2. Piella Metric (I_{QUS})

A new qualitative metric is proposed by Piella based on Wang and Bovik quality index technique with visual saliency as prime consideration [7]. Visual saliency reflects local relevance of an image. Certain parts of an image are preattentively distinctive. It provides immediate significant visual stimulation to human visual system. Piella suggested the technique using local variance as the salience of an image which is represented as $s(A|w)$ and defined by local weight $L_a(w)$ as

$$L_a(w) = \frac{s(A|w)}{s(A|w) + s(B|w)} \tag{10}$$

This metric suggest the information transfer from source to fused image. More importance is given to window weights and variants are defined where saliency is higher. Equivalent image quality index I_{QUe} over window cardinality $|W|$ for family of window W is computed by averaging as

$$I_{QUe}(A,B) = \frac{1}{|W|}\sum_{w \in W} I_{QUe}(A,B|w) \tag{11}$$

Based on similarity I_{QUS} is defined by Piella [7], which represents similarity between input image A and fused image F over window w

$$I_{QUS} = \frac{1}{|W|}\sum_{w \in W}\left[L_a(w) I_{QUe}(A,F|w) + \left(1 - L_B(w)\right) I_{QUe}(B,F|w)\right] \tag{12}$$

3. Wang Metric (I_S)

In this metric structural information of fused image is basis of assessment. The structural information such as mean, variance between fused and reference image is taken into consideration [5]. Amount of structural distortion is directly varies with image degradation. The metric assesses the image quality by measuring the structural difference between the reference and fused images. Structural information used in metric $I_S(R,F)$ consists of three components such as luminance, contrast and structural comparison [5]. Metric depending on structural information $I_S(R,F)$ is defined as

$$I_S(R,F) = \frac{(2\mu_R\mu_F + C_1)(2\sigma_{RF} + C_2)}{({\mu_R}^2 + {\mu_F}^2 + C_1)({\sigma_R}^2 + {\sigma_F}^2 + C_2)} \tag{13}$$

where R and F represent the reference and fused images, respectively. μ_R and μ_F denotes the mean of reference and fused image respectively whereas standard deviation represented for reference image as σ_R and fused image as σ_F . Here C_1=6.503 and C_2=58.5 for 8 bit gray scale image. Fused image can take values between zero and one but matches well with ground truth with increasing closeness of metric to unity [5].

4. Xydeas (M_G)

A metric based on sobel edge operator is proposed by Xydeas and Petrovic to extract high frequency information [8]. A Sobel edge operator is applied to get the edge potency of input image $A(i,j)$, $m_A(i,j)$ and orientation $\alpha_A(i,j)$

$$m_A(i,j) = \sqrt{{s^x}_A(i,j)^2 + {s^y}_A(i,j)^2} \tag{14}$$

$$\alpha_A(i,j) = \tan^{-1}\frac{{s^x}_A(i,j)}{{s^y}_A(i,j)} \tag{15}$$

Here ${s^x}_A(i,j)$ and ${s^y}_A(i,j)$ are the results obtained by horizontal and vertical convolution with Sobel operators. Gradient based relative strength is then defined by

$$M^{AF}(i,j) = \begin{cases} \frac{m_F(i,j)}{m_A(i,j)} & m_F(i,j) > m_A(i,j) \\ \frac{m_A(i,j)}{m_F(i,j)} & otherwise \end{cases} \tag{16}$$

So the metric proposed is given by the equation

$$M_G = \frac{\sum_{n=1}^{N}\sum_{m=1}^{M}[M^{AF}(i,j)w^A(i,j) + M^{BF}(i,j)w^B(i,j)]}{\sum_{n=1}^{N}\sum_{m=1}^{M}[w^A(i,j) + w^B(i,j)]} \tag{17}$$

5. Zheng (E_{SP})

The modified metric based on spatial frequency is proposed by Zheng *et al.* [9]. Two new diagonal frequencies are defined in this improved technique based on spatial frequency viz. main diagonal frequency f_{MD} and secondary diagonal f_{SD} a

$$f_{MD} = \sqrt{\frac{1}{2^{\frac{1}{2}}}\cdot\frac{1}{MN}\sum_{i=2}^{M}\sum_{j=2}^{N}[F(i,j) - F(i-1,j-1)]^2} \tag{18}$$

$$f_{SD} = \sqrt{\frac{1}{2^{\frac{1}{2}}}\cdot\frac{1}{MN}\sum_{j=1}^{N-1}\sum_{i=2}^{M}[F(i,j) - F(i,j-1)]^2} \tag{19}$$

Calculation of equivalent spatial frequency in improved technique is done using four types of gradient frequencies as

$$f_{SPi} = \sqrt{(f_R)^2 + (f_C)^2 + (f_{MD})^2 + (f_{SD})^2} \tag{20}$$

Ratio of SF error (E_{SP}) between fused and reference images having spatial frequencies as f_{SPF} and f_{SPR} respectively is defined as follows:

$$E_{SP} = \frac{f_{SPF}}{f_{SPR}} - 1 \quad (21)$$

Quality of fused images is better when ratio of spatial frequency approaches zero value. Certainly positive value of ratio denotes over fused image whereas negative value denotes under fused image.

EXPERIMENTAL RESULTS AND DISCUSSION

The assessment is carried out on six image fusion algorithms ranging from primitive to advanced techniques. Primitive techniques consist of max, mean and mean compositions. Advanced techniques include the image fusion based on spatial frequency (SF), Computationally Efficient Multiscale Image Fusion (CEMIF) and Discreet Wavelet Transform (DWT) algorithm based image fusion. Various Image quality assessments play an important role in various image processing applications.

TABLE I. PRIMITIVE METRIC ANALYSIS

Fusion Type	Metric Values for 'Building' Dataset						
	H	MSE	D_A	D_M	M_{NAE}	M_{NCC}	$PSNR$
MAX	5.3394	0.0541	0.1311	064.000	0.3046	1.1778	60.7990
MIN	5.7320	0.0251	0.1396	138.000	0.3244	0.6894	64.1416
MEAN	6.1656	0.0199	0.1132	093.000	0.2630	0.9357	65.1359
SF	6.6790	0.0566	0.1818	116.000	0.4224	0.9211	60.6021
CEMIF	7.1764	0.0472	0.1767	112.000	0.4106	0.9403	61.3949
DWT	6.5776	0.0542	0.1309	121.000	0.3041	1.1779	60.7938

Experimental results indicate that MSE and PSNR have simple structure, easy implementation and its computational complexities are less. These metric do not bear good results for all five datasets. PSNR results are acceptable for most of image fusion methods. PSNR serves as best tool for quality evaluation in conventional domain. SSIM based metric is widely used method for measurement of image quality. It works accurately can measure better across distortion types as compared to MSE and PSNR, but fails in case of highly blurred image.

This Analysis will brings out a new trend in the quality metrics of the image and proves to be efficient than the conventional metrics. Wang's metric is proved to have lowest value and shows good result for all dataset. Table I shows the performance of conventional techniques for sample image 'Building'.

TABLE II. ADVANCED METRIC ANALYSIS

Fusion Type	Metric Values for 'Building' Dataset				
	I_H	I_{QUS}	I_S	M_G	E_{SP}
MAX	1.2257	0.7141	0.8248	0.5469	-0.1841
MIN	1.1549	0.8062	0.8291	0.5989	-0.3761
MEAN	0.7591	0.8562	0.8132	0.4910	-0.4013
SF	0.9536	0.7092	0.8256	0.6937	0.1264
CEMIF	0.5271	0.8548	0.8092	0.6804	-0.0962
DWT	0.6572	0.7265	0.8107	0.4482	-0.1510

Table II shows the performance of advanced metric values for image dataset 'Building'. The fused thermal images can also be subjectively evaluated by 5 respondents to give the following result shown in Table III.

TABLE III. SUBJECTIVE QUALITY ANALYSIS

Subject	**Sample Image Dataset**				
	Building	***Forest***	***Road***	***Smoke***	***Trees***
A	CEMIF	MAX	CEMIF	DWT	DWT
B	CEMIF	CEMIF	MEAN	MIN	DWT
C	DWT	MAX	MEAN	DWT	CEMIF
D	SF	MAX	MEAN	DWT	DWT
E	MAX	MEAN	DWT	MAX	MAX

It can be noted that of the 5 assessments made, 8 times (32%) the fused image by DWT with Haar based fusion method was adjudged the best. It can also be inferred from the table that each respondent definitely adjudged Haar based fused image best in either of the image sets. It can be noted that though SF method is quite an advanced method in comparison to some of the other algorithms but it proved low performance. In the spatial frequency based fusion it is observed that through the process of block decomposition, the information of images were enhanced, but at the cost of blocking artifacts that degrades the overall quality of the image. A foggy effect was produced on the overall image in MEAN fusion which gives visual feel of the image with low intensity. Foggy effect in the CEMIF based fused image, comparing it with DWT with Haar based fused image, which was rated the best is more. In Max based fusion, which was rated inferior than advanced fusion techniques, during the formation at each level of fusion, difference between the corresponding pixels of the input images and the filtered image is significantly less. Considering the ratio of the pixel intensity does not physically contribute to an explanation of enhancement of the sharpness of an image in primitive image fusion techniques.

From the comparison tables it is observed that the Wang's Metric based on nonlinear correlation coefficient gives the best result in accordance with human subjective evaluations. The correlation coefficient (CC) is the most popular similarity metric in for fused thermal image quality measurement. The low performance of CC is observed in case of constant gain of both images. From analytical results it is observed that Entropy is high for CEMIF fused images. DWT with highest percentage of occurrence in both subjective and objective quality evaluation schemes found to be the best algorithm between them. Gradient based Xydeas metric shows high results for primitive techniques. But low performance is observed for advanced algorithm. Among conventional techniques, PSNR shows the best performance for quality evaluation. Results are approximately in accordance with subjective evaluations. The comparative performance of PSNR is shown below charts.

CONCLUSION

The paper introduces a general analytical framework for different image fusion algorithms. In context of the paper some statistical parameters between original and synthesized images have found. The performance of the existing image fusion techniques is analyzed based on theoretical evaluation metrics. When available images have strong correlation then performance of image fusion algorithms is better. Optimal results in spatial or spectral domain are difficult than transformed domain results. Combining visual inspection and objective assessment it is possible to see that analytical observations are in accordance with theoretical results. Wavelet based image fusion method produces the synthesized images closest to those the corresponding multi sensors would observe at the high-resolution level. The metrics takes different values with varied condition and application. Relative change in information contents in an image is observed with the noise addition and hence changes in the metric value. The choice of metric is dependent on the area of application. The metric analyzed are normally pixel level or low level. The metric based on correlation correction is found to have the better performance for all fusion techniques based on available data set than above listed metrics. No metric in the study is found to have equal performance for all applications. Formulation of exact relationship between subjective and corresponding objective technique is still an open problem.

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A MOBILE PHONE BASED CONTEXT-AWARE UBIQUITOUS MUSIC LEARNING THROUGH ADVANCED INFORMATION TECHNOLOGY

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ABSTRACT

Recently, wireless technology can enhance the ubiquitous learning performance of teaching, learning and self-study. Advances in multimedia technology, provide an opportunity to enhance web-based learning of music through advanced information technology. This paper presents a new context-aware ubiquitous music teaching and learning system (i.e. Context-Aware ubiquitous Music System) that effectively integrates Information Technology. This system detects the location of the student, retrieves the learning content, based on wireless networks.

Keywords: *Multimedia, online learning, music, context-aware learning; mobile learning, ubiquitous learning;*

INTRODUCTION

Mobile devices, such as smart phones, have indeed become an important tool for content creation. This trend began years ago with the first camera phones, but today, millions of people use smart phones to create, store and transfer all sorts of contents, including photos, audio recordings, videos and even novels[1]. The progress of wireless technologies has brought up a new trend in a learning environment, from simply using computers and networks to teach and learn, to a new learning mode called u-Learning [2].

Many studies of mobile learning (M-learning) and ubiquitous learning (U-learning) have been conducted in order to improve and extend technological support for learning over the past ten years. Thus, M-learning and U-learning play an important role in taking forward different e-learning environments [3]. It provides various online learning coursewares and combines it with mobile devices. Context-aware technologies do play an important role in setting up the bridge of conversation between students and their social environment.

The context aware system gives the opportunity to music lovers to listen his favorite music anywhere and anytime without any playlist. The proposed framework creates a dynamic playlist. It is not created on listener's ratings or users listening history. The raga extraction purely depends on demand of user.

LITERATURE SURVEY

This framework will investigate actual academic use of mobile phones among students and teachers, their attitudes towards using them as learning or teaching tools and if there is a significant difference in attitudes of the participants towards using mobile as learning or teaching tools based on the job criteria [4, 5, 7].

An intelligent music sharing system is introduced for mobility prediction and preference extraction. The human mobility prediction method based on geo-trajectory mining, also extracts preferences of user for supporting file sharing among peers. This framework uses smartphones with Bluetooth and GPS interfaces [6].

A context-aware music recommendation system, called MPlist, dynamically and automatically creates a music playlist for music lovers based on their context (i.e. current location and activity), listening preference, genre interested in, nearby users listening profiles, other users listening preferences and music from labels and tags mined from music experts and the web[8].

Mindful strategies, which bring about numerous other benefits for both teachers and students, can also help to cultivate self-awareness and confidence, emotional intelligence and resilience in the face of stress rooted in a wide range of pressures to perform and produce in a fast-paced environment [9].

Outcome based education (OBE) focuses on abilities procured by the learners. It assists the progress of learners by creating abilities, impacting qualities, states of mind and determination and expanding expertise. With the help of Information and communication Technologies (ICT) quality education is achieved depending on the learners' level of ability. This framework provides the tools for knowledge

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construction, reflecting, sharing and collaboration in project work [10].

DESIGN OF LEARNING SCENARIO

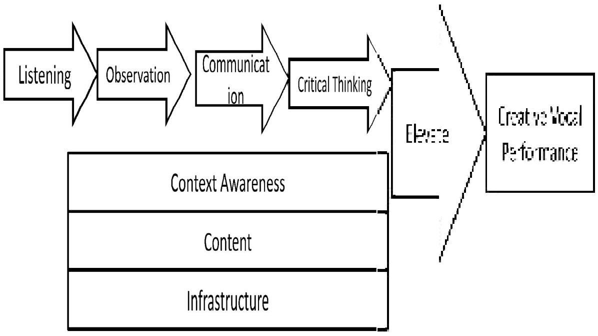

Fig 1 Phases of creative vocal performance

The learning scenario includes two parts, principal activities and supply service. The principal activities contains listening, observation, communication, critical thinking whereas the supply services has context Awareness, content, and Infrastructure. The principal activities request students to immerse and participate in ways of singing, whereas supply service provides learning technologies and learning contents in the form of Raga, whose major goal is to assist students to render good vocal concert in a real environment.

In each process of principal activity, students can accumulate practical experience and assimilate specialized knowledge to be applied in a vocal concert.

This framework provides four kinds of different learning activities for students to foster different abilities, which include Listening, observation, communication and critical thinking.

(1) Listening is an important prerequisite for singing. Singing means understanding and rendering of Ragas. These Ragas are a collection of different phrases, which in turn are specific rules called as 'chalan'. All these phrases integrate and embed to create a mellifluous and enthralling rendition. Listening also acts an add-on for improving a rendition by gaining inputs from other exponents.

(2) Observation is an important activity to extend the viewpoints of students and thus to improve their performance. The potential of students to understand the Raga 'chalan' is constrained by the learning environment of the traditional classroom. The immersion of students in such an environment can produce new ideas and Raga impressions by giving them external stimuli.

(3) Communication is a fundamental means of social interaction between humans, but here interaction can be carried out with the help of technology. In the process of communication with the environment, students are able to learn the different facets of a Raga or presentation style of the Raga. Such communication experiences can act as an inspiration and later be utilized at the time of vocal performance.

(4) Critical thinking plays a significant role in the learning process. It includes a complex combination of skills along with rationality, open mindedness, judgment, honesty and self-awareness. Students face difficulties in developing critical thinking in basic education due to ignorance by their parents and teachers. Critical thinking helps to focus and understand the intricacies of a Raga and thus bring all such details during their performance. Critical thinking is essentially required by students of music in order to track their own flaws and improvise their style of singing and gain more knowledge from the jargon of music.

SYSTEM ARCHITECTURE

This section deals with the design and implementation of the context-aware ubiquitous music learning system. The purpose of this system is to enhance the learning interest and motivation of students for their singing ability. This study proposes a context-aware ubiquitous classical music teaching and learning system, and it relies on learner's location to appropriately recommend suitable Raga for individual student. Figure 2 shows the detailed system architecture of the proposed context-aware ubiquitous music learning system.

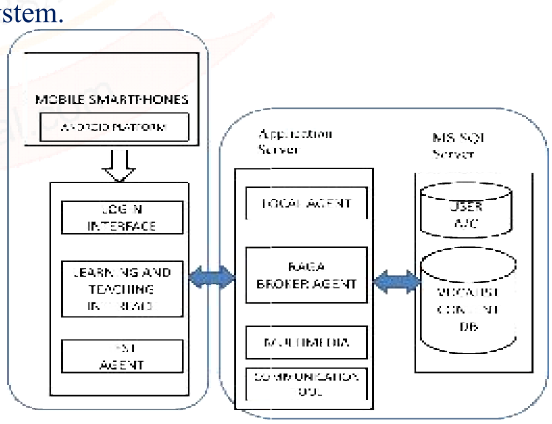

Fig 2: System Architecture

This system is based on a three-tier architecture consisting of client side, an application server and a database system as shown in Figure 2. On the client side, the system permits the students to access the learning contents from any location at student position by utilizing location detecting agent. Firstly android platform provides a Login Interface to validate the user. The user account database stores the username and password of all valid users. On the application server side, a context-aware singing platform is built to provide appropriate learning contents i.e. Raga, automatically in accordance with each student's needs. This includes the functions of different thaats and different Ragas using the communication tool. It also includes the Raga broker agent, user account database and Vocalist Content Database.

The application server connects the client side with the central database. On the database system side, the Vocalist Content Database sub-system and a Portfolio sub-system are implemented to store the data in a SQL database server. The data in the Vocalist Content Database sub-system include different Ragas performed by different vocalists and multimedia contents.

The client system can appropriately recommend Raga to individual students in order to enrich their learning based on the existing Raga theory supported by the proposed wireless positioning techniques. The server system aims at automatically recommending the playlist of suitable Raga of different thaats to individual student. Moreover, to support the off-line learning mode, the data is stored temporarily during the wireless network connection between client database and server database.

In this framework, to measure the learning results, a questionnaire is used to evaluate the learning situations regarding the users attitudes, system acceptance, system quality, content quality, and interaction with the environment.

CONCLUSION

The aim of this learning methodology is to aid students to apply and implement knowledge to solve problems faced in a learning classical music. This study uses the indoor WLAN positioning technique and smartphone to create the teaching and learning the context-aware ubiquitous music environment for students. Students have been able to acquire more information and knowledge. The results of our research showed that most of the students approved this system's benefits and are willing to use similar systems in the future. Students can improve their learning performance and attract the attention of other students through this system efficiently.

Moreover, students can efficiently improve their learning experience due to the usage of this innovative system. This innovation will attract attention and interest of students and thus help them observe the nuances and inculcate these novel ideas in their own performance.

Thus, an environment full of activity, culture and content has a great potential to encourage students to engage in curricular activities and to gain more knowledge, skills and experience as compared to the traditional learning methodology in the classroom.

FUTURE WORK

In the future, the developed system will add more functions including personalized learning guidance, more friendly interaction interface. This will consequently bring about a transformation in the learning methodology and make learning music more interesting and technology-friendly for the techno-savvy students.

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A BRIEF SURVEY OF ELECTRONIC PAYMENT SYSTEM AND ITS SECURITY

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ABSTRACT

Recently communications and information technology became widely used in various aspects of life. The internet becomes the main network for information support. Using of internet enabled public and private organizations to develop its business and expand its activities. Private organizations applied the principles of e-commerce to improve the quality of services which provided to customers. While public sector organizations started to apply the principles of e-government in an effort to increase efficiency and effectiveness and achieve maximum equality among citizens. One of the major challenges raised by widespread use of e-government and e-commerce application is security issues especially e-payment.

In this research we will review different payment protocols and security methods that are being used to run online payment systems. We will survey some of the popular systems that are being used today, with a deeper focus on the PayPal system, Near Field Communication (NFC). In addition, we will also discuss the weaknesses in the systems that can compromise the customer's trust and the measurement and also the judgment about the quality of security in electronic payment systems.

Keywords: *E-payment, Secure Socket Layer (SSL), Secure Electronic Transaction (SET), 3D-Secure, Cyber crime, Web-security*

INTRODUCTION

Electronic commerce or e-commerce provides participants, including consumers and merchants, with a number of benefits, such as convenience and time savings. E-commerce transactions can be categorized into business to business (B2B), business to consumer (B2C), consumer to consumer (C2C), and public/private sectors to government [1]; we focus on B2C transactions in this paper. In B2C transactions, the credit card is the most widely used method of payment for Internet ecommerce transactions.

E-payment systems (EPS) have become a most important factor in the growth of electronic commerce and e-government application. An electronic payment system is an essential part in new business-to-consumer and business-to-business e-commerce [1] [2] [3]. The development of e-business contributed considerably to the development of electronic payment systems so as to meet the needs of e-procurement processes and to facilitate the completion of the transactions [4] [5]. As a result of this development in this area, the diseased soul's owners were increased to ambitions to commit cyber crime and penetrate privacy of others especially that the numbers of workers in the field of information were increasing. Then more legislation is required to deal with these crimes.

The research reported here builds on the electronic payment security; we study the security of e-commerce protocols and we propose a new efficient protocol to ensure a high security for electronic payment transactions.

The objective of our protocol is to provide issuers with the ability to authenticate cardholders during an online purchase without involving the third party VISA or MasterCard. We define a new transaction flow involving cardholder, merchant, payment gateway and card issuer, and allowed parties to identify themselves to each other and exchange information securely using digital certificate. For some implementation reasons, the cardholder is not requested to have his digital certificate, he use the password code to be authenticated by the card issue

SECURITY REQUIREMENTS OF E-PAYMENT

A. INFORMATION CONFIDENTIALITY

All information during the transactions has the request of being kept confidential. For instance, account number and user name may be embezzled by others who have access to them; business opportunity may be lost if order and payment information of your customer's are obtained by competitors.

B. DATA INTEGRITY

E-commerce should provide medium to identify data integration, ensuring the Web data do not be altered in transmission.

C. AUTHENTICATION OF PARTICIPANTS

The parts involved may have never met each other. So to make the transaction successful, the first step is to identify the two parts, which is the essential prerequisite of transactions.

D. NON-REPUDIATION

The transaction must have such services that enable one party to prevent another party denying having taken a particular action, e.g. sending order/payment information, confirmation of order/payment. Both consumer and merchant also require this service.

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E. END-USER IMPLEMENTATION REQUIREMENT.

We focus here on the major barriers causing implementation failures in SET and other protocols including usability, flexibility, affordability, speed of transaction, and interoperability.

- **Usability** – The system must be easy to implement, including installation. The consumer requires the card issuer and merchant to provide a secure system that is not complex, while the merchant requires the acquirer and security software developers to provide a simple application that meets the security requirements.
- **Flexibility** – The system must allow e-commerce consumers to order products or services from any location, and not just from one PC. Here, the consumer is the entity requiring the flexibility service, while the merchant is the entity providing the service.
- **Speed of transaction** – The transaction speed must be acceptable for e-commerce end-users.
- **Interoperability** – The system must be interoperable between different computing platforms, web browsers and server software packages in order to enable its use by the widest possible spectrum of e-commerce consumers and merchants.
- **Affordability** – The costs of implementing and using the system must be affordable for consumers and merchants, since these end-users are unlikely to be prepared to pay significantly extra to participate in Internet e-commerce transactions. For example, consumers are not willing to pay for a digital certificate in order to conduct e-commerce transactions although it is required in some e-payment scheme such a SET. Merchants will also not wish to invest significantly in engineering e-payment infrastructure.
- **Reliability** – The system must be reliable since it is used for the transmission and manipulation of sensitive information.
- **Availability** – The system must be available when needed.
- In this paper, we consider how E-commerce security requirements are fulfilled by our new protocol based on payment gateway and digital signature.

Our Secure Electronic Payment (SEP) protocol avoids the complexities relating to the implementation unlike SET and 3D-secure, integration and utilization are also easier than before.
For the convenience of written expression, we use the following notational conventions in this paper.
C : Cardholder
D: Decrypt
E: Encrypt
M : Merchant
PG : Payment Gateway
IB : Issuer Bank or Cardholder Bank
CA: Certificate authority
Vshop : Virtual Shopping Site
PAN: Card Number
PIMD: PI Message Digest
POMD: Payment Order Message Digest

K: Symmetric key generated randomly
Krm: Private key of merchant
Krpg: Private key of payment gateway
Kris: Private key of issuer bank
Kum: Public key of merchant
Kupg: Public key of payment gateway
Kuis: Public key of issuer bank
CVV2: Card Verification Value or Crypto (three digits)
ExD: Expiry date of the card
OI: Order Information
PI: Payment Instructions
OIMD: OI Message Digest
S: Sign
V: Verify signature
H: Hash
||: Concatenation
#: Disconnect
Eq: Equal

Our SEP protocol includes the following entities (see fig 1).

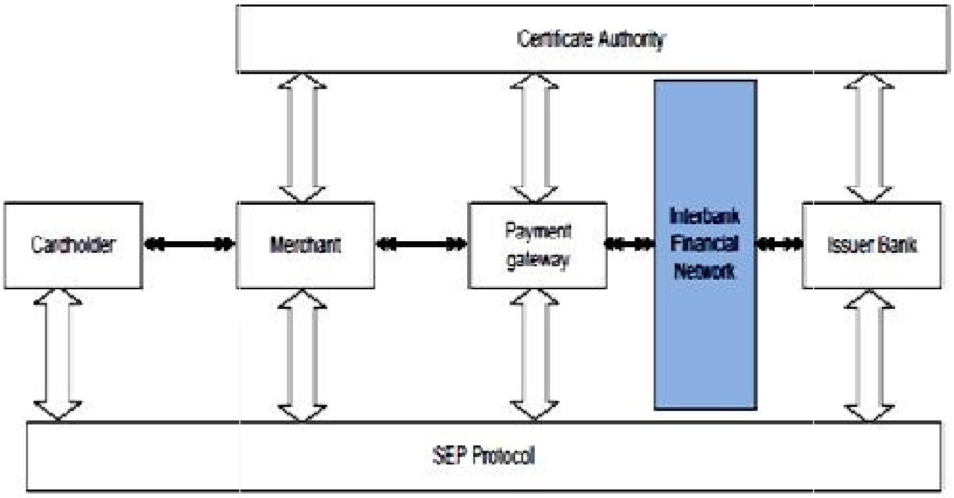

Fig 1 Entities in SEP protocol

The standard description of SEP is illustrated in fig 2.

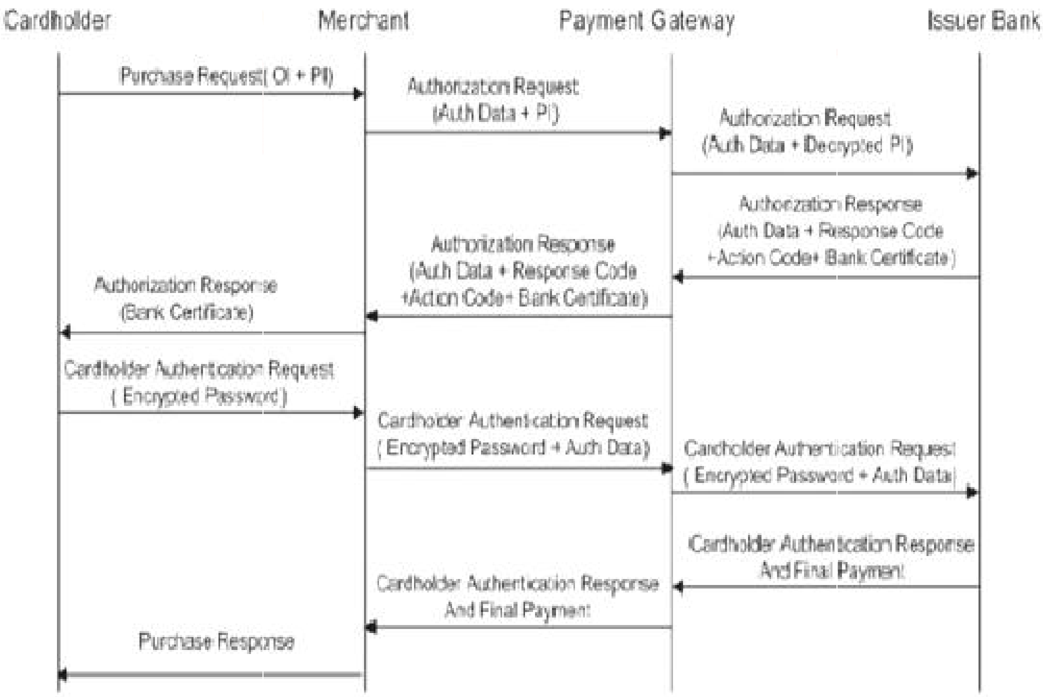

Fig 2 Description of SEP Protocol.

A. REGISTRATION PROCESS

Merchant, payment gateway and issuer bank should register and obtain certificates from certificate authority (CA) before they involve in the SEP transaction.
Cardholder should register and obtain a password from his issuer bank (IB) before he involve in the SEP transaction. Purchase Request
Cardholder browses for items, select items to be purchased from the Vshop and get an order which contain the list of items to be purchased. Before stating purchase the cardholder and the merchant agree upon the order description amount. The cardholder then sends to the merchant his local ID and a fresh random challenge. The purpose of this is to give the cardholder with the merchant's signature certificate and the payment encryption certificate.
1) Cardholder generates OI, encrypted PI and dual signature. The dual signature is encrypted under a symmetric key generated randomly for the encryption; the cardholder is not requested to have his own certificate.
2) Cardholder prepares the purchase request and sends it to the merchant (see fig 3).
3) The merchant extract the symmetric key, process the OI and transmit the encrypted PI to the payment gateway. (see fig 4).

B. AUTHORIZATION REQUEST

1) Merchant signs and sends authorization request to payment gateway, he sends the symmetric key K1 used for dual signature, the encrypted PI. The authorization request is encrypted under a symmetric key generated randomly. The payment gateway verifies the dual signature and gets PI. (see fig 4)
2) The payment gateway transmits the authorization with PI to the issuer bank through a secure and private interbank financial network. (see fig 5).

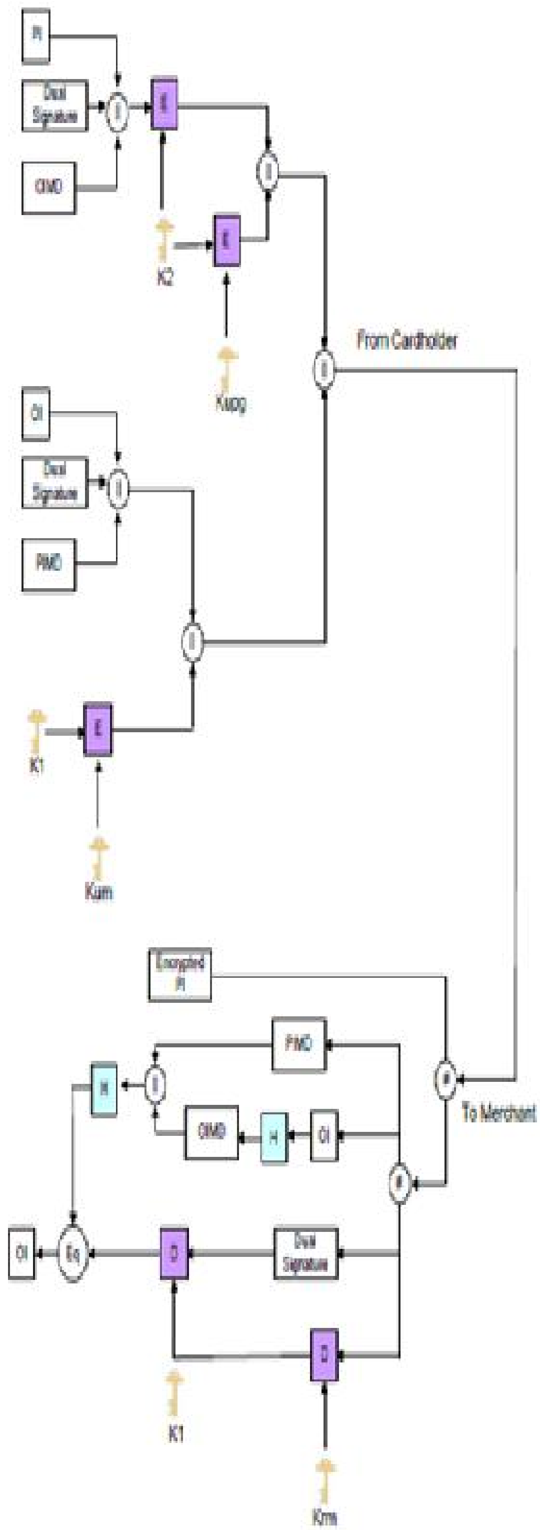

Fig 3. Purchase request from cardholder to merchant.

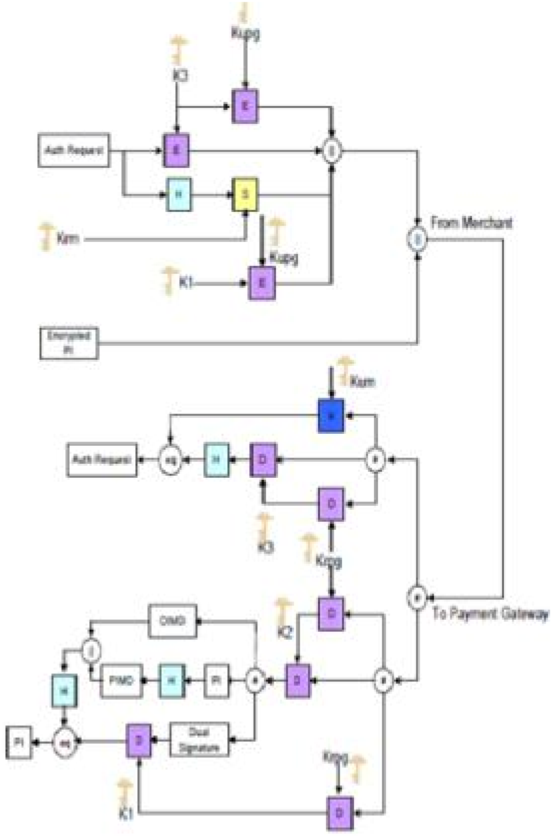

Fig 4.Authorization request from merchant to payment gateway.

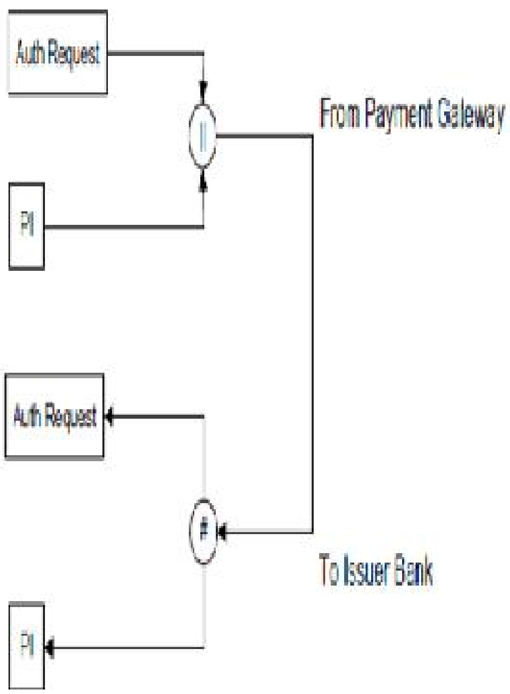

Fig 5 Authorization request from payment gateway to issuer bank.

C. AUTHORIZATION RESPONSE

1) The issuer bank verifies PI, verifies authorization request and run some issuer controls to check if the cardholder is allowed to make this transaction.
2) The issuer sends an authorization response and issuer bank certificate to the payment gateway through the secure interbank financial network (see fig 6). The authorization response contains the response code and the action code. The response code indicates if the authorization request is approved or no, the action code indicates if the cardholder is asked to be authenticated using his password. The purpose of this step is to give the cardholder with issuer bank encryption certificate.
3) The payment gateway signs and sends the authorization response and issuer certificate to the merchant. (see fig 7). The merchant check the action code, if the action code equals to 'Y' witch mean that the cardholder should be authenticated then, the merchant sends an authentication request to the cardholder containing the issuer certificate and some authorization data(see figure 8).

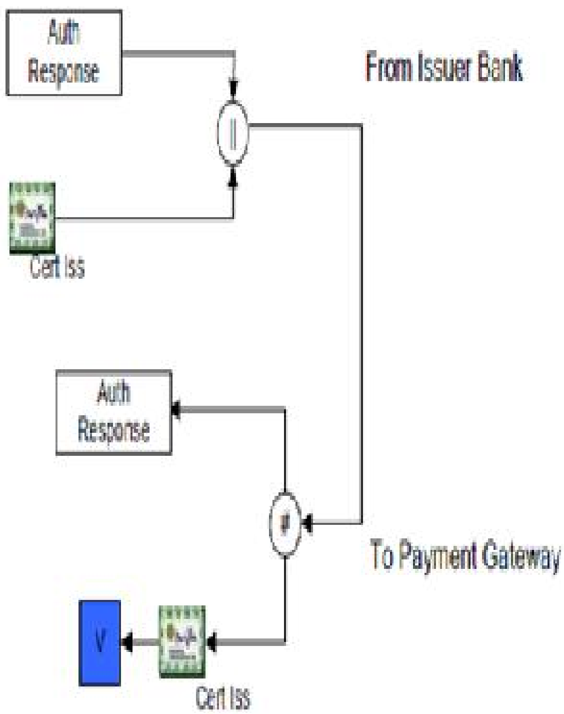

Fig 6. Authorization response from issuer bank to payment gateway.

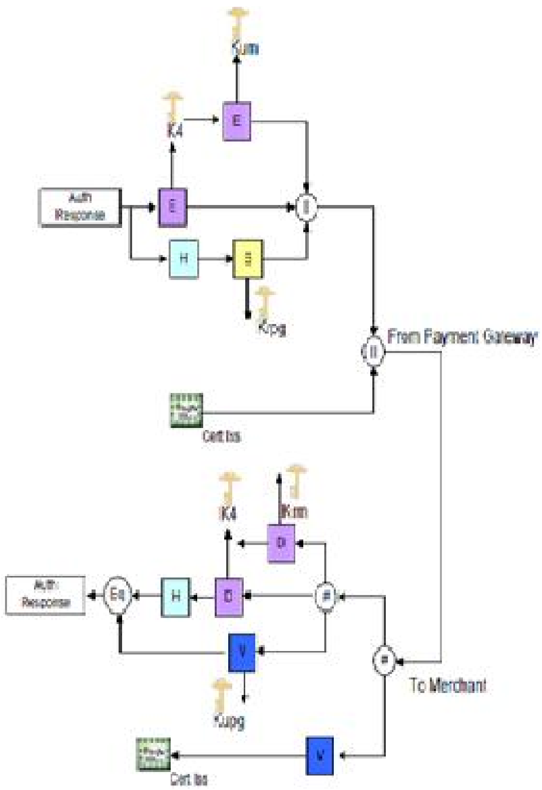

Fig7. Authorization from payment gateway to merchant.

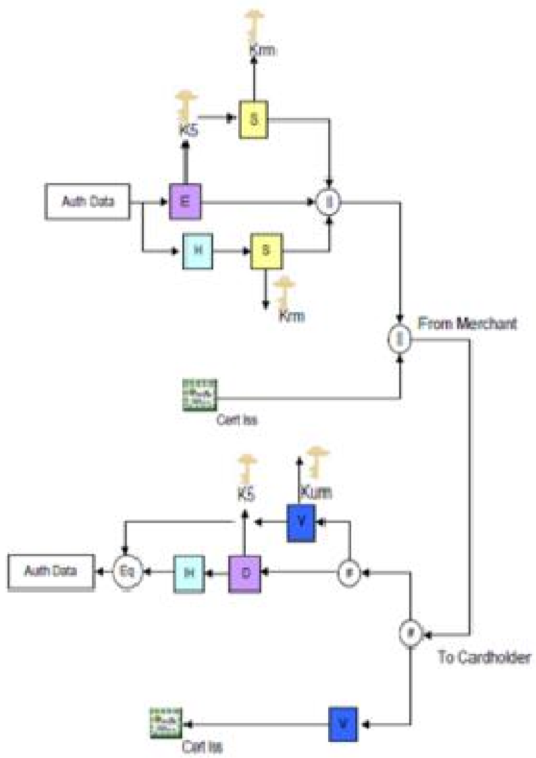

Fig 8. Authorization response from merchant to cardholder.

D. CARDHOLDER AUTHENTICATION REQUEST

1) The cardholder verifies the issuer certificates and sends his personal password encrypted under the symmetric key. (see fig 9)
2) The merchant verifies the authorization data and transmit the encrypted password to the payment gateway. (See fig 10)
3) The payment gateway verifies authorization data, the hash of the encrypted password and transmits the encrypted password to the issuer for verification. The issuer decrypts the encrypted password and checks if it is the correct one for this cardholder. (see. fig 11)

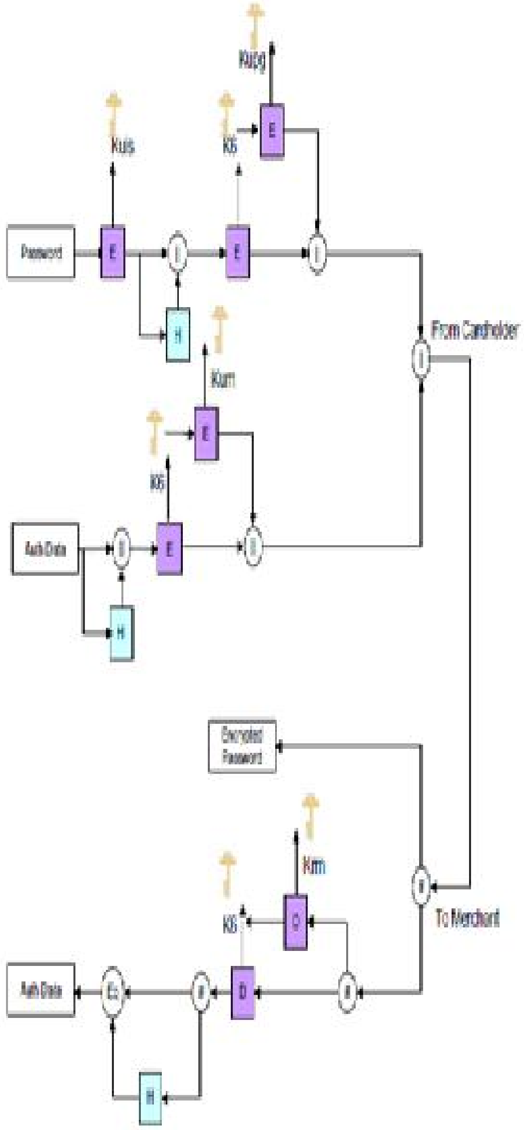

Fig 9.Cardholder authentication request from cardholder to merchant.

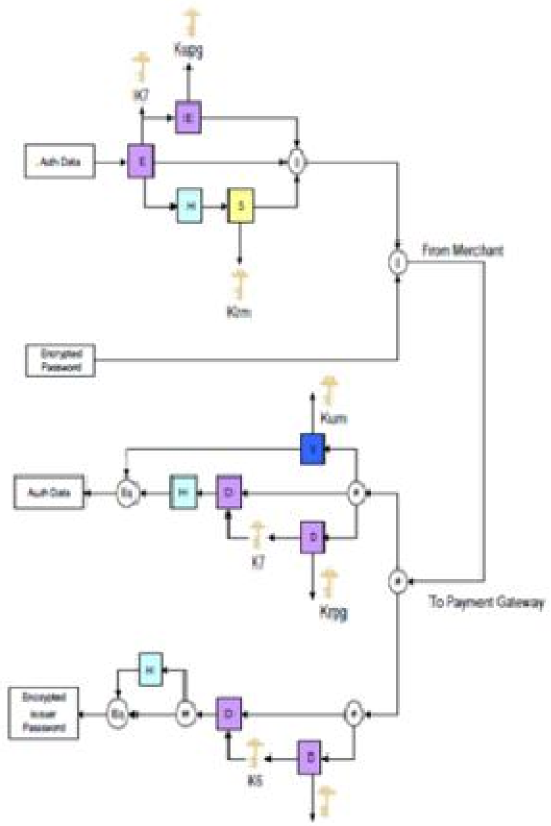

Fig10. Cardholder Authentication request from merchant to payment gateway.

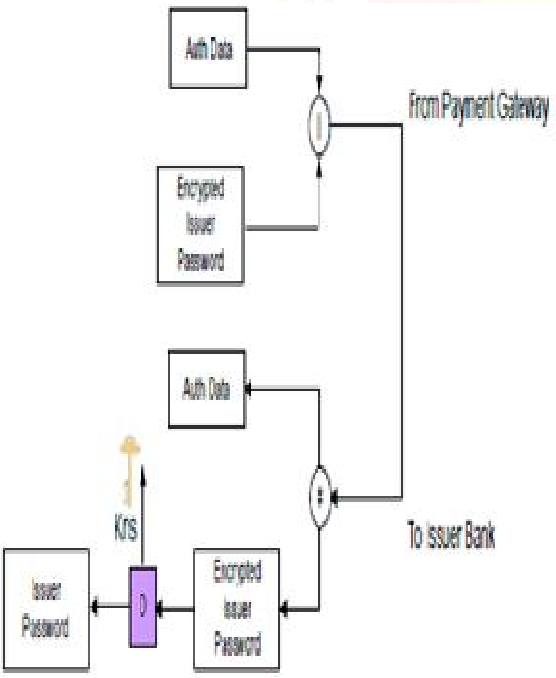

Fig11. Cardholder authentication request from payment gateway to issuer.

E. CARDHOLDER AUTHENTICATION RESPONSE AND FINAL PAYMENT

1) The issuer bank decrypts and verifies the password code, ensures the consistency between the authorization request and payment response to the payment gateway. (see fig.12).
2) Finally the payment gateway transmits the payment response to the merchant (see figure 13). Merchant verifies the response and ships the good to the cardholder

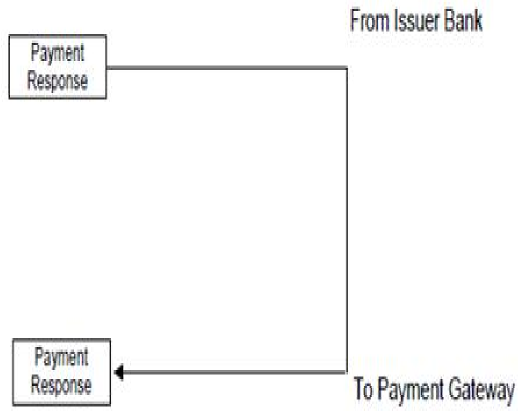

Fig 12. Payment response from issuer to payment gateway

F.SEP AND INFORMATION CONFIDENTIALITY.

For each step of transmission a symmetric key is generated randomly to encrypt electronic payment data. The encryption prevents the illegal information access and information stealing in transmission.

G. SEP AND AUTHENTICATION

- Cardholder authenticates merchant and issuer bank
- Merchant authenticates payment gateway and issuer bank
- Payment gateway authenticates merchant and issuer bank
- Issuer bank authenticates cardholder using the password code.

H. SEP AND INFORMATION INTEGRITY

Data integrity is ensured by using MACs (Message Authentication Code) based on hash functions MD5 (16 bytes) or SHA-1 (20 bytes). The MAC is sent for every message transmitted between ecommerce actors.

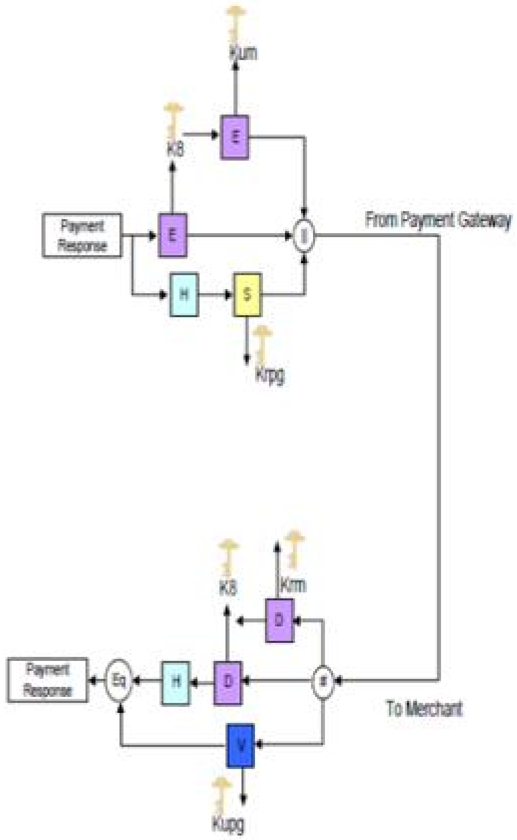

Fig 13. Payment response from payment gateway to merchant

SEP AND NON-REPUDIATION

The non-repudiation property is guarantee by using the password code during the cardholder authentication request.
The issuer bank authenticates the card and the cardholder, so the cardholder cannot deny the fact that he had sent information afterwards.
SEP and End-user Implementation Requirements

- **Usability:** cardholder, merchant needs to install a special plug. The initialization process is so simple, since the cardholder does not need to have his certificate.
- **Flexibility:** SEP protocol have the desirable property that it can be used from any PC, as is currently the case for e-commerce transactions relying simply on (20 bytes). The MAC is sent for every message transmitted between ecommerce actors.

LAW REGARDING SECURITY OF E-PAYMENTS

A. Cyber crime privacy:
Cyber crime privacy can be divided into two main types as follows:
- Crime committed through the use of electronic media as a tool to commit the crime as it is threatened by electronic means or slander and libel and others.
- The crime that targeted electronic means or their contents as the destruction of an information system or steal information from a site or network or electronic information system or infringing on privacy and confidentiality.
B. Cyber Crime Law:
The Information Systems Crimes Act on maintaining the rights and privacy of personal and financial rights as well as all that would affect the security and stability of the country by selecting the excesses of the Internet users.

DISCUSSION AND CONCLUSION

In this paper we improved how well SEP protocol meets the e-payment security requirements and identified end-user implementation requirement. We presented our analysis for E-payment, as an example of security challenges in third-party service integration using cyber laws.
Online payments through are relatively safe because they use SSL technology which is the safest mechanism being used today or another secure methods (for example, using public-key cryptography). But the problem is the SSL protocol is not flawless.
But in reality, the security of online payment also depends on the customer himself. He should gain knowledge in how to use the internet so that he can be more aware of email scams and website URLs that may not be from payment system website. For example for PayPal users, the lack of knowledge and common sense appears to have caused more problems than insecurity. However, there probably is no best way to be fully secured other than to just avoid online purchases altogether. We believe that our study takes some steps in the security problem space that web applications have brought.
Fundamentally, we believe that the emergence of this new web programming paradigm demands new research efforts on ensuring the security quality of the
systems it produces.

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A BRIEF INTRODUCTION OF WIRELESS COMMUNICATION

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ABSTRACT

The term wireless refers to communication without wires. In order to transmit information (voice or data) using wireless communication we need antenna. The antenna is the device which couples RF energy from one medium (i.e. waveguide, transmission line etc.) to the other medium (i.e. air). We require two systems viz. transmitter and receiver to complete end to end wireless link.
Wireless communication uses electromagnetic waves as medium for carrying the information through the channel between transmitter and receiver.
Provide electronic exchange of multimedia data, Voice, data, video, music, email, web pages, etc.
Communication Systems of today Radio and TV broadcasting, Public Switched Telephone Network (voice, fax, modem) Cellular Phones Computer networks (LANs, WANs, and the Internet) Satellite systems (pagers, voice/data, movie broadcasts)Bluetooth

Keywords: *Wireless, Communication, Antenna, Channel.*

INTRODUCTION

Wireless Communication is the fastest growing and most vibrant technological areas in the communication field. Wireless Communication is a method of transmitting information from one point to other, without using any connection like wires, cables or any physical medium.
We live in a World of communication and Wireless Communication, in particular is a key part of our lives. Some of the commonly used Wireless Communication Systems in our day – to – day life are: Mobile Phones, GPS Receivers, Remote Controls, Bluetooth Audio and Wi-Fi etc.
Wireless communication is the transfer of information between two or more points that are not connected by an electrical conductor. The most common wireless technologies use radio. With radio waves distances can be short, such as a few meters for television or as far as thousands or even millions of kilo meters for deep-space radio communications. It encompasses various types of fixed, mobile, and portable applications, including two-way radios, cellular telephones, personal digital assistants (PDAs), and wireless networking. Other examples of applications of radio wireless technology include GPS units, garage door openers, wireless computer mice, keyboards and headsets, headphones, radio receivers, satellite television, broadcast television and cordless telephones. Somewhat less common methods of achieving wireless communications includes the use of other electromagnetic wireless technologies, such as light, magnetic, or electric fields or the use of sound. Wireless operations permit services, such as long-range communications, that are impossible or impractical to implement with the use of wires. The term is commonly used in the telecommunications industry to refer to telecommunications systems (e.g. radio transmitters and receivers, remote controls etc.) which use some form of energy (e.g. radio waves, acoustic energy, etc.) to transfer information without the use of wires. Information is transferred in this manner over both short and long distances.

WHAT IS WIRELESS COMMUNICATION?

Anyone who is up to date on the Wireless World will reassuringly say that the dependency on Wireless Technology has increased over the last year. These days, any person from the age of 5 to 95 can hold some sort of portable device – be it a cell phone or a pager or a toaster – that not only allows one to communicate with family and friends, but now one can check his email, his stock portfolios, and browse the web all from whatever device he is holding in his hand or nearby on his desk – it could even be a toaster (Audrey anyone?)
Perhaps as little as four years ago no one would have ever thought that the technological world – which literally exists worldwide and not only in the heart of the Silicon Valley as every one says –

could bring our favorite hobbies of web browsing and email to our brand new miniature Nokia cellular phones. The Wireless Hierarchy, to be discussed in the next section, breaks down into several components. The question is no longer "How do we get data to a portable device (such as a cellular phone)?" Now that this technology has been developed and continues to be developed since certainly not everything has the Internet on it (e.g. our shoes), the question becomes "How **fast** can we get this data to a portable device (such as my toaster)?"

The terms "Wireless" and "Mobile" get tossed quite frequently in any discussion of Wireless Communication or Wireless Technology. Are there differences between the two terms? There are many differences, of course, and some of these differences are very significant and some are rather irrelevant. This will also be covered in a section from now. Wireless Communication is simply a medium. Wireless Communication is about the tools used to communicate from one device to another. As subscribers to such technology, one needs to find the best type of wireless services that suits his needs. The goal of this survey paper is not to market any particular product that utilizes wireless technology of any sort. What shall be described in this paper is simply to define and understand Wireless Architecture and discussing the various protocols that exist in this field today. Several products will be mentioned and comparisons will be made, but in no means will a particular product be marketed.

Wireless Application Protocol, also known as WAP to those who inhibit the Wireless World, is a survey paper of its own. However, WAP will be addressed as well not only because there is a need to discuss WAP, but because it would be unjust to not even mention WAP when discussing Wireless Technology. WAP has been one of the most recent and the most fully developed protocols out there. In very little time, WAP served as a basis and model for other protocols such as another very recent protocol on the market today – Ericsson's Bluetooth. Although these protocols serve different purposes, they cover similar bases and have very similar concepts and goals, which shall also be discussed ahead as well. WAP allows things such as web surfing on cellular phones – something other protocols did not cover. This highlights one of the main topics of this survey paper, all which will be discussed ahead.

OBJECTIVES

"wire-less" technology is any type of technology that eliminates the need for wires.

The most common wireless technologies use radio waves. The concept of radio started as the transmission of telegraph messages without connecting wires. The etymology of "radio" or "radiotelegraphy" reveals that it was called "wireless telegraphy" which was later shortened to "wireless." What makes that task of a very simple definition even more difficult with radio is that the term itself does not define a single item. When I say radio, do you think of music broadcast over the airwaves? When I say wireless do you think of voice communications? The concept of radio continues to evolve. In the early half of the 21st century the term wireless could be used to describe a short-range computer networking system, with technologies such as Wireless Local Area Network (WLAN), Wi-Fi, and Bluetooth. The term wireless is also Wireless technology is how we start: the voice coming out of our mouth is transmitted wirelessly to the ears of the person with whom we're talking to. Other forms of Wireless technology was invented to reduce the investments and/or avoid the need to deploy cables (sometimes, a very difficult job) to transmit our voice to distances bigger than what our lungs allow.

ARCHITECTURE

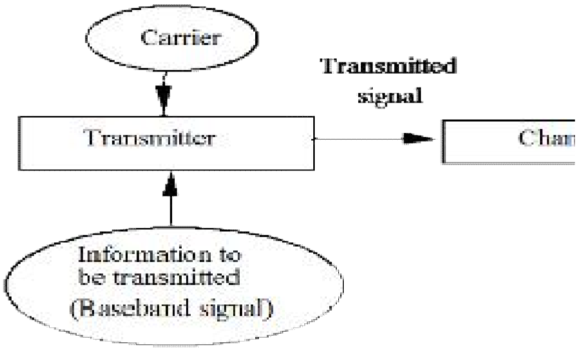

Fig1. Architecturer of Wireless Communication

ADVANTAGES

4.1 Cost effectiveness-Wired communication entails the use of connection wires. In wireless networks, communication does not require elaborate physical infrastructure or maintenance practices. Hence the cost is reduced.

Example − Any company providing wireless communication services does not incur a lot of costs, and as a result, it is able to charge cheaply with regard to its customer fees.

4.2 Flexibility -Wireless communication enables people to communicate regardless of their location. It is not necessary to be in an office or some telephone booth in order to pass and receive messages.

Miners in the outback can rely on satellite phones to call their loved ones, and thus, help improve their general welfare by keeping them in touch with the people who mean the most to them.

4.3 Convenience-Wireless communication devices like mobile phones are quite simple and therefore allow anyone to use them, wherever they may be. There is no need to physically connect anything in order to receive or pass messages.

Example − Wireless communications services can also be seen in Internet technologies such as Wi-Fi. With no network cables hampering movement, we can now connect with almost anyone, anywhere, anytime.

4.4 Speed-Improvements can also be seen in speed. The network connectivity or the accessibility were much improved in accuracy and speed.

Example − A wireless remote can operate a system faster than a wired one. The wireless control of a machine can easily stop its working if something goes wrong, whereas direct operation can't act so fast.

4.5 Accessibility-The wireless technology helps easy accessibility as the remote areas where ground lines can't be properly laid, are being easily connected to the network**.**

Example − In rural regions, online education is now possible. Educators no longer need to travel to far-flung areas to teach their lessons.

DISADVANTAGES

5.1 Organs made by different companies may not be able to communicate with each other or you may need to extra effort to overcome these problems.

5.2 Ethernet. The wireless networks are often slower than networks Alnosolh directly using the techniques of Ethernet showed greater success in preventing breaches of its predecessor.

5.3 Lesser range

Normally, the range of a medium-range wireless network is up to around 100 meters. This may be suitable for a home or a small office, but insufficient for larger structures. To increase the range, additional access points or repeaters will be required. This is an extra charge which increases the overall cost.

5.4 Reliability**-** wireless networks work with radio wave communication, the signal is affected by much interference. It is also subjected to certain propagation effects. The movement of the user also creates instability in the signals. These disturbances to the signal may become difficult to handle for the network administrator.

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CONCLUSION

In conclusion, wireless communications globally is something that people can expect as technology advances. Wireless communications has a lot of benefits and can make the world a lot more efficient. It does have concerns though as with every other new advancement that is made in today's world. The issues with security regarding access to a person's personal information or the negative impact that it may seem to have on society are a few things that are holding back the progress that wireless technology could be making. With more research and experiments conducted, the problems associated with wireless communications can be reduced and make it a more significant part of the world. Wireless technology will be very important in the near future where the need for wires connecting individual devices seems to be coming to an end

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ELECTRONIC FUND TRANSFER

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ABSTRACT

The design of an electronic funds-transfer (EFT) system, using the UNITY parallel programming methodology, is presented. The process begins with a high-level specification that captures the essence of transaction processing in the system. In a series of refinement steps, this specification is transformed into one that leads directly to a program suitable for execution on the distributed architecture of the EFT system. Each refinement step involves replacing a data structure by a distributed version that can be implemented efficiently on the target architecture. By defining a correspondence between the replaced data structure and its distributed counterpart, it can be demonstrated formally that each refinement step preserves the intent of the original specification.
The task is interrelated and interwoven in to electronic commerce.

Keywords: *EFT, Debit Card, Payment etc.*

INTRODUCTION

Electronic Funds Transfer (EFT) is a system of transferring money from one bank account directly to another without any paper money changing hands. One of the most widely-used EFT programs is Direct Deposit, in which payroll is deposited straight into an employee's bank account, although EFT refers to any transfer of funds initiated through an electronic terminal, including credit card, ATM, Fed wire and point-of-sale (POS) transactions. It is used for both credit transfers, such as payroll payments, and for debit transfers, such as mortgage payments. For payments, funds are transferred electronically from one bank account to the billing company's bank, usually less than a day after the scheduled payment date. The growing popularity of EFT for online bill payment is paving the way for a paperless universe where checks, stamps, envelopes, and paper bills are obsolete. The benefits of EFT include reduced administrative costs, increased efficiency, simplified bookkeeping, and greater security. Regulation E governs financial transactions with electronic payment services, specifically with regard to disclosure of information, consumer liability, error resolution, record retention, and receipts at electronic terminals. Electronic commerce is now a common feature of many commercial enterprises. However most designers and implementers of electronic commerce system have concentrated on the provision of electronic payments (Electronic Fund Transfer). Other aspects of electronic commerce have received less attention, in particular, many components that are well matched to implementation on massively distributed system. Commerce involves not only payments for goods and services but also their creation, advertisement, delivery, maintenance and disposal. In the wake of e-commerce, Indian Government has started the project of digital India; BHIM app is Indian Government. Creation to enable the poor people of India to benefit from the Electronic Fund Transfer.

TYPES OF EFT

ATM/Debit Card Transactions ,You may use ATM/debit cards to withdraw cash, make transfers between your Citizens Community Bank accounts, deposit funds, complete point-of-sale transactions, make account inquiries, and for other banking activities.

- Online Banking External Funds Transfer: You may enroll in online banking to perform electronic transfers to external accounts. When you enroll, you will be provided terms and conditions that apply to electronic transfers using our online banking services.
- Online Banking Bill Payment: Online payments include payments made through the services for which the Payment Account is Bank account, including, without limitation, any payment that you schedule through our Online Bill Pay service, payments to certain Bank accounts, and payments made in the

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form of fundstransfers to eligible loan or line of credit accounts.

WORKING

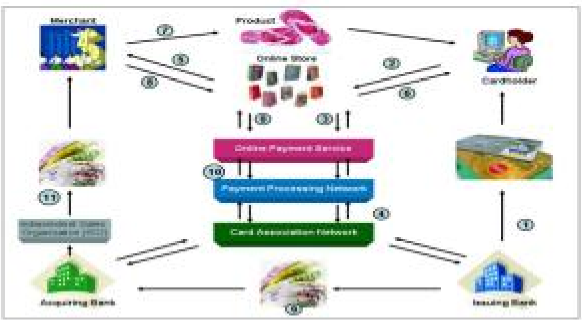
Online Payment Process In discussing the online payment process, I took the example of a credit card transaction as this is most commonly use when making payments for the purchases made online.

- **Online Credit Card Payment Process** - In the processing of a credit card payment, there are several entities that play important roles to make the online payment possible.
- **Cardholder** – The individual or the entity or simply the customer that uses his credit card to pay the purchases made online.
- **Issuing Bank** – The financial institution that issues a credit card to the cardholder.
- **Merchant** – The entity or an individual that is selling products/goods or services.
- **Acquiring Bank** – An entity that is often referred to as the merchant bank or acquirer. It is the financial institution that enables merchants to accept credit card payments.
- **Payment Application** – The application that is used by the merchant to request credit card authorization and settlement of funds between the merchant and the acquiring bank.
- **Third-party Processor** – Also known as payment processing networks, frontend processors, or just processors, the organization that works with an acquiring bank (merchant bank) to process credit card transactions via the card issuers/associations.

Card issued

The customer has a credit card with him issued by the issuing bank with the credit limit and an available balance.

- **Buy button**: The customer visits a web site or the online shop using standard web browser and start shopping and add the product(s) into his shopping cart. Upon 8 check out, he is required to submit his credit card information, expiration date, billing address..



- **Authorization response**: The issuing financial institution verifies the credit card information and determines whether the customer has sufficient credit available to pay for the purchase. An authorization number is generated and the available credit is reduced by the authorized amount.
- **Merchant notification**: The third-party processor receives the authorization message and other pertinent information from the card association or issuer and initiates the process of communicating the authorization message to the merchant.
- **Shopper notification**: The merchant's server receives the information and is programmed to send immediately the purchase approval or decline message to the cardholder/customer.
- **Fulfillment:** The merchant begins the process of fulfilling the customer's order with the appropriate product/service.
- **Settlement request**: The merchant compiles a batch of orders that have been fulfilled and begins the process of transmitting batch to the third-party processor for the settlement.
- **Settlement:** For each credit card transaction in the batch, the appropriated financial institution is debited and the cardholder's credit card statement is updated. The acquiring bank receives the funds and makes a deposit into the merchant's bank account.
- **Settlement response**: The merchant receives the notification that the funds have been deposited into his bank account.

Funds available: The interval between the merchant's issuance of a settlement request, funds transfer and funds availability can take up to several days, depending on the issuing bank, the acquiring bank and the third-party processor.

ADVANTAGE

● **Time savings**:- Money transfer between virtual accounts usually takes a few minutes, while a wire transfer or a postal one may take several days. Also, you will not waste your time waiting in lines at a bank or post office.

● **Reduced risk of loss and theft**.:-You can not forget your virtual wallet somewhere and it can not be taken away by robbers. Although in cyberspace there are many scammers, in one of the previous articles we described in detail how to make your e-currency account secure.

- **User-friendly**:- Usually every service is designed to reach the widest possible audience, so it has the intuitively understandable user interface. In addition, there is always the opportunity to submit a question to a support team, which often works 24/7.

DISADVANTAGE

- **Restrictions:-** Each payment system has its limits regarding the maximum amount in the account, the number of transactions per day and the amount of output.
- **The risk of being hacked:-** If you follow the security rules the threat is minimal, it can be compared to the risk of something like a robbery. The worse situation when the system of processing company has been broken, because it leads to the leak of personal data on cards and its owners.
- **The lack of anonymity**:-The information about all the transactions, including the amount, time and recipient are stored in the database of the payment system. And it means the intelligence agency has an access to this information. You should decide whether it's bad or good.
- **The necessity of Internet access:-** If Internet connection fails, you can not get to your online account

OBJECTIVE

- Electronic fund transfer is system of transfer of money from B2B (business to business) B2C(business to consumer) C2C(Consumer to Consumer involving, customers, Banks financial institution corporate, Governments etc. there is a design issue related to safely , each to end user i.e. penetration affordability and security.
- Capabilities of communication infrastructure and various interface : there is need to study the speed of communication infrastructure specifically related to speed in kbps to tbps (kilo byte per seconds to tera byte per second)to avail the facility of EFT on electronic interface.
- In order to design and built the application for EFT computer professionals will face the difficulty of resource management.

The specific issue involved is of
(a)Routing
(b)Cost of algorithm
(c)Safety of data and its management in term of security and privacy .
(d)Up gradation of existing software and system, network and other EFT . enabling interface ,management of traffic on computer system etc.
(e)Protection: (security and privacy issue) Electronic fund transfer involves two parties, service provider and customer.
(f)Synchronization and error control: it is very much desirable to sort out the issue of synchronization of accounts of service provider and customer.

FUTURE OF SCOPE

Electronic fund transfer is reality in today technological world. A deal will come in near future where the role of paper (currency) base money will be very minimum in economy. The world currencies will be exchange on electronic plat form. The future of electronic transfer will depend on

- **Stronger security**: Today we can configure a full proof authentication system. But the problem with very high level of security in that they a make transaction number some. For instant you could take a thumbprint scan every time you use digital wallet.
- **Smart card**: As debit card and credit card are widely used for EFT. In future the cards will have to smarter so as to restrict the unauthorized user. Smart cards should also have to be immune to card cloning.
- **Use of biometrics**: Many researchers support use of biometrics in EFT transaction.
- **Mobile payments**: While mobile phone base payments rely on credit/debit cards or bank account (net banking) they may be done away with the need to carry that piece of plastic.
- **Tax evasions**: The EFT transactions reduce the tax evasions. The World Government are supporting the EFT. This requires the research on the part of computer professional like software professional, hardware professional application developer etc a greater duty towards making of safe, secure, fast and temper proof technologies to archive the objective of EFT.

CONCLUSION

Electronic payments are rapidly evolving and future is looking to bring more convenience and security than ever before. The use of pay-TM, BHIM App, etc along with the e-shopping on Amazon, flip cart, etc requires safety, security and privacy issue. The modern economics is moving

towards the computer driven technology of e-commerce, NEFT, RTGS etc which is base on concept of electronic fund transfer. The Electronic Fund Transfer technology is used in e-commerce, e-retailing bank transaction etc. It is also used to empower the poor people. In India,
India Government is using the DBT (Direct Benefit Transaction), BHIM-app, scholarship programmer's payment, Governments servant
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salary through EFT. The is an ever growing field and in here future will transform the economic and found delivery system this EFT technology will reduce the traditional way of fund transfer to minimal. The printing of currencies (which is major exchequer Government treasuries) will also reduce if the technology of electronic fund transfer (EFT) is full proof

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CACHING TECHNIQUES FOR IMPROVING PERFORMANCE OF WEB APPLICATION

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ABSTRACT

The Internet these days has become part and parcel of almost every section of our life. There is hardly any field or business left which does not uses Internet. This resulted in an incredible growth in amount of information to be served via the World Wide Web. This trend of increasing traffic on the Internet is likely to continue further. Increasing popularity of World Wide Web has introduced new issues such as Internet traffic, bandwidth consumption thereby leading to latency in service being provided by the application servers. Despite technological advances this huge traffic can lead to considerable delays in accessing objects on the web.

Caching of objects in the World Wide Web is widely used technique to reduce network traffic, user perceived retrieval delays and server load. Caching involves storing copies of objects at locations that are relatively closer to the user. This allows user requests to be served faster than if they were served directly from the original web server. Caching may be performed at different levels, namely at the browser, at proxy server or at web-server levels. This paper discusses different types of web caching techniques, their working and classifications and architectures of the caching techniques.

Keywords: *WWW, Internet, Browser, Traffic, Bandwidth, Latency, Proxy, Cache*

INTRODUCTION

The World Wide Web has evolved into the most widespread infrastructure for Internet based information system in the last decade. It is one of the most ideal places for business and entertainment to enrich their presentation with interactive features. This has caused the evolution of web growing and rising fast and drastically. Web traffic is significant, and demands continue to increase at rapid rate. Highly accessed web sites may need to serve over millions of hits per second. The Internet and the web have changed the way we conduct business and get educated. Whether utilizing e-commerce applications, outsourcing internal processes, or simply improving communications with suppliers and partners, business is increasingly conducted over the Internet.

Most business organizations and government departments nowadays have developed and provided Internet based electronics services (e-Services) that feature various intelligent functions. This form of services is commonly called e-service intelligence (ESI). ESI integrates intelligent technology and methodologies into e-service system for realizing intelligent, Internet information searching, presentation, provision, recommendation, online system design, implementation, and assessment for Internet users. These intelligent technologies include machine learning, soft computing, intelligent languages and data mining etc. ESI has been recently identified as a new direction for the future development stage of e-services. E-services offer great opportunities and challenges for many areas of services, such as government, education, banking, tourism, commerce, marketing, finance and logistics. They involve various online service providers, delivery system and applications including e-government, e-learning, e-shopping, e-marketing, e-banking, and e-logistics.

PROBLEMS IN ACCESSING WEB INFORMATION

The quick expansion of the World Wide Web has resulted in congestion and network traffic [15]. Web data transformation has been almost double in every half year, and despite efforts for capacity increases demands aren't always kept up. Improving response time and access latencies for clients become quite important and challenging issue, web caching has been proposed a technique to reduce both Internet traffic as well as latency for requested object.

Human interaction with objects or so called interactive features has leaded the Web to be more easily guided and capable to perform business task between distance places. These pages are linked and managed for certain purposes that perform as a web application. These interactive web pages consist of pages that are able to perform application's logical task. The rising popularity of using Web applications in WWW causes tremendous load on the Internet traffic.

However caching a document does not come free. It creates some additional overheads to handle it and can also cause other problems. Most documents on the Internet change over time as they are updated. Static and Dynamic caching are two different technologies that are widely used to reduce download time and congestion. Static caching stores the content of a web page which does not change. There is no need to request the same information repeatedly. This is an excellent approach to fight congestion. Dynamic caching is slightly different. It determines whether the content of a page has been changed. If the contents have changed, it will store the updated version. If these two technologies are implemented simultaneously, then the latency and congestion can be diminished significantly.

NEED OF WEB CACHING

Caching is a technique used to store popular documents closer to the user. It uses algorithms to predict user's needs to specific documents and stores important documents. Caching can occur anywhere within a network, on the user's computer or mobile devices, at a server or at an Internet Service Provider (ISP). Web cache performance is directly proportional to the size of the client community. The bigger the client community is, the greater the possibility of cached data being requested, hence, the better the cache's performance.

Deploying caches close to clients can reduce overall backbone traffic considerably. Cache hits eliminates the need to contact the originating server. Thus additional network communication can be avoided.

To improve web server availability, caching systems can also be deployed in 'reverse' fashion, where caches are managed on behalf of content providers who want to improve the scalability of their site under existing or anticipated demand. In these cases, caches not only improve the availability and fault-tolerance of their associated web servers, but also act as load balancers [3].

Web caching is the temporary storage of web objects (such as HTML documents) for later retrieval. There are three significant advantages to web caching.

- To Reduce wide area bandwidth usage (fewer requests and responses that need to go over the network)
- To Reduce the load placed on origin servers (fewer requests for a server to handle)
- To Reduce latency (responses for cached requests are available immediately, and closer to the client being served). Together, they make the Web less expensive and better performing.

Caching can also be utilized in the middle, between the client and the server as part of proxy. Proxy caches are often located near network gateways to reduce the bandwidth required over expensive dedicated Internet connections. These systems serve many users (clients) with cached objects from many servers.

MECHANISM OF WEB CACHING

All caches have a set of rules that they use to determine when to serve an object from the cache, if it's available. Some of these rules are set in the protocols and some are set by the administrator of the cache (either the user of the browser cache, or the proxy administrator).

Generally, there are the most common rules that are followed for a particular request:

1. If the object's headers notify the cache not to keep the object, then it will do so. Simultaneously, if there is no validation, then most caches will mark that as un-cacheable item.
2. If the object is authenticated or secured, then it will not be cached.
3. A cached object is considered fresh if:
   - It has an expiry time or other age-controlling directive set, and is still within the fresh period.
   - If a browser cache has already seen the objet, and has been set to check once a session.
   - If a proxy cache has seen the object recently, and it was modified relatively long ago. Fresh documents are served directly from the cache, without checking with the origin server

4. If an object is stale, the origin server will be executed to validate the object, or notify the cache whether the existing copy still good.

Freshness and validation are the most important mechanisms that make cache works with content. A fresh object will avoid sending the entire object all over again if it has not been changed.

Caches can be placed directly in front of a particular server, to reduce the number of requests that the server must handle. Most proxy caches can be used in this fashion, but this form has a different name to reflect the fact that it caches objects for many clients but from only one server.

Cache (memory) is memory that is stored very close to the CPU, say on the same chip as the CPU, to allow fast access. Similarly, a disk cache is memory that is used to store frequently accessed disk pages for fast access. Web caching is the storage of Web objects near the user to allow fast access, thus improving the user experience of the Web surfer. Examples of some Web objects are Web pages (the HTML itself), images in Web pages, etc. Web objects can be cached locally on the user's computer or on a server on the Web.

TYPES OF CACHES FOR WEB OBJECTS:

5.1 Browser cache: Browser caching typically occurs closest to the end user, such as the user computer's hard disk. Browsers' cache Web objects on the user's machine.[11] A browser first looks for objects in its cache before requesting them from the website. Caching frequently used Web objects speeds up Web surfing. For example, we often use google.com and yahoo.com. If their logos and navigation bars are stored in our browser's cache, then the browser will pick them up from the cache and will not have to get them from the respective websites. Getting the objects from the cache is much faster than getting them from the websites. The Netscape browser uses both a memory cache and a disk cache, whose sizes on my-computer are set to 1 MB and 7.5 MB, respectively. Microsoft's browser, the Internet Explorer, is set to use a disk cache of 63 MB on my-computer (there is no mention of a memory cache). A memory cache is faster than a disk cache, and the Netscape browser uses the two to form a small cache hierarchy.

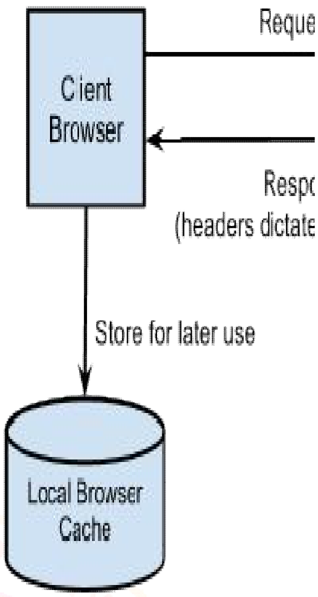

Fig. 1 Browser cache

5.2 Proxy cache: Proxy caches are situated at network access points for web users [1, 11]. Consequently proxy caches can store documents and directly serve requests for them in the network, thereby avoiding repeated traffic to web servers. This results in reducing network traffic, load on web servers, and the average delays experienced by network users while accessing the web [2]. Proxy caching is widely used by computer network administrators, technology providers, and businesses to reduce user delays on the Internet A proxy cache server receives the HTTP request from clients for a web object and if it finds the requested object in its cache, it returns the object to the user without disturbing the upstream network connection or destination server. If it is not available in the cache, the proxy attempts to fetch the object directly from the originating server. Finally the originating server, which has the object, gets it, possibly deposits it and returns the object to the user. The benefits of proxy caching are supported to reduce network traffic and reduce average latency. A proxy cache is installed in a network near the Web users as shown in fig. 2, to reduce bandwidth consumption.

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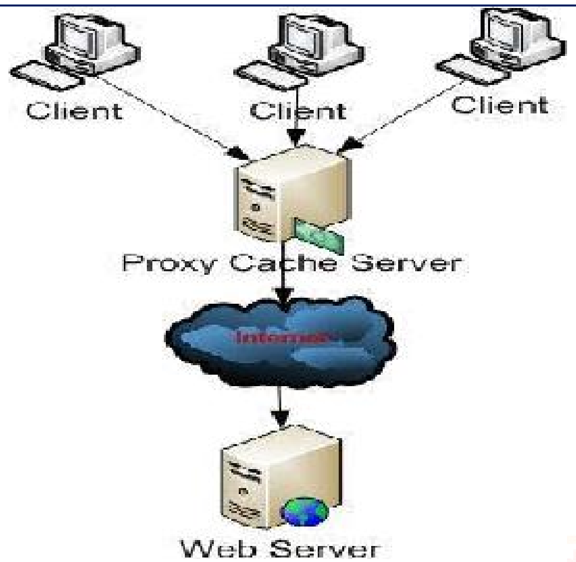

Fig. 2. A standalone Proxy configuration

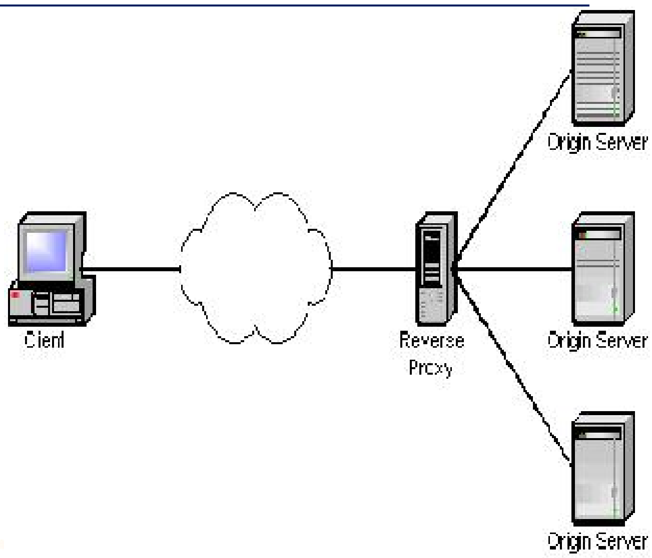

Fig.4. Reverse proxy

5.3 Transparent proxy cache: One of the main drawbacks of the proxy server approach is the requirement to configure web browsers. A "transparent" proxy cache, on the other hand, intercepts browser Web requests without the browser being aware of the interception. Transparent proxies are placed at "gateways" so that all Web requests automatically go through the proxy. An example of a gateway is the server through which all enterprise Web traffic is funneled out to the Internet and back in.

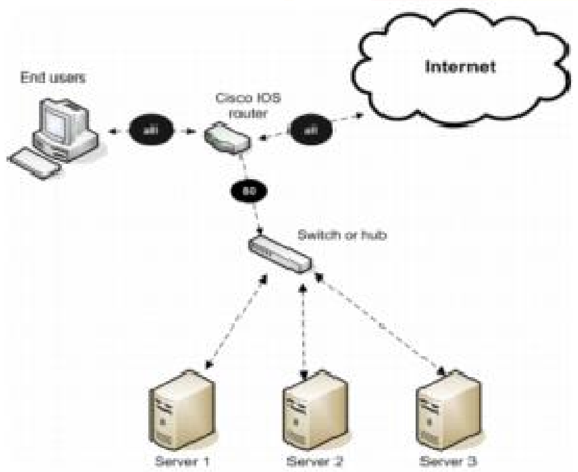

Fig.3. Transparent proxy configuration

5.4 Reverse (inverse) proxy cache: To reduce the load on a website, a proxy cache, called the "reverse" proxy, is placed in front of the website server(s). The reverse proxy intercepts browser's requests to the websites. If the reverse proxy does not have the requested Web object, it gets the object from another cache or from the website itself.

Web objects can have an expiry time associated with them after which the object is considered to be "stale". A stale object is not used. If the object in the cache is stale, then it is equivalent to the object not being in the cache. An expiry date can be specified in the http header of a Web object. The expiry date is specified using EXPIRES and CACHE-CONTROL http headers.

Proxy caches come in two varieties: software that is installed on servers or separate boxes called appliances. Cache appliances contain only caching software and run on specialized operating systems fine-tuned for caching.

ADVANTAGES OF WEB CACHING

Web caching has the following advantages:

- Faster delivery of Web objects to the end user.
- Reduces bandwidth needs and cost. It benefits the user, the service provider and the website owner.
- Reduces load on the website servers.
- Reduce congestion in web traffic.
- Reduce latency in web content delivery.

CONCLUSION

Response time is an important issue in any application, may it be online or offline. Availability of tremendous amount information on the World Wide Web and millions and trillions of users accessing that information leads to tremendous increase in traffic, server load and latency. This leads to delay in response being obtained by the user from the server. These techniques reduces load on traffic and reduces latency. Depending in the situation and requirement different caching techniques are used. The purpose of all the caching techniques is to reduce server and traffic load, reduce bandwidth requirement and increase speed, but still some issues such as storing the cache, updating the cache, remove and retrieving the cache are common among them for designing and deploying caching techniques

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CYBER SECURITY: TECHNOLOGIES, PROCESSES AND PRACTICES DESIGNED TO PROTECT NETWORKS

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ABSTRACT

Cyber Security plays an important role in the field of information technology. Securing the information has become one of the biggest challenges in the present day. Whenever we think about the cyber security the first thing that comes to our mind is 'cyber crimes' which are increasing immensely day by day. Various Governments and companies are taking many measures in order to prevent these cyber crimes. Besides various measures cyber security is still a very big concern to many. This paper mainly focuses on challenges faced by cyber security on the latest technologies .It also focuses on latest about the cyber security techniques, ethics and the trends changing the face of cyber security.

Keywords: *Cyber security, cyber crime, cyber ethics, social media, cloud computing, android apps.*

INTRODUCTION

Today man is able to send and receive any form of data may be an e-mail or an audio or video just by the click of a button but did he ever think how securely his data id being transmitted or sent to the other person safely without any leakage of information?? The answer lies in cyber security. Today Internet is the fastest growing infrastructure in everyday life. In today's technical environment many latest technologies are changing the face of the mankind. But due to these emerging technologies we are unable to safeguard our private information in a very effective way and hence these days cyber crimes are increasing day by day. Today more than 60 percent of total commercial transactions are done online, so this field required a high quality of security for transparent and best transactions. Hence cyber security has become a latest issue. The scope of cyber security is not just limited to securing the information in IT industry but also to various other fields like cyber space etc. Even the latest technologies like cloud computing, mobile computing, E-commerce, net banking etc also needs high level of security. Since these technologies hold some important information regarding a person their security has become a must thing. Enhancing cyber security and protecting critical information infrastructures are essential to each nation's security and economic wellbeing. Making the Internet safer (and protecting Internet users) has become integral to the development of new services as well as governmental policy. The fight against cyber crime needs a comprehensive and a safer approach. Given that technical measures alone cannot prevent any crime, it is critical that law enforcement agencies are allowed to investigate and prosecute cyber crime effectively. Today many nations and governments are imposing strict laws on cyber securities in order to prevent the loss of some important information. Every individual must also be trained on this cyber security and save themselves from these increasing cyber crimes.

CYBER CRIME

Cyber crime is a term for any illegal activity that uses a computer as its primary means of commission and theft. The U.S. Department of Justice expands the definition of cyber crime to include any illegal activity that uses a computer for the storage of evidence. The growing list of cyber crimes includes crimes that have been made possible by computers, such as network intrusions and the dissemination of computer viruses, as well as computer-based variations of existing crimes, such as identity theft, stalking, bullying and terrorism which have become as major problem to people and nations. Usually in common man's language cyber crime may be defined as crime committed using a computer and the internet to steal a person's identity or sell contraband or stalk victims or disrupt operations with malevolent programs. As day by day technology is playing in major role in a person's life the cyber crimes also will increase along with the technological advances.

CYBER SECURITY

Privacy and security of the data will always be top security measures that any organization takes care. We are presently living in a world where all the information is maintained in a digital or a cyber form. Social networking sites provide a space where users feel safe as they interact with friends and family. In the case of home users, cyber-criminals would continue to target social media sites to steal personal data. Not only social networking but also during bank transactions a person must take all the required security measures.

Table 1

Incidents	Jan-June 2012	Jan-June 2013	% Increase/ (decrease)
Fraud	2439	2490	2
Intrusion	2203	1726	(22)
Spam	291	614	111
Malicious code	353	442	25
Cyber Harassment	173	233	35
Content related	10	42	320
Intrusion Attempts	55	24	(56)
Denial of services	12	10	(17)
Vulnerability reports	45	11	(76)
Total	5581	5592	

Table I

The above Comparison of Cyber Security Incidents reported to Cyber999 in Malaysia from January–June 2012 and 2013 clearly exhibits the cyber security threats. As crime is increasing even the security measures are also increasing. According to the survey of U.S. technology and healthcare executives nationwide, Silicon Valley Bank found that companies believe cyber attacks are a serious threat to both their data and their business continuity. 98% of companies are maintaining or increasing their cyber security resources and of those, half are increasing resources devoted to online attacks this year The majority of companies are preparing for when, not if, cyber attacks occur Only one-third are completely confident in the security of their information and even less confident about the security measures of their business partners.

There will be new attacks on Android operating system based devices, but it will not be on massive scale. The fact tablets share the same operating system as smart phones means they will be soon targeted by the same malware as those platforms. The number of malware specimens for Macs would continue to grow, though much less than in the case of PCs. Windows 8 will allow users to develop applications for virtually any device (PCs, tablets and smart phones) running Windows 8, so it will be possible to develop malicious applications like those for Android, hence these are some of the predicted trends in cyber security.

TRENDS CHANGING CYBER SECURITY

Here mentioned below are some of the trends that are having a huge impact on cyber security.

A) WEB SERVERS

The threat of attacks on web applications to extract data or to distribute malicious code persists. Cyber criminals distribute their malicious code via legitimate web servers they've compromised. But data-stealing attacks, many of which get the attention of media, are also a big threat. Now, we need a greater emphasis on protecting web servers and web applications. Web servers are especially the best platform for these cyber criminals to steal the data. Hence one must always use a safer browser especially during important transactions in order not to fall as a prey for these crimes.

B) CLOUD COMPUTING AND ITS SERVICES

These days all small, medium and large companies are slowly adopting cloud services. In other words the world is slowly moving towards the clouds. This latest trend presents a big challenge for cyber security, as traffic can go around traditional points of inspection. Additionally, as the number of applications available in the cloud grows, policy controls for web applications and cloud services will also need to evolve in order to prevent the loss of valuable

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information. Though cloud services are developing their own models still a lot of issues are being brought up about their security. Cloud may provide immense opportunities but it should always be noted that as the cloud evolves so as its security concerns increase.

C) APT'S AND TARGETED ATTACKS

APT (Advanced Persistent Threat) is a whole new level of cyber crime ware. For years network security capabilities such as web filtering or IPS have played a key part in identifying such targeted attacks (mostly after the initial compromise). As attackers grow bolder and employ more vague techniques, network security must integrate with other security services in order to detect attacks. Hence one must improve our security techniques in order to prevent more threats coming in the future.

D) MOBILE NETWORKS

Today we are able to connect to anyone in any part of the world. But for these mobile networks security is a very big concern. These days firewalls and other security measures are becoming porous as people are using devices such as tablets, phones, PC's etc all of which again require extra securities apart from those present in the applications used. We must always think about the security issues of these mobile networks. Further mobile networks are highly prone to these cyber crimes a lot of care must be taken in case of their security issues.

E) IPV6: NEW INTERNET PROTOCOL

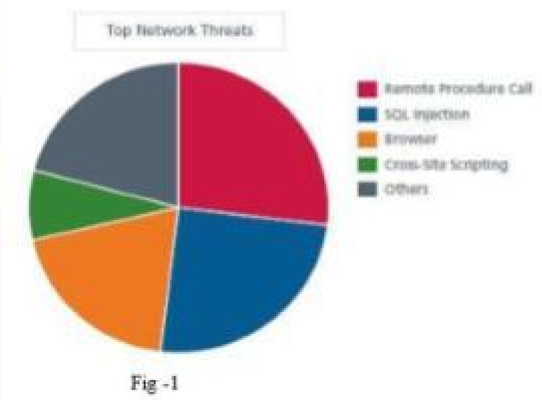
IPv6 is the new Internet protocol which is replacing IPv4 (the older version), which has been a backbone of our networks in general and the Internet at large. Protecting IPv6 is not just a question of porting IPv4 capabilities. While IPv6 is a wholesale replacement in making more IP addresses available, there are some very fundamental changes to the protocol which need to be considered in security policy. Hence it is always better to switch to IPv6 as soon as possible in order to reduce the risks regarding cyber crime.

F) ENCRYPTION OF THE CODE

Encryption is the process of encoding messages (or information) in such a way that eavesdroppers or hackers cannot read it.. In an encryption scheme, the message or information is encrypted using an encryption algorithm, turning it into an unreadable cipher text. This is usually done with the use of an encryption key, which specifies how the message is to be encoded. Encryption at a very beginning level protects data privacy and its integrity. But more use of encryption brings more challenges in cyber security. Encryption is also used to protect data in transit, for example data being transferred via networks (e.g. the Internet, ecommerce), mobile telephones, wireless microphones, wireless intercoms etc. Hence by encrypting the code one can know if there is any leakage of information.

Hence the above are some of the trends changing the face of cyber security in the world. The top network threats are mentioned in below

Fig -1



The above pie chart shows about the major threats for networks and cyber security.

ROLE OF SOCIAL MEDIA IN CYBER SECURITY

As we become more social in an increasingly connected world, companies must find new ways to protect personal information. Social media plays a huge role in cyber security and will contribute a lot to personal cyber threats. Social media adoption among personnel is skyrocketing and so is the threat of attack. Since social media or social networking sites are almost used by most of them every day it has become a huge platform for the cyber criminals for hacking private information and stealing valuable data.

In a world where we're quick to give up our personal information, companies have to ensure they're just as quick in identifying threats, responding in real time, and avoiding a breach of any kind. Since people are easily attracted by these social media the hackers use them as a bait to get the information and the data they require. Hence people must take appropriate measures especially in dealing with social media in order to prevent the loss of their information. The ability of individuals to share information with an audience of millions is at the heart of the particular challenge that social media presents to businesses. In addition to giving anyone the power to disseminate commercially sensitive information, social media also gives the same power to spread false information, which can be just being as damaging. The rapid spread of false information through social media is among the emerging risks identified in Global Risks 2013 report.

Though social media can be used for cyber crimes these companies cannot afford to stop using social media as it plays an important role in publicity of a company. Instead, they must have solutions that will notify them of the threat in order to fix it before any real damage is done. However companies should understand this and recognise the importance of analysing the information especially in social conversations and provide appropriate security solutions in order to stay away from risks. One must handle social media by using certain policies and right technologies.

CYBER SECURITY TECHNIQUES

A) ACCESS CONTROL AND PASSWORD SECURITY

The concept of user name and password has been fundamental way of protecting our information. This may be one of the first measures regarding cyber security.

B) AUTHENTICATION OF DATA

The documents that we receive must always be authenticated be before downloading that is it should be checked if it has originated from a trusted and a reliable source and that they are not altered. Authenticating of these documents is usually done by the antivirus software present in the devices. Thus good antivirus software is also essential to protect the devices from viruses.

C) MALWARE SCANNERS

This is software that usually scans all the files and documents present in the system for malicious code or harmful viruses. Viruses, worms, and Trojan horses are examples of malicious software that are often grouped together and referred to as malware.

D) FIREWALLS

A firewall is a software program or piece of hardware that helps screen out hackers, viruses, and worms that try to reach your computer over the Internet. All messages entering or leaving the internet pass through the firewall present, which examines each message and blocks those that do not meet the specified security criteria. Hence firewalls play an important role in detecting the malware.

E) ANTI-VIRUS SOFTWARE

Antivirus software is a computer program that detects, prevents, and takes action to disarm or remove malicious software programs, such as viruses and worms. Most antivirus programs include an auto-update feature that enables the program to download profiles of new viruses so that it can check for the new viruses as soon as they are discovered. An antivirus software is a must and basic necessity for every system.

Figure: 2

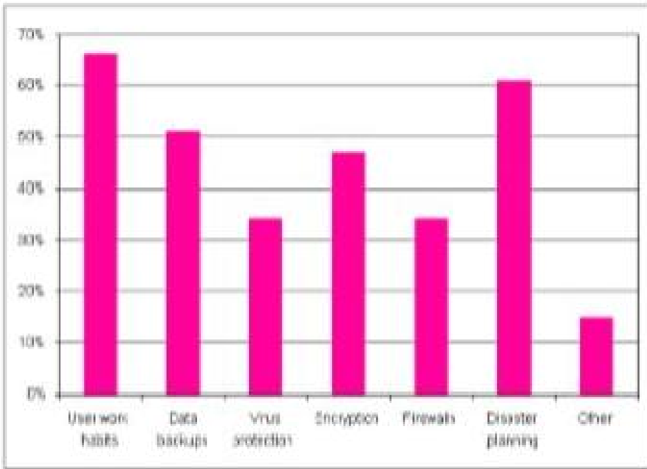


Table II: Techniques on cyber security

CYBER ETHICS

Cyber ethics are nothing but the code of the internet. When we practice these cyber ethics there are good chances of us using the internet in a proper and safer way.

THE BELOW ARE A FEW OF THEM

DO use the Internet to communicate and interact with other people. Email and instant messaging make it easy to stay in touch with friends and family members, communicate with work colleagues, and share ideas and information with people across town or halfway around the world don't be a bully on the Internet. Do not call people names, lie about them, send embarrassing pictures of them, or do anything else to try to hurt them. Internet is considered as world's largest library with information on any topic in any subject area, so using this information in a correct and legal way is always essential. Do not operate others accounts using their passwords. Never try to send any kind of malware to other's systems and make them corrupt. Never share your personal information to anyone as there is a good chance of others misusing it and finally you would end up in a trouble. When you're online never pretend to the other person, and never try to create fake accounts on someone else as it would land you as well as the other person into trouble. Always adhere to copyrighted information and download games or videos only if they are permissible.

The above are a few cyber ethics one must follow while using the internet. We are always thought proper rules from out very early stages the same here we apply in cyber space.

CONCLUSION

Computer security is a vast topic that is becoming more important because the world is becoming highly interconnected, with networks being used to carry out critical transactions. Cyber crime continues to diverge down different paths with each New Year that passes and so does the security of the information. The latest and disruptive technologies, along with the new cyber tools and threats that come to light each

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FUTURE TRENDS OF QUERY PROCESSING USING EFFECTIVE ALGORITHM IN MOBILE ENVIRONMENT

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ABSTRACT

The Processing of query is the method or technique of achieving the required result from a database design in a visionary and faithful manner. On demand of user the design based on data is able to respond result requested by the user is called as query processing. In huge database design, which may be successively on un-expectable and arbitrary environments, to produce efficient database it is difficult for query plans based on result existing uniquely at compile time.

It is based on future scopes of query processing based on algorithm in movable atmosphere. We focus on different algorithms and methods in the area of movable atmosphere. It will propose the best algorithm for processing of query and gives the best performance with related to constraints using time and cost. Nowadays use of mobile computing supports the facility to access the result as per requirement of user any time anywhere. Mobile environment has various aspects like power storing cost of communication and bandwidth constraint. To suggest the best algorithm which fulfills the expected result using proper methodology with effective query processing based algorithms in moveable environment.

Keywords: *Query processing, mobile computing, mobile devices, mobile environment, mobile database.*

INTRODUCTION

The fundamental part of any DBMS is query processing and optimization. The results of queries must be available in the timeframe needed by the submitting user. Query processing techniques based on multiple design dimensions can be classified. The main aim of the query processing is to minimize cost of each query execution. The cost may be in the form of time or space complexity, thus different query processing algorithm used in processing to reduce the size of intermediate and final result as well as processing cost. The query processing in a mobile environment involves join processing among different sites which includes static servers and mobile computers.

Query processing taking maximum usability with fast access to global query processing in mobile computing environment. The process of selecting the best algorithm is to be used in response of study of various algorithms. Recently wireless communication and mobile computing have become emerging most popular and spreading field in the mobile environment. The prime goal that mobile peripheral is predictable to satisfy two main objectives like effectiveness and suitability. Movable device is fruitful only if the end user receives it as helpful instrument that growths their efficiency and offers for more suitable for social life.

Mobile devices have many limitations, connectivity problems, excellence of mobile service, security during communication and transmission. The usage of moveable laptop, computers, palmtops and PDA (personal digital assistants) with united communication competences enables in mobile environment [1].

Query model: Processing methods are categorized affording to the query model they accept. Some systems adopt a variety query model, where scores are attached directly to base tuples. Other techniques assume a join query model, where scores are calculated over join outcomes. A third type accepts combined query model, where there are fascinated in position groups of tuples [2].

Data access methods: Processing techniques are classified according to the data access methods they assume to exist in the underlying data sources. For example, some techniques assume the availability of random access, while others are restricted to only sort access.

Implementation level: Processing methods are characterized permitting to their level of combination with database organizations. For example, some approaches are applied in an application layer on uppermost of the database system, while others are employed as query operators.

Data and query uncertainty: Processing methods are categorized based on the ambiguity involved in their data and query models. Some methods crop exact answers, while others allow for estimated answers, or transaction with ambiguous data.

Ranking function: Processing systems are categorized established on the limitations they execute on the fundamental ranking (scoring) function. Most projected systems undertake monotone scoring purposes.

RELATED WORK

Query processing denotes to the sort of actions elaborate in removing facts from a database. The events comprise renovation of queries in sophisticated database languages into terminologies that can be used at the physical level of the file system, a diversity of query optimizing renovations, and real assessment of queries. The genuine apprising and recovery of data is achieved over and done with various low level procedures. Examples of such processes for a relational DBMS can be such as projection, join, selection, Cartesian product [3].

Although the DBMS is planned to progression these low-level processes powerfully, it can be relatively the load to a user to acquiesce demands to the DBMS in these designs. There are three stages that a request permits from end to end during the DBMS' handling of that query [4]:

- Parsing and translation
- Optimization
- Evaluation

The first phase in handling a query acquiesced to a DBMS is to transform the query into a form functioning by the query processing engine. Assured classifications of characters represent several types of symbols such as keywords, operators, operands, literal strings, etc. Similar all languages, there are rules that rule how the tokens can be collective into logical declarations [5].

The prime job of the parser is to abstract the tokens from the rare string of characters and convert them into the matching core data origins and structures. The past job of the parser is to confirm the validity and syntax of the unique query string.

In second phase, the query processor put on guidelines to the core data structures of the query to alter these structures into corresponding, but further competent illustrations. The instructions can be constructed upon mathematical prototypes of the relational algebra expression and tree upon cost estimates of unlike algorithms functional to processes or upon the semantics within the query and the relations it involves [6].

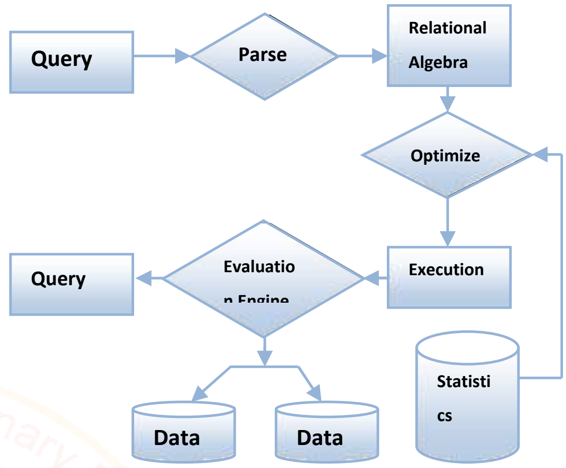

Fig.1. Query processing

The last phase in query processing is the evaluation stage. The finest valuation plan user created by the optimization engine is designated and then performed. In addition processing of query in a simple serial manner, some of a query's single operations can be processed in similar either as self-governing processes or as relevant pipelines of processes or threads. Anyway of the method chosen, the actual results should be same [7].

Consider for sample:

Select marks from student where marks < 50

This can be interpreted into either of the subsequent relational algebra expressions:

$\sigma_{marks<50}\ (\Pi_{marks}(student))$

$\Pi_{marks}\ (\sigma_{marks<50}(student))$

This can also be symbolized as either of the following query trees:

$\sigma_{marks<50}$ | Π_{marks} | student

Π_{marks} | $\sigma_{marks<50}$ | student

Fig.2. Query-evaluation plan.

MEASURES OF QUERY COST

The rate of query estimate can be measured in terms of a number of dissimilar resources, comprising disk accesses, CPU time to execute a query, and, in a scattered or parallel database system, the cost of communication.

The response time for a query evaluation strategy, assuming no other action is going on the computer, would excuse for all these costs, and could be used as a good degree of the cost of the strategy. In huge database systems, however, disk accesses are usually the most significant cost, since disk accesses are slow associated to memory operations [8].

Also CPU speeds have been cultivating much more rapidly than have disk speeds. Thus, it is likely that the time spent in disk action will remain to govern the total time to execute a query. Finally, estimating the CPU time is relatively hard compared to approximating the disk-access cost. Therefore, most people consider the disk-access cost a sound degree of the cost of a query-evaluation plan.

The query optimization engine spawns a set of candidate evaluation plans. Some will, in heuristic theory, produce a faster, more efficient execution. Others may, by prior historical results, be well-organized than the theoretical models; this can very well be the case for queries dependent on the semantic nature of the data to be processed.

Still others can be more capable due to outside agencies such as network congestion, contending applications on the same CPU, etc. [9].

QUERY PROCESSING ALGORITHMS

Queries are eventually condensed to a number of file scan processes on the fundamental physical file structures. For each relational operation, there may be remaining several dissimilar access paths to the specific records needed. The query execution engine can have a gathering of dedicated algorithms planned to process precise relational operation and access path combinations.

Selection Algorithms:

The Select operation must pursuit over the data files for records gathering the selection standards. The Followings are certain examples of simple (one attribute) selection algorithms [10]:

Linear search: Every single record from the file is read and matched to the selection benchmarks. The execution cost for searching on a non-key attribute is b_r, where b_r is the number of blocks in the file expressive relation r. On a key attribute, the average cost is $b_r/2$, with a worst case of b_r.

Binary search: A binary search, on fairness, achieved on a primary key attribute has a worst-case cost of $\lceil \log (b_r) \rceil$. This can be significantly well-organized than the linear search, for a enormous number of records.

Search by a primary index on equality: With a B^+-tree index, fairness comparison on a key attribute will have a worst-case cost of the height of the tree plus one to recover the record from the data file. An equivalence comparison on a non-key attribute will be the equal excluding that several records may come across the condition, in which case, add the number of blocks comprising the records to the cost.

Search by a primary index on comparison: When the comparison operators (<, ≤, >, ≥) are used to regain multiple records from a file organized by the search attribute, the first record sustaining the condition is located and the total blocks before (<, ≤) or after (>, ≥) is added to the cost of detecting the first record.

Search by a secondary index on equality: Recover one record with fairness comparison on a key attribute; or recover a set of records on a non-key attribute. For a single record, the cost will be identical to the cost of discovering the search key in the index file plus one for regaining the data record [11].

For several records, the cost will be identical to the cost of locate the search key in the index file in addition to one block is access for each data record is retrieve, while the data file is not disciplined on the search attribute.

JOIN ALGORITHMS

The join algorithm can be implementing in a dissimilar ways. In terms of disk accesses, the join operation can be very costly, so implement and utilize competent join algorithms is significant in minimize a query's execution time. The following are four well known types of join algorithms [12]:

Nested-Loop Join: It consists of inner for loop nested within an external for loop. To demonstrate this algorithm uses the following notations.

Notations:

r, s	Relations r and s
tr	Tuple (record) in relation r
ts	Tuple (record) in relation s
nr	Number of records in relation r
ns	Number of records in relation s
br	Number of blocks with records in relation r
bs	Number of blocks with records in relation s

Here is a sample pseudo-code listing for joining the two relations r and s utilizing the nested-for loop:

```
For each tuple tr in r
for each tuple ts in s
if join condition is true for (tr, tr)
```

add tr+ts to the result

Every record is in the external relation r scan one time, and in the internal relation s is scan nr times, resultant in nr * ns total record scan. If only one block of every relation can fit into memory, then cost is nr * bs + br. If all blocks in both relations can fit into memory, then cost is br + bs. If all of the blocks in relation s can fit into memory, then the cost is the same to both relations appropriate in memory br + bs [13].

Therefore, if one of the relations can fit completely in memory, then it is beneficial for the query optimizer to select that relation as the inner one. Still even if the worst case for the nested-loop join is quite costly, it has benefit in that it does not compel any limitations on the access paths for whichever relation, despite of the join state [14].

Index Nested-Loop Join: This algorithm is similar as Nested-Loop Join, apart from an index file on the inner relation's join attribute is used against a data-file scan on each index search for in the inner loop is fundamentally an impartiality selection for utilize one of the selection algorithms. Let c be the cost for lookup, then the worst-case cost for joining is $b_r + n_r * c$.

Sort–Merge Join: This algorithm can be used to execute natural joins and equi-joins and requires that each relation be sort by the ordinary attributes among them.

Hash Join: The hash join algorithm is used to execute natural joins and equi-joins. The hash join utilize two hashes table file structure to dividing each relation's records into sets contain identical hash values on the join attributes. Each relation is scan and its equivalent hash table on the join attribute values is built.

DIFFERENT INDEX FILE STRUCTURES

The execution time of a range of operations such as select and join can be condensed by using indexes. To review some of the type of index file structures and the role they play in reducing execution time and overhead [15]:

Dense Index: Data-file is ordered by the search key and every search key value has a separate index record. This structure requires only a single seek to find the first occurrence of a set of contiguous records with the desired search value.

Sparse Index: Data file is well-organized by the index search Key and only some of the search key values have similar index records. Every index record's data file pointer points to the first data-file record with the search key value. Whereas this structure can be less competent than a dense index to find the required records, it requires less storage space and less overhead during addition and removal operations.

Primary Index: The data file is disciplined by the attribute that is also the search key in the index file. Primary indices can be dense or sparse. This is also directed to as an Index-Sequential File.

Secondary Index: In the data file is efficient by an element is dissimilar as of the search key in the index file. Secondary index must be dense.

Multi-Level Index: The index structure containing of two or more tiers of records where higher tier's records point to associated index records of the tier below.

The lower tier's index records hold the pointers to the data-file records. Multi-level index can be used, for occurrence, to decrease the number of disk block reads essential throughout a binary search.

Clustering Index: The two-level index structure where the records in the first stage contain the cluster field value in one area while a second area position to a block in the second stage. The records in the second stage have one area that points to real data file record or to a further level block.

B^+-tree Index: Multi-level index with a balanced-tree structure. Finding a search key value in a B^+-tree is comparative to the height of the tree highest number of seek required is [log (height)].

LAYERS OF QUERY OPTIMIZATION

The crisis of query processing can itself be decomposed into several subprograms, equivalent to various layers. The input is a query on scattered data expressed in relational calculus.

There are four main layer are concerned to map the distributed query into an optimized order of local operation, each proceed on a local database. The first three layers are performing by a fundamental site and use global information; the local sites do the fourth [16].

Query optimization: An optimizer fundamentally enumerates a certain set of plan and selects the plans with the minimum projected cost. It is mostly divided into following four layers [17]:

Query Decomposition: The first layer spoils the distributed calculus query into an arithmetical query on global relations. The data required for this exchange is found in the global theoretical schema describing the global relations [18].

Data Localization: The contribution to the second layer is an arithmetic query on distributed relations. The key role of the second layer is to focus the query's data using data scattering information.

Global Query Optimization: The contribution to the third layer is a fragment query, that is, an arithmetical query on fragments. The objective of query optimization is to find an execution approach for the query, which is close to optimum. [19].

Local Query Optimization: The last layer is executed by all the sites having fragments elaborate in query. Each sub-query executing at one site, called a local queries, then enhanced using the local schema of the site [20].

CONCLUSION

The major goal that mobile device is projected to satisfy two important objectives like efficiency and convenience. The use of movable devices with united communication competencies enables in mobile computing.

The core objective is to explore the enactment upgrading of mobile query processing, concentrating on the server and client sides. The cost of query evaluation can be measured in expressions of a number of diverse resources, including disk accesses, *CPU* time and cost of communication.

Some of the basic methods and algorithms of query processing and optimization for query performance engine can have a mass of dedicated algorithms planned to process and applying using well-organized and significant in reducing a query's execution time.

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TABLE I: Significant Analysis of Query processing

Integrated communication capabilities	Phases of Query	Measures Of Query Cost	Query Processing Algorithms	Index File Structures
1. Query model: Processing methods are categorized affording to the query model they accept. Some systems adopt a variety query model, where scores are attached directly to base tuples.	**1. Parsing and Translation:** The first phase in handling a query acquiesced to a DBMS i to transform the query into a form functioning by the query processing engine. High-level query languages such as SQL denote a query as a string, or order, of characters.	The rate of query estimate can be measured in terms of a number of dissimilar resources, comprising disk accesses, *CPU* time to execute a query, and, in a scattered or parallel database system, the cost of communication.	**Selection Algorithms:** The *Select* operation must pursuit over the data files for records gathering the selection standards. **1. Linear search:** Every single record from the file is read and matched to the selection benchmarks. **2. Binary search:** It works on fairness, achieved on a primary key attribute **3. Search by a primary index on equality:** An equivalence comparison on a non-key attribute will be the equal excluding that several records may come across the condition **4. Search by a primary index on comparison:** It is used to regain multiple records from a file organized by the search attribute. **5. Search using a secondary index on equality:** Recover one record with fairness comparison on a key attribute.	The execution time of a range of operations such as select and join can be condensed by using indexes. **1. Dense Index:** Data-file is ordered by the search key and every search key value has a separate index record.
				2.Sparse Index: Data file is well-organized by the index search Key and only some of the search key values have similar index records.
2. Data access methods: Processing techniques are classified according to the data access methods they assume to exist in the underlying data sources.	**2. Optimization:** In second phase, the query processor put on guidelines to the core data structures of the query to alter these structures into corresponding, but further competent illustrations.	The response time for a query evaluation strategy, assuming no other action is going on the computer, would excuse for all these costs, and could be used as a good degree of the cost of the strategy.		**3. Primary Index:** The data file is disciplined by the attribute that is also the search key in the index file. **4. Secondary Index:** The data file is efficient by an element is dissimilar as of the search key in the index file.
3. Implementation level: Processing methods are characterized permitting to their level of combination with database organizations.	**3. Evaluation:** The last phase in query processing is the evaluation stage. The finest valuation plan user created by the optimization engine is designated and then performed.	CPU speeds have been cultivating much more rapidly than have disk speeds. Thus, it is likely that the time spent in disk action will remain to govern the total time to execute a query.	**JOIN ALGORITHMS:** The join algorithm can be implementing in a dissimilar ways. In terms of disk accesses, the join operation can be very costly, so implement and utilize competent join algorithms is significant in minimize a query's execution time. **1. Nested-Loop Join:** It consists of inner for loop nested within an external for loop. **2. Index Nested-Loop Join:** This algorithm is	**5. Multi-Level Index:** The index structure containing of two or more tiers of records where higher tier's records point to associated index records
4. Data query uncertainty: Processing methods are categorized based on the		Finally, estimating the CPU time is relatively hard compared to approximating the disk-access cost.		**6. Clustering Index:** The two-level index structure where the records in the first stage contain the cluster field

ambiguity involved in their data and query models.		Therefore, most people consider the disk-access cost a sound degree of the cost of a query-evaluation plan.	similar as Nested-Loop Join, apart from an index file on the inner relation's join attribute is used against a data-file scan on each index lookup. **3. Sort–Merge Join:** This algorithm can be used to execute natural joins and equi-joins and requires that each relation be sort by the ordinary attributes among them. **4. Hash Join:** The hash join algorithm is used to execute natural joins and equi-joins.	value in one area while a second area position to a block in the second stage.
5. Ranking Function: Processing systems are categorized established on the limitations they execute on the fundamental ranking function.		The query optimization engine spawns a set of candidate evaluation plans. Some will, in heuristic theory, produce a faster, more efficient execution.		**7.B^{+}-tree Index:** Multi-level index with a balanced-tree structure. Finding a search key value in a B^{+}-tree is comparative to the height of the tree highest number of search required.

TABLE II: Comparative Analysis of the Query optimization Layers:

Query optimization layers	**Query decomposition**	**Data localization**	**Global query optimization**	**Local query optimization**
Working of Layer	The first layer spoils the distributed calculus query into an arithmetical query on global relations.	The key role of the second layer is to focus the query's data using data scattering information.	The objective of query optimization is to find an execution approach for the query, which is close to optimum.	The last layer is executed by all the sites having fragments elaborate in query. Each sub-query executing at one site.
Types of Sites	**Global**	**Global**	**Global**	**Local**
Types of schema	**Global**	**Global**	**Global**	**Local**
Types of System	**Distributed**	**Distributed**	**Distributed**	**Centralized**
Types of query	**Algebraic**	**Fragmented**	**Algebraic/Fragmented**	**Fragmented**
Quality of Query	**Better**	**Good**	**Good**	**Poor**

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VISUALIZATION OF HUGE DATABASE IN FORENSIC PROCESS: AN ANALYTICAL STUDY

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ABSTRACT

Visualization and forensic acting an important role for huge data area. As a conception of large database, any action on data likes analysis, retrieval, collection, searching, understanding and removal of data via network requires security. For such data presentation, visualization is used. Here the data may be of different types such as geographic, spatial, temporal, network data like email, log or audit data and human related data etc. This paper focuses on the various techniques for visualization and forensic for good presentation of more secure data

Keywords: *visualization, forensic, database*

INTRODUCTION

Forensic may be computer or cyber forensic; it is also known digital forensic. It includes identification, collection, protection, examination, and analysis of digital information that is nothing but digital evidence. Collection and examination of computer related field includes audio, video and graphical images. Digital data forensic recovers files that have been damaged or deleted accidentally or hidden [1].

The graphical presentation of information is a qualitative understanding of the information contents to different viewers. Information may be data, processes, relations, or concepts. Graphical presentation may include graphical entities like points, lines, shapes, images, text as well as attributes like color, size, position, shape. Understanding may involve detection, measurement, comparison etc and is enhanced via interactive techniques and providing the information from multiple views and with multiple techniques.

RELATED WORK

Visualization and forensic techniques are applied on various types of data shown in Table 1.

DATA	VISUALIZATION AND FORENSIC TECHNIQUES
Files	Hierarchical and non hierarchical
Log data	Explorative visualization
Digital forensic data	Data mining, encryption and visualization
Real time forensic data	Animated and time sequence scatter plots and parallel coordinated plot
Network packet level data	Network forensic system using visualization
Cyber forensic	Security and graph visualization, network scan

Table 1: Data and applied techniques

VISUALIZATION AND FORENSIC TECHNIQUES

Forensic process includes visualization, therefore such related techniques are discussed those are as follows,

3.1 Nonhierarchical and Hierarchical forensic visualization:

While searching and understanding data on hard drives visualization technique is used. It is a great task to search or manage huge amount of data by analyst. Due to visualization it is possible to present file information in graphical manner. Visualization makes the easier understanding of relationship among multiple files. Visualization also helps to reduce the time to recognize doubtful file and enhance the probability, to locate illegal facts in forensic process. There are two types of forensic visualization technique hierarchical and nonhierarchical technique.

Nonhierarchical visualization does not show the relationship between iles and directories. It only shows the file within directory and subdirectories.

In nonhierarchical visualization light and darken square of block are used to show large and small files respectively.

Hierarchical visualization shows relationship between files in directory structure. It shows tree structure of files to display in one screen. Files are visualized by colored box and its size is denoted by two parameters, user selected display region and percentage of selected directory occupy by file. Tree maps are further modifying into filter tree maps. Instead of focusing on size attributes these maps focuses on time. Filter tree maps are more flexible to the forensic examiner by providing better use of screen real estate. Filter tree maps makes the relationship between file easier. So it has been found that forensic visualization techniques search more and equal number of files [2].

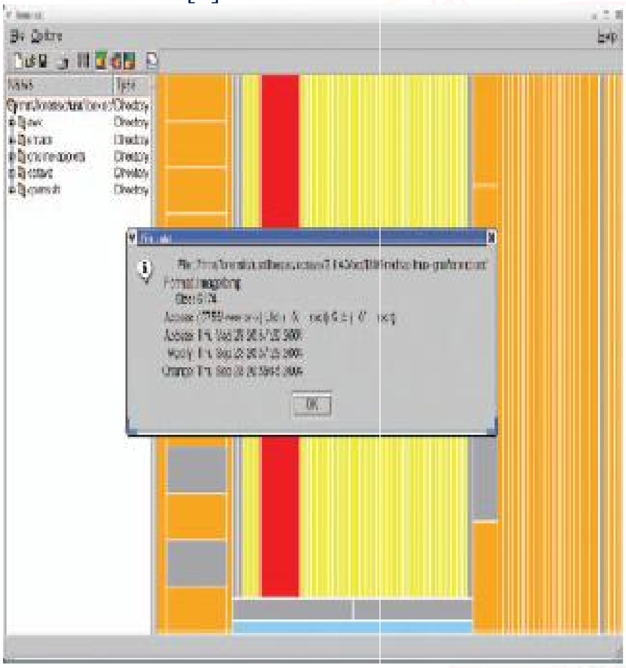

Fig.1: Shows the filtered tree map diagram with large red rectangle surrounded by smaller yellow rectangles. The red rectangle shows an image file accessed more recently than the surrounding yellow files.

Here Sheldon Teerlink et al discuss a visualization technique to display file related details such as file size, last access date, file creation and modification date, file type, owner and number of nodes for fragmentation [4]. Visual analysis of typical computer forensic data is done with the help of filtered tree map technique. This technique is better as compared to typical tree map.

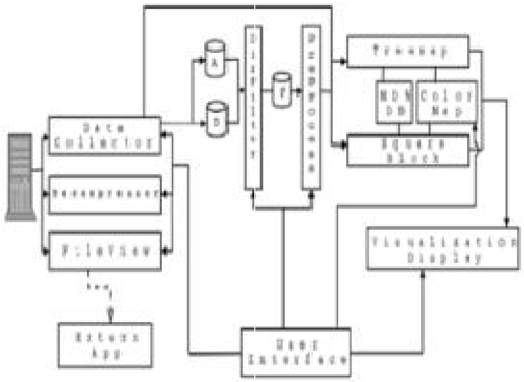

Fig 2: High-level view of the forensic software architecture.

3.2 Forensic Analysis and Explorative Visualization of Log Data:

In case of intrusion detection system, signature extends and manual log analysis is necessary. It acts as protection against security attacks and occurrences. As there are large amount of data, therefore log analysis is dull and time consuming job in the context of intrusion detection system and forensic investigation. Here Sebastian Schmerl et al [3] proposed a review data representation approach for log data visualization in a three dimension space as shown in fig. 3 and also simplifies the security analysis process. Virtual information space procedure and their advantage for audit data analysis are given. This approach is developed with the help of ADO (Audit Data Ocular) tool.

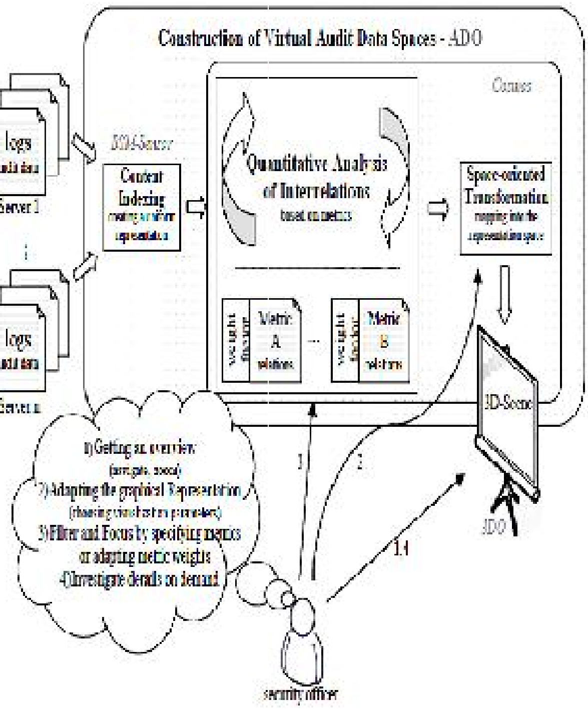

Fig 3: Construction of virtual audit data space

3.3 Digital forensic data visualization:
For the establishment and simulation of undergraduate research in computer security, author [5] proposed educational approach to apply lots of knowledge in computer science. This approach helps to increase student skill, form learning communities of scholar within discipline etc. Data mining and data encryption are the two techniques.

3.4 Visualization of real time and forensic data:
Here Sven Krasser et al. provides system for real time novel network traffic visualization [6]. Also allows efficient browse and analysis of real time and forensic packets. To allow insight into both legal and spiteful network activity, 2D and 3D coordinated display are examined. Here animated and time sequence scatter plots and parallel coordinated plot are used in 2D and 3D. When data packets transfer through network 2D and 3D visualization is used for forensics data analysis. This system also reduces packet transmission time.

3.5 Visualization of network forensic analysis:
Seung-hoon et al. proposed more efficient network forensic system using visualization [7]. This new network forensic analysis provides the panoramic view and centralized analysis of packet level data. Spiteful network traffic is also found by analyzing flow of data. While collecting data in network forensic, location is also an important aspect for visualization. Visualization is used for the analysis of Internet usage and port scanning. It also used to detect ping of death and fraggle DOS attacks in network traffic. TCP and UDP ports are classified as source and destination port those are considered by network packets. Network traffic is also an important aspect for a specific network link. Colors of TCP and UDP can change according to the amount of network traffic. When the network traffic increases, it changes TCP color from green to yellow and yellow to red. For UDP blue becomes green and violet. As compare to Ethereal and Sniffer this network forensic system helps to easily identify network patterns and events. But for weighty network traffic it reduces frame per seconds.

3.6 Interactive 3D forensic visualization:
Eddie Soon Eu Hui et al proposed a virtual interactive prototype [8]. It is used as research guide to progress predefine forensic. Proposed virtual lab is also considered as database library of presented forensic cases those are converted to digital form. Main objective of proposed system is to generate real time virtual simulation environment. Prototype applications are useful for forensic agents as training ground.

3.7 Network scans visualization system:
Chris Muelder et al proposed a network scanning system which facilitates characterization using visualization. Various types of scanning method given such as data filtering scan data and fingerprints and feedback loop. While performing data scan on network, destination port and address along with packet time are necessary. Feedback looping allows user to remember insight from low level semantic view data to support interpretation of high level semantic data. Feedback allows large cognitive insight [9].

3.8 Windows Registry tool in digital forensic:
An application and operating system file that includes allocated and unallocated blocks could examine using prototype visualization tool. It is nothing but graphical representation of windows registry. As structure is complex therefore windows registry is used than index explorer index.dat file and SQLite database. This tool also recovers deleted data [10].

3.9 LMML Browser for LMML files:
This permits faster, smoother input of forensic data, for better automation and visualization, so that they can be used by medical examiners, investigators, as well as judicial courts [11]. Firstly data is inputted relevant to the current part, and then precise the details of the injuries in the injury form. Finally they can check as they type how the forensic report will be rendered by the LMML. LMML Browser gives two kinds of output: the forensic report and some visualization of the input forensic data to explore the injuries.

ANALYSIS

Forensic techniques have some complexities those are given below. It is also discussed that visualization is used to reduce this complexities.

4.1 Complexities: Forensic techniques take the lot of effects for the evidence of computer and network data due to following cause:

1. The analysis of log data in the context of forensic investigations and IDS signature development is a tedious and time-consuming task, due to the large amount of textual data.
2. A great deal of time is wasted by analysts trying to interpret massive amounts of data

that isn't correlated or meaningful without high levels of patience and tolerance for error.
3. When searching large hard drives, tedious efforts of forensic examiners are needed.
4. To recognize doubtful file more time increases.
5. Digital investigations are becoming more time consuming and complex as the volumes of data requiring analysis continue to grow.
6. Log files are often large in size and multi-dimensional, which makes the digital investigation and search for supporting evidence more complex.
7. Manual analysis of network traffic is inefficient and extremely time consuming. Network traffic analysis includes rapidly detecting and classifying malicious activity contained within network traffic.

4.2 Utilization: To reduce the complexities of forensic techniques for computer and network data different visualization techniques are used. Visualization techniques in digital forensic provide the following features:

1. To allow relevant evidence to be found in the timely manner, evidence visualization and browsing needs to be intuitive for the examiner. Visualizing the evidence allows the investigators to find coherent evidence faster and more intuitively.
2. To aid forensic specialists to direct their search to suspicious files; in effect aiding the interpretation process. Visualization improves the computer forensic analysis process.
3. As there are large amount of text data, therefore log analysis is dull and time consuming job in the context of intrusion detection system and forensic investigation. Therefore audit data and existing relations between audit events are visualized in a three dimensional space.
4. Visualization techniques are more important for forensic examiners to represent file statistics such as file size, last access date, creation date, last modification date, owner, number of i-nodes for fragmentation, and file type.
5. Visualization has the potential to greatly increase the efficiency and the effectiveness of forensic data analysis.
6. Information visualization techniques are applied for manual and automated analysis of network traffic, to appropriately and effectively bring the human into the analytic loop.
7. Visualization techniques are also used for the analysis of port scanning network traffic and to detect various attack patterns.
8. Network forensic system using visualization allows users to easily identify information of network patterns and events compared to Ethereal, Sniffer, and other similar packet analysis programs.

CONCLUSION

This paper discussed various visualization techniques used for forensic data. Number of visualization techniques implemented on simple data. But the visualization for forensic data takes lots of efforts. Forensic visualization is generally applicable in case of networking when the data transfer from one place to other. Paper also focuses on important features of visualization techniques in digital forensic. Secure data transmission and their effective visualization is the main goal of proposed techniques

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A THEORETICAL VIEW OF CLOUD COMPUTING AND ITS SECURITY ISSUES

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ABSTRACT

Cloud computing is one of today's most exciting technology because of its cost-reducing, flexibility, and scalability. With the fast growing of cloud computing technology, Data security becomes most important in cloud computing technology. Now days many software companies are offering cloud services to various customers. There is lot of benefits for both cloud service providers and customers such as reduced capital cost, Improve Accessibility, Globalizing the workforce etc., at the same time most of the customers are willing to use cloud services. This creates a serious problem towards customers for the security for important business data as the data is stored in the cloud owns by unknown provider. This may lead to losing privacy of the customer's business details.

Keywords: *Cloud computing, Security, Cloud security Issues, Cloud security threats*

INTRODUCTION

Cloud services are popular because they can reduce the cost and complexity of owning and operating computers and networks. Since cloud users do not have to invest in information technology infrastructure, purchase hardware, or buy software Licenses, the benefits are low up-front costs, rapid return on investment, rapid deployment, customization, flexible use, and solutions that can make use of new innovations. Cloud Computing is a technology which depends on sharing of computing resources than having local servers or personal devices to handle the applications. In Cloud Computing, the word “Cloud” means “The Internet”, so Cloud Computing means a type of computing in which services is delivered through the Internet (Fig1).The goal of Cloud Computing is to make use of increasing computing power to execute millions of instructions per second. Cloud Computing uses networks of a large group of servers with specialized connections to distribute data processing among the servers.

Cloud Computing consists of a front end and back end. The front end includes the user's computer and software required to access the cloud network. Back end consists of various computers, servers and database systems that create the cloud. The user can access applications in the cloud network from anywhere by connecting to the cloud using the Internet (Fig1). Some of the real time applications which use Cloud Computing are Gmail, Google Calendar, Google Docs and Dropbox etc.

Fig1. Cloud Computing

A major concern in Cloud adoption is security and the US Government has announced a Cloud Computing Security Group in acknowledgement of the expected problems such networking will entail. However, basic network security is flawed at best. Even with modern protocols, hackers and worms can attack a system and create havoc within a few hours. Within a Cloud, the prospects for incursion are many and the rewards are rich. Architectures and applications must be protected and security must be appropriate, emergent and adaptive. Should security be centralized or decentralized? Should one body manage security services? What security is necessary and sufficient? How do we deal with emergent issues?

SECURITY ISSUES

The security issues in cloud computing environment are greatest challenge. Understanding the risks of the security and privacy in the cloud computing environment and developing efficient and effective solutions for it is really a very difficult task. Confidentiality, integrity, reliability and availability are widely used terminology for security issues in cloud computing environment means that the user's data in the cloud should remain confidential and protected from unauthorized access. So the implementation of the cloud computing architecture must be ensured about the security of its resource nodes. Some of the security issues occur in cloud computing are listed below.

1. Cloud Security.

This includes organizational and technical issues related to keeping cloud services at an acceptable level of security by ensuring the computing resources available and usable by its authentic users. Security threats to cloud infrastructure would affect multiple users even if only one site is attacked. These risks can be overcome by using encrypted file systems, security applications, data loss software and buying security hardware.

2. Privacy in Cloud.

Privacy is the process of making sure that the user's data remains private, confidential and restricted from unauthorized users. Due to data virtualization the users data may be stored in various virtual data centers rather than in the local computers. So the unauthorized users may access the private information of the authorized users. Data authentication is one of the most popular options of security before putting the sensitive data into cloud.

3. Data integrity and Reliability.

In cloud computing, anyone from any location can access the data. Cloud does not differentiate between common data and sensitive data. So an important aspect of cloud services is availability of user's data with reliability. It is necessary for the cloud service provider to ensure the integrity by making their system capable to check over the cloud data from any unauthorized access.

4. Performance and Bandwidth cost.

The major issues that can affect performance in cloud based environment are due to the unethical transaction-oriented and data access applications. So the users who are at a long distance from cloud providers may experience high latency and delay, this is due to the availability bandwidth in the network. Bandwidth cost may be low for smaller Internet-based applications, which are not data intensive, but could significantly, grow for data-intensive applications. The service providers instead of saving money on hardware, they should spend more for the bandwidth. This can deliver intensive and complex application over the network.

5. Governance

Governance implies management and oversight by the organization over procedures, standards and policies for application development and data technology service acquirement, also because the style, implementation, testing, use, and watching of deployed or engaged services.

6. Compliance

Compliance refers to an association's responsibility to work in agreement with established laws, specifications and standards. One with all the foremost common compliance problems facing a company is information location means storage of data or information.

Fig2. Securing the cloud

Top five Security Concerns

1. **Data Access from mobile.**
2. **Access Control and Identity management.**
3. **Ongoing COMPLIANCE concerns.**
4. **Co-mingling of CUSTOMER DATA.**
5. **Security STANDARDS and DERTIFICATIONS.**

SECURITY THREATS

A threat is define as an external force by which the nodes existing in one state transfers into other. A node in the cloud environment stores the data and information and gives the user a platform to use the application in the form of services. There are significant numbers of attacks or intrusions occurs in the cloud based applications. Some attacks are given below.

1. SQL Injection Attack.

An SQL injection is a computer attack mostly affects to SAAS model, in which malicious code is embedded with a poorly-designed application, executes unauthorized SQL commands by taking advantage of insecure interface connected through Internet.SQL injection attacks are used to access information from databases, which is protected from public access.SQL injection attacks are avoided by ensuring systems having strong input validation.

2. Abuse and Nefarious Use of Cloud Computing

In this threat the hackers take the advantages of shortcomings in the authentic registration process associated with cloud. After the successful registration, the cloud service providers offer SAAS, IAAS and PAAS services to the users. But hackers may be able to conduct susceptible activities like Spamming and Phishing. This threat exists in all the three layers of the service models.

3. Net Sniffers

Net sniffer is a type SAAS service model threat in which the attackers use to gain access through applications, which can capture packets flowing in a network and if the data that is being transferred through these packets is not encrypted. Then data can be publicly available and read by any one.

4. Session Hijacking

Session hijacking is a security attack on a user session over a protected network. When a user logs into a website, a session is created on that Web Server for that user, this session contains all this user's information being used by the server so the username and password is not required at every page request. So hackers having adequate knowledge can exploits a valid computer session and gains access to a user's session identifiers through HTTP. The Web server uses a unique identifier (Session Identifier) to authenticate the users for the session. The hackers by using Session Hijacking attack unethically gets the user's session identifier and then gain the illegal access to the user data. The most common Session hijacking attacks are Session Prediction, Session Side jacking, Session Fixation, Cross Site Scripting and available in SAAS and PAAS.

5. Man in the Middle Attack

Another type of session hijacking is known as a man-in-the-middle attack. Where the attacker uses a sniffer to observe the communication between devices and collect the data that is transmitted. In this the attackers make independent connections with the victim's computer and making them believe that they are connected directly to each other over a private connection. But in fact the entire session is controlled by the attackers. This is a threat to SAAS.

6. Denial of Services

A Denial of Services is a attack in the SAAS layer, that attempts to make the network resource and services actually assigned to the authorized users virtually unavailable. As it acts as an interrupt or suspend of services for authorized users temporarily or indefinitely.

7. Flooding Attacks

Flooding is a Denial of Service attack that is designed to increase network conjunctions by flooding it with huge amount of traffic. Flooding attacks occur when a network or service becomes so weighed with packets contains data. It attacks a server or host with connections that cannot be completed and finally fills the host memory buffer with unused and redundant data. Once the buffer is full no further connections can be made. So the result is a Denial of Service. It is available in PAAS and IAAS layer of cloud service model.

8. Privacy Breach

Since data from various users and business organizations available together in a cloud environment, so breaching in cloud environment will attack the data of the authorized users. Hence the unauthorized users can access the private data of the cloud users and do some susceptible activities with the data. This will affect mostly the SAAS users.

CONCLUSION

Cloud computing is a newly emerging thing and many organizations are moving toward the cloud but lacking due to security reason. In this paper we discussed security issues and security threats. Security is the most important and biggest issue in cloud computing, so these issues have to be resolved as soon as possible to make maximum benefit of cloud usages.

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A COMPARATIVE ANALYSIS OF WEB CONTENT MINING TECHNIQUES

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ABSTRACT

Web content mining is the part of data mining techniques and is used to extract useful information by using various mining techniques. Content data is the collection of data from which a web page is designed. It may consist of text, images, audio, video, or structured records such as lists and tables. Nowadays, web log mining is a very popular and computationally expensive task. Data collection, Data preprocessing, Pattern discovery and Pattern analysis are the major task of web content mining. So that, the paper represents comparative study report on various algorithms used for web mining. In web mining, content discovery is plays an important role for finding user perspective information in web page over web content mining.

Keywords: *Decision Tree; K-Nearest Neighbor; Naïve Bayes; Support Vector Machine; Neural Network; Cluster Hierarchy construction algorithms*

INTRODUCTION

Web mining is the process of extraction of large amount of hidden information which are present in the database. There are various techniques to mine data from database that are clustering, classification and association rule. There are various fields in which data mining is used like e-commerce, health and science; web mining is also the application of data mining. Web mining is use to identify the hidden information or data from World Wide Web. In other words finding out the useful patterns from the unstructured data is known as web mining. It is also used to understand the behavior of customer [1].

1.1 Web content mining

Web content mining targets the knowledge discovery in which the main objects are the traditional collection multimedia documents. It could be differentiated from two points of view: Agent-based approach and database approach. Web content mining is the process of gathering useful information from Web content [7]. Web content consists of several types of unstructured data like text, images, audio or video data, records such as lists or tables and structured hyperlinks. It mainly focuses on the structure of inner documents.

1.2 Web structure mining

The goal of web structure mining is to generate structural summary about the website and web page. Web structure mining is one of three categories of web mining for data, is a tool used to identify the relationship between Web pages that are connected by information or direct link connections. Web structure mining is the collection of methods which are used for mining or analyzing the structure of a website or hierarchy or the links of a website. In web structure mining the structure of a web is mined on the basis of hyperlinks and interlinks.

1.3 Web usage mining

The web usage mining is used to find out the hidden patterns of web data. Web usage mining technique is also use to discover the patterns of web data .The web usage mining related to the application of data mining tools and technique. The web usage mining is used to discover usage patterns from web data in order to understand the user's need for navigating on the web. Web usage mining is used to discover the navigation patterns from web data, predicts the behavior of user while the user interacts with the web and also it helps to improve large collection of resources [4].

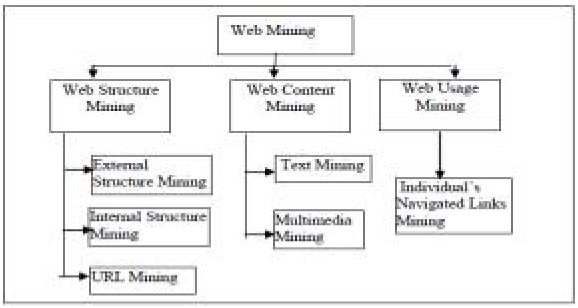

Figure2: Web Content Taxonomy

BACKGROUND

Internet has become the most significant medium for sharing and gathering of the information. As we know that the use of internet is increasing day by day. In recent years the size of the database has increased rapidly. There are so many private and public organization which produces large amount of data day by day for example customer care, financial forecast, marketing policies, even medical diagnosis and many other applications. It was very difficult to extract the important information from web. So Web content mining used to extract the pattern from web servers on the basis of content patterns of web data. Web content mining is the mining, extraction and integration of useful data, information and knowledge from web page content [8].

TECHNIQUES

3.1 Decision tree learning (DT) :

Decision tree learning uses a decision tree to go from observations about an item to conclusions about the item's target value. It is one of the predictive modeling approaches used in statistics, data mining and machine learning. Tree models where the target variable can take a discrete set of values are called classification trees; in these tree structures, leaves represent class labels and branches represent conjunctions of features that lead to those class labels. Decision trees where the target variable can take continuous values are called regression trees.

3.2 *k*-nearest neighbors (*k*-NN):

In pattern recognition, the k-nearest neighbors algorithm (K-NN) is a non- parametric method used for classification and regression[1]. In both cases, the input consists of the k closest training examples in the feature space. The output depends on whether k-NN is used for classification or regression.

In k-NN classification, the output is a class membership. An object is classified by a majority vote of its neighbors, with the object being assigned to the class most common among its k nearest neighbors (k is a positive integer, typically small). If k = 1, then the object is simply assigned to the class of that single nearest neighbor

3.3 Naïve Bayes Classifier (NBC):

In Machine Learning, Naïve Bayes Classifier are a family of simple probabilistic classifiers based on applying bayes' theorem with strong independent assumptions between the features.

Naive Bayes has been studied for text categorization, the problem of judging documents as belonging to one category or the other with word frequencies as the features. With appropriate pre-processing, it is competitive in this domain with more advanced methods including support vector machines.[2] It also finds application in automatic medical diagnosis.[3]

3.4 Support Vector Machines (SVM):

In machine learning, support vector machines are supervised learning models with associated learning algorithms that analyze data used for classification and regression analysis. Given a set of training examples, each marked as belonging to one or the other of two categories, an SVM training algorithm builds a model that assigns new examples to one category or the other, making it a non-probabilistic binary linear classifier . An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible. New examples are then mapped into that same space and predicted to belong to a category based on which side of the gap they fall.

In addition to performing linear classification, SVMs can efficiently perform a non-linear classification using what is called the kernel trick, implicitly mapping their inputs into high-dimensional feature spaces.

When data are not labeled, supervised learning is not possible, and an unsupervised learning approach is required, which attempts to find natural clustering of the data to groups, and then map new data to these formed groups. The clustering algorithm which provides an improvement to the support vector machines is called support vector clustering[2] and is used in industrial applications either when data are not labeled or when only some data are labeled as a preprocessing for a classification pass.

3.5 Artificial neural networks (ANNs)

Artificial neural networks (ANNs) or connectionist systems are computing systems inspired by the biological neural networks that constitute animal brains. Such systems learn tasks by considering examples, generally without task-specific programming.

An ANN is based on a collection of connected units or nodes called artificial neurons. Each connection between artificial neurons can transmit a signal from one to another. The artificial neuron that receives the signal can process it and then signal artificial neurons connected to it.

3.6 Cluster Hierarchical Construction Algorithm (CHCA):

In data mining and statistics, hierarchical clustering is a method of cluster analysis which seeks to build a hierarchy of clusters. Strategies for hierarchical clustering generally fall into two types:[1]

- Agglomerative: This is a "bottom up" approach: each observation starts in its own cluster, and pairs of clusters are merged as one moves up the hierarchy.
- Divisive: This is a "top down" approach: all observations start in one cluster, and splits are performed recursively as one moves down the hierarchy.

In general, the merges and splits are determined in a greedy manner. The results of hierarchical clustering are usually presented in a dendrogram.

In order to decide which clusters should be combined (for agglomerative), or where a cluster should be split (for divisive), a measure of dissimilarity between sets of observations is required. In most methods of hierarchical clustering, this is achieved by use of an appropriate metric (a measure of distance between pairs of observations), and a linkage criterion which specifies the dissimilarity of sets as a function of the pair wise distances of observations in the sets.

ARCHITECTURE OF WEB CONTENT MINING

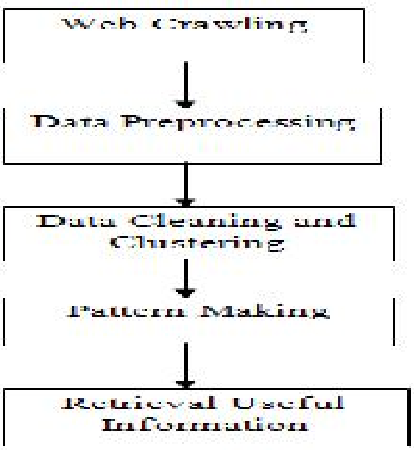

Figure 1: Diagrammatic Representation for Web Content Discovery

i) Web Crawling: A Web crawler is an Internet bot which helps in Web indexing. They crawl one page at a time through a website until all pages have been indexed. Web crawlers help in collecting information about a website and the links related to them, and also help in validating the HTML code and hyperlinks. A Web crawler is also known as a Web spider, automatic indexer or simply crawler.

ii) Data Preprocessing: The selection of useful data is an important task in the data pre-processing stage. The data's were selected in each data type to generate the cluster models for finding web user access and server usage patterns. The removal of irrelevant and noisy data is an initial step in this task. The most recently accessed data were indexed with higher value of 'time index' while the least recently accessed data were placed at the bottom with lowest value [21]. This becomes the critical step to obtain more precise analysis result due to time dependence characteristics of Web usage data.

iii) Data Cleaning and Clustering: The method of removing noise from the content . The method of clustering is broadly used in different projects by researchers for finding the usage patterns or user profiles [28]. The clustering algorithms become the most mining method in websites and the cluster objects include user groups (to describe user actions) and web pages.

iv) Pattern Discovery and Analysis: Using this pattern discovery and pattern analysis, relevant and useful information can be easily predicted based on data analysis and Graph.

In this phase the activities of the users on the web are discovered. The frequent patterns discovery phase needs the web pages which are visited by the user. In the pattern discovery, sequences of the pages are irrelevant. Also the identical pages are ignored, and the pages are arranged in a predefined order. Frequent item set mining, clustering, statistical analysis, classification and sequential analysis are the techniques which involved in pattern discovery phase.

i. Frequent Item set Mining
ii. Clustering
iii. Classification

Table 1: Comparison Between various Web Content Mining Algorithms

Parameters	Decision Tree	K-Nearest Neighbor	Naïve Bayes
Time Complexity	O(h)	O(nd+kn)	O(NP)
Storage	Sparse Matrix	K-d Tree	Array
Technique	**1.** Boosted Tree **2.** Bootstrap Aggregate **3.** Rotation Forest	**1.** The 1-nn Classifier **2.** The Weighted -nn Classifier	**1.** Gaussian Naïve Bayes **2.** Multinomial Naïve Bayes **3.** Bernoulli Naïve Bayes **4.** Semi-supervised Parameter mation
Efficiency	**1.** Good in many Domains. **2.** Efficient for small Data Sets.	High Robust	**1.** Good in many Domains. **2.** Efficient for Large Data Sets
Speed	Fast	Slow	Very Fast

Parameters	Support Vector Machine	Neural Network	Hierarchical Clustering
Time Complexity	O(N^3)	O(N^2)	O(N^2)
Storage	Vector	Matrix	Linkage Metrics
Technique	**1.** Primal **2.** Duel **3.** Kernel Trick **4.** Modern Methods	**1.** BackPropagation **2.** Supervised Learning **3.** Unsupervised Learning **4.** Reinforcement Learning	**1.** Agglomerative Clustering **2.** Divisive Clustering
Efficiency	**1.** Significantly High **2.** Better Accuracy	Highly optimize	Less optimize
Speed	Fast with Active Learning	Very Fast	Slow

CONCLUSION

The performance of different classification methods still depends extraordinarily on the general characteristics of the data to be classified [11]. The definite relationship between the information to be arranged and the execution of different characterization techniques still stays to be found. To determine the best classification method for a certain dataset we need to use trial and error in different field to find the best performance [13].The machine learning helps in doing research in a better way. On the basis of above parameters, we get the result that Support Vector Machine (SVM) is a faster algorithm as compared to others and gives better accuracy than other algorithms

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MICROCONTROLLER BASED SMART TRAFFIC CONTROL SYSTEM USING IR WIRELESS SENSOR

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ABSTRACT

Nowadays, controlling the traffic becomes major issue because of rapid increase in automobiles and also because of large time delays between traffic lights.
The present traffic light controlling system could not sufficient to tackle the traffic congestion due to the lack of efficiency in the designing. The Traffic Light Controllers are generally based on microcontrollers and microprocessors but it uses predefined hardware. The rapidly increasing the traffic and congestion on the highways. So consequently, year by year the rate of car accidents is increasing in the most of countries. To avoid such problems we exploit the emergence of new technique called as "Smart Traffic Controller". So wireless sensor is required as a solution of this problem. This paper deals with the information about how the sensor are used. How they are directed. Where they are located and how it is communicated to the central processing unit. The performance of Smart Traffic Controller is more efficient than conventional one and also it has more simple architecture, fast response time and scope for further expansion.

Keywords: *Microcontroller control system wireless network ,Sensor ,Traffic controller*

INTRODUCTION

In this paper, the aim of the Smart traffic signal using microcontroller by using wireless network is to provide the orderly an act of changing position of traffic. With the growth of the urbanization, industrialization and population, there has been a huge growth in the traffic. With growth in traffic, there is occurrence of bundle of problems too; these problems include traffic jams, accidents and traffic rule violation at the heavy traffic signals. In this situation traffic lights based on Smart Traffic control lights are the IR based signaling devices that are placed on the intersection points and employed to control the flow of traffic on the road. The history of the traffic light control goes back to 1868 when the first traffic lights system was installed in London and today this system could be found in all major cities of the world . Most of the traffic lights around the world follow a predetermined timing circuit. Sometime the vehicles on the red light side have to wait for green signal even though there is little or no traffic. Several attempts have been made to make traffic light's sequence dynamic so that these traffic lights operate according to the current volume of the traffic. Most of them use the sensor to calculate current volume of traffic but this approach has the limitation that these techniques based on counting of the vehicles and treats a emergency vehicles as the ordinary vehicles means no priority to ambulance, fire brigade or V.I.P vehicles. As a result, emergency vehicles stuck in traffic signal and waste their valuable time. Another limitation of this approach is that sensor based system needs the line of sight path between the sensor & vehicles which results in low performance. This paper is extremely useful in the context India where with scarcity of road network and ever increasing population exacerbated the problem of traffic management. In some cities the problem is so much so severe that the people have to wait for several hours. This given method of handling the problem of the traffic can be proved to be very beneficial for this country which is riding on the new initiative such as smart city mission, urbanization and migration settlement. we will not have to stop all vehicles on the road at the time of passing of the VVIP caravan which would have adverse implication over common citizen

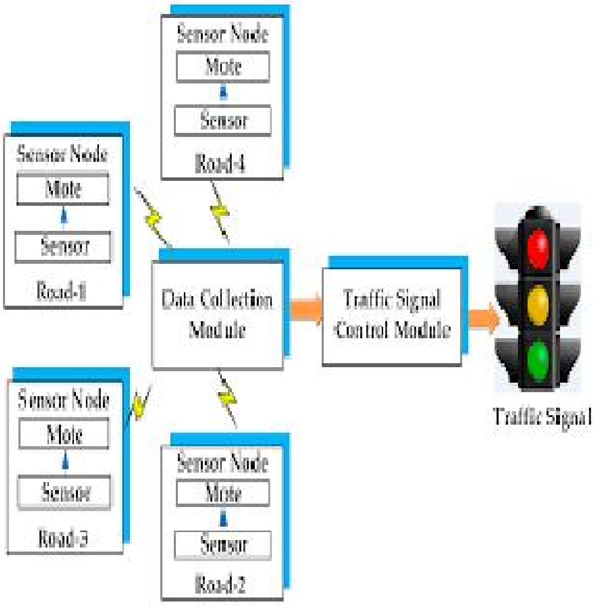
Traffic congestion

EXISTING SYSTEM

Now days, the conventional traffic system depends upon the timers where the vehicle density is not taken into account. So the people have to wait for their turn to change position irrespective of vehicle density on road. For example, suppose a junction which has four roads in four directions. There is no difficulty if the vehicle density is equally disturbed. But in case, when the vehicle density is more in one side of road as compared to all the other three sides. In this condition it permits traffic to flow with the use of timer.

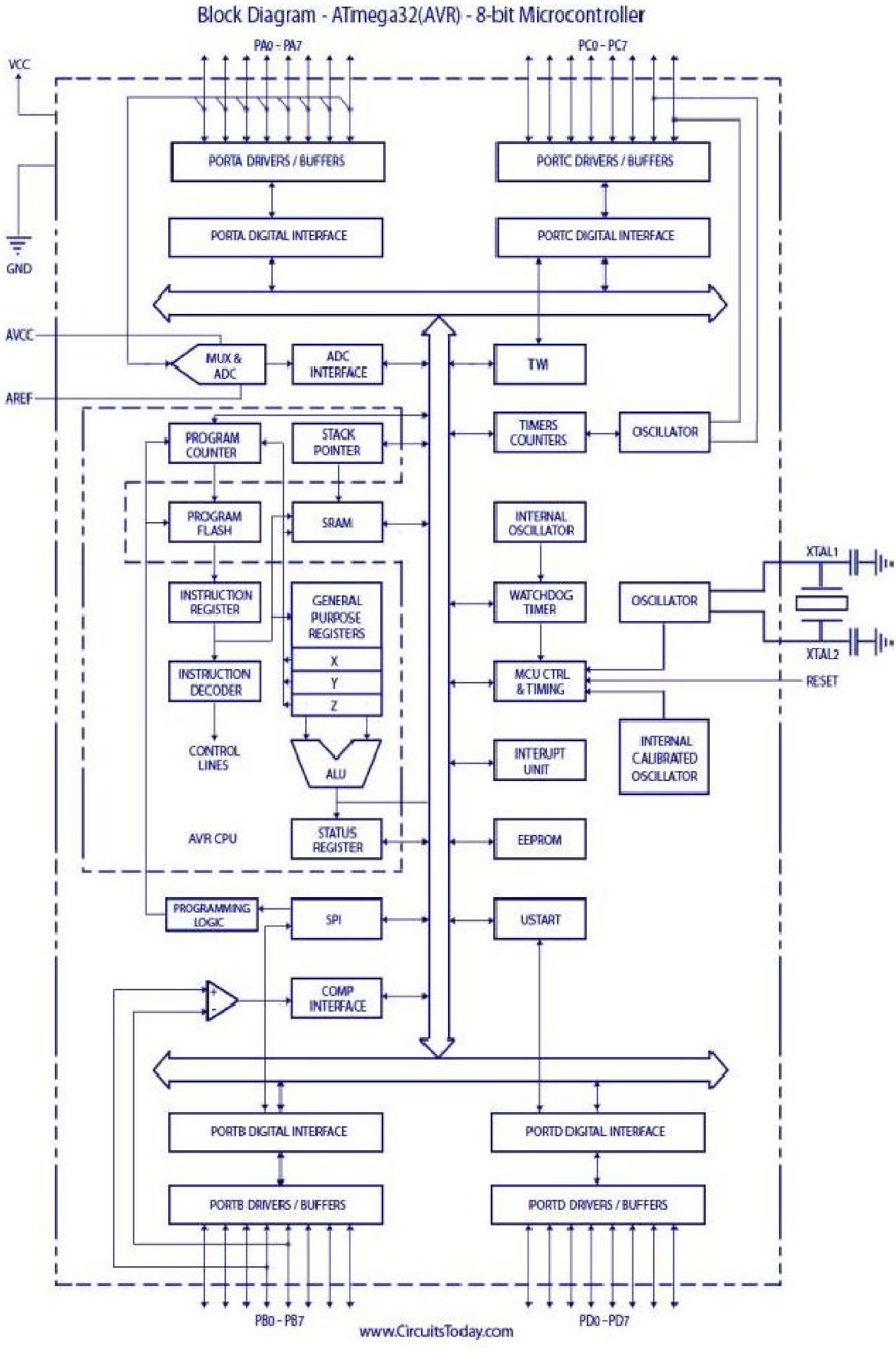
IR SENSORS

In this system we will use IR sensors to measure the traffic density. They are arranged on each side of the road and are interfaced to the microcontroller. Based on these sensors, controller detects the traffic and control the traffic system. IR sensors are connected to the microcontroller. If there is traffic on road then that particular sensor output becomes logic zero otherwise logic one. Based on logic 0 and logic 1 output, the microcontroller changes the glow time of the green LED of the corresponding junction to a higher value. Thus as a number of vehicle increases, the green light glows for more time. An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. It is also capable of measuring heat of an object and detecting motion. Infrared waves are not visible to the human eye. In the electromagnetic spectrum, infrared radiation is the region having wavelengths longer than visible light wavelengths, but shorter than microwaves. The infrared region is approximately demarcated from 0.75 to 1000µm. The wavelength region from 0.75 to 3µm is termed as near infrared, the region from 3 to 6µm is termed mid-infrared, and the region higher than 6µm is termed as far infrared.



MICROCONTROLLER

Micro-controller unit is constructed with ATMEGA32 Microcontroller chip. The high-performance, low-power Atmel 8-bit AVR RISC-based microcontroller combines 32KB of programmable flash memory, 2KB SRAM, 1KB EEPROM, an 8-channel 10-bit A/D converter, and a JTAG interface for on-chip debugging. The device supports throughput of 16 MIPS at 16 MHz and operates between 4.5-5.5 volts. By executing instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power


Block Diagram - ATmega32(AVR) - 8-bit Microcontroller
PA0 - PA7
PC0 - PC7
VCC
GND
AVCC
AREF
PORTA DRIVERS / BUFFERS
PORTC DRIVERS / BUFFERS
PORTA DIGITAL INTERFACE
PORTC DIGITAL INTERFACE
MUX & ADC
ADC INTERFACE
TWI
PROGRAM COUNTER
STACK POINTER
TIMERS COUNTERS
OSCILLATOR
PROGRAM FLASH
SRAM
INTERNAL OSCILLATOR
XTAL1
INSTRUCTION REGISTER
GENERAL PURPOSE REGISTERS
WATCHDOG TIMER
OSCILLATOR
X
Y
Z
XTAL2
INSTRUCTION DECODER
MCU CTRL & TIMING
RESET
CONTROL LINES
ALU
INTERUPT UNIT
INTERNAL CALIBRATED OSCILLATOR
AVR CPU
STATUS REGISTER
EEPROM
PROGRAMMING LOGIC
SPI
USTART
COMP INTERFACE
PORTB DIGITAL INTERFACE
PORTD DIGITAL INTERFACE
PORTB DRIVERS / BUFFERS
PORTD DRIVERS / BUFFERS
PB0 - PB7
PD0 - PD7
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ADVANTAGES

- A modernised way of controlling traffic.
- Number of road accidents can be reduced to a large extent.
- Easy traffic regulation in busy cities such as Metro cities, mega cities etc.
- Easy for interfacing .
- Readily available in market

FUTURE SCOPE

- The reliable intelligent driver assistance systems and safety warning systems is still a long way to go.
- As technology improves, Driving on roads will be just like surfing the Web: there will be traffic congestion but no injuries or fatalities.
- In future this system can be used to inform people about the condition of traffic at different places.
- Data transfer between the microcontroller and computer can also be done through telephone network, data call activated SIM.

CONCLUSION

My paper has been successfully designed and tested. Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC□s and with the help of growing technology the project has been successfully implemented. In this paper we have studied the optimization of traffic light controller in a City using IR sensors and microcontroller By using this system configuration we try to reduce the possibilities of traffic jams, caused by traffic lights. No. of passing vehicle in the fixed time slot on the road decide the density range of traffic and on the basis of vehicle count microcontroller decide the traffic light delays for next recording interval

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BRIEF DESCRIPTION OF BOOLEAN RETRIEVAL MODEL

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ABSTRACT

Information retrieval deals with the representation, storage, organization of, and access to information items. The representation and organization of the information items should provide the users with easy access to information of their interest. Information retrieval support three types of classic IR models viz. Boolean model, Vector space model and Probabilistic model in which the Boolean model is a simplest retrieval model based on set theory and Boolean algebra. In the Boolean model, documents and queries are represented to set of index terms. The Boolean retrieval model is a model for information retrieval in which we can pose any query which is in the form of a Boolean expression. The model views each document as just a set of words. The intersection operation is the crucial one means we need to efficiently intersect postings lists so as to be able to quickly find documents that contain both terms. This operation is sometimes referred to as merging posting lists means this slightly counterintuitive name reflects using the term merge algorithm for a general family of algorithms that combine multiple sorted lists by interleaved advancing of pointers through each; here we are merging the lists with a logical AND operation.

Keywords: *Information retrieval, Term Document Incidence Matrix, Dictionary, Postings, docID*

INTRODUCTION

Information retrieval deals with the representation, storage, organization of, and access to information items such as documents, Web pages, online catalogs, structured, unstructured and semi-structured records, multimedia objects. The representation and organization of the information items should be such as to provide the users with easy access to information of their interest.Information retrieval (IR) is finding documents of an unstructured nature usually text documents from a corpus, of such text documents which satisfy an information need. A large repository of documents stored on to the computer which is the corpus. User has an information need. Some of the documents in the corpus are relevant because they satisfy that information need. An information retrieval system is going to retrieve those specific document that are relevant to that person. Here we are assuming that these documents are semi structured. [1,2]

An information retrieval process begins when a user enters a query into the system. Queries are formal statements of information needs, for example search strings in web search engines. In information retrieval a query does not uniquely identify a single object in the collection. Instead, several objects may match the query, perhaps with different degrees of relevancy. IR refers to the method of extracting the information resources in a pre-defined automated manner, from an available lot of information resources. The search operations can be formulated on the basis of the metadata/full text or other indexing techniques. The main aim of IRS is to obtain relevant information by comparing the query with the associated and available documents [3].

CLASSIC INFORMATION RETRIEVAL MODELS

In information retrieval process basic three models are used. These are Boolean model, vector space model and probabilistic model. In the Boolean model, documents and queries are represented to set of index terms. Thus we say that the model is set theoretic. In vector space model, documents and queries are represented as vector in a t-dimensional space. Thus we say that the model is algebraic. In the probabilistic model, the framework for modeling document and query representation is based on probability theory. Thus as the name indicates, we say that the model is probabilistic.

2.1 The Boolean retrieval model

The Boolean retrieval model is a simplest retrieval model based on set theory and Boolean algebra. The Boolean model considers that index terms are present or absent in a document. At a result, the index term weights are assumed to be all binary, i.e. {0,1}. A query *q* is composed of index terms linked by three connectives NOT, AND and OR. Thus a query is essentially a conventional Boolean expression which can be represented as a disjunction of conjunctive vectors.

This retrieval model is not used by modern search engine like a google. We have to look at the scenario in two ways: first query is a Boolean query, i.e. query is constructed using terms which are connected to one another using AND, NOT and OR operator. Second is each document is thought of as a set of terms.

2.2 Term Document Incidence Matrix

A large repository of document stored on the computer which is the corpus. On the basis of user query (it must be in Boolean form) find out the relevant document in the corpus. For example, the literature of E. Balguruswamy which contains the term *constructor* and *inheritance and not pointers.* By using the Boolean model we solve this query. First up on we create *Term Document Incidence Matrix (TDIM).* Find out the terms in TDIM and represent it in the binary form and perform simple bitwise operations on it and we get the accurate result. In term-document incidence matrix contains 1 if the corresponding word appears in the document otherwise 0. Record the presence and absence of terms in this document is called term document incidence matrix.

2.3 An example of Boolean retrieval model using Bitwise operation

Let us consider the following documents in a collection:

Doc1: industry grow brought prosper ever country good amount take place city

Doc2: city pollution grow industry plant start product middle city

Doc3: city many beauty park variety plant flower

Doc4: grow flower depend season amount water fertilize apply soil

Doc5: job industry not depend season year

For each document that we parse, we want to record what terms appear in the document. The result is a binary term-document incidence matrix, as in Figure 1. Terms are the indexed units they are usually words and for the moment you can think of them as words, but the information retrieval literature normally speaks of terms because some of them are not usually thought of as words. Now, depending on whether we look at the matrix rows or columns, we have a vector for each term, which shows whether the term occurs in document or not.

	Doc 1	Doc2	Doc3	Doc4	Doc5
industry	1	1	0	0	1
Grow	1	1	0	1	0
brought	1	0	0	0	0
prosper	1	0	0	0	0
Ever	1	0	0	0	0
country	1	0	0	0	0
good	1	0	0	0	0
amount	1	0	0	0	0
take	1	0	0	0	0
Place	1	0	0	0	0
city	1	1	1	0	0
pollution	0	1	0	0	0
Plant	0	1	1	0	0
Start	0	1	0	0	0
product	0	1	0	0	0
middle	0	1	0	0	0
many	0	0	1	0	0
beauty	0	0	1	0	0
Park	0	0	1	0	0
Variety	0	0	1	0	0
flower	0	0	1	1	0
depend	0	0	0	1	1
season	0	0	0	1	1
water	0	0	0	1	0
Fertilize	0	0	0	1	0
Apply	0	0	0	1	0
Soil	0	0	0	1	0
Job	0	0	0	0	1
not	0	0	0	0	1
Year	0	0	0	0	1

Figure 1 A term-document incidence matrix. Matrix element (*t*, *d*) is 1 if thedocument in column *d* contains the word in row *t*, or is 0 otherwise.

In the above term-document incidence matrix we have a 0/1 vector for each term. To answer the query ***"city and plant but not season"*** we take the vectors for city, plant and complement of season. Perform the bitwise ANDing Operation as shown in the Figure2:

	Doc 1	Doc2	Doc3	Doc4	Doc5
City	1	1	1	0	0
Plant	0	1	1	0	0
NOT season	1	1	1	0	0
Result of Bitwise AND	0	1	1	0	0

Figure 2 A Binary representation of presence and absence of term city, plant and season in the five documents and ANDing bitwise operation

In the above table 01100 is the result of ANDING these three vectors. So the Doc2 and Doc3 satisfy this query. They contains the word city and plant but not contain season. No other document satisfy all the three conditions. Result for query "city AND plant AND NOT season" as shown in the following Figure3.

Doc2: **city** pollution grow industry **plant** start product middle **city**

Doc3: **city** many beauty park variety **plant** flower

Figure 3 - Results of documents where the given query satisfies.

The Boolean retrieval model is a model for information retrieval in which we can pose any query which is in the form of a Boolean expression of terms, that is, in which terms are combined with the operators AND, OR, and NOT. The model views each document as just a set of words.

So storing presence of terms in a document in a matrix requires large amount of memory. We can cut down on the space using sparse matrix. Sparse is the matrix in which most of the entries are zero. Only 1 entry is present in the sparse matrix and not 0. When minimum entries are 1 and maximum entries are 0, so this shows that this term document incidence matrix is highly sparse matrix.

2.4 An example of Boolean retrieval model using Merge Algorithm

We keep a dictionary of terms (sometimes also referred to as a vocabulary or lexicon we use dictionary for the data structure and vocabulary for the set of terms). Then for each term, we have a list that records which documents the term occurs in. Each item in the list – which records that a term appeared in a document (and, later, often, the positions in the document) – is conventionally called a posting. The list is then called a postings list (or inverted list) and all the postings lists taken together are referred to as the postings [1].

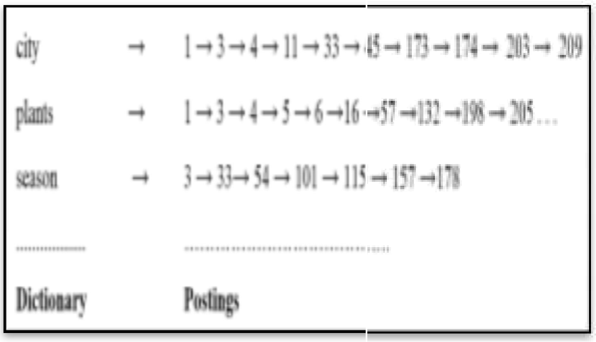

Figure 4 The two parts of an inverted index.

The dictionary is commonly kept in memory, with pointers to each postings list, which is storedon disk

Within a document collection, we assume that each document has a unique serial number, known as the document identifier (docID). During index construction, we simply assign successive integers to each new document when it is first encountered. The input to indexing is a list of normalized tokens for each document, which we can equally think of as a list of pairs of term and docID as in Figure 6. The core indexing step is sorting this list so that the terms are alphabetical, giving us the representation in the middle column of Figure 6. Multiple occurrences of the same term from the same document are then merged. Instances of the same term are then grouped and the result is split into a dictionary and postings, as shown in the right column of Figure 6. Since a term generally occurs in a number of documents, this data organization already reduces the storage requirements of the index. The dictionary also records some statistics, such as the number of documents which contain each term (the document frequency, which is here also the length of each postings list). This information is not vital for a basic Boolean search engine but it allows us to improve the efficiency of the search engine at query time and it is a statistic later used in many ranked retrieval models. The postings are secondarily sorted by docID. This provides the basis for efficient query processing. This inverted index structure is essentially without rivals as the most efficient structure for supporting ad hoc text search.

ciry → 1 → 3 → 4 → 11 → 33 → 45 → 173 → 174 → 203 → 209
season → 3 → 33→ 54 → 101 → 115 → 157 →178
Intersection =⇒3→ 33

Figure 5 Intersecting the postings lists for city and season from Figure 4

Doc1: city pollution grow industry plant start product middle city	Doc2: city many beauty park variety plant flower

Term	**docID**	**Term**	**docID**
city	1	beauty	2
pollution	1	city	1
Term list		**Doc. Freq.→**	**Postings**
grow	1	city	1
beauty		1 →	2
industry	1	city	2
city		3 →	1→ 2
plant	1	flower	2
flower		1 →	2
start	1	grow	1
grow		1 →	1
product	1	industry	1
industry		1 →	1
middle	1	many	2
many		1 →	2
city	1	middle	1
middle		1 →	1
city	2	park	2
park		1 →	2
many	2	plant	1
plant		2 →	1→ 2
beauty	2	plant	2
pollution		1 →	1
park	2	pollution	1
product		1 →	1
variety	2	product	1
start		1 →	1
plant	2	start	1
variety		1 →	2
flower	2	variety	2

Figure 6 Building an index by sorting and grouping. The sequence of terms in each document, tagged by their documentID (left) is sorted alphabetically (middle). Instances of the same term are then grouped by word and then by documentID. The terms and documentIDs are then separated out (right). The dictionary stores the terms and has a pointer to the postings list for each term. It commonly also stores other summary information such as here the document frequency of each term. We use this information for improving query time efficiency and later for weighting in ranked retrieval models. Each postings list stores the list of documents in which a term occurs and may store other information such as the term frequency (the frequency of each term in each document) or the position(s) of the term in each document.

Each is assigned unique docID. This is the standard way in which sparse matrix are represented in order to conserve space. So we store the list of docID corresponding to the document containing that term t. This is an inverted index or search index is like index of book.

Suppose there are thousands of documents which contains the words "city and plant". Consider processing the query city AND plant for this first locate city in the dictionary as relative its posting then locate plant in the dictionary as relative its posting. Now merge these two posting using merge algorithm.

Pseudo code for Merge: INTERSECT (p1, p2)

```
  Answer ← { }
While p1≠NIL and
      p2≠NIL
      Do if
(docID(p1)=docID
      (p2))
      then
ADD(answer,docI
      D(p1))
   p1 ← next(p1)
   p2 ← next(p2)
      else if
(docID(p1)<docID
      (p2))
   then    p1 ←
      next(p1)
   else    p2 ←
      next(p2)
   return answer
```

Figure: 7 Merge Algorithm

p1 indicates pointer to current location in list 1
p2 indicates pointer to current location in list 2
We need find their intersection i.e. which docID are common. How do you take intersection of these two sorted list? For this merge sort is used. Merge sort is divide and conquer algorithm which divide the sorted array into two parts. This pseudo code is used for taking the intersection of the two posting list. Answer list is going to contain the document docID that are common to both the list. Initially the answer list is empty. Two pointers p1 and p2 points to the heads of both the posting list. In the merge step we are going to keep advancing these pointers p1 and p2. We are going to walk through both these list in particular order so that

when both the pointers have reach the end of the list. The answer list is going to contain the intersection of the elements in both the list i.e. it going to contain the docID of the documents which contain both these terms [1]. The intersection operation is the crucial one: we need to efficiently intersect postings lists so as to be able to quickly find documents that contain both terms. (This operation is sometimes referred to as merging postings lists. This slightly counterintuitive name reflects using the term merge algorithm for a general family of algorithms that combine multiple sorted lists by interleaved advancing of pointers through each; here we are merging the lists with a logical AND operation.)

There is a simple and effective method of intersecting postings lists using the merge algorithm (see Figure 7): we maintain pointers into both lists and walk through the two postings lists simultaneously, in time linear in the total number of postings entries. At each step, we compare the docID pointed to by both pointers. If they are the same, we put that docID in the results list, and advance both pointers. Otherwise we advance the pointer pointing to the smaller docID. If the lengths of the postings lists are x and y, the intersection takes $O(x + y)$ operations. Formally, the complexity of querying is $\Theta(N)$, where N is the number of documents in the collection. Our indexing methods gain us just a constant, not a difference in Θ time complexity compared to a linear scan but in practice the constant is huge. [1]

To use this algorithm, it is crucial that postings be sorted by a single global ordering. Using a numeric sort by docID is one simple way to achieve this. We can extend the intersection operation to process more complicated queries.

APPLICATIONS OF BOOLEAN RETRIEVAL MODEL

Email search are the applications of Boolean retrieval model. If you search an email the result you get will not be ranked accordance to relevance. Basically you will be ranked in chronological order from most recent first to less recent. Desktop search is also the applications of Boolean retrieval model. As on typing the word you will immediately getting set of result. Windows Vista onwards operating system itself provides you system to search files by building an inverted index. So email search and desktop search are the popular examples of Boolean retrieval search. In Boolean model searching, desktop search is a smallest scale information retrieval system, the largest scale is web search whereas intermediate scale is enterprise search also called domain specific search or vertical search, which provides search over documents within a particular subject area. Westlaw retrieves documents based on Boolean query i.e. Westlaw uses Boolean retrieval mode.

CONCLUSION

From the above tutorial we conclude that, Boolean retrieval method is easy for the system. Users get transparency it is easy to understand why a document was or was not retrieved. Users get control means it easy to determine whether the query is too specific (few results) or too broad (many results). Intersection operation is sometimes referred to as merging postings lists this slightly counterintuitive name reflects using the term merge algorithm for a general family of algorithms that combine multiple sorted lists by interleaved advancing of pointers through each; here we are merging the lists with a logical AND operation. The semantics of result is precise. There is no gradation and there is no ranking in Boolean retrieval model.

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QOS BASED ENERGY EFFICIENT ROUTING FOR QUERY PROCESSING IN MOBILE ENVIRONMENT

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ABSTRACT

The key goal of mobile computing environment is to expand mobility into the area of autonomous, mobile and wireless domains in such a way that a set of nodes form the network routing infrastructure in an ad-hoc manner. Mobile computing environment exhibits the characteristics such as lack of infrastructure, variability in bandwidth and the broadcast nature of the network. Due to mobility of the nodes, query processing in mobile computing environment suffers from a number of constraints like disconnection, power and resource problems, security risks etc. The multimedia applications are typically delay-sensitive and have high bandwidth requirements. It is also seen that the node energy in the network cannot get utilized properly for the query processing. Due to dynamically varying network topology and the limited availability of resources, Quality of service (QoS) routing is another big challenge in mobile ad hoc networks (MANETs). QoS parameters include bandwidth, delay, jitter, security, network availability, battery life and packet loss. researchers are working on reduction of energy consumption in mobile networks by improving the Qos measures.

Keywords: *QoS routing, Quality of service, mobile computing, mobile ad hoc networks.*

INTRODUCTION

In the modern era, the variety of small devices like smart phones, PDAs and sensors are rapidly growing. The access to computing and data is essential from static as well as the moving devices. Mobile environment encompasses the mobility of hardware, communication among the moving devices and access to data as well as software residing on these mobile devices. To access the data from mobile hosts, various kinds of queries are to be used like location queries, continuous queries, existence queries and data queries [1]. In mobile ad hoc networks, nodes communicate with each other by means of broadcast radio signals where all nodes in the network get the broadcasted message [2]. Since the multimedia applications are typically delay-sensitive and have high bandwidth requirements, it is crucial to provide Quality of service (QoS) while designing wireless ad hoc networks. The wireless channel is shared among adjacent hosts and network topology can always change as hosts move. There are many techniques for solving the QoS routing problem in MANETs. Recently, most of the research work has been focused on designing medium access protocols (e.g., the IEEE 802.11e medium access control (MAC) specifications [1] for efficiently managing and allocating resources at the MAC layer) which includes designing QoS signaling system for efficient resource management such as INSIGNIA [3]. One of the efficient approaches to reduce communication overhead is to design a continuous answer maintenance scheme that allows the user to collaborate with peers to continuously maintain the answer which bypasses the always processing of the query from scratch, in order to maintain QoS.

QUALITY OF SERVICE IN MOBILE COMPUTING

Quality of service (QoS) mechanism controls the performance, reliability and usability of a telecommunications service. Quality of Service (QoS) refers to a set of service requirements that needs to be met by the network while transporting a packet stream from a source to its destination. The network is expected to guarantee a set of measurable pre-specified service attributes to the users in terms of end-to-end performance, such as delay, bandwidth, probability of packet loss, delay variance (jitter), power consumption etc. QoS parameters include bandwidth, delay, jitter, security, network availability, battery life and packet loss. The important QoS metrics for multimedia applications are delay, jitter, loss, and throughput. End-to-end delay is the time between the arrival of a packet and its successful delivery to the receiver. Access delay is the time between packet arrival and packet transmission by the sender. Jitter is the variation of delay and is an important metric for multimedia applications. Bandwidth is the measure of data transmission capacity and influences throughput, which is the amount of data successfully transmitted and received in unit time. [4]Some of factors that influence QoS of Wireless Network include:

1.Throughput of Network
2.Retransmission Attempts
3.Data Dropped
4.Medium Access Delay

ENERGY EFFICIENT ROUTING IN MOBILE COMPUTING ENVIRONMENT

Mobile computing devices faces a common problem of limited battery capacity. Batteries with limited capacity cannot be powered anywhere and anytime in a critical situation. Power failure of a mobile node not only affects the mobile node itself but also affects the ability to forward packets to next node. To take full advantage of the lifetime of nodes, traffic should be routed in such a way that energy consumption can be minimized while maintaining the QoS parameters[5]. Energy related metrics that have been used to determine energy efficient routing path. They are [6]

- Energy consumed/packet
- time to network partition
- variance in node power levels
- cost/packet
- maximum node cost

QOS ROUTING IN MOBILE COMPUTING ENVIRONMENT[2]

QoS routing plays an important role for providing QoS in wireless ad hoc networks. The goals of QoS routing are in general twofold: selecting routes with satisfied QoS requirement(s), and achieving global efficiency in resource utilization. In QoS implementation when a node sends a message, a QoS aware routing first determines existence of a direct route to destination node within a given routing table. If the route is available, then by using a route selection model for a connected network it evaluates the routing performance. An optimal route to send message directly will be find out . If the route is not available then a best relay node is selected according to the route selection model of interrupted network. The sending node sends the message to a selected relay node having higher performance. If there is no such high performance node, the sending node will store the message in buffer temporarily. In the QoS aware routing, when the network is connected, a message is quickly sent to the destination node. When the network is interrupted, the message is delivered by the store-carry- forward paradigm[7]. Multimedia applications are typically delay-sensitive and have high bandwidth requirements. Here we first discuss some key design considerations in providing QoS routing support, and present a review of previous work addressing the issue of route selection subject to QoS constraints.

OVERVIEW OF QOS ROUTING SCHEMES

Various strategies are employed in achieving the Efficient query processing/ data transmission with QoS routing. Schemes are used in such a way that it should reduce the communication overhead in acquiring cost-effective delay-constrained routes.

1. Distributed dynamic channel allocation algorithm[8][9] achieves the fault tolerance, high concurrency, efficient in channel reuse . Distributed dynamic channel allocation algorithms have gained more attention because of their high reliability and scalability. Under our algorithm, a cell that tries to borrow a channel doesn't have to wait until it receives reply message from each of its interference neighbors. A cell can borrow a channel as long as it receives reply message from each member of a Group of its neighbors and there is at least one common available channel allocated to that Group. Thus the proposed algorithm is fault tolerant. Moreover, a cell can lend a channel to multiple borrowers (at most 3) as long as any two of them are not neighbors. So, our approach achieves a high channel utilization.
2. In earlier systems neither guard channel nor channel prerequest scheme can guarantee a desired level of QoS for the profiled MTs. A novel call-admission control (CAC) algorithm proposed in [10] can maintain any desired level of QoS, when the successful call completion rate is very high. In this algorithm, the new call arrival rate is estimated continuously. When the estimated arrival rate is higher than a predetermined level, some new calls are blocked

irrespective of the availability of channels. The main motive of this new call preblocking is to maintain a cell's observed new call arrival rate. This method guarantees any desired level of QoS for profiled users.

3. In mobility prediction technique[11] each BS performs predictions for all active mobile terminals under its service. The technique is built upon the assumption that future MTs would be equipped with reasonably accurate positioning capability. This scheme does not require any cell geometry assumption. it incorporates road topology information into the prediction technique, which yields better prediction accuracy for MTs that are carried in vehicles. to prioritize handoff calls over new calls. With mobility prediction, the reservations at each BS could be dynamically adjusted according to the resource demands of mobile terminals that are anticipated to hand off into the cell from its neighboring cells.

4. The renegotiation scheme is a scheme in which the bandwidth allocation is changed dynamically based on the availability. If a low priority service has been admitted with a bandwidth less than what it had asked and after sometime extra bandwidth is available due to completion of a high priority service then the remaining bandwidth is given to the low priority service and thus increases the QoS of the lower priority service.

5. Software-defined networks (SDNs) [12]are the next-generation networking paradigm that decouples the data forwarding from the centralized control. a QoS-aware adaptive routing (QAR) proposes the multi-layer hierarchical SDNs. Specifically, the distributed hierarchical control plane architecture is employed to minimize signaling delay in large SDNs via three-levels design of controllers, i.e., the super, domain (or master), and slave controllers., QAR algorithm combines the reinforcement learning and QoS-aware reward function.

6. Ant colony optimization[13] is a promising solution that can be applied in wireless ad hoc networks. since existing routing protocols requires additional control message exchange between neighbors to compute QoS parameters. it becomes slow to react to fast topology change and increase network load and overhead. The Simple Network Management Protocol (SNMP) is used to obtain these values locally which helps to decrease the overhead introduced to collect information from neighbor nodes and to obtain an accurate estimate of QoS parameters.Artificial ants evaluate these values to find the paths that satisfy application QoS requirements. The simulation results implemented using the ns-3 network simulator show that QoS routing based on ant colony optimization (QoRA) is scalable and performs well.[1]

7. Data reduction is another approach to decrease the size of data that is needed in the communication. The key idea in this approach is less amount of data consumes less amount of power in transmission. Various data reduction techniques includes packet merging, packet compression, data aggregation, and data fusion. This technique jointly considers four QoS factors viz., energy consumption, time delay, result accuracy and packet error rate. [14] this QoS based approach optimizes the execution of periodical queries with COUNT and AVERAGE aggregations.

ANALYSIS OF QOS ROUTING SCHEMES

Fault Tolerant Dynamic Allocation scheme[8][9] looks in to methods of reusing the channels effectively between two cells, which are separated by a minimum distance so that they do not interfere with each other. The channels are allocated dynamically as opposed to static allocation where the channels are allocated and reserved beforehand.

The Call Admission Control (CAC) [10] employs pre -blocking of calls based on the available bandwidth for handling calls. This algorithm is based on two schemes which were used earlier namely Pre request scheme and the guard channel scheme. CAC algorithm utilizes both the schemes and gives better performance in terms of successful call completion rates (SCCR) and provides guaranteed QoS for profiled users.

In the Mobility prediction techniques [11] hand off losses are reduced and due to which the blocking and the dropping probabilities are significantly reduced. In this mobility prediction scheme road topology information is gathered and stored in a database and the path or the trajectory of the mobile host is calculated. No assumption about the shape of the cell is assumed. [Soh 03]

The renegotiation scheme ensures that the higher priority services get their requested bandwidth and they are not affected in any way.

To realize the merits of dedicated QoS provisioning and fast route (re-)configuration services over the decoupled SDNs, various QoS requirements in packet delay, loss, and throughput should be supported by an efficient transportation with respect to each specific application.

Artificial ants evaluate the parameter values to find the paths that satisfy applications QoS requirements. The simulation results implemented using the ns-3 network simulator show that QoS routing based on ant colony optimization (QoRA) is scalable and performs well.[1][13]

the QoS based data reduction approach optimizes the execution of periodical queries with COUNT and AVERAGE aggregations[14].

CONCLUSION

Query processing in mobile computing environment suffers from a number of constraints. Quality of service (QoS) provisioning is becoming a critical issue in designing wireless ad hoc networks. Considering these constraints/parameters various methods have been proposed by authors which are proved to be best for their related area. The simulation results implemented using the ns-3 network simulator show that QoS routing based on ant colony optimization (QoRA) is scalable and performs well. By analyzing all the schemes, we can say that various QoS requirements in packet delay, loss, and throughput should be supported by an efficient transportation with respect to each specific application for efficient query processing

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STUDY TO REVIEW E-LEARNING USING DATA MINING AND CLOUD COMPUTING

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ABSTRACT

Data mining is a technique to extract the information from a large amount of data that stored multiple heterogeneous data base. Data stored in data warehouse, world wide web (www), and external sources. The www is becoming one of the most popular medium of learning. The e-learning i.e. electronic learning is a technology based learning such as computer based learning, web based learning, virtual classes etc. E-learning is one of the most important applications of data mining. Cloud computing is related to IT sectors. Cloud computing has significant impact on learning. e- learning using cloud computing reduced the cost of learning, and offers more benefits to user like security and portability. Cloud computing in allow the user to take a benefits of new technologies provided by cloud service providers from anywhere in the world. This paper is focused on how data mining and cloud computing play a major role in e-learning..

Keywords: *data mining, e- learning, cloud computing, IaaS, PaaS, SaaS*

INTRODUCTION

Data base are full of large data that can be used by the people. And time to time there is a need to update that data. Update refers to add new data, edit the data or delete the data that has no longer need from database. Knowledge management developed some techniques for handling data and among them data mining is one.

Data mining: Data mining is subfield of computer science. Data mining is a process or technique to uncover the information from huge of dataset. The main aim of data mining is to extract the information and transfer it into an understandable structure.

E-learning: Day by day the educational system are growing and changing. As the IT technology has developed the education has changed. New media like computer, laptop, mobile, tablet have been used by the people for getting information, for learning new things and the internet play a vital role in refers to using electronic applications and processes to learn. E learning processes include web-based learning, computer-based learning, virtual class [1,2].

Cloud computing: Cloud computing is a new form of Internet based computing that provides shared computer processing resources and data to computer and other devices on demand. The goal of cloud computing is to allow users to take benefits from all of these technologies without the need for deep knowledge about or expertise with each one of them.

LITERATURE REVIEW

Many papers have published to investigate the effectiveness of data mining techniques in e-learning process. In [3], author have discussed the data mining techniques and application of data mining in various field. In [1] the author has explained data mining functionality for e-learning domain as well as how the classification/prediction model, association rule model, clustering data mining model used in e-learning. In [2], author have been focused on aspects regarding cloud computing such as cloud computing service models and also focused on how the cloud platform can improved the e learning process.

Introductory details of data mining and its techniques are explained in details in [4], like clustering ,association rules, sequence discovery and summarization. In [5] the author have provided information about cloud computing model, deployment model, service model , and focused on e-learning process according to this at least two entities involved students and trainers in e-learning process. Author has also given how students and trainers involved in e-learning system. In [6] the author gave details description about how data mining can be applicable in e-learning domain as well as education systems and also focused on steps of e-learning data mining process and influence of data mining in e-learning system.

DATA MINING AND E-LEARNING

TECHNIQUES OF DATA MINING

Data mining is the search for new and valuable information in large volume of data. It is cooperative effort of humans and computer. Two primary goals of data mining tend to create Prediction model and Description model.

Prediction modeling is the process by which a model is created to predict an outcome. It involves using some variable or field in the data set to predict unknown or future values of the other variable of interest.

Descriptive modeling on the other hand focuses on finding patterns describing the data that can be interpreted by humane. Which produces new nontrivial information based on the available data set.

The goal of predictive and descriptive model can be achieved using a variety of data mining techniques as shown in figure 1.

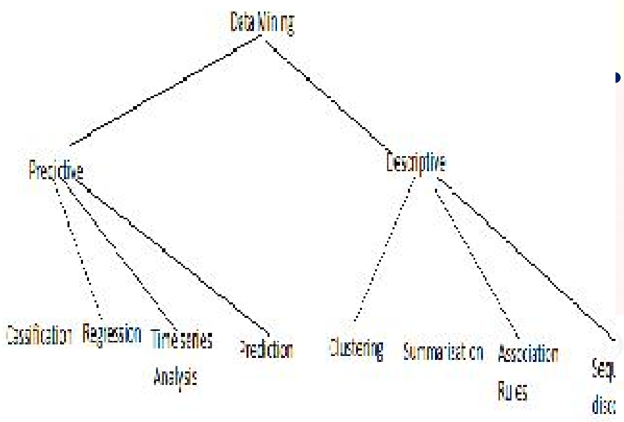

Figure 1. Data Mining Models

- **Classification:** Classification is a grouping of data into predefined classes or groups. It is referred as supervised learning because the classes are determined before examining the data [3][4].
- **Regression:** It is used to map a data item to a real valued prediction variable. Regression assumes that the target data fits into some known type of function e.g. linear or logistic etc. and then determined the best function of this type that models the given data [3][4].
- **Time series analysis:** In time series analysis the value of an attribute is examined along with time, because value of an attribute varies over time. The values usually are obtained as evenly spaced time point[3][4].
- **Prediction:** The prediction technique is predicting a future state rather than a current state. It discovers the relationship between independent variables and the relationship between dependent and independent variables. Prediction applications are flooding, speech recognition, machine learning and pattern recognition[3][4].
- **Clustering:** It is technique of grouping of object based on some similarities, or clustering is a collection of similar data objects which shows same characteristics. It is a unsupervised learning.
- **Summarization:** It is technique that gives the summary type information for example the mean of some numeric type attributes. It maps the data into subsets with simple description. It derives representative information about database. It is an abstraction of data.
- **Association Rules:** Association rules are an if/then statement that helps to discover relationship between unrelated data in database. It is used to find the relationship between the objects which are frequently used together. For example if the customer buys the bread then 80 % possibility that it would like to parches butter also.
- **Sequence Discovery:** This technique is used to determined sequential patterns in data. The patterns are based on time sequence of actions. These patterns are similar to associations in that data are found to be related, but the relationship is based on time.[3][4]

ASPECT OF E-LEARNING

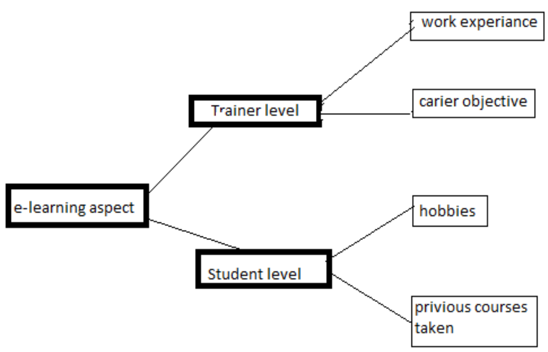

Figure 2. E-learning aspect

In e-learning system usually there are two groups of users: first the learners or students and second is the learner provider or trainer.

- Students involved in taking online course, taking exams, sending feedback, sending homework , project etc.
- The Trainer involved preparing test, accessing test, homework, project taken by the student, sending feedback and communicating with students [5].

Many universities provide the different courses which are accessible online via Internet. All the information about learners like their personal details including name, age, gender and address are stored in database apart from this information like learners interest, hobbies will be very valuable for data mining tool in order to handle patterns by building intelligent models which is based on the huge amount of data [6].

CLOUD COMPUTING AND E-LEARNING

A) CLOUD SERVICES MODEL

The cloud aims to cut cost and helps the user focus on their core business instead of being impeded by IT obstacles. It is a Dilivery Service. The cloud's services model are Saas (software as a service), PaaS(platform as service), IaaS(infrastructure as service).

SaaS: This model provide the facility to user/end user to access through the internet. Sometime the software cost is so high that the user can not afford, that time cloud provider allow the user to hire the software as per his/her needs rather than parching software .

Paas: The PaaS is like a developer. PaaS service model provide operating system, application, development platform, virtual machine and control structure. This service model enable the user to developed or create its own application that run on the cloud infrastructure provided by service provider [2]. The cloud service provider manages the operating systems and cloud infrastructure. The responsible of user/end user is to install and manage the application that user has developed.

Iaas: This model provide the virtual infrastructure, virtual machine, virtual storage. The user that used this model should not need to parches and manage the hardware and software infrastructure component.

B) ABSTRACT MODEL OF CLOUD COMPUTING AND E-LEARNING

Cloud computing has become an attractive technology. Due to its advanced features like scalability, cost effectiveness and flexibility of resources constrained environment many technologies even e-learning has accepted it. Combining of e- learning with advantages like flexibility, diversity and scalability and cloud computing will make education better and better.

In cloud based e- learning system the institutions are responsible for the content management, creation and deliver while the service provider of the cloud are responsible for constructing as well as management of the system.

As the figure 2. Shows that the user sent the request to the cloud service provider which then connect to the e-learning cloud in order to give a response to a user's request [5].

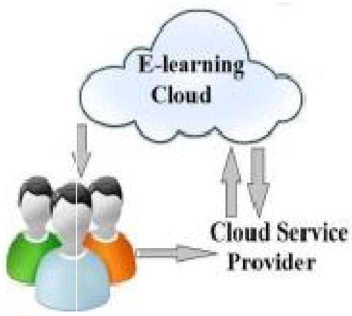

Figure 3: Abstract model of cloud computing based e-learning

DESCRIPTIVE METHOD WITH RESPECT TO E-LEARNING.

DATA MINING METHODOLOGY USED IN E-LEARNING

Many researchers have focused on how data mining techniques helps to improved e-learning as a quality education. In [1], how association rules and classification techniques can used in e-learning. In [7], the author described the data clustering, classification or prediction method and association rule method used for improving e-learning.

- Association Rule Method: An association rule is a model that identifies or discover the specific type of data association. It applied to e-learning system to find association or relationship among attributes in database.
- Classification/Prediction Method: Classification is a process of mapping data into predefined classes or groups. Prediction model predict the future data state based on past and current data. For ex. In e-learning processes learners are classified into big spenders and budget spender or courses are classified into different groups like expensive courses, cheap courses, small duration courses etc[1].
- Clustering Method: clustering promote group based collaborative learning and to provide incremental student diagnosis. It used to group

similar course materials which might be help to e-learner to find and organize distributed courseware resources [7]. Universities can cluster students into various groups that will be based on student satisfaction, student loyalty and degree of complaints to understand students patterns towards course completion [8].

APPLICATION OF DATA MINING IN E-LEARNING

- The database should stored details of students including their name, age, gender, address and their qualification, hobbies, their achievement.
- Many private companies provide training for their employees. Database stored all information like work experience, income range, current post, carrier objectives, interest area of work. These information about employees and student very useful for data mining tools to discover hidden patterns by building intelligent model based on the huge amount of data[1].
- Various universities provide different online courses. By applying data mining the provider would enable to suggest the courses and relevant courses to the learners in their interested area and also provide a registration web page.
- Data mining models helps to predict future behaviors which helps in decision making process of efficiency [1].
- Data mining models with e-learning would help to management or course provider to which area management should invest more such as in degree courses, professional courses or certificate courses[1].

APPLICATION OF CLOUD COMPUTING IN E-LEARNING

- Cloud offer the low cost hardware and fast internet connectivity to e-learning system.
- Cloud provides all resource services required by the e-learners or teachers in the rental form.
- E-learning cloud environment provides the flexibility to users that can only pay for the resource they have used.
- Clod provides all modern learning requirements to e-learners.
- The construction of the environment of e-learning software and hardware or large amount of investment in e-learning system as well as human resources , all these are handled by the service provider of e-learning cloud[9].
- E-learning provides large data center.

ADVANTAGES OF CLOUD COMPUTING IN E-LEARNING

- Low cost: The students/users can run their applications from cloud through their PC, laptop, mobile phone, tablets. They do not need any higher configured computer. They need only Internet connectivity. Similarly users need not pay more cost for large memory because they can hare the memory as per their need and pay for only that space they had used[10][11][12].
- Improved performance: Client machine do not create problem on performance when they are working[10][11][12].
- Data security: Data is always secured while the user used the cloud based applications for e-learning because the software and users data are stored in remote server as well as at other location. Cloud service provider create a number of copies of users data. Unfortunately if the server gets damage or crash even though users data will be safe and do not get any harm[10][11][12].
- Benefits for students: E-learning using cloud computing is very benefiters for learner. They can take online courses, attend the online exams, get feedback from instructor and send their project, assignments through online to teachers[10].
- Benefits for teachers: Teacher also get more benefits over cloud based e-learning. They can prepare online test for students, access the test, homework, deal with project, online communicate with students[10].
- Improved document format comp ability: Some text format and font do not able to open in some PC, mobile but with cloud based e-learning application this type of problem has solved[10].
- Portability: Portability is a key feature of cloud base e-learning. Students can access their data ,give exam , or communicate with teachers from anywhere[10].

CONCLUSION

This paper presents various data mining techniques, and has also focused on cloud computing and how the data mining and cloud computing are effectively applicable in e- learning. Data mining techniques classification/prediction model, clustering and association rule model have became necessity for e-learning process. Cloud computing is an emerging technology. E-learning uses the more benefits of cloud based application. Cloud computing technology becomes popular in both the learner and instructor. Its best features are low cost, portability, degree of maintaines and security etc. In future work hopefully we review various other data mining algorithm and technique

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STUDY OF TASKS SCHEDULING IN CLOUD COMPUTING ENVIRNOMENT

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ABSTRACT

Cloud computing is a huge distributed computing environment contains a large amount of virtualized computing resources available for individual or an organization. Reason behind development or introduction of cloud computing is to provide the guarantee of Quality of Service (QoS) which is quite challenging. Scheduling of job and maintaining load is becoming a main issue in cloud environment. This can be achieved by adopting appropriate task scheduling algorithm [1].

In this paper various task scheduling algorithms from different authors are described and conclusion is drawn is from those algorithms.

Keywords: *Cloud computing, Quality of Service (QoS), Virtual machine (VM),Virtual Machine Tree(VMT) task scheduling, Particle Swarm Optimization (PSO), Ant colony optimization (ACO)*

INTRODUCTION

CLOUD COMPUTING

A Cloud is the collection of interconnected computer that are provided by one or more unified computing resources. In this growing market of business and organization, cloud computing is the alternative for their day-by-day increasing needs. A Cloud provider first constructs a computing system called cloud. In this there are several virtual machines interconnected to each other. The provider processes the task of the users. "Cloud computing is not a well behaved model for providing wanted, user- required, flexible access to a shared pool of configurable computing resources that can be quickly provided and released with low care effort or service, These are going to study the divisible task scheduling of high performance computing algorithms. Cloud computing environment where multiple virtual machines (VMs) can share physical resources (CPU, memory, and bandwidth) on a single physical host and multiple VMs can share the bandwidth of a data center by using network virtualization. This is because many users and applications essentially share system resources [2].

TASK SCHEDULING

Task scheduling is defined as the process of mapping of the task or jobs to the virtual machines (VM's) i.e. computing resources for their processing. It is well known fact that the task scheduling is a NP-complete problem. So a well efficient algorithm is always required for task scheduling. As the jobs or task need computing resources for their execution and there is also a possibility that the computing resource might not be available at the current location. Task migration is required to transfer these tasks to the computing resource rich location for faster execution [3].

TASK SCHEDULING METHODS

According to the collected information with the requirements of all tasks and the real time state of all services, design more reasonable strategy to deal in a market place with more profit for service provider as well as user. It deals with one traditional scheduling algorithm FCFS and four different optimized scheduling methods based on priority and non- priority concepts. The brief descriptions for all these scheduling methods are as follows:

FCFS (first come first serve) algorithm is easy to understand and implement. FCFS provides an efficient, simple and error free process scheduling algorithm that saves valuable CPU resources. It uses non preemptive scheduling in which a process is automatically queued and processing occurs according to an incoming request or process order.

1. First method introduces an optimized algorithm for task scheduling based on ABC (Activity Based Costing) in Cloud Computing based on priority concept for tasks with the profit for service provider. The traditional way for task

scheduling cannot meet the market requirement well enough. Activity based costing is a method of measuring the cost of the objects and the performances for each activity and it calculates the cost better than traditional ones in Cloud Computing Environment.

2. Second method proposes a particle swarm optimization (PSO) algorithm which is based on small position value (SPV) rule. In order to minimize the cost of the processing, a model formulated for task scheduling in cloud computing environment.

3. Third method proposed a scheduling algorithm based on QoS driven in Cloud Computing. This algorithm amalgam many task attributes with considering user privilege, expectation, task length and the pending time in queue to compute the priority and sort tasks by the priority. Fourth scheduling method is presented a tree based data structure called Virtual Machine Tree (VMT) for efficient execution of cloudlets or tasks with the priority concept for virtual machines and for tasks also. Modified DFS is also used for achieve good results [4].

Various parameters shall be considered by scheduling techniques in clouds. These parameters may be performance, makespan, scalability, throughput, cost, resource utilization, fault tolerance, migration time or overhead. Cloud task scheduling based ABC, Particle Swarm Optimization (PSO) and Ant Colony Optimization (ACO) approaches are used for allocation of incoming jobs to virtual machines (VMs) considering the makespan parameter to achieve a high user satisfaction.

1. The main idea concluded from ACO is to simulate the foraging behavior of ants that try to search for the abundant food sources. They exploit a special kind of chemical pheromone to communicate with each other.
2. In PSO the swarm fly over an environment following the best members of the swarm and directing their movement toward good areas from their environment. Initially, this algorithm assigns random positions to all particles in search space. It advances the position of each particle successively based on its velocity using the global best known position and the best position known to a particle. Over time, the particles get together around optima or several optima.
3. ABC algorithm is based on the skillful foraging behavior of honey bee swarm. A typical hive may include 5,000 to 20,000 individual bees. Honey bees assume to have different functions within their colony through time. Grown bees (from 20 to 40 days) usually become foragers. Foraging bees typically take up one of three roles: active foragers, scout foragers or inactive foragers. Active foraging bees go to a food source, check neighbor sources, collect food and return back to the hive. Scout bees examine the area surrounding the hive searching for plentiful new food sources. At any time some of the foraging bees become inactive. These inactive foragers set back near the hive door. When active foragers or scouts return to the hive, they may play a waggle dance to the waiting inactive bees based on the quality of the food source. This waggle dance transfers information to the inactive bees about the location and food amount. Inactive bees take this information from waggle dance and may become active foragers. In general, an active bee continues aggregating food from a particular source until that source is consumed. At this time this active bee becomes an inactive forager [5].

2.3. TASK SCHEDULING MODEL

In order to adapt to the parallel and distributed cloud computing environment and deal with QoS scheduling, adopt the dynamic batching mode. In this mode, tasks are not mapped onto services as they arrive; instead they are collected in a set that is examined for mapping. And according to the collected information including the requirements of all tasks and the real time state of all services, design more reasonable scheduling strategy to deal with QoS. QoS Scheduling based on following strategies: (1) the task owned higher priority should be scheduled prior to tasks with lower priority;(2) a task should be completed as soon as possible [6].

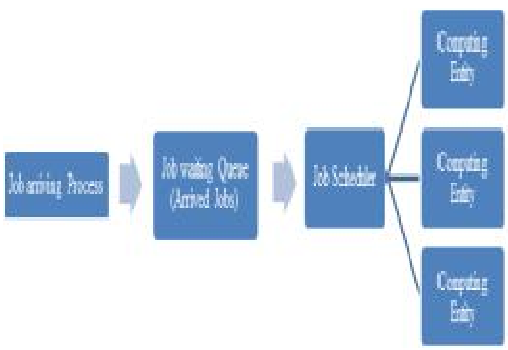

Fig. 1 Scheduling Model in Cloud Data Centers

As shown in the figure 1, the scheduling model in a cloud datacenter consists of four components, namely, computing entity, job scheduler, job waiting queue, and job arrival process.

1. Computing entity is provided through the implementation of a virtualization technique in the cloud computing system. A number of virtual machines that provide computing facilities, such as the operating system and software, are present in the cloud system to process the submitted tasks. A computing entity is characterized by its computing capacity, which indicates the number of instructions it can process in a second.
2. Job scheduler is an important component of the scheduling process in a cloud computing environment. A job scheduler determines the execution order of the jobs waiting in the queue.
3. Job waiting queue is the line of jobs for execution waiting to get assigned to a particular machine.
4. Job arrival process is the procedure in which jobs arrive into the scheduling system [7].

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ROLE OF CONTAINER TECHONOLOGY IN CLOUD COMPUTING

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ABSTRACT

Cloud computing is big pool of virtually accessible resources offering on demand services to user in real time. The container technology will change the way cloud interact and help users to get maximum benefits out of it. The high volume of data is been transferred form various computing sources, data is very important for every individual now a day. That is why transfer and security of data is very vital for everyone. Another thing comes is resource share ability and big data to overcome all the challenges lots of research is in progress. Containers are actually lightweight virtualization solution to replace virtual machines in cloud, which leads to proper management of data with security. The following paper addresses container technology and its role in cloud computing.

***Keywords**:Cloud Computing, virtual Machine; container; big data;*

INTRODUCTION

Containers are a lightweight virtualization solution to replace virtual machines for deploying cloud applications as they are less resource and time consuming.

Virtual machines (VMs) are an infrastructure as a service (IaaS) focusing on hardware virtualization whose techniques have been used at the infrastructure layer. To achieve sharing and elasticity of resources, the cloud makes use of such virtualization techniques for administering, scheduling, provisioning and security. However, VMs suffer from slow start up time and show lower densities even when full.

Containers offer as a lightweight virtualization solution to install applications across various domains and sectors. They allow infrastructure and platform to be shared in a secure and portable manner, along with application packaging and management. They help for faster deployment of applications and have faster start up times. They are less resource and time consuming and can be scaled up or down providing higher density levels than full VMs. They are easier and portable across infrastructure deployment of applications in an interoperable way. Using containers will accelerate responsive application development of distributed applications providing an additional layer of protection by isolating applications and the host, without using incremental resources. They also allow easy updates to applications. Fig. 1 (a) and (b) shows the difference between traditional hypervisor and container-based architectures. This paper tried to convey the importance of container over virtualization on cloud environment.

APPLICATION OF CONTAINER TECHONOLOGY

Containers are a type of virtualization which aims at reducing the resources utilization done by VMs, especially in memory. In order to achieve that, containers are virtualized at the kernel level, where the OS's kernel manages multiple isolated user-space instances at the same time. In the last years, containers have won popularity as an alternative to VMs.

Containers are expected to reduce resources and improve flexibility of virtualized environments, because services running on containers directly interact with the OS, without redirecting their instructions to the hypervisor. However, the containers virtualization does not isolate services as well as VMs, which may pose security issues in some Cloud deployments.

TYPES OF CONTAINER TECHONOLOGY

Popularity and development of big data applications is significantly increased in current times, due to rapid growth of datasets. Compared to traditional applications, big data applications spend a lot of time to transfer data among computing nodes, container can overcome such a challenges of big data.

Basics of container technology contain different Operating Systems (OS) and Container Engines.

3.1 OPERATING SYSTEMS

Most Linux operating system distributions are based on convenience, and include big, preinstalled packages, just in case the user might want them. Docker[1], in contrast, is designed for lightweight virtualization—to run many identical machines as possible with the least amount of resources in terms of memory, disk, and CPU. In response, vendors have developed container-optimized builds of Linux that attempt to balance the capabilities teams might need in a Linux distribution with the minimalism that containers demand. Here are a few of the most popular ones:

a) RancherOS

Containing just the Linux kernel and Docker itself, the RancherOS [16] system image fits into just 22 MB of disk space. RancherOS eliminate systemd, the service management system built into most versions of Linux, instead starting the Docker Daemon itself as the init, or "bootstrap" system.

b) CoreOS Container Linux

Designed to work with CoreOS [16] Linux tools and systems, CoreOS Container Linux is preconfigured to run Linux containers. It also comes with automatic updates turned on; operating systems update themselves without any handling.

c) Ubuntu Snappy

Canonical, the parent company of UbuntuLinux, claims that Snappy [16], its answer for containers, runs over seven times more docker containers than any other distribution. Snappy is designed to have high performance, a small footprint, and delta updates to operating system and applications, keeping download small.

d) Red Hat Atomic Host

These tools will let you host Linux containers in a minimal version of Red Hat Enterprise Linux. Organizations that run Red Hat enterprise and want to use containers will want to have their hosts run the Red Hat Atomic Host [16] operating system.

e) Microsoft Nano Server

Nano Server [16] is a small, remoteadministered, command-line operating system designed to host and to run as containers, possibly in the cloud. Yes, Microsoft does have Windows Server-based container capability, and Nano is specifically built for that purpose.

3.2 Container Engines

Container engines are of the following type

a) VMware Photon

Weighing in at 220 MB on disk, Photon [16] is a large container operating system than some others, although it's still only about one hundredth the size of the latest version of Windows. This Linux container host is designed to integrate with VMware's vSphere virtualization products.

b) Container runtimes

Despite its popularity as a de-facto standard, Docker is just one of a set of competing, lightweight virtualization tools for Linux from which you can choose. Options include:

c) Docker

Docker's [1] eponymously named open source containerization engine works with most of the products that follow, as well as many open-source tools.

d) Commercially Supported Docker Engine (CSDE)

This extension for Docker [2] is proprietary, owned by Docker the company. CSDE enables support for running docker instances on modern windows servers.

e) rkt

Pronounced "rocket" and developed by CoreOS, rkt [3] is the main competitor to Docker for containers.

f) Solaris Containers

This container architecture for Solaris [4] pre-dates Docker. IT organizations that have already standardized on Solaris may wish to explore this option.

g) Microsoft Containers

A competing alternative to Linux, Microsoft Containers [5] can support Windows containers under very specific circumstances.

h) Cluster management and deployment

Your team can create images and pass them around from development to test and back. Now comes the hard part: supporting them in production. That means registering artifacts, deploying them to production as a system, and managing servers and collections of servers, including a collection of servers in the cloud, known as a "cluster." Cluster management tools manage workloads, including moving instances from one virtual host to another based on load, and allocating resources, such as CPU and memory.

i) Kubernetes

While there is no standard for cluster management, Google's open source product, Kubernetes [6], is the most popular. Supported by Amazon's AWS, Google's Cloud Engine (GCE) and Microsoft's Azure Container service, Kubernetes is relatively portable, which helps to prevent vendor lock-in and it can even run on a private cloud, such as OpenStack. Microsoft, Amazon, and Google all provide container services that run Kubernetes, with commercial support options available.

j) Apache Mesos

A tool for abstracting computing resources, Apache Mesos [7] can run both Docker and rkt images side-by-side in the same cluster. DC/OS [8] is a platform build on Mesos that functions as a datacenter operating system.

k) Docker Swarm

Docker's free product for cluster management, Swarm [2] runs from the command line, and comes bundled with Docker 1.12 and higher versions. Now it's just Docker's native orchestration capabilities.

l) Docker Data Center

A web-based dashboard that provides full management of Docker, including a control panel, registry, monitoring, logging, and continuous integration, Docker Data Center [2] runs Docker Swarm for cluster management. Although Docker the standard is free, the data center is a commercial product with commercial support. Of course, Docker Data Center embraces and extends the company's free, open source products: Docker and Swarm.

m) Storage containers

Containers are designed to be interchangeable—even fungible, like currency. That works exceptionally well for web servers, where identical servers can be added to or removed from a cluster based on demand. Storage and databases, on the other hand, need persistent locations to house data, or at least a standard interface layer. Organizations that want to move to all-container infrastructure need storage, and companies have appeared to meet that demand.

n) ClusterHQ

These tools help to put databases into containers. Although the vendor that developed ClusterHQ [9] went out of business it left behind a great deal of open source software at github.com/ClusterHQ [1][9].

o) BlockBridge

BlockBridge [10], the "elastic storage platform" company, offers storage as a container using Docker, with options for OpenStack and software-defined secure storage.

p) EMC / lib storage

The EMC / lib storage [1] system offers a code library to enable container storage that's, free and open.

q) Docker Plugins for Storage

EMC, NetApp, and others have created plug-in to support storage [1], which Docker makes available for download.

r) Container security

Single sign-on, LDAP integration, auditing, intrusion detection and prevention and vulnerability scanning—all are pain points for organizations moving to containers. Even traditional devices and software's are difficult to configure on container clusters. Fortunately, a handful of vendors are working to address this need. The space is so new, however, that two emerging companies do not yet have a shipping product offering.

s) Twistlock

You build Docker images out of components, such as an operating system, a web server, or a content management system. The problem is that outdated software on an image could harbor security risks. Twistlock's [11] vulnerability scanner addresses that by comparing images against a database of known threats. This is an automated audit, against a database that's constantly updated. Other core features include more classic intrusion detection, and regulatory compliance systems.

t) Aqua Container Security

Like Twistlock, Aqua [12] focuses on the ability to create, monitor, and enforce policy for containers, along with integration with CI, running security checks on every build.

u) StackRox

Co-founded by Sameer Bhalotra, a former security executive at Google and senior director for cyber security at the Executive Office of the President of the United States, StackRox [13] is preparing a similar product in this area. While the startup remains in stealth mode, with no product offering on its website as yet, the company is one to watch.

v) Aporeto

Another stealth-mode startup, Aporeto [14] says it will provide a "comprehensive cloud-native security solution for deploying and operating modern applications," microservices and containers.

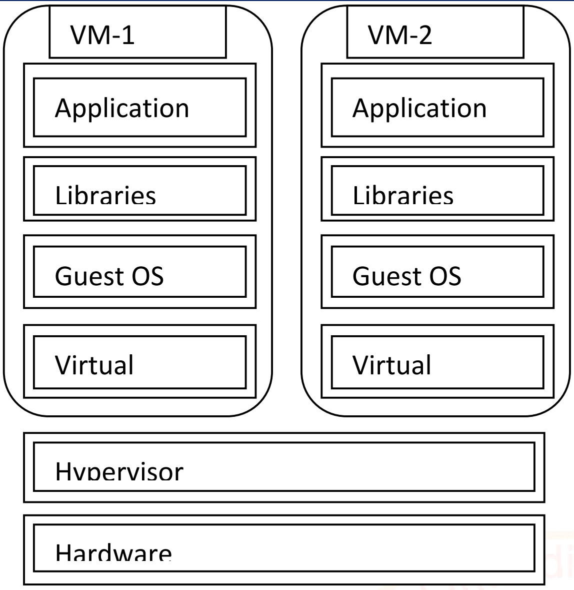

Fig 1(a): - Virtual Machines

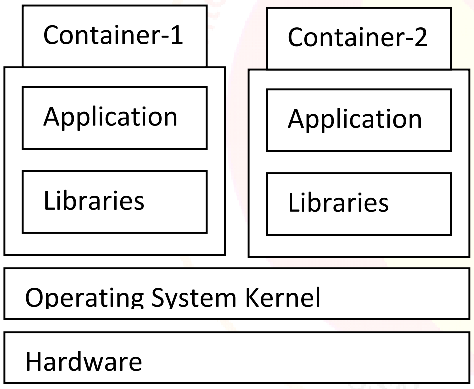

Fig 1(b): - Containers

CLOUD CONTAINER TECHONOLOGY

Now, cloud containers are a hot topic in the IT world in general, and security in particular. The world's top technology companies, including Microsoft, Google and Facebook, all use them. Although it's still early days, containers are seeing increasing use in production environments. Containers promise a streamlined, easy-to-deploy and secure method of implementing specific infrastructure requirements, and they also offer an alternative to virtual machines [15].

The key thing to recognize with cloud containers is that they are designed to virtualize a single application e.g., you have a MySQL container and that's all it does, provide a virtual instance of that application. Containers create an isolation boundary at the application level rather than at the server level. This isolation means that if anything goes wrong in that single container it only affects that individual container and not the whole VM or whole server. It also stops compatibility problems between applications that reside on the same operating system (OS). So far, cloud containers have predominantly been the domain of Linux-based servers, but Microsoft Windows Server 2016 will introduce Windows Server containers and Hyper-V containers [15]. But still there are key questions that need answers, such as how exactly are containers different to traditional hypervisor-based virtual machines.

The key differentiator with containers is the minimalist nature of their deployment. Unlike virtual machines, they don't need a full OS to be installed within the container, and they don't need a virtual copy of the host server's hardware. Containers are able to operate with the minimum amount of resources to perform the task they were designed for; this can mean just a few pieces of software, libraries and the basics of an OS. This results in two or three times as many containers being able to be deployed on a server than virtual machines.

Cloud containers are also very portable, once the container has been created, it can be deployed to different servers very easily. From a software lifecycle perspective this is great, as containers can be copied to create development, test, and integration and live environments very quickly, and do not require the usual configuration. From a software- and security-testing perspective this has a large advantage, because it ensures that the underlying OS is not causing a difference in the test results.

One downside of containers is the problem of splitting your virtualization into lots of smaller chunks. When there are just a few containers involved, it's an advantage because you know exactly what configuration you're deploying and where. However, if you fully invest in containers it's quite possible to soon have so many containers that it becomes difficult to manage. Do you have the ability to deploy patches to hundreds of different containers? If a specific library needs updating inside a container because of a security concern, do you have an easy way to do this? Problems of container management are a common complaint, even with container management systems such as Docker. Virtual machines are generally considered easy to manage, primarily because there are significantly fewer VMs compared to containers.

Containers are deployed in one of two ways: either by creating an image to run in a container or by downloading a pre-created image, such as from Docker Hub. Although Docker is by far the largest and most popular container platform, with plenty of large companies using its solution, there are alternatives, such as LXD and Rocket. However, at this time, Docker has become synonymous with containerization. Originally built on a technology called LXC, Docker has become the predominant force in the world of containers. The library of pre-created images in Docker Hub is large, and should allow most standard requirements to be met with minimal effort.

CLOUD CONTAINER SECURITY

Once cloud containers became popular, one of the biggest concerns was how to keep them secure. Until quite recently, Docker containers had to run as a privileged user on the basic OS, which meant that if key parts of the container were compromised, root or manager access could potentially be obtained on the underlying OS, or vice versa. Docker now supports what is called user namespaces, allowing containers to be run as specific users. There is of course the issue of security of images downloaded from Docker Hub; by downloading an image, the security of the container could not necessarily be guaranteed. Docker has addressed this with a feature called Docker Content Trust, which verifies the publisher of the image. The images can also be scanned for vulnerabilities. This goes some way toward providing assurance, but their verification processes may not be thorough enough if you are using containers for particularly sensitive applications. In this case, it would be sensible to create the image yourself to ensure your security policies have been compulsory.

COMPARITIVE STUDY

CONTAINERIZATION VS. VIRTUALIZATION

Containerization gained importance with the open source Docker, which developed a method to give containers better portability allowing them to be moved among any system that share the host OS type without requiring code change. With Docker container, there are no guests OS environment variable or library dependencies to manage

One of the biggest concerns was how to keep them secure. Until quite recently, Docker container had to run as a privileged user on the assistant OS, which meant that if key parts of the container were compromised, root or administrator access could potentially be obtained on the assistant OS, or vice versa.

CONCLUSION

There aren't many organizations that won't benefit from introducing cloud containers to their infrastructure. Their portability, both internally and in the cloud, coupled with their low cost, makes them a great alternative to full-blown virtual machines. However, it will be the case that in most companies there is a case for both containers and virtual machines. Both have their strong points and their weaknesses, and can complement each other rather than compete
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THERMAL PAINT AND CFD ANALYSIS OF GAS TURBINE BLADE AND ITS REQUIREMENT FOR LOW COST TESTING.

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ABSTRACT

In a view to increase the operating efficiencies the modern gas turbines are de-signed to operate at elevated temperatures which are just few degrees below the material withstanding temperature. An accurate thermal mapping technique is required to anticipate the behavior of the engine component material to avoid failure before completion of the service life. A range of contact and non contact type of sensors are available for thermal mapping of gas turbine components but certain inherent disadvantages of these sensors make them unable to perform satisfactorily in the harsh and aggressive environment of the gas turbine. The literature survey reveals that the thermal paints have the advantages of both the contact and non contact sensors and can be qualified as a better alternative for thermal mapping of gas turbine engines. Thermal paints are identified as effective thermal sensors for thermal mapping of complex gas turbine hot section components compared to conventional thermometry techniques. Thermal paints change their color permanently when exposed to elevated temperatures generating a color pattern with distinguished color profiles with each color representing its formation temperature. Temperature sensitive thermal paints find a wide application in thermal mapping of engine components operating at high temperatures with a major reference to aerospace applications.

Experimental set-up will prepare simulation model for obtaining temperature distribution on blades. By performing experimentation on simulation model certain results will be carried out i.e. color pattern on blades specifies a range of temperature, which will further compared with CAE and CFD tool results and accordingly conclusion will be drawn.

Keywords*- CFD – Computational Fluid Dynamic, CAE- Computer Aided Engineering.*

INTRODUCTION

Operation of aero-engines at elevated temperatures to increase the working efficiency is a common practice in design of modern gas turbine engine leading to damage mechanisms like creep, low cycle fatigue, high cycle fatigue and thermo-mechanical fatigue causing premature failures. Exhaustive thermal mapping of the engine components operating in real conditions is essential to ensure a reliable performance of the engines in harsh environments. Conventional thermometry fails to generate a complete thermal map of the components with critical geometries and rotating at heavy speeds in aggressive environments. Labor intensive pains have to be taken to mount the contact type thermal sensors like thermocouples and thermostats on the components generating stresses within them and also are intrusive in nature. The cable network is quite complex and source of errors at the read out units. Non contact type of sensors like optical pyrometer is a quite challenging option for temperatures measurements due to limitations in generating a proper database of exact radiation emission characteristics of different materials for a range of temperatures. Thermal paints are comparatively preferred alternative temperature sensors due to their capability of generating a complete thermal gradient on the component surface. Also providing a visual record of the temperature distribution is an additional advantage. Thermal paints exhibit a range of color profiles when heated at different temperature with each color representing the temperature at which it is formed. Also there are no mounting issues even on the most complex geometries compared to the thermocouples and temperature plugs where mounting is quite difficult and permanently distorts the components geometry. Alternatively the thermal paints can be coated easily as good as regular paints and re-moved using common paint recovers without any damage to the component material and geometry. The tested components can be reused for further operation making it a cost effective solution.

During the engine operation for thermal paint test the exhaust gas flowing on the painted components deposits carbon soot on their surface distorting the transformed thermal paint color pattern lead-ing to discrepancies in thermal paint data interpretation. An auto-matic interpretation algorithm is developed to interpret the thermal paint data by digital image processing technique. Image of the thermal paint color pattern after testing is acquired and given as an input to the developed software which analyses the image pixel by pixel and gives the temperature as the output. Deposition of the carbon exhaust on the paint colors during testing generates a noisy image incapable of data interpretation.

COMPUTATIONAL FLUID DYNAMICS (CFD) ANALYSIS

Problem Definition for CFD Analysis
Here the blade and vane assembly is considered for simulating hot fluid flow over a profile. Specific domain for this purpose is set and by applying boundary condition required results can be obtained. Here also we are using same material properties as we have used in FEA analysis. The prepared domain for CFD analysis is shown below figure.

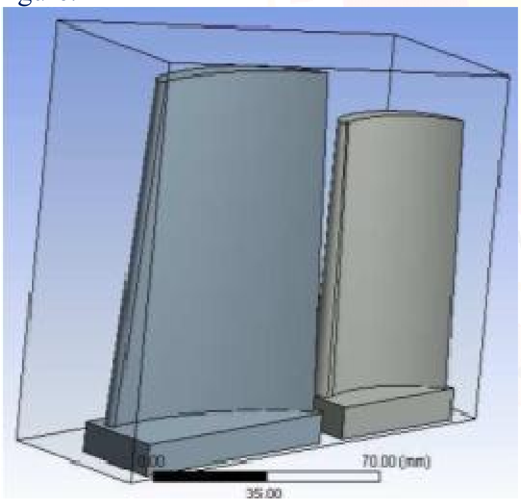

Figure1: Blade and vane assembly domain for CFD analysis

CFD Analysis:
We are using ANSYS 14.0 Fluent CFD tool for performing this analysis.
Projects in ANSYS Workbench are built by adding and connecting systems. Each system is displayed in the Project Schematic as a block of cells. You complete your analyses by working through each cell in order. In general, data flows from the top to bottom within systems and from left to right between systems. Output data from upstream cells is provided as input data to downstream cells.

Table 5: Properties of blade material

Properties	Units	N 155
ρ	Kg/cu m	8249
K	W/m-K	20.0
α	E-06/0C	17.7
Cp	J/Kg K	435
Hydraulic Diameter Inlet	mm	71.42
Hydraulic Diameter Outlet	mm	66.67
Velocity at inlet	m/s	10

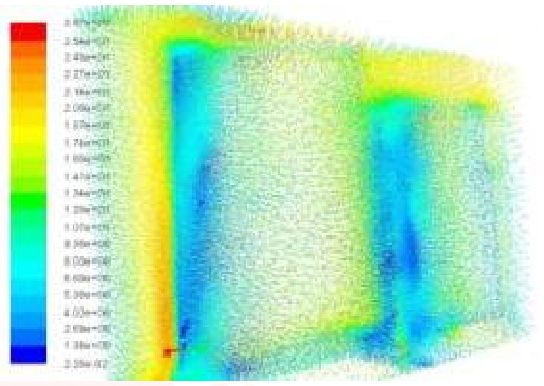

Figure 2: Velocity Counters on Blade profile.

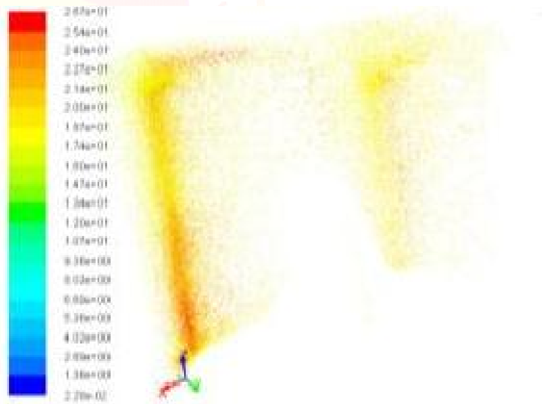

Figure 3: High Velocity points on Blade profile.

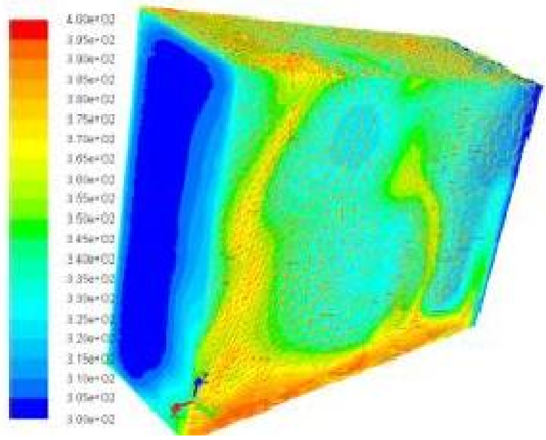

Figure 4: Temperature Counters on Blade profile

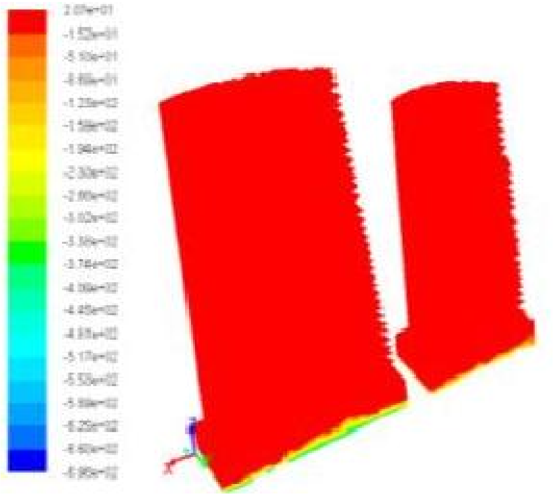

Figure 5: Pressure distribution on Blade profile

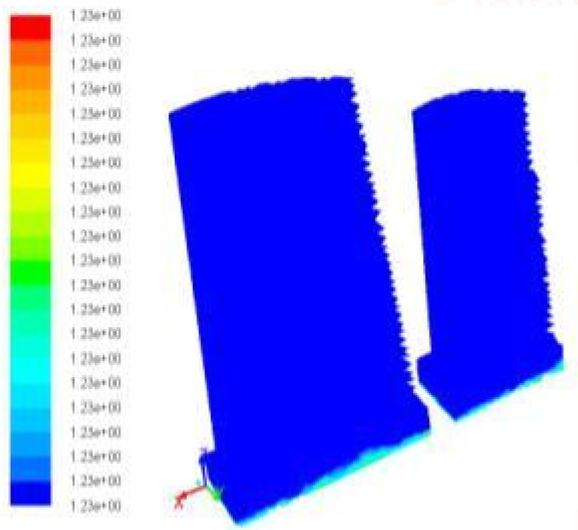

Figure 6. Density distribution along a blade profile

Above figures illustrates the nature of fluid flow, temperature distribution, Velocity vectors etc. By studying these results we can understand where the possible defects may accurse. Also the behaviour of blade material at high temperature.

By above analysis results we can tabulate results as per following.

Table 6: Results obtained by performing CFD analysis.

Sr No	Properties	Minimum Value	Maximum Value
1	Velocity	0 m/s	25.69 m/s
2	Temperature	1000C	8000C
3	Pressure	-996.20 Pa	20.66 pa
4	Density	1.22 kg/m3	1.22 kg/m3
5	Turbulence	0.0037 m2/s2	175.36 m2/s2
5	Heat Transfer Rate	153 w	153 w

CONCLUSIONS

Based on the analysis of both FEA and CFD analysis it is to be state that, the root cause of failure of gas turbine blade is high working temperature with high pressure difference. Results show the temperature counters on blade profile which illustrate the possible damage due to overheating.

Conducting thermal mapping using FEA and CFD tool provides extensive information about failure of gas turbine blade. It gives better approximate solutions with material saving. It can be implemented where the direct contact thermal mapping techniques cannot be applied. The following observations can also conclude accordingly.

1) Due to high temperature at middle and top of the blade there is always possibility of failure.
2) Pressure difference affects the blade material at high temperature.
3) Turbulence in hot fluid is due to pressure difference.
4) FEA and CFD tools are best for thermal mapping of gas turbine blade and are also reliable

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RECONDITIONING & PROGRAMMING FOR IMPROVISATION OF PERFORMANCE PARAMETERS OF YASKAWA MOTOMAN INDUSTRIAL ROBOT

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ABSTRACT

This project focuses on the performance improvisation of industrial robot by using methods of conditioning, and programming. Industrial robot performance can be improvised for the parameters such as, Accuracy, Repeatability, Resolution, Work volume, Operational speed, Positional error, etc. Many uncertain factors influence the accuracy and repeatability of robots. These factors include manufacturing and assembly tolerances and deviations in actuators and controllers. The effects of these uncertain factors must be carefully analyzed to obtain a clear insight into the manipulator performance. In order to ensure the position and orientation accuracy of a robot end effectors as well as to reduce the manufacturing cost of the robot, it is necessary to quantify the influence of the uncertain factors.

This project uses the non-conventional method for performance analysis of industrial robots. This method incorporates vision based calibration system which is easy, cheap and very handy way of calibration compared to current expensive methods.

Keywords-*Robot Calibration, Image Processing, Vision Systems*

INTRODUCTION

The first step in studying the accuracy, repeatability, and resolution of industrial robots is to look at the current state of the art. This applies not only to robots themselves, but also to the most advanced metrology systems.

Robot manufacturers, as an industry standard, publish the repeatability of each machine. These specifications are determined by performing stringent experiments in accordance with ISO 9283. As a general rule of thumb, larger robots have larger errors in repeatability.

The aim of this project is to analyze Yaskawa Motoman SV3X robot for various performance parameters. This robot possesses manipulator arm which is of articulated type.

Analysis of this robot can be done using various ways, which can identify the errors in operating conditions of robot accurately. These results can be obtained under various conditions. Programming of this robot can be done using teach through method or offline method. These programs are written specifically for calibration of accuracy, precision and repeatability.

Robot calibration is needed to keep track of working values under operating conditions of the robot. Robot accuracy can be affected by repetitive tasks and also with time. Hence maintenance is needed to achieve better results from working robot. Calibration helps find errors or deviations of robot coordinates from required positions. Using regular calibration we can help increase productivity by keeping robot updated.

LITERATURE SURVEY

Industrial Robots

An industrial robot is defined by ISO as an automatically controlled, reprogrammable, multipurpose manipulator programmable in three or more axes. The field of robotics may be more practically defined as the study, design and use of robot systems for manufacturing (a top-level definition relying on the prior definition of robot).

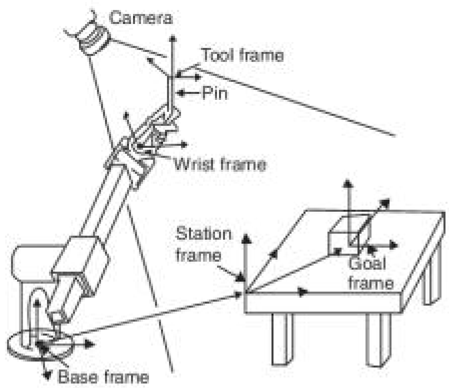
Most industrial robots are set up for an operation by the teach-and-repeat technique. In this mode, a trained operator (programmer) typically uses a portable control device (a teach pendant) to teach a robot its task manually. Robot speeds during these programming sessions are slow.

Robot Calibration

Robot calibration is the process of determining the actual values of kinematic and dynamic parameters of an industrial robot (IR). Kinematic parameters describe the relative position and orientation of links and joints in the robot while the dynamic parameters describe arm and joint masses and internal friction.

A calibrated robot has a higher absolute positioning accuracy than an uncalibrated one, i.e., the real position of the robot end effecter corresponds better to the position calculated from the mathematical model of the robot. Absolute positioning accuracy is particularly relevant in connection with robot exchangeability and off-line programming of precision applications. Besides the calibration of the robot, the calibration of its tools and the workpieces it works with (the so-called cell calibration) can minimize occurring inaccuracies and improve process security.

One of the main technological barriers in the robotics industry has been the reduction of error between the tool frame and the goal frame. The sources of this error are readily identified. Modeling differences between the controller and the robot account for most of the error between the base frame and the tool frame. Inaccurate fixturing and manufacturing processes can account for the differences between the station and goal frames, as shown Fig. 1.



Standard Robot Frames [9]

Measurement Systems

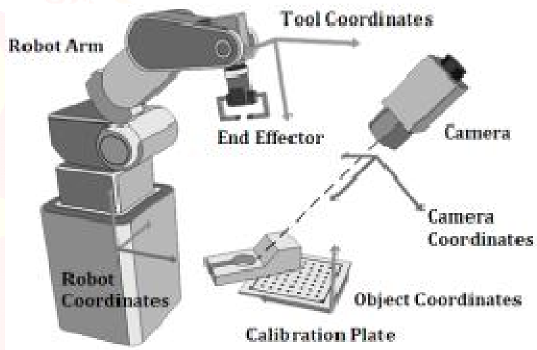
The second step of the calibration process is necessary for the determination of the “best fit” set of parameters to the actual robot. The types of measurement required comprise tool positions corresponding to joint positions. Since the fitting cannot be of better quality than that of the original data collection, it is very important to obtain a good set of data.

Ideally the requirements for measurement systems are –

- Robot tool center position over all robot workspace has to be measureable with small restrictions on the admissible tool-frame orientation
- Measurements have to be non-tactile, otherwise external forces and torques can generate elastic deformations disturbing the calibration results
- Maximum position errors should be less than10% of the repeatability of the robot, and at worst 0,1 mm
- Measurements should be possible without manual interaction

Vision-Based Measurement System

The main advantages of using a vision-based measurement system for robot calibration are: orientation measurements are feasible, measurement data can be easily recorded for further processing, good potential for high precision, measurements can be adjusted to the scale of the problem and it is a low cost system compared with the very expensive systems based on laser interferometry, theodolites and coordinate measuring arms.

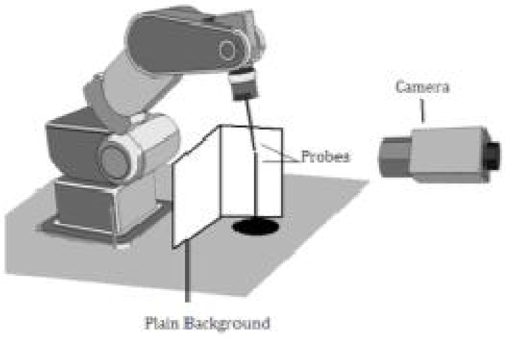


Camera based Calibration Setup [13]

A vision-based measurement system is described in Fig. 2, using a low cost CCD camera and a calibration board of points. The objective is to describe the experimental assessment of the vision system overall accuracy. The outputs show very good results for the application and a good potential to be highly improved with a CCD camera with more resolution and with a larger calibration board.

TEST SETUP

The setup for calibration of Yaskawa Motoman SV3X robot is shown in Fig. 3. It includes mounting of one of the two probes on the robot arm itself and another on the base. These probes are installed so that it can match pointers at home and final positions. A camera is mounted on X and Y axes at distance of 420 mm so that two images can be taken for an experimentation purpose. A custom white background is installed at the back of each axis so that image processing can be made free of background noise and hence achieving better results.



Overview of Test Setup [13]

Design of Experiments

Robot calibration is done under various conditions. These conditions can have different parameters and these parameters are needed to interact with each other so that combined effect of these parameters can be studied on the system.

We are testing the Motoman Robot System under following parameters –

- Speed (N) – It is the speed with which the robot arm moves under given test condition, we have taken three speeds for our robot, 558, 1122, 2250 rad/sec.
- Trajectory (P) – Trajectory or path of robot arm is changed between Straight, Circular and Zigzag type.
- Load carried (W) – Load is applied to robot arm so that effect under loaded condition can be studied. We have to study robot under No Load, Half Load and Full Load condition.
- Number of Cycles (n) – The number of cycles helps to know the robot performance with respect to time and repetitions. So we chose the number of cycles as 10, 25 and 50 times.

Standard L9 Orthogonal Array is used for any system with up to 4 control parameters. Each of them has 3 levels.

EXPERIMENTAL TEST SETUP L9 ORTHOGONAL ARRAY

No.	N(rad/s)	P(Path)	W(kg)	n(Times)
1	558	Straight	0	10
2	558	Circular	2	25
3	558	Zigzag	3.5	50
4	1122	Straight	2	50
5	1122	Circular	3.5	10
6	1122	Zigzag	0	25
7	2250	Straight	3.5	25
8	2250	Circular	0	50
9	2250	Zigzag	2	10

EXPERIMENTATION

Image Processing

Image processing is done using MatLab. The steps involved are given below:

Reading the image

First step in image processing is to read the image in the MATLAB. To do this we use following inbuilt function –

A = imread (filename, *fmt*)

This reads a grayscale or color image from the file specified by the string filename. If the file is not in the current directory, or in a directory on the MATLAB path, specify the full pathname.

Cropping the image

I=imcrop (I)

This command creates an interactive Crop Image tool associated with the image stored in array I, called the target image. The Crop Image tool is a moveable, resizable rectangle that you can position interactively using the mouse.

RGB to Gray Conversion

J=rgb2gray (I);

This command converts the truecolor image I to the grayscale intensity image J. rgb2gray converts RGB images to grayscale by eliminating the hue and saturation information while retaining the luminance. rgb2gray converts RGB values to grayscale values by forming a weighted sum of the R, G, and B components.

Thresholding the gray image

level = graythresh(I)

This computes a global threshold (level) that can be used to convert an intensity image to a binary image with im2bw. level is a normalized intensity value that lies in the range [0, 1].

- Conversion into binary image

BW = im2bw(I, level)

This command converts the grayscale image I to a binary image. Binary image is the image containing only high and low values. The output image BW replaces all pixels in the input image with luminance greater than level with the value 1 (white) and replaces all other pixels with the value 0 (black).

- Calculating total white area of image

total = bwarea(BW)

This function estimates the area of the objects in binary image BW. Total is a scalar whose value corresponds roughly to the total number of on pixels in the image, but might not be exactly the same because different patterns of pixels are weighted differently.

- Complementing the image

IM2 = imcomplement(IM)
This computes the complement of the image IM. IM can be a binary, grayscale, or RGB image. IM2 has the same class and size as IM. In the complement of a binary image, zeros become ones and ones become zeros; black and white are reversed.4

- Removing Noise from the image

BW2 = bwareaopen(BW, P)
This removes from a binary image all connected components (objects) that have fewer than P pixels, producing another binary image, BW2. The default connectivity is 8 for two dimensions, 26 for three dimensions, and conndef (ndims(BW), 'maximal') for higher dimensions.

Profile Projector

Profile projectors are robust measuring tools commonly used in machine shops, quality assurance departments and occasionally on assembly shop floors. They are suitable for measuring and quality control for a wide range of size and weights of objects. The most basic use of a profile projector is to identify a point or edge on the shadow and from this point to calculate a length. By magnifying the image, the operator is less likely to make a mistake when deciding where the edge or point starts.

In our case, we took printouts of our images on transparent papers, and then observed them under Nikon V12-A profile projector. Readings are taken using digital coordinate system for edges and final distance between two probes is calculated. An actual experimental measurement is shown in Fig. 6.7, which shows probe position measurements at 20x zoom.

RESULTS

Robot Controller Data

The XRC controller uses a Teach pendant to program and review robot system data. This teach-pendent show all the information of robot at runtime. This data can be used to get values of robot coordinates for further use. To get the position of data we need to go to setup menu and then we need to open current position tab. This includes robot position information, related to joints, base, robot, tool or user frame. We used robot frame to take the data for our calculations.

The average error calculated using controller data is in the range of 0.107.

Image Processing Data

MATLAB RESULTS FOR IMAGE PROCESSING

No.	Speed (rad/sec)	Path	Load (kg)	Cycles	Average Error (mm)
1	558	Straight	0	10	0.167
2	558	Circular	2	25	0.272
3	558	Zigzag	3	50	0.444
4	1122	Straight	2	50	0.295
5	1122	Circular	3	10	0.458
6	1122	Zigzag	0	25	0.212
7	2250	Straight	3	25	0.358
8	2250	Circular	0	50	0.254
9	2250	Zigzag	2	10	0.219

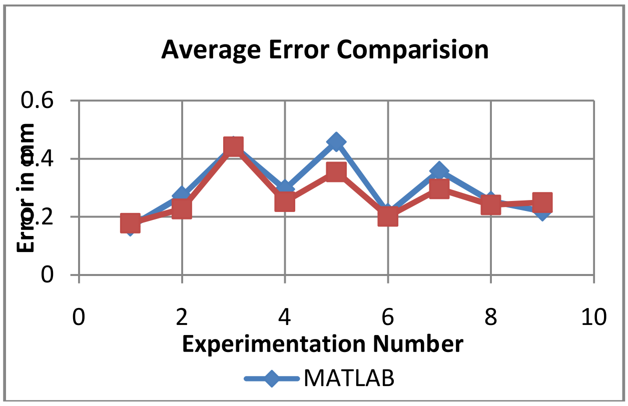
From Table II we can calculate average error as 0.2976. This value can be confirmed using values obtained through profile projector.

Profile Projector Data

PROFILE PROJECTOR RESULTS

No.	Speed (rad/sec)	Path	Load (kg)	Cycles	Average Error
1	558	Straight	0	10	0.178
2	558	Circular	2	25	0.151
3	558	Zigzag	3	50	0.360
4	1122	Straight	2	50	0.205
5	1122	Circular	3	10	0.254
6	1122	Zigzag	0	25	0.214
7	2250	Straight	3	25	0.242
8	2250	Circular	0	50	0.203
9	2250	Zigzag	2	10	0.185

From Table III we calculated average error as 0.271. This shows that the robot accuracy calculated using image processing and profile projector are near about equal. Thus this method confirms the results obtained using image processing.



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Average Error Comparison

Above Fig. 4 shows comparison between results obtained using Image Processing by MATLAB, and manually by Profile Projector. Both the curves tend to have similar nature and this shows that both methods are giving appropriate results.

ANALYSIS

Regression Analysis

The results of average error obtained using MatLab image processing and Profile Projector are analyzed using regression analysis in MS-Excel. Following Table IV gives us values of R2 and Standard Errors. From this table it is clear that our design model is acceptable with percent values of 83.6% to 85.8%.

REGRESSION ANALYSIS STATISTICS

Regression Statistics	MatLab	Profile Projector
Multiple R	0.914380365	0.926141485
R Square	0.836091453	0.857738051
Adjusted R Square	0.672182906	0.715476102
Standard Error	0.058646185	0.043679228

Analysis of Variance

Following Table V gives us the analysis of variance of all four variables for MATLAB and Profile Projector. From this table it is clear that Variable 3 affects the system most in both. Variable 3 is Load in our experiments, and so it is main factor for error in system.

ANALYSIS OF VARIANCE

Intercept	MATLAB		Profile Projector	
	Coeff.	Std. Error	Coeff.	Std. Error
	0.298	0.0196	0.271	0.015
X Variable 1	-0.009	0.024	-0.01	0.018
X Variable 2	0.009	0.024	0.026	0.018
X Variable 3	0.104	0.024	0.079	0.018
X Variable 4	0.025	0.024	0.026	0.018

From this analysis we can get the regression equation as follows,

$$E = k - kN \times N + kP \times P + kL \times L + kn \times n$$

So we get final equations obtained after putting values of Table V in equation (1) as

$$E = 0.298 - 0.0087 \times N + 0.0092 \times P + 0.105 \times L + 0.0248 \times n$$

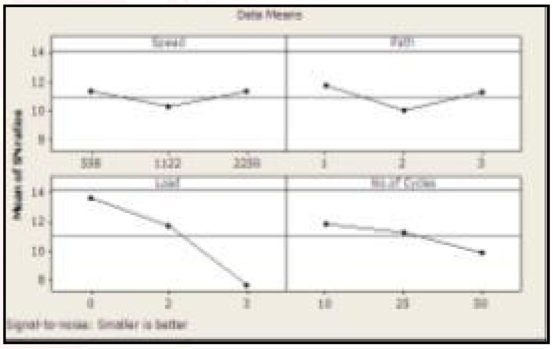
$$E = 0.271 - 0.01 \times N + 0.0275 \times P + 0.0785 \times L + 0.0255 \times n$$

Equation (2) and (3) are regression equations for MatLab and Profile Projector respectively

Analysis of Taguchi Design

Taguchi analysis is done using Minitab software. The inputs and outputs are given to Minitab so that it can analyze the data and give us the best set out of it.

Fig. 5 shows us that the S/N ratios for load variable are changing drastically. This suggests that third variable i.e. load have the highest influence on the system. For optimum result we always want to maximize S/N ratio. From Fig. 5 we can easily see that S/N ratio is more in the case of Speed of 2250, Straight Path, No Load and 10 cycles, and less at Speed 1122, Circular Path, Load of 3.5 Kg and 50 number of Cycles. Using these settings we can predict following results.



Graph of Main Effects Plot for S/N Ratios

CONCLUSIONS

The Yaskawa Motoman SV3 series robot is tested for its performance parameters using non-conventional methods. The conclusions of this projects work can be summed up as follows:

1. From the image processing data shown in Table 5.6, the final error is calculated as 0.2976 mm. This value shows that through image processing we can get the errors in the range of microns. Also this error value shows that the current system is showing errors and needs maintenance and calibration.
2. The data from Table 5.8 obtained from Profile Projector shows the error of 0.271 mm. This confirms our calculation using Image Processing. The Fig. 5.1 shows that the data obtained through image processing and profile projector is similar. Thus our system of image processing proved acceptable.
3. The regression analysis of both systems shows acceptable values of R^2 as 83% to 85%. Also

the normal behavior of input data as shown in Fig. 5.3 shows that our design for experiments using Taguchi approach of L9 Orthogonal array is working well. Taguchi analysis has given best set amongst all the experimental set and according to its prediction the output matches with optimal value.

4. The highest influencing factor in this system is Load followed by Number of cycles, Path and Speed. The Accuracy varies directly with Load, Path and number of Cycles, but shows inverse relation with Speed.
5. The method of image processing is proved to be economical as there is very less cost factor in this method. Also this method is accurate for calibration of robot systems from the results obtained from both MATLAB and Profile Projector, thus method can be used to analyze the robot performance parameters.

FUTURE SCOPE

1. The current method can be modified for better accuracy by upgrading current equipments. Such as by taking lesser diameter probes with more tolerance values, higher resolution cameras, and more accurate calibration scale.
2. The current system can only find the accuracy of system to a specific point. To achieve pose accuracy we need to mount the camera system onto gripper itself. By mounting camera on gripper the 3D analysis of image needs to be done and pattern recognition is required. For doing this we require automated camera with continuous video analysis.
3. Arrangements of sensors like Proximity, infrared, or photo diodes can add more accuracy to the system, as the outputs of these sensors can give us results closer to accuracy.
4. To get accuracy while moving of robot arm, tracking systems like Laser Interferometry or less costly contact systems like one used in Robotrak can be used to get path data.
5. Theodolite systems can serve as cheap and accurate system to measure pose and distance of end effectors compared to other systems.
6. Use of high resolution cameras can add more accuracy to the system as they will accommodate more pixels for given distance.
7. More sophisticate Camera calibration techniques can be used to get accuracy while calculating robot accuracy.
8. Installation of closed robot environment can prevent robot system from external jerks and noise, so that results can be more accurate.

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CULTIVATION OF CORIANDER CROP THROUGH AEROPONIC SYSTEM

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ABSTRACT

The experiment was laid out in shadenet on the farm of Department Of Farm Structure Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during Rabi season of 2017-18. The experimental site was fairly uniform and levelled. Aeroponic System structure was designed for the cultivation of leafy vegetables by Aeroponic hydroponic methods. The dimensions of portable hydroponic structure were 600 x 356 x 300 mm and was made from locally available materials. The structure was made up of mild steel Water Container. Cultivation of Coriander by using two different Environmental Condition one is in Aeroponic System and on the open field. Yield of coriander was found 50 % more in the Aeroponic System than open field condition. Cultivation of vegetables using aeroponic system designed by us gives 35-40 % more cropping area than the field. The estimated cost of this Aeroponic system was estimated project was about Rs. 1687/-.

Keywords- *hydroponics, aeroponic system, Coriander, Nutrient Solution, Control Environment.*

INTRODUCTION

The "hydroponics" a word derived from Greek words "Hydros" means water and "Ponos" means working. Hydroponics is a system of agriculture that utilizes nutrient-laden water rather than soil for plant nourishment (Bridgewood, 2003). Hydroponics is the fastest growing sector of agriculture, and it could very well dominate food production in the future.

Aeroponic systems do not require pesticides, require less water and space than traditional agricultural systems, and may be stacked in order to limit space use vertical farming (Growing Power, 2011; Marginson, 2010). This makes them optimal for use in cities, where space is particularly limited and populations are high-self-sustaining city-based food systems mean a reduced strain on distant farms, the reduction of habitat intrusions, fewer food miles, and fewer carbon emissions. Ingle S. B and et. al. (2016) reported that the crop growth of fenugreek seed after 30 day the crop had 42 leaves and average height of 13.1 cm. Total yield of Fenugreek crop is found to be 70 % more in Aeroponic structure than open field Thus, cultivation of vegetables using aeroponic system designed by Ingle S. B. and et. al. gives 35-45% more cropping area than the field.

MATERIALS AND METHODS

Study Area

The experiment was conducted during Rabi season of 2017 in Shade Net at the field of Department Farm Structures, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The experimental site was fairly uniform and levelled.

Water source

The source of water on the experimental plot was bore well at department of Farm Structure Unit, Dr. PDKV, Akola.

Constructional Details

Covering material

The Structure of aeroponic system model is placed in white green Shade Net house, which provides good weathering conditions for growing of vegetable crops.The frame structure was covered with 50 per cent Shade Net. In addition to this U.V. film with 200 micron gauge was used in Shade Net up to height of 1 m from ground level, for retaining CO_2 in Shade Net house.So, as to increase the growth of plant inside Shade Net.

Construction

An Aeroponic system is consist of steel container of size 600 x 356 x 300 mm, in which thick plastic sheet with 24 number of Cups are provided. The Submersible Motor of 40W (0.06 HP) is used to convey the water to roots of the plants with the help of spray nozzle.

Crop detail

Selection of crop

The selection of crop to be raised in Aeroponic system and is made based on physical size of the structure and economics of crop production.

Coriander (*Coriandrum sativum*) is an annual plant in the family Umbellifers, with leaves consisting broadly lobed at the base of the plant, and slender and feathery higher on the flowering stems. It is cultivated worldwide as a semiarid crop, and its seeds are a common ingredient in dishes from South Asia.

Crop period

The total crop period of Coriander crop in the field from 20 November 2017 to 19 December 2017.

Temperature, Relative Humidity and Light Intensity

Daily inside and outside temperature, relative humidity and light intensity measurement at 8:00, 12:00 and 4:00 hours was carried out with the help of digital thermometer, hygrometer& LUX Meter.

Nutrients

Following Micronutrients are required for the system.

Nitrogen: Phosphorus: Potassium (NPK 19:19:19) 100% Water Soluble

Dose	**Water**
60 gm.	50 liter

Liquid Micro-Nutrients

Dose	**Water**
30 gm.	**50liter**

Nutrient	**% Required**
Zinc (Zn)	3
Iron (In)	2.5
Molybdenum (Mo)	0.1
Manganese (Mn)	1
Copper (Cu)	1
Boron (B)	1

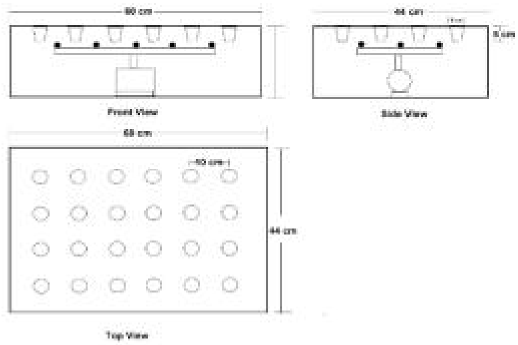


Fig 1. Design of Aeroponic system

Fig 2. Aeroponic System

Fig 3. Internal View of Aeroponic System

RESULT AND DISCUSSION

Environmental parameter

Temperature, relative humidity, light intensity and concentration of CO_2 are the major factors for plant growth. In the present study temperature, relative humidity, light intensity and concentration of CO_2 was recorded throughout the experiment.

Temperature

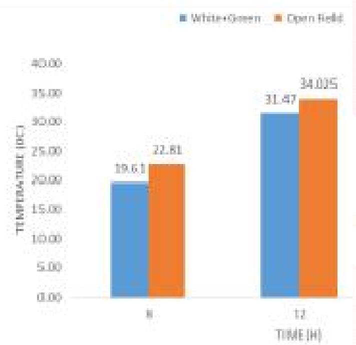
The temperature plays vital role in the vegetative growth i.e. respiration, photosynthesis transpiration, nutrient uptake etc. The average temperature recorded inside the White Green Shade Net house at 8:00 h was 19.61^{0}C, at 12:00 h was 31.47^{0}C and at 16:00 h was 25.65^{0}C respectively. The outside average temperature recorded 8:00 h was 22.81^{0}C, at 12:00 h was 34.02^{0}C and at 16:00 h was 27.1^{0}C.

Relative humidity

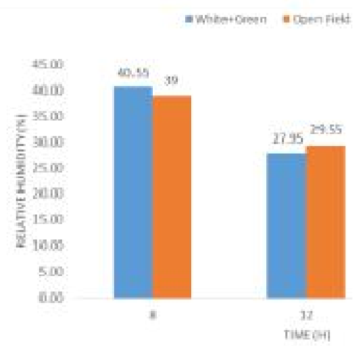
Relative humidity play an important role for plant growth, respiration, transpiration and water uptake by the plant during the growth. The average relative humidity recorded inside the White Green Shade Net house at 8:00 h was 40.55%, at 12:00 h was 27.95 % and at 16:00 h was 30.10 % respectively. Also the outside average relative humidity recorded 8:00 h was 39 % at 12:00 h was 29.55 % and at 16:00 h was 31.45 %.

Light intensity

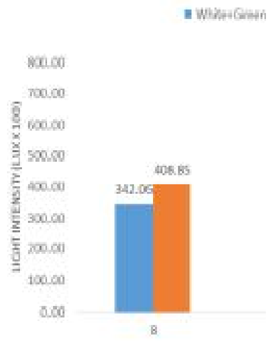
Light plays an important role in progress of photosynthesis of plant. Appropriate light intensity accelerate photosynthesis process at specific environmental condition. Therefore, study of light effect is unavoidable part of the study. The average light intensity recorded inside the White Green Shade Net house at 8:00 h was 34205 lux, at 12:00 h was 43290 lux and at 16:00 h was 42050 lux respectively. Also the outside average temperature recorded 8:00 h was 40885 lux at 12:00 h was 71615 lux and at 16:00 h was 40057 lux.



Graph 1: Temperature with respect to time in Open field and White Green Shade Net house



Graph 2: Relative Humidity with respect to time in Open filed and in White Green Shade Net house



Graph 3: Light Intensity with respect to time in Open field and White Green Shade Net

Germination of seeds

Germination of coriander seeds occurred after 7 days from sowing and in soil germination occurred after 8-9 days from sowing.

Irrigation

First irrigation was provided immediately after sowing seeds then after every day the irrigation was given to the crop. The amount of water applied was 50litter in steel container.

Crop growth stage:

1. after 7 days from sowing: The crop growth of coriander seed after 7 day had 2 leaves and average height of 1.5 cm.

2. after 15 days from sowing: The crop growth of coriander seed after 15 day had 4 leaves and average height of 3.2 cm.

3. after 30 days from sowing: The crop growth of coriander seed after 30 day had 25 leaves and average height of 10.1 cm.

Table 1: Biometric Characteristics of Coriander Crop in Aeroponic Model

Date	No. of leaves	Internodes distance (cm)	Height(cm)	No. of branch	Diameter of steam(cm)
28-11-17	2	0.3	3	1	0.2
01-12-17	3	0.3	3.2	1	0.2
04-12-17	5	0.4	3.5	2	0.3
07-12-17	11	0.5	4.1	3	0.3
10-12-17	17	0.5	5.2	3	0.3
13-12-17	19	1	6.5	3	0.3
16-12-17	21	1.2	7.2	3	0.3
19-12-17	24	1.3	8.3	4	0.4

Table 2: Biometric Characteristics of Coriander Crop in Open Field

Date	No. of leaves	Internodes distance (cm)	Height(cm)	No. of branch	Diameter of steam(cm)
28-11-17	-	-	-	-	-
01-12-17	2	-	1	1	0.2

04-12-17	3	0.3	3	1	0.2
07-12-17	4	0.3	3.5	2	0.3
10-12-17	6	0.4	4.0	2	0.3
13-12-17	9	0.4	4.2	3	0.3
16-12-17	11	0.5	5.2	3	0.4
19-12-17	14	0.5	6.5	5	0.5

Yield

Total yield of Coriander crop was found in Aeroponic structure was 250 gm & open field was 123 gm, Thus, cultivation of vegetables using aeroponic system designed by us gives 35-40 % more cropping area than the field.

Fig 4. Growing of Coriander in Aeroponic System

Cost estimation of Aeroponic System

The estimated cost of this Aeroponic system was estimated and is given in Table 3The total cost for the project was about Rs. 1687/-

Table 3: Cost Estimation

Material	Quantity	Amount (Rs.)
Tray	1	400
Aggregate	250 gm.	50
Coriander seeds	20 gm.	20
Submersible motor	1	350
Rubber pipe	1	10
Spray nozzle	12	25
Thick Plastic sheet	1	350
Hydroponic Plastic Cups	24	72
CPVC Pipe	1	190
CPVC Elbow	4	40
CPVC Tee	7	140
CPVC End Caps	4	40
	Total	1687 /-

CONCLUSION

From the Experiment conducted in Shade net house on Field of Department of Farm structures, Dr.PDKV, Akola in Designed Aeroponic System following conclusions were drawn,

1. The “aeroponic system” was designed and installed successfully.
2. Highest germination was achieved i.e. 98% in Aeroponic system which was 32% more than germination percentage quoted by the manufacturing company of seed (Durga Seed India)
3. Yield of Coriander, crop in aeroponic system was 50% more than the yield obtained from open field conditions.

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RANSOMWARE: A CHALLENGE TO CYBER WORLD

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ABSTRACT

With the increase in use of Internet and technology cybercrimes are also increasing. Ransomware encrypts victim's data and do not release decryption key until the ransom is paid. Ransomware is a new way of extortion. Ransomware do not allow you to access your device for Ransom. In this paper Ransomware is discussed in detail.

Keywords:- *Ransomware, Ransom, Crypto.*

INTRODUCTION

Ransomware is a malware, which is designed to restrict access to system until Ransom is paid. Ransomware may lock thr computer or encrypt files and restrict access.The demand is displayed either by a text file or web page in browser. Ransomware may enter into system via spam email, downloads & botnet, advertisement and many more.

Ransomware is medium to generate revenues using Crypto Ransomware and Locker Ransomware.Crypto Ransomeware encrypt files and data on system and Locker Ransomware Locks the victim's Computer.Crypto Ransomware mostly accept payments in form of cryptocurrency and Locker in the form of vouchers.

TYPES OF RANSOMWARE

These Ransomware are improved with the technological advances and widespread use of Internet, to make it more terrifying and powerful over the years.Some of the Ransomware are explained below:

FAKEAV – This malware forces users to purchase their bogus antimalware software by showing fake scanning results.

A Ransomware zip's certain type of files usually .DOC, .XL, .DLL, .EXE and overwrites these, keeping only the password protected zip files in the user's system along with a ransom note in the notepad.

SMS Ransomware asks to call a premium SMS number and also displays a Ransomware page continuously to users as long as they do not pay the ransom.

A Ransomware targets Master Boot Record of a vulnerable system to prevent the operating system from loading and displays its ransom notification.

Reveton or Police Ransomware impersonates local police by showing a notification page, informing them that they were caught doing an illegal or malicious activity online. Reveton employ different payment methods

Some Ransomware play an audio recording using the victim's native language and some bears a fake digital certificate.

CryptoLocker Ransomware encrypts files, rather thanlocking the system to ensure that users will pay though the malware is deleted. The spammed message contain malicious attachment, downloading attachment downloads the CryptoLocker malware.

CryptoDefense or Cryptorbit, malware demands payment for its decryption services.This can easily spread compared to other via removable drives eliminating need of relying on downloader malware to infect systems. This malware not only encrypts atabase, web, Office, video, images, scripts, text, and other nonbinary files but also deletes backup files to prevent restoration of encrypted files.

BitCrypt is more refined Ransomware incorporate Cryptocurrency e.g., Bitcoin theft with two variants first uses an English ransom note and the second uses a multilingual ransom note.

FAREIT variant, information stealing malware can steal information from various Cryptocurrency wallets containing important information like transaction records, user preferences, and accounts.

CryptoLocker variant Ransomware abuse Windows PowerShell feature to encrypt files to make threats undetected on the system and/or network.

Bitcoin (CTB) Locker Ransomware uses the Tor network to mask its C&C communications, asks for Bitcoins as ransom. CTB Locker variant

TorrentLocker Ransomware adds CAPTCHA code and redirection to a spoofed site.

PROCESS

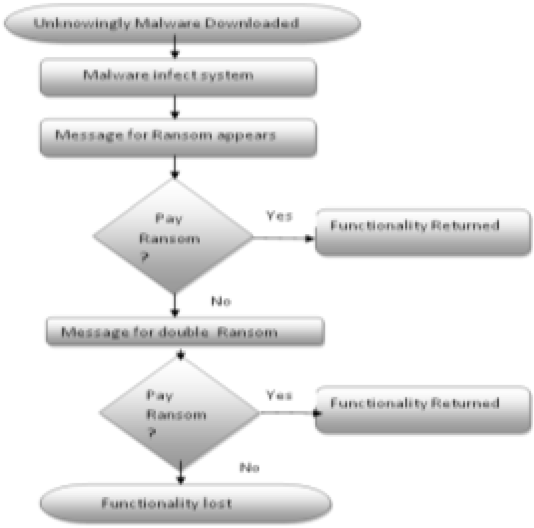

Fig: Ransomware Process

CONCLUSION

Cybercriminals are always look for new tricks and techniques, opportunities to make damage and compromise. Ransomware is a type of virus or malware that prevents or limits users from accessing their system resources. Ransomware forces its victims to pay the ransom through certain online payment methods to grant access to their systems, or to get their data back. Cybercriminals primarily focus on refining existing tools and techniques surely Ransomware is evolving progressively. Thus, it is important for users to know how Ransomware functions and best possible ways to protect them from Ransomware threat. Mobile Ransomware attacks are expected to increase due to the migration of business on portable devices and so it becomes essential we should be able to identify how, where, when, and why a threat operates.

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INVESTIGATIONON SOLAR OPERATEDKNAPSACK SPRAYER IN VEGETABLE PRODUCTION

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ABSTRACT

Traditionally the hand lever operated knapsack sprayerinvolves fatigue due to continuous hand lever operation results in the low efficiency. Now a days the power operated knapsack sprayers available in the market but it is associated withmore vibrations, noise levels causes the high level of fatigue during the operation hence labors are reluctant to use this types of sprayer. Also in the remote area due to unavailability of fuel and electricity there were lot of problems occurred in the agricultural operation. In orderto overcome theseproblems solar cum hand operated Knapsack Under this study performance evaluationof solar sprayer was carried out in laboratory as per the Indian standard using different test rigs in testing center and field tests were carried out on different crops in the field. The field efficiency of using SPV, battery cum hand operated knapsack sprayer and Hand lever operated knapsack sprayer was 89.42 and 80.39 per cent, respectively and the solution required for spraying one ha field were found to be 498 litres and 512 litres, respectively. SPV, battery cum hand operated knapsack sprayer has twotimes greater field capacity than hand operated knapsack sprayer.

Key Words:*Knapsack sprayer, performance of SPV module, flow rate, laboratory test, field test, nozzles, Okra and Bitter guard*

INTRODUCTION

Spraying is one of the most important operations in crop production. The need of chemical application arises from man's desire to protect his crop from attack of various pests and diseases. Spraying operation is a complex process and can be influenced by many variables. The magnitude and uniformity of spray deposition depend on the canopy geometry, pesticide properties; spray equipment design, application parameters and weather conditions (Thread Gill and Smith, 1975).

“Energy - demand” is one of the major threads for our country. Finding solutions, to meet the “energy demand” is the great challenge for social scientist, engineers, entrepreneurs and industrialist of our country. According to them, applications of non-conventional energy are the only alternate solution for conventional energy demand. SPV cum Hand operated hybrid knapsack sprayer can use in remote areas by using solar energy, when solar and electrical energy not available hand operated lever can be used for spraying operation without creating pollution and noise.This type of sprayer makes spraying operation ecofriendly.

METHODOLOGY

This deals with the performance evaluation ofSolar cum hand operated hybrid knapsack sprayerin laboratory and field. The methodology used for research work is discussed in following sections.

Performance of SPV module at different atmospheric condition

For study of V-I characteristics of module, it was placed on flat surface in sunshine hours from 9.00am to 5.00pm. When solar radiation incident on module, electric current is generated. Charge controller was used to control the charging and prevents from reverse flow of current. Amultimeter was used to measure the current and voltage in the circuit. Solar intensity was measured by pyranometer, wind velocity measured by anemometer, panel temperature measured by IR thermometer and ambient temperature measured by mercury thermometer.

Fig4: Field Test of sprayer on Bitter gourd crop

The observation of V_m, I_m of solar panel was recorded at different condition and the power was determined by using the equation.

$$P_m = I_m \times V_m ....(1)$$

Where,
P_m= Power, W I_m= current, A V_m= Voltage, V

Efficiency of SPV module

The efficiency of the solar panel was determined by the following equation.

$$\eta = \frac{Vm \times Im}{I \times S} X\,100 \text{ .... } (2)$$

Where,
Vm– Maximum voltage, V Im – Maximum current, A,
I – intensity of radiation, W/m^2S – Area of the cell, m^2

Fill factor of solar cells can be calculated by using the following relation;

$$F.F. = \frac{(Vm \times Im)}{(Voc \times Isc)} \text{ .... } (3)$$

Where,
V_{oc} – open circuit voltage, V, I_{sc} – short circuit current, A

Therefore, the maximum power output, Pm in Watts can be calculated as:

$$Pm = V_m \times I_m = V_{oc} \times I_{sc}$$

Field Evaluation of Solar sprayer

1. Speed of operator

For calculating travelling speed two poles 15m apart was placed approximately in middle of the test run. On the opposite side also two poles were placed in similar position, 15m apart so that four poles forms corners of rectangle, parallel on long side of the plot. The speed was calculated from the time required for operator to travel the distance (15 m) between two poles. Average of such reading was taken to calculate the speed of operator. The forward speed of operation was calculated by observing the distance travelled and time taken and calculated by following formula (Mehta et al., 2005).

$$S = \frac{L}{T} \text{.......... } (4)$$

Where,
S = speed of operation, (m/s) L = distance travelled, m t = time taken, s

2. Theoretical field capacity

For calculating the theoretical filed capacity, working width of spray nozzle and travelling speed has been taken in to consideration. It is always greater than the actual field capacity. Theoretical field capacity is calculated by using following formula (Mehta, et. al. 2005).

$$T.F.C. = \frac{S \times W}{10} \text{ .... } (5)$$

Where,
T.F.C. = theoretical field capacity, (ha/h)
W = theoretical width of Spray nozzle, (m)
S = speed of operation, (km/h)

3. Effective field capacity

For calculating effective field capacity, the time consumed for actual work and lost for other activities such as turning and filling the tank of spray. Effective field capacity was calculated by following formula (Mehta, et. al. 2005).

$$E.F.C. = \frac{A}{T_P + T_1} \text{ .... } (6)$$

Where,
E.F.C. = effective field capacity (ha/h) A = area (ha) Tp= productive time (h)
T_1= non-productive time, (h)

4. Field efficiency

Field efficiency will be calculated by taking ratio of effective field capacity to theoretical field capacity. It is always expressed in percentage. It was calculated by following formula (Mehta et al., 2005).

$$\text{Field efficiency (\%)} = \frac{E.F.C.}{T.F.C.} \times 100 \text{....... } (7)$$

Where,
E.F.C. = effective field capacity (ha/h) T.F.C. = theoretical field capacity (ha/h)

The field test was carried out in following steps:

$$\text{Area of Test plot} = \text{Length} \times \text{Width} \text{ .... } (8)$$

$$\textit{Application Rate} = \frac{\text{Volume rate } (\frac{lit}{h})}{\text{Area rate of sprayer } (\frac{ha}{h})}, \text{ lit/ha .... } (9)$$

RESULTS & DISCUSSION

Performance evaluation of SPV module

The performance evaluation of the SPV module was evaluated considering V-I characteristics, power output and its conversion efficiency. From fig.2 clear that maximum solar intensity was at 12:30 pm (682.36 W/m^2) and minimum at 5:00 pm (101.35 W/m^2). Maximum current and voltage of SPV module obtained at solar intensity 658.10 W/m^2 and ambient temp of 32.9^o C is 0.61 A and 18.43 V respectively.

Effects of ambient temperature and SPV module temperature, solar intensity on power output

According to study of SPV parameters over different atmospheric condition at maximum and minimum ambient temperature 40.1^{o}C and 24.2^{o}C at 13:30 pm and 9:00 am respectively, Maximum and minimum module temperatureWas 48.2^{o}C and

33.39°C at 14:30 pm and 17:00 pm respectively. Fig.3 gives the variation in solar intensity, ambient temperature and module temperature with respect to time. From figure, it has been observed that as solar intensity increases, increase in ambient temperature was found which resulted in increase in module temperature. The maximum solar intensity was found to be (682.36 W/m^2) with corresponding ambient and module temperature of about 36.6^{0}C and 45.33 ^{0}C at 12.30 pm, respectively.

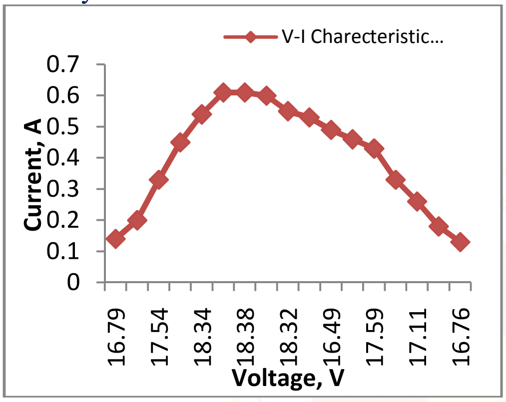

Fig 2.V-I Characteristic of SPV Module.

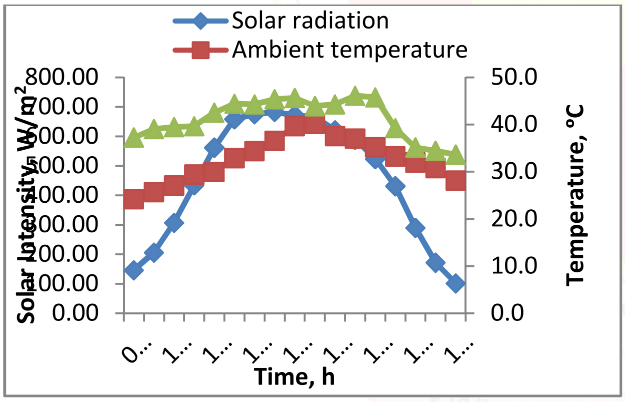

Fig 3.Variation in solar intensity, ambient Temperature and module temperature with respect to time

Fig.4 gives the variation in power output, ambient temperature and module temperature with respect to time. It was observed that as ambient temperature increases, module temperature was also increased which resulted an increase in power output due to thermal losses in system. The maximum ambient temperature was found to be 40.1^{0}C with corresponding module temperature of about 48.2 ^{0}C which cause decrease in power output of about 9.56 Watt at 13: 30 pm. The maximum power output was found to be 11.24 Watt at 11.30 am with corresponding ambient and module temperature of about 32.9 and 44.2 ^{0}C, respectively.

Maximum and minimum solar intensity 682.36 W/m^2 and 101.35 W/m^2 recorded at temperature of 36.6°C and 28.1°C respectively. It was observed that increases in ambient temperature resulted in increase in solar intensity and vice versa. Fig.5 shows variation in solar intensity and ambient temperature with respect to time.

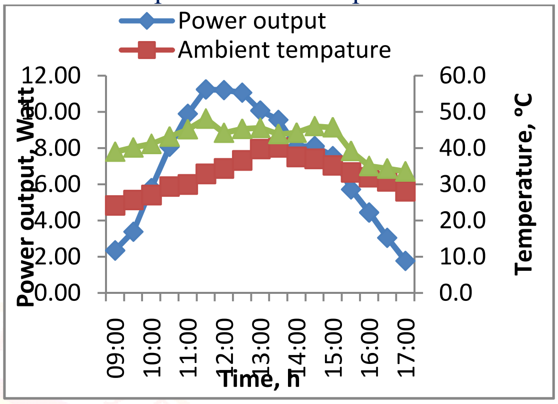

Fig 4. Variation in power output, ambient temperature and module temperature with Respect to time.

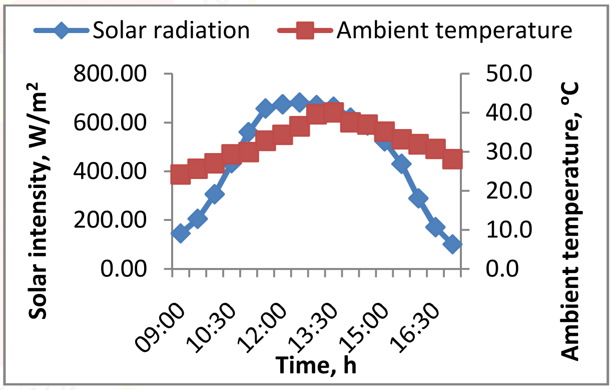

Fig 5.Variation in solar intensity and ambient temperature with respect to time.

Effects of solar intensity on power output and efficiency of SPV Module

According to observations recorded maximum and minimum power output 11.24 W and 2.18 W was obtained at solar intensity 658.10 w/m^2 and 101.35 W/m^2 respectively. It was observed that increase in solar intensity resulted increase in power output of SPV module and vice versa. Fig.6 shows variation in power output of SPV module against the solar intensity.

Variation in power output of SPV module with respect to solar intensity

The maximum and minimum efficiency of SPV Module was 12% and 8% at solar intensity of 433.93 W/m^2 and 620.73 W/m^2. It was resulted that Efficiency of SPV module increases as increase in ambient temperature and solar intensity and decreases as increase in panel temp. Increases beyond limit maximum efficiency of module is obtained at standard temperature 25°C and intensity of solar radiation 1000 W/m^2. Fig.7 shows variation in efficiency of SPV module with respect to solar intensity.

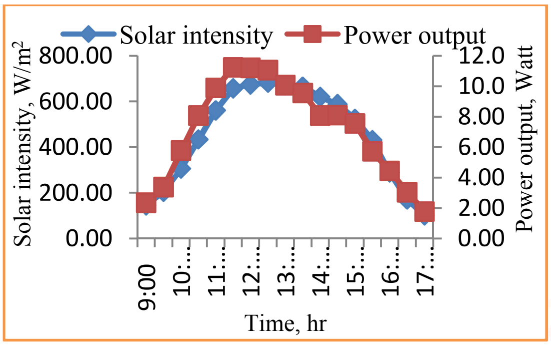

Fig.6Variation in power output of SPV module against solar intensity Curve

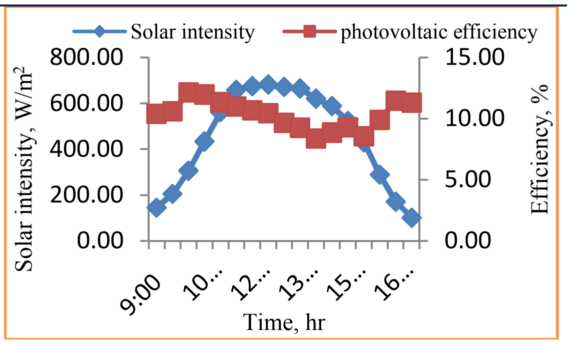

Fig.7Variation in efficiency of SPV Module against solar intensity Curve.

Table 1. Comparison between different points in spraying of okra and bitter guard using hollow cone nozzle and twin nozzle by SPV, battery cum hand operated knapsack sprayer

S.N.	Parameters	Okra Crop		Bitter guard Crop	
		Hollow cone nozzle	Twin nozzle	Hollow cone nozzle	Twin nozzle
1	Time for Spray (h/ha)	12.19	10.15	18.32	15.66
2	Swath width (m)	0.51	0.61	0.51	0.61
3	Speed of operation (km/h)	1.83	1.83	1.48	1.48
4	Theoretical field capacity (ha/h)	0.093	0.111	0.075	0.090
5	Actual Field Capacity (ha/h)	0.080	0.094	0.059	0.072
6	Field efficiency (%)	86.02	84.68	78.66	80.00
7	Solution required (lit/ha)	498	520	823	815

Table 2.Observations of parameters of SPV module in different atmospheric condition

S.N.	Time, h	Ambient temp., °C	I, W/m2	Sw, m/s	SPV Panel			Power, W	η,%
					Current, A	Voltage, V	Module temp., °C		
1	09:00	24.2	145.56	1.11	0.14	16.79	39.02	2.35	0.10
2	09:30	25.7	205.56	0.88	0.2	16.93	40.2	3.39	0.11
3	10:00	27.1	306.69	0.92	0.33	17.54	41.2	5.79	0.12
4	10:30	29.4	433.93	1.60	0.45	17.95	43.2	8.08	0.12
5	11:00	30.0	561.47	1.60	0.54	18.34	45.2	9.90	0.11
6	11:30	32.9	658.10	1.10	0.61	18.43	48.2	11.24	0.11
7	12:00	34.4	675.07	2.30	0.61	18.38	44.24	11.21	0.11
8	12:30	36.6	682.36	1.00	0.6	18.45	45.33	11.07	0.10

9	13:00	39.7	671.53	0.80	0.55	18.32	45.61	10.08	0.10
10	13:30	40.1	665.04	0.20	0.53	18.04	43.89	9.56	0.09
11	14:00	37.6	620.73	0.40	0.49	16.49	44.26	8.08	0.08
12	14:30	37.0	588.80	1.20	0.46	17.62	46.09	8.11	0.09
13	15:00	35.2	523.45	1.20	0.43	17.59	45.76	7.56	0.09
14	15:30	33.3	431.06	1.10	0.33	17.36	39.21	5.73	0.09
15	16:00	32.0	289.43	0.90	0.26	17.11	35.11	4.45	0.10
16	16:30	30.8	171.41	0.60	0.18	16.96	34.41	3.05	0.11
17	17:00	28.1	101.35	1.10	0.11	16.18	33.59	1.78	0.11
Avg.			454.80	1.06	0.40	17.56		7.14	0.10

Table 3. Observation for field efficiency of SPV, battery cum hand operated knapsack sprayer

S. N.	Length (m)	Time (Sec)	Speed (Km/hr.)	Width of spraying(m)	T.F.C (ha/hr.)	E.F.C. (ha/hr.)	Field efficiency (%)	Avg. field efficiency (%)
1	15	29	1.86	0.50	0.093	0.080	86.11	
2	15	31	1.74	0.52	0.091	0.082	90.06	89.42
3	15	30	1.80	0.51	0.092	0.085	92.10	

Table 4. Observation for field efficiency of hand operated knapsack sprayer

S. N.	Length (m)	Time (Sec)	Speed (Km/hr.)	Width of spraying(m)	T.F.C (ha/hr.)	E.F.C. (ha/hr.)	Field efficiency (%)	Avg. field efficiency (%)
1	15	44	1.23	0.46	0.056	0.045	79.20	
2	15	48	1.13	0.48	0.054	0.043	80.37	80.39
3	15	46	1.17	0.45	0.053	0.043	81.59	

CONCLUSIONS

This research work was undertaken for development of SPV, battery cum hand operated knapsack sprayer for field crop spraying.. Following conclusions are made from the present research study. Maximum short circuit current (I_{sc}) power (W) developed by the solar cells is found at 11:30 am.The relation between the I_{sc} and V_{sc} represents that the V_{sc} always approximately remains constant and I_{sc} vary according to increase in ambient temperature and it is maximum at noon. The V-I characteristic of the solar PV module changes as the solar intensity increases and Isc also increases as the solar intensity increases. The field trial data represented that time require to spray 1 ha field by SPV, battery cum hand operated knapsack sprayer is 1.75times less than time required to spray by Hand lever operated knapsack sprayer, feels less fatigue to operator. Field capacity of SPV, battery cum hand operated knapsack sprayerand Hand operated knapsack sprayer were obtained as 0.082ha/h and0.044 ha/h, respectively, that means SPV, battery cum hand operated knapsack sprayer has2times greater field capacity than Hand operated knapsack sprayer

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SOLAR DRYER ASSISTED WITH AGRO RESIDUE BASED HOT AIR GENERATORFOR DRYING OF AGRICULTURAL PRODUCTS

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ABSTRACT

Dryingis very important process applicable for agricultural and industrial products. Drying is the moisture removing process from the productsand will helpful for preserving the products for long time. Solar drying is the oldest method of products drying. Open air solar drying method is used frequently to dry the agricultural products however quality could not maintain in this method and require more time In order toproduce better quality produce solar drying methods is the alternative method of drying wherein the colour, aroma and taste of the product could be maintained. Different solar drying methods are direct solar drying, indirect solar drying, and mixed mode solar drying but these dryers would be functional only during clear sunshine hours of the day time. Some agricultural commodities need to be dried continuouslywhere combined solar dryer assisted with agro residue based hot air generator could be used effectively for uninterrupted drying. In this paper an attempt has been made to reveal the various solar biomass hybrid drying system for efficient drying of fruits and vegetables. A wide range of solar dryers is available with various characteristics for drying of crops and food products. A prototype solar dryer with a biomass combustor is designed and developed for the use of small scale rural farmers to dry their harvested fruits and vegetables. The traditional direct sun drying was only dependent on the availability of solar radiation.

***Key words**: Biomass combustor, solar cabinet dryer, drying rate, hot air generator, preheater*

INTRODUCTION

India receives good amount of solar radiation in the range of 4–7 kWh/m2-dayaround 300–330 days in a year. Thus, it is one of the most promising sources of energy.Unlike fossil fuels and nuclear energy, it is an environmentally clean source of energy.Secondly, it is free and available in adequate quantities in almost all parts of the worldwhere people live in. Solar energy is always in an advantageous position comparedwith depleting fossil fuels. In a tropical country like India, most of the energy demandscan be met by simple systems that can convert solar energy into appropriate forms. Byproper application of technologies, excellent thermodynamic match between the solarenergy resources and many end-uses can be achieved (Sreekumar 2011a, b).

Drying is one of the most prevailing methods of food preservation, where themoisture is removed preventing the growth of micro-organisms that causes fooddamage. This method helps in reducing the weight and volume of the productwhich reduces the transportation and storage load and also helps in storing thefood in ambient temperature.Solar drying has been considered as one of the most promising areas for the utilizationof solar energy, especially in the field of food preservation. Open sun dryingis the most common method employed in tropical countries for the drying of agricultural products, food stuffs, etc. The method is simple, as it does not involveany costly equipment. The product to be dried is spread under sun, and the moistureevaporates from it over a course of time. Even though the process is simple, itsuffers from disadvantages such as dust contamination, insect infestation, microbialcontamination and spoilage due to rains. Product dried in this way is unhygienicand sometimes unfit for human consumption (Garg and Prakash 1997).

The hybrid solar dryers combine the features of the direct and indirect type solar- energydryers. Here the combined action of incident direct solar radiation on the product to be dried and airpre-heated in a solar collector heater produces the necessary heat required for the drying process. Solar air heater with PCM (Phase change media) based thermal storage system is the solarenergy collection for it’s off sunshine hours use. A phase change material is a solid and meltedwhich stores energy. The melting temperature may be fixed or may vary over a small range. Thestored energy is recovered upon solidification of the liquid. In this system, solar energy stored inthermal energy storage system (TESS), during sunny days and recovered later at night or duringcloudy days. (R. T. ramteke, 2016)

Prasad et al., (2006) reported the performance evaluation of hybrid drier for turmeric (Curcuma longa L.) drying at village scale. The developed natural convection solar drier with biomass burner was capable of producing the air temperature between 55 and 60 0C, that was optimum for dehydration of turmeric rhizomes as well as other spices, herbs, fruits and vegetables. Drying time for turmeric had been drastically reduced compared to open sun drying by 86%. The efficiency of the whole unit observed was 28.57%. The system was predestined for application on small farms in developing countries due to its low investment

SOLAR BIOMASS HYBRID DRYING SYSTEM

In the Department of Unconventional Energy Sources, Dr. PDKV, Akola solar dryer assisted with agro residue based hot air generator was designed and developed for continuous drying of Agril. produce. The hybrid biomass combustor and solar dryer will provide the solution for efficient utilization of available biomass. It utilizes the flue gas heat for application like drying of fruit and vegetables with minimum pollution and product degradation. The overall efficiency of biomass utilization in biomass combustor cum hot air generator can be increased by using wasteheat from the flue gases through circulation.The dryer design uses direct solar energy and biomass energy through hot air, produced by a combustor, and circulates inside the dryer for drying of product.

Components of the system

1. Solar dryer
2. Agro residue based combustor cum hot air generator
3. Pre-heater

1. Solar dryer:

A natural convection solar cabinet type solar dryer was retrofitted toagro residue based hot air generator system having capacity of 50 kg for drying of various agril. produce. It was consisted 8 trayswith collector area 3.84m^2.

2. Biomass combustor

Biomass combustor is used to produce hot air by burning agro residue. Tube and shell type heat exchanger was being used to heat the air. This hot air was supplied to the solar cabinet dryer where the products are placed for drying.

3. Pre-heater

In order to increase the efficiency of biomass combustor preheater was used wherein four heat exchangers were used which helps to recirculate the heat available in exhaust flue hot gases.

Fig 1.Solar dryer assisted with agro residue based hot air generator

The combustor was manufacture using galvanized iron sheet, with two concentric cylinders innercylinder having inverted cone at top with exhaust holes for escape flue gases. This flue gases are recirculated for more heat. The sufficient spaced provided in between two cylinders for proper heat exchange between hot flue gases and fresh air which is transfer to dryer for drying purpose. Air at ambient temperature coming from the blower come in contact with inner shell of the combustor and get heated. A chimney was provided at side of the combustor for the release of the flue gases. The developed solar dryer took shorter drying time with 9 hours of day time solar radiation and 6 hours of night time with biomass combustor. This hybrid dryer produces a better quality product and depends on the heat source; reduce the drying time by up to 50 percent compared to traditional drying.

DRYING OF AGRICULTURE PRODUCT

Vasanthi (2002) studied the development of efficient biomass based dryer for medicinal plants drying. The drying of medicinal plants was conducted at an average air flow rate of 0.2 - 0.3 m/s. When the experiment was carried out with load condition, the maximum temperature of 50 to 55 ºC was attained inside the unit after 30 minutes of combustion process. The maximum temperature of 50- 55ºC was maintained by adjusting the airflow rate through the door. The efficiency of the biomass fuel based drying system was varied from 30.5% to 37.5% for different selected medicinal plants drying. Dryer efficiency significantly depended on the initial moisture content of the drying material and the airflow rate. Tariganel *al.* (2005) reported that a mixed mode natural convection solar dryer, designed for small-scale commercial producers of agricultural products in non-electrified locations, has been demonstrated which was combined with a simple biomass burner and bricks heat storage as back-up heating system. The back-up heating system which can be constructed with easily available materials, tools and skills, can improve the viability of the dryer. Certain key design features of the dryer contributed to produce an acceptable thermal efficiency and uniformity of drying air temperature across the trays. These features include the jacket and gap enclosing the drying chamber and arranging the bricks for storing heats. However, improvements in the performance of dryer could be achieved through further modifications, which include:

• Increasing the distance between tray 1 and bottom plate of drying chamber to decrease the excessive temperatures on the tray, especially during burning fuels;

• Using two layers of glazing to reduce the thermal losses from the cabinet. In addition, Performance test should be made with different kind of agricultural products and with

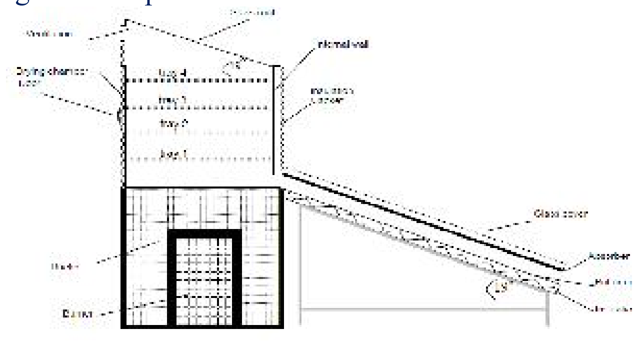

Fig2.: Cross Section of Dryer

Andrew *et al.* (2013) state that a natural convection indirect solar dryer with backup biomass burner for small scale pepper berry farmers was design and implemented. The proposed solar dryer could preserve and protect the pepper berries from rain, dust, insects and animals during whole drying process. It was also portable, cheap and affordable. Therefore, it can easily be handled from one place to another for drying of pepper berries at the required site. The proposed natural convection solar dryer was found to be more suitable for small scale rural farmers living far from national grid. The additional biomass backup burner allowed the continuous drying process at nights and during wet seasons. It shortened the drying duration of pepper berries from 5-7 days to a single day with continuous drying. It increased the productivity of small scale rural pepper farmers as they could produce the dried pepper berries in a shorter period of time. Moreover, the chemical specifications of dried pepper berries using proposed dryer also met the set standards of American Spices Trade Association.

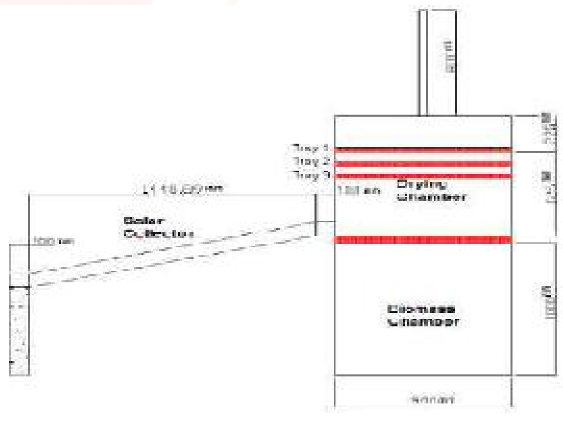

Fig.3: Components of proposed prototype solar dryer model

Daniel *et al.,* (1996) studied that processing of agricultural produce not only contributed to food preservation but also offered better opportunity for expanded product utilization and added value. Direct sun drying method was time consuming and it was taken 4-6 days to dry agricultural food products (20 mm thick, loading rate 5 kg/m2) to 14-16 per cent moisture content. Product quality suffered because of prolonged drying, which made the product susceptible to contamination. Solar dryers produced better quality products within a relatively shorter period, but depended mainly on the weather and, therefore, not reliable and attractive during the rainy season or in wet weathers.

Ana Salvatierra-Rojas (2017) Drying of paddy rice is problematic in monsoonregions such as the Philippines, where rainfall events canoccur even during the dry season. Sun drying poses ahigh risk for spoilage, when the time is too short to pileand cover the paddy in case of sudden rainfall. Thisproblem may be solved with the inflatable solar dryer, asthe water-proof structure protects the paddy even underheavy rainfall. The dryer is easy to transport and can beinstalled at a new location within 30 min. The simpledesign is easy to operate and maintain as it is made ofplastic material and has few moving parts.

B. K Bala et al [12] proposed the solar tunnel drierwas installed at the yard of the workshop of theDepartment of Farm Power and Machinery,Bangladesh Agricultural University, Mymensingh,Bangladesh. The drier was placed on raised platform.Mushrooms used for solar drying were collected fromthe local markets of Mymensingh and Savar. Threetests on solar drying of Mushrooms were carried outat Bangladesh Agricultural University, Mymensinghin the month of May in 2007 and in the month of
March and May in 2008.

Ojike. O et al [14] samples of pawpaw fruit weredried in the open-air and with solar dryers. Vitamin A, B1, B2, C and E were analysed to determine theirconcentrations before and after drying. In all casesthere were significant changes in the concentration ofvitamins after drying. The changes were much inopen-air drying than in solar dryers used. Thus, theuse of solar dryers for drying of pawpaw is highlyrecommended. Among the solar dryers usedLatitudinal box dryer gave the best result in terms ofvitamin retention.

Sarmidi Amin (2008) Cocoa farmers need cheaper dryers. As an effort to help Indonesian cocoa farmers to overcome the above-mentioned situation, a solar tunnel dryer has been designed, manufactured, and tested. The dryer was designed to use solar energy as its energy source either for raising temperature of drying air or driving the fan. The dryer capacity was designed for 500 kg wet beans per batch.

CONCLUSIONS

The paper enlighten on various solar biomass hybrid drying system for drying of agricultural produce. Solar energy in India, there was a need to enhance the output of solar drying system by extending the drying operation beyond solar hours. The thermal efficiency of the combustor-cum-air heater would be about more than 70 per cent for hot air temperature of and hotair temperature of 60^0C. It would not emit fly ash/smoke and has provision of control of the air temperature and flow rate.The system could be used at village level and in the industry for drying green chillies,spinach, coriander etc. The system would be cost effective for continuous operation of drying of high valued crops

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NEW EMERGING TREND INDIAGNOSIS AND TREATMENT USING PILL-CAMERA: A SURVEY

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ABSTRACT

The aim of technology is to make products in a large scale for cheaper price and increased quality. As the current manufacturing technology is at macro level but the future lies in manufacturing product at molecular level. On the basis & advent of nanotechnology one such product manufactured is pill camera. "Camera Pill" or Capsule endoscopy is a new diagnostic tool that permits a direct visual examination of the small intestine, an area of the body not previously accessible using upper endoscopy from above or colonoscopy from below. The pill, known as the Capsule Endoscopy, is about the size of a multivitamin and is swallowed with a sip of water. The pill is made of specially sealed biocompatible material that is resistant to stomach acid and powerful digestive enzymes and thus every care is taken such that the caps will not rupture or burst. Its non-invasive diagnostic alternative that is relatively quick, easy, office based test that will encourage people to see their doctors to get checked for diseases, Capsule endoscopy helps your doctor evaluate the small intestine. This part of the bowel cannot be reached by traditional upper endoscopy or by colonoscopy. The most common reason for doing capsule endoscopy is to search for a cause of bleeding from the small intestine. It may also be useful for detecting polyps, inflammatory bowel disease (Crohn's disease), ulcers, cancers, and anemia and tumors of the small intestine. It takes picture of our intestine and transmits the same to the receiver of the computer for analysis of our digestive system. This process can help in tracking any kind of disease related to digestive system.

Keywords:*colonoscopy, endoscopy polyps,crohn's disease.*

INTRODUCTION

The pill camera is a new diagnostic tool that permits a direct visual examination of the small intestine. It is that area of the body which is not previously accessible using upper endoscopy or colonoscopy. The pill is known as M2A capsule endoscopy. It is a recent technology in which thousand of digital photos of small bowel are provided for medical use. It is too effective that it provides two photos per second when a large size Capsule (like Vitamin) is ingested. Swallow able camera capsule naturally passes over the body within 8 to 72 hours and it provides 60,000 images for quick diagnosis.

Nanotechnology: Pill camera is one of its example which takes pictures of our intestine and transmits the same to the receiver of the Computer for analysis of our digestive system. This process can help in tracking any kind of disease related to digestive system.

PILL –SIZED CAMERA

Imagine a vitamin pill-sized camera as shown in figure that could travel through your body taking pictures, helping diagnose a problem which doctor previously would have found only through surgery. No longer is such technology the stuff of science fiction films.

Figure I: Pill Sized Camera

VIDEO CHIP

Video chip consists of the IC CMOS image sensor which is used to take pictures of intestine .The lamp is used for proper illumination in the intestine for taking photos. Micro actuator acts as memory to store the software code that is the instructions. The antenna is used to transmit the images to the receiver. For the detection of reliable and correct information, capsule should be able to design, to transmit several biomedical signals, such **as pH, temp and pressure.**

COMPONENTS OF CAPSULE CAMERA

As shown in the figure capsules consist of Eight Components with their respective function as below:-

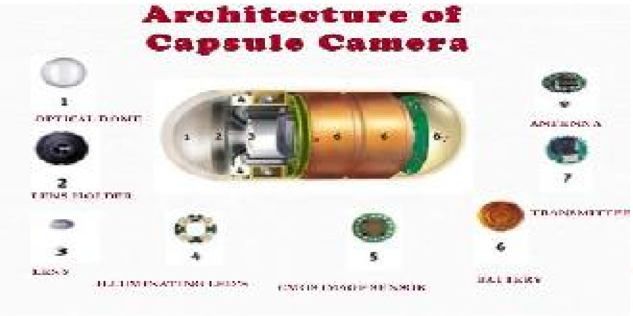

Figure II: Components of Capsule Camera.

1. OPTICAL DOME:

- This shape results in easy orientation of the capsule axis along the central axis ofsmall intestine and so helps propel the capsule forward easily.
- The Optical Dome contains the Light Receiving Window.

2. LENS HOLDER:

- The Lens Holder is that part of the capsule which accommodates the lens.
- The lens is tightly fixed to the holder so that it doesn't get damage.

3. LENS:

- The Lens is an integral component of the capsule. It is arranged behind the Light Receiving Window.

4. ILLUMINATING LED'S:

- Around the Lens & CMOS Image Sensor, four LED□s (Light Emitting Diodes) are present.These plural lighting devices are arranged in doughnut shape.

5. CMOS IMAGE SENSOR:

- CMOS Image Sensor is the most important part of the capsule. It is highly sensitive and produces very high quality images. It has 140º field of view and can detect objects as small as possible

6. BATTERY:

- Battery used in the capsule is button shaped and two in number as shown in figure Batteries are arranged together just behind the CMOS Image Sensor. Silver Oxide primary batteries are used (Zinc/Alkaline Electrolyte/Silver Oxide).Such a battery has an even discharge voltage, disposable and doesn't cause harm to the body.

7. ASIC TRANSMITTER:

- The ASIC (Application Specific Integrated Circuit) Transmitter is arranged behind the Batteries as shown. Two Transmitting Electrodes are connected to the outlines of the ASIC Transmitter. These electrodes are electrically isolated from each other.

8. ANTENNA:

- The Antenna is arranged at the end of the capsule.
- It is enclosed in a dome shaped chamber.

DATA RECORDER

- Once the patient swallows the capsule they can continue with their daily activities. After eight hours they return to the physician's office with the Data Recorder so the images can be downloaded, and a diagnosis can be made. A patient will fast for at least two hours before swallowing the Pill Cam ESO video capsule.
- The capsule is easily swallowed with water while the patient lies on his or her back. The patient is then raised by 30 degree angles every two minutes until the patient is sitting upright. Similar to the Pill Cam SB procedure, the patient is wearing the Data Recorder on a belt around the waist.
- A Pill Cam capsule endoscopy requires no preparation or sedation, and recovery is immediate. Both the Pill Cam SB and Pill Cam ESO disposable capsules make their way through the rest of the gastrointestinal tract and then are passed naturally and painlessly from the body, usually within 24 hours.
- Both PillCam SB and ESO video capsules are 11 mm x 26 mm and weigh less than 4 grams. The procedure produces a series of black and white x-ray images of the lumen, or cavity, of the small intestine.

METHODOLOGY

- It is slightly larger than normal capsule. The patient swallows the capsule and the natural muscular waves of the digestive tract propel it forward through stomach, into small intestine, through the large intestine, and then out in the stool.
- It takes snaps as it glides through digestive tract twice a second. The capsule transmits the images to a data recorder, which is worn on a belt around the patient's waist while going about his or her day as usual.

- The physician then transfers the stored data to a computer for processing and analysis. The complete traversal takes around eight hours and after it has completed taking pictures it comes out of body as excreta.
- Study results showed that the camera pill was safe, without any side effects, and was able to detect abnormalities in the small intestine, including parts that cannot be reached by the endoscope.
- The tiniest endoscope yet takes 32-megapixel images per second and offloads them wirelessly.
- See how it works inside the body in animation. Pop this pill, and eight hours later, doctors can examine a high-resolution video of your intestines for tumor's and other problems, thanks to a new spinning camera that captures images in 360 degrees developed by the Japanese RF System Lab.

I. USES:

1. Crohn's Disease.
2. Mal-absorption Disorders.
3. Tumors of the small intestine & Vascular Disorders.
4. Ulcerative Colitis
5. Medication Related To Small Bowel Injury

II. ADVANTAGES:

1. Biggest impact on the medical industry.
2. Nano robots can perform delicate surgeries.
3. They can also change the physical appearance.
4. They can slow or reverse the aging process.
5. Used to shrink the size of components.
6. Nano technology has the potential to have a positive effect on the Environment

CONCLUSION

- Nanotechnology has the power to revolutionize the world of production, but it is sure to increase unemployment in next generation. This pill camera technology has glorified biomedical science and helped doctors to diagnose such a complicated intestinal bowel in easy way.
- Use of Pill camera on large scale will reduce unwanted death rate in upcoming decades. But in rare case the capsule which is swallowed if does not pass through body further then, it may need to be removed endoscopic or surgically. So this proposed capsule endoscopic model has to be further modified after knowing its disadvantage which occurs while the transmission of video image

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MODELING AND STATISTICAL OPTIMIZATION OF DILUTE ACID HYDROLYSIS OFCATTAILS USING RESPONSE SURFACE METHODOLOGY.

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ABSTRACT

Dilute acid hydrolysis method was applied for the pretreatment of commonly occurring Cattail plants to produce fermentable sugars. Compositional analysis of the Cattails showed the major components of the lignocellulosic material were cellulose, hemicellulose, and lignin to be 40.09, 22.86 and 24.12 % respectively. A four variable central composite design for response surface methodology (RSM) was employed to evaluate the simultaneous effect of acid concentration, soaking time, temperature and treatment time on the total reducing sugar concentration obtained during acid hydrolysis of Cattails. A validated quadratic statistical model was developed to relate the hydrolysis variables to the total sugar concentration. The optimal conditions of hydrolysis as obtained from RSM were as follows: acid concentration 2% v/v,soaking time 15 minutes, temperature 115^{0}Cand treatment time 8 minute. The maximum concentration of total reducing sugar under these conditions was found to be83mg/L.

Keywords: *Acid hydrolysis, Cattails, lignocellulosic biomass, central composite design, optimization*

INTRODUCTION

The entire world is now aware of the problems arising by the use of crude oils and also the limited nature these reserves. Hence the focus has been shifted towards finding sustainable and environment friendly choices. Bioethanol has been getting the worldwide approval as an alternative for conventional fuels. The biomass is available worldwide and it is cheap. Conversion of abundantly available biomass to ethanol has been considered as a cost effective route. (Chen et al., 2009; Hahn-Hagerdal et al., 2006; Yang and Wyman, 2004). The biomass or precisely lignocellulosic biomass mainly consists of three components- cellulose, hemicellulose, and lignin. For converting the lignocellulosic material to bioethanol, first lignin needs to removed and subsequently the hydrolysis of the hemicellulose and a reduction in the fraction of crystalline cellulose in order to improve the accessibility of the substrate to celluloytic enzymes needs to be achieved.(Amenaghawon et al., 2013; Ballesteros et al. 2008; Emmel et al., 2003; Hosseini and Shah, 2009). Several methods have been studied and applied worldwide; typically categorized as physical (size reduction), chemical (acid hydrolysis, alkaline pretreatment, ozone, steam, and solvent pretreatment) and biological (enzymatic hydrolysis) or some combination of the three (Alvira et al., 2010; Fang et al., 2010; Lau and Dale, 2009).

Dilute acid treatment is one of the most commonly employed methods for this purpose. This process has several advantages over the other methods (Taherzadeh and Karimi 2007). It can either be used as a pretreatment step to improve the performance of hydrolysis or a standalone hydrolysis process for the production of fermentable sugars. Various dilute acids such as sulphuric acid, hydrochloric acid, phosphoric acid, and nitric acid have been used to remove hemicellulose and enhance the digestibility of cellulose.There are many factors like acid to biomass ratio, hydrolysis time particle size, hydrolysis temperature, acid concentration, etc. which affect the yield of fermentable sugars during this process.

Traditionally, optimizing these factors involves varying one factor at a time and keeping the others constant. This method has its drawbacks as is time consuming, cumbersome and often does not explain the effect of interaction between the various factors. Response surface methodology based on statistically designed experiments is a technique that has been found to be very useful in analyzing the simultaneous effect of several factors on a process. It is employed for multiple regression analysis of quantitative data obtained from statistically designed experiments (Montgomery 2005).

In this work, the modeling and optimization of dilute acid hydrolysis of cattail plants was studied. Cattails are one of the most common and easily identified water-loving plants. It is found growing in dense stands in areas with shallow water or seasonal flooding, or as a narrow band along the margins of deeper water. It is a widespread plant, found throughout most of North America, Europe, Asia and Africa.They have the ability to spread rapidly by vegetative reproduction forming dense rhizome mats and litter. This has an impact on species diversity by alteration of habitat. Dense Typha growth and litter may reduce the opportunity for other plants to establish or survive (Wesson and Waring 1969). They rapidly close any open water giving few opportunities for other plants to establish. The objective of this study was to determine the optimum values of acid concentration, soaking time, hydrolysis temperature and treatment time to determine their effect on the production of fermentable sugars. Central composite design for response surface methodology was adopted for optimizing the factors.

MATERIALS AND METHODS

Feedstock Preparation

Cattails were collected locally from a pond located at Kathora road, Amravati (20N58 77E50).

The plants were cut near to root and were washed with tap water and partially dried in sunlight for 48 h. The dried biomass was cut in to pieces of 2-5cm size and further the biomass was again dried in sunlight for 7days to remove left over moisture. The dried biomass was finally pulverized in a Bajaj kitchen grinder (Model GX 3) to the size range of 2 to 5 mm.

Dilute Sulphuric Acid Hydrolysis

The biomass was subjected to pretreatment with Sulphuric acid. The purpose of this treatment is to select effective parameters which facilitate the maximum release of sugars from biomass. The dilute acid pretreatment of biomass samples was carried out by treating 10 g biomass sample with dilute sulphuric acid using varied acid concentrations (0.5-2.5% v/v) and soaking time (0 to 60 min) at 100˚-160^{0}C temperature range for treatment time of 0-10 min.

ANALYTICAL METHODS

The hydrolyzate after treatment was separated by filtering the contents through double layered muslin cloth. The acid hydrolyzates obtained after acid treatment was analyzed for the amount of sugars using DNSA method (Miller 1959). The parameters investigated for optimization studies are summarized in Table 1.

The effect of change of one parameter on the amount of sugars was studied by keeping other parameters constant.

Table 1 Parameters under investigation for optimization of DA pretreatment

Range	Conc. %(v/v)	Soaking Time (min)	Temp(^{0}C)	Treatment time (min)
Min	0.5	0	100	2
Max	2.5	60	160	10
Interval	0.5	15	15	2

Experimental Design and Optimization by RSM

A four independent variable central composite design (CCD) for response surface methodology was used to develop a statistical model relating the response (total reducing sugar concentration) to the studied independent variables (acid concentration, soaking time, hydrolysis temperature, treatment time). The ranges of the variables varied over five levels are shown in Table 2.

Independent variable	Symbol	Coded and actual values				
		-2	-1	0	+1	+2
Acid concentration (%)	X_1	0.5	1.0	1.5	2.0	2.5
Soaking Time (min)	X_2	0	15	30	45	60
Temperature (^{0}C)	X_3	100	115	130	145	160
Treatment Time (min)	X_4	2	4	6	8	10

Table 2: Coded and Actual Levels of the Factors for Four Variable Central Composite Design

The CCD is a design that combines the vertices of the hypercube whose coordinates are given by a 2n factorial design with star points (Box et al., 1978). The star points provide the estimation of curvature of the nonlinear response surface. The experimental design made up of 31 runs and the statistical model whose equation was determined by analysis of multiple regression was developed using Minitab17software.The 31 experimental runs were randomized to maximize theeffects of unexplained variability in the observed responses due to extraneous factors (Amenaghawon et al 2014).

STATISTICAL ANALYSIS

The effect of acid concentration, soaking time, temperature and treatment time on the total reducing sugar concentration was evaluated. The results obtained from the 31 experimental runs carried out according to the central composite design are summarized in Table 2. A second order polynomial was fitted to the data presented in Table 2 using multiple linear regressions to determine the optimum conditions for the dilute acid hydrolysis of cattails. The following second order polynomial was found to represent the relationship between the total reducing sugar concentration produced during acid hydrolysis and acid concentration, soaking time, temperature and treatment time:

$$Y = 70.00 + 2.08 X1 + 0.08 X2 - 1.50 X3 + 3.17 X4 - 1.58 X1*X1 + 1.92 X2*X2 + 1.17 X3*X3 + 1.96 X4*X4 - 1.12 X1*X2 + 0.25 X1*X3 + 1.13 X1*X4 + 1.75 X2*X3 - 1.13 X2*X4 + 0.50 X3*X4 \quad (1)$$

The predicted response levels of total reducing sugar concentration using Equation (1) are also presented in Table 3. The fit of the statistical model for the total reducing sugar concentration was assessed by carrying out analysis of variance (ANOVA) and the results are presented in Tables 4 and 5.

.

Table 3:Central Composite Design Matrix for the Optimization of Variables and the Response Values of Total Reducing Sugar Produced During Acid Hydrolysis.

Run	Coded Values				Actual Values				Response (Y)	
	X1	X2	X3	X4	X1	X2	X3	X4	Observed	Predicted
1	1	1	1	-1	2	45	145	4	66	67.42
2	1	1	1	1	2	45	145	8	82	74.75
3	0	0	0	0	1.5	30	130	6	79	70.00
4	-1	-1	1	1	1	15	145	8	70	66.42
5	0	0	0	0	1.5	30	130	6	62	70.00
6	0	0	0	0	1.5	30	130	6	62	70.00
7	0	2	0	0	1.5	60	130	6	79	77.83
8	1	-1	-1	1	2	15	115	8	83	80.58
9	-1	-1	-1	1	1	15	115	8	67	72.42
10	-1	1	-1	1	1	45	115	8	72	69.08
11	1	1	-1	-1	2	45	115	4	69	67.42
12	0	0	2	0	1.5	30	160	6	69	71.67
13	0	0	0	-2	1.5	30	130	2	55	55.83
14	-1	1	-1	-1	1	45	115	4	65	68.25
15	0	0	0	2	1.5	30	130	10	71	68.50
16	-2	0	0	0	0.5	30	130	6	63	59.50
17	0	0	0	0	1.5	30	130	6	72	70.00
18	1	-1	-1	-1	2	15	115	4	71	70.75

19	-1	1	1	1	1	45	145	8	63	70.08
20	-1	1	1	-1	1	45	145	4	70	67.25
21	1	-1	1	-1	2	15	145	4	66	63.75
22	0	0	0	0	1.5	30	130	6	82	70.00
23	1	-1	1	1	2	15	145	8	72	75.58
24	-1	-1	-1	-1	2	15	115	4	65	67.08
25	-1	-1	1	-1	1	15	145	4	59	59.08
26	0	0	-2	0	1.5	30	100	6	82	77.67
27	1	1	-1	1	2	45	115	8	66	72.75
28	0	0	0	0	1.5	30	130	6	67	70.00
29	0	-2	0	0	1.5	0	130	6	78	77.50
30	2	0	0	0	2.5	30	130	6	66	67.83
31	0	0	0	0	1.5	30	130	6	66	70.00

Table 4**:** Analysis of Variance (ANOVA) for Quadratic Model for total Sugar Concentration.

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Model	15	877.26	62.662	1.47	0.228
Linear	4	399	99.75	2.34	0.099
X1	1	104.17	104.167	2.44	0.138
X2	1	0.17	0.167	0	0.951
X3	1	54	54	1.27	0.277
X4	1	240.67	240.667	5.65	0.03
Square	4	363.51	90.878	2.13	0.124
X1*X1	1	71.69	71.688	1.68	0.213
X2*X2	1	105.05	105.05	2.47	0.136
X3*X3	1	38.92	38.922	0.91	0.353
X4*X4	1	109.67	109.667	2.57	0.128
2-Way Interaction	6	114.75	19.125	0.45	0.835
X1*X2	1	20.25	20.25	0.48	0.5
X1*X3	1	1	1	0.02	0.88
X1*X4	1	20.25	20.25	0.48	0.5
X2*X3	1	49	49	1.15	0.299
X2*X4	1	20.25	20.25	0.48	0.5
X3*X4	1	4	4	0.09	0.763
Error	16	681.83	42.615		
Lack-of-Fit	10	299.83	29.983	0.47	0.86
Pure Error	6	382	63.667		
Total	31	1559.1			

Table 5: Statistical Information for ANOVA.

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
6.52798	56.27%	18.00%	0.00%

The coefficient of determination (R^2) of the model was 56.27% as shown in Table 5. This value indicates that the model was able to represent the actual relationship between the variables considered in this study.
An R^2value indicates that the model explains 56.27% of the variability in the response for the region studied while the remaining 43.73% was as a result of chance. The coefficient of variation (C.V.) obtained was 10.351%. The coefficient of variation indicates the degree of precision with which the runs were carried out. A low value of C.V. suggests a high reliability and reproducibility of the design (Mason et al, 1989; Montgomery, 2005). The results of ANOVA of the response model are presented in Table 4. Values of ''Prob. > F'' less than 0.05 indicate the model terms were significant. Values greater than 0.10 indicate the model terms were not significant.Model F-value of 1.47and a very low probability value of 0.228implies that the response model was significant. The "Lack of Fit" F-value of 0.47 implies that there was insignificant lack of fit. The "Lack of Fit" (Prob > F) value of 0.86 implies that there is 86% chance that the "Lack of Fit" F-value could occur due to noise.

RESPONSE SURFACE OPTIMIZATION OF DILUTE ACID HYDROLYSIS OF CATTAIL PLANTS

To determine the optimal levels of the variables that influence the acid hydrolysis of Cattail plants, response surface plots were generated according to Equation (1). The three-dimensional (3D) plots were generated by keeping two variables constant at the centre point and varying the others within the experimental range. The resulting response surfaces showed the effect of acid concentration, soaking time, temperatureand treatmenttime on the total reducing sugar concentration.
Figure 1 shows the effect of acid concentration and soaking time on the total sugar concentration.At low temperatures, the total sugar concentration increased with increase in acid concentration. The same trend was observed at high temperatures as the total sugar concentration also increased with increase in acid concentration. The trend observed may be as a result of the catalytic activity of the acid. Increasing the acid concentration during hydrolysis leads to a corresponding increase in the concentration of hydrogen ions which in turn increases the rate of the hydrolysis reaction and consequently the rate at which the glycosidic bonds are broken will increase resulting in a high conversion of hemicellulose fraction into fermentable sugars (Kumar et al., 2009; Mosier et al., 2002). Hu et al. (2010) investigated the acid hydrolysis of sugar maple wood extract at atmospheric pressure using dilute sulphuric acid. They observed that increasing the concentration of acid resulted in an increase in the concentration of fermentable sugars. This led them to conclude that the acid acted as a catalyst in the cleavage of the β (1–4) glycosidic linkages in the xylooligomers to yield xylose monomers. Lenihan et al. (2010) also reported that increasing the concentration of acid at mild temperatures resulted in an increase in the rate of the hydrolysis reaction.

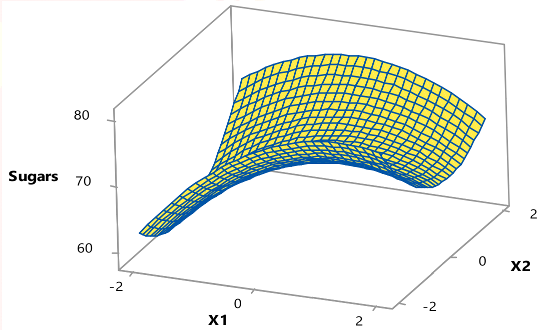

Figure 1: Response Surface Plot Showing the Effect of Acid Concentration and Soaking time on Total Reducing Sugar Concentration.

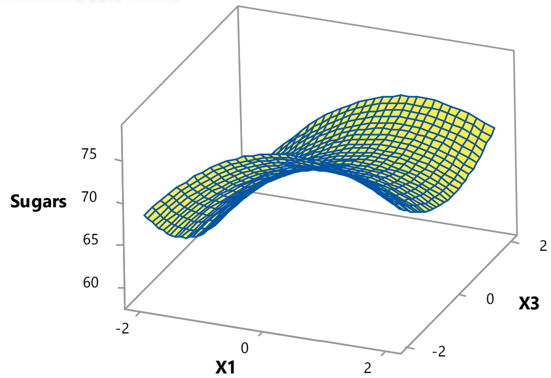

Figure 2: Response Surface Plot Showing the Effect of Acid Concentration and Temperature on Total Reducing Sugar Concentration

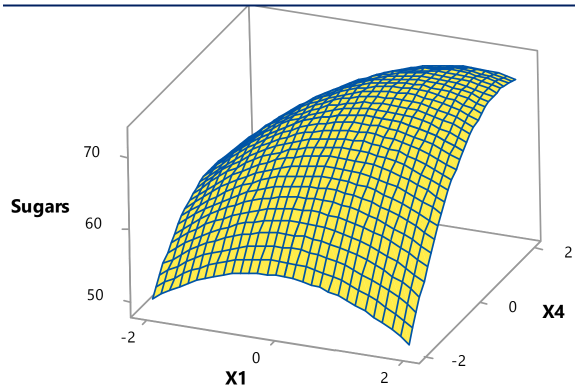

Figure 3: Response Surface Plot Showing the Effect of Acid Concentration and Treatment time on Total Reducing Sugar Concentration.

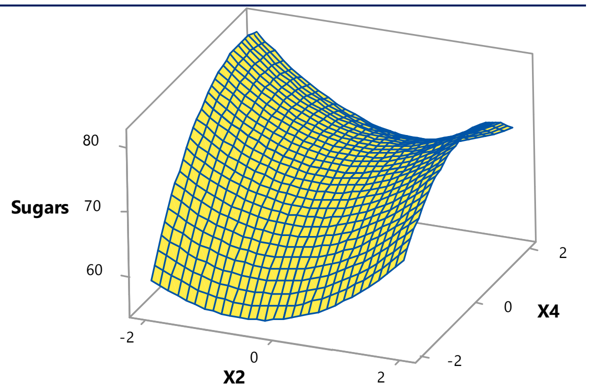

Figure 5: Response Surface Plot Showing the Effect of Treatment time and Soaking time on Total Reducing Sugar Concentration.

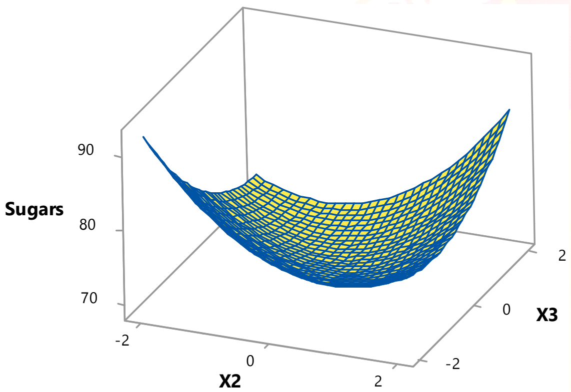

Figure 4: Response Surface Plot Showing the Effect of Temperature and soaking time on Total Reducing Sugar Concentration.

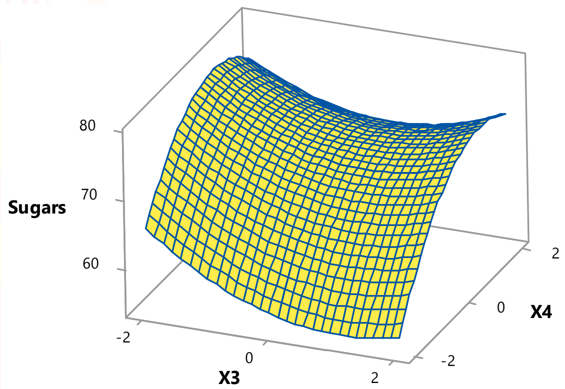

Figure 6: Response Surface Plot Showing the Effect of Temperature and Soaking time on Total Reducing Sugar Concentration

Figure 1 shows the effect of acid concentration and soaking time on the total sugar concentration.
It can be observed that the amount of sugars obtained increased initially as the acid concentration was increased along with the soaking time, indicating braking of hemicellulose in the cattail biomass. Maximum sugar concentration is observed at acid concentration of 1.5% and samples soaked for 10 minutes. Further increase in the acid concentration from 1.5% to 2.5 % shows a decline in the amount of sugars obtained.
Figure 2 shows a higher amount of sugars initially at low temperatures and increase in the acid concentration from 0.5 % to 1.5%. However, as the temperature increases, we find a decrease in the sugars till a temperature of 130^{0}C. This situation reverses on further increase in temperature. According to Kumar et al., 2009 and Mosier et al., 2002, this may be as a result of the catalytic activity of the acid. Increasing the acid concentration during hydrolysis leads to a corresponding increase in the concentration of hydrogen ions which in turn increases the rate of the hydrolysis reaction and consequently the rate at which the glycosidic bonds are broken will increase resulting in a high conversion of hemicellulose fraction into fermentable sugars. However, the present results differ for a further increase in acid concentration post 1.5 %, where we can find a downward shift in the amount of sugars.
Figure 3 shows the effect of the interaction between hydrolysis time and acid concentration on the total reducing sugar concentration produced at a hydrolysis. A similar study on Eucalyptus wood chips was performed by Amenaghawon et al 2014,who reported that for the entire range of acid

concentration investigated, the concentration of total reducing sugars produced generally increased with increase in hydrolysis time. This suggests that the hemicellulose fraction of the lignocellulosic biomass was being broken down to produce fermentable sugars. Although the hydrolysis time in this study is very low as compared to the reported cases, the sugar production seems to follow similar trends.

Figure 4 shows Response Surface Plot Showing the Effect of Temperature and soaking time on Total Reducing Sugar Concentration.

Atlow soaking times, increase in the temperature show a decrease in the amount of sugars. However, at higher soaking times, the increase in the temperature shows a contrary trend. At low temperature and low soaking times, amount of sugars obtained is low; which increases eventually with increase in temperature.

Figure 5 represents the Response Surface Plot Showing the Effect of Treatment time and Soaking time on Total Reducing Sugar Concentration.

The maximum sugar concentration was obtained at a higher soaking times and higher treatment times. During investigation, it is observed that at lower soaking time, the increase in treatment time results in increase in production of sugars. Whereas, at higher soaking time, the sugars increase up to a treatment time of 6 minutes. Further increase in soaking time leads to a decrease in amount of sugars.

Figure 6 shows Response Surface Plot Showing the Effect of Temperature and Soaking time on Total Reducing Sugar Concentration.

The effect of hydrolysis time and temperature on the total sugar concentration is presented in Figure 6. It can be seen that there is a significant increase in the sugar concentration with time in the course of the hydrolysis reaction. Same trend is followed for the range of temperatures investigated. The maximum sugar recovery was obtained at a time of 10 minutes. Similar results have been reported by Romero et al. (2010) for the dilute sulphuric acid hydrolysis of olive tree biomass.

During the investigation, the optimum values of parameter which facilitate highest yield of sugars (83 mg/L) during hydrolysis were: acid concentration 2%, Soaking time 15 minutes, temperature 115 minutes and reaction time 8 minutes.

The validity of the results obtained by the statistical model was confirmed by the correlation between the predicted and observed values of sugars. At optimization parameters, the amount of sugars predicated by the model (80.58 mg/L) and the measured values (83 mg/L) are reasonablyclose.

CONCLUSION

The dilute sulphuric acid pretreatment of Cattail biomass to investigate the optimum parameters in order to obtain the maximum amount of sugars was performed. It is observed that the change in the parameters affect the yield of sugars greatly. A statistical model to predict the result indicated that the experimental results can be correlated to the predicted results. The optimum values of parameter which facilitate highest yield of sugars (83 mg/L) during hydrolysis were: acid concentration 2%, Soaking time 15 minutes, temperature 115 minutes and reaction time 8 minutes. The optimum amount of sugars i.e. 83 mg/L obtained experimentally was fairly close to 80.58 mg/L which was predicted by the model.

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STRUCTURAL AND OPTICAL CHARACTERIZATIONS OF CHEMICALLY SPRAY DEPOSITED SNO_2 THIN FILMS

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ABSTRACT

Nanostructured tin dioxide thin filmswere deposited onto glass substrate by using chemical spray pyrolysis method at room temperature. X-ray diffraction studies reveal that the films are polycrystalline in nature with tetragonal structure and preferential orientation along (110) plane. Optical band gap (Eg) of the as deposited nanocrystalline thin film was found to be 2.96 eV, which shows that these films are suitable for optoelectronic devices such as for solar cell and optical filters.

***Keywords**: Nanostructures; Thin films; Optical properties; Polycrystalline.*

INTRODUCTION

The study and application of thin film technology is entirely entered in to almost all the branches of science and technology. Tin dioxide (SnO_2) thin film is well known as a wide band gap n type semiconductor [1] with high simultaneous electrical conductivity and optical transparency in visible region of the spectrum [2] and with a wide band gap ~3.6 eV. Due to its electrical, optical, and electrochemical properties, SnO_2 is widely used as transparent electrodes in solar cells, flat panel displays, and chemical sensors. Recently, SnO_2has been integrated into micro machined silicon devices as a sensing element of micro sensors. Several methods have been used to deposit tin dioxide thin films including reactive sputtering [3], thermal evaporation [4], chemical vapor deposition [5], sol-gel method [6], electrodeposition [7] and spray pyrolysis[8]. Among these techniques, spray pyrolysis is particularly attractive for metal oxide thin films deposition also this technique is simple, cheap, and easily adaptable for large area film deposition.

EXPERIMENTAL DETAILS

Nanostructured tin oxide thin films were deposited onto glass substrate by chemical spray pyrolysis method from aqueous solutions containing $SnCl_2$ as source materialat room temperature. The precursor solution was prepared in water with addition of concentrated HCl with constant stirring to get required pH of the solution, which was then sprayed onto the heated glass substrates. Before deposition the substrates were boiled in the concentrate chromic acid (0.5M) for 1 hour and then kept in it for next 48 hours. The substrates were then washed with double distilled water. Several trials were conducted to optimize the different deposition parameters such as substrate temperature, spray rate, concentrations of cationic and anionic sources etc.

The average thickness of the as deposited SnO_2 thin film was measured by using gravimetric method. The structural studies were carried out by using Philips PW 1710 diffractometer with Cu-Kα radiation of wavelength 1.5405 Å. The optical characteristics were studied usingUV-VIS-NIR spectrophotometer (Hitachi-330), to find band gap energy of SnO_2 thin films.

RESULTS AND DISCUSSION

3.1. Structural Analysis

Crystalline structure of the nanostructured SnO_2 thin films were studied using Philips PW 1710 diffractometer with CuKα radiation of wavelength 1.5405 A^0. Figure 1 shows the XRD pattern for tin oxide (SnO_2) thin films deposited at 300K. There are six orientation peaks that could be observed in the deposited thin film identified as (110), (101), (200), (210), (211) and (220) orientation peaks at diffraction angle such as 26.732, 33.713, 37.982, 42.561, 51.804 and 54.753 respectively. All the peaks were well consistent with JCPDS data of SnO_2 (Table 1) confirming the thin films has tetragonal phase formationwith a preferred orientation (110).

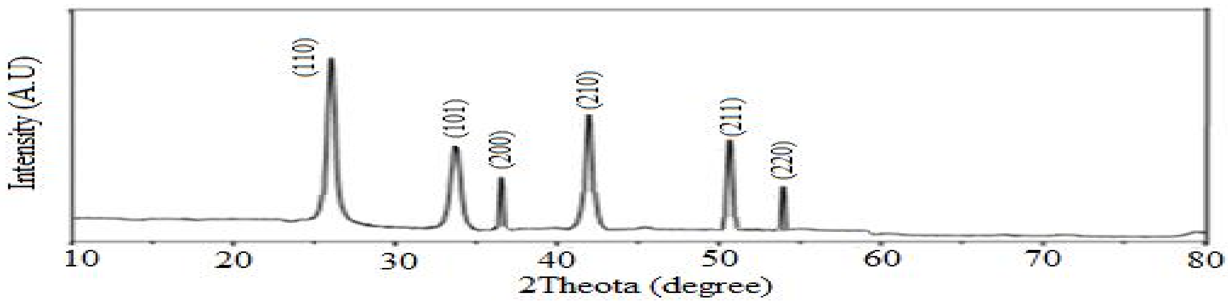

Fig.1: XRD pattern for Tin oxide thin films

Table1. Comparison of observed and standard XRD data of SnO_2 thin films (JCPDS card 41-1445).

Film	Observed data		Standard data		hkl	phase
	2θ(degree)	d (A^0)	2θ(degree)	d (A^0)		
	26.732	3.401	26.611	3.347	1 1 0	Tetragonal
	33.713	2.599	33.893	2.642	1 0 1	Tetragonal
	37.982	2.379	37.950	2.369	2 0 0	Tetragonal
SnO_2	42.561	2.101	42.635	2.118	2 1 0	Tetragonal
	51.804	1.783	51.781	1.764	2 1 1	Tetragonal
	54.753	1.669	54.759	1.675	2 20	Tetragonal

3.2. Optical Analysis

The optical absorption studies were carried out for the wavelength range 300 to 1100 nm (fig.2) and the absorption spectra is analyzed to find band gap energy of tin oxide thin films. The nature of transition is determined by using the relation,

.

$$\alpha = \frac{A(h\upsilon - Eg)^n}{h\nu} \qquad (1)$$

where, hυ is the photon energy, Eg is the band gap energy, A and n are constants. For allowed direct transitions n = 1/2 for allowed indirect transitions n = 2

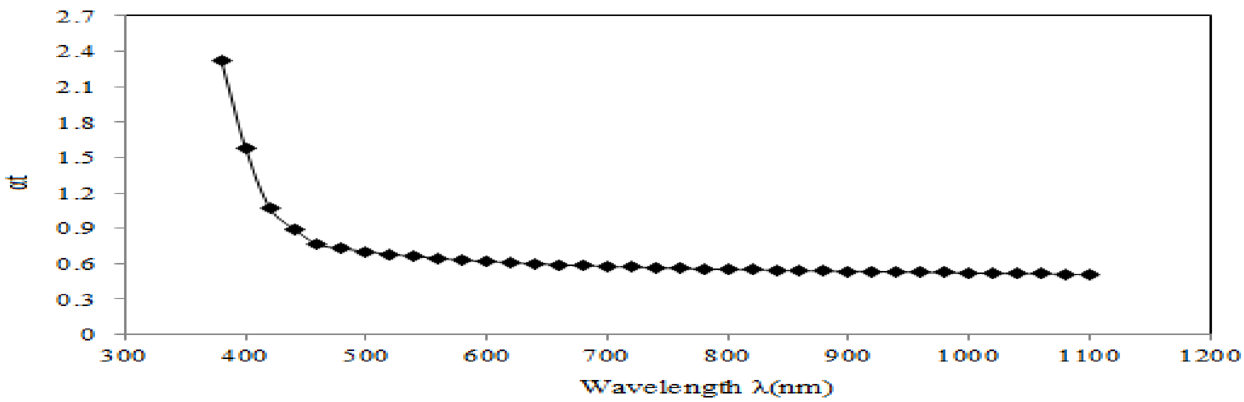

Fig.2: Variation of optical absorption verses wavelength for Tin oxide thin film

Figure 3 shows the plot of $(\alpha h\upsilon)^2$ versus hυ of as deposited SnO_2 thin film. It has been observed that the graph was linear over a wide range of photon energies which was due to direct type of transition. When the linear portion was extrapolated to the hυ axis the intercept gives the band gap which was 2.96eV. The reported band gap values for SnO_2 thin film for single crystal was 3.6eV [9]. The less value may be due to growth of grain and improvement of the degree of crystallization

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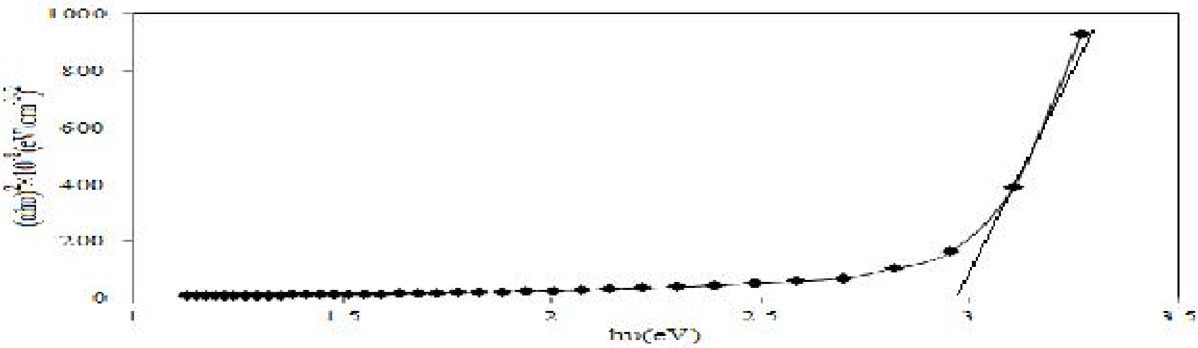

Fig.3. Plot of $(\alpha h\upsilon)^2$ versus hυ for Tin oxide thin film

CONCLUSIONS

In the present paper, structural and optical characterizations of chemically spray deposited SnO_2 thin films have been reported. The X-ray diffractometry study reveals the formation of tetragonal structure, with the strongest peaks attributed to (110) plane of SnO_2. Optical band gap (Eg) of the as deposited nanocrystalline tin oxide thin film was found to be 2.96 eV, which shows that these films are suitable for optoelectronic devices such as for solar cell and optical filters.

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CODING TECHNIQUE FOR DNA BASED STORAGE

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ABSTRACT

Humans always want to access the maximum information in minimum time and space. As the next generation computers and High speed internet are achieving that due to which we moved from bones, rock and paper in olden days to the punched cards, magnetic tapes, gramophone records, floppies, bulky hard drives to thelatest technology optical discs including CDs, DVDs, Blu-ray discs, and flash drives. As result it made personal data storage convenient.As the time goes these storage devices will decay and they are non-biodegradable and can harm the environment. The new generations are coming with the demand for data storage is growing exponentially and there is need for storage of the data for longer time. Storage medium should have a high capacity and high storage density and it should stand extreme environment conditions. Deoxyribonucleic acid (DNA) is good for the purpose as there is diverse encoding model for reading and writing data onto DNA. DNA uses organic memory device with large data storage and can be used to solve the computational problems.

***Keywords**: Storage Device, Biodegradable, Deoxyribonucleic acid, Encoding Model, Computational problems.*

INTRODUCTION

The macromolecule DNA is unique and it is non-volatile recording media as we can still recover DNA of species extinct more than 10,000 years and has high storage capacity a human cell with mass of 3 picogram can hosts DNA encoding 6.4GB of information. The laboratories outlined architectures for archival DNA based storage density of up to 700TB/gram and 2PB/gram, used Huffman coding, differential coding and single parity check coding [1]. The "digital universe" forecast to grow over 16 zettabytes in 2017 and along with that there is greater need of storage. Worlds data is stored on magnetic and optical media, tape technology has tape cartridge of 185TB and dense form is $10GB/mm^3$ and optical discs is capable to store 1PB and density of about $100GB/mm^3$ to store zettabytes require millions of units and physical space and it should be durable as rotating disc are rated 3-5 years and tape rated 10-30 years. Synthetic DNA sequence considered potential medium for digital data storage [2]. DNA is similar to sequential code of 0's and 1's in a computer. From the research just four grams of DNA can store all the information that world produce in a year [3].

RELATED WORK

DNA is optimal medium as it consist of adenine, guanine, cytosine and thymine (A, G, C and T) already paired into nucleotide base pairs A-T and G-C which can be utilized for storing information in form of binary code. DNA is considered ideal as single nucleotide can represent 2 bits of information and 455 EB of data can be encoded in 1 gram of single stranded DNA, as DNA is 3 dimensional it offers high space storage information which can be extended to infinity by drying and protecting from oxygen and water. The work analyses writing and reading data in the DNA by using Cryptography and stenography which are DNA secret writing algorithms. Microvenus Projects and Genesis project to encode data on DNA [4]. Other works like rewriteable addressable data (RAD) module which stores digital information in chromosome, it use serine integrase and excisionase function adapted from bacteriophage to restore specific DNA sequences [5]. Other work encoded computer files totaling 739kB of hard disk storage with estimated Shannon information 1 of $5.2 * 10^6$ bits into DNA code, synthesised, sequenced and reconstructed original DNA file with 100% accuracy however challenged they faced was there was difficulty in synthesizing long sequence of DNA [6]. The recent work developed new architecture which overcomes drawback of read only the require decoding entire file they used the coding technique and DNA editing with data reliability, specify and sensitivity to access and provide high data storage capacity and results showed DNA is versatile media suitable to both ultrahigh density archival and rewritable storage application [7]. This work created DNA fountain which is robust and approach information capacity per nucleotide. Stored data 2.14*10^6 bytes in DNA and managed to retrieve 215 Petabyte/gram of DNA which was higher than previous technique [8].

PROPOSED SOLUTION

DNA based storage architecture is shown in Figure 1. The digital information and storage are the source and media other blocks represents processing method which is applied on the digital information and storage. Synthesis is biochemical process which creates double stranded DNA string which is encoded data string. Storage stores the DNA string it helps in communication from one point to other. Information source is encoded using standard and error-control coding schemes. The code words are synthesized and added in process and stored. Sequencing is performed through Sanger sequencing or through High Throughput Sequencing (HTS) technique.

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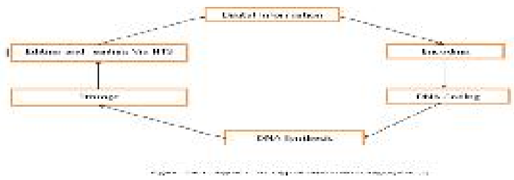

CONCLUSION

Data storage in DNA is improving at promising rate by research teams all over the world. To come to full potential the DNA based data storage technology has to face challenges. As DNA has qualities of density, robustness, stability and energy efficiency it can be used for archival purposes. There is improvement in reading and writing of data in DNA storage. The cost to do that is also getting lower as the research across the world is taking place.

ACKNOWLEDGMENTS

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COLLAGE PLACEMENT MANAGEMENT SYSTEM AND RESUME GENERATION

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ABSTRACT

Earlier Training and Placement Officer have to go through manual format but this system help Training and Placement Officer to match company criteria with student profile and depending upon it the students will be shortlisted. All the work regarding the placement activities is done by this system; from collecting data to shortlist the student. This system provides the facility to automated resume and simplified registration process. To generate the list of eligible students for placement. This system place the best co-ordination between teacher and student regarding campus recruitment activities. In This system the admin can conduct the mock-s test, and the according to company criteria they can short - lists the student. Student can discuss their difficulties with the departmental staff, Alumni. Students can interact with alumni and TPO. Students get the details of the company and placement criteria. System can be used from anywhere. Notification regarding to recruitment is directly on their EMAIL and Mobile phone.

Keywords- Notification system, Automatic resume generation system, Placement, mock-test.

INTRODUCTION

The increasing advantages of automated system is at the highest position thus many manual process are automated. Computer application, mobiles, E-mails, SMS techniques and online services are demanding now-a-days. Educational institutes like colleges needed their manual system to function on computer system. College placement management system and resume generation is one of such system which is of great importance for campus recruitment activities. In colleges various companies come for recruiting students for their firms. Companies provide a particular criteria to provide recruitment to those student . This criteria is different for different companies. Individual company come up with the individual ideas and demands which is included in their criteria.

The need of the company is explained in those formats . Earlier Training and Placement Officer have to go through this format manually, this whole hectic procedure is replaced by our system we are proposing an Online Training and Placement Management System to maintain the data, Record by providing online platform. To implement the system these technique can be data mining, classification, data preprocessing and decision tree algorithm This project focus on developing a web as well as mobile application for the Placement Department of the college. By using Decision trees algorithms, tree-shaped structures that represent decision sets. A decision tree is a predictive model that can be viewed as a tree. They generate rules, which are used for the classification of data. Decision trees are the supportable technique for building understandable models. Data mining help end users extract useful information from large databases. Classification is a data mining technique which is most commonly used, it employs a set of data which are pre-classified. Placement Officer of the college can used this system as an application to manage student records and data for the placement. Sometimes student are unable to submit the information manually due to some problems and thus not get updated about the placement activities, this application provide an Online platform for such student . Students logging should be able to upload their information in the form of a resume. So , all the information will store the details of the students including their background information, educational qualification, personal details, university marks and all the information related their resume In our proposed system one will save time and collect information of all college student and fetch them according to criteria given by company . This placement management system is design to improve existing system.

Admin can notify the students about the recruitment online via sending E-mail and SMS. This system can be use as an application for college to manage the student records according placement. This system consists of three main modules :-

1. Training And Placement Officer.
2. Departmental Staff.
3. Student

The need of College Placement Management System are, To reduce maximum chances of errors in manual work. Save time for the process. To improve the existing system. To reduce the paper work and utilize the maximum capabilities. To increase the accuracy and efficiency of placement procedure. Management of student data. In order to enhance the existing placement problem the Online Placement system is designed, so that placement activities becomes more interactive, automated and effective. All the resume sends by the student which can be maintain in the database. It reduces the paper work and storage are and Avoid fake Entry. Helpful for college and student

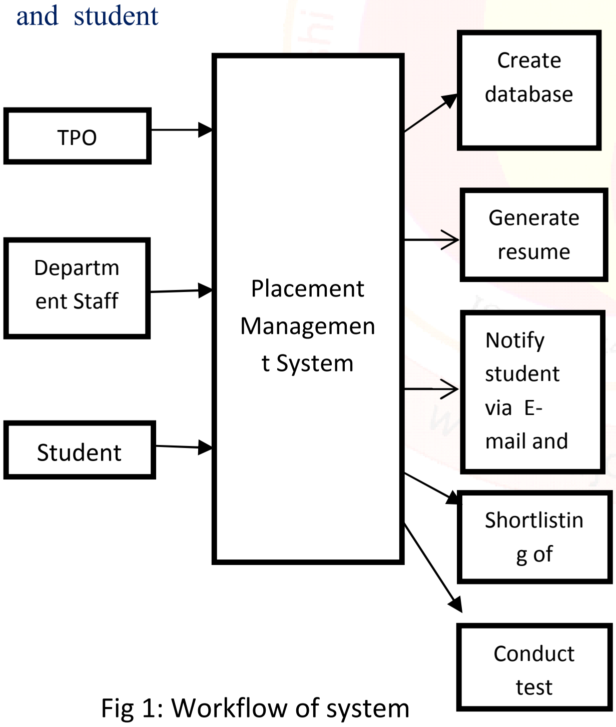

Fig 1: Workflow of system

LITERATURE REVIEW

S.R. Bharamagoudar, Geeta R. B. , S.G. Totad, create the website which tracks all the details of a student from the day one to the end of the course. It focusing on present day information in an easy and intelligible manner which provide facilities like online registration and profile creation of student. It uses HTML, CSS, JAVA SCRIPT, PHP, SQL languages for creating database. which can be used for all reporting purpose, tracking of attendance, progress in the course, completed semesters,, exam details object or any other assignment details, final exam result and all these will be available through a secure.[1]

Zhaoli Wang1 , Xinhuai Tang, This system proposed an efficient algorithm that is based on an automatically modeling of user demands. They used vector to present job and resume and the core part is the Genetic Algorithm. In this algorithm, they record a user's interest by recording resumes the user downloads and at the same time using genetic algorithm to obtain enterprise's degree of interest for different resume items. A resume can be divided into different items such as "age", "school" etc. The items can be express so each resume can be represented by the words in the resumes for the item. Then they used genetic algorithm to calculate weight this is they create 5000 resumes by program randomly and about 3% of these resumes can afford the requirements.[2]

Nilesh Bhad, Pooja Kamble, Sunita Sinai, Prof. Yogesh Thorat, proposed to created system supplies automation in all the processes. It create an system which provide authorized user name and password. This system can be used as an application for the training and placement of the college to manage student information with related to placement. In this the admin of the system can see the student information and validate it for company registration. The admin generate student list based on company criteria /and details of companies provided to the student .Searching and sorting can be done and generate the report. Overall process of training and placement done automatically. The system gets online registration of all the user, deactivation and activation of the user, personalization to the user, resources to be provided online communication between the online feedback, users, other setting option.[3]

T. Jeevalatha, N. Ananthi, D. Saravana Kumar, In this paper, they have used the Artificial Neural Network and Decision tree algorithms and they collected high school mark, higher secondary mark and category, degree mark in last semester and data was processed in artificial neural network and decision tree for to predict who are getting chance to be placed in the interview and they concluded that decision tree is the best algorithm and its accuracy is 95%.The decision tree generated the various rules and finally the output is predicted as whether the students are placed or not in the campus interviews. [4]

Mulla Kajal, Mahadik Awanti, Pandharpatte Sonali, Kalantre Rashmi, Bansode Swapnali Prof. Inamdar S. Y, In this paper they can successfully login authorized person to system and register them. In our system admin can check the Student list those eligible according to criteria given by the Company and notify them instantly and update the information anytime successfully. They can create three module for that this are admin/TPO module, student module and company module.[5]

A. Arjuna Rao , K. Sujatha2 , V. Bhagya Sree ,B. Dileep Kumar, create the system which is used as an website application for the TPO of the faculty to manage college data with regard to placement and conduct online mock test for scholars. It arrange the written test, preplacement, group discussion, interview. This method reduce the manually work like maintaining of their resume and causing job alerts for many students.[6]

Prof. Payal Banode, Ashvini Vairagade, Amol Deogade, Prof. Shweta Bhelonde, In this proposed system author discussed about the training and placement tool from students and faculty point of view. This application provides information about vacancies in companies or industrial sectors. They are focused on web development software application. It is easily accessed or registration from anywhere and its is beneficial to Company for easily see student data and information.[7]

Xiangpei Hu, Lirong Wu, Chao Li and Minfang Huang, This system trying to design a campus recruitment recommendation system for college placement office by making use of SMS .The first one is need to generate profiles for company requirement according to real-world campus recruitment process. This process focusing on the profile representation for company and student. Profile matching methods and two-side matching.

PROPOSED SYSTEM

This system is aimed at developing an online application for the Placement Department of the college. The system will be an android based as well as web application. Once this application is opened at the front end all the data and events will be available to everyone. This placement management system have the three users; they are training and placement officer of the college, departmental staff and student. Student module deals with information and all the other details of student. The student who have registered , First student should login into the system by entering their valid E-mail address and password. Student can able to update his information (such as name, branch, year, aggregate marks, contact number, email, etc.).TPO have the authority to access the data and send all the notification on the student's EMAIL and SMS on their phone number. Departmental staff can provide the departmental information and regarding to campus selection process information to the TPO as well as student.

CONCLUSION

System proposed to the accuracy and providing the facilities for student. CV's are categorized according to various streams. Reduce manual work and documentation And providing a online platform which is access at any time It has user friendly interface having quick authentication access to documents. The Overall process of the training and placement department is automated. Which is helpful for the college campus recruitment system, It is useful to all the student as well as the colleges for selection process. In future the system build for the automatic resume and conducting the mock-test, and the student getting notification on SMS and EMAIL. Students can interact with alumni and TPO. Students get the details of the company and placement criteria. System can be used from anywhere. All the drawback of manual system can overcome by propose system.

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EFFECT OF SKIN FIBRE ORIENTATION ON MECHANICAL PERFORMANCE OF A CURVED BEAM SANDWICH STRUCTURE

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ABSTRACT

Curved sandwich structures occupy most areas of applications of sandwich structures including aircraft, missiles, space and naval industries. Hence, the main objective of this paper was to determine effect of skin fibre orientation on bending performance of a curved beam sandwich structure. Two different FE models were generated varying the fibre orientation. Ansys V16 software package was used for modelling and simulation. It was found that the magnitudes of von Mises stress and the resultant total displacement increased as we vary the fibre orientation in the order 0°, ±30°, ±45°, ±60°, and 90°.

Keywords: *Ansys V16, Curved beam, Fibre Orientation, Von Mises Stress.*

INTRODUCTION

Sandwich structures which are employed for engineering applications are generally subjected to impact and dynamic loads. There are several parameters which affect the performance of curved sandwich beams. One of these parameters, which has not been studied so far, is the orientation of fibres in the skin or face sheet of the curved sandwich beam. It is essential to determine the orientation of the skin fibre that gives best performance for a given type of loading. This study attempts to fill this gap in the literature. Andrew M. Layne and Leif A. Carlsson[1] designed a fixture for testing curved sandwich beams in flexure. The fixture was designed to produce pure bending in the beam according to four-point flexure principle outlined in the ASTM standard D6415-99. Jianshu Shen, et al. [2] studied the effect of various parameters on the response of curved sandwich panels under blast loads. Buket O kutan baba and Srinivasa Thoppul [3] studied the effect of curvature and debonds on the flexural strength and stiffness of curved beam sandwich structures. Ebrahim Sadeghpourand Mojtaba Sadighi [4] analysed the behaviour of the debonded curved sandwich beam under free vibration since the sandwich beams have a vulnerability to debonding between face sheets and core. Assma Hassan Ismail [5] assessed curved beam made of layered composite material to know the effect of radius of curvature and curve shape on them. He concluded that the middle layer is subjected to less stress because the moment centre pass through it where the resultant stress is zero. Seyed M. Hashemi and Ernest J. Adique [6] studied the free vibration analysis of curved sandwich beams. FEM is used to evaluate system behaviour at higher frequencies, where a large number of elements are needed to achieve accurate results. it has been observed that Numerical analysis or experimental validation on effect of skin fibre orientation on mechanical performance of curved beam sandwich structures has not been undertaken. Hence the main objective of this paper is to examine the effect of skin fibre orientation on various performance parameters of a curved sandwich beam with the help of finite element analysis.

MATERIAL MODELS

The highly anisotropic and nonlinear nature of the PU foam makes material modelling a challenge. Various research papers on the mechanical properties of foams were referred for the material model of the PU foam used in this study. The data available in [7] was adopted for our study. The element type used in this study is Shell – 3D 4 node 181.

Five different models with fibre orientations of 0º, ±30º, ±45º, ±60º, 90º were created.

Material model data for the foam and E glass/epoxy laminates are given in the tables below.

Table 2.1. Material model data for PU foam

Parameter	MPa
D11	17.4
D12	2.3
D13	2.3
D14	0
D15	0
D16	0

D22	5.7
D23	1.9
D24	0
D25	0
D26	0
D33	5.7
D34	0
D35	0
D36	0

Table 2.2. Material model data for E glass/epoxy laminate

D44	1.9
D45	0
D46	0
D55	6
D56	0
D66	6

RESULTS AND DISCUSSION

The response of the model to load in terms of the five parameters for each orientation of the fibre is described below.

3.1 FIBRE ORIENTATION: 0°

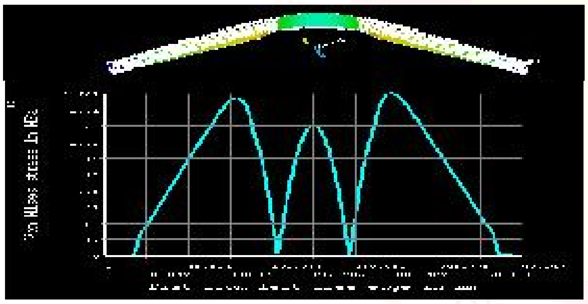


Fig 3.1.1. Variation of vonMises stress along the length of the specimen. We observe two peaks at the line of application of loads and one at the apex of curvature. The peaks are due to compressive stresses generated. From these peaks, we can infer that compressive stresses are more dominant than the tensile stresses in this particular problem.

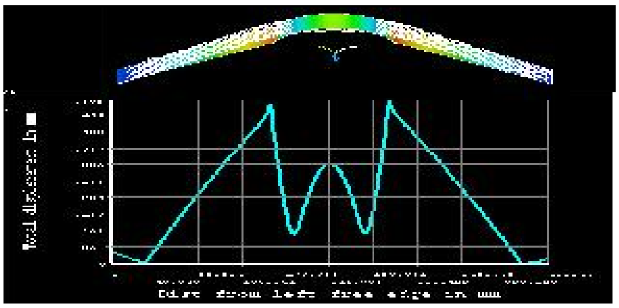


Fig 3.1.2.Variation of total displacement along the length of the specimen. Two spikes in the plot indicate the location of delamination of the specimen.

3.2 FIBRE ORIENTATION: ±30°

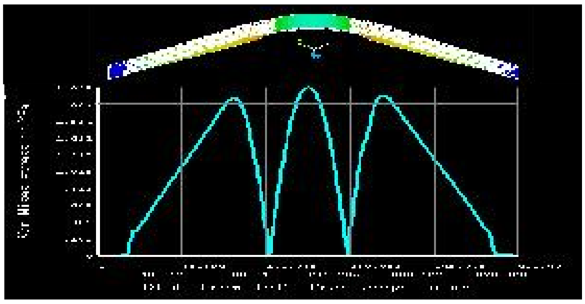


Fig 3.2.1 Variation of vonMises stress along the length of the specimen.

Parameter	Value
E_x	58000 MPa
E_y	10000 MPa
E_z	10000 MPa
μ_{xy}	0.25
μ_{yz}	0.3
μ_{zx}	0.25
G_{xy}	8000 MPa
G_{yz}	5000 MPa
G_{zx}	5000 MPa

It can be observed that the magnitude of stress is slightly higher at the lines of application of forces and at the apex of the curvature in relation to the plot for 0° fibre orientation.

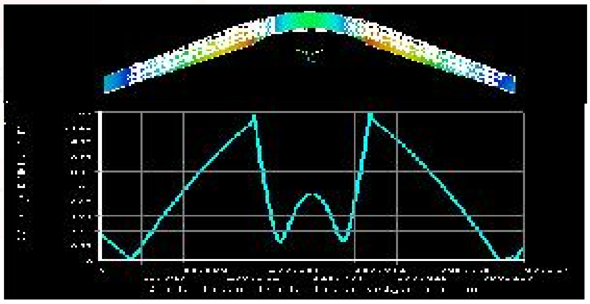
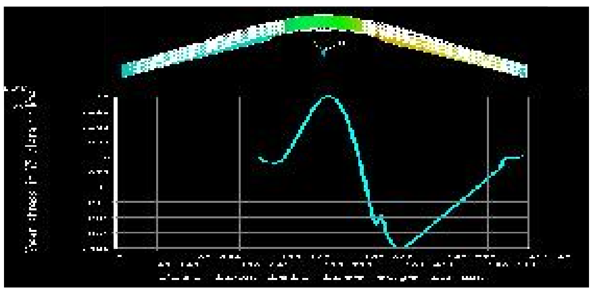


Fig 3.2.2 Variation of total displacement along the length of the specimen.



The plot is similar to that of the 0° orientation. The magnitude of displacement at the lines of application of force is slightly higher than that for 0° orientations, and the magnitude at the apex is slightly lower.

3.3 FIBRE ORIENTATION: ± 45°

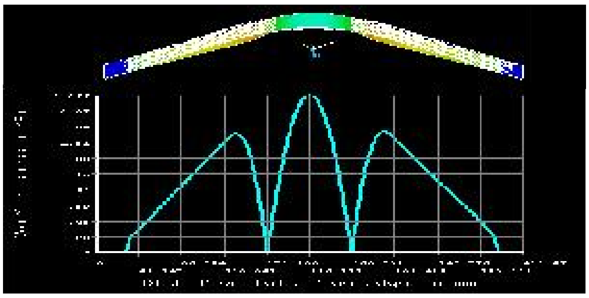


Fig .3.3.1 Variation of vonMises stress along the length of the specimen. While the distribution of the stress remains same as in the case of the other fibre orientations, the peak at the apex is found to be greater than the peaks at the lines of applications of force. Also, the magnitude of stress at the apex is much higher at 2MPa in relation to that for 0° fibre orientation.

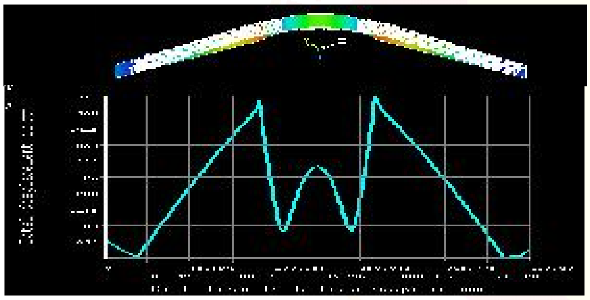


Fig 3.3.2 is plot of total displacement along the length of the specimen. While the nature of the distribution has remained the same, the magnitudes at the lines of application of force have increased and magnitudes have decreased at the apex.

3.4 FIBRE ORIENTATION: ±60°

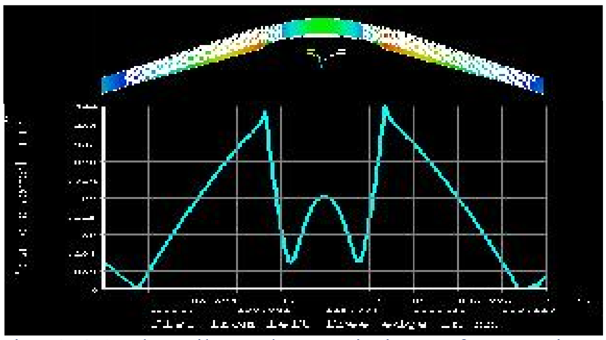


Fig 3.4.1 describes the variation of vonMises stress along the length of the specimen. The stress at the apex is much higher than those at the lines of application of force. In relation to models with 0° and 45°, the stress at the apex here is higher at 2.3MPa, whereas stresses at the line of application of forces is lesser at 1.7MPa.

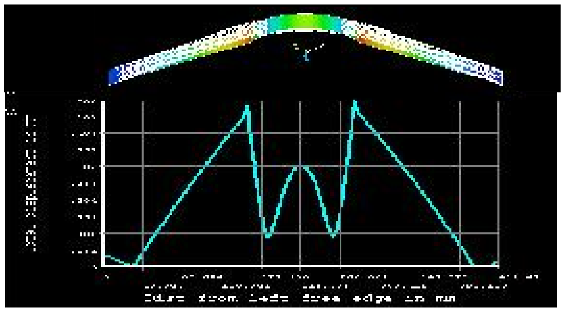


Fig 3.4.2 is a plot of total displacement along the length of the specimen. The distribution of total displacement remains same but the magnitude at the lines of application of force is slightly higher and at the apex of curvature is slightly lesser.

3.5 FIBRE ORIENTATION: 90°

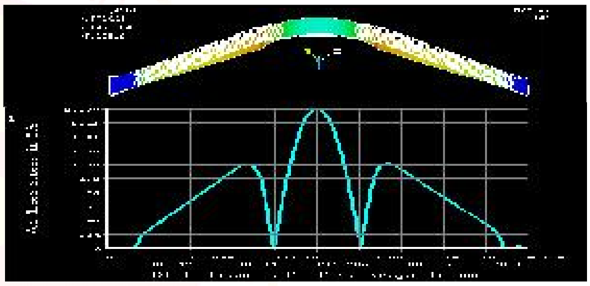


Fig 3.5.1 describes the variation of vonMises stress along the length of the specimen. In relation to the curve for ±45° orientation, which has similar distribution of stresses, the stress at the apex of curvature is similar but a dip in the stress at the lines
of application of force, from 1.9MPa to 1.45MPa can be observed.

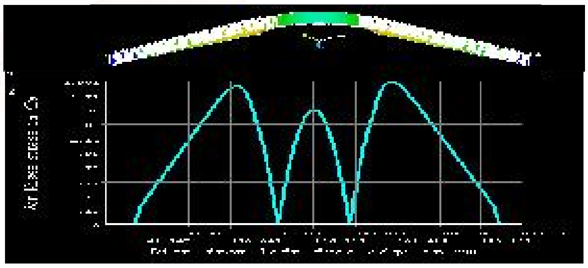


Fig 3.5.2 describes the plot of variation of total displacement along the length of specimen. The displacement values are slightly higher than the previous orientations. Distribution of displacement is the same as others.

VARIATION OF PARAMETERS WITH FIBRE ORIENTATIONS

The variation of magnitudes of different parameters with fibre orientations are presented below.

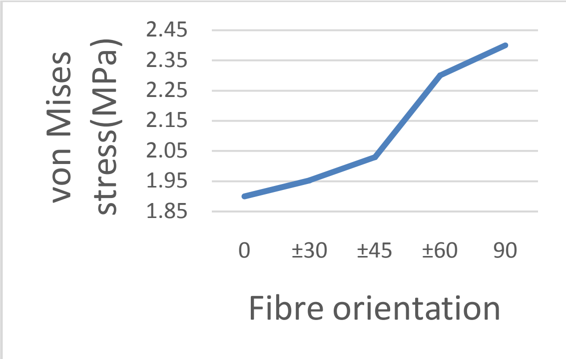


Fig 4.1. Variation of vonMises stress with fibre orientation.

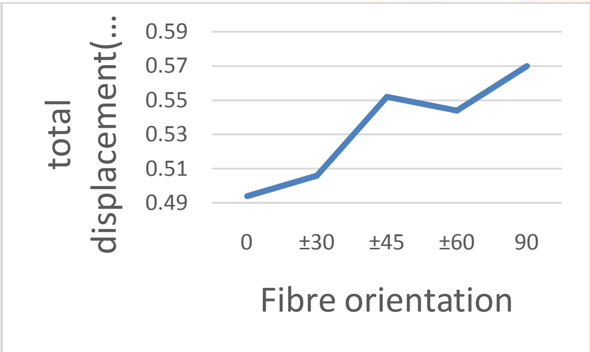


Fig 4.2 Variation of total displacement with fibre orientation.

It can be observed from the graphs that the values of vonMises stress, and the resultant total displacement vary almost linearly as we move from 0° to 90° fibre orientation.

CONCLUSION

With an intention to analyse the effect of orientation of fibre of the face sheets on the mechanical performance of the curved sandwich beam, a curved specimen was modelled using the ANSYS software package and analysed. Following conclusion was drawn from the analysis. The graphs of variation of parameters along the length of the specimen show that for some fibre orientations of the skins, the vonMises stress peaks at the apex of curvature and for some, the peak is at the lines of application of force. Similar conclusions can be drawn for the another parameter.

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DIGITAL INFORMATION LITERACY: NEED OF THE DAY

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ABSTRACT

Now a day, digital literacy is a major issue in today's digital society. Digital information is becoming essential to almost every aspect of modern life which means that there is a need as never before for student, teachers and citizens also who are information literate in a digital context. In this context I have highlighted the importance & Need of digital literacy in the educational institute. This will be benefited by implementing in the teaching and learning process.

Keyword: *Digital literacy, Digital Information Literacy, Information Literacy, Internet Literacy, Computer Literacy, ICT.*

INTRODUCTION

In this digital era information is growing at surprisingly fast speed in the digital society. Today not a single person i.e. whether man or woman, adult or child, literate or illiterate, poor or rich can do their work properly without information. Digital literacy involves mere ability to use software or operate a digital device. It includes a large variety of technical, cognitive and sociological skill in order to perform tasks and solve problems in digital environments. These skills are referred to in the literature as "digital literacy" (Gilster, 1997).

Again, digital literacy involves critically engaging with technology and developing a social awareness of how a number of factors including commercial agendas and cultural understandings can shape the ways in which technology is used to convey information and meaning. Digital accessibility has extremely empowered all of us, students and non-student alike. It means being able to communicate and represent knowledge in different context to different audiences.

WHAT IS DIGITAL INFORMATION LITERACY?

Digital information literacy is the ability to recognize the need for, to access, and to evaluate electronic information. The digitally literate can confidently use, manage, create, quote and share sources of digital information in an effective way. The way in which information is used, created and distributed demonstrates an understanding and acknowledgement of the cultural, ethical, economic, legal and social aspects of information. The digitally literate demonstrate openness, the ability to solve the problems, to critically reflect, technical capability and a willingness to collaborate and keep up to date prompted by the changing contexts in which they use information. The use of computers, the Internet and the World Wide Web has become integral to many forms of information access, communication, and knowledge generally.

DEFINITION

- The American Library Association (ALA 2000) states that, "to be information literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate and use effectively the needed information".
- Digital literacy is the ability to use information and communication technologies to find, evaluate, create and communicate information, requiring both cognitive and technical skills.
- It is the ability to identify, use, acknowledge, create and evaluate information sourced from an electronic device such as a computer or a cell phone.

COMPONENTS OF DIGITAL INFORMATION LITERACY

Components of digital information literacy may vary by user but, Digital literacy is an umbrella concept for important skill clusters whose names are often used as synonyms; their content, however, is not exactly the same. ICT refers to a set of user skills that enable active participation in a society where services and cultural offerings are computer supported and distributed on the internet.

It is about collaborating staying safe and communicating effectively. It's about cultural and social awareness and understanding, and it's about being creative. Being digitally literate is about knowing when and why digital technologies are appropriate and helpful to the task at hand and when they are not. It can be helpful to think of digital information literacy as made up of a number of inter-related components or dimensions. (G. Meenambika, et.al 2015).

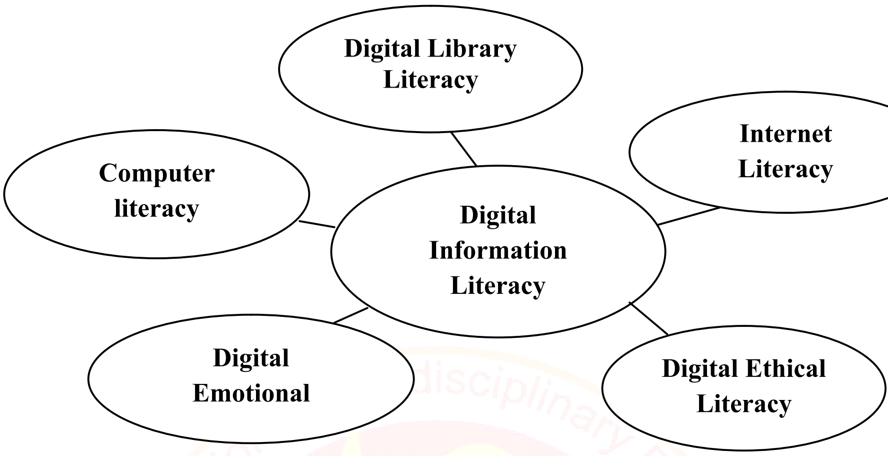

Fig. Components of Digital Information Literacy

- Digital Library Literacy
- Internet Literacy
- Computer Literacy
- Digital Ethical Literacy
- Digital Emotional literacy

DIGITAL LIBRARY LITERACY

- Handling library database effectively and efficiently
- Digital copyright issue
- Locating Quality information through library websites

INTERNET LITERACY

- Internet Knowledge in getting relevant information
- Online query or search skills
- Navigation capability
- Evaluate information efficiently
- Internet safety usage

Using social networks in useful ways. Using Blogs, Face book, Twitter in effective manner. Online youth civic engagement is a noteworthy development, and there have been successful institutional and individual initiatives aimed at empowering youth and providing them with online means to voice their opinions and concerns in society

Net literacy improves computer access with secured data sharing.

COMPUTER LITERACY

- Basic computer skills
- Hardware and software applications

Net generation students are ICT skilled is not true. They are using ICT in playing video games and chatting in social network, we have to engage them in online learning through mobile devices and promote the usage of library websites.

Librarians can arrange training programs in accompany with teachers for computer literacy.

ETHICAL LITERACY

- Plagiarism Awareness
- Acknowledgement for previous works referred
- Giving references in their works

Today's college graduates live in world where it is important to understand key information policy issue. Intellectual property, privacy and first amendment issues are fundamental to operating as an informed citizen in today's information society and directly affect the work of individuals who create, as well as use, networked information. (G. Meenambika, 2015)

EMOTIONAL LITERACY

Emotional literacy is to gain emotional intelligence

- Self awareness
- Self management
- Social awareness
- Self awareness is to respond to the forums in internet and limit to share the privacy.

- Self management with social networking sites. Face book group study. Student who participated in the Face book group scored higher in quizzes and also in exams.
- Social awareness in providing information in internet. Example digital natives are not aware of social responsibility and security risks before giving any information in the internet.

National security is questionable due to lack of Cyber security literacy in digital transfer of information. (G. Meenambika, et.al 2015)

NEED OF DIGITAL INFORMATION LITERACY

In this digital environment skill is needed for user. For security and safe use of digital resources, digital literacy is must in digital this age. Digital natives are always with laptop or smart devices in their hand, but how effective they are using internet for their capacity building is questionable. There are so many problems like cyber crime, copyright issue, security threats, social unawareness etc. To avoid and prevent threats in digital world, digital information literacy is essential. It is nothing but creating awareness in digital space. (G. Meenambika, et.al 2015)

- **Values & Status of Digital Information Literacy in education:**

Educational institutions are continuously updating their curriculum for digital information literacy to keep up with accelerating technological developments. This often includes computers in the classroom, the use of educational software to teach curriculum, and course materials being made available to students online. Some classrooms are designed to use smart boards and audience response systems. These techniques are most effective when the teacher is digitally literate as well.

Teachers often teach digital literacy skills to students who use computers for research. Such skills include verifying credible sources online and how to cite web sites. Google and Wikipedia are used by students "for everyday life research." Educators are often required to be certified in digital information literacy to teach certain software and, more prevalently, to prevent plagiarism amongst students. (Wikipedia 2018)

- **Values of Digital Information Literacy in society:**

Digital literacy helps people communicate and keep up with societal trends. Literacy in social network services and Web 2.0 sites helps people stay in contact with others, pass timely information and even sell goods and services. This is mostly popular among younger generations, though sites like LinkedIn have made it valuable to older professionals.

Digital literacy can also prevent people from believing hoaxes that are spread online or are the result of photo manipulation. E-mail frauds and phishing often take advantage of the digitally illiterate, costing victim's money and making them vulnerable to identity theft.

Research has demonstrated that the differences in the level of digital literacy depend mainly on age and education level, while the influence of gender is decreasing. Among young people, digital literacy is high in its operational dimension. Young people rapidly move through hypertext, have a familiarity with different kinds of online resources. However, the skills to critically evaluate content found online show a deficit (Gui and Argentin, 2011).

Building on digital literacy is the concept of digital creativity which is the expression of creative skills in the digital medium. This can include programming, websites and the generation and manipulation of digital images.

Key digital-literacy essential skills for learner:

- **Searching effectively.** From researching a school report to watching the latest music video, users need to learn how to evaluate the quality, credibility, and validity of media and to give proper credit to the source. (Learn responsible search strategies.)
- **Protecting their and others' private information online.** With so many ways to share information, user need to learn internet safety basics, such as creating strong passwords, using privacy settings, and respecting their friends' privacy.
- **Giving proper credit when using other people's work.** In a world where anything can be copied, pasted, and even claimed as one's own, it's critical that user learn to correctly cite sources.
- **Understanding digital footprints.** What makes digital media so cool -- the ability to interact -- also creates tiny tracks across the web. User need to know that whenever they create a profile, post something, or comment on something, they're creating a composite profile potentially viewable by others.
- **Respecting each other's ideas and opinions.** To be digitally literate, user must understand

that what makes the web an amazing place is that for this vast virtual world to function properly, we must all be good digital citizens.

CONCLUSION

It is suggested to provide training programs to develop skills in using digital resources. And orientation program should be arranged for creating awareness among digital information users and to increase their skills and capability. We need to commit over selves to change education at classroom level. Educational institutes must provide a solution to standardized digital literacy skills, training and certification across India.

Today, we need to look at whether internet, computer, emotional & ethical skills are present among the rural area specially. In this digital world we must also aware about fair and unfair use of digital resources to the citizens.

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ASSESSMENT OF NOISE LEVEL AND ABATEMENT SOLUTIONS A CASE STUDY FOR JALGAON CITY

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ABSTRACT

Increasing noise pollution is a critical problem of modern society. Jalgaon is a rapidly growing industrialized city in which noise pollution level is also growing day by day. The national highway no. 6 also passes from the heart of the city. It is a major cause of noise pollution in Jalgaon city. In the present study few stations are selected in the city considering residential and commercial zone. The noise levels in these zones is assessed using a noise level meter on various days of a week. The average noise intensities are assessed and are presented here. It is found that the noise level in Jalgaon city is alarmingly high. Some measures are also proposed here to abate the noise level in city.

Key words: *Noise Pollution, assessment, effects, abatement.*

INTRODUCTION

The fruit of Silence is prayer. The fruit of Prayer is faith. The fruit of Faith is love. The fruit of Love is service. The fruit of Service is peace.Mother Teresa [1] .Silence does not refer to just a physical silence around, rather it refers to an eternal silence inside too. Noise is unwanted level of sound. It is an environmental pollution. It is a great concern of the modern life style. Traffic, machines, domestic equipments, office machines, etc are common sources of noise pollution loud speakers, TVs, musical instruments, unwanted talks are most critical sources of noise pollution. They are the most disturbing ones. The rising level of sound pollution has disturbed the life of people in urban areas specially. People are having problems like lack of concentration, blood pressure, headache etc. The most affected community due to air pollution is the residents of congested areas people working in factories, traffic police, drivers etc.

Sound pollution in residential areas is a topic that has been explored by many researchers. Chakraborty [3] has done studies on noise levels in Indian metro cities and has proposed control measures also. Jain [4] has worked on noise intensities along highways. Agrawal [5] found that minimum noise level on highways is more than the maximum permissible noise level limit (65 dB). They have worked out the mean dissatisfaction levels due to sound pollution. They have also developed a traffic noise dispersion model through computer simulation. The present study focuses on assessing the noise levels, particularly vehicular traffic noise, in the Jalgaon city at strategic locations. The strategic locations are carefully chosen as places near to Hospitals, Worship places like Temples, Gurudwaras, Mosques, educational buildings like Schools, Colleges and silent zones like Parks. The noise level at these locations is measured using a sound intensity recording device at various times of the day and on various working days. It is found that the sound intensity at public places is significantly more than the permissible levels [2]. Here, some strategies are proposed to control the noise pollution in Jalgaon city.

The study are in the present study is shown in figure 1.

Fig 1: Google image of work place (Jalgaon city).

MATERIALS AND METHODS

The Jalgaon city (21.0077° N, 75.5626° E) is located in the western part of Maharashtra, India. The city is spread over 68 sq. km. Area. To study the intensity of noise pollution in Jalgaon city, monitoring of noise level has been conducted in strategic locations. The zones are Commercial zone, Residential zone and, Silent zone as per categorization of the Central Pollution control Board (CPCB) India.

The noise levels were recorded in morning hours from 6.00 to 10.00 and in evening hours from 6.00 to 10.00 at an interval of 20 s from Monday through Sunday at both locations. A sound level meter used for this study is as shown in the figure 2:

Fig 2.: Sound level meter.

The sound level meter has a facility to set the time interval after which the sound intensity should be recorded. It also retains the peak value recorded in a particular study.

RESULTS AND DISCUSSIONS

The noise levels are recorded near the Omkareshwar temple during Dec 7 to 13, 2017. The recording is done in morning hours as well as in evening hours which are crucial from noise pollution point of view. The records for morning hours are as shown in figure 3:

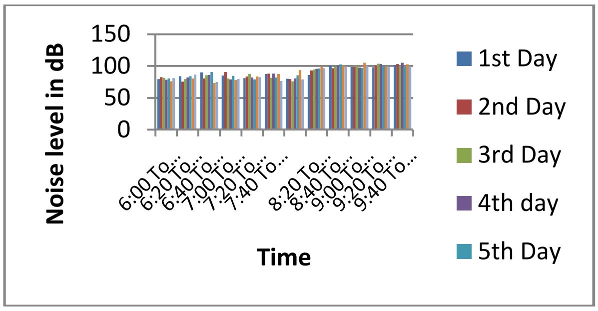

Fig 3.: Noise levels near Omkareshwar temple in morning hours.

The same for evening hours is shown in figure 4.

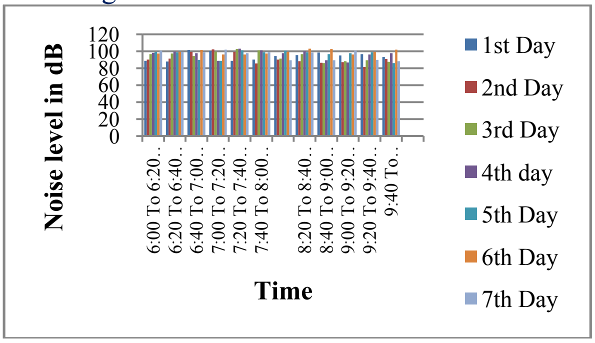

Fig 4.: Noise level at Omkareshwar temple in evening hours.

At Omkareshwar temple it can be seen that the noise pollution is significantly more than the permissible maximum level that is 65 dB at almost all the times. It is also seen that the noise level is more at evening hours as compared to the morning hours. The loud speakers are one of the major contributors to this noise pollution. The Omkareshwar temple is a residential and posh zone of Jalgaon city.

The average of the 7 days for the Omkareshwar temple location has also been worked out. It is shown in figure 5.

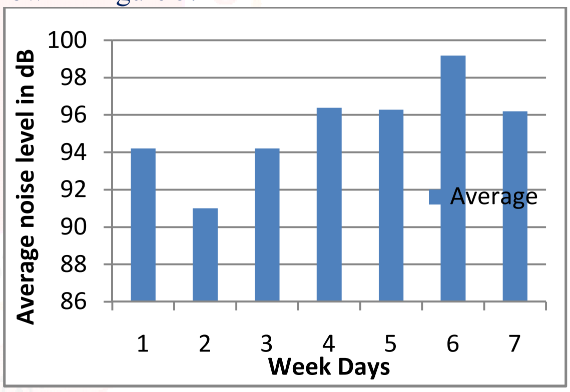

Fig. 5: Average sound levels at location Omkareshwar temple.

Similar studies are done at Bahinabai Choudhary Garden also. It is garden where people come for relax. Yet it is located near to highway and is badly affected due to noise pollution. There are several hospitals near to this garden. The noise pollution affects them also. Figure 6 shows the average noise pollution levels near Bahina Bai Garden.

Again it is evident that the noise level is very very high. It can never be accepted as a noise level in gardens or hospital zones. In fact prolonged exposure to this noise level may cause hearing impairment to the persons.

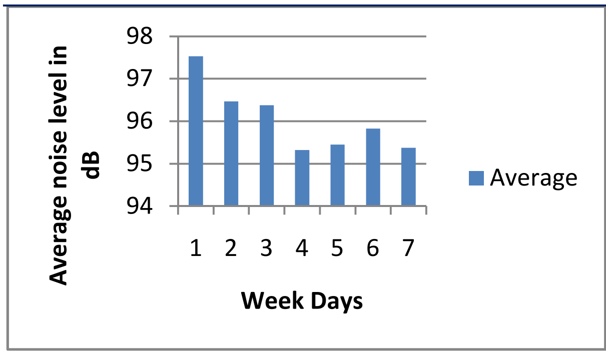

Fig. 6: Noise levels near Bahina Bai Garden (Average values).

Another important location in Jalgaon city is Chitra Chowk. The noise level measurements for this location are given in fig 7.

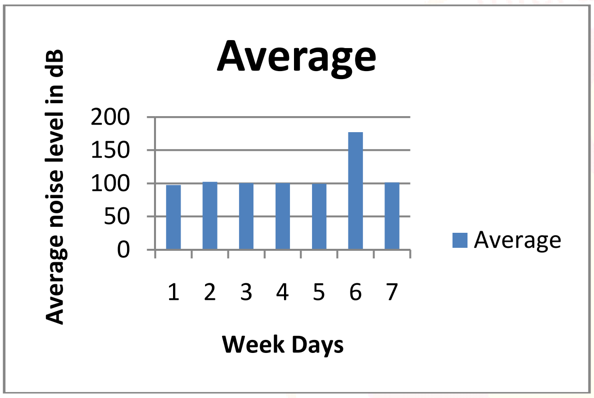

Fig. 7: Noise levels near Chitra Chowk (Average values).

Chitra chowk is a commercial area. Yet the noise pollution in general is over 80 – 100 dB. It is almost at the peak level of acceptable limit or even above. The permissible limit is 85 – 89 dB.

The noise levels have also been measured at Civil Hospital, Jalgaon. The values are shown in figure 8.

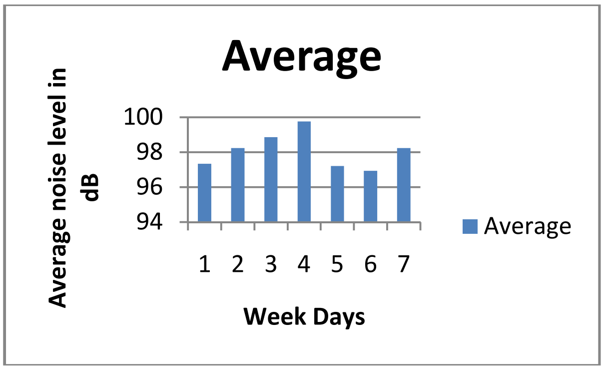

Fig. 8: Noise levels near Civil Hospital.

It can be seen that the noise level is significantly over the permissible levels. The permissible level is 45 dB.

CONCLUSION

From the present study of the work we are found that the noise level of the selected station is exceeding the limit given in IS code. So because of that noise the distubance to the living human being is more. To minimise the noise level, some suggetsions are given as under:

1. Use of loud speakers must be with due permissions of authorities only.
2. Use of pressure horns of vehicles in cities must be prohibited.
3. Proper maintenance of roads.
4. Removal of road side encroachments.
5. Planting of recommended plant species.
6. Servicing and maintenance of vehicles.
7. Mass awareness initiatives regarding the issue of noise pollution.

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"ANALYSIS OF AN INDUSTRIAL STRUCTURE FOR WIND LOAD"

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ABSTRACT

Paper includes the comparison between various configurations of industrial shed. There are various type of industrial shed. But here we compare the various of industrial shed, such as hot rolled steel shed such as shed using Howe truss, A-truss, Portal truss etc. This paper will gives us the suitable configuration of industrial shed by making and comparing design and analysis of various configuration of industrial shed. This structure is proposed to design according to IS : 800 - 2007 and the dead, live and the wind load analysis is done according to IS :875 - 1987 (Part-I, Part-II, Part-III). Design of industrial shed by using STADD Pro-2007 which gives vary quickly and accurately. Comparison between various configurations of industrial shed using various types of truss type which gives us that which shed is suitable for the industrial shed and which is more effective in strength and economical point of view. This paper work compares the design of various configuration of industrial shed and concluded that which suitable & economical in all views. The comparison gives us suitable configuration which suitable strength point of view.

Keywords: *Howe truss, STADD Pro-2007, Dead load, Live load, Wind load*

INTRODUCTION

Aim: The widely accepted aims of the seismic design of structural system are best defined by recalling the industrial structure that are to be satisfied.

Objectives:

- To study the industrial shed as per its drawing details, in Bentley Staad-Pro V8i.
- To study the structure as per code, with all the member sections as per the drawings.
- To design the structure against Dead Loads, Live Loads, Wind Loads.

Scope of the present study: To study how analysis is to be carried out in staad pro. It also includes the comparison of test result of various type of frame structure building during earthquake

Need:

- Good deformation control.
- Perform well in earthquake prone zone.
- Good durability during earthquake.
- Industries/ Factories are essential for nation's growth.
- The operations and physical circumstances change constantly unlike in the factories where the process, the method and the operations are generally respective.
- Timings and schedules vary considerably from place to place.

METHODS

Phase 1:

Introduction - Aim: Seismic analysis of an industrial structure for various seismic zone. Objective: To design the industrial shed as per its drawing details, in Bentley STAAD-PRO V8i. Scope: Modeling of the steel frame under the three analysis mentioned above using Staad Pro software is done and the results so obtained are compared. Need: Good deformation control and Perform well in earthquake zone. Study of different papers as well as books.

Phase 2 :

Study of different IS Codes which are useful during calculations.
IS : 800 - 2007 the dead, live and the wind load analysis is done according to IS :875 - 1987 (Part-I, Part-II, Part-III).
Detailed study of Methods for analysis Problem consideration. Analysis of the structure manually.

Phase 3:

A major portion of the analysis is carried out in Bentley Staad. Pro V8i.Seismic Analysis by using Staad.Pro V8i. Results, Conclusion, Scope, References.

EXPERIMENTAL WORK

Design a Howe Roof Truss for an industrial building for the following data:

1. Overall length of the building =20.90m 2.Overall width of the building=15.90m
3. Width(c/c of roof column)=15m 4.c/c spacing of trusses=7.5m
5. Rise of truss=1.5m 6.Self weight of purlins =318N/m 7.Height of column =6.38m
8. Roofing and side covering-Asbestos cement sheets (Dead weight=171N/m^2)

The building is located in industrial area MIDC, Akola. Both the ends of the truss are hinged. Use steel of grade Fe 410.

Step 1.- Truss Configuration

Let □ be the inclination of the roof with the horizontal

tan□=1.5/7.5=1/5 □=11º19'≈11.30º

Length of rafter=√(15/2)^2+1.5^2=7.64m

Length of each panel L_0U_1, U_1U_2, U_2U_3, U_3U_4, U_4U_5, U_5U_6, U_6U_7=7.64/7=1.091m

Panel length on plan=1.091 x cos(11.19º)=1.070m

Area of plan =spacing x panel length on plan =7.5 x 1.070=8.025m^2

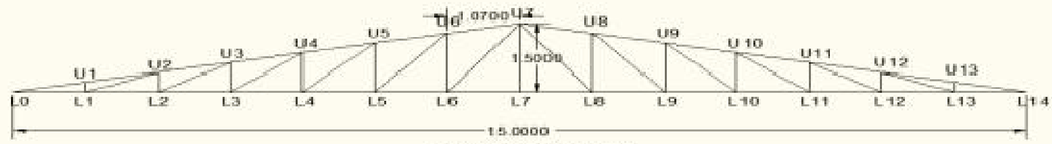


FIG:Truss configuration

STEP 2.-Dead Load Calculation

Self Weight of Truss=(Span/3+5)x10 =(15/3+5)x10 =100 N/m^2

Weight of Roofing Material=171 N/m^2

Assume Weight of Bracing=12 N/m^2

Total Load =288 N/m^2

Total Dead Load on each panel point=Total Load x Area=283 x 7.5 =3183N≈3.183KN/m^2

Dead Load Panel point due to the purlin=self wt. of purlin x spacing =318 x 7.5 =2385 N≈2.385KN/m^2

Dead load on intermediate panel point =3183+2385=5568N≈5.56KN

Dead load on end panel point =5.56/2=2.78KN

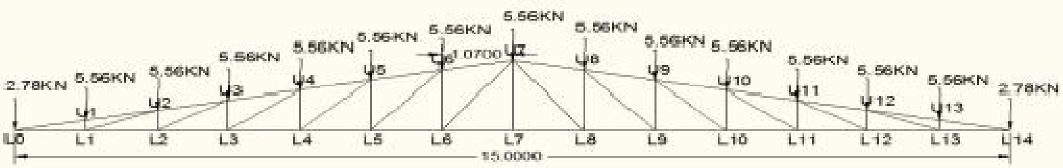


FIG:Dead load at panel point

STEP 3.- Live Load Calculation

□=11.90

Let as assume that no access is provided to the roof. The live load is reduced by 20N/m^2 for each one degree above 10º slope □ > 10º

LL=0.75-0.02 x (□-10)=0.75-0.02 x (11.09-10)=0.726KN ≈726.2N/m^2 > 0.4KN

LL=2/3 x 0.726=0.484

LL on intermediate panel=0.484 x 7.5 x 1.5=5.44 KN

LL on end panel point=5.44/2=2.72KN

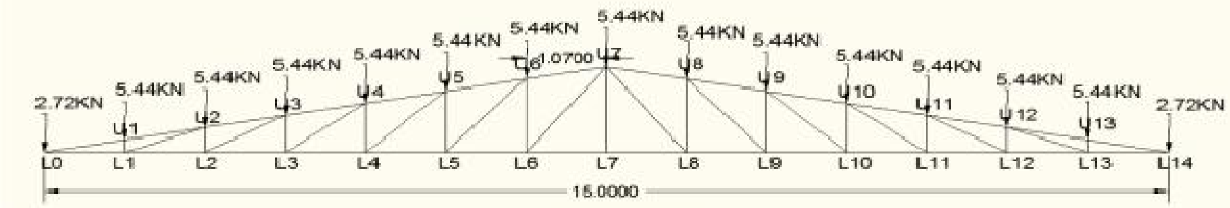


FIG: Live load at panel point

STEP 4.- Wind Load Calculation

Let as assume the life of the industrial building to be 50 year and the land to be plain and surrounded by small building.

K1=1.0 (for 50 year)

From Table 2; IS: 875 (part 3) – 1987

K2=0.89 (for torsion category 3, building height=6.38)

K3=1.0 (for plain land)

K4=39m/s (zone 2)

Design wind speed,(Vz) From Table 1; IS: 875 (part 3) – 1987

Vz = K1 x K2 x K3 x V_b=1 x 0.89 x 1 x 39=34.32m/s

Design wind pressure,(P_z)

$P_z = 0.6 \times (V_z)^2 = 0.6 \times (34.32)^2$=706.71m/s

Height of building column above ground level=h= 6.38m

Width of building, W=15m

h/w=6.38/15=0.425

1/2 < h/w < 3/2

1/2 < 6.38/15 < 3/2

0.5 < 0.42 < 1.5

□=11.19, from (book s.k.duggal, page no.791 appendix XXII)

Let us assume the building ho have normal permeability.

The internal air pressure coefficient Cpi are ± 0.2 for both the windward and leeward sides.

Wind ward sides (C_{pe}),10 □> -0.8

11.19 □> Cpe

20 □.> -0.8

C_{pe} = 0.8

Leeward sides (C_{pe}), 10 □.> -0.6

11.19 □> C_{pe}

20 □> -0.6

C_{pe}=0.6

Windward sides, F =(C_{pe} - C_{pi}) x Pd x A =(0.8-0.2) x 0.706 x 1.091 x 7.5 =-3.46KN

Wind load on each intermediate panel point=3.46

Wind load on each end panel point =3.46/2 =1.73KN

Leeward sides, F =(C_{pe} - C_{pi}) x Pd x A =(-0.6-0.2) x 0.706 x 1.091 x 7.5=-4.62KN

Wind load on each intermediate panel point = 4.62 KN

Wind load on each end panel point = 4.62/2 =2.31KN

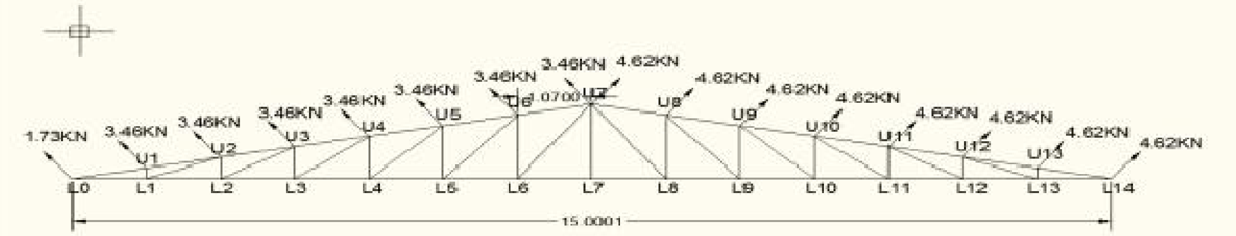


FIG: Wind load at panel point

By using STAAD PRO 2008 software details are-

Number of Nodes	210	Highest Node	210
Number of Elements	487	Highest Beam	487

Load cases and combination

Type	L/C	Name
Primary	3	DL
Primary	4	LL
Primary	5	WLX
Primary	6	WLZ
Combination	1	1.2(DL+LL+WLX)
Combination	2	1.2(DL+LL+WLZ)
Combination	7	1.7(DL+LL)
Combination	8	1.5(DL+WLX)
Combination	9	1.5(DL+WLZ)

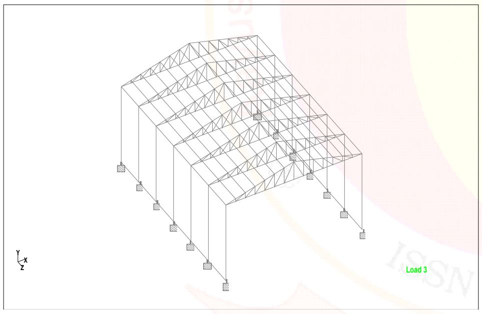
Section properties:

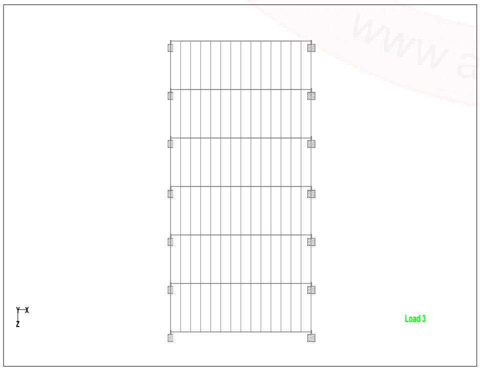
Prop	Section	Area (cm^2)	I_{yy} (cm^4)	I_{zz} (cm^4)	J (cm^4)	Material
1	ISA75X 75X5 SD	14.540	141.378	79.656	1.229	STEEL

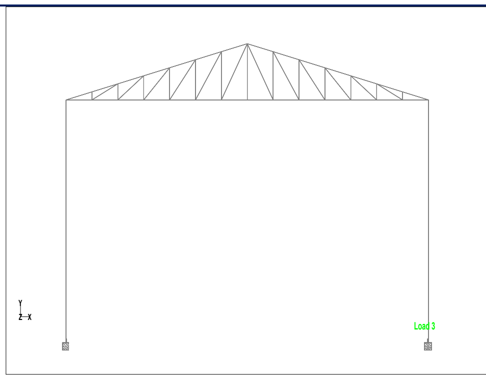
Load combination:

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
1	1.2 (DL+LL+WLX)	3	DL	1.20
		4	LL	1.20
		5	WLX	1.20
2	1.2 (DL+LL+WLZ)	3	DL	1.20
		4	LL	1.20
		6	WLZ	1.20
7	1.7(DL+LL)	3	DL	1.70
		4	LL	1.70
8	1.5(DL+WLX)	3	DL	1.50
		5	WLX	1.50
9	1.5 (DL+WLZ)	3	DL	1.50
		6	WLZ	1.50

STAAD Model:







RESULT

	Beam	Node	L/C	Axial Fx (kN)
Max Fx	82	57	7:1.7(DL+LL)	**590.634**
Min Fx	69	44	7:1.7(DL+LL)	**-586.777**
Max Fy	206	118	1:1.2(DL+LL+WLX)	3.982
Min Fy	310	173	7:1.7(DL+LL)	8.821
Max Fz	330	166	9:1.5(DL+WLZ)	68.100
Min Fz	77	53	9:1.5(DL+WLZ)	274.771
Max Mx	1	1	9:1.5(DL+WLZ)	-250.297
Min Mx	15	15	9:1.5(DL+WLZ)	-250.290
Max My	330	180	9:1.5(DL+WLZ)	69.169
Min My	330	166	9:1.5(DL+WLZ)	68.100
Max Mz	220	106	8:1.5(DL+WLX)	69.116
Min Mz	220	120	8:1.5(DL+WLX)	70.184

CONCLUSION

In this project the study is done for analysis of an industrial structure for wind load. In this project study mainly done for industrial structure which is in MIDC, AKOLA. Different loads are consider such as dead load, live load, wind load. In proposed work, the forces developed due to seismic action in X direction and Z direction, are considered. The results obtained from the above analysis are to be tabulated, compared and conclusions are drawn. By using software analysis result. Combination of axial force 1.7(DL+LL) & 1.5(DL+WLZ) in maximum value of 1.7(DL+LL)=590.634KN &1.5(DL+WLZ)=274.771KN

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PERFORMANCE OF DIFFERENT TYPES OF MULTI-STORY FRAME STRUCTURE DURING EARTHQUAKE

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ABSTRACT

The principle objective of this project is to comparison between RCC and Steel Structure multi-storeyed building manually with same building dimension.The design involves load calculations and analyzing the whole structure. The design methods used is Limit State Design conforming to Indian Standard Code of Practice. Analysis the members due to Seismic load. The proposal structure is a 12 storied building with 3 m as the height of each floor. The overall plan dimension of the building is 24.0 m x 24.0m.

Key words: *RCC frames structure, Steel structure*

INTRODUCTION

Earthquake is a natural phenomenon, which is generated in earth's crust. Duration of earthquake is usually rather short, lasting from few seconds to more than a minute or so. But thousands of people loose their lives due to earthquakes in different parts of the world.

FRAME STRUCTURE

Initially there was no distinction between the supporting structure and protecting skin, however separation of supporting and protecting function leads to the framed system. A framed system may be defined as "A framed structure in any material is one that made stable by skeleton that is able to stand by itself as a rigid structure without depending on floors or wall to resist deformation." Material such as steel, reinforced concrete and wood, which are strong in both tension and compression, make best members for framing.

MATERIAL OF CONSTRUCTION

Most of the framed buildings are constructed in reinforced cement concrete. RCC is composite material that is it made of concrete + steel. Concrete is obtained by mixing cement, sand, small stone, water in required proportion. Steel used is called reinforcement. They are round in shape and can twisted as per requirement. Reinforced take care of the weakness the concrete has and hence result in economical composite material.

Frame build up of beam and columns

1.Steel & 2.Concrete. Resisting lateral load by bending of beam and columns. Provide lots of open interior space. Make building flexible.

Concrete frame structures are a very common or perhaps the most common type of modern building. This type of building consists of a frame or skeleton of concrete. Horizontal members of this frame are called beams and vertical members are called as columns. Humans walk on flat planes of concrete called slab. The column is the most important as it is the

Figure1: RCC Frame structure

Figure 2: Steel Frame structure

The role of steel structure is important in construction area. Steel have the some physical properties like as high strength per unit weight and ductility. Because of ductile nature steel structure gives the sufficient warning before failure by the way excessive deformation. These properties of steel are very important in case of seismic resistant design. The resistance to lateral loads from earthquake is the reason for the evolution of various structural systems.

AIM:-

The aim of project is to find out Performance of different types of multi-story frame structure during earthquake.

OBJECTIVES

- Study of different types of frame structure like RC frames and steel frames building and their performance during an earthquake
- To analyse different types of frame structure multi-story buildings
- Analysis is done with the use of STAAD.PRO software

NEED

- The behavior of structure changes with the material for construction due to its properties
- To make building better resistances to collapse
- Good deformation control
- Perform well in earthquake prone zone
- Good durability during an earthquake
- Suitable for any number of stories

SCOPE

- To study how analysis is to be carried out in STAAD pro.
- It also includes the comparison of test result of various type of frames structure building during earthquake

METHODOLOGY

Different Phases of methodology

Phase- I

a) Introduction: A general idea about the topic along with need and scope is stated.
b) Methodology: Total breakdown structure of line of work is given

Phase-II

a) Detailed study: Various types of seismic forces, various technique, various mathods, seismic consideration as per IS 1893:2002, IS 800:2007
b) Analysis for various types multi-story frame structure during earthquake

Phase- III

a) Observation: Observation obtained from the various analyses is done.
b) Results: results are derived on basis f the analysis.
c) Conclusion and limitation
d) Future Scope: future scope for work regarding this topic is stated.
e) References: various literatures

EXPERIMENTAL WORK

CASE STUDY

Find forces and shear at different floor levels. For 12-story RCC and steel frames building

Table 1: Frame detailing required for analysis

Particulars	RCC structure	Steel structure
No. of story	12	12
Plan dimension	30mx48m	30mx48m
Total height of building	36m	36m
Size of beam	300×600mm	300×600mm
Size of column	300×600mm	Encased I section
Slab thickness	120mm	120mm
Dead load	4KN/m^2	4KN/m^2
Live load	On each floor 3KN/m^2 On roof 1.5KN/m^2	On each floor 3KN/m^2 On roof 1.5KN/m^2
Seismic zone	II, III, IV, V	II, III, IV, V
Soil condition	Hard soil	Hard soil
Response reduction factor	3.0	4.0
Importance factor	1.0	1.0

Solution for RCC frames structure building (for Zone II)

Design parameter:
zone factor, Z=0.1
Importance factor, I=1.0

Response reduction factor, R=3.0
Seismic weight: Floor area=24×24=576m^2
Dead load= 4KN/m^2
Weight of partitions = 2KN/m^2
For live load upto and including 3KN/m^2
Percentage of live load to be considered = 25%
Total seismic weight on the floors, W = $\sum W_i$
Where $\sum W_i$ is the sum of load from all the floors, which includes dead load and appropriate percentage of live loads.
Effective weight at each floor except the roof = 4.0+2.0+0.25×3 = 6.75KN/m^2
And at the roof = 4.0KN/m^2
Weight of the beam at each floor and the roof = 0.3×0.6×240×25 = 1080KN
Weight of the columns at each floor = 0.3×0.6×2.4×25×25 =270 KN
Weight of the column at roof = ½×270 = 135 KN
Total plan area of building = 24×24 = 576m^2
Equivalent load at roof level = 4×576+1080+135 = 3519KN
Equivalent load at each floor = 6.75×576+1080+270 = 5238KN
Seismic weight of the building, W = 3519+5238×12 = 66375 Kn
Base shear: Fundamental natural period of vibration of frame

$T_a = 0.07h^{0.75} = 0.075\ (36)^{0.75} = 1.028s$

Average response acceleration coefficient, S_a/g, for 5% damping and type I soil is 1.04
Design horizontal seismic coefficient,

$A_h = ZI(S_a)/2Rg = 0.1×1.0×1.04/(2×3) = 0.01733$

Base shear $V_B = A_hW$ = 0.01733×66375=1150.278KN
Lateral load and shear forces at various floor levels
Design lateral forces at floor i, $Q_i = V_B (W_ih_i^2/\sum W_ih_i^2)$
The calculation of design lateral forces at each floor level is shown in table 1.2

Table 2 : Lateral loads and shear forces for RCC structure

Mass no.	W_i(kN)	hi (m)	$W_ih_i^2$ (KN/m^2)	$(W_ih_i^2/\sum W_ih_i^2)$	Q_i (kN)	V_i (kN)
1	3519	36	4560624	0.1605	184.619	184.619
2	5238	33	5704182	0.200	230.055	415.169
3	5238	30	4714200	0.1659	190.831	606.00
4	5238	27	3818502	0.1343	154.482	760.482
5	5238	24	3017088	0.1061	120.044	880.526
6	5238	21	2309958	0.0812	93.402	973.928
7	5238	18	1697112	0.0597	68.671	1042.599
8	5238	15	1178550	0.0414	47.621	1090.22
9	5238	12	754272	0.026	29.907	1120.127
10	5238	9	424278	0.0149	17.139	1137.266
11	5238	6	188568	0.0066	7.591	1144.857
12	5238	3	47142	0.0016	1.840	1146.697
$\sum W_ih_i^2$ = 28414476						

Solution for steel frames structure building (for Zone II):
Given data:
Ground floor: ISHB 450@ 872 N/m with 12 mm thick and 250 mm wide cover plateon each flange.
Remaining floor ISHB 450 @ 872 N/m
Beam section
Along 7.5 m intermediate beam (L_1): ISMB 400@ 616 N/m
All other beam (L_2): ISMB 225@312 N/m
Slab : 120mm thick RCC slab on all floor
Wall 230mm thick
Solution :
Zone factor for seismic zone II= 0.1
Impact factor is 1.0
Response reduction factor for steel frame building is 4 (Table 7 of IS 1893:2002)
Consider a floor finish of 1KN/m^2
Seismic weight: Dead load = 4KN/m^2
Load of beam ISMB 400 = 24×3×0.616 =44.352 KN
Load of beam ISMB 225 = (24×2+24×4)×0.312 =44.92kN
Load of column ISHB 450 = 3×16×0.872=41.85
Wall on permeter beam = 0.23×18×(3-0.225)= 11.488KN/m
Total load due to wall = 11.488×(24×2+24×2)=1102.848kN
Floor load =24×24×12=6912KN

Live load: At roof 1.5×0.25×90=33.75

At all other 3×0.25×90=67.5

$W_1=W_2= W_3=W_4=W_5=W_6= W_7 =W_8 =W_9=W_{10}= W_{11}$=44.352+44.92+41.85+1102.848+6912+67.5= 8213.46KN

W_{12}= 44.352+44.92+41.85/2+6912+33.75=7055.94KN

Equivalent lateral force method

Foundation natural period of vibration

Where d is in meter, is the base dimension of the building at plinth level along the considered direction of lateral forces.

T_a== $0.085(36)^{0.75}$ =1.249s

The building is located at heard soil site, S_a/g=2.5

The total design seismic base shear (V_B) along the principle directionis

$V_B=A_hW$

Where W is the seismic weight of building

The design horizontal acceleration spectrum value,

$A_h= ZI(S_a)/2Rg$ = (0.1×1×2.5)/(2×4) = 0.03125

W=8213.46+7055.94= 15269.40KN

V_B=0.03125×15947.9=498.37 KN

The floorwise calculations of the lateral forces are tabulated below:

Table 3: Lateral loads and shear forces for steel structure

Mass no.	W_i(kN)	hi (m)	$W_ih_i^2$ (Kn/m^2)	($W_ih_i^2/\sum W_ih_i^2$)	Q_i (kN)	V_i (kN)
1	7055.94	36	9144498.24	0.196	97.68	97.68
2	8216.46	33	8947724.94	0.192	95.68	193.66
3	8216.46	30	7394814	0.1588	79.141	272.801
4	8216.46	27	5989799.34	0.128	63.79	336.591
5	8216.46	24	4732680.96	0.101	50.335	386.926
6	8216.46	21	3623458.86	0.0778	38.773	425.699
7	8216.46	18	2662133.04	0.0571	28.456	454.155
8	8216.46	15	1848703.5	0.0397	19.78	473.935
9	8216.46	12	1183170.24	0.0254	12.658	486.593
10	8216.46	9	665533.26	0.014	6.977	493.57
11	8216.46	6	295792.56	0.0063	3.139	496.709
12	8216.46	3	73948.14	0.0015	0.747	497.45
$\sum W_ih_i^2$ = 46562257.08						

Similarly the Lateral load and shear forces are calculated for Zone III, Zone IV and ZoneV, RCC and STEEL frames structure.

RESULT AND DISCUSSION

Table 4: This are Lateral loads and shear forces for RCC structure at each floor level For all Zone:

MASS NO.	Zone II		Zone III		Zone IV		Zone V	
	Q_i (kN)	V_i (kN)	Q_i (kN)	V_i (kN)	Q_i (kN)	V_i (kN)	Q_i (kN)	V_i (kN)
1	184.619	184.619	295.448	295.448	443.172	443.172	664.758	664.758
2	230.055	415.169	368.16	663.608	552.240	995.412	828.36	1493.118
3	190.831	606.00	305.388	968.996	458.083	1453.495	687.12	2180.238
4	154.482	760.482	247.219	1216.215	370.829	1824.385	556.243	2736.481
5	120.044	880.526	195 308	1411.523	292.96	2117.345	439.444	3175.925
6	93.402	973.928	149.472	1560.995	224.209	2341.554	336.314	3512.239
7	68.671	1042.599	109.895	1670.89	164.843	2506.397	247.265	3759.504
8	47.621	1090.22	76.209	1747.099	114.313	2620.71	171.470	39.0.974
9	29.907	1120.127	47.860	1794.959	71.791	2692.501	107.686	4038.66

10	17.139	1137.266	27.427	1822.386	41.141	2733.642	61.712	4100.372
11	7.591	1144.857	12.149	1834.535	16.56	2750.202	27.335	4127.707
12	1.840	1146.697	2.945	1837.48	4.417	2754.619	6.626	4134.333

Table 5: This are Lateral loads and shear forces for Steel frames structure at each floor level For all Zone:

MASS NO.	Zone II		Zone III		Zone IV		Zone V	
	Q_i (kN)	V_i (kN)	Q_i (kN)	V_i (kN)	Q_i (kN)	V_i (kN)	Q_i (kN)	V_i (kN)
1	97.68	97.68	156.289	156.289	234.443	234.443	351.65	351.65
2	95.68	193.66	153.091	309.98	229.6	464.043	344.47	696.120
3	79.141	272.801	126.626	436.006	189.939	653.982	284.909	981.029
4	63.79	336.591	102.066	538.072	153.099	807.081	229.649	1210.678
5	50.335	386.926	80.536	618.608	120.805	927.886	181.207	1391.885
6	38.773	425.699	62.037	680.645	93.055	1020.941	139.583	1531.468
7	28.456	454.155	45.531	726.176	68.29	1089.231	102.445	1633.913
8	19.78	473.935	31.656	757.832	47.484	1136.715	71.227	1705.14
9	12.658	486.593	20.253	778.085	30.38	1167.095	45.571	1750711
10	6.977	493.57	11.163	789.248	16.745	1183.84	25.117	1775.828
11	3.139	496.709	5.023	794.271	7.535	1191.375	11.303	1787.131
12	0.747	497.45	1.196	795.467	1.794	1193.169	2.691	1789822

In steel frame, base shear is decreased as compared to RCC at roof for 12 storey building. Shear force in beams of RC frames is more than steel frames.

CONCLUSIONS

In this paper the study is done for seismic analysis of RCC and steel building with the same building dimensions.

- Steel is ductile material and therefor is absorbs more and more sismic forces and vibration
- The earthquake resistant design criteria is adopted such as strong column weak beam concept.
- As the Zone are changes the the seismic forces changes. The RCC and steel building are stable against seismic forces in heavier severity.
- Shear forces in beams of RC structures are more as compared to Steel structures.
- RCC framed structure is less resistant to earthquake.
- Base shear in steel structure is less than the RC structures because of less seismic weight which gives better response during earthquake

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TECHNOLOGIES INVOLVED IN INDOOR NAVIGATION

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ABSTRACT

Mobile applications are very important in any mobile phone. With the help of mobile applications the phone can be used in many purposes other than making a calls and sending messages. They can bring new functions to the mobile which will make it easier for the user to easily interact with his or her device.

Navigation is one of the important uses of mobile device, outdoor navigation uses Global positioning system (GPS) which are installed in all smartphones and tablets.However,GPS cannot provide indoor navigation as the signals get blocked by walls and ceiling. The indoor navigation can be provided with other mobile technology like Bluetooth which is already installed in all smartphones and tablets.

In order to enable the capability of indoor navigation using mobile phone, a recent technology that utilizes Bluetooth technology is introduced, which is Beacons. Beacons are small transmitters used as point of reference for mobile device. Beacons have transmitters that run on Bluetooth low energy technology they can be programmed with messaging by using applications. Beacons proximity sensors detect when Bluetooth enabled device enters into the range and sends particular information related to that place or object according to the programming.

Keywords: *Mobile Applications; Bluetooth low energy; Beacons; proximity sensor; indoor navigation; Global positioning system.*

INTRODUCTION

The indoor navigation is mainly provided with Beacons which have the transmitters, which run on the Bluetooth low energy technology; beacons can be programmed with a message by using the application. We can increase the use of Bluetooth beacons with mobile application. There have been many projects in which the Bluetooth beacons are used. The navigation is provided by linking a particular beacon with a particular landmark or a particular book in the library and it will give basic information of the book to the reader without even picking up the book. These beacons are popularly used in the book fares or in malls or in restaurants and in many public places.

The prerequisite is that the person entering in the particular location or an event should have the mobile application downloaded in the smartphone or tablet and should turn on the Bluetooth in the phone. Then according to the position of the person, the beacon nearby in that location within the range will send information to the smartphone.In that way the person will know the information without even using the internet data and without the help of other person. To provide the indoor navigation in these events the Technologies involved are as under.

BLUETOOTH

The Bluetooth specification was first developed in 1999 and it was used in mobile phones in 2000. It is one of the popular wireless devices which securely transfer data between devices. It is found in Mobile phones, computers and other digital devices. Its popularity is because of low power consumption and less cost. The data transfer range varies from less than a meter to 100 meters (Class 1), Mobile device use class 2 and the range is 10 meters in the 2.4-2.485 GHz bands2 [1].Fig 1 shows different categories of Bluetooth devices. Bluetooth technique is present in almost all the smartphones and tablets. It helps for communication of data between the devices with low cost and low power using radio transmission [2].

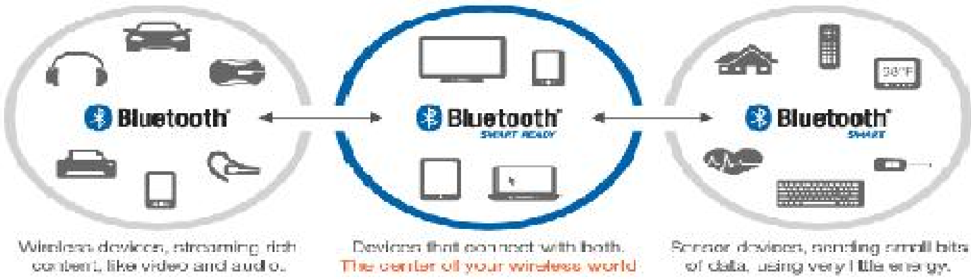


Fig. 1 A diagram showing different categories of Bluetooth devices [1].

Bluetooth Low Energy (BLE) -

BLE is recently created energy-efficient small distance covering wireless communication protocols [3]. It is used for the applications and products requiring low current consumption and low implementation complexity and having low production costs [4].It is used for single hop wireless communication due to its low cost and low power consumption properties. It allows large number of devices to be connected to the internet of things.

Android Programming-

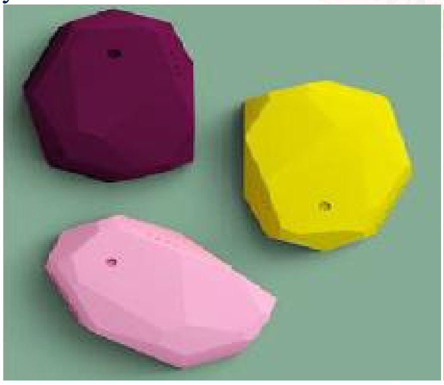
It is open source and Linux based operating system for mobile devices, was developed by open Handset Alliance and Google [5, 6]. They are Java program with Application programming Interface (API) in android platform. With help of API user interface to make a phone call can be built, can play a game and send message and can create many more applications [7]. Android has many applications like music, News, multimedia, sports, Lifestyle, food and drink, travel finance and list goes on [5, 8]. Google launched the first beta version of Software development kit (SDK) in 2007 and the commercial version called as Android 1.0 released in September 2008 and 4.1 Jelly Bean in June 2012. Android is user friendly and has many features like Android OS screen, which gives beautiful user interface and multi touch facilities [5].

System Requirements-

Android programming to work successfully requires operating system Microsoft Windows XP or Later Version, Mac OS X 10.5.8 or later version with Intel chip or Linux including GNUC Library 2.7 or later. The software's required are Java JDK5 or later version, Android SDK, Java Runtime Environment (JRE) 6, Android Studio, and Eclipse IDE for Java Developers and Android Development Tools (ADT) Eclipse Plug-in. The other technologies required are android studio and Eclipse IDE [5].

Bluetooth Beacons-

The Bluetooth beacons shown in Fig. 2 transmit data using the Bluetooth low energy and the data is sent over short distance using less energy and less cost. It comes with the inbuilt battery with life of 1 to 3 years [1].The location of mobile device like handheld computer or mobile phones are found out using Bluetooth beacons. It is less expensive and it allows mobile device to find location and it remains anonymous to other beacons or to other devices.



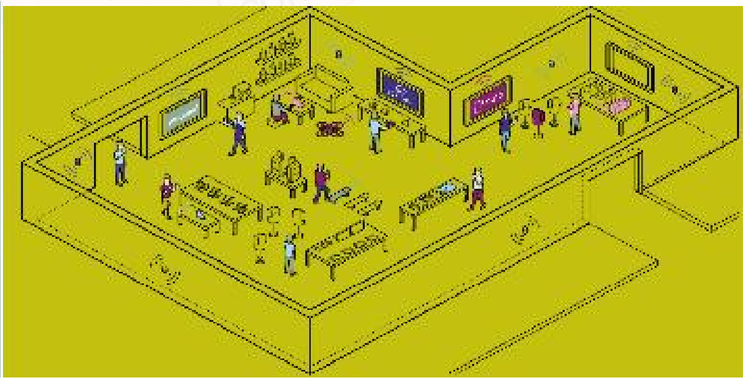


Fig. 2 Beacons [9].Fig. 3 Implementation of beacons for showing the Discounts [10].

RELATED WORK

The beacons are very useful in libraries inform about number of books person has borrowed and due date of the books or for advertising services and informing about particular events and its publicity and promotional message of the event [11]. Used in hotels to inform the customers about the menu, prices and the order can be placed with the help of BLE. The customer does not have to wait for the waiter to come and take the order. In that time theorders received. BLE technology can be used for accuracy requiring jobs like turn on and off the lights, display some content on different screen, serving host with water or snacks [12]. They are also useful at home to remind about particular work to be done like make grocery list, visit kids school for parents meeting the list is never ending.

CONCLUSION

Bluetooth technology and Mobile application is playing very important role in providing indoor navigation without the use of Internet data. The smart phone with the application installed and has turned the Bluetooth and as soon as they come into the range of the beacon the relevant information in events, zoo, museum, library or any seasonal discount is sent to the user within seconds without requirement of any person. Beacons are very handy and can be programmed easily as per the requirement. As the technologies in the world are progressing it becomes very efficient to achieve information in less time.

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ULTRASONIC VELOCITY OF ACRYLATES WITH DECANE-2-OL AT 313.15 K

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ABSTRACT

Thermodynamic data involving ultrasonic velocities of binary liquid mixtures of methyl acrylate, ethyl acrylate andbutyl acrylate with decane-2-ol have been measured at 313.15 K and at atmosphericpressure. Study of thermodynamic properties involves challenges of interpreting the excess quantities as a means of understanding the nature of intermolecular interactions among the mixed components. Experimental values of ultrasonic velocities were correlated with recently proposed Jouyban-Acree model. Deviations inisentropic compressibility were calculated and have been fitted to Redlich-Kisterpolynomial equation. Excess parameters like specific acoustic impendence, intermolecular free length,available volume, intrinsic pressure, molecular association and molar sound velocity were also calculated.Graphical representations of excess derived thermodynamic parameters used to explain the type and extent ofintermolecular interactions.

Keywords: *Intramolecular interactions, isentropic compressibility, specific acoustic impendence, available volume, JouybanAcree model.*

INTRODUCTION

Thermodynamic properties are essential in designing industrial equipments. There has been an increasing interest in the study of molecular interactions and a number of experimental techniques have been used to investigate the interactions between the components of binary liquid mixtures. The knowledge of thermodynamic properties of liquid-liquid systems is of considerable importance due to their wide range of applicability as solvent media in various physicochemical studies, in processing and product formation. Study of thermodynamic properties involves challenges of interpreting the excess quantities as a means of understanding the nature of intermolecular interactions among the mixed components. The knowledge of sound velocity in liquids has been found very helpful in the study of ultra spectrometry for liquids [1], in multiphase flows [2], crystal growth from solutions [3], structural isomerization and molecular motions of liquid n-alkanes [4], sonochemical removal of nitric oxide from flue gases [5], shear impendence spectrometry [6], ultrasonic spectrometry of polystyrene latex suspensions [7]. Density and ultrasonic velocity are important basic data used in process simulation, equipment design, solution theory and molecular dynamics [8, 9].

MATERIALS AND METHODS

Chemicals used in present study were of analytical grade and supplied by S. D. Fine Chemicals Pvt., Mumbai (India) with quoted mass fraction purities: decane-2-ol (> 0.998), methyl acrylate, MA, (> 0.997), ethyl acrylate, EA, (> 0.998) and butyl acrylate, BA, (> 0.995).

Experimental Part

Masses were recorded on a Mettlar one pan balance, which can read up to fifth place of decimal with an accuracy of ± 0.01 mg. Ultrasonic velocities were measured [10] at frequency of 2 MHz by a single crystal ultrasonic interferometer (Model F-81, Mittal Enterprises, New Delhi, India). Temperature was controlled using water bath (GeminiScientific Instruments, Chennai, India) having accuracy ± 0.02 ^{0}C. Ultrasonic velocities of decane-2-ol, methyl acrylate, ethyl acrylate and butyl acrylate at 313.15 K were observed as 1362, 1118, 1123 and1157 m.s^{-1} respectively.

Computational Part

Deviation in isentropic compressibility were calculated using relation,

$\Delta\kappa_s = \kappa_s - \kappa_s^{id}$ (1)

Where κ_s is isentropic compressibility and was calculated using Laplace relation,

$\kappa_s = (1/ u2\rho)$ (2)

κ_s^{id} was calculated from relation,

$\square s^{id}$ = Σ □i[□s,i + TVoi(αoi2) / Cp,i] - [T(ΣxiVoi) (Σ □iαoi)2 / Σ xiCp,i] (3)

Where□i is ideal state volume fraction of component i in mixture and is defined by,

ϕi = xiVoi / (ΣxiVoi) (4)

T is temperature and □s,i, Voi, αoi, and Cp,i are isentropic compressibility, molar volume, coefficient of isobaric thermal expansion and molar heat capacity respectively, for pure component i. αoiis calculated from measured densities by relation,

α = [(ρ1/ ρ2)-1] / (T2-T1) (5)

From ultrasonic velocity different thermodynamic parameters like specific acoustic impendence (Z), intermolecular free length (Lf), available volume (Va), intrinsic pressure (□int), can be calculated, which provides better insight in understanding of molecular interactions in pure and binary liquids mixtures, which are given by relations,

Z = uρ(6)

Lf = K(□s)1/2 (7)

Va = Vm [1-(uexpt /u□)] (8)

Where K is the temperature dependent constant whose values are 1.976×10^{-6} at 313.15 K respectively, u□= 1600 m/s.

For binary liquid mixtures intrinsic pressure can be given as,

□i = bRT (Kη12/u12)1/2(ρ122/3/M127/6) (9)

Where b is packing factor, K is a temperature independent constant having value of 4.28×10^9, R is gas constant andη_{12}, u_{12}, ρ_{12} are viscosity, ultrasonic velocity and density of mixture.

The excess functions are important to understand molecular interactions between components of liquid mixtures.Excess function Y^E represents excess of a given quantity Y of a real mixture over its value for an ideal mixture Y^{id}at same conditions of temperature, pressure and composition. It is expressed by following relation,

$Y^E = Y - Y^{id}$(10)

Where Y denotes Z, Lf, Va, □int and Y^E represents corresponding excess thermodynamic properties such as excess specific acoustic impedance (Z^E), excess intermolecular free length (Lf^E), excess available volume (Va^E) and excess intrinsic pressure ($\square int^E$).

Molecular association (M_A) and Rao's constant or molar sound velocity (R) for liquid mixtures can be calculated as,

M_A = [(u/□x1u1)2-1] (11)

R = (M/ ρ) u1/3 (12)

Where M is average molecular weight.

Table 1: Ultrasonic Velocities (u), Isentropic Compressibility Deviation (□□s), Excess specific acoustic impendence (Z^E), Excess intermolecular free length (L_f^E), Excess available volume (Va^E), Excess intrinsic pressure ($\square int^E$), Molecular association (M_A) and Rao's constant (R) for Acrylates (1) + Decane-2-ol (2) at 313.15 K.

$Ξ_1$	υ	Δκσ	Z^E	$Λ_ϕ^E$	$ςα^E$	$π_{ιντ}^E$	M_A	P
	$(μ.σ^{-1})$	$(ΤΠα^{-1})$	$(Κγ.μ^{-2}.σ^{-1})$	(μ)	$(μ^3.μολ^{-1})$	(ατμ)		
	Μετηψλ Αχρψλατε + Δεχανε–2–ολ							
0	1362	0	0	0	0	0	0	2.171
0.0552	1347	7.36	−4.96	0.001	1.017	−224.10	−0.002	2.101
0.0997	1335	13.08	−8.59	0.002	1.751	−254.20	−0.004	2.045
0.1555	1321	19.04	−12.15	0.002	2.453	−346.15	−0.005	1.976
0.1999	1309	24.54	−15.50	0.003	3.033	−360.40	−0.006	1.920
0.2554	1295	30.09	−18.63	0.004	3.555	−431.51	−0.007	1.851
0.3000	1284	34.01	−20.72	0.004	3.875	−433.76	−0.007	1.796
0.3555	1270	38.85	−23.26	0.005	4.213	−487.36	−0.008	1.728
0.3999	1259	42.17	−24.90	0.005	4.393	−474.87	−0.009	1.674
0.4538	1245	46.47	−27.09	0.006	4.585	−507.88	−0.010	1.608
0.4999	1234	48.37	−27.77	0.006	4.578	−492.04	−0.010	1.552
0.5554	1221	49.66	−28.00	0.006	4.465	−510.55	−0.009	1.485
0.5999	1210	50.69	−28.26	0.006	4.351	−473.90	−0.009	1.432
0.6550	1197	50.18	−27.51	0.006	4.074	−480.36	−0.009	1.366
0.6999	1186	49.30	−26.75	0.006	3.806	−432.72	−0.009	1.312
0.7555	1173	45.94	−24.56	0.006	3.337	−423.18	−0.008	1.247
0.7999	1163	41.39	−21.85	0.005	2.867	−361.27	−0.007	1.194
0.8555	1150	34.41	−17.96	0.005	2.228	−338.55	−0.006	1.129
0.8999	1140	26.41	−13.64	0.003	1.620	−262.39	−0.004	1.077
0.9555	1128	12.84	−6.51	0.002	0.743	−227.48	−0.002	1.013
1	1118	0	0	0	0	0	0	0.962
	Ετηψλ Αχρψλατε + Δεχανε–2–ολ							
0	1362	0	0	0	0	0	0	2.171
0.0554	1348	4.69	−2.58	0.000	0.757	−186.63	−0.001	2.112
0.0999	1336	9.18	−5.23	0.001	1.396	−212.21	−0.003	2.065
0.1553	1322	13.69	−7.61	0.001	2.007	−285.62	−0.004	2.008

0.1998	1310	17.98	−10.00	0.002	2.519	−297.64	−0.006	1.961
0.2556	1296	22.10	−12.03	0.002	2.974	−354.19	−0.008	1.903
0.2999	1285	25.02	−13.39	0.002	3.259	−354.28	−0.008	1.857
0.3554	1272	27.51	−14.28	0.002	3.463	−396.13	−0.008	1.800
0.4000	1261	29.89	−15.30	0.002	3.629	−385.91	−0.009	1.755
0.4555	1247	32.85	−16.62	0.003	3.791	−410.01	−0.010	1.698
0.4999	1237	33.38	−16.50	0.003	3.744	−390.27	−0.009	1.653
0.5554	1224	34.10	−16.48	0.003	3.664	−401.23	−0.008	1.597
0.5999	1213	34.99	−16.76	0.003	3.599	−370.37	−0.009	1.553
0.6555	1200	34.44	−16.20	0.003	3.376	−369.14	−0.009	1.497
0.6999	1190	32.84	−15.16	0.003	3.108	−328.58	−0.008	1.453
0.7556	1177	30.62	−13.93	0.003	2.747	−315.53	−0.007	1.398
0.7999	1167	27.48	−12.30	0.003	2.369	−265.32	−0.006	1.354
0.8555	1155	21.64	−9.41	0.002	1.792	−242.86	−0.004	1.300
0.8999	1145	16.49	−7.07	0.001	1.307	−184.21	−0.003	1.257
0.9555	1133	7.58	−2.99	0.001	0.588	−150.75	−0.001	1.203
1	1123	0	0	0	0	0	0	1.160
	Βυτψλ Αχρψλατε + Δεχανε–2–ολ							
0	1362	0	0	0	0	0	0	2.171
0.0555	1350	1.91	−1.24	0.000	0.419	−119.45	−0.001	2.134
0.0998	1340	3.89	−2.63	0.000	0.775	−148.09	−0.002	2.104
0.1556	1328	5.70	−3.78	0.000	1.115	−202.81	−0.003	2.068
0.1998	1318	7.59	−5.05	0.001	1.409	−219.09	−0.005	2.038
0.2554	1306	9.30	−6.08	0.001	1.674	−258.69	−0.006	2.001
0.3000	1297	9.92	−6.35	0.001	1.787	−266.65	−0.005	1.973
0.3556	1285	11.44	−7.24	0.001	1.976	−291.97	−0.006	1.936
0.3998	1276	11.93	−7.42	0.001	2.035	−289.17	−0.006	1.907
0.4555	1264	13.21	−8.13	0.001	2.147	−302.27	−0.007	1.871
0.5000	1255	13.42	−8.15	0.001	2.142	−290.51	−0.007	1.843
0.5555	1244	13.19	−7.83	0.001	2.074	−292.80	−0.007	1.807
0.5999	1235	13.12	−7.69	0.001	2.013	−272.16	−0.006	1.778
0.6555	1224	12.50	−7.18	0.001	1.873	−263.36	−0.006	1.743
0.6999	1215	12.09	−6.88	0.001	1.754	−236.42	−0.006	1.715
0.7554	1204	10.98	−6.15	0.001	1.541	−217.39	−0.005	1.679
0.7999	1195	10.13	−5.63	0.001	1.361	−182.66	−0.005	1.651
0.8545	1185	7.38	−3.98	0.000	1.006	−154.27	−0.003	1.617
0.8999	1176	5.75	−3.08	0.000	0.745	−114.21	−0.003	1.588
0.9550	1166	2.07	−1.01	0.000	0.307	−78.53	0.000	1.554
1	1157	0	0	0	0	0	0	1.526

Deviation in isentropic compressibility were fitted to Redlich-Kister[11]equation,

$$Y = x_1x_2\sum_{i}^{n} a_i(x_1 - x_2)^i \qquad (13)$$

Where Y is $\Delta\kappa_s$and n is degree of polynomial. Coefficient $a_i$was obtained by fitting Eq (13) to experimental results using a least-squares regression method. Optimum number of coefficients is ascertained from examination of variation in standard deviation (σ) calculated using relation,

$$\sigma(Y) = \left[\frac{\sum (Y_{\exp t} - Y_{calc})^2}{N - n}\right]^{1/2} \qquad (14)$$

Where N is number of data points and n is number of coefficients. Calculated values of coefficients $a_i$along with standard deviations are given in Table 2.

Table 2:Parameters of Redlich-Kister Polynomial Equation for deviation in isentropic compressibility for Acrylates (1) + Decane-2-ol (2)at 313.15 K.

Property	a_0	a_1	a_2	a_3	a_4	σ
	Methyl Acrylate + Decane-2-ol					
Δk_s /(TPa^{-1})	53.2667	40.2340	26.3259	-5.7219	-11.7939	0.36265
	Ethyl Acrylate + Decane-2-ol					
	14.6449	16.7048	29.8820	-1.1945	-46.9233	0.33076
	Butyl Acrylate + Decane-2-ol					
	-1.5641	5.8635	19.6866	-5.8184	-37.5566	0.35663

JouybanAcree [12, 13] recently proposed model for correlating ultrasonic velocities of liquid mixtures at various temperatures. The proposed equation is,

lnymT = f1lny1T +f2lny2T+ f1f2 Σ [Aj (f1-f2) j/T] (15)

Where ymT, y1T and y2T is ultrasonic velocities of mixture, solvents 1 and 2 at temperature T, respectively, f1and f2 are mole fraction and Aj are model constants. The correlating ability of model was tested by calculating the average percentage deviation (APD) between the experimental and calculated values of ultrasonic velocities as,

APD = (100/N) Σ [(| yexpt - ycal |)/ yexpt)] (16)

Where N is number of data points in each set. JouybanAcree model provides reasonably accurate calculations for ultrasonic velocity of binary liquid mixtures and could be used in data modeling. The optimum numbers of constants Aj, in each case, are determined from the examination of the average percentage deviation value which is represented in Table 3.

Table 3:Parameters of Jouyban-Acree Model for ultrasonic velocity for Acrylates (1) + Decane-2-ol (2).

Property	a_0	a_1	a_2	a_3	a_4	σ	APD
	Methyl Acrylate + Decane-2-ol						
$u\ (m.s^{-1})$	0.0818	-0.2291	-1.8521	0.5625	3.2343	1313.8158	0.0178
	Ethyl Acrylate + Decane-2-ol						
	0.0988	0.0216	-1.0346	-0.4437	1.2038	1310.0579	0.0201
	Butyl Acrylate + Decane-2-ol						
	-0.0444	-0.2932	-0.9405	0.7343	1.9723	1329.7640	0.0197

RESULTS AND DISCUSSION

Figure 1shows graphical variation of deviation in isentropic compressibility (□□s) of acrylates with decane-2-ol at 313.15 K.

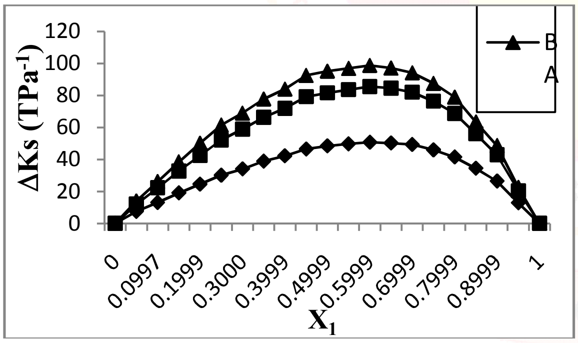

Figure 1 Variation of isentropic compressibility for Acrylates (1) + Decane-2-ol (2).

In present study of binary liquid mixtures, values of □□s are found to be positive for all mixtures. □□s attributed to relative strength of effects which influenced free space, according to which positive □□s arise due to breaking of hydrogen bonds in self associated decane-2-ol and physical dipole-dipole interactions between decane-2-ol monomers and multimers contribute to increase in free space, decrease in sound velocity and positive deviation in □□s.

Figure 2 shows graphical variation of excess specific acoustic impendence (Z^E) with mole fraction acrylates with decane-2-ol at 313.15 K, which clearly indicates exactly reverse graphical variation of □□s.Deviations in Z^E more negative, as length of carbon chain in acrylates increases. Negative values of Z^Ein curves and opposite behavior in □□s curves reinforce that, structure breaking effect and weak interactions between unlike molecules dominates.

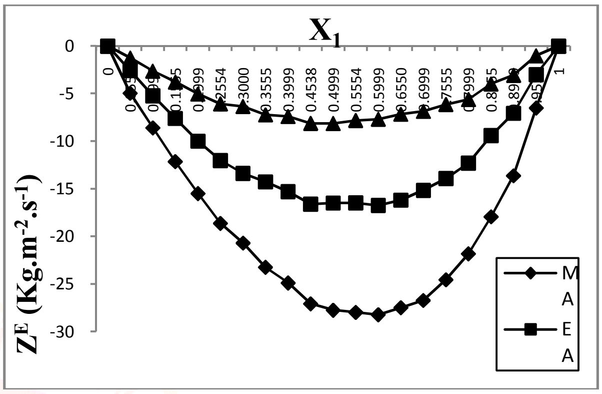

Figure 2 Variation of excess specific acoustic impedance for Acrylates (1) + Decane-2-ol (2).

Table 1 represents variation of excess intermolecular free length (Lf^E) for acrylates with decane-2-ol. Values of $Lf^E$are found to be positive for all systems which suggests that, rupture of hydrogen bonded chain of decane-2-ol and resulting loosening exceeds the interaction i. e. hydrogen bonding and dipole-dipole between unlike molecules. The degree of intermolecular hydrogen bond also decreases as the intermolecular chain length is increased. Positive values of Va^E over entire range of compositionmean strong molecular interactions.Values of □int^E are found to be negative in all binary liquid mixtures. Less magnitude of □int^E suggests that, weaktypes of intermolecular interactions are present with some dispersion due to dissociation of decane-2-ols aggregates with addition of solute (acrylates) in the binary liquid mixtures. Excess internal pressure is used to study intermolecular interactions in liquid mixtures.

Evaluated values of derived thermodynamic parameter such as deviation isentropic compressibility (□□s) were fitted to Redlich-Kister polynomial equation at 313.15 K and are represented as in Table 2 with their standard percentage deviation. The Redlich- Kister equation was originally developed to correlate the excess Gibb's energy function and calculate the values of the activity coefficients. Experimentally measured fundamental values of ultrasonic velocity were correlated using recently proposed Jouyban-Acree model. Constants (Aj) calculated from least square analysis along with average percentage deviation (APD) are presented in Table 3.

CONCLUSION

Positive values of □□s decide compactness due to molecular arrangement. Negative values of Z^E represent the weak interactions are dominant over dispersion forces. Lf^E values increase with increase of chain length in acrylates. Positive values of Va^Emean strong molecular interactions. Negative values of □int^E suggest weak types of intermolecular interactions in liquid mixtures.

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OPTIMIZATION OF FILTRATION METHOD BY USING TECH-CLEAN CANDLE FILTER SYSTEM

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ABSTRACT

An optimization study was carried out to compare different filter cleaning processes and to evaluate better one. Filtration is key unit process in water treatment, textile industries, sugar industries, food industries chemical industries etc. This process is of normal cycle i.e. filtration followed by backwashing. Backwash is up flow cycle for cleaning of clogged media, water is used to remove deposits from the filter bed. The water should return the media quickly to its original perfectly clean state for the next cycle. The significance of these data is discussed in the context of the potential economic cleaning of the filter bed and candles to use it again in its original state. Prototype of the candle mentioned in this research study has been created by the students and the teacher along with the company employees in VISHNU –MALTI Industrial Estate

Keywords* – *candle, chemical cleaning, filtration, Tech-clean system, ultrasonic cleaning

INTRODUCTION

Candle filter is a vital unit process in the filtration process. It captures and removes coagulated and flocculated matter and other suspended matter not removed during the earlier treatment processes. The pores in the filter bed slowly become clogged with each filter run and the media progressively collects deposit through the continuous use. During normal operations cleaning is initiated by excessive head loss, deterioration in filtrate quality or when the predetermined time for a filter run has elapsed Candle Filters are very well suited for handling flammable, toxic and corrosive materials since they are designed for hazardous environments when high pressure and safe operation are required. Likewise, they may be readily jacketed for applications whenever hot or cold temperatures are to be preserved. Candle Filters are available in all sizes and the larger types may have an area of 200 m2 and contain 250 or more filtering elements installed in 2.5 to 3.0 meter diameter vessels. The operating pressure range is quite wide but most of the Candle Filters operate at a pressure of 6 bars. The objective of our work is to study of fluidization process through practical observations so as to provide a process model on which optimization of the process can be made.

1.1 NEED OF CLEANING CANDLES

The need for large scale and heavy-duty washing and cleaning has existed since the industrial revolution or even before. There are several different approaches to these more traditional cleaning processes but they can be grouped in terms of the ones used in each of the various types of manufacturing industries.

- As the filters are used in various industries to clean or filter various fluids of various densities this tends to clog the filter membrane.
- As the filter membrane gets clogged system pressure increases.
- Internal stresses are generated due to increase in pressure
- Quality of filtration gets decreased.
- It may lead to system failure and leakages.

Hence to avoid all above problems, cleaning of candle filter is essential to increase the life of filter. Some of the filter processes are explained below.

1.2 VARIOUS CANDLE CLEANING PROCESS

- **Simple water cleaning**:-Candles from filters are removed after predominant time period for cleaning, primary process for cleaning of candle is to wash with water followed by scrubbing with brushes. Then further process of cleaning depends upon filter material of membrane, media, size of candle, cost encored on cleaning and efficiency of filtration process to be used.

- **Chemical cleaning**: - Chemical cleaning is the processes used to clean the clogged filter which are used in industries. Acid bath or salt bath is used to clean the candles to increase their life. Acid such as hydrochloric acid (HCl), sulphuric acid (h2So4) are used in various concentrations with a diluting media it also depends upon size of candle filter. As filter membranes are made of various low strength materials, so chemical cleaning has limitations.
- **Ultrasonic cleaning**: - In ultrasonic cleaning the candle which is to be cleaned is placed in the water tub. A ultrasonic system creates ultrasonic sound waves which creates bubbles in water, these bubbles travels along the candle membrane by removing the clogged dirt, hence cleaning is obtained. Frequency of sound waves depends upon candle to be cleaned, size, and other various factors. Ultrasound is particularly effective for cleaning because it is capable of dislodging and removing surface contamination in the form of inorganic dirt or microbiological material through the shock waves and jet formation that accompany acoustic cavitations bubble collapse. This type of cleaning can be used for both small and large items and can penetrate deep into crevices and cavities in the surface of an object.
- **Pressurized air cleaning**: - Compressed air is used to clean the membrane of candle, high pressurized jet of air is forced on to candle membrane. This causes to removal of contaminants or dirt accumulated on the membrane.

2 Tech-clean candle filter system

CONSTRUCTION

- Prototype of the candle used in research paper has been created by the students and the teacher along with the company employees in VISHNU –MALTI Industrial Estate

  Parts used in system-
- bearing 3304 (water proof) 2 no’s
- lock nut m18, m22, m20 pitch std
- pulley 22-8M-20 6f type -2 no’s and 44-8M-20 6f type - 2 no’s (make opti-belt)
- and belt for it 20 width(c.d.-216.5 mm)and(c.d.412.5 mm)
- bearing 3306 (water proof)
- internal circle for bore 72 mm -2 no’s, for bore 52 mm - 2 no’s
- flange mounting bearing 20 mm id (UCFL204 D1-20)(waterproof) 2 no’s
- ball nut SSVW2510-5.0P and screw length 1635 mm(with machining)(make super slide)
- linear bush with housing LMA-20 UU -2 NOS make super slide
- guide rod DIA 20 x 1680 mm L 2 NOS make super slide
- Candle to be filtered.

2.1 WORKING PRINCIPAL

Tech-clean system is a compact, environmental and user friendly candle cleaning equipment. Filtration process i.e. polymer filtration takes place from outside of candle to inside. By this particles are stacked to surfaces and small acnes inside the filtration media which makes it too difficult to clean during filtration process, the contaminants are trapped inside and on the surface of filtration media of removable mesh pack candle. After prolonged filtration the filter pressure increases and efficiency of filtration and candle starts to drop down.

First filter is removed and then pre cleaning is done by solvent or by polymer. The process is followed by chemical cleaning/ultrasonic cleaning. Post cleaning is carried out by tech clean to remove maximum contamination stuck in the filtration media and on the surface media Tech clean system works on the back flush mechanism. Flow of polymer is normally coarse to fine the filtration is out to in wash and back wash is from in to out.

The cleaning is effective by two methods high pressure water jet spray nozzle which operates in high pressure up down direction Centrifugal force- high speed rotation creates centrifugal force to push the particles further outside rotation high and pushing of high pressure jet cleans the candles uniformly cross the length and diameter. spray nozzle which operates at high pressure 60 bar in up down direction in mesh pack in RPM candle .High speed rotation low to 500 rpm creates a centrifugal force to push the particles outside this cleans the candle to maximum level.

Fig.2.1.1 Tech-clean candle filter

TESTING OBSERVATIONS

2.2 BUBBLE TEST

A bubble point test is a test designed to determine the pressure at which a continuous stream of bubbles is initially seen downstream of a wetted filter under gas pressure. To perform a Bubble Point Test, gas is applied to one side of a wetted filter, with the tubing downstream of the filter submerged in a bucket of water. The filter must be wetted uniformly such that water fills all the voids within the filter media. When gas pressure is applied to one side of the membrane, the test gas will dissolve into the water, to an extent determined by the solubility of the gas in water. Downstream of the filter, the pressure is lower. Therefore the gas in the water on the downstream side is driven out of solution. As the applied upstream gas pressure is increased, the diffusive flow downstream increases proportionally. At some point, the pressure becomes great enough to expel the water from one or more passageways establishing a path for the bulk flow of air. As a result, a steady stream of bubbles should be seen exiting the submerged tubing. The pressure at which this steady stream is noticed is referred to as the bubble point.

2.3 BUBBLE POINT TEST PROCEDURE

A forward bubble point integrity test is a procedure which measures the pressure needed to be applied to the upstream side of a filter causing bulk or open pore flow through the largest pores of a wetted filter. This measurement is taken from the downstream side of the filter housing where a flexible piece of tubing has been attached and the other end submerged into a beaker of water. The bubble point is indicated by vigorous bubbling from the tubing. The accuracy of this test will rely on the operator's ability to successful recognize this point.

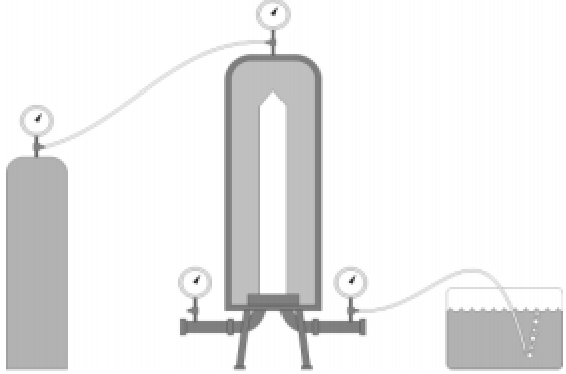


Fig.3.2.1 Tech-clean candle filter

MATERIALS REQUIRED TO PERFORM TEST

- Compressed air or nitrogen
- Pressure regulator
- Filter, Filter housing
- Hose barbs
- Beaker
- Tubing
- Filter adapters

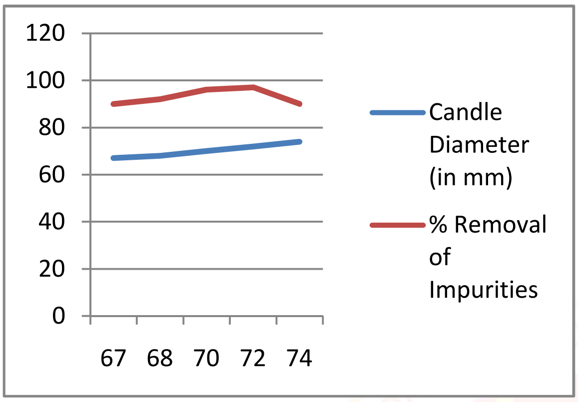
2.4 TEST METHOD

- Record the filter part number(s), lot number, and product information. Also include physical observations.
- Wet the filter to be tested with water.
- Place the wetted filter in the appropriate housing.
- Connect the outlet fitting from the compressed air pressure regulator to the upstream side of the test filter. Check that the gauge which is connected to the pressure regulator has subdivisions of at least 0.5 psig, and has the capacity to measure up to 100 psig. A digital pressure gauge can also be used.
- Connect the outlet fitting from the compressed air pressure regulator to the upstream side of the test filter.
- Connect a piece of flexible tubing from the downstream port of the test filter into a beaker filled with water.
- Starting from zero pressure, gradually increase the pressure to the test filter using the pressure regulator.
- Observe the submerged end of the tubing for the production of bubbles as the upstream pressure is slowly increased in 0.5 psig increments. Note the rate that the bubbles appear for the end of the submerged tube.
- The bubble point of the test filter is reached when bubbles are produced from the tube at a

steady rate. Record the pressure to the nearest 0.5 psig as indicated on the pressure gauge.

2.5 TEST CONSIDERATIONS

- Ensure that the filter is thoroughly and uniformly wet such that all the pores are filled with water. Failure to wet the filter may result



in premature air flow resulting in false failure.
- Diffusive flow of air through the filter will occur at pressures lower than the bubble point. Ensure that the pressure recorded is in fact the pressure at which a steady stream of bubbles is noted.
- If failure occurs open the filter housing to ensure that the filter is installed correctly in the housing. Replace the housing cover and retest. If another failure is recorded remove and dispose of the filter element.

4. Observations and Results

Variation Of % Removal Of Impurities WITH Changing Diameter Of Candle

5.RESULT AND DISCUSSION

Graph 4.1 Candle Diameter Vs % Of Impurities

As shown in above graph % removal of impurities is plotted against diameter of candle. In this candle increase in diameter increases the capability of candle for effective impurity removal. More specifically, it has been stated that this particular candle design can give effective impurity removal for the diameter ranging from 67 mm to 72 mm once the diameter crosses 72mm again the affectivity in impurity removal decreases.

CONCLUSION

Various types of candle cleaning process have been studied such as ultrasonic cleaning, air Jet cleaning, chemical cleaning, water cleaning etc. The acute problem in various filtration processes have been identified and worked out by optimized process using candle filters. The process is flexible and versatile in nature which can clean various types of candles. Tech clean is particularly effective for cleaning because it is capable of dislodging and removing surface contamination in the form of inorganic dirt or microbiological

SR .NO.	Candle Diameter in mm	Flow Rate in Lit/Hr	% Impurities After Salt Bath	% Removal Of Impurities
1.	67	1.08	10	90
2.	68	1.14	12	92
3.	70	1.17	8	96
4.	72	1.08	9	97
5.	74	1.08	9	90

material through the water jet and centrifugal force. Increased cleaning speed which can often be applied to assembled components without the need to break them down into individual units.

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TESTING OF CIRCUIT BREAKER BY USING SINGLE PHASE AC-AC CONVERTER

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ABSTRACT

This paper presents review on a single phase ac-ac converter that is capable of creating voltage output to buck or boost mode. According to the IEC 60898 standard for circuit-breaker testing there should be proper test procedure and tripping time characteristics which is necessary for the process of quality control. Commercially available current sources for CB testing are designed using a motor-driven tap-changing auto-transformer for ac output current regulation. But there is problem associated with this type of source is that this cannot provide step change in output current. To overcome this problem here we design a single-phase ac–ac converter with power factor correction and output current control. The important advantages of the proposed circuit are low component count and fast responses for the standard requirement, especially a current step at the beginning of the test. The proposed single-phase ac–ac converter can operate in either buck or boost mode to accommodate the need for a wide range of output current while satisfying the ramping and step current requirements in the standard.

Keywords- *buck - boost mode, circuit-breaker, power factor correction, ramping and step current, single-phase ac–ac converter.*

INTRODUCTION

A Circuit-Breaker (CB) is important equipment in residential, commercial and industrial systems. It is used to protect an electrical circuit from damage caused by overload or short circuit. The test procedure and tripping time characteristics of the CB detailed are given in IEC 60898 which is necessary in the process of quality control. The available current sources for CB testing are designed using a motor-driven tap-changing auto-transformer for ac output current regulation. But recently, several ac–ac converters have been improved in terms of higher current rating capability and higher efficiency. They also have included the power factor correction (PFC) to regulate the input current to be sinusoidal wave shaping with nearly unity power factor. Now a day, the ac–ac converters are widely applied to various industrial applications such as UPS, voltage stabilizer, electric welding, and etc. [7], [5].

There are many topologies of single-phase ac–ac converter has developed. The single-phase ac–ac two-leg, three-leg and four-leg (two full-bridges) converters have been reported. They are widely accepted choices of converters in UPS, motor drive or grid-connected applications. These topologies consist mainly of two stages; a controlled rectifier (e.g., boost PFC topology) and a single-phase inverter. They can be operated in either buck or boost mode for the expected level of ac output voltage. The output frequency is controlled and can be set to the different values from the input frequency. The three leg and two-leg single-phase ac–ac converters are operated in hard switching scheme, producing the switching loss and electromagnetic interferences [2], [5].

In a buck-type ac–ac chopper reported in [6], the ac output voltage is controlled using the sinusoidal pulsed-width modulation (SPWM). But this system introduces a distortion on the ac output voltage at the zero-crossings.this also controls the output voltage to the values less than the input voltage due to its buck-type topology.

Resonant converters have also been used in the ac–ac conversion applications [3], [7]. The resonant converter is suitable for applications with a fixed frequency; it cannot provide the ac voltage output with different frequency.

In ac–ac z-source converters, the z-source network is used to store energy and the output voltage is load dependent [3], [8]. The output voltage is varied with the duty ratio created from a PWM signal.

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The main requirements of ac–ac converter for circuit-breaker testing are a widely range of output voltage control with lowest harmonic distortion and high input unity power factor. And hence, it must be capable of operating in buck and boost modes with the required step current and ramp rate specified in [1].

The single-phase ac-ac converter has been represented in the system application for CB testing [9] according to the CB testing standard (IEC 60898). It used four switches to control input current and output current. The first part integrates rectifier and boost converter to regulate the dc link voltages and control the ac input current with sin wave in phase with the ac input voltage. The output current control is based on half-bridge topology to drive the positive and negative pulses by means of *SPWM* technique to the output.

A single phase ac–ac converter is suitable for CB testing application because it supports all key requirements of CB testing standard as described in table 1 in [1].

MATERIAL AND METHODS

The AC-AC converter uses four switches to control the output voltage and the input current. The output voltage is generated by using SPWM technique to generate pulses from dual dc-link capacitors. The operation of the switches controls the output voltage and input current .the gate control signals are created from two close-loop controls, the closed loop control of output voltage and the close-loop control of the input current.

The proposed system is shown in Fig. 1. below. The ac–ac converter topology consists of four main switches ($S_1 - S_2$), two dc-link capacitors (C_1 and C_2), an inductor (L_S), diodes (D_1 and D_2), and a power transformer (T_1). In the system, the Vc_1, Vc_2, i_s and v_s sources which are measured and fed back to the digital controller. In The first part of operations, the switches control the voltage charging of dc link capacitors. The dc-link capacitor (C_1) is charged and Vc_1 is maintained constant during the positive cycle of V_S while the capacitor voltage Vc_2 is charged and maintained constant during the negative cycle.

The second part of operations is output signal generation by using bipolar SPWM topology. The input voltage is used as the reference signal for controlling the input current i_S. The output current is regulated by the switches S_1 and S_3 during the positive pulse while the switches S_2 and S_4 operate during the negative pulse, using the sinusoidal PWM (SPWM) technique. The primary winding of the power transformerT_1, with a turn ratio of 86:3, is connected to the output of the DC–AC converter. The transformer's secondary winding is short-circuited through the CB during testing. The output current is amplified by an order of the transformers turn ratio. The proposed topology yields power factor in the range of (0.97–0.99) under various output frequencies.

RESULT AND DISCUSSION

By using MATLAB Simulation study shows the results such as AC input current control, power factor correction, DC-link voltage control, and AC output current control.

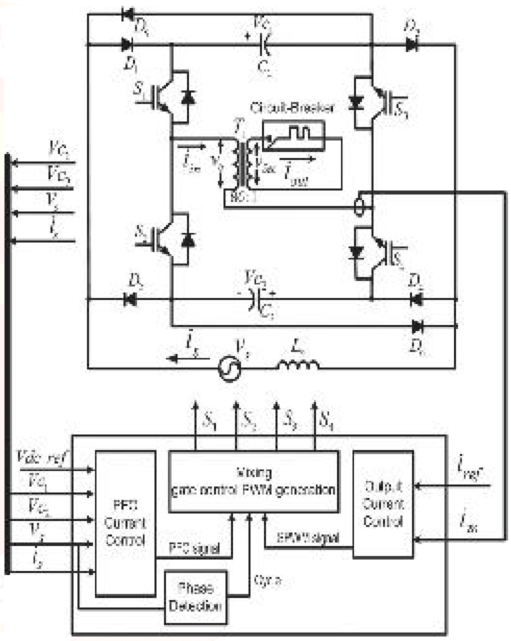

Fig.1. Proposed ac–ac converter with dc-link voltage and ac output current controllers

CONCLUSION

There are many topologies of AC-AC converter had been reported. The buck type ac–ac converter, resonant converter, ac–ac z-source converters, etc. But all this topologies having some drawbacks to overcome all this problems here we design a single phase AC-AC converter. The important advantages of the proposed circuit are low component count and fast responses for the standard requirement, especially a current step at the beginning of the test. The proposed single-phase ac–ac converter can operate in either buck or boost mode to accommodate the need for a wide range of output current while satisfying the ramping and step current requirements in the standard.

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EFFECT OF BIO-DIESEL BLENDS AND PRODUCER GAS ON CI ENGINE

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ABSTRACT

In order to meet the energy requirements, there has been growing interest in alternative fuels like biodiesels, methyl alcohol, ethyl alcohol, biogas, hydrogen and producer gas to provide a suitable diesel substitute for internal combustion engines The performance of the CI engine was investigated for Dual Fuel Mode and mixed fuel mode operation in terms of brake thermal efficiency, specific energy consumption and compared with the base line performance of the engine. The specific energy consumption is found to be minimum in the tune of 13.8 MJ/kw-hr and the exhaust gas temperature is observed higher in the range of 427^{o}C. The increment in load on the engine increases the brake thermal efficiency, exhaust gas temperature, liquid fuel replacement and lowered the specific energy consumption. The maximum liquid fuel replacement in the tune of 46.73% is possible with the use of mixed fuel

Keywords: *Bio-fuel, Producer Gass, Renewable Energy, Bio-diesel, IC Engine.*

INTRODUCTION

The producer gas generated through the process of gasification from bio-mass such as wastes from agricultural products, wood chips, coconut shells, groundnut shell, etc can be considered as alternative fuel for IC engines. Gasification is a process that converts carbonaceous materials, such biomass into carbon monoxide and hydrogen by reacting the raw material at high temperatures with a controlled amount of oxygen. The resulting gas mixture is called producer gas and is itself a fuel. Gasification is a very efficient method for extracting energy from many different types of organic materials, and also has applications as a clean waste disposal technique [2].

ICompression ignition (CI) engine could be operated with following fuels either alone or in the form of mixture. Use of diesel in CI engine is a well-proven technology. In India, a large variety of biomass feedstock is available in huge amounts. As these are available locally, biomass gasifier-based power generation may be an appropriate option for decentralized power generation in many parts of the country [4]. Biomass gasifier-based system capable of producing power from a few kilowatts up to several hundred kilowatts has been successfully developed indigenously. The utilization of producer gas in the diesel engine in dual fuel operation is an established technology for conservation of Diesel. Producer gas could be used in CI engine, without any modification in the engine. However, it cannot replace the diesel completely. Diesel replacements up to 70–90% have been achieved in the dual fuel mode. Because of its poor ignition/delay ignition characteristics some minimum amount of Diesel is required to start the ignition. On the other hand, the use of plant oil as fuel for CI engine is not new. The all properties of plant oils were close to diesel except viscosity and volatility. Various methods were adopted to overcome these problems. It included blending of oils with diesel, heating of plant oils before injecting into the combustion chamber of engine and esterification of plant oils [2].

1. Overview of producer gas:

Operation of modern spark ignition or compression ignition stationary engines with gasoline or diesel fuel is generally characterized by high reliability and minor efforts from the operator. Under normal circumstances the operator's role is limited to refueling and maintenance. There is little need for action and virtually no risk of getting dirty. Start and operation can in fact be made fully automatic.

Operation of wood gas engines can also be dangerous if the operator violates the safety rules or neglects the maintenance of the system. Poisoning accidents, explosions and fires have been caused by unsafe designs or careless handling of the equipment. It may be assumed that modern systems are designed according to the best safety standards, but it is still necessary to handle the equipment in a responsible manner [5].

2. Fuelling Of Engines by Producer Gas:

Producer gas, the gas generated when wood, charcoal or coal is gasified with air, consists of some 40 per cent combustible gases, mainly carbon monoxide, hydrogen and some methane. The rest are non-combustible and consists mainly of nitrogen, carbon dioxide and water vapor. The gas also contains condensable tar, acids and dust. These impurities may lead to operational problems and abnormal engine wear. The main problem of gasifier system design is to generate a gas with a high proportion of combustible components and a minimum of impurities [5].

3. Possibilities of Using Producer Gas with Different Types of Engines:

1. Power produced by the engines
2. Specific energy consumption
3. Brake thermal efficiency

B. Parameters Calculation:

With a view to calculate the parameters mentioned above, it was essential to pick up the following signals from the test bench.

1. RPM of the engine
2. Load on engine
3. Fuel consumption rate
4. Producer gas consumption rate
5. Voltage generated by the alternator
6. Current generated by the alternator

Once the parameters were selected, the essential instruments required for sensing these parameters were installed at the appropriate points in the experimental set-up.

4. Experimental setup

A. Details of Engine Specification:‘Field Marshal’ make 10HP diesel engine was used.

B. Details of Gasifier Specification: A Downdraft wood waste gasifier, Associated Engineering Work (AEW) make having the technical collaboration with SPRERI was used for generation of producer gas from wood chips as an input feed stock.

Experimental Test Rig: The main components of the experimental setup are Engine two fuel tanks (Diesel and Jatropha blend), Gasifier unit, gas flow meter, fuel consumption measuring unit, Electrical resistance loading arrangement, voltmeter, ammeter and digital tachometer meter. Fig. IV-I shows the schematic diagram of the experimental setup used for experimentation.

converted to the above mode of operation. Compression ratios of ante-chamber and turbulence chamber diesel engines are too high for satisfactory dual fuel operation and use of producer gas in those engines leads to knocking caused by too high pressures combined with delayed ignition. Direct injection diesel engines

Spark ignition engines, normally used with petrol- or kerosene, can be run on producer gas alone. Diesel engines can be converted to full producer gas operation by lowering the compression ratio and the installation of a spark ignition system. However, not all types of diesel engines can be

TEST METHODOLOGY

A. Parameters Selection:

The selections of appropriate parameters were essential for engine calculations and set-up available. The main parameters desired from the engine are listed below.

4. Fuel consumption
5. Speed of the engine

have lower compression ratios and can generally be successfully converted [5].

Fig. IV-I Schematic diagram of experimental test rig

The engine was started with diesel for at least 30 minutes and once the engine warms up, it is switched over to Jatropha biodiesel blend. For switching the engine from diesel to Jatropha biodiesel blend, a two way valve was provided on the control panel. Both the fuels from the two tanks can be feed to the engine through this valve separately. One end of the valve is connected to Jatropha biodiesel blend tank and the other end is connected to diesel. The fuel from the valve enters into the engine through this fuel measuring unit. With the help of this fuel measuring unit, Fig. IV-II shows the schematic layout of the experimental s

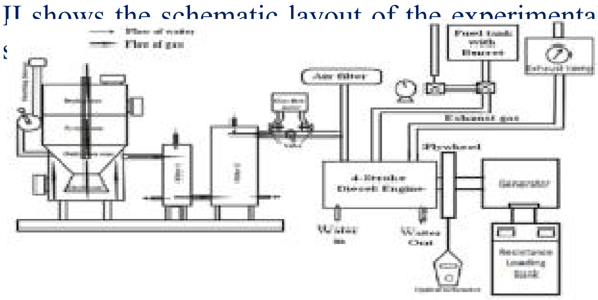

Fig. IV-II Layout of experimental test rig

5. RESULTS AND DISCUSSION:

Liquid fuel replacement shows the variation of percentage of fuel replacement with load for diesel-producer gas in dual fuel mode and in Blend-producer gas in mixed fuel operation. There is an improvement in percentage of fuel replacement with all dual fuel combinations In mixed fuel (Diesel-Biodiesel-producer gas) mode the replacement of liquid fuel increases with increased in load.

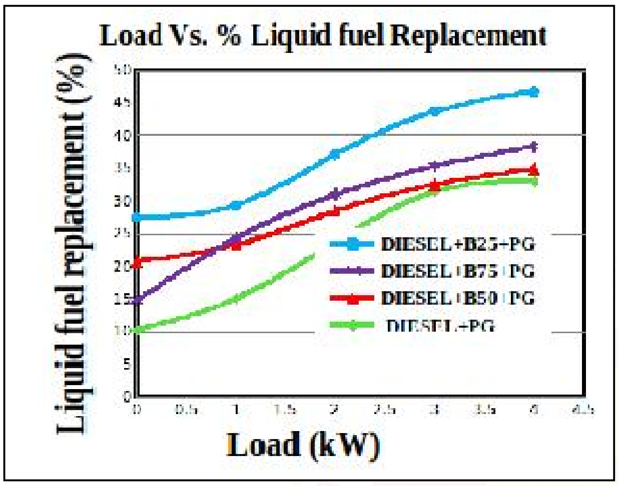

Fig.5.10 Percentage liquid fuel replacement with load in mixed fuel mode

For all loads, the Diesel-B25-PG gives the maximum fuel replacement at all load condition due to the lower percentage of bio-diesel and required amount of PG entering in the cylinder. At lower loading condition replacement of liquid fuel was lower and increases with increased in load on the engine. The bio-diesel contains more percentage of oxygen and consequently less percentage of calorific value than that of diesel fuel. Therefore increasing the percentage of bio-diesel in diesel, required more amount of fuel for maintaining the speed of the engine due to lower value of calorific value of bio-diesel, this behavior of more fuel consumption was expected for all power outputs Fuel substitution values were maximum for Diesel-B25-Producer gas operation compared to other combination combinations. Injected fuel properties such as viscosity and calorific value may be considered as responsible for the observed trend. The percentage of respective fuels substituted with Diesel-Producer gas and Diesel-B25-Producer gas respectively were 33.02%, 46.73%. With the increase in producer gas flow rates, the liquid fuel replacement increases. It can be seen that the maximum liquid fuel replacement has gone up to 46.73 % in Diesel- B25-Producer gas mode. At high load operations, insufficient air flow decreases the liquid fuel replacement.

8.CONCLUSION

From the experimentation on the engine the following conclusions were drawn and the best combination of fuel is found for the minimum consumption of the diesel.

- IMaximum liquid fuel replacement in the tune of 46.73% is achieved in mixed fuel mode operations, with no engine modification.
- In the dual fuel mode of operation, while using wood chips, higher liquid fuel savings is achieved at part load conditions.
- The maximum Brake thermal efficiency is observed to be 26.08 % in mixed fuel mode(Diesel-B25-PG) at higher load
- Specific energy consumption is found to be minimum in mixed fuel mode in the tune of 13.8 MJ/kW-hr
- The exhaust gas temperature is observed higher in mixed fuel mode in the range of 427 ^{O}C
- Smoke emission in all mode of operation is comparatively higher as compared to neat diesel.
- It is observed that, the increment in load on the engine, increases the brake thermal efficiency, Exhaust gas temperature, Smoke density, liquid fuel replacement and lowered specific energy consumption for the existing engine set up.

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HERMETIC STORAGE TECHNOLOGY FOR SMALLHOLDER FARMERS IN INDIA

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ABSTRACT

The development of new storage technique is the important consideration to reduces the storage losses. While fulfilling the food demand of an increasing population remains a major global concern, more than one-third of food is lost or wasted in postharvest operations. Reducing the postharvest losses, especially in India , could be a sustainable solution to increase food availability, reduce pressure on natural resources, eliminate hunger and improve farmers' livelihoods and its recent need as well as Eco-friendly technology for doubling farmers income. Cereal grains are the basis of staple food in most of the developing nations, and account for the maximum postharvest losses on a calorific basis among all agricultural commodities. As much as50%–60% cereal grains can be lost during the storage stage due only to the lack of technical inefficiency. The present research was inform that the necessity of the new storage technology in the market. This paper also shows results of previous study of hermetic storage. Use of hermetic storage methods can reduce these losses to as low as 1%–2%. The study has revealed that hermetic bags provide a safe and convenient method for farmers to preserve their agricultural commodities. Hence, the adoption of hermetic bags must be encouraged in the developing countries and also this study provides a comprehensive literature review of the grain postharvest losses in developing countries, the status and causes of storage losses and technological interventions to reduce the post harvest losses. Millions of farmers in India depend on cereal and legumes for food security as well as to get more income. Storage is a key challenge due to insect damage after harvest. The basics of hermetic storage, and their effectiveness on several crops in different localities are discussed in detail.

Keywords: *postharvest losses, food security, grain storage, smallholders, hermetic storage, storage period.*

INTRODUCTION

Food security has been fundamental concern of the mankind over the millennia. Agriculture, including animal husbandry and fisheries, has been predominant provider of food. Current world population is expected to reach 10.5 billion by 2050 (UN March, 2013),further adding to global food security concerns. This increase translates into 33% more human mouths to feed, with the greatest demand growth in the poor communities of the world. According to Nikos Alexandratos and Bruinsma, (2012) food supplies would need to increase by 60% (estimated at 2005 food production levels) in order to meet the food demand in 2050.

Globally, the losses of food grain are 2 billion tons per year. (Ibtimes,2014). Food availability and accessibility can be increased by increasing production, improving distribution, and reducing the losses. Thus, reduction of post-harvest food losses is a critical component of ensuring future global food security. Reduction in these losses would increase the amount of food available for human consumption and enhance global food security. A reduction in food loss also improves food security by increasing the real income for all the consumers (World Bank, 2011). Increasing agricultural productivity is critical for ensuring global food security, but this may not be sufficient. Food production is currently being challenged by limited land, water and increased weather variability due to climate change. To sustainably achieve the goals of food security, food availability needs to be also increased through reductions in the post-harvest process at farm, retail and consumer levels (FAO,2013). India succeeds in record production of food grain. Out of these grain 70 percent are stored at farmers field/house.

BACKGROUND

In numerous parts of the world, grain quality protection is a serious issue during storage (Gras *et* *al*., 2000). A decrease in the quantity of fat, carbohydrate, vitamins and protein in grain during storage can happen as a consequence of infestations by insect, mould and rodents where insufficient grain storage methods apply (Lamboni and Hell, 2009). Seed quality is very essential to farmers as it measures the potential performance of the seed in optimal conditions. As good quality seed is free from different diseases and has better seed health, it is expected to produce healthy seedlings with no initial disease inoculums (Nguyen, 2001).

However, main cause of contamination and deterioration of grain quality is improper storage conditions i.e. climatic conditions including increased dampness, temperature and moisture inside the structure (Williams, 2004). Storage structure is regarded as most important factor in handling and storage of grains as farmers require some facilities to store their produce. The important function of any storage structure is to offer high protection from insect, pests, rodents, birds etc., and it must be able to provide hermetic conditions to the stored products as well as easier to fill and empathize it. Most of the losses in grains occur in storage because poor farmers could not afford high construction costs and use cheap, inadequate structures to store their grains (Obetta and Daniel, 2007). This necessitates improvement of the storage technologies.Factors that usually affect the farmers' choice of the storage methods include the cost of building the storage method, availability of the materials, expertise for building the storage facility, climatic conditions of the area and the types of pest problems in the area (FAO, 1985). In West Africa, farmers store their crops in homes, on the field, in the open, jute or polypropylene bags, conical structures, raised platforms, clay structures and baskets (Addo *et al.,* 2002). In East and Southern Africa, farmers store crops in small bags, in wood and wire cribs, pits, metal bins, wooden open-air or roofed cribs, and in raised platforms and roofed iron drums enclosed with mud (Kankolongo *et al.*, 2009). In general, the materials from which these storage structures are made, make it easy for rodents to make holes through them as well as absorb moisture from the environment leading to the development of insect pests and moulds in the storage facilities thereby reducing green gram quality.

Demand of proteins in daily diet is met out from pulses which are low in quantity. As per recommendation of pulses in agricultural production system we have almost reached to maximum level. India produced 17.38 million tonnes of pulses in 2014 -2015 (Directorate of Economics and Statistics). Pulses are chief and cheap source of body-building proteins particularly for vegetarians and for poor because animal proteins are beyond their reach. The Increase in population and stagnation of the pulse production in India has resulted in the reduction of its per capita availability from 27.5kg in 1999 to merely 14.94kg in 2003-2004 as compared to recommended annual requirement of 23.5 kg for balanced diet (Phirke 1993). As a result, pulse prices have shoot up beyond the reach of large number of people. A majority of people today lack sufficient proteins and calories in their daily diet because they simply can not afford high cost of pulses or other foods.

Pulses can remain in edible condition for a long time, if properly stored in bags or silos. However, pulses are more difficult to store than cereals and suffer much greater damage from insects and microorganisms resulting in deterioration of quality (Mills, 1994). Most important factors of grain deterioration are the interaction of temperature, humidity and moisture, which are the determining factors in accelerating or delaying the complex degradation reactions (Kreyger, 1972). In general, high temperature and high moisture grain allows a very short time for post harvest operations (Hall, 1980). It becomes essential to determine the allowable time before spoilage for wide range of moisture contents and temperatures. This would help farmers by informing them the number of days before which the grain has to undergo post harvest treatments. This ensures the quality of grain to be maintained throughout the storage period (Nithya et al., 2011). Hence, only good quality grain can be sent for further processing to provide safe and nutritive products for the consumers. The safe storage guidelines will help farmers to determine the number of days in which the grain has to be dried for a particular temperature moisture combination (Karunakaran, 1999). The time period for which the grain can be stored safely without deterioration or without any significant loss in its quality and quantity is known as the safe storage time (Schroth, 1996).

Among the new gaseous application technologies that have successfully replaced fumigants are the manipulation of modified atmospheres (MAs) through the use of bio generated MAs, for insect control and for quality preservation of grains, stored paddy, polished rice, wheat, pulses, cocoa or coffee beans, high moisture corn, etc. The MAs can be achieved either by the natural respiration of the grain and the insects or by artificially flushing of gases. Sufficiently sealed structures generate the MA by reducing the O2 and increasing the CO2 concentrations. The sealed structures keep moisture levels of the grain constant which prevents mould growth. This technology is also termed as sealed storage, airtight storage, or assisted hermetic storage, bio-generated modified atmosphere (MA), etc. Hermetical Storage is based on the principle of generation of an oxygen-depleted, carbon dioxide-enriched atmosphere caused by the respiration of the living organisms in the ecological system of a sealed storage. Among the advantages of hermetic storage, the generation of MA eliminates the need for chemical treatments, fumigants, etc. These structures may help in reduction in moisture migration from the environment to the grain, protection from rodents, reducing losses of germination and vigour of the grain. Generally the hermetic storage is made up of rigid materials like metals. These rigid storages are having difficulties in handling and occupy the space permanently. If a flexible hermetic storage is used, both the problems will be solved.

1.Why hermetic storage for seeds?

The principal reasons for using hermetic storage for seeds is to prevent further insect development, by creating a low oxygen, high CO2 atmosphere lethal to insects already present inside the container. It is also used to prevent rodent penetration during storage, and prevent the growth of molds as well as deterioration of the commodity by protecting it from the high outside relative humidity levels that prevail in hot humid climates. In the case of seeds, maintaining seed germination percentage and vigor is the dominant consideration (De Bruin,2005).

2.Alternatives to hermetic storage

Alternatives to hermetic storage and modified atmosphere include use of fumigants, refrigeration, freezing, and conventional unprotected storage. With fumigants full penetration of the commodity is often a problem, repeated applications are frequently necessary and fumigants do not prevent losses from rodents or the growth of molds. In addition insects have developed tolerance to widely used fumigants and the most popular fumigant, Methyl Bromide is being phased out. Refrigeration, in the case of seeds, remains widely used, but consumes significant energy, and requires special facilities. Freezing, another expensive process, has also been used. Most of the world still uses conventional storage, such as storage of bagged grains under large tin roofs in open warehouses. This provides no protection from rodents, limited protection by spraying against insects, and no meaningful steps to prevent mold growth. In hot humid climates losses are frequently of 12.5 to 25 %. (Minagri, 2006).Hermetic storage as compared to older storage processes is still relatively new, and not as well known, but its use in some 20 countries and its increasing acceptance in particular niche markets where the need for better storage techniques is urgent, is causing rapid growth. Particularly noteworthy in this respect are applications for seeds, cocoa, coffee, rice (including basmati rice, brown rice and rice bran) as well as large stores of staple grains.

3.Future Applications

Among promising new large-scale applications are those with high moisture corn(30 %) used for ethanol production and for the starch industry – both use large amounts of dry corn and then re-moisturize before processing. Ethanol produced from corn is a fast growing industry due to the increased energy prices worldwide. In the U.S. high moisture corn is already being used for feeding cattle. In China high moisture corn is being used for ethanol production during the cold winter months.

4.Applications of Hermetic Storage

The applications for which hermetic technology has been most widely accepted are:

• Long-term storage of cereal grains, primarily rice, corn, barley, and wheat.

• Long-term storage of a variety of seeds to preserve germination potential and vigor.

• Quality preservation of high-value commodities, such as cocoa and coffee.

In addition, still newer applications for HS are emerging, such as safe storage of high moisture corn; storage of specialized, difficult to store products such as brown rice, rice bran and basmati rice; and the prevention of growth of toxinogenic aflatoxins in corn and peanuts, or ochratoxins in coffee. HS is also used to store oily commodities such as cottonseeds or peanuts to prevent the growth of free fatty acids (FFAs), and resulting rancidity

5.Hermetic Storage Technology

Successful use of hermetic storage is based on the need to achieve one or more of the three following goals:

• Low oxygen, high carbon dioxide atmosphere to prevent infestations (molds and insects), and oxidation
• Preventing entry of moisture
• Protection from rodents

6. Technology innovators

The Purdue Improved Crop Storage (PICS) hermetic bag system has proven effective in storing a variety of crops including cowpeas, maize, peanuts, sorghum, wheat, and common beans against insect pests (Murdock *et al.,* 2012).The PICS bag is a triple bagging hermetic technology consisting of two liners made out of high-density polyethylene (HDPE) and an outer woven layer of polypropylene that provides protection during handling. Together, these bags establish MAS by creating an oxygen-depleted environment which is lethal to insect growth and development (Murdock *et al*., 2012). The ability of the PICS technology to generate MAS system has raised the question of its capacity to manage aflatogenic fungi. An investigation in U.S by William *et al.* (2014) proved that PICS were effective in preventing aflatoxin contamination in maize stored in the laboratory.

In the Philippines, Elepano and Navarro (2008) reported that, the aflatoxins in maize grains stored in single-layer GrainPro® (an alternative to triple-layer hermetic bags) cocoons hermetic bags did not increase with storage time. The current study was undertaken to establish the effectiveness of the triple-layer hermetic bag against aflatoxin in maize stored under the field condition. An assessment of social acceptability, benefits and challenges farmers have encountered upon using the PICS bag was made.

The triple-layer hermetic PICS bags were developed under the Bean/Cowpea CRSP project in the late 1980s with funding from USAID (Murdock *et al.,* 2003). As an organic-hermetic storage, PICS bag works by creating an airtight seal in which oxygen levels are dramatically decreased in a relatively short time through insect, fungal and seed respiration (Quezada *et al.*, 2006). This technology was originally created for West and Central African cowpea farmers under the name ―Purdue Improved Cowpea Storage (PICS) bags and served as protection against extremely destructive cowpea seed beetles, which prevented long-term storage to capture price increases later in the marketing season.

The Purdue Improved Crop Storage (PICS) hermetic bag system is now known to have proven effective in storing a variety of crops including cowpeas, maize, peanuts, sorghum, wheat, and common beans against insect pests (Murdock *et al.,* 2012) PICS bags have been disseminated to millions of farmers in West and Central Africa, with close to 50% of the cowpea not sold at harvest being stored in these simple containers (Moussa *et al.,* 2014; Ibro *et al*., 2014). To prevent moulding and rotting in tropical and subtropical conditions, maize should be dried at save moisture content and impurities removed before storing in hermetic conditions (Weinberg *et al.,* 2008).

Hermetic Bag Available in India			
Grainpro Bag	Ecotact Hermetic bag	Save Grain Bag	Super grain bag
			
www.grainpro.com.	www.ecotact.com	www.savegrainbags.com.	www.swisspack.co.in

Source –www.Google.com

Fig 1- Availability of Hermetic bag in Indian Market

CONCLUSION

The choice largely dependent on farmer's economic power, level of education, and the intended duration of storage, quantity to be stored and available facilities for storage**.** The present study suggests that Green gram grain should be stored at 10-12% moisture in hermetic bag under ambient condition. The study has revealed that hermetic bags provide a safe and convenient method for farmers to preserve their agricultural commodities. Hence, the adoption of hermetic bags must be encouraged in the developing countries.Hermetic storage is a sustainable, cost effective, user-friendly and environmentally benign technology that makes the use of pesticide and fumigants in post harvest and seed storage unnecessary. The technology has already been adapted for the protection of many different commodities in quantities ranging from that of conventional grain bag size to many thousands of tonnes. Applications of hermetic storage are very likely to expand even more rapidly in the future, as the available forms of hermetic storage continue to increase and more users experience and understand the advantages of this "green" technolog

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COMPUTATIONAL ANALYSIS OF FLOW OVER AIRFOIL

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ABSTRACT

This paper presents computational investigation of invicid flow over an airfoil. The drag and lift forces can be determined through experiments using wind tunnel testing, in which the design model has to be placed in the test section. This work presents a computational method to deduce the lift and drag properties, which can reduce the dependency on wind tunnel testing. The study is done on air flow over a two- dimensional NACA 0012 (NACA is National Advisory Committee for Aeronautics) Airfoil using ANSYS FLUENT (version 10) to obtain the surface velocity distribution, from which drag and lift are calculated using integral equations of velocity over finite surface areas. In addition the drag and lift coefficients are also determined. The fluid used for this purpose is air. The CFD simulation results shows the wide range of variation in the lift and drag force in less time thus suggesting an alternative to experimental method of determining drag and lift.
Index Terms—NACA 0012 Airfoil, ANSYS FLUENT

INTRODUCTION

The external aerodynamics of an airplane or turbine blade determines many relevant aspects such as stability, comfort and high cruising speeds. The flow around this airfoil body is characterized by highly turbulent and two-dimensional separations, and there is a growing need for more insight into the physical features of these dynamical flows on the other hand, and powerful numerical tools to analyze them Incorpera et.al.[1].

While maintaining results that are close to reality, the use of computational fluid dynamics (CFD) allows a more convenient approach than experiment, as many of the cases considered would be difficult to observe in a laboratory setting. A number of different problems in CFD are examined to illustrate useful concepts of fluid mechanics [2] Wind turbines interact with the wind, capturing part of its kinetic energy and converting it into usable energy. The wind is characterized by its speed and direction, which are affected by several factors. Atmospheric turbulence causes important fluctuating aerodynamic forces on wind turbine blades as well as airplane body. Turbulence is an irregular motion of fluid that appears when fluids flow past soil surfaces or when streams of fluid flow past or over each other.

Airfoil operation is of increasing interest as a result of the desire to improve the performance of general aviation aircraft at low-speed, high-aspect-radio sailplanes wings, as well as to improve the design of remotely piloted vehicles, jet engine fan blades, and propellers at high altitude. Different significant problems may contribute to diminish the aerodynamic performance of the airfoils. Flow control in the area around the airfoil region, has focused on the mitigation of these problems, using different strategies like flapping or flexible wings or boundary layer control Incorpera et.al.[1].

For smooth drive of airfoil, drag force should be reduced. It is achieved by making analysis of airflow over the airfoil body at different angle of attack. This work reports the effect of the change in lift and drag forces at various inlet angles for the constant flow velocity.

A. Airfoil Nomenclature [3]

Chord length – length from Leading edge (LE) to Trailing edge (TE) of a wing cross section that is parallel to the vertical axis of symmetry Mean camber line – line halfway between the upper and lower surfaces Leading edge (LE) is the front most point on the mean camber line Trailing edge (TE) is the most rearward point on mean camber line.

Camber – maximum distance between the mean camber line and the chord line, measured perpendicular to the chord line -

0 camber or encumbered means the airfoil is symmetric above and below the chord line

Thickness – distance between upper surface and lower surface measured perpendicular to the mean camberlin.

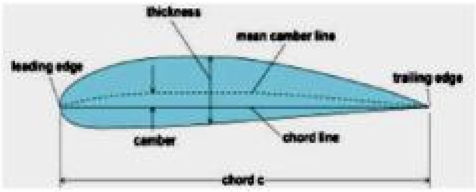

Fig. 1. Airfoil Geometry [3]

Lift on a body is defined as the force on the body in a direction normal to the flow direction. Lift will only be present if the fluid incorporates a circulatory flow about the body such as that which exists about a spinning cylinder. The velocity above the body is increased and so the static pressure is reduced. The velocity beneath is slowed down, giving an increase in static pressure. So, there is a normal force upwards called the lift force.

The drag on a body in an oncoming flow is defined as the force on the body in a direction parallel flow direction. For a windmill to operate efficiently the lift force should be high and drag force should be low. For small angles of attack, lift force is high and drag force is low. If the angle of attack (α) increases beyond a certain value, the lift force decreases and the drag forces increases. So, the angle of is an important parameter.

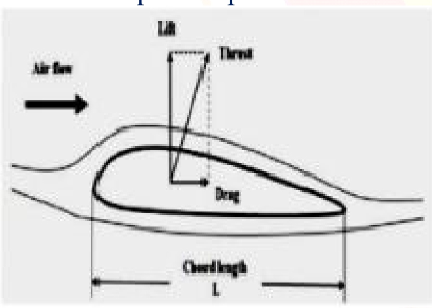

Fig. 2. Airfoil Physics [3]

An airfoil means a two dimensional cross- section shape of a wing whose purpose is to either generate lift or minimize drag when exposed to a moving fluid. The word is an Americanization of the British term aerofoil which itself is derived from the two Greek words Aeros ("of the air") and Phyllon ("leaf"), or "air leaf".

NACA 0012 airfoil is considered for present analysis. NACA is National Advisory Committee for Aeronautics). First digit indicate the camber as a percentage of chord. Second digit describing the distance of maximum camber from the airfoil leading edge in tens of percent of chord. Last two digit describing the distance of maximum thickness of airfoil as a percent of chord. The NACA 0012 airfoil is symmetrical, the 00 indicating that it has no camber. The 12 indicates that the airfoil has a 12% thickness to chord length

ratio. It is 12% as thick as it is long. The blade is made up of single airfoil. The chord length is varying throughout the blade. Analysis is done by changing the blade angle with different wind speed.

A real-life airfoil is very complex shape to model or to study experimentally. However, the simplified airfoil shape employed by NACA generates fully two-dimensional regions of separated flow which enable a better understanding of such flows. The geometry represented in Fig. 2, shows the flow around this body is strongly influenced by the angle of attack, which indicates that the large portion of aerodynamic drag is generated by the development of different velocity profile by changing the angle of attack at the velocity inlet.

METHODOLOGY

A. Creating the geometry and mesh generation:

This interactive process is the first pre-processing stage. The objective is to produce a mesh for input to the physics of pre- processor. Before a mesh can be produced a close geometric solid is required. For commercial code, geometry is usually created using commercial software (either separated from the commercial code itself, like Gambit, or combined together, like Flow Lab) For research code, commercial software (e.g. Gridgen) is used. In this case, geometry is simple so the geometry and meshing is created in ANSYS WORKBENCH. The basic steps involve:

1. Defining the geometry of the region of interest
2. Creating the domain of the fluid flow and providing boundary conditions
3. Setting properties for mesh

This preprocessing stage is highly automated. In ANSYS WORKBENCH geometry can be imported from other sources also.

B. Feeding the physics in FLUENT:

The interactive process is the second pre-processing stage and is used to create the input required by the solver. The mesh files are loaded into the physics preprocessor. The physics model that is to be include in the simulation is selected and fluid properties and boundary conditions are specified.

C. Solving the problem in FLUENT solver:

The component that analyses the problem is called the solver. It produces the required results in batch process; it is solved as follows,

1. The partial differential equations are integrated over the entire control volume in the domain region. This is equivalent to applying a basic conservation law (mass or momentum) to each control volume.
2. These integral equations are converted into a system of algebraic equations by generating a set approximation for the terms in the integral equations.
3. The algebraic equation is solved iteratively.

An iterative approach is required because of the nonlinear nature of the equations and as the solution approaches the exact solution, it is said to converge. For each iteration an error or residual is reported as a measure of the overall conservation of the flows properties.

How close the final solution is to the exact solution depends on a number of factors including the size and shape of the control volume, and size of the final residuals. Complex physical processes such as turbulence are often modeled using empirical relationship. The approximation inherent in this model also contributes to differences between the CFD solutions and the real flow.

The solution process requires no user interaction and is therefore usually carried out as the batch process. The solver produces a result file which is then passed to the post processor.

D. Visualization of the results in FLUENT Post Processor

The post processor is the component used to analyze, visualize and present the result. Post processing includes anything from the obtaining point values to complex animated sequences.

Examples of some important features of Post Processor are:

- Visualization of the geometry and the control volume
- Vector plots showing the magnitude and direction of the flow
- Visualization of the variation of scalar variables through the domain
- Quantitative numerical calculations.
- Charts showing graphical plots of variables.

CFD ANALYSIS OF AIRFOIL

The current analysis considers constant flow velocity while the effect of variation in angle of attack is presented. In order to solve this problem following steps are required,

Preliminary data of the problem is needed. Creating geometry in ANSYS workbench. Feeding the physics in fluent pre.

Solving the problem in fluent solver. Visualizing the result in fluent post.

Fig. 3. *ANSYS* Workbench Geometry

A. Creating the mesh in ANSYS CFD mesh:

Grids can either be structured (hexahedral) or unstructured (tetrahedral).

Generally unstructured meshing is used for complex geometry. As the airfoil geometry is simple, structured meshing is used. In mesh generator different boundary conditions are given to the domain.

1. Velocity inlet to the front vertical inlet of the domain. (V=10m/s)
2. Pressure outlet to all remaining three sides of domain. (P=100KPa)
3. Wall is given as boundary condition to airfoil.

The mesh generator has a following structure:

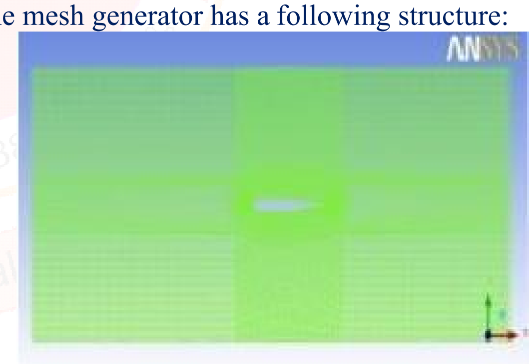

Fig. 4. *ANSYS* Workbench Meshing: The mesh file in the CFD is imported in Fluent pre-processor.

RESULTS AND DISSCUSSIONS

Initially reference value is provided with solution controls to the imported mesh. After that the flow is kept in the direction normal to the airfoil and initial velocity is given as 10m/s. We obtained the velocity contour as follows,

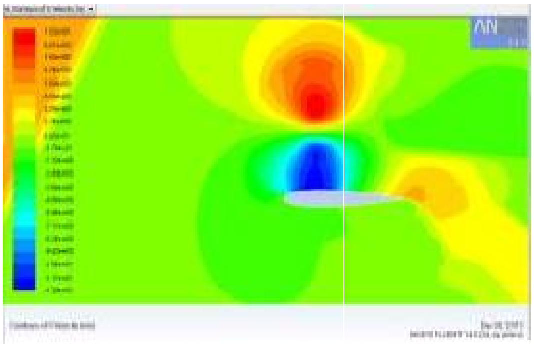

Fig. 5. Velocity Contour at 0 degree

This velocity contour shows that drag and lift force are equally dominant, as at 0 degree air flow is equally distributed over both the sides. So the ratio of lift force to drag force (L/D ratio) is not that effective to give the required lift.

The following results were seen in the Fluent post for different angle of attack. Visualization of velocity contour when angle changes from 0 deg. to 9 deg with the interval of 1deg.

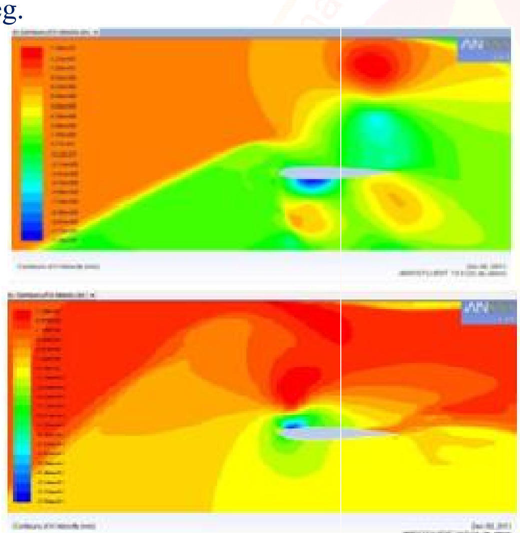

Fig. 7. Velocity Contour at 0 degree

As shown in figure (7) the blue region in 0 deg velocity contour is replaced by greenish yellow region in 5 deg, show that lift force is effective and drag force is low. This is mainly due to tilting of airfoil in upward direction which gives sufficient increment in the flow rate and reduction in the resistance to the flow specifically at 5 degree. So the L/D ratio is sufficient to give the required lift.

In the table (1) we are considering the angle of attack with respect to the horizontal plane that is in the X direction, perpendicular to the velocity inlet where V=10 m/s, the angle is varying from 0 degree to 9 degree with difference of 1 degree gives different L/D ratios at angle of attack varying from 0 degree to 9 degree. From which it is very clear that by varying angle of attack we get maximum L/D ratio at 5 deg. The tilting of airfoil in upward direction gives sufficient increment in the flow rate and reduction in the resistance to the flow specifically at 5 degree.

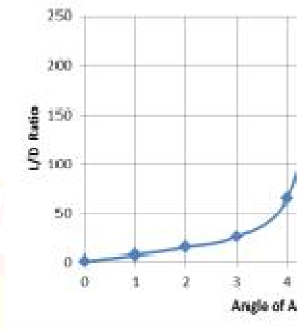

Fig. 8. Chart of Angle of Attack Vs L/D Ratio

The graph in Fig (8) shows the variation of the L/D ratio at different angle of attack varying from 0 deg to 9 deg at the interval of 1 deg. L/D ratio is maximum at 5 deg. At this angle of attack, the tilting of airfoil in upward direction creates rise in pressure at lower surface of airfoil, so the velocity of flow falls giving lift to the airfoil. It indirectly decreases the resistance to the flow of body.

CONCLUSION

Based on the CFD analysis of the flow over airfoil it can be concluded that the velocity of flow over the upper surface is faster than the velocity of flow on the lower surface, due to the tilting of airfoil in upward direction rise in pressure takes place at lower surface of airfoil, so the velocity of flow falls giving lift to the airfoil. As lift force is important for upward motion and drag force is the controlling parameter, we require higher lift to drag ratio. From the computed lift and drag forces the maximum L/D ratio is obtained at the 5 deg. So, for the considered geometry, best angle of attack so as to reduce the resistance and support the smooth flow, is 5 degree

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EFFECT OF LITHIUM SUPEROXIDE AND BORON TRIOXIDE ON THE CONDUCTIVITY OF LITHIUM SULPHATE

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ABSTRACT

Solid Electrolyte has potential applications in new electrochemical devices such as solid state battries, fuel cell and chemical sensors. The Lithium Sulphate being the good solid electrolyte possesses two phases, monoclinic at room temperature and cubic [FCC] above 853°K. The high temperature phase is reported to be a super ionic conductor due to its rotation – like motion of the sulphate ions, which enhances the cation migration and therefore very much useful for battery materials. The Boron Trioxide is glass former and posses many useful properties in its crystallized form, like potential engineering applications and posses many scientific interest like enhance ionic conductivity by suppressing the effects of grain boundaries in ionic conducting crystalline solids. In the present paper the effect of Boron Trioxide and Lithium Superoxide on the conductivity of Lithium Sulphate is studied. The Boron Trioxide with LiO2 is added in the molar percentage as (80:10):10, (85:5):10 and (83:7):10.The samples are prepared using fast quenching technique. The prepared samples are characterized by XRD and electrical conductivity of the sample is measured in the frequency range 20Hz to 2MHz over the temperature range of transition of lithium Sulphate. The variation in the conductivity is explained in the light of XRD and frequency dependence of conductivity.

Keywords: *Lithium superoxide, Boron Trioxide, lithium sulphate, grain boundary*

INTRODUCTION

Lithium superoxide (LiO_2) is an inorganic compound which has only been isolated in matrix isolation experiments at 15-40 K.[1] Experimental studies indicate that the LiO_2 molecule contains highly ionic bonds.[2] Eighteen different values were attained using six isotopic species. This indicated that the force constant between the two oxygen atoms corresponds with the constant found for the O_2^- ion. Studies indicate that there is little to no covalent character in the LiO_2 molecule.The bond length for the O-O bond was determined to be 1.34 Å. Using a simple crystal structure optimization, the Li-O bond was calculated to be approximately 2.10 Å.[3] Lithium superoxide is extremely reactive because of the odd electron present in the π* molecular orbital.[4].There has been quite a few studies regarding the clusters formed by LiO_2 molecules. The most common dimer has been found to be the cage isomer. Second to it is the singlet bypyramidal structure. Studies have also been done on the chair complex and the planar ring, but these two are less favorable, though not necessarily impossible.[1].The predominant use of lithium superoxide is in rechargeable lithium batteries. Rarely are superoxides stable for any significant amount of time as they exist merely as transition states. In January 2016, researchers from Argonne National Laboratory, US, claimed that crystalline LiO_2 could be stabilized in a Li-O_2 battery by using a suitable graphene-based cathode.[5]

Boron trioxide (or diboron trioxide) is one of the oxides of boron. It is a white, glassy solid with the formula B_2O_3. It is almost always found as the vitreous (amorphous) form; however, it can be crystallized after extensive annealing. The electrical conductivity of Li_2SO_4 was found to be of the order of 0.9S/cm at 823^0k [7]. This high conductivity is due to enhanced cation mobility observed by a strong coupling of the rotation of the otherwise translationally immobile sulphate ions [6, 8]. This motion of sulphate ions is depicted as the paddle wheel or cogwheel model [8, 9, 10].The high temperature plastic phase or solid electrolyte posses grain boundaries. The grain boundaries block the ionic transport and add its resistivity to the bulk resistance. The grain boundary resistance is of several orders of magnitude high than bulk resistivity [11, 12, 13]. In present paper the grain boundaries effect on the bulk conductivity of (Li_2O:B_2O_3) added Li_2SO_4 is analyzed using impedance measurements.

EXPERIMENTAL

Unhydrated Li_2SO_4 and Li_2O, B_2O_3 reagent grade materials are the starting compounds. The compositions (LO: BO) _LS :(80:10) _10 %,(LO: BO) _LS :(83:7) _10% and (LO:BO)_LS:(85:5) _10% mixed in proportion to form 15 gm batches. The homogeneous mixed powders are melted in electric furnace at around 900^{o}C.The homogenous melts are quenched in stainless steel mould kept at room temperature. The conductivity measurement are performed by complex impedance method using Agilent E 4980A meter in the frequency range from 20 Hz to 2MHz.The reproducibility of the measurement is verified at least for three times. The temperature range of measurement of conductivity is from 250^{o}C to 550^{o}C

CONDUCTIVITY MEASUREMENT (LI_2O_B_2O_3):LI_2SO_4

The electrical conductivity plots for above compositions are depicted in fig.1. From the conductivity plot it has been observed that conductivity of amorphous lithium borate glass enhances with the addition of lithium sulphate. The exhaustive analysis of the above sample has been carried out in the research work of P.R.Gandhi [14]. When this conductivity is compared with crystalline lithium sulphate it is observed that conductivity enhances by four orders of magnitude. The increase in the conductivity has been attributed to more open structure of glass as compared to its counterpart and common ion effect. The glass transition temperature as obtained from the DTA shows minimum transition temperature for 20 mol% lithium sulphate. This minimum transition temperature also supports the conductivity maxima. Bray and Kogh Moh has explained how the dilation of the lithium borate glass occurs with addition lithium sulphate. The tetrahedra structure of SO_4 and BO_4 expands the matrix which in turn favors the lithium ion conductivity. This is also supported by the observed minimum in the activation energy. Fig 2

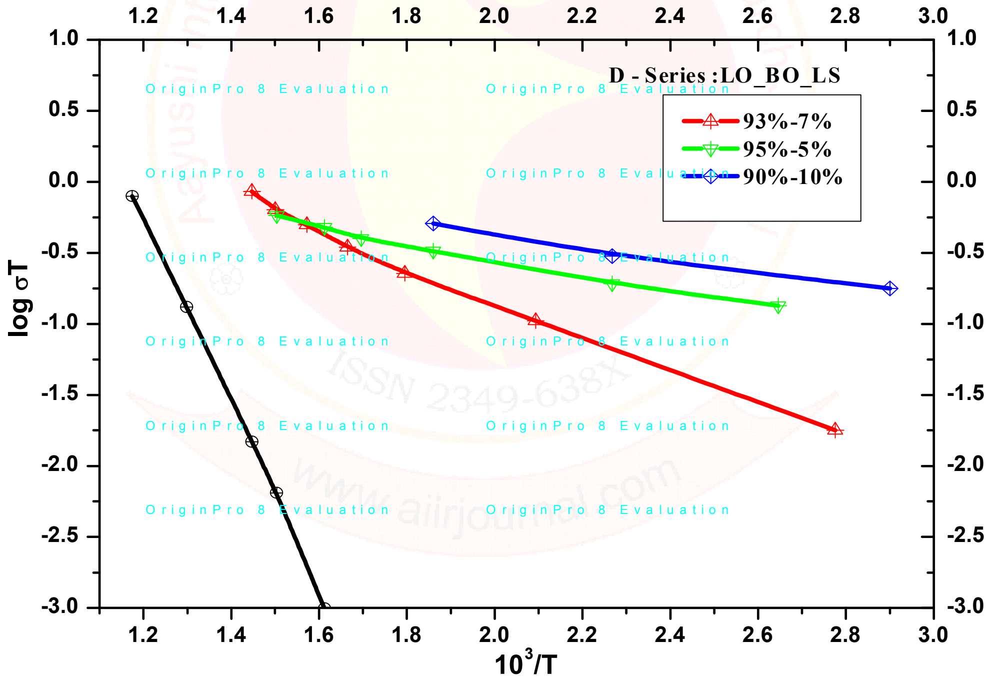


Fig 1 **Conductivity plot for LO_BO_LS**

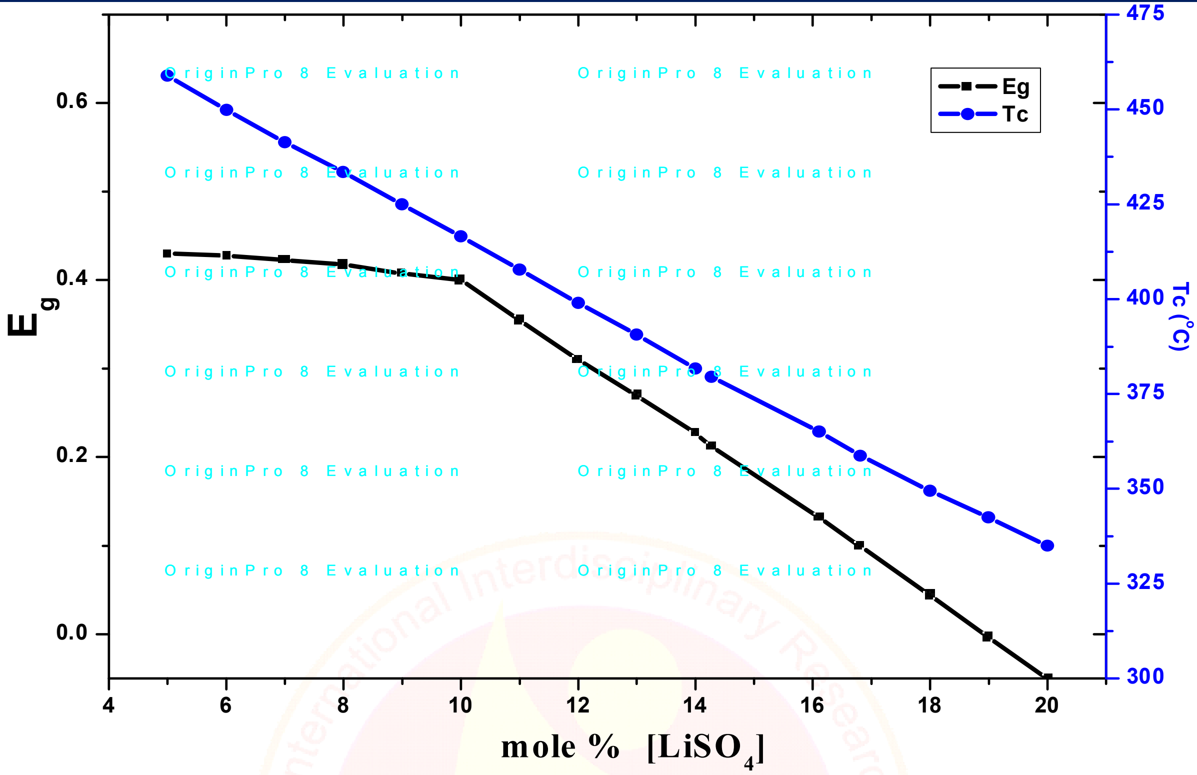


Fig 2.Activation Eng with mole % LS at different temp

X-RAY DIFFRACTION

The samples added with different salts and quenched by fast quenching technique shows white circular rings with good mechanical strength to handle easily. The room temperature x-ray pattern of samples prepared in this series is shown in figures.3 and Fig 5 and respective h k l planes are shown in fig.4 and fig 6. From the figure it is clear that the phase present in the samples is monoclinic lithium sulphate and the weak peaks are for the salts which are added in it.

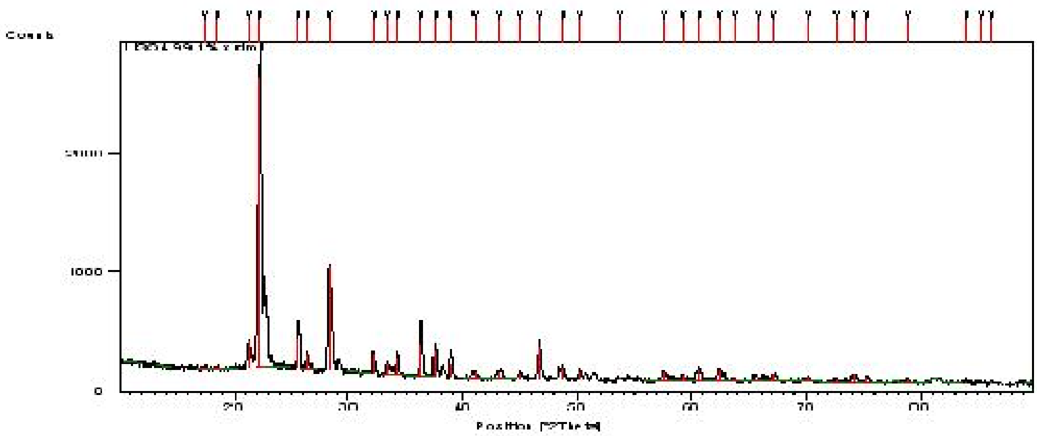


Fig 3: (Li_2O_B_2O_3) _LS: (85_5_10)

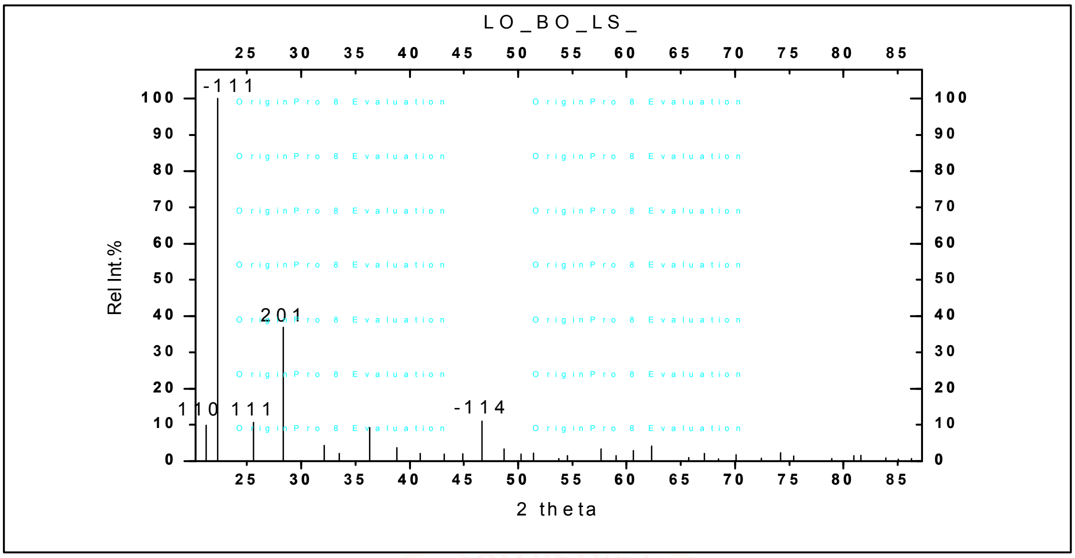


Fig 4: h k l values (LO_BO) _LS: (85_5_10)

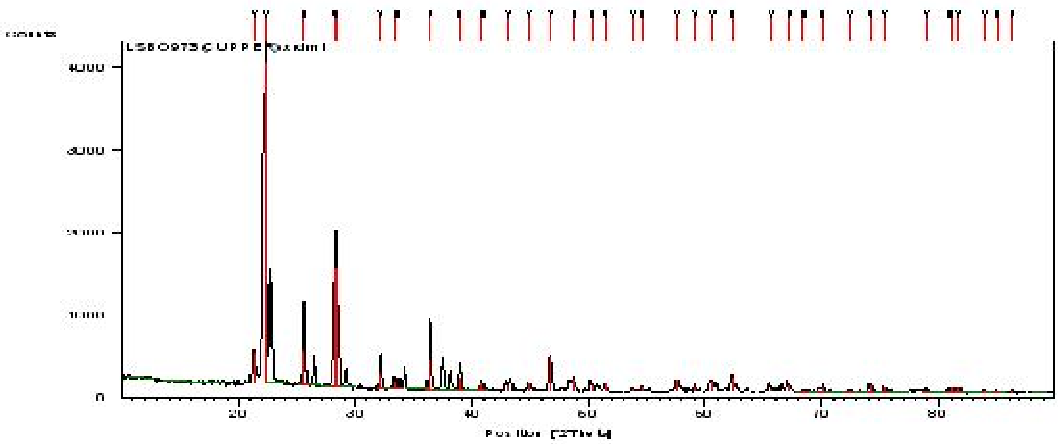
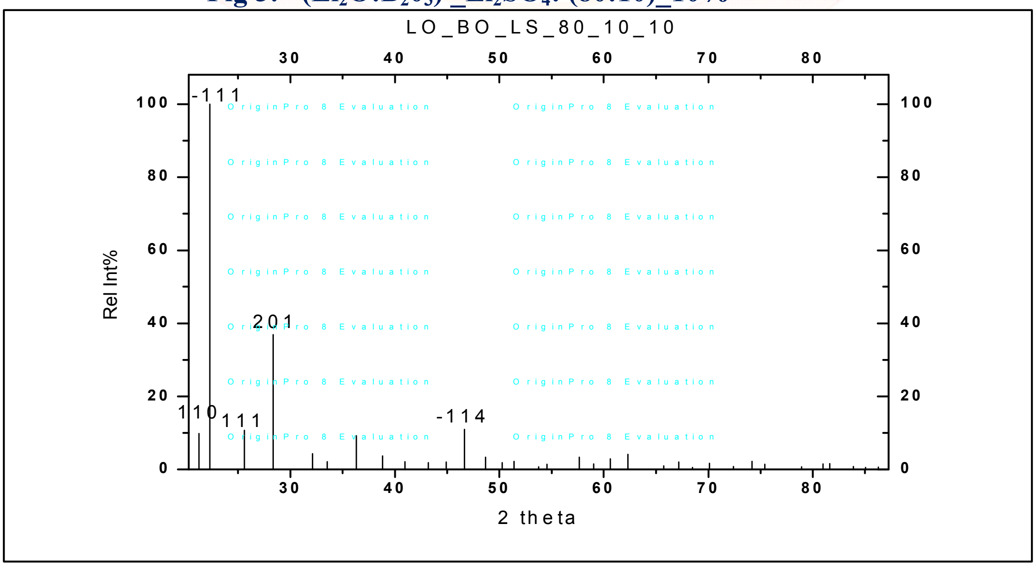


Fig 5: $(Li_2O{:}B_20_3)$ _Li_2SO_4: (80:10)_10%



The following table, 4.T.4, gives the presence of different phases found in all series prepared in the present work. From the table it is evident that there are no traces of trapping of FCC phase of lithium sulphate at room temperature. The attempt to add salt with high latent heat in lithium sulphate found inactive in trapping the high temperature phase of lithium sulphate;

COMPOSITION	d values from XRD with intensity		d values ICCD	components
$(Li_2O:B_2O_3)$_Li_2S0_4 (80:10)_10%	3.99211 3.15642 1.94519	100.00 35.76 11.66	3.992 3.15 1.94	$Li_2B_2O_4$(X) $Li_2B_2O_4$(X) Li Borate Hydroxide(T)
$(Li_2O:B_2O_3)$_Li_2S0_4 (85:5)_10%	3.96260 3.43276 4.21974	100.00 15.60 12.41	3.96 3.438 4.21	Li Borate Hydrate(O) Li Hydroxide Borate(A) Li Borate(X)

Table 4.T.4

DIFFERENTIAL THERMAL ANALYSIS

The DTA curve for lithium sulphate salt revealed the phase transition as an endothermic peak at 575°C, as shown in figure 7. Moreover no peak for dehydration has been observed in quenched lithium sulphate salt. In series$(Li_2O_B_2O_3)$:Li_2SO_4 the earlier reported lithium borate highest conducting glass composition has been added with the understanding that amorphous lithium borate glass having maximum disorder in its structure with highest number of BO_4 tetrahedral concentration [14] may stabilize the FCC phase of lithium sulphate. The figure 7 shows the shift in the endotherm for different mol % $Li_2O\_B_2O_3$ added lithium sulphate also the inset shows the variation in endotherm temperature with $Li_2O\_B_2O_3$. This variation in endotherm temperature is also given in table 4.T.6. The maximum drop in transition temperature is from 575°C to 298°C for 10 mol% added lithium borate glass system. The common ion effect of lithium may dilute the monoclinic phase of lithium sulphate and therefore it shifts the transition temperature to observed value. The similar results for stabilization of α-AgI in glass matrix of $Ag_2O:B_2O_3$ has been reported by Tatsumisago [9].

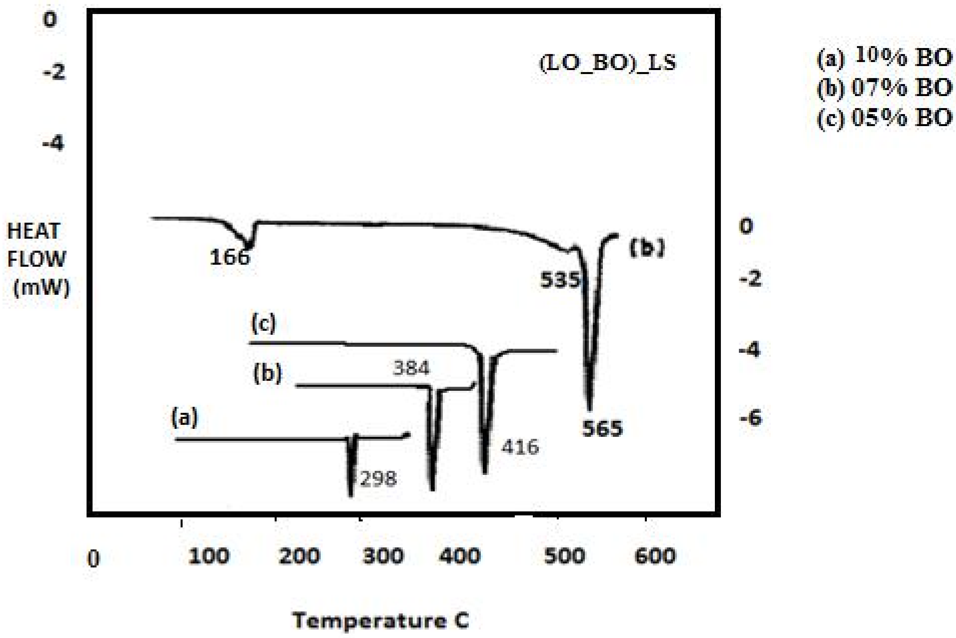
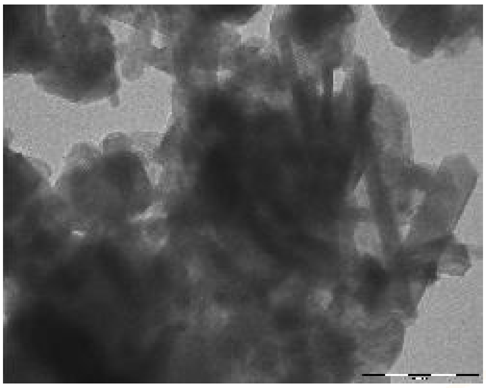


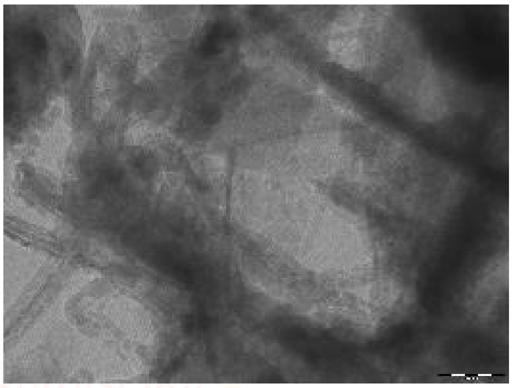
Fig 7

TRANSMISSION ELECTRON MICROSCOPY

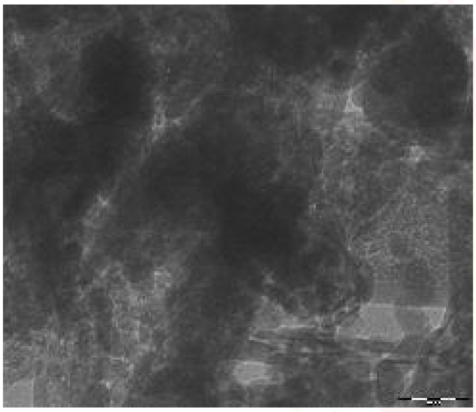
Following figures 8,9,10 shows TEM of samples of different compositions along with electron diffraction pattern

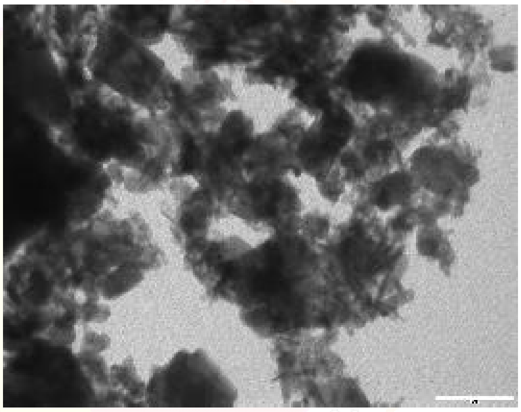
TEM for composition LO_BO_LS_87_3_10





500nm 200nm





100nm 1 micro m

Fig 8

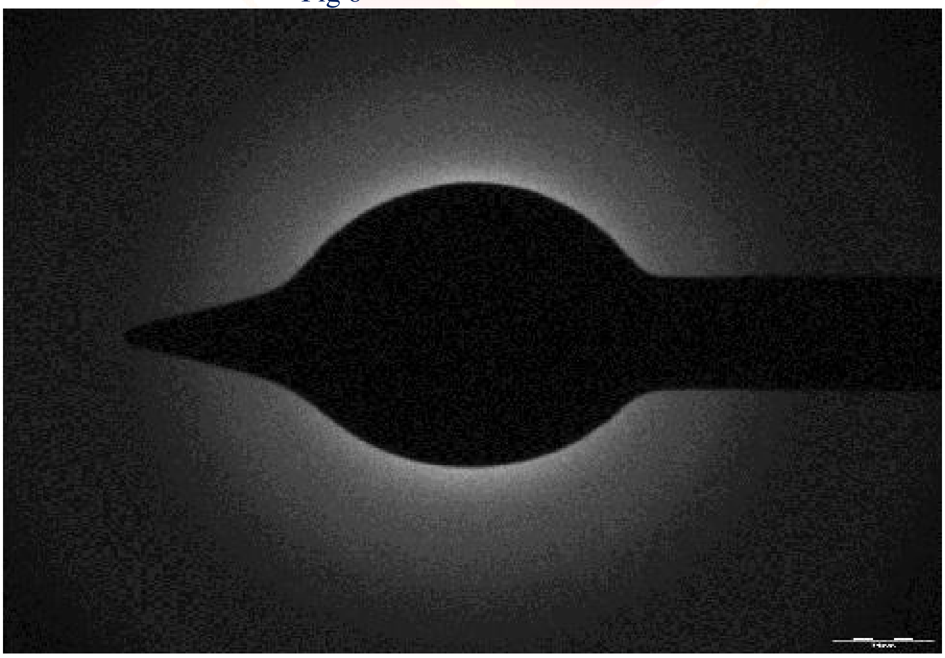


Fig 9 TEM micrograph with ED pattern of Li_2SO_4_B_2O_3_ 93_07

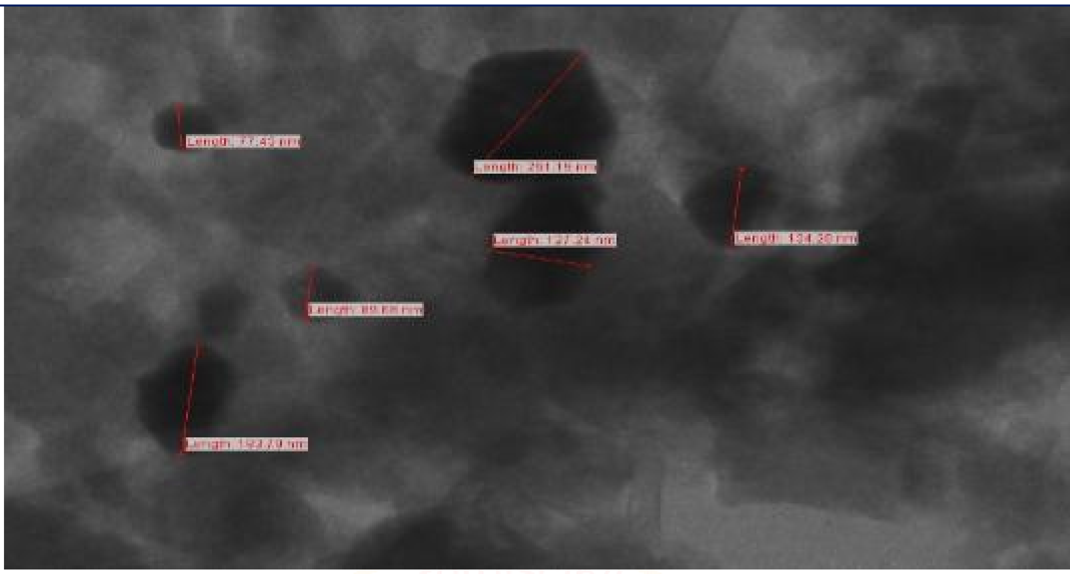


Fig 10: TEM micrograph showing particle size

CONCLUSIONS

1. In TEM figures Since density of particle per unit volume appears to be small it tends to small conductivity and hence in such samples the conductivity may have low values .In TEM figures of small sized algomoration of particle the conductivity may have low values and larger sized algomoration of particle in the form of group may have moderate conductivity. Rod like structure of the particles gives high density of particle aligned in a particular direction and hence larger conductivity.

2. In almost all series combinations obvious grain boundary significance was observed, and the siliceous phase can be observed. The blocking effect contributed from the siliceous phase is therefore negligible; however, the specific grain boundary resistivity is still two to three orders of magnitude higher than the bulk resistivity.

3. The addition of, B_2O_3, and Li_2O may increase both the grain boundary resistivity and the grain boundary thickness, which can be consistently explained by the space charge effect.

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CONDUCTOMETRIC MEASUREMENTS OF SUBSTITUTED THIOCARBAMIDO NAPHTHOL

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ABSTRACT

This is a developing era for various innovations in chemical, industrial and pharmaceutical and medicinal sciences. Recently researchers can be determined the significances and applications of synthesized molecule in various sciences with the help of conductrometric measurements. Conductrometric study provided valuable information regarding to transport properties of drugs. This type of measurements and studies become interdisciplinary bridge in between chemical and biological sciences. Considering all these facts we determined the conductrometric parameters (viz. G, k and μ) and thermodynamic parameters (viz. ΔH; ΔSand ΔG) of 5-phenylthiocarbamido-1-naphthol at different concentration and 308 K in 80% ethanol water mixture.

Key Words: *5-Phenylthiocarbamido-1-naphthol, conductrometric parameter, and thermodynamic parameter*.

INTRODUCTION

Conductivity is a good tool in pharmacodynamics study of drugs. Transport property and permeability of drugs efficiently influence by conductivity of electrolyte, these two are prime biopharmaceutical parameters which are accountable for effective bioavailability and good in vitro and vivo correlation[1]. Nowadays pharmaceutical technologist has a great challenge to raise the solubility and dissolution rate and oral bioavailability of weakly water soluble drugs[2]. Hydrotropic Salisation is considered as one of the sophisticated methods of solubalisation[3]. Enhance the aqueous solubalisation of insoluble drugs by adding hydrotropic agents, number of researchers work on the effect of solubility enhancers[4,5]. The valuable information about solute-solute and solute-solvent interactions obtains from the coductometric measurements[6]. Gomaa and Al-Jahdalli[7] was investigated ionic association of divalent asymmetric electrolyte $Cu(NO_3)_2$ with Kryptofix-22 in mixed (MeOH-DMF) solvents at different temperatures by conductometric measurements. Conductometric measurements of the alkali metal at different proportion of mixed solvents were carried out by Izonfuo and Obunwo[8] and Roy et al[9]. Very few researchers investigated the thermodynamic parameter and Walden product of different complexes and they also examine the comparison of transition metal complexes among the halide group[10-14]. An ion pair formation and thermodynamic parameters of Glycine Bis-1-amidino-O-methylurea cobalt (III) halides in water-methanol mixture at different temperatures was investigated by Singh et al[15]. Recent work deals with determination of thermodynamic parameters viz. ΔH; ΔS and ΔG study of 5-phenylthiocarbamido-1-naphthol by conductometric measurements at different concentrations and constant temperature 308 K in 80% ethanol-water mixture. This study also contributes to solvent-solvent, solute-solvent and solute-solute interactions and the effects of various substituents.

MATERIALS AND METHODS EXPERIMENTAL

Freshly prepared solution used for analysis. The solvents were purified by standard method. 0.01M, 0.005M, 0.0025M and 0.0012M solutions of 5-phenyl thiocarbamido-1-naphthtol 80% ethanol-water mixture were prepared. Maintain Thermal equilibrium at 308K of solution was maintained by using thermostat. After getting thermal equilibrium, conductivity of that electrolyte solution was measured.

RESULT AND DISCUSSION

Firstly 0.01 M concentration of solution was prepared then by serial dilution method solutions of 0.005M, 0.0025M and 0.0012M with 80% ethanol-water mixture were prepared.

Conductance of each solution by using Conductivity Bridge at 308 K was measured. The results obtained are given in Table-1 to Table-2. From the data observed conductance (G), specific conductance (k) and molar conductance (μ) were determined by known literature method.

TABLE – 1 - CONDUCTOMETRIC MEASUREMENTS AT DIFFERENT CONCENTRATIONS OF 5-PHENYLTHIOCARBAMIDO-1-NAPHTHOL				
The values of G, k and μ AT DIFFERENT CONCENTRAT AND 308 K				
% of solution (Ethanol-water)	Concentration C (M)	Observed conductance (G)	Specific conductance (k)	Molar conductance (μ)
80%	0.01 M	0.0309	0.03684	3.68487
	0.005 M	0.01656	0.02055	4.11067
	0.0025 M	0.01119	0.01021	4.08422
	0.0012 M	0.00904	0.00871	7.25840

From Table 1 it was noted that observed conductance (G) and specific conductance (k) decreases and molar conductance (μ) increases along with decreasing concentrations. The specific conductance increases with increasing temperature. Specific constant (Ksp), log (Ksp) and thermodynamic parameters viz. (ΔG), (ΔS) and (ΔH) of 5-phenylthiocarbamido-1-naphthol were calculated by known literature methods at different concentrations at 308K. Results are computed in **Table 2**.

TABLE – 2 - CONDUCTOMETRIC MEASUREMENTS AT DIFFERENT CONCENTRATION OF 5-PHENYLTHIOCARBAMIDO-1-NAPHTHOL at 308 K						
SYSTEM: LIGAND [PTCN]			MEDIUM - 80% ETHANOL-WATER			
Temp. (K)	Conc. M	Ksp	Log Ksp	ΔG	ΔH	ΔS
308	0.01	0.0970	4.30373	-24968.44	-80244.5	347.237
	0.005	0.0155	4.81081	-27910.3	-89699	388.15
	0.0025	0.00739	5.1311	-29768.49	-95671.5	413.993
	0.0012	0.00486	5.31857	-30856.15	-99166.7	429.118

The change in thermodynamic parameters values closely affected by temperature, molar concentrations and percentage compositions. These parameters shackle by another factors viz. the solute (drug)-solvent interactions, solvent-solvent interactions, solvent-solvent-solute interactions and –solute-solute-solvent interactions. Variation in these parameters affected by the internal geometry as well as internal and intra hydrogen bonding

As observed, μ values increase with decreasing in concentration indicating less solvation or higher mobility of ions. This is due to the fact that increased thermal energy results ingreater bond breaking due to dilution. Also negative values of ΔG indicate that reaction is spontaneous. Negative values of enthalpy change (ΔH) suggest exothermic reaction. Favorable at lower temperature and positive value of (ΔS) revels entropically favorable. The change in thermodynamic parameters values closely affected by molar concentrations and percentage compositions. These parameters shackle by another factors viz. solute (drug)-solvent interactions, solvent-solvent interactions, solvent-solvent-solute interactions and –solute-solute-solvent interactions. Variation in these parameters affected by the internal geometry as well as internal and intra hydrogen bonding

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PQ MATERIAL SHOWING CHARACTERISTIC PROPERTIES

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ABSTRACT

All the PQ derivative materials formed were investigated though FTIR, NMR spectroscopic and Mass spectrometric analysis. The thermal properties of the materials were studied by TG and DT analysis. Morphological studies of the materials were carried out through XRD, AFM and SEM studies and material is further subjected to electrical characterization by DC- conductivity measurement using Four probe conductivity instrument. The optical investigations, providing the temperature-dependent conductive defects formation in the obtained strutures.

Keywords- *PQ, Conductive defects, CeCl3*

INTRODUCTION

Typically, poly(quinoline)s have high thermal stability with glass-transition temperatures (Tg) above 200˚C and onset thermal decomposition temperatures (Tdec) above 400˚C, high oxidative stability, high electrical conductivity, and outstanding mechanical and optically clear film forming properties.[8 – 10] These characteristics make poly(quinoline)s interesting materials for electronic and/or electro-optical devices. Over the last decade, Jenekhe,Jen, and others have investigated extensively the optical and electronic properties of poly(-quinoline)s including photo-conductivity,[10] optical nonlinearity,[3 –2] photoluminescence,[1–8] electroluminescence, [2–7] charge-transfer,[38] and electron transporting properties[7–4] for their potential applications in OLEDs,[2–3] organic photovoltaic devices,[1] and selective chemosensors (proton and metal ions).[4 – 5]

EXPERIMENTAL SECTION MATERIAL AND METHOD

1 equiv of the diacetyl monomer, 1 equiv of 3,3-dinonanoylbenzidine, 6.0 g of diphenyl phosphate, and 3 g of *m*-cresol were added to a cylindrical reaction vessel. The reactor was purged with argon for 20 min. The mixture was mechanically stirred under static argon as the temperature was gradually raised to 140°C over a period of 12 h. The polymerization mixture was stirred at this temperature for 72 h and then precipitated into 10% triethylamine/ethanol. The precipitate was collected by vacuum filtration and extracted on a Soxhlet apparatus for 72 h with 20% triethymine/ethanol. The polymer was dissolved in CHCl3 and precipitated into ethanol, collected by vacuum filtration, and dried at 60 °C in a vacuum for24 h.

RESULTS AND DISCUSSION

Conjugated rigid-rod polyquinolines have excellent thermal stability and high mechanical strength [1,2].These *n*-type semiconducting polymers [3] have interesting electronic [2 b], photoconductive [4], and nonlinear optical [5] properties. Recently, some polyquinolines were used as both the electron-transport layer and an emission layer in polyquinoline/poly(*p*-phenylenevinylene) heterojunction light-emitting

diodes (LEDs) [6]. The attractive combination of excellent thermal, mechanical, and optoelectronic properties of the conjugated polyquinolines has motivated our synthesis of new derivatives for electroluminescent device applications.

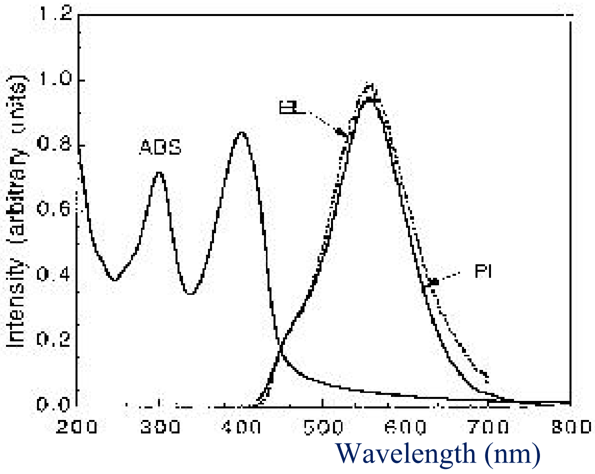

Fig. 1. Optical absorption, photoluminescence (excited at 399 nm) and electroluminescence (8 V) spectra of Bu-PPQ thin films.

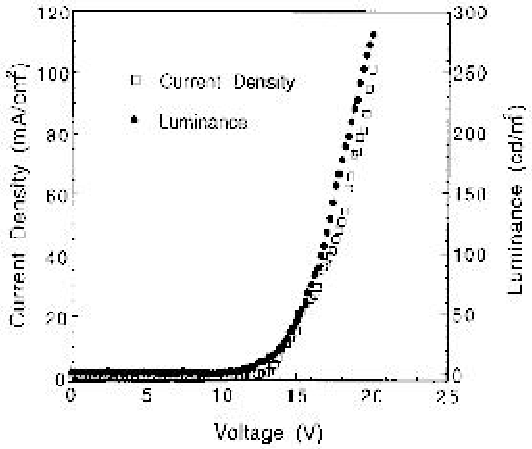

Fig. 2. Current –voltage and voltage –luminance characteristics of the electroluminescent device ITO/TAPC: PS/Bu-PPQ/Al.

Figure 1 shows the optical absorption, steady-state photoluminescence (PL), and electroluminescence (EL)spectra of Bu-PPQ. This polymer shows a strong absorption with a p-p* transition at 399 nm. The optical absorption edge bandgap is 2.78 eV (446 nm). Bu-PPQ thus has absorption peak and bandgap identical to those of PPPQ,which were previously reported [2 b]. This suggests that the ground state
electronic structure of PPPQ does not change with the introduction of the *tert*-butyl groups inBu-PPQ. Also shown in Fig. 1 is the steady-state PL spectrum of Bu-PPQ thin film excited at 399 nm. The PL spectrum shows an emission peak at 554 nm. The yellow emission corresponds to a large Stokes shift of 155 nm (0.87 eV),which is characteristic of excimer emission of the solid film of many conjugated polymers [10]. The PL emission of Bu-PPQ showed a 20 nm blue shift compared to PPPQ(**1**), which has a PL emission peak at 574 nm. This indicates that the introduction of the *tert*-butyl groups in Bu-PPQ modifies the excited state electronic structure of the parent polymer PPPQ. That chain packing of conjugated polymers should significantly influence their excited state properties more than their ground state electronic properties has been predicted [10]. The EL spectrum of the device ITO/TAPC:PS/Bu-PPQ/Al at a bias voltage of 8 V is shown in Fig. 1. The EL emission peak is at 554 nm. It can be seen that the EL spectrum is identical to the PL spectrum, indicating that the EL emission is from the Bu-PPQ layer only and that the electroluminescence and photoluminescence of Bu-PPQ originate from the same excited states. Figure 2 shows the current–voltage and luminance–voltage characteristics of the EL device. The turn-on voltage of the ITO/TAPC:PS(50 nm)/Bu-PPQ(50 nm)/Al device was 8 V. It showed bright yellow color emission, which can be clearly seen under room light. The luminance of the device was 280 cd/m2 at a current density of 100 mA/cm2. The EL efficiency of the device was estimated to be 0.26% photons/electron. These values were about six times higher than those of PPPQ (**1**) under the same conditions. For example, the device ITO/TAPC:PS(50 nm)/PPPQ(50 nm)/Al had a luminance of 45 cd/m2 at the same current density of 100 mA/cm2. The large enhancement of electroluminescence in the *tert*butyl- substituted Bu-PPQ (**2**) compared to the parent polyquinoline **1** can be understood in terms of reduced concentration quenching of luminescence facilitated by increased interchain packing distances [10]. Observation of efficient electroluminescence in the ITO/TAPC:PS/Bu-PPQ/Al devices implies that the emissive Bu-PPQ layer also exhibits good electron transport (*n*-type) characteristics, in accord
with prior findings for other polyquinolines [3, 6].

In summary, a new electroluminescent, yellow lightemitting *n*-type conjugated polymer, Bu-PPQ (**2**), has been synthesized and characterized. Although the substitution of *tert*-butyl groups in Bu-PPQ did not change the optical absorption properties of the parent PPPQ, a more efficient electroluminescence with an EL quantum efficiency of 0.26% photons/electron and a luminance of 280 cd/m2 was observed. The brightness and efficiency of light-emitting diodes from Bu-PPQ (**2**) were six times higher that those of PPPQ (**1**) with no *tert*-butyl substitution. These results also demonstrate that thin films of the new polyquinoline exhibit good electron transport (*n*-type) characteristics in EL devices.

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ANALYSIS OF MUNICIPAL SOLID WASTE MANAGEMENT SYSTEM INCORPORATED AT AKOLA CITY

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ABSTRACT

Akola is 3rd largest city in Vidarbha, and rapidly growing in the fields like Health care, Education, Industries and so on. As being developing city Akola is estimated to produce 200 MT waste on daily basis. Solid waste management (SWM) has multidimensional impact on progress of the city and thus nation, environment etc. understanding the importance of SWM present study is to understand the present practices undertaken by Akola Municipal Corporation (AMC) to handle, the waste. It was found that AMC lacks in meeting various standards laid by the SWM Rules 2016 and needs to increase its capacity to collect and dispose the waste in scientific manner.At same time active participation of citizens is expected to enhance the work.

Keywords: *Akola Municipal Corporation, AMC, solid waste management, SWM Rules 2016.*

INTRODUCTION

Akola city renowned as Cotton City, is a district place with potential to grow in various avenues. Akola is leading name in health care in western Vidarbha,providing various services like skin care, heart surgery, cancer treatment and many more. Recently Akola city has undergone city limit expansion, now it has increased from 28 km^2 to 124 km^2 area. Thus one can understand major changesin city and its impact on Solid Waste Management's overall system.

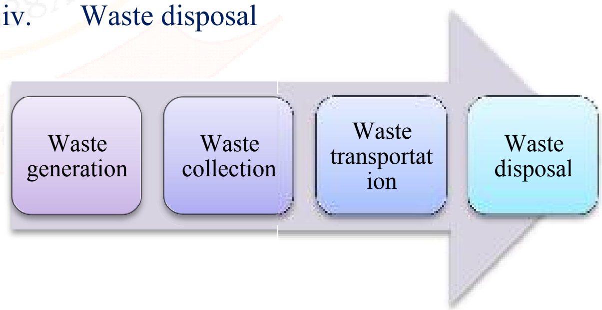
As per Solid Waste Management Rules by 2016, solid wastemeans and includes solid or semi-solid domestic waste, sanitary waste, commercial waste,institutional waste, catering and market waste and other non-residential wastes, street sweepings, silt removed orcollected from the surface drains, horticulture waste, agriculture and dairy waste, treated bio-medical wasteexcluding industrial waste, bio-medical waste and e-waste, battery waste, radio-active waste generated in thearea under the local authorities and other entities mentioned in said rules;

The quantity of waste generated is dependent on various parameters like standard of living of respective people, population, industrialization, degree of urbanization and so on. Solid waste generated in any city has tremendous impact on the heaths of people of that city, on environment, development of the region and so on i.e. it has multi-dimensional impact towards humans. Understanding the importance of SWM, present study is based on SWM practices deployed by Akola Municipal Corporation and briefly comparing it against SWM Rules 2016 laid by GOI, Ministry of Environment, Forest and Climate Change.

EXISTING MUNICIPAL SOLID WASTE MANAGEMENT (SWM)AT AKOLA

Solid waste management means to collect, segregate, process, and to dispose the waste so as to mitigate its harmful effects on environment. Akola Municipal Corporation (i.e. AMC) has following steps for SWM.

i. Waste generation
ii. Waste collection
iii. Waste transportation
iv. Waste disposal



WASTE GENERATION

Estimated population of Akola city for 2018 is 4, 44,470, but being city with potential it has 60 to 70 thousand floating population on daily basis. City is spreaded over 124 km^2, divided in 80 electoral wards and 4 zones. Thus generating around 200MT of wastes (400 gm per capita) as per Urban and Regional Development Plans Formulation and Implementation Guidelines for Class 1 city. The composition for solid waste for class 1 is as below

Sr. No	Waste type	Percentage
1.	Organic waste	46
2.	Sand and Grit	33.9
3.	Stone	7.8
4.	Polythene	7.2
5.	Cloth	4.2
6.	Paper	1.9
7.	Metal and glass	2.4

Sources of waste generation are Household level waste, colleges, schools, offices, street vendors, parks, playground, and city travelers and so on. Akola has Mahatma JyotibaPhuleJanta Bazar i.e. Local Market which is in heart of city and also District level market generating minimum 5 tons of waste on daily basis. There is poor clarity in the composition of waste as there is no such study done till date which will comment on chemical composition of waste so generated.

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Stray animals in Waste Bin of Phule Market

Waste Collection

AMC has dedicated staff and vehicles to collect the waste generated. Striving to make Akola dustbin free city recently AMC has started tempo service for waste collection and reduced the number of open spots of waste dumping. Waste collectors charge 30 rupees per month to each house and 50 to 100 rupees per month to hotels (cost dependent on quantum of waste for hotels) against everyday scheduled pick up of their waste, also incorporates daily sweeping of streets in the city limits.

Fig. Waste pickup vehicles with open lids

Fig. Tricycle for Bio Hazard waste collection

WASTE TRANSPORTATION

Waste collectors are themselves responsible to transfer the waste directly to Naygaon dumping ground which is 5 kilometer away from center of city. Waste is transported by Tata Ace (tempos) making around 3 trips per day, but it is not a serious practice to cover up the respective vehicle

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thus creating nuisance around the said route. It is noticed that there is no such sub collection center or segregation center but the waste is directly dumped off daily to the said location from all parts of city. Considering all the capacity in total about 180 MT is transported daily out of 200MT

Fig. Biomedical Waste Transferred openly on Main Road and in charge using no safety measures

WASTE DISPOSAL

Waste generated in Akola is poorly segregated only biomedical waste is separately disposed (incinerated) at Badnera90 kilometers away from Akola. But there is no such treatment of waste so collected it is just dumped in the ground and which is far away from being safe and scientific. Due to this there is always foul smell in dumping area and fumes coming out, which is due to fire outburst from waste due to unknown the reasons. During . the survey the disposal ground was found to lack basic amenities for waste disposers, improper approach road, poor security, no safety equipment's, stray animals, open defecation, poor kid's, people scavenging putting their life to threat. The Naygaon dumping ground 11acres in area has railway line passing near to it (can be seen in figure) and thus life of railway passengers prone to various infections.

Fig. Railway passing in vicinity of Dumping ground and marshy land

Fig. Fumes, active scavenging in huge waste in the Naygaondumping ground

Machine, Manpower for SWM

Sr. No.	Type	Number
1	Tata ace	85
2	Tri cycle	25
3	Hand Carts	603
4	Excavator	6
5	Tractor, Trolleys	22
6	Workers	770

OBSERVATIONS

If compared with latest SWM Rules 2016 laid by Government of India, following are the shortcomings at corporation level, waste picker level and waste generator level

- AMC lacks to carry 20 MT wastes daily basis to said location.
- Waste segregation is done only in dry and wet waste but further classification (biodegradable, non – biodegradable and domestic hazardous waste) for segregation is resisted and no further treatment is done.

- Waste collectors do not make any alternate arrangements if the respective collector is unable to serve his job and is no regularity in using safety equipment's (mask, gloves, fluorescent jackets, shoes).
- There is no sub collection center, or segregation center or storage center, on the other hand direct dumping of all kind of wastes is done.
- The disposal land is found short in capacity as per demand/ need and has poor safety, no electrification and no scientific method for disposal of waste, no compound wall no greenery.
- Not all people opt to forward their waste to waste pickers and lack of people's discipline so as to carry out SWM.

CONCLUSIONS

Akola is developing city and has surely undergone drastic change due to city limit extension, if compared with earlier SWM practices, AMC is better than yesterday but not up to mark as the newly drawn SWM Rules 2016. Various plans are under consideration and requires actual implementation of it. Present day deployed infrastructurelacks to meet today's demand itself and thus there will be increase in funds required, AMC needs to increase all the capacities of the SWM system from collection to safe disposal. It is high time for AMC to make concrete blue print to work focusing on waste segregation, reuse, recycle and energy recovery from waste. AMC should opt for newer, efficient technologies and working methods, so as to make the said works effective, productive and scientific in nature thus, fortify overall system. At same time peoples active participation is needed for waste reduction at source itself so as to make SWM practice a success.

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JUMPING LOAD SEISMIC ANALYSIS STUDY OF MULTISTOREY BUILDING

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ABSTRACT

For seismic evaluation of buildings having various geometrical discontinuities, it is required to carry out seismic analysis of a building by one of methods including time history method, response spectra method and static equivalent method. Untill now analysis of building have been done by static equivalent method manually.Further building can be similarly analyzed computationally using STAAD.Pro by static equivalent method by varying its geometrical features of building. Effects due to various discontinuities can be studied by varying loads and load combinations. Here mainly effects on building due to floating column, jumping of load which is initiated in building due presence of floating or hanging column have been studied. Case study of comparison of such building with or without floating column is in progress.

Keywords:Floating Column, Jumping load, Staad-pro software, Storey drift, Nodal displacements, Base shear.*

INTRODUCTION

Many urban multistory buildings in India today have open first storey as an unavoidable feature. This is primarily being used to accommodate parking or reception lobbies in the first storey. The behavior of a building during earthquakes depends mainly on its overall shape, size and geometry, in addition to how the earthquake forces are carried to the ground. The earthquake forces developed at different floor levels in a building need to be brought down along the height to the ground by the shortest path; any deviation or discontinuity in this load transfer path results in poor performance of the building. Buildings with a few storey wider than the rest cause a sudden jump in earthquake forces at the level of discontinuity. Buildings that have fewer columns or walls in a particular storey or with unusually tall storey tend to damage or collapse which is initiated in that storey. Many buildings with an open ground storey intended for parking collapsed or were severely damaged.

This sudden jump of earthquake forces or load is jumping load .It is observed that overall maximum load of structure or building is transferred through column. Since column is main element in load transfer path it needs to be without geometrical discontinuity thus it gets essential to avoid features like floating column in building.

floating column: A column is supposed to be a vertical member starting from foundation level and transferring the Load to the ground. The term floating column is also a vertical element which (due to Architectural design/ site situation) at its lower level (termination Level) rests on a beam which is a horizontal member. The beams in turn transfer the load to other columns below it.

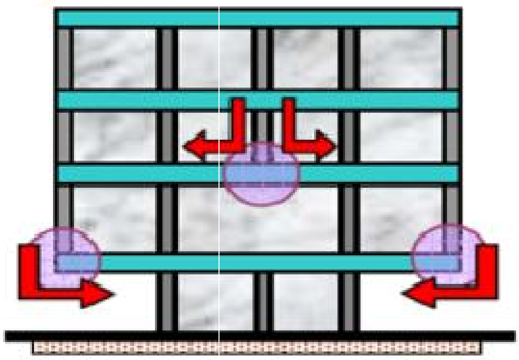

Figure 1: Floating Column
(Source: IITK-BMTPC Earthquake Tip 6)

1.2 Aim

To study Jumping load seismic analysis of multistoried building

1.3 Objective

- To study effect of past earthquake.

- To study effect of RC structures.
- To study seismic resistance consideration for seismic resistivity.
- To study continues load path and jumping load concept and its effects.
- To simulate RC structure with jumping load consideration subjected to seismic forces, computational.
- To study effect of geometrical discontinuity leading to load jumping on multistory RC structure.

LITURATURE REVIEW

General:

On the basis of the topic selected various literatures were gone through on the reasons and findings related to earthquake the literatures were studies on

- Reasons for earthquake occurrence
- Global and Indian seismic mapping
- Effect of earthquake on engineering & non engineering structures
- Methods to overcome earthquake effect
- Various load consideration and analysis methods for seismic forces
- Effect of geometrical discontinuity on seismic behavior of structure
- Continues load path, ductile designing etc. for seismic resistivity.

The secondary data from various research journals as well as reports are studied and some important learning's are mentioned below.

Sabari S, et al. (1) studied Seismic Analysis of Multistorey Building with Floating Column. The time history of roof displacement, inter storey drift, base shear, column axial force are computed for both the frames with and without Floating Column. The compatible time history and Bhuj earthquake data has been considered. The static and free vibration results obtained using present finite element code is validated. The dynamic analysis of frame is studied by varying column size dimension. It is concluded that by increasing the column size the maximum displacement and inter storey drift values are reducing. **N. Kara et al.(2)** performed Nonlinear seismic response of structural systems having vertical irregularities due to discontinuities in columns the effects of the structural irregularity which is produced by the discontinuity of a column in a plane frame subjected to seismic loads including the gravity loads is investigated. Investigation is carried out by adopting the linear and the nonlinear static and dynamic analyses of the structural system**.** The study involves a large number of numerical analysis by considering the plane frame structural systems having a specific height and span geometries. Results of the numerical analysis are presented including the variation of the normal force in the column to identify the load path in the structural system, the pushover curves to recognize the inelastic weakness of the system and the story drifts to determine the seismic demand in figures. It is found that the results of the nonlinear static and dynamic analyses give much more useful information regarding the irregularity than the linear analysis. Therefore the decision on the acceptance of the column discontinuity or on an empirical rule to deal with the column discontinuity should be based on a nonlinear analysis. Furthermore, it can be employed to determine acceptable degree of irregularity. **E. Pavan Kumar et al. (3)** performed case study on Earthquake Analysis of Multi Storied Residential Building. In seismic analysis the response reduction was considered for two cases both Ordinary moment resisting frame and Special moment resisting frame. The main objective this paper is to study the seismic analysis of structure for static and dynamic analysis in ordinary moment resisting frame and special moment resisting frame. Equivalent static analysis and response spectrum analysis are the methods used in structural seismic analysis. We considered the residential building of G+ 15 storied structure for the seismic analysis and it is located in zone II. The total structure was analyzed by computer with using STAAD.PRO software. Finally it can be conclude that the results of static analysis in OMRF & SMRF values are low when comparing to that of dynamic analysis in OMRF & SMRF values. Hence the performance of dynamic analysis SMRF structure is quiet good in resisting the earthquake forces compared to that of the static analysis OMRF & SMRF. **Nakul A. Patil et al. (4)** made Comparative Study of Floating and Non-Floating Columns With and Without Seismic Behavior work included the analysis and design of the floating column and non floating column structures by using software ETABS-2015.The work done, is to compare the response of RC frame buildings with and without floating columns under earthquake loading and under normal loading. The effect of earthquake forces on various building models for various parameters is proposed to be carried out with the help of response spectrum analysis. Finally, analysis results in the building such as storey drifts, storey displacement, and amount of steel required were compared in this study. The results reveal that the building with non-floating columns is preferable over the building with floating columns during earthquake observations made were Provision of floating columns increases story displacements. Same is with story drift, provision of floating columns increases story drift. **Shiwli Roy et al. (5)** studied Behavioral studies of floating column on framed structure and presented the floating column and RCC column analysis on multistoried building and analyzed by STAAD PRO V8i. Here G+3, G+5 and G+10 structures are analyzed and compared with parameters shear force and bending moment. The analysis on floating column for G+3, G+5 and G+ 10 structures showed that if the height of the structure increases, the shear force and bending moment also increases. The column shear varies according to the situation and the orientation of columns also the moment at every floor increases and shear force increases but it is same for each floor column. **Dr. C.P. Pise et al. (6)** noticed the behavior of floating column for seismic analysis of multistory building. In this paper present study about analysis of G+5 Building with and without floating column in highly seismic zone v. Linear static and time history analysis are carried out of all the two models from linear static analysis compare all the of models result obtained in the form of seismic parameter such as time period, base shear, storey displacement, storey drift .and from time history analysis plot the response of all the models .modeling and analysis done by using sap 2000v17 software. Conclusions drawn on the basis of study are .It was observed that in building with floating column has more time period as compared to building without floating columns also It was observed that in building with floating column has less base shear as compared to building without floating column . It was observed that displacement floating column building is more as compared to without floating column building. It was also observed that building with floating column has more storey drift as compared to building without floating column. From dynamic analysis it was observed that floating column at different location results into variation in dynamic response **Dr. Om Prakash et al. (7)** studied Seismic Response Evaluation of RC Frame Building with Floating Column. This aims to study the impact of the floating column under earthquake excitation for different soil conditions and where there is no text or zoom determining factor in I.S. The linear dynamic analysis of the 2 D framework of a multi-storey with and without floating column to achieve the above objective no response (effect) factors secure and economical design of the structure under a different excitement earthquake. The results of different models indicate that the presence of the floating column changing moments in the beams and columns analysis. It can be concluded from this behavior building .as noted above, in the case drop side columns. Storey site goes a decisive shift to higher as the peak height of the building. It can also be concluded that the story is the most important site in the high 50% of the structure. **Sukumar Behera (8)** performed seismic analysis of multistory building with floating column. The behavior of multistory building with and without floating column was studied under different earthquake excitation. The compatible time history and Elcentro earthquake data has been considered. The PGA of both the earthquake has been scaled to 0.2g and duration of excitation are kept same. A finite element model has been developed to study the dynamic behavior of multi story frame. The static and free vibration results obtained using present finite element code are validated. The dynamic analysis of frame is studied by varying the column dimension. It is concluded that with increase in ground floor column the maximum displacement, inter storey drift values are reducing. The base shear and overturning moment vary with the change in column dimension. **Stella Evangeline et al. (9)** made push over analysis for RC building with and without floating columns and an attempt was made to reveal the effects of floating column & RC building effected with seismic forces. For this purpose Push over analysis was adopted because this analysis yielded performance level of building for design capacity (displacement) carried out up to failure, it helped determination of collapse load and ductility capacity of the structure. To achieve this objective, three RC bare frame structures with G+4 stories will were analysed and compared the base force and displacement of RC bare frame structure for earthquake forces by varying column dimensions using SAP 2000 14 analysis package. **Krishna G Nair et al. (10)** reviewed seismic analysis of reinforced concrete buildings. Based upon the accuracy of results needed and the importance of the building that needs be analysed various seismic analysis procedures can be adopted like Linear Static Analysis, Nonlinear Static Analysis, Linear Dynamic Analysis and Nonlinear Dynamic Analysis. Study of all these analysis procedures were carried out in this work. This is especially important in seismic loading, because when a section is designed to yield, and it turns out to be stronger than designed, it may cause the wrong part to yield, putting the whole structure into failure. In smaller structures it may not be worth the effort needed to construct a proper detailed model to investigate the effects of seismic loading. If very accurate and precise result is required from the analysis, non-linear dynamic analysis should be carried out. But this method is more complicated and it requires more computations. Finding relevant time histories for the location chosen can also be a challenge. Therefore alternative methods are needed.

METHODOLOGY

PHASE-I

- Study of earthquake occurrences and its effects
- Detail study of seismic analysis method
- Conceptual tips for seismic resistivity

PHASE-II

- Detail study on effect of geometrical discontinuity in structure
- Detail study on effect of RC structure
- Detail study of IS 1893:2002(static equivalent method)

PHASE-III

- To model and analyze a RC structure without discontinuity for seismic and normal forces
- To model and analyze a RC structure with discontinuity for seismic and normal forces
- To do comparative study on behavior of structure due to jumping load creation

DETAIL STUDY

4.1 Seismology Of India

Basic Geography of India

India lies at the northwestern end of the Indo Australian Plate, which encompasses India, Australia, a major portion of the Indian Ocean and other smaller countries. This plate is colliding against the huge Eurasian Plate as shown in figure. And going under the Eurasian Plate; this process of one tectonic plate getting under another is called subduction. A sea, Tethys, separated these plates before they collided. Part of the lithosphere, the Earth's Crust, is covered by oceans and the rest by the continents. The former can undergo subduction at great depths when it converges against another plate, but the latter is buoyant and so tends to remain close to the surface.

Three chief tectonic sub-regions of India are the mighty Himalayas along the north, the plains of the Ganges and other rivers, and the peninsula. The Himalayas consist primarily of sediments accumulated over long geological time in the Tethys. The peninsular part of the country consists of ancient rocks deformed in the past Himalayan-like collisions. Erosion has exposed the roots of the old mountains and removed most of the topography. The rocks are very hard, but are softened by weathering near the surface. Before the Himalayan collision, several tens of millions of years ago, lava flowed across the central part of peninsular India leaving layers of basalt rock.

Coastal areas like Kachchh show marine deposits testifying to submergence under the sea millions of years ago.

SEISMIC ZONES OF INDIA

The varying geology at different locations in the country implies that the likelihood of damaging earthquakes taking place at different locations is different. Thus, a seismic zone map is required to identify these regions. Based on the levels of intensities sustained during damaging past earthquakes, the 1970 version of the zone map subdivided India into five zones – I, II, III, IV and V .The maximum Modified Mercalli (MM) intensity of seismic shaking expected in these zones were V or less, VI, VII, VIII, and IX and higher, respectively. Parts of Himalayan boundary in the north and northeast, and the Kachchh area in the west were classified as zone V. The seismic zone maps are revised from time to time as more understanding is gained on the geology, the seismotectonics and the seismic activity in the country. The Indian Standards provided the first seismic zone map in 1962, which was later revised in 1967 and again in 1970. The map has been revised again in 2002, and it now has only four seismic zones – II, III, IV and V. The areas falling in seismic zone I in the 1970 version of the map are merged with those of seismic zone II. Also, the seismic zone map in the peninsular region has been modified. Madras now comes in seismic zone III as against in zone II in the 1970 version of the map. This 2002 seismic zone map is not the final word on the seismic hazard of the country, and hence there can be no sense of complacency in this regard.

The national Seismic Zone Map presents a large scale view of the seismic zones in the country. Local variations in soil type and geology cannot be represented at that scale. Therefore, for important projects, such as a major dam or a nuclear power plant, the seismic hazard is evaluated specifically for that site. Also, for the purposes of urban planning, metropolitan areas are micro zoned. Seismic microzonation accounts for local variations in geology, local soil profile, etc.

4.2 Seismic Analysis Methods

Seismic analysis is a subset of structural analysis and is the calculation of the response of a building or structure to earthquakes. It is part of the process of structural design, earthquake engineering or structural assessment and retrofit in regions where earthquakes are prevalent.

To do seismic analysis of building following methods

- Seismic Analysis By Response Spectra
- Seismic Response By Time-History Analysis
- Equivalent Static Method

Out of which we are going to study base shear method by IS 1893:2000 in detail i.e. equivalent static method.

Earthquake motion causes vibration of the structure leading to inertia forces. Thus a structure must be able to safely transmit the horizontal and the vertical inertia forces generated in the super structure through the foundation to the ground. Hence, for most of the ordinary structures, earthquake-resistant design requires ensuring that the structure has adequate lateral load carrying capacity. Seismic codes will guide a designer to safely design the structure for its intended purpose. Seismic codes are unique to a particular region or country. In India, IS 1893 is the main code that provides outline for calculating seismic design force. This force depends on the mass and seismic coefficient of the structure and the latter in turn depends on properties like seismic zone in which structure lies, importance of the structure, its stiffness, the soil on which it rests, and its ductility. Part I of IS 1893:2002 (here after we refer it as the code) deals with assessment of seismic loads on various structures and buildings. Whole the code centres on the calculation of base shear and its distribution over height. Depending on the height of the structure and zone to which it belongs, type of analysis i.e., static analysis or dynamic analysis is performed.

The total design lateral force or design seismic base shear (Vb) along any principal direction shall be determined by the following expression:

$Vb = Ah \times W$

Now,

The design horizontal seismic coefficient can be determined by following expressions from IS 1893:2002 (Part 1), clause 6.4.2

$$Ah = \frac{Z\ I}{2R}\frac{Sa}{g}$$

Provided that for any structure with T <0.1 s, the value of Ah will not be taken less than Z/2 whatever be the value of I/R

Z = Zone factor, to be taken from IS 1893:2002 (Part 1), clause 6.4.2 (Table 2)

I= Importance factor, depending upon the functional use of the structures, characterised by hazardous consequences of its failure, post-earthquake functional needs, historical value, or economic importance IS 1893:2002 (Part 1),clause 6.4.2 (Table 6).

R =Response reduction factor, depending on the perceived seismic damage performance of the structure, the ratio (I/R) shall not be greater than 1.0(Table 7). The values of R for buildings are given in IS 1893:2002 (Part 1), clause 6.4.2 (Table 7)

$\frac{Sa}{g}$ = Average response acceleration coefficient, Depends on type of soil and is taken from IS 1893:2002 (Part 1), clause 6.4.5.for this fundamental natural period T is required which can be taken as clause 7.6.1, 1893:2002 (Part 1).

Thus by obtaining the values as shown above value of acceleration Ah can be found out.

Also,

W = Total seismic weight of the structure

It depends on the no. of stories structure has and total load each storey carries, total earthquake load is calculated for single storey similarly for each storey load is taken out and sum of loads from each floor is total seismic weight of structure i.e. W.

For % of imposed load on structure clause 7.3.1 from 1893:2002 (Part 1) can be referred which can be taken as per (Table 8)

By obtaining Ah and$W$, design base shear can be calculated (Vb).

The design base shear (Vb) computed in 7.5.3 shall be distributed along the height of the building as per the following expression:

$$Qi = Vb\ \frac{Wi\ hi^2}{\sum_{j=1}^{n} Wj\ hj^2}$$

Where

Qi = Design lateral force at floor i,

Wi = Seismic weight of floor i,

hi= Height of floor i measured from base,

n = Number of storey's in the building is the number of levels at which the masses are located.

4.3 Seismic resistive consideration for RC structure

For a structure to posses resistivity towards seismic forces it needs to be designed keeping in mind the conceptual design tips which are as discussed below.

1 Light weight

2 Ductility

3 Frame structure

4 Strong bond (beam-column joint)

5 Geometrical shape

- Size of Buildings
- Layout of building (horizontal)
- Layout of Buildings (Vertical)
- Soft storey
- Adjacency of structures
- Floating columns

6 Torsion and Twisting:

7 Structural configurations

- Box action
- Opening and its influence

8 Provision of bands

- Role of Horizontal Bands

4.4 Study of continuous load path

- Gravity load
- Lateral load

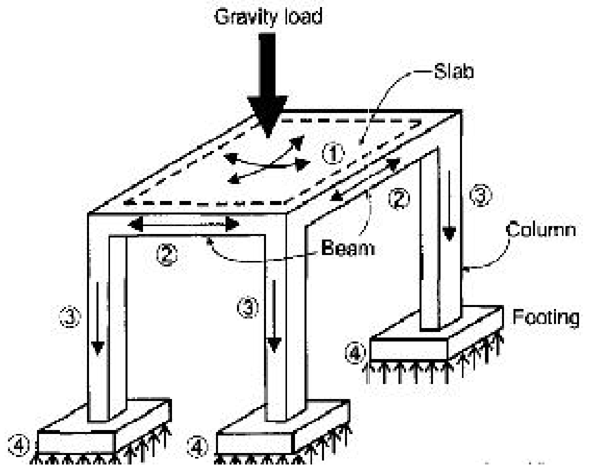

Figure 2: An isometric view of a concrete structure showing a gravity load path**.**

1) **Lateral load path**

- **vertical components: shear walls and frames;**
- **Horizontal components: roof, floors, and foundations.**

CONCLUSION

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From the various studies, it has been observed that the effect of seismic forces is tremendous on the structure. However, the various factors are responsible for amplifying the effect of it. With the literature review done, previous study and learning made it has been found that the geometrical shape plays an important role. Similar way, the role of continuous load path is magnificent. As the upper and the lateral loads needs to be transferred to ground through continuous chain, any of the discontinuity leads to the accumulation of load magnitude. This accumulated load tries to transfer downward, however in condition of missing lower member, the load tries to jump and thus, impact value increases leading to higher distruction. this phenomenon of load accumulation and then sudden transfer in form of jump is known as jumping load and its impact in case of floating column is sever and more destructive as in comparison with structure with complete load paths . thus, study over here shows that floating columns or jumping loads should be eliminated from the structure to reduce seismic disaster effect

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PYROLYTIC REACTOR FOR FUEL OIL RECOVERY FROM PLASTIC WASTE: A REVIEW

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ABSTRACT

Plastic have woven their way into our daily lives and now pose a tremendous threat to the environment. As petroleum is the main source of plastic manufacturing, the recovery of plastic to liquid oil through pyrolysis process has a great potential since the oil produced has high calorific value comparable with the commercial fuel. The process of converting waste plastic into value added fuels is explained as viable solution for recycling of plastic. The available plastic waste could categorize as low density polyethylene (LDPE), high density polyethylene (HDPE) and polypropylene (PP). A series of tests were carried out at a temperature range of 350 to 550^oC. The experiments were conducted on domestic plastic waste. Under pyrolysis condition plastic waste was decomposed into three products viz., pyrolytic oil, producer gas and solid residue. The oil recovered from plastic waste by pyrolysis has similar physical properties of the petroleum oil. This paper reviewed the pyrolysis process for each type of plastics and the main process parameters that influenced the final end product such as oil, gaseous and char. The key parameters that were reviewed in this paper included temperature inside the reactor, type of reactors and residence time of pyrolysis.

Keywords: *Alternate fuel, plastic waste utilization, pyrolysis and pyrolytic oil.*

INTRODUCTION

A plastic material is any of a wide range of synthetic or semi-synthetic organic solids that are mouldable. Plastics are typically organic polymers of high molecular mass, but they often contain other substances. They are usually synthetic, most commonly derived from petrochemicals, but many are partially natural. Due to their light weight, durability, energy efficiency, coupled with a faster rate of production and design flexibility, the plastics are employed in entire gamut of industrial and domestic area. Plastics production in India further rises to 4.77 MT in 2005–2006 (Banerjee*et al.,*2014), maximum of which is polypropylene (PP) and high-density polyethylene (HDPE). Among different types of plastic polymer, low-density polyethylene (LDPE) demonstrates maximum growth in consumption in India closely followed by HDPE and PP. On an average, the commodity plastics viz. PE, PP, PVC, and polystyrene (PS) accounts 80% of the total plastic consumption in India. In 1990–1991, the per capita consumption of plastics in India was 0.8 kg but within a decade, per capita consumption significantly increases to 3.5 kg. However, it is still far below than the global average (18 kg). However, the projected estimates of per capita plastics consumption in 2021 may reach to a substantial figure of 10.9 kg, which seems a realistic considering the rapidity with which plastics are replacing its competitive materials. Annually 1.3 MT of plastic waste is generated in India, which is 36% of total India's plastics consumption. Nearly, 42% of total generated plastic waste is recycled in India by 20,000 recycling industries with total potential of 0.37 MT/annum.

Every year human produce nearly 280 million tons of plastic, and much of that plastic ends up in the environment, harming marine life and other ecosystems (Chanashetty and Patil 2015). The chemical bonds that makes plastic so durable makes it equally resistant to natural processes of degradation. Since plastics are non-biodegradable in nature, it is very difficult to eliminate the waste plastics from nature. The majority of the plastic waste ends up in landfills, and becomes a carbon sink where it may take up to 1000 years to decompose and potentially leak pollutants into the soil and water. The uncontrolled incineration of plastic produces polychlorinated dibenzo-pdioxins, a carcinogen. So, converting the waste plastic into crude oil will have two benefits. Firstly, the hazards caused due to plastic waste can be reduced and secondly, we can obtain some amount of oil from it, which can be further purified to be used as a fuel in different areas such as domestic fuel, fuel for automobiles and industries etc. Thereby, our dependency on fossil fuels will reduce to a certain extent.

MATERIAL AND METHODS

Pyrolysis is a thermo-chemical decomposition of organic material at elevated temperatures in the absence of oxygen (or any halogen). It involves the simultaneous change of chemical composition and physical phase, and is irreversible. The word is coined from the Greek-derived elements pyro "fire" and lysis "separating" (Rai 2004). Additionally, the scale of pyrolysis plants is more flexible than incineration plants (Chen *et al.,* 2014). Now a days, pyrolysis is getting attention for its flexibility to generate a combination of solid, liquid and gaseous products in different proportions just by the variation of operating parameters such as temperature or heating rate. It also provides an opportunity of transforming materials of low-energy density into bio-fuels of high-energy density, at the same time recovering high value chemicals. One of the great advantages of this process is that many types of raw material can be used, including industrial and domestic residues. Different types of pyrolysis have been developed: fast, intermediate, slow. In practice, the processes of thermal treatment of waste can operate with a small amount of air present. The fractions of municipal solid waste (MSW) subjected to pyrolysis mainly consist of paper, cloth, plastics, food waste and yard waste. Prerequisite for the successful application of pyrolysis is the appropriate choice of input materials and the setting of optimal process conditions. For these reasons, the suitability or unsuitability of selected types of waste and their mixtures for the pyrolysis process has been verified many times by laboratory experiments with subsequent assessment of the quantity and quality of the individual products of pyrolysis (Grycova *et al.,* 2016).

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Table 1. Mainoperating parameters for pyrolysis process

Parameters	Conventional	Fast	Flash
Pyrolysis Temperature (K)	550 - 900	850 - 1250	1050 - 1300
Heating rate (K/s)	0.1- 1	10 - 200	> 1000
Particle size (mm)	5 - 50	< 1	< 0.2
Solid residence (s)	300 - 3600	0.5 -10	< 0.5

(Source: Demirbas 2009)

There are different types of pyrolysis process. Conventional pyrolysis (slow pyrolysis) proceeds under a low heating rate with solid, liquid, and gaseous products in significant portions. It is an ancient process used mainly for charcoal production. Vapours can be continuously removed as they are formed. The fast pyrolysis is associated with tar, at low temperature (850–1250K) and gas at high temperature (1050-1300K). At present, the preferred technology is fast or flash pyrolysis at high temperatures with very short residence time. Fast pyrolysis (more accurately defined as thermolysis) is a process in which a material, such as biomass, is rapidly heated to high temperatures in the absence of oxygen (Singhad *et al*., 2011).

Fig 1. Pyrolysis of waste tyres and plastic

Types of pyrolysis reactors used to utilize different domestic waste

The reactor type being used for the pyrolysis of waste has to be given great importance because of the large amount of heat to be transferred across the reactor wall to ensure material degradation. Reactors described in various literature used in the pyrolysis of different wastes include batch or semi-batch reactors, fluidized bed reactors. For many years, scientists have explored the mechanisms of this process in laboratories around the world, so slow, fast and intermediate pyrolysis are already well known. However, there is still a big challenge to make pyrolysis economically viable, thus the next studies should focus on the implementation of the latest developments in pilots and on an industrial scale.

Batch and semi-batch reactor

In most researchers utilized batch or semi-batch reactors for thermal and catalytic pyrolysis of plastic, as well as post-consumer plastic waste, as it is easy to control the process parameters. Some of the important parameters that were identified include reaction temperature, mass ratio of plastic: catalyst, and reaction time. The temperatures used for the process ranged in 300–900^{o}C, and the reaction time 30-90 min (Shah *et al.,* 2010). In case of catalytic pyrolysis, mass ratio of reactant: catalyst varied from 30:1 to 2:1 was used to increase the product yield and selectivity. It is also possible to perform catalytic pyrolysis on polymer waste at low temperature (200 - 275 ^{o}C). The reaction was carried out in a locally manufactured reactor, with the volume of 1 lit. The reactor was added with a pressure valve. During the pyrolysis process, the production of condensable vapour and fuel gases exerted pressure on the pressure valve, and the valve opened at certain pressure to release these products into condenser and collection system. Thermal pyrolysis of LDPE bags at275^{o}C produced 48.6% (by wt.) of oil, 40.7% (by wt.) of gases, and 10.1% of char (by wt.). This result was comparable to some thermal pyrolysis process in batch reactor and fixed-bed reactor in laboratories. Catalytic pyrolysis of the polymer waste using zeolite at 255 ^{o}C, on the other hand, was able to produce 51.19 % (by wt.) of oil, 35.88% (by wt.) of gases, and 12.50% (by wt.) of waxes. The oil was identified to be a mixture of hydrocarbons in the range of kerosene and petrol, and could be used as fuel after upgrading.

Fluidized bed reactor

Although pyrolysis of plastic waste in batch reactor is well studied, there are some drawbacks in its application in recycling industry (Elordi *et al*., 2009). It is more favourable to develop a continuous pyrolysis process, as it does not require frequent materials charging and restarting the process. In addition, continuous pyrolysis process is also less labour-intensive. Trials were using fluidized bed reactors, due to several advantages they possess, including excellent mixing properties, as well as improved heat transfer from reactor to polymer, compared to batch reactors (Yuan *et al*., 2014). As polymer waste can be fed into reactor at constant temperature, it is possible to produce a narrower and more uniform spectrum of products by manipulating the residence time of polymer waste in the reactor. However, care has to be be taken to avoid bed de-fluidization, as this can easily when melted plastic stick on the fluidized bed. The main components in the product gas were ethane and propane.

Fluidised-bed reactors were used to study the behaviour of fast pyrolysis and to investigate the secondary cracking of oil at longer residence times. Fluidised-bed reactors were characterized by a high heating rate and a good blending of the feedstock. Therefore, such reactors are widely used in laboratory studies in order to describe the influence of temperature and residence time on pyrolysis behaviour and products. This type of reactor seems to be a good solution for waste polymer pyrolysis (Chen *et al*., 2014). A fluidized bed reactor (FBR) is a type of reactor device that can be used to carry out a variety of multiphase chemical reactions. In this type of reactor, a fluid (gas or liquid) is passed through a solid granular material (usually a catalyst possibly shaped as tiny spheres) at high enough velocities to suspend the solid and cause it to behave as though it were a fluid. This process, known as fluidization, imparts many important advantages to the FBR. As a result, the fluidized bed reactor is now used in many industrial applications.

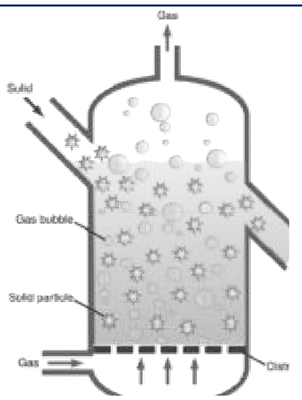

Fig. 2 Basic diagram of a fluidized bed reactor

Types of reactor	Types of materials
Batch and semi-batch reactor	Mixture of LDPE and PP; PE; PP MPW and MSW
Fluidized bed reactor	LDPE and PP; PVC ;MPW and MSW
Conical spouted bed reactor (CSBR)	HDPE; Mixture of LDPE, HDPE and PP
Fixed bed reactor	PET; PE

Table 2: Design of reactors and systems for plastic pyrolysis

(Source: Wonga *et al.*, 2015

The flow chart of pyrolysis of plastic waste is given in Fig.3.

Fig 3. Flow chart of conversion of plastics waste into liquid fuel

RESULTS AND DISCUSSION

Usually the pyrolysis of waste is aimed at energy recovery, because the products often have good properties as fuels. Moreover, energy (especially electricity) is always a desirable product, which is easy to sell. Additionally, parts of the products can be combusted in order to meet the pyrolysis energy demand. Pyrolysis also makes it possible to convert waste into an energy source for the home, and on a larger scale pyrolysis plants may use the pyrolysis products for other purposes, which increases the profitability of the process. The complex composition of pyrolytic oil and some properties of char could make them favourable as a raw material for some industry sectors and a few propositions are mentioned below (Jouhara *et al.*, 2017).

Pyrolytic gas

In general, it is possible to say that the composition of the pyrolytic gas is strongly dependent on the pyrolysis temperature and feedstock. Slow pyrolysis of biomass waste such as wood, garden waste and food residue at low temperatures (below 400 ^{o}C) produces small amounts of gas, which is high in CO_2, CO and light hydrocarbons. The gas heating value from slow pyrolysis is around 10-15 MJ/Nm^3 and varies in dependence on temperature and heating rate. Fast pyrolysis of biomass produces gas with a heating value around 14 MJ/Nm^3. On the other hand, higher temperatures (above 700^{o}C), especially when pyrolysis is combined with gasification, produces syngas, which contains more hydrogen and carbon monoxide. The pyrolysis of plastics produces pyrolytic gas, of which the major components are hydrogen light hydrocarbons: methane, ethane, ethane, propane, propane, butane and butane. This gas has a significant calorific value, e.g. a heating value of gas from PP and PE varied between 42 and 50 MJ/kg (Jung *et al.*,2010). The most suitable demand on pyrogas is its use as a source of the energy required for the pyrolysis process itself. However, the exhaust gas has to be controlled. Therefore, emission control units and gas cleaning devices should be used and it does not matter whether the gas will be combusted or not.

Pyrolytic oil

Pyrolytic oil offers more opportunities for use than gas, but, depending on the composition of the feedstock and the process parameters, the composition of the liquid product from pyrolysis may differ radically. Pyrolytic oils originating from biomass consist largely of the following compounds: acids, sugars, alcohols, ketones, aldehydes, phenols and their derivatives, furans and other mixed oxygenates. They can be used for the production of heat, electricity, synthetic gas or chemicals. Temperatures between 500 and 600^{o}C provide the highest yields of oil, when biomass is processed with heating values of around 15-20

MJ/kg. On the other hand, pyrolytic oil from plastics has a higher heating value, about 30 -45 MJ/kg, depending on the polymer and it contains a smaller aqueous fraction. Physical properties such as viscosity, the research octane number and the motor octane number, pour point, flash point or Diesel index could be a good indication of pyrolytic oil quality as a fuel (Ahmad *et al.* 2015). The heating value of oils from mixed plastic waste could be estimated at 40 MJ/kg. Detailed information about oils obtained from different plastics and their mixtures with other waste. It can be summarized, that the liquid phase is usually the predominant product of the pyrolysis of plastics. Those oils are a valuable material, which can be used in a variety of ways.

Pyrolytic char

Pyrolysis conditions are usually optimized in order to maximize the liquid and gas products; however, a solid fraction named as pyrolytic char is also produced. This char mainly consists of a carbon-rich matrix that contains almost all the inorganic compounds present in the raw wastes and a significant amount of condensed by-products formed during the pyrolysis process and dispersed throughout the solid porous structure. The heating value of char obtained from co-pyrolysis of waste (mixture of biodegradable and non–biodegradable) is approximately 34 MJ/kg, which is comparable with typical coal. Char obtained in pyrolysis is not only a good fuel, but it can also be processed into activated carbon. At a temperature of 2000^{o}C the char was completely carbonized with almost 100% carbon content. The use of waste materials to produce activated carbon is preferable because it reduces the cost of producing activated carbons. An interesting application of char from the pyrolysis of mixtures of wastes is its valorisation as an adsorbent of pollutants. Moreover, due to their potential adsorptive properties, the solid chars are good precursors for manufacturing activated carbons by means of physicochemical activation. The prevalent metal in char obtained from the co-pyrolysis of plastics and biomass is magnesium. Calcium (Ca), potassium (K) and iron (Fe) are significant elements in this char, too. However, zinc (Zn), chromium (Cr), nickel (Ni), molybdenum (Mo), manganese (Mn) and aluminium (Al) also appear (Bernardo *et al*. 2012). The carbonaceous materials obtained have sufficient quality to be reused as precursors for adsorbents. Another application of char from the pyrolysis of wood is its use as an organic fertilizer, which offers many advantages.

Table 3.Comparison of pyrolytic oil from some polymers with standard liquid fuels

Properties	HDPE	PP	Gasoline	Diesel
Heating value (MJ/kg)	40.50	40.80	42.50	43.00
Viscosity at 40^{0}C (mm^2/s)	5.08	4.09	1.17	1.9 - 4.1
Density at 15 ^{0}C (g/cm^3)	0.89	0.86	0.780	0.87
Research octane number	85.30	87.60	81 - 85	–
Motor octane number	95.30	97.80	91- 95	–
Pour point, ^{o}C	-5	-9	-	6

(Source: Ahmad *et al*., 2015)

Table 4 Comparison of HDPE, LDPE and PP with petrol and diesel

Fuel properties	HDPE	LDPE	Petrol	Diesel
Density (kg/m^3)	795.45	530.35	711 to 737	820 to 900
Viscosity (poise)	0.775	0.652	1.5 to 4	1 to 3.97
Specific gravity	0.776	0.655	0.82	0.81 to 0.96
Flash point (^{o}C)	23	24	22	26
Fire point (^{o}C)	27	28	25	29
Cloud point (^{o}C)	Below 2	Below 0	1 to 3	2.5 to 4
Pour point (^{o}C)	- 4.5 to -5	- 2	- 4 to - 20	- 2 to - 12
Colour	Yellow, light transparent	Pale yellow	Brown transparent	Dyed blue

(Source: Raj Kumar and Y. Tembhurne, 2016)

CONCLUSIONS

The pyrolysis studied here presents an efficient, clean and very effective means of removing the debris that we have left behind over the last several decades. By converting plastics to fuel, we could solve two issues, one of the large plastic seas, and the other of the fuel shortage. This dual benefit, though will exist only as long as the waste plastics last, but will surely provide a strong platform for us to build on a sustainable, clean and green future and it would be a great boon to our economy. Pyrolysis gives ready-to-use fuels in an easy and safe way. The thermal decomposition of polymers produces oils with good qualities, which can be used both as a liquid fuel and as a source of chemicals and the char can be used as activated carbon or fertilizer. The developing technology of pyrolysis of plastic waste would allow the efficient utilization of plastic waste for fuel recovery.

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HORIZONTAL REACTOR FOR BIO-CHAR PRODUCTION FROM AGRICULTURAL CROP RESIDUE

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ABSTRACT

A reactor was developed for bio-char production from agricultural crop residue of pigeon-pea stalks. The horizontally oriented reactor of 1.5 kg capacity was developed in Central Institute of Agricultural Engineering, Bhopal. The study was conducted at three levels of predefined temperature of 450, 500 and 550°C and residual time duration of 60, 120 and 180 min for optimization of temperature for obtaining the better quality of bio-char. The average recovery of bio-char prepared from pigeon-pea stalk was found to be 40.30%. Total carbon (TC), total organic carbon (TOC), and total inorganic carbon (TIC) of pigeon-pea stalks of sized Ø ≤ 5 mm (D_1), Ø = 5 to 7 mm (D_2) and Ø ≥ 7 mm (D_3) was found in the range of 45.1 to 45.8, 41.6 to 42.3 and 2.6 to 4.1%, respectively. Similarly, these value were determined at three temperature levels of 450, 500 and 550°C and found to be 68, 67.03 and 3.5%; 81.51, 69.11 and 6.5%; 68.4, 65.18% and 6.7%, respectively. Fixed carbon in bio-char was found to be 80% higher than that of its stalk and around 40% of total carbon was found higher in bio-char than that of the pigeon pea stalks. The pH value of bio-char prepared at 450, 500 and 550°C was found in the range of 6.1 to 6.8, 7.7- to 8.5 and 7.7 to 9.5, respectively.

Keywords: *Pigeon pea stalks, bio-char, fixed carbon and horizontal reactor*

INTRODUCTION

Bio-char is commonly defined as charred organic matter, produced with the intent to deliberately apply to soils to sequester carbon and improve soil properties (Blackwell *et al.,* 2008). The only difference between bio-char and charcoal is its utilitarian intention; charcoal is produced for other reasons (e.g. heating, barbeque, etc.) than that of bio-char (Mchenry, 2009). In a physicochemical sense, bio-char and charcoal are essentially the same material. It could be argued that bio-char is a term that is used for other purposes than scientific, i.e. to re-brand charcoal into something more attractive-sounding to serve a commercial purpose. However, from a soil science perspective it is useful to distinguish any charcoal material and those charcoal materials where care has been taken to avoid deleterious effects on soils and to promote beneficial ones. Research in India showed that pigeon-pea helped to reduce bulk density of the soil, helping to increase the root volume and root weight of the crop in the rotation (Zwieten *et al.,* 2009). Top-growth stalk production has been reported as high as 35 tons of fresh weight green matter per acre. Dry matter top growth production is about 2.5 tons/acre, contributing about 25 kg of nitrogen per ton of dry matter (Singh *et al.,* 1992; Sukiran and Kheang, 2011). Keeping in mind the importance of the bio-char a horizontal bio-char reactor system was developed for preparation bio-char from agricultural residues.

MATERIAL AND METHODS

The experiment was planned using three independent parameters namely diameter of stalks, charring temperature and duration. Details regarding the experiment are given in Table 1.

Table1. Experimental for evaluation of bio-char production system

Sr. No	Test Name	Charring temp, (°C)	Charring time , (min)	Diameter, (mm)
1	D_1T_1 Du_1		60	
2	D_1T_1 Du_2		120	D1 ≤ 5
3	D_1T_1 Du_3		180	
4	D_2T_1 Du_1	450	60	

5	D_2T_1 Du_2		120	D2 > 5 &< 7
6	D_2T_1 Du_3		180	
7	D_3T_1 Du_1		60	
8	D_3T_1 Du_2		120	D3 ≥ 7
9	D_3T_1 Du_3		180	
10	D_1T_2 Du_1		60	
11	D_1T_2 Du_2		120	D1 ≤ 5
12	D_1T_2 Du_3		180	
13	D_2T_2 Du_1	500	60	
14	D_2T_2 Du_2		120	D2 > 5 &< 7
15	D_2T_2 Du_3		180	
16	D_3T_2 Du_1		60	
17	D_3T_2 Du_2		120	D3 ≥ 7
18	D_3T_2 Du_3		180	
19	D_1T_3 Du_1		60	
20	D_1T_3 Du_2		120	D1≤ 5
21	D_1T_3 Du_3		180	
22	$D_2T_3Du_1$	550	60	
23	D_2T_3 Du_2		120	D2 > 5 &< 7
24	D_2T_3 Du_3		180	
25	D_3T_3 Du_1		60	
26	$D_3T_3Du_2$		120	D3 ≥ 7
27	D_3T_3 Du_3		180	

Note: D_1, D_2 and D_3 are diameters of pigeon pea stalks, mm; T_1, T_2 and T_3 are temperatures, °C; Du_1, Du_2 and Du_3 are residual time in reactor, min

For efficient application of the system the physical properties of the pigeon-pea were studied. The physical properties such as bulk density and true density were determined (Downie *et al.,* 2009). Size reduction of pigeon pea stalks were needed to fulfill the requirements of rapid heating and to achieve bio-char yields and it was made by bio-mass cutter. The pigeon-pea stalks were selected and cut down to 80-100 mm in length. The cut pieces were separated in three different diameter sets as □ ≤ 5(D_1), □> 5 - 7(D_2), □ ≥ 7 mm (D_3).Temperature of reactor chamber was set at three levels such as 450 °C, 500 °C and 550°C. The recovery of the bio-char was determined by using following equation.

$$\text{Bio-char recovery, } (\%) = \frac{\text{Bio-char mass}}{\text{Bio-mass}} \times 100 \text{---} (\text{Eq.1})$$

The reactor was made up of mild steel of 2 mm thickness having diameter of 300 mm and length of 1500 mm. Electrical heating element of 6 kW capacity was wrapped externally throughout the reactor body to raise the temperature from room temperature to predefined set temperature. The experimental set-up of the horizontal bio-char system is shown in Fig. 1. For charring, the material was fed into the reactor and the temperature was raised from ambient to predefined temperature (450, 500 and 550°C). These experiments were carried out for different residual time ranging viz., 60, 120 and 180 min to find out the optimum temperature and time to obtain the best quality bio-char from pigeon-pea crop-residue. Material selected for the study include pigeon pea stalk of different diameters. Properties of bio-char such as moisture content, volatile matter, ash content, iodine value, pH, and true density, bulk density were determined in laboratory.

Fig.1. Experimental set-up of horizontal bio-char reactor System

RESULTS AND DISCUSSION

Recovery of bio-char

The recovery of bio-char at charring temperature 450, 500, and 550°C of 27 samples of pigeon pea stalk were evaluated in bio-char reactor. The recovery of bio-char of 27 samples is ahown in Fig. 2.. Less percentage of bio-char production may be due to presences of some un-charred raw material in experiment condition due to temperature regime inside the reactor. There was possibility that complete fast pyrolysis could not take place. The recovery in different experiments varied from 33 to 60%. The average bio-char recovery was found to be 40.36 %.

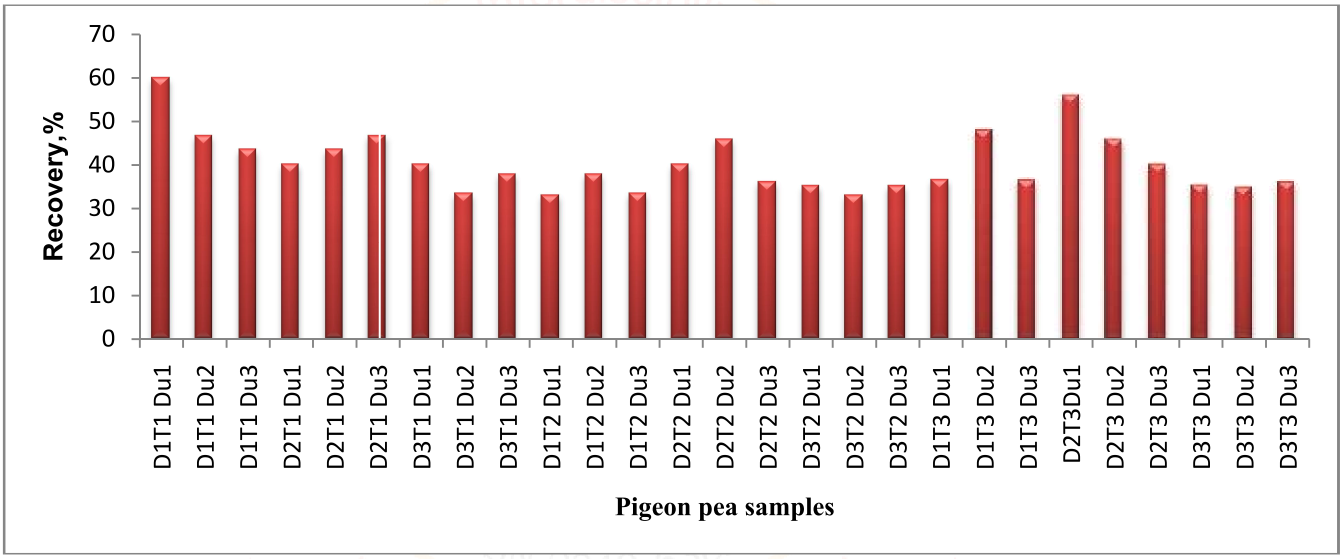

Fig. 2 Recovery of bio-char of of pigeon pea samples

Effect of size of pigeon-pea on moisture content, ash content, fixed carbon and volatile matter

The effect of sizes of pigeon-pea stalks on its moisture content, volatile matter, ash content and fixed carbon, is shown in Fig.3 to Fig. 6. The moisture content, volatile matter, ash content and fixed carbon was found to be in the ranged of 4.1 to 4.9 %, 59.10 to 65.12 %, 1.8 to 2.54 % and 22.6 to 33.6 %, respectively. No remarkeble variation was observed in moisture content, fixed carbon, ash content, volatile matter and fixed corbon of pigeon-pea stalk samples and bio-char samples .

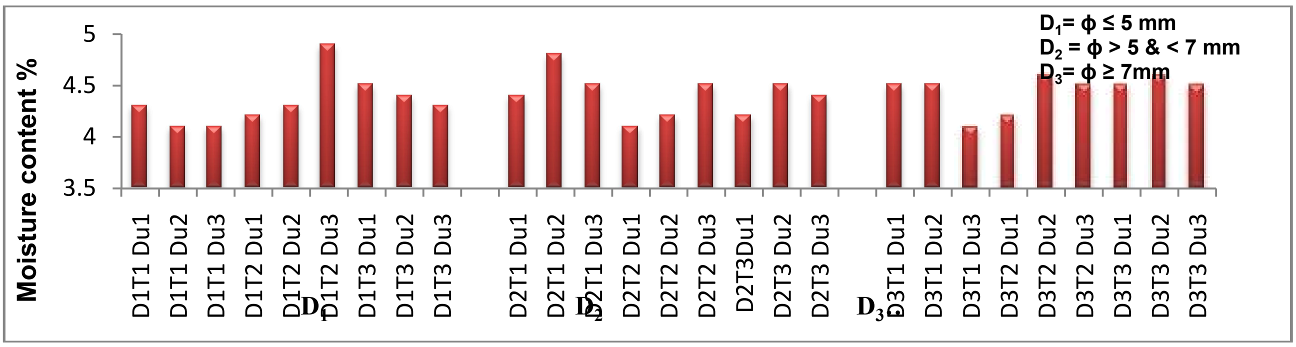

Fig. 3 Effect of sizes of pigeon pea on its moisture content

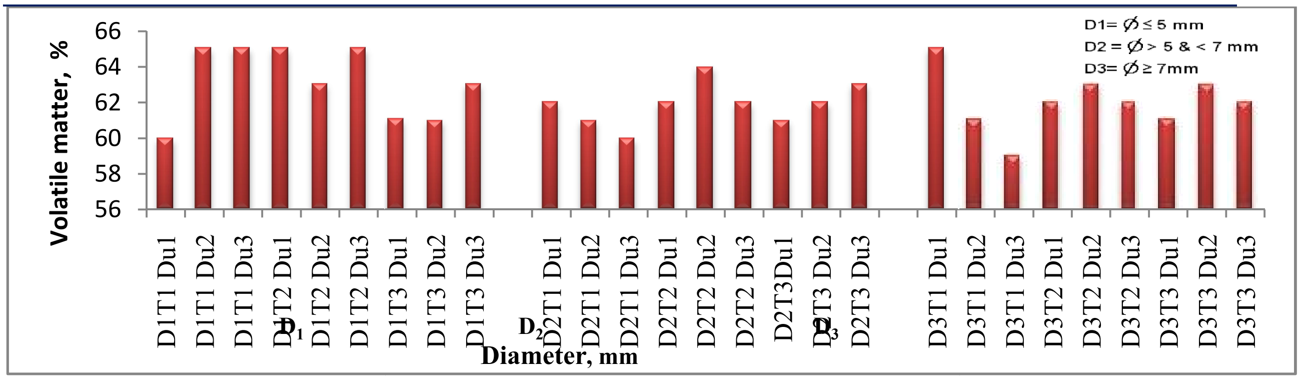

Fig. 4 Effect of sizes of pigeon pea on volatile matter

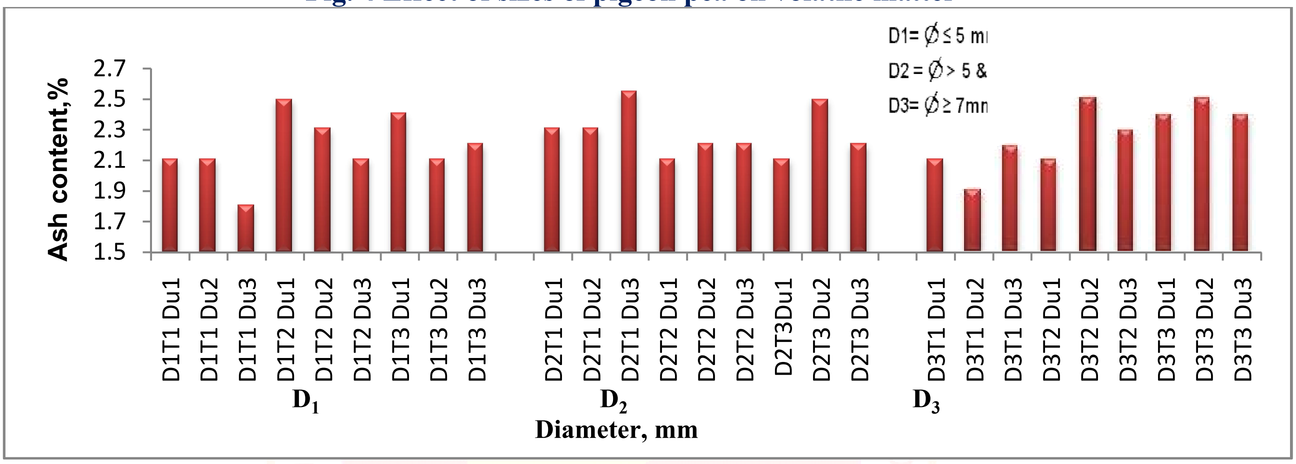

Fig.5 Effect of sizes of pigeon pea on ash content

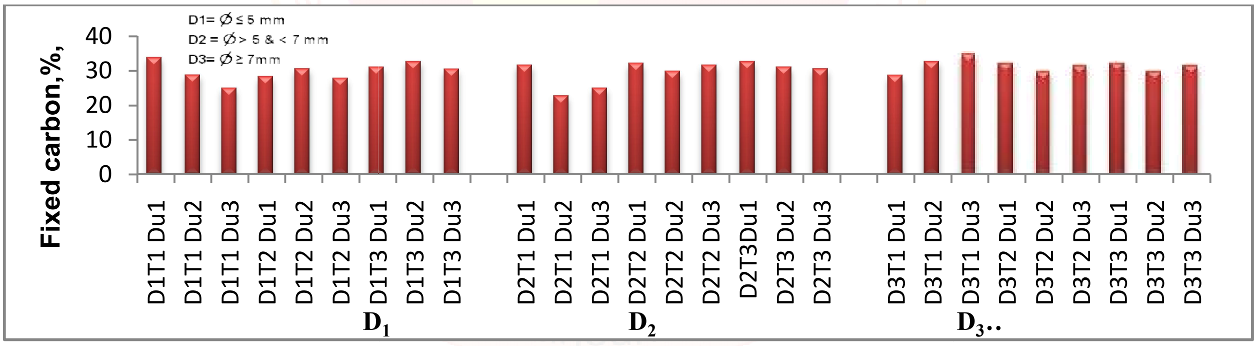

Fig 6 Effect of sizes of pigeon pea on fixed carbon

Iodine value of pigeon-pea stalk was measured and found in the range 201 to 298. The standard deviation of their value was 29.26. Similarly, pH value was also determined and found in the range of 4.1 to 5.1. The total carbon (TC), total organic carbon (TOC) and total inorganic carbon (TIC) of stalk of D_1 D_2 and D_3 were found out and presented in Fig.7. The range of total carbon was found to be 45.1 to 45.8 %, TOC ranged from 41.6 to 42.3 % and TIC ranged from 2.6 to 4.1 %. The average value of TC, TOC and TIC of pigeon-pea stalk of D_1 size were found to be 45.18, 42.35 and 2.83 %, respectively. Similarly for D_2 it was 45.14, 42.45 and 2.69 % and for D_3 it was 45.83, 41.64 and 4.19 respectively. Very minor variation was observed in D_1 D_2 and D_3 size of pigeon-pea stalks.

Stalk diameter	**TC (%)**	**TOC (%)**	**TIC (%)**
D_1	45.18	42.35	2.83
D_2	45.14	42.45	2.69
D_3	45.83	41.64	4.19

Table 2 Total carbon percentage in pigeon pea stalks

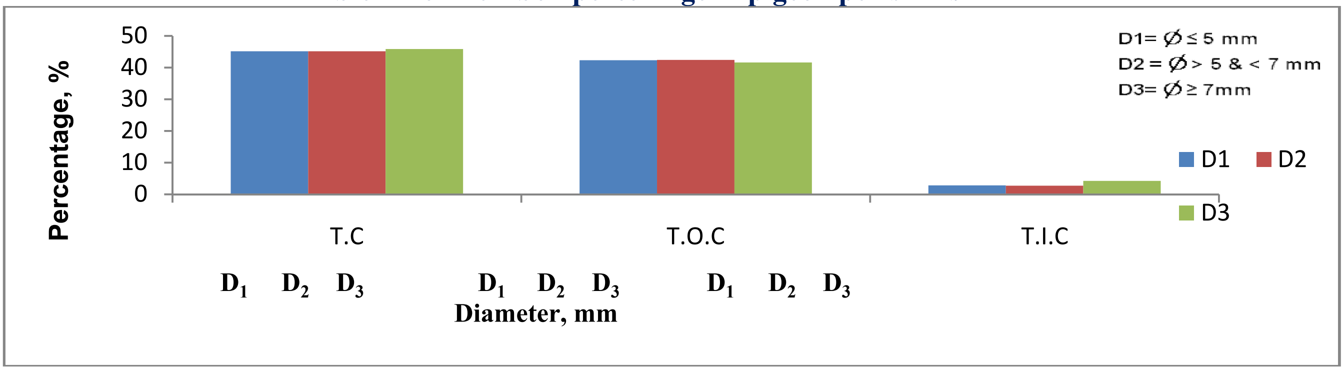

Fig. 7 Effect of sizes of pigeon pea stalk on TC, TOC and TIC

Effect of diameter of bio-char on bulk density

The average value of bulk density of bio-char of size D_1, D_2 and D_3 charring at 450 °C was found to be 230.6, 587.3 and 636.3 kg/m^3, respectively. Similarly, the average value of bulk density of size D_1, D_2 and D_3 charring at 500 °C was found to be 547, 590 and 284.3 kg/m^3, respectively and it was 548, 579 and 284.6 kg/m^3 when charred at 550 °C (Fig. 8).

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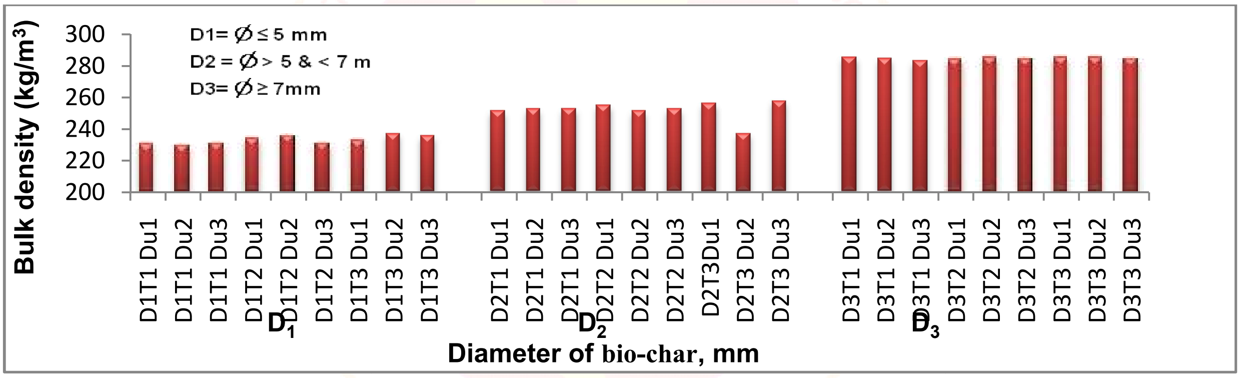

Fig. 8 Effect of diameter of bio-char on bulk density

It is clear from the Fig. 8 that as the diameter of stalk increased the bulk density also increases and the bigger sized produced layered size char. Similarly, the true density of D_1, D_2 and D_3 size of pigeon-pea stalk bio-char was determined and found to be 452.2, 453.6 and 454.4 kg/m^3.

Comparison of pigeon-pea stalk and its bio-char

The parameters of pigeon-pea stalk and bio-char was studied and shown in Table 3.

Table 3. Comparison on pigeon-pea stalk and bio-char

Sr. No.	Parameters	Average value	
		Stalk	Bio-char
1	Moisture content ,%	4.45	2.1
2	Volatile matter,%	63.48	42.03
3	Ash content,%	2.23	1.4
4	Fixed carbon,%	29.78	54.30
5	pH value	4.6	7.5
6	Iodine value, mg/gm	253.51	757.6
7	Bulk density, kg/m^3	271.66	256.40
8	True density, kg/m^3	543.03	459.44
9	Total carbon,%	45.39	75.77
10	**Total organic carbon (TOC),**	42.14	65.54

11	**Total inorganic carbon (TIC), %**	3.24	5.61

It was observed that about 50 % moisture contents different was observed in pigeon-pea stalk and its bio-char. Similarly, it was seen from the Table 3 that around 30 % different in volatile matter of stalk and its bio-char was observed. Fixed carbon in bio-char was found to be 80 % higher than that of its stalk. Around 40% of total carbon was found higher in bio-char than that of the pigeon pea stalks.

CONCLUSIONS

The recovery of bio-char prepared from pigeon pea was varied from 33 to 60 % and on an average it was found to be 40.36 %. Fixed carbon in bio-char was found to be 80 % higher than that of its pigeon pea stalk. Around 40% of total carbon was found higher in bio-char than that of the pigeon pea stalks.

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FORCE DEVELOPMENT PATTERN IN THICK AND THIN PLATE BY CLASSICAL METHOD

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ABSTRACT

It is important to make structure safe and secure for inhabitants till its useful life. Being part of construction designng it becomes upmost important to design structure safe and stable Plate element plays important role in Structure with change in near thickness the nature of failure changes and thus it is very important to study the effect of forces on plate with different thickness. Basically plate is a planer structure with a very small thickness in comparison to the planer dimensions. Plate is broadly classified into thick and thin on the basis of their width to thickness ratio. This Project presents a systematic Study of two widely accepted theory for the plates Analysis. Kirchhoff–Love theory for thin plates and Mindlin–Reissner theory for thick plates. According to this theory we knows that bending is predominant and shearing action is negligible in thin plate while shear stresses are developed and deflection is small in thick plate. Also knowing that plate undergoes bending which can be represent by deflection of middle plane of plate.

Keywords: *Kirchhoff–Love theory, Mindlin–Reissner theory*

1. INTRODUCTION

1.1 General: A plate is a planer structure with a very small thickness in comparison to the planer dimensions. If the width to thickness ratio of the plate is 8 to 10 then plate is classified as thick plate. Mindlin-Reissner theory is used for the analysis of such thick plates. If the width to thickness ratio of the plate is 8 to 100 then plate is classified as thin plate. It is intermediate plate also Kirchhoff–Love theory is use for analysis of such thin plates. If these ratio is 80 to100 then it is called membrane. The forces applied on a plate are perpendicular to the plane of the plate. Therefore, plate resists the applied load by means of bending in two directions and twisting moment. A plate theory takes advantage of this disparity in length scale to reduce the full three- dimensional solid mechanics problem to a two dimensional problem. The load carrying action of plates resembles that of beams or cables to a certain extent. Hence plates can be approximated by a grid work of beams or by a network of cables, depending on the flexural rigidity of the structures. Plates are of wide use in engineering industry. Many structures such as ships and containers require complete enclosure of plates without use of additional covering which consequently saves the material and labour. Nowadays, plates are generally used in architectural structures, bridges, hydraulic structures, pavements, containers, airplanes, missiles, ships, instruments and machine parts. Plates are usually subdivided based on their structural action.The aim of plate theory is to calculate the deformation and stresses in a plate subjected to loads. The analyses of plates are categorized into two types based on thickness to breadth ratio: thick plate and thin plate analysis. In any structure each element plays an individual role for dissolving action and maintaining stability of structure, however the skill of designing is in determining the nature of force development in the structural member with change in geometry and there after deciding on the basis of analysis result. One such important structural element is slab/ plate with change in near thickness the nature of failure changes and thus it is very important to study the effect of forces on plate with different thickness.

1.2 Aim : To study the force development pattern in thick and thin plate by classical method.

1.3 Objective :

1. To study classification of plates.
2. To study forces acting on plates.
3. To study Plate Analysis and Theory of Plates.

2. LITERATURE REVIEW

Charles R. Steele et.al. (1) In this literature the author introduced the fundamental terms of Theory of Plates, also derive the basic equations which describe the behavior of plates taking advantage of the plate's thin, planar character. **Ivo Senjanović1 et.al .(2)** Introduce an outline of the modified Mindlin theory for moderately thick plate is presented. Instead of three variables, i.e. deflection and two rotations of cross-sections, the problem is reduced to only one, where bending deflection is used as a potential function for determining the remaining displacements, strains and sectional forces. **S. Timoshenko and Woinowsky Krieger - Theory of plate and shells 1987 (3)** In this book author gives solutions of each and every complications regarding plate and continuum structures. Also provide us the value of coefficients for deflection, moments and shear force for various plates with varying boundary conditions, which is based on classical method**. Dr Fehmi Cirak Finite Element Formulation for Plates-Handout 3. (4).** Introduce overview of plate theory and kinematics of Kirchhoff plates. **Sanjib Goswami[1] et.al (5)** Study a new displacement based higher order element has been formulated that is ideally suitable for shear deformable composite and sandwich plates. Suitable functions for displacements and rotations for each node have been selected so that the element shows rapid convergence, an excellent response against transverse shear loading and requires no shear correction factors. It is completely lock-free and behaves extremely well for thin to thick plates**. Uroˇs Bohinc[1] et.al. (6)** In this Author address error controlled adaptive finite element method for thin and thick plates also present a procedure for determining the most suitable plate model for each particular finite element of the selected mesh, that is provided as the final output of the mesh adaptivity procedure. **Torgeir Rusten et.al. (7)** Introducing topic of the Chapters of plate theory, both classical thin plate theory and theory for thick plates. While the membrane formulation is characterized by the fact that loads and responses are in the plane, the plate models consider out of plane loads and responses. **F. Auricchio et.al (8).** Introduce a new formulation for a triangular finite element developed within the framework of shear deformable plate theory. The element takes advantages of internal rotational degree of freedom and a linked interpolation between the transverse displacement and the rotation. **Saeed Mirzaei[a] et.al. (9).** Introduce numerical method is developed for the buckling analysis of moderately thick plate with different boundary conditions. The procedure uses the finite strip method in conjunction with the refined plate theory (RPT). Various refined shear displacement models are employed and compared with each other.

3. DETAIL STUDY

3.1 Classification of Plates:

a) Plates may be classified into three groups according to the ratio **a/h**, where a is a typical dimension of a plate in a plane and h is a plate thickness.

1. The first group is presented by **thick plates** having ratios a/h = 8 to10. The analysis of such bodies includes all the components of stresses, strains, and displacements as for solid bodies using the general equations of three-dimensional elasticity. In this plate shearing is predominant.
2. The second group refers to plates with ratios a/h = 80 to100. These plates are referred to as **membranes** and they are devoid of flexural rigidity. Membranes carry the lateral loads by axial tensile forces acting in the plate middle surface. These forces are called membrane forces; they produce projection on a vertical axis and thus balance a lateral load applied to the plate-membrane. Inplane forces developed. Forces are resisted by stretching action
3. The most extensive group represents an intermediate type of plate, so called **thin plate** with 8 to 10 ≤a/h≤ 80 to100 Bending action is predominant and effect of shearing is negligible

b) Depending on the value of the deflection of the plate

1. **Thin plate with large deflection:** In this case maximum deflection w_{max} ≥5t. In plane forces are produced or stretching is predominant. Forces are resisted by stretching action. There are tensile stresses in neutral plane.
2. **Thin plate with small deflection:** In this case maximum deflection w_{max} ≤0.2t**.** Bending is predominant, forces are resisted by bending action here effect of shearing is negligible.
3. **Thick plate with very small deflection :** In this case maximum deflection w_{max} ≤ least lateral dimension / 50. Shearing stresses are predominant called as shear deformation.

3.2 Theory of Plate

There were many plate theories formulated after the Euler–Bernoulli beam theory was proposed. The Euler–Bernoulli beam theory also known as the engineer's beam theory is a simplification of the linear theory which provides a means of calculating the load-carrying and deflection characteristics of beams. Of the numerous plate theories that have been developed since the late 19th century, two are widely accepted and used in engineering. They are:Kirchhoff–Love theory of plates and Mindlin–Reissner theory of plates.

3.2.1 Thin Plate Theory: Thin plate theory is based upon assumptions initiated for beams by Bernoulli but first applied to plates and shells by Love and Kirchhoff. This theory is known as Kirchhoff's plate theory. The basic assumptions according Kirchoff are:

1. The line normal to the neutral axis before bending remains straight after bending.
2. The normal stress in thickness direction is neglected. (This assumption converts the 3D problem into a 2D problem.)
3. The transverse shearing strains are assumed to be zero.(shear strains γxz and γyz will be zero). Thus, thickness of the plate does not change during bending.

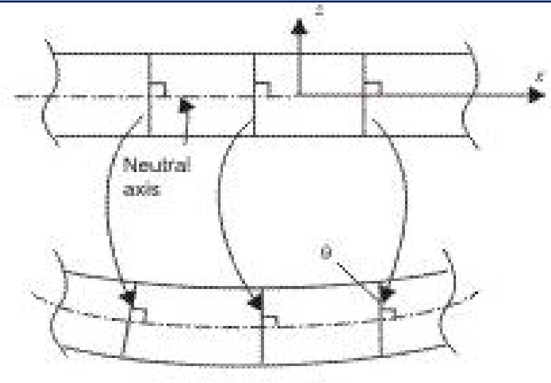

Fig 3.1 Kirchhoff plate after bending

Basic relationships

Let, a plate of thickness t has mid-surface at a distance $t2$ from each lateral surface. For the analysis purpose, X-Y plane is located in the plate mid-surface, therefore z=0 identifies the mid-surface. Let **u, v, w** be the displacements at any point (x, y, z).

The above assumptions are graphically shown in Fig 3.1

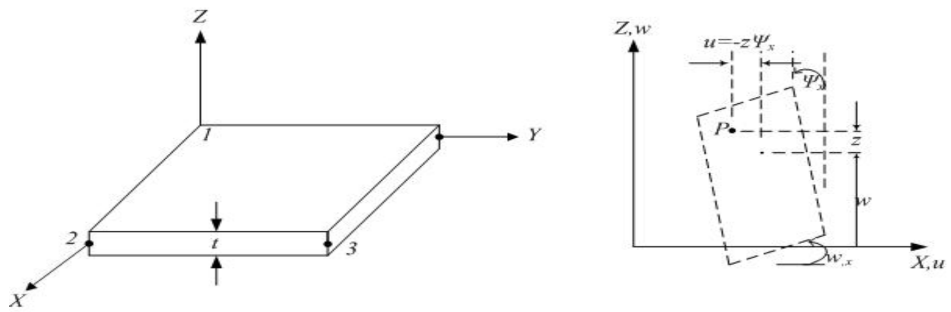

Fig 3.2 Thin plate element

Then the variation of u and v across the thickness can be expressed in terms of displacement w as

$$u = -z\frac{\partial w}{\partial x} \qquad v = -z\frac{\partial w}{\partial y} \qquad \text{....... (3.2.1)}$$

w is the deflection of the middle plane of the plate in the z direction. Further the relationship between, the strain and deflection is given by,

$$\varepsilon_x = \frac{\partial u}{\partial x} = -z\,\frac{\partial^2 w}{\partial x^2} = z\,\chi_x$$
$$\varepsilon_y = \frac{\partial v}{\partial y} = -z\,\frac{\partial^2 w}{\partial y^2} = z\,\chi_y$$
$$\gamma_{xy} = \frac{\partial u}{\partial y} + \frac{\partial v}{\partial x} = -2z\,\frac{\partial^2 w}{\partial x \partial y} = z\,\chi_{xy} \qquad \text{.... (3.2.2)}$$

Where,

ε corresponds to direct strain

γ corresponds to shear strain

χ corresponds to curvature along respective directions.

Or in matrix form, the above expression can written as

$$\begin{Bmatrix} \varepsilon_x \\ \varepsilon_y \\ \gamma_{xy} \end{Bmatrix} = -z \begin{bmatrix} \frac{\partial^2}{\partial x^2} \\ \frac{\partial^2}{\partial y^2} \\ \frac{\partial^2}{\partial x \partial y} \end{bmatrix} w \qquad \text{.... (3.2.3)}$$

Or,

E = - ZΔ .... (3.2.4)

Where, ε is the vector of in-plane strains, and Δ is the differential operator matrix.

Constitutive equations

From Hooke's law,

$$\sigma = [D]\varepsilon \qquad \text{..... (3.2.5)}$$

Where

$$[D] = \frac{E}{(1-\upsilon^2)}\begin{bmatrix} 1 & \upsilon & 0 \\ \upsilon & 1 & 0 \\ 0 & 0 & \frac{1-\upsilon}{2} \end{bmatrix} \qquad \text{..... (3.2.6)}$$

Here, [D] is equal to the value defined for 2D solids in plane stress condition

Calculation of moments and shear forces

Let consider a plate element of $dx \times dy$ and with thickness *t*. The plate is subjected to external uniformly distributed load *p*. For a thin plate, body force of the plate can be converted to an equivalent load and therefore, consideration of separate body force is not necessary. By putting eq. (3.2.4) in eq. (3.2.5)

$$\sigma = -z[D]\Delta w \qquad \text{....... (3.2.7)}$$

It is observed from the above relation that the normal stresses are varying linearly along thickness of the plate (Fig. 3.3) Hence the moments (Fig. 3.4) on the cross section can be calculated by integration.

$$M = \begin{Bmatrix} M_x \\ M_y \\ M_{xy} \end{Bmatrix} = \int_{-t/2}^{t/2} \sigma z dt = -\left(\int_{-t/2}^{t/2} z^2 dt\right)[D]\Delta w = -\frac{t^3}{12}[D]\Delta w$$

.... (3.2.8)

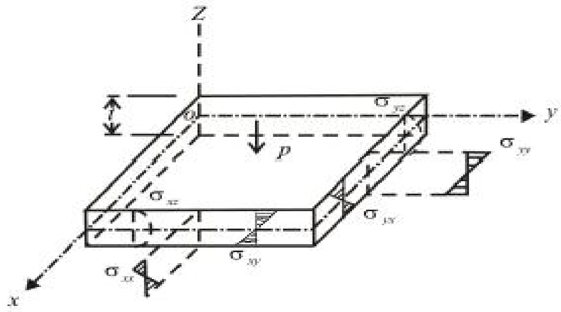

Fig 3.3 Stresses in plate

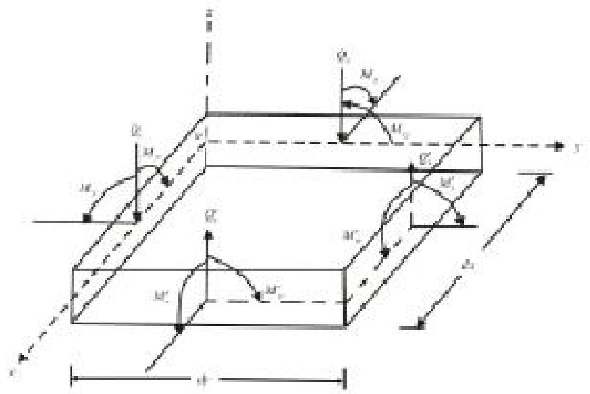

Fig 3.4 Forces and Moment in plate

On expansion of eq. (3.2.8) one can find the following expressions.

$$M_x = -\frac{Et^3}{12(1-\upsilon^2)}\left(\frac{\partial^2 w}{\partial x^2} - \upsilon\frac{\partial^2 w}{\partial y^2}\right) = D_P(\chi_x + \upsilon\chi_y)$$

$$M_y = -\frac{Et^3}{12(1-\upsilon^2)}\left(\frac{\partial^2 w}{\partial y^2} + \upsilon\frac{\partial^2 w}{\partial x^2}\right) = D_P(\chi_y + \upsilon\chi_x)$$

$$M_{xy} = M_{yx} = \frac{Et^3}{12(1+\upsilon)}\frac{\partial^2 w}{\partial x \partial y} = -\frac{D_P(1-\upsilon)}{2}\chi_{xy}$$

...... (3.2.9)

Where, DP is known as flexural rigidity of the plate and is given by,

$$D_P = \frac{Et^3}{12(1-\upsilon^2)} \qquad \text{....... (3.2.10)}$$

Let consider the bending moments vary along the length and breadth of the plate as a function of *x* and *y*. Thus, if *Mx* acts on one side of the element

$$M_x' = M_x + \frac{\partial M_x}{\partial x} dx$$

acts on the opposite side. Considering equilibrium of the plate element, the equations for forces can be obtained as

$$\frac{\partial Q_x}{\partial x} + \frac{\partial Q_y}{\partial y} + p = 0 \quad \text{....... (3.2.11)}$$

$$\frac{\partial M_x}{\partial x} + \frac{\partial M_{xy}}{\partial y} = Q_x \quad \text{....... (3.2.12)}$$

$$\frac{\partial M_{xy}}{\partial x} + \frac{\partial M_y}{\partial y} = Q_y \quad \text{....... (3.2.13)}$$

Using eq (3.2.9) in eqs.(3.2.12) & (3.2.13), the following relations will be obtained.

$$Q_x = -D_p \frac{\partial}{\partial x}\left(\frac{\partial^2 w}{\partial x^2} + \frac{\partial^2 w}{\partial y^2}\right) \quad \text{.... (3.2.14)}$$

$$Q_y = -D_p \frac{\partial}{\partial y}\left(\frac{\partial^2 w}{\partial x^2} + \frac{\partial^2 w}{\partial y^2}\right) \quad \text{.... (3.2.15)}$$

Using equations. (3.2.14) and (3.2.15) in eq. (3.2.11) following relations will be obtained.

$$\frac{\partial^4 w}{\partial x^4} + 2\frac{\partial^4 w}{\partial x^2 \partial y^2} + \frac{\partial^4 w}{\partial y^4} = -\frac{p}{D_p} \quad \text{.... (3.2.16)}$$

Equation (3.2.16) represent governing differential equation for thin plate.

3.2.2 Thick Plate Theory

Although Kirchhoff hypothesis provides comparatively simple analytical solutions for most of the cases, it also suffers from some limitations. For example, Kirchhoff plate element cannot rotate independently of the position of the mid-surface. As a result, problems occur at boundaries, where the undefined transverse shear stresses are necessary especially for thick plates. Also, the Kirchhoff theory is only applicable for analysis of plates with smaller deformations, as higher order terms of strain-displacement relationship cannot be neglected for large deformations. Moreover, as plate deflects its transverse stiffness changes. Hence only for small deformations the transverse stiffness can be assumed to be constant. Contrary, Reissner–Mindlin plate theory (Fig. 3.5) is applied for analysis of thick plates, where the shear deformations are considered, rotation and lateral deflections are decoupled. It does not require the cross-sections to be perpendicular to the axial forces after deformation.

It basically depends on following assumptions

1. The deflections of the plate are small.
2. Normal to the plate mid-surface before deformation remains straight but is not necessarily normal to it after deformation.
3. Stresses normal to the mid-surface are negligible.

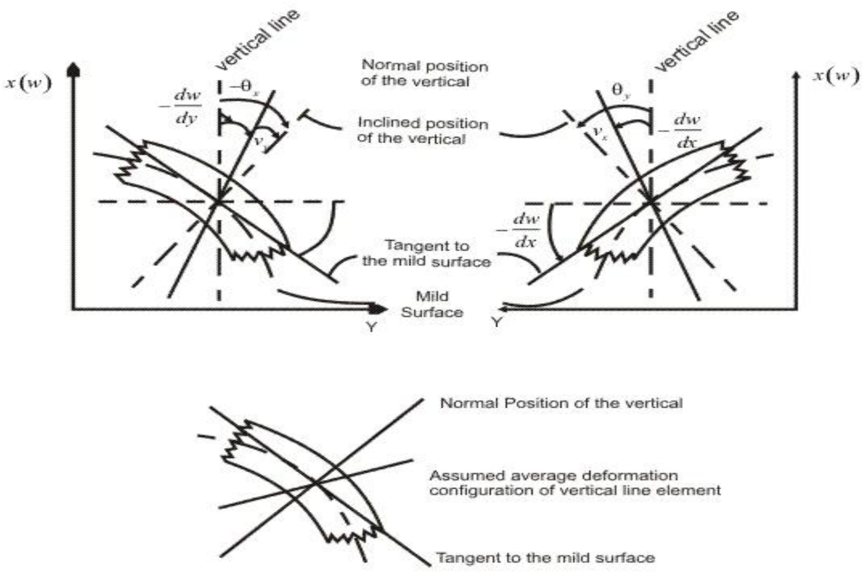

Fig. 3.5 Bending of thick plate

Thus, according to Mindlin plate theory, the deformation parallel to the un-deformed mid surface, *u* and *v*, at a distance *z* from the centroidal axis are expressed by,

$$u = z\theta_y \quad \text{……… (3.2.17)}$$

$$v = -z\theta_x \quad \text{………… (3.2.18)}$$

Where θx and θy are the rotations of the line normal to the neutral axis of the plate with respect to the *x* and *y* axes respectively before deformation. The curvatures are expressed by

$$\chi_x = \frac{\partial \theta_y}{\partial x} \quad \text{………… (3.2.19)}$$

$$\chi_y = -\frac{\partial \theta_x}{\partial y} \quad \text{………… (3.2.20)}$$

Similarly the twist for the plate is given by,

$$\chi_{xy} = \left(\frac{\partial \theta_y}{\partial y} - \frac{\partial \theta_x}{\partial x} \right) \quad \text{………… (3.2.21)}$$

Using equations.(3.2.9)-(3.2.10), the bending stresses for the plate is given by

$$\begin{Bmatrix} M_x \\ M_y \\ M_{xy} \end{Bmatrix} = \frac{Et^3}{12(1-\upsilon^2)} \begin{bmatrix} 1 & \upsilon & 0 \\ \upsilon & 1 & 0 \\ 0 & 0 & \frac{1-\upsilon}{2} \end{bmatrix} \begin{Bmatrix} \chi_x \\ \chi_y \\ \chi_{xy} \end{Bmatrix} \quad \text{……(3.2.22)}$$

Or

$$\{M\} = [D]\{\chi\} \quad \text{……..…..(3.2.23)}$$

further, the transverse shear strains are determined as

$$\gamma_{xz} = \theta_y + \frac{\partial w}{\partial x} \quad \text{……..…..(3.2.24)}$$

$$\gamma_{yz} = -\theta_x + \frac{\partial w}{\partial y} \quad \text{……..…..(3.2.25)}$$

The shear strain energy can be expressed as

$$U_s = \frac{1}{2}\alpha GA \iint_A \left[(\gamma_x)^2 + (\gamma_y)^2 \right] dx\, dy \quad \text{……..…..(3.2.26)}$$

$$= \frac{1}{2}\alpha GA \iint_A \left[\left(\theta_y + \frac{\partial w}{\partial x}\right)^2 + \left(\theta_x + \frac{\partial w}{\partial y}\right)^2 \right] dx\, dy$$

Where, $G = \frac{E}{2(1+\mu)}$. The shear stresses are

$$\begin{Bmatrix} \tau_{xz} \\ \tau_{yz} \end{Bmatrix} = \frac{E}{2(1+\mu)} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{Bmatrix} \gamma_x \\ \gamma_y \end{Bmatrix} \quad \text{……..…..(3.2.27)}$$

Hence the resultant shear stress is given by,

$$\begin{Bmatrix} Q_x \\ Q_y \end{Bmatrix} = \frac{Et\alpha}{2(1+\mu)} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{Bmatrix} \gamma_x \\ \gamma_y \end{Bmatrix} \quad \text{……..…..(3.2.28)}$$

Or,

$$\{Q\} = [D_s]\{\gamma\}$$

here "α" is the numerical correction factor used to characterize the restraint of cross section against warping. If there is no warping i.e., the section is having complete restraint against warping then α = 1 and if it is having no restraint against warping then α = 2/3. The value of α is usually taken to be $\pi^2/12$ or 5/6. Now, the stress resultant can be combined as follows.

$$\begin{Bmatrix} \{M\} \\ \{Q\} \end{Bmatrix} = \begin{bmatrix} [D] & 0 \\ 0 & [D_s] \end{bmatrix} \begin{Bmatrix} \{\chi\} \\ \{\gamma\} \end{Bmatrix} \qquad \text{……..…..(3.2.29)}$$

Or,

$$\begin{Bmatrix} M_x \\ M_y \\ M_{xy} \\ Q_x \\ Q_y \end{Bmatrix} = \begin{bmatrix} \frac{Et^3}{12(1-\mu^2)} \begin{bmatrix} 1 & \mu & 0 \\ \mu & 1 & 0 \\ 0 & 0 & \frac{1-\mu}{2} \end{bmatrix} & \begin{matrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{matrix} \\ \begin{matrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{matrix} & \frac{Et}{2(1+\mu)} \begin{vmatrix} \alpha & 0 \\ 0 & \alpha \end{vmatrix} \end{bmatrix} \begin{Bmatrix} \chi_x \\ \chi_y \\ \chi_{xy} \\ \gamma_x \\ \gamma_y \end{Bmatrix} \qquad \text{……..…..(3.2.30)}$$

$$\begin{Bmatrix} M_x \\ M_y \\ M_{xy} \\ Q_x \\ Q_y \end{Bmatrix} = \begin{bmatrix} \frac{Et^3}{12(1-\mu^2)} \begin{bmatrix} 1 & \mu & 0 \\ \mu & 1 & 0 \\ 0 & 0 & \frac{1-\mu}{2} \end{bmatrix} & \begin{matrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{matrix} \\ \begin{matrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{matrix} & \frac{Et}{2(1+\mu)} \begin{vmatrix} \alpha & 0 \\ 0 & \alpha \end{vmatrix} \end{bmatrix} \begin{Bmatrix} \frac{\partial \theta_y}{\partial x} \\ \frac{\partial \theta_x}{\partial y} \\ \frac{\partial \theta_y}{\partial y} - \frac{\partial \theta_x}{\partial x} \\ \theta_y + \frac{\partial w}{\partial x} \\ \theta_x + \frac{\partial w}{\partial y} \end{Bmatrix} \qquad \text{……..…..(3.2.31)}$$

The above relation may be compared with usual stress-strain relation. Thus, the stress resultants and their corresponding curvature and shear deformations may be considered analogous to stresses and strains.

4. CONCLUSIONS

On the basis of the work highlighted in this paper. It can be concluded on the basis of theory of plate analysis:

1. In thin plate bending is predominant, forces are resisted by bending action also the effect of shearing is negligible.
2. In Thick plate Shearing stresses are predominant also deflection of plate is small.

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