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Message from Assistant Editor In Chief

Let me first of all take this opportunity to wish all our readers a very happy, peaceful and prosperous year ahead.

This is the Second issue of the Second Volume of International Journal of Engineering Research and General Science. A total of 26 research articles are published and I sincerely hope that each one of these provides some significant stimulation to a reasonable segment of our community of readers.

In this issue, we have focused mainly on the need of advancement in upcoming technology with the recent research that can have a great impact in our society through conceptual ideas implementation approach. As such, we encourage submission of more recent and relevant ideas and research papers from our readers too, which will be published in the upcoming issues.

Author's response for this issue was really inspiring for us. We received many papers from many countries in this issue than previous one but our technical team and editor members accepts very less number of research papers for the publication. We have provided editors feedback for every rejected as well as accepted paper so that authors can work out in the weakness more and we shall accept the paper in near future. We apologize for the inconvenient caused for rejected Authors but I hope our editor feedback helps you discover more horizons for your research work.

I would like to take this opportunity to thank each and every writer for their contribution and would like to thank entire International Journal of Engineering Research and General Science (IJERGS) technical team and editor member for their hard work for the development of research in the world through IJERGS.

Last, but not the least my special thanks and gratitude needs to go to all our fellow friends and supporters. Your help is greatly appreciated. I hope our reader will find our papers educational and entertaining as well. Our team have done good job however, this issue may possibly have some drawbacks, and therefore, constructive suggestions for further improvement shall be warmly welcomed.

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Chemically Reactive Boundary Layer Flow Past an Accelerated Plate with Radiation and Newtonian heating

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ABSTRACT. An analysis is performed to study the effect of heat and mass transfer chemically reactive flow past an accelerated vertical plate with Newtonian heating in the presence of radiation. Closed form analytic solutions are obtained for temperature, concentration, velocity by Laplace Transform technique and presented graphically for different values of physical parameters. Expressions of skin friction, Nusselt number, and Sherwood number are obtained and presented in graphical forms. The effects of various parameters on flow variables are illustrated graphically and the physical aspects of the problem are discussed.

KEY WORDS: Free convection, mass transfer, chemical reaction, Newtonian heating, radiation, accelerated plate.

INTRODUCTION:

Free convection flow over a vertical surface are very much interested to study due to their potential applications in soil physics, geo–hydrology, biological system etc. The unsteady flow has its importance in space science technology and in aerodynamics. In nature many transport processes exist in which the simultaneous heat and mass transfer occur as a result of combined buoyancy effects of thermal diffusion and diffusion of chemical species. The phenomenon of combined heat and mass transfer frequently occurs in chemically processed industries, distribution of temperature and moisture over agricultural fields, dispersion of fog and environmental pollution and polymer production. A number of investigations have already been carried out with combined heat and mass transfer under the assumption of different physical situations. The illustrative examples of mass transfer can be found in the book of Cussler [1].Combined heat and mass transfer flow past a surface is analyzed by Chaudhary et. al. [2] , Muthucumaraswamy et. al. [3] and Rajput et. al. [4] under different physical conditions. Chaudhary et. al. [5] pioneered unsteady heat and mass transfer flow past a surface by Laplace Transform method. An unsteady flow past an exponentially accelerated plate with variable mass transfer is analyzed by Asogwa et. al.[6].

Mass transfer with chemical reaction is one of the most commonly encountered circumstances in chemical industry as well as in physical and biological sciences. It is found that in many chemical engineering processes, chemical reaction takes place between foreign masses (present in the form of ingredients) and the fluid. This type of chemical reaction may change the temperature and the heat content of the fluid and may affect the free convection process. However, if the presence of such foreign mass is very low then we can assume the first order chemical reaction so that heat generation due to chemical reaction can be considered to be very negligible. Here only first order chemical reaction is considered. A reaction is said to be of the first order if the rate of reaction is directly proportional to the concentration. Flow past a vertical plate with chemical reaction is analyzed by Fayez[7] and Sarada et. al. [8] under different physical situations. Bhaben et. al. [9] analyzed chemical reaction effects on flow past a vertical plate with variable temperature.

Generally, the problems of free convection flows are usually modeled under the assumption of constant surface temperature, ramped wall temperature, or constant surface heat flux. However, in many practical situations where the heat transfer from the surface is taken to be proportional to the local surface temperature, the above assumptions fail to work. Such types of flows are termed as conjugate convective flows, and the proportionally condition of the heat transfer to the local surface temperature is termed as Newtonian heating. Recently, Newtonian heating conditions have been used by researchers in view of their practical applications in several engineering devices, for instance in a heat exchanger where the conduction in solid tube wall is greatly influenced by convection in the fluid flowing over it. Unsteady boundary layer flow past a vertical plate with Newtonian heating is elucidated by Chaudhary et.al.[10]. Chemical reaction and mass transfer effects on flow past a surface with Newtonian heating is analyzed by Rajesh [11]. Combined buoyancy effect on unsteady flow past an impulsively started plate with Newtonian heating is analyzed by Raju [12].

In the above mentioned studies, the effects of radiation on flow has not been considered. The radiation effect on convective flow and heat transfer flow has become more important industrially. In the context of space technology and the process involving high temperatures the effects of radiation are of vital importance. Recent development in hypersonic flight, missile reentry, rocket combustion chambers, power plants for interplanetary flights have focused attention on thermal radiation and emphasize the need for improved understanding of radiation heat transfer in these processes. Natural convective flow past a plate in the presence of radiation is studied by Chaudhary et. al. [13]. Thermal radiation effect on an impulsively started vertical plate with mass transfer using finite difference scheme is elucidated by Prasad et.al. [14]. Rajput et. al. [15] analyzed the radiation effect on an impulsively started infinite vertical plate with variable mass transfer by Laplace transform technique. Radiation and Newtonian heating effects on flow past an impulsively started vertical plate under different physical conditions are analyzed by Narahari et. al. [16] and Das et. al. [17]. Recently, Jain [18, 19] pioneered effects of radiation and chemical reaction on flow past a vertical surface using Laplace Transform technique. Very recently chemically reactive double diffusive convective flow is analyzed by Jain [20]

The aim of the present work is to provide an exact solution for the problem of chemically reactive fluid flow over a moving vertical plate in presence of radiation with Newtonian heating. The solutions are obtained numerically for various parameters entering into the problem and discussed them from the physical point of view.

MATHEMATICAL ANALYSIS: Consider unsteady two-dimensional flow of an incompressible and electrically conducting viscous fluid along an infinite vertical plate. The x'-axis is taken on the infinite plate and parallel to the free stream velocity and y'-axis normal to it. Initially, the plate and the fluid are at same temperature T'_∞ with concentration level C'_∞ at all points. At time t' > 0, It accelerates with a velocity U_R in its own plane. At the same time, the heat transfer from plate to the fluid is directly proportional to the local surface temperature T' and the plate concentration is raised linearly with respect to time. It is assumed that there exist a homogeneous chemical reaction of first order with constant rate K_l between the diffusing species and the fluid. Since the plate is infinite in extent therefore the flow variables are the functions of y' and t' only. The fluid is considered to be gray absorbing-emitting radiation but non scattering medium . The radiative heat flux in the x'-direction is considered negligible in comparison that of y'-direction. Then neglecting viscous dissipation and assuming variation of density in the body force term (Boussinesq's approximation), the problem can be governed by the following set of equations:

$$\frac{\partial T^{'}}{\partial t^{'}} = \frac{\kappa}{\rho C_p} \frac{\partial^2 T^{'}}{\partial y^{'2}} - \frac{1}{\rho C_p} \frac{\partial q_r}{\partial y^{'}} \qquad \ldots(1)$$

$$\frac{\partial C^{'}}{\partial t^{'}} = D \frac{\partial^2 C^{'}}{\partial y^{'2}} - k_l C^{'} \qquad \ldots(2)$$

$$\frac{\partial u'}{\partial t'} = \nu \frac{\partial^2 u'}{\partial y^{'2}} + g\,\beta\,(T^{'} - T_{\infty}^{'}) + g\,\beta_c\,(C^{'} - C_{\infty}^{'}{}') \qquad \ldots(3)$$

with following initial and boundary conditions

$$u' = 0,\; T^{'} = T_{\infty}^{'},\; C^{'} = C_{\infty}^{'} \text{ for all } y',\, t' \leq 0 \qquad \ldots(4)$$

$$u' = U_R,\; \frac{\partial T^{'}}{\partial y^{'}} = -h_s T^{'},\; C^{'} = C_{\infty}^{'} + \left(C_w^{'} - C_{\infty}^{'}\right)\frac{u_R^2\, t^{'}}{\nu} \qquad \text{at } y' = 0,\, t' > 0$$

$$u' \to 0,\; T^{'} \to T_{\infty}^{'},\; C^{'} \to C_{\infty}^{'} \qquad \text{as } y^{'} \to \infty,\, t^{'} > 0$$

The radiation heat flux term, by using the Rosseland's approximation is given by

$$q_r = -\frac{4\sigma^{'}}{3\kappa^{*}} \frac{\partial T^{'4}}{\partial y^{'}} \qquad \ldots(5)$$

where U_R is reference velocity, g is gravitational acceleration, C_p is specific heat at constant

pressure, D is mass diffusivity, β is thermal expansion coefficient, β_C is concentration expansion coefficient,

ρ is density, κ is thermal conductivity of fluid, κ^{*} is mean absorption coefficient, ν is kinematic

viscosity and , q_r is radiative heat flux, $\sigma^{'}$ is Stefan-Boltzmann Constant.

We assume that the temperature differences within the flow are such that $T^{'4}$ may be expressed as a linear

function of the temperature T'. This is accomplished by expanding $T^{'4}$ in a Taylor series about $T_{\infty}^{'}$ and

neglecting higher-order terms

$$T^{'4} \simeq 4\,T_{\infty}^3\,T' - 3T_{\infty}^4 \qquad \ldots(6)$$

By using equations (5) and (6), equation (1) gives

$$\rho C_p \frac{\partial T'}{\partial t'} = \kappa \frac{\partial^2 T'}{\partial y'^2} + \frac{16\sigma' T_\infty'^3}{3\kappa^*} \frac{\partial^2 T'}{\partial y'^2} \qquad \qquad …(7)$$

Introducing the following dimensionless quantities

$$t = \frac{t'}{t_R}, \; y = \frac{y'}{L_R}, \; u = \frac{u'}{U_R}, \; k = \frac{U_R^2 \, k_1}{v^2},$$

$$Pr = \frac{\mu C_p}{\kappa}, \; Sc = \frac{v}{D}, \; \theta = \frac{T' - T_\infty'}{T_\infty'}, G = \frac{g\beta_T T_\infty' v}{U_R^3}$$

$$C = \frac{C' - C_\infty'}{C_w' - C_\infty'}, \; Gm = \frac{v \, g \, \beta_C \, (C_w' - C_\infty')}{U_R^3}, \; k = \frac{v k_1}{U_R^2}, \; R = \frac{\kappa^* \kappa}{4\sigma' T_\infty'^3}$$

$$\Delta T = T_w' - T_\infty', U_R = (vg\beta\Delta t)^{1/3},$$

$$L_R = \left(\frac{g\beta\Delta T}{v^2}\right)^{-1/3}, \; t_R = (g\beta\Delta T)^{-2/3} v^{1/3}$$

$$\qquad \qquad \qquad …(8)$$

where L_R is reference length, t_R is reference time, Gm is modified Grashof number, Pr is Prandtl number, Sc is Schmidt number and u is dimensionless velocity component, θ is dimensionless temperature, C is dimensionless concentration, μ is viscosity of fluid, t is time in dimensionless coordinate, R is radiation parameter and k is chemical reaction parameter.

The governing equations (1) to (3) reduce to the following non-dimensional form

$$Pr \; \frac{\partial \theta}{\partial t} = (1 + \frac{4}{3R}) \frac{\partial^2 \theta}{\partial y^2} \qquad \qquad …(9)$$

$$\frac{\partial C}{\partial t} = \frac{1}{Sc} \frac{\partial^2 C}{\partial y^2} - kC \qquad \qquad …(10)$$

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial y^2} + G\theta + Gm \, C \qquad \qquad …(11)$$

with the following initial and boundary conditions

$$u = 0, \; \theta = 0, \; C = 0 \qquad \qquad \text{for all } y, t \leq 0 \qquad …(12)$$

$$u = 1, \frac{\partial \theta}{\partial y} = -\gamma(1+\theta), C = t \qquad at \quad y = 0, t > 0 \qquad \qquad \ldots(13)$$

$$u \to 0, \theta \to 0, C \to 0 \qquad \qquad as \ y \to \infty, \ t > 0$$

On taking Laplace-transform of equations (9) to (11) and boundary conditions

(12, 13), we get

$$(1 + \frac{4}{3R}) \frac{d^2\bar{\theta}}{dy^2} - p\,Pr\,\bar{\theta} = 0 \qquad \qquad \ldots(14)$$

$$\frac{d^2\bar{C}}{dy^2} - (k + pSc)\bar{C} = 0 \qquad \qquad \ldots(15)$$

$$\frac{d^2\bar{u}}{dy^2} - p\,\bar{u} = -G\bar{\theta}\,(y,p) - Gm\bar{C} \qquad \qquad \ldots(16)$$

$$\bar{u} = \frac{1}{p}, \frac{d\bar{\theta}}{dy} = -\gamma\left(\frac{1}{p} + \bar{\theta}\right), \bar{C} = \frac{1}{p^2} \quad at \ y = 0, t > 0 \qquad \qquad \ldots(17)$$

$$\bar{u} \to 0, \bar{\theta} \to 0, \bar{C} \to 0 \qquad \qquad as \ y \to \infty, \ t > 0$$

Where p is the Laplace-transform parameter and $\gamma = \frac{h_s \nu}{U_R}$ is Newtonian heating Parameter. Equation (13) gives θ=0 when ϒ=0

which physically means that no heating from the plate exists.

Solving equations (14) to (16) with the help of boundary condition (17), we get

$$\bar{\theta}\,(y,p) \ = \ \frac{b \exp\,(-y\,\sqrt{pa}\,)}{p(\sqrt{p} - b)} \qquad \qquad \ldots(18)$$

$$\bar{C}(y,p) \ = \ \frac{\exp\,(-y\,\sqrt{(kSc + p\,Sc)}\,)}{p^2} \qquad \qquad \ldots(19)$$

$$\bar{u}(\ y,p) = \frac{\exp(-y\sqrt{p})}{p}$$

$$+ \frac{Gb\exp(-y\sqrt{p})}{p^2(\ a - 1)(\ \sqrt{p} - b)} - \frac{Gm\exp(-y\sqrt{p})}{p^2(\ 1 - Sc)(\ p - d)}$$

$$-\frac{G\,b}{p^2\,(a-1)\left(\sqrt{p}-b\right)}\left\{\exp\left(-\,y\,\sqrt{pa}\,\right)\right\}$$

$$+\frac{Gm\,\exp\left(-\,y\,\sqrt{(p+k)Sc}\,\right)}{p^2(p-d)\left(1-Sc\right)} \qquad \qquad \text{…(20)}$$

On taking inverse Laplace-transform of equations (18) to (20), we get

$$\theta = \exp(-2\gamma\eta\sqrt{t}+b^2t)\,\mathrm{erfc}\,(\eta\sqrt{a}\text{-}b\sqrt{t}\,)-\mathrm{erfc}\left(\eta\sqrt{a}\right) \qquad \qquad \text{…(21)}$$

$$C = \frac{t}{2}\{\exp(2\eta\sqrt{kSc\,t}\,)\mathrm{erfc}\,(\eta\,\sqrt{Sc}+\sqrt{kt}\,)+\exp(-2\eta\sqrt{kSc\,t}\,)\mathrm{erfc}\,(\eta\,\sqrt{Sc}-\sqrt{kt}\,)\}$$
$$+\frac{\eta\sqrt{Sct}}{2\sqrt{k}}\{\exp(2\eta\sqrt{kSc\,t}\,)\mathrm{erfc}\,(\eta\,\sqrt{Sc}+\sqrt{kt}\,)-\exp(-2\eta\sqrt{kSc\,t}\,)\mathrm{erfc}\,(\eta\,\sqrt{Sc}-\sqrt{kt}\,)\}$$

$$\text{…(22)}$$

For $Sc \neq 1$

$$u = \mathrm{erfc}(\eta)$$

$$+\frac{Gb}{a-1}\left\{\frac{1}{4\sqrt{\pi t}}\exp(-\eta^2)+b\exp(b^2t-2b\eta\sqrt{t})\mathrm{erfc}(\eta-b\sqrt{t})\right\}$$

$$-\frac{Gb}{a-1}\left\{\frac{1}{4\sqrt{\pi t}}\exp(-\eta^2 a)+b\exp(b^2t-2\gamma\eta\sqrt{t})\mathrm{erfc}(\eta\sqrt{a}-b\sqrt{t})\right\}$$

$$+\frac{Gm}{k\,Sc}\left\{t\left(1+2\eta^2\right)\mathrm{erfc}(\eta)-\frac{2\eta e^{-\eta^2}}{\sqrt{\pi}}\right\}+\frac{Gm(1-Sc)}{k^2Sc^2}\,\mathrm{erfc}(\eta)$$

$$-\frac{Gm(1-Sc)}{2k^2\,Sc^2}\{\exp(\frac{kSc\,t}{1-Sc})((\exp(2\eta\sqrt{\frac{kSc\,t}{1-Sc}})\mathrm{erfc}(\eta+\sqrt{\frac{kSc\,t}{1-Sc}})+\exp(-2\eta\sqrt{\frac{kSc\,t}{1-Sc}})\mathrm{erfc}(\eta-\sqrt{\frac{kSc\,t}{1-Sc}})$$

$$+\frac{Gm(1-Sc)}{2k^2Sc^2}\exp(\frac{kSc\,t}{1-Sc})(\exp(2\eta\sqrt{\frac{kSc\,t}{1-Sc}})\mathrm{erfc}(\eta\sqrt{Sc}+\sqrt{\frac{k\,t}{1-Sc}})+\exp(-2\eta\sqrt{\frac{kSc\,t}{1-Sc}})\mathrm{erfc}(\eta\sqrt{Sc}-\sqrt{\frac{k\,t}{1-Sc}})$$

$$-\frac{Gm\,t}{2k\,Sc}\left(\exp(2\eta\sqrt{kSct}\,)\mathrm{erfc}(\eta\sqrt{Sc}+\sqrt{kt}\,)+\left(\exp(-2\eta\sqrt{kSct}\,)\mathrm{erfc}(\eta\sqrt{Sc}-\sqrt{kt}\,)\right.$$

$$-\frac{Gm\eta}{2kSc}\sqrt{\frac{tSc}{k}}\left(\exp(2\eta\sqrt{kSct})\,\mathrm{erfc}(\eta\sqrt{Sc}+\sqrt{kt})+\left(\exp(-2\eta\sqrt{kSct})\,\mathrm{erfc}(\eta\sqrt{Sc}-\sqrt{kt})\right)\right.$$

$$-\frac{Gm(1-Sc)}{2k^2Sc^2}\left(\exp(2\eta\sqrt{kSct})\,\mathrm{erfc}(\eta\sqrt{Sc}+\sqrt{kt})+\left(\exp(-2\eta\sqrt{kSct})\,\mathrm{erfc}(\eta\sqrt{Sc}-\sqrt{kt})\right)\right.$$

$$\ldots(23)$$

Where $b=\dfrac{\gamma}{\sqrt{a}},\quad a=\dfrac{Pr}{1+R},\quad \eta=\dfrac{y}{2\sqrt{t}}\quad d=\dfrac{kSc}{1-Sc}$

In expressions, $\mathrm{erfc}(x_1+iy_1)$ is complementary error function of complex argument which can be calculated in terms of tabulated functions in Abramowitz et al. [21].The tables given in Abramowitz et al. [21] do not give $\mathrm{erfc}(x_1+iy_1)$ directly but an auxiliary function $W_1(x_1+iy_1)$ which is defined as

$$\mathrm{erfc}(x_1+iy_1)=W_1(-y_1+ix_1)\exp\{-(x_1+iy_1)^2\}$$

Some properties of $W_1(x_1+iy_1)$ are

$$W_1(-x_1+iy_1)=W_2(x_1+iy_1)$$

$$W_1(x_1-iy_1)=2\exp\{-(x_1-iy_1)^2\}-W_2(x_1+iy_1)$$

where $W_2(x_1+iy_1)$ is complex conjugate of $W_1(x_1+iy_1)$.

SKIN-FRICTION:

From velocity field , skin-friction at the plate in non dimensional form is expressed as:

$$\tau=-\left(\frac{\partial u}{\partial y}\right)_{y=0}$$

For $Sc\ne 1$

$$=\frac{1}{\sqrt{\pi t}}+\frac{2Gm}{kSc}\sqrt{\frac{t}{\pi}}+\frac{Gb}{a-1}\left\{\frac{b}{\sqrt{\pi t}}+b^2\exp(b^2 t)\,\mathrm{erfc}(-b\sqrt{t})\right\}$$

$$+\frac{Gm(1-Sc)}{k^2Sc^2}\left(\exp(\frac{kSct}{1-Sc})\right)\sqrt{\frac{kSc}{1-Sc}}\left\{\mathrm{erf}(\sqrt{\frac{kSct}{1-Sc}})+\mathrm{erf}(\sqrt{\frac{kt}{1-Sc}})\right\}$$

$$+ \frac{2\,\mathrm{Gm}(1-\mathrm{Sc})}{\mathrm{k}^{\,2}\mathrm{Sc}^2\sqrt{\pi t}} - \frac{\mathrm{Gb}^3\sqrt{a}}{(a-1)}\,e^{b^2 t}\mathrm{erfc}(-b\sqrt{t}) - \frac{\mathrm{Gb}^2}{(a-1)}\,e^{b^2 t}\sqrt{\frac{a}{\pi t}}$$

$$- \frac{\mathrm{Gm}\,t}{\mathrm{k}\,\mathrm{Sc}}\left\{ \sqrt{\mathrm{kSc}}\,\mathrm{erf}\left(\sqrt{\mathrm{kt}}\right) + \sqrt{\frac{\mathrm{Sc}}{\pi t}}\,e^{-\mathrm{kt}} \right\}$$

$$- \frac{\mathrm{Gm}(1-\mathrm{Sc})}{\mathrm{k}^{\,2}\mathrm{Sc}^2}\left\{ \sqrt{\mathrm{kSc}}\,\mathrm{erf}\left(\sqrt{\mathrm{kt}}\right) \right\} + \frac{\mathrm{Gm}}{2\mathrm{k}^{3/2}\sqrt{\mathrm{Sc}}} \qquad \dots(24)$$

NUSSELT NUMBER

From temperature field, the rate of heat transfer in non-dimensional form is expressed as

$$\mathrm{Nu} \;=\; -\frac{\nu}{\mathrm{U_R}(\mathrm{T}' - \mathrm{T}'_\infty)}\frac{\partial \mathrm{T}'}{\partial y'}\bigg|_{y'=0}$$

$$= \frac{1}{\theta(0,t)} + 1 \qquad \dots(25)$$

$$b\sqrt{a}\left\{ 1 + \frac{1}{e^{b^2 t}(1 + \mathrm{erf}(b\sqrt{t}) - 1)} \right\}$$

SHERWOOD NUMBER

From the concentration field, the rate of concentration transfer, which when expressed in non-dimensional form, is given by

$$\mathrm{Sh} \;=\; -\frac{\partial \varphi}{\partial y}\bigg|_{y=0}$$

$$= t\left\{ \sqrt{\frac{\mathrm{kSc}}{2}}\left(2 + \sqrt{\frac{\mathrm{Sc}}{\pi t}}\,\exp(-kt) \right) \right\} + \frac{1}{2}\sqrt{\frac{\mathrm{Sc}}{\mathrm{k}}}\,\mathrm{erf}\sqrt{(kt)} \qquad \dots(26)$$

DISCUSSION: In order to determine the effects of various parameters such as R, K, Sc on flow characteristics the numerical values of temperature field, velocity field, skin-friction, Nusselt number are computed and shown in the figures. Further,

In order to get physical insight into the problem, the values of Schmidt number are chosen to represent the presence of species by hydrogen (0.22) and water vapor (0.60) at 25^0C temperature and 1 atmospheric pressure, the values of Pr are chosen 0.71 and 7 which represent air and water respectively at 20^0C temperature and 1 atmospheric pressure. The values of other parameters are chosen arbitrary.

The effect of radiation parameter R on temperature profile against y (distance from the plate) is revealed in Figure 1. It is evident from the figure that the magnitude of temperature is maximum at the plate and then decays to zero away from the plate. The

increase in temperature is very less far away from the plate in comparison to near the plate. Moreover, it is noticed that an increase in radiation parameter increases the temperature due to increase in thermal boundary layer thickness of fluid. Figure 2 elucidates the effect of time on temperature and it is found that it increases with an increase in time in the whole flow field. The magnitude of temperature is maximum at the plate and then decays to zero asymptotically. Figure shows that fall in the temperature is more near the plate than away from the plate and this fall in temperature is more for higher values of time. The effects of Pr and ϒ on temperature profile is elucidated in Figure 3 & 4 respectively. It is observed that temperature is maximum at the plate then tends to zero asymptotically. Moreover, thickness of thermal boundary layer decreases as Pr increases. The reason is that the thermal conductivity of fluid decreases with increasing Pr, resulting a decrease in thermal boundary layer thickness. It is obvious from figure that it decreases sharply for Pr = 7 than that of Pr = 0.71. On the other hand, the thermal boundary layer thickness increases with an increase in Newtonian heating parameter ϒ as a result the surface temperature of the plate increases.

Figure 5 exhibits the species concentration profiles verses η. It is clear from figure that the concentration at the plate is equal to time then increases to maximum value after that tends to zero as η → ∞. Moreover, an increase in the value of Sc leads to a decrease in concentration boundary layer thickness in the whole field. It is due to the fact that since increase of Sc means decrease of molecular diffusivity which results in decrease of concentration boundary layer. Hence, the concentration of species is higher for small values of Sc. It is also observed that concentration increases with an increase in time whereas it falls with an increase in chemical reaction parameter k. It is noteworthy that since increase in k gives rise to increase in Sc so the same effect is observed as that in the case of increase of Sc.

Figure 6 illustrates the influences of Sc, t on the velocity against η for Pr=0.71 and 7. It is noticed that at the plate, fluid velocity is equal to one then it increases and attains maximum velocity in the vicinity of the plate(η<1) after that it decreases and vanishes far away from the plate for Pr=0.71 whereas for Pr=7 same phenomenon is observed in opposite direction. Further, magnitude of velocity for Pr=0.71 is higher than that of Pr=7. Physically, it is possible because fluids with high Prandtl number have high viscosity and hence move slowly. In addition, magnitude of velocity decreases with an increase in time at each point in the flow field for both Pr=7 and Pr=0.71 when hydrogen gas is present in the flow. The change in velocity is more near the plate than away from the plate due to increase in parameters Sc, t. On the other hand the magnitude of velocity decreases with an increase in Sc for water. It is justified since increase in the value of Sc increases the viscosity of fluid which reduces the velocity of fluid whereas velocity increases with an increase in the value of Sc for Pr=0.71.

Figure 7 indicates the effects of G, Gm on velocity profile for Pr=7 and 0.71. It is noticed that the magnitude of velocity increases with η then attains its maximum value then decreases far away from the plate for Pr=0.71 and for Pr=7 same shape of velocity profile is observed in reverse direction. For Pr=7 boundary layer separation occurs for all values of parameters. Moreover with an increase in Gm the magnitude of velocity decreases for air whereas increases for water. Moreover with an increase in value of G the magnitude of velocity increases for air but decreases for water.

The effects of k, ϒ on velocity profile for Pr=7 and Pr=0.71 is indicated in Figure 8. It is clear from figure that the magnitude of velocity is equal to one at the plate then increases to maximum value after that it decreases to zero value for Pr=0.71 but for Pr=7 the same shape of profile is found in reverse direction. On the other hand it is observed that fluid velocity increases with an increase in the value of chemical reaction parameter k for air but it decreases with an increase in value of k for water. It is due to the fact that increase in chemical reaction parameter k gives rise to an increase in viscosity of fluid which means velocity boundary layer thickness

decreases. It is also concluded from figure that fluid velocity increases with an increase in value of ϒ for Pr=0.71 whereas for water the magnitude of velocity decreases with an increase in value of Newtonian heating parameter. The change in thickness of velocity profile due to variation in the values of ϒ and k is more near the plate than away from the plate.

Figure 9 depicts the skin- friction against time t for different parameters. It is clear from figure that for smaller values of t the maximum value of skin friction occurs and then it decreases rapidly with an increase in t (t ≤0.5) and after this value of t the value of skin friction falls slowly. The magnitude of skin friction decreases sharply with an increase in t for higher values of Gm and k. Moreover, the Figure depicts that the value of skin-friction increases with an increase of Gm. It is observed from figure that magnitude of skin friction is lower for hydrogen gas (Sc=0.22) in comparison to water vapor (Sc=0.60). Physically, it is correct since an increase in Sc serves to increase momentum boundary layer thickness. Moreover, magnitude of skin friction increases with an increase in the value of chemical reaction parameter k.

Figure 10 exhibits the Nusselt number against time. It is observed that Nusselt number decreases as time passes and it decreases sharply for $t \le 0.4$. It is also concluded from the figure that there is a decrease in it with an increase in the value of radiation parameter R and Newtonian heating parameter ϒ. Further, the value of Nusselt number increases with an increase in Pr. It is consistent with the fact that smaller values of Pr are equivalent to increasing thermal conductivities and therefore heat is able to diffuse away from the plate more rapidly than higher values of Pr, hence the rate of heat transfer is reduced.

Figure 11 depicts the effect of chemical reaction parameter k and Schmidt number Sc on Sherwood number. It is found that Sherwood number increases with an increase in k and Sc. Since increase in Sc means decrease in molecular diffusivity which in turn gives rise to increase in Sherwood number as Sherwood number is the ratio of convective and diffusive mass transfer coefficient. Chemical reaction parameter increases the interfacial mass transfer so Sherwood number increases with an increase in k.

CONCLUSION: This paper presents an exact solutions of natural convection flow of chemically reactive incompressible fluid past a vertical plate with Newtonian heating and variable mass diffusion in the presence of radiation. The Laplace transform technique is used for solving the problem. Numerical evaluations of closed form solutions were performed and some graphical results were obtained to illustrate the details of flow, heat and mass transfer characteristics and their dependence on some physical parameters. From the present study we can make the following conclusions:

1. Increasing radiation parameter and Prandtl number the temperature decreases whereas it increases with increasing time.

2. Concentration profile decreases with an increase in Sc and k whereas it increases with an increase in time.

3. Fluid velocity decreases with an increase in Sc, k, G and ϒ for water whereas velocity increases with an increase in the value of Sc, G, k, ϒ for air. On the other hand it is observed that fluid velocity decreases with an increase in the value of time for both Pr=7 and Pr=0.71. It is also found that velocity of fluid decreases with an increase in value of Gm for air but it increases for water. Further, velocity also decreases with an increase in value of Pr.

4. There is a rise in the value of skin friction with an increase in Schmidt number, chemical reaction parameter and modified Grashof number. The rate of heat transfer increases with an increase in the value of Prandtl number but decreases with increase in ϒ and radiation parameter. Sherwood number increases with an increase in chemical reaction parameter and Schmidt number.

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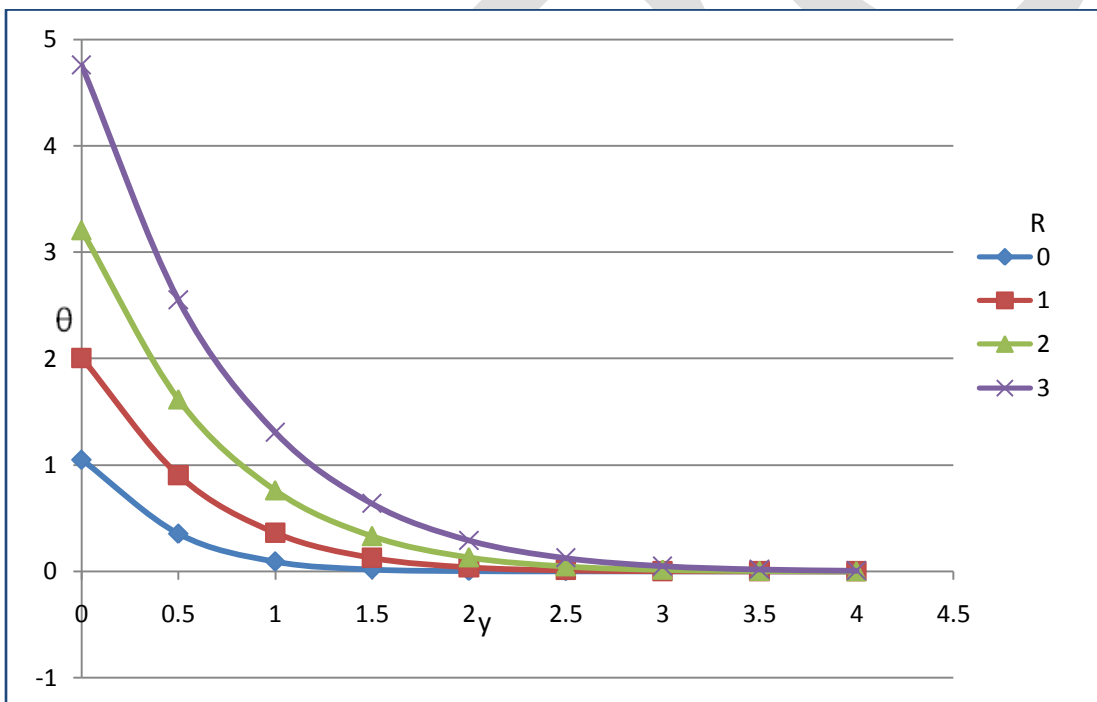**Figure 1: Temperature profile ϒ=1, Pr=0.71, t=0.2**

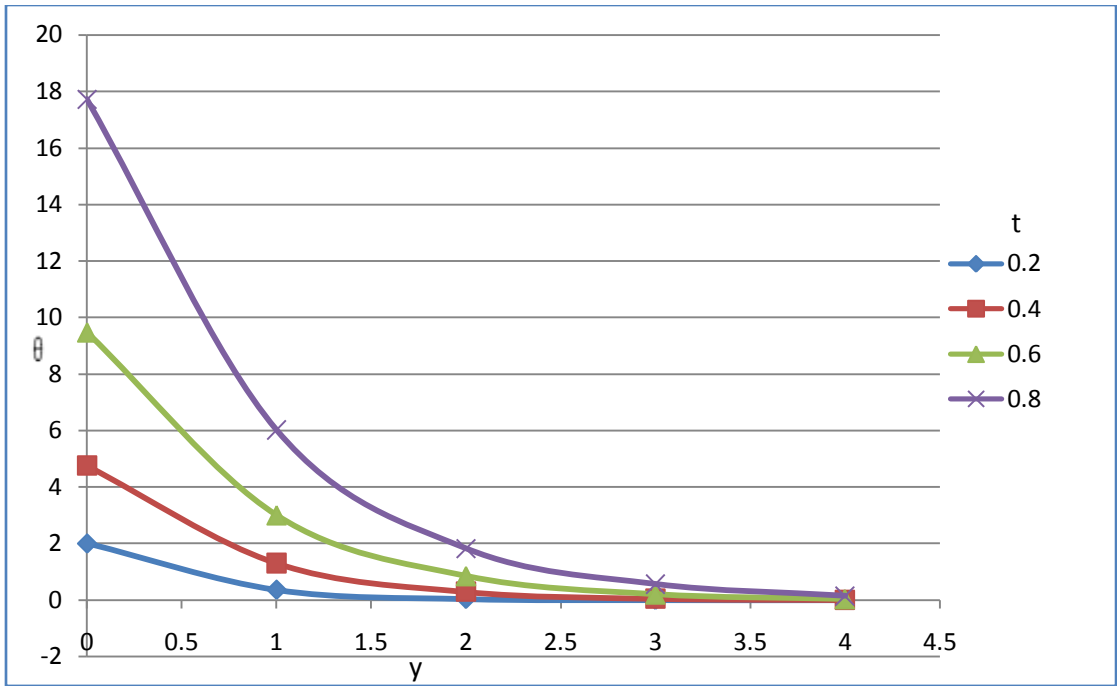**Figure 2: Temperature profile ϒ=1, Pr=0.71, R=1**
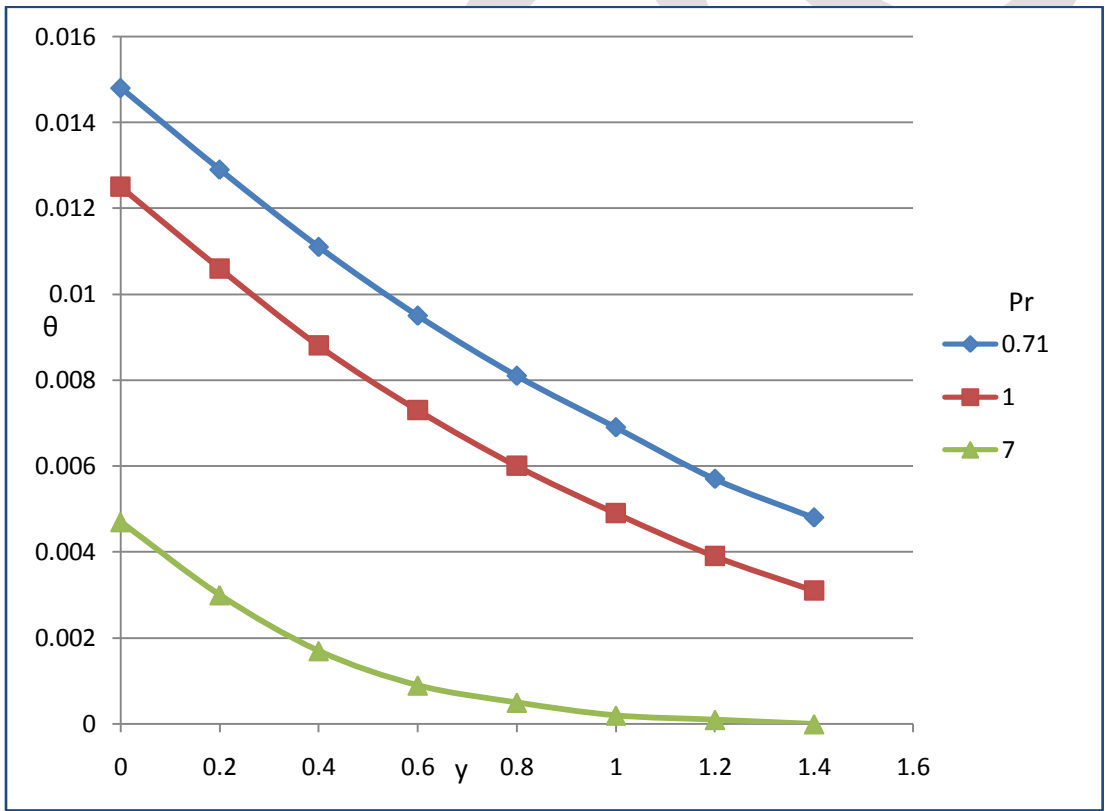
.**Figure 3: Temperature profile ϒ=0.01, R=5, t=0.2**
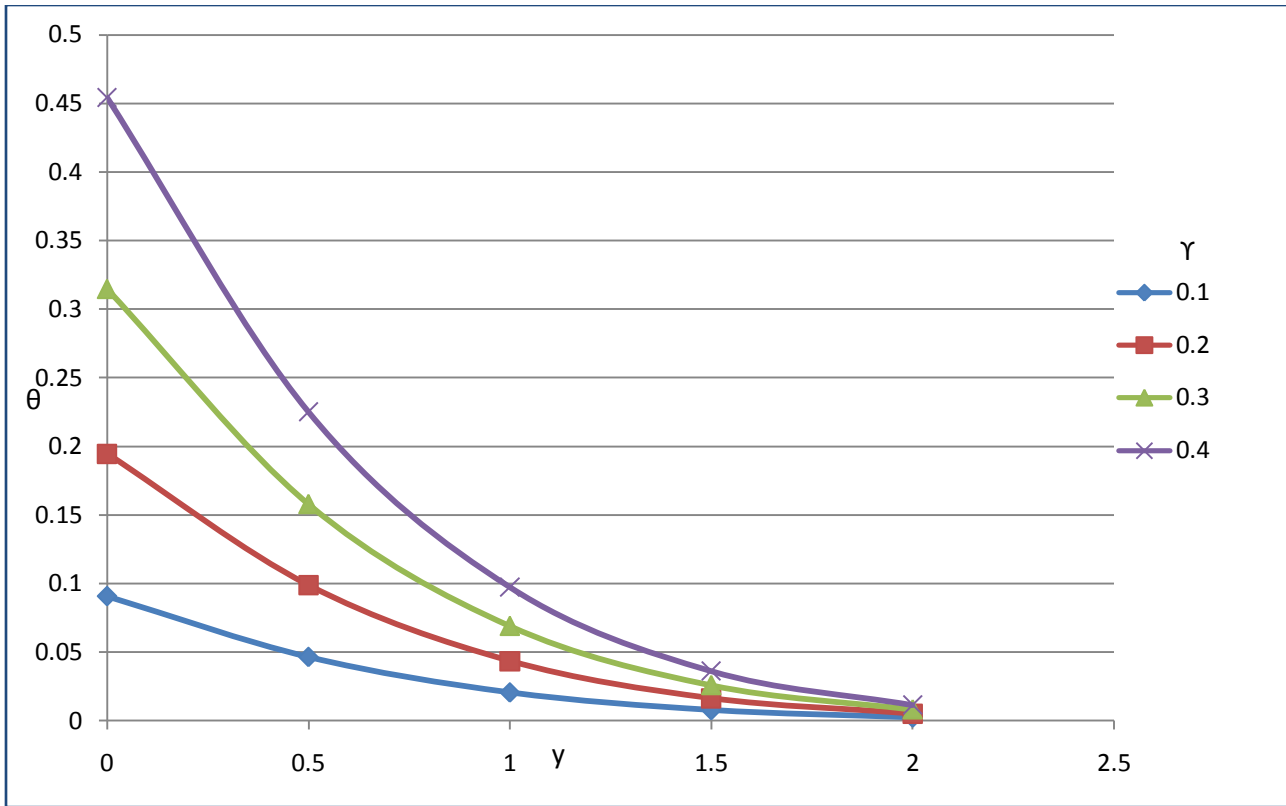
Figure 4: Temperature profile t=0.2, Pr=0.71, R=1
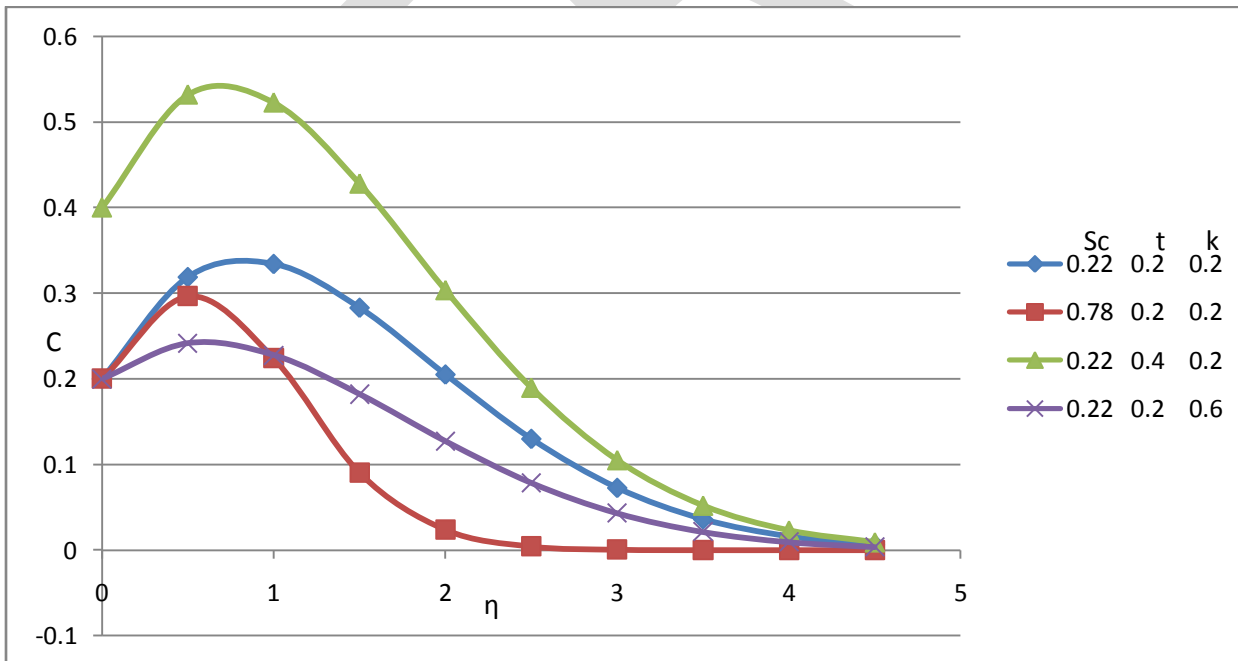
Figure 5: Concentration profile

Sc	t	Pr
0.22	0.2	0.71
0.60	0.2	0.71
0.96	0.2	0.71
0.22	0.4	0.71
0.22	0.2	7
0.60	0.2	7
0.96	0.2	7
0.22	0.4	7
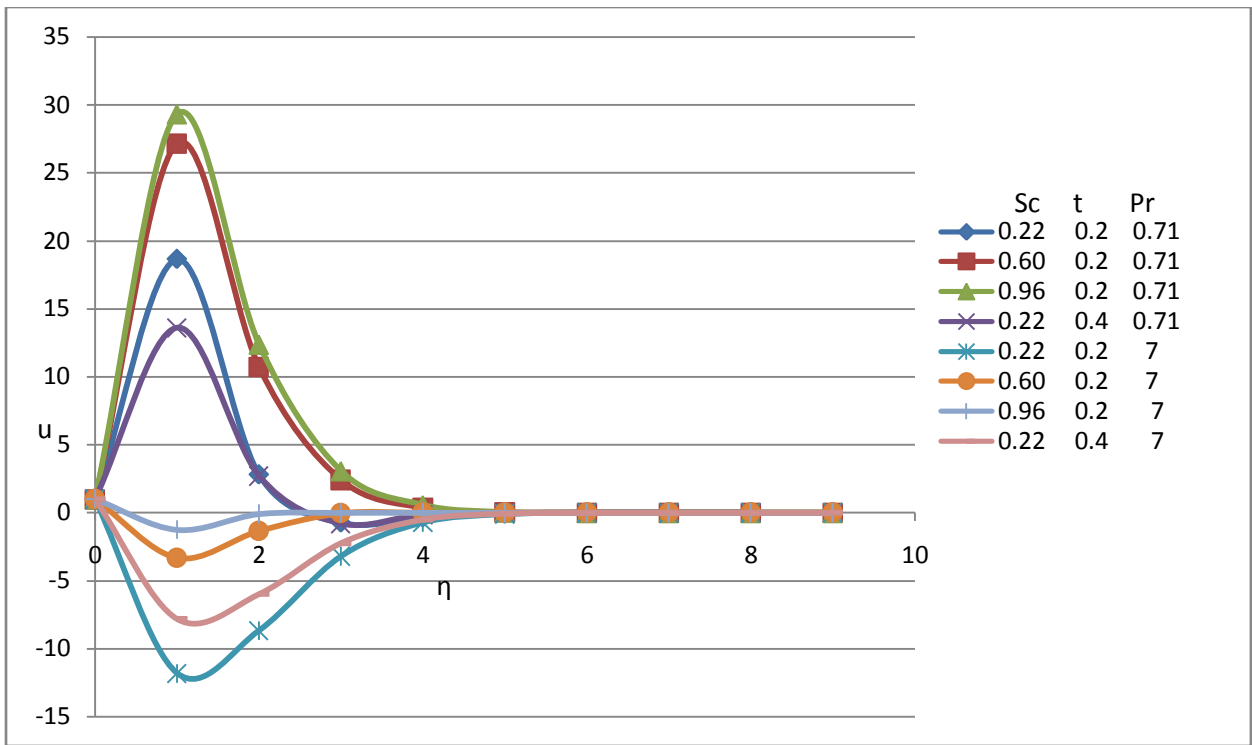
Figure 6 : Velocity profile for R=2, k=0.2, G=5, Ɣ=1, Gm=2

G	Gm	Pr
5	2	0.71
7	2	0.71
5	4	0.71
5	2	7
25	2	7

Figure 7: Velocity profile Sc=0.22, t=0.2, Ɣ=1, k=0.2, r=2

Figure 8: Velocity profile R=1, t=0.2, Sc=0.22, G=5, Gm=2

Figure 9: Skin-friction for R=3, G=5, Pr=7, ϒ=0.2

Figure 10: Nusselt number

Figure 11 : Sherwood number

Optimal Integrated planning of a Public Transit System

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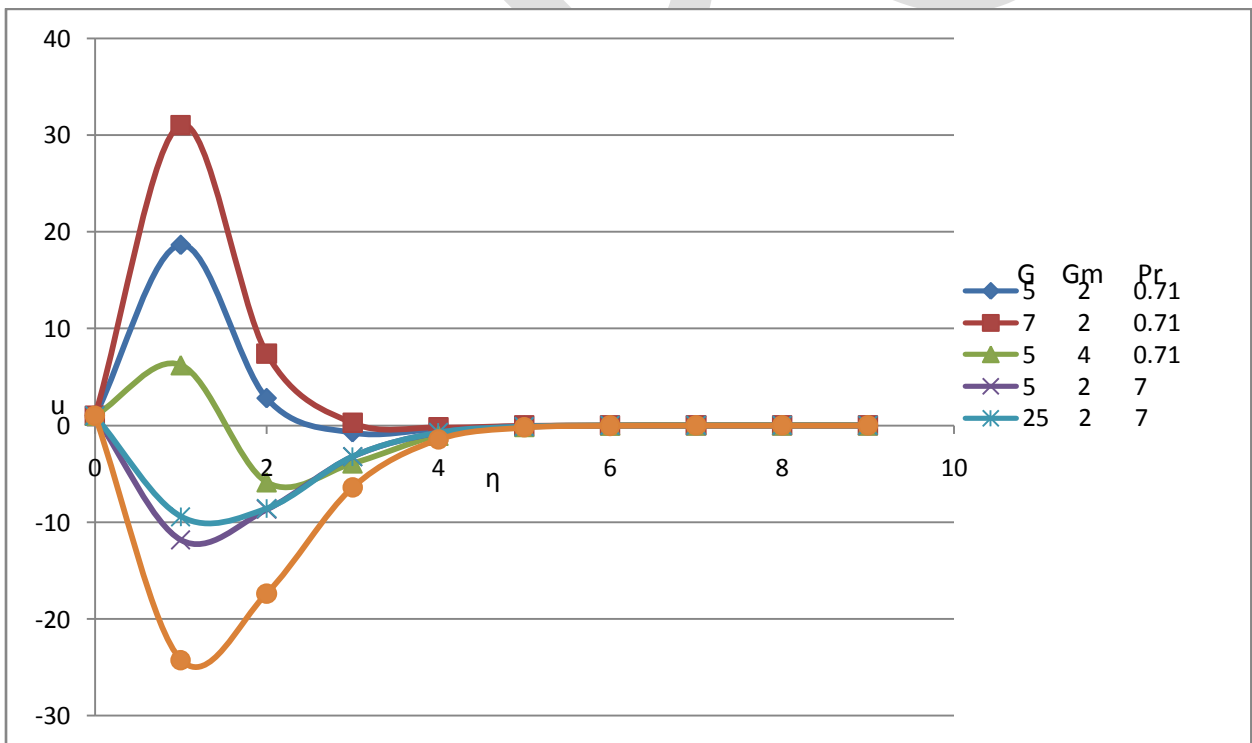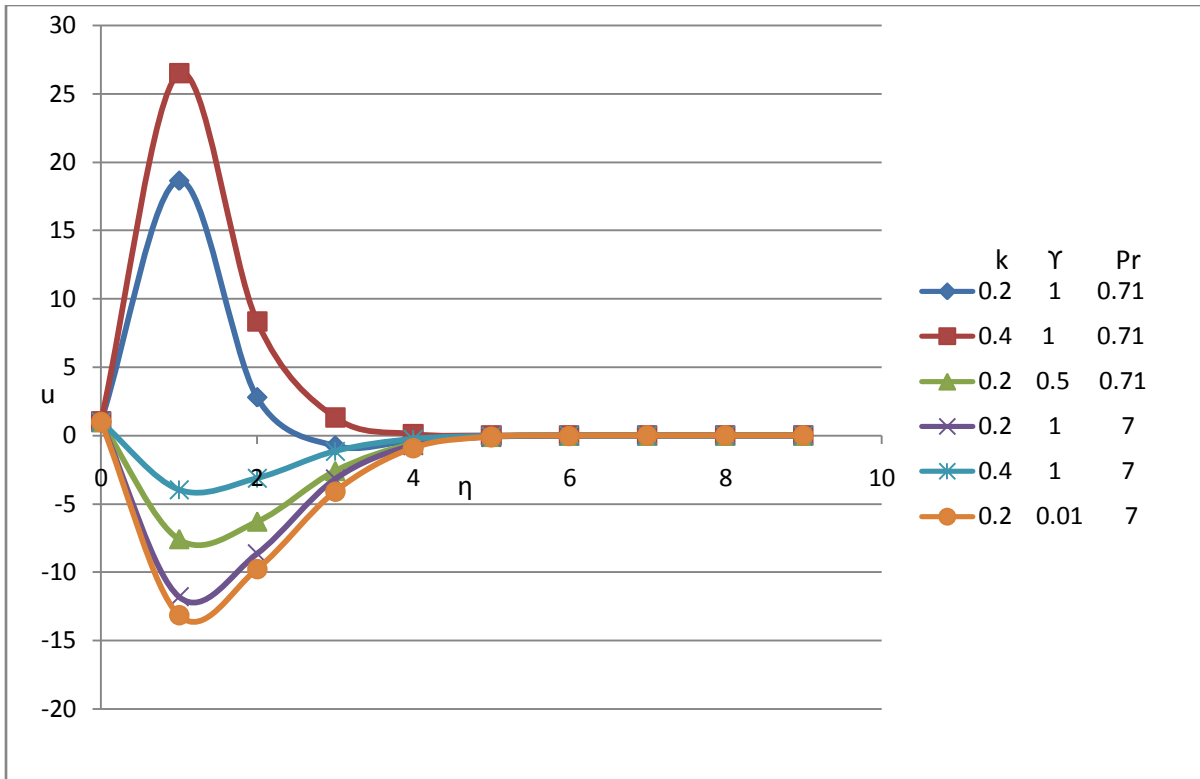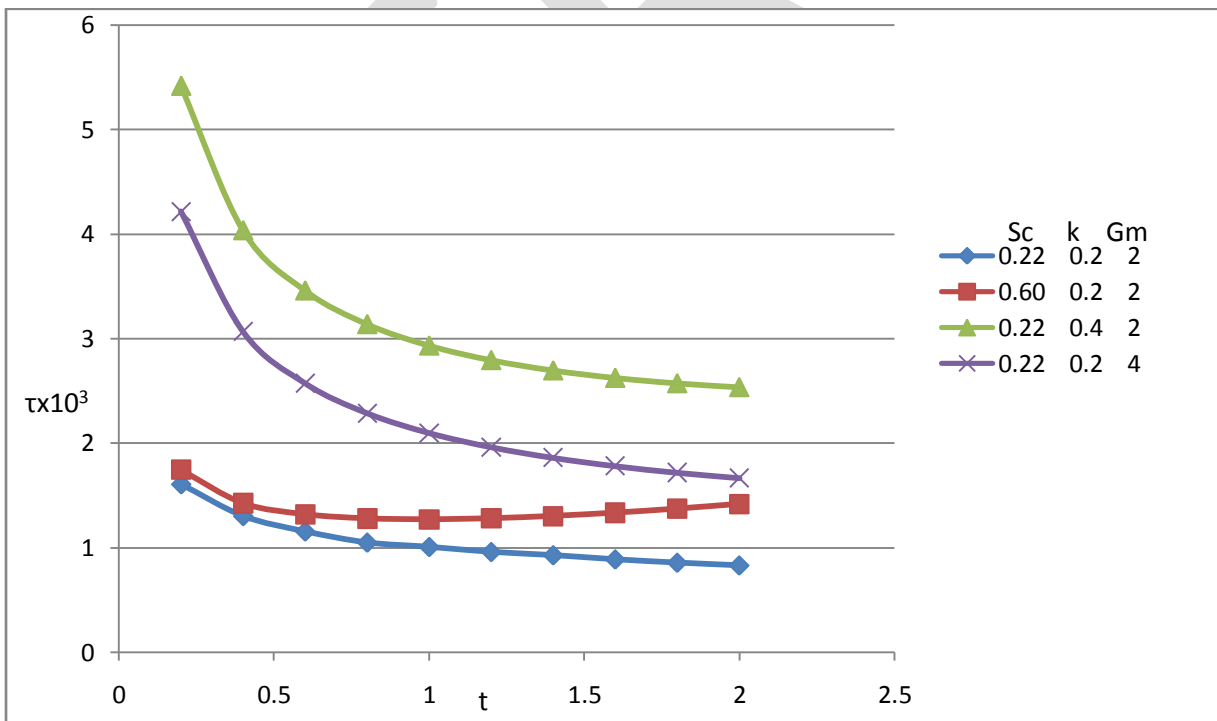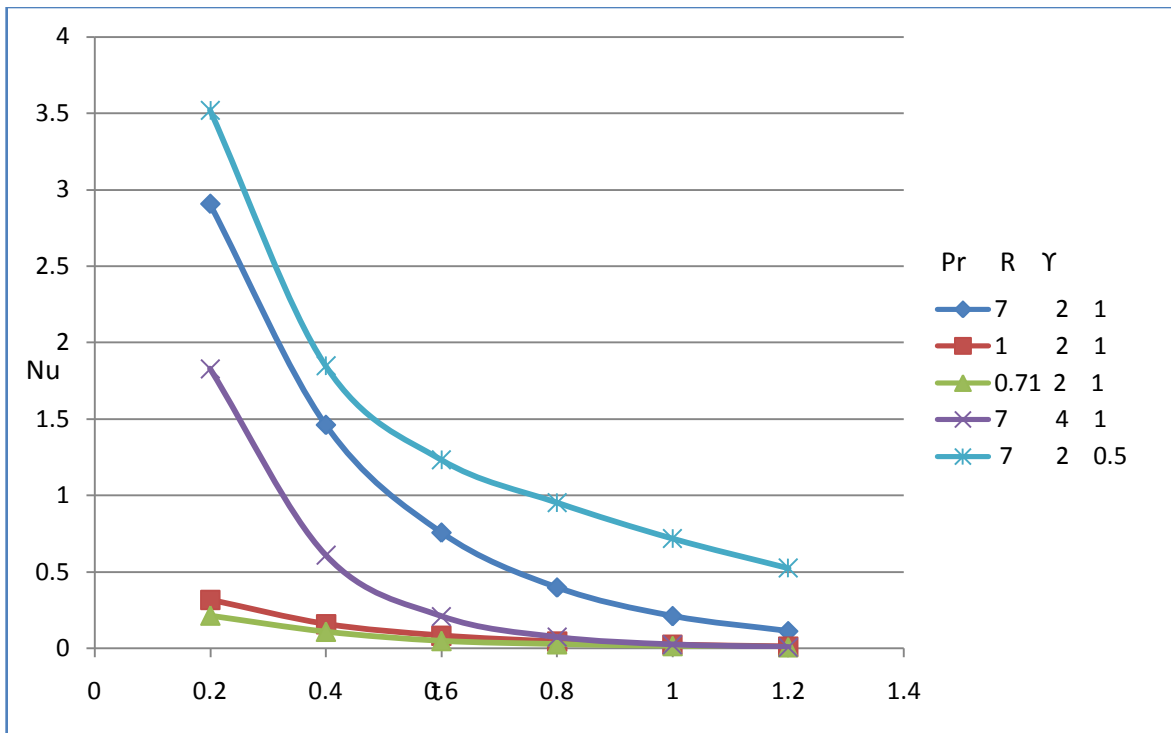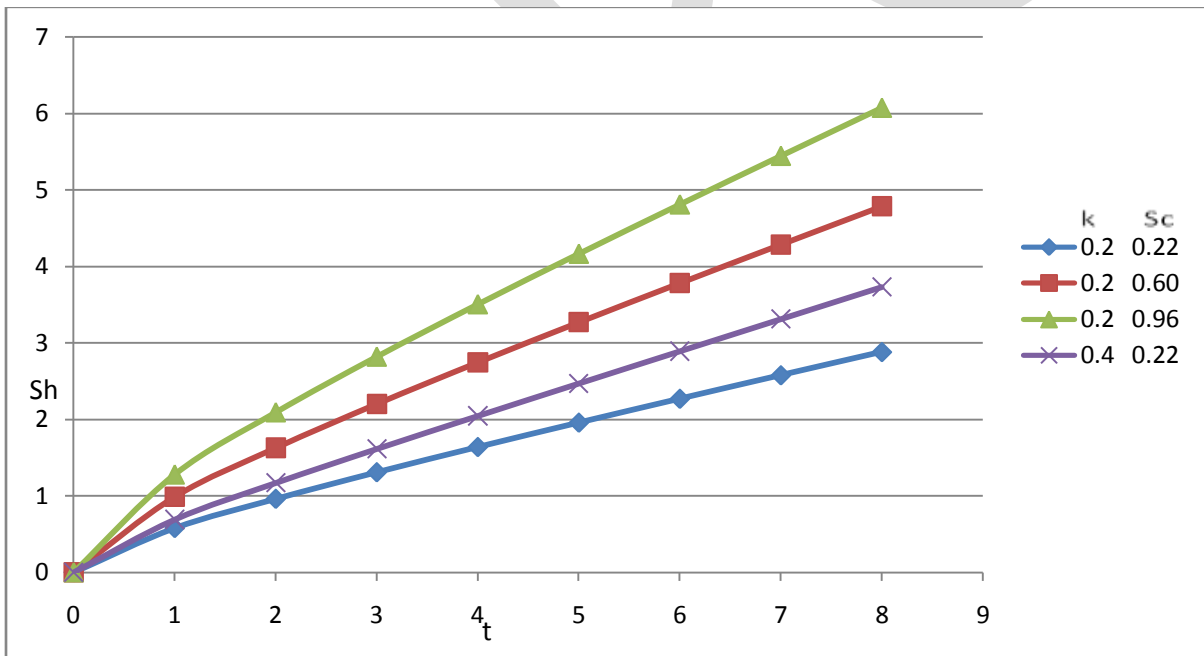[2] Corresponding Author, Professor, Department of Civil and Environmental Engineering, California State University, Fullerton, CA. 92834, USA, cputcha@fullerton.edu , Phone: 657-278-7017

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Abstract: This paper is a study of the public transit systems. It includes an analysis of various regional transportation modes and arrives at optimal number of commuters patterns. The main focus is on the study of public transit systems issues in a medium size metropolitan environment. The thrust of this paper however is the establishment of criteria for public transportation needs of today and for the foreseeable future. While the final routes arrived are optimal, instead of using traditional optimization tools, an innovative approach in planning and organizing commuter travel using surveys is explained first and then the concept of TRUNK-BRANCH in public transit usage is presented in detail using a hypothetical example. Multi-modal approach is presented as possible solution to public transit. This paper delineates an approach in planning a public transit system that can be introduced in a small to medium scale environment. Attempts are made to address issues in public transportation in urban areas of any magnitude, from an average town, county partial system, to the 'one-line' origin-destination system.

INTRODUCTION

Studies on issues regarding public transit systems in a metropolitan environment are numerous. However, very few introduce any kind of a design concept, yet on a large scale. The basic approach of many of the research papers deals with fixing temporary commuting problems. The approach in this paper deals with issues in a metropolitan environment, and on a regional basis, embracing a wide range of problems and solutions. The establishment of criteria for public transit systems is presented by using the concept that gave birth to a Trunk-Branch system. Those commuter concentrations along certain routes, by way of survey information, may be the key to better planning of public transit. This approach is indeed the key element in design of a public transit transportation system for now and for the foreseeable future

The above-mentioned approach in planning a public transit system can be introduced on any scale anywhere, small scale, as well as large complex 'megalopolis' regions. Addressing issues in public transit in urban areas, of any magnitude, will be best served by the origin-destination survey method approach. The need of this research paper arose because the existing systems address minimal non-coordinated transportation routes, complicating commuter needs, wasting people's time and resources. Based on observations of mass transit in many metro-areas, it is obvious that in congested areas, where high-density population corresponds to heavy street traffic, a solution other than just buses and taxi-cabs needs to be found.

Subsequently many such metro-areas had to construct either elevated transport or underground subway systems, for moving people quickly within or out of the congested areas. For example, one method to avoid congestion at intersections could be the implementation of "ONE-WAY" streets that also avoids left turn accidents. The trend of inter-county commuting will continue to grow due to community allegiance, prohibitive housing prices, and extraordinary moving expenses. In this paper subway/metro, public transit/mass transit/rapid transit, lines /routes, riders/commuters are used interchangeably.

STUDY OBJECTIVES

This paper attempts to demonstrate an innovative approach in public transit design. No design of an actual system is provided however, except suggestions wherever appropriate. The main idea for our paper originated and prompted by the Orange County (O.C.) California bus system.

LITERATURE REVIEW

An effort has been made regarding transit design to locate trends similar to Trunk-Branch (T-B) design approach [9, 11]. The closest came to be the 'feeder' method, or bus lanes that share a common traffic route, referred to as 'trunk'. Most of the research papers do not address the issues of a basic design approach at all [3], nor the actual implementation by way of modes, multimodal systems based on a design, rather most of the papers deal with operational issues [3, 5]. Some of the research papers are sponsored by the bus industry promoters [1, 6, 7, 8, 11]. Public transport studies reviewed include primarily existing large systems. There is no consistent existing method that fits into T-B model. Many papers deal with surveys, except that some utilize U.S. Census information, seeking auto-less poor people, some relying on samplings, others on phone interviews, and or casual street survey, or any guessing techniques. Some research deals with car-bus accidents [12], frequency of stops, and idling engines which increase air pollution [8]. All transportation planning efforts in the U.S. under federal rules start with a multi-modal approach within a wide study corridor. Many studies – especially those assuming Bus Rapid Transit (BRT) or Light Rail (LRT) as an option – develop trunk-branch alternatives and have bus feeder services.

The authors of this paper believe that there is a growing demand for public participation in decision making as well as concern for safety and pollution issues. A primary factor regarding commuting and other uses in mind must be what's in the public interest. In addition, public transportation must provide maximum commuting possibilities to reach any destination, not only to work within a metropolitan area but also to the full satisfaction of the public.

METHODOLOGY

The concept, introduced herein, addresses an innovative approach, the process of which will be explained in the paragraphs that follow. Contrary to the present existing political scenario, which is to satisfy special interest groups to some extent, this research paper describes a simple method, by involving the general public to its maximum. Mass transit, as some identify correctly, its importance should originate with the public. The paper describes in detail how to obtain information from commuters. First we employ the SURVEY method on a low budget approach. Next is the description of the "Trunk-Branch" concept and design sequence. Analyzing data obtained from the public is the basis as it helps in commuter problems' solutions and then coming up with a "Dynamic Master Plan" which is essential to create and establish a range of transit solutions. The project is a guide for design, but it is not an actual means of implementation. Hence, this paper does not deal with detailed design of subway, or elevated systems; however, it introduces the three modes of public transit.

TRUNK-BRANCH (T-B) DESIGN SEQUENCE

T-B is a three-part design concept, components of which are:

1. Commuter surveys to establish a database
2. Trunk-Branch calculations and configurations
3. Dynamic Master Plan (DMP)

COMMUTER SURVEYS

Surveys provide a systematic approach. Public participation is critical. Steps in organizing surveys needed for public transportation may be overwhelming, nevertheless possible. Surveys are conducted to find out commuters' needs, (commuting by train, bus, etc.), and these are as good as people's intentions. Surveys, while voluntary, must be strongly encouraged. Surveys should be conducted everywhere, including schools (elementary, high schools, colleges), places of work, clubs, organizations and cultural centers. Surveys can be conducted in worship sites (churches, temples, mosques, etc.), and shopping centers, government centers, neighborhood centers, and any location where people gather. It does not make any difference what people use to move around, it is the need to know the facts for future consideration in planning road-networks and public transportation. The survey method description is a low budget deal; it can be conducted periodically, and is of enormous benefit.

Survey Instructions

Surveys are usually conducted in person, however surveys can also be conducted using carton boxes filled with forms and displayed in public places (sample form shown in Figure 1). First, ask people politely to fill out a form as instructed. Instructions to prospective commuters should include the following as a minimum: fill in for every trip that day, for each separate segment, per week that month and as many cards as needed for the current month only. Each month will be indicated by a different color for ease of identification. A method of transportation means how one gets from here to there, by bus, by car, on foot, bicycle, train, etc. Hence, by indicating one of the above means of transportation can help in identifying public needs. Any comments should be written on the back of a card. Survey data-base should provide a baseline for future critical decisions. Of interest are the additional participants in the SURVEY who are the population dispersed in and outside of metro-areas. This is to determine the density of commuters on segments of streets and roads everywhere, each and every month. That includes cities, county, regional centers, etc. The tendency and patterns of a commuting public can then be examined, and thus only by way of the survey method, as suggested above.

Please indicate major street intersections of trip origin and destination

(No name or address required)

Leaving from: _____   Going to: _____

City / Town / Neighborhood: _____ /_____

Please check one:

Time of trip: am (morning)   noon (midday)   pm (afternoon / evening)

Driving alone   Driver + passenger   Driver + multiple passengers

---

Means of transportation (please circle):

car   truck   bike   bus   taxi   train   boat   walking   jogging   cable car
other

Please add comments on the back of this card

Figure 1: Sample Commuter Survey Information Card

It is imperative that critical that those all who commute any distance in the metropolitan area participate in the periodical surveys. Every effort must be made to maximize participation of the public that will yield a better view and understanding of the needs, and consequently a better basis to work with to construct a more valid "Trunk". It is the civic duty to help in planning a better public transit system. More data with public assistance will result in creating a more reliable data base; it will show people movement patterns (individual or group) in a particular segment and also on a wider scale. Any other survey methods like sampling methods provide a trend while T-B surveys indicate public needs. The authors are fully aware of some of the caveats and limitations of the sampling techniques used in this study such as non-randomness, lack of consistency for filling the forms as well as duplicates from the same person.

Trunk-Branch (T-B) Concept

The "Trunk-Branch" concept is based on a principle that any line originated at some point must have a destination, i.e. a terminal point. Any such line may run parallel to any other line (in vertical view, or by way of overlay). The implementation of this simple principle in a transportation network, where transit routes are of concern, allows route design that include, for the sake of speedy transit, selective express lines. This creates somewhat an advantage over existing route outlines (like bus routes crossing each other) as generally depicted by various bus companies schematics on their schedules.

T-B is based on results from analyzed survey data, and by manipulating any possible routes; it is therefore the surveys that are the essence of T-B. A number of possible T-B models may emerge as a result of available data. It is important because it shows where there is a concentration of prospective ridership, and therefore merging routes from branches. Thus T-B helps in resolving design matters in public transportation. The advantage of T-B configuration is that it allows the formation of express lines, or a combination of 'express-local' service. It lends itself best for an implementation of a true rapid transit system, (i.e. express or quick) for transportation of people. The T-B based design system benefits more riders as more public vehicles (bus or train) frequent the 'trunk', and thus serving the commuting public better. T-B is therefore providing a lead to an overall design for a comprehensive public transit system. It does not determine the medium of transportation to be instituted, rather the trend of population movement across a county, within a county, or outside the limits of a county.

The characteristics of T-B are that a branch is not considered a feeder, rather is an extension and a tree-like branch of a trunk. Secondly, branches merge into a Trunk, and then split back into branches where appropriate (see Figure 2). T-B is a demand oriented approach concept. It reflects the pattern of a commuting environment.
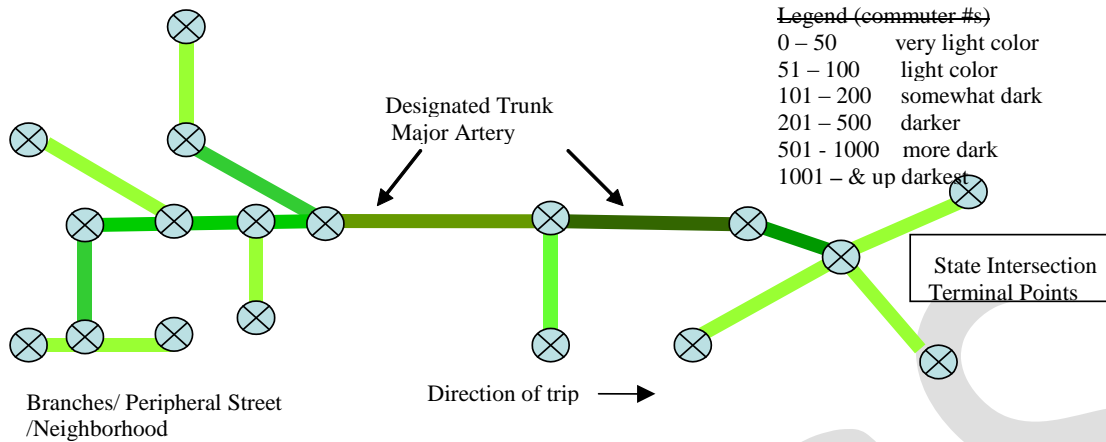
Figure 2: Trunk-Branch concept development illustration

Note: Overlapping, merging 'Branch' segments become a potential 'Trunk' by adding up the number of commuters based on the surveys, and expressed here in color (shades of gray to black); Any color shade does NOT represent commuters, but a range of numbers (i.e.,commuters); Lines represent streets/roads; The concept of 'Direction' in reality works both ways, i.e. people commute in any direction.

Defining T-B Network Procedures

T-B is unique in its approach by defining 'Nodes' at 2 points and its possible direction, confined to existing conditions, or by default, i.e. entering a desired X 'Node' value. That is important to state because most major street intersections are preferred. For instance, transit cannot be provided to a cul-de-sac. Trunks do not necessarily reflect modes of operation; however, they are best suited for rail systems. They benefit more riders (sub-trunk – frequent riders) thus better serving the commuting public, as more public vehicles (bus, train) frequent the 'trunk', and thus leading to an overall comprehensive design of a public transit system.

Processing of a Commuter Record

A preprocessing procedure may be used to convert intersection data to Global Coordinate System values, as defined by surveyor's maps, and confined by taking Global Positioning System (GPS) readings. A node 'N' is predetermined, based on default value, namely (x, y) coordinates of an intersection. Each defined 'Node' may have up to 3 possible outgoing attributes as indicated by node in-out arrows (see Figure 3).
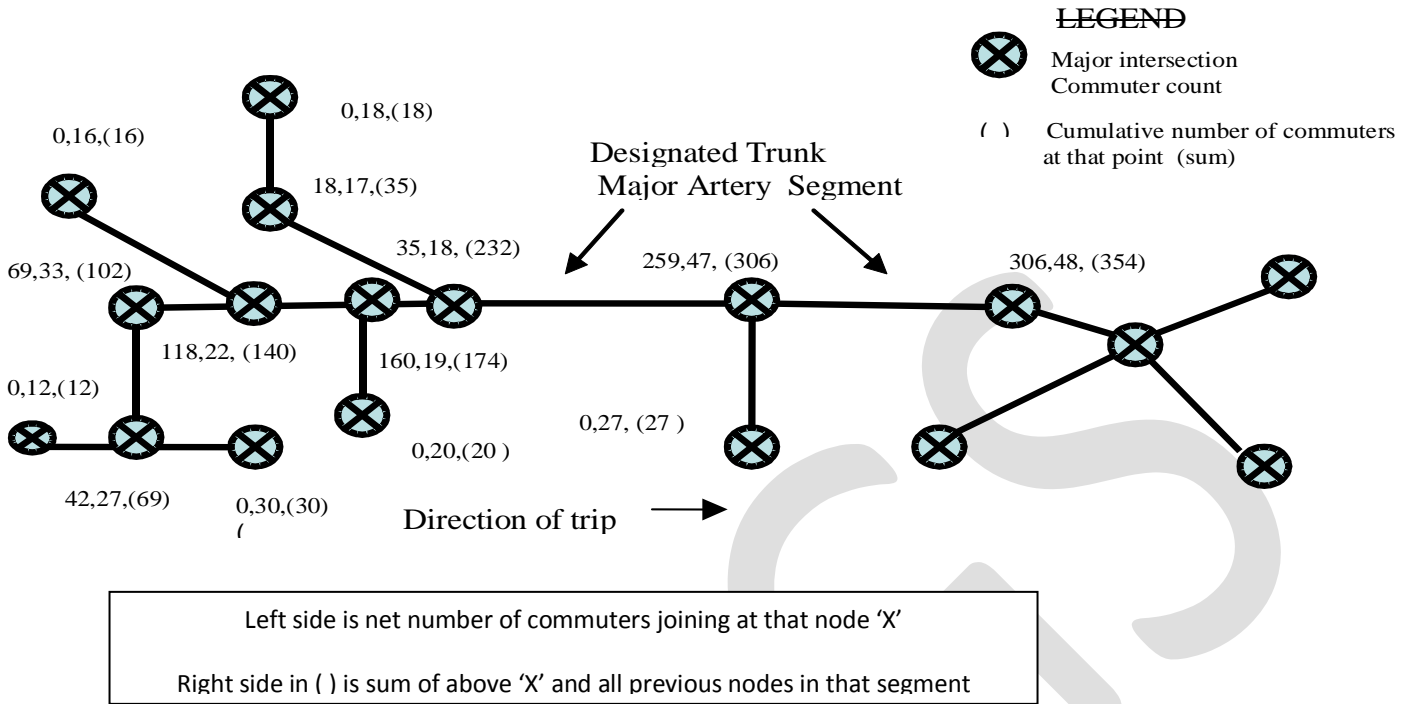
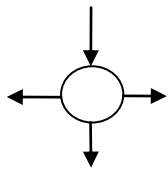**Figure 4**: Trunk-Branch concept illustration example

Figure 3: Three outgoing attributes

T-B is a class of its own. For clarification purposes a general case is presented here. For the purpose of T-B design, intersections are defined for convenience as conventional nodes. As indicated earlier a 'Node' identifies an intersection, or landmark, or point of interest, and is assigned a pair of coordinates (x, y). The number at the node for example 18,17,(35) where left number represents added commuters at that point (i.e., 'N'), and that in parenthesis is the sum of commuters at that point at a particular time. This is done for each and every commuter record processed (Figure 4). The whole operation is internal and according to an algorithm. Therefore the calculations depict a T-B path for each survey card (entered by a commuter). Based on the initial and final destination, an algorithm will find the direction of next 'Node', add to the sum, and then repeat the iteration process until the destination 'Node' is found. This essentially provides the algorithm for a software program that can be handled separately.

T-B legend shown in the example (Figure 2) is only a suggestion. It starts with a pale color (T-lines), the deeper the color of a segment between two nodes the heavier the concentration of commuters on that segment (between two nodes only). For a designer T-B intensity-shade of color may correspond to either single/multiple lanes or rail-tracks. A dark color of T means it reached saturation, and destined to be a Trunk. Different densities in color-shade may vary along any line, indicating commuter embarking or disembarking at a 'Node'.

Processing the Example

The cumulative progresses are shown in an example (Figure 5). Let A, B, C represent nodes (x, y coordinate address).

(a)Single record – one commuter   (b) When a record (or records) is added to the sum
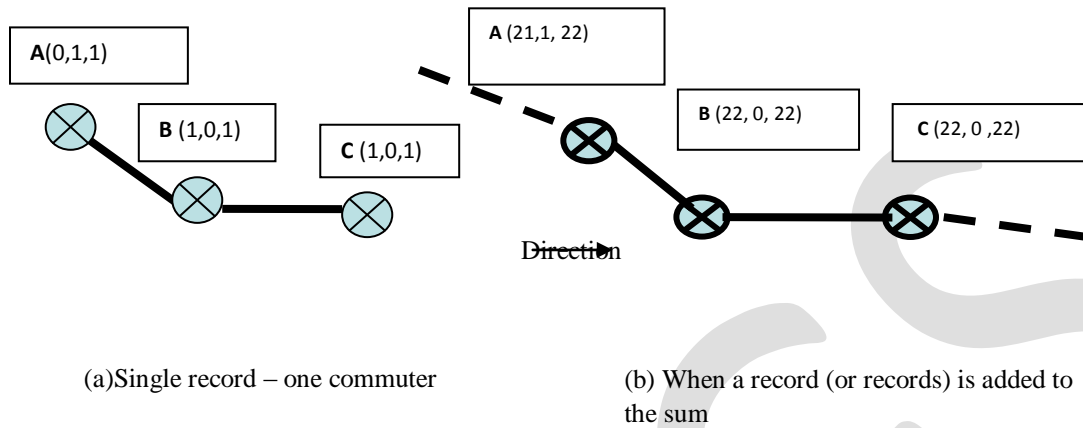
Figure 5: Calculation example for A, B, C Nodes

Let A (i, j, k), B (i, j, k) and C (i, j, k) represent the formula for each node being processed where

  i = previous number of commuters (from previous nodes)

  j = present number of commuters (added at node)

  k = total number of commuters (at that node)

A middle node assumes the following formulation:

  $i_e = j_f + j_g$ where I_e is middle node, j_f is left side node, j_g is right side node
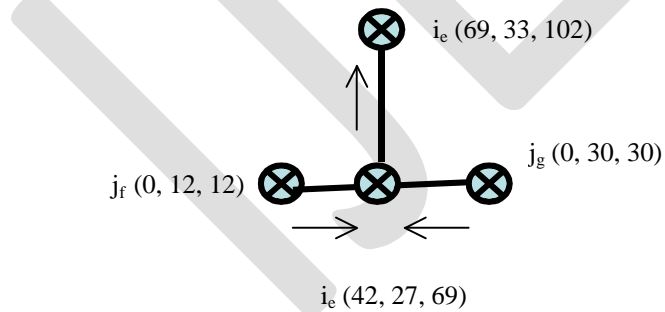
Figure 6: Segment of Figure 3 demonstrating concept calculations

The above example depicts a trip of one (or more) commuter within an overall T-B system (schematically). It does not matter where in the system the trip takes place.

Each individual commuter card is one new record. Therefore a one (1) is being added to the commuter count in calculating the number 1(sum), the new sum is then (1+ previous sum). It's entirely internal to the system, not visible to the user, and is part of the processing; it is presented here solely for explanation of the buildup method of a T-B network. As more commuter records are processed, the number to the left and inside parenthesis may or may not change, while the number in parenthesis (sum), serving as the color-change-argument, may change, as represented in the graphics (Figure 2). A dark color indicates a possible design consideration for a rapid, (express) efficient commuter's channel. The rationale of a 'RANGE' of numbers is an indicator for commuter density. That occurrence helps in defining a possible TRUNK.

The evolution of a single commuter record (survey card) as part of and into a complex T-B system has been demonstrated here. T-B concept can be applied to major highways (freeways/expressways) as well as rail and bus (surface, elevated, subways). It has many advantages. It allows different configuration study models for the purpose of designing a proper transportation network. Based on the survey study it helps to optimize the use of the overall system. T-B may indeed unintentionally coincide with a major route (thoroughfare). T-B thus serves as a guide in establishing a workable master plan, which in turn enables planning of an efficient public transit system. It can be shown that it is adaptable for use of an inter-modal arrangement of any magnitude.

This paper described software principles only. To accomplish the T-B processing procedures, a complete software package must be developed for use.

Dynamic Master Plan (DMP)

A DMP for Public Transit is an overall plan that serves to devise a layout part by part of an intended successful public transit system. DMP means a progressive, adjustable plan to satisfy the needs of the commuting public, implementation of which will eventually accomplish its purpose i.e., better commuting. DMP emanates naturally from a T-B configuration. It is the closest dealing with actual issues of implementation. By its very definition it should be updated periodically to reflect commuters needs, and it does not matter whether they use public transit or other means of transportation. It serves the public and appropriate authorities for future planning and statistics.

A master plan processor may use an adjustment formula to optimize route generation. Thus T-B has many advantages over other planning methods. Its design is independent of special implementation interests (buses, car lovers etc).

PUBLIC TRANSIT SYSTEMS

No particular transit system is being recognized as preferred for T-B design. Definitely no single mode of transportation can satisfy the needs of a metropolitan area. It only depends on the will of the public to invest in the best possible transportation infrastructure. As indicated below, three basic systems of transportation are identified in this paper [12]:

- Category A – Freeways or divided, controlled-access highways which serve only through traffic.
- Category B – Arterials, some of which are partially grade separated multilane roadways serving mostly through traffic.
- Category C – Urban streets, which serve primarily local traffic accessing the served area.

The most desirable system, true RAPID TRANSIT, is the underground system. A rail system independent of traffic lights, it takes off lots of cars from the streets and tons of health damaging fumes. It delivers fast, safe, and secure commuter service void of accidents, compared to roads, no 'freeway rage', reliable, controllable, and long lasting, but more costly to build.

SUMMARY, LIMITATIONS, CONCLUSIONS AND RECOMMENDATIONS

T-B is a viable method and could be the basis for design of a public transit system. Based on the surveys and T-B results, it allows transit professionals /administrators to make any adjustments and improvements, serves as a guide in any further developments, and enhancements needed to provide better service to the general public.

Metropolitan areas require multiple modes of transportation to satisfy their changing public needs. People happen to travel long distances. Examples of multiple needs are trips to work or business, medical, educational or cultural activities or appointments. Hence the outcome of any design has to be a system that satisfies the needs and convenience of commuters. Current systems do not address the needs of commuters and most deal just with ground surface transit like buses. Surface street transportation is getting saturated and causing damage to public health, loss of time and productivity. Contrary to other studies T-B is not involved in bus fare, bus comfort, or any guessing techniques like Census Bureau statistics. T-B is based on real data. In reviewing the studies of various transportation modes, including existing large transit systems (mostly buses) it is apparent that no matter what kind of system, none can provide the speed and safety to move large number of commuters [10,13]. There is no consistent existing method for planning that fits into a model or lends itself for T-B adaptation.

Federal/state support is unavoidable to construct the infrastructure. No county or large city can afford a massive mass transit construction. The cost to the federal government is evident everywhere [4]. There is a traditional obsession with cars, a costly addiction. Car culture is contributing to soil and water contamination by leaking oil and other fluids. Gasoline stations are a major problem in contamination of soil and air, thus adding to deadly air pollution mix. Also to be considered is the economic component of global warming. Car and bus manufacturers, oil barons and insurance companies are a problem, and the politically misguided public only worsens traffic conditions everywhere. Poor conditions on public vehicles as well as security concerns discourage people from using transit systems. Only quick, fast, safe and secure delivery of mass transit will solve commuters' problems.

As for existing systems, changes and adaptations can be made, based on the T-B analysis. It may be necessary to consolidate present carriers for better efficiency or to replace them with an integrated system. It is not about eliminating anything in existence, it is about diversifying. Railroad commuter trains proved to be of benefit to distant housing dwellers [12]. There are public bus systems and specialized services like transport to medical facilities, which are in abundance. However there is a lack of coordination, causing time loss to commuters and unnecessary expenses. It takes will and courage to change for the better.

Conclusions

The problem of integrated planning of a public transportation system, which is essentially, an optimization problem, has been solved using an innovative approach of TRUNK_BRANCH approach which resulted in excellent results.

ACKNOWLEDGEMENTS

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Performance of Solar Flat plate by using Semi- Circular Cross Sectional Tube

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Abstract— Solar flat plate collector is a solar thermal device which is use to raise the temperature of any fluid up to 100^0C. Generally a large number of arrays of circular cross sectional tube are attached to the absorber tube to transfer of heat from absorber tube to working fluid. When using semi circular type tube blow the absorber plate, the area of intimate contact is increases between fluid and absorber plate and also resistance due to adhesive is decreases. Due to this reason performance of solar flat plate collector is increased.

Keywords— Solar flat plate collector, semi-circular tube, absorber plate.

INTRODUCTION

Solar energy is very large, inexhaustible and clean source of energy. Solar energy is the radiation resulted by nuclear fusion reactions in the sun. This energy radiates outwards in all the directions. But, only a tiny fraction 1.4×10^{14}kW, of the total radiation emitted by the sun is intercepted by the earth. The quantity of solar energy striking the Earth's surface averages about 1,000 watts per square meter under clear skies, depending upon weather conditions, location, and orientation of the surface [01]. However, even with this small fraction it is estimated that 30 min of solar radiation falling on earth which is equal to the world energy demand for one year [02].

The solar thermal energy is collected by a device called solar collector. A flat plate collector is such type of solar thermal collector which is using in such place where moderate heat is require. It can increase the temperature of the fluid up to 100^0C above ambient temperature [01]. It is also simple in design, have no moving parts and require little maintenance. They are also relatively cheap and can be used in variety of application. A simple flat plate consists of four components (i) absorber plate (ii) tubes fixed to the absorber plate (iii) the transparent cover (iv) the collector box. The collector plates absorb the maximum possible amount of solar irradiance and transfer this heat to the working fluid which is flowing in absorber tube. The fluid used for heat transfer generally flows through a metallic tube, which is connected to the absorber plate. The absorber is usually made of metallic materials such as copper, steel or aluminum and surface is generally black. The collector box can be made of plastic, metal or wood type insulator to prevent heat loss and the transparent front cover must be sealed so that heat does not escape, and the collector itself is protected from dirt and humidity. The heat transfer fluid may be either water or water with antifreeze liquid. Still the heat losses due to the temperature difference between the absorber and ambient air result in convection and radiation losses. The main advantage of a flat plate collector is that it utilizes both beam and diffuse components of solar radiation [03]. Efficiency of flat plate collector depends on the temperature of the plate, ambient temperature, solar insolation, top loss coefficient, emissivity of plate, transmittance of cover sheet, number of glass cover. Tracking system is also important for improve the efficiency of flat plate collector. Tracking is desirable for orienting a face of solar device towards the sun, therefore collector collecting maximum solar radiation and due to this better performance.

Y.Y. Nandurkar and R.S. Shelke [04] conducted experiments in which reducing area of liquid flat plate collector by increasing tube diameter and reducing riser length. Solar flat plate collector having increasing diameter of copper tube of flat plate collector with integral fins performances is better than the ISI flat plate collector. The present work is an study on the comparative performance analysis of ISI flat plate collector with modified flat plate collector. It is found that the modified flat plate collector with increase in diameter of test section, Nusselt number and Reylonds number is increased with second power of tube diameter.

Thundil Karuppa R. Raj [05] et al investigates a new solar flat plate collector which is of sandwich type. The new type of collector is the water sandwich type collector which is made by bracing two corrugated metal sheets on one another. The absorber is made of 2 sheets of GI (1 mm) with integrated canals, painted silica based black paint. The outer casing which provides mechanical strength to the equipment is insulated to reduce the heat losses from back and sides of the collector. The new collector is differ is the absence of heat carrying metallic tubes. The working fluid is made to pass through the channels that are formed when two corrugated metal sheets are braced one over another. Efficiency of the flat plate conventional is 24.17 and efficiency of the new collector is 20.19%.

Vipin Awasthi [06] et al reported the thermal performance of double glazed flat plate solar collectors with different range of design variable on top heat loss coefficient. The temperature of the absorber surface is above ambient temperature, the surface re-radiates some of the heat and it has go back to the surroundings. Coatings enhance the absorption of sunlight and also enhance the long wavelength radiation loss from the surface. A good coating will produce an absorber surface that is a good absorber of short-wavelength solar irradiance but a poor emitter of long-wavelength radiant Energy. The collector tilt angle is increases then the top heat loss Coefficient and overall transfer coefficient is gradually decreases.

A.T. Fatigun [07] et al conduct experiment in which the effect of tube spacing on the performance of a flat plate collector is compares. Two same aperture area of solar flat plate collector is compare of average adjacent tube spacing of 11 cm (A) and 20 cm (B). Average of 11 cm spacing between adjacent lines yielded 15 turns while 20cm average line spacing yielded 9 turns of tubing per Flat plate. The efficiency of collector (B) was found to be significantly higher than that of collector (A), i.e. 10% and 21% was obtained for collectors (A) and (B) respectively.

Sunil.K.Amrutkar [08] et al evaluates the performance of flat plate collector with different geometric absorber configuration. By varying the collector plate material, glazing material, the efficiency and outlet temperature of flat plate collector is also vary. To reducing the collector area and minimizing the number of tubes, cost of collector is also reduced.

Useful Heat gain by Semi-circular tube

A large number of geometrical parameters influence the performance of a flat plate collector as selective surfaces, numbers of covers, spacing between covers and absorber plate etc. In this study, shape of tube is considered to be semi circular cross-sectional area. The tube attached to the absorber plate is semi circular, so that area of absorbing surface is more than that of a circular tubing system in solar flat plate collector.

The one dimensional flow of heat in the absorber plate in a direction at right angles to the direction of fluid is considered. When considered tube is attached blow of tube, the resistance to heat flow to the tube from the plate may be consisted of three components; (i) the resistance due to the bonding material between the plate and the tube; (ii) the resistance due to the temperature gradient in the fluid at the tube wall; (iii) the resistance due to the wall thickness of the tube. Now, calculating the useful heat gained by fluid per unit length. When cthe volume of fluid contains by circular tube and semi-circular tube assume to be same.
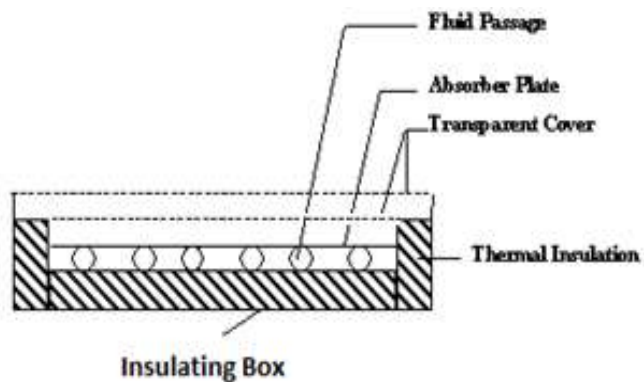
Fig. No.-01 Flat Plate Collector with circular cross-sectional tube

Let, $T_b=100^0C$ and $T_f=60^0C$

Inner diameter of tube (Di) =10mm

$C_w=250W/m^2k$

$C_b=40W/m^2k$

$h_{fi}=100W/m^2k$

Where

T_b=Base temperature above the bond

T_f=Fluid temperature

C_b=Bond conductance

C_w=Conductance of the tube wall

h_{fi}=Film heat transfer co-efficient

$$Q_u = \frac{T_b-T_f}{\frac{1}{C_b}+\frac{1}{\pi D_i h_{fi}}+\frac{1}{C_w}} \quad [09]$$

=115.174 W/m²

Now when considered that the fluid is flowing through semi circular cross-sectional area, then the resistance due to bonding material and resistance due to wall thickness are eliminated. Dci=1.414D_i, is the diameter of semi circular tube. So, the useful heat gain (Q_u) by tube is increases.
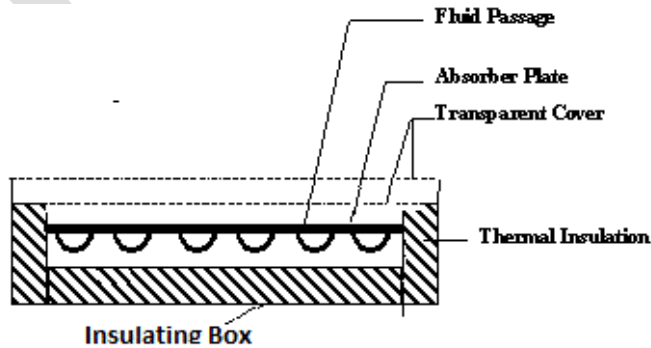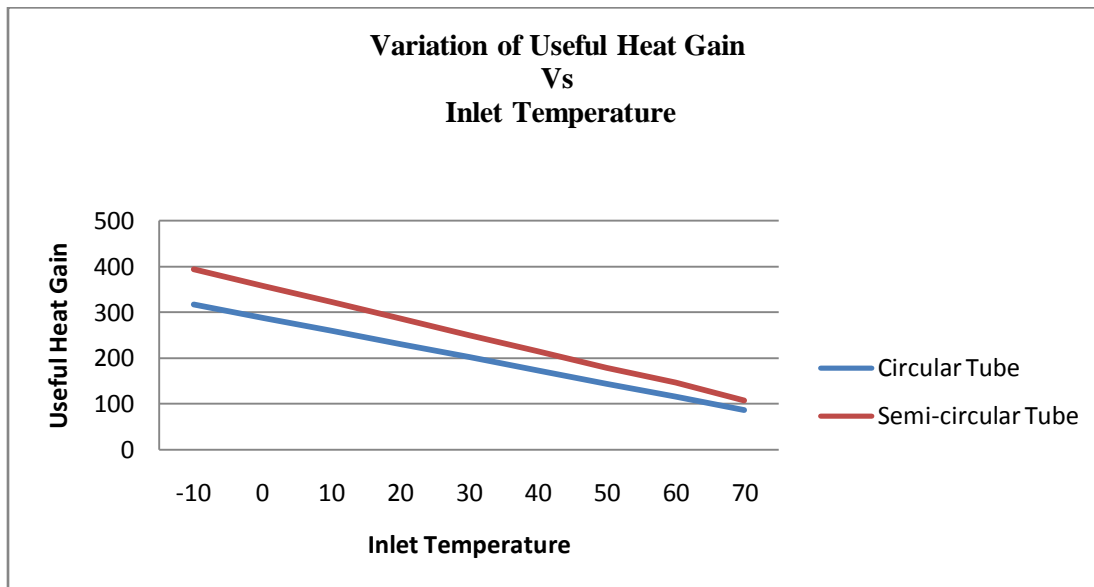

Fig. No.-02 Flat Plate Collector with semi-circular cross-sectional tube

And the useful heat gain is given as

$$Q_u = \frac{T_b - T_f}{\frac{1}{\pi D_{ci} h_{fi}}}$$

$$=177.69 \text{ W/m}^2$$

Variation of Useful Heat Gain
Vs
Inlet Temperature

Result and discussion: By using the semi-circular tube below the absorber plate, the useful heat gain is increase. The graph shows that when using the fluid at low temperature, the semi-circular type tube absorbed more heat than circular tube. This result also indicates that when using the fluid having low melting point the useful heat gain by the fluid is more.

Conclusion: The flat plate collector with semi circular cross sectional tube has absorbed more heat than that of circular cross-sectional area tube, due to increasing absorbing area of tube, reducing the resistance due to the bonding material between the plate and the tube and the resistance due to the wall thickness of the tube. So, this method improves the efficiency of flat plate collector.

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Dynamic Hand Gesture Recognition for Human Computer interaction;

A Comparative Study

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Abstract:

As computers become more pervasive in society, facilitating natural human–computer interaction (HCI) will have a positive impact on their use. Hence, there has been growing interest in the development of new approaches and technologies for bridging the human–computer barrier. The ultimate aim is to bring HCI to a regime where interactions with computers will be as natural as an interaction between humans, and to this end, incorporating gestures in HCI is an important research area. Gestures have long been considered as an interaction technique that can potentially deliver more natural, creative and intuitive methods for communicating with our computers. The use of hand gestures as a natural interface serves as a motivating force for research in gesture taxonomies. Gesture recognition is done in three main phases i.e. detection, tracking and recognition. The main goal of this study is to provide researchers in the field of gesture based HCI with a summary of progress achieved to date and to help identify areas where further research is needed.

Keywords: Gesture, Detection, Tracking, Hand, Gesture recognition, Human computer interaction, Representations, Recognition, Natural interfaces,

Introduction:

Computer is used by many people either at their work or in their spare-time. Special input and output devices have been designed over the years with the purpose of easing the communication between computers and humans, the two most known are the keyboard and mouse. Every new device can be seen as an attempt to make the computer more intelligent and making humans able to perform more complicated communication with the computer. This has been possible due to the result oriented efforts made by computer professionals for creating successful human computer interfaces. As the complexities of human needs have turned into many folds and continues to grow so, the need for Complex programming ability and intuitiveness are critical attributes of computer programmers to survive in a competitive environment. The computer programmers have been incredibly successful in easing the communication between computers and human. With the emergence of every new product in the market; it attempts to ease the complexity of jobs performed.

Earlier, Computer programmers were avoiding such kind of complex programs as the focus was more on speed than other modifiable features. However, a shift towards a user friendly Environment has driven them to revisit the focus area. The idea is to make computers understand human language and develop a user friendly human computer interfaces (HCI). Making a computer understand speech, facial expressions and human gestures are some steps towards it. Gestures are the non-verbally exchanged information. A person can perform innumerable gestures at a time. Since human gestures are perceived through vision, it is a subject of great interest for computer vision researchers. The project aims to determine human gestures by creating an HCI. Coding of these gestures into machine language demands a complex programming algorithm.

In the present world, the interaction with the computing devices has advanced to such an extent that as humans it has become necessity and we cannot live without it. The technology has become so embedded into our daily lives that we use it to work,

shop, communicate and even entertain our self. It has been widely believed that the computing, communication and display technologies progress further, but the existing techniques may become a bottleneck in the effective utilization of the available information flow. To efficiently use them; most computer applications require more and more interaction. For that reason, human-computer interaction (HCI) has been a lively field of research in the last few years. The interaction consists of the direct manipulation of graphic objects such as icons and windows using a pointing device. Even if the invention of keyboard and mouse is a great progress, there are still situations in which these devices are incompatible for HCI.

Gestures:

Gesture acts a medium of communication for non vocal communication in conjunction with or without verbal communication is intended to express meaningful commands. These gestures may be articulated with any of the body parts or with combination of one or many of them. Gestures being major constituent of human communication may serve as an important means for human computer interaction too. Though the significance and meaning associated with different gestures differ very much with cultures having less or invariable or universal meaning for single gesture. For instance different gestures are used for greeting at different geographical separations of the world. For example pointing an extended finger is a common gesture in USA & Europe but it is taken to be as a rude and offensive gesture in Asia. Hence the semantic interpretation of gestures depends strictly on given culture.
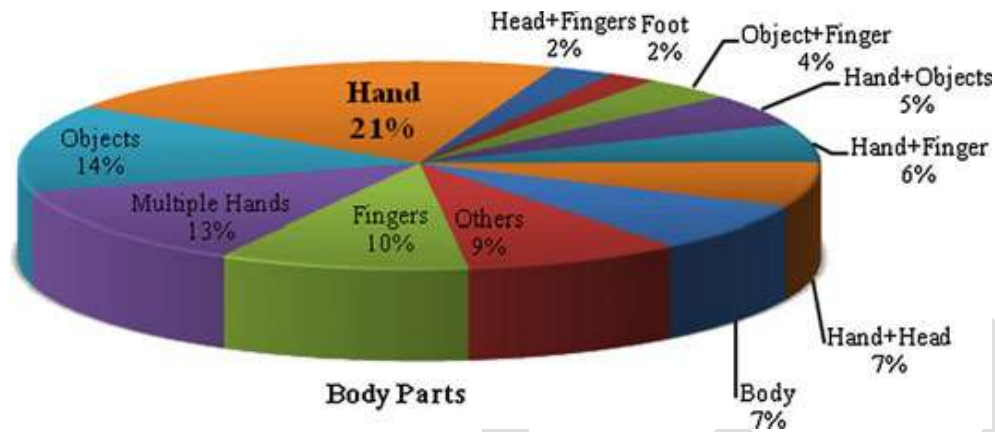
Different Types of Gestures

Types	Meaning	Examples
Symbolic Gesture	Gestures have a single meaning within each culture.	Sign Language, Command Gesture
Deictic Gesture	Gestures direct the listener's attention to specific events or objects in the environment.	Pointing Gestures
Iconic Gesture	Gestures represent meaningful objects or actions.	Predefined Gesture
Pantomimic Gesture	Gestures that depict objects or actions, with or without accompanying speech.	Mimic Gesture

It is hard to settle on a specific useful definition of gestures due to its wide variety of applications and a statement can only specify a particular domain of gestures. Many researchers had tried to define gestures but their actual meaning is still arbitrary.

Bobick and Wilson have defined gestures as the motion of the body that is intended to communicate with other agents. For a successful communication, a sender and a receiver must have the same set of information for a particular gesture. As per the context of the project, gesture is defined as an expressive movement of body parts which has a particular message, to be communicated precisely between a sender and a receiver.

Researcher Karam in his work reported that hand has been widely used in comparison to other body parts for gesturing as it is a natural form of medium for communication between human to human hence can best suited for human computer interaction also as shown Below.

The *piechart* shows the different body parts or objects identified for gesturing

Kendon has situated these communicative hand movements along a "gesture continuum", defining five different kinds of gestures:

1) *Gesticulation* – spontaneous movements of the hands and arms that accompany speech.

2) *Language-like gestures* – gesticulation that is integrated into a spoken utterance, replacing a particular spoken word or phrase.

3) *Pantomimes* – gestures that depict objects or actions, with or without accompanying speech.

4) *Emblems* – familiar gestures such as "V for victory", "thumbs up", and assorted rude gestures.

5) *Sign languages* – Well defined Linguistic systems, like American Sign Language.

Gesture Recognition:

"Gesture recognition the term collectively refers to the whole process of tracking human gestures to their representation and conversion to semantically meaningful commands."

Research in hand gesture recognition aims to design and development of such systems than can identify explicit human gestures as input and process these gesture representations for device control through mapping of commands as output. Creation and implementation of such efficient and accurate hand gesture recognition systems are aided through two major types of enabling technologies for human computer interaction namely contact based and vision based devices.

Contact based devices employed for hand gesture recognition systems are based on physical interaction of user with the interfacing device i.e. the user needs to be accustomed with the usage of these devices, hence not adaptable to the naïve users. The main disadvantage of contact based devices is the health hazards, which are caused by its devices like mechanical sensor material which raises symptoms of allergy, magnetic devices which raises risk of cancer etc. The contact based can be uncomfortable for user since they require physical contact with the user, still having a verge over the accuracy of recognition and less complexity of implementation goes in favor of these devices.

Restrained by the dependence on experienced users the contact based devices do not provide much acceptability, hence vision based devices have been employed for capturing the inputs for hand gesture recognition in human computer interaction. This

set of devices relies on captured video sequence by one or several cameras for interpreting and analyzing the motion. Vision based also uses hand markers for detection of human hand motion and gestures. The hand markers can be further classified as reflective markers which are passive in nature and shines as strobes hit it whereas LED light are active in nature and flashes in sequence. In these systems each camera delivers marker position from its view with a 2D frame which lightens with either strobe lights or normal lights.

Vision based devices though is user friendly but suffer from configuration complexity, implementations and occlusion problems, but are more users friendly and hence more privileged for usage in long run.

Hand Gesture Recognition:

Hand gesture plays an important part of human communication. Hand gesture has been the most common and natural way for human to interact and communicate with each other. Hand gesture provides expressive means of interactions among people that involves hand postures and dynamic hand movements. A hand posture represents static finger configuration without hand movement, whereas dynamic hand movement consists of a hand gesture with or without finger motion. The ability to detect and recognize the human hand gesture posed many challenges to researchers throughout the decades. Hand gesture recognition studies have gained a lot of attentions for Human-Computer Interaction (HCI).

Hand gestures are classified into two type's static and dynamic gestures.
Static hand gestures are defined as orientation and position of hand in the space during an amount of time without any movement and if a movement is there in the aforementioned time duration it is called dynamic gesture.

Dynamic hand gestures include gestures involving body parts like waving of hand while static hand gestures include single formation without movement like jamming the thumb and forefinger to form the "ok" symbol is a static pose which represents static gesture. Dynamic hand gestures done intentionally for communication are called conscious dynamic gestures, whereas unintentionally (unawareness) done gesture carried out during causal physical activity is known as unconscious dynamic gesture. 35% of human communication consists of verbal communication and 65 % is non verbal gesture based communication.
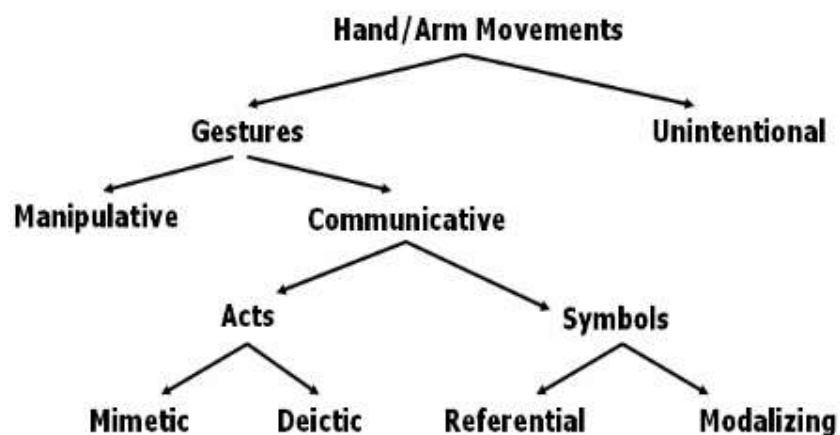
From Figure, gestures can be divided into manipulative and communicative. Manipulative gestures are the ones used to act on objects in an environment (object movement, rotation, etc.). Communicative gestures, on the other hand, have an inherent communicational purpose.

The use of hand gestures provides an attractive and natural alternative to these cumbersome interface devices for human computer interaction. Using hands as a device can help people communicate with computers in a more intuitive way. When we

interact with other people, our hand movements play an important role and the information they convey is very rich in many ways. We use our hands for pointing at a person or at an object, conveying information about space, shape and temporal characteristics. We constantly use our hands to interact with objects: move them, modify them, and transform them.

A gesture is scientifically categorized into two distinctive categories: dynamic and static. A dynamic gesture is intended to change over a period of time whereas a static gesture is observed at the spurt of time. A waving hand means goodbye is an example of dynamic gesture and the stop sign is an example of static gesture. To understand a full message, it is necessary to interpret all the static and dynamic gestures over a period of time. This complex process is called gesture recognition.
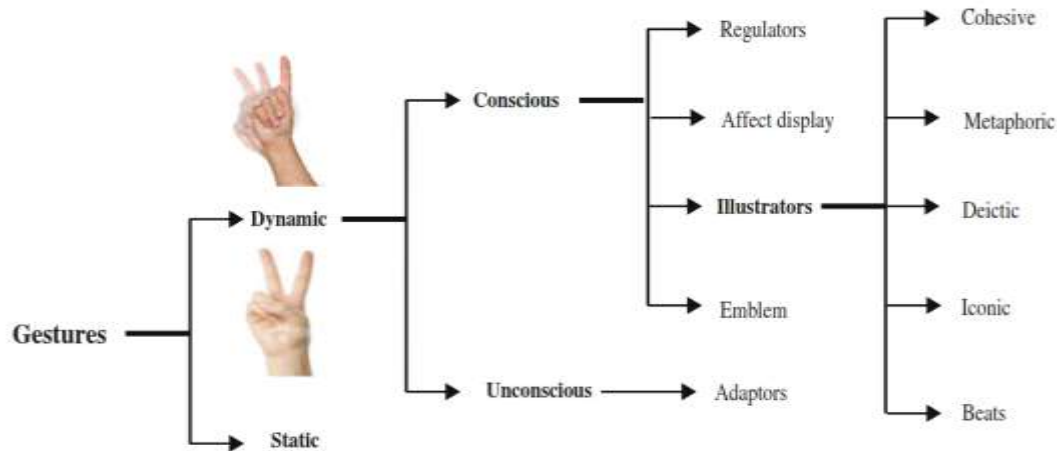
Gesture can be categorized into five types i.e. emblems, affect displays, regulators, adaptors and illustrators. Emblematic gestures also referred as emblem or quotable gestures are direct translation of short verbal communication like waving hand for good bye or nodding for assurance. The quotable gestures are specifically culture specific. Gestures conveying emotion or intensions are called affect displays.

The affect displays are generally universal less dependent on culture. Gestures controlling interaction are called regulators. Gestures like headshaking, quickly moving one's leg that enables the release of body tension are called adaptors. Adaptors are generally habit of communicators that are not used intentionally during a communication. Illustrator gestures emphasize the key point in speech to depict the communications pronouncing statements. Being emphasized by the communicators pronouncing statements these gestures are inherently dependent on communicators thought process and speech. These gesticulations could further be categorized into five sub category namely beats, deictic gestures, iconic gestures, metaphoric gestures and cohesive gestures.

- ✓ Beats are short and quick, rhythmics and after repetitive gestures.
- ✓ Concrete pointing to real location object or person and abstract pointing to abstract location or period of time are called deictic gestures.
- ✓ Hand movements depicting figural representation or actions for example moving hand upward with wiggling gingers to depict tree climbing are called iconic gestures.
- ✓ Abstractions are depicted by metaphoric gestures.
- ✓ Thematically related but temporally separated gestures are called cohesive gestures. The temporal separation of these thematically related gestures is due to interruption of current communicator by any other communicator.

The two major categories of hand gesture representation are 3D model based methods and appearance based methods.
- ➢ The 3D model based hand gesture recognition has different techniques for gesture representation namely 3D textured volumetric, 3D geometric model and 3D skeleton model.

The 3D model based hand gesture representation defines 3D spatial description of human hand for representation with temporal aspect being handled by automation. This automation divides the temporal characteristics of hand gesture into three phases (McNeill 1992) i.e. the preparation or prestroke phase, the nucleus or stroke phase and the retraction or poststroke phase in which every phase corresponds to one or many transitions of spatial states of the 3D human model. One or many cameras focus on the real target and compute parameters spatially matching the real target and then follow its motion during the recognition process in 3D model. Thus the 3D model has an advantage that it updates the model parameters while checking the matches of transition in temporal model, leading to precise hand gesture recognition and representation, though making it computationally intensive with requirement of dedicated hardware. There are also many methods that combine silhouette extraction with 3D model projection fitting by finding target self oriented. Generally three kinds of model are generally used.

- ✓ 3D textured kinematic/volumetric model contains very high details of human body skeleton and skin surface information.
- ✓ 3D geometric models are less precise than 3D textures kinematic/volumetric models with respect to skin information but contains essential skeleton information.

Appearance based hand gesture representation include color based model, silhouette geometry model, deformable gabarit model and motion based model. Appearance based hand gesture representation methods are though broadly classified into two major subcategories i.e. 2D static model based methods and motion based methods, each sub category is having further variants. The commonly used 2D models include:

- ✓ Color based model uses body markers to track the motion of body or body part. As Bretzner et al. (2002) proposed hand gesture recognition employing multi-scale color features, hierarchal models and particle filtering.
- ✓ Silhouette geometry based models include several geometric properties of the silhouette such as perimeter, convexity, surface, bounding box/ellipse, elongation, rectangularity, centroid and orientation. The geometric properties of the bounding box of the hand skin were used to recognize hand gestures.
- ✓ Deformable gabarit based models: they are generally based on deformable active contours (i.e. snake parameterized with motion and their variants. used snakes for the analysis of gestures and actions in technical talks for video indexing.
- ✓ Motion based models are used for recognition of an object or its motion based on the motion of object in an image sequence. Local motion histogram was introduced which uses an Adaboost framework for learning action models.

Gesture Recognition Classification:

Hand movements are thus a mean of non-verbal communication, ranging from simple actions (pointing at objects for example) to more complex ones (such as expressing feelings or communicating with others). In this sense, gestures are not only an ornament of spoken language, but are essential components of the language generation process itself. A gesture can be defined as a physical movement of the hands, arms, face and body with the intent to convey information or meaning. In particular, recognizing hand gestures for interaction can help in achieving the ease and naturalness desired for human computer interaction. Users generally use hand gestures for expression of their feelings and notifications of their thoughts.

Most of the complete hand interactive mechanisms that act as a building block for hand gesture recognition system are comprised of three fundamental phases: detection, tracking and recognition.
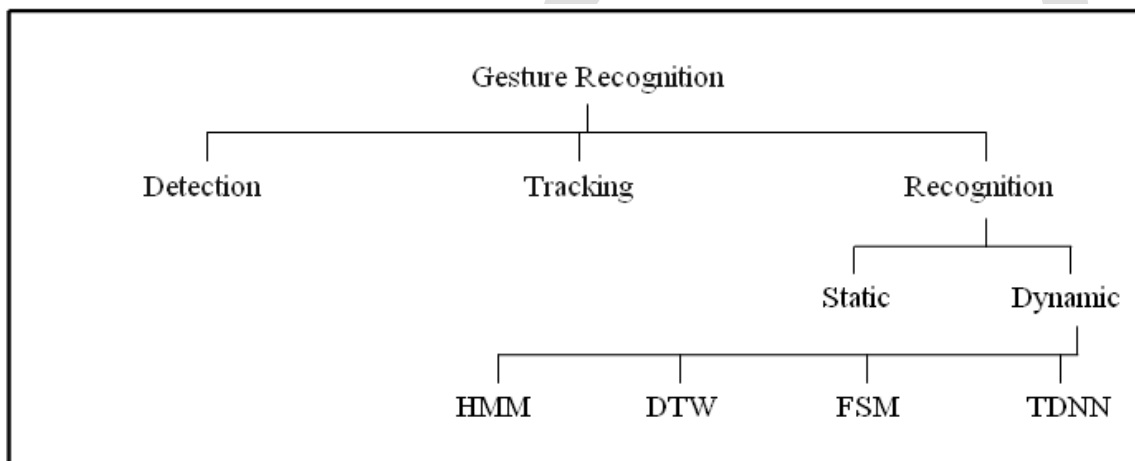
Detection:

The primary step in hand gesture recognition systems is the detection of hands and the segmentation of the corresponding image regions. This segmentation is crucial because it isolates the task-relevant data from the image background, before passing them to the subsequent tracking and recognition stages.

Tracking:

If the detection method is fast enough to operate at image acquisition frame rate, it can be used for tracking as well. However, tracking hands is notoriously difficult since they can move very fast and their appearance can change vastly within a few frames. Tracking can be defined as the frame-to-frame correspondence of the segmented hand regions or features towards understanding the observed hand movements. The importance of robust tracking is twofold. First, it provides the inter-frame linking of hand/finger appearances, giving rise to trajectories of features in time. These trajectories convey essential information regarding the gesture and might be used either in a raw form (e.g. in certain control applications like virtual drawing the tracked hand trajectory directly guides the drawing operation) or after further analysis (e.g. recognition of a certain type of hand gesture). Second, in model-based methods, tracking also provides a way to maintain estimates of model parameters variables and features that are not directly observable at a certain moment in time.

Recognition:

The overall goal of hand gesture recognition is the interpretation of the semantics that the hand(s) location, posture, or gesture conveys. Hand gesture recognition techniques can be further classified under static and dynamic gestures. To detect static gestures (i.e. postures), a general classifier or a template-matcher can be used.

A dynamic hand gesture is then considered as a path between an initial state and a final state. The main limitation of the approaches based on automata is that the gesture model must be modified when a new gesture needs to be recognized. Moreover, the computational complexity of such approaches is generally huge Vision based hand gesture recognition for human computer interaction since it is proportional to the number of gestures to be recognized which is not the case for methods based on other techniques.

Hidden Markov model:

HMM were introduced in the mid 1990s, and quickly became the recognition method of choice, due to its implicit solution to the segmentation problem. In describing hidden Markov models (Ramage 2007) it is convenient first to consider Markov chains. Markov chains are simply finite-state automata in which each state transition arc has an associated probability value; the probability values of the arcs leaving a single state sum to one. Markov chains impose the restriction on the finite-state automaton that a state can have only one transition arc with a given output; a restriction that makes Markov chains deterministic. A hidden markov model (HMM) can be considered a generalization of a Markov chain without this Markov chain restriction (Charniak 1993). Since HMMs can have more than one arc with the same output symbol, they are nondeterministic, and it is impossible to directly determine the state sequence for a set of inputs simply by looking at the output (hence the "hidden" in "hidden Markov model"). More formally, a HMM is defined as a set of states of which one state is the initial state, a set of output symbols, and a set of state transitions. Each state transition is represented by the state from which the transition starts, the state to which transition moves, the output symbol generated, and the probability that the transition is taken (Charniak 1993). In the context of hand gesture recognition, each state could represent a set of possible hand positions. The state transitions represent the probability that a certain hand position transitions into another; the corresponding output symbol represents a specific posture and sequences of output symbols represent a hand gesture. One then uses a group of HMMs, one for each gesture, and runs a sequence of input data through each HMM. The input data, derived from pixels in a vision-based solution can be represented in many different ways, the Vision based hand gesture recognition for human computer interaction most common by feature vectors (Staner and Pentland 1995a). The HMM with the highest forward probability determines the users' most likely gesture. An HMM can also be used for hand posture recognition.
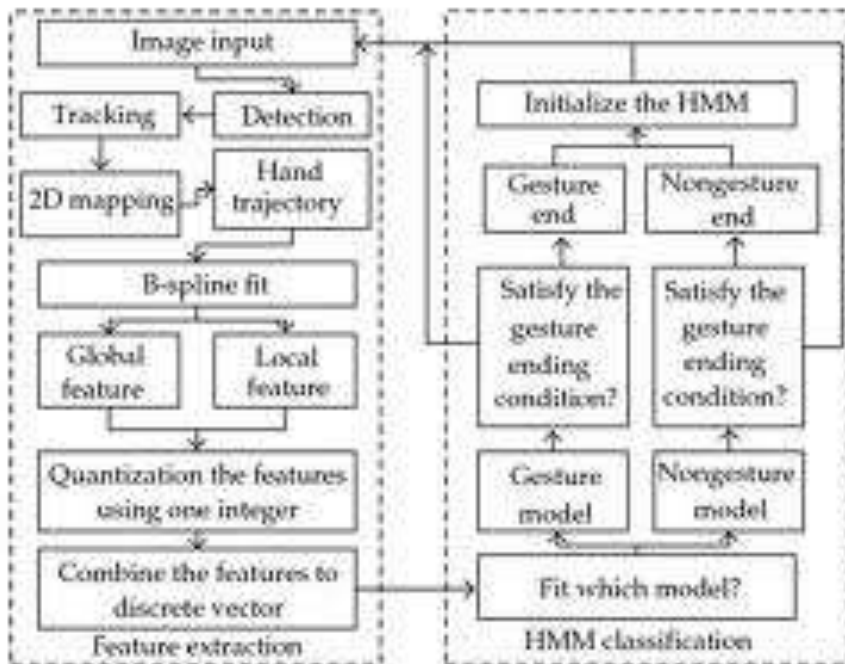
HMM is a dual-stochastic process model indicated by parameters, which is used to describe the probability statistic performance of stochastic processes and it is evolved from Markov chain.

According to the state observation probability density continuity, HMM can be divided into continuous hidden Markov model (CHMM) semi-continuous Hidden Markov Model (SCHMM) Discrete Hidden Markov Model (DHMM).

DHMM: Signal as a discrete concept of measurement, first observation to quantify the characteristics of the signal after carrying out identification, this method is characterized by training speed and recognition speed, but the recognition rate is relatively low.

CHMM: Observation features as a continuous probability density function, each state has a set of different probability density function. This method is characterized by relatively high recognition rate, however, identification of training speed and slow, real-time are bad.

SCHMM: Observation vector is a continuous probability density, but the sequence of all samples of the entire state share a group of probability density. DHMM overcome the disadvantage of low accuracy to identify, also reduces the complexity of calculating the CHMM, take into account the real-time and recognition rate.

A Hidden Markov Model, HMM = (S; C; π; A; B) , represents a stochastic process in time, in terms of (hidden) states S, (visible) observations C, initial state probabilities π, state transition probabilities A and output probabilities B.

HMM is one of the best approaches used in pattern recognition as it has the ability

to overcome the problems of spatio-temporal variabilities. In addition, HMMs have been successfully applied to gesture recognition, speech recognition and protein modeling. Introduction of HMMs makes the recognition-based segmentation more powerful because segmentation and recognition are optimized simultaneously during recognition with HMMs.

In a *hidden* Markov model, the state is not directly visible, but output, dependent on the state, is visible. The adjective 'hidden' refers to the state sequence through which the model passes, not to the parameters of the model HMM has three fundamental problems: evaluation, decoding and training.

1. Evaluation: The problem is to calculate an output observable symbol sequence or vector O given an HMM parameter set λ. The following problem is solved by using

Forward-Backward algorithm.

2. Decoding: The problem is to determine an optimal state sequence which is associated with the given observable symbol sequence or vector O by a given HMM parameter set λ. The following problem is solved by using Viterbi algorithm.

3. Training: The problem is to maximize the output probability of generating an observable symbol sequence or vector. The following problem is solved by using BaumWelch algorithm.

HMM has three topologies Fully Connected (i.e. Ergodic model) where any state can be reached LR such that each state can go back to itself or to the following states and LRB model in which each state can go back to itself or the next state only. We choose left-right banded model as the HMM topology, because it is good for modelling-order constrained time-series and its properties also change over time in sequence and the number of states are decided on the basis of complexity of a gesture.

One main concern of gesture recognition is how to segment some meaningful gestures from the continuous sequence of hand motion. This is considered as a highly difficult process for two major problems, which arise in real-time gesture recognition system to extract meaningful gestures from continuous gesture . The first problem is the segmentation (spotting) that means how to determine when gesture starts and when it ends in hand motion trajectory. The second problem is caused by the fact that the same gesture varies in shape, trajectory and duration, even for the same person. To overcome these problems, HMM is used in our system because it is capable of modeling spatiotemporal time series of gestures effectively and can handle non-gesture patterns. Moreover, NN and DTW hardly represent the non-gesture patterns. Lee proposed an ergodic model based on adaptive threshold to spot the start and the end points of input patterns, and also classify the meaningful gestures by combining all states from all trained gesture models using HMM.

Dynamic time warping:

It has long been used to find the optimal alignment of two signals. The DTW algorithm calculates the distance between each possible pair of points out of two signals in terms of their associated feature values. It uses these distances to calculate a cumulative distance matrix and finds the least expensive path through this matrix. This path represents the ideal warp—the synchronization of the two signals which causes the feature distance between their synchronized points to be minimized. Usually, the signals are normalized and smoothed before the distances between points are calculated. DTW has been used in various fields, such as speech recognition, data mining, and movement recognition. Previous work in the field of DTW mainly focused on speeding up the algorithm, the complexity of which is quadratic in the length of the series. Examples are applying constraints to DTW, approximation of the algorithm and lower bounding techniques. Eamonn and Pazzani (2001) proposed a form of DTW called Derivative DTW (DDTW). Here, the distances calculated are not between the feature values of the points, but between their associated first order derivatives. In this way, synchronization is based on shape characteristics (slopes, peaks) rather than simple values. Most work, however, only considered one-dimensional series.
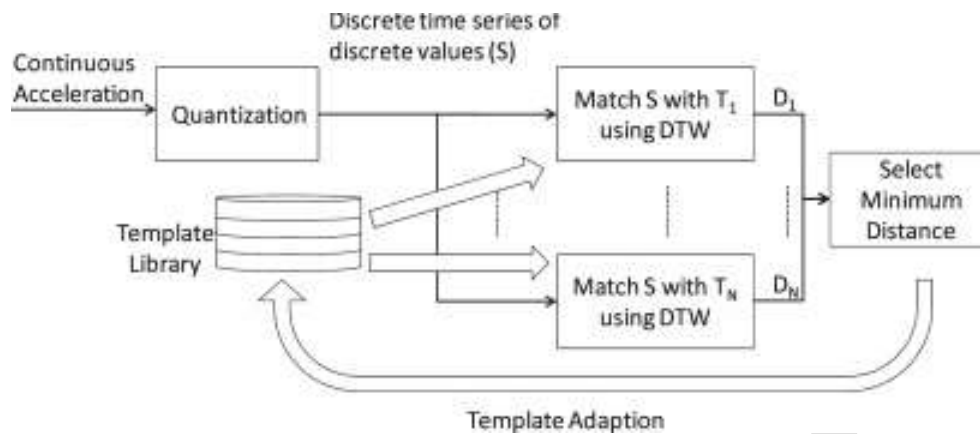
A dynamic time warping algorithm is used to perform the time alignment and normalization by computing a temporal transformation allowing the two signals to be matched.

Depth features from human joints are compared through video sequences using Dynamic Time Warping, and weights are assigned to features based on inter-intra class gesture variability.

Feature Weighting in Dynamic Time Warping is then applied for recognizing begin-end of gestures in data sequences Dynamic Time Warping (DTW) is commonly used in gesture recognition tasks in order to tackle the temporal length variability of gestures. In the DTW framework, a set of gesture patterns are compared one by one to a maybe infinite test sequence and a query gesture category is recognized if a warping cost inferior to a given value is found within the test sequence.

Dynamic time warping (DTW) is a template matching algorithm. To recognize a gesture, DTW warps a time sequence of joint positions to reference time sequences and produces a similarity value.

However, all body joints are not equally important in computing the similarity of two sequences.

DTW method is a timeline based on the dynamic operation of technology; it applies to those with time variable problem. Although it in some small semantic mission was a success the next, but in order to achieve changes in the scope of variables, required a very large number of template matching to calculate the volume too much; but also for the definition of the mode of identification is also not ideal.

Time delay neural networks:

Time delay neural network (**TDNN**) is an alternative neural network architecture whose primary purpose is to work on continuous data. The advantage of this architecture is to adapt the network online and hence helpful in many real time applications.
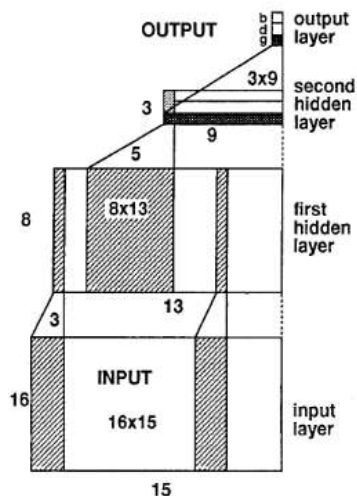
The architecture has a continuous input that is delayed and sent as an input to the neural network. The desired output of the network is the present state of the time series and inputs to the neural network are the delayed time series (past values). Hence, the output of the neural network is the predicted next value in the time series which is computed as the function of the past values of the time series.

These are special artificial neural networks which focus on working with continuous data making the architecture adaptable to online networks hence advantageous to real time applications. Theoretically, time delay neural networks are also considered as an extension of multi-layer perceptron. TDNN is based on time delays which gives individual neurons the ability to store the history of their input signals. Therefore the network can adapt to sequence of patterns. Due to the concept of time delay, each neuron has access not only to present input at time t but also to the inputs at time. Therefore each neuron can detect relationship between the current and former input values which might be a typical pattern in the input signal. Also, the network is able to approximate functions that are derived from time sampled history of input signal. Learning of typical TDNN can be accomplished by standard back propagation as well as its variants.

The TDNN is a feed-forward network consisting of three layers: input, hidden, and output layers. Figure illustrates a TDNN. Note that the time delays are applied to the input vector x(k) and presented as inputs to the network. These time-delayed inputs provide the network with temporal information about the system being identified. The hidden layer activation function is a design parameter, which in this study was selected to be the tan-sigmoid function. Other commonly used options are radial basis functions, log-sigmoid, etc. The matrices Wx,Wy, and the bias vectors b are the variable parameters that are updated following a particular training algorithm in order to reproduce or mimic the input-output mapping of the plant. The output of the TDNN is given by.

$$\hat{y}(k+1) = f\left(W_x \times [x(k) \quad x(k-1) \quad \cdots \quad x(k-d)]^T + b_1\right) \times W_y + b_2$$
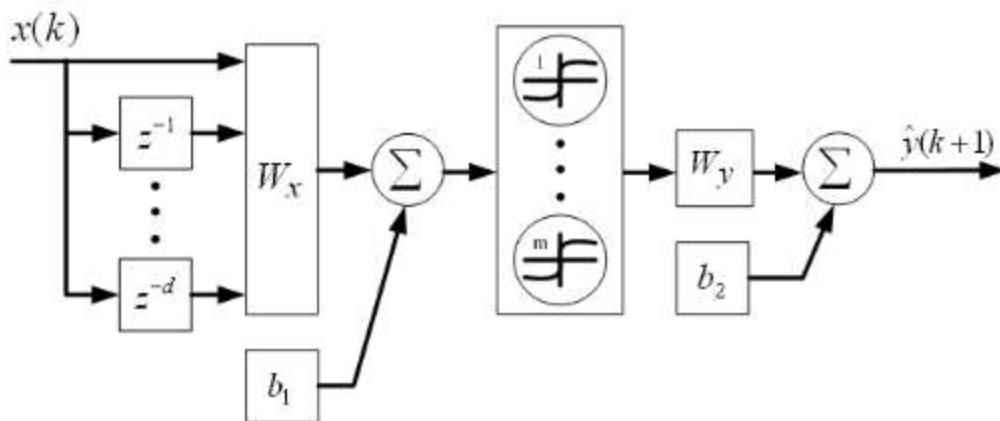
Finite state machine:

A finite state machine is one that has a limited or finite number of possible states (an infinite state machine can be conceived but is not practical). A finite state machine can be used both as a development tool for approaching and solving problems and as a formal way of describing the solution for later developers and system maintainers. There are a number of ways to show state machines, from simple tables through graphically animated illustrations. Usually, the training of the model is done off-line, using many possible examples of each gesture as training data, and the parameters (criteria or characteristics) of each state in the FSM are derived. The recognition of hand gestures can be performed online using the trained FSM. When input data (feature vectors such as trajectories) are supplied to the gesture recognizer, the latter decides whether to stay at the current state of the FSM or jump to the next state based on the parameters of the input data. If it reaches a final state, we say that a gesture has been recognized.
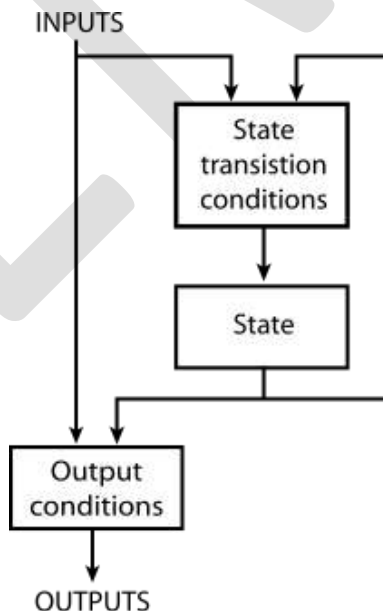
Compared to the HMM based systems, while the number of states and the structure of the HMM must be predefined, in our proposed approach, a gesture model is available immediately. The statistical nature of an HMM precludes a rapid training phase. To train an HMM, well-aligned data segments are required, whereas in the FSM representation the training data is segmented and aligned

simultaneously to produce a gesture model. Another advantage of using FSM is that it can handle gestures with different lengths/states. The only one input to the FSM is the spatio-temporal variance, which produces the recognizer after some training sessions.

FSM is more robust to spatio-temporal variability of incoming gesture sequence, where FSM adapts quickly to accommodate this variability during the training phase. Unlike other template matching algorithms, where an image sequence is first converted into a static shape pattern, and then compares it to prestored action prototypes during recognition, recognizer only compares the selected key frames of the incoming video sequence with the existing key frames in FSMs. The key frame based shape comparison greatly enhances the recognition speed.
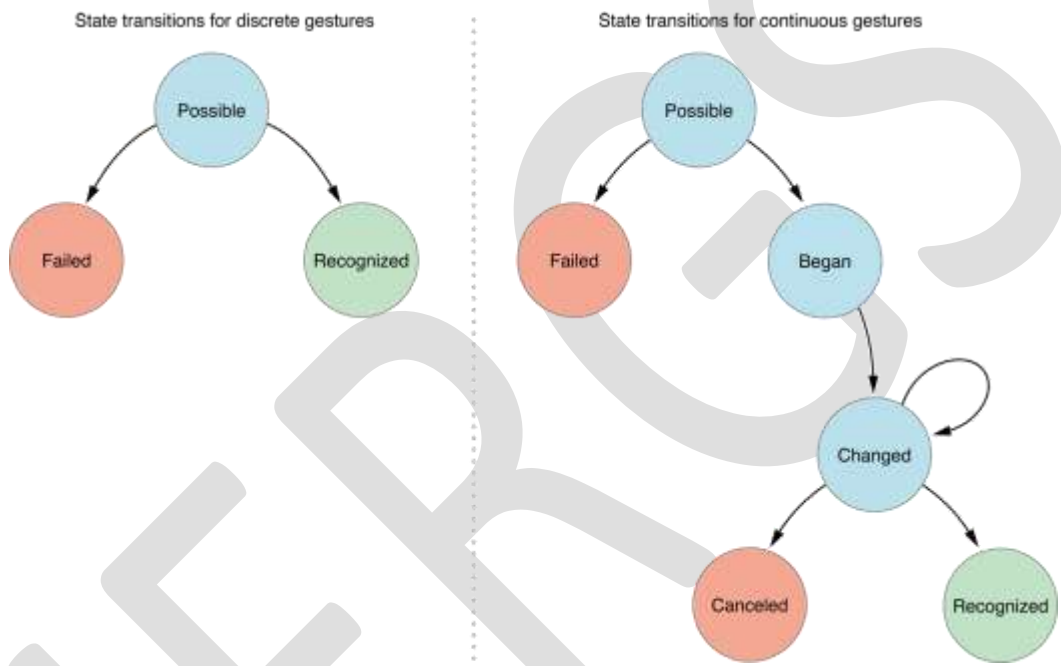
Comparison between different Gesture Recognition Techniques:

Technique	Principle	Parameter	Advantages	Disadvantage
Hidden Markov Model	Generalization of a markov chain without markov chain restriction. Set of status, transitions represent the set of possible hand positions	Pixels in vision-based input	Easily extended to deal with strong TC tasks. Embedded re-estimation in possible easy to understand	Large assumption about the data. Huge no. Of parameters needs to be set. Training data required is large.

Dynamic Time Warping	Optimal alignment of features is found & ideal warp is obtained based on cumulative distance matrix	Shape characteristics	Reliable time alignment. Robust to noise. Easy to implement	Complexity is quadratic. Distance matrix need to be defined. DTW to strong TC tasks not achieved.
Time Delay Neural Network	Special artificial neural network based on time delays giving individual neurons ability to store history making the system adapt to sequence of patterns.	Time sampled history of input signal	Faster learning. Invariance under time or space translation. Faster execution	Lacking robustness. Based on typical patterns of input that is inconsistent
Finite State Machine	Limited or infinite no of possible states	Feature vector such as trajectories	Easy to implement. Efficient predictability. Low processor overhead	Not robust. Ridged condition of implementation

Applications areas:

Application	Principle	Substitute	Purpose
Information Visualization	Interact data with more natural way	Mouse and keyboard	Scientific visualization. Audio-video presentation.
Desktop application	Interact with computer generated environment in more natural way	Mouse and keyboard	Wearable computers
Sign language	Automatic translation	Camera based devices	Communication system for disabled
Robotics	Control and program robots	Mouse and keyboard	Mobile robots. Multi DoF robots. Programming by demonstrations.
Virtual reality	Provide realism to man-made environment	Data glove	Realistic manipulation of virtual object.
Ubiquitous computing	Use signals to transfer data between different devices	Remote contact devices	Smart room, interaction
Games	Interactions with player's hands and body positions	Mouse and keyboard	Feels on field effect

Conclusion:

In today's digitized world, processing speeds have increased dramatically, with computers being advanced to the levels where they can assist humans in complex tasks. Yet, input technologies seem to cause a major bottleneck in performing some of the tasks, under-utilizing the available resources and restricting the expressiveness of application use. Hand Gesture recognition comes to rescue here. Computer Vision methods for hand gesture interfaces must surpass current performance in terms of robustness and speed to achieve interactivity and usability.

The importance of gesture recognition lies in building efficient human–machine interaction. Its applications range from sign language recognition through medical rehabilitation to virtual reality. Constructing an efficient hand gesture recognition system is an important aspect for easily interaction between human and machine. In this work we provided a comparative study on various gesture recognition systems with emphasis on detection, tracking and recognition phases which are essential for gesture detection and extraction.

Over the last decade numerous methods for gesture taxonomies and representations have been evaluated for the core technologies proposed in the gesture recognition systems. However the evaluations are not dependent on the standard methods in

some organized format but have been done on the basis of more usage in the gesture recognition systems. Hence the analysis of the detailed survey presented in the paper states the fact that the appearance based gesture representations are more preferred than the 3D based gesture representations in the hand gesture recognition systems. Though there are vast amount of information and research publications available in both the techniques but due to complexity of implementation the 3D model based representations are less preferred.

In this paper various methods are discussed for gesture recognition, these methods include Time Delay Neural Network, HMM, Dynamic Time Warping, Finite State Model. For dynamic gestures, HMM tools are perfect and efficient especially for robot control. TDNNs are used as classifier and for capturing hand shape. The selection of specific algorithm for recognition depends on the application needed. FSM is a simple to implement but lengthy in operation. DTW is advantageous in continuous recognition applications.

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Assessment of AP, STEMI, NSTEMI and therapy Prescription based on vascular age- A Decision tree approach

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ABSTRACT - AP, STEMI and NSTEMI are the main categories of acute coronary syndrome which causes damage to the coronaries and make the patients prone to high risk of death. Several studies with different technologies have been made in diagnosis and treatment of the events, which includes association rules, logistic regression, fuzzy modeling, and neural network, CART, ID3. The existing techniques are confined to small datasets that are specific to one particular disease and this knowledge mined is not indispensible for classification of risk factors for the events. The implemented methodology uses C4.5 and C5.0 decision tree algorithm for identification of related risk factors by constructing two different decision trees for the events that includes Angina Pectoris, St-elevation Myocardial Infarction and Non-St-Elevation Myocardial Infarction based on attribute selection measure that includes Information Gain, Gain Ratio. Using performance measures, correctly classified values have been found for both the algorithms and accuracy is calculated. The implemented methodologies, C4.5 and C5.0 decision tree algorithm gives high classification accuracy of 86 % and 89.3% compared to the aforementioned existing techniques. Rule based classification technique provides a therapy selection for the events diagnosed, based on the vascular age, which aids the patients in reducing their risk levels and doctors to treat the patient with required therapy instead of angioplasty.

Keywords—Classification, Attribute selection measures, Information gain, Gain ratio, C4.5 and C5.0 decision tree algorithm, risk factors, Rule based classification.

INTRODUCTION

The objective of the implemented system was to develop a data mining system based on decision trees for the assessment of acute coronary syndrome related risk factors targeting in the reduction of the events. Decision-tree-based algorithms give reliable and effective results that provide high-classification accuracy with a simple representation of gathered knowledge, support decision-making processes in medicine. Data-mining analysis was carried out using the C4.5 and C5.0 decision tree algorithms extracting rules based on the risk factors (age, sex, FH, SMBEF, SMAFT, TC, TG, HDLM, HDLW, GLU, HXHTN, HXDM, SBP, DBP and LDL)

The C4.5 algorithm, which uses the divide-and-conquer approach to decision tree induction, was employed. The algorithm uses a selected criterion to build the tree. It works top–down, seeking at each stage an attribute to split on that which best separates the classes, and then recursively processing the sub problems that result from the split. The C5.0 algorithm boosts the constructed decision tree such that the misclassification error over the classified data is found and removed which results in higher accuracy over classified risk factors identified for the events AP, STEMI, NSTEMI.

In the implemented system, the following attribute selection measures were used: Information Gain, Gain Ratio. Based on these attribute selection measures, different decision trees are constructed. Using performance measures, training and testing datasets are compared and accuracy is calculated. Rule based classification technique provides a therapy selection for the events diagnosed, based on the vascular age, which aids the patients in reducing their risk levels and doctors to treat the patient with required therapy instead of angioplasty.
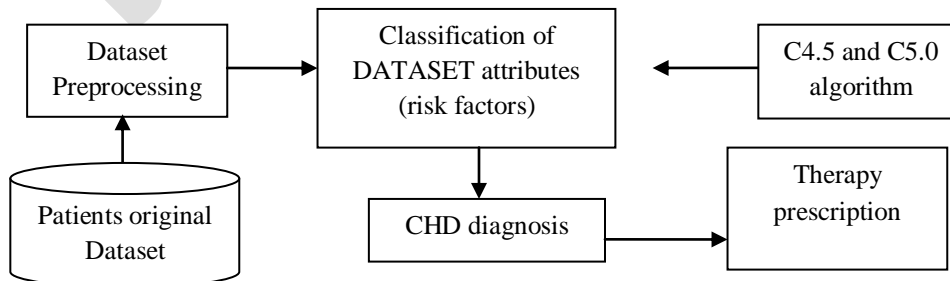

Fig.1. Block Diagram of the Acute coronary syndrome diagnosis system

DATASET PREPROCESSING

   The data preprocessing is the first processing module that analyze data that has not been carefully screened, unscreened data can produce misleading results. If there is much irrelevant and redundant information present or noisy and unreliable data, then knowledge discovery during the training phase is more difficult.Thus, the representation and quality of data is first and foremost before any process. Steps involved in dataset preprocessing are as follows,

- Missing values are filled using K-Nearest Neighbor algorithm
- Duplications were removed
- Data were coded

The Steps involved in **filling up the missing values** are:

1. Determine parameter K = number of nearest neighbors

2. Calculate the distance between the query-instance and all the training samples

3. Sort the distance and determine nearest neighbors based on the K-th minimum distance

4. Gather the values of 'y' of the nearest neighbors

5. Use average of nearest neighbors as the prediction value of the query instance and replace the missing field with the Predicted value.

   If both the row has same value that is, the values **duplicated**, then any one of the row is removed from the dataset. None of the row is removed if at least one value differs in any column of the tuple. It is done after filling up the missing values in the dataset.

```
 if (Rown==Rowm&&Missing values==Nil) then
          Delete (Rown||Rowm)
 Else if (Rown==Rowm &&Missing values==found)
          Apply K-NN
          Return (Missing value: K-NN value)
 Repeat until Missing values==Nil
          If (Rown==Rowm) then
             Delete (Rown||Rowm)
          Else
             Checkout next record
 Else
          Return (no duplication found)
```

          Data coding is the process of assigning the dataset attribute values to a specified categorical or numerical value. It is done in order to make the representation of risk factors precise and classification to be done efficiently with that simpler representation.

Risk factors	Coded values			
Age	30-40: 1	41-50: 2	51-60: 3	60+: 4
Sex	Female: F	Male: M		
Family History	Yes: Y	No: N		
Diabetes	Yes: Y	No: N		
Hypertension	Yes: Y	No: N		
Smoking (B/A)	Yes: Y	No: N		
Systolic blood pressure	N: 120	H>140	L<100	
Diastolic blood pressure	N: 80	H>100	L<70	
Total Cholesterol	N: 180	H>200		

High Density Lipoprotein	N: 50-70	H>70	L<40
Low Density Lipoprotein	N: 130	H>130	L<130
Triglyceride	N: 160	H>160	
Glucose	N: 100-140	H>145	L<60
Class	AP: 1	STEMI: 2	NSTEMI: 3

Age	Sex	FH	SMBEF	HXHTN	HXDM	SMAFT	SBP	DBP	TC	HDLW	HDLM	LDL	TG	GLU	CL
65	2	1	1	2	1	2	80	90	200	50	30	80	67	112	1
31	1	1	1	2	1	1	100	80	45	60	50	100	56	110	2
45	1	2	2	2	1	2	149	60	80	70	40	120	100	90	3
45	1	2	2	2	1	2	149	60	80	70	40	120	100	90	3
80	2	2	1	1	1	1	150	?	190	80	60	23	150	150	3

TABLE I. ORIGINAL DATASET

Age	Sex	FH	SMBEF	HXHTN	HXDM	SMAFT	SBP	DBP	TC	HDLW	HDLM	LDL	TG	GLU	CL
65	2	1	1	2	1	2	80	90	200	50	30	80	67	112	1
31	1	1	1	2	1	1	100	80	45	60	50	100	56	110	2
45	1	2	2	2	1	2	149	60	80	70	40	120	100	90	3
80	2	2	1	1	1	1	150	**70**	190	80	60	23	150	150	3

TABLE II. PREPROCESSED DATASET

Age	Sex	FH	SMBEF	HXHTN	HXDM	SMAFT	SBP	DBP	TC	HDLW	HDLM	LDL	TG	GLU	CL
3	N	Y	Y	N	Y	N	L	H	H	N	L	N	N	N	1
1	Y	Y	Y	N	Y	Y	N	N	N	N	N	H	N	H	2
1	Y	N	N	N	Y	N	H	N	N	H	N	H	N	N	3
4	N	N	Y	Y	Y	Y	H	N	H	H	H	N	H	H	3

TABLE III. CODED DATASET

CLASSIFICATION OF RISK FACTORS AND CHD DIAGNOSIS

The C4.5 algorithm employs a divide-and-conquer approach to construct decision tree. The algorithm uses a selected criterion to build the tree using attribute selection measures that includes Information Gain and Gain Ratio. The attribute producing highest measure thrive to be the root node based on which further splits occur. Finally, it works top–down, seeking at each stage an attribute to split on that which best separates the classes, and then recursively processing the sub problems that result from the split.

Input:
1) Training dataset *D*, which is a set of training observations and their associated class value.
2) Attribute list *A*, the set of candidate attributes.
3) Selected splitting criteria method.
Output: A decision tree.

C4.5 decision tree construction module having the following attribute selection measures are to be investigated for training the dataset.

1. Information Gain (IG)

Information gain is based on Claude Shannon's work on information theory. InfoGain of an attribute *A* is used to select the best splitting criterion attribute. The highest InfoGain is selected to build the decision tree

$$InfoGain(A) = Info(D) - InfoA(D) \qquad .. \text{Eq. 1}$$

Where,

$$Info(D) = -\sum_{i=1}^{m} pi \, log2(pi) \qquad .. \text{Eq. 2}$$

$$InfoA(D) = \sum_{j=1}^{v} \frac{|Dj|}{|D|} info(Dj) \qquad .. \text{Eq. 3}$$

2. Gain Ratio (GR)

Gain ratio biases the decision tree against considering attributes with a large number of distinct values. So it solves the drawback of information gain

$$Gain\,Ratio(A) = \frac{Info\,Gain(A)}{SplitinfoA(D)} \qquad .. \text{Eq. 4}$$

$$Splitinfo A(D) = -\sum_{j=1}^{v} \frac{|Dj|}{|D|} \, log2 \left(\frac{|Dj|}{|D|} \right) \qquad .. \, Eq. \, 5$$
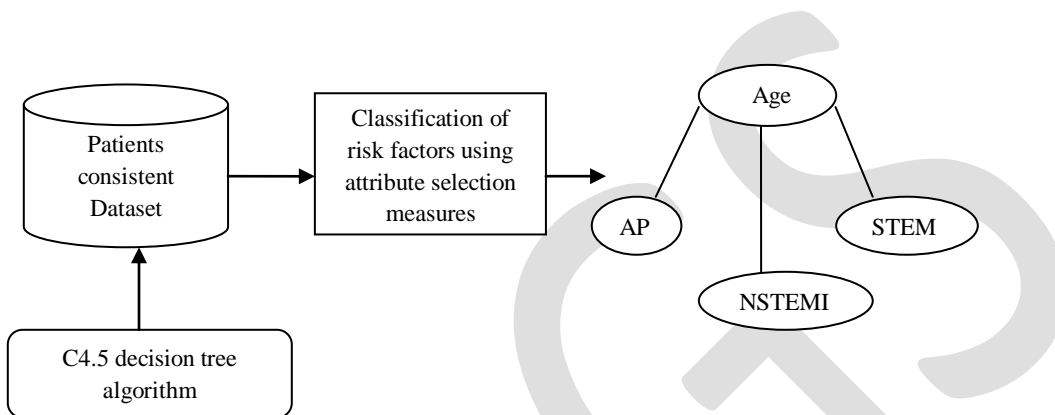

Fig.2. Classification of risk factors and CHD Diagnosis

Classification of Risk factors using Attribute selection measures for the coded dataset after Preprocessing

1. *Information Gain(IG) - Calculated for Age*

   Info Gain (A) = Info (D) − InfoA (D)

$$Info(D) = -\frac{1}{4} \, log2 \left[\frac{1}{4}\right] - \frac{1}{4} log2 \left[\frac{1}{4}\right] - \frac{2}{4} log2 \left[\frac{2}{4}\right] = 0.4515$$

$$Info A(D) = 2/4 \left(-\frac{1}{4} \, log2 \left[\frac{1}{4}\right] - \frac{1}{4} log2 \left[\frac{1}{4}\right] - 0 \right) + 2/4 \left(0 - 0 - \frac{2}{4} log2 \left[\frac{2}{4}\right] \right) = 0.2257$$

$$Info \, Gain(A) = 0.4515 - 0.2257 = 0.2258$$

2. *Gain Ratio(GR) - Calculated for Family history*

$$\frac{Info \, Gain(A)}{Splitinfo A(D)} = \frac{0.2258}{-\frac{2}{4} log2 \left[\frac{2}{4}\right] - \frac{2}{4} log2 \left[\frac{2}{4}\right]}$$

$$= \frac{0.2258}{0.3010} = 0.7501$$

Attribute having highest Gain Ratio is considered to be the root node based on which further classification of risk factors proceeds. The heart disease dataset obtained from UCI Repository contains 250 records in which 150 are considered as training dataset and 100 as testing dataset.

Deploying of C4.5 algorithm over the training dataset results in a decision tree construction, for which attribute Age produces highest measure over the other splitting criterion such that attribute age is assigned to be the root node, based on the latter further

classification of risk factors occurs. The accuracy of risk factors classification obtained using C4.5 algorithm is 86% which is higher than its predecessors ID3, CHI-SQUARED STASTICS and CART.
.

C5.0 algorithm offers boosting to generate several classifiers on the training data. When an unseen example is encountered to be classified, the predicted class of the example is a weighted count of votes from individually trained classifiers. C5.0 creates a number of classifiers by first constructing a single classifier. A second classifier is then constructed by re-training on the examples used to create the first classifier, but paying more attention to the cases of the training set in which the first classifier, classified incorrectly. As a result the second classifier is generally different than the first.

- Choose K examples from the training set of N examples each being assigned a probability of 1/N of being chosen to train a classifier.
- Classify the chosen examples with the trained classifier.
- Replace the examples by multiplying the probability of the misclassified examples by a weight B.
- Repeat the previous three steps X times with the generated probabilities.
- Combine the X classifiers giving a weight log (BX) to each trained classifier.

BOOSTING PROCESS:

STEP1: Take N = 250; k = 250
Probability of $P(N) = 1/N = 1/250 = 0.004$

STEP2: Classification using attributes selection measures

STEP3: Weight (B) = 1, 2, 3(class label)
Probability of misclassified records, $P_m(K) = 1/10$
Probability of records,
$P(K1) = P_m(K)*B1 = 1/10*1 = 0.1$ (class 1)
$P(K2) = P_m(K)*B2 = 1/10*2 = 0.2$ (class 2)
$P(K3) = P_m(K)*B3 = 1/10*3 = 0.3$ (class 3)

STEP4: Repeat for all misclassified records (k=10) such that total time of execution, X=3

STEP5: Combine the classifier by assigning Weight to each classified record
Weight = log (B3*X) = log (3*10) = 1.4

STEP6: Total misclassification error = Total probability * weight assigned for misclassified record.
Error = 0.004 *1.4
= 0.0056% for 10 misclassified records

Rule Sets

C5.0 can also convert decision trees into rule sets. This is due to the fact that rule sets are easier to understand than decision trees and can easily be described in terms of complexity. That is, rules sets can be looked at in terms of the average size of the rules and the number of rules in the set.
Rules can be represented as follows.
Rule No. : (Records Manipulated/Records with positive result, decision branch (lift))
Attribute-1 ……Attribute - n
Class label [accuracy]

DECISION TREE CONSTRUCTION:

Read 250 cases (16 attributes) from heart disease. Data
Age = 1:
:....Diabetes-Y
: : :..DBP-H: 3(60/10)
: : :..DBP-N: 1(15/7)
: : :..DBP-L:
: :   :..HDL-L: 2(10/3)
: :..Diabetes-N: 1(70/5)
Age = 2

:....Family History-Y:
: :..TCL-H: 2(8/2)
: :..TCL-N: 1(20/6)
:.Family History-N
:..SBP-H: 3(18/12)
:..SBP-N: 1(5/2)
        :..SBP-L: 2 (13)

RULE SET GENERATION:
Rule 1: (60/10, lift 1.2)
        DBP-H
        Diabetes-Y
        Age=1
    -->   Class 3 [0.889]

Rule 2: (8/2, lift 1.2)
        TCL-H
        Family History-Y
        Age=2
    -->   Class 2 [0.905]

Rule 3: (5/2, lift 1.6)
        SBP-N
        Family History -N
        Age=2
    -->   Class 1 [0.872]

Rule 4: (10/3, lift 1.5)
        HDL-L
        DBP-L
        Diabetes-Y
        Age=1
    -->   Class 2 [0.883]

Evaluation on training data (100 cases):
Rules

No   Errors
4   100 (10.7%)

(1)   (2)   (3)   <-classified as
----   ----   ----   (1) Class 1
 23   27   50   (2) Class 2
                                  (3) Class 3

        C5.0 algorithm provides high classification accuracy of 89.3% by employing boosting over misclassified records and generation of rule set for decision making process to be more precise, understandable and efficient. Compared to C4.5 algorithm, C5.0 is less time consumption, reduce error rate, simple to interpret and produces more accurate result.

VASCULAR AGE (THERAPY PRESCRIPTIONS)

        It is based on Rule-based classification in which rules are set for risk factors and those that satisfy the rules is considered for further process of vascular age determination and therapy prescription. Risk Factors used for prescribing therapy for CHD patients are Age, HDL, Smoking, Diabetes, SBP and TC. Each factor has its own score such that summation of all the factors gives a total scores value that determines vascular age. A therapy is prescribed for a patient based on his/her vascular age that includes nitrate, statin, aspirin, Ace inhibitor, Beta blocker, etc.,
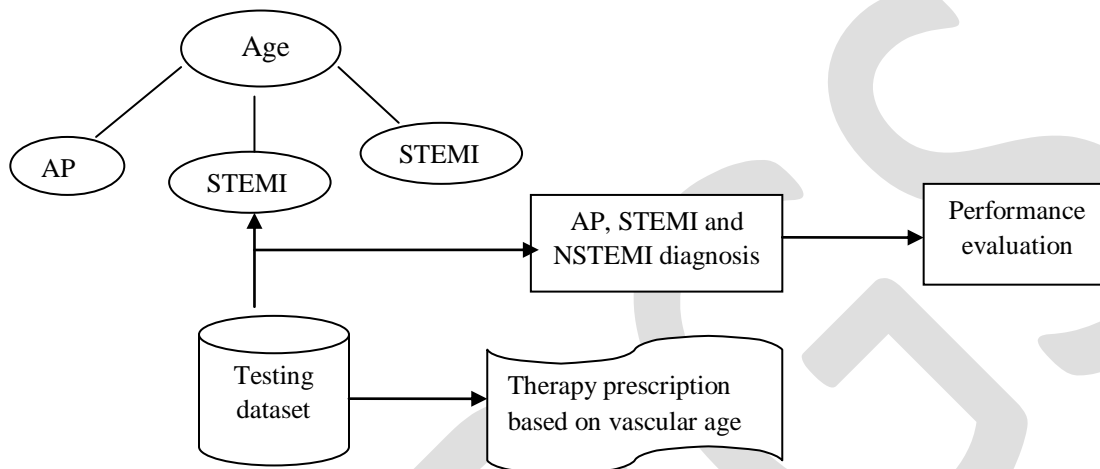
Fig.3. Vascular age determination and Therapy Prescription

TABLE IV AGE SCORE

Age	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75+
Men	0	2	5	6	8	10	11	12	14	15
Women	0	2	4	5	7	8	9	10	11	12

TABLE V TOTAL CHOLESTEROL SCORE

TC	<160	160-199	200-239	240-279	280+
Men	0	1	2	3	4
Women	0	1	3	4	5

TABLE VI HIGH DENSITY LIPOPROTEIN SCORE

HDL	<35	35-44	45-49	50-59	60+
Men	2	1	0	-1	-2
Women	2	1	0	-1	-2

TABLE VII SYSTOLIC BLOOD PRESSURE SCORE

SBP	<120	120-129	130-139	140-149	150-159	160+
Men	0	2	3	4	4	5
Women	-1	2	3	5	6	7

TABLE VIII SMOKING AND DIABETES SCORE

Smoking	No	Yes	Diabetes	No	Yes
Men	0	4	Men	0	3
Women	0	3	Women	0	4

TABLE IX TOTAL POINTS FOR VASCULAR AGE DETERMINATION

Total Points	< -1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17+
Vascular Age: Men	<30	30	32	34	36	38	40	42	45	48	51	54	57	60	64	68	72	76	80+
Vascular Age: Women	<30	<30	31	34	36	39	42	45	48	51	55	59	64	68	73	79	80	80	80+

In case, if the training dataset contains a patient record having above specified risk factors as in Table IX, then all their corresponding risk factor scores are retrieved from the stored score tables and finally summation of all the retrieved scores for the specific risk factors gives a total points based on which vascular age is determined for the patient diagnosed with CHD. Here, his Total score points are 9, for which his vascular age is determined to be 51. For such cases, the therapy or medication to be prescribed are Nitrate, Statin, Ace-inhibitor and Beta-blocker. If the prescribed medicine has no effect or curing or reducing the risk factor levels then angioplasty is preferred for the patient.

TABLE X VASCULAR AGE CALCULATION

No.	Risk Factor	Risk Score
1	Age	2
2	Sex	M
3	TC	1
4	HDL	1
5	SBP	2
6	Smoking	0
7	Diabetes	3
Total Points		9
Vascular age		51

PERFORMANCE EVALUATION

In order to evaluate the performance of C4.5 and C5.0 algorithms, the following factors are to be investigated.

1) Correct classifications (%CC): is the percentage of the correctly classified records.

$$\%CC = (TP + TN)/N$$

2) True positive rate (%TP): corresponds to the number of positive examples correctly predicted by the classification model.

3) False positive rate (%FP): corresponds to the number of negative examples wrongly predicted as positive by the classification model.

4) True negative rate (%TN): corresponds to the number of negative examples correctly predicted by the classification model.

5) False negative rate (%FN): corresponds to the number of positive examples wrongly predicted as negative by the classification model.

6) Sensitivity: is defined as the fraction of positive examples predicted correctly by the model.

$$Sensitivity = TP/ (TP +FN)$$

7) Specificity: is defined as the fraction of negative examples predicted correctly by the model.

$$Specificity = TN/ (TN+FP)$$

8) Support: is the number of cases for which the rule applies (or predicts correctly); that is, if we have the rule $X \rightarrow Z$, Support is the probability that a transaction contains {X, Z}.

$$Support = P (XZ) = no\ of\ cases\ that\ satisfy\ X\ and\ Z/|D|$$

9) Confidence: is the number of cases for which the rule applies (or predicts correctly), expressed as a percentage of all instances to which it applies, that is, if we have the rule $X \rightarrow Z$, Confidence is the conditional probability that a transaction having X also contains Z

$$Confidence = P (Z|X) = P (XZ)/P (X)$$
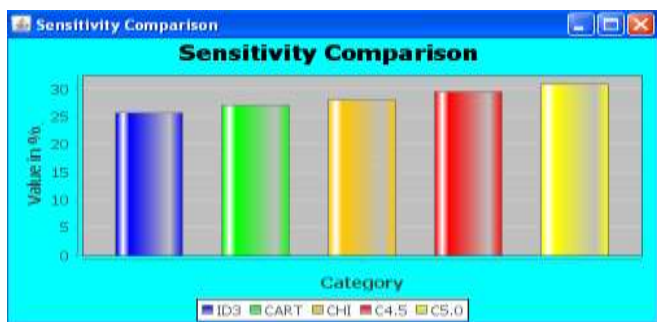
Fig.4. Sensitivity comparison of Decision tree algorithms
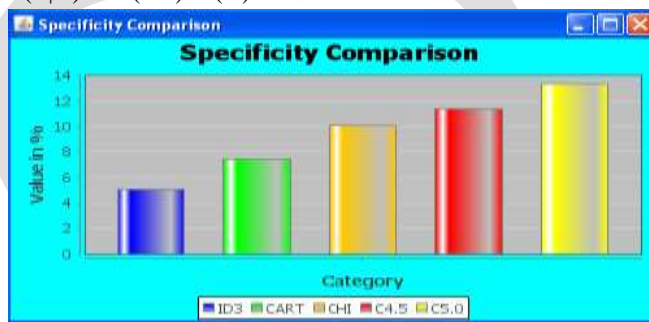
Fig.5. Specificity comparison of Decision tree algorithms

RESULT ANALYSIS

C4.5 and C5.0 algorithm used attribute selection measures for constructing two different decision trees. The training and testing datasets were compared after decision tree construction for finding out correctly classified values. Using Performance measures, the dataset's attribute value has been correctly classified and accuracy is calculated. C4.5 and C5.0 decision tree algorithm gives high classification accuracy of 86 % and 89.3%.Accuracy comparison graph proves the accuracy of classification of risk factors for the events AP, STEMI and NSTEMI such that high classification accuracy of 89.3% is obtained by deploying C5.0 decision tree algorithm over the datasets.
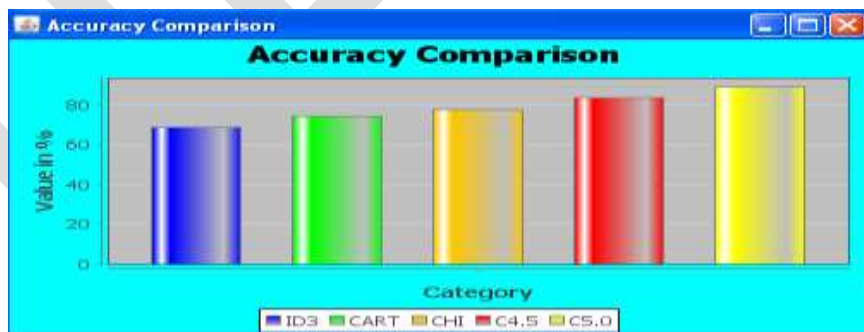
Fig.6. Accuracy of Decision tree algorithms

Finally, testing dataset value is used for determination of vascular age, based on which a specific therapy is prescribed for a patient diagnosed with CHD.
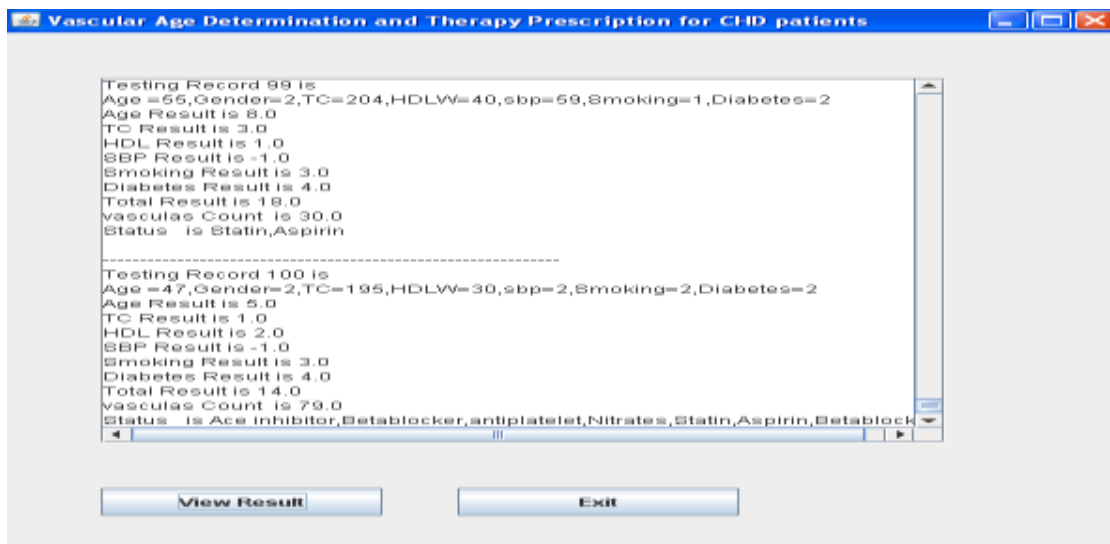
Fig.7.Vascular Age determination and therapy selection for CHD patients

DIFFERENCE BETWEEN C4.5 AND C5.0 DECISION TREE CONSTRUCTION

C4.5 DECISION TREE CONSTRUCTION	C5.0 DECISION TREE CONSTRUCTION
Handles discrete and continuous data only	Handles dates, times, timestamps, ordered discrete attributes, and categorical data
Attribute selection measures used are • Information gain • Gain ratio	Attribute selection measure used is Distance measure alone. So, reduces manipulation, time consumption.
No boosting over decision tree construction and classification.	Boosting plays a significant role in it by assigning weights to the decision tree formed and reduces misclassification error. Thus, increases accuracy.
Produces result in the form of decision tree	Produces result in the form of rule set which is more precise and ease to interpret.

CONCLUSION

The implemented methodology uses C4.5 and C5.0 decision tree for assessment of acute coronary syndrome related risk factors and reduction of the events that includes Angina Pectoris, St-elevation Myocardial Infarction and Non-St-Elevation Myocardial Infarction. C4.5 Decision tree algorithm identifies most important risk factors for the events using attribute selection measures whereas C5.0 algorithm uses attribute selection measure for classification ,boosting for increasing the accuracy over classified risk factors and rule set generation for making decision more accurate and precise. Accuracy obtained by deploying C4.5, C5.0 algorithm is 86% and 89.3% which justifies that C5.0 algorithm has highest accuracy compared to other decision tree approaches that includes ID3, CHI-SQUARED STATISTICS, GINI INDEX, CART and C4.5. Rule based classification is used for determination of vascular age based on which a specific therapy is prescribed for a patient diagnosed with the events.

FUTURE WORK

Future work involves in decision tree construction for more events instead of finding for limited number of events with large dataset values and also grouping of different diseases and generating rules separately for diagnosis, therapy prescription of different events rather than finding specific disease, such that it makes clinicians to interpret the result for several disease at once in case of emergencies.

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A Hybrid Skin Color Model for Face Detection

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ABSTRACT – For a human vision system performing the process of face detection is an easy task compared to an intelligent machine. This paper contains a system for human Face detection by combining various skin color models. It's an amalgamation of three diverse skin color models specifically the RGB, YCbCr and HSV. A hybrid Skin color model has been proposed for varying illumination conditions. The main objective for using is to overcome the problem of illumination conditions availability in an arbitrary image. Skin detection can be defined as the process of finding skin-colored pixels and regions in a given image. Skin detectors classically transform a given pixel into an appropriate color space and the classification is used to label whether it is a skin or non-skin pixel. The extraction of skin region is carried out using a set of bounding rules based on skin color distribution. Later the segmented face regions are classified using combination of morphological operations. Experimental results on the benchmark face databases such as FERET and the acquired images showed that the proposed model is able to achieve an accurate detection for near-frontal face orientation and skin color.

Keywords: Face detection, skin color models, skin likelihood, skin segmentation, extraction of skin region, morphological operations, face regions.

1. Introduction

In today's era of fast growing biometric systems several approaches of face detection have been proposed. Face detection is one of the elementary techniques enabled by human-computer interaction (HCI), whereas still the process for best system is under hunt as it has become a challenging problem in the field of pattern recognition and holds a very important position in computer vision research. Face detection is essentially a step of processing system to check for presence of object (human face) and subsequently the position of object in an image. Given an arbitrary image the face detection system should be able to analyze the image and determine the various features, region of face.

There are several challenges in a face detection system as human face has varying posture, orientations, expressions and skin color. There also exist some exterior factors such as compound backgrounds, occlusion, and quality of image and differing illuminating conditions. These all factors contribute extensively to the overall problem.

According to the literature survey [1] and [2] lot of approaches of face detection are based on knowledge, invariant feature approach, statistical and template matching etc. Some methods which are used earlier namely the Gaussian model [7], Gaussian mixture density model [8] and histogram based model [9]. Detecting of faces in color images has become important for a face detection system. As the color being one of the timely and most useful components to extract skin regions. Numerous color spaces have their luminance component and chromatic component separated, and they hold a higher dissimilarity between skin pixels and non-skin pixels over differing illuminating conditions. Skin color models that employ only on chrominance subspaces [3] likely Cb-Cr and H-S found to be efficient in characterising varying human skin colors.

In this paper we have proposed a hybrid skin color model that is a combination of RGB, YCbCr and HSV for a face detection system. Face detection is based on extracting skin color information of skin regions in a given image. Skin-color is an important and relatively steady feature for face, and it can be detached from most of the environment objects. The skin-color of human appears very differently in various conditions.

In this hybrid model a two phase process is carried out. In the initial phase skin information is extracted in skin regions of a given image, which yields a result of separate skin and non-skin regions (a skin likelihood image). Later skin-segmentation process is deployed which generates a binary image of resultant image from first phase.

This model utilises the additional hue and chrominance information of the image on top of standard RGB properties to improve the dissimilarity between skin pixels and non-skin pixels. In our approach, skin regions are classified using the RGB boundary rules introduced by Peer et al. [4] and also additional new rules for the H and CbCr subspaces.

The rules are constructed based on the skin color distribution obtained from the training images. The cataloguing of the extracted regions is further refined using a parallel blend of morphological operations. The rest of the paper is organised as follows: Brief description of the various steps: Section 2: A System Overview, Section 3: The Hybrid Skin Color Model, Section 4: Morphological Operations. Section 5: Experimental Results and comparative study. Finally, Section 6: Conclusion of the paper.

2. A System Overview

Face detection is a field which integrates the system such as: Computer vision, Computer graphics, Physiology, Evaluation.

An overview on a face detection system is explained as given in the Figure 1.
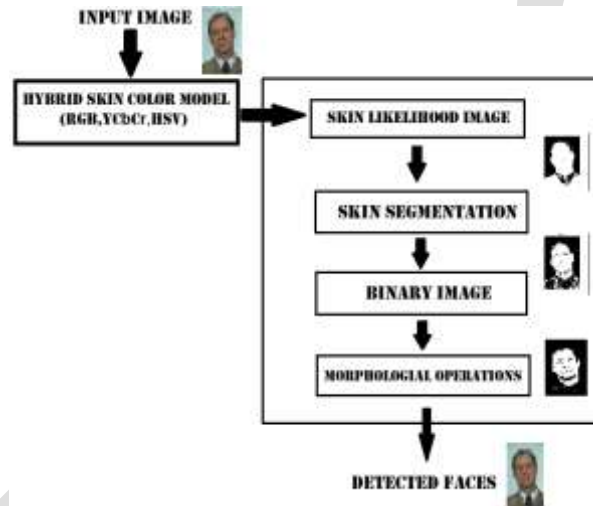
Figure 1: Face Detection system overview

The proposed face detection system consists of two image processing steps to detect the human face in a given arbitrary image. Initially the set of input images are taken as first step of face detection. Colors play a significant role for object detection. In our proposed hybrid skin color model (color based approach), a combination of RGB, YCbCr and HSV are used to construct the bounding rules for skin color distribution. The unique features of the image are extracted and skin likelihood image is obtained. The bounding rules are used to segment the skin regions from the resultant images (binary image).

In the second step a combination of morphological operations is carried out to extract the skin regions to remove non-skin regions. Adding or removing the pixel from an object is fully based on the size or shape of the structuring element, which defines the neighbourhood pixel. Hence morphing process is completed by filling all the holes present in skin regions with proper shape of face region. Lastly the box is drawn around retained face regions which detect faces.

3. The hybrid skin color model

3.1 Color Segmentation

Color being one of the prominent components, human facial skin component is subspace of the total color space. It would be precise to use face color correlations by deploying appropriate color model. A hybrid model is a combination of RGB, YCbCr and HSV skin color model. RGB is one of the device dependent color space where the resultant color always depends on the set up deployed.

An overview of RGB, YCbCr and HSV skin color model is explained.

RGB: A different way to a device dependency is to imagine an RGB cube within a color space representing all possible colors. We define a color by its values on the three axes, however the exact color will depend on the position of the cube within the perceptual color space, i.e. move the cube (by changing the set-up) and the color will change. They are known as device calibrated color spaces [12].
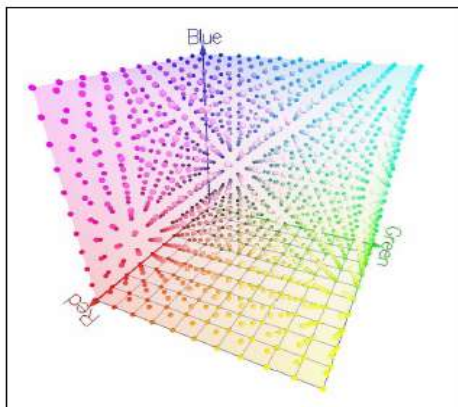

Figure 2: RGB color space

RGB space may be displayed as a cube based on the three axis corresponding to red, green and blue, [CST 2004] where the value of (R,G,B) is classified as skin

$$R>95 \text{ and } G>40 \text{ and } B>20$$

YCbCr: The YCbCr color space is commonly used in image processing as it separates the luminance, in Y component, form the chrominance described through Cb and Cr components. Several definitions of this transformation exist as [6]: two color difference in Cb and Cr values is formed by subtracting luma from RGB red and blue values

$$Y=0.299R+0.587G+0.114B$$
$$Cb=B-Y$$
$$Cr=R-Y$$
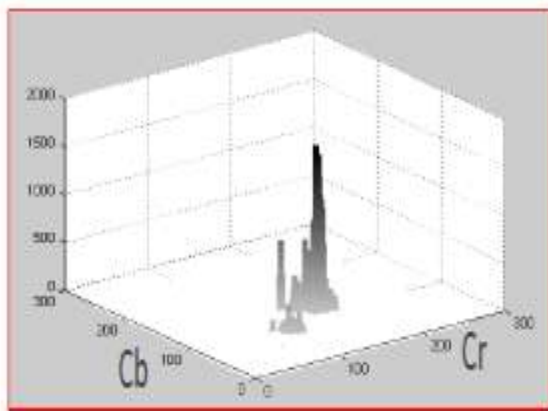
Figure 3: Skin color distribution in CbCr color space.

The Cb and Cr components are used to characterize the skin color information. It is shown that skin color is localized in a small cluster in this color space [10].

HSV: In situations where color description plays an integral role, the HSV color model is often preferred over the RGB model. HSV color model is the cylindrical representation of RGB color model. HSV stands for hue, saturation and value. In each cylinder, the angle around the central vertical axis corresponds to "hue" or it form the basic pure color of the image, the distance from the axis

corresponds to "saturation" or when white color and black color is mixed with pure color it forms the two different form "tint" and "shade" respectively. The HSV model describes colors similarly to how the human eye tends to perceive color.
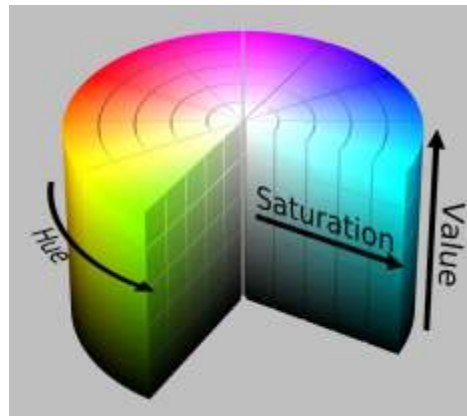
Figure 4: HSV color space

.
 RGB defines color in terms of a combination of primary colors, whereas, HSV describes color using more familiar comparisons such as color, vibrancy and brightness.

Hence by considering all the features of RGB, YCbCr and HSV skin color models, a hybrid model is proposed. To build a color model, set of images were analyzed and the properties of skin color in various spaces. The images containing skin color regions were either exposed to uniform illumination or flashlight illumination.

A.   Illuminant bounding rules

Illumination in Computer vision can be defined as the methods for acquiring, processing, analyzing, and understanding images. The illumination of the subject is a key element in creating an object (image), and the interchange of light and shadow is also important. The position of the light sources can make a considerable difference in the type of object that is being presented. In divergence, a single light source, such as daylight, can serve to highlight any texture or interesting features. Illumination is an important concept in computer graphics**.**

Images were analyzed in hybrid color spaces (i.e., RGB, YCbCr and HSV). In RGB color space all the 3 channels are not distinguished, so a simple histogram will show the uniformity across spectrum values. In RGB space the skin rules introduced by Peer et al. [4], [11] are:

1.   Uniform daylight illumination rule can be defined as
$(R > 95)$ AND $(G > 40)$ AND $(B > 20)$ AND $(\max\{R, G, B\} - \min\{R, G, B\} > 15)$ AND $(|R - G| > 15)$ AND $(R > G)$ AND $(R > B)$

2.   The skin color under flashlight or lateral illumination rule is given by
$(R > 220)$ AND $(G > 210)$ AND $(B > 170)$ AND $(|R - G| \leq 15)$ AND $(R > B)$ AND $(G > B)$

Considering both the illuminations conditions i.e., uniform daylight and lateral illumination, A logical OR is used to combine both the illuminating conditions and a bounding rule is obtained.
But the CbCr subspace is a strong discriminates of skin color,

$C_B >= 60$ && $C_R >= 130$
$C_B >= 130$ && $C_R >= 165$

And in HSV model hue shows the significant discrimination of skin color regions

$H >= 0$ && $H <= 50$

S>=0.1 && S<=0.9

B.	Skin segmentation

The hybrid model a combination of the bounding rules from all the 3 skin color models. The segmentation process is a precise and accurate. Segmentation technique uses all 3 color space to boost up face detection rate.
Skin color detection may avoid extensive search of face regions in a given entire image. Initially the process of rejecting non-skin regions, so that only the skin like areas of given image i.e. the skin color segmented image for further processing.

From all 3 color models, the RGB color model is lighting sensitive, in YCbCr color model the distribution of skin areas is consistent in Cb and Cr components across different races and lastly the HSV color model hue is not reliable when saturation is low. Hence combination of these color models overcomes the illumination conditions and yields better result than individual color model.
But still there exists some common issues in resulting segmented skin color regions:
   a.	The fragmented regions often consist of holes and gaps.
   b.	The extracted skin color regions may not be face regions; there are possibilities that certain skin regions (arms & legs) are exposed limbs.
   c.	Even the similarity of skin color may exist in foreground and back ground objects.

4. Morphological operations

The face detection system involves subsequently the usage of morphological operations to refine the skin regions extracted from the segmentation phase.
Initially the simple hole filling operation to fill any individual holes or gaps, and the process of simple dilation is applied on the regions, the dilate function maintains the size of individual blobs of skin detected. Then flood fill operation is used to close gaps and holes within each region.

Later the determination of the skin likelihood region is evaluated for properties. The height and width ratio of the region bounding box has range of values lies between 1.6 and 0.8. The ratio above 1.6 would not suggest a human face, as the orientation is vertically longer height than width. Ratios below 0.8 are misclassified as arms, legs and other elongated objects. After the height and width ratio is applied it results in face detection.

5. Results:

Our proposed face detection method was implemented with MATLAB. Testing was carried out with benchmark face database set such as FERET and acquired images. The images are near-frontal faces and also of various indoor, outdoor scenes with varying lighting conditions.

Two performance metrics are defined to estimate the success of face detection system. They are FDR and SDR.(refer original paper)

False Detection Rate (FDR) is defined as the number of false detections over the total number of detections.

FDR = false detections   X100%
         number of detections

Success Detection Rate (SDR) is defined as the number of correctly detected faces over the actual number of faces in the image, where the number of detected faces is equal to the number of faces minus the number of false dismissals.

SDR = correct detected faces   X100%

number of faces

By considering set of parameters the performance of hybrid model was evaluated. The parameters are face detected, time to execute using combination of skin color model, false positive and accuracy.

Table 1: Results of face detected on RGB, YCbCr and HSV Color spaces

No. of Images (20)	FDR (%)	SDR (%)	Time to execute	Face detection
RGB	41.01	67.00	4.6623	16
YCbCr	35.16	76.15	4.6463	17
HSV	32.62	78.14	6.3046	17

Table 2: Results of face detected on combination of two color spaces

No. of Images (20)	FDR (%)	SDR (%)	Time to execute	Face detection
RGB + YCbCr	40.10	68.02	5.6236	15
YCbCr + HSV	33.01	77.12	6.4053	17
RGB + HSV	39.13	67.32	5.9743	16

Table 3: Results of face detected on hybrid model (RGB, YCbCr, HSV color spaces).

No. of Images (20)	FDR (%)	SDR (%)	Time to execute	Face detection
RGB + YCbCr + HSV	31.26	79.14	4.5243	18

Comparative study:

The 3 color sub spaces RGB, YCbCr and HSV are compared for the varying illuminating conditions with set of images. Now through the analysis process the obtained results are as follows, for the daylight illumination YCbCr color spaces gives better results compare to other two color model. In lateral illumination HSV color space is better   compared to RGB and YCbCr.

Illumination conditions	No of images	RGB (%)	YCbCr (%)	HSV (%)	Analysis
Daylight illumination	10	64	69	65	YCbCr is better color space.
Lateral illumination	10	53	54	57	HSV is better color space

Set of face detected result set images:

FERET DATABASE:

BENCHMARK IMAGES:

Aquired images:

6. Conclusion:

A hybrid skin color mode was used to detect human faces. A combination of RGB, YCbCr and HSV are used to construct the bounding rules for skin color distribution. The unique features of the image are extracted and skin likelihood image is obtained. The bounding rules are used to segment the skin regions from the resultant images (binary image). Thus it is two phase of IP steps separating skin and non-skin pixels and performing morphological operations by considering the illuminations conditions. The skin segmentation was combination of RGB, YCbCr and HSV subspaces which verified discrimination between skin and non-skin regions. The experimental results showed the system is a simple implementation and should be feasible in real time. In our future work we intend use soft computing techniques such as fuzzy inference rules to detect faces which may yield better results.

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Infinity State Zero Model Number

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ABSTRACT - The concept of number system formation is proposed here addition with several properties directing to appropriate consequence. An analysis on complements of number also given which may introduce us to the concept of negative thing and can explain most of the logic in Mathematics. A master number reside with zero and divide itself and create sub-number which is bounded in an external circle of a fixed position . The numbers may also provide internal circle and circle in circle . At a range of point the circle is fulfilled and consumed by zero where all sub-number converge to the master . New number are formed by combination and again bounded to a circle . The process continues infinitely. Meanwhile the concept is useful in every area of science. Application in distributed system is shown. The system having the special property as every object is described with every object which may give the appropriate description of nature.

1. Introduction

We are looking into the universe with every of ours perspective view. In free state object spread equally to all direction. Now we are looking over the concept of number system formation although modern mathematics having several types of number system. Further we can describe "Mathematics as connections".

1.1 History and concept of Number System

In the Babylonian mathematics having sexagesimal positional number system of base 60 . The lack of a positional value(or zero) was indicated by a space between sexagesimal numerals. A punctuational symbol was co-opted as a placeholder in the same sexagesimal number system but it was not true zero because it was not used alone or it does not use at the end of the number. Later in Arabia and India zero treated like any other number which refers to the word void and the concept of number system as " place to place 10 times in a value" is the origin of modern decimal number system. Later in China the concept of "subtraction, addition, negative number and positive number" was established. The Greecks were insured about the status of 0 as a number because the question arise "How nothing can be something"? As a number in most system 0 was identified before the idea of negative things that go lower then. Successive position of digits have higher weights , so inside a numeral the digit zero is used to skip a position and give appropriate weights to the preceding and following digits. Zero having infinite number of factors. Any number divide by zero is undefined.

1.2 Elementary Number theory

0 is the smallest non-negative integer. Zero is followed by 1 and no natural number precedes 0.The number 0 may or may not be considered a natural number, but it is a whole number and hence a rational number , a real number as well as an algebraic number and a complex number. The number 0 is neither positive nor negative and appears in the middle of a number line. It is neither a prime number nor a composite number. It cannot be prime because it has an infinite number of factors and cannot be composite because it can not be expressed by multiplying prime numbers (0 must always be one of the factors). Zero is even because it can be divisible by 2. Although we know about the property of zero but the question is that, how the number system formed?

2. Review on existing work(Delta Function)

ABC means basic facts about the subject. In Greece it denoted as αβ∂. Now let us discuss about the Delta(∂) functions. Delta means change. We can define two types of energy acted upon any object.

1. Internal energy
2. External energy

So, if any external energy acts upon any object we can simply derive that, Total energy=internal energy + external energy.

2.1 Impulse Function

When a large force acts for a short time, then the product of force and time called impulse in applied mechanics. The unit impulse function is the limiting function,

$$\partial(t-1) = 1/e, \quad a < t < a + e$$

$$= 0, \quad \text{otherwise.}$$

The value of the function(height of the strip in the figure) becomes infinite as e $\longrightarrow$ 0 and the area of the rectangle/strip is unity.

$$\int_0^\infty \partial(t-a).dt = 1$$
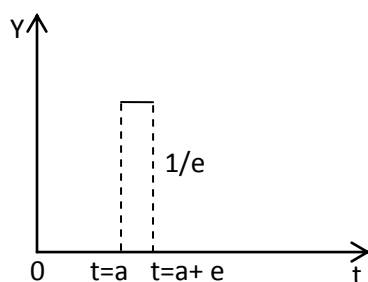
Figure 2.1.1 Impulse function.

The Unit impulse function defined as follow,

$$\partial(t-a) = \infty, \quad \text{for } t=a$$

$$=0, \quad \text{for } t \neq a.$$

Two types of delta function are,

1. Dirac delta function[7].
2. Kronecker delta function[7].

Now we arrive to a basic point, first we are starting with a question, "If we throw a stone on water what will happen?" The answer can be simply given, the position where hit it creates an empty space and creates a number of circle around the empty space. So how the empty space fulfilled? We can say that, the circles created before consumed to empty space and converged to original point. Let us look at the effect of energy as impulsion, as we mentioned earlier in free state object spread equally to all direction. Now we may be able to understand, proposed model of number system described in section 3.

3. Proposed Model

3.1 Infinity state zero model number

3.1.1 Method:

A master number reside with zero. Then the master number is divided into sub-numbers in a fixed position of a circle and bounded into that circle. At that point of view master number is also a sub-number. When the circle is completed, it is consumed to zero and all sub-number converge into the master .The master number again divide and the sub-numbers combine with zero, itself, with other and with the master forming compound number which also act like sub-numbers .Every number fulfill its own circle. Sub-numbers are

only created and bound to circle only when all sub-numbers converge to the master which was created before. The process continues to infinity. See figure 3.1.1

Let, the master number is 5. As we mentioned earlier in a free state object spread equally to all direction. We take master number 5 because it appears at the middle of the natural number digit. It divides into sub-numbers equally as 1,2,3,4 and 6,7,8,9 in a fixed position of an external circle and Sub-numbers orient in that position of the corresponding circle.

External Circle: The circle, in which the sub-numbers are bounded is called external circle.

Internal circle: The Circle created between 0 and 5 by transitioning between them called internal circle.

Now look closely to the master number 5.Logically it appears after 4 means it must be belongs to external circle, but it resides with zero it also belongs to internal circle, which gives the special property existent with non-existent or reversely. Here we take the perspective view on external circle when after 4 to 5 or transition from 0 to 5 means existent property and perspective view on internal circle transition from 5 to 0 means non-existent property. But it can not be same time belonging to both circles, for that reason we take perspective view. These effects can be described by,

1. Distance effect.

2. Small particle effect.

Distance effect: Any object resides too much distant from another object it seems to having the property of existent with non-existent. Distant may be close to ∞.

Small particle effect: Any object is much small close enough to 0, it changes the state so frequently that remains with the property of existent with non existent.

Now let us look at an example, a person traveling on bus he will notice that road is moving, person stand beside road notice the bus is moving. We can not combine both result but can take either one of their perspective view. Here we describe everything by its corresponding weight or state.
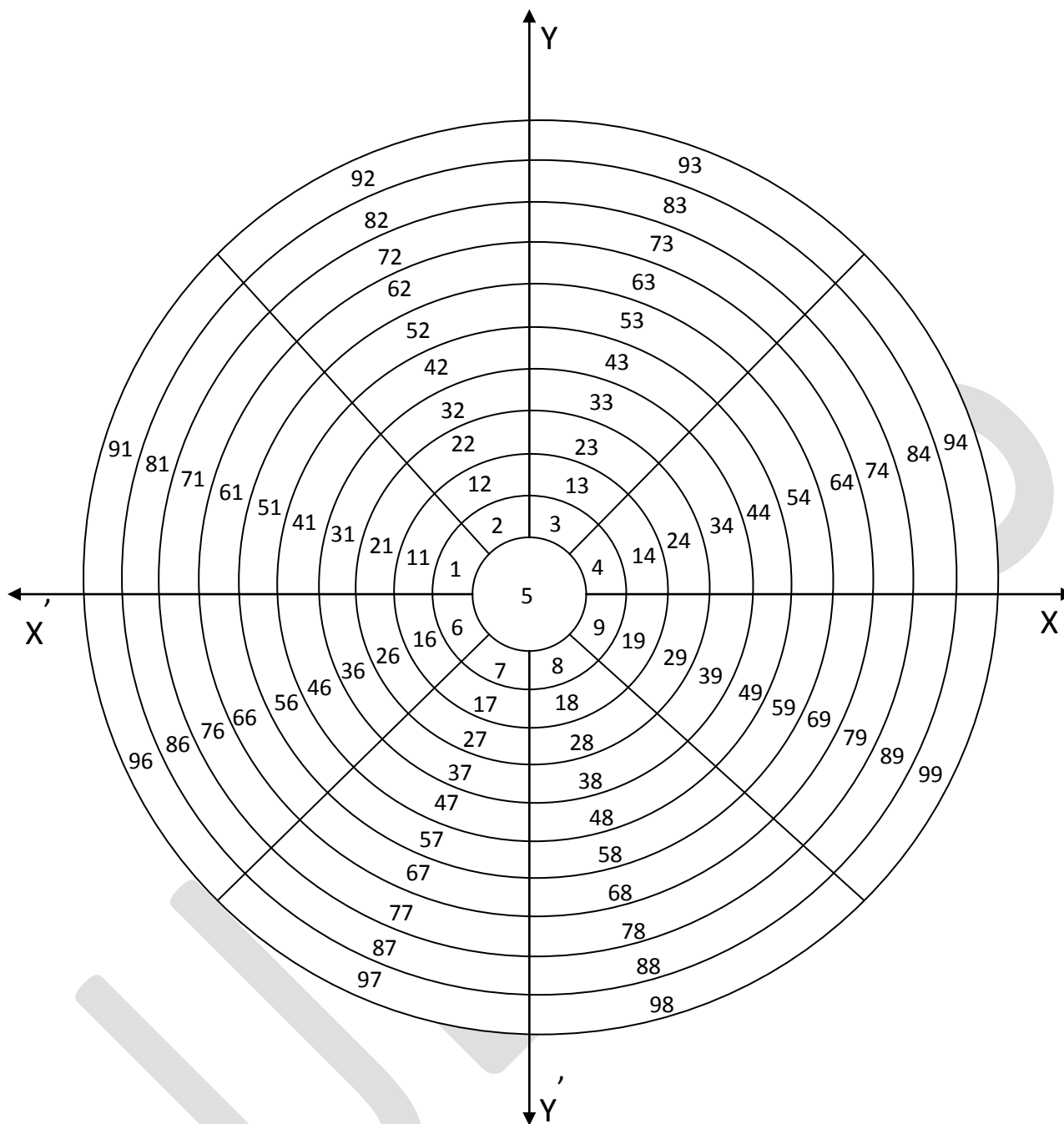
Figure 3.1.1 Infinity zero model number.

Now back to the example, every number having corresponding weight or state. 5 is higher weight than 4 because when we count 5, from external circle added with internal circle. Same time 6 has higher weight than 5 because from internal circle it added with external circle. Now See figure 3.1.2 and 3.1.3. we see that ,starting from Zero :1,2,3,4,6,7,8,9 are bounded in a external circle.1 starts with a direction – and going to direction + when the number going from 2 to 3.Again a transition is occurred when a half circle completed while the number is 4 then next number is 5.Transition occurred between 0 to 5.Again 6 starts with a direction + and going to – when the number is 8.And when the next number is 9 the circle number 1 is fulfilled , but not completed. Any circle complete if and only if its corresponding internal circle is completed. We see in the figure 3.1.2 that in circle number 1(external) we start from a direction – and when the circle is fulfilled the direction is same as the starting.
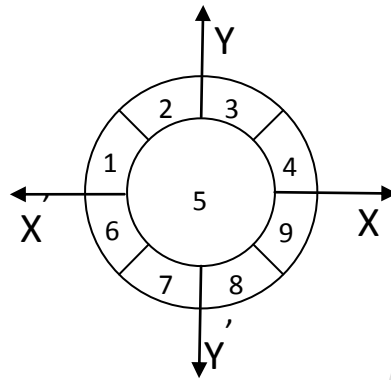
Figure 3.1.2 Number bounded in a circle of fixed position.
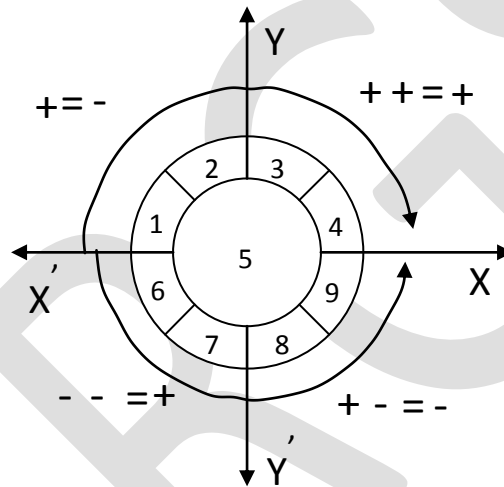
Figure 3.1.3 Internal and External circle

Now after 9 the next number is 10,means 1 combine with 0.We have seen that while starting from 0 when the number was 4 then we count 5 means transition from 0 to 5 and while any number(here 1) combine with 0 then 5 give up control or transition from 5 to zero where an internal circle is completed .As the internal circle completed then the external circle is also completed or All sub-numbers 1,2,3,4,6,7,8,9 consumed to zero and converged to the master. See figure 3.1.4.
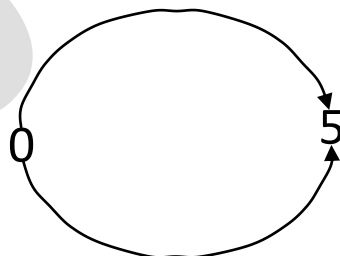
Figure 3.1.4 Complete internal circle process.

Now the sub-numbers begin to combine with itself, other sub-number and the master number. For example 1 combine with itself with 2,3,4,5,6,7,8,9 and creates its own circle. Any number only can combine with its current mate and the lower circle sub-numbers which was consumed to zero and converged to master before (Figure 3.1.5).
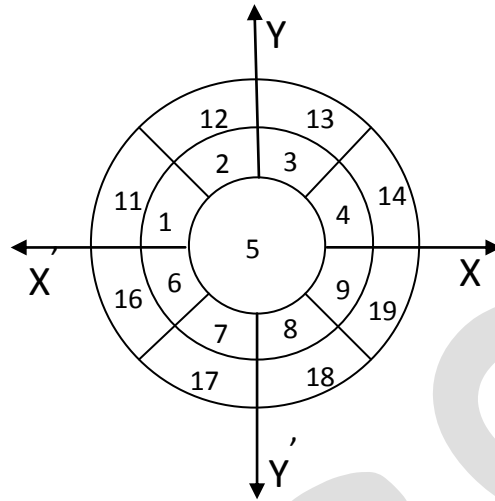
Figure 3.1.5 Circle of 1

Look closely any number combination with 0 and master is not shown in figure 3.1.1 or the $0^{th}, 2^{nd}, 4^{th}, 6^{th}$,…..circle are not shown. Rather any number combine with 0 and master number thought as separate number line. If we want to show any number combined with 0 and 5 it may be as bellow(Figure 3.1.6 and 3.1.7), Here we only show the combination process, if we want to see whole numbers as the $0^{th}, 1^{st}, 2^{nd}, 3^{rd}, 4^{th}$,…..circles then the system may be like bellow(Figure 3.1.8),
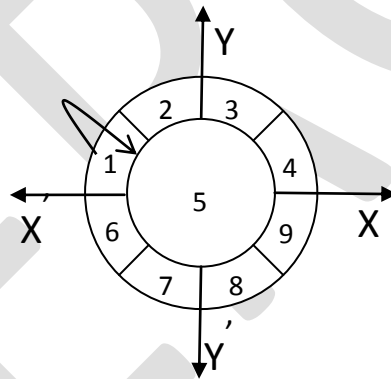
Figure3.1.6 Number combination with zero(10)
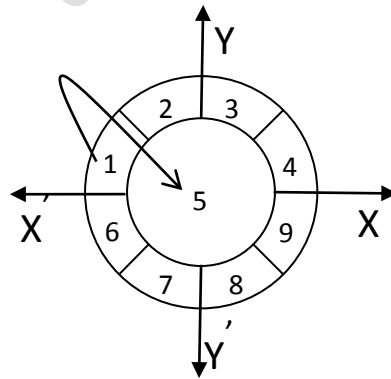
Figure 3.1.7 Number combining with master(15)

But we strongly reject this system (figure 3.1.8) because we can not show all circles same time because any sequence comes positively and negatively one after another which continues to infinity, if we separate any part from the sequence it is not visible to other part of that sequence. So external circle is not visible to internal circle process or if we can show external circles, we can not show internal circles. For that reason we use infinity state zero model number system in Figure 3.1.1(Showing all external circles. Internal circles as the thought of combination). If we can show and consider both separate part same time (Although not possible) the result can be converted to anywhere as wishes which may be logical or illogical or both(Reiman Series Theorem).

Now we can show the circle of 2,3,4,5,….10,11,..100,….and for all numbers(Figure 3.1.1). The number system process continues to infinity (Figure 3.1.1).
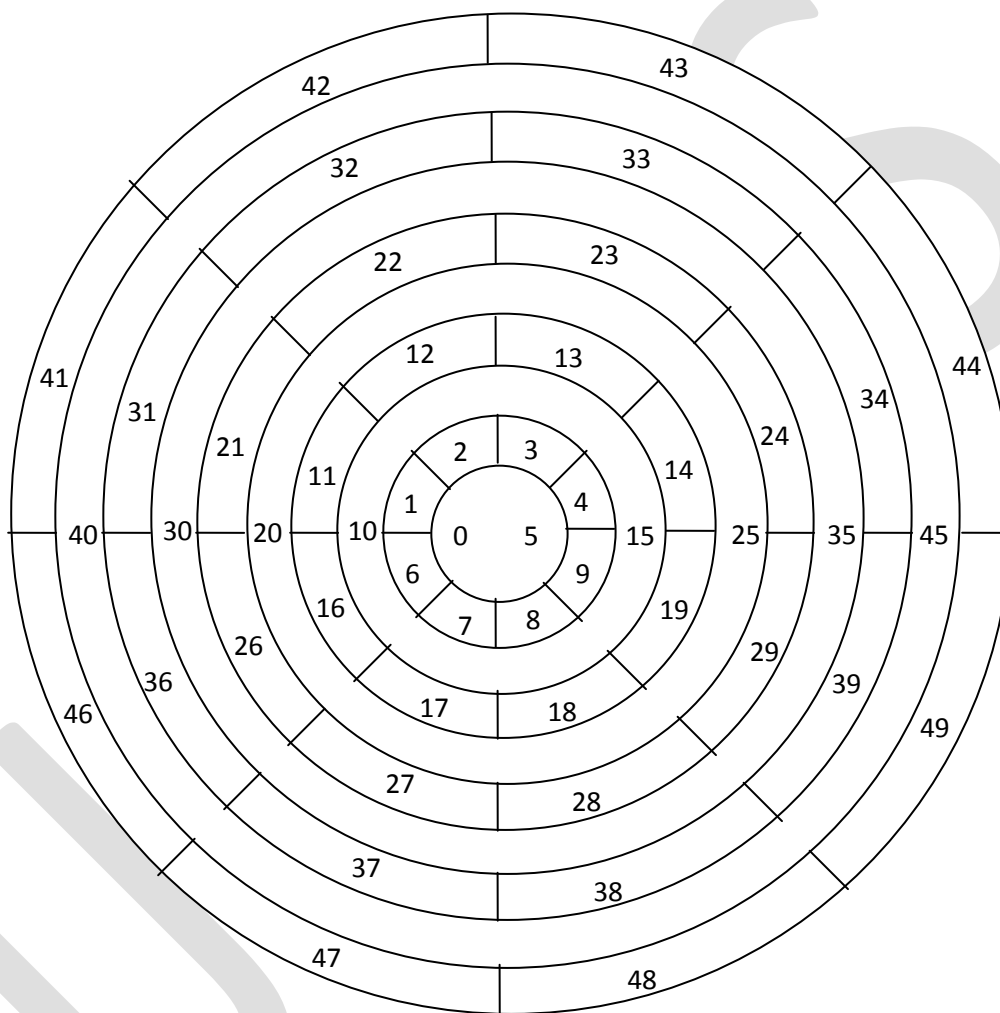
Figure 3.1.8 All number sequence.

3.1.2 Properties of the Number system

Circle in circle:

In a external circle when every number of that circle completed their own circle or any number combine with more than 1 internal circle then a circle in circle is produce. For example in circle number 1 ,the number 1,2,3,4,5,6,7,8,9 complete their own circle after that a circle in circle is created .While the number is 99 then the next number is 100 or here 1 combine with two internal circle. A circle in circle is produced. As another example when the circle number is 3 means 11,12……19,when last number of circle 3 completed its own circle or 19 complete its own circle by 19 combine with 9 the next number is 200,a circle in circle is created.

Identity:

We can begin concept of identity as with a question "Is the number 9999, circle of 999 or 99 or 9?"

The question can be answered as bellow by Identity:-

9999 is not the circle of 9 because 9 can not combine with 999.Because 999 is created after 9 and 999 is not converged to the master before 9 or 999 is not the mate of 9 in same circle. On the other hand 9999 is the circle of 99.because 99 can combine with itself and other which was converged to the master before itself and the number of same circle. But 99 having a circle of its own when the number is 999.Here the number 999 is in the circle of 99.But 999 yet not having an identity or its own circle .For that reason for the number 9999 identity is given to 999 or easy word 9999 is the circle of 999.If any number having its own circle, identity is given to possibly new one.

Cross-point: If we draw a straight line through the master number from a position of a circle to the opposite end of that circle, the summation of one end with other end will always be equal or same as other straight line goes through the same circle (figure 3.1.9).
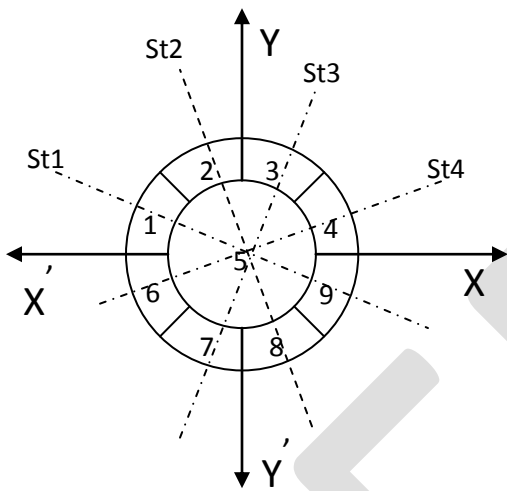
Figure 3.1.9 Summation and cross point of a circle.

Cross-point of all straight line is 5.In 1st circle two end point of 1st straight line st1 is 1 and 9.Then the summation is 1+9=10.Similarly in the 1st circle for the straight lines,

St1 ⟶ 1 + 9 = 10
St2 ⟶ 2 + 8 = 10
St3 ⟶ 3 + 7 = 10
St4 ⟶ 4 + 6 = 10

For 3rd circle the summation of two end point of the straight line,

St1 ⟶ 11 + 19 = 30
St2 ⟶ 12 + 18 = 30
St3 ⟶ 13 + 17 = 30
St4 ⟶ 14 + 16 = 30

Similarly for the 5th circle and so forth…………The summation is same .The summation of two end point of any one of the straight line provide the total number of internal + external circle. For our decimal number system the base is 10, if base is r and two end point of straight line are e1 and e2 of a certain circle then,

$$Total\ number\ of\ (internal + external)\ circle = \frac{e1 + e2}{r}$$

Here, number 18 is in the position of total internal + external circle:18+12=30;Then, 30/10=3.So total internal + external circle position for 18 is 3.Now when the number is 5 or any number combining with 5 ,then the total internal+ external circle can be calculated by the perspective view on internal circle or external circle.5 or any number combining with 5 provide the same number. So e1=e2.

Perspective view on external circle for 5 or any number combining with 5 then,

$$Total\ number\ of\ (internal + external) circle = \frac{2 * e1}{r}$$

Perspective view on internal circle for 5 or any number combining with 5 then,

$$Total\ number\ of\ (internal + external) circle = \frac{2 * e1}{r} - 1$$

For number 0 or any number combining with 0 provide the same number. Then,

$$Total\ number\ of\ (internal + external) circle = \frac{2 * e1}{r}$$

Number 0 or any number combining with 0 and 5 or any number combining with 5 can be seen as a separate number lines.

Finding circle in circle(Climbing Method):

1. Summation of two end point of certain external circle is as bellow,
For 1st circle is 10,3rd circle is 30…….similarly we get result from various circles as,
10,30,50,70,90,110,130,150,170,190,210,230,250,270,290,310,330,350,370,390,410,430,450,470,490,510,530,550,570,590,610,630,6
50,670,690,710,730,750,770,790,810,830,850,870,890,910,930,950,970,990,1010,1030,1050,1070,1090,1110,1130,1150,1170,1190,1
210,1230,1250,1270,1290,1310,1330,1350,1370,1390,1410,1430,1450,1470,1490,1510,1530,1550,1570,1590………………………
………………and so forth.
2. Dividing the sum by base 10 and adding the constituent part of numbers if exists until no combination is found then we get,

111, 113, 115, 117, 119, 121, 123, 125, 127, 129, 131, 133, 135, 137, 139, 141, 143, 145, 147,

3 5 7 9 11 **4**
c.p

6 8 10 12 5 7 9 11 13 **6**
c.n

8 10 12

2
c.n

1 3

4
c.n

1 3

149, 151, 153, 155, 157, 159, 161, 163, 165, 167, 169, 171, 173, 175, 177, 179, 181, 183, 185,

14 7 9 11 13 15 **8**
c.p

10 12 14 16 9 11 13 15 17 10 12 14

5

6
c.n

2 4

1 3 5 7

2 4 6

8
c.n

1
c.p

3 5
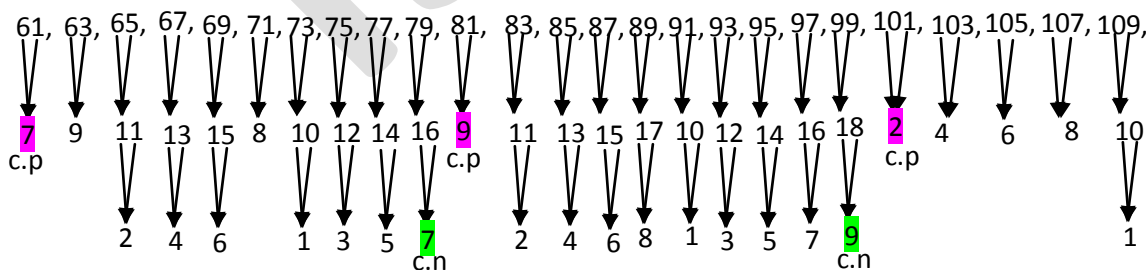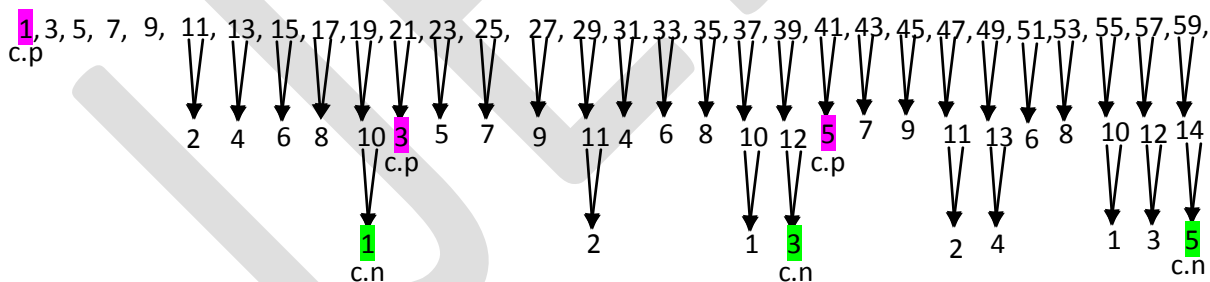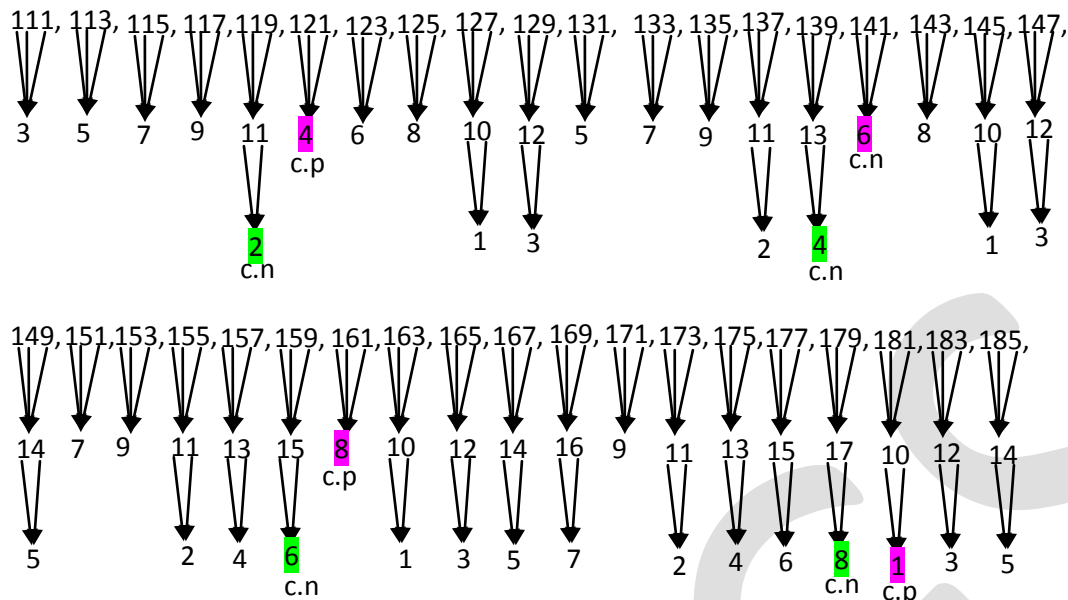
And so forth….

Here we see that a sequence as 1,3,5,7,9,2,4,6,8 and after 8 again back to 1.This sequence is called formal sequence.

Continuous pass (c.p):-Is the variable, which contain the number of total internal + external circle number of start position of the formal sequence. Here c.p is shown by number with red color.

Control to next (c.n): Contain the value of formal sequence which again back to the number as the variable c.p . it provide or give control to the next number of formal sequence and the number which get control made as c.p. Here c.n is shown by number with Green color.

3. If a number is e1, then get it's total internal+ external circle number. Let the number is y.

Initialize total circle in circle x=0.

4. Start from c.p .when we get c.n then take the total number of internal+ external circle found at c.n. Let the number is z.

5. if((z+1)≤ y) then,

x=x+1;

Update the value of c.p to the number of formal sequence where c.n pass the control.

Repeat step 4.

Else

x=x;

6. End.

Example:- 1.See that the first number at formal sequence is 1.so c.p = 1 .

2. Start from 1

3. When the value again back to 1 from formal sequence as bellow

1,3,5,7,9,2,4,6,8,1

The value is assigned to c.n .now c.n=1 .

4. Find total internal + external circle at c.n .it is 19.

5. Add 1 with 19 then 1+19=20

6. Now we want to see any number which having any circle in circle .Let the number is 86, then

      86+84=170

       170/10=17

17 is the total internal + external circle for 86.But 20>17.So 86 do not have circle in circle.

For further illustration formal sequence used by c.p(Red color) and c.n(Green color) is shown bellow,
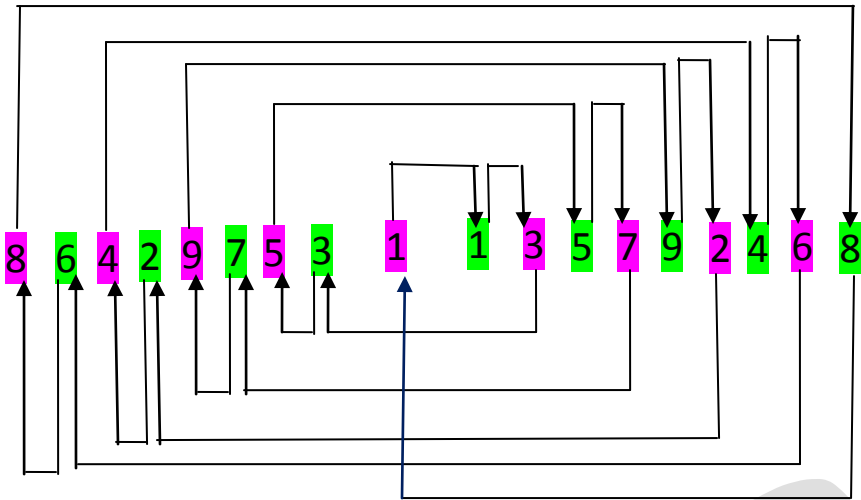
Figure 3.1.10 Formal sequence used by c.p and c.n.

So, we can define the position of any number as,

Position of a number= Total number of (internal+ external) circle + Total number of circle in circle.

There may be found other several circles such as self combination. We neglect these circles for increasing cost and other phenomena. Now the most interesting part is that, when we want to describe the exact position of any number then, we have to need all numbers which reside in the circles was created before its own resident circle. Same time its current mates are also needed. So we can reach to a conclusion that" Every object is describe with every object".

3.2 Self combination and number combination with 0 or Binary number system.
Method:

Any number or master number combination with zero and itself (as 10,11,50,55…etc) how can we show them? This is described by binary number model. The concept is same like as ring protocol. Any number does not know about itself, if it wants to know it has to visit all the number to its circle. Here we let two number as 0 and 1. Here 1 as the master number (or representative of any numbers). In this system external circle also acts as a internal circle because of happening is so frequent and fast that coincides with the property as existent with non-existent.(Figure 3.2.1),

1. 1 reside with zero.
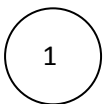
2. Counting 0 first

3. Count 1, means that now 1 having the existent property, transitioning from 0 to 1.
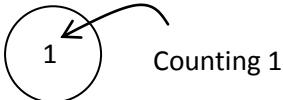
4. Now as 1 having the existent property another 1 is provided to a external circle as bellow,
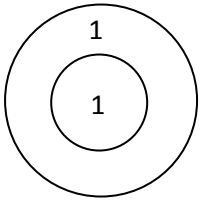
5. External circle is fulfilled the 1 in the external circle combine with 0 means consumed to zero and produce 10. Now look at internal circle where transition from 1 to 0 is done and here complete 1 internal circle. Also look at external circle that 1 consumed to zero means transition at external circle is 1 to 0 where external circle act as internal circle.
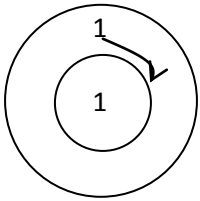
6. Now 1 converged to master and produce the number 11 by combination with master.
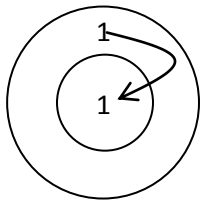
6. Now all 1's converged to master meaning existent property. Then another 1 is provided to external circle.
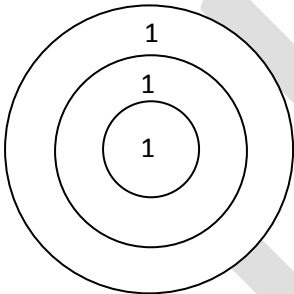
7. At first external circle transition was 1 to 0 and internal was 0 to 1. As the 2nd external circle fulfilled 1 of that circle consumed to 0.means transition will occur at internal circle from 1 to 0.Thus the number is 100.Higher order external circle acts as internal circle depending on lower order internal circle.
8. 1 at 2nd external circle now combine with internal circle master keeping transition from 0 to 1, produce 101.
9. Then the number will be 110.see that now 1st external circle completed as internal circle. Now the 2nd external circle completed because it has completed all of the lower internal circles bellow of it. Now it can combine with 1 to each circle.

10.111 is produced and another 1 is provided to an external circle.
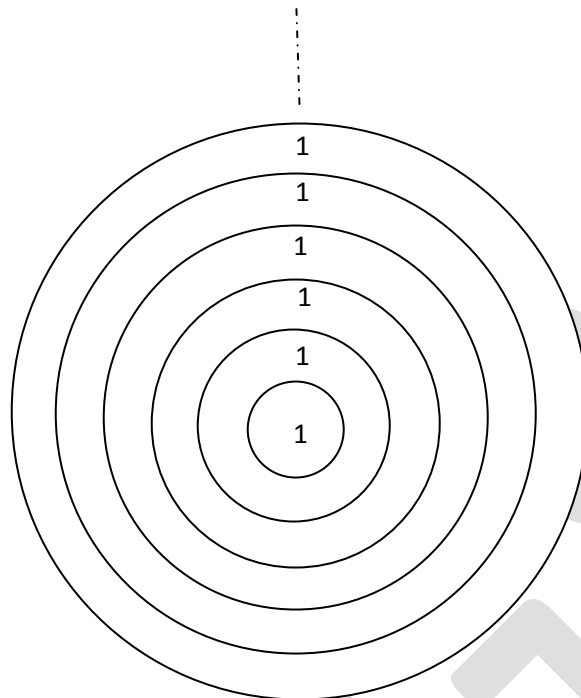Thus we can produce all binary number sequence. Binary number system model as bellow,

Figure 3.2.1 Binary Number system

4. Analysis

4.1 Complements of Numbers.

Complements are used in digital computers for simplifying the subtraction operation and for logical manipulations .There are two types of complements provided for each base r system,

1. r's complement.

2. (r-1)'s complement.

4.1.1 The r's complement:-

Let given a positive number =N,

 Base= r.

 N is the positive integer number having n integer part of digits.

 Then r's complement of N can be defined as,

 $r^n - N$ where N≠0 and

 0   where N=0

10's complement of decimal number can be formed by leaving all least significant zero's unchanged .Subtracting first non zero LSB digit from 10 and then subtracting all higher significant digit from 9.

The 2's complement can be formed by leaving all LSB zeros .First nonzero digit unchanged and then replacing 1's by 0's and 0's by 1's in all higher significant digits.

4.1.2. The (r-1)'s complement:-

Given positive number N in base r system with n integer part of digits and a fraction part of m digits ,The (r-1)'s complement of N can be defined as ,

$$r^n - r^{-m} - N$$

9's complement of any decimal number is formed simply by subtracting every digits from 9 1's complement is most simpler form. The 1's are changed to 0's and 0's are changed to 1.r's complement can be obtained from the (r-1)'s complement after addition of r^{-m} to the least significant digit.

It is worth mentioning that ,the complement of complement restore the original number .The r's complement of N is r^n-N and complement of(r^n-N) is { r^n-(r^n-N)}=N.

Similarly for (r-1)'s complement we can show that complement of complement restore the original number.

If any number having n integer part of digit and m fractional part of digit then it's complement also have m integer part of digit.

4.1.3 Subtraction using r's complement:-

Subtraction between two positive numbers (M-N) both of base r may be done as the following procedure.

1.Add the minuend M to the r's complement of subtrahend N.

2. if an end carry occurs ,discard it and the result is positive.

3.if an end carry does not occur ,take the r's complement of the number obtained in the 1st step and place a negative sign.

The proof of procedure is as bellow:

Addition of M to the r's complement of N gives (M+r^n-N).For numbers having integer part of n digits

And r^n =1 in the (n+1)'th position(What has been called the end carry),M and N are positive numbers.

a. (M + r^n - N) >= r^n if m>=N

b. (M + r^n - N) < r^n if M<N

In case, a. answer is positive and equal to M-N ,which is obtained directly discarding the end carry.

In case , b. answer is negative and equal to -(M-N),which is detected from the absence of an end carry .The answer is obtained by taking a second complement and adding a negative sign.

-{r^n –(M+r^n-N)}

= - (N-M)

4.1.4 Subtraction using (r-1)'s complement:-

Subtraction between two possible numbers (M-N) both of base r may be done as the following procedure.

   a. Add minuend M to the (r-1)'s complement of the subtrahend N.
   b. If an end carry occur add 1 to the LSB digit and the result is positive.
   c. If end carry does not occur take the (r-1)'s complement of the number obtained in first step and place a negative sign.

4.1.5 Subtraction between same number:-

In some cases problem arises when subtraction between same number .The example is given bellow.

4.1.5.1. Example:-Subtract (110-110) using 9's and 10's complement.

Solution:- Here M=N=110

And n=3 and m=0

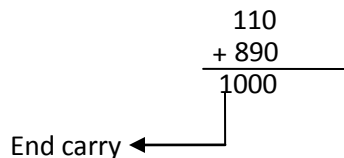Using 9's complement:-9's complement of 110 is

10^3-10^{-0}-110 =889

```
  110
+ 889
─────
  999
```

Here no carry occur .So 9's complement of 999 is (10^3-10^{-0}-999)=000

So the result is -0 which is totally complicated matter.

Using 10's complement:- 10's complement of 110 is (10^3-110)=890

So,

```
      110
    + 890
     1000
```

End carry ←⌐

Discarding the end carry the result is +000.Although (r-1)'s complement is much faster than the r's complement ,then r's complement is better than the (r-1)'s complement for performing arithmetic operation.

4.1.6. For 0 ,r's and (r-1)'s complement:-

Addition and subtraction can only be done between two numbers with same number of integer part of digit and same number of fractional digit.

When we find the complement of zero, it is encountered as integer part of digit .If we consider 0 as the integer part of digit ,then 10's complement of 0 itself is $(10^1-0)=10$.But we know that complement of complement restore the original number .Here complement of 10 do not restore 0.Here an end carry occurs as we know any number having n part of integer digit then it's complement must also have n part of integer digit. For that reason the end carry just discarded. We see 9's complement as,
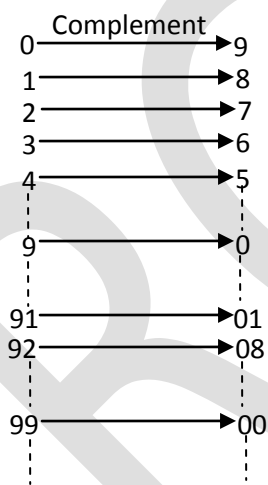
And 10's complement as,
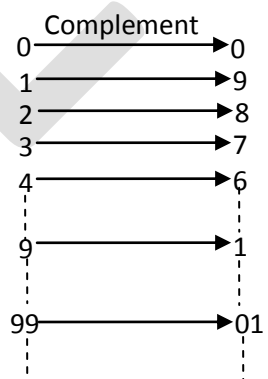
Subtraction operation done by taking complements of that number which being to be subtracted. If a number is N in (M-N), to find its complement it is taken such a position that the number of that position is added to M. Here we are taking the number(complement) perspective view on N. For example if 7 -4 is done we add a number perspective view on 4.Hence the number is 6(10's complement). So, to perform subtraction operation we take perspective view on addition. We can define the position of complement for number N from the infinity state zero model number.

4.1.6 Defining position of complement for N

We can define the position of complement for number N from the infinity state zero model number(r's complement).
If any number N having n integer part of digit then by following method,
1. Let a=10^n

k=n - 2

b=Total (internal+external) circle for N.

c=Total circle in circle for N.

z=Position of the complement for N.

x=(2*a)/10;

2.Perspective view on external circle:-

If (N==0) then,
{
z=0;
}
 Else if(k≤0) Then,
{
If(b>0) Then,
{
z= x – b;
}
}
Else if(c≠0) then,
{
z= x – b+10^k - c;
}
Else
{
z= x – b+10^k - 1;
}

Perspective view on internal circle:-

If(N==0) then,
{
z=0;
}
Else if(k≤0) then,
{
If(b≤0) then,
{
If(LSB of N is 5) then,
{
z=x – 2;
}
}
Else if(LSB of N is 5) then,
{
z= x – b-2;

```
}
Else
{
z=x-b;
}
}
Else if(c≠0) then,
{
If(LSB of N is 5) then,
{
z= x − b+10^k - c-2;
}
Else
{
z= x − b+10^k - c;
}
}
Else if(c==0 and LSB of N is 5) then,
{
z= x − b+10^k - 3;
}
Else
{
z= x − b+10^k - 1;
}
```

3.Draw straight line from a circle positioned at x or x-1(Depending on N belongs to internal or external circle) to all lower circle of it through the master number and ended at opposite end of the circle position x or x-1 (As we mention earlier for 0 or any number combine with zero the number line would be start from 0 to all number combining with zero and for 5 or any number combine with 5 the number line would be start from 5 to all number combining with 5.So they treated like separate number lines).

4.For number N belongs to a straight line, at position z find the number at opposite end (From N) of the line.This number is the complement of N.

Example:-Find complement of 19.
Solution: Here n=2;
k= 2 -2 =0;
a=100;
b=3;
c=0;
x=20;
So the position of complement for N is,
z = x −b+0
   =20-3=17
Straight lines drawn fom circle number 19 through 5 to all circles,19 falls to straight line 1(Figure3.1.6). At opposite end of straight line 1,at position 17 the number is 81.
So 81 is the complement of 19.

The concept of complement in infinity state zero model number can be shown as a simple phylosophy "As higher as lower".If we define a higher position for a number N,complement can be found at lower position.

From binary model we see that the last number created for n=3 is 111 and the first number created is 1 or 001.Notice that r's complement of 111 is 001.

Basic operation on mathematics is mostly addition and subtraction.We notice that subtraction operation is described by perspective view on addition.All mathematical operation can be simply describe by addition,consequence of addition and perspective view on addition.The universe is additive!

5. Application

The concept described in chapter 3(Infinity state zero model number system) can be widely use in Mathematics, Physics, chemistry, Computer science etc. The use of the concepts in distributed system can be as bellow.

5.1 Distributed system application

Here we define 3 types of nodes.

1.**Client:**The nodes request for specific events.   2.**Intermediate manipulator:** This nodes are responsible for manipulating clients request, scheduling and pass the request to appropriate servers to serve.   3.**Server:**These nodes handle request and serves to the appropriate client defined by the intermediate manipulator node.

Now as the use of the concept, think all numbers as client, number combining with zero as the intermediate manipulator node and any number combining with master as the server node. This system is applicable for wide computational network.

5.1.1 Method:

Here the master number as the whole system. The system divides into sub-part.as we know every number has own circle except zero. The number at higher level is the smaller circular area. Here the intermediate manipulator are thought of as virtually connected and parent manipulator having the knowledge of its children manipulator. The process is as bellow,

1.Client request for an event to its corresponding intermediate manipulator.(For example if a client node is 7 then its corresponding intermediate node is 0).Client send request along with its address and destination address .

2.Intermediate manipulator handle the request, verify and find the appropriate server.

f the server is intermediate manipulators corresponding server then,

The server perform operation and send the result to the corresponding intermediate node.

 The intermediate node pass the result to the client.

Else if,

The server is not corresponding to intermediate manipulator then, find the appropriate children manipulator which having the knowledge about the requested server.

Else,

The current manipulator request its parent manipulator to find appropriate along with its current state status. 3.Repeat step 2 until no appropriate server is found. A monitoring node is established to monitor that if the process arrives to leaf manipulator node the system terminated.
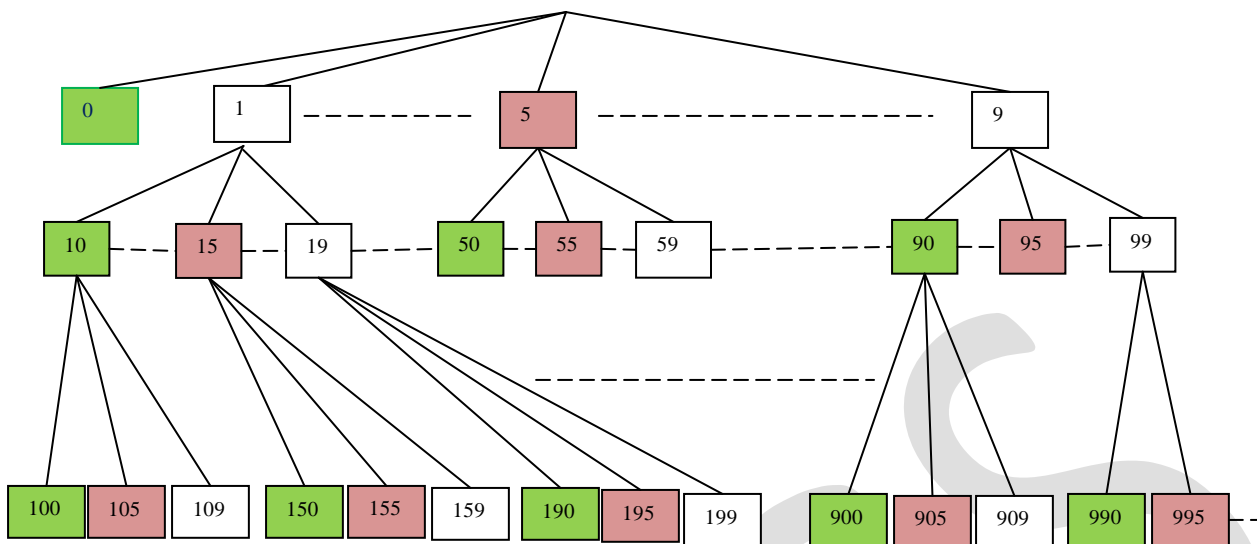
See figure 5.1.1.

Figure 5.1.1 Proposed Distributed approach.

Example 5.1.1.1:- A client node(Let 109) request for an event to a server 995 what will happen?

Solution:- 1.The client 109 send request to its corresponding manipulator 100.The manipulator decides if the request can handle by its corresponding server but its corresponding server can not. So it decides if its children manipulator having the ability but children manipulator not having such ability. So it request parent manipulator 10 by giving its status. Manipulator 10 decide if the server 15 can serve but it does not.

2.Manipulator 10 now decide if its children manipulator 110,120,….150…190 except 10 can handle but the do not. So 10 request its parent manipulator 0 to handle request. Manipulator 0 decides if server 5 can handle request but it does not. So it decide if children manipulator can do the job. Manipulator 90 can do the job.

3.Manipulator 0 request to 90 with its status.90 check if 95 can do the job. Then it request its children manipulator 990 to do the job with its status while it computes that 990 can do the job.

4.Manipulator 990 find that 995 can do the job. It request to 995.Server 995 do necessary computing and send result to 990.Manipulator 990 send back result to 90.

5.Manipulator 90 receive result and 990 remove status from 90.Manipulator sends back result to manipulator 0 and removes status. Then 0 sends back result to10 and removes status.10 sends result to 100 and removes status and at last 100 sends result to client 109 and removes status from 109.

 The system shown in figure 5.1.1 dashed lines means other several number or nodes. Blue colored numbers as manipulator and red as server. If our total address space is 2^n-1(Binary) dividing address space we can form a huge computational system. Although several protocols and algorithms have been established for distributed system this system can be used for more reliable, secured, huge computational power and efficient system although there remains a problem of time consumptions.

5.2 Other applications.

Nuclear energy:- The number system described in chapter3 can be used to produce huge amount of nuclear energy. Note that in Radiant object neutron of nucleus divides into electron and proton. Electron emits as β ray. Application of other fields are as Classification in Computer science, Neural network, Artificial intelligence etc.

6. Conclusion

We find several property from the infinity state zero model number system such as the property of master number "Same time it is one and everyone ",which exactly used in distributed system for centralized algorithm. From finding circle in circle we notice that "Every object is exactly described with every object". The most interesting part is that, in this number system we described everything as fixed but factors added with them making it variable and relative. But in theory of relativity by Sir Albert Einstein "Mass of any object is relative". It is possible to find other property from this number system model and the concept can be used in all aspect of science. In this century it is challenge for mathematics to solve the scientist Hilbert's 20th problem as "The master algorithm can be devise" and its time remaining to solve the problem .The infinity state zero model number may be able to make impact or help for solution. Analysis on complement describe the concept of negative things which is mostly used in modern computer science and from this model it is seen that "Mathematics as connections".

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Design of Robust and Power Efficient Full Adder Using Energy Efficient Feed through Logic

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ABSTRACT – An Energy Efficient Feedthrough Logic (EE-FTL) is proposed in this paper to reduce the power consumption for low power applications. The EE-FTL is well suited to arithmetic circuits where the critical path is made of a large cascade of inverting gates. It has a unique characteristic where the output is pre-evaluated before the inputs from the preceding stage are ready. The proposed logic style requires low power when compare to the existing feedthrough logic (FTL). The proposed circuit is simulated and a comparison analysis has been carried out using 90-nm, 1.2V CMOS process technology. A CMOS Full Adder is designed by the energy efficient feedthrough logic and the simulation result in MicroWind environment shows that the proposed logic reduces the power consumption by 77%, 70% and 36% over FTL, Low Power FTL (LP-FTL) and Constant Delay Logic (CDL), respectively. The problem of requirement of inverter as in dynamic logic is completely eliminated in the proposed logic.

Keywords— Feedthrough logic(FTL), critical path, pre-evaluated, constant delay.

INTRODUCTION

Energy efficiency is one of the most required features for modern electronic systems designed for high-performance and portable applications. In one hand, the ever increasing market segment of portable electronic devices demands the availability of low-power building blocks that enable the implementation of long-lasting battery-operated systems. The invention of the dynamic logic in the 80s is one of the answers to this request as it allows designers to implement high performance circuit block, i.e., arithmetic logic unit (ALU), at an operating frequency that traditional static and pass transistor CMOS logic styles are difficult to achieve. However, the performance enhancement comes with several costs, including reduced noise margin, charge-sharing noise, and higher power dissipation due to higher data activity. Because of dynamic logic's limitations and diminished speed reward, a slowly rising need has emerged in the past decade to explore new logic style that goes beyond dynamic logic. To improve the performance of dynamic logic circuit in terms of speed and power, new logic family called feedthrough logic was proposed in [4], where FTL concept is extended for the design of low power and high performance arithmetic circuits. This logic works on domino concept along with the important feature that output is partially evaluated before all the inputs are valid. This feature results in very fast evaluation in computational block. In this paper, the proposed design of a low power FTL circuit that further improves the power consumption of FTL.

The total power dissipated in a generic CMOS digital gate is given by

$$P_{total} = P_{static} + P_{dynamic} + P_{short\ circuit}$$
$$= V_{dd}I_i + V_{dd}F_{clk}\sum V_{i\ swing}C_{i\ load}\alpha_i + V_{dd}\sum I_{i\ sc}$$

Where $V_{i\ swing}$ is the voltage swing, $C_{i\ load}$ is the load capacitance, α_i the switching factor, $I_{i\ sc}$ is the short circuit current and I_I is the leakage current at node i respectively and F_{clk} denotes the system clock frequency.

II. PRINCIPLE OF CONVENTIONAL FTL

FTL logic [Fig.1 (b)] in CMOS technology was first introduced in [4] and [5]. Its basic operation is as follows: when CLK is high, the pre-discharge period begins and Out is pulled down to GND through M2. When CLK becomes low, M1 is on, M2 is off, and the gate enters the evaluation period. If inputs (IN) are logic "1," Out enters the contention mode where M1 and transistors in the NMOS PDN are conducting current simultaneously. If PDN is off, then the output quickly rises to logic "1."

- It only requires NMOS transistor logic expression
- The critical path is constant regardless of the logic expression

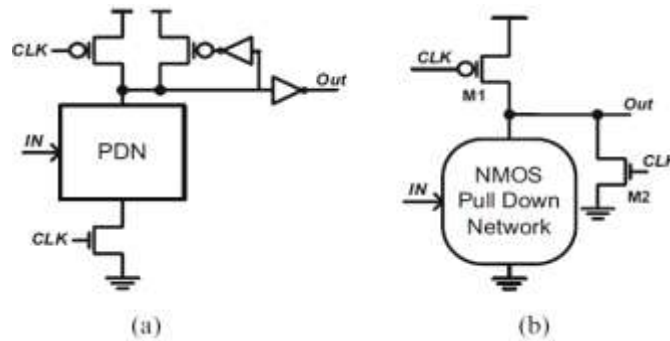▪ The output is pre-evaluated before the inputs from the preceding stage is ready

Fig.1 (a) Dynamic Domino Logic (b) FTL

Despite its performance advantage, FTL suffers from reduced noise margin, excess direct path current, and nonzero nominal low output voltage, which are all caused by the contention between M1 and NMOS PDN during the evaluation period. Furthermore, cascading multiple FTL stages together to perform complicated logic evaluations is not practical. Consider a chain of inverters implemented in FTL cascaded together and driven by the same clock. When CLK is low, M1 of every stage turns on, and the output of every stage begins to rise. This will result in false logic evaluations at even numbered stages since initially there is no contention between M1 and NMOS PDN because all inputs to NMOS transistors are reset to logic "0" during the reset period.

Existing FTL Techniques

1. LP-FTL

The low power FTL circuit is shown in Figure 2 (a). This circuit reduces VOL by using one additional PMOS transistor MP2 in series with MP1. The operation of this circuit is similar to that of FTL. During reset phase i.e. when CLK = 1, output node is pulled to ground (GND) through Mr. During evaluation phase output node charges through Mp1 and Mp2. When CLK goes low (evaluation phase) Mr is turned off and the output node conditionally evaluates to logic high (VOH) or low (VOL) depending upon input to NMOS block. If the NMOS block evaluates to high then output node pulled toward VDD i.e. VOH =VDD, otherwise it remain at logic low i.e. VOL. Since Mp1 and Mp2 are in series the voltage at drain of MP1 is less than VDD. During evaluation due to ratio logic the output node pulled to logic low voltage i.e. VOL which is less than the VOL of existing FTL. This reduction in VOL causes significant reduction in dynamic power consumption but due to the insertion of PMOS transistor Mp2 propagation delay of the LP-FTL increases.
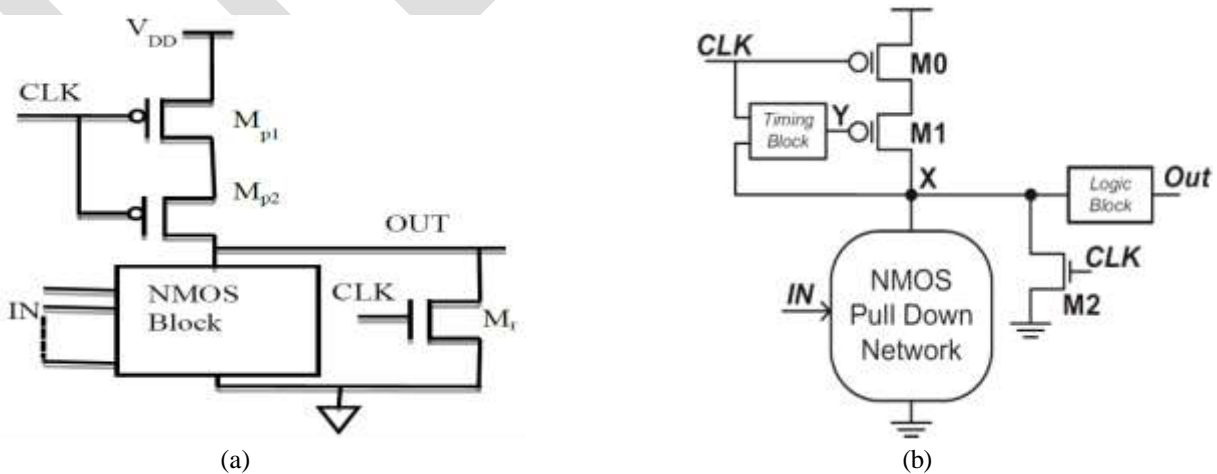

Fig.2 (a) Low Power Feedthrough Logic (LP-FTL), (b) Constant Delay Logic(CD Logic)

2. CD Logic

To mitigate the contention problems, CD logic is proposed with a schematic shown in Figure 2 (b). Timing block (TB) creates an adjustable window period to reduce the static power dissipation. When CLK is high, CD logic predischarges both X and Y to GND. When CLK is low, CD logic enters the evaluation period and three scenarios can take place: namely,   the contention, C–Q delay and D–Q delay modes. The contention mode happens when CLK is low while IN remains at logic "1". In this case, X is at a nonzero voltage level which causes Out to experience a temporary glitch. The duration of this glitch is determined by the local window width, which is determined by the delay between CLK and CLK_d. When CLK_d becomes high, and if X remains low, then Y rises to logic "1", and turns off M1. Thus the contention period is over, and the temporary glitch at Out is eliminated.

C–Q delay mode takes places when IN make a transition from high to low before CLK becomes low. When CLK becomes low, X rises to logic "1" and Y remains at logic "0" for the entire evaluation cycle. D–Q delay mode utilizes the pre-evaluated characteristic of CD logic to enable high-performance operations. In this mode, CLK falls from high to low before IN transit, hence X initially rises to a nonzero voltage level. As soon as IN become logic "0", while Y is still low, then X quickly rises to logic "1". If CLK_d rises slightly slower than X, then Y will initially rise (thus slightly turns off M1) but eventually settle back to logic "0". CD logic can still perform the correct logic operation in this case, however, its performance is degraded because of M1's reduced current drivability. The CD logic reduce short circuit power dissipation which occur in contention period but it also suffer from additional transistors overhead and the need of adjust the window size depending upon environment.

PROPOSED ENERGY-EFFICIENT FEEDTHROUGH LOGIC

The proposed EE-FTL circuit is shown in Figure 3. This circuit consists of additional PMOS pull up transistor (T3) in series with T1. The T3 transistor is controlled by the drain signal of T2 transistor. The inverted clock signal is given to source of T2. The output signal is taken to control gate terminal of T2. T4 transistor is connected to reset the node X, when CLK is high. T6 transistor is used to reset the output terminal. The single bit input signal is given to pull down NMOS transistor T5. There are two modes of operation in EE-FTL circuit namely, reset mode and evaluation mode. When CLK is high, both X and OUT pre-discharges to GND. Thus the output of EE-FTL circuit is always at logic "0" when CLK is high. So it is called as reset mode.

When CLK is low, circuit enters the evaluation mode and the contention mode take place. In the contention mode, CLK is low while input (IN) at logic "1". In this case, both PUN and PDN will simultaneously conduct, which causes a temporary glitch at output node. This will create direct path exist between power supply and ground. The power dissipation occurs due to this short circuit current is known as short circuit power dissipation. This effect can be reducing by EE-FTL circuit. The output node become a non zero voltage level at this mode. This voltage level is used to turn on the transistor T2 by feedback method. The high level inverted clock signal pass through T2 and disables the T3 transistor. Thus the direct path is disabled till the entire contention period and the glitches also eliminated.
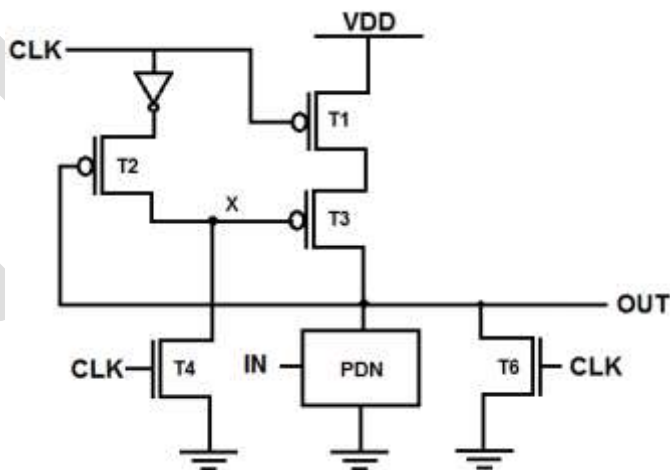

Fig.3 ENERGY-EFFICIENT FEEDTHROUGH LOGIC (EE-FTL)

Design of Full Adder Using EE-FTL Technique

A one bit CMOS full adder is designed using EE-FTL technique is shown in figure 4. The carry generation circuit and sum generation circuit is configured by EE-FTL. Since the output of FTL is inverted, two inverters is used at the end of both sum and carry section. Common clock signal is used in the entire circuit. The inputs which are in series at sum generation circuit will increase the parasitic effects, when both inputs A and B are at logic "1" and carry input is logic"0". But EE-FTL circuit will not be affected by this condition.
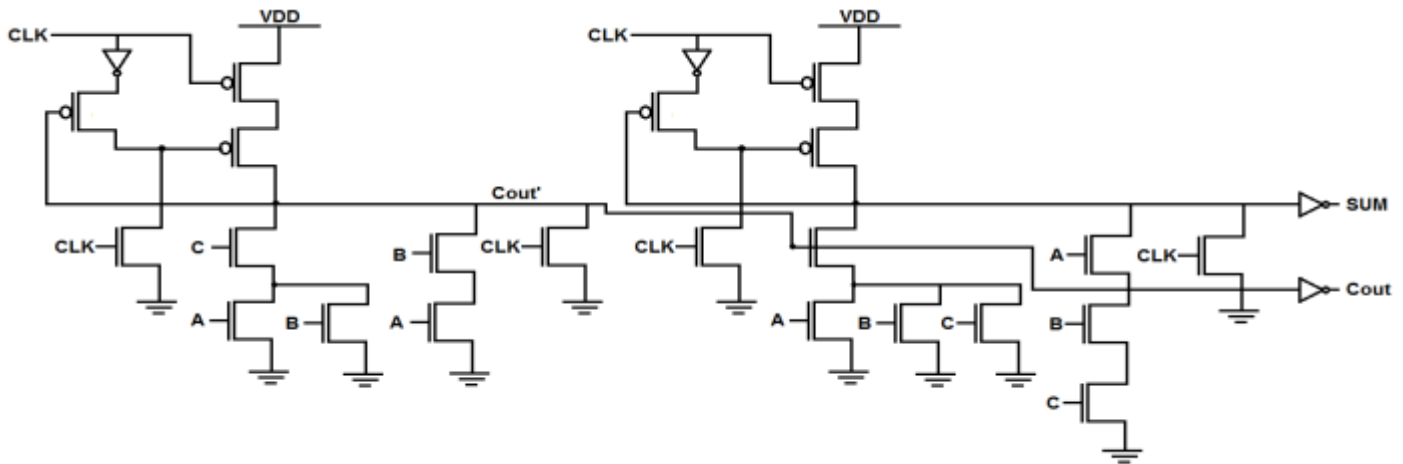
Fig.4 CMOS Full Adder using EE-FTL technique

SIMULATION RESULT AND DISCUSSION

The full adder is designed using several techniques styles such as LP-FTL, MFTL, CDL and EE-FTL. These adders are designed using MICROWIND DSCH2 tool. The several parameters such as power, area and delay are obtained from simulation results. Figure 5 shows the simulated waveform of full adder circuit using EE-FTL. Table 1 shows the comparison of several parameters. The area overhead of EE-FTL is less compare to CD logic but high when compare to FTL, LP-FTL techniques. The EE-FTL technique has less speed than the other techniques which is tolerable when power is main concern compare to delay. While EE-FTL require more area compare to FTL, EE-FTL is still an attractive choice in a high-performance full-custom design because of very less power consumption. Figure 6 shows the bar chart of data in comparison table. The overall comparison makes the EE-FTL is more suitable for low power arithmetic circuits.
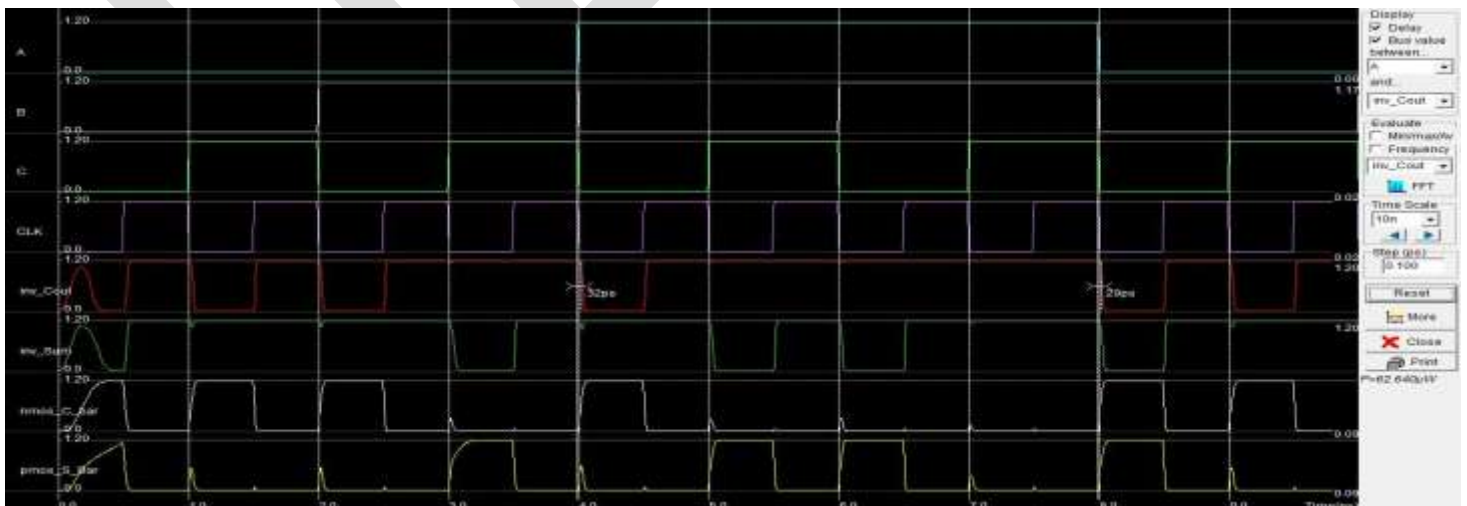

Fig.5 Simulated Waveform of Full Adder Using EE-FTL

Table 1 Comparison Table of one bit full adder using EE-FTL

Logic Style	Area (μm²)	Power (μW)	Delay (ps)	Power Delay Product(PDP) (fJ)	Energy Delay Product(EDP) (fJ.ps)
FTL	177.9	273	18	4.914	88.452
LP-FTL	207.3	211	25	5.275	131.875
CDL	389.7	98.62	28	2.761	77.308
EE-FTL	303.6	62.64	29	1.816	52.664
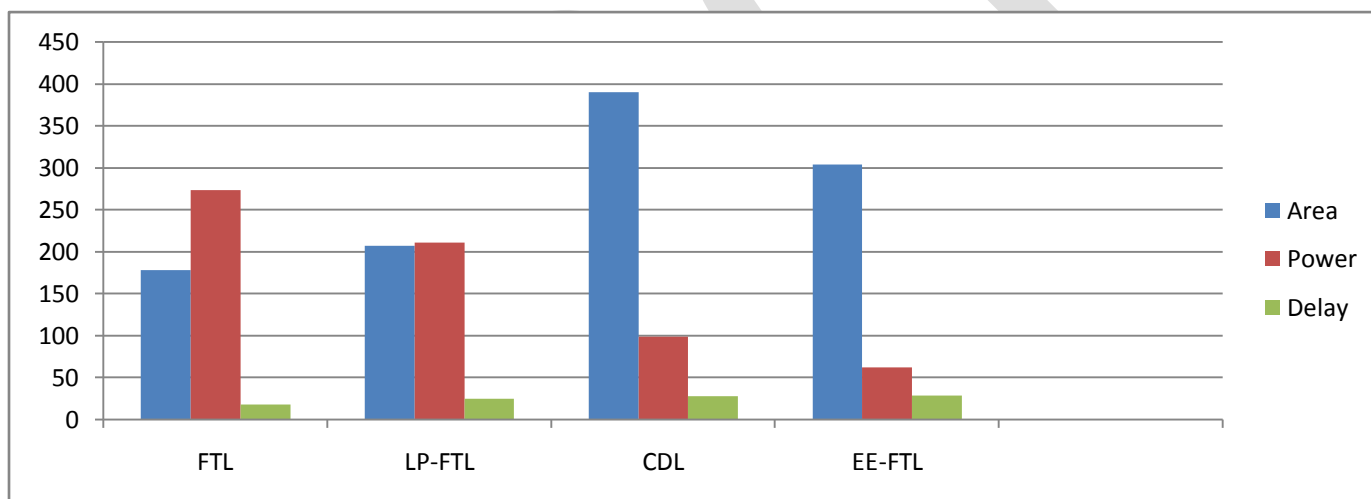
Fig.6 Bar Chart of One Bit Full Adder parameters

CONCLUSION

A new energy efficient feedthrough logic was proposed in this paper to reduce short circuit power dissipation in contention mode. The pre-evaluated feature of EE-FTL makes it particularly suitable in a circuit block where performance is the primary concern. The proposed logic style requires low power when compare to the existing feedthrough logic. The proposed circuit is simulated and a comparison analysis has been carried out using 90 nm, 1.2V CMOS process technology. A CMOS Full Adder is designed by EE-FTL techniques and the simulation result in MicroWind environment shows that the proposed logic reduces the power consumption by 77%, 70% and 36% over FTL, LP-FTL and CDL, respectively. The simulation result confirms that at same frequency of operation the power delay product of proposed circuits is much better than that of existing FTL structure.

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Fault Tolerant DC-DC Converter for DTG Servo Power Amplifier Supply

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ABSTRACT - Forward converter is one of the most studied topologies due to its lower ripple, lower parts count and hence high reliability. Owing to the need of miniaturization of Inertial Navigation System, a mini power module had to be developed for which forward converter topology was selected. A configuration of grouping the outputs into HMCS was attempted. The converter for DTG servo power amplifier had to supply the current demanded by the sensor electronics which is dynamic. Interleaved forward converter provides a better solution to satisfy the increased power and dynamic load conditions. As an added advantage, though one portion gets faulty, the other portion can provide half the maximum load, giving continuous power. The paper discusses the benefits of interleaving in the converter supplying the servo power amplifier experiencing dynamic load conditions and simulations for both single and interleaved converter design validation.

Keywords— Interleaving, Dynamic Load, Hybrid Micro Circuit (HMC), Stresses, Dynamically Tuned Gyroscopes (DTG), Flux imbalance, phase shifted control

INTRODUCTION

Inertial Navigation System (INS) consists of inertial sensors: Dynamically Tuned Gyroscopes (DTG) and Ceramic Servo Accelerometers (CSA) and its associated Electronics. As part of developing miniature Inertial Navigation System (mINS), a mini power module had to be developed. For the ease of miniaturization, forward topology was selected and it offers additional merits like low output voltage ripple and low input r.m.s current [1]. A configuration in which the outputs were grouped into 3 types of Hybrid Micro Circuits (HMCs) was proposed. The servo loop power amplifier of the sensors experiences dynamic loads which has to be met by the +30V/1.25A converter. Interleaving of converters is a good choice to meet the dynamic load conditions and also has an advantage that though one converter gets faulty the other converter takes up half the maximum load giving uninterrupted power. The interleaving of converters distributes the current stresses and power loss in each converter cell [3]. Interleaved PWM can balance the current rating on the switches in each converter cell. Interleaving [8] also distributes power losses and thermal stresses of semi conductors due to smaller power processed through independent power stages. Interleaving means to parallel the stages so that they share common filter capacitor [8].

The key benefits [2] of interleaving are:

1. Reduced r.m.s current in the input capacitors
2. Ripple current cancellation at the output capacitor
3. Reduction of peak currents in primary and secondary of transformer
4. Improved transient response
5. Reduced EMI due to reduction in peak currents.

The paper discusses the comparison of forward, interleaved and push pull topologies, design of interleaved as well as single converter in case of the +30V/1.25A converter and SABER simulations to validate the design.

COMPARISON

A. Single Forward Converter

A single forward converter consists of a single switch and derived from a buck converter, forward converter delivers power from input source to the load during the on time of the switch and it is one of the discussed topologies [4]. Also for miniaturization purposes, due to lower parts count accompanied by low output voltage ripple, forward converter is a designer's choice.
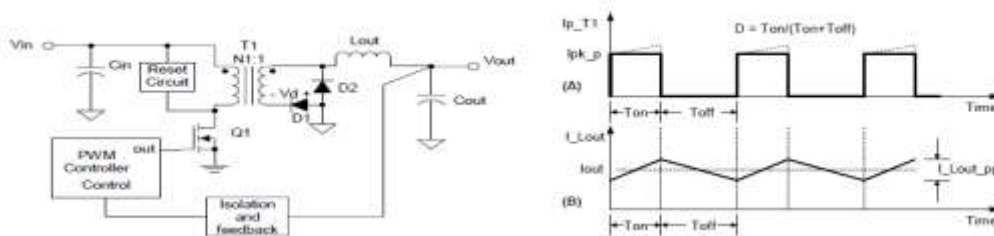

Fig. 1 Single Forward Converter

To reduce size and weight of magnetic components, frequency can be increased but at the cost of increased switching and core losses and EMI [1]. The single transformer and inductor are designed to carry the full peak current. In forward converters duty cycle and voltage stresses are restricted by each other [6], higher duty cycle means higher stresses on switches and lower stresses on the corresponding secondary diodes.

B. Interleaved Forward Converter

In interleaved forward converter the switches are driven by phase shifted control signals and current through switches is only a fraction of the input current[9]. Also input current ripple and conduction losses are reduced giving improved efficiency. Each converter carries only half of current and hence shares the total power.
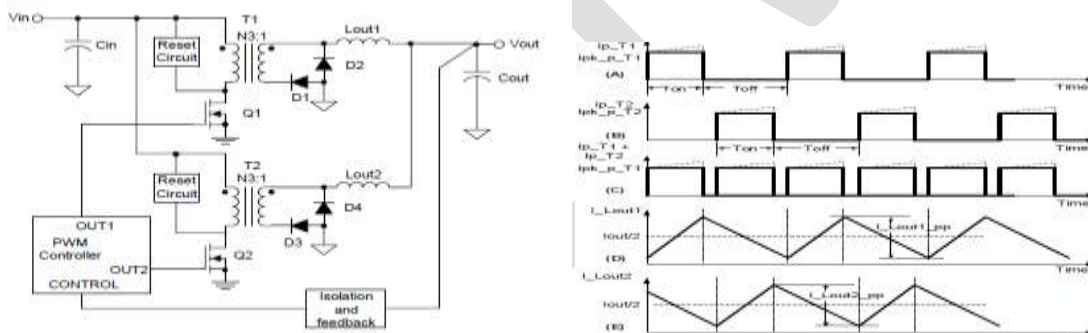

Fig.2 Interleaved Forward Converter

The two converter modules are operated through phase shifted PWM scheme so that output inductor current partially cancels each other. Therefore ripple voltage on output capacitor is reduced. By equal phase shift among paralleled stages, output filter capacitor ripple is lowered due to ripple cancellation effect. When the converters are paralleled, both of them share a common output capacitor and the distributed magnetic structure and minimum output filter size makes interleaving options attractive for high power density and low profile packaging. Multi converters can increase the equivalent duty cycle of the total module [6]. Also as intensity of EMI is proportional to peak currents, an interleaved converter of same total power as a single forward converter generates less EMI [5].In case one converter gets faulty, other converter takes up the service and support the nominal load though it cannot take up the occasional peak load. This is very important in case of the dynamic loads experienced by the DTG.

Two transformers are smaller than for a single forward converter but the two transformers occupy more volume and cost than a single transformer.

C. *Push Pull Vs Interleaved Converter*

A push pull converter consists of two forward converters connected in anti phase. When one transistor switches on, flux swings in one direction of B-H curve, in order to reverse direction the first transistor switches off and second transistor switches on. In order for the two areas of the flux density to be equal, the saturation and switching characteristics of the switching transistors must be identical under all working conditions and temperatures. A phenomenon common in push pull converters is flux walking [8]. If the transistor characteristics are not identical, "flux walking" to one direction of B-H curve occurs driving the core into the saturating region. If one of the two switches of the converter fails, the core does not get reset and continues to move along the same direction of BH curve. Saturation of the core leads to high collector current spike in one of the transistors. This excessive current produces large amounts of power loss in the transistor heating it up which further unbalances transistor characteristics, thus saturating core even more, producing saturation currents. This cycle continues until transistor goes to thermal runway, which leads to destruction.

When compared to push pull, the certainty that there is no flux imbalance problem in interleaved forward converter is the best argument for its use. Also in case of an interleaved converter when one converter gets faulty, the current through the switch can be sensed and the faulty portion can be isolated whereas in push pull converter isolation is meaningless as flux imbalance cannot be overcome. The converters are connected in parallel and in case if one fails, the other would function as an independent converter supporting half the maximum load.

DESIGN

Design includes design of transformer (core and number of turns), output filter, switch and its controller for both single and interleaved configuration.

A. *Core Selection*

Ferrite R material is chosen as the core material due to operation at high frequencies and increased resistivity. The core curves[7] of the various materials are given below.
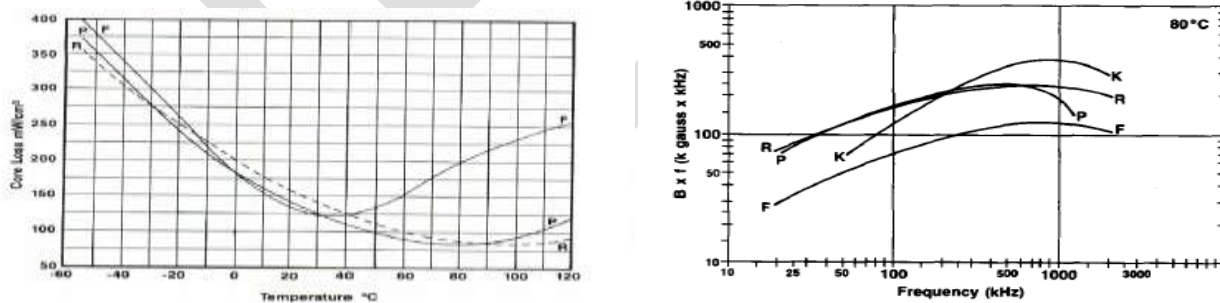

Fig.3. Curves for Various Cores

The parameters for the design are briefed below:

TABLE I: DESIGN SPECIFICATIONS

Parameters	Single	Interleaved(Per Phase)
V_{in}	28 V	28 V
V_{out}	30 V	30 V
I_{out}	1.25 A	0.625 A
P_{out}	37.5 W	18.25 W
I_{out}	1.25 A	0.625 A
F_{sw}	400 KHz	200 KHz

In a single forward converter the core selection is based on full output power whereas in case of interleaved core is chosen for half output power as each transformer supplies only half the output power.

$$\text{Transformer area product } A_p = \frac{\sqrt{D_{max}} \times P_{out} \times (1+1/n)}{K_w \times J \times 10^{-6} \times B_m \times F_{sw}} \qquad (1)$$

Converter is designed for a maximum of 62% duty cycle, efficiency of 80% and B_m: 0.12 T, J=3A/mm^2, Winding factor K_w=0.3.

B. Number Of Turns

Number of turns in primary

$$N_p = \frac{V_{in} \times D_{max}}{B_m \times A_c \times 10^{-6} \times F_{sw}} \qquad (2)$$

Turns ratio

$$T_{ratio} = \frac{V_o + V_d \times D_{max}}{V_{in} \times D_{max}} \qquad (3)$$

Number of turns in secondary

$$N_{30} = T_{ratio} \times N_p \qquad (4)$$

Number of turns in reset winding

$$N_{reset} = \frac{1 - D_{max}}{D_{max}} \times N_p \qquad (5)$$

D. Output Filter

$$L = \frac{V_{out}(1-D_{min})}{2 \times K \times I_{out} \times F_{sw}} \qquad (6)$$

$$C = \frac{K \times I_{out}}{8 \times F_{sw} \times V_{ripple}} \qquad (7)$$

$$\text{Where } D_{min} = \frac{V_{in\,min} \times D_{max}}{V_{in\,max}} \qquad (8)$$

$$K = \frac{I_{ripple}}{I_{out}} \qquad (9)$$

E. Switch And Controller

Due to lower on state resistance, MIL Grade IRFM3415 is selected as the switch and UC1525B is selected as the controller. The two outputs which are phase shifted from each other are used to feed the two switches of the interleaved converter. In single forward converter both these outputs are OR ed to obtain the required signal. So for a single converter the frequency is about 400 KHz and in interleaved converter each converter is designed for a frequency of 200 KHz.

TABLE II: OBTAINED VALUES

Values	Single	Interleaved
Core	42106 TC	42106 TC
N_p	15	31
N_{30}	27	56
N_{reset}	9	19
L	39.3 uH	157 Uh
C	4 uF	4 uF

SIMULATION RESULTS

Simulations for both the configurations are done using SABER software and results were plotted. The controller output, transformer primary currents, inductor currents and output voltages have been observed.
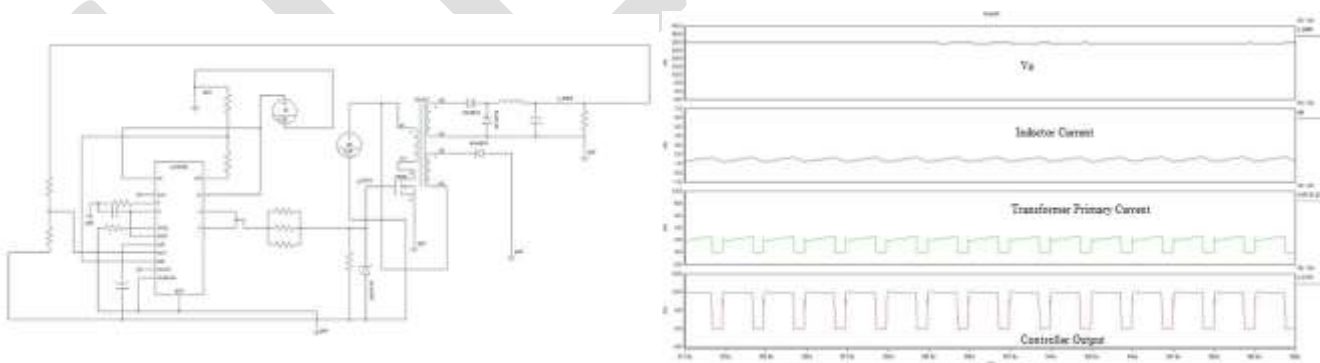
(a)
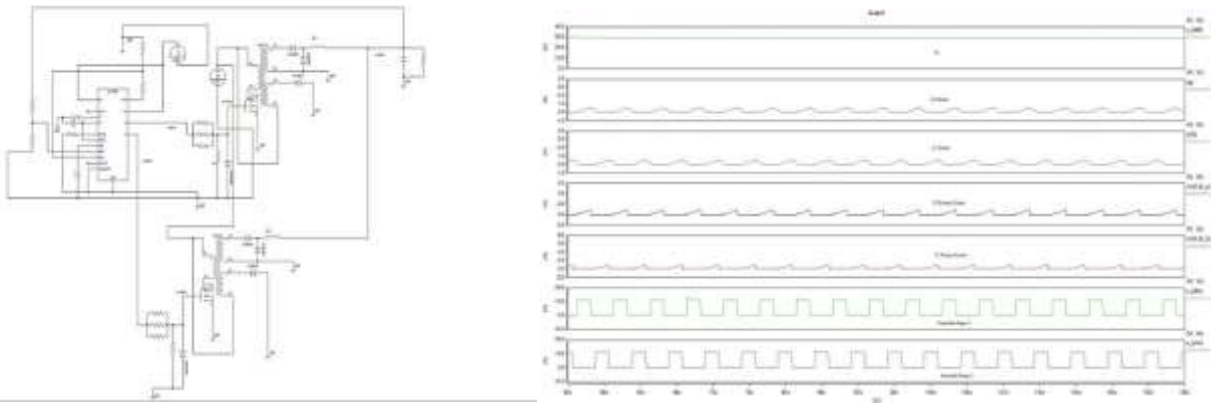
(b)

Fig.4 Simulation Results a) Single Forward Converter b) Interleaved Converter

It can be seen that the transformer primary and inductor currents are higher for single converter than the interleaved configuration. This highlights the benefits of interleaved converter over the single converter.

CONCLUSION

Both single and interleaved forward converter configurations were studied. Interleaving can be proposed as a fault tolerance measure to support the dynamic load conditions experienced by the system. The interleaving and single converter configurations were designed and validated through SABER software.

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Influence of antibiotic on the growth of M.canis and H.capsulatum

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ABSTRACT - Antibiotics are organic substance which check the the growth of fungus . During the study for the influence of antibiotic on the growth of fungi -10 gms of each antibiotics were added to 50 ml of Sabourd dextrose (SD) liquid media . Later on they inoculated with fungus and incubated at 25±1°c for 15 days .After 15 days grown fungal were measured . The growth performance of M. canis and Histoplasma capsulatum on different antibiotics are as in order – 1. Actidione< chloromycetin<penicillin< streptomycin< tetracycline< control (M. canis) 2. Actodione< streptomycin<tetracycline< chloromycetin <control (H. capsulatum). During my study finally It was concluded that actidione was antibiotic the best drug which check the growth of fungal growth population . tetracycline and penicillin was found to be best growth promoter of mycelial fungus in both genera

Key words-Antibiotic ,control , mycelia,fungus

INTRODUCTION:

Antibiotics are organic substances which are responsible for influencing of mycelia fungus. Sometime they showed their worst growth and sometime they are responsible for the best growth of mycelia fungus . The present papers deals with influence of antibiotic on Microsporum canis and Histopalsma capsulatum , Though several reportings have been made on the influence of antibiotics on fungi Aytoon RS 1956 , Gaumann E, JAGGGO, Braun R Gilardi, GI, Gunderson K Robinson PM(1947,1965,1967)

Procedure:

 Selected antibiotics were added in a ratio of 10 mg to 50 ml liquid medium . Later on they were inoculated with fungus and incubated at 25±1°C for 15 days. Selected fungal sps were grown on a thin layer of SDA medium in petridishses at room temperature . After incubation of period of 15 days 5mm blocks were cut and transferred using aseptic technique to 250ml . PH of the medium was adjusted to 5.8with the help of 0.1MKOHand 0.5 M KH2PO4 solution and incubated for 15 days at 250C.After the incubation of 15 days mycelials were collected by filtering them through pre-weighed whatmans one to one filter paper individually and it was transferred to label butter paper envelope. It was dried in side and incubate at temperature of 60±1°c.after 24 hours of this drying procedure the envelopes with mycelials mats were kept in a sealed desicator over fused calcium chloride for 24 hours. Finally grown fungal were measured in weight in milligram.

CALCULATION OF DATA:

The available data of mean dry weight of mycelium was calculated along with standard error .The data were further analysed stastically for ANOVA and critical difference

OBSERVATION:

Temperature25ºC　　　　　　　　　Wt expressed in mg　　　　　PH 5.8

Antibiotics	Microsporum canis	Histoplasma capsulatum
Actidione	178.000± 2.242	186.666±1.666
Chloromycetin	422.333± 1.452	465.000±2.887
Penicillin	466.666 ± 1.666	502.000±1.763
Streptomycetin	526.000 ± 0.816	311.000±2.081
Tetracyclin	547.666 ± 2.333	460.333±2.323
Control cd at 1%	620.000 ± 0.880	564.000±0.353

Anova table of M. canis

Source of variation	Sum of squares	Degree of freedom	Mean sum of squares	f- ratio
Antibiotic	263234.40	4.00	65808.60	65808.60
Error	10.00	10.00	1.00	
Total	263244.40	14.00		
Control cd at 1%	620.000 0.880			

Anova table of H. capsulatum

Source of variation	Sum of squares	Degree of freedom	Mean sum o squares	F- ratio
Antibiotic	212372.40	4.0	53093.10	53093.13
Error	10.0	10.00	1.00	
Total	212382.40	14.0		
Control cd at 1%	564.000 0.353			
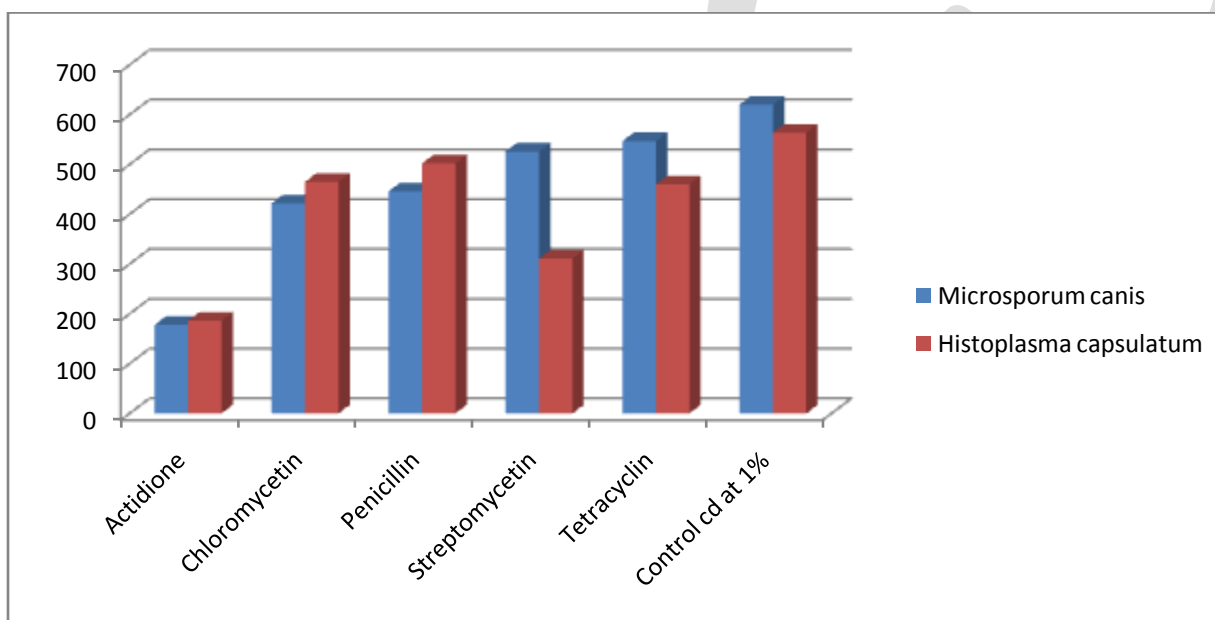
Figure 1showing graph of influence of antibiotic in M. canis and H.capulatum

RESULT AND DISCUSSION:

The result is highly significant for both the species . Tetracyclin control condition was found to be proved as the best growth of M. canis and Actidione was found to be the worst growth of M.canis. In the case of H. capsulatum Penicillin was found to be best growth performer and actidione was found to be worst growth performer.

The growth performer of these antibiotic in the case of Microsporum canis were as in ascending order-

Actidione<Chloromycetin <Penicillin< Streptomycetin< Tetracyclin< Control.

Growth performance of H. capsulatum-

Actidione< Streptomycin< Tetracyclin< Chloromycetin< Penicillin< Control

Discussion:

A view of relevent literatures showed the effect, The concentrations of Griseofulvin required to inhibit growth and produce the characteristic morphological distortions were determined for dermatophytes (highly sensitive) fungal plant pathogen (moderately sensitive) filamentous non pathgenic fungi (poorly sensitive) . Addition of Griseofulvin to small inocula of the dermatophytes Microsporum gypseum Trichophyton mentagrophytes complete and permanent growth inhibition. EL Nakib, Mustafa A, WL McLellan jr, jo lampen (1965), In vitro susceptibility of microconidia and arthroconidia , arthroconidia of all strains appeared to be more resistant to fluconazole, Griseofulvin and Itraconazole than microconidia Riberia O petro,Sa O Paulo (2008) , Paeceliomyces virdis controlled by antibiotics in vitro Barath Z Betina V Koman V (1972) ; contribution to the study of morphological changes in filamentous fungi and yeast induced by antibiotic Musik V, Serna J, Sesek V, SEMERDIZIEVA MVODRACEK M(1974) cs Sasek V , Muslik V , (1974); Factors effecting the changes in Amphoterricin B sensitivity of Candida albicans during growth Gale EF , Johnson M, Keridge D, Koh TY , (1975) ; Factors influencing the susceptibility of candida albicans by the polygenic antibiotics mystein and Amphotericin Johnson B White R , sensitivity and mycelia phase of of the Histoplasm capsulatum Cheung SC, Koyabashi GS, Medoff G (1976. Various authors like Kim JC etal 2001,Takashi etal 1990,Yashukava 1994, Tomada H etal 1999 contribute the role of several antibiotic on fungi.

Conclusion:

Conclusively Actidione was found to be worst growth in both fungal genera hence Actidione was the best antibiotic drug to check the growth of both fungal genera. tetracycline and penicillin was found to be best growth in mycelial fungus in both genera

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A Review of Intelligent Agents

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ABSTRACT – An intelligent agent (IA) is an autonomous entity which observes through sensors and acts upon an environment using actuators (i.e. it is an agent) and directs its activity towards achieving goals. Intelligent agents are often described schematically as an abstract functional system similar to a computer program. For this reason, intelligent agents are sometimes called abstract intelligent agents (AIA).

Keywords— IA, AIA, PSA

INTRODUCTION

Intelligent agents in artificial intelligence are closely related to agents in economics, and versions of the intelligent agent paradigm are studied in cognitive science, ethics, the philosophy of practical reason, as well as in many interdisciplinary socio-cognitive modeling and computer social simulations.

Intelligent agents are also closely related to software agents (an autonomous computer program that carries out tasks on behalf of users).

Agent applications can be classified in four areas; interface agents, information agents, believable agents, and cooperative problem solving and distributed AI.

STRUCTURE OF AGENTS

A simple agent program can be defined mathematically as an agent function which maps every possible percepts sequence to a possible action the agent can perform or to a coefficient, feedback element, function or constant that affects eventual actions:

$$f : P^* \rightarrow A$$

Agent function is an abstract concept as it could incorporate various principles of decision making like calculation of utility of individual options, deduction over logic rules, fuzzy logic, etc

The program agent, instead, maps every possible percept to an action.

COMPONENTS FOR AGENTS
- learning element - responsible for making improvements.
- performance element - what we have up to now considered to be the entire agent. Takes percepts and then decides on actions.
- critic - gives the learning element feedback on how the performance element is doing and if it needs to be modified.
- problem generator - it suggests actions that lead to new and informative experiences.

TYPES OF AGENTS

1. COLLABORATIVE AGENTS

Agents whose implemetation is focused into autonomy and cooperation are collectively called, *collaborative* . Some of them exhibit learning capabilities as well, but this property is not of primary importance to them. Collaborative agents use sophisticated notions of autonomy, responsiveness and proactiveness to achieve negotiation. They usually appear in coarse-grained muti-agent systems, and most of the time they are static. They may or may not feature mentalistic attributes that govern their behavior. Collaborative agents are most suitable for:

Situations where the problem is too large for a single agent and must be distributed due to resource limitations.

- Situations where there is a need for interconnection of multiple existing systems
- Problems whose nature is itself distributed.
- Problems whose solution requires accessing a distributed set of resources
- Situations in which the problem-solving capacity is distributed
- Situations in which the enhancement of modularity is of prime interest.

2. INTERFACE AGENTS

Agents focused in autonomy and learning and whose goal is to perform tasks for their owner are called *interface* agents. Typically, such agents observe the actions of the user, interact with him/her and attempt to learn by imitation, or direct feedback. Their abilities in negotiation are limited and most of their interactions with other agents (if any) relate to receiving advisory information. Interface agents are seemingly smart software pieces that help their owner automate and perform tasks. Applications include:

- Personal Assistants/Organizers
- Preferential Information Filters
- Financial Decision Systems
- Entertainment
- Miscellaneous Aids
- Tutorial Systems

3. MOBILE AGENTS

Mobile agents are software processes capable of moving around wide area networks, interacting with remote hosts, collectiing information on behalf of their owner and consequently returning to their "home" host. Mobile agents exhibit sophisticated social ability, proactiveness and autonomy. They are mainly used in:

- Situations where local resources are limited (CPU or storage for example) and there is a need to use remote resources to complete tasks.
- Situations where asynchronous distributed computation needs to be achieved.
- Situations where coordination is complex.
- Situations where the cost of bringing vast amount of remote information to the local node is big, thus necessitating the use of a mobile agent to set off and fetch it.

4. INFORMATION AGENTS

Information agents are tools that coordinate the retrieval, management, selection and manipulation of information. They may be mobile or collaborative, and perharps they will exhibit many of the properties (esecially the learning ones) of interface agents. They find application ground in situations where the amount of information available for a user or the solution to a problem is unmanageably large and some way to filter it down to a selection of the most essential and useful pieces is needed.

CLASSES OF INTELLIGENT AGENTS

1. simple reflex agents
2. model-based reflex agents

3. goal-based agents
4. utility-based agents
5. learning agents

1. SIMPLE REFLEX AGENTS

Simple reflex agents act only on the basis of the current percept, ignoring the rest of the percept history. The agent function is based on the *condition-action rule*: if condition then action.

This agent function only succeeds when the environment is fully observable. Some reflex agents can also contain information on their current state which allows them to disregard conditions whose actuators are already triggered.

Infinite loops are often unavoidable for simple reflex agents operating in partially observable environments. Note: If the agent can randomize its actions, it may be possible to escape from infinite loops.
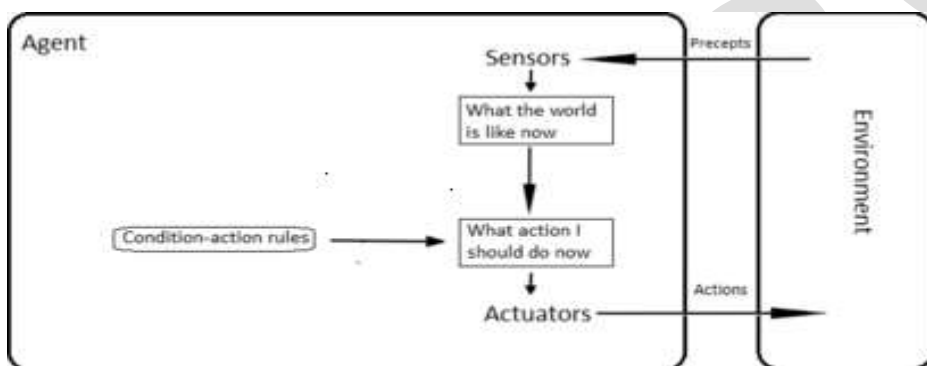
2. MODEL BASED REFLEX AGENTS

A model-based agent can handle a partially observable environment. Its current state is stored inside the agent maintaining some kind of structure which describes the part of the world which cannot be seen. This knowledge about "how the world works" is called a model of the world, hence the name "model-based agent".

A model-based reflex agent should maintain some sort of internal model that depends on the percept history and thereby reflects at least some of the unobserved aspects of the current state.
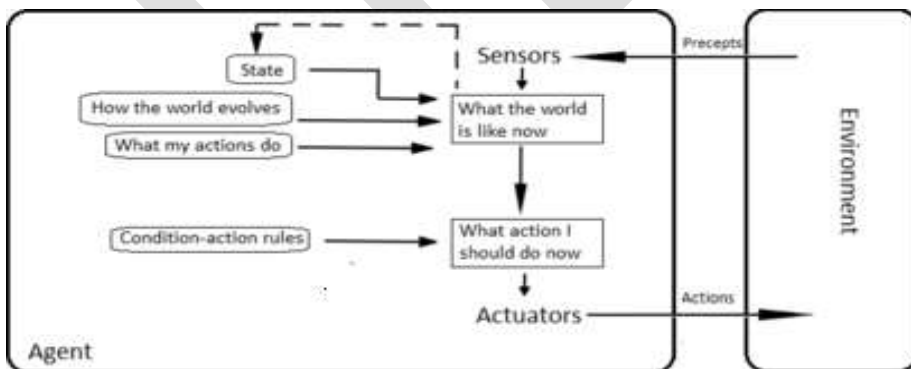
3. GOAL BASED AGENTS

Goal-based agents further expand on the capabilities of the model-based agents, by using "goal" information. Goal information describes situations that are desirable. In some instances the goal-based agent appears to be less efficient; it is more flexible because the knowledge that supports its decisions is represented explicitly and can be modified
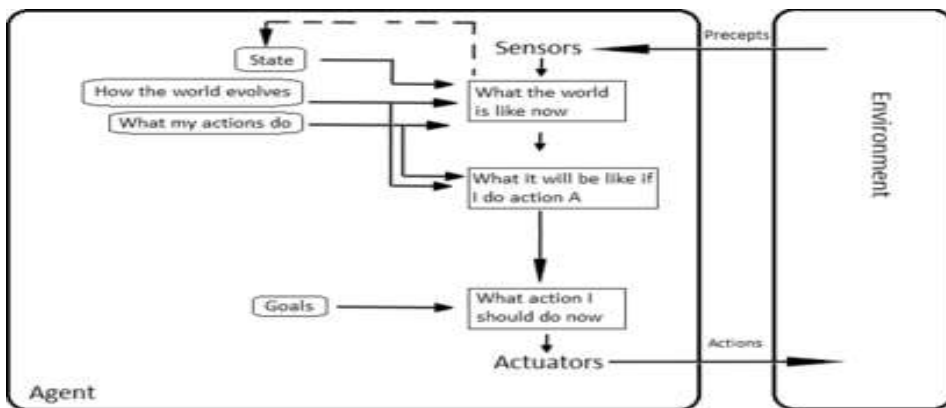
4. UTILITY BASED AGENTS

Goal-based agents only distinguish between goal states and non-goal states. It is possible to define a measure of how desirable a particular state is. This measure can be obtained through the use of a *utility function* which maps a state to a measure of the utility of the state. A more general performance measure should allow a comparison of different world states according to exactly how happy they would make the agent. The term utility, can be used to describe how "happy" the agent is.

A rational utility-based agent chooses the action that maximizes the expected utility of the action outcomes- that is, the agent expects to derive, on average, given the probabilities and utilities of each outcome. A utility-based agent has to model and keep track of its environment, tasks that have involved a great deal of research on perception, representation, reasoning, and learning.
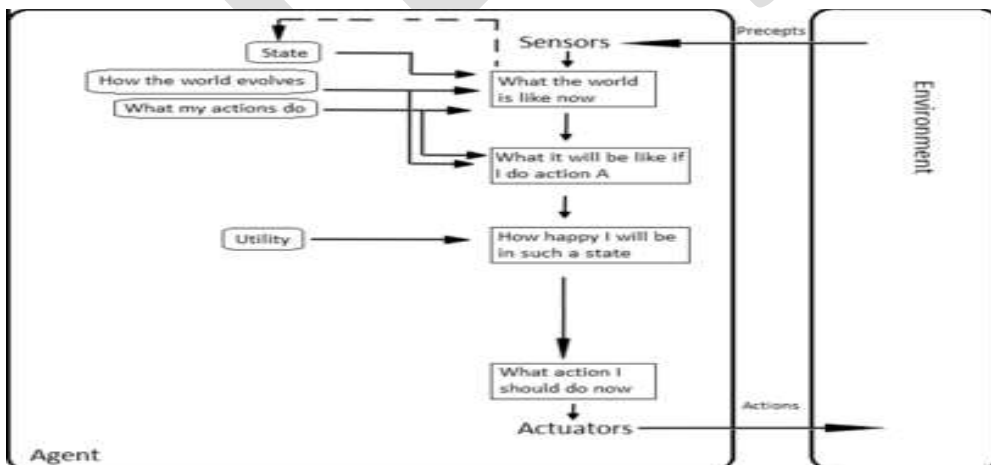
5.LEARNING AGENTS

Learning has an advantage that it allows the agents to initially operate in unknown environments and to become more competent than its initial knowledge alone might allow.

The learning element uses feedback from the "critic" on how the agent is doing and determines how the performance element should be modified to do better in the future. The performance element is what we have previously considered to be the entire agent: it takes in percepts and decides on actions.

The last component of the learning agent is the "problem generator". It is responsible for suggesting actions that will lead to new and informative experiences.
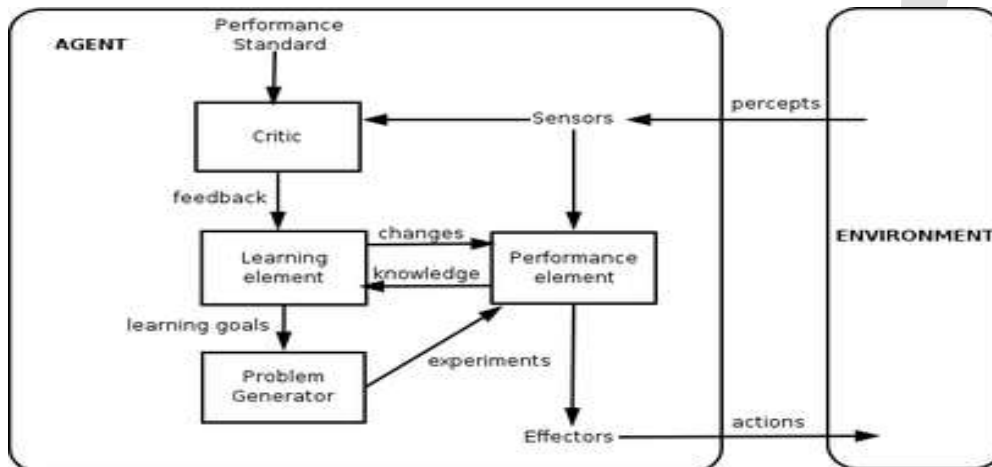
WHAT KIND OF PROBLEMS INTELLIGENT AGENTS CAN SOLVE

To understand how intelligent agents work, it is best to examine some of the practical problems that intelligent agent can help solve. An intelligent agent can help you find and filter information when you are looking at corporate data or surfing the Internet and don't know where the right information is. It could also customize information to your preferences, thus saving you time of handling it as more and more new information arrived each day on the Internet.

APPLICATIONS OF INTELLIGENT AGENT

Customer Help Desk

Customer help desk job is to answer calls from customers and find the answer to their problems. When customers call with a problems, the help desk person manually look up answers from hardcopy manuals, but those hardcopy manuals have been replaced with s earchable CD-ROM collections, and some companies even offer searches over the Internet. Instead of hiring help desk consultants, or having the customers search through the internet for an answer, with intelligent agent, customer describe the problem and the agent automatically searches the appropriate databases (either CD-ROM, or the Internet), then presents a consolidated answer with the most likely first. This is a good example of using intelligent agent to find and filter information.

Web Browser Intelligent

A web browser intelligent, such as an IBM Web Browser Intelligent is an agent which helps you keep track of what web site you visited and customizes your view of the web by automatically keeping a bookmark list, ordered by how often and how recent you vis it the site. It allows you to search for any words you've seen in your bookmark track, and takes you back to the site allowing you to

find and filter quickly. It also help you find where you were by showing you all the different track you took starting at the current page. It also let you know by notifying you when sites you like are updated, and it could also automatically download pages for you to browse   offline.

Personal Shopping Assistant(PSA)

IBM's Personal Shopping Assistant uses intelligent agent technology to help the Internet shopper or the Internet shop owner to find the desired item quickly without having to browse page after page of the wrong merchandise. With the Personal Shopping Ass istant, stores and merchandise are customized as the intelligent agent learned the shopper's preferences as he/she enters in any on-line mall or stores or looking at specific merchandise. It could also arrange the merchandise so that the items you like t he most are the first one you see. Finally, Personal Shopping Assistant automates your shopping experience by reminding you to shop when a birthday, an anniversaries, or item that is on sale occurred.

CONCLUSION

As agents gain a wider acceptance and become more sophisticated, they will become a major factor in the future of the Internet. Intelligent agents will not completely replace surfing altogether, but they will make information gathering much easier for the users or consumer. Instead of searching through lists and lists of unwanted sites, the user could ask their agent to start searching, and in a few moments, it come back with the information that is needed immediately.

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2 KHz Successive Acoustic Pulse Signal Generation with Different Phases for SODAR System Using PC Sound Card and MATLAB Graphical User Interface

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ABSTRACT – The Paper " 2 KHz Successive Acoustic Pulse Signal Generation with different Phases for SODAR system using PC Sound card and MATLAB Graphical User Interface" is extension work for the paper title "2 KHz Mono Pulse Acoustic Signal Generation for SODAR Application using PC Sound card and MATLAB graphical user interface". In previous paper the work has carried out with generating an Acoustic signal with specified frequency with some span of delay. This acoustic signal has propagated in one direction into the atmosphere. Here in this paper the work has carried out for generating the acoustic signal with some phase difference, which cause the change in the direction of the signal propagation. Here the generated signal has in time delay and for each time delay phase of the signal has changes in between 45, 90, 135 degrees, to obtain three directions in propagation signal as shown in the Fig 1.The SODAR (Sound Detection And Ranging) is an instrument that to measure the wind profile in the lower atmosphere of the earth. The volume measurement of the wind profile by remote sensing device, like SODAR have a great advantage compared to point measurements in a one height. In SODAR, acoustic pulses are sent vertically and at a small angle to the vertical. A thus transmitted sound pulse is scattered by the fluctuations and gradients as well as wind shear. There are five basic parameters that determine how the SODAR sends the beam. These are Transmit Frequency (FT), Transmit Power (PT), Pulse Length (τ), Rise Time ($\beta\tau$) and Time between pulses (T). There are two further parameters, namely "Tilt angle" and "Half beam width", which describes the beams of the antenna, but cannot be controlled by the software like MATLAB. MATLAB is a high-level language and interactive environment for computations, visualizations and programming. This language tool, and built-in mathematical functions will enable you to explore multiple approaches and reach a solution faster than with spreadsheets or traditional programming languages, such as C or C++ or VC++. Among the five basic parameters mentioned above, Transmit Frequency (FT), Pulse Length (τ) and Time between pulses (T) are controlled by designing the Graphical User Interface (GUI) of MATLAB. GUIs also known as graphical user interfaces or UIs provide point-and-click control of software applications, eliminating the need to learn a language or type commands in order to run the application.Thus using this GUI, user desired values of a SODAR beam can be generated. This paper is divided into four different layers such as user layer, application layer, operating system layer, and Hardware / Physical layer. The user layer gives the input to the application layer by mouse click or inputs through GUI icons. The application layer performs the signal processing such as parameter determination and further communicates with the operating system layer. The operating system layer acts as a bridge between hardware layer and application layer. Finally the Hardware / Physical layer takes care of commands executions, which are given by operating system layer. The advantage with this design of GUI replaces the ancient analog system using for beam generation.

Keywords: Successive -pulse, phase, Acoustic, SODAR, atmosphere, propagation, Sound Card, GUI, Transient, Rise Time, Transmit Power, Pulse length. Tilt, angle, MATLAB.

I. INTRODUCTION

The SODAR (Sound Detection And Ranging) is an instrument that to measure the wind profile in the lower atmosphere of the earth. The volume measurement of the wind profile by remote sensing device, like SODAR have a great advantage compared to point measurements in a one height. In SODAR, acoustic pulses are sent vertically and at a small angle to the vertical. A thus transmitted sound pulse is scattered by the fluctuations and gradients as well as wind shear. There are five basic parameters that determine how the SODAR sends the beam. These are Transmit Frequency (FT), Transmit Power (PT), Pulse Length (τ), Rise Time ($\beta\tau$) and Time between pulses (T). There are two further parameters, namely "Tilt angle" and "Half beam width", which describes the beams of the antenna, but cannot be controlled by the software like MATLAB.
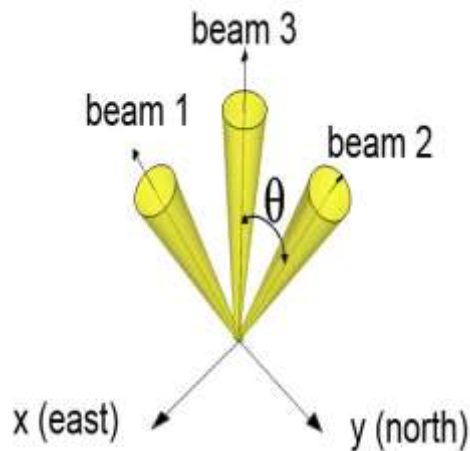
FIG1: ANATOMY OF SODAR SYSTEM SIGNAL DIRECTION.

MATLAB is a high-level language and interactive environment for computations, visualizations and programming. Meanwhile you have a chance to analyze data, develop algorithms and a create models and applications. This language tool, and built-in mathematical functions will enable you to explore multiple approaches and reach a solution faster than with spreadsheets or traditional programming languages, such as C or C++ or VC++.Main Key features of the MATLAB is 1. Mathematical functions for linear algebra, statistics, Fourier analysis, filtering, optimization, numerical integration, and solving ordinary differential equations. 2. Built-in graphics for visualizing data and tools for creating custom plots. 3. Development tools for improving code quality and maintainability and maximizing performance. 4. Tools for building applications with custom graphical interfaces. 5. Functions for integrating MATLAB based algorithms with external applications and languages such as C, Java, .NET, and MicrosoftExcel. 6. Creating Apps with Graphical User Interfaces in MATLAB. In this paper GUI has taken major role into generation of SODAR signal. GUIs also known as graphical user interfaces or UIs provide point-and-click control of software applications, eliminating the need to learn a language or type commands in order to run the application. MATLABapps are self-contained MATLAB programs with GUI front ends that automate a task or calculation. The GUI typically contains controls such as menus, toolbars, buttons, and sliders. Many MATLAB products, such as Curve Fitting Toolbox, Signal Processing Toolbox, and Control System Toolbox, include apps with custom user interfaces. You can also create your own custom apps, including their corresponding UIs, for others to use. GUIDE (GUI development environment) provides tools for designing user interfaces for custom apps. Using the GUIDE Layout Editor, you can graphically design your UI. GUIDE then automatically generates the MATLAB code for constructing the UI, which you can modify to program the behavior of your app. With the help of this MATLAB apps we are going to access the SOUND CARD of the system (PC/ LAPTOPS) to generate the specified user desire sound in frequency and other parameters. A sound card also known as an audio card is an internal computer expansion card that facilitates the input and output of the sound signals to and from a computer under control of computer programs like MATLAB, C language and VC++. Typical uses of sound card include providing the audio component for multimedia application such as music composition, editing video or audio, education and entertainment games, presentation, and video applications like projection. Sound functionality can also be integrated onto the motherboard, using basically the same components as a plug in card. The best plug in card, which use better and more expensive components, can achieve higher quality than integrated sound. The integrated sound system is often still referred as a sound card. The powerful GUI function facilitate the time-height plots in such a way that the plot can be stored, retrieved and processed to eliminate unwanted fixed echo-signals, which are of non-atmospheric origin for the SODAR system. In order to present the data on the client area of a window, the GUI is critical in visual C++ programming language. The present system is divided into layer, and Hardware / physical layer. Fig 1 shows the block diagram of the layer structure of system-based applications. Each layer takes care of the commands received from respective layers. The user layer gives the input to the application layer by mouse click or inputs through GUI icons. The application layer performs the signal processing such as parameter determination and further communicates with the operating system layer. The operating system layer acts as a bridge between hardware layer and application layer. Finally the hardware / physical layer takes care of commands executions, which are given by operating system layer.
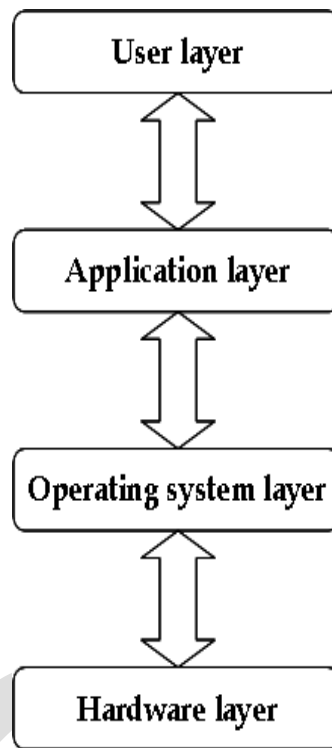
FIG 2: BLOCK DIAGRAM OF LAYER STRUCTURE FOR THE PC-BASED APPLICATION.

II. DESIGN FEATURES

There are five basic parameters that determine how the SODAR sends the beam. These are Transmit Frequency (FT), Transmit Power (PT), Pulse Length (τ), Rise Time ($\beta\tau$) and Time between pulses (T). There are two further parameters, namely "Tilt angle" and "Half beam width", which describes the beams of the antenna, but cannot be controlled by the software like MATLAB. Apart from this first thing is that we need to access the sound card to generate the sound signal internally by using the software program. Here it is going to describing that how we are going to access the sound card by using MATLAB program. Basically an analog output object associated with the winsound device is created. One are more channels are then added to the analog output object, a0. This will allow the winsound device to run in stereo mode. Before accessing sound card, the output data to a sound card using the "data acquisition" tool box generates the analog output. These data has stored in the HANDEL.MAT file, will be used to generate the further sound signal in wave form and displayed in the axes window.

```
a0 = analogoutout ('winsound', 0);
addchannel(a0, [1,2]) ;
```

FIG 3: BASIC SYNTEX OF MATLAB TO ACCESS SOUND CARD

HANDEL.MAT contains two variables: 1.The data that will be output to the sound card and 2. The sample rate are at which the data was originally sampled. The data and sample rate are loaded from the HANDEL.MAT into the MATLAB with function of "load handel". The analog output objects is configured to use the loaded sample rate. For the loaded data to be output, it must first be queued in the data acquisition engine must consist of a column of data for each channel of the analog output object.

Data = [y y];
putdata (a0, data);

FIG 4: BASIC SYNTEX OF MATLAB TO OUTPUT THE DATA.

Now the analog output object and the data acquisition engine are started with the START command. Starting the output object means that the hardware device and the data acquisition engine are both running. Running does not necessarily mean that the data is being output. For data to be output. A trigger must occur, by default, an immediate trigger occurs as soon as the object is started.
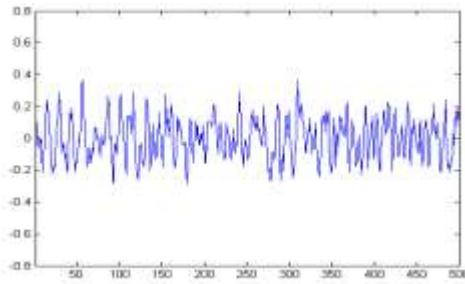

FIG 5: ANALOG OUTPUT IN AXIS WINDOW

A corresponding plot is drawn while the sound plays when total program has executed in the MATLAB workspace. When the data has been output, the analog output object is stopped automatically. The analog output object should be deleted with the "DELETE" command to free memory and other physical resources.
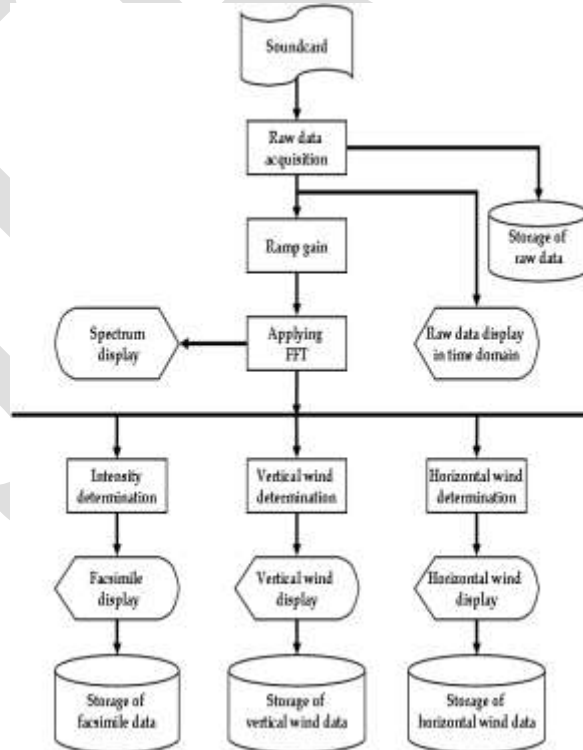
FIG 6: THE STRUCTURAL BLOCK OF SODAR SOFTWARE.

III. GUI SIMULATION RESULTS

Main frame of SODAR GUI will consists five buttons namely 1. SODAR ON: when we select this button on, the basic phenomenon has starts in the background and gives the message if it's ready to select the other parameters. 2. TRANSIENT FREQUENCY: when this button will press immediately it will asks the range of values in Kilo Hertzs, which indicates the frequency of the original SODAR signal.

FIG 7: SODAR antenna at Dept. of Systems Design, Andhra University. Sponsored by UGC and ISRO.
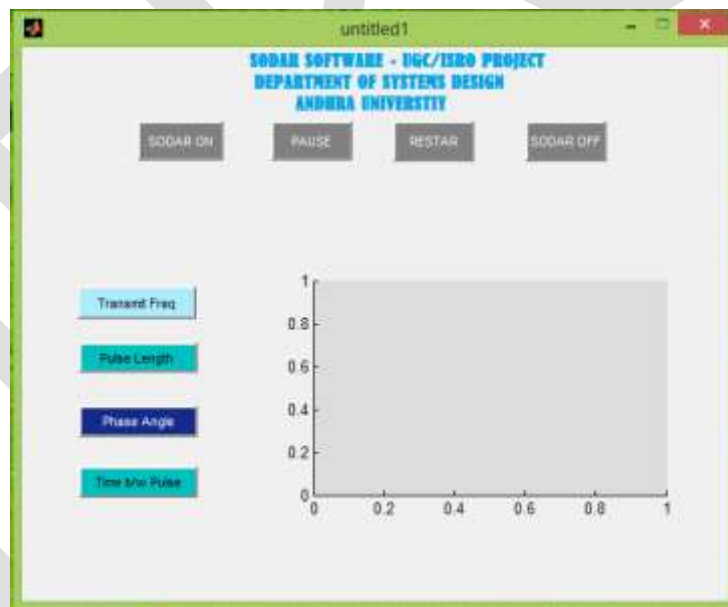
FIG 8: MAIN FRAME OF SODAR GUI IN OFF STATE
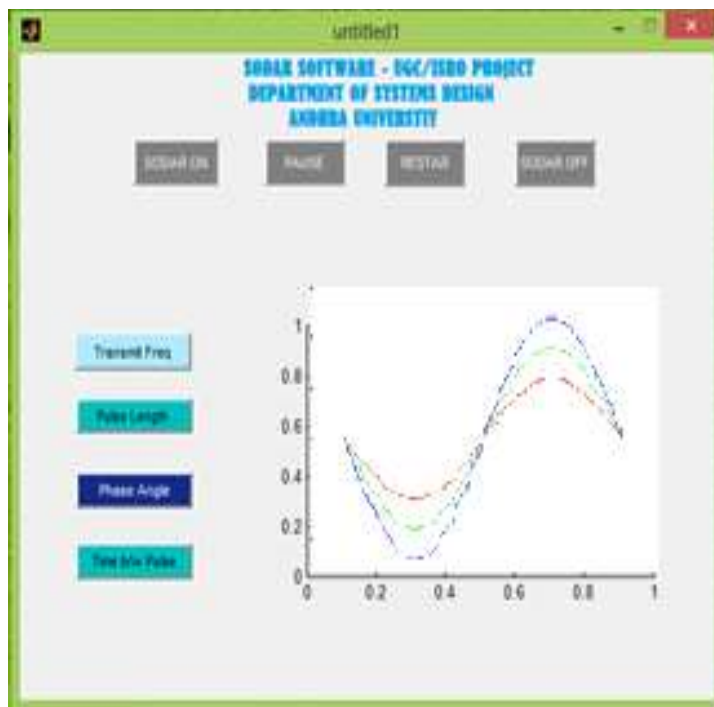
FIG 9: MAIN FRAME OF SODAR GUI IN ON STATE
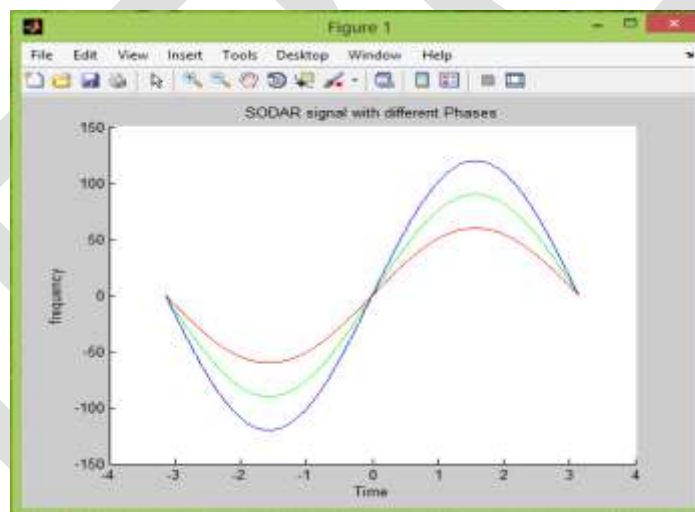
FIG 10: SODAR SIGNAL WITH DIFFERENT PHASES

3. PULSE LENGTH: Which describes the length of the SODAR signal pulse in the time in mille seconds/ seconds. 4. PHASE ANGLE: This parameter is most important in this paper, which is decides the particular tilt angle of the propagation signal. Here basically taken three values in between 45 to 135 degrees lower the degree will tilt the signal left side and higher the degree will tilt towards the right side. So signal with same Frequency with different phase will propagate different sides. This process of propagation will continue until or unless we stop the system. 5.TIME BETWEEN PULSES: This is one of the important factor that plays major role when reception of the SODAR signal is going. Mostly in all SODAR systems we will take it as 2 seconds of duration to get better echo and eliminate the interference between transmitted and reception signal. 6. GRAPH AXIS: Which shows the whether the sound card is generating the sound signal or not. If this graph is pure sine wave then the signal will have better transmission. 7. SODAR RESTART: Sometimes it necessity to restart the total process of the system, so at that time we need not to stop all the hardware and software. This button will simple restart the entire system and rearrange the parameters with previous values. If you want to change the parameters of the system the it need to stop the system and then enter the new values. 8. SODAR OFF: this switch is for off the

total signal generation from the PC SOUND CARD only and also use full for reset/clear the memory of the sound card. In this paper we are only discussing about transmission of the SODAR signal. If we include the reception part in the GUI will have few more buttons and graph axis to display the output signal and its type like time-frequency graph or 'fft' of the reception signal. 9. PAUSE: Its simple button, which pauses the generation of the signal until unless re-click on the same button. After re-click, the system will starts its process with previous values only.
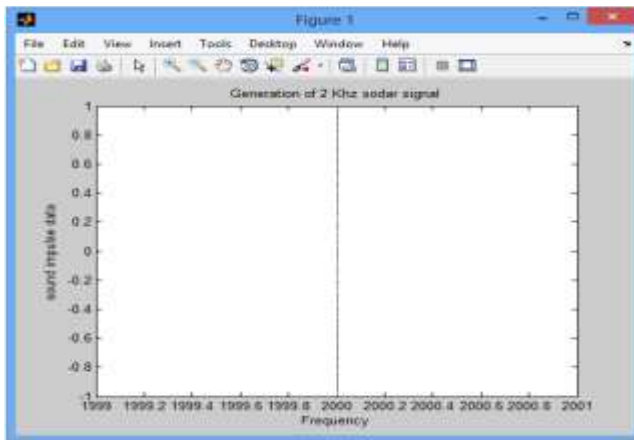
FIG 11: GENERATION OF 2 KHz SIGNAL WITHOUT GUI

Above figure shows the signal generated by sound card with a raw program, in which we do not have the chance to modify the characteristics of the signal.
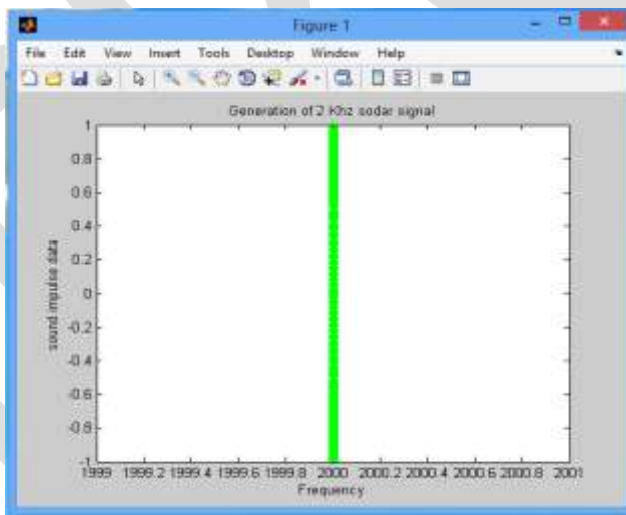

FIG 12: GENERATION OF 2 KHz SIGNAL GUI

Above figure shows the signal generated by sound card with the help of GUI, in which we have the provision to modify the characteristics of the signal. This GUI is programmed in such way if the SOUND card has any problem, which may lead to generate the Nosie, will adjust itself and outputs the user desired pure sine wave and displays the signal in the impulse format as shown above figure.

IV. CONCLUSIONS

Defining the parameters for SODAR system to using object- oriented application like MATLAB, will gives tremendous advantages. This object – oriented program are rich in structure, methods and attributes.This paper is divided into four different layers such as user layer, application layer, operating system layer, and Hardware / Physical layer. The user layer gives the input to the application layer

by mouse click or inputs through GUI icons. The application layer performs the signal processing such as parameter determination and further communicates with the operating system layer. The operating system layer acts as a bridge between hardware layer and application layer. Finally the Hardware / Physical layer takes care of commands executions, which are given by operating system layer. Therefore designing of this software will also reduce the cost effect and hardware compellability and can use worldwide with Microsoft platform.

V. ACKNOWLEDGEMENT

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A Review on Design of Fixtures

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ABSTRACT - In machining fixtures, minimizing workpiece deformation due to clamping and cutting forces is essential to maintain the machining accuracy. The various methodology used for clamping operation used in different application by various authors are reviewed in this paper. Fixture is required in various industries according to their application. This can be achieved by selecting the optimal location of fixturing elements such as locators and clamps. The fixture set up for component is done manually. For that more cycle time required for loading and unloading the material. So, there is need to develop system which can help in improving productivity and time. Fixtures reduce operation time and increases productivity and high quality of operation is possible.

keywords: fixture, accuracy, clamping, productivity.

I. INTRODUCTION

The fixture is a special tool for holding a work piece in proper position during manufacturing operation. For supporting and clamping the work piece, device is provided. Frequent checking, positioning, individual marking and non-uniform quality in manufacturing process is eliminated by fixture. This increase productivity and reduce operation time. Fixture is widely used in the industry practical production because of feature and advantages.

To locate and immobilize workpieces for machining, inspection, assembly and other operations fixtures are used. A fixture consists of a set of locators and clamps. Locators are used to determine the position and orientation of a workpiece, whereas clamps exert clamping forces so that the workpiece is pressed firmly against locators. Clamping has to be appropriately planned at the stage of machining fixture design. The design of a fixture is a highly complex and intuitive process, which require knowledge. Fixture design plays an important role at the setup planning phase. Proper fixture design is crucial for developing product quality in   different terms of accuracy, surface finish and precision of the machined parts In existing design the fixture set up is done manually, so the aim of this project is to replace with hydraulic fixture to save time for loading and unloading of component. Hydraulic fixture provides the manufacturer for flexibility in holding forces and to optimize design for machine operation as well as process functionability.

Steps of fixture design

Successful fixture designs begin with a logical and systematic plan. With a complete analysis of the fixture's functional requirements, very few design problems occur. When they do, chances are some design requirements were forgotten or underestimated. The workpiece, processing, tooling and available machine tools may affect the extent of planning needed. Preliminary analysis may take from a few hours up to several days for more complicated fixture designs. Fixture design is a five-step problem-solving process. The following is a detailed analysis of each step.

Step 1: Define Requirements

To initiate the fixture-design process, clearly state the problem to be solved or needs to be met. State these requirements as broadly as possible, but specifically enough to define the scope of the design project. The designer should ask some basic questions: Is the new tooling required for first-time production or to improve existing production?

Step 2: Gather/Analyze Information

Collect all relevant data and assemble it for evaluation. The main sources of information are the part print,

process sheets, and machine specifications. Make sure that part documents and records are current. For example, verify that the shop print is the current revision, and the processing information is up-to-date. Check with the design department for pending part revisions. An important part of the evaluation process is note taking. Complete, accurate notes allow designers to record important information. With these notes, they should be able to fill in all items on the "Checklist for Design Considerations." All ideas, thoughts, observations, and any other data about the part or fixture are then available for later reference. It is always better to have too many ideas about a particular design than too few. Four categories of design considerations need to be taken into account at this time: workpiece specifications, operation variables, availability of equipment, and personnel. These categories, while separately covered here, are actually

interdependent. Each is an integral part of the evaluation phase and must be thoroughly thought out before beginning the fixture design.

Step 3: Develop Several Options

This phase of the fixture-design process requires the most creativity. A typical workpiece can be located and clamped several different ways. The natural tendency is to think of one solution, then develop and refine it while blocking out other, perhaps better solutions. A designer should brainstorm for several good tooling alternatives, not just choose one path right away. During this phase, the designer's goal should be adding options, not discarding them. In the interest of economy, alternative designs should be developed only far enough to make sure they are feasible and to do a cost estimate. The designer usually starts with at least three options: permanent, modular, and general-purpose workholding. Each of these options has many clamping and locating options of its own. The more standard locating and clamping devices that a designer is familiar with, the more creative he can be. Areas for locating a part include flat exterior surfaces (machined and unmachined), cylindrical and curved exterior surfaces. The exact procedure used to construct the preliminary design sketches is not as important as the items sketched. Generally, the preliminary sketch should start should start with the part to be fixtured. The required locating and supporting elements, including a base, should be the next items added. Then sketch the clamping devices. Finally, add the machine tool and cutting tools. Sketching these items together helps identify any problem areas in the design of the complete fixture.

Step 4: Choose the Best Option

The total cost to manufacture a part is the sum of per-piece run cost, setup cost, and tooling cost. Expressed as a formula:

$$\text{Cost per Part} = \text{Run Cost} + \frac{\text{Setup Cost}}{\text{Lot Size}} + \frac{\text{Tooling Cost}}{\text{Total Quanity Over Tooling Lifetime}}$$

These variables are described below with sample values from three tooling options: a modular fixture, a permanent fixture, and a hydraulically powered permanent fixture.

Step 5: Implement the Design

The final phase of the fixture-design process consists of turning the chosen design approach into reality. Final details are decided, final drawings are made, and the tooling is built and tested. The following guidelines should be considered during the final-design process to make the fixture less costly while improving its efficiency. These rules are a mix of practical considerations, sound design practices, and common sense [9].

i. Use standard components: The economies of standard parts apply to tooling components as well as to manufactured products. Standard, readily available components include clamps, locators, supports, studs, nuts, pins and a host of other elements. Most designers would never think of having the shop make cap screws, bolts or nuts for a fixture. Likewise, no standard tooling components should be made in-house. The first rule of economic design is: Never build any component you can buy. Commercially available tooling components are manufactured in large quantities for much greater economy. In

most cases, the cost of buying a component is less than 20% of the cost of making it.

Labor is usually the greatest cost element in the building of any fixture. Standard tooling components are one way to cut labor costs. Browse through catalogs and magazines to find new products and application ideas to make designs simpler and less expensive.

ii. Use prefinished materials: Prefinished and preformed materials should be used where possible to lower costs and simplify construction. These materials include precision-ground flat stock, drill rod, structural sections, cast tooling sections, precast tooling bodies, tooling plates, and other standard preformed materials. Including these materials in a design both reduces the design time and lowers the labor cost.

iii. Eliminate finishing operations: Finishing operations should never be performed for cosmetic purposes. Making a fixture look better often can double its cost. Here are a few suggestions to keep in mind with regard to finishing operations.

iv. Keep tolerances as liberal as possible: The most cost-effective tooling tolerance for a locator is approximately 30% to 50% of the workpiece's tolerance. Tighter tolerances normally add extra cost to the tooling with little benefit to the process. Where necessary, tighter tolerances can be used, but tighter tolerances do not necessarily result in a better fixture, only a more expensive one.

II .IMPORTANT CONSIDERATIONS WHILE DESIGNING JIGS AND FIXTURES.

Designing of jigs and fixtures depends upon so many factors. These factors are analyzed to get design inputs for jigs and fixtures. The list of such factors is mentioned below :

a. Study of workpiece and finished component size and geometry.

b. Type and capacity of the machine, its extent of automation.

c. Provision of locating devices in the machine.

d. Available clamping arrangements in the machine.

e. Available indexing devices, their accuracy.

f. Evaluation of variability in the performance results of the machine.

g. Rigidity and of the machine tool under consideration.

h. Study of ejecting devices, safety devices, etc.

i. Required level of the accuracy in the work and quality to be produced.

III. MEANING OF LOCATION

The location refers to the establishment of a desired relationship between the workpiece and the jigs or fixture correctness of location directly influences the accuracy of the finished product. The jigs and fixtures are desired so that all undesirable movements of the workpiece can be restricted. Determination of the locating points and clamping of the workpiece serve to restrict movements of the component in any direction, while setting it in a particular pre-decided position relative to the jig. Before deciding the locating points it is advisable to find out the all possible degrees of freedom of the workpiece. Then some of the degrees of freedom or all of them are restrained by making suitable arrangements. These arrangements are called locators. These are described in details below[11]:

1.PRINCIPLES OF LOCATIONS

The principle of location is being discussed here with the help of a most popular example which is available in any of the book covering jigs and fixtures. It is important that one should understand the problem first. Any rectangular body many have three axis along x-axis, y-axis and z-axis. It can more along any of these axes or any of its movement can be released to these three axes. At the same time the body can also rotate about these axes too. So total degree of freedom of the body along which it can move is six. For processing the body it is required to restrain all the degree of freedom (DOF) by arranging suitable locating points and then clamping it in a fixed and required position. The basic principle used to locate the points is desirable below. Six Points Location of a Rectangular Block. It is made to rest on several points on the jig body. Provide a rest to workpiece on three points on the bottom x-y surface. This will stop the movement along z-axis, rotation with respect to x-axis and y-axis. Supporting it on the three points is considered as better support then one point or two points. Rest the workpiece on two points of side surface (x-z), this will fix the movement of workpiece along y-axis and rotation with respect to z-axis. Provide a support at one point of the adjacent surface (y-z) that will fix other remaining free movements. This principle of location of fixing points on the workpiece is also named as 3-2-1 principle of fixture design as numbers of points selected at different faces of the workpiece are 3, 2 and 1 respectively. If the operation to be done on the cylindrical object requires restriction of the above mentioned free movements also than some more locating provisions must also be incorporated in addition to use of the Vee block. Guohua Qin[1] focuses on the fixture clamping sequence. It consists of two parts:

a. For the first time he evaluated varying contact forces and workpiece position errors in each clamping step by solving a nonlinear mathematical programming problem. This is done by minimizing the total complementary energy of the workpiece-fixture system. The prediction proves to be rigorous and reasonable after comparing with experimental data and referenced results.

b. The optimal clamping sequence is identified based on the deflections of the workpiece and minimum position error. Finally, To predict the contact forces and to optimize the clamping sequence three examples are discussed.
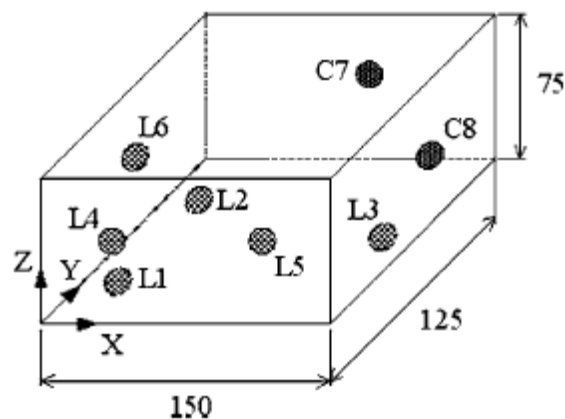

Fig. 1 Scheme of 3-2-1 fixture setup [1].

First mathematical modeling for clamping sequence is done then he determined the contact forces in clamping sequence as shown in fig. 1. After that he optimized of clamping sequence for higher stiffness workpiece and low stiffness workpiece. He found that with the use of optimal clamping sequence, good agreements are achieved between predicted

results and experimental data and the workpiece machining quality can be improved .

For a fixture designer, the major portion of design time is spent deciding how to locate the work piece in the fixture. You know that any free body has a total of twelve degrees of freedom as below:

 6 translational degrees of freedom**: +X, -X, +Y, -Y, +Z, -Z**

And 6 rotational degrees of freedom:

- Clockwise around X axis (**CROT-X**)

- Anticlockwise around X axis (**ACROT-X**)

- Clockwise around Y axis (**CROT-Y**)

- Anticlockwise around Y axis (**ACROT-Y**)

- Clockwise around Z axis (**CROT-Z**)

- Anticlockwise around Z axis (**ACROT-Z**)

You must fix all the 12 degrees of freedom except the three transitional degrees of freedom (-X, -Y and -Z) in order to locate the work piece in the fixture. So, 9 degrees of freedom of the work piece need to be fixed. But, how? By using the **3-2-1 method** as shown below in fig. 2 :
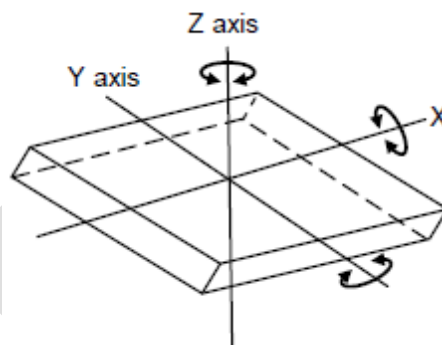
Fig. 2 Available Degree of Freedom of Rectangular Block[11]

Now, rest the work piece at **two** points of side surface (XZ), and you will be able to fix the **+Y** and **ACROT-Z** degrees of freedom. Now, rest the work piece at **one** point of the adjacent surface (YZ), and you will be able to fix the **+X** and **CROT-Z** degrees of freedom. So, you can successfully fixate **9** required degrees of freedom by using the 3-2-1 principle of fixture design.

Nicholas Amaral [6] develop a method for modeling workpiece boundary conditions and applied loads during a machining process, optimize support locations, using finite element analysis (FEA) and analyses modular fixture tool contact area deformation. The workpiece boundary conditions are defined by locators and clamps. To constrain using linear spring-gap elements the locators are placed in a 3-2-1 fixture configuration and modeled using all degrees of freedom of the workpiece. To model cutting forces during drilling and milling machining operations, the workpiece is loaded. Fixture design integrity is verified. To develop an algorithm to automatically optimize fixture support and clamp locations. To minimize deformation in workpiece, subsequently increasing machining accuracy ANSYS parametric design language code is used. Unnecessary and uneconomical "trial and error" experimentation on the shop floor is eliminated by implementing

FEA in a computer-aided-fixture-design environment.

2. DIFFERENT METHODS USED FOR LOCATION

There are different methods used for location of a work. The locating arrangement should be decided after studying the type of work, type of operation, degree of accuracy required. Volume of mass production to be done also mattes a lot. Different locating methods are described below.:

Flat Locator

Flat locators are used for location of flat machined surfaces of the component. Three different examples which can be served as a general principle of location are described here for flat locators. These examples are illustrated in Fig. 3
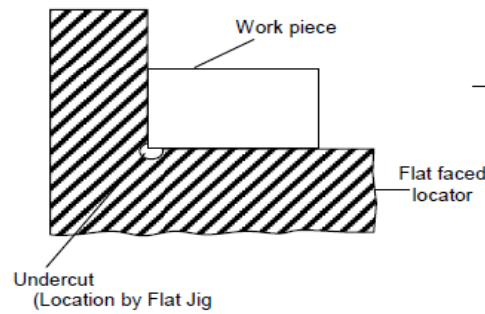
Fig. 3 Flat locator[11]

A flat surface locator can be used as shown in first figure. In this case an undercut is provided at the bottom where two perpendicular surfaces intersect each other. This is made for swarf clearance. The middle figure shows flat headed button type locator. There is no need to made undercut for swarf clearance. It is used for locating components having drilled holes. The cylindrical component to be located is gripped by a cylindrical locator fitted to the jig's body and inserted in the drilled hole of the component.

Jack Pin Locator

Jack pin locator is used for supporting rough workpieces from the button as shown in Fig. 4. Height of the jack pin is adjustable to accommodate the workpieces having variation in their surface texture. So this is a suitable method to accommodate the components which are rough and un-machined.
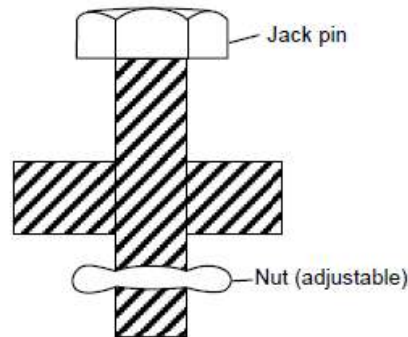

Fig. 4 Jack Pin Locator[11]

Drill Bush Locator

The drill bush locator is used for holding and locating the cylindrical workpieces. The bush has conical opening for locating purpose and it is sometimes screwed on the jigs body for the adjustment of height of the work.
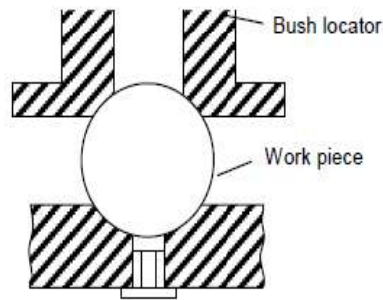

Fig. 5 Drill Bush Locator[11]

Vee Locators

This is quick and effective method of locating the workpiece with desired level of accuracy. This is used for locating the circular and semi-circular type of workpiece. The main part of locating device is Vee shaped block which is normally fixed to the jig. This locator can be of two types fixed Vee locator and adjustable Vee locator. The fixed type locator is normally fixed on the jig and adjustable locator can be moved axially to provide proper grip of Vee band to the workpiece.
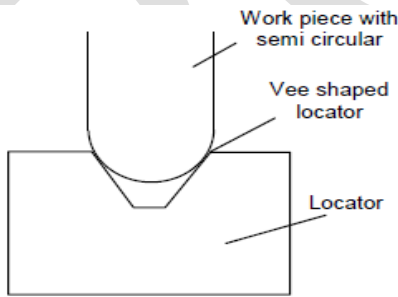

Fig. 6 Vee Locator[11]

Locating error and machining error were studied by systematic method of error identification and calculation, in which. using finite element analysis (FEA). The machining error, the surface error shown in fig. 7 generated from machining operations by Y. Wang [7].
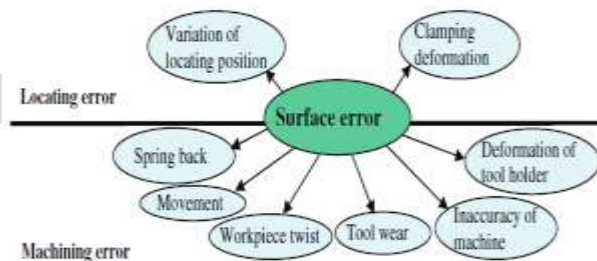

Fig. 7 Surface error sources [7].

A methodology of machined surface error calculation and error decomposition was presented in this paper. The research has

focused on (a) surface error including both locating error and machining error, also machining error generated during multi machining operations was analyzed; (b) the sensitivity of individual errors was investigated, and the resultant surface error of locating and machining was evaluated against tolerance; and (c) the method is suitable for both components with complex geometry as well as simple geometry.
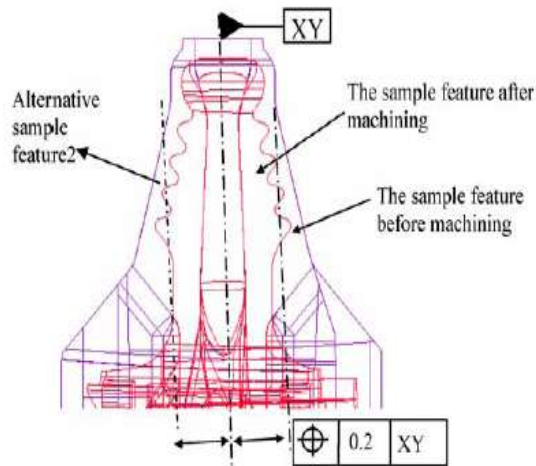
.

Fig. 8 Tolerance of the sample feature [7]

The surface error analysis of a sample feature of turbine blades was presented to demonstrate the developed procedure and analysis. The result suggested that the component does not satisfy the tolerance requirement due to fixture related errors such as clamping deformation shown in fig. 8, workpiece movement, and workpiece twist. The methods of error reduction were proposed

IV. CLAMPING

To restrain the workpiece completely a clamping device is required in addition to locating device and jigs and fixtures. A clamping device holds the workpiece securely in a jig or fixture against the forces applied over it during on operation. Clamping device should be incorporated into the fixture, proper clamp in a fixture directly influence the accuracy and quality of the work done and production cycle time. Basic requirement of a good clamping device are listed below :

a. It should rigidly hold the workpiece.

b. The workpiece being clamped should not be damaged due to application of clamping pressure by the clamping unit.

c. The clamping pressure should be enough to overcome the operating pressure applied on the workpiece as both pressure act on the workpiece in opposite directions.

d. Clamping device should be capable to be unaffected by the vibrations generated during an operation.

e. It should also be user friendly, like its clamping and releasing should be easy and less time consuming. Its maintenance should also be easy.

f. Clamping pressure should be directed towards the support surfaces or support points to prevent undesired lifting of workpiece from its supports.

g. Clamping faces should be hardened by proper treatments to minimize their wearing out.

h. To handle the workpieces made of fragile material the faces of clamping unit should be equipped with fiber pads to avoid any damage to workpiece.

J. Cecil[5] proposed an innovative clamping design approach is described in the context of fixture design activities. The clamping design approach involves identification of clamping surfaces and clamp points on a given workpiece. This approach can be applied in conjunction with a locator design approach to hold and support the workpiece during machining and to position the workpiece correctly with respect to the cutting tool. Detailed steps are given for automated clamp design. Geometric reasoning techniques are used to determine feasible clamp faces and positions. The required inputs include CAD model specifications, features identified on the finished workpiece, locator points and elements.

1.DIFFERENT TYPES OF CLAMPS

Different variety of clamps used with jigs and fixtures are classified into different categories are discussed here:

Strap Clamp

This is also called edge clamp. This type clamping is done with the help of a lever pressure acting as a strap on the workpiece. Different types of strap clamps are discussed below.

Heel Clamp

Rotation of the clamp in clockwise direction is prevented and it is allowed in anticlockwise direction. For releasing the workpiece the clamping nut is unscrewed. The free movements in anticlockwise direction takes place before un-securing the nut to release the workpiece.
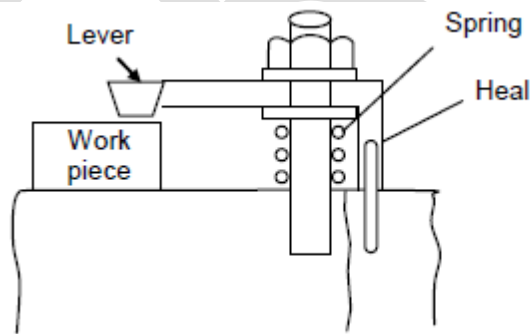

Fig. 9 Heel Clamp[11]

Bridge Clamp

The bridge clamp applies more clamping pressure as compared to heel clamp. The clamping pressure experienced by the workpiece depends on the distances „x‟ and „y‟ marked. To release the workpiece the nut named as clamping nut is unscrewed. The spring lifts the lever to release the workpiece.
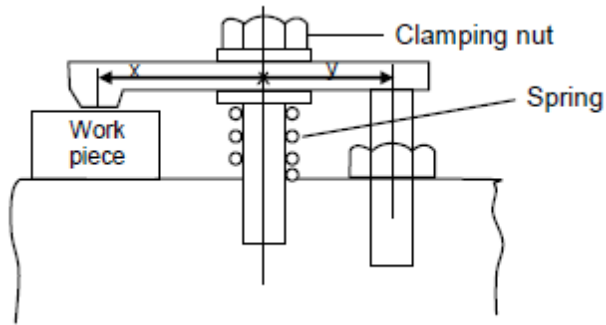
Fig. 10 Bridge Clamp

Edge Clamp or Side Clamp

A side clamp is also known as edge clamp. In this case the surface to be machined is always clamped above the clamping device. This clamping device is recommended for fixed length workpiece. Releasing and clamping of the workpiece can be accomplished by unscrewing and screwing of the clamping nut respectively.
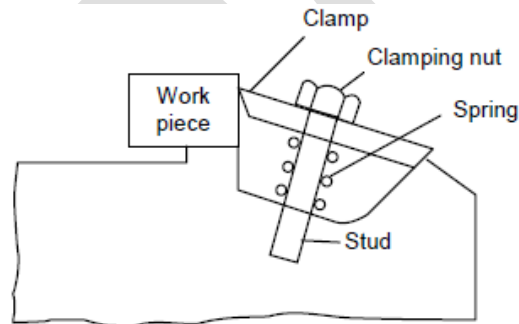

Fig. 11 Edge Clamp or Side Clamp[11]

Screw Clamp

The screw clamp is also known as clamp screw. This clamping apply pressure directly on the side faces of the workpiece.
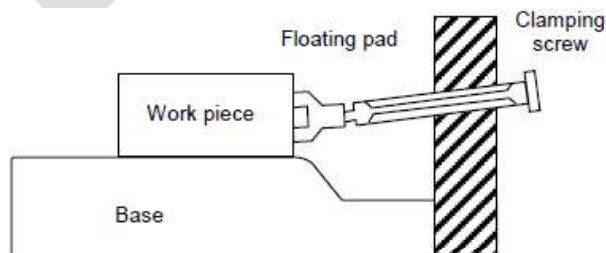

Fig. 12 Screw Clamp[11]

There is a floating pad at their end to serve the following purposes :

a. It prevents displacement of workpiece and slip.

b. It prevents denting of clamping area of workpiece.

c. The available cushion prevents deflection of screw.

In addition to the above there are some disadvantages associated with this method. The clamping pressure largely depends on the workpiece; it varies from one workpiece to other. It is more time consuming and more efforts are required.

Latch Clamp

Latch clamps are used to clamp the workpiece, the clamping system is normally locked with the help of a latch provided. To unload the workpiece the tail end of the latch is pushed that causes the leaf to swung open, so releasing the workpiece. Here time consumed in loading and unloading is very less as no screw is tightened but clamping pressure is not so high as in other clamping devices. Life of this type of clamping device is small.

Equalizing Clamps

Equalizing clamp is recommended to apply equal pressure on the two faces of the work. The pressure applied can be varied by tightened or loosening the screw provided for the purpose.
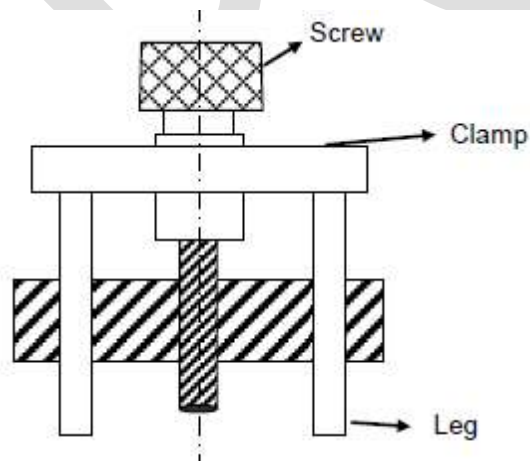

Fig. 13 Equalizing Clamps[11]

Power Driven Clamping

Light duty clamps are used manually because small power is required to operate these clamps. Hand clamping leads to application of variable pressure, operator's fatigue and more time consumed. The power driven clamping over comes the above mentioned problems of hand clamping. Power clamps are operated on the base of hydraulic or pneumatic power. Power clamps are high pressure clamping, these are quick acting, easily controllable, reliable and less time consuming.

V. SOFTWARE FOR FIXTURE DESIGN

NX streamlines the entire tool development process including part design, tool assembly layout, and detailed tooling design and validation. Using NX's advanced functionality, step-by-step guidance and associatively with part designs, you can work with even the most challenging tooling and fixture designs. These are discussed below[10]
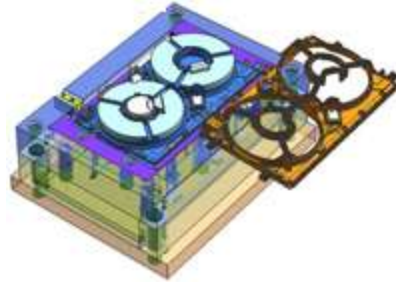

Fig. 14 NX Mold Design[10]

NX Mold Design shown in fig. 14 automates and streamlines the entire mold development process including part design, tool design and motion validation. You can ensure fast response to design changes and high-quality molds.
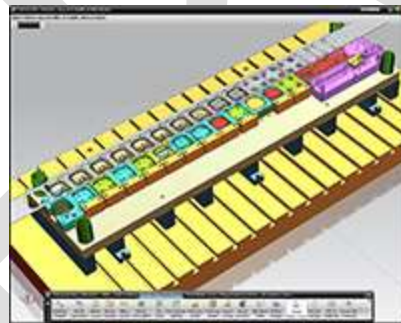

Fig. 15 NX Progressive Die Design[10]

NX guides you through all of the stages required to design a progressive die, automating the most tedious tasks and streamlining the most complex processes which is shown in fig.15. NX Progressive Die Design is a comprehensive solution for both straight break and freeform sheet metal parts. You can design the complete die structure with associatively to the part design at every stage.
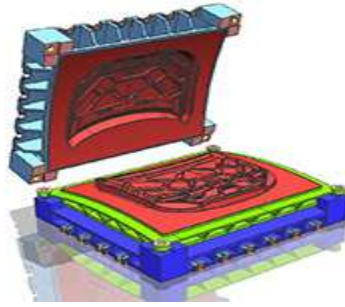
Fig. 16 NX Stamping Die Design[10]

The advanced capabilities in NX for designing automotive stamping dies include formability analysis, die planning, die face design, detailed die structure design and die validation. NX Stamping Die Design guides you in defining the process used to manufacture complex stamped sheet metal parts, producing a representation of the press line and modeling the shape of the sheet metal as it leaves each press.
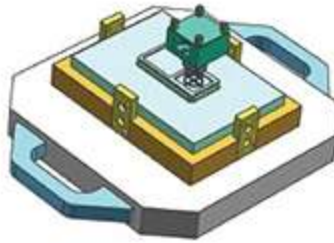

Fig. 17   NX Electrode Design[10]

NX Electrode Design incorporates numerous industry best practices into a step-by-step approach that automates the electrode design and manufacturing process.
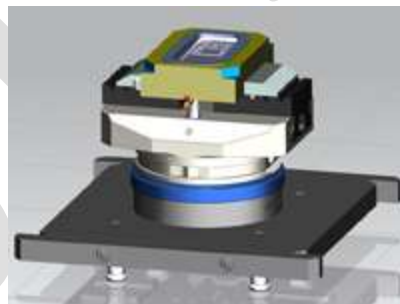
Fig. 18 NX for Jig and Fixture Design[10]

Because jig and fixture designs are fully associative to the part model, you can quickly and accurately update fixtures based on part model changes. You can easily position and mate fixture components with the NX assembly capabilities, and then automatically create drawings and documentation for the fixture and its components. NX also allows you to simulate the kinematics of fixtures, such as opened and closed positions, and check for strength and distortion.

Michael Stampfer[2] presented a paper which deals with the problem of setup and fixture planning for the machining of box-shaped parts on the horizontal machining centers. The setup and fixture planning shown in fig. 2. The central topic of this research is the automation of the conceptual design of fixtures shown in fig. 3. This topic is deal with the setup planning.
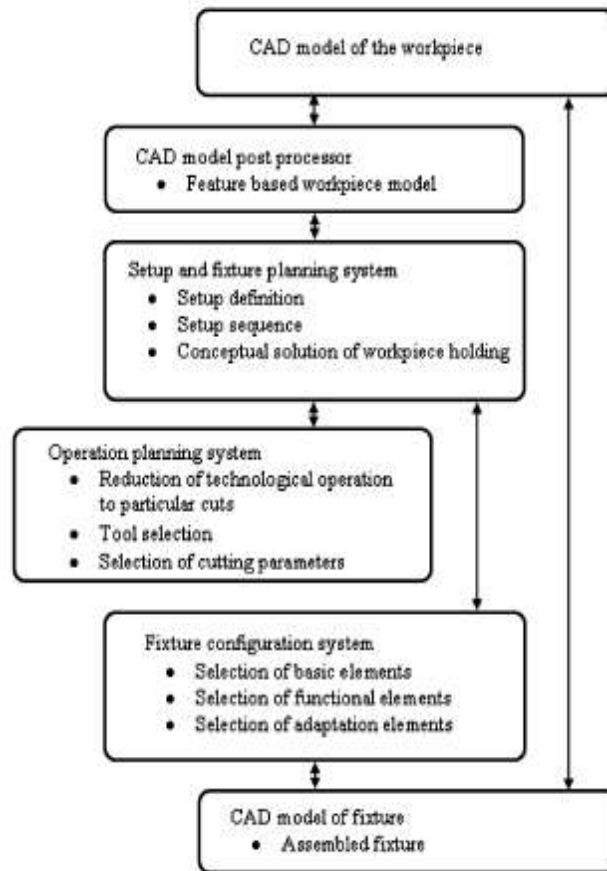
Fig. 19 Integrated process planning and fixture planning system[2].

The integrated handling of tasks of setup and fixture planning and the finding of solution in an integrated system is , the main aim of the author. Based on the workpiece model, the setup sequence, the conceptual solution of fixture for each setup determined automatically by the developed system.

1.Fixturing Functional Requirements

From a layout point of view, fixtures have six basic functional requirements :

(1) Stable resting, (2) accurate localization. (3) support reinforcement, (4) stable clamping, (5) foreclosure(or total restraint) and (6) quality performance.

The functions have strong precedence conditions. The first five functions are required at the fixturing stage, and sequentially. When a workpiece is placed into a fixture, it must first assume a stable resting against the gravity. Then, the locators should provide accurate localization. Next, supports are moved in place, and finally clamps are activated for the part immobilization (force-closure). The part location must be maintained in the process of instantiating clamps without workpiece lift-off. The performance of the fixture is ultimately defined as workpiece geometric error during the manufacturing stage. The geometric error is mainly determined by the fixture localization accuracy and the workpiece static and elastic deformation during manufacturing. There are additional constraints to be satisfied such as interference-free and easy loading and unloading.

2. Design Consideration in Fixtures

a. The main frame of fixture must be strong enough so that deflection of the fixture is as minimum as possible. This deflection of fixture is caused because of forces of cutting, clamping of the workpiece or clamping to the machine table. The main frame of the fixture should have the mass to prevent vibration and chatter.

b. Frames may be built from simple sections so that frames may be fastened with screws or welded whenever necessary. Those parts of the frame that remain permanently with the fixture may be welded. Those parts that need frequent changing may be held with the screws. In the situation, where the body of fixture has complex shape, it may be cast from good grade of cast iron.

c. Clamping should be fast enough and require least amount of effort.

d. Clamps should be arranged so that they are readily available and may be easily removed.

e. Clamps should be supported with springs so that clamps are held against the bolt head wherever possible.

f. If the clamp is to swing off the work, it should be permitted to swing as far as it is necessary for removal of the workpiece.

g. All locator's clamps should be easily visible to the operator and easily accessible for cleaning, positioning or tightening.

h. Provision should be made for easy disposal of chip so that storage of chips doesn't interfere with the operation and that their removal during the operation doesn't interfere with the cutting process.

i. All clamps and support points that need to be adjusted with a wrench should be of same size. All clamps and adjustable support points should be capable of being operated from the fronts of the fixture.

j. Work piece should be stable when it is placed in fixture. If the work piece is rough, three fixed support points should be used. If work piece is smooth, more than three fixed support points may be used. Support point should be placed as farthest as possible from each other.

k. The three support points should circumscribe the centre of gravity of the workpiece.

l. The surface area of contact of support should be as small as possible without causing damage to the workpiece. This damage is due to the clamping or work forces.

The importance of fixture design automation is emphasized by Djordje Vukelic [3]. General structure of the automated design system shown in fig. 20 with a highlight on the fixture design systems and their main characteristics.
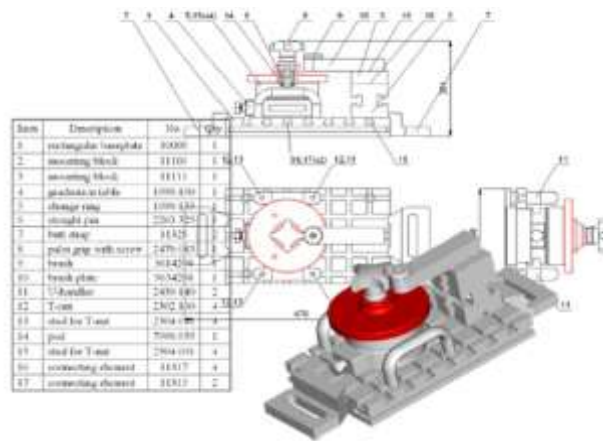
Fig. 20 Layout of working [3].

It also shows a structure and a part of output results of the automated modular fixture design system. The expert systems have been mostly used for the generation of partial fixture solutions, i.e., for the selection of locating and clamping elements.

Shrikant [8] discussed various design and analysis methods in the context of to improve the life of fixture, different fixture geometries are compared experimentally and are selected. The proposed eccentric shaft fixture will fulfilled researcher Production target and enhanced the efficiency, fixture reduces operation time and increases productivity, high quality of operation,

Weifang Chen [4] developed a multi-objective model was established to increase the distributing uniformity of deformation and to reduce the degree of deformation. The deformation is analyzed by optimizing the finite element method. To solve the optimization model a genetic algorithm was developed. A satisfactory result was obtained by illustrating an example, which is superior than the experiential one.
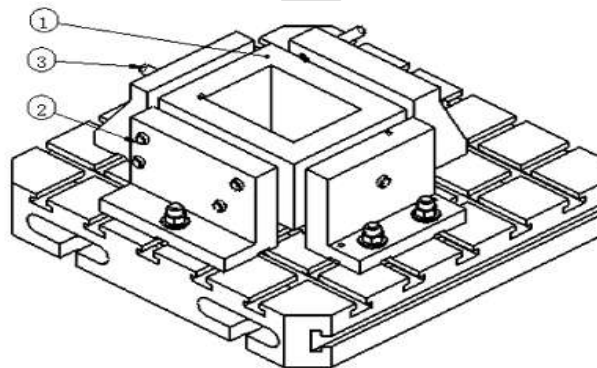
Fig. 21 A real case fixture configuration [4]

The multiobjective model can reduce the machining deformation effectively and improve the distribution condition. This paper presented a fixture layout design shown in fig. 21 and clamping force optimization procedure based on the GA and FEM. The optimization procedure is multi-objective: minimizing the maximum deformation of the machined surfaces and maximizing the uniformity of the deformation. The ANSYS software package has been used for FEM calculation of fitness values. The combination of GA and FEM is proven to be a powerful approach for fixture design optimization problems. In this study, both friction effects and chip removal effects are considered. a database is established to reduce the computation time, for the chromosomes and fitness values, and the meshed workpiece FEA model is

repeatedly used in the optimization process.

Fig. 22 shows the existing CAD model of fixture which is used for machining of hydraulic lift housing. In this fixture clamping is done manually so there is extra time loss for loading and unloading operation. To avoid this problem there is necessity to develop new design to improve the productivity.
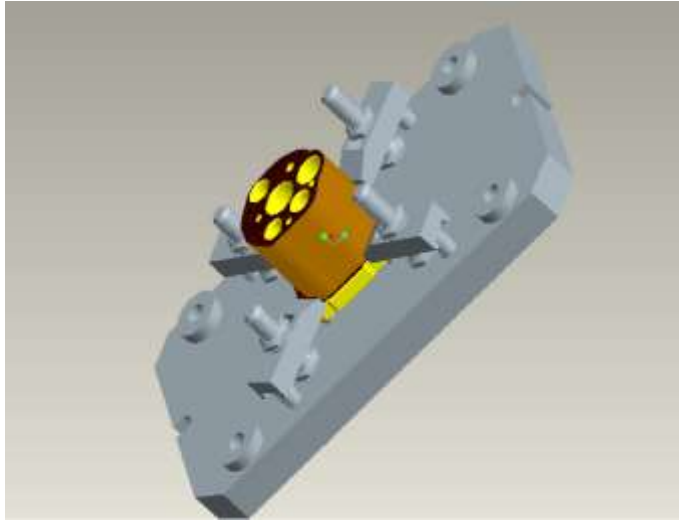
Fig. 22 CAD model of complete fixture assembly

- **Type of machine**
-Vertical machining centre.

- **Operations**
-Drilling.

-Reaming.

-Champer.

Machining parameter for drilling

- Cutter diameter 18 mm
- Number of flute 4
- Spindle speed 500 rpm
- Feed 0.15 mm/rev
- Radial depth 18 mm
- Projection length 90 mm

Machining parameters for reaming

- Cutter diameter 26 mm
- Number of flute 4
- Spindle speed 120 rpm
- Feed 0.25 mm/rev
- Radial depth 26 mm
- Projection length 90 mm

3.TYPES OF FIXTURE AND ITS INDUSTRIAL APPLICATIONS

Vise Fixture It is easy to clamp workpiece with regular shape and parallel sides in a vise. However, workpieces with round or irregular shapes are very difficult to clamp properly. Hence, special jaws are created to hold workpieces with irregular shape properly and at the same time, it also avoid damage to the important surfaces. Stop pin is used to prevent bending of the workpiece by the application of clamping force. guide pins are used to secure alignment. When it is necessary to hold the workpiece firmly in all the direction.

Fig. 23 Vise Fixture[11]

Facing Fixture Milling machines are extensively used for facing seating and mating flat surfaces. Milling is often the first operation on the workpiece. The workpiece is positioned by three adjustable spherical ended pads 'A'. These pads are adjusted to suit the variation in the size of workpiece and lock in the position by check nuts. Two self adjusting supports 'A' are pushed upward by light spring. These springs are used to make sure that the support 'A' is positively in contact with the workpiece. Clamping screw is used to lock support 'B'. On tightening the edge clamp, the workpiece is pushed against the fixed jaw. This jaw is keyed in the fixture body to provide solid support to workpiece against the heavy thrust developed in the operation. The cutter should be fed to the workpiece in such a manner that the milling thrust should be directed towards the solid support of fixed jaws. The setting can be set in the path of cutter to set it before starting of facing operation. Four clamping slots are provided to take care of the heavy forces developed during the operation.

Boring Fixture According to the type of boring operation, boring fixture are used. Boring Fixture may have characteristics of a drill jig or a mill fixture. The workpiece always has an existing hole which is enlarged by the boring operation. It may be final or may be preliminary to grinding and other sizing operation.
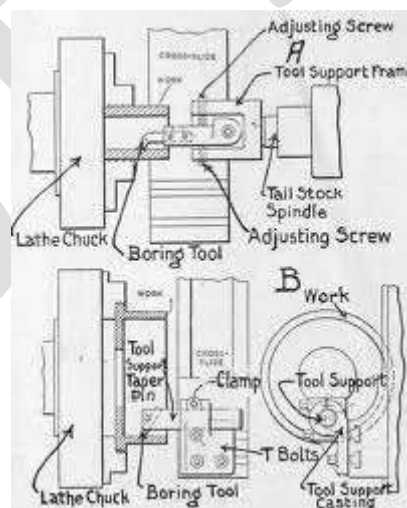

Fig. 24 Boring Fixture[11]

Face Plate Fixture It can be used conveniently for machining of simple and small components. Addition of locators and clamps on face plate help in quick location and clamping of workpiece. Face plate fixture is useful for facing

number of workpieces simultaneously on the lathe.

Turning Fixture These are generally special face plates. Their swing should be lesser than the swing of the machine. These are used for quick location and clamping. Typical turning fixture . The workpiece rests on angle plate and its boss is centralized with machine axis by sliding *v*-block which can be operated with knurled screw. The overhang of turning fixtures should be minimum bare necessary for the operation. Fixture should be balanced with workpiece in position.

Fig. 25 Turning Fixture[11]

The clamping arrangement should be capable of withstanding the various forces developed during operation.

a. Cutting force tangential to cutting circle.

b. Axial force and radial force due to feed of tool.

c. Bending forces due to pressure of tool on workpiece.

Back Plate for Turning Fixture It consists of workpiece locating and clamping elements. These fixtures are generally used for facing turning and boring operation. The workpiece should be located correctly with respect to rotating machine spindle for all these operations.

Grinding Fixture The standard magnetic tables are used to rest workpiece such that resting surface will be parallel to the surface to be ground. However, for light workpiece with lesser resting area, the resting area tends to tilt and fly off the magnetic table due to high speed of grinding wheel and due to high feed, also. Hence, it is necessary to provide additional support by nesting the workpiece. This can be done by placing the solid plates around the workpiece. The nest plates are held firmly by the magnetic force of table with more weight and more resting area. The nest plates surround the workpiece from outside and arrest its movement in the horizontal plane. Thus, this arrangement will help in preventing it from flying off and tilting due to high speed and feed in grinding operation.

Fig. 26 Grinding Fixture[11]

VI.HYDRAULIC CLAMPING

Hydraulic clamping is actuated by cylinders. Clamping fixtures mainly consist of clamping nut which is attached to cylinder ram. A Pressurized fluid pulls ram and clamps against workpiece. Unclamping, port connected to unpressurized discharge line. For clamping and unclamping we use three way direction control valve, lever and pedal.

MULTIPLE CLAMPING

Single direction control valve can actuate number of clamps through number of cylinders to pressure or discharge lines. Clamping pressure is varied by regulating pressure of fluid.

High pressure – heavy roughing cut

Low pressure – light finish cut.

A risk of sudden pressure drop in event of power failure can be countered by provision of non return valve in pressure supply line.

AIR ASSISTED HYDRAYLIC WORK HOLDING

It is divided into three groups of components. First group of component, the shop air system (6-12bar) provides power, in the form of pneumatic pressure. Shop air(pressurized air) system consists of air inlet, filter/regulator/lubricator device, the safety valve /release valve. The second group of component is hydraulic booster consists of booster, check valve, and manifold. The final group is clamping system- hold, position, and support work piece.
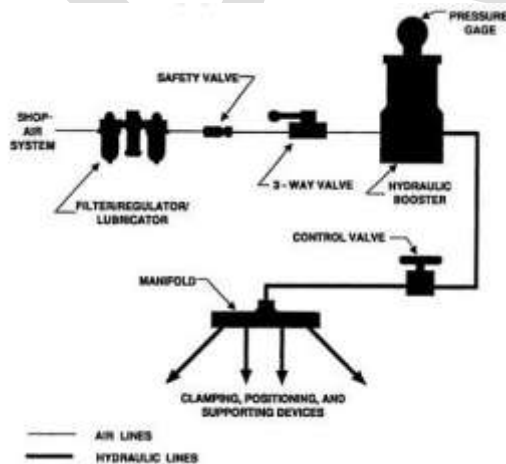
Fig. 23 Hydraulic workholding system.

Shop air is just used for boosting .In addition electric booster and hydraulic pump are used to air- operated booster system. Hydraulic pump is used for larger applications. Accumulator is installed between clamps and power source which maintain the necessary pressure when power is disconnected

VII. Conclusion

The efficiency and reliability of the fixture design has enhanced by the system and the result of the fixture design

has made more reasonable. To reduce cycle time required for loading and unloading of part, this approach is useful. If modern CAE, CAD are used in designing the systems then significant improvement can be assured. To fulfill the multi-functional and high performance fixturing requirements optimum design approach can be used to provide comprehensive analyses and determine an overall optimal design. Fixture layout and dynamic clamping forces optimization method based on optimal fixture layout could minimize the deformation and uniform the deformation most effectively .The proposed fixture will fulfilled researcher production target and enhanced the efficiency, Hydraulic fixture reduces operation time and increases productivity, high quality of operation, reduce accidents.

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Cloud Based Anti Vehicle Theft by Using Number Plate Recognition

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ABSTRACT –The growth of technology is increasing day by day to fulfill needs of the humans. The proposed system is implemented to make human work easier. Anti-Vehicle Theft Using Number Plate Recognition in Cloud is an image processing technology with cloud computing environment which uses number plate to identify the theft vehicle. The objective is to design an efficient automatic theft vehicle identification system by using the vehicle number plate. The system is implemented on the public places like check post, toll gate and police checking. The proposed algorithm consists of four major parts: Vehicle identification,Extraction of number plate region, Recognition of plate characters and compare with cloud database.Moving object detecting algorithm is used for vehicle identification. For extracting the number plate Smearing algorithm and segmentation are used. The characters and numbers are recognized by using OCR technique. The extraction result is then used to compare with the database so as to come up with the specific information like the Vehicle's owner name and address, place of registration, vehicle's number and RC book details. The developed project is going to be implemented and simulated in Mat lab, and its performance is testing on a real image.

Keywords - Vehicledetection,Extraction of plate region, Classification of a vehicle, Recognition of plate characters.

I.   Introduction

Anti-vehicle theft using number plate recognition in cloud plays an important role in numerous real-life applications. This system is implemented in tollgate, check post and police checking to identify the vehicle theft. The main motto of Anti-vehicle theft using number plate recognition in cloud is reducing the vehicle theft throughout the entire country. The main reason for implementing this system in cloud environment is the police department will easily identify the theft vehicle in other state also because cloud is a pooled resource i.e. Cloud computing provides a network, including data storage space, shared pool of resources, specialized corporate and user applications and computer processing power**.** All the vehicle details are stored in cloud database so it willmake easier to identify thestolen vehicle which was under consideration.

Automatic Number Plate Recognition or as frequently called 'number plate recognition' is a special form of optical character recognition (OCR). License plate recognition (LPR) is a type of technology, mainly software, which enables computer systems to read automatically the registration number (license number) of vehicles from digital pictures. Transformation of pixels of the digital image into the ASCII character is the automatic reading of the number plate. The license plate recognition has special type of OCR technology, today optical character recognition (OCR) technology is considered strictly a type of technology - mainly software - that scan the paper documents and convert them into editable files. Special camerais needed to avoid motion blur which can decrease the recognition accuracy dramatically to capture the fast moving vehicle. IR is the best illumination   retro-reflective plates, because it reflect this kind of light very well and it is not visible for the human eye. This will work well during day and night and provides constant good image quality. ANPR cameras are needed to meet these requirements, like AHRs ANPR cameras, which provide flexible shutter control with built-in IR flash and able to catch the vehicles up to 250km/h which is suitable for all kind of license plate reading applications.

II.   Proposed system

Anti-Vehicle Theft Using Number Plate Recognition in Cloud is to identify the theft vehicle in an efficient way. The theft of vehicle becomes major problem in this competitive world. Based on number plate recognition technique theft vehicle can be easily bounded. In this technique the details of each and every vehicle is predefined in the cloud server. Storing the data in cloud become easy and secure one, if RTO offices use cloud server for storing purpose at the time of vehicle registration. In this system new and secure number plate called High Security Registration Plate (HSRP) is used uniformly all over the country which was partially implemented.

A. HSRP

A High Security Registration Plate is a highly secure number plate aimed to bring about a uniform pattern of displaying registration marks across the country. It helps to easily identify the vehicle using camera in the public places and also helps to reduce the vehicle theft. HSRP plates are made of aluminum featuring unique details apart from the registration number. The number plate have a unique seven-digit laser code, a self-destructive sticker with the engine and chassis numbers of the vehicle, chromium-based chakra hologram to prevent counterfeiting, 'IND' inscribed in blue color, with India inscribed at a 45 degree angle in hot stamping foil across all letters and numbers on the plate and it has a non-removable and non-reusable snap lock.

B. Snap lock

The snap lock will attach the number plate in place on the vehicle. Any attempt to replace or remove the snap lock will cause the lock to break which makes it impossible to install any other number plate on the vehicle. The replacement of HSPR due to any damage can be provided only by the RTO.

C. Laser code

The unique seven-digit laser code is the biggest safety advantage. It is meant to be scanned by laser detector cameras to determine if the number plate details match the laser code and whether or not the registration plate belongs to the vehicle. So the laser detector camera will have to be installed on roads. Thesetype of cameras are not present in India so far and will have to be imported. The cameras are installed on fixed positions or used as hand-held devices. The cameras also do the recording details of speeding vehicles.

III. Working process

This system is implementing to identify the theft vehicle all over the country. The laser detection camera is used to identify the number plate. It captures the whole image of the vehicle and then locates the location of the number plate. The located number plate is now extracted and divides the number plate into number of segments. By using OCR concept the segmented character image is converted into ASCII value. After converting the image into character, the character value along with the laser code is sent to the cloud provider. For this purpose the system used to calculate the vehicle's number should configure with the cloud provider i.e. the API used to access the cloud provider is installed in the computer. In cloud server it compares the registration number and laser code with the database which is already stored and return the result to the respective system from which the request is sent. If the registration number is fake or registration number and the laser code is not matching then the alert message is sent to respective else the alert message is sent to the system as well as the mail is sent to the person who registered a complaint if complaint is in process.

IV. SYSTEM DESIGN

The process can be started by activating the camera. The camera used here is the laser code detection camera. It is useful to detect both the number from number plate and laser code in it. It will search for camera until the camera is active. Once the camera is activated then it searches for vehicle images. After the capturing of image the number plate recognition method is finding for the location of the number plate. After finding the location of the number plate the located region is extracted using extraction method. The extracted plate is in image format, and then the number from that image is extracted using optical character recognition method. At the end of this technique the number and the laser code from the number plate is in digital string format.

Now the character is sent to the cloud environment through internet. In cloud environment the database about each and every vehicle is stored and also the complaints registered about any vehicle are stored. First compare a number with the vehicle's owner detail database. Here it checks the registration plate is valid or not. If the registration plate is not valid then it sends the alert message to the computer where the validation process is requested. Otherwise it checks for any complaints under police station from all over India is registered. If any complaints under the respective vehicle are found then it sends the alert message to the system from which

the request is sent and also mail to the person who registered the complaint. Otherwise the message with vehicle details is sent to the respective system that the vehicle is genuine. The overall process and the transaction are done through the internet.
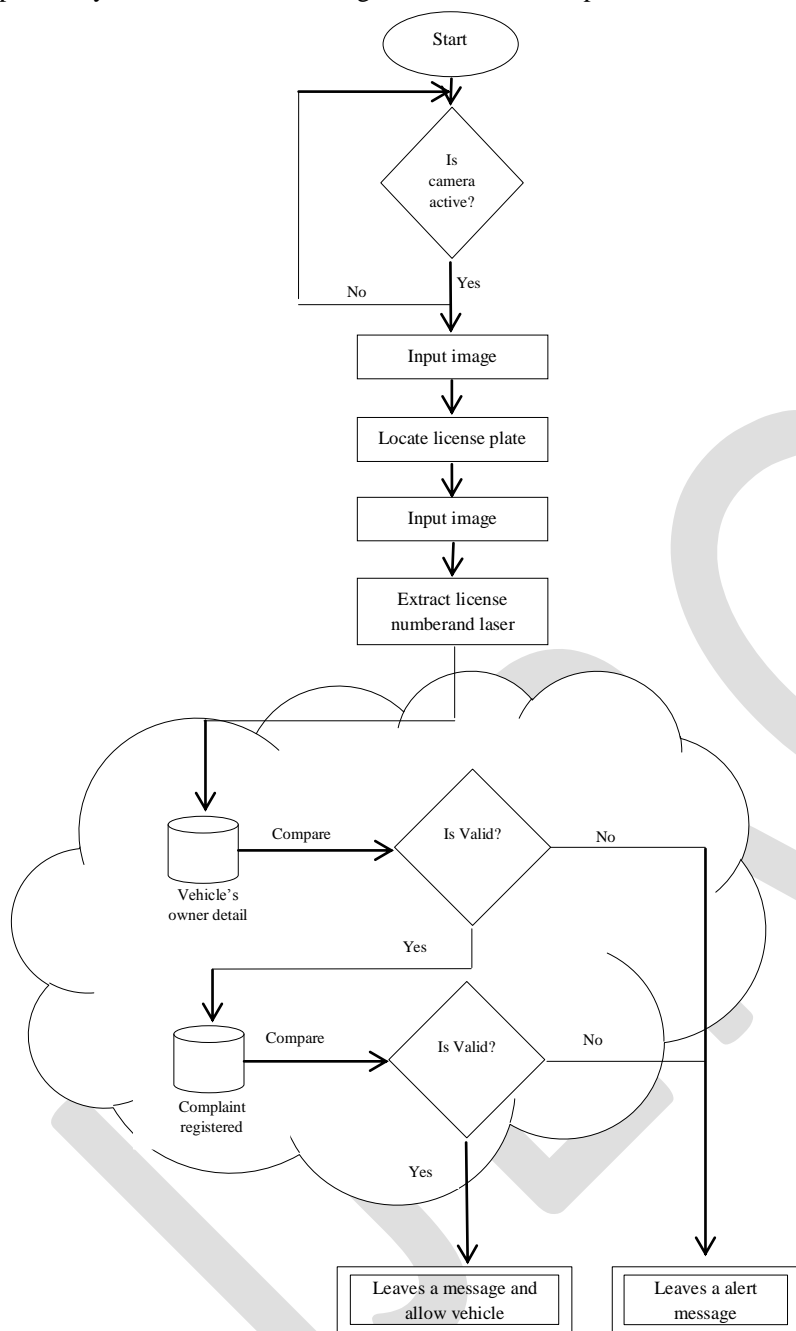

Fig 1.1 System Design For Anti Vehicle Theft Using Number Plate Recognition in Cloud

V. Implementation

A. Extraction of image

The captured number plates are cropped using edge detection algorithm.Filtration of the images improve the image resolution and the final image is segmented to extract each number. The standard format of each alpha numeric image is predefined in the database. The extracted image is matched with the database by comparing the matrix value. If the captured image is matched in the database then respected string value is returned.

B. Designing user interface page

In the designing of user interface page, the login details are provided to the authorized person but not to everyone. It is mainly focused to implement in a tollgate. After creating the login details, the authorized persons can check the updates and match the extracted string with the database to find the status of the vehicle. While matching the returned string value is sent to the cloud database. To find the theft vehicle it is mandatory that the owner should registered a complaint in the police station. If the number matches then the alert message is sent to the respective device from where the request is sent.

C. Testing the application in private cloud

The whole process is developed and tested in private cloud using Microsoft Windows Azure platform.

D. Implement the application in public cloud

After testing process is successfully finished in private cloud it can be move to public cloud for implementation.

VI. Conclusion

Anti-vehicle theft using number plate recognition in cloud is implemented in tollgate to identify the vehicle. Nowadays, vehicle license plate recognition system has become a key to lots of traffic related applications. Extracting the number from the number plate is one of the most important stages. Anti-vehicle theft using number plate recognition in cloud consists of two modules, one for extract number from number plates and one for verifying extracted number and user details in cloud database. In additions, it can be applied to all kind of license plate and it is not sensitive to complex background, non-uniform illumination condition and inclined license plate. Anti-vehicle theft using number plate recognition in cloud implements the system to find the stolen vehicle in an efficient way and to recovery the vehicle. The proposed system is implemented in tollgate to identify the vehicle. After the successive of this, it can be upgrade and implement in the public places like traffic signal, petrol bunk, and check post and so on. It is very useful to find the vehicle where it is. If the theft vehicle is caught by the camera then the current information about the vehicle is send to the database it can be seen by police department. By using this method will reduce the vehicle theft and also culprit will not escape. The proposed system will reduce the cost of infrastructure.

The number plate recognition technique is tested under MAT lab and the virtual environment is created under the private cloud for testing purpose in Windows Azure. After the completion of testing it can be tested on the public cloud. It is very useful to find the vehicle where it is. If the theft vehicle is caught by the camera then the current information about the vehicle is send to the database it can be seen by police department.

VII. Biography

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The Role of Retail Banking In Indian Economy

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ABSTRACT - Retail banking is when a bank executes transactions directly with consumers, rather than corporations or other banks. Services offered include savings and transactional accounts, mortgages, personal loans, debit cards, and cards. Today, retail banking is being considered as one of the most innovative financial services provided by the various commercial Public Sector Banks (PSBs), private sector and foreign banks. Retail banking has a huge potential considering the growing demand for its products namely, term deposits, consumer durable loans, auto loans, debit card, credit cards, ATM facilities, insurance, online banking, etc. The growing sector of retail lending has contributed significantly to the development of the economy. Like other developed countries, India too, has a developed retail banking sector which accounts for one-fifth of all banks credit. Retail lending across the globe has been a showcase of innovative services in the commercial banking sector. Countries, like China and India, have emerged as potential markets with changing investment opportunities. The higher growth of retail lending in emerging economies can be attributed to the rapid growth of personal wealth, favorable demographic profile, rapid development in information technology, the conducive macroeconomic environment, financial market reforms and small micro-level supply side factors. The retail banking strategies of banks are undergoing a major transformation, as banks are beginning to adopt a mix of strategies like organic growth acquisition and alliance formation. This has resulted in a paradigm shift in the marketing strategies of the banks. PSBs are adopting aggressive strategies, leveraging their branch network to garner a large share of the retail market. This article attempts to highlight the prospects and the future role of retail banking in India. Retail banking is widely recognized as an important factor for the economic development of a country. Retail banking helps the Indian banking industry by providing a wide range of innovative services. Retail loan is estimated to have accounted for nearly one-fifth of all bank credit. Over the past few years housing sector is experiencing a boom in its availability of credit. The retail loan market has decisively got transformed from a seller's market to a buyer's market. The days are gone when getting a retail loan was difficult. All the above statements bring out the speed of development that retail banking is experiencing in India. Retail banking is a very wide term that refers to the dealings of commercial banks with individual customers, both on liabilities and assets side. Mortgages, loans (e.g., personal/housing, auto and educational) on the asset side are the more important products offered by the banks. Related ancillary services include credit cards and depository services.

Keywords: Retail Banking, Information Technology, Financial Market Reforms, Public Sector Banks, Retail Banking Sectors, , Commercial Banks, Indian Banking Industry, Economic Development,

Introduction

Retail Banking in which banking institutions execute transactions directly with customers Typical products: savings and transaction accounts; mortgages; personal loans; debit and credit cards, etc Working principle: Law of Large Numbers; probabilistic modeling Critical success factors: Distribution – Branch, channels Branding Unit costs – cost per account, cost per transaction Pricing Risk management .The term is generally used to distinguish these banking services from investment banking, commercial banking or wholesale banking. It may also be used to refer to a division of a bank dealing with retail customers and also be termed as personal banking services According to the Report's Customer Experience Index, which surveyed over 18,000 bank customers across 35 markets, 10% of retail banking customers are likely to leave their banks in the next six months while an additional 41% say they are unsure if they will stay or go. To re-build the customer-bank relationship, the Report finds banks can become more customer-centric more personal interactions. Retail banking what's been good for Indian banks hasn't been good enough for the country scorching pace of growth since liberalization: CAGR of around 30% to touch a figure of INR 9700 Billion. Bankable households are growing at a CAGR of 28% (2007-11) what's powering this growth? Economic prosperity and growth rate Young population (70%<35 years) Technology channels: ATM, POS, Web, Mobile Retail loans constitute 7% of our economy versus 35% in other Asian countries Retail assets are at only 25% of total banking assets 41% of India's adult population is un-banked Number of loan accounts: 14% of adult population 73% of farm households have no access to institutional credit Share of money lenders in rural debt has moved from 17% in 1991 to 30% in 2002

Service wise division of retail banking transactions:

Serial NO	Services	Percentage
1	Credit card	29
2	Debit card	27
3	ECS dr	17
4	Neft/Eft	15
5	Necs/Ecs	12
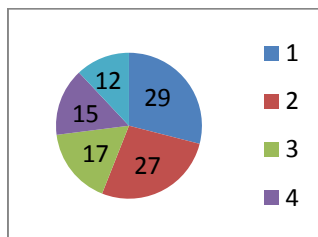
SOURCE: RBI Monthly Report

Retail Banking in the World

North America continues to lead the Customer Experience Index with Canada (81%), and the United States (80%) in the lead. Italy, Saudi Arabia and China reported the largest relative gains in share of customers with positive experience this year. Fees, Mobile Capabilities, Quality of Service or Knowledge of Customers? This is the single most important factor driving customers to switch banks. The World Retail Banking Report provides insights into customer attitudes towards retail banking using a comprehensive Voice of the Customer survey which polled over 18,000 retail banking customers in 35 countries. The survey analyzes customer experiences across 80 banking touch points that span the products banks offer, the importance of different channels for obtaining services and the transactions that occur over the lifecycle of a banking relationship some banks turned to consolidation as a way of cutting expenses in order to survive difficult economic conditions. Often consolidation works as intended, but it also has its limitations. Federal law prohibits any single bank in the United States from holding more than 10 percent of the U.S. customer market. When banks merge, they also make gains in their customer base. Several banks in the United States are approaching the 10-percent mark, so for those banks, further consolidation may not be a way to solve their problems. Global Retail Banking 2020 study, up to 50 percent of branches in today's U.S. bank networks may be declared obsolete -- although not necessarily defunct -- by 2020. Given that branches constitute 75 percent of a bank's total retail distribution costs, according to research from Capgemini, implementing smart, technologically savvy retail strategies will be critical to driving shareholder value.

Trends in Retail Banking

According to the Report's Customer Experience Index, which surveyed over 18,000 bank customers across 35 markets, 10% of retail banking customers is likely to leave their banks in the next six months while an additional 41% say they are unsure if they will stay or go. To re-build the customer-bank relationship, the Report finds banks can become more customer-centric more personal interactions

ATM machines and Internet Banking, many consumers still prefer the personal touch of their neighborhood branch bank. Technology has made it possible to deliver services throughout the branch bank network, providing instant updates to checking accounts and rapid movement of money for stock transfer

Retail banking now encompasses not just branches, but also anywhere that banking services can be conveniently provided to consumers. Whether it means a service kiosk in a train station, a mini-branch in a grocery store, a premium branch in a central business district, or a bank-on-wheels that visits corporate workplaces, proximity to targeted customers ultimately matters more than having a traditional bank façade. Flexibility and agility will provide a competitive advantage for bank

Technology is becoming the centerpiece of retail bank executives will expect their IT departments to identify and implement technology-based solutions to enhance the customer experience. Some banks, are even experimenting with quasi-Internet cafes,

offering high-tech lounge environments with relaxing furnishings and Wi-Fi access along with ATMs, self-service kiosks, areas for plug-in consumer devices, tutorials for mobile and Web banking and videoconferencing for service consultations delivered by call center staff. Furthermore, the move to a cash-light society will trigger still more changes in how branches are deployed.

As per the RBI statistical data for year ranging from 1998-2008 the mean personal loan is Rs.12, 463,240 Lakhs against a total bank credit of Rs. 66,899,292 Crores. This average personal loan amount is against a population of 1054 million on other hand housing loans amounts to housing loans Rs. 70, 22,354 Lakhs

The role of Retail Banking in Indian Economy

Retail banking in India is not a new phenomenon. It has always been prevalent in India in various forms. For the last few years it has become synonymous with mainstream banking for many banks. The typical products offered in the Indian retail banking segment are housing loans, consumption loans for purchase of durables, auto loans, credit cards and educational loans. The loans are marketed under attractive brand names to differentiate the products offered by different banks. As the Report on Trend and Progress of India, 2003-04 has shown that the loan values of these retail lending typically range between Rs.20, 000 to Rs.100 lack. The loans are generally for duration of five to seven years with housing loans granted for a longer duration of 15 years. Credit card is another rapidly growing sub-segment of this product group. In recent past retail lending has turned out to be a key profit driver for banks with retail portfolio constituting 21.5 per cent of total outstanding advances as on March 2004. The overall impairment of the retail loan portfolio worked out much less then the Gross NPA ratio for the entire loan portfolio. Within the retail segment, the housing loans had the least gross asset impairment. In fact, retailing make ample business sense in the banking sector. While new generation private sector banks have been able to create a niche in this regard, the public sector banks have not lagged behind. Leveraging their vast branch network and outreach, public sector banks have aggressively forayed to garner a larger slice of the retail pie. By international standards, however, there is still much scope for retail banking in India. After all, retail loans constitute less than seven per cent of GDP in India *vis-à-vis* about 35 per cent for other Asian economies — South Korea (55 per cent), Taiwan (52 per cent), Malaysia (33 per cent) and Thailand (18 per cent). As retail banking in India is still growing from modest base, there is a likelihood that the growth number

Seem to get somewhat exaggerated. One, thus, has to exercise caution is interpreting the growth of retail banking in India .The following away the retail Banking Contributing service to development of Indian Economy

Credit Cards: While usage of cards by customers of banks in India has been in vogue since the mid-1980s, it is only since the early 1990s that the market had witnessed a quantum jump. The total number of cards issued by 42 banks and outstanding, increased from 2.69 core as on end December 2003 to 4.33 core as on end December 2004. In view of this ever increasing role of credit cards a Working Group was set up for regulatory mechanism for cards. The terms of reference of the Working Group were fairly broad and the Group was to look into the type of regulatory measures that are to be introduced for plastic cards (credit, debit and smart cards) for encouraging their growth in a safe, secure and efficient manner, as also to take care of the best customer practices and grievances redressed mechanism for the card users. The Reserve Bank has been receiving a number of complaints regarding various undesirable practices by credit card issuing institutions and their agents. The RBI and a set of guidelines would be issued which are going to pave the path of a healthy growth in the development of plastic money in India. The RBI is also considering bringing credit card disputes within the ambit of the Banking Ombudsman scheme. While building a regulatory oversight in this regard we need to ensure that neither does it reduce the efficiency of the system nor does it hamper the credit card usage.

Housing Credit: Housing credit has increased substantially over last few years, but from a very low base. During the period 1993-2004, outstanding housing loans by scheduled commercial banks and housing finance companies grew at a trend rate of 23 per cent. The share of housing loans in total non-food credit of scheduled commercial banks has increased from about 3 per cent in 1992-93 to about 7 per cent in 2003-04. Recent data reveal that non-priority sector housing loans outstanding as on February 18, 2005 were around Rs. 74 thousand core, which is, however, only 8.0 per cent of the gross bank credit. As already pointed out, direct housing loans up to Rs. 15 lack irrespective of the location now qualify as priority sector lending; housing loans are understood to form a large component of such lending.

Support to Indian middle class People: The rise of the Indian middle class is an important contributory factor in this regard. The percentage of middle to high income Indian households is expected to continue rising. The younger population not only wields increasing purchasing power, but as far as acquiring personal debt is concerned, they are perhaps more comfortable than previous

generations. Improving consumer purchasing power, coupled with more liberal attitudes toward personal debt, is contributing to India's retail banking segment.

Economic superpower. Retail banking has played a role in a growing economy of India. As the growth story gets unfolded in India, retail banking is going to emerge a major driver. How does the world view us? I have already referred to the BRIC Report talking India as an economic superpower. A. T. Kearney, a global management consulting firm, recently identified India as the 'second most attractive retail destination' of 30 emergent markets.

Increasing purchasing power of middle class people: The rise of the Indian middle class is an important contributory factor in this regard. The percentage of middle to high income Indian households is expected to continue rising. The younger population not only wields increasing purchasing power, but as far as acquiring personal debt is concerned, they are perhaps more comfortable than previous generations. Improving consumer purchasing power, coupled with more liberal attitudes toward personal debt, is contributing to India's retail banking segment.

Financial market reforms: The subject matter of retail banking is of prime importance. In recent years, commercial banks have witnessed development in the form of retail lending, all over the world. The growth in the field of retail lending is primarily because of the speedy advancement in the IT sector, evolving macroeconomic environment, numerous micro level demand and supply side factors and financial market reform. This criterion is based on the market research report on retail banking

Engine of economic growth: Retail banks play a critical role in their home economies, and their activities have implications for the global economy as well. They offer critical credit functions, which largely fuel the engine of economic growth in their economies. When problems hit the retail banking sector the result is often dire economic circumstances for the economy as a whole. When retail banks are failing, little or no credit is available for credit seekers, and economic activity becomes depressed.

Mass-market banking: Retail banks offer a variety of important services to their customers. The retail banking sector is often described as a typical mass-market banking, offering services such as savings and checking accounts and all kinds of personal loans, including auto loans and student loans. Retail banks also offer mortgage services, debit and credit card services and ATM services--all of which have become essential to today's consumers.

Volume driven business. Retail Credit ensures that the business is widely dispersed among a large customer base unlike in the case of corporate lending, where the risk may be concentrated on a selected few plans. Ability of a bank to administer a large portfolio of retail credit products depends upon such factors like; strong credit assessment capability, sound documentation, strong possessing capability, regular constant follow- up, skilled human resource, technological support.

Automation of banking process: The growth in retail banking has been facilitated by growth in banking technology and automation of banking processes to enable extension of reach and rationalization of costs. ATMs have emerged as an alternative banking channels which facilitate low-cost transactions vis-à-vis traditional branches / method of lending. It also has the advantage of reducing the branch traffic and enables banks with small networks to offset the traditional disadvantages by increasing their reach and spread.

Easy and affordable access: Retail loans through a wide range of options / flexibility. Banks even finance cost of registration, stamp duty, society charges and other associated expenditures such as furniture and fixtures in case of housing loans and cost of registration and insurance, etc. in case of auto loans.

Financial Liquidity: Banks Making financing attractive by offering free / concessional / value added services like issue of credit card, insurance, etc.Continuous waiver of processing fees administration fees, prepayment charges, etc. by the Banks. As of now, the cost of retail lending is restricted to the interest costs.

Economic prosperity: The consequent increase in purchasing power has given a fillip to a consumer boom. Note that during the 10 years after 1992, India's economy grew at an average rate of 6.8 percent and continues to grow at the almost the same rate – not many countries in the world match this performance.

Changing consumer demographics: The Size of population indicate vast potential for growth in consumption both qualitatively and quantitatively. India is one of the countries having highest proportion (70%) of the population below 35 years of age (young population). The BRIC report of the Goldman-Sachs, which predicted a bright future for Brazil, Russia, India and China, mentioned Indian demographic advantage as an important positive factor for India.

Technological innovations: Technological factors played a major role. Convenience banking in the form of debit cards, internet and phone-banking, anywhere and anytime banking has attracted many new customers into the banking field. Technological innovations relating to increasing use of credit / debit cards, ATMs, direct debits and phone banking has contributed to the growth of retail banking in India.

Increase the Bank Liquid cash: Treasury income of the banks, which had strengthened the bottom lines of banks for the past few years, has been on the decline during the last two years. In such a scenario, retail business provides a good vehicle of profit maximization. Considering the fact that retail's share in impaired assets is far lower than the overall bank loans and advances, retail loans have put comparatively less provisioning burden on banks apart from diversifying their income streams.

Decline in interest rates: The interest rates were decreased in Indian money market have also contributed to the growth of retail credit by generating the demand for such credit. The interest rates on retail loans have declined from a high of 16-18% in 1995-96 to presently in the band of 7.5-9%. Ample liquidity in the banking system and falling global interest rates have also compelled the domestic banks to reduce it

Declining cost of incremental deposits: Banks could afford to quote lower rate of interest, even below PLR as low cost [saving bank] and no cost [current account] deposits contribute more than 1/3rd of their funds [deposits].The declining cost of incremental deposits has enabled the Banks to reduce their interest rates on housing loans as well as other retail segments loans.

Change of Terms of Loans: Offering retail loans for short term, 3 years and long term ranging term ranging from 15/20 years as compared to their earlier 5-7 years only

Challenges of Retail Banking in India

Retention of customers: According to a research by Reichheld and Sasser in the Harvard Business Review, 5 per cent increase in customer retention can increase profitability by 35 per cent in banking business, 50 per cent in insurance and brokerage, and 125 per cent in the consumer credit card market. Thus, banks need to emphasize retaining customers and increasing market share.

Rising indebtedness: India's position, of course, is not comparable to that of the developed world where household debt as a proportion of disposable income is much higher. Such a scenario creates high uncertainty. Expressing concerns about the high growth witnessed in the consumer credit segments the Reserve Bank has, as a temporary measure, put in place risk containment measures and increased the risk weight from 100 per cent to 125 per cent in the case of consumer credit including personal loans and credit cards (Mid-term Review of Annual Policy, 2004-05).

Network management challenges: Difficulty in maintaining and optimizing the performance of retail banking networks. Illustratively, ensuring that all bank products and services are available, at all times, and across the entire organization is essential for today's retails banks to generate revenues and remain competitive. Besides, there are network management challenges, whereby keeping these complex, distributed networks and applications operating properly in support of business objectives becomes essential. Specific challenges include ensuring that account transaction applications run efficiently between the branch offices and data centers.

Money laundering: KYC Issues and money laundering risks in retail banking is yet another important issue. Retail lending is often regarded as a low risk area for money laundering because of the perception of the sums involved. However, competition for clients may also lead to KYC procedures being waived in the bid for new business. Banks must also consider seriously the type of identification documents they will accept and other processes to be completed. The Reserve Bank has issued details guidelines on application of KYC norms in November 2004.

Sub-prime crisis**: A major challenge to retail banking surfaced in late 2008. Retail banks as well as commercial banks had provided sub-prime mortgages to consumers who were not qualified for the size of the loans they received. Although this**

process generated much of the housing boom of the early 21st century, eventually the loans became too cumbersome for borrowers to pay back. This problem led to loan defaults across the United States and led to many bank failures, not only in the United States but around the world. It produced serious deterioration in the global economy and led to the economic and financial crisis that dominated the political landscape in early 2009.

Massive infusion of capital: While retail banks have their share of problems, it is anticipated that with the massive infusion of capital into the banking and financial services sector by the federal government's economic stimulus program, most retail banks will survive, and the smaller retail banks may seek to merge with other banks

Strategy Knowing Your Customer: service should be at the end all in retail banking. Someone has rightly said, "It takes months to find a good customer but only seconds to lose one." Thus, strategy of Knowing Your Customer (KYC) is important. So the banks are required to adopt innovative strategies to meet customer's needs and requirements in terms of services/products etc.

Outsourcing activities: The issue of outsourcing has become very important in recent past because various core activities such as hardware and software maintenance, entire ATM set up and operation (including cash, refilling) etc., are being outsourced by Indian banks.

Conclusion

There is a need of constant innovation in retail banking. In bracing for tomorrow, a paradigm shift in bank financing through innovative products and mechanisms involving constant up gradation and revalidation of the banks' internal systems and processes is called for. Banks now need to use retail as a growth trigger. This requires product development and differentiation, innovation and business process reengineering, micro-planning, marketing, prudent pricing, customization, technological up gradation, home / electronic / mobile banking, cost reduction and cross-selling. While retail banking offers phenomenal opportunities for growth, the challenges are equally daunting. How far the retail banking is able to lead growth of the banking industry in future would depend upon the capacity building of the banks to meet the challenges and make use of the opportunities profitably. However, the kind of technology used and the efficiency of operations would provide the much needed competitive edge for success in retail banking business. Furthermore, in all these customers' interest is of paramount importance. So, it is vital for banks to improve their customer services and cut off predatory lending strategies, particularly in the area of interest on credit cards. Finally we say that retail banking is one of the most tremendous areas now days to be looked after by the banking industry as it contributes 7% to our GDP and 14% to employment.

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A Review of Various Techniques Used for Shaft Failure Analysis

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ABSTRACT - The various methodology used for failure analysis of the shaft used in different application by various authors are reviewed in this paper. This paper presents the comparison of the different   methodology used, their application and limitation by various authors. The objective of present work is to study the various methodologies used for the shaft failure analysis and to choose best methodology suitable for the failure analysis of shaft used in gear box which is mounted on the overhead crane to prevent repetitive failure.

Shaft failure leads to heavy loss due to stoppage and repairing cost associate with the breakdown.

Keywords: Shaft failure, Methodology, Overhead crane, Failure Analysis, Stresses.

I.   INTRODUCTION

A shaft [1] is a rotating member usually of circular cross-section (solid or hollow), which is used to transmit power and rotational motion in machinery and mechanical equipment in various applications. Most shafts are subjected to fluctuating loads of combined bending and torsion with various degrees of stress concentration. For such shafts the problem is fundamentally fatigue loading. Failures of such components and structures have engaged scientists and engineers extensively in an attempt to find their main causes and thereby offer methods to prevent such failures.

A crane is mechanical equipment for lifting and lowering a load and moving it horizontally with the hoisting mechanism an integral part of the machine. A crane with a single or multiple girder movable bridge, carrying a movable trolley or fixed hoisting mechanism and travelling on an overhead fixed runway structure is known as overhead crane. Material handling is a vital component of any manufacturing and distribution system and the material handling industry is consequently active, dynamic and competitive. Overhead crane is used for material handling purpose and hence it is very useful for any industry.

II . BACKGROUND OF FAILURE ANALYSIS

Failure analysis is [2] the process of collecting and analyzing data to determine the cause of a failure and how to prevent it from recurring. It is an important discipline in many branches of manufacturing industry. Such as the electronics industry where it is a vital tool used in the development of new products and for the improvement of existing products. However, it also applied to other fields such as business management and military strategy. Failure analysis and prevention are important functions to all of the engineering disciplines. The materials engineer often plays a lead role in the analysis of failures, whether a component or product fails in service or if failure occurs in manufacturing or during production processing. In any case, one must determine the cause of failure to prevent future occurrence or to improve the performance of the device, component or structure.

Failure analysis can have three broad objectives.

1. Determining modes

2. Failure Cause

3. Root causes.

Failure mode can be determined on-site or in the laboratory, using methods such as fractography, metallographic and mechanical testing. Failure cause is determined from laboratory studies and knowledge of the component and its loading and its environment. Comparative sampling or duplication of the failure mode in the laboratory may be necessary to determine the cause. Root failure cause is determined using knowledge of the mode, the cause and the particular process or system. Determining the root failure cause require complete information about the equipment's design, operation, maintenance, history and environment. A typical failure analysis might include fractography, metallographic and chemical analysis. Failure analysis of a rear axle of an automobile was discussed in [7].

The failed component is examined and its condition documented. If appropriate, scale or deposits are collected and any fracture surface features are documented. A scanning electron microscope (SEM) is often used to evaluate fracture surfaces for material defects, determine fracture modes and measure fracture features and particles precisely. Metallographic is particularly powerful when combined with typical non-destructive examination (NDE) methods such as ultrasonic testing, eddy current, magnetic particle testing or liquid penetrate testing. Failure of a component indicates it has become completely or partially unusable or has deteriorated to the point that it is undependable or unsafe for normal sustained service. There are some of typical root cause failure mechanisms such as fatigue failures that cause by repeating cycle, corrosion failures, stress corrosion cracking, ductile and brittle fractures, hydrogen embrittlement, liquid metal embrittlement, creep and stress rupture. It is possible for fracture to be a result of multiple failure mechanisms or root causes. A failure analysis can provide the information to identify the appropriate root cause of the failure. The common causes of failure are like misuse or abuse, assembly errors by manufacturer, improper maintenance, design errors, improper material and heat treatment process for the material and manufacturing defect like unforeseen operating condition and inadequate environmental protection or control [10].

Fig.1 .failure of shaft

III. Causes and Analysis of Shaft failure

1. Causes of failure

Austin H. Bonnett, [3] discuss the causes of shaft failures. This paper focus on failures associated with fatigue.

Table No.1 Causes of shaft failure

CAUSE OF SHAFT FAILURES	PERCENT
Corrosion	29%
Fatigue	25%
Brittle Fracture	16%
Overload	11%
High-Temperature Corrosion	7%
Stress Corrosion Fatigue/Hydrogen Embrittlement	6%
Creep	3%
Wear, Abrasion, and Erosion	3%

XU Yanhui[4] says that shaft damaged can be induced by sub synchronous resonance(SSR).
J.feller[5]fatigue loading on wind turbine drive trains due to the fluctuating nature of wind is major cause of premature failure of gearboxes. The shaft fail due to fatigue, which arises due to following reasons [4]

a. Presence of cyclic over-loads
b. Stress concentration. They may be due to production or operation causes e.g. under cuts, machining, traces, knotches etc.
c. Wrong adjustment of bearing, insufficient clearances.

In corrosion failures, the stress is the environment and there action it has on the shaft material. At the core of this problem is an electrochemical reaction that weakens the shaft.

Eccentric Shaft is widely appreciated for its features like corrosion resistant, long service, effective performance and reliability[5].

Corrosion is a process that occurs when oxygen, water, acids and salts mix together. The temperature must be above 0˚C, when the relative humidity is below 40% almost no corrosion from 40-60% (relative humidity) significant corrosion is to be expected [27].

The redox (reduction-oxidation-reaction) is a chemical reaction. Thus happens when one electron is transferred to the other. In such an electron transfer reaction the electron cuts (oxidation) through a material on an electron uptake (reduction).

Many structural alloys corrode merely from exposure to moisture in air [3] but the process can be strongly affected by exposure to certain substances. Corrosion can be concentrated locally to form a pit or crack or it can extend across a wide area more or less uniformly corroding the surface. Because corrosion is a diffusion-controlled process it occurs on exposed surfaces. As a result,

methods to reduce the activity of the exposed surface such as passivation and chromate conversion can increase a material's corrosion resistance. However, some corrosion mechanisms are less visible and less predictable. Many times corrosion will act in conjunction with fatigue loading to cause a shaft failure [11].

According to Osgood all machine and structural designs have problems in fatigue [8]. Failure of an elevator shaft due torsion-bending fatigue was given in [9]. Overload failures are caused by forces that exceed the yield strength or the tensile strength of a material. The appearance of an overload failure depends on whether the shaft material is brittle or ductile [11].

1. Miscellaneous non fracture-type shaft failure

There is a broad category of shaft failures or motor failures that does not result in the shaft breaking. The following is a list of the more common causes (it is acknowledged that fatigue failures that are caught in the early stages would also fit in the non fracture category)[3].

• Bending or deflection causing interference with stationary parts
• Incorrect shaft size causing interference, run out or incorrect fit
• Residual stress causing a change in shaft geometry
• Material problems
• Excessive corrosion and wear.

2. The tools of shaft failure analysis

The ability to properly characterize the microstructure and the surface topology of a failed shaft are critical steps in analyzing failures[3].

1) Visual inspection
2) Optical microscope
3) Scanning Electron Microscope
4) Transmission electron microscope
5) Metallurgical analysis

Fig.2. Failure caused by rotational bending [3]

Fig.3. Shaft fatigue [3]

Fig. 4. Failure due to reverse torsional loading [3]

IV. Fatigue failure

One of the more common causes of shaft failure is due to fatigue. Metal fatigue is caused by repeated cycling of the load [7]. It is a progressive localized damage due to fluctuating stresses and strains on the material. Metal fatigue cracks initiate and propagate in regions where the strain is most sever. The concept of fatigue is very simple when a motion is repeated the object that is doing the work becomes weak. Fatigue occurs when a material is subject to alternating stresses, over a long period of time. Examples of where Fatigue may occur are: springs, turbine blades, airplane wings, bridges and bones.

There are 3 steps that maybe view a failure of a material due to fatigue on a microscopic level:

1. Crack Initiation: The initial crack occurs in this stage. The crack may be caused by surface scratches caused by handling or tooling of the material, threads (as in a screw or bolt), slip bands or dislocations intersecting the surface as a result of previous cyclic loading or work hardening.

2. Crack Propagation: The crack continues to grow during this stage as a result of continuously applied stresses.

3. Failure: Failure occurs when the material that has not been affected by the crack cannot withstand the applied stress. This stage happens very quickly.

Location of the 3 steps in a fatigue fracture under axial stress.

One can determine that a material failed by fatigue by examining the fracture sight. A fatigue fracture will have two distinct regions; One being smooth or burnished as a result of the rubbing of the bottom and top of the crack (steps 1 & 2). The second is granular, due to the rapid failure of the material.

The most effective method of improving fatigue performance is improvements in design [3].

a. Eliminate or reduce stress raisers by stream lining the part
b. Avoid sharp surface tears resulting from punching, stamping, shearing or other processes
c. Prevent the development of surface discontinuities during processing. Reduce or eliminate tensile residual stresses caused by manufacturing.
d. Improve the details of fabrication and fastening procedures

Metal fatigue is a significant problem because it can occur due to repeated loads below the static yield strength. This can result in an unexpected and catastrophic failure in use because most engineering materials contain discontinuities. Most metal fatigue cracks initiate from discontinuities in highly stressed regions of the component. The failure may be due the discontinuity, design, improper maintenance or other causes. A failure analysis can determine the cause of the failure.

Understanding fatigue [3] strength and endurance limits is important because most shaft failures are related to fatigue associated with cyclic loading. These limits are expressed by an S–N diagram, as shown in Fig. 5.

For steel, these plots become horizontal after a certain number of cycles. In this case, a failure will not occur as long as the stress is below 27 klbf/in. No matter how many cycles are applied. However, at 10 cycles, the shaft will fail if the load is increased to 40 bf/in. The horizontal line in Fig. 8 is known as the fatigue or endurance limit. For the types of steels commonly used for motors, good design practice dictates staying well below the limit. Problems arise when the applied load exceeds its limits or there is damage to the shaft that causes a stress raiser.
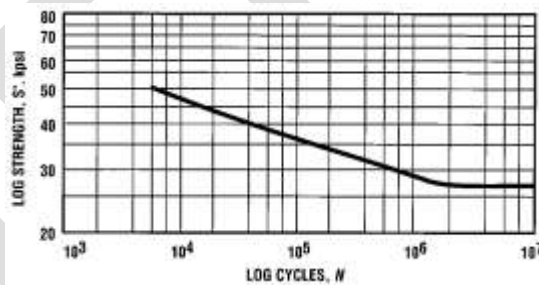

Fig. 5 S-N curve [3]

V. Modes of fracture

1. Monotonic Overload

i. Brittle: Brittle fracture may occur at stresses for below the yield strength. In case of materials subjected to impact and shock loads and usually occur without warning. Brittle fractures are most likely to occur on large-sized components or structures as a result of shock loading.

ii. Ductile: If a material is subjected to load above the yield point and the process of deformation continues, fracture eventually occur. Ductile fractures require a considerable amount of energy to plastically deform the material in necking region. Ductile fractures are very important in metal working operations, such as deep drawing, forging etc.

2. Subcritical Crack Growth

A. Failure under static load Parts under static loading may fail due to:

i. Ductile behaviour: Failure is due to bulk yielding causing permanent deformations that are objectionable. These failures may cause noise, loss of accuracy, excessive vibrations and eventual fracture. In machinery bulk yielding is the criteria for failure. Tiny areas of yielding are in ductile behaviour in static loading.

ii. Brittle behaviour: Failure is due to fracture. This occurs when the materials (or conditions) do not allow much yielding such as ceramics, grey cast iron, or heavily cold-worked parts.

B. Dynamic loading:

Under dynamic loading, materials fail by fatigue. Fatigue failure is a familiar phenomenon fatigue life is measured by subjecting the material to cyclic loading. The loading is usually uniaxial tension, but other cycles such as torsion or bending can be used as well.

Fatigue failures are caused by slow crack growth through the material. The failure process involves four stages
1. Crack initiation
2. Micro-crack growth (with crack length less than the materials grain size) (Stage I)
3. Macro crack growth (crack length between 0.1mm and 10mm) (Stage II)
4. Failure by fast fracture.

Cracks initially propagate along the slip bands at around 45 degrees to the principal stress direction this is known as Stage I fatigue crack growth. When the cracks reach a length comparable to the materials grain size, they change direction and propagate perpendicular to the principal stress. This is known as Stage II fatigue crack growth.

VI. Theories of failure

1. Maximum principal stress theory - Good for brittle materials

According to this theory when maximum principal stress induced in a material under complex load condition exceeds maximum normal strength in a simple tension test the material fails. So the failure condition can be expressed as

$$\sigma_1 \geq \sigma_{ult}$$

2. Maximum shear stress theory - Good for ductile materials

According to this theory when maximum shear strength in actual case exceeds maximum allowable shear stress in simple tension test the material case. Maximum shear stress in actual case in represented as

$$\tau_{max,act} = \frac{\sigma_1 - \sigma_3}{2}$$

Maximum shear stress in simple tension case occurs at angle 45 with load, so maximum shear strength in a simple tension case can be represented as

$$\tau_{45} = \tau_{max,act} = \frac{\sigma_y}{2}$$

Comparing these 2 quantities one can write the failure condition as

$$\frac{1}{2}(\sigma_1 - \sigma_3) \geq \frac{1}{2}\sigma_y$$

3. Maximum normal strain theory - Not recommended

This theory states that when maximum normal strain in actual case is more than maximum normal strain occurred in simple tension test case the material fails. Maximum normal strain in actual case is given by

$$\text{strain}_{max,act} = \frac{\sigma_1}{E} - v\frac{\sigma_2}{E} - v\frac{\sigma_3}{E}$$

Maximum strain in simple tension test case is given by

$$strain_{max} = \frac{\sigma_y}{E}$$

So condition of failure according to this theory is

$$\frac{\sigma_1}{E} - v\frac{\sigma_2}{E} - v\frac{\sigma_3}{E} \geq \frac{\sigma_y}{E}$$

Where E is Youngs modulus of the material

4. Total strain energy theory - Good for ductile material

According to this theory when total strain energy in actual case exceeds total strain energy in simple tension test at the time of failure the material fails. Total strain energy in actual case is given by

$$T.S.E_{act} = \frac{1}{2E}[\sigma_1^2 + \sigma_2^2 + \sigma_3^2 - 2v(\sigma_1\sigma_2 + \sigma_2\sigma_3 + \sigma_3\sigma_1)]$$

Total strain energy in simple tension test at time of failure is given by

$$T.S.E_{simp} = \frac{\sigma_y^2}{2E}$$

So failure condition can be simplified as

$$\frac{1}{2E}[\sigma_1^2 + \sigma_2^2 + \sigma_3^2 - 2v(\sigma_1\sigma_2 + \sigma_2\sigma_3 + \sigma_3\sigma_1)]$$

5. Shear strain energy theory - Highly recommended

According to this theory when shear strain energy in actual case exceeds shear strain energy in simple tension test at the time of failure the material fails. Shear strain energy in actual case is given by

$$S.S.E_{act} = \frac{1}{12G}[(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2]$$

Shear strain energy in simple tension test at the time of failure is given by

$$S.S.E_{simp} = \frac{\sigma_y^2}{6G}$$

So the failure condition can be deduced as

$$\frac{1}{12G}[(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2] \geq \frac{\sigma_y^2}{6G}$$

Where G is shear modulus of the material

V**II. Tools used for shaft failure analysis**

Non destructive testing (NDT) is a wide group of analysis techniques used in science and industry to evaluate the properties of a material, component or system without causing damage. The terms Non destructive examination (NDE), Non destructive inspection (NDI) and Non destructive evaluation (NDE) are also commonly used to describe this technology.

a. Magnetic Particle inspection

Magnetic Particle Inspection (MPI)[13] is a non-destructive testing (NDT) process for detecting surface and slightly subsurface discontinuities in ferromagnetic materials such as iron, nickel, cobalt, and some of their alloys and must be performed to worldwide standards such as EN473 and ISO9712 by qualified personnel. The process puts a magnetic field into the part. The piece can be magnetized by direct or indirect magnetization. Direct magnetization occurs when the electric current is passed through the test object and a magnetic field is formed in the material. Indirect magnetization occurs when no electric current is passed through the test object, but a magnetic field is applied from an outside source. The magnetic lines of force are perpendicular to the direction of the electric current which may be either alternating current (AC) or some form of direct current (DC) (rectified AC).

A close-up of the surface of a (different) pipeline showing indications of stress corrosion cracking (two clusters of small black lines) revealed by magnetic particle inspection. Cracks which would normally have been invisible are detectable due to the magnetic particles clustering at the crack openings. The scale at the bottom is numbered in centimetres [13].
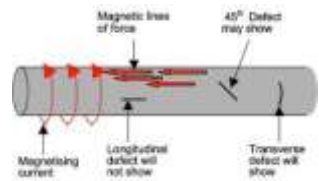
Fig.6 Magnetic Particle Inspection

The presence of a surface or subsurface discontinuity in the material allows the magnetic flux to leak, since air cannot support as much magnetic field per unit volume as metals [14]. Ferrous iron particles are then applied to the part. The particles may be dry or in a wet suspension. If an area of flux leakage is present, the particles will be attracted to this area. The particles will build up at the area of leakage and form what is known as an indication.

b. Residual Stress Failures

These stresses are independent of external loading on the shaft. Many manufacturing or repair operations can affect the amount of residual stress, including [3].
• drawing
• bending
• straightening
• machining
• grinding
• surface rolling
• shot blasting or peening
• polishing.

All of these operations can produce residual stresses by plastic deformation. In addition to the above mechanical processes, thermal processes that introduce residual stress include:
• hot rolling
• welding
• torch cutting
• heat treating

All residual stress may not be detrimental, if the stress is parallel to the load stress and in an opposite direction, it may be beneficial. Proper heat treatment can reduce these stresses if they are of excessive levels.

a. Radiography

Radiography is [13] a non-destructive testing method which utilizes radiation to penetrate the material under test. The radiation sources have extremely short wavelengths, of about $1/10000^{th}$ that of visible light. Two types of radiation source are commonly used for industrial radiography, x-rays and gamma rays from radioactive isotopes.

Fig.7 Radiography testing machine

Image capture [14] is another important aspect of radiography. The most common method in use is to capture images on film. Radiography is carried out based on the geometrical shape of the material and the information required. The configuration of the sample with respect to the placement of the film radiation source has considerable influence on the information that can be obtained.

Radiographers use a Radiographic Image Quality Indicator (IQI) or penetrameter as a quality assurance tool.

b. Liquid Penetrant Testing

Liquid Penetrant Testing (PT) is based on capillary action and is a very effective test method that exposes surface-opening discontinuities for visual inspection. Either fluorescent or visible dyes are used.

Fig.8 Liquid Penetrant Testing

The surface is first prepared to remove anything that could obscure surface openings or otherwise interfere with the examination and then it is dried. The penetrant is applied by a suitable means and after the specified penetration time has elapsed any remaining penetrant on the material surface is removed. The developer is applied immediately. Final interpretation needs to be made within 7 to 60min after the dwell time of developer.

c. Electromagnetic Inspection

Electromagnetic Testing (ET), [13]as a form of non-destructive testing is the process of inducing electric currents or magnetic fields or both inside a test object and observing the electromagnetic response. If the test is set up properly a defect inside the test object creates a measurable response.

Fig.9 Electromagnetic Inspection Testing

The term "Electromagnetic Testing" is often intended to mean simply Eddy-Current Testing (ECT). However with an expanding number of electromagnetic and magnetic test methods, "Electromagnetic Testing" is more often used to mean the whole class of electromagnetic test methods, of which Eddy-Current Testing is just one [14].

Ultrasonic InspectionIn ultrasonic testing (UT) [13] very short ultrasonic pulse-waves with centre frequencies ranging from 0.1-15 MHz and occasionally up to 50 MHz are transmitted into materials to detect internal flaws or to characterize materials. A common example is ultrasonic thickness measurement which tests the thickness of the test object for example to monitor pipe work corrosion.

Fig.10 Ultrasonic Inspection

Ultrasonic testing [14] is often performed on steel and other metals and alloys, though it can also be used on concrete, wood and composites albeit with less resolution. It is a form of non-destructive testing used in many industries including aerospace, automotive and other transportation sect.

B. ROLE OF METALLOGRAPHIC EXAMINATION

1. THE OPTICAL MICROSCOPE

THE OPTICAL MICROSCOPE USE FOR PHASE IDENTIFICATION. THE OPTICAL MICROSCOPE, OFTEN REFERRED TO AS THE "LIGHT MICROSCOPE", IS A TYPE OF MICROSCOPE WHICH USES VISIBLE LIGHT AND A SYSTEM OF LENSES TO MAGNIFY IMAGES OF SMALL SAMPLES (10X, 40X. . . 2000X) MAGNIFIES THE BEAM.

FIG.11 OPTICAL MICROSCOPE

THE OPTICAL MICROSCOPE IS MOST COMMONLY USED FOR THE ANALYSIS SPECIMEN TO BE OBSERVED, THE SAMPLE IS TO GROUND FIRST BY USING DIFFERENT GRAIN SIZES SAND PAPER. THEN POLISHED LIKE MIRROR IMAGE AND THEN ETCHED WITH A SOLUTION FOR A CERTAIN LENGTH. CAREFUL TECHNIQUE IS CRITICAL IN SAMPLE PREPARATION IS REQUIRED, OTHERWISE OPTICAL MICROSCOPE IS USELESS. OPTICAL MICROSCOPY HAS SEVERAL TRANS-ILLUMINATING TECHNIQUE OF OPERATION:

1. Bright field illumination, sample contrast comes from absorbance of light in the sample.

2. Transmission mode is commonly used for transparent specimens mounted on glass slides. This mode is commonly used for biological specimens.

3. Dark field illumination, sample contrast comes from light scattered by the sample. This method is used for surface contaminant identification.

4. Cross-polarized light illumination, sample contrast

Cross-polarized light illumination, sample contrast comes from rotation of polarized light through the sample

2) Scanning Electron Microscopy (SEM)

The SEM has important role in failure analysis in all the laboratories. The SEM is used for image as well as probe. It uses the high energy electron focused beam to generate signal at solid surface.

SEM equipped with Electron Source (Gun), Electron Lenses, Sample Stage, display unit, Detector. SEM Detectors allow information to be gathered from conductor potential to elemental analysis of materials.

Fig.12 Scanning Electron Microscopy

Various probe methods have evolved associated with the SEM. The SEM is routinely used to generate high-resolution images of objects shapes (SEI) and to show chemical compositions variations. The SEM is a surface imaging tool and cannot image effectively through oxides compared to an optical microscope. SEM is a non destructive as it does not result in loss of sample & can be performed repeatedly.

Osman asi [7] SEM examination revealed some inclusion in the surface close to the crack initiation

3) Heat-affected zone (HAZ)

The portion of a metal work-piece that has been so altered by heat is termed the ―heat-affected zone or HAZ. All thermal cutting & welding processes create an HAZ in the metal. The changes induced by heat can include:

1. Altering the microstructure of particular steels, leading to an increase in the hardness of the cut edge relative to the un-cut metal.

2. Altering the microstructure of particular steels, leading to a decrease in the strength.

3. The formation of nitrides on the cut edge, which can affect the weld ability of the cut face.

4. Darkening or discoloration of the surface of the metal next to the cut face ('heat-tint').

Osman asi [7] discussed typical micro-fracture appearance fracture surface of the failed axle shaft exhibits heat-affected region (HAZ)leads to crack initiation

Chen lie[22] discuss Laser cladding is especially fit for repairing the wearing high-accuracy components due to the potty heat affected zone.

4) Energy Dispersive X-Ray Spectroscopy (EDX)

Energy Dispersive X-ray analysis (EDX) is also referred as EDS or EDX analysis. EDX is an analytical technique used for the elemental analysis or chemical characterization of a specimen. The EDX system works as an integrated feature of the SEM and cannot operate on its own. During EDX Analysis, the object is bombarded by electron beam inside the SEM. Those electrons collide with the specimen's own electrons, knocking some of them off in the process. When the electron is displaced, it gives up some of its energy by emitting an X-ray. Every element releases X-rays with unique amounts of energy during the transfer process. Thus, by measuring the amounts of energy present in the X-rays being released by a specimen during electron beam bombardment, the atom identity can be known. A detector used to convert X-ray energy into voltage signals; this signal is sent to a pulse processor, which measures the signals and passes them onto an analyzer for data display and analysis. The detector used is Si(Li) detector. Also new system equipped with silicon drift detectors (SDD) with Peltier cooling systems are gaining more popularity.
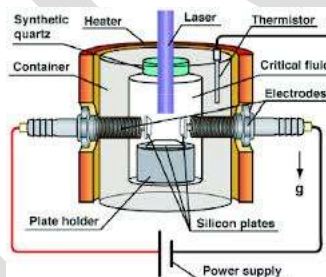
Fig.13 Energy Dispersive X-Ray Spectroscopy

Osman Asi [7] carried out EDX analysis indicated the main elements of these inclusions are O, Ca, Si, Al and Mg which are not contained in the original material (except Si). Such components are often seen in improper welded location of steels. These also act as crack initiation

C. MECHANICAL TESTING

a. Hardness testing

Different Methods of Hardness Testing: There are four typical methods for testing the hardness of metals. These are the sclerometer method introduced by Turner in 1896, the scleroscope method recently invented by Shore, the indentation test adopted by Brinell about 1900 and the drill test introduced by Keep a few years earlier. The principles underlying each of the four methods are briefly described in the following [15] [19].

Fig.14 Hardness Testing Machine

1. Turner's Sclerometer: In this form of test a weighted diamond point is drawn, once forward and once backward, over the smooth surface of the material to be tested. The hardness number is the weight in grams required to produce a standard scratch. The scratch selected is one which is just visible to the naked eye as a dark line on a bright reflecting surface. It is also the scratch which can just be felt with the edge of a quill when the latter is drawn over the smooth surface at right angles to a series of such scratches produced by regularly increasing weights.

2. Shore's Scleroscope: In this instrument, a small cylinder of steel, with a hardened point, is allowed to fall upon the smooth surface of the metal to be tested and the height of the rebound of the hammer is taken as the measure of hardness. The hammer weighs about 40 grains, the height of the rebound of hardened steel is in the neighbourhood of 100 on the scale, or about 6-1/4 inches, while the total fall is about 10 inches or 254 millimetres.

3. Brinell's Test: In this method, a hardened steel ball is pressed into the smooth surface of the metal so as to make an indentation of a size such as can be conveniently measured under the microscope. The spherical area of the indentation being calculated and the pressure being known, the stress per unit of area when the ball comes to rest is calculated and the hardness number obtained. Within certain limits, the value obtained is independent of the size of the ball and of the amount of pressure.

Fig.15 brinell's test

4. Keep's Test: In this form of apparatus a standard steel drill is caused to make a definite number of revolutions while it is pressed with standard force against the specimen to be tested. The hardness is automatically recorded on a diagram on which a dead soft material gives a horizontal line, while a material as hard as the drill itself gives a vertical line, intermediate hardness being represented by the corresponding angle between 0 and 90 degrees.

   Hardness is a measure of how resistant solid matter is to various kinds of permanent shape change when a force is applied. Macroscopic hardness is generally characterized by strong intermolecular bonds, but the behaviour of solid materials under force is complex. Therefore, there are different measurements of hardness: scratch hardness, indentation hardness, and rebound hardness.[26]

b. Fatigue test

   A method for determining the behaviour of materials [18] under fluctuating loads. A specified mean load (which may be zero) and an alternating load are applied to a specimen and the number of cycles required to produce failure (fatigue life) is recorded. Generally, the test is repeated with identical specimens and various fluctuating loads. Loads may be applied axially, in torsion or in flexure. Depending on amplitude of the mean and cyclic load, net stress in the specimen may be in one direction through the loading cycle or may reverse direction. Data from fatigue testing often are presented in an S-N diagram which is a plot of the number of cycles required to cause failure in a specimen against the amplitude of the cyclical stress developed. The cyclical stress represented may be stress amplitude, maximum stress or minimum stress. Each curve in the diagram represents a constant mean stress. Most fatigue tests are conducted in flexure, rotating beam, or vibratory type machines. Fatigue testing is generally discussed in [18]"Manual on Fatigue Testing," ASTM STP 91A

Fig.16 Fatigue Testing

c. Tensile Testing

Tensile testing [16]-[17] also known as tension testing, is fundamental materials science test in which a sample is subjected to a controlled tension until failure. The results from the test are commonly used to select a material for an application, for quality control and to predict how a material will react under other types of forces. Properties that are directly measured via a tensile test are ultimate tensile strength, maximum elongation and reduction in area. From these measurements the following properties can also be determined.

Young's modulus, Poisson's ratio, yield strength, and strain-hardening characteristics. Uniaxial tensile testing is the most commonly used for obtaining the mechanical characteristics of isotropic materials. For anisotropic materials, such as composite materials and textiles, biaxial tensile testing is required. The most common testing machine used in tensile testing is the universal testing machine. This type of machine has two crossheads; one is adjusted for the length of the specimen and the other is driven to apply tension to the test specimen. There are two types: hydraulic powered and electromagnetically powered machines. The machine must have the proper capabilities for the test specimen being tested. There are three main parameters: force capacity, speed and precision and accuracy. Force capacity refers to the fact that the machine must be able to generate enough force to fracture the specimen. The machine must be able to apply the force quickly or slowly enough to properly mimic the actual application. Finally, the machine must be able to accurately and precisely measure the gauge length and forces applied for instance, a large machine that is designed to measure long elongations may not work with a brittle material that experiences short elongations prior to fracturing.

d. Impact Testing

Two standard tests, the Charpy and Izod, measure the impact energy (the energy required to fracture a test piece under an impact load) also called the notch toughness.

The Charpy test is the test to determine the resistance of a material against shocks.

The test temperature is very important because the resistance does decrease with decreasing temperature. Impact testing fits into two main categories: (a) low velocity impact, and (b) high velocity impact [20]. These two main categories lead to three main types of impact testing. Charpy impact testing and drop weight impact testing fall into the category of low velocity impact testing (here it should be noted that an impact test machine can be used for high velocity impact also[21]. Ballistics impact testing falls into the category of high velocity impact testing. Technology has increased to the point that there are now sophisticated measuring devices for instrumented impact testing.

Fig.17. Impact testing[3]

VIII. Conclusion

The various failure of shaft is discussed in this paper. Some of the failure of shaft is basically due to negligence in repairing and maintenance, special care is to be taken for stress relieving in welding repairing works. So in order to overcome this problem, failure analysis of shaft in gear box for overhead crane is to be done by following steps.

1. Modeling of shaft with the existing dimension.
2. Finding out the various load and stresses on the shaft.
3. Failure analysis of Existing shaft to find out reasons of failure.
4. Based on analysis composition of the shaft can be change.
5. Redesign of the shaft.

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Harmonics Elimination PWM (HEPWM)

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ABSTRACT —-This paper proposes PWM Multi Level inverter to take advantage of the cascaded H-bridges inverter by utilizing all of the levels in the inverter even at low modulation indices. In order to deal with harmonic elimination, a sine wave is compared with carrier triangular wave is presented. This approach requires a modified carrier waveform that can be calculated based on short functions requiring only depth of modulation. The results show the viability of obtaining practically sinusoidal output waveforms, which are highly desirable in most inverter applications. The improvements in harmonic spectrum are pointed out, which prove the validity of the multilevel modulation.

Key Word –PWM inverter, Multi level inverter, harmonics elimination, sinusoidal pulse width modulation, THD, motor drives, and active power filters.

INTRODUCTION

Pulse width modulation is a method that is widely used now as a switching pulse to turn on and off the thyristors to give alternating current waveform at the output of an inverter circuit. The output waveform of an inverter will be a square-wave and contains harmonics from the 3rd harmonics, and as the 3rd harmonic located very close to the fundamental frequency and very difficult to filter it as we need to design very high order filter, therefore nowadays we prefer to use PWM method to reduce the total distortion because of the harmonics or simply called THD. To generate the PWM signal, we need two signals and compare both, a modulating sine-wave signal with let say 50Hz frequency and the carrier triangular-wave signal with frequency higher than the modulating signal frequency. With PWM method, the 3rd harmonic will appear not at the 3 times frequency of the fundamental but actually at the frequency of the carrier signal, therefore in designing the PWM, we need to use higher frequency for the carrier signal but lower frequency for the modulating signal.

Multilevel inverters have been proposed for such uses as static var compensation, motor drives, and active power filters. For many of these applications, multilevel inverters will operate in the low amplitude modulation index region, and some levels of the inverter will go unused most of the time if conventional multilevel carrier-based PWM techniques are used [1].

There are three topologies of multilevel inverters-cascaded, flying capacitor and diode clamped, each having its own advantages in various applications. Cascaded H-Bridge multilevel inverter is one of the popular converter topologies used in high-power-medium-voltage (MV) drives. The cascaded inverter type dynamic voltage restorer with neural control strategy is proposed [2]. The H Bridge cells are normally connected in cascade on their ac side to achieve medium-voltage operation and low harmonics distortion

The industry requires power equipment increasingly high, in the megawatt range. The rapid evolution of semiconductor devices manufacturing technologies and the designer's orientation has enabled the development of new structures of converters (inverters) with a great performance compared to conventional structures. So, these new technologies of semiconductor are more suited to high power applications and they enable the design of multilevel inverters. a multilevel converter not only achieves as high power ratings. But also enables the use of renewable energy sources [3]. Recent advances in power electronics have made the multilevel concept practical [4]. In fact, the concept is so advantageous that several major drives manufacturers have obtained recent patents on multilevel power converters and associated switching techniques. Furthermore, several IEEE conferences now hold entire sessions on multilevel power conversion. It is evident that the multilevel concept will be a prominent choice for power electronic

systems in future years, especially for medium-voltage operation. Finally, the simulation of a multilevel PWM single phase inverter is designed and harmonics elimination analysis is achieved.

MULTI LEVEL INVERTER STRUCTURES

As previously mentioned, three different major multilevel converter structures have been applied in industrial applications: cascaded H-bridges converter with separate dc sources, diode clamped, and flying capacitors. it should be noted that the term multilevel converter is utilized to refer to a power electronic circuit that could operate in an inverter or rectifier mode. The multilevel inverter structures are the focus of in this paper. A seven level single phase cascaded inverter consists of three full bridges connected in series on the AC side. Each bridge can create three different voltage levels. Due to switch combination redundancies, there are certain degrees of freedom of how to generate the multilevel AC output voltage. The AC outputs of each of the different full-bridge inverter levels are connected in series such that the synthesized voltage waveform is the sum of the inverter outputs. The number of output phase voltage levels L in a cascade inverter is defined by **L= 2s+1**, where **s** is the number of separate DC sources.

Each H-bridge is fed with the same value of DC voltage hence it can be called as symmetrical cascaded multilevel inverter. Each full bridge inverter can generate three different voltage outputs: +Vdc, 0, and –Vdc. The phase output voltage is synthesized by sum of three inverter outputs, van= va1+ va2+ va3. (1)

The seven-level output waveform is obtained by different switching combinations. For a stepped waveform such as the one depicted in **Figure (1b)** with s steps, the Fourier Transform for this waveform follows [5, 6]:

$$V(wt) = \frac{4Vdc}{\pi} + \sum_{n=1,3,5...} (\cos(n\theta1) + \cos(n\theta2) + \cos(n\theta3)+..+ \cos(n\theta s))\frac{\sin(nwt)}{n} \quad , n=1, 3,5,7,9 ... \quad (2)$$
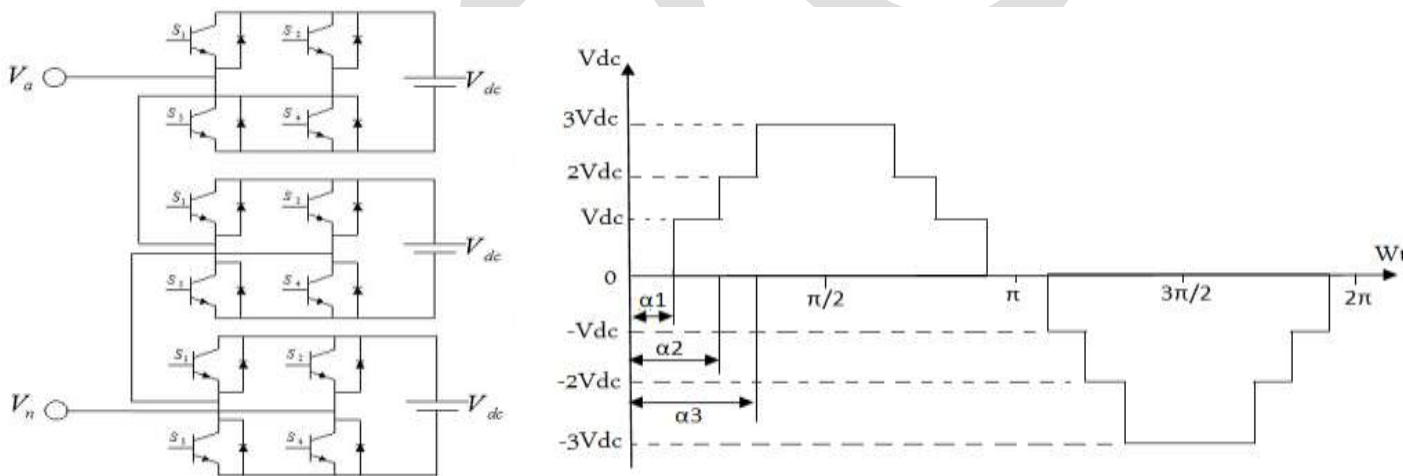
FIGURE 1.a) SINGLE-PHASE STRUCTURE OF A SEVEN CASCADED H-BRIDGES INVERTER, b) OUTPUT PHASE VOLTAGE WAVEFORM OF 7-LEVEL CASCADE INVERTER WITH 3 SEPARATE DC SOURCES

From eq. (2), the magnitudes of the Fourier coefficients when normalized with respect to Vdc are as follows:

$$H(n) = \frac{4c}{n\pi} + [\cos(n\theta1) + \cos(n\theta2) + \cdots + \cos(n\theta s)], \qquad , n=1,3,5,7,9,... \qquad (3)$$

The conducting angles, θ1, θ2,..., θs, can be chosen such that the voltage total harmonic distortions a minimum. Generally, these angles are chosen so that predominant lower frequency harmonics, 5th, 7th, 11th, and 13th, harmonics are eliminated [7].

The main advantages and disadvantages of multilevel cascaded H-bridge converters are as follows [8, 9].

Advantages:

- The number of possible output voltage levels is more than twice the number of dc sources (L= 2s+ 1).

- The series of H-bridges makes for modularized layout and packaging. This will enable the manufacturing process to be done more quickly and cheaply.

Disadvantages:

- Separate dc sources are required for each of the H-bridges. This will limit its application to products that already have multiple DCSs readily available.

The cascaded inverter as shown in Figure (1a) has 12 inverter states which allow bi-directional current flow and a fixed inverter output voltage. They are listed in Table (1).

SWITCHING STATE	VOLTAGE Van						
	+V	+2V	+3V	0	-V	-2V	-3V
S1	1	1	1	0	0	0	0
S2	1	1	1	1	0	0	0
S3	0	0	0	0	1	1	1
S4	0	0	0	1	1	1	1
S5	0	1	1	0	0	0	0
S6	1	1	1	1	1	0	0
S7	0	0	0	0	0	1	1
S8	1	0	0	1	1	1	1
S9	0	0	1	0	0	0	0
S10	1	1	1	1	1	1	0
S11	0	0	0	0	0	0	1
S12	1	1	0	1	1	1	1

TABLE 1 INVERTER STATE OF CASCADED SEVEN LEVEL INVERTER

PULSE-WIDTH MODULATION PWM AND SIGNAL DEFINITIONS

The Pulse-width Modulated (PWM) inverter is the most favoured one for industrial applications. The control schemes of PWM inverters are broadly classified as programmed PWM inverters and sinusoidal PWM inverters. The sinusoidal PWM method is very popular in many applications. Linear algebraic equations are solved to obtain the switching angles resulting in eliminating the unwanted harmonics.

Pulse-width modulation can take different forms. The pulse frequency is one of the most important parameters when defining a PWM method and can be either constant or variable. A constant-frequency (CF) PWM signal can be produced simply by comparing a reference signal, r (t), with a carrier signal, c (t), as depicted in Figure(2).

Three types of carrier signals are commonly used in constant-frequency PWM:

1. Sawtooth Carrier, reported in Figure(2.a): The leading (rising) edge of PWM output occurs at fixed instants in time while the position of the trailing (falling) edge is modulated as the reference signal level varies. Hence the method is also called constant-frequency trailing-edge modulation.

2. Inverted Sawtooth Carrier, reported in Figure(2.b): The trailing (falling) edge of PWM output occurs at fixed instants in time while the position of the leading (rising) edge is modulated as the reference signal level varies. The method is usually referred to as constant-frequency leading-edge modulation.

3. Triangle Carrier, reported in Figure (2.c): Both the leading edge and the trailing edge of the PWM output is modulated. The rising and falling edge of the triangle are usually symmetric so that the pulse is centred within a carrier cycle when the reference is a constant. The method is called constant-frequency double-edge modulation.
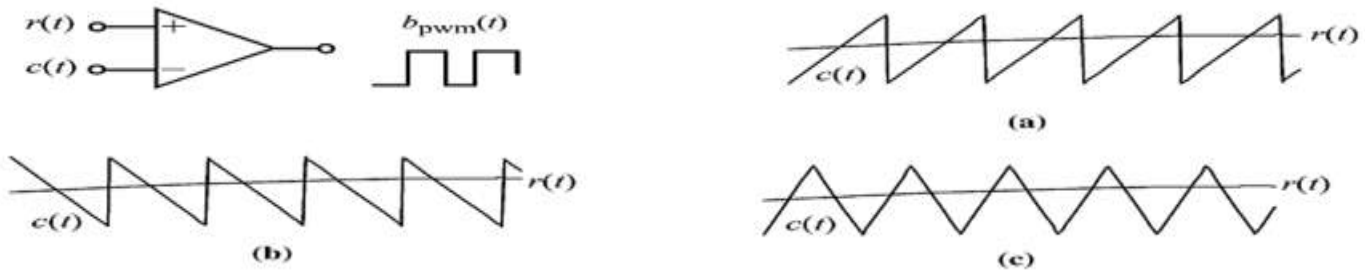
Figure (2) PULSE-WIDTH MODULATION, a) SAWTOOTH CARRIER   ,b) INVERTED SAWTOOTH CARRIER,   c) TRIANGLE CARRIER.

For AC–DC and DC–AC converters, the reference signal typically contains at least one sinusoidal component at the fundamental frequency of the AC input or output of the converter. For poly-phase converters, each phase will have a separate reference and their sinusoidal components are shifted from each other by the same phase angle that separates the input or output phase voltages. Often, the PWM references also contain harmonics of the fundamental component.

DESIGN CALCULATIONS AND CONSIDERATIONS

In order to eliminate 7 non-zero harmonics, we will need to obtain the angles from the earlier equation. And using the equations, we have 7 non-linear equations with 7 variables; now we need to use **eq. (1)** to calculate the angles using Newton- Raphson method of iteration. And finally we obtain the angles.

In general Fourier series is given by,

$$V(wt) = ao + \sum_{n=1}^{\infty}(an \cos nwt + bn \sin nwt) \quad (4)$$

In this case Fourier series expansion of output voltage waveform is given by

$$V(wt) = \sum_{n=1}^{\infty}(bn \sin nwt) \quad (5)$$

Where $a_o = a_n = 0$ (due to quarter wave symmetry)

$$bn = \frac{1}{\pi}\sum_{0}^{2\pi} Vdc \sin nwt \, dwt \quad (6)$$

$$bn = \frac{4Vdc}{n\pi}\cos n\,\alpha \quad (7)$$

$$bn = \frac{4Vd}{n\pi}\sum_{i=0}^{s} \cos n\alpha i \quad (8)$$

Where the modulation index **M** is defined as

$$M = \frac{\wedge V1}{4Vdc} \quad (9)$$

For a 7-level inverter, the equations should be solved, and the switching angles must be less than $\pi/2$.

The Pspice schematic diagram of 7level inverter and comparator circuits is shown in Fig. (3) and Fig. (4), respectively.
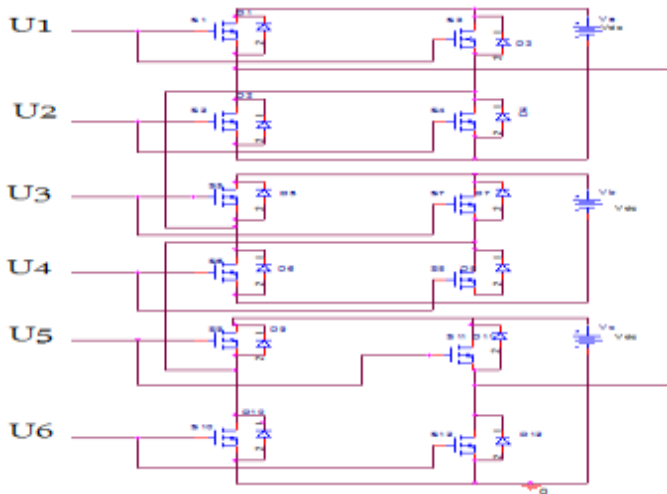
Figure (3) SINGLE PHASE SEVEN-LEVEL CASCADED MULTILEVEL INVERTER
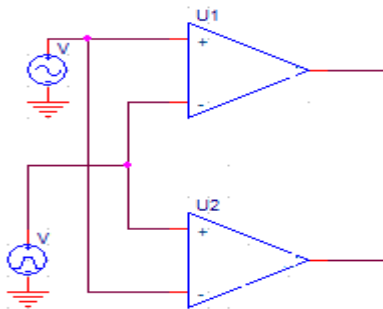
 FIGURE (4) COMPARATOR

Figure (5) shows the input carrier and references waveforms and output comparator U1 and U2 waveforms.
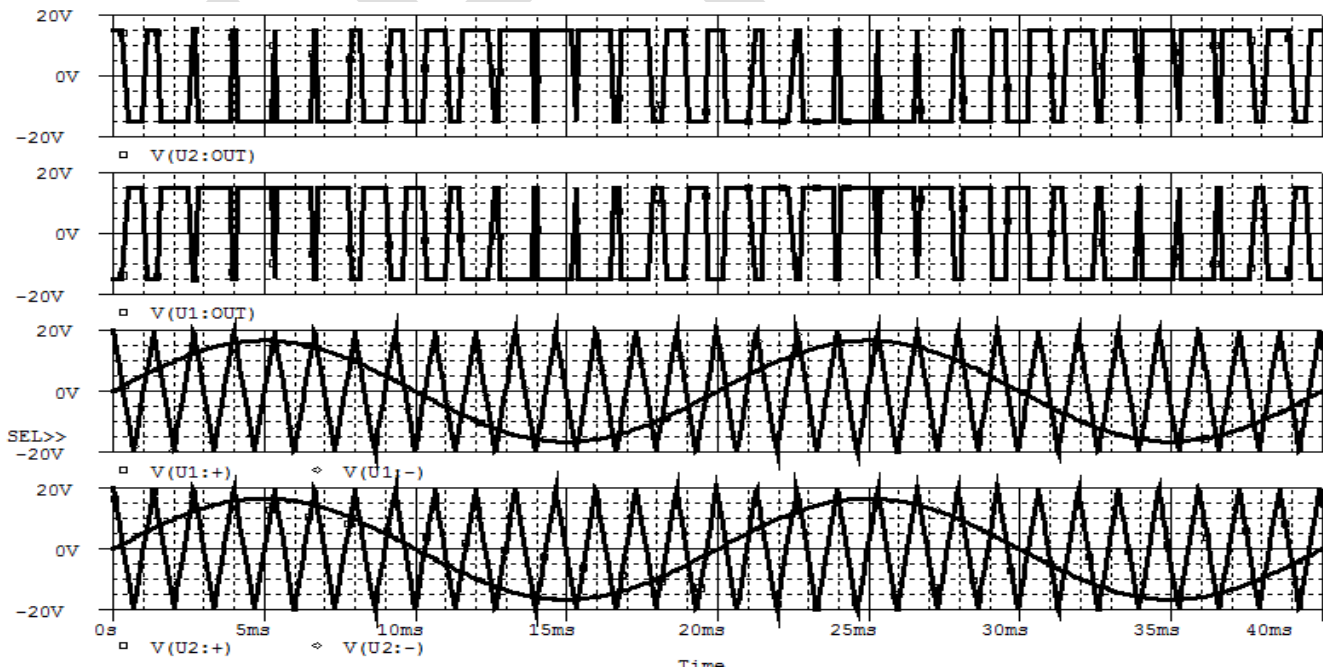
FIGURE (5) CARRIER AND REFERENCES WAVEFORMS AND OUTPUT COMPARATOR 1 AND 2 WAVEFORMS
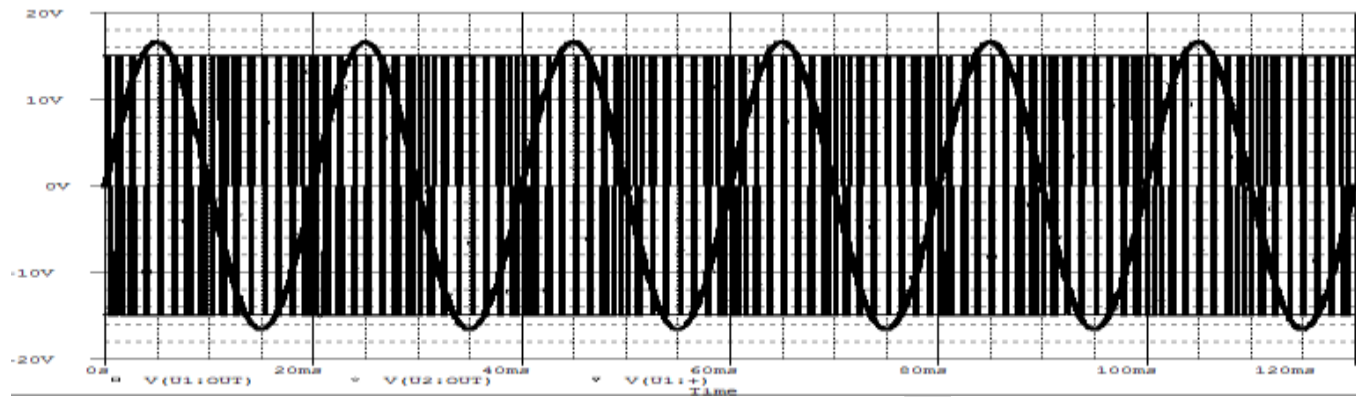
FIGURE (6) REFERENCES WAVEFORMS AND OUTPUT COMPARATOR U1 AND U2 WAVEFORMS.

SIMULATION RESULTS AND DISCUSSION

The simulation model of single phase seven level inverter is shown in Fig. (3). It consists of three full bridge inverters connected in series. The switching pulses are given from the switching circuit to the switches. The single phase AC output is given to the load. The input voltages for all the three full bridge inverters are same.

The THD values for different values of modulation index are shown in the Fig.7. From the Figure, it can be inferred that when modulation index is higher, the THD value is lower. Hence the simulation results are shown for M=0.8.
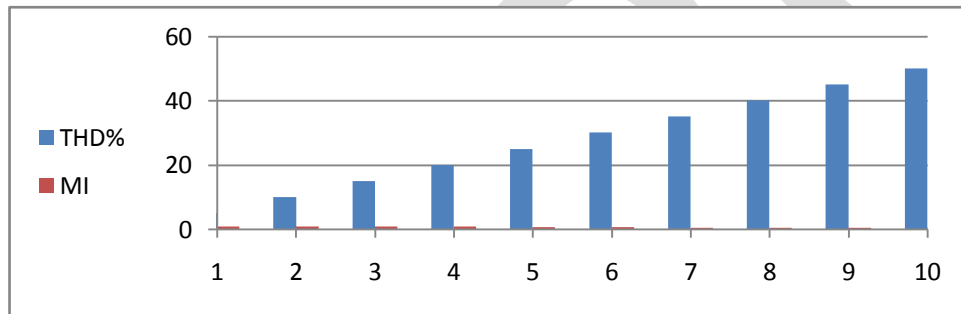
FIGURE.(7). THD FOR VARIOUS VALUES OF MODULATION INDEX

FIGURE (8) shows the Switching Pulses for Seven-Level Cascaded Multilevel Inverter Simulation with MI=0.83. and the input voltage was 100V for each bridge of multilevel inverter . The switching angles obtained using eq. (8), and given to the switching circuit whose output is given to switches of cascaded multilevel inverter.
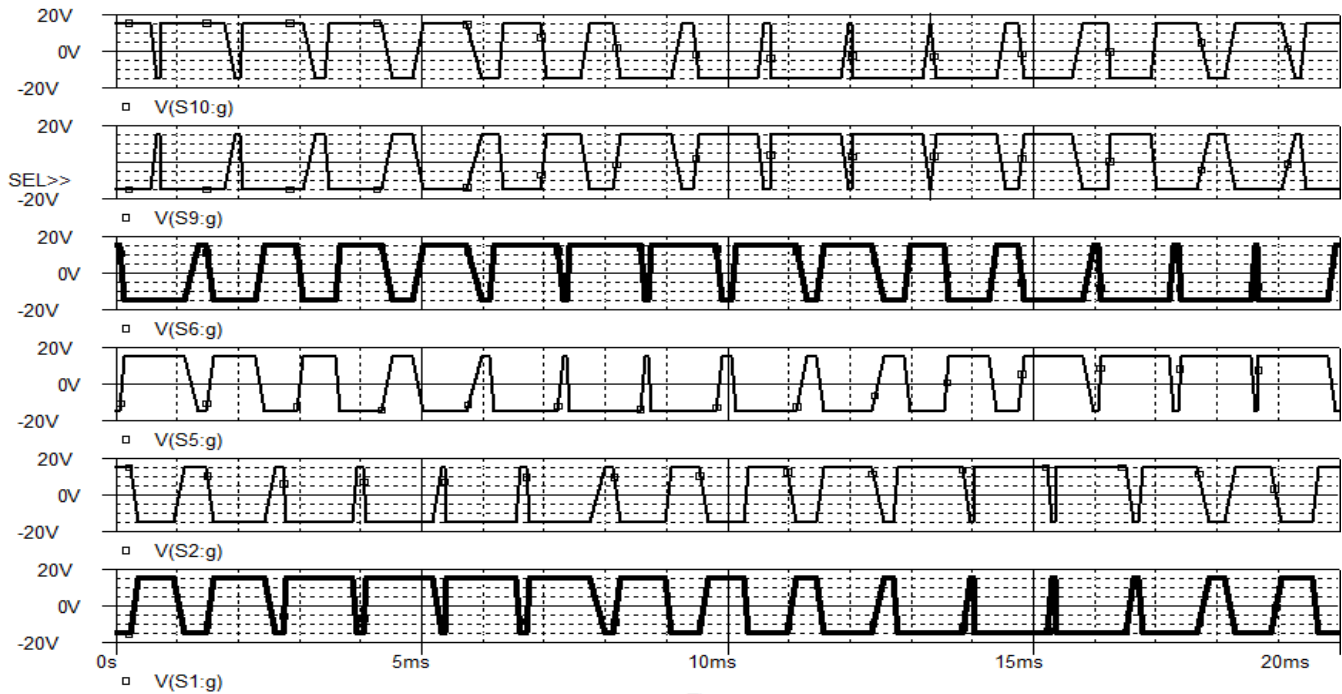
Figure (8): SWITCHING PULSES FOR SEVEN-LEVEL CASCADED MULTILEVEL INVERTER

The output voltage of the seven-level cascaded multilevel inverter is shown in Figure.(9).and Figure.(10).
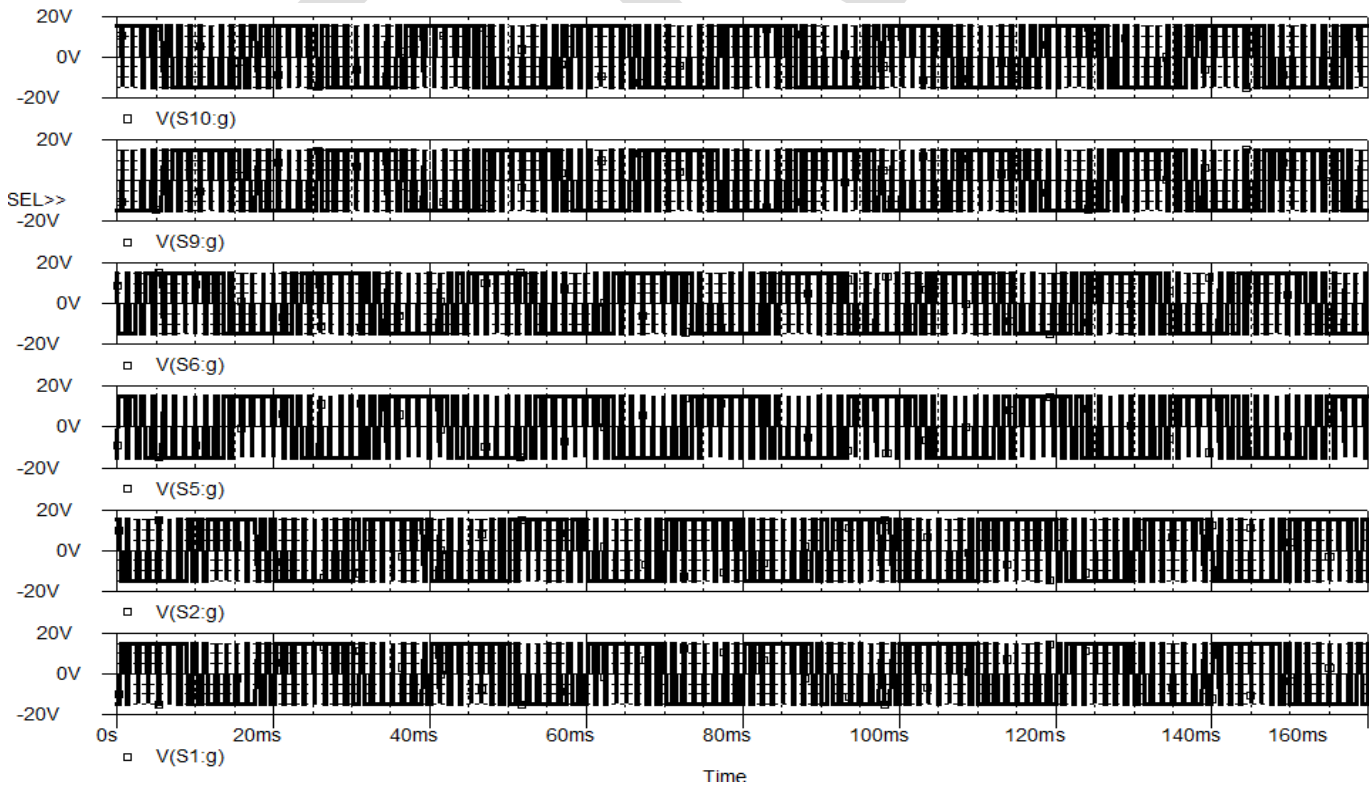
FIGURE (9) THE OUTPUT FOR EACH SWITCH
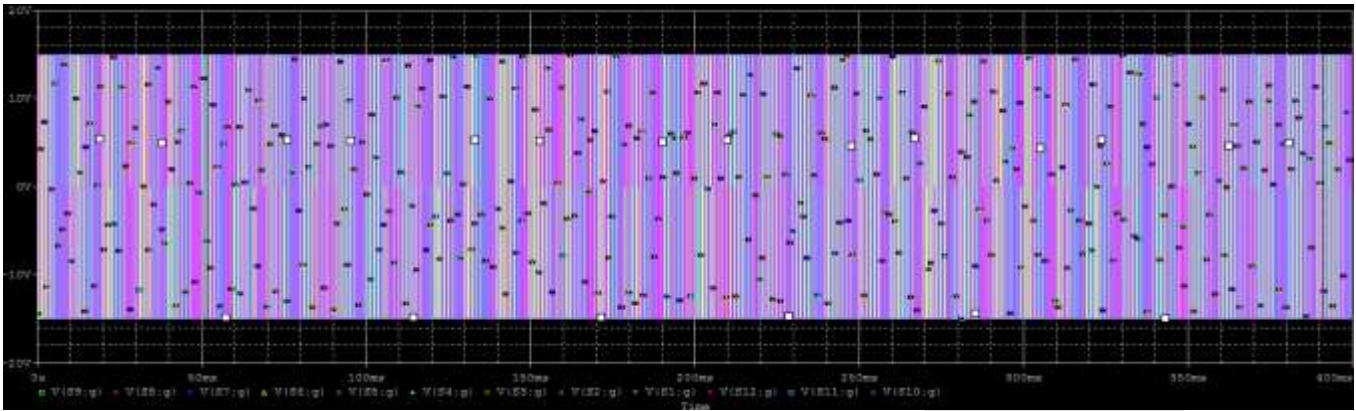
FIGURE (10) THE OUTPUT FOR ALL SWITCHES
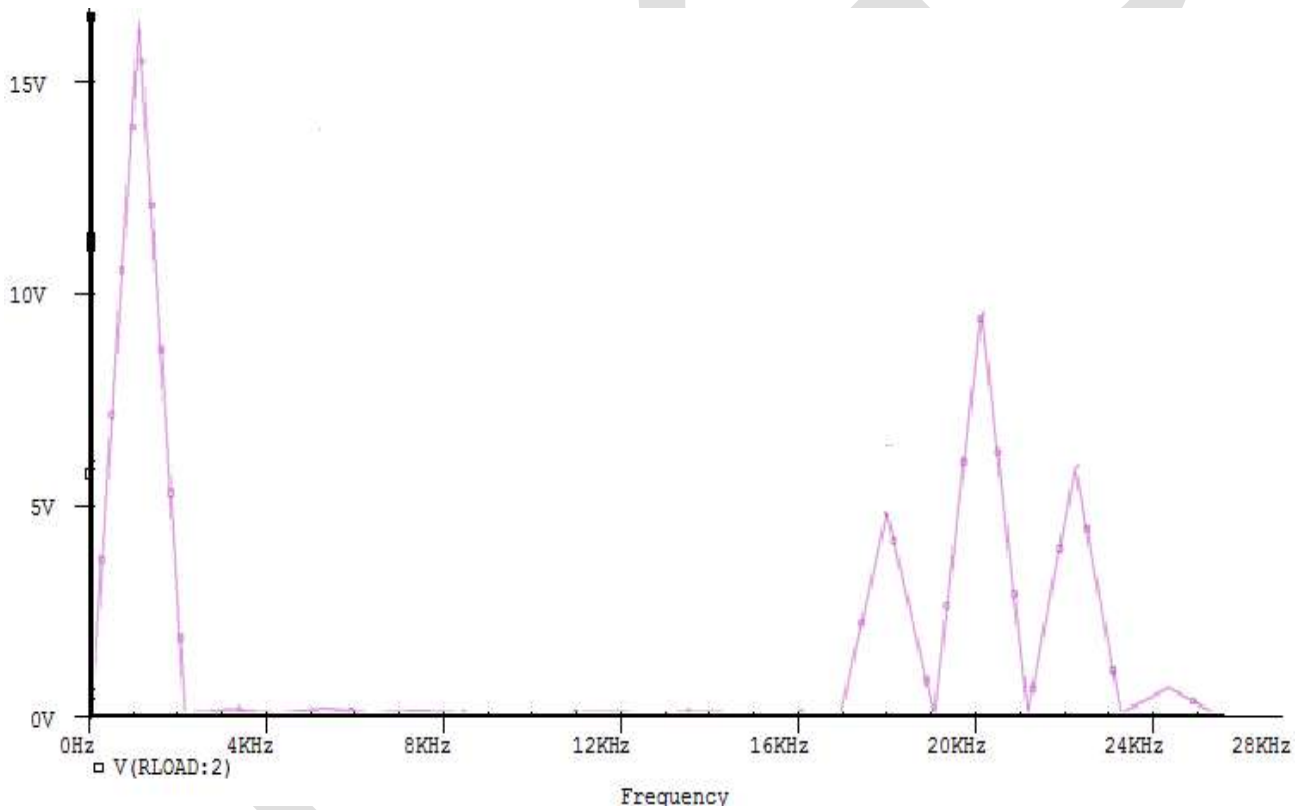
FIGURE 11: FREQUENCY SPECTRA OF THE CIRCUIT WITHOUT FILTER
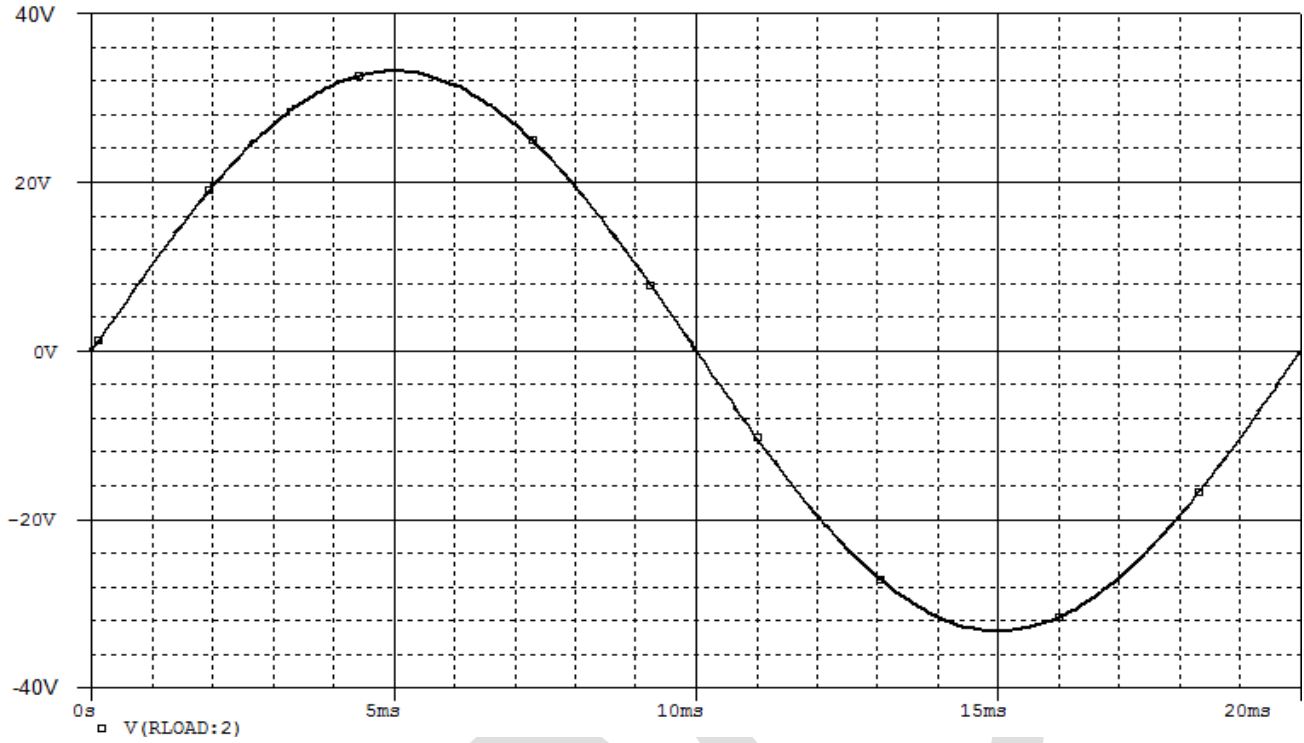
Figure (12)OUTPUT VOLTAGE ON THE LOAD WITH FILTER
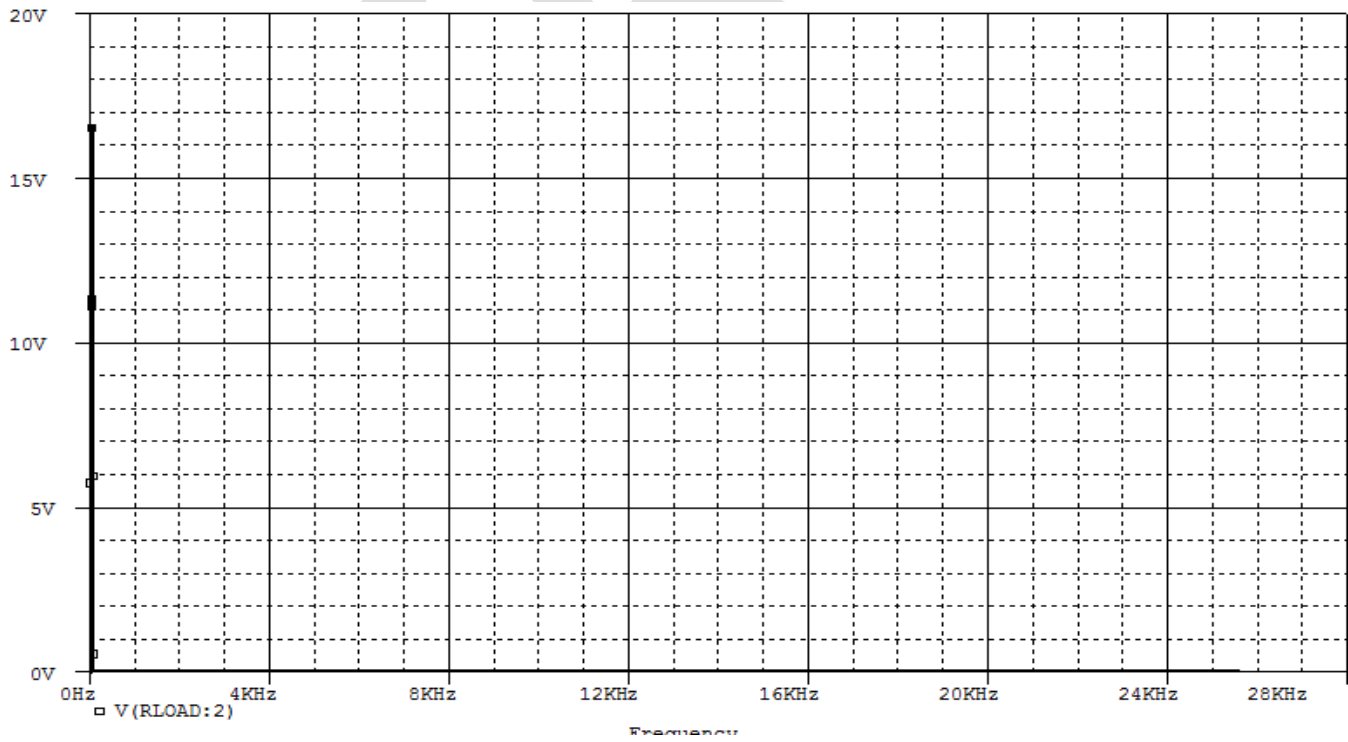
Fig (13) RLOAD FREQUENCY WITH FILTER.

CONCLUSION

In single inverter without filter is draw more harmonics, in this paper, the multilevel inverter   designed by using Pspice software, and %THD was discussing. In this model PWM techniques along with LC filter were designed to bring down harmonics within its limit. As a result of study multilevel inverter single phase has greater advantage even without using filter design the harmonics are hidden to some level. Multilevel inverter can be used in high power application which has balanced voltage.

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Automatic Response System Using SMS

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ABSTRACT – This paper presents a novel method to send SMS through mobile at the remote host on a mobile service as well for internet host. The method is based on the reliability of the software en-corporate. The system uses a specified code, which is being used to access a data base system. The data residing the code will be immediately resend to the user regarding which the request had been send. The utility of the work enhances from the educational system to the various business unit. The software is being created in the J2ME.

Keywords— SMS, J2ME, Mobile Device, GPRS,GSM,Automatic Response,Short code.

INTRODUCTION

Application for mobile devices are becoming increasingly sophisticated. Java Micro Edition (J2ME) is intended to make programming uniform and simple for mobile devices, following the same goals as Java technology for desktop and enterprise computing. As noted in [1], J2ME addresses a wide range of pervasive and mobile technologies; it is actually a suite of Java profiles specialized for various technologies.

Short Message Service (SMS) in wireless systems provides the capability of limited-size data messages to subscriber's cellular phone. And the development of value added services based upon the GSM standard is becoming increasingly important to both network operators and the subscribers to such networks. This project outlines a wireless service system capable of providing real time information of the student information of the college. The system allows a user to the service to receive student information on demand primarily by means of short messages delivered to their GSM mobile phone.

So far SMS was sent from the Internet to the mobile phones. We are introducing a new system to send SMS in the reverse order also, but with a difference. Here people can send SMS from their mobile phone to a particular number (short code number) and request for a service or information. Here, the customers have to use codes rather than long messages. You can get a dedicated short code number for your purpose or use predefined number. In both case, the customer/user will send the code to the assigned number and in turn the code along with the mobile number will be routed to server. The processed result (SMS message) will be sent back to the customer's mobile at the same moment itself. Here, the customer will be spending money for the short code message and all you need to invest is for the response SMS, which in turn you can charge your customers for the service being provided. This service is possible with the addition of an MSISDN reply number to any SMS, and gives the opportunity to respond to your message using that number.

The various questionnaires for the stakeholders prepared by the school/college staff and the author were successfully administered through the system. The system supports a consultative style of decision-making that enables the stakeholders to contribute their views. The server can compile the responses, and then present the results to all. Hence, the school/college leaders can make timely and informed decisions that improve the school's programmers. In addition, the system facilitates communication between the school and the home, and encourages collaboration. Finally, it supports the teachers in analyzing the students, and performs both formative and summative evaluation of lessons and other academic programs as referred by [2]. Project is limited to use of only text messages. At present multimedia message (MMS) support is not implemented. The scope of Project is limited to use of GSM protocol while sending and receiving message from application (i.e. not using TCP/IP to send/receive message which is more cost effective)

II   LITERATURE REVIEW

G. Lawton [9] proposed new techniques for coming generation of mobile phones will enable objects from enterprise systems to be distributed across a range of devices of different scales. This object mobility will provide for applications that can take advantage of device-local data and processes to support rich client interaction. However, such mobilized applications bring with them new challenges for the software architect. Distributed objects running on telephones or other small mobile devices will have to work within a number of key constraints, such as limitations on memory and available APIs, and the need to maintain data integrity.

II.1 Classroom through interactive SMS

Classroom interactivity has a number of significant benefits: it promotes an active learning environment, provides greater feedback for lecturers, increases student motivation, and enables a learning community. On the other hand, interactive activities for large classes (over 100 students) have proven to be quite difficult. During the past six years the rapid proliferation of mobile devices, particularly cellular phones, in the student demographic has changed the levels of student access to information and communications technology (ICT) in the classroom - presenting an extraordinary opportunity to develop interactive classroom systems and to enhance students' learning experience. This paper aims to describe the development of a classroom interaction system as well as to understand the impact that mobile applications such as short -message-services (SMS) can have on students' learning experience. A variety of positive outcomes from the use of CFS technologies have been reported including improved understanding of important concepts increased student engagement and participation, improved quality of discussion in the classroom and a better teacher awareness of student difficulties [13]. . Mobile phones are regarded as essential devices by the student demographic and have the advantages of being familiar, permanently configured to work correctly, and battery lives generally measured in days rather than hours.

III   PROBLEM FORMULATION

Here we are taking the area of acquiring general information related to subject. The subject can be any education institute, professional organization, medical organization and many more. Let us suppose it could be an educational system and one want to know about general information related to a student. Such as his address, marks in current academic year, aggregate, age, roll number etc. One of the oldest methods is to go to institute & ask for that particular information. The drawback of this approach is the queue & wandering from one department to another in which user has to spend his precious time. An alternative approach is to call enquiry office but there are vast chances of that they will asked to call again & again or may be most of the times telephone lines are busy. Another approach is to check on related colleges websites in which user can login & find information. But to access an Internet, users need to have knowledge & facility of computer, which is not available everywhere, always.

The SMS is accepted by the program (JsmsEngine) running on computer i.e. application server. Listen for incoming SMS, if message received message and save to database (or file). System then will read the SMS message from database (or file) and interpret the keyword in the SMS for example: GET 12345 ABC (I would like the system to able, identify different keywords to perform different respond, white space will be used to determine end of the keyword). (Optional) if possible I would like the system to be customize to be respond on certain keyword (system admin will able to set the desire keyword and the system responds.) Later the system will be respond according to keyword in the SMS received (for example, SMS message received keyword is TITLE and system will respond back with a SMS "Hello world". Each different set of keyword will have a different set of respond. Java to Micro Edition will be used as language for mobile programming & Java data base connectivity & Jsms Engine for implementation of project. Here we are considering student database for case study but this project can also be developed for employee's information in an organization. The data flow of the system is shown in the Fig 1.
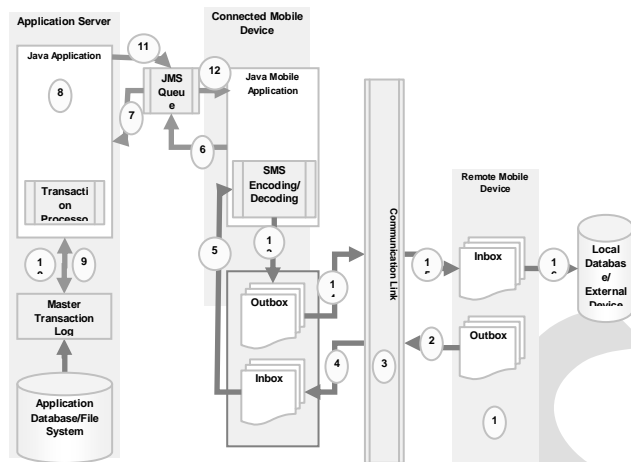
Fig1. Data Flow diagram

IV ARCHITECTURE REVIEW

 Architecture followed in this software is very simple three tier architecture as shown in Fig. 2, which has three different layers for three different type of task. The first one is *Presentation Layer or Application Layer* is the form which provides the user interface to either programmer or end user. Programmer uses this layer for designing purpose and to get or set the data back and forth. *Business Layer* is a layer which we use to write the function which works as a mediator to transfer the data from Application or presentation layer to data layer. In the three tier architecture we never let the data access layer to interact with the presentation layer. This layer has also a class where we declare the variable corresponding to the fields of the database which can be required for the application and make the properties so that we can get or set the data using these properties into the variables. These properties are public so that we can access its values. *Data Access Layer* is a class which we use to get or set the data to the database back and forth. This layer only interacts with the database. We write the database queries or use stored procedures to access the data from the database or to perform any operation to the database.
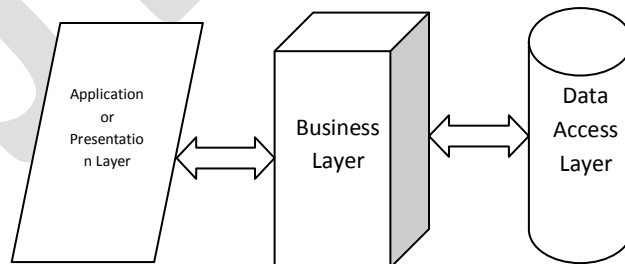
Fig 2 Three Tier Architecture

Remote Mobile initiates a Data Request, frames a SMS manually or automatically and sends a SMS to the Mobile number of Connected Mobile Device as shown in Fig 3. Message sent over GSM link is then captured by operator and then redirected again over GSM link to Inbox of Connected Mobile Device Message in Inbox is then read by Java Mobile Application running on Mobile Device and suitable decoding (formatting) of message is done After Message is decoded to suitable format, message is sent to Java Messaging Service Queue (which is hosted on Application Server), via serial communication port Standard Java Application running on server retrieves the message from JMS Queue Standard Java Application frame a query as per message received, fire a Query through Transaction processor and retrieve desired data. Transaction processor too creates Log of data retrieved Standard Java Application posts data retrieved to JMS queue which then read by Java Mobile Application on Mobile Device and then decoded to suitable SMS format.
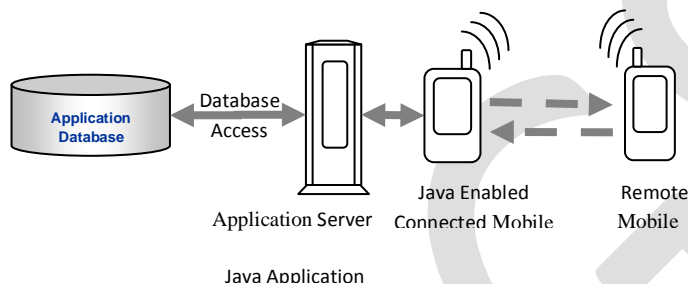
Fig3. Application architecture

V.USE CASE DIAGRAM

The Use case diagram is used to identify the primary elements and processes that form the system. The primary elements are termed as "actors" and the processes are called "use cases." The Use case diagram shows which actors interact with each use case. A use case diagram is a type of behavioral diagram. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals—represented as use cases—and any dependencies between these use cases. Component of Use Case Diagram- Use Cases, Actors, System boundary boxes (optional), Associations, Include, Extend, Generalization and Actor Generalization as shown in Fig 4.

V.1 CLASS DISCRIPTION

Class diagrams are the blueprints and model the static structure of a system as shown in Fig 5. You can use class diagrams to model the objects that make up the system, to display the relationships between the objects, and to describe what those objects do and the services that they provide. Class diagrams are useful in many stages of system design, classes that often translate into actual software classes and objects when start writing code. During the implementation phase of a software development cycle, class diagram is used to convert models into code and to convert code into models.
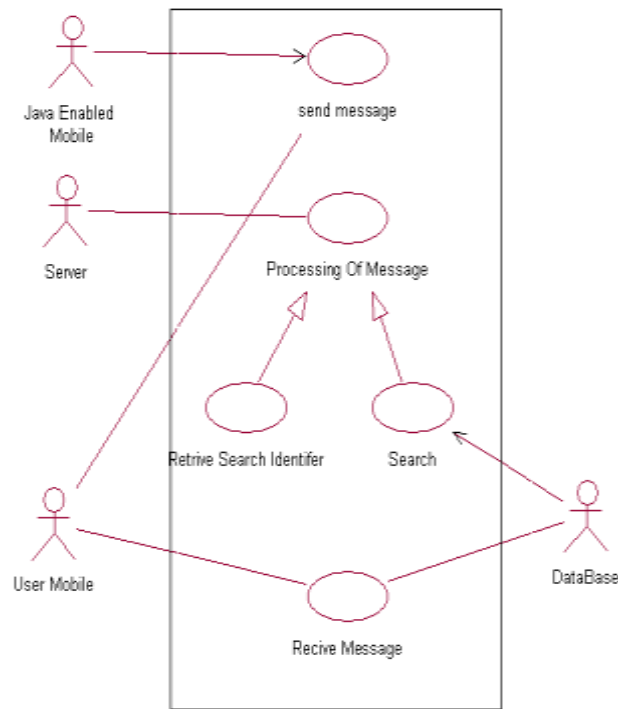
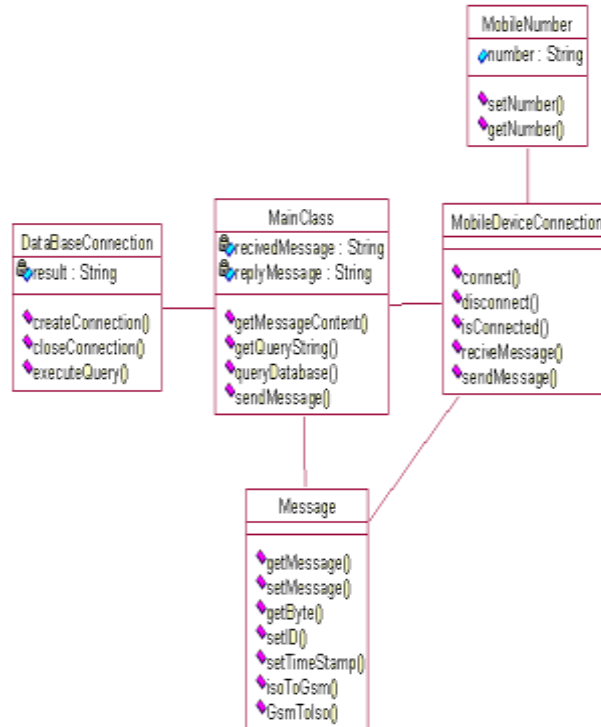Fig4. Use Case Diagram for Automatic Response System Using SMS

Fig5. Class Diagram for Automatic Response System Using SMS

V.2 SEQUENCE DIAGRAM

Sequence diagrams model the flow of logic within system in a visual manner, enabling you both to document and validate your logic, and are commonly used for both analysis and design purposes as shown in Fig. 6. Sequence diagrams are the most popular artifact for dynamic modeling, which focuses on identifying the behavior of the system. A sequence diagram shows, as parallel vertical lines, different processes or objects that live simultaneously, and, as horizontal arrows, the messages exchanged between them, in the order in which they occur. This allows the specification of simple runtime scenarios in a graphical manner. The main purpose of a sequence diagram is to define event sequences that result in some desired outcome. The focus is less on messages themselves and more on the order in which messages occur; nevertheless, most sequence diagrams will communicate what messages are sent between a system's objects as well as the order in which they occur. The diagram conveys this information along the horizontal and vertical dimensions: the vertical dimension shows, top down, the time sequence of messages/calls as they occur, and the horizontal dimension shows, left to right, the object instances that the messages are sent to.
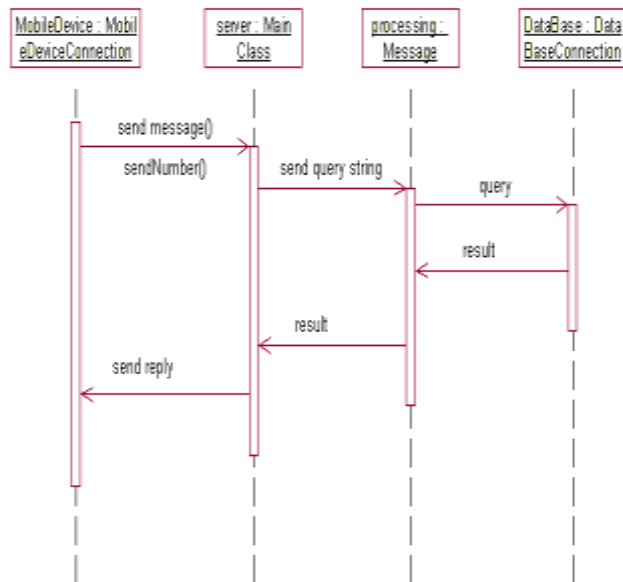
Fig6. Sequence Diagram for Automatic Response System

CONCLUSION

The reasons for the enormous popularity of SMS have been the fact that this mechanism of sending and receiving messages not only saves time but costs less as well. The advantage for network operators has been the ease of deploying equipment from any vendors that implement the standard. Like other cellular standards. The above proposed and developed application is a mobile application for adding values to an institution. This application can only run on the cell phone having GPRS enabled services with them. This application can further be enhanced by adding various features to it like we can send and receive various information regarding students on a cell over the air (OTA).Even a student can view their assignments on the mobile phone by just using certain services that can be availed from the server. The scope of Project is limited to use of GSM protocol while sending and receiving message from application (i.e. not using TCP/IP to send/receive message which is more cost effective)

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Design of low Cost CNC Drilling Machine

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ABSTRACT - This paper aims at describing the design of a computer numeric control drilling machine. The said machine is designed with a view to keep the cost of the machine at minimum, hence making is suitable for use in small or medium scale industries. Along with the design of the mechanical components, the electronics and the software has also been designed. The said machine has also been fabricated and successfully tested.

Keywords— Drilling machine, CNC drilling machine electronics, CNC machine design, computer numeric control, low cost automation, CNC software, CNC graphical user interface.

INTRODUCTION

A drilling machine is a device for making holes in components. The manually operated type of drilling machine creates problems such as low accuracy, high setup time, low productivity, etc. A CNC machine overcomes all these problems but the main disadvantage of a CNC drilling machine is the high initial cost and requirement of skilled labour for operating the machine. Hence, there arises a need for a low cost CNC machine which can not only drill holes with high accuracy and low machining time but also have low initial cost. The need for skilled operator is eliminated by providing a software with a more user friendly graphical user interface.

COMPONENTS

The machine consists of the following components
i. The mechanical components
    It includes the structure of the drilling machine i.e. the base, support structure, beams, lead screw, bearing, gears, etc.
ii. The electrical system
    The electrical system consists of the motor, motor control unit, power unit and interfacing.
iii. The control or computing system
    The control or the computing system positions the tip of the drill at the required position and the provides the depth of cut.

DESIGN CONSIDERATIONS

A. Work piece size

As a basis for further development of the drilling machine, the maximum component size (maximum travel along the axis) is selected as

X = 400 mm.
Y = 400 mm.
Z = 200 mm.

B. Configuration selection

The different configurations are considered from fabrication point of view, and it is found that the gantry configuration is most suitable because of the following qualities.
1. Provides better rigidity.
2. Better accuracy.
3. Ease of operation and programming.

C. Drilling machine components

The drilling machine is divided into three sub systems. These are
1. The mechanical structure.
2. The Electrical system.
3. The Program.

MECHANICAL SUB ASSEMBLIES

The machine structure is further divided into following sub assemblies.

1. Frame sub-assembly.
2. Y axis sub-assembly.
3. X axis sub-assembly.
4. Z axis sub-assembly.

A. Frame sub assembly

Four L cross section beams welded together to form each of the top and bottom part of the frame. Four more beams are bolted vertically to these portions to form the frame structure.

Two beams are placed horizontally along X axis and bolted to the vertical beams to form the guides for the X axis base.
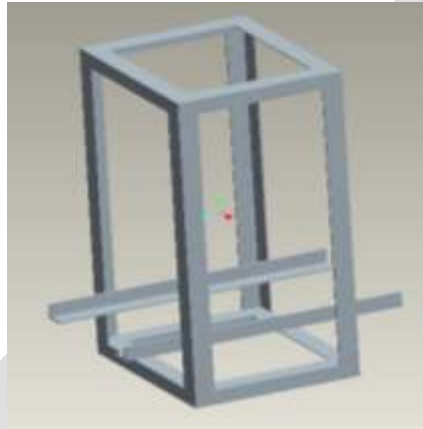
Fig.1 Frame sub assembly

B. X axis sub assembly

Two bearings are placed on either sides of the X axis screw. These bearings are then supported in the bearing seat provided in the side plates. A mid plate is provided which has internal threading for contact with the screw. Two guide rods are fit between the two side plates.

Each of the side plates has two M6 taps at the bottom to screw them to the frame.

The motor is screwed to the motor support plate which is in turn attached to the guide rods. The shaft of the motor has a radial hole which is used to couple the motor to the screw.
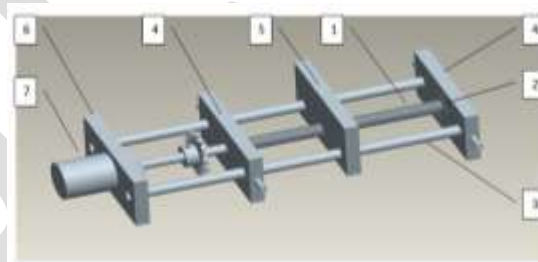
Fig.2 X axis sub assembly

1	Screw
2	Bearing
3	Guide rod
4	Side plate
5	Mid plate
6	Motor support plate
7	Motor
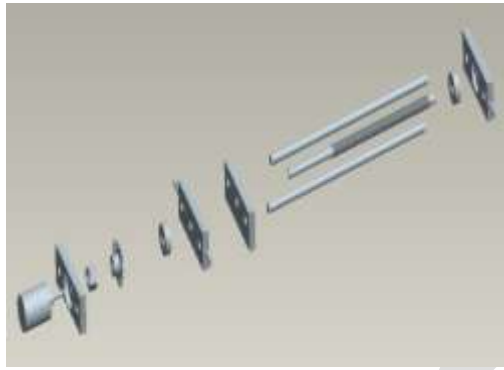
Fig.3 X axis sub assembly (Exploded view)

C. Y axis sub assembly

The Y axis is similar in construction to the X axis sub assembly. The mid plate has two M6 taps for the attachment of Z axis sub assembly.

D. Z axis sub assembly

The Z axis is also similar in construction to the X axis sub assembly. The mid plate has a provision for the attachment of the drill motor.
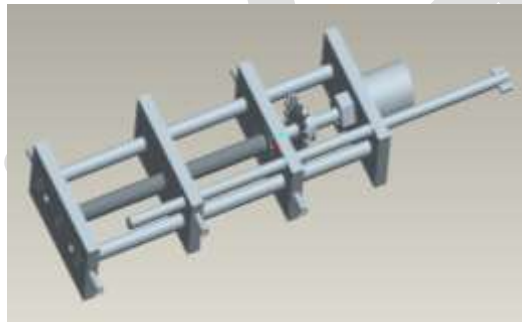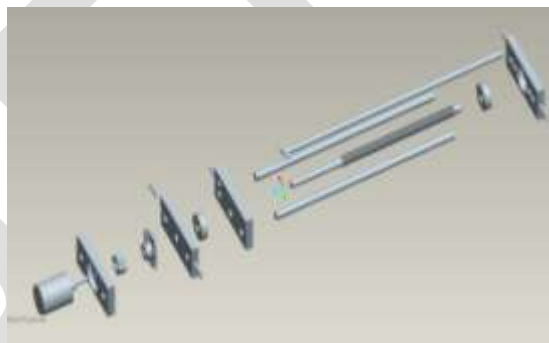

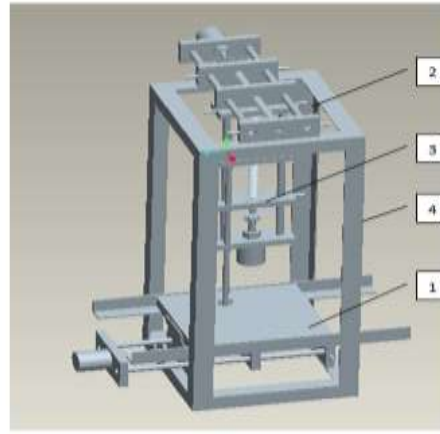Fig.4 Z axis sub assembly

Fig.5 Z axis sub assembly (Exploded view)

Fig.6 Final assembly

1	X axis sub assembly
2	Y axis sub assembly
3	Z axis sub assembly
4	Frame sub assembly

DESIGN CALCULATIONS

A. X axis lead screw

The movement required is	= 400mm
For safer side selecting length of screw as	= 500mm
Size	= M10 x 1
Pitch, p	= 1 mm
Major diameter, do	= 10 mm
Mean diameter, d	= do- p/2
	= 10-1/2
	= 9.5 mm

B. Y axis lead screw

The movement required is	= 400mm
For safer side selecting length of screw as	= 500 mm
Size	= M10 x 1
Pitch, p	= 1 mm
Major diameter, do	= 10 mm
Mean diameter, d	= do- p/2
	= 9.5 mm

C. Z axis lead screw

The movement required is	= 200 mm
For safer side selecting length of screw as	= 300 mm
Size	= M10 x 1
Pitch, p	= 1 mm
Major diameter, do	= 10 mm
Mean diameter, d	= do- p/2
	= 9.5 mm

POWER CALCULATION

The load on the Y axis is maximum, hence the power required at Y axis sub assembly will be maximum. Hence the power required at Y axis lead screw is considered for selecting the motor. The power required is calculated next.
Co-efficient of friction, $\mu = 0.0015$

$$\tan \alpha = p/(\pi d)$$

$$= 1/(\pi \times 10)$$

$$= 0.0318$$

$$\tan \phi = \mu$$

$$= 0.0015$$

Mass on lead screw in Y-direction, m_y = 5 kg

External force, Fey   = $m_y \times g$

                =5 x 9.81

                =49.05 N

Frictional force, F_{fy} = $\mu \times m_y \times 9.81$

(selecting μ=0.0015)

                = 0.0015 x 5 x 9.81

                = 0.0736 N

Total force , $F_{ty} = F_{ey} + F_{fy}$

          F_{ty} = 49.05 + 0.0736

                =49.1236 N

Tangential force required at the circumference of screw is,
$F_y = F_{ty} \times [\tan\alpha\tan\phi] / [1 - \tan\alpha \times \tan\phi]$

   =49.1236 x [0.0318+ 0.0015] / [1-0.0318x0.0015]

   = 1.636 N

On the basis of tangential force torque required for screw rotation is,
$T_Y = F_Y \times d/2 + \mu \times F_{TY} \times R$

   = 1.636 x 10/2 + 0.0015 x 49.1236 x (10/2)

   = 8.5484 N-mm

   = 0.0854 Kgf-cm

Speed of lead screw, NY
                N_Y = 30 rpm.

Angular speed, $W_Y = 2\pi N/60$

                = 3.14 rad/sec

Power, $P_Y = T_Y \times W_Y$

                = 0.0854 x 3.14

                = 0.2681 W

BEARING SELECTION

The lead screw is supported using two bearings, one at each end. A total of six bearings are used.
Diameter of the non threaded portion of the lead screw is 10mm. Hence the bore of the bearing is required to be 10mm.
Based on the standard bearings available, the 1900 series bearing is selected. The specifications of this bearing are

Outer diameter = 30 mm
Bore   = 10 mm
Thickness   = 9 mm

ELECTRICAL AND ELECTRONIC SYSTEM

A. Motor selection

The power required to operate the CMM has been calculated in the previous section. Assuming frictional losses and factor of safety, the following motor is selected

Type   -   Stepper motor
Holding torque -   18 Kg.cm
Current   -   3 Ampere
Voltage   -   12 Volt
Torque   -   2 kgf.cm

Three Motors are used, one for each axis. Additional fourth motor is used to which the drill is attached.

B. Power supply

Current of 3 ampere is supplied to each of the four motors using adapter whose input rating of $100 - 240V$ and 0.4 Ampere (max) while output rating is 12 volt and 3 Ampere

Fig.7 X axis sub assembly

Fig.8 Z axis sub assembly

Fig.9 Final assembly

SOFTWARE SYSTEM

The working of the different buttons is explained next

A. Reset axis button

When the 'Reset axis' button is clicked
Motors for all the three axis start to rotate in counter clockwise direction. They start to bring the axis to their respective home position. The motors stop when the respected proximity sensors are activated. This indicates that the home position has been reached.

B. Co ordinate input

The required X and Y co ordinates are entered in the respective text boxes. The depth of drill operation required is entered in the text box labeled " Z co ordinate". When "start machine" button is clicked, motor for each axis starts to rotate in clockwise direction. The motors stop when the value indicated in the respective dialog boxes is reached.
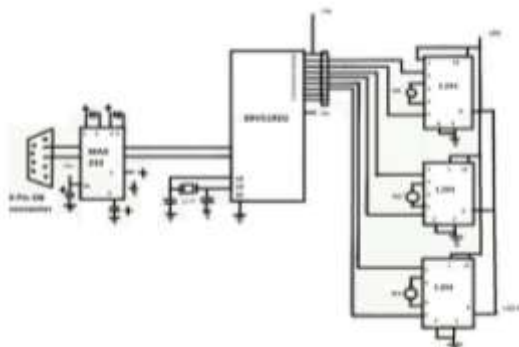
Fig. 10 Circuit diagram

OPERATING THE MACHINE

A. Drilling machine connections

The block diagram of system is provided.
The adapter is connected to AC power supply and the point provided on the machine circuit board.
The RS 232 cable is connected to the corresponding port on the machine circuit board and the PC.
The power to the machine is switched on using the ON/OFF switch provided on the circuit board.

B. Steps

Open the exe file of the program. The program screen appears.
Start the program from the drop down menu in the tool bar at the top left corner.
Click on the 'Reset axis' button. This will move the CMM to its home position.

Enter the desired values of X, Y and depth of cut in the respective text.
Click 'Start' button.
The machine X and Y motors start and position the drill on the desired position.
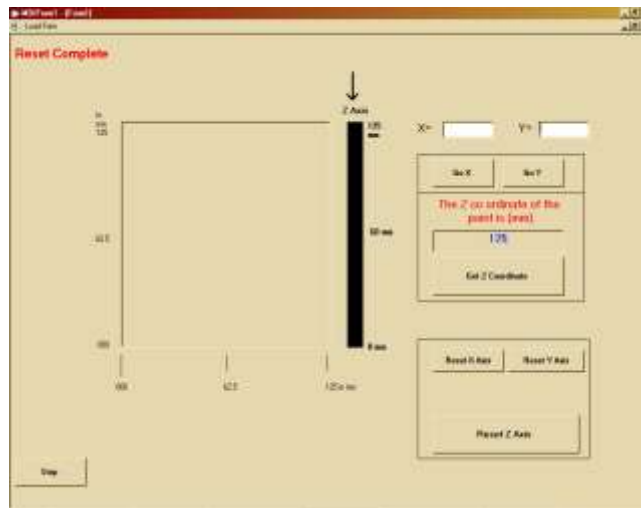The drill motor starts and then the Z axis motor starts, thus providing the depth of cut.

Fig.11 Program screen

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Image Denoising and Deblurring Using Non-Local Means Algorithm in Monochrome Images

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ABSTRACT – Image deblurring and denoising are the fundamental problems generally arise in the field of image processing with several applications. This paper presents both areas of image restoration. Image deblurring and denoising methods are most commonly designed for removal of both impulsive noise and Gaussian noise. Impulsive noise is a most common noise which affects the image quality during image acquisition, transmission, reception or storage and retrieval process in the area of image denoising. Impulsive noise can be categories into two i.e., Salt and Pepper Noise and Random Valued Impulsive Noise. Image deblurring methods are most commonly designed for Gaussian noise. The proposed work concentrates on removal of both Impulsive noise and Gaussian noise from images. Removal of impulsive noise is carried out using a non-linear filter that involves two phases, i.e. detecting the noise and also followed by filtering. Hence we proposed an efficient filter method for suppressing the noise in an image. The numerical results will confirm that proposed methods yields the better performance, in the terms of PSNR (Peak Signal to Noise Ratio).

Keywords

Salt and Pepper noise, Random Valued Impuse noise, image denoising, image deblurring, Gaussian noise, non-local means, non -linear filters.

INTRODUCTION

The aim of digital image processing is to improve the potential information for human interpretation and processing of an image data for transmission, storage and representation for autonomous machine perception. The image quality get degrades due to contamination of various types of noise. Additive white Gaussian noise, Rayleigh noise, Impulsive noise normally corrupt an image during the processes of acquisition, transmission and reception and storage and retrieval. For a useful and meaningful processing such as pattern recognition and image segmentation, have very good visuality in applications like mobile phone, television, digital cameras etc., the acquired image signal must be denoised and deblurred. Image denoising and image deblurring are the two sub-areas of image restoration. Its objective is to reconstruct the original image or the better estimation from the noise data while preserving fine image details. Additive White noise, (i.e., Gaussian noise) is indicated by adding noise to each pixel in an image that is independent from the unknown image, and also it will affect the whole pixels of the image. Both impulse noise and gaussian is caused by malfunctioning pixels in the physical device such as camera sensors, fault memory locations in hardware or transmission of data in a noisy channel. The images corrupted by noisy pixels can take the maximum and minimum value in the dynamic range. It severely degrades the image quality and also there is a loss of information details. There are various techniques have been proposed for removing impulsive noise and gaussian noise from the test images. There are many and diverse denoising methods have been proposed. The *median filter* was one of the most popular nonlinear filters for removing the impulsive noise, i.e., fixed valued and random valued impulse noise. Median filter generally replaces the intensity value of the center pixel with median value. However the filter approaches might blur the image, some fine details and edges of the test image will not be preserved. Due to its simplicity in implementation and also effectiveness in noise suppression, various changes have been done in the filter, such as Center *weighted median* filter and *weighted median* (WM) filter [2], [3]. The conventional median filter applies the median operation to each pixel completely, that is without considering whether it is noisy or noise-fee pixel. But still, filtering approaches is subjected and causes for the image degradation. In order to overcome the problems of these median filter, two switching scheme was introduced. The first switching scheme 1) Impulse detector – A detector analyses local characteristics of the 3x3 sliding window around each pixel using some considerations and marks the noise pixels in the corresponding local window. 2)The second switching scheme- Noise Filtering Process, only the marked pixels are processed rather than the whole area pixels of an image. The phenomenon of this scheme is so-called *switching median* filters [4] & [5]. In addition to median filter, there are various used to handle out the impulse noise. An alpha trimmed mean based method (ATMBM) was proposed by Luo [6]. In this method, impulse detection and in filtering process it replaces the noise pixel value by a continuous combination of its original pixel value and the median of its sliding window. In [7], Yu et al. proposed a rank-ordered relative differences (RORD-WMF) method to identify corrupted pixels based on ranking the pixel in the sliding window. Dong and Xu has proposed a new modified Directional Weighted median (DWM) [8] method. The decision tree is a simple but analysis the multiple variable processes more easily [9]. It can break down a complex decisions into the collection of simpler decisions, thus give a solution which is often easier to analysed [10]. Based on the above concepts, a new decision tree based denoising method (DTBDM) is presented here.To contrast, the effects of removal of impulsive noise, the results of restored pixels are written as a part of input data. By doing so, this method include the pixel-intensity interaction to enhance its filtering capability in decreasing impulse noise, while preserving image details.

PROPOSED DENOISING ALGORITHM

Gaussian noise is equally distributed over the signal. Impulsive noise is denoted by changing part of an image pixel with noisy values, this noise affects image pixel by pixel not the whole area of an image. Such noise is introduced during an acquisition process or due to transmission errors. Impulsive noise can be classified as fixed valued impulse noise and Variable type impulse noise .An image containing noise can be described as follows:

$$x(i,j) = \begin{cases} \eta(i,j) & \text{probability } p \\ y(i,j) & \text{probability } 1-p \end{cases} \qquad (1)$$

where x(i, j) denotes a corrupted image pixel, y(i, j) denotes a uncorrupted image pixel and η(i, j) denotes a corrupted pixel at the location (*i, j*).In fixed value impulse noise, corrupted pixels take either minimum or maximum values i.e. $\eta(i, j) \in \{N_{min}, N_{max}\}$, and for variable type impulse noise,(i.e.,RVIN) corrupted pixels take any value within the range minimum to maximum value i.e., $\eta_{i,j} \in [N_{min}, N_{max}]$,where N_{min} and N_{max} denote the lowest and the highest pixel values within the specified range respectively .

0   {0,255}   255
(a)   Fixed value Impulse Noise

0   {0,255}   255
(b) Variable type impulse Noise
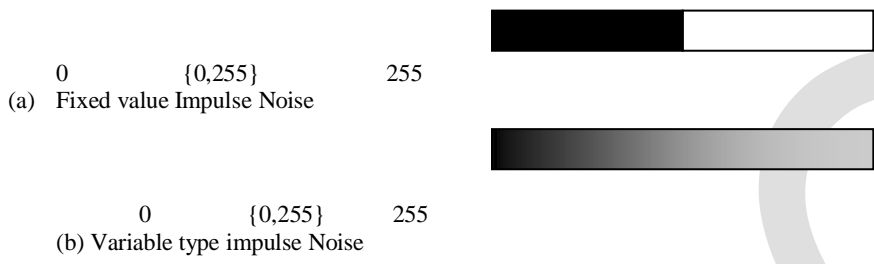
Fig. 1. Representation of Various Impulse Noise

Hence, it is little difficult to remove variable type impulse noise rather than fixed value impulse noise. For the preservation of fine image details and also suppression of noise is the main challenging phenomenon. The difference between fixed value and variable type impulse noise are represented in Fig. 1. In the case of fixed value impulse noise, the pixel is replaced with noise may be either N_{min} (0) or N_{max} (255), where as in variable type impulse noise situation it may range from N_{min} to N_{max}. Suppressing variable type impulse noise is more difficult than removing fixed-valued impulse noise. The differences in gray levels between a corrupted pixel and its uncorrupted neighbors are significant most of the times.

Noise Detection Scheme

Normally, two concerns are included in developing a determination process. First, it determines, its measure by using statistical parameter to capture and also to represent the local property of region. Second, a procedure to determine a threshold value for an unknown image. The existing denoising methods use many different approach to determine whether a given image pixel is a noisy one in this sense. Based on two-state methods, the new impulse detectors that is attempt to indicate each image pixel as either corrupted or an uncorrupted pixel. The phenomenon of these two methods is to determine image pixels to be significant. One of the simplest and most inherent methods is to compare a image pixel's intensity with the median pixel intensity in its neighborhood. Another relative complex method such as the ACWM, DWM and DTBDM use more complex criteria to conclude whether a pixel is an impulsive one. However, this approach is simple or complex, each image pixel is decided under the same decision, without considering the property of each image pixel. Furthermore, these existing methods are resulted poor performance, when the density of is high. In fact, the level of impulse noise in an image is different. Some pixels look more like corrupted pixels, and some do not look like corrupted pixels. Theoretically, for separate levels, independent decision rules should be adopted. Hence, prior to making a decision, all pixels should be grouped based on the level of how impulsive-like. Then, in different group, adopt different decision rules. In statistics, there are various methods for detecting outliers. Among them, a conventional measure of the outlyingness of an observation with respect to a sample is the ratio between its distance to the sample mean and standard deviation (SD). Due to the statistics, the impulse noise can be detected easily. In response to the aspects aforementioned, a novel detection paper mechanism for impulse noise is proposed in this paper. The flowchart of denoising algorithm is shown in Fig. 2.

A new detection mechanism has been proposed based on the new statistics. Most of the existing detection methods are often realized by comparing certain number of local neighborhood statistics to the same number of corresponding thresholds. However, all these existing detection methods mentioned above, deal with every pixel under the same rule without considering the outlyingness differences among the pixels. The proposed detection mechanism describes the outlyingness of the pixels and divides the pixels into four clusters based on the ROR values. The simple absolute deviation to the median is used to identify the impulsive noise in each cluster. In fact, according to the principle of the proposed detection mechanism, different decision rules could be adopted in different clusters. Therefore, to choose a suitable decision rule of every cluster, the median filter analysis and the detection method in DWM are used to get better results. Detecting one by one pixel can get good results, but the efficiency may be low. Therefore, a new detection pattern has been proposed that detects all the noisy pixels once in the block, and this method could be called as the block-wise pattern. For good performance, the capability of noise detection is very important. Here, the new detection method is compared with other methods like DTBDM. A new impulse detector should be able to detect most of the corrupted pixels as possible. If there are too many undetected noisy pixels, these pixels will lead to the presence of noticeable noise patches. Compared to other methods the proposed method can identify most of the noisy pixels. The results show that our method is more robust to the noise ratio than the other methods.

Non-Local Means Filtering (NLM)

Basically, the NL-means filter estimates an uncorrupted intensity as average weighted for all pixel in the image, and the weighted value are proportional to the similarity between the neighbor pixel value being processed and the surrounding pixels of neighbor pixels. However, these nonlocal means filtering method are very efficient in preserving image details when denoising. This filtering method also to remove combination of impulse and Gaussian noise. The best solution could be to locally varying parameters, so that they are primely tuned to remove the particular amount and various noises present in each part of the image.

DEBLURRING ALGORITHM

Image deblurring is the exercise of processing the whole image to view it a better representation of the section. In this process of restoring the original sharp image a mathematical model of the blurring is used. So, first a mathematical model is devised that relates, the
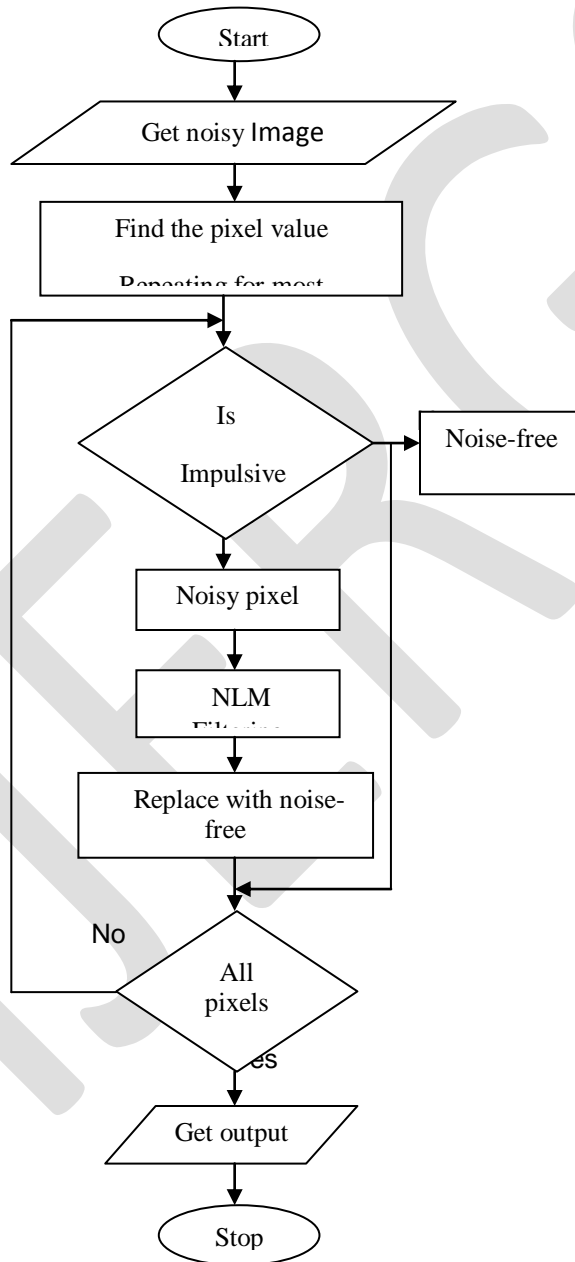
Fig. 2. Flowchart of denoising algorithm

given blurred image to the unknown true image. Image Deblurring techniques are sensitive to noise, yet a small amount of noise, which is unavoidable in low-light conditions, can disintegrate the quality of gaussian blur kernel estimation dramatically. Iteratively deblur and denoised, a blurry and noisy image. However, directly applying image denoising methods often slightly damages the blur information

that is removed from the original image, leading to kernel estimation. A new method is proposed for handling noise in image deblurring based on new theoretical and practical insights. The key observation is that applying an iterative filtering process, so that the noise level in an image get greatly reduces, while preserving the blur information in the statiscally independent direction to the filter. A non-local self similarity constraint is combine with non-locally centralized sparse representation (NCSR) is proposed. The proposed image deblurring methods are effective in restoring image structures from blurred image data. However, they tend to over smooth the local image details. This drawback is overcome by combining iterative shrinkage regularization with a NL self-similarity constraint, which helps to sharpen image edges and restore the fine details. Experimental results validate the performance of the proposed approach in both evaluation indexes and visual quality. As mentioned in Table II and Table III, that our algorithm achieves higher performance quality results than existing methods on blurry and noisy images.

EXPERIMENTAL RESULTS

Image Denoising

The proposed NLM method is compared with developed existing denoising methods, including the ACWM (Adaptive Center Weighted Median), DWM (Directional Weighted Median), and DTBDM (Decision Tree Based Denoising Method) and shown the resulted image and graph in Fig. 3,Fig. 4 ,Fig.5 and Fig.6. A set of standard and real images are commonly used in the review of image denoising. The results of various denoising methods are described in Table II. From the Table II, the proposed NLM has achieved highly competitive denoising performance.

TABLE I
PSNR (dB) results for cameraman image on different

level of noise densities

Noise Density (%)	Median Filter	DWM	DTBDM	NLM
5	26.85	27.08	36.21	38.26
10	26.21	26.59	32.89	34.19
15	25.73	25.76	31.35	32.01
20	24.57	25.15	30.18	30.47
50	18.19	18.33	24.28	29.62
70	14.32	14.53	20.89	26.17
90	11.73	11.75	14.52	23.39

Image Deblurring

The deblurring methods is applied to the simulated blurred images and compare the proposed method with BM3D and shown the resulted image in Fig. 6. In the simulated image deblurring, two generally used blur kernels are 9×9 uniform blur kernel and 2D Gaussian function (nontruncated) with standard deviation is used for simulations. The results of various deblurring methods are reported in Table IV. From Table IV, the proposed method has achieved highly competitive deblurring performance.

TABLE II

Comparative Results in PSNR (dB) of Image Corrupted by 5 Percent Impulses

Images Method	Lena	Boat	Peppers	House
Median	34.67	25.82	25.24	31.25
DWM	35.93	30.31	27.99	34.92
DTBDM	36.32	35.71	31.37	40.05
Proposed	**40.17**	**38.82**	**38.12**	**42.14**

(a)Original Image   (b) Noisy Image   (c) Median

(d) DWM   (e) DTBDM   (f) Proposed

Fig. 3. Results of Different Methods in restoring 15 percent corrupted image "Boat".

(a)Original Image   (b)Noisy Image   (c) Median

(d) DWM   (e) DTBDM   (f) Proposed

Fig. 4. Results of Different Methods in restoring 10 percent corrupted image "Real".

TABLE III
PSNR (dB) results for lena image on different
level of noise densities.(Filtering Without Detection)

Noise Density	PSNR(dB)			
	Noisy Image	Median Filter	CWM Filter	AM Filter
1	29.31	35.62	37.38	**47.70**
5	22.34	34.93	36.49	**42.68**
10	19.31	33.97	35.25	**39.88**
15	17.49	32.82	33.97	**38.11**
20	16.25	31.39	32.39	**36.73**
25	15.27	30.18	30.60	**35.39**
30	14.48	28.39	28.89	**34.38**
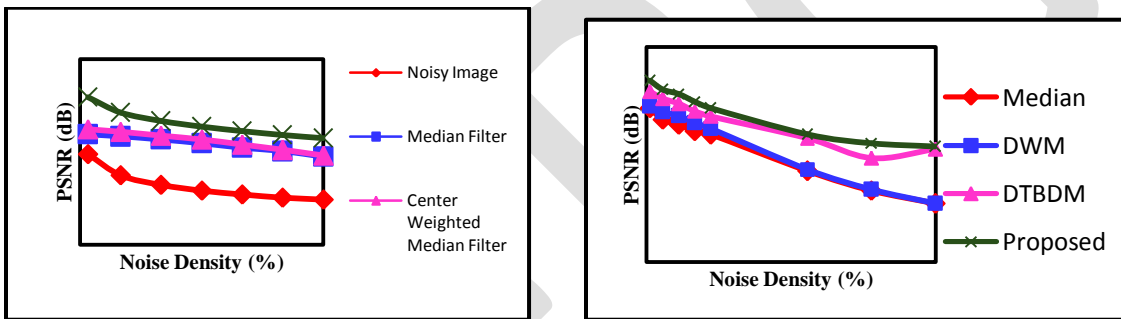
Fig. 5.Comparison graph of various denoising method

   (a) Original Image   (b) Noisy Image   (c) Median

(d) DWM   (e) DTBDM   (f) Proposed
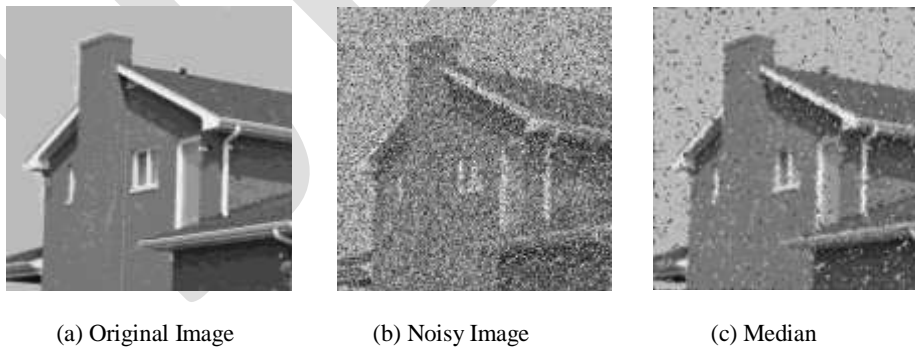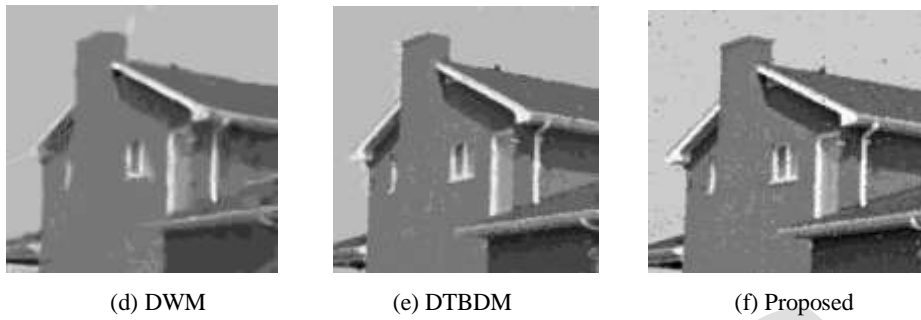
Fig. 6. Results of Different Methods in restoring 50 percent corrupted image "House".

TABLE IV

Comparative Results in PSNR (dB) of deblurring methods

Images Method	Lena	Boat	Peppers	House
Noisy	20.17	23.33	20.14	20.14
BM3D	30.09	28.73	30.16	32.86
Proposed	32.05	29.09	31.96	34.24
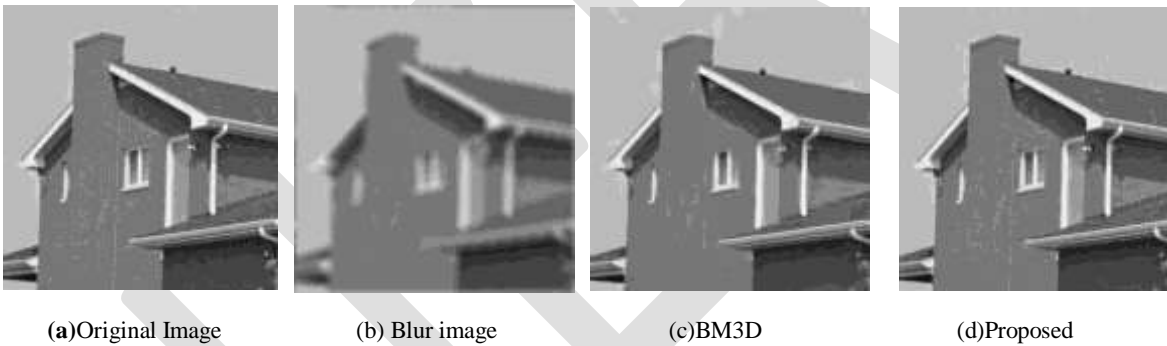
(a)Original Image   (b) Blur image   (c)BM3D   (d)Proposed
Fig. 7.Results of different deblurring performance comparison on "house.

(a)   Original Image   (b) Blur image   (c) BM3D   (d) Proposed
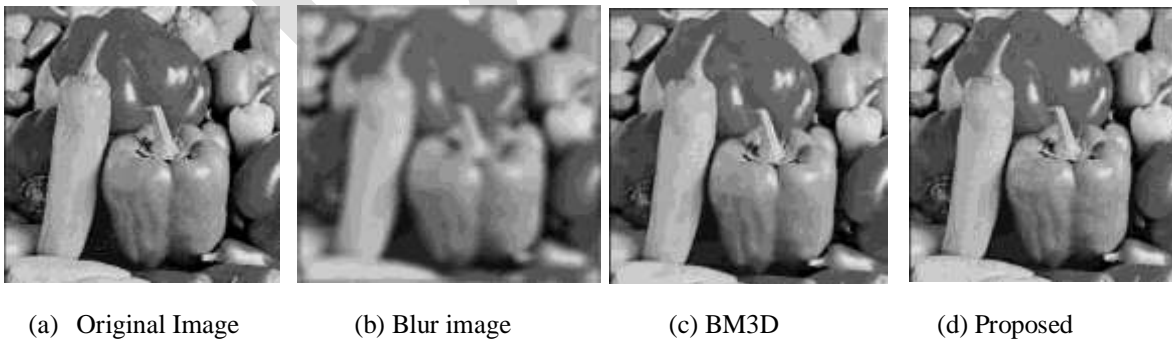
Fig. 8.Results of different deblurring performance comparison on "Peppers".

CONCLUSION

In this paper, a novel restoration method is presented for both image denoising and image deblurring. The noise which is defined as the difference between degraded image and the original image should be minimized for improvement in their performance on image restoration. To first, a novel denoising method is proposed for suppression of noise at all level of noise density. Second,, in deblurring method ,a new combine constraint of non-local similarity and Non-locally centralized Sparse Representation is proposed for achieving higher performance. The reconstructed edges are much sharper and more image fine structures are recovered easily. Experimental results on image denoising, and deblurring demonstrated with proposed work, can achieve higher performance than other principal denoising and deblurring methods.

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Improving the Labour Productivity through Other Resources in Construction Field

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ABSTRACT

Productivity remains an intriguing subject and a dominant issue in the construction sector, promising cost savings and efficient usage of resources. Productivity is one of the most important issues in both developed and developing countries. Human Resource Management or HRM is the process of managing people in a company/firm as well as managing the existing inter-personal relationships. These two processes are key in the success and growth of a business. Human resource management is the management process of an organization's workforce, or human resources. It is responsible for the attraction, selection, training, assessment, and rewarding of employees, while also overseeing organizational leadership and culture and ensuring compliance with employment and labour laws.

HR now focuses on strategic initiatives like mergers and acquisitions, talent management, succession planning, industrial and labour relations, and diversity and inclusion. Successful implementation ensures that all employees know their role, career path and also feel part of an organization which is able to manage and reconcile their expectations as well as those of the organization and its objectives. Based on those factors a questionnaire has been prepared in labours point of view. In this thesis , questionnaire survey have been conducted with various companies among **100 labours** and using SPSS software their response have been extracted for studying the impact of human resource management practices on productivity and financial performance in construction industry and appropriate solution was given for all impacts.
Keywords: Human resource management, Labors, Engineers, Entrepreneurs, Response, Analysis

I INTRODUCTION
1.1.GENERAL
The process of attracting, developing and maintaining a talented and energetic workforce to support organisational mission, objectives and strategies is the ultimate aim of human resource management.HRM is the process of finding out what people want from their work, what an organization wants from its employees, and then matching these two sets of needs.
Purpose of this research is to improve management strategies, decrease the mismatch between required and available skilled labor and to discuss the consequences of ignoring the interests of craftsmen. Perhaps most important, the consultants can provide the supervisor and crew with the training that will yield the greatest productivity improvements.
1.2 NEED FOR HUMAN RESOURCE   MANAGEMENT
To improve the quality of human resource management practices.
To decrease the total cost and duration of the project.
To eliminate unnecessary labour cost involved in construction

1.3 OBJECTIVE
The main objective are
To study the impact of human resource management among construction labours.
To identify the current scenario followed in human resource management in Civil Engineering field.

2.0 FACTORS IDENTIFICATION
There are some factors which influence HRM at a greater level. These factors were identified based on personal analysis and literature study. Personal analyses of construction project managers were done.
2.1 FACTORS IRRESPECTIVE TO LABOURS

2.1.1 PHYSICAL FACTORS
Site congestion factor will never enable the labor to do work in comfortable manner and over time work will not give good productivity in any job. In most of the cases design complexity will affect the speed of work.
2.1.2 ECONOMIC FACTORS

On time payment should be done right at the time when the work is accomplished. Discontinuity of work schedule will affect labors financial status and sufficient amount of pay should be given to labor.

2.1.3 PSYCHOLOGICAL FACTORS

Psychological factors deals will many parameters. In civil Engineering point of view ,In recent years the cultural difference is making the worker to work uncomfortably and work satisfaction with respect to job is very much necessary.

2.1.4 ORGANIZATIONAL FACTORS

Quality of work is good/maintained in firm. Sufficient Crew size should be provided by the firm for accomplishing the task. Accommodation and food should be maintained in a better manner by the top manager.

2.1.5 ENVIRONMENTAL FACTORS

It is very clear to mention that climatic condition will affect the working performance but the firm is the primarily responsible for resolving HVAC problems to labors. The project manager and the site supervisor should always maintain the site condition in a good manner.

2.1.6 DESIGN FACTORS

Innovative design methodology creates discomfort in work but proper training approach will eradicate this problem. It is must to say that violation of code practices by the firm should be totally abolished only the design problems won't occur.

2.1.7 MATERIAL FACTORS

It is necessary to supply quality materials by the firm at any cost but in some cases desolate materials are used in small scale firms. Another serious problem is the co-workers are mishandling the materials due to lack of training.

2.1.8 EQUIPMENT FACTORS

Usage of mechanical equipment's for an prolonged period of time is still found in most of the firms and due to this factor equipment malfunctioning will take place oftenly.It is necessary to have proper maintenance of equipment and proper training for operating equipment's to the labor's.

2.1.9 PROJECT FACTORS

Sufficient men and materials are not found in some working site due to this factor the time period for accomplishing a work is delayed. A good transportation facility should be provided by the firm to the labors.

2.1.10 EXTERNAL FACTORS

Political / Governmental problems often aroused in some firms and due to this work schedule is disturbed .In small scale firms, resources are managed in an improper manner whereas in partnership based firms contractual conflicts are found.

3.0 DATA COLLECTION AND ANALYSIS

3.1 GENERAL

Various data's have been collected for designing the questionnaire. A translated questionnaire in Tamil language has been prepared, for the labors for convenient purpose.

3.2 QUESTIONNAIRE DESIGN

The design of questionnaire was done based on the analysis made in various literatures reviews. The design of questionnaire was done based on the factors to be considered irrespective to labours.

3.3 QUESTIONNAIRE SURVEY

The prepared Questionnaire on human resource management in Construction industry is distributed to 100labors and their response have been extracted Responses from all three levels (large scale, medium scale and small scale) of companies are equally distributed.

3.5 DATA ANALYSIS USING STATISTICAL TOOL

The answered questionnaires were collected and using SPSS software it is analised.SPSS Statistics is a software package used for statistical analysis. Long produced by SPSS Inc., it was acquired by IBM in 2009, and current versions are officially named IBM SPSS Statistics. Companion products in the same family are used for survey authoring and deployment (IBM SPSS Data Collection), data mining (IBM SPSS Modeler), text analytics, and collaboration and deployment (batch and automated scoring services).
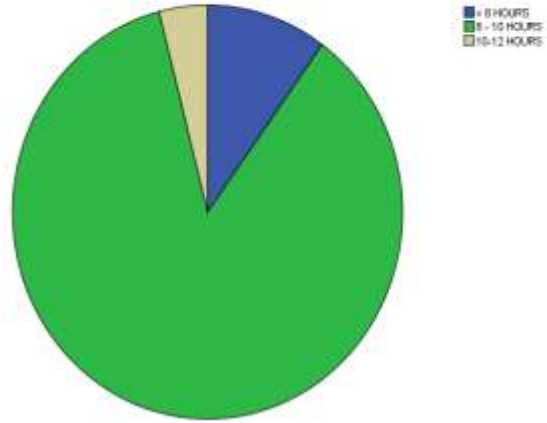
4.0 RESULTS AND DISCUSSIONS

SPSS 17, a statistical tool is used to analyze the obtained data from Questionnaire. The values should be labeled in variable view of SPSS and the obtained data should be filled in data
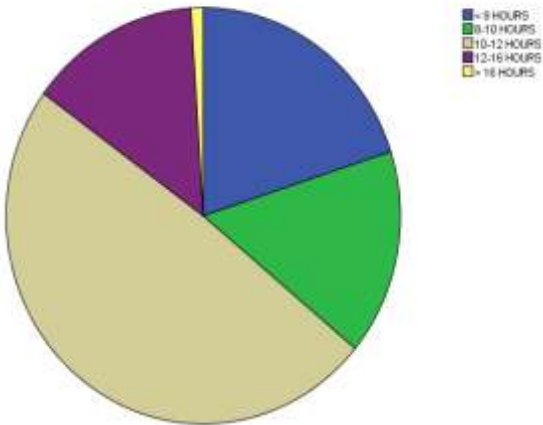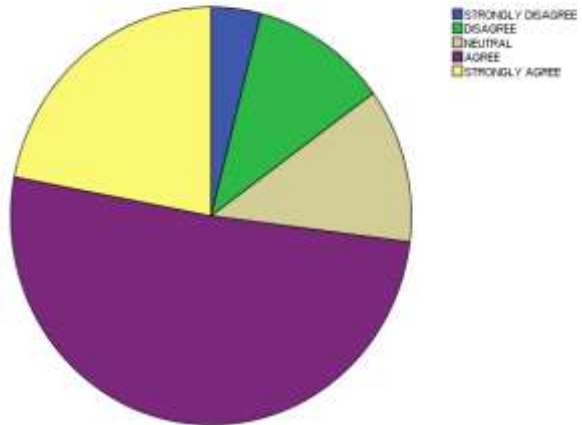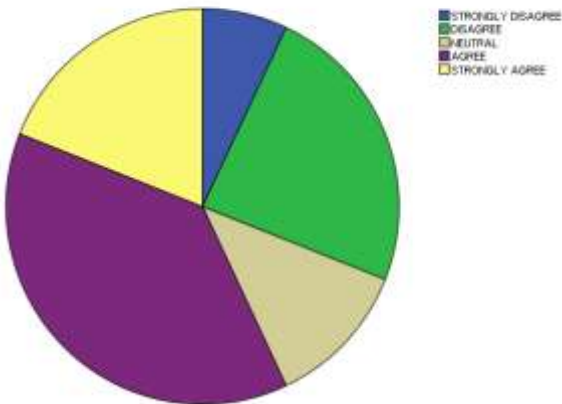
AGE
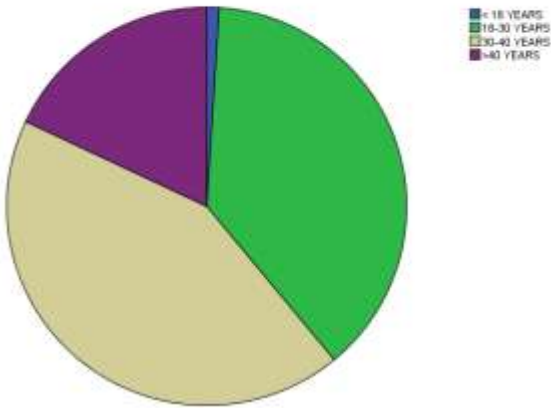
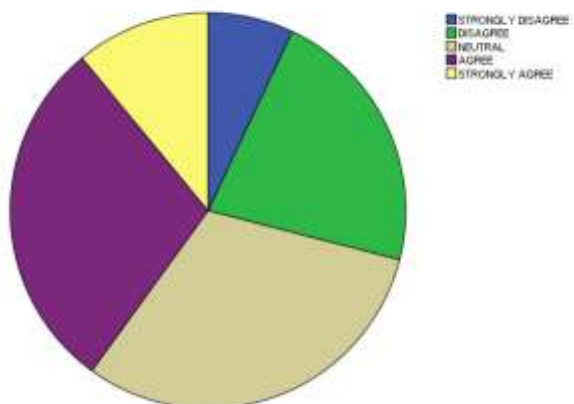AVERAGE WORKING HOURS/DAY

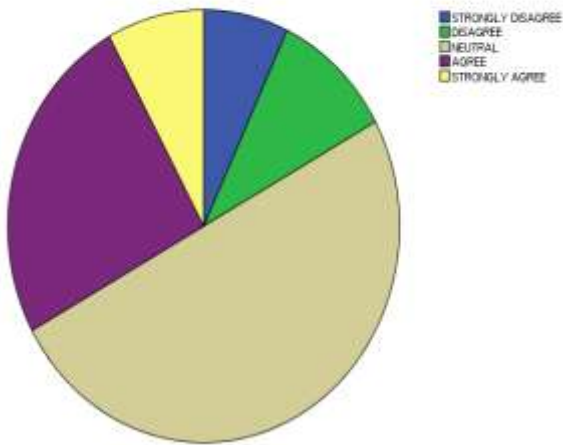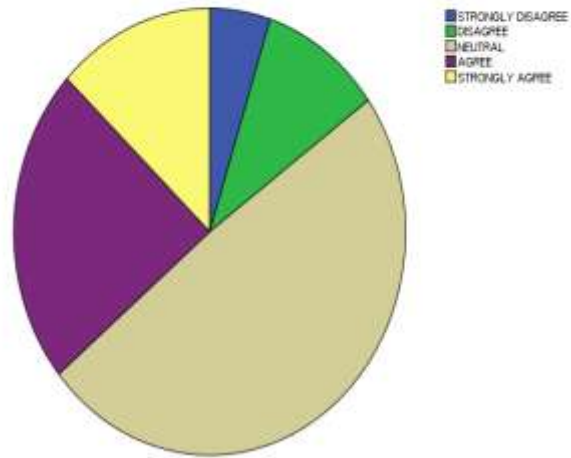AVERAGE WORKING HOURS YOU CAN DO / DAY

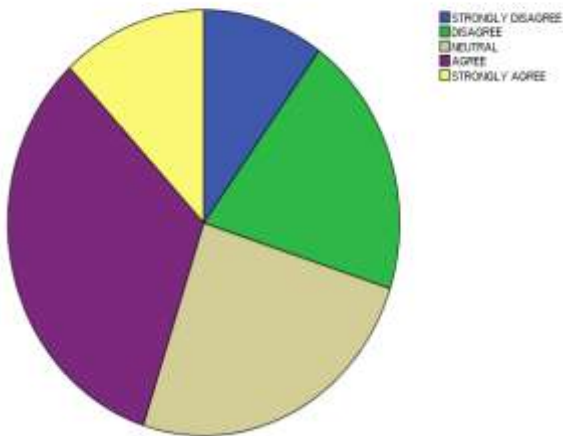
SITE CONGESTION FACTOR

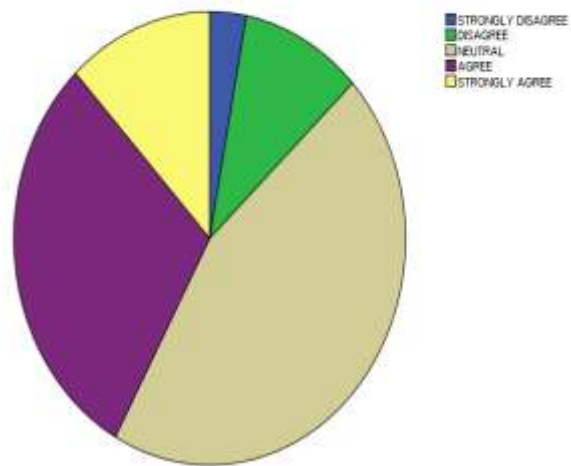OVER TIME WORK

DESIGN COMPLEXITY
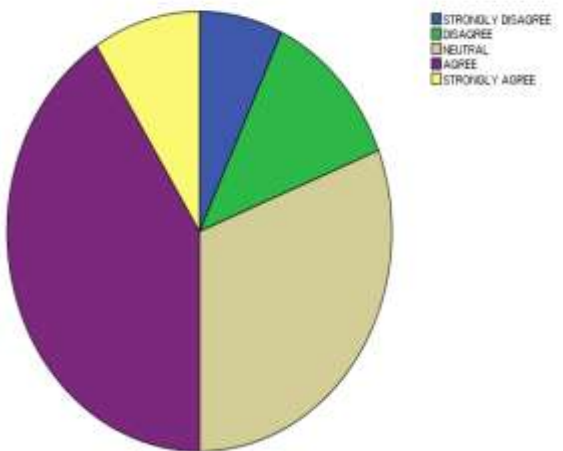
INCENTIVE/FINANCIAL REWARDS
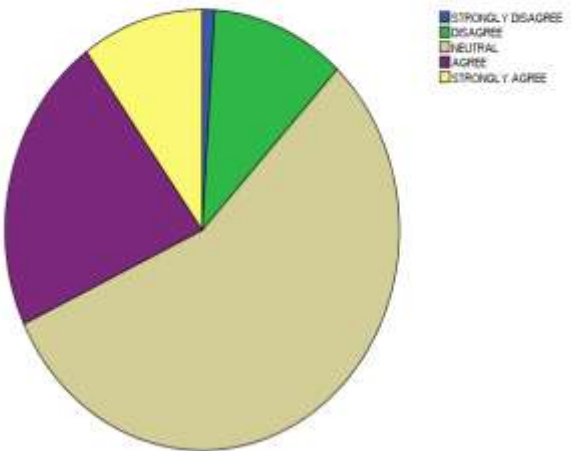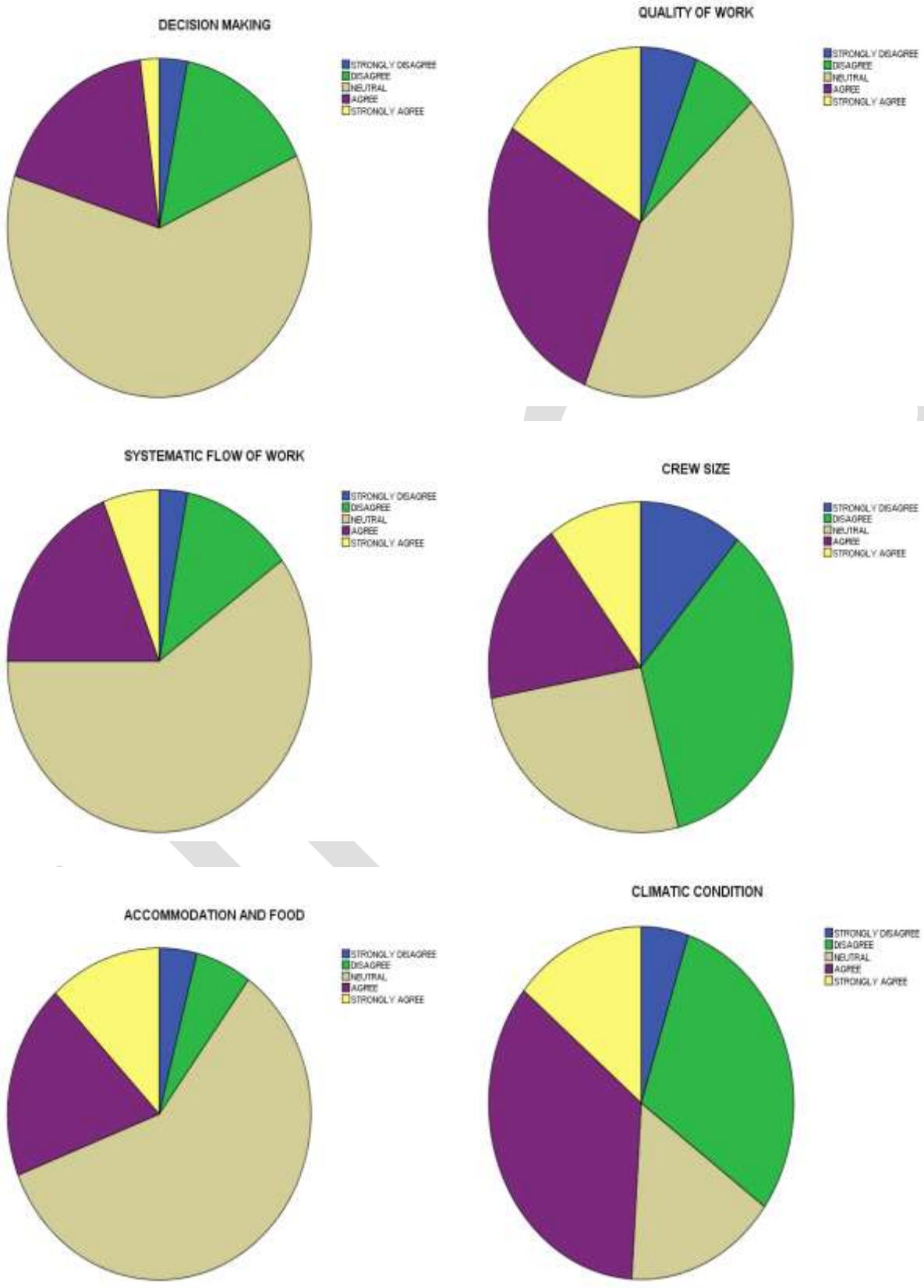

ON TIME PAYMENT

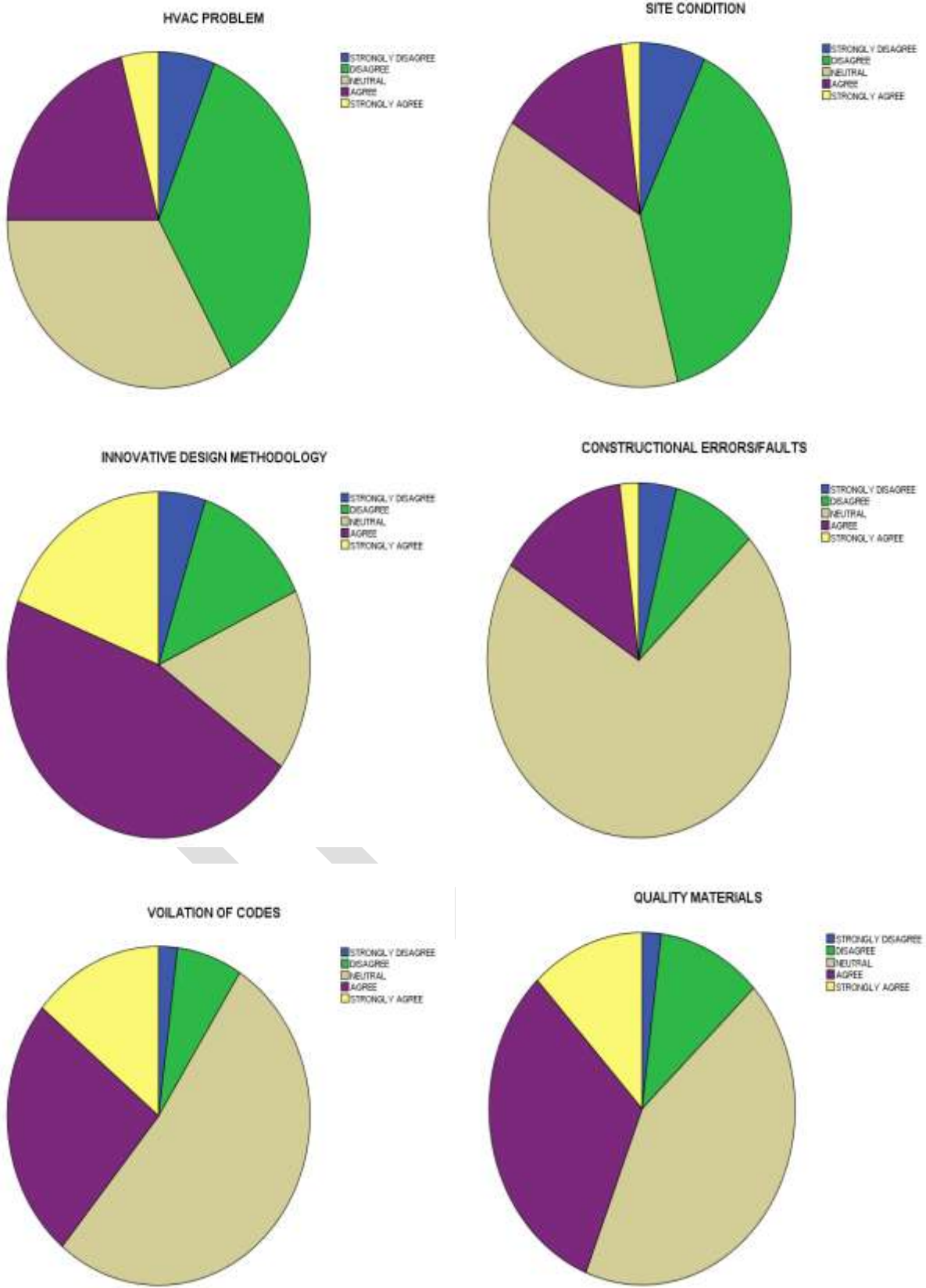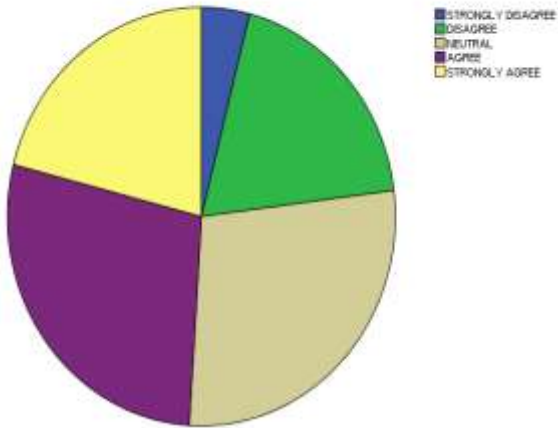DISCONTINUITY OF WORK SCHEDULE

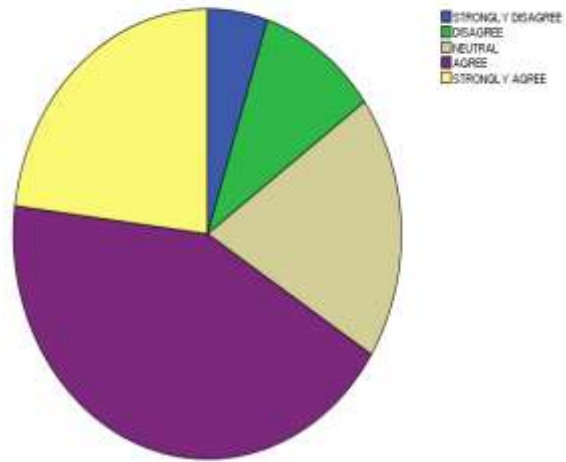SUFFICIENT AMOUNT OF PAY

CULTURAL DIFFERENCE

WORK SATISFACTION

DECISION MAKING

QUALITY OF WORK

SYSTEMATIC FLOW OF WORK

CREW SIZE

ACCOMMODATION AND FOOD

CLIMATIC CONDITION

HVAC PROBLEM

SITE CONDITION

INNOVATIVE DESIGN METHODOLOGY

CONSTRUCTIONAL ERRORS/FAULTS
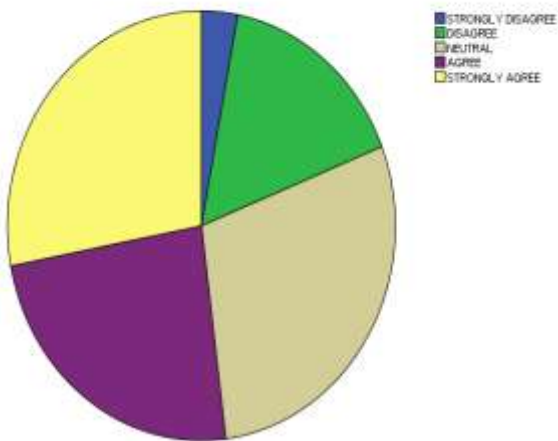
VOILATION OF CODES
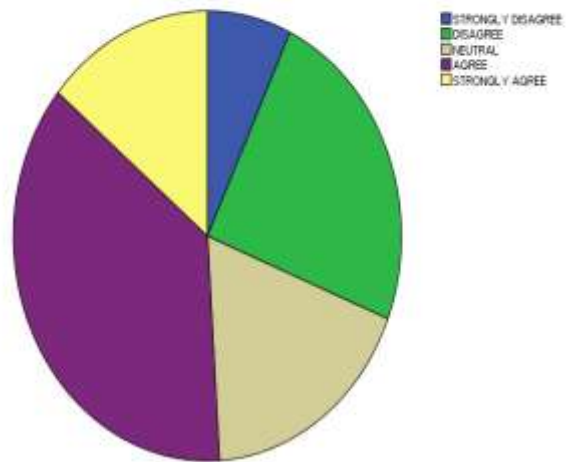
QUALITY MATERIALS

DESOLATE MATERIAL USAGE
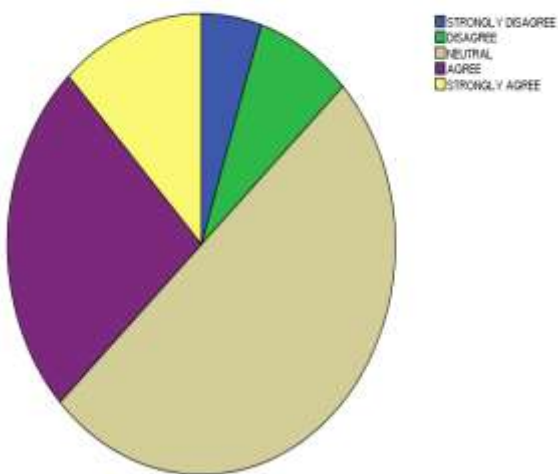

MISHANDLING OF MATERIALS
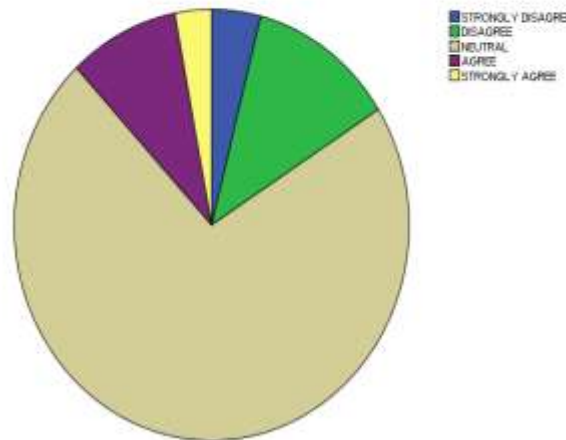

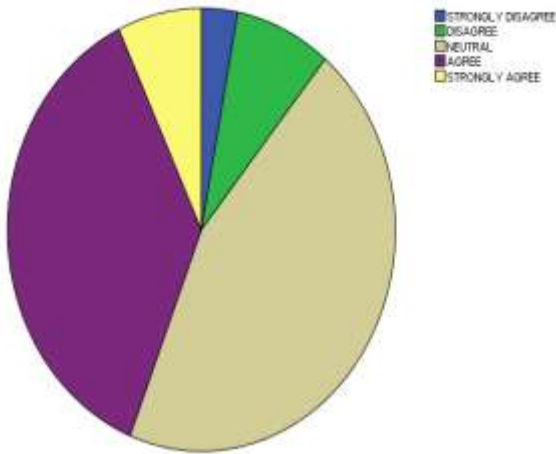PROLONGED EQUIPMENT USAGE

EQUIPMENT MALFUNCTION

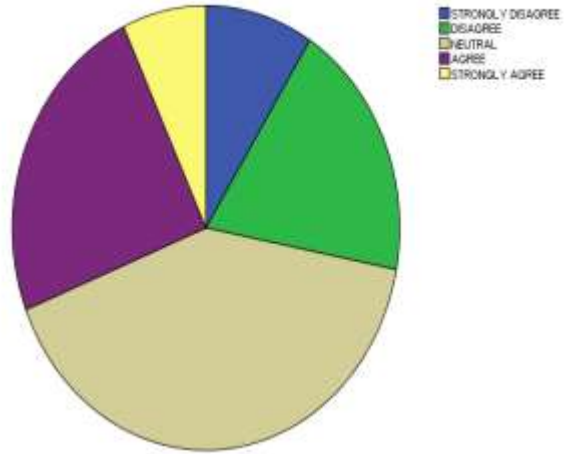POOR MAINTENANCE OF EQUIPMENTS

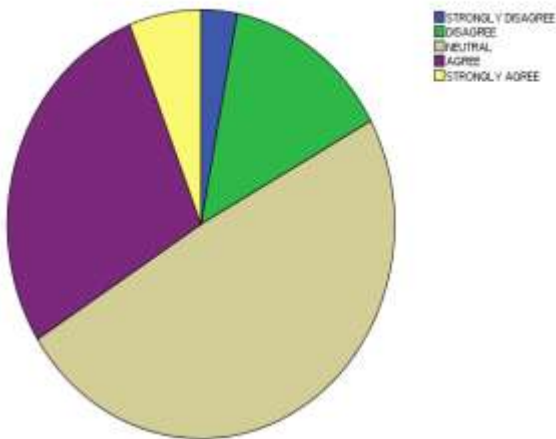TRAINING FOR OPERATING EQUIPMENTS
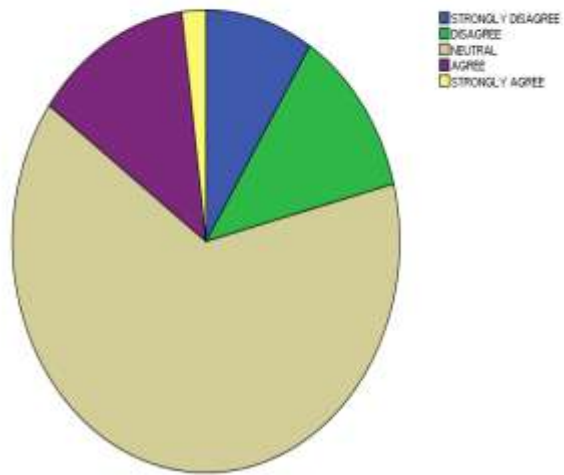
SUFFICIENT MEN AND MATERIALS
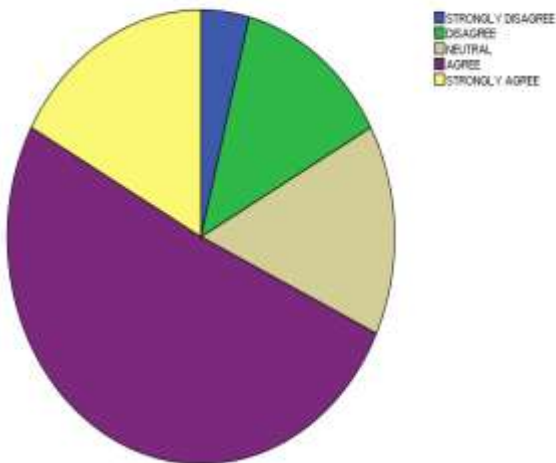

TIME PERIOD FOR ACCOMPLISHMENT
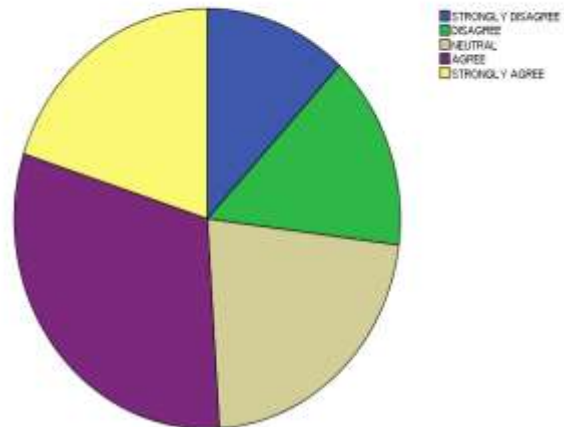

TRANSPORTATION FACILITY

POLITICAL/GOVERNMENTAL PROBLEMS

IMPROPER RESOURCE MANAGEMENT

CONTRACTUAL CONFLICTS

CONCLUSION AND RECOMMENDATIONS

From the response attained from various labours in many construction sites, the following are some of the inferences made from the obtained results which possess >50% impacts.

75 % of the people fairly agree that site congestion is creating them to work uncomfortably and 15 % of people disagrees this statement but 10% of people gave neutral answer for this factor. However this explains that site congestion will reduce the productivity of a labour in high range.

70% of people agrees that their firm is following an improper form of resource management and 15% of people answers neutrally to this statement but the balance 15% of people disagrees this statement. Thus the firm should be trained enough to follow an proper resource management scheme.

65 % of the people fairly agree that innovative design methodology will discomfort their job and 20 % of people disagrees this particular statement but 15% of the people answers neutrally for this statement. Hence normal design methodology has to be adopted in constructional works.

65% of the people agrees that their co-workers are mishandling materials due to lack of training and 20% of people answers neutrally to this statement but the balance 15% of people disagrees this statement.Thus,sufficient training is essential to labours for handling materials in an proper manner.

60 % of people fairly agrees thatover time work losses their efficiency and 30 % of people agrees this statement but only 10 % of people disagrees this statement. Thus over time work shouldn't be imposed to labours.

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Torque of Rotating Device Prior an Airplane Landing

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ABSTRACT - This papers focuses on the calculations to understand the torque required to spin the wheel of an airplane before it touches the runway. This measure is part of a proposed solution that is expected to eliminate the smoke generated by the airplane as it lands. The landing smoke is the result of high velocity difference between the landing gear wheels and the runway. Therefore, a slip occurs and causes serve grinding between the tyre and the runway where the tyre happens to be the softer surface. The calculations are based on the assumption that there is a turbine is installed on the side of the wheel.

Keywords

Airplane Wheel ; Landing smoke; Torque; Landing gear;side wind turbine; Translational drag; Rotational drag.

NOMENCLATURE

$T_{turbine}$ torque required to spin the wheel

T_{Dt} translational drag torque

T_{Dr} rotational drag torque

T_{shaft} rotating shaft torque

F_{Dt} translational drag force

F_{Dr} rotational drag force

F_r total rotating force

F_w wheel weight force

I wheel moment of inertia

I_t tire moment of inertia

I_r rim moment of inertia

ω wheel angular speed

t time required to spin the wheel

A_f wheel front area against the wind – rectangle shape

A_s wheel side area – tow sides and circumference

ρ air density at sea level

C_{Dt} transitional drag coefficient

C_{Dr} rotational drag coefficient

C_r rolling friction coefficient

R_s shaft radius

INTRODUCTION

The friction provided by the ground at the airplane touches the runway is always limited and the wheel with inertia needs time to accelerate to the landing speed. Therefore, a slip takes place and higher temperature and smoke are generated. The process of aircraft landing can be identified as one which has a considerable number of effects on the surrounding environment. These range from environmental pollution to other direct impacts on the airport itself. The environmental pollution that results encompasses not just air, and noise but water pollution (Luther, 2007)[1]. Air pollution from aircrafts is caused by two crucial sources of exhaust gases and landing smoke. This paper focuses on the imminent effects of air pollution with regard to the smoke generated during aircraft landing. The aircraft landing procedure causes pollution through a burning of tyres as result of impact of landing and the friction between tyres and the runway surface. The landing effects generate moderately high levels of air pollution (Tomita, 1964)[2]. During aircraft landing, the main wheels are the first to make contact with the ground and spin up; the nose wheel then drops to the runway and the brakes are applied to bring the aircraft to a stop. Visible landing smoke is mainly due to the wheel spin up and subsequently, due to the release of fine aerosol from brake abrasion. Thus, landing smoke is primarily a result of brake and tire wear (Cadle & Williams, 1978)[3]. However, the proposed solution deals with designing side wind turbines. This turbine should be able to spin the airplane's rear wheel before it touches the runway in order to eliminate the landing smoke. Our example for this study is the rear wheel of the Boeing 747-400. The wheel data and the airplane landing speed have been used in this study and the calculations are aimed at knowing how much torque is required to spin the airplane's rear wheel. As the wheel has a symmetric shape, it is imperative that there be a side wind turbine to spin it with.

CALCULATIONS

The wheel is moving through the air with anticlockwise rotation about its axel and zero angle of attack. The forces acting on the wheel and angular direction are shown in figure-1. The torque required from the turbine are anticlockwise direction while the air and shaft torque are clockwise direction. The air flow velocity considered as the airplane landing speed. The air drag force is the source of the side wind turbine torque which depends on the wind.

Data

Airplane approach speed (V) = 157 knots = 80.768 m/s [4]

Time (t) = 30 sec (time is assume to be enough to spin the wheel).

Table-1, shows the tire and rim data.

Table-1 tire and rim data

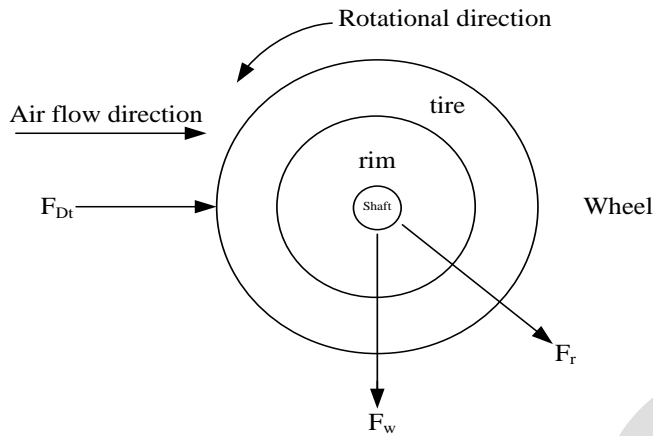|	Weight (kg)	Radius (m)	Width (m)
Tire [5]	110	0.622	0.5588
Rim [5]	74.4	0.255	--------
Wheel axel shaft [6]	--------	0.065	--------

Figure-1 Forces on an Airplane Wheel while landing

The relation for the torque on wheel is given by torque and Newton's Second Law for Rotation. In our example, the main equation for solution is:

$T_{turbine}$-T_{air}-T_{shaft}= T_{wheel}

Where,

$T_{turbine}$ torque required to rotate the wheel (Nm)

T_{air} air resistance torque (Nm). This torque is two types: $T_{air}= T_{D\ translational}+ T_{D\ rotational}$ [7]

T_{shaft} wheel shaft torque (Nm)

T_{wheel} wheel torque (Nm)

1-Wheel Torque
The solution comprises of following working formulae,

$\omega = \alpha t$

Where,

ω wheel angular speed (rad /sec)

α angular acceleration, (rad/sec^2)

$T_{wheel} = \alpha I = I \frac{\partial \omega}{\partial t}$ [8]

We first have to calculate angular acceleration (α) and moment of inertia (I). here, we have to mention that the side wind turbine weight is not consider. So, the designer have to find the weight of the turbine and then re-calculate the equations. Here, the mass moment of inertia of rim (thin plate and circular ring) is given by [9],

$I_r = \frac{m R_r^2}{2}$ for thin plate, and $I_r= m\ r^2$ for circular ring

Assume the weight of the ring is $m_1+m_2 = 74.4$ Kg, $m_1 = m_2= 37.2$ Kg

Where, m_1 is the weight of the rim flat plate part and m_2 is the weight of the rim circular ring part. Incorporation of values gives us the required moment of inertia of rim.

$$I_r = m_1 \frac{r^2}{2} + m_2 r^2 = \frac{37.2}{2} \ 0.255^2 + 37.2 \ (0.255)^2 = \ 3.628 \text{kg-m}^2$$

Moment of Inertia for Tire

By using circular ring equation; $I_t = m \ r^2$

$I_t = 110 \ (0.622)^2 = 42.56 \text{ kg-m}^2$

Total wheel moment of inertia, $I = I_t + I_r = 3.628 + 42.56 = 46.19 \text{ kg-m}^2$

In order to find angular velocity (ω), we have the following relation [8],

$V = r \ \omega$

Rearranging the equation for ω, we get

$$\omega = \frac{V}{r} = \frac{80.768}{0.622} = 129.85 \text{ rad /sec } (1239.98 \text{rpm})$$

Similarly, the angular acceleration,

$$\alpha = \frac{\partial \omega}{\partial t} = \frac{\omega f - \omega i}{t} = \frac{129.85 - 0}{30} = 4.328 \text{ rad/sec}^2$$

$T_{wheel} = I_{wheel} \alpha$

$T_{wheel} = 46.19 \text{ x } 4.33$

$T_{wheel} = 0.2 \text{kN.m}$

2-Air Resistance Torque

There are two types of aerodynamic drag forces acting on the wheel. The component of these forces gives the total aerodynamic drag on the wheel. The two types are translational and rotational drag.

A-Translational Torque

The translational torque is result of translational drag force multiply by the wheel radius. The translational drag is aerodynamic force facing the wheel when it moving during the air. However, the torque in this case can be determined by this equation:

$T_{Dt} = F_{Dt} \ r$

Where,

F_{Dt} translational drag force

To find translational torque, we have to determine the translational force:

$F_{Dt} = \frac{1}{2} \rho \ C_{Dt} A_f V^2$ [7]

Where,

$C_{D,t} = 1.98$ as flat plate against the wind 90^0 [12]

Wheel frontal area, $A_f = 2r * t_w = 0.5588 \text{ m} \times 1.244 \text{m} = 0.695 \text{ m}^2$. Here, we use the wheel facing area which is rectangle shape.

Air Density ρ_{air}= 1.225 kg/m^3

Air velocity (Airplane approach speed) V = 80.768 m/s

Hence,

$F_{Dt} = \frac{1}{2} * 1.98 * 0.695 * 1.225 * (80.768)^2$

F_{Dt}= 5.498 KN

And,

$T_{D\ translational} = 0.622 * 5.498 = 3.42$ KN. m

B- RotationalDrag Torque

Rotational drag torque is result of rotational drag force multiply by wheel radues. rotational drag force is result of rotating wheel through the air about its axel. Rotational drag force can be calculated by:

$F_{Dr} = \frac{1}{2}\rho C_{Dr}A_S r^2 \omega^2$[7]

Where,

A_s Area of Wheel side (two sides and circumference wheel area)

$A_S = 2\pi r^2 + 2\pi r\ t_w = 2\pi\ r\ (r + t_w) = 2*3.1416^2\ (0.622 + 0.5588)$

$A_s = 23.31$ m^2

Air Density ρ_{air}= 1.225 kg/m^3

C_{Dr} rotational drag coefficient

Some previews studies have been done to estimate the drag coefficient by experiments. The researchers found that the distribution of pressure force on a wheel is different when it is at stationary or when it rotates. An experiment was done on a racing car wheel by Fackrell and Harvey[10]; they found that the pressure distribution is morewhen the wheel rotating compared with the same wheel at stationary position. In addition, the coefficients of rotational drag increases to an approximate 10% of the total rotational wheel drag. This is according to wind tunnel experiment on the wheel of a racing car byMorelli.A [11].

That lead to C_{Dr} is 10% of C_{Dt} i.e.

$C_{Dr} = 0.1 * 1.98 = 0.198$

Hence,

$F_{Dr} = \frac{1}{2} * 1.225 * 0.198 * 23.31 * (0.622)^2 (129.85)^2$

F_{Dr}= 18.44 KN

And,

T_{Dr}= 11.47kN.m

T_{air}= T_{Dt}+T_{Dr} = 3.42 + 11.47 = 14.89 kN.m

3-Torque for Shaft Rotation

The forces acting on the wheel are shown in figure-2. The translational drag and wheel weight forces are acting on the axel shaft. Here, we can calculate the rolling force and then determine the rolling torque:

$$T_{rolling} = C_r * F_r * R_s \text{ [12]}$$

Where,

C_r rolling coefficient friction $= 0.001$ (assumption as steel to steel)[13]

R_s wheel axel shaft radius $= 0.065m$

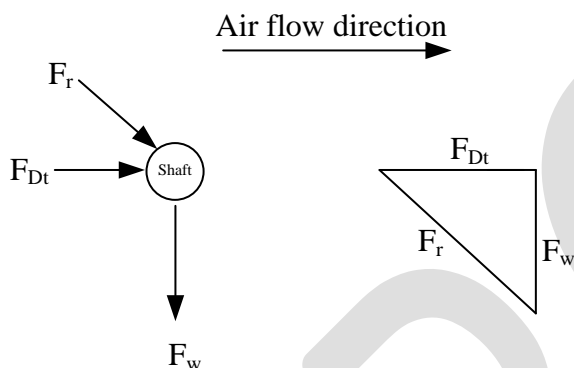F_r rolling force, can be calculate as:

Figure-2 Diagram of forces acting on wheel shaft

$F_w = 184.4 * 9.81 = 1.81 \text{ KN}, \qquad F_{Dt} = 5.498 \text{ KN}$

Hence,

$$F_r = \sqrt{F_{Dt}^2 + F_w^2} = \sqrt{(5.498)^2 + (1.81)^2} = 5.788 \text{ KN}$$

And

$$T_{shaft} = 0.001 * 0.065 * 5.788 = 0.376 \text{KN.m}$$

Now the overall torque required by the side wind turbine to spin the wheel during 30 seconds could be given as,

$$T_{turbine} = T_{wheel} + T_{air} + T_{shaft}$$

$$= 0.2 + 14.89 + 0.376$$

$$T_{turbine} = 15.47 \text{kN.m}$$

RESULTS AND DISCUSSIONS

The above listed calculations give us a maximum value of 15.84 kNm for the torque required to rotate an airplane wheel after a time lapse of 30 seconds. The table-2 gives the values of required torque (turbine torque), air torque, wheel torque and angular speed at different times.

Table-2 Variation of angular speed and torques with time

Time (seconds)	Angular speed (rad/sec)	T_{wheel} (kN.m)	T_{air} (kN.m)	$T_{turbine}$ (kN.m)
1	4.328	0.20	3.43	4.38
5	21.642	0.20	3.74	4.69
10	43.280	0.20	4.69	5.64
20	86.560	0.20	11.62	12.19
30	129.850	0.20	14.89	15.84
60	129.850	0.10	14.89	15.74
90	129.850	0.07	14.89	15.33
120	129.850	0.05	14.89	15.32

A graphical representation of the tabulated values and discussion on the obtained curves is given here. The figure-3shows that angular speed increases until it reaches a maximum at129.85 rad/secby acceleration at 4.328rad/sec^2 and then it becomes constant. We get a straight line at a wheel torque of 0.2 kNm during the time range of 0 to 30 seconds as shown in figure-4. Here the curve descents after 30 seconds due to the reason that the angular speed becomes constant after this duration of time. The relation between angular speed and time ($\frac{\partial \omega}{\partial t}$) describes clearly the descent in wheel torque reason.

The variation of torque of air with time is shown in figure-5. Here the air torque curve rises to 14.89kN.m and then becomes constant as it is a function of angular speed. The air torque is the summation of translational and rotational torques. It is rising during the 30 seconds as the rotational torque is a function angular speed. Therefore, when the angular speed becomes constant the air torque turns into steady value. The required torque (turbine torque) is shown in figure-6; it rises until 30 seconds and then becomes almost stable as the wheel continues to rotate with a constant speed. The slight descent in the curve shows decrease in the required torque as it effects by the wheel torque reduction.
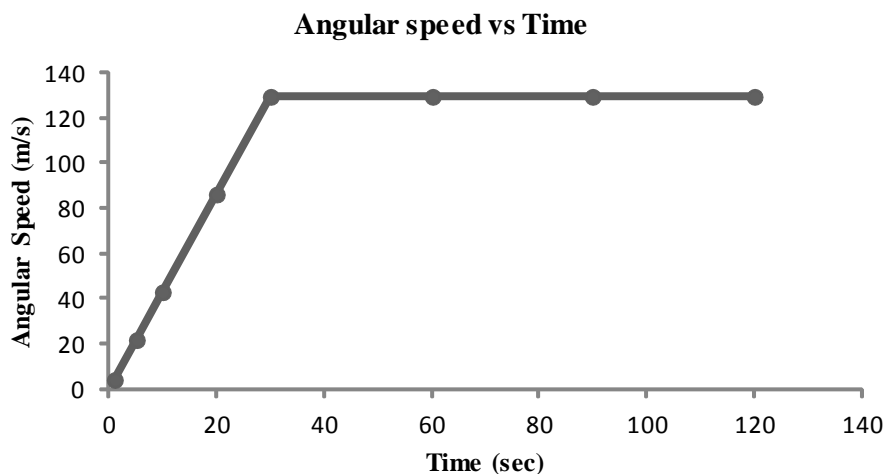
Figure-3 Variation of Angular Speed of wheel

Wheel Torque vs Time
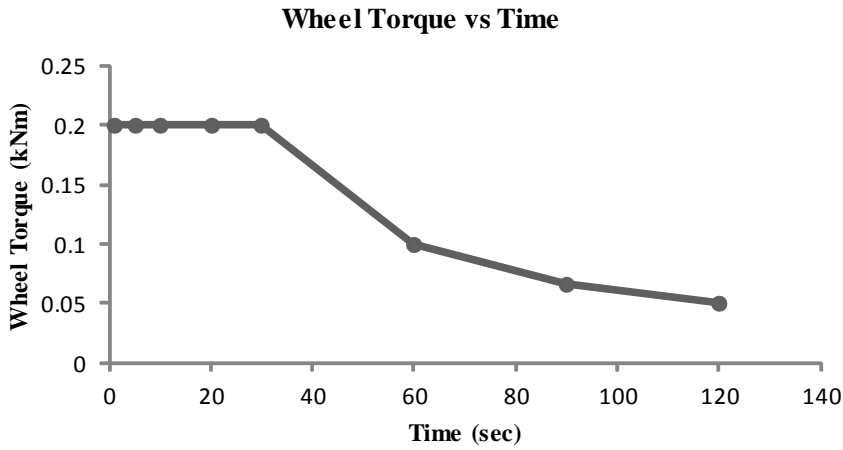

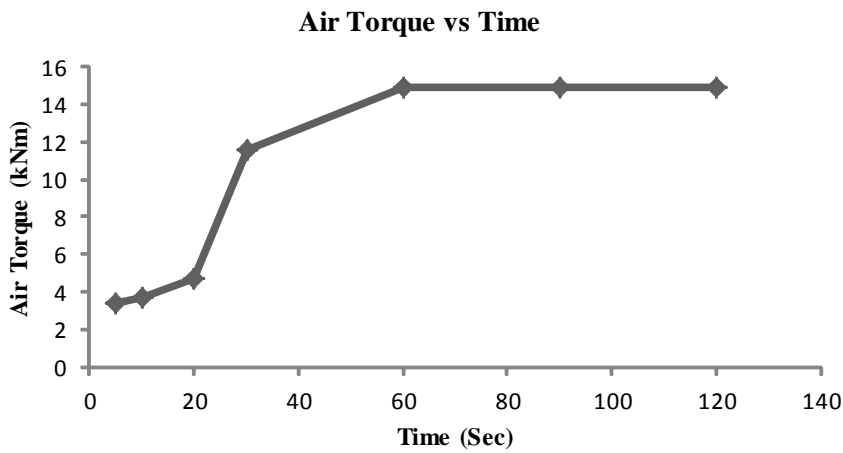**Figure-4 a graph of wheel torque against time**

Air Torque vs Time

Figure-5 a plot showing variation of air torque with time
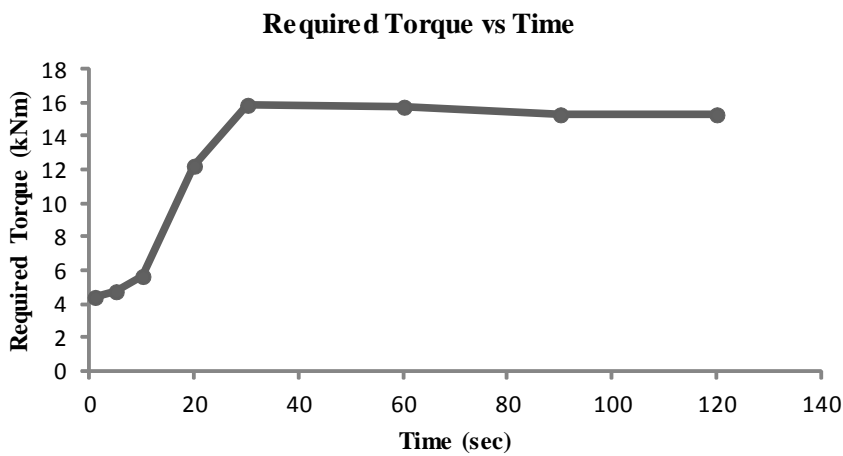
Required Torque vs Time

Figure-6 diagram of the required torque with time variation

CONCLUSION

When aircraft wheels touchdown the runway askidding phenomenon is observed. If wheels do not rotate before touchdown then this skidding can lead to landing smoke, tyres failure, and rubber loss. A simple device that can avoid skidding and can be fixed to external portion of tyre rim is a Side Wind Turbine. This device will interns eliminate the landing smoke by a percentage which will depend on the angular speed of the airplane wheels. As the speed of rotation of wheels relate to the torque of side wind turbine, its designing has to be equilibrated between its efficiency and weight. An increase in the turbine weight will cause anincrease in the total wheel weight and then more torque is required to spin the wheel. In addition, the shape of turbine must be suitable so that it can fit within the airplane undercarriage during retraction. Calculations made in this research paper give the basis for design of a side wind turbine and are useful for applications in aviation performance.

ACKNOWLEDGEMENT

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Multimedia Content Downloading In VANET with Density Estimation

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ABSTRACT – The existence of Internet-connected navigation and infotainment systems is becoming a truth that will easily lead to a remarkable growth in bandwidth demand by in-vehicle users. This content downloading system will induce the vehicular user to use the resource to the same extent as today's mobile customers. By this approach communication-enabled vehicles are paying attention in downloading different contents from Internet-based servers. We summarize the performance limits of such a vehicular multimedia content downloading system by modeling the content downloading process as an optimization problem, and maximizing the overall system throughput with density measurement. Results highlight the methods where the Roadside infrastructure i.e., access points are working at different capabilities irrespective of vehicle density, the vehicle-to-vehicle relaying, and the penetration rate of the vehicular communication.

Keywords— Vehicular ad-hoc network, Multimedia Content, Content downloading System, Max-flow problem, Security issues, Deployment, Density Estimation.

1. INTRODUCTION

Multimedia content downloading in vehicular networks by the vehicles has received increasing attention from the research community. Initially, the availability of Infrastructure-to-Vehicle (I2V) communication capabilities are based on high-throughput Dedicated Short-Range Communication (DSRC) technologies, is seen as an opportunity for transfer of large data to mobile nodes that would not be possible through the existing 2G/3G infrastructure, Next the availability of Vehicle-to-Vehicle (V2V) connectivity has fostered a number of proposals to make use of the cooperation among vehicular users so as to improve their downloading performance. Our framework introduces a DTNG time-invariant graph. We do not assume the contacts between mobile nodes to be atomic but allow them to have random duration, and also account for the presence of roadside infrastructure and channel contention. Such an approach allows us to significantly enhance the AP deployment over the given road layout, since we maximize the overall throughput and also provide the optimal solution instead of an approximation.

At the result, the access point or relay shows the vehicle capability prior and sends the corresponding low quality or high quality file. This achieves the vehicle to receive the proper file resource. Vehicle density is calculated based on previous temporal changes and the new vehicle density is calculated. The access points' capabilities are adjusted so that it works more in high vehicle density environment and works less in low vehicle density environment.

This paper is organized as follows: Section II describes the previous work, while Section III discusses contribution of work. In Section IV, we build the system model and assumption, while we generate the Dynamic Network topology graph in Section V and we formulate the max-flow problem in Section VI, Results, derived in the design guidelines described in Section VII. In section VIII, we evaluate the vehicle density based data downloading. Section IX describes Security issues; finally section X summarizes our major findings and point out direction of future work.

2. RELATED WORK

The authors U. Paul, M.M. Buddhikot, A.P. Subramanian, and S.R. Das were stated that the complete measurement analysis of network resource deployment and the subscriber activities using a large-scale data set collected within a nationwide 3G cellular network. The data set keeps close to more number of subscribers over thousands of base stations. They then examine how efficiently network resources are used by different subscribers as well as by different applications. They also find out the network traffic from the point of view of the base stations and find significant temporal and spatial variations in different parts of the vehicles in network.

In order to address such coverage uncertainties the authors Z. Zheng, P. Sinha, and S. Kumar were given a idea about new the alternating coverage for mobile users, called α-coverage, and examined how such coverage can be attained by systematic deployment of more APs to create an efficiently scalable infrastructure. In other way, a deployment of APs provides α-coverage to a network resource, if the path with length α on the road network meets with at least one AP in network topology. The authors Z. Lu, Z. Zheng, P. Sinha, and S. Kumar were also stated that with increasing popularity of media enabled devices; the need for high data-rate services for mobile users is obvious.

3. MY CONTRIBUTION

The density measurement in vehicular network my contributions to this problem are as follow:

- The access point or relay tracks the vehicle capability prior and sends the corresponding low quality or high quality file. This achieves the vehicle to receive the proper file resource
- Vehicle density is calculated based on previous temporal changes and the new vehicle density is calculated.
- The access points' capabilities are adjusted so that it works more in high vehicle density environment and works less in low vehicle density environment.
- Vehicle density based download scenario is applied to Access Points.

Proposed methods where the Roadside infrastructure i.e., access points are working at different capabilities irrespective of vehicle density.

4. SYSTEM MODEL AND ASSUMPTIONS

4.1. Network Model

We create a network composed of fixed roadside APs and vehicular users, where some of them are downloader's. They are interested in downloading multimedia content from the Internet through the APs. We consider the general case in which every downloader may be interested in different content. Downloader's can either use direct connectivity with the APs, if available, or be assisted by other vehicles acting as intermediate relays. In particular, we consider the following data *transfer paradigms*:

Direct transfers, a direct communication between an AP and a downloader. This shows the typical way mobile users interact with the infrastructure in today's wireless networks;

Connected forwarding, the result shows traffic relaying through one or more vehicles that create a multi hop path between an AP and a downloader, where all the links of the connected path exist at the time of the data transfer. This is the conventional approach to traffic delivery in ad hoc networks;

Carry-and-forward, the traffic relaying through one or more vehicles that store and carry the data, and delivering them either to the target downloader or to another relay which meet such downloader sooner.

Our approach allows us to processing a road layout and an associated vehicular mobility trace, so as to build a time expanded graph that represents the temporal network evolution. By using this graph, we formulate a max-flow problem whose solution matches our goals.

5. DYNAMIC NETWORK TOPOLOGY GRAPH

Dynamic network topology graph (DNTG) generate a from a different vehicular mobility trace in network topology, considering that on the corresponding road layout there are: (i) a set of A candidate locations (a_i, i = 1, . . . ,A) where APs could be located, (ii)a set of V vehicles (v_i, i = 1, . . . , V) travel over the road layout and participating in the network, and (iii) a set of D vehicles that wish to download data from the APs.

The major aim of the DNTG is to model all possible opportunities through which data can flow from the APs to the downloader's, possibly via relays. With known mobility trace, we identify the *contact events* between any pair of nodes (i.e., two vehicles, or an AP and a vehicle).

Each contact event is characterized by:

Link quality, The quality level of the link between the two nodes; specifically, we take as link quality metric the achievable data rate at the network layer, which depends on the distance between the two nodes

The contact starting time, i.e., the time instant at which the link between the two nodes is established or the quality level of an already established link that takes on a new value;

A contact ending time, i.e., the time instant at which the link is removed, the quality level of link has changed.
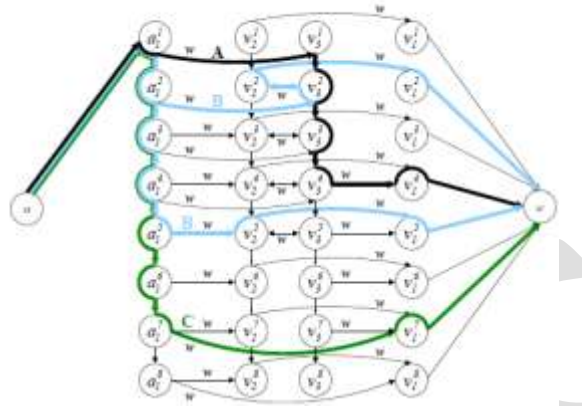
Figure1. A sample DNTG, in presence of one Access point A and three vehicles v1,v2 & v3, the first of which (v1) is a downloader while the others (v2, v3) can act as relays. The connection established in network during each frame is represented by a row of vertices. In the above graph, we highlight paths that are agent of the carry and-forward (A), connected forwarding (B), and direct (C) transfer paradigms.

Each vehicle V_i participating in the network at frame k is represented by a vertex V_i^k ($1 \le$ i $\le$V) in the DNTG, where as each candidate AP location A_i is mapped within each frame k onto a vertex A_i^k($1 \le$ i $\le$ A). We denote by V^k and A^k theset of vertices representing, respectively, the vehicles and APs in the DNTG at time frame k, while we denote by $D^k \mathsf{C} V^k$ the subset of vertices representing the downloaders that existin the network at frame k. All non-downloader vehicles in$R^k = V^k \backslash D^k$can act as relays, according to the data transfer paradigms outlined above.

Within each frame k, a directed edge ($V_i^k \in V_j^k$) exists fromvertex $V_i^k \in R^k$ to vertex $V_j^k \in V^k$ if a contact between thenon-downloader vehicle V_i and another vehicleV_j is active during that frame. Each edge of this frame type is associated with a weight w (V_i^k , V_j^k), equal to the rate of that corresponding contact event. The set including such edges is defined as L_v^k . Similarly, a directed edge (A_i^k ,V_j^k) comes from vertex $A_i^k \in A^k$ to vertex $V_j^k \in V^k$ if a contact between the candidate AP Ai and the vehicle V_j is active during frame k. Again, these edges are associated with weights w(A_i^k , V_j^k), equivalent to the contact event rate, and their set is defined as L^k a. A directed edge (V_i^k , V_i^{k+1}) is also drawn from any vertex $V_i^k \in R^k$ to any vertex $V_i^{k+1} \in R_i^{k+1}$, for $1 \le k \le$ F. While the edges in L_v^k and L_a^k represent transmission opportunity, those of the form (V_i^k, V_i^{k+1}) model the possibility that a nondownloader vehicle $V_i$physically carries some data during its association from frame k to frame k + 1. Accordingly, these edges are associated with a weight representing the vehicle storage capabilities, since they do not involve any rate-limited data transfer over the wireless medium. However, dealing with vehicular nodes as conflicted to resource-constrained hand-held devices, we take the weight of such edges to be assume on an infinite value. A directed edge (A_i^k , A_i^{k+1}) of infinite weight is also drawn between two any vertices representing the same candidate AP at two consecutive frames, i.e., from $A_i^k \epsilon A^k$ to $A_i^{k+1} \epsilon A^{k+1}$ ($1 \le$ k $\le$ F). We will refer to the edges of the kind (V_i^k , V_i^{k+1}) or (A_i^k , A_i^{k+1}) as intra-nodal.

The DNTG is therefore a weighted directed graph, representing the network topology development over time. An example of DNTG is given in Fig. 1, in presence of one AP and three vehicles v1, v2,& v3, with v1 being a downloader and v2, v3 possibly acting as relays. There, contact events divide different frames that correspond to rows of vertices in the DNTG, where intra-nodal edges connect vertices which represent the same vehicle or candidate Access point over time. To minimize the graph size, in this example we assume the achievable network-layer rate w to be constant during the complete lifetime of a link; in our performance evaluation, instead, we consider a more complex model, which accounts for pragmatic variations of the rate as a function of the distance between the two nodes. And also, note that the graph allows the capture of all the data transfer paradigms previously discussed. It is thus possible to identify paths in the graph that correspond to (1) direct download from the Access point to the downloader, as path C, (2) connected forwarding through 3-hops (frame 2) and 2-hops (frame 5), as path B, and (3) carry-and-forward through the movement in time of the relay vehicle v3, as path A.

6. THE MAX-FLOW PROBLEM

With specified DNTG, our next step is the formulation of an optimization problem whose goal is to maximize the flow from $\propto$ to ω, i.e., the total amount of downloaded data by the downloader's. Denoted by x (V_i^k, ω) the traffic flow over an edge connecting two generic vertices, our intention can be expressed as:

$$max \sum_{k=1}^{F} \sum_{V_i^k \in D^k} x(V_i^k, \omega). \qquad (1)$$

The max-flow problem needs to be solved taking into account several constraints for e.g., non negative flow and flow conservation, maximum number of APs that can be activated, and channel access. We detail such constraints below.

6.1 Constraints

Non-negative flow and flow conservation: The flow on each existing edge in DNTG must be greater than or equal to zero. Also, for any vertex in the graph, the amount of flow entering the vertex must equal the amount of outgoing flow.

Channel access: In view of the fact that we consider an IEEE 802.11-based MAC scheme with RTS/CTS and we assume unicast transmissions, two or more of the following events cannot take place simultaneously for a tagged vehicle, and the time duration of each frame must be shared among the tagged vehicle:

- The vehicle transmits to a neighboring vehicle;
- A neighboring vehicle receives from any relay;
- The vehicle receives from a neighboring relay;
- A neighboring relay transmits to any vehicle;
- The vehicle receives from a neighboring AP;
- A neighboring AP transmits to any vehicle.

Here, we only consider the total amount of data carried by each flow. Due to the use of RTS/CTS in 2) a neighboring vehicle receiving data is accounted, considering that: 1) is a subcase of 2); 3) is a subcase of 4); 5) is a subcase of 6), for the generic vertex $V_i^k \epsilon V^k$ and for any frame k. In addition, for each candidate AP, we have that its total transmission time during the generic frame k cannot exceed the frame duration. Thus, for any k and $A_j^k \epsilon A^k$, we have the equation as:

$$\sum_{V_i^k \in V^k (a_j^k, v_i^k) \epsilon L_a^k} \frac{x(a_j^k, v_m^k)}{x(a_j^k, v_m^k)} \le \tau^k \qquad (2)$$

The above constraints allow a vehicle under coverage of an AP to use I2V and V2V communication within the same frame. Next, we consider the case where a vehicle under the coverage of either one AP is not configured to work in   ad hoc mode, i.e., the communication with other vehicle is not possible. Then, for every frame k and $V_j^k \in R^k$, $V_m^k \epsilon v^k$ such that $(V_j^k, V_m^k) \in L_v^k$, the following constraint holds:

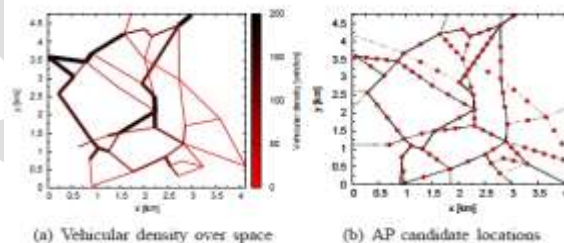(a) Vehicular density over space   (b) AP candidate locations

Figure2. Simulation scenario: (a) road layout and average density of vehicles computed over a whole day; (b) giving out of the AP candidate locations over the road layout.

$$\mathrm{x}(v_j^k, v_m^k) \leq \left(1 - \max_{\substack{a_i^k \in A^k \\ (a_j^k, v_i^k) \epsilon L_a^k}}^{k} \{y_i\}\right) w(V_j^k, V_m^k) \tau^k \quad (3)$$

Where y_i, i = 1, . . . ,A, are Boolean variables, whose value is 1 if the candidate AP Ai is activated and the value becomes 0 otherwise.

Maximum number of active APs: The final set of constraints imposes that no more than one candidate APs are selected, through the variables yi. Then, for any i, we can write:

$$y_i \in \{0,1\} \,;\, \sum_{i=1}^{A} y_i \leq \hat{A} \,;\, x(\propto. a_i^1) \leq My_i \quad (4)$$

Where M ϵ R is a randomly large positive constant.

7. DERIVING DESIGN GUIDELINES

We influence the problem formulation obtained in the previous section to show which factors issue the most in content downloading in vehicular networks and to provide practical hints for the design of a real system. We consider a real-world road topology, covering an area of 20 km2 in the urban area. The vehicular mobility in the region has been synthetically generated at urban area, through a multi-agent microscopic traffic simulator. In Fig. 2(a), we describe the road layout, high lighting the different traffic volumes observed over each road segment.

We consider a traditional technology penetration rate, i.e., that only a fraction of the vehicles, namely 10%, is equipped with a communication interface and is ready to participate in the content downloading process, either as relays or as downloader's. Also, the number of vehicular downloader's that concurrently request content is assumed to be 1% of the vehicles participating in the network. AP locations are selected along the roads such that the distance between two adjacent APs is slightly equal to 150 m, resulting in 92 candidate locations, shown in Fig. 2(b). The value of the achievable network-layer rate between any two nodes is attuned according to the distance between them. We bounded the maximum node transmission range to 200m; this distance allows the establishment of a reliable communication in 80% of the cases. In the urban, village, and suburban traces, each lasting about 5 hours, this leads to an average density of 90, 62.5, and 33.5 veh/km respectively. The value of the attainable network-layer rate between every two nodes is adjusted according to the distance between them. To summarize, we illustrate the following conclusions:

- Traffic relaying, through either connected forwarding or carry-and-forward, can considerably increase the average per-downloader throughput, even when the road layout is covered by more APs;
- Multi-hop data transfers involving more than one relay are less beneficial to the content downloading process.

8. VEHICLE DENSITY BASED ACCESS POINT DATA DOWNLOADING

In addition, the access point or relay tracks the vehicle capability prior and sends the corresponding low quality or high quality file. This achieves the vehicle to receive the proper file resource.

Vehicle density is calculated based on previous temporal changes and the new vehicle density is calculated. The access points' capabilities are adjusted so that it works more in high vehicle density environment and works less in low vehicle density environment.

9. SECURITY ISSUES

9.1 Digital signatures as a building block

The message authenticity is necessary to protect VANETs from outsiders. But since safety messages will not contain any sensitive information confidentiality is not required. As a result, the exchange of safety messages in a VANET needs authentication but no need for encryption of message. Symmetric authentication mechanisms usually encourage less overhead per message than their asymmetric counter parts. But digital signatures are a better choice in the VANET setting, because safety messages are typically standalone and should be sent to receivers as quick as possible.

9.2 Estimation of the signature size

As we intend using a PKI for supporting security in VANETs, it is significant to choose a Public Key Cryptosystem (PKCS) with a tolerable implementation overhead in the vehicular network. According to DSRC, safety messages are sent with a periodicity of 100 to 300 ms. this imposes an upper bound on the processing time overhead; this overhead is shown as follows:

$$Toh(M) = Tsign(M) + Ttx(M|SigPrKV [M]) + Tverify(M)$$

Where Tsign (M), Ttx (M), and Tverify (M) are the necessary time durations to sign, transmit, and verify a message M, respectively; SigPrKV [M] is the signature of M by the distributing vehicle V and includes the CA's certificate of the signing key. The above expression shows the two factors that affect the choice of a particular PKCS: (1) the execution speeds of the signature generation and the verification operations, and (2) the sizes of key, signature, and certificate.

10. CONCLUSION

We examined the main factors affecting the performance of content downloading process in vehicular networks, by formulating and solving a max-flow problem over a time extended graph representing a realistic vehicular trace.

The major findings in our analysis are as follows:

Our major ideas are that a density-based AP deployment yields performance close to the optimum result, and that multi-hop traffic delivery is valuable, although the gain is negligible beyond 2 hops from the AP.

The access points' capabilities are adjusted so that it works more in high vehicle density environment and works less in low vehicle density environment.

To our best knowledge, this paper addressing the security of vehicular networks in a systematic and quantified way. In terms of future work, we aim to further develop this proposal. In particular, we plan to explore in more detail the respective merits of key distribution by the manufacturers or by legislative bodies; we will also going to carry out additional numerical evaluations of the solutions.

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Effect of Velocity and Particle Size on the Coefficient of Heat Transfer in Fluidized Bed Heat Exchanger

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ABSTRACT - Fluidized bed Heat exchangers are important inmany industrial applications. Understanding how a fluidized bed as a multiphase flow system operates will improve its capabilities and operations. Minimum fluidization velocity and local gas holdup are important parameters used to characterize the hydrodynamic behavior of a material inside the fluidized bed.

Fluidization is the phenomenon of imparting the properties of a fluid to a bed of particulate solids by passing atmospheric air through the material. Fluidized beds are reactors in which fluidization of particulate solids takes place. Fluidized beds are an important asset in many industrial processes because they present several advantages that include a high rate of heat and mass transfer, low pressure drops, and uniform temperature distribution.

Experiments have been carried out in a setup i.e. in a fluidized bed heat exchanger, to find out the Heat transfer coefficient between different silica sand particles and in different velocities of air. The whole sand bed is heated by cartage heater. An experiment is performed with three different sand particles with different diameter and ten different gas velocities. The bed particles are chosen by taking Geldart's criteria. Silica sand particles are of diameter 300-450μm, 425-650μm and 600-850μm. Fluidization is carried out by using air having normal temperature.

It was found in literature survey that Higher rate of heat transfer is obtained by increasing the flow rate and by decreasing the size of the particle.

The experimental results showed that the Heat transfer coefficient is increased with increasing the air velocity. It is also found that the Heat transfer decrease by increasing the particle size for Geldart B group particles.

Keywords: Fluidization, Fluidized bed heat exchanger, Bubbling Fluidization,Silica sand, heat transfer, Thermal coefficient, Heat Transfer coefficient, Operating variables,Gas velocity

1. INTRODUCTION

The major objectives of this work are to study the heat transfer effect on the fluidized bed, to determining the heat transfer rate at different points in the fluidized bed, to determine the effect of heat transfer at different sand particle and with varying velocity of air. A setup of thermal-coil is inserted in the fluidized bed to study the effect of heat transfer rate from the particle to fluid that is air bubbling Gas-Solid fluidized bed in order to find the suitability of sand as a bed material in Gas-Solid fluidized bed An experiment has been carried out in a setup of fluidized bed heat exchanger with atmospheric air as a fluidizing medium and silica sand of diameter 300-450μm, 425-650μm and 600-850μm diameter.

When a gas flow is introduced through the bottom of a bed of solid particles, it moved upward through the bed via the empty spaces between the particles. At low gas velocities, aerodynamic drag on each particle has also low, and thus the bed remained in a fixed state. Increased in the velocity, the aerodynamic drag forces started to counteract the gravitational forces caused the bed to expand in volume as the particles moved away from each other. Further increasing the velocity, it is reached a critical value at which the upward drag forces exactly equal the downward gravitational forces, caused the particles to become suspended within the fluid. At this critical value, the bed is said to be fluidized and is exhibit fluidic behavior. By further increased in gas velocity, the bulk density of the bed is decreased, and its fluidization became more efficient, until the particles no longer formed a bed and are "conveyed" upwards by the gas flow. When it fluidized, a bed of solid particles behaved as a fluid, like a liquid or gas.

A large amount of research is done on this technology due to the advantages of fluidized bed reactors. Most current research have been done to explain how the velocity of gas affects the heat transfer in fluidized bed under varying particle size and velocity of air. Lots of literature available on the heat transfer coefficient, but there is considerably less literature available on the heat transfer coefficient in that they give effect of different velocities on heat transfer in presence of horizontal cartage heater.
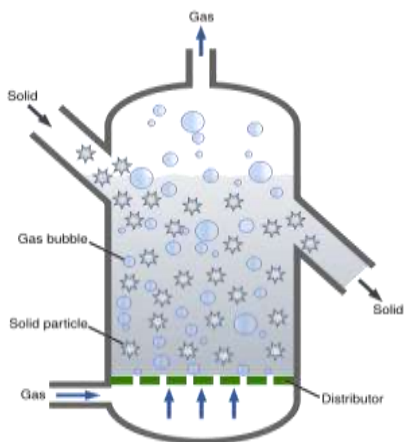
Figure1: schematic drawing of a fluidized bed

Anusaya M. Salwe, 2013 made her study on Local heat transfer coefficient around a horizontal heating element in gas-solid fluidized bed and concluded that the heat transfer rate is observed maximum at the 0 degree and minimum at 180 degree from the bottom of the chamber. They also carried out experiments in a laboratory gas-solid fluidized bed heat exchanger. Heat transfer coefficient between immersed heated tube and bubbling fluidized bed is found experimentally around a tube. An experiment is performed with three different particle diameter and ten different superficial gas velocities. The bed particles used were Geldart B silica sand particles of diameter 200μm, 350μm and 500μm. Fluidizing media used was atmospheric air. The experimental result shows that Heat transfer coefficient is increase with increase in the air velocity and it is found to be decreased by increased in the particle size for Geldart B group particles. G.K.Roy& K.J .R. Sarma(1970) concluded that the heat transfer in fluidized bed is by convection. Francesco Miccio, Andrea De Riccardis, Michele Miccio (2009) determined the heat transfer coefficient for bubbling fluidized bed. Araí A. BernárdezPécora and Maria Regina Parise, (2006) concluded that Heat transfer coefficient increases with the solid particle mass flow rate. Jelena N. Janevski, BranislavStojanović, (2004) concluded that thermal conductivity depends on the intensity of mixing and heat transfer rate is higher in axial direction than radial direction.

2. EXPERIMENTAL PROGRAMME

The two-dimensional fluidized-chamber (shown schematically in Fig. 1) is 150 mm in length, 120 mm width and 800 mm tall (internal dimensions), constructed of 1 mm thick galvanized sheets. This fluidizing air is regulated by butterfly valve before passing through a sintered-metal plate distributor. Metal distribute plate is fixed in between fluidizing chamber and lower rectangular funnel. Pressure drop across the distributor is sufficiently high that at most fluidizing conditions it exceeds the pressure drop over the rest of the bed.

Fluidized bed heat exchange chamber contains bed of sand particles which is of same dimension as that of fluidizing chamber; the height of sand bed is 120 mm with inserted cartage heater (thermal coils[7]) as well as systems of air supply, and heat supply from the dimmer stat[8]. The heating coil is located 100 mm above from the bottom of the fluidized bed. The heater has dimension of 15 mm diameter. The surface of the active side of the heater is inserted in the sand particles. Air enters from the blower[1] and is transferred through the pipes towards the nozzle[6]connecting the distributor plate in the fluidized bed and the blower pipeline. Quartz sand[3] with diameters in the range of 300-450μm, 425-650μm and 600-850μm was employed in fluidized bed. The power of the heat exchanger can be varied using a dimmer stat.

Air from the blower is supplied from the atmosphere and ambient temperature and pressure. The air from the blower is connected through a butterfly valve where the velocity of the air coming can be controlled.
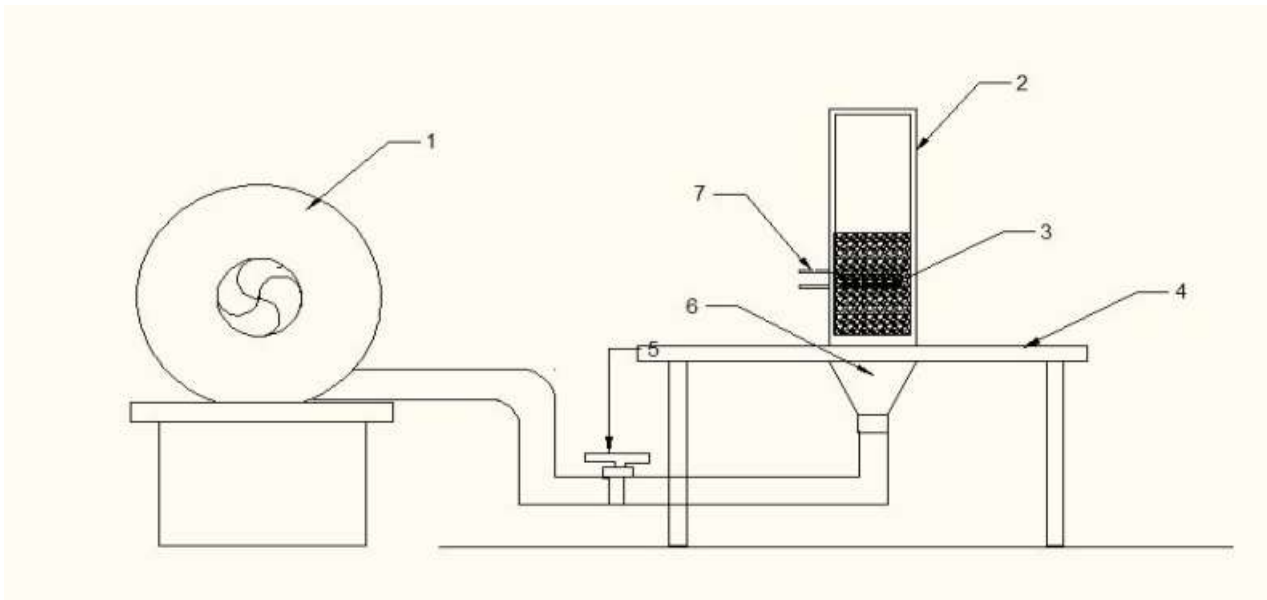
Figure 2: General Experiment setup

(1.Blower, 2.Fluidised bed chamber, 3.Be particles, 4.Support, 5.Valve (butterfly valve),

6. Distributor plate setup, 7.Thermal coils (with fins and without fins))

Readings are taken by taking one sand particle at different velocities. All the readings are taken at a steady state. Likewise all the readings are taken for different sand particle, with varied velocity of air.

2.1 INSTRUMENTATION

In the setup, different 4 number of k type thermo couples are attached to the chamber in contact with sand bed, for getting different temperature reading from different places of fluidized bed. 2 more thermo couples are attached on the upper and lower surface of cartage heater for giving the temperature reading. A Voltmeter and Ammeter is used to vary the voltage and current. A blower of the capacity 1.5 m³/min. is used to supply compressed air to the fluidizing column through diffuser and distributor plate. A butterfly valve mounted over an inlet pipe allows regulating the rate of flow of air. A differential manometer is connected across an orifice meter. Readings of the manometer is calibrated to get the velocity of the inlet air. Another differential manometer is connected to the fluidizing medium to find the pressure drop across the column.
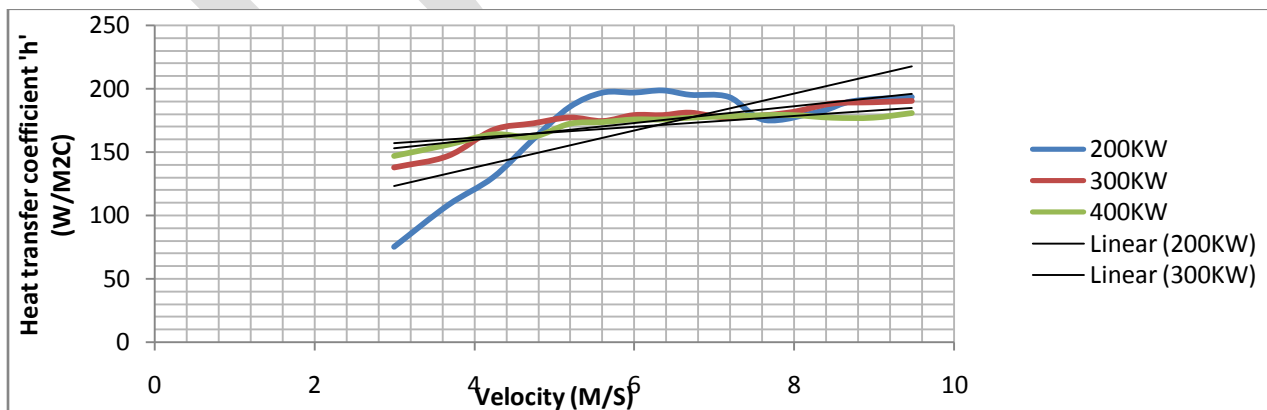
3. RESULTS

Figure 3: Distribution of heat transfer coefficient in different velocities for Sand particles size 300-450μm.
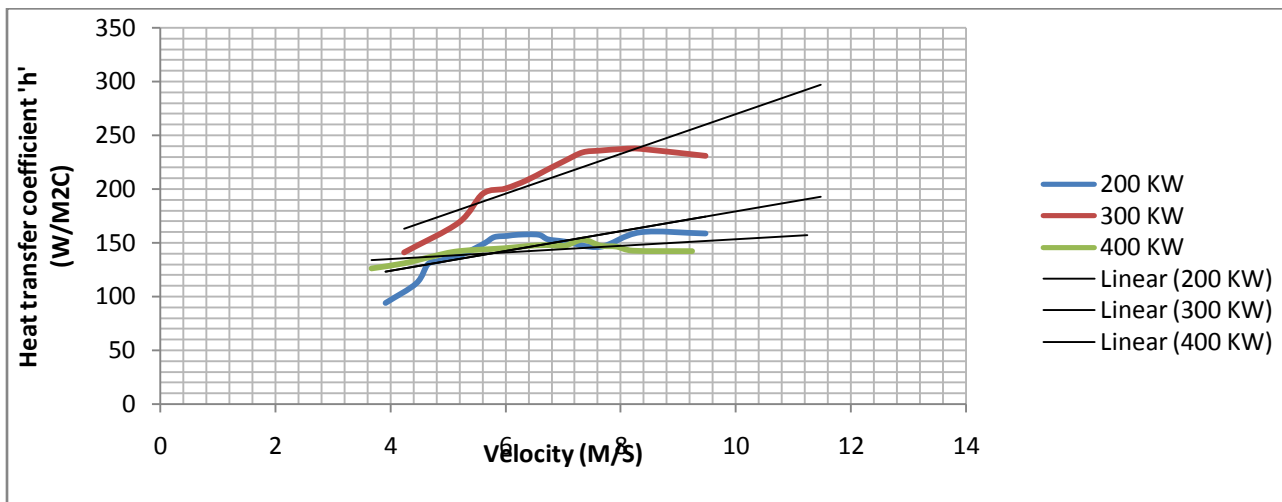
Figure 4: Distribution of heat transfer coefficient in different velocities for Sand particles size 425-650µm.
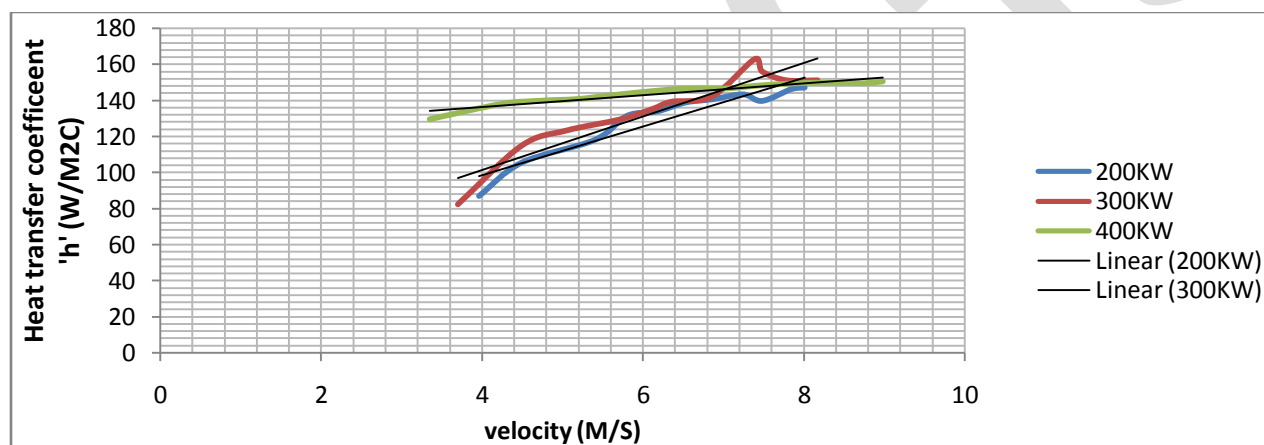

Figure 5: Distribution of heat transfer coefficient in different velocities for Sand particles size 600-850µm.

4. CONCLUSIONS

[1] Silica sand is having good fluidizing properties.
[2] The overall heat transfer coefficient h increases with increase in velocity and as the particle size increase, the heat transfer coefficient decreased. This is proved in fig.3, 4 and 5.
[3] Heat transfer coefficient between heated tube and silica sand varies between 80 to 250 W/m^2K.

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Hydrogeochemical Characteristics and Evolution of Coastal Groundwater at Cuddalore Area, Tamilnadu, India

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ABSTRACT - The hydrogeochemical data of groundwater's of the different aquifers of the Cuddalore coastal area, Tamilnadu were examined to determine the main factors controlling the groundwater chemistry and salinity as well as its hydrogeochemical evolution. The geology of the area plays a significant role in the determination of the groundwater potential of the region. The area underline by the various geological formations ranging in age from the oldest Archaean rocks to recent sediments. Groundwater of the coastal alluvial aquifer has the highest conductivity values in the study area due to the impact of seawater and agricultural activities. Piper diagram showed that Cl and SO4 are the dominant anions, whereas Na is the most dominant cation, where it is sometimes replaced by Ca and/or Mg in the hydrochemical facies of the ground waters. The paper revealed that the groundwater has been evolved from Ca-HCO3 recharge water through mixing with the pre-existing groundwater to give mixed water of Mg- SO4 and Mg-Cl types that eventually reached a final stage of evolution represented by a Na-Cl water type. Different ionic ratios revealed the impact of seawater and marine aerosols on the hydrochemical composition of groundwater of the Quaternary aquifer. Dissolution of carbonate and sulfate minerals in the aquifer matrices and recharge areas as well as cation exchange are shown to modify the concentration of ions in groundwater. Groundwater-mineral equilibrium showed the prevailing dissolution-precipitation reactions in the groundwater.

Keywords: Hydrogeochemistry, Groundwater, water facies, saline water,

INTRODUCTION

Groundwater often serves as drinking water in rural areas located along the Cuddalore coast of Tamilnadu, India. Many problems normally arise due to indiscriminate use of ground water over long periods. This includes problems such as water logging, sea water intrusion in coastal aquifer, critical lowering of water table, land subsidence and water quality deterioration, and are often attributed to an inadequate analysis of the response of various aquifer stresses on the ground water behavior. Groundwater in an alluvial aquifer, probably the dominant type of aquifer in the coastal area, is relatively vulnerable to the contamination by seawater intrusion, which

makes groundwater unsuitable for drinking. As a result of chemical and biochemical interaction between groundwater and contaminants from urban, industrial and agricultural activities along with geological materials through which it flows, it contains a wide variety of dissolved inorganic chemical constituents in various concentrations. When seawater intrusion is the only cause for the salinity of groundwater in an aquifer system, the groundwater does not only exhibit high total dissolved solids (TDS) but also shows high concentrations of most major cations and anions (Richter and Kreitler, 1993). Hydrogeochemical data helps in estimating the extended of mixing, the circulating pathways and residence time of groundwater (Edmunds, 1994). The type and concentration of salts in depend on the geological environment and movement of groundwater (Ragunath, 1987). The purposes of this study are to examine spatial and temporal variations of groundwater chemistry in a coastal aquifer system, which is located in Cuddalore coastal area, and to interpret reasonable processes that control the groundwater chemistry. Chemical compositions of groundwater and Chemical aspects were used to determine factors affecting the hydrogeochemistry of groundwater in the study area.

LOCATION OF THE AREA

Area chosen for study is Cuddalore region, which is located in southern part of Cuddalore district in the east coast of India (Figure 1). It lies in between $79^{o} 29^{\cdot\cdot}E$ to $79^{o} 54^{\cdot\cdot}E$ longitude and $11^{o} 20^{\cdot\cdot}N$ to $11^{o} 45^{\cdot\cdot}N$ latitudes (Fig 1). Long term average rainfall of the district is 1160.36mm. Groundwater in this area is overexploited for agriculture and industrial purposes are predominant land use in this area, which induces salinity in the coastal aquifers, and coastal stretch of Cuddalore district is about 10km. The geology of the area plays a significant role in the determination of the groundwater potential of the region. The area lies between the various geological formations ranging in age from the oldest Archaean rocks to recent sediments. The most common outcrops in the area are limestone, sandstone and clays. These are covered in places by lateritic, kankar and alluvium. The tertiary formation having good potential groundwater covered by sandstone argillaceous and pebble bearing grits, clays (variegated) with lignite seams and pebble beds.
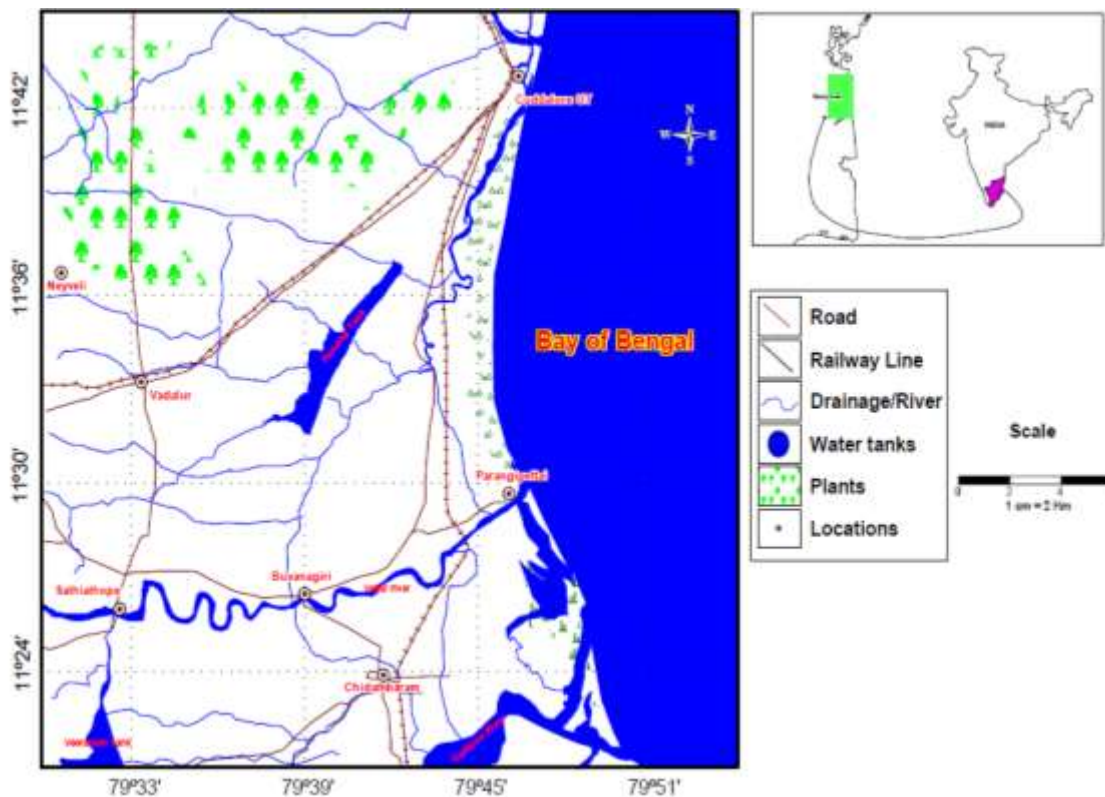
Fig 1: Location map of the study area.

MATERIAL AND METHODS

Totally fifty four groundwater samples were collected during post monsoon (POM) and pre monsoon (PRM) in year 2007 mostly covered by the shallow aquifers in this region. The samples collected after 10 minutes pumping and stored in polyethylene bottles. pH, electrical conductivity (EC) and total dissolved solids (TDS) were measured by handheld pH, EC and TDS meter in the field. The collected samples were analyzed for major cations, like Ca^+ and Mg^+ by Titrimetry, Na^+ and K^+ by flame photometry (AIMIL); anions, like Cl^- and HCO_3^- by Titrimetry, SO_4^-, PO_4^-, NO_3^- and H_4SiO_4 by Spectrophotometer (JENWAY 6505). The analyses (APHA 1998) were done by adopting standard procedures.

RESULT AND DISCUSSION

Groundwater samples were collated in space and time and analyzed for major and minor dissolved ions using standard procedures. The results of the physical – chemical analysis of the ground waters of Cuddalore coastal aquifers for two seasons are given in table 1 the maximum minimum and average of the samples. In general pH of the waters is alkaline in nature. The pH is controlled by total alkalinity of the ground water and partially by sea water mixing. pH in the study area varies from 6.6 to 8.1 with an average of 7.4 in post monsoon and in pre monsoon it ranges from 6.4 to 7.8 with an average of 7.17. EC varies from 354 to 1596 $\mu s/cm$ with an average of 827 $\mu s/cm^2$ in post monsoon and 258 to 2630 $\mu s/cm$ with an average of 827.32$\mu s/cm$ in pre monsoon. Total

dissolved solids (TDS) ranges vary from 247.8 to 1117 mg/l with an average of 579.41 mg/l in post monsoon and 208.60 to 1809 mg/l with an average of 581.82 mg/l in pre monsoons. The water samples of the study area are classified as fresh to brackish in nature. Bicarbonate is the dominant anion followed by chloride, sulphate, nitrate and phosphate in post monsoon season and in pre monsoon bicarbonate is the dominant anion followed by chloride, sulphate and phosphate. The dominant cations are as follows: calcium followed by sodium, potassium and magnesium during post monsoon and calcium followed by magnesium, sodium and potassium in pre monsoon. The spatial distribution of EC of samples was carried out for all five major seasons (figure 2). In general, EC found to be higher near the coastal areas. The Neyveli mine area shows high concentration in pre monsoon which indicate the over exploration of groundwater. The EC spatial diagram mainly shows variation of the concentration in area wise. Majority of the coastal regions of the study area affected by the salt water intrusion due to the over exploration of groundwater by Veeranam metro project, Neyveli Lignite mines, agriculture and domestic purposes (Prasanna et al, 2010).

Table 1: Comparison of chemical composition of water with WHO (2004) and ISI (1995) in mg/l (except EC in $\square$s/cm and pH)

| Parameters	POM 07		PRM 07		WHO (2004)	Highest desirable	ISI (1995)
	Min	Max	Min	Max			
pH	6.60	8.10	6.40	7.80	6.5-8.5	7-8.5	6.5-9.2
EC	578.90	3104.15	495.99	2833.56	1400.00	-	-
TDS	320.50	2152.00	331.27	1973.05	1000.00	500.00	1500.0
Ca	26.90	125.36	20.85	101.48	500.00	75.00	200.0
Mg	12.20	66.60	7.47	81.67	-	30.00	100.0
Na	22.50	421.25	16.60	504.10	200.00	-	-
K	15.70	76.00	7.18	57.89	-	-	-
Cl	74.50	856.24	68.36	984.25	250.00	250.00	1000.0
HCO$_3$	81.70	394.20	75.24	331.72	-	300.00	600.0
SO$_4$	1.40	27.36	2.86	41.20	400.00	150.00	400.0
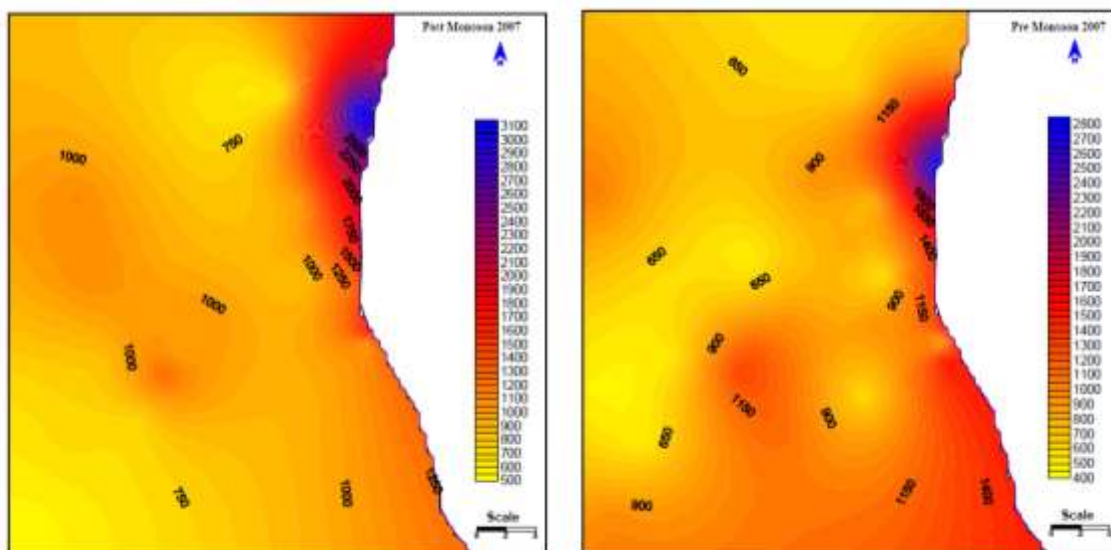
Figure 2: Spatial distribution of EC (µs/cm) in groundwater during the year 2007

The trilinear piper diagram is one way of comparing quality of water. It is the first step of determining the water facies for the purposes of studying the evolution of groundwater (Vajrappa et al, 2007). studied Irrigation effects on the salinity of the Arba and Riguel Rivers (Spain), they evolved from a Calcium Bi Carbonate composition by using the Piper Classification. Geological hydro geochemical investigation of the Uranium potential of an area between Orange and Kuruman River (Levin, 1980) has discussed the salinity of groundwater with the Piper diagram. The geochemical evolution of groundwater can be understood by plotting the concentration of major cations and anions in the Piper (1994) trilinear diagram. It consists of two lower triangular fields and a central diamond shaped fields. All the three fields have incorporation of major ions only.
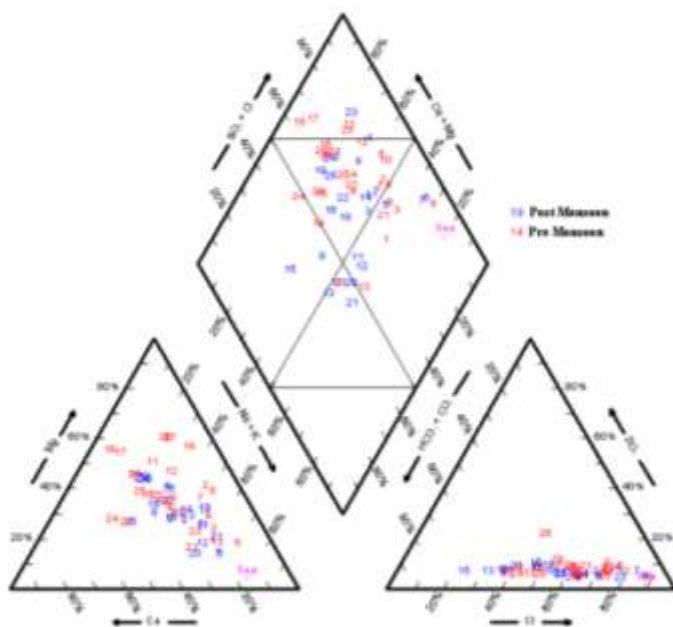

Figure 3: Hill Piper Plot for the groundwater in 2007 (after Hill Piper, 1944)

The Triangular fields are plotted separately with epm values of cations Ca,Mg alkali earth, (Na+ K) alkali, HCO3 weak acid SO4 and Cl strong acid. Water facies can be identified by projection of plots in the central diamond shaped field (Chidambaram 2000 and Pandian and Sankar 2007). Hydro geochemical facies interpretation is a useful tool for determining the flow pattern, origin of chemical histories of groundwater masses. The plot (Figure 3) of POM samples fall in the Na-Cl (40%) type of water, followed by Mg-Cl (28%), Na-HCO3 (16%), Ca-Cl (8%) and Ca-HCO3 (8%) type of water. In PRM (41%) sample fall in Na-Cl type of water, followed by Mg-Cl (31%), Ca-Cl (14%), Na-HCO3 (8%), Ca-HCO3 (3%) and Mg-HCO3 (3%). The concept of Hydrogeochemical facies offers a mass regional relation between chemical character, lithology and regional flow pattern. For all 2 seasons there exists a continuous mixing of Na, Cl and Mg with few representations of HCO_3 and Ca. Thus, the ground water chemistry of the area is mainly controlled by chemical weathering followed by infiltration, leaching, evaporation, sea water intrusion and anthropogenic activities. The POM and PRM seasons Na-Cl type of water dominated in coastal areas indicating sea water intrusion and the representation of other samples indicate rock weathering, evaporation and leaching

The SAR (alkali hazard) and specific conductance (Salinity hazard) is plotted in USSL diagram (Figure 43), classification of water for irrigation purpose can be determined. In year 2007, POM samples fall in C3S2 range and one sample fall in C3S2 area, comparatively POM POM 07 data shows that the salinity concentration increases from medium to high conductivity due to saline water intrusion. Soils in this terrain are to be preferablly salt tolerance plants (Karanth 1989). In PRM sample fall C2S2 (40%) and C3S1 (60%) it indicates the high salinity and medium sodium hazard. applications of gypsum, make water feasible and also increases soil permeability (Goyal and Jain 1982).
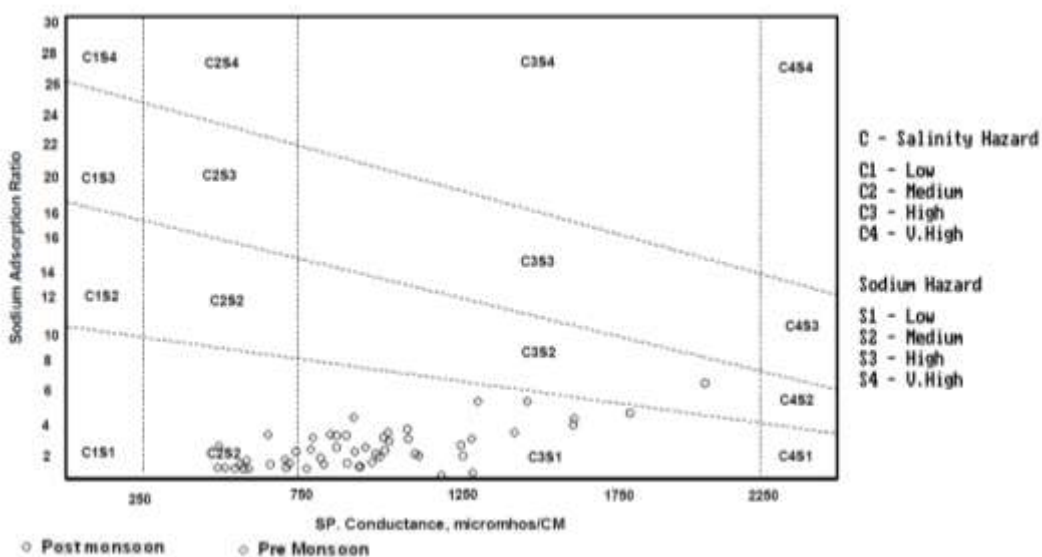

Figure 4: USSL classification for the groundwater in 2007 (after USSL, 1954)

The Piper diagram (Johnson 1975) in year 2007 (Figure 5), POM (48%) and PRM (42%) samples fall in zone contaminated with gypsum and also with few representations in static and disco-ordinate regimes indicating weathering of bed rocks and intensive ion exchange process in this region. During PRM season most of the samples (38%) fall in Ca+Mg and SO4+Cl category. The PRM seasons in 2007 have higher secondary salts precipitation, with fewer representations in Ca+Mg and SO4+Cl and Ca+Mg, SO4+Cl and HCO3+CO3 indicating the secondary precipitation of salts in all seasons.
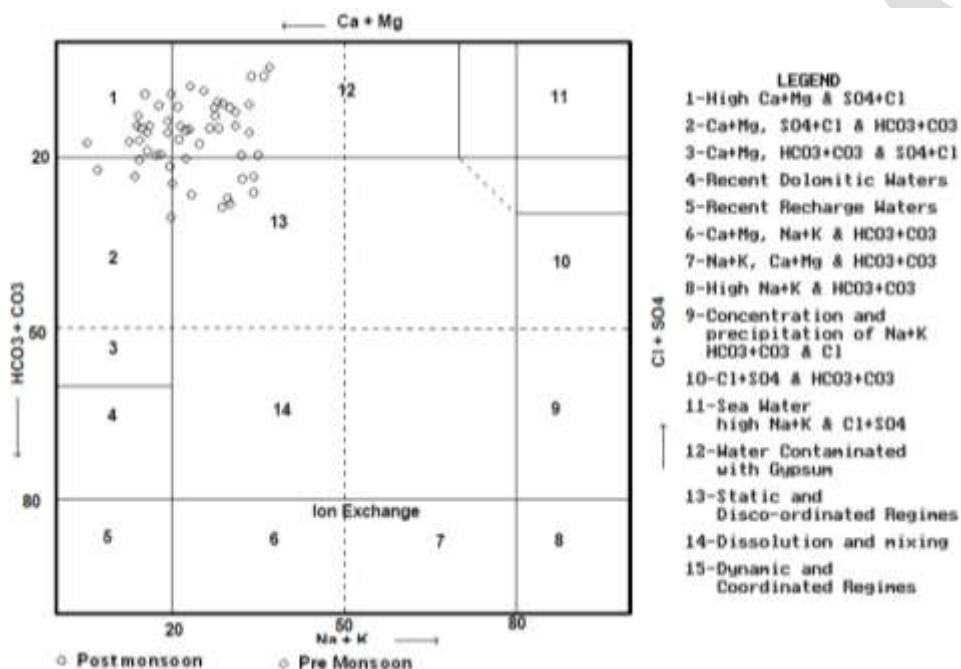

Figure 5: Reconstructed Diamond field of Piper for the groundwater in 2007 (After Johnson, 1975)

The Na+/Cl− couple: In natural waters these two chemical elements are often connected to halite (NaCl) dissolution. The evolution of Na+ is studied according to the chlorides contents, because this is considered as a steady tracer and conservative of the very soluble evaporates; rarely incoming in saline precipitation, and not intervening in the oxidation-reduction phenomena, and little influenced by the bacteria intervention (Seghir ,2008). For the strong concentrations of chlorides, one observes a direct relation between Na and Cl, indicating that a common origin of these two chemical elements For the weak concentrations of chlorides, one observes a constant excess of sodium contents, it explains itself by another origin of the ion of soda that made increase the concentration of sodium This contribution supplementary could come from the alteration of soda silicates (Clays). But since, this

excess of Na is derived due to the deficit of Ca in relation to HCO3 - and SO4 (Figure 6), the increase of Na contents cannot explain itself that by the process of base exchange related to the clayey minerals. This process fixes an ion of Ca after liberation of two ions of Na+. The Ca/(HCO3 + SO4)- Na/Cl diagram (Seghir 2008) in 2007 almost all the samples fall in the natural state and the samples of PRM fall near to the base exchange zone.
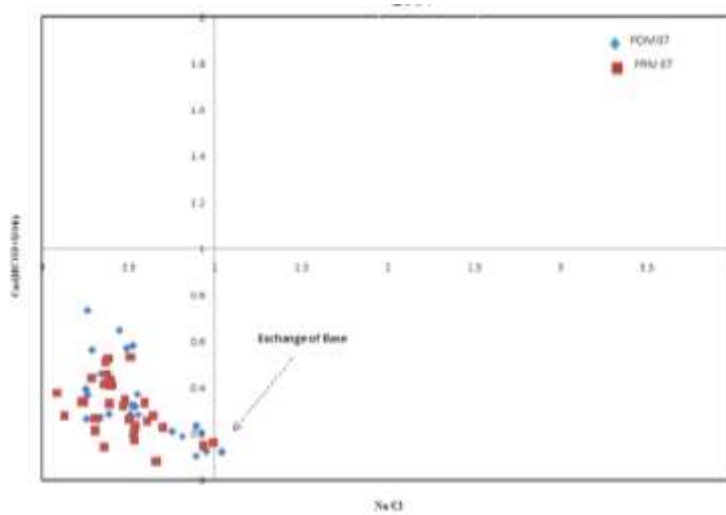

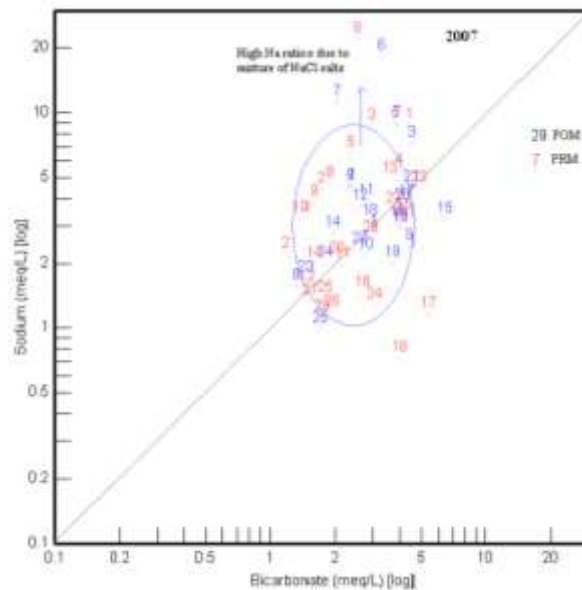Figure 6: Basis Exchange of groundwater in 2007

Figure 7: Relationship between Na and Cl compared against a 1:1

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The ionic relationship between Na and Cl is observed to determine their magnitude on the total salinity of groundwater in the coastal area. This is true for most groundwater samples in the year 2007 (Figure 7) except at lower concentrations, where the ratio tends to be greater than 1 indicating cation exchange reactions where Ca or Mg is exchanged for Na in groundwater or Na is derived from another source such as localized mineral hydrolysis. Na is derived from another source such as localized mineral hydrolysis.

CONCLUSIONS

In the study area, hydrogeochemical characteristics of groundwater of Cuddalore area have been studied and the groundwater quality is mainly controlled by weathering, precipitation, mixing of seawater, ion-exchange reactions, and anthropogenic inputs. The dominant water facies is $Mg^+- Cl^-$, $Ca^+- Cl^-$, Na^+-Cl^- in post monsoon $Mg^+ – Cl^-$, $Ca^+- Cl^-$, $Na^+- HCO_3^-$ in pre monsoon season. SAR ratio for POM and PRM seasons, most of the samples fall in Class II and Class III indicating the salinity concentration increases from medium to high conductivity due to saline water intrusion.. In general, EC found to be higher near the coastal areas. Majority of the coastal regions of the study area affected by the salt water intrusion due to the infiltration of contaminant water from industry and over exploration of groundwater for agriculture and domestic purposes.

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Photocatalytic Degradation and Mineralization of Reactive Textile Azo Dye Using Semiconductor Metal Oxide Nano Particles

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ABSTRACT – The textile industry consumes considerable amounts of water during the dying and finishing operations. Dyes extensively used are found to be toxic and considered to be resistant to biodegradation. In this work a detailed investigation of heterogeneous photocatalytic degradation of Navy blue HE2R **1** (NB), azo dye of reactive class is presented using UV/P-25TiO_2/ZnO_2/H_2O_2 process in aqueous suspension under 8W low-pressure mercury vapor lamp irradiation by using Semiconductor metal oxide nano particles. Here we also report the optimization of various experimental parameters such as effect of catalyst concentration, effect of substrate concentration, effect of addition of H_2O_2. The obtained results show that the employment of UV/P-25TiO_2/ZnO_2/H_2O_2 process and selection of optional operational parameters lead to complete decolorization and substantial mineralization of Navy blue HE2R **1** (NB) dye which is supported by showing decreases in Chemical Oxygen Demand (COD) and Total Organic Carbon (TOC) of the dye solution.

Keywords: Photocatalysis, Textile dye: Navy blue HE2R 1 (NB), Titanium dioxide, H_2O_2, COD, TOC, ZnO, AOP, Mineralization.

1. INTRODUCTION

Azo dyes represent the largest class of textile dyes in industrial use. These reactive azo dyes are not easily amenable by conventional treatment methods due to their stability and non biodegradable nature. The colored wastewaters released by textile industry effluent pose a potential environmental hazard to ecosystem and must be treated before being discharged into the natural water bodies. Till today no economical and technically fit solution for the effective degradation and mineralization of the hazardous, organic compounds present in textile industry effluents is available. Various generic methods like physical, biological and chemical are being explored and employed however they have their own limitation as the physical methods like adsorption on activated carbon, reverse osmosis etc. do not lead to complete mineralization, rather they simply transfer the pollutants from one phase to another causing secondary pollution [1]. Biological treatment methods have proven to be ineffective not only due to the resistance of azo dyes to aerobic degradation [2] but also due to the formation aromatic amines which are carcinogenic [3].

Therefore in the last decade, attention has been focused on treatment technologies that lead to the complete destruction of the dye molecules. Among these treatments advanced oxidation processes (AOPs) have emerged as powerful remediation treatments to destroy refractory pollutants in water. Among all the AOPs heterogeneous photocatalysis has been found to be the most promising treatment process for the degradation of various dyes at lab scale. But to extend this process to treat real textile industrial effluent, more focused and detailed study is the need of current research and development activities. In comparison with other AOPs semiconductor mediated photocatalysis with H_2O_2 ranks the foremost due to its ability to photosensitize the complete mineralization of wide range of organic pollutants without production of harmful by-products.

Therefore in the present study a detailed study on the heterogeneous photocatalytic degradation of some selected azo dyes has been carried out using P-25 TiO_2 and Merck ZnO. Azo dyes which are selected for the present study are generally used in textile industry and are found to have serious health hazardous to aquatic organism as well as human beings. It is noteworthy that no studies about reactive azo dyes Navy Blue HE2R (NB) using photocatalytic degradation employing TiO_2/ZnO are found in literature. This is the first report on it. Study is also focused to extend the results obtained for the degradation of this dye to treat the real industrial textile effluents. Most of the published work is focused on the degradation of dyes using TiO_2. Literature reveals a few work on the application of ZnO for the degradation and decolorization of dyes based on spectrophotometer observations and no attention has been

given till date to study mineralization of these dyes giving COD and TOC data. Therefore here a detailed study for the photocatalytic degradation and mineralization of NB dye has been carried out. In the present investigation, studies are carried out using very economic 8 W low pressure mercury vapour lamp giving very good degradation effectively in 5-6 hrs by employing various AOPs.

The colored wastewaters released by textile industry effluent pose a potential environmental hazard to ecosystem and must be treated before being discharged into the natural water bodies. Till today no economical and technically fit solution for the effective degradation and mineralization of the hazardous, organic compounds present in textile industry effluents is available. Various generic methods like physical, biological and chemical are being explored and employed however they have their own limitation as the physical methods like adsorption on activated carbon, reverse osmosis etc. do not lead to complete mineralization, rather they simply transfer the pollutants from one phase to another causing secondary pollution [11]. Biological treatment methods have proven to be ineffective not only due to the resistance of azo dyes to aerobic degradation [4] but also due to the formation aromatic amines which are carcinogenic [5].

To overcome the shortcomings in the existing treatment techniques research and development in innovative technologies during the last decade have shown that advanced oxidation processes (AOPs) have been applied for water purification effectively. These processes involve generation and subsequent reaction of ·OH hydroxyl radical by using the combination of powerful oxidizing agent and UV light. Many oxidation processes such as UV /TiO_2, UV /O_3, UV /H_2O_2, Photo-Fenton are currently employed for this purpose.

Currently, chemical methods such as advanced oxidation processes (AOPs) seem to be more promising for the treatment of textile industrial effluents [8]. Among the various advanced oxidation process (AOPs) heterogeneous photocatalysis on metal oxide semiconductor particles has been found to be very effective for removing the organic pollutants from wastewater [9-11]. The basic principle of heterogeneous photocatalysis using semiconductor oxide is well established [12] and can be briefly summarized in the following simplified processes. The photo-excitation of semiconductor particles promotes an electron from the valence band to the conduction band thus leaving an electron deficiency or hole in the valence band, in this way, electron/hole pairs are generated. Both reductive and oxidative processes can occur at/or near the surface of the photoexcited semiconductor particle. In aerated aqueous suspensions, oxygen is able to scavenge conduction band electrons forming superoxide ions ($O_2^{·-}$) and its protonated form, the hydroperoxyl radical ($HO_2^·$)

$$O_2 \;+\; e^- \;\rightarrow\; O_2^{·-} \quad (1)$$

$$O_2^{·-} \;+\; H^+ \rightarrow\; HO_2^· \quad (2)$$
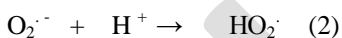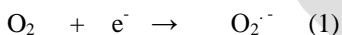
In this way, electron/hole recombination can be effectively prevented and lifetime of holes is prolonged. $HO_2^·$ can lead to the formation of H_2O_2.

$$HO_2^· \;+\; e^- \;\rightarrow\; HO_2^- \quad (3)$$

$$HO_2^- \;+\; H^+ \;\rightarrow\; H_2O_2 \quad (4)$$

Photogenerated holes can react with adsorbed water molecules (or hydroxide anions) to give hydroxyl radicals:

$$H_2O + h^+ \;\rightarrow\; HO^· + H^+ \quad (5)$$
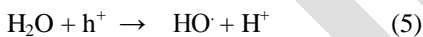
Or they can also be filled by an adsorbed organic donor. The whole process can end in complete mineralization of organic compounds. Further the addition of H_2O_2 to this heterogeneous system increases the concentration of ·OH radicals and it also inhibits electron hole recombination process at the same time and hence consequently increases the degradation rate dramatically. Keeping in view the concept of zero discharge and emerging strict environmental legislations for the disposal of wastewater in the rapidly developing countries, exhaustive research on photocatalytic treatment at laboratory scale and probing its suitability at an industrial level is a need of current research and development activities.

The aim of the present work is to investigate an effective and economical AOP for the degradation of azo dye of reactive class. Here we have undertaken detailed study on photo degradation of Navy Blue HE2R 1(NB) azo dye which is extensively used in

textile industry and to the best of our knowledge; this is the first report on the photocatalytic degradation of this dye. We have employed UV/TiO$_2$/H$_2$O$_2$ processes for complete decolorization and substantial decreases of Chemical Oxygen Demand (COD) and Total Organic Carbon (TOC) of dye solution under optimized conditions of experimental parameter.

Navy blue HE2R (Reactive Blue 172)
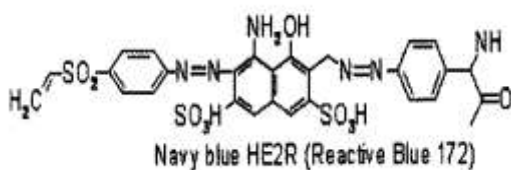
2. EXPERIMENTAL

2.1. Reagent and Chemicals

TiO$_2$ (LR grade Merck with 99 % purity: mixture of anatase and rutile) of band gap = 3.2 eV, H$_2$O$_2$ (30%, w/w, Merck),) Reactive textile dye Navy Blue HE2R (Reactive blue 172) was obtained from local textile industry, Solapur India. All chemicals were used in the form as received without further purification. The solutions were prepared in Millipore water.

2.2. Photoreactor

The experiments were carried out in batch immersion well photocatalytic reactor procured from 'Scientific Aids and Instruments Corporation' Chennai, India. (Refer Fig.1) The reactor consists of double wall immersion well made of quartz which was placed inside the glass reactor fitted with standard joint. The whole assembly of the reactor as procured from the manufacturer also consists of 8W low pressure mercury vapor lamp (peak emission at 254 nm) which was placed inside the immersion well. Water was circulated through the inlet & outlet provided by the reactor in order to maintain the constant temperature between 30 ± 1^0C.
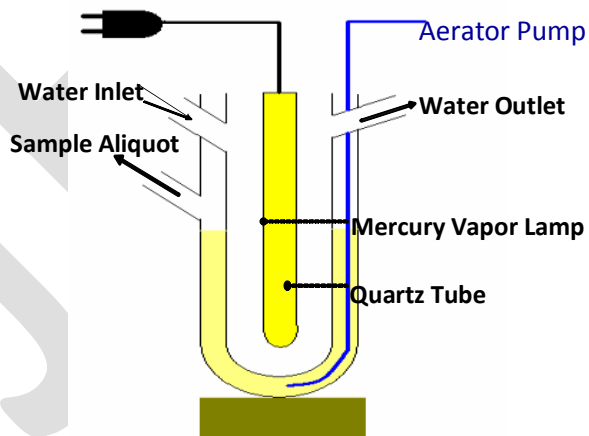

Fig. 1. Photoreactor

2.3 Procedure

The photodegradation of NB was carried out with different AOPs such as (i) UV (ii) UV/TiO$_2$ (iii) UV/TiO$_2$/H$_2$O$_2$ to identify the most suitable and economical process for complete decolorization and substantial mineralization of the dye. Effect of various experimental parameters such as time of irradiation, catalyst concentration, substrate concentration and addition of H$_2$O$_2$ was carried out to arrive at optimized experimental conditions. For that, from the stock solution of NB of concentration 0.01 mol/L, various solutions of desired concentrations were prepared in Millipore water. The photodegradation experiments were carried out in photoreactor in which 250 mL of NB solution was taken. The solution was agitated with the help of aeration pump and magnetic stirrer. To study the effect of time of irradiation photocatalytic degradation experiments were carried over the range of 3-8 hrs. Effect of catalyst concentration was studied by varying the amounts of TiO$_2$ L To study the effect of substrate concentration, the photocatalytic degradation experiments were carried out at optimized catalyst concentration.. For each experiment, aliquot was taken out after every one hour with the help of syringe, which was then filtered through 0.2 μm, 13 mm diameter millipore disc and analyzed for its concentration with Schimadzu UV-visible Spectrophotometer to study the decolorization and degradation. The degree of mineralization of the dye was confirmed by COD and TOC analysis.

2.4 Analysis

Optical absorption spectrum for NB was determined by double beam Schimadzu UV- visible Spectrophotometer. The characterized wavelength of NB was found to be 610 nm which was used to monitor the decolorization and degradation of the dye. Chemical oxygen demand (COD) was measured by the dichromate reflux method [13] and total organic carbon (TOC) was measured using commercially available test kits (NONOCOLOR TOC 60) from Macherey–Nagel, Germany [14] to determine the mineralization of the dye solution under optimized conditions.

3. RESULTS AND DISCUSSION

The photo degradation of NB was carried out with different AOPs such as (i) UV (ii) UV/ TiO$_2$/ZnO (iii) UV/ TiO$_2$/ZnO /H$_2$O$_2$ to identify the most suitable and economical process for complete decolorization and substantial mineralization of the dye.

3.1 Optimization of various experimental parameters

(i) Effect of time of irradiation (ii) Effect of catalyst concentration (iii) Effect of substrate concentration (iv) Effect of addition of H$_2$O$_2$

3.1.1 Effect of time of irradiation

The effect of time of irradiation on photocatalytic degradation of NB was studied over the range of 3-8 hours. Obtained results show that maximum degradation of NB can be achieved in first 3 hours. The minimum time of irradiation for maximum degradation was found to be 5 hours. Beyond this, the rate of degradation of NB is almost constant.

3.1.2 Effect of Catalyst Concentration

Effect of catalyst concentration was studied by varying the amounts of TiO$_2$ /ZnO ranging from 50 to 125 mg/250mL, in order to obtain an optimum catalyst concentration for the maximum photodegradation, which could save unnecessary use of excess of photocatalyst. For these studies the substrate concentration was kept constant (2.5×10^{-5} mol/L). Fig. 2. shows that the degradation efficiency increases up to 100mg/250mL of the dye solution, above which it shows reduction in degradation efficiency. Beyond this

dose the substrate molecules available are not sufficient for adsorption by the increased number of TiO_2 /ZnO particles. Hence the additional amount of catalyst is not involved in catalyst activities & the rate does not increase with an increase in the amount of catalyst [15]. Also at high TiO_2 concentrations particles aggregate this reduces the interfacial area between the reaction solution and the photocatalyst. Thus the number of active sites on the catalyst surface decreases. The surplus addition of catalyst makes the solution more turbid and the reduction in degradation efficiency may be due to the reduction in penetration of light with surplus amount of TiO_2/ZnO. In the present investigation 100 mg of TiO_2 in 250mL of dye solution was found to be optimized dose for maximum degradation of NB.
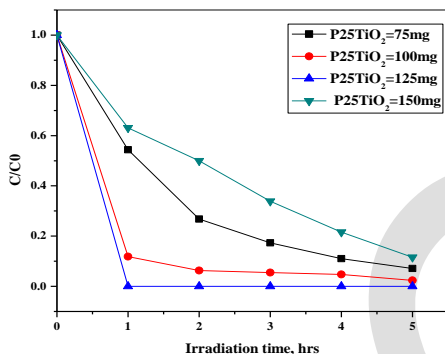

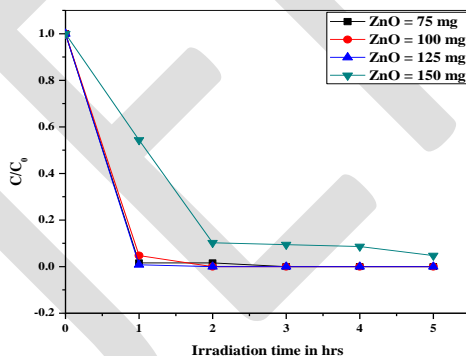**Fig.2. Optimization of Catalyst Concentration for the degradation of NB using P-25 TiO_2**

Fig.3. Optimization of Catalyst Concentration for degradation of NB using Merck ZnO

3.1.3 Effect of Substrate Concentration

The effect of substrate initial concentration on degradation of NB dye was studied at different concentrations varying from $1x10^{-5}$ to 2.5×10^{-4} mol/L since the pollutant concentration is a very important parameter in water treatment. Experimental results are presented in Fig.3, which shows that the degradation rate depends on the initial concentration of dye NB. The rate of degradation was found to increase with increasing concentration of NB up to 2.5×10^{-5} mol/L. Further increase of concentration decreases the rate of

degradation. This may be explained on the basis that, on increasing the concentration of NB, the reaction rate increases as more molecules of the dye are available for degradation. Also with an increase in dye concentration, the solution becomes more intense colored and the path length of photons entering the solution is decreased thereby fewer photons reached the catalyst surface. Hence, the production of hydroxyl and superoxide radicals are reduced [15]. Therefore the photodegradation efficiency is reduced. Moreover, at the higher concentration, the number of collisions between dye molecules increases whereas the number of collisions between dye molecules and ·OH radical decreases. Consequently, the rate of reaction is retarded [16]. Hence in the present investigation the optimized substrate concentration of NB was found to be 2.5 x 10^{-5} mol/L.for P25 TiO$_2$
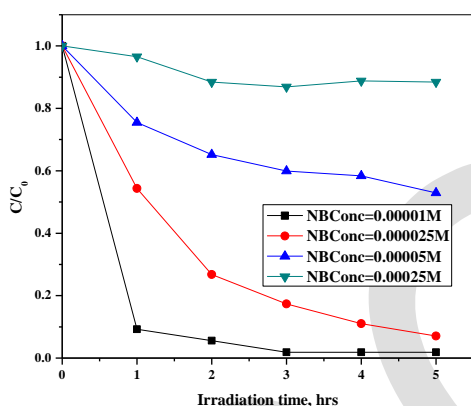

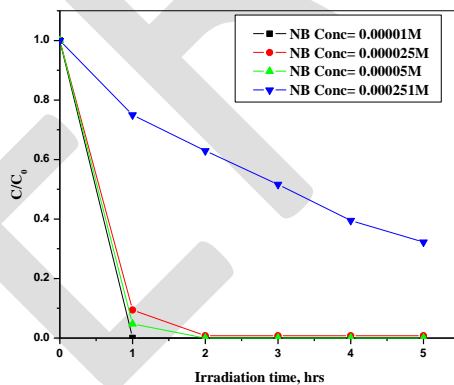**Fig. 4. Optimization of Substrate Concentration for degradation of NB using Degussa P-25 TiO$_2$**

Fig.5. Optimization of Substrate Concentration for degradation of NB using Merck ZnO

3.1.4 Effect of addition of H$_2$O$_2$

The effect of addition of H$_2$O$_2$ to the system with optimized catalyst concentration and optimized initial substrate concentration was studied by varying the amount of H$_2$O$_2$ ranging from 0.175 g/250 mL to 0.475 g/250 mL. Fig.4 shows the variation in the photodegradation rate of NB for different amounts of H$_2$O$_2$. The highest rate of degradation was found for H$_2$O$_2$ = 0.375 g and beyond this the rate of degradation of NB was not significant. The addition of H$_2$O$_2$ to the heterogeneous system increases the concentration of ·OH radicals.
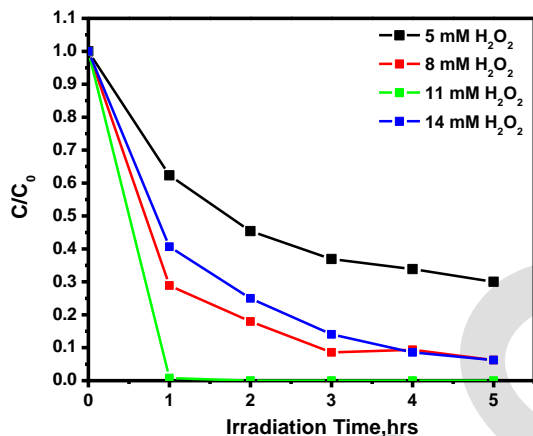
$$TiO_2 (e-) + H_2O_2 \rightarrow TiO_2 + OH^- + OH \quad (6)$$

Fig. 6. Optimization of Concentration of H_2O_2 using P-25 TiO_2

Being an electron acceptor, H_2O_2 does not only generate $^.OH$ radicals but it also inhibits electron hole recombination process at the same time, which is one of the most important practical problems in using TiO_2 as photocatalyst. When the H_2O_2 concentration becomes high, the excess H_2O_2 consumes hydroxyl radicals and it performs like a hydroxyl radical scavengers [17].

$$H_2O_2 + ^.OH \rightarrow HO_2^. + H_2O. \quad (7)$$
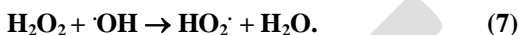
When H_2O_2 was added, maximum degradation was achieved in the first hour only. Complete degradation was achieved in 2hrs. Thus in present investigation the optimized amount of H_2O_2 was found to be 0.375g/250mL. The photocatalytic degradation of NB using different AOPs such as (i) UV (ii) UV/TiO_2 (iii) UV/TiO_2/ZnO /H_2O_2 is shown in Fig 5. and the corresponding spectral changes observed for UV/TiO_2/ZnO/H_2O_2 process are depicted in Fig 6.

4.0 ESTIMATION OF CHEMICAL OXYGEN DEMAND (COD) AND TOTAL ORGANIC CARBON (TOC)

The COD is widely used as an effective technique to measure the organic strength of wastewater. The test allows measurement of waste in terms of the total quantity of oxygen required for the oxidation of organic matter to the CO_2 and water. The COD of the dye solution was estimated before and after the treatment under optimized conditions. The reduction in the COD and TOC values of the treated dye solution indicates the mineralization of dye molecules along with color removal.

Table. 1. % Reduction in COD and TOC for degradation of NB

Name of the dye	% Reduction in COD		% Reduction in TOC		% degradation/ decolorization (By using UV-Spectrophotometer)	
	P-25 TiO$_2$	Merck ZnO	P-25 TiO$_2$	Merck ZnO	P-25 TiO$_2$	Merck ZnO
Navy Blue HE2R (NB)	85%	43.75%	65%	25%	92.91%	94.67%

In the selected dyes under study indicate that poor photocatalytic efficiency of P-25 TiO$_2$ than Merck ZnO. During photocatalytic experiments the observed changes in colour for the catalyst Degussa P-25 TiO$_2$.

Fig. 7. Decolorization of NB using Degussa P-25 TiO$_2$

Which clearly indicate the decolorization and degradation of NB dye. Graph 27 showed that Merck ZnO effectively degrade the dye only in 1 hr. In case of NB degradation, Merck ZnO was found to be best photocatalyst among all the three photocatalysts on the basis of UV-visible spectroscopic data. In case of Merck ZnO % decolorization was maximum but from COD and TOC data depicted in table 3. It was observed that P-25 TiO$_2$ is the most efficient photocatalyst because % reduction in COD and TOC was 85%

and 65% substantial mineralization achieved in P-25 TiO_2 while in case of Merck ZnO % deduction in COD and TOC is only 43.75% and 25%respectively indicate poor degree of mineralization.

On the basis of COD and TOC data P-25 TiO_2 was found to be the best photocatalyst han Merck ZnO. The order of photocatalytic efficiency was found to be P-25 TiO_2 > Merck ZnO > Merck TiO_2.

5. ACKNOWLEDGEMENTS

6. CONCLUSIONS

The results obtained in the present study show the great efficiencies of advanced oxidation processes in removing diazo dyes which are resistant to other conventional treatment processes. This is the first report on the photocatalytic degradation of NB. The application of heterogeneous photocatalytic treatment using TiO_2 for the degradation of NB have been found to be promising process. Further addition of H_2O_2 to the above system made the degradation much faster and could degrade the dye only in couple of hours. Degradation of NB was found to increase in the order UV < UV/TiO_2 < UV/TiO_2/H_2O_2. The employment of UV/TiO_2/H_2O_2 process led to complete decolorization and to 85 % decrease in COD and 65 % decrease in TOC values resp. The observations of these investigations clearly demonstrated the importance of choosing the optimum degradation parameters which are essential for any practical application of photocatalytic oxidation process. Thus UV/TiO_2/H_2O_2 seems to be the most appealing choice for the complete degradation and substantial mineralization of NB and may be extended to treat real industrial wastewater.

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