

PERFORMANCE EVALUATION OF EXTERNAL GEAR PUMP WITH THE USED OF BURNT OIL

Dipen A. Rana¹

¹Assistant Professor, Mechanical Engineering Department, ShriS'adVidyaMandal Institute of Technology, Bharuch-392001, (India)

ABSTRACT

The external gear pump is external rotary positive displacement pump. Gear pump provides smooth pumping action & high volumetric efficiency. It is used in industrial machine for a fluid delivery and for a cooling purpose. It is used with a wide range of fluid viscosity. In this present work with the help of external helical gear type gear pump test rig generate experimental data with the used of contaminated burnt oil as fluid medium. Setup runs at a different rpm with adjusted speed of motor through vari-o-state, which measure with the help of the tachometer. At a different rpm of gear rotor check the performance of external gear pump. This data validate with the theoretical estimation & good agreement found.

Keywords : *Contaminated Burnt Oil, Helical Gear, External Gear Pump test Rig, Suction Pressure, Discharge Pressure, Discharge Flow Rate, Varies rpm*

1. INTRODUCTION

The pump is the heart of the hydraulic system. Like a heart in a human body, a hydraulic pump generates a flow by moving the fluid in an environment with an adverse pressure gradient. The pumps are generally categorized in two distinct groups, positive-displacement pumps and kinetic pumps. The gear pump is gaining widespread application and acceptance for automotive oil and fuel delivery purposes due to its simplicity and versatility in design and manufacture. It is basically an internal gear type rotary positive displacement pump. It is driven by engine crankshaft. Gear pump pumps provide high volumetric efficiency and smooth pumping action. Further, they work well with a wide range of fluid viscosities.

1.1 External Gear Pump Operation

All pumps used in fluid power systems are of the positive displacement type that includes gear, vane, and piston pumps. The gear pump is made of two or more gears rotating inside a closed casing. The driving gear motion is produced by a motor, while the driven gear motion occurs through the meshing of the teeth of the two gears. As the gears start to rotate, the teeth are in and out of contact with each other. As a tooth leaves the contact region, a vacuum is created. The liquid that runs into this space to fill this vacuum has to be supplied through the pump's inlet port. Once filled with the fluid, the fluid follows in pockets between the teeth, trapped in place because of the sealed housing, until it reaches the pump's outlet port. In other words, the gear pump works like a rotating conveyor belt that moves pockets of liquid between the teeth of the gears.

1.2 Previous Work

James R. McBurnett, William D. McMillan (2000) [1] positive displacement gear pump useful for pumping hydraulic fluid includes a drive gear and an idler gear. In a first embodiment, the drive gear has symmetrical teeth, whereas the idler gear has asymmetrical teeth. The asymmetrical teeth of the idler gear include working surfaces which have a profile corresponding to the profile of the working and non-working surfaces of the drive gear, but have a non-working surface which has been relieved so as to be substantially flat. Consequently, in the zone of the pump where the gears mesh, a large backlash is created which substantially prevents bubble formation. In a second embodiment, the drive gear, as well as the idler gear, has non-contact surfaces which are substantially flat to create even a larger backlash for relieving cavitations when the teeth are made wider in the axial direction. By preventing bubble formation, cavitation which occurs at high pump speeds is substantially eliminated, thus avoiding pump damage which results from cavitations. Niranjani Himatlal Deliwala (2009) [2] presented invention relates to the external type of rotary gear pump for carrying high volume of the liquid. This rotary gear pump consists of impeller assembly, timing gears and reduction gears which ensure the handling of high volume of liquid by the gear pump. Because of inbuilt speed reduction the pump can directly be coupled with the prime mover there by reducing the overall cost and space, the timing gears reduces the noise level and enhances the working life of the pump. These pumps are used for loading, un-loading and transfer high volumes for wagon decanting, cargo un-loading of various viscous liquids such as edible oils, fuel oils, viscous chemicals etc. M Suresh Kumar and K Manonmani (2010) [3] CFD integrated development process for the gear rotor pump inlet components such as the suction pipe, strainer, and ports has been executed using a three-dimensional transient mathematical model. The effects of the rotor speed, strainer porosity, and number of ports on the pump performance have been investigated. The results showed that the inlet pipe size, the free area ratio of the strainer, and the sizing of the ports have vital roles in the suction capacity, flow velocity, and volumetric efficiency of the gear rotor pump. M. Suresh Kumar, K. Manonmani (2010) [4] Gear rotor pumps are widely used in automotive industry for engine oil lubrication. Often, dust particles mix with the oil flowing through the pump and affect the engine life ultimately. This phenomenon was studied by a CFD investigation at different conditions in three phases. In first phase, the effect of fluid viscosity, rotor speed and port cover grooves were studied with non-contaminated oil and validated experimentally. Suction pipe, strainer and ports were added in the second phase to predict the flow behavior around the inlet region. These factors have vital role on suction capacity, flow velocity and volumetric efficiency. In third phase, different solid concentrations were simulated and found that wear rate, dilatancy and shear layer movement of oil-solid particle mixtures influence the oil pumping mechanism. Jha Maneesh, Poojari Ambika (2013) [5] According to the invention, there is provided a pump performance analyzer for a centrifugal pump. The pump performance analyzer comprises pressure transducers disposed at pre-determined locations of the centrifugal pump for measuring suction and discharge pressures thereof, a flow rate indicator for indicating a flow rate corresponding to a pump operating head computed based on a specific gravity of an operating fluid of the centrifugal pump and a difference of the suction and discharge pressures, a cavitations indicator for computing a Net Positive Suction Head available (NPSHA) based on a difference of a fluid vapor pressure and the suction pressure and generating a cavitations alert when the NPSHA is less than a Net Positive Suction Head required (NPSHR) at the indicated flow rate, and a pump wear-out indicator for computing a pump operating head and a power at closed discharge valve

operation and generating an alert when the head and power deviate from pre-determined head and power at a zero flow rate condition.

II EXPERIMENTAL TESTING

2.1 Experimental Set-Up



Fig.1 Experimental set-up

The experimental set-up consist of gear pump, in which suction side a vacuum gauge is attached while on the discharge side a pressure gauge is fitted for measurement of the delivery head.. Schematic arrangement of test rig of External Gear type oil pump is shown in Fig.1.1 test rig consists of a motor, oil sump, voltmeter, ammeter, tachometer and vari-o-stat for varies motor speed. In external gear type oil pump test rig 25.4 mm pipe is used in both side suction as well as delivery side.The main parameters that were observed from the test rig are speed of the gear pump, vacuum Pressure of the oil at inlet, discharged pressure of oil at outlet, measure discharge flow.

2.1.1 Testing methodology

First of all the vari-o-stat is connected to the main current supply line. Through variac connection attached with ammeter and motor of single phase. After that work done the power switch is on and varies variac voltage to set required rpm of motor with the help of tachometer. Certain rpm range (850- 1200) set with the help of tachometer and measure the value of inlet pressure and outlet pressure through pressure gauge for each rpm. At the time of set each rpm also measure ampere to know about actual load on the motor required for each rpm.

At the time of experiment observed that the motor is not run speed below 800 rpm and above 1250 rpm. Because motor running with the overload condition so ampere is increase and chance to damage the motor. So we collect data of motor speed between 850 rpm to 1200 rpm. Collected data shown in observation table 1.2. At the each rpm measure the discharge flow rate with the help of delivery tank capacity of 64 liter. Start the set up and continue to remain in running condition. After five minutes to set each rpm with the help of vari-o-stat measure the discharge flow rate. Measure the flow rate for time interval of 10 second. Delivery tank volume capacity is 64 liter, so first at 850 rpm run the pump and for 10 second time period collect oil in to discharge tank. The depth of oil quantity in delivery tank is measure with the help of scale. Take three consecutive reading at same rpm and select average value.

2.1.2 Observation

Table.1 Experimental Observation Table

SR NO.	Pump Speed (RPM)	Vacuum gauge Pressure (Pascal)	Discharge Pressure (Pascal)	Discharge Q_{actual} m^3/sec
1	850	-11990.07	13789.5	0.00053
2	920	-13332.3	27579.0	0.000576
3	1032	-13998.9	34473.8	0.00065
4	1060	-14665.5	34473.8	0.00067
5	1200	-18665.2	34473.8	0.00076

III THEORETICAL ANALYSIS

3.1 Gear Specification

The teeth on helical gears are cut at an angle to the face of the gear. When two teeth on a helical gear system engage, the contact starts at one end of the tooth and gradually spreads as the gears rotate, until the two teeth are in full engagement.

Gear pump which is used in experiment is helical gear type pump as shown in Fig 2. Helical gear side view and front view is also shown in figure respectively.



Fig2 Gear Pump Assembly/Helical Gear Side View/Gear Front View

The dimensional specification of helical gear which is used in experimental set up of gear pump is shown in table 2.

Table.2 Gear Specification

Gear type	Helical gear
Gear diameter	43cm
Gear width	43cm
Gear teeth taper(HELIX ANGLE)	15°(degree)
Number of tooth on gear	8
Gear tooth height	0.09cm
Flank	0.02cm
Clearance between gear tooth and pump body	.00025 to.00075 cm
Distance between two gear centre axis	3.6cm

3.2 Theoretical Discharge Calculation

Now for theoretical discharge of pump (all dimension are in meter),

$$Q_{\text{theoretical}} = \frac{2alZN}{60} \tag{1}$$

Where, a = area enclosed between two teeth

l = axial length of teeth

Z = number of teeth in each gear

N = rotational speed in r.p.m.

To find out area enclosed between two teeth applying the equation of area for trapezium section because are enclosed between two teeth is trapezoidal. Figure shows the trapezoidal section and their equation for find out area.

Here a = area enclosed between two teeth $= (a + b) h/2$ (2)

$$= (4+14) 9/2$$

$$= 81\text{mm}^2 = 8.1 \times 10^{-5}\text{m}^2$$

$$l = \text{axial length of teeth} = 0.043\text{m}$$

$$Z = \text{number of teeth in each gear} = 8$$

Put all this value in equation for find out theoretical discharge in m³/ sec.

3.3 Volumetric Efficiency Of Gear Pump

Volumetric efficiency calculated by ratio of actual discharge versus theoretical discharge.

$$h_v = \frac{Q_{act}}{Q_{th}} \tag{3}$$

Table.3Volumetric efficiency of gear pump at different rpm.

Sr no.	RPM	Q _{actual} m ³ / sec	Q _{theoretical} m ³ / sec	$h_v = \frac{Q_{act}}{Q_{th}}$
1	850	0.00053	7.89×10^{-4}	67.17
2	950	0.000576	8.49852×10^{-4}	67.77
3	1032	0.00065	9.585216×10^{-4}	67.80
4	1060	0.00067	9.84528×10^{-4}	68.02
5	1200	0.00076	1.11456×10^{-3}	68.18

IV RESULTS AND DISCUSSION

Figure 3 shown line graph at various rpm theoretical and actual discharge of oil at various rpm. From graph it is clearly seen that there are difference between actual and theoretical discharge of external gear pump, which affect the volumetric efficiency of pump. The difference is occurs due to the contaminated burnt oil is used as fluid medium. The viscosity of burnt oil is less which affect the overall discharge of flow rate.

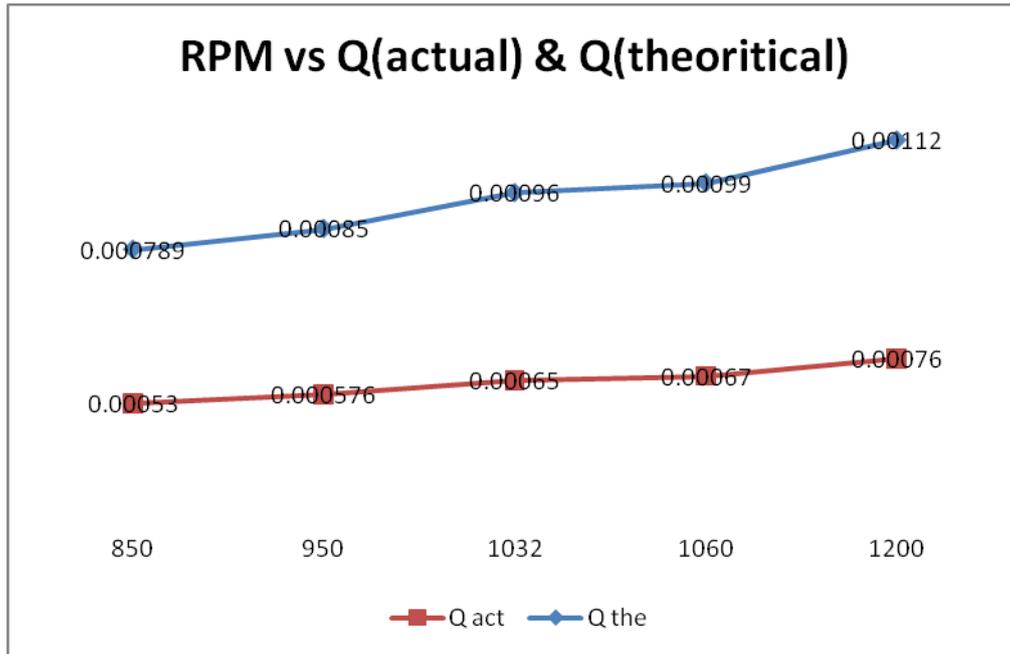


Fig.3 Line Graph of Rpm Vs Discharge Flow Rate

From Fig.4 it is clearly seen that as the rpm increase the volumetric efficiency of external gear pump is also increase. The volumetric efficiency is low due to the contaminant burnt oil is used and vibration of shaft, which connect the motor to the pump.

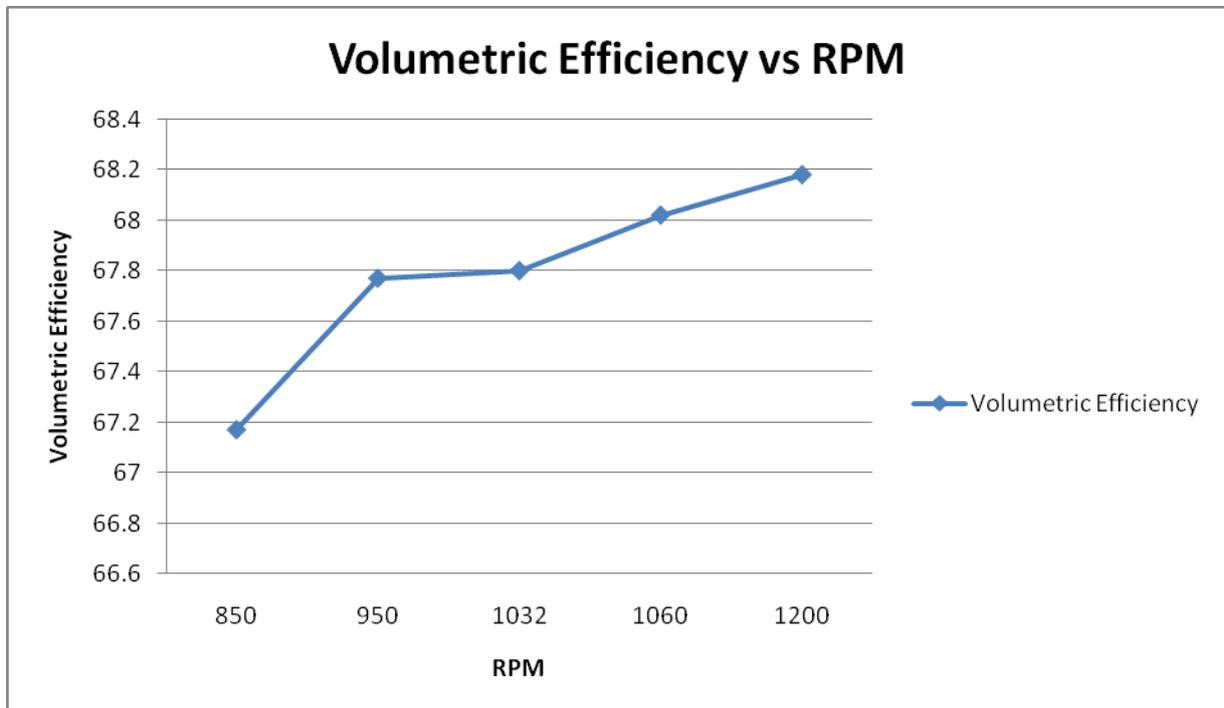


Fig.4Line Graph of Volumetric Efficiency Vs Pump Rotor Rpm

V CONCLUSION

This study focused only on the oil flow in the suction pipe to delivery pipe and did not consider phenomena such as cavitations, air entrainment and bubble formation. From research conclude that as the rpm of gear rotor increase discharge flow rate is increase. Due to the use of burnt oil the pump efficiency decrease because of burnt oil contain less viscosity and many rust and carbon particles contamination in burnt oil.

Future research will be extended to investigate the possibilities of cavitations, noise generation, and air entrainment in the suction line, inlet ports, and chambers, and their effects on the pump performance. It is imperative that the amount of turbulence and entrained air is kept to a minimum. Entrained air can cause a reduced efficiency as well as vibration, noise, and/or accelerated corrosion. The challenge was to ensure that as much oil as possible would be fed evenly into the pump, even when operating at high speeds. By performing a series of CFD simulations, the design of the intake channel was optimized. In this way, it is now possible to pre-evaluate designs more accurately at lower costs and shorter times using CFD, which will considerably reduce the turnaround time of a physical model test and provide more information about the inner behavior of fluids.

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SOFT ERROR TOLERANT HIGHLY RELIABLE MULTI PORT MEMORY CELL DESIGN

Murugeswaran S¹ And Shiymala S²

¹ PG Scholar, ² Professor, Department of VLSI Design, SBM College of Technology, Dindugal, Tamilnadu, (India).

ABSTRACT

In a Very Large Scale Integrated (VLSI) circuit, memory design and development is the predominant domain. Static Random Access Memory (SRAM) is used as a discrete component in earlier stages of the system design, and now it is used as an Embedded SRAM for System on Chip (SOC) designs. Designing and developing of memory in each manufacturing technology node is continuous challenge and it is the first priority of the evaluation of manufacturing technology. Reliability of a product describes the ability of a system or component to perform its required functions under stated conditions for a specific period of time. Quality of product is decided based on reliability of the chip. For an Integrated Circuit (IC), as a critical product specification under today's aggressive technology scaling, to achieve reliability in leading-edge technology has always been very difficult and costly to measure. In this project, highly reliable multiport SRAM memory cell for CMOS technology is designed and developed. Simulation results are reported to show that the proposed two port memory cell (14T) is highly reliable for Single Event Upset (SEU). Single soft error is modelled for evaluating the multiport memory cell which is self-tolerant with respect to SEU

Keywords: SRAM, Multi Port Memory, Single Event Upset (SEU), CMOS, Soft Error, Reliability, Read – Write Circuitry, Power Delay Product (PDP)

I INTRODUCTION

Single Event Upsets (SEUs) induced by particle radiation are becoming an increasing important threat to the reliability of memories fabricated in Nano scale CMOS technologies. SEUs are caused by particle-induced charge which is derived from direct ionization from heavy ions and indirect ionization from protons and neutrons. An energetic particle passes through the sensitive node of a semiconductor device it frees electron-hole pairs along its path as it loses energy. The electric field present in a reverse-biased junction depletion region can separate electron-hole pairs, so that the particle-induced charge is very efficiently collected through drift processes leading to an accumulation of extra charge at the sensitive node. When the amplitude of the accumulated charge is enough and the time is long enough, it can generate a large voltage transient pulse which changes temporarily the value of the sensitive node. In addition, the sensitive areas of semiconductor device are the strongly reverse biased diffusion areas where the induced transient current flows from the N-type diffusion to the P-type diffusion. As a result, when a radiation particle strikes PMOS transistor, only a positive transient pulse is generated, on the contrary, when a radiation particle strikes NMOS transistor, only a negative transient pulse is induced.

II SRAM DESIGN

The demand for static random-access memory (SRAM) is increasing with large use of SRAM in System-On-Chip and high performance VLSI circuits. Due to the need of battery operated device, the scaling in CMOS technology continues. Nanoscale CMOS SRAM memory design faces several challenges like reducing noise margins and increasing variability, due to the continuous technology scaling. In SRAM the data is lost when the memory is not electrically powered. Advances in chip design using CMOS technology have made possible the design of chips for higher integration, faster performance, and lower power consumption. To achieve these objectives, the feature size of CMOS devices has been dramatically scaled to smaller dimensions over the last few years. Power consumption of SRAMs account for a significant portion of the overall chip power consumption and due to high density, low power operation is a feature that has become a necessity in today's microprocessors. The basic architecture of a static RAM includes one or more rectangular arrays of memory cells with support circuitry to decode addresses, and implement the required read and write operations. Additional support circuitry used to implement special features, such as burst operation, may also be present on the chip

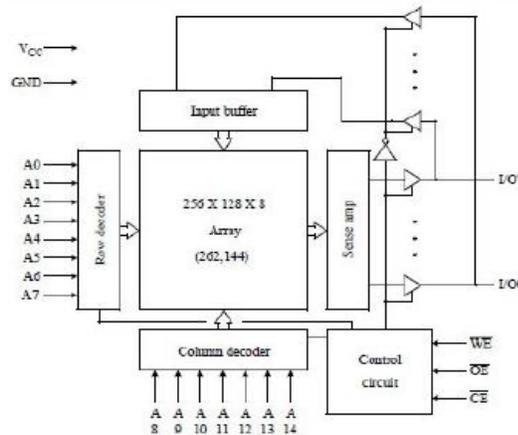


Fig 2.1 SRAM Block diagram

2.1 Conventional 6T SRAM Cell

An SRAM memory cell is a bi-stable flip-flop made up of four to six transistors. The flip-flop may be in either of two states that can be interpreted by the support circuitry to be a 1 or a 0. A typical SRAM cell is made up of six MOSFETs. Each bit in an SRAM is stored on four transistors (M1, M2, M3, M4) that form two cross-coupled inverters. This storage cell has two stable states which are used to denote 0 and 1. Two additional access transistors serve to control the access to a storage cell during read and write operations. In addition to such six-transistor (6T) SRAM, other kinds of SRAM chips use 4, 8, 10 (4T, 8T, 10T SRAM), or more transistors per bit. Four-transistor SRAM is quite common in stand-alone SRAM devices (as opposed to SRAM used for CPU caches), implemented in special processes with an extra layer of poly-silicon, allowing for very high-resistance pull-up resistors.

The principal drawback of using 4T SRAM is increased static power due to the constant current flow through one of the pull-down transistors. This is sometimes used to implement more than one (read and/or write) port, which may be useful in certain types of video memory and register files implemented with multi-ported SRAM circuitry. Generally, the fewer transistors needed per cell, the smaller each cell can be. Since the cost of processing silicon wafer is relatively fixed, using smaller cells. Access to the cell is enabled by the word line (WL in figure) which controls the two access transistors M_5 and M_6 which, in turn, control whether the cell should be connected to the bit lines: BL and BL bar. They are used to transfer data for both read and write operations. Although it is not strictly necessary to have two bit lines, both the signal and its inverse are typically provided in order to improve noise margins.

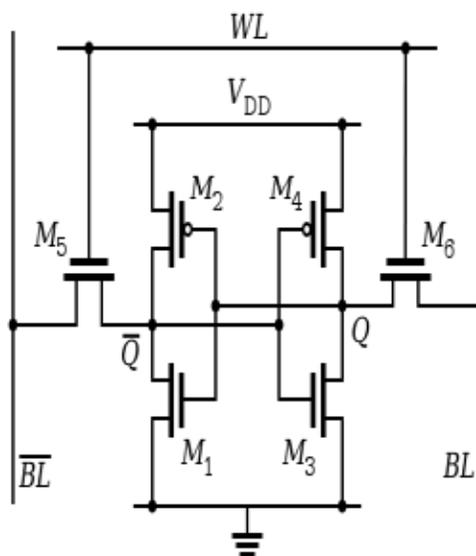


Fig.2.2 Conventional 6T SRAM cell

2.2 Read and Write Operations

To select a cell, the two access transistors must be “on” so the elementary cell (the flip-flop) can be connected to the internal SRAM circuitry. These two access transistors of a cell are connected to the word line (also called row or X address). The selected row will be set at VCC. The two flip-flop sides are thus connected to a pair of lines, B and B-bar. The bit lines are also called columns or Y addresses. During a read operation these two bit lines are connected to the sense amplifier that recognizes if a logic data “1” or “0” is stored in the selected elementary cell. This sense amplifier then transfers the logic state to the output buffer which is connected to the output pad. There are as many sense amplifiers as there are output pads. During a write operation, data comes from the input pad. It then moves to the write circuitry. Since the write circuitry drivers are stronger than the cell flip-flop transistors, the data will be forced onto the cell. When the read/write operation is completed, the word line (row) is set to 0V, the cell (flip-flop) either keeps its original data for a read cycle or stores the new data which was loaded during the write cycle.

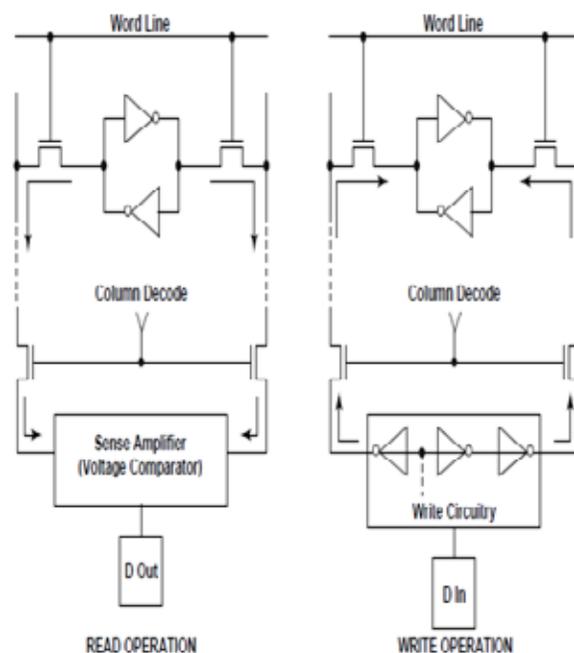


Fig2.3 Read Write Operation of SRAM

2.3 Problems in 6T SRAM Cell

The potential stability problem of this design arises during read and writes operation, where the cell is most vulnerable towards noise and thus the stability of the cell is affected. If the cell structure is not designed properly, it may change its state during read and write operation. There are two types of noise margin which affects the Cell stability that are discussed shortly.

During the read operation, a stored “0” can be overwritten by a “1” when the voltage at node V1 reaches the V_{th} of nMOS N1 to pull node V2 down to “0” and in turn pull node V1 up even further to “1” due to the mechanism of positive feedback. This results in wrong data being read or a destructive read when the cell changes state. Conventional 6T SRAM suffers severe stability degradation due to access disturbance at low-power mode.

2.4 8T SRAM Cell

With the aggressive scaling in technology, substantial problems have been encountered when the conventional 6T (six transistors) SRAM cell configuration is utilized. This cell shows poor stability at very small feature sizes, the hold and read static noise margins are small for robust operation. Therefore, an extensive literature can be found on designing SRAM cells for low power operation in the deep sub-micron/nano ranges. The common approach to meet the objective of low power design is to add more transistors to the original 6T cell. An 8T cell can be found to solve the problem. This cell employs two more transistors to access the read bitline. The transistor configuration (i.e. M1 through M6) is identical to a conventional 6T SRAM cell. Two additional transistors M7 and M8 (thus yielding an 8T cell design) are employed in to reduce the leakage current.

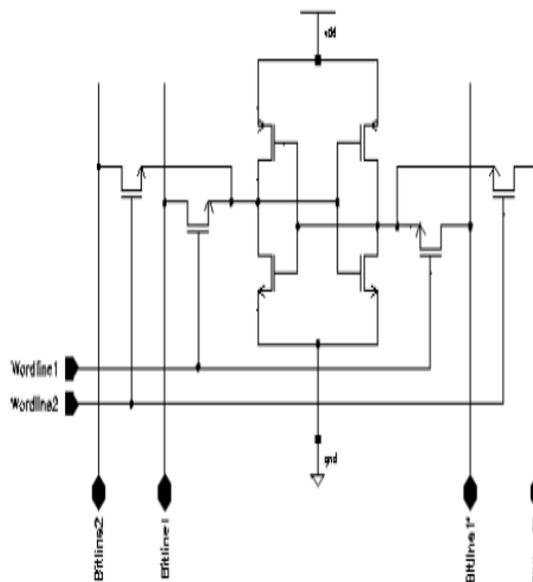


Fig 2.3 8T SRAM Circuit

2.5 Read and Write Operations

This Circuit is two write-read(2WR) type of 8T-SRAM memory cell which has similar structure with the standard single-port SRAM. But it has two sets of data and address paths. So this is a dual-port memory cell. Each address and data path can complete the write and read operation independently. This SRAM cell is the component to store binary information. It has both read and write capabilities. The word line defines operational modes.

- When both Wordline1=Wordline2=0, both access transistors are off and cell is isolated. To perform read operation.
- When Wordline1=1 and Wordline2=0, the Bitline1 is selected and perform the write operation.
- When Wordline1=0 and Wordline2=1, the Bitline2 is selected and perform the write operation.
- When Wordline1=1 and Wordline2=1, the output is “AND” operation of Bitline1 and Bitline2.

2.6 12T SRAM Cell

The proposed SRAM cell is demonstrated in figure 2.4. This structure consists of 12 transistors which six main transistors are same as conventional 6T. The four additional transistors respect with 6T are used to separating the read and write path of cell. The cell is single ended structure which does the read operation from one side of cell. Using separated path for read and write operation increases the control over the array of the cell in the catch design by simultaneous read and write operations which is in contrast with shared access path as conventional 6T cell. Circuit functionality modes are; Write, read and hold mode. The WWL and RWL are independent signals and Hold Signal (HS) is produced by them. Both write and read modes are called active mode. For choosing between active and idle (hold) mode, M12 transistor is used on the top place which separates virtual supply voltage from supply

voltage rail. This transistor acts as a power gating transistor. In active mode the M12 transistor should be in ON mode by producing zero in HS signal (HS=0). After that the write and read operation can be done.

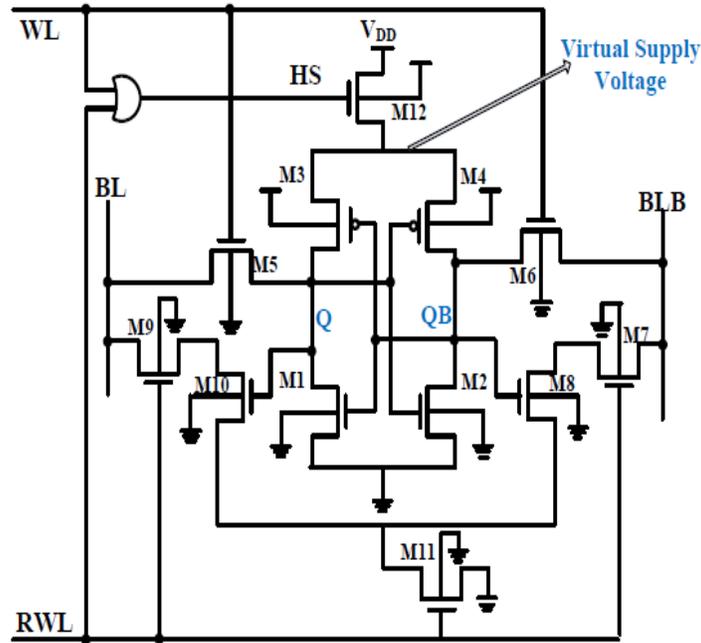


Fig 2.412T SRAM Circuit

2.6 Read and Write Operations

The write paths proposed architecture consist of two transistors (M5 and M6). In write mode, these transistors activate with WWL signal and write the value of BL and BLB on the storage nodes. The write operation can be performed at supply voltages as lower voltage. Inability of access transistors to change the cell's value in write operation is called write failure. The read operation is done only from QB storage node. In this mode RWL signal becomes one and BL and BBL pre-charge to one. When cell saves the one, (Q=1 and QB=0) the M10 becomes ON and reads the Q node by passing the current through M8 and M9. On the other case, when zero is saved in cell (Q=0 and QB=1) the M8 becomes ON and BLB line discharges through M7 and M11.

2.7 Single Event Upset

Single Event Upsets (SEU) occurs when the SEE leads to a logic gate switch, voltage transients, or alteration of stored information. Single Event Effects (SEE) are caused by the interaction of ionizing particles with semiconductor devices. The passing of an ionizing particle through a semiconductor device generates electron-hole pairs (EHPs) along the track path and may be collected at the terminals of a device. Linear Energy Transfer (LET) is defined as the energy loss per unit path length, normalized by the density of the material. LET has units of

MeV/mg/cm². A calculation of the charge deposited per unit length can be determined if the LET of the ion, average energy needed to create an EHP for a material, and density of the material are known. For silicon, an ion with a LET of 97 MeV/mg/cm² will deposit 1pC of charge per micron length of the ion track. SEUs don't just happen in deep space or when high levels of radiation are present. The same cosmic rays that warm the earth's atmosphere carry energetic particles that cause upsets in earth-based equipment.

III SENSITIVE NODES

In CMOS circuits, the “off” transistors struck by a heavy ion in the junction area are most sensitive to single event upset (SEU) by particles with high enough LET (linear energy transfer) of around 20 MeV-cm²/mg. When these particles hit the silicon bulk, the minority carriers are created and if collected by the source drain diffusion regions, the change of the voltage value of those nodes occurs. The induced transient voltage pulse may propagate through several of logic gates. Because a particle can induce an SEU when it strikes either the channel region of an off NMOS transistor or the drain region of an off PMOS transistor, it is considered that the strike at an off PMOS drain area. Particles can induce SEU when it strikes at the channel region of an off NMOS transistor or the drain region of an off PMOS transistor. The ionization can induce a current pulse in a p-n junction. A schematic view of how the SEE induced current pulse translates into an SEE induced voltage pulse is shown in figure 3.1. Single event upsets are events in which an incident particle can strike key node within a device resulting in a local ionization that can cause a state change in a bit with sufficient voltage.

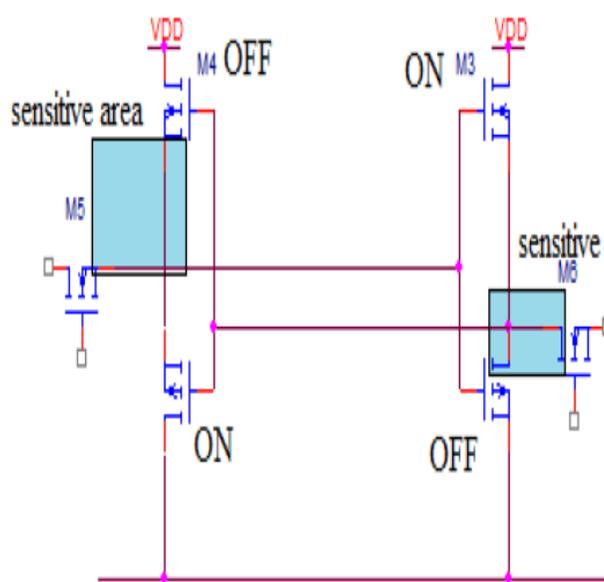


Fig 3.1 Critical Nodes within Circuit

When a PMOS is struck, a positive transient pulse is induced which is 0 to 1 SEU and when NMOS is struck a negative transient pulse is generated which is 1 to 0 SEU.

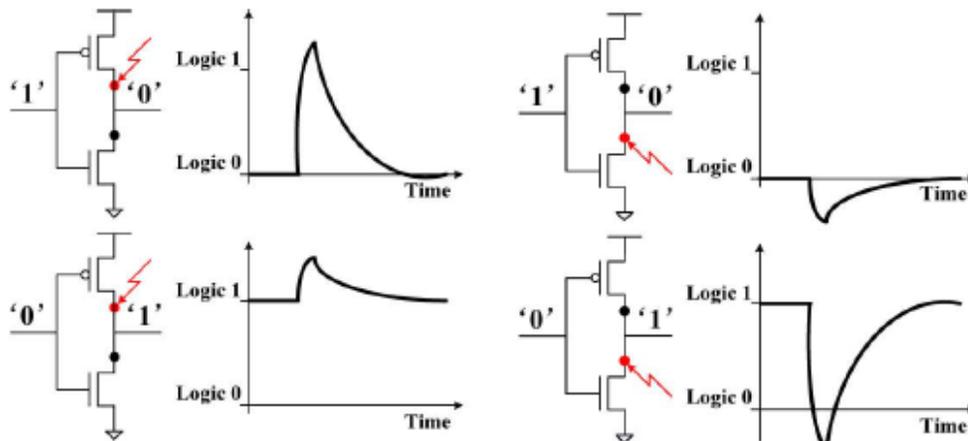


Fig 3.2 0 to 1 SEU and 1 to 0 SEU

A particle can induce SEU when it strikes at the channel region of an off NMOS transistor or the drain region of an off PMOS transistor. The ionization can induce a current pulse in a p-n junction.

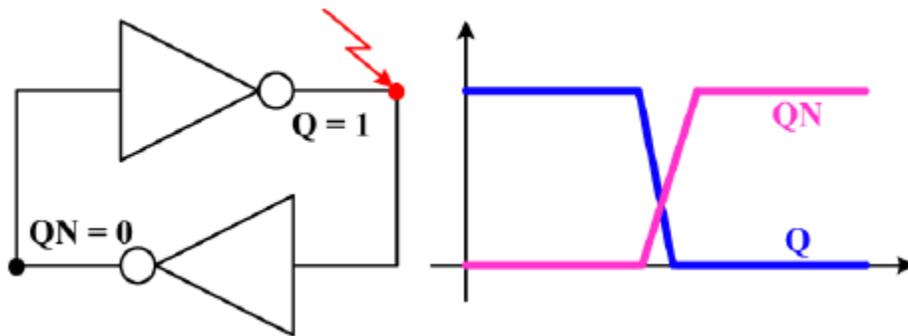


Fig 3.3 1 to 0 SEU occurrence in SRAM 6T cell

Using radiation hardened memory cells to increase the SEU immunity is a less area, power and delay consuming solution.

IV PROPOSED METHOD

In order to cope with the different drawbacks a new low-power and highly reliable radiation hardened memory cell is proposed using 12 transistors, which is capable of fully tolerating SEU at its any sensitive node, but also can tolerate multiple-node upset on two fixed nodes independent of the stored value. Here, access transistors are NMOS transistors N1 and N8 which are controlled by a word line WL. In the proposed cell, the output nodes are Q and QN which are connected to bit lines BL and BLN through access transistors N8 and N1 respectively. First, Hold operation is considered. Word line WL is '0', transistors P3, P4, N5, N6 and N4 are turned ON and the other transistors are turned OFF. It is shown that the state of the memory cell is maintained. Second, Read operation is

introduced. Bit lines BL and BLN are pre-charged to VDD. When word line WL is '1', node Q keeps its initial state '1', because transistors P3, P4 and N5 are still ON. However, bit line BLN is discharged through transistors N1 and N4. Then according to the voltage difference between bit lines BL and BLN, the state of the memory cell is output by a differential sense amplifier.

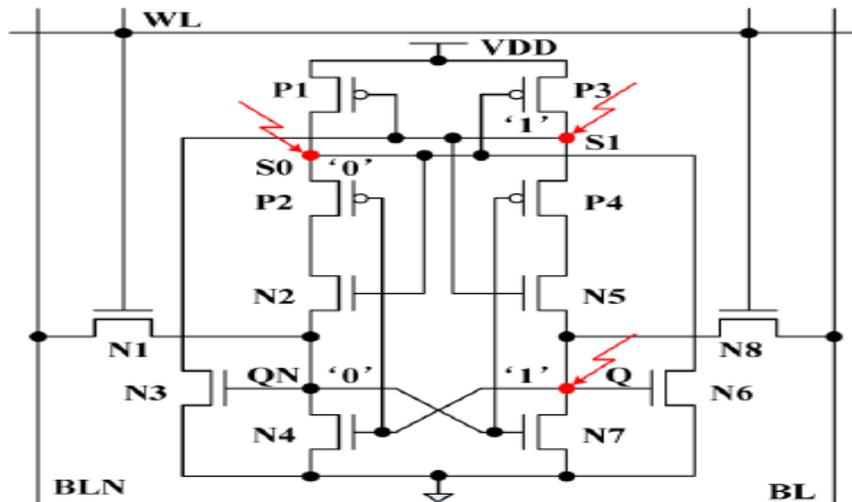


Fig 4.1 Radiation Hardened Memory Cell – 12T

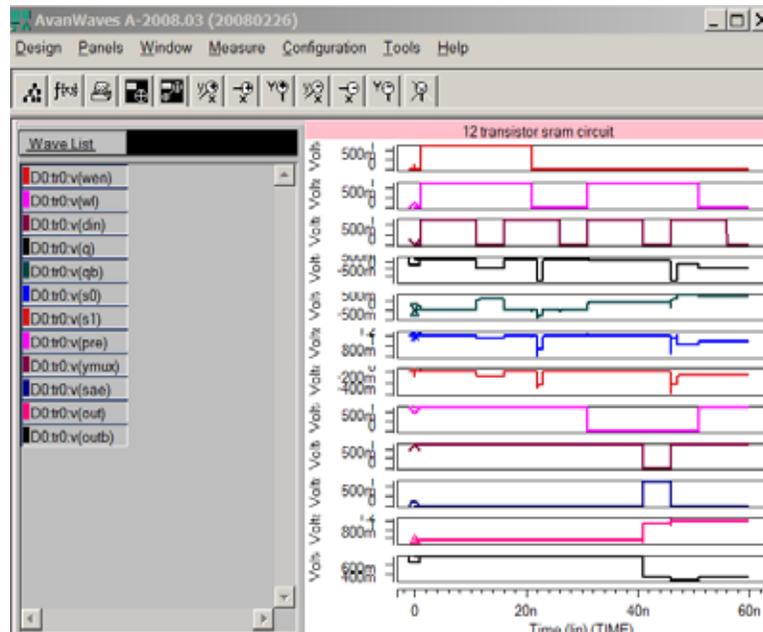


Fig 4.2 12T SRAM with SEU @ Q with Read Protected

Finally, in order to modify the state of this cell, word line WL is '1', and bit lines BL and BLN are set to '0' and '1' respectively. Node QN is forced to '1', thus transistors N7, N3, P1 and N2 are turned ON, transistors P3, P4 and N5 are turned OFF. Simultaneously node Q is pulled down to '0' so that transistors N4 and N6 are both OFF and transistor P2 is ON. Then word line WL is changed to '0', the new state of the memory cell is stored.

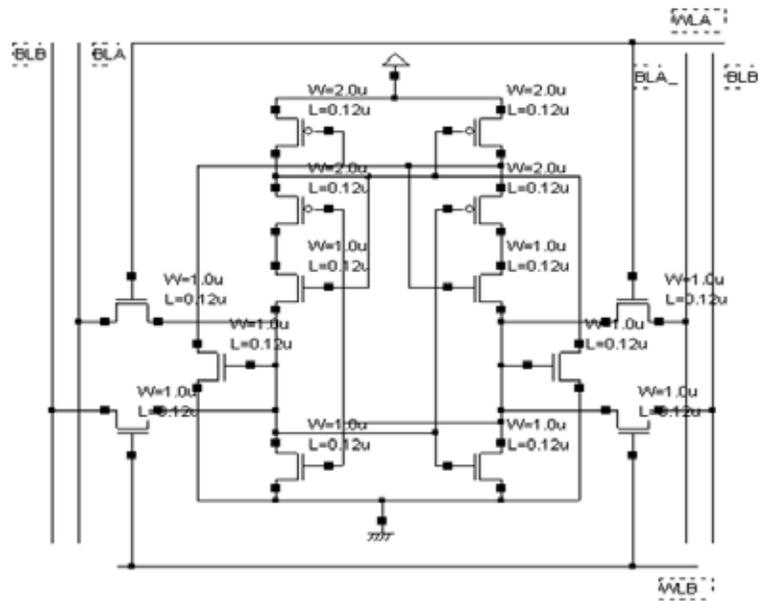


Fig 4.3 14T Radiation Hardened Memory Cell

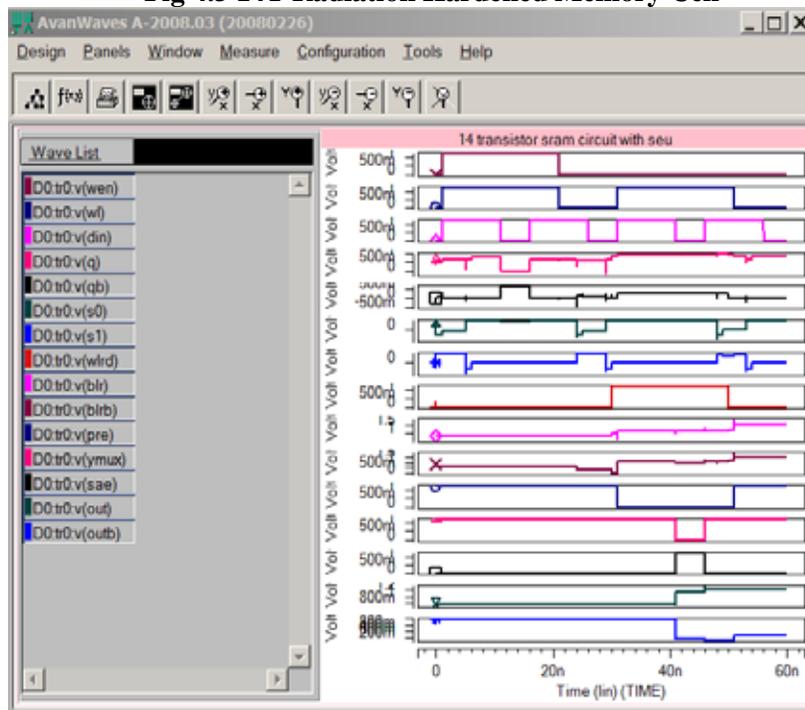


Fig 4.4 14T SRAM Write with SEU @ S0, S1

SRAM circuits are designed for both read and write operation also with and without SEU for 6T, 8T, 12T and 14T techniques. From Results we analyzed that 12T and 14T SRAM circuits are not affected even if the SEU are injected and retain the data and are proved reliable circuits. Also analysis have shown that 14T SRAM transistor consume

very less power when compared to other circuits. But when there is a SEU and when the data reliability is maintained 14T SRAM consumes more power and very less delay.

Table: 4.1 Comparison of Power, Delay and PDP for SRAM circuits.

Circuit Model	RESULTS		
	DELAY	POWER	PDP
6T SRAM_WR	39ns	251uw	10pJ
6T SRAM_SEU	9.9ns	2.71Mw	2.71mJ
8T SRAM_WR	29ns	241uw	7.2pJ
8T SRAM_SEU_RD	29ns	1.68Pw	50.6MJ
12T SRAM_WR	40ns	232uw	9.3pJ
12TSRAM_SEU_RD	39ps	6.6Gw	26.7MJ
14T SRAM_WR	29ns	124uw	3.73pJ
14T SRAM_SEU	41ps	48.7Gw	19J

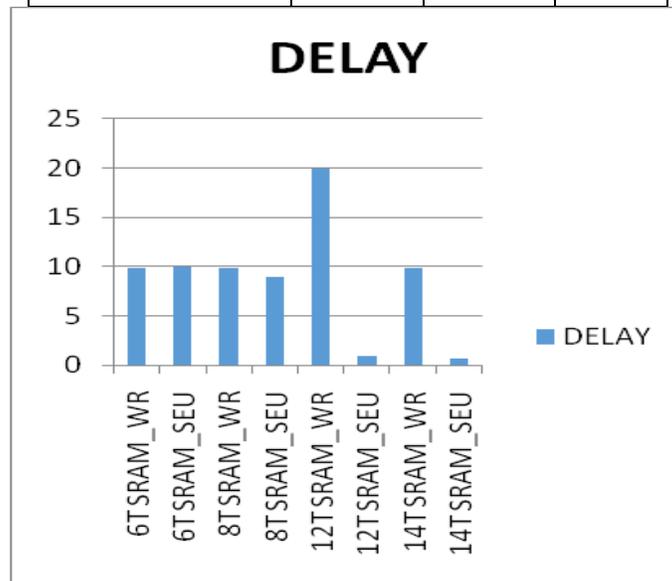


Fig 4.5 Comparison chart for delay (ns) in various SRAM logic

Table 4.1 shows that when there is a SEU, the proposed 12T and 14T hardened memory cells consume higher power with reduced delay which is shown in the comparison chart.

V CONCLUSION

In this paper, a novel low-power and highly reliable radiation hardened memory cell RHM-12T and RHM 14-T structures are proposed to provide perfect protection against SEU in memory. Reliability of a product describes the ability of a system or component to perform its required functions under stated conditions for a specified period of time. Quality of product is decided based on reliability of the chip. For an Integrated Circuit (IC), as a critical product specification under today's aggressive technology scaling, reliability has always been very difficult and costly to measure, and to achieve in leading-edge technology. In this project design and development of SRAM circuits with various methods of implementation carried out with different transistor count with 6T, 8T, 12T and 14T logics with and without Single Event Upset. From the results, it is proved that 12T and 14T transistors are reliable and retain the data even at presence of SEU whereas other two logic undergoes SEU error. Therefore, designers should choose the optimal sizes of transistors to provide a good tradeoff in terms of static noise margin and other performances. Also power consumption is very less for 14T structure when compared to other logics. The future enhancement can be extended to work on the power consumed by this 14T structure during the SEU event occurrence which consumes higher power but with promising decrease in delay parameter. The future work can be done with the SRAM logic implementation on Multi Port Memories.

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BIOGRAPHICAL NOTES

Mr. MURUGESWARAN S is presently pursuing M.E final year in Electronics and Communication Engineering Department (specialization in VLSI design) from SBM College of Engineering and Technology, Dindugal, Tamilnadu, India.He also holds M.S degree (Specialization in VLSI-CAD) from Manipal University.He completed his Bachelor of Engineering (ECE) from Manonmaniam Sundaranar University, Tamilnadu in the year 1999.He also holds two US Patents.

Dr. SHIYAMALA S, M.E., Ph.D., is working as a Professor in Electronics and Communication Engineering Department, from SBM College of Engineering and Technology, Dindugal, Tamilnadu, India.She completed her M.E and Ph.D. from Anna University during the year 2004 and 2013. She also have 15 years of teaching experience.

FAULT-TOLERANCE SUPPORT FOR DYNAMIC OPTIMAL PROPORTIONAL-SHARE IN A SELF-ORGANIZING CLOUD SYSTEM

N.P. Ponnuviji

Student, Department of Computer Science and Engineering, SRM University, Chennai, (India)

ABSTRACT

The increasing popularity of Cloud Computing as an attractive alternative to classic information processing systems has increased the importance of its correct and continuous operation even in the presence of faulty components. But fault tolerance is still a crucial issue in SOC. By utilizing VM technology, the performance and fault isolation of cloud resources can be provisioned on demand in a fine grained, multiplexed manner. The design of the DOPS resource allocation method, utilizes the proportional share model. The key idea is to redistribute available resources among running tasks dynamically, where these tasks could use up the maximum capacity of each resource in node. To locate for qualified nodes in the SOC environment, a fully decentralized range query protocol called P-G CAN has been tailored for DOPS. Pointer Gossiping is responsible for making sure every node in the system eventually knows important information about every other node's state including those that are unreachable. The sensitivity analysis conducted on the model, violates certain assumptions that creates more impact on the dynamic optimal resource allocation of multiple attributes due to faulty components. Hence an analysis will be made in a VM environment, aiming to find a node already present in the network and identify a zone that can be split. Thereby, updating the routing tables of nodes neighbouring the newly split zone. During this step, faulty nodes will be identified and re-routing will be done either by merging zones or managing with the neighbour node, all performed dynamically by the SOC system.

Keywords:*Dynamic Optimal Proportional Share (DOPS), Pointer-Gossiping Content Addressable Network (PG-CAN), Self –Organizing Cloud (SOC), Sun Grid Engine Cluster (SGE), Virtual Machine (VM).*

I INTRODUCTION

Cloud computing is sharing of resources on a large scale that leads to cost effective and location independent. Based on the utility and consumption of computing resources, the jobs will be allocated into the corresponding resources and transmitted through a cloud. A cloud involves deploying groups of remote servers and software networks that allow centralized data storage and online access to computer services or resources. It is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks,

servers, storage, applications and services). The increasing demand for flexibility in obtaining and releasing computing resources in a cost-effective manner has resulted in a wide adoption of the Cloud Computing paradigm. Fault tolerance computing is one that can continue to correctly perform its task in the presence of hardware failures, network failures. The faults on the resources may occur due to network fault, physical fault, media fault, processor fault, process fault, service expiry fault, etc., A new architecture called self-organizing cloud (SOC) can connect a large number of desktop computers on the Internet by a P2P network. Through multiple VM instances constructed by SOC idle resources will be allocated to tasks waiting for execution. Even though optimization of task's resources allocation under user's budget is dealt under SOC, the process of handling fault-tolerance problem is still pending. In this paper, we provide a fault-tolerance support for DOPS based PG-CAN system, that dynamically analyse the weights and cost of resources and identify the optimal resource and find whether it could be split up into zones, thereby, providing an optimal route by eliminating unqualified nodes in the network.

II EXISTING SYSTEM

In the existing system, the transmission in the cloud takes place after identifying the valid resources based on the resources requirements and budget and are named as qualified nodes. When suddenly due to a hardware failure or network failure when a resource or node becomes unqualified (i.e., not able to perform transmission), the cloud server makes the transmission pending. The problem is identified manually by rectifying Convex Optimization Problem. Hence in this scenario, to locate qualified nodes in the SOC environment, a fully decentralized range query protocol, named pointer-gossiping CAN (PG-CAN) has been tailored for DOPS.

2.1 Disadvantages

- Identification of fault-tolerance is not handled in both centralized and decentralized environment.
- The SOC does not handle the fault-tolerance support in the DOPS based VM environment.
- Manual analysis of rectifying Convex Optimization Problem only is dealt.
- The sensitivity analysis of how violation would impact the optimal resource allocation is not handled.

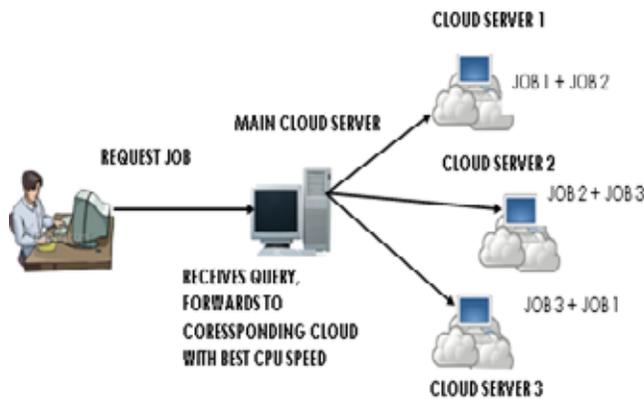


Figure -1 Architecture Diagram of Existing System

- Fails to identify the Unqualified nodes in the SOC system.

2.2 Resource Allocation in Cloud

Resource allocation is an integral, evolving part of many data centre management problems such as virtual machine placement in data centres, network virtualization, and multi-path network routing. Since the problems are inherently NP-hard, most existing systems use custom-designed heuristics to find a suitable solution. However, such heuristics are often rigid, making it difficult to extend them as requirements change.

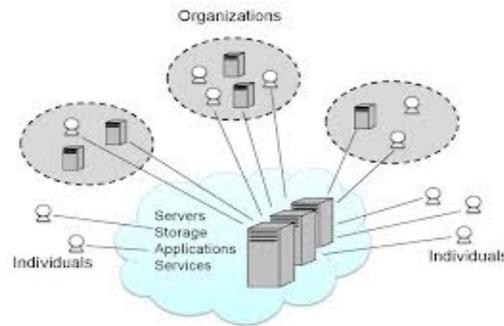
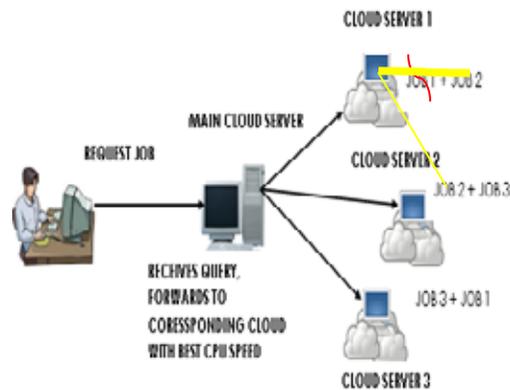


Figure-2 Resource Allocation in Cloud

Resource provisioning for cloud services in a comprehensive way is crucial to any resource allocation model. Any model should consider both computational resources and network resources to accurately represent and serve practical needs. Another aspect that should be considered while provisioning resources is energy consumption. This aspect is getting more attention from industry and governments parties. Calls of support for the green clouds are gaining momentum.

III PROPOSED SYSTEM

In the proposed system, novel cloud architecture, namely self-organizing cloud (SOC), can connect a large number of desktop computers on the Internet by a P2P network. Each participating computer acts as both a resource provider and a resource consumer. They operate autonomously for locating nodes with more abundant resource or unique services in the network to offload some of their tasks; meanwhile they could construct multiple VM instances for executing tasks submitted from others whenever they have idle resources. We focus on two key issues in the design of SOC: 1) the multi attribute range query problem in a fully decentralized environment for locating a qualified node to satisfy a user task's resource demand with bounded delay and 2) how to optimize a task's execution time by determining the optimal shares of the multi attribute resources to allocate to the tasks with various QoS constraints, such as the expected execution time and limited budget.



When JOB1 becomes unqualified, the SOC dynamically, switches to another optimal JOB or Resource and continues the transmission

Figure-3 Architecture Diagram of Proposed System

The Proposed System comprises the following modules:

A. Creation of Jobs

Initially, the user creates the job that he wants to execute. The user can specify the priority by which the tasks have to be executed. The user can also specify the server name in which the task has to be scheduled.

B. Resource Allocation Module

Once the job is created, the manager updates the job based on the user specified priority that to be executed on the server. The optimal resource vector is also computed in this module for the processes. Based on this optimal resource vector, the resources are allocated for the jobs that are created by the user. The resources along with their weights will be assigned and allocated at the first stage.

C. Optimal Routing Module

Based on the allocated resources, the DOPS identifies the optimal resources and finds whether it could be split up into zones. It will analyse the weights assigned for each resources and its cost using the Interior –Point Method. To overcome, the Convex-Optimization problem (i.e., maximize the usage of resources and minimize the cost involved), Interior –Point method will be applied. Now an optimal route will be identified (can be one or more routes).

D. Faulty Node Identification Module

Once the transmission is started, the resources present in the optimal routes, may suddenly become unqualified, due to the following reasons-

- i) Overload in the resource.
- ii) Network Fault.
- iii) Processor Fault.

iv) Media Fault, etc.,

E. Pointer Gossiping CAN

A resource discovery protocol, namely pointer-gossiping CAN (PG-CAN) is used to find the qualified nodes. Like traditional CAN, each node under PG-CAN is responsible for a unique multi-dimensional range zone randomly selected when it joins the overlay. Every node will periodically propagate the state-update messages about its available resource vector to the duty node whose zone encloses this vector. The query message will be routed to the duty node.

F. Re-routing Module

This module we implement the Sun Grid Engine (SGE) Cluster that identifies the faulty node or unqualified node. This engine collects the details of the load balance status of main cloud server and also the remaining proxy cloud servers spread along the split-up zones. Once the faulty node is identified, the SGE removes it from the cloud server using the PG-CAN, then identifies the next new optimal path in the VM environment, and performs the transmission along the new path dynamically. It also allocates the process to the corresponding jobs located in the server dynamically, by doing the required updating in the routing table of the resources in the cloud. This module undergoes a set of sub-modules given below:-

F-i). Node-Joining Module

This module entirely changes the optimal route, by removing the faulty node from the zone and adding the new node to the zone for further transmission. It updates its own routing table and also the routing table of main server and proxy cloud server.

F-ii) Node Departing Module

This module removes the relevant information about the faulty node. It also removes the faulty node's information from main cloud server and proxy cloud server. The routing tables are updated at regular intervals based on the transmission. Information related to the load balance of existing nodes, network traffic and process allocation of jobs is dealt at regular intervals.

G. Task Scheduling

In the task scheduling process, each task is allocated a resource using pointer relay algorithm. The current node sends the query message to another duty node; upon receiving such a message, the remote duty node will also perform the process of task scheduling. Each process on completing its execution will be notified by the user. This task scheduling process is based on cloud activator protocol. This protocol allocates the resource to process whenever it's being interrupted by other processes during its execution. When a process is executing on a server, when no interrupt occurs, the process completes by its optimal resource allocation strategies. In case, when interrupt occurs during the process execution, the protocol activator which uses the algorithm of resource query. This maintains the random selection policy.

Upon receiving the query result, the requesting node will randomly choose one out of them as the final resource node for executing the submitted task. With this random selection policy, we can effectively mitigate the decision conflict among different tasks.

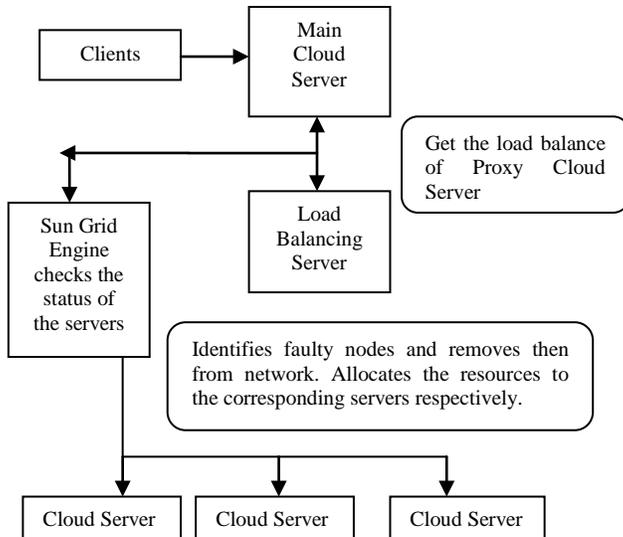


Figure-4 Flow Diagram of Proposed System

H. Advantages

- ∃ Identifies the faulty or unqualified nodes during transmission dynamically in both centralized and decentralized environment.
- ∃ The SGE (Sun Grid Engine) cluster handles the fault-tolerance support in the DOPS based VM environment.
- ∃ Brute-force strategies and Interior-point method is applied in rectifying Convex Optimization Problem.
- ∃ Contrary to existing solutions which often generate bulky messages per request, our protocol produces only one lightweight query message per task on the Content Addressable Network (CAN) using the Pointer Gossiping technique.

IV RELATED WORK

Shen Di et.al [7] explored integrating volunteer computing into cloud architectures using a self-organizing cloud to reap the huge potential of untapped commodity computing power over the internet. Dr. Lakshmi Prasad et.al [8] has analysed and proposed various ways to handle fault-tolerance. The occurrence of various faults and its types during various scenarios are dealt. Zhang et.al [4] proposed a Byzantine fault tolerance framework for building reliable system in voluntary resource cloud infrastructure. The paper analysis failures happened on primary level will decrease the overall performance of a BFT group. When the primary is faulty, a primary updating procedure will be triggered in the Request Execution phase. Patra et.al [5] approached fault taxonomy and need of fault tolerance in cloud computing. Various proposed models for fault tolerance are discussed and compared on the basis of Metrics

for fault tolerance in cloud. But faces more challenges which need some concern for every framework or model. Chandrakala et.al [6] proposed a load balancing algorithm for virtual machine. The algorithm checks the CPU utilization depending on the request. The intermediate node is used to monitor the load of each node.

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THE COST CONTROLLING AND MONITORING OF CONSTRUCTION PROJECT THROUGH EARNED VALUE MANAGEMENT SYSTEM

Ms. Radhika R. Gupta¹, Prof. Parag S. Mahatme², Prof. Taran C. Bhagat³

¹ P. G Student, ^{2,3} Assistant Professor, Civil Engineering Department,
Prof. Ram Meghe College of Engineering and Management,
Badnera, Amravati, Maharashtra, (India).

ABSTRACT

India is one of the most developing countries in the world; various achievements have been made in construction industry. In last few decades, the concept of project management has gained increasing demand among big construction industries. During the construction project it has been observed that certain causes may lead to delay in construction activities. This will result in time and cost overrun in the project. So it has become a major problem to complete the project on schedule and within the estimated cost. As a solution to this, the concept of construction project management by Earned Value Management System (EVMS) is evaluated. Earned Value Management is a powerful methodology used in monitoring and controlling of the project. EVMS is the project management technique developed to measure the performance and progress of the project based on the combination of schedule, cost and work performed. By using this technique, the project status can be investigated in ongoing project at any stage which detects whether the project is under or over budget and behind or ahead of the planned schedule. Also the estimate cost and time required to complete the project from current situation can be investigate.

Keywords- Construction Management, Cost Controlling, Earned Value, Performance Measurement, Monitoring.

I INTRODUCTION

In the world of construction the project manager needs strict monitoring and control over the project. Monitoring is the most important component in project management. It deals with measuring performance of project at certain time interval and reports that performance to organization for process control. After getting such monitored information, the concerned authority decides to take further action to control the project before it become insurmountable. Thus, monitoring and controlling is most important component process throughout entire life of the project.

Construction projects need significant capital investment and the most of which are used up during the execution stage of the project. All construction projects inherit a large degree of risk and may bear the loss, if the project completion is delayed or the costs are overrun. The traditional method of project cost monitoring is

based on simple parameters using two data sources that is the budget (or planned) spending and the actual spending. The comparison of budget versus actual spending merely tells what was planned to be spent versus what was actually spent at any given time. Besides, it does not relate any current performance trend to forecast future performance. Therefore, because of these limitations, the concept of Earned Value Analysis is evaluated for monitoring and controlling project cash flows.

1.1 Need of Earned Value Management System

The Earned Value Management System is needed for following reasons,

1. To check whether we are ahead or behind the schedule of the project.
2. To check whether we are currently under or over budget of the project.
3. To check how efficiently we are working with the project.
4. To know when the project is likely to be complete.
5. To know what is the remaining or entire project is likely to cost.

1.2 Concept of Earned Value Management System

The Earned Value Management system is “a technique developed by a project manager to measure the project performance that integrates scope, schedule and resources of the project. EVMS is a valuable technique to determine real gains and losses on projects and provides a means to balance gains/losses and maximize the gains and also a powerful tool to control simultaneously physical and cost performance. Performance is measured by determining the budgeted cost of work performed (i.e., earned value) and comparing it to the actual cost of work performed (i.e., actual cost). Progress is measured by comparing the earned value to the planned value.

To determine cost performance, EVM compares how much we have spent to what we planned to have spent to do the work we have done. To determine time performance, it compares the amount of work done to the amount of work scheduled to be done. It requires the continues monitoring of actual expenditures and the amount of work done (expressed in cost units). To make these comparisons, EVM calculates cost and schedule variances, along with performance indices for project performance management. Based on these results, it forecasts the date and cost of the project at completion and highlights the possible need for corrective action. It is an effective and useful project tool that helps the client and as well as contractor to assess the project performance.

1.3 Elements of Earned Value Management System

The elements of earned value management system which helps to track the status of project are-

Planned Value (PV)

It is also called as Budgeted Cost of Work Schedule (BCWS). Planned value is defined as, "The authorized budget assigned to the scheduled work to be accomplished for a schedule activity or work breakdown structure elements." The planned value can be calculated by using following formula,

$$P. V = \% \text{ Planned work completed} \times \text{BAC}$$

BAC = Budgeted cost at completion

Earned Value (EV)

It is also called as Budgeted Cost of Work Performed (BCWP). Earned Value is defined as, "The value of work performed expressed in terms of the budget assigned to that work for a schedule activity or work breakdown structure element." Earned value is total cost of work completed / performed as of reporting time. Earned Value can be calculated by using following formula,

$$E. V = \% \text{ complete work} \times BAC$$

Where, BAC = Budget at completion

Actual Cost (AC)

It is also called as Actual Cost of Work Performed (ACWP). Actual cost is defined as, "The total costs actually incurred and recorded in accomplishing work performed for a schedule activity or work breakdown structure element." Actual cost is the total cost taken to complete the work as of reporting date. The actual cost can be calculated by using following formula,

$$A. C = \text{Hourly Rate} \times \text{Total hour spent}$$

Cost Variance (CV)

Cost variance is the algebraic difference between the worth of the work that has been carried out and to the amount of money that was spent to do it. Mathematically it is represented by,

$$CV = EV - AC$$

A positive value of CV shows the project is spending less than the planned budget means it is favorable while the negative value shows that actual cost is exceeded than the budgeted amount which is unfavorable condition.

Schedule Variance (SV)

Schedule Variance is the algebraic difference between the worth of the work that has been carried out and to the amount of money that has to be spent according to the planning to do it. Mathematically it is represented by,

$$SV = EV - PV.$$

It determines whether the project is ahead or behind the schedule. Positive value of SV shows the project is ahead of the planned schedule which is a favourable condition and negative value shows it is behind which is an unfavourable condition.

Cost Performance Index (CPI)

Cost Performance Index is the ratio of earned value (EV) to actual costs (AC). It indicates the efficiency of resource use and measures the worth of the work that is achieved by spending every single unit cost. CPI is represented mathematically as,

$$CPI = EV / AC$$

A ratio less than 1 is an unfavourable and suggests the value of the work that has been accomplished is less than the amount of money spent and the cost is overrun. Whereas, the ratio more than 1 indicates favourable condition n tells more amount of work is achieved as that of the corresponding cost.

Schedule Performance Index (SPI)

Schedule Performance Index is the ratio of earned value (EV) to planned value (PV). It indicates the efficiency of time use and measures the worth of the work that is achieved by spending every single unit time. SPI is represented mathematically as,

$$SPI = EV / PV$$

A ratio less than 1 is an unfavourable and suggests the value of the work that has been accomplished is less than the amount of time spent and the cost is overrun. Whereas, the ratio more than 1 indicates favourable condition n tells more amount of work is achieved as that of the corresponding time.

Budget at Completion (BAC)

Budget at Completion is the total amount of money expected to be spent on the project. The “Fig.1” indicates the ideal graph of EVM elements.

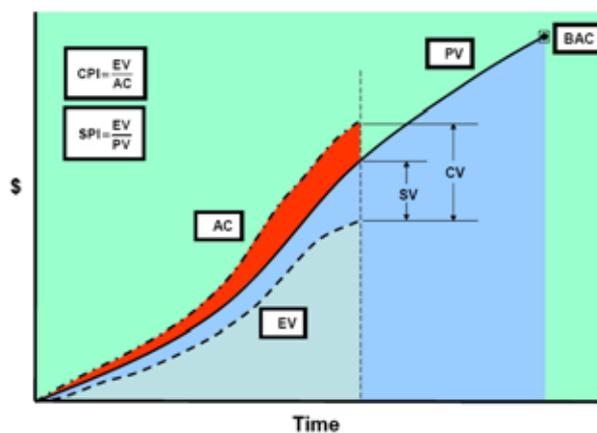


Figure 1 – Elements of EVMS

1.4 Advantages / Benefits of EVMS

1. EVM keeps the management on their toes. As EVA is done periodically, management tries to make sure that all the project parameters are on track.
2. It is used to measure and predict the progress in the ongoing project.
3. It is the only system used at present which track the project in terms of work, time and money.
4. It allows the project manager to be on time and on budget.
5. The cost performance index (CPI) and schedule performance index (SPI) provides an early warning signal.
6. It can be applied to any construction project and is mainly useful for huge construction project.
7. Timely performance measurement makes sure that steps can be taken to the bring project back on track before it's too late.

1.5 Disadvantage / Drawbacks of EVMS

1. While doing Earned Value analysis, we don't take quality into consideration..
2. Cost of implementing Earned value management causes managers to not use it extensively. Generally, software is required and coordination between different departments should be good to achieve the goal.
3. It is required to be carried out at different stages as the uncertainty may occur any time throughout the project.

II METHODOLOGY

The construction projects are so vast and complex in nature and therefore for simplification of work, use of software's came into existence. The WBS for the project is created and several activities are identified. The following recommended steps for the successful implementation of earned value analysis –

1	Create Project
2	Define WBS
3	Creating Calendars
4	Define Activities
5	Appoint Activity Durations
6	Assign Logic Links
7	Perform Scheduling
8	Allocating Resources / budgeting
9	Creating Baselines
10	Updating Schedule
11	Earned value analysis
12	Publishing Reports

III CONCLUSION

On the basis of concept of EVMS, and it's methodology, we have concluded the following points,

1. On comparing Earned Value Management method to traditional management, traditional management does not allow for analysis of physical amount of work performed. Earn value management allows both schedule cost analysis against physical work performed.
2. Earned Value provides an early warning signal to managers to take the corrective action.
3. It helps the project manager to understand time estimate for the completion of the project and provide further insight for making better decision about the project schedule.
4. Where the traditional method focuses on planned accomplishment, the Earned Value Management goes one step ahead and examines actual accomplishment.
5. Timely performance measurement makes sure that steps can be taken to bring project back on track before it's too late.
6. Earned Value Management gives executives, project manager and other stakeholder's ability to visualize project status throughout the project life cycle and helps to manage the project more effectively.

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BRANDING THROUGH DIGITAL TSUNAMI

Ekta Singhal

Department of Commerce and Business Administration, University of Allahabad, Allahabad (India)

ABSTRACT

The world is changing rapidly and we are witnessing a hyper connected economy, a transformed marketplace that is driven by empowered customers, who have more control and influence over the Brand than ever before. A strong wave of Digital Revolution is silently sweeping the world. Digital media is redefining consumer mindsets, patterns of purchase, and decision making. Enabled with mobile and digital connectivity, they can compare products, access price and product information, check availability, and get reviews from friends before making a purchase decision. With the emergence of new technologies, customers have unlimited access to information and the ability to share it instantly with the world. The manifestation of the Brand and its connection with consumers has taken a totally new dimension in the Digital age. Now every Brand is looking to have a presence on all the major Social Media Networks and to have a smart phone application. However most of the companies invest limited resources for marketing the Brand online. Brand development online is a critical piece in the corporate identity puzzle. Based on the existing fragmented literature this paper reviews Internet as the strong medium for Brand Building. It also highlights the changes in Branding strategy in the Social Media age.

Keywords: Brands, Brand Online, Customers, Digital Revolution, Internet, Social Media Networks.

I. PROLOGUE

Branding has been one of the significant business topics over the past few years. Its intersection with the explosive growth of Internet has led to new business challenges. Many argued that the Internet would do away with the need for Brands. This argument suggested that the Brand would be irrelevant because consumers could access and compare any product or service from every possible provider via the Internet and they would always choose the one with the lowest price. However the argument was grossly flawed. It assumed that customers were primarily price-driven and that Brand played little role in the decision-making process. In fact, the Brands are even more important in cyberspace than they are in other channels. With more and more choices from various providers that are relatively unknown, customers tend to choose providers they know i.e. one that represents a set of values or attributes that are meaningful, clear, and trusted: Brand. With the lack of sensory interaction online and fears over security, the creation of trust through the development of strong Internet Brands has become a critical context for marketers. Many online businesses are, therefore, searching for new Internet Brand strategies that might assist them in creating some distinctiveness while engaging their customers (Kenney and Curry, 1999) ^[1]. Nevertheless, the Internet has opened doors for Brand campaigns that may not have been available in the past.

II. BRANDS

2.1. CONCEPT

A brand is a name, term, sign, symbol, design, or combination of these which is used to identify the goods or services of one seller or group of sellers and to differentiate them from those of competitors (Kotler et al., 2002)^[2]. To many, a Brand suggests the best choice (Ginden, 1993)^[3]; while others see a Brand as something the customer knows and will react to (*The Economist*, 1988)^[4]. Despite the formal definition, the purpose of Branding is essentially to build the product's image (Cleary, 1981)^[5]. This image will influence the perceived worth of the product and will increase the Brand's value to the customer, leading to Brand loyalty (*The Economist*, 1988)^[6]. Once consumers become accustomed to a certain Brand, they do not readily accept substitutes (Ginden, 1993)^[7]. Organizations seek ways to exploit this human trait thereby leading to the popularity of Branding. Branding means more than establishing the name for a company or for a product line. It is a long-term state of mind, which requires the management of the company's strategy, the coordination of its objectives and resources. A brand is not just a simple participant in a market; it creates and manages the market through a vision of what the product category should be (Kapferer, 2008)^[8]. The brand becomes the magnet required by the production with the intent to attract consumers (Kornberger 2010)^[9]. The companies seek to maximize the points of contact with the Brand, in order to generate the clients' attachment.

2.2. BRANDS AND THE DIGITAL REVOLUTION

Now every brand strives to have a presence on all the main Social Media Networks and to have a Smartphone application. This creates new markets and adds new opportunities for Brands to interact and connect with consumers and online communities. With the new Digital and Social Media horizons the brands need to be up-to-date, attractive, and consistent in all their online interaction with the target consumers. One of the distinguishing features of the current digital age is the transfer of control from companies to the consumers and users. In the traditional communication world, enterprises and their advertising agencies controlled the communication process and television had the most influential role in building brands. However enterprises do not control what they want to communicate about their Brands anymore. Moreover, it is not the brand that decide the time and channel of communication anymore. The consumers are now taking the initiative in searching for information and looking up brands online and offline. Besides the information aspect, consumers have powerful means for sharing and forming opinions and experiences about Brands in Social Media and across the digital space.

III. MARKETING UPDATE: BRANDING IN THE SOCIAL MEDIA AGE

3.1. INTERNET BRANDING

An online presence has become an essential requirement for Brand Building. Building a Brand online will help consumers break through the over-communication clutter. The Branding experts need to integrate commerce and Brand Building online. The Internet is a good means to seek out niches (Harvey, 2003)^[10]. The Internet can be used to initiate dialogue with customers, collect data, create opportunities for offering special promotions to customers, and have a global reach. An organization's website is its most visible face to the public. A website can create an integrated Brand experience that consistently reinforces the Brand positioning. To be successful

the organization's website should build its Brand Equity and not deplete it. There are four ways in which the Internet can add value: Information, Entertainment, Convenience, and Cost savings. Brands that integrate brick and mortar with a 'cyberspace' presence will be the formidable competitors.

3.2. BUILDING A BRAND ONLINE

New ideas in Online Branding have been developed over the past few years. The Internet can be used in various innovative ways to build a strong Brand. A new version of direct marketing i.e. E-mailing Campaign can be adopted. It provides the customer with the same amount of information and costs less than traditional direct mailing campaigns. One of the best ways to develop this campaign is through an opt-in system. This is where the customer signs up to receive e-mails and updates from a company. This results in a much higher participation rate than those campaigns that are totally unsolicited.

One of the new digital developments has been the emergence of the Blog. It has become an integral part of the organization's online marketing strategy, regardless of a small firm or a multinational firm. It can be used as a marketing tactic to drive traffic back to the company's website. Just as other social media sites this enables the marketers to respond to comments and interact with their customers. In addition, it is extremely effective in attracting new customers to the brand and maintaining the current customer base (Klein, 2007) ^[11].

Another new concept has been the use of Social Media Networks such as Facebook, Google+, Twitter, LinkedIn, Pinterest and MySpace to help develop awareness of a company's Brand. This is a game changer for businesses engaging in marketing, sales, customer service and other business activities. These networks have the potential to send visitors to Websites without traditional advertising methods. These are becoming a proven branding mechanism. eMarketer found that more than half of social networking users have become fans or followers of a Brand Online and users are more likely to say something positive about a Brand than something negative. This has led to the widening of the success gap between enterprises using Social Media in an informal, adhoc manner and those taking a more planned and strategic approach. Facebook is still the leading Social Media Network with approximately 1.26 billion users and 1.23 billion monthly active users. However, Social Media is not an end unto itself. It should be integrated and work hand-in-hand with all the other marketing and PR initiatives which should be continued to reach all the marketing touch points.

IV. IMPACT OF THE INTERNET ON BRANDS

Social Media is the newest tool for marketers to shape their Brands and distinguish themselves from their competitors. A growing number of marketers are turning to Social Media as a Branding tool to reach mass audiences. Social Media is no longer something marketers can ignore. It's a compelling and creative medium that offers companies the opportunity to tell their story in a more innovative way. Brands now have an opportunity to communicate directly with customers and build some additional channels to enhance their traditional marketing and PR initiatives. Social networks are also a valuable source of industry information. It provides information about the trends and directions of Brand development and data for competitive analysis. The information so collected enables the enterprise to understand the needs and expectations of customers.

Active involvement in social networks allows the enterprise to initiate two-way communication to build customer loyalty and Brand Resonance. To achieve this, the companies must regularly update information on their websites regarding events and new products, support customer service department, organize competitions and promotions as well as use social networks to recruit new employees.

V. FUTURE OF BRANDING

Branding is not a static concept but an evolving one which has passed through several phases of development. It has to adapt to the digital world and embrace the great opportunities which it offers. In the Digital Age and Social Media reign the Brands have an increasing need to have a very clear and differentiated identity in order to stand out and appeal to their target markets. This clear and differentiated identity will be delivered by the strategic and creative sides of Branding. The technological advances and market dynamics are working for the benefit of the consumer by forcing Brands to be more promising and genuine. This new and enhanced Branding will have a new set of rules to deliver efficiently in the Digital age. A Brand that is always consistent in delivering on its promises, and always true to itself and its customers will be recognized and resonated both online and offline. This is the basic expectation from Big Brands. The core principles of Brand Building will remain the same but Branding manifestation and applications will have to adopt more transparent and innovative ways in order to sail through the Digital Tsunami.

VI. EPILOGUE

It is imperative for organizations to actively engage with their customers and transform the basis of their expectation to stay ahead in this competitive environment. Enterprises can redefine the rules of customer engagement by enabling self service mechanisms, offering personalized services and experiences, and engaging consumers in the co-creation innovation process. Organizations must realize the potential of this trend and institute necessary cultural and organizational changes to become truly Digital Consumer-Centric. Moreover the enterprises should come up with a comprehensive communication strategy to focus more on the Digital front- ‘channelize, mobilize, and socialize’ to stay ahead in today’s click and mortar game. However there are several risks associated with utilizing the Digital Media as a means of Brand promotion. This channel puts the integrity of the company at risk as the Internet is not regulated. Companies must relentlessly monitor the Internet for everything that mentions their Brand, either in a positive or negative way. An active Brand protection system will eliminate any unsafe activity against the Brand or the company that it represents. Nevertheless, the Digital Revolution has opened doors for Brand Building Strategies that may not have been available in the past.

VII. FUTURE RESEARCH

With the continuous development of technology, the Digital world will continue to gain popularity. It will be the most influential source of information and interaction where Brands will have to exist and interact with their customers. The near future will add another layer of complexity to the process of Brand Building where the “Mobility” factor will be in sync with Digital Media. More people are accessing the Internet through their mobile devices and very soon even the mobility vehicles will be connected to the Digital world. Therefore, the

future is going to be Digital, Mobile and Connected. Enterprises will have very little control over their communication with customers. They will have to enter the game of Digital-Mobile-Connectivity according to new rules of Branding that are based on more transparency and genuineness. Branding will have to adapt and evolve to the dynamics of the new Digital world and this will open avenues for future research and study.

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UTILIZATION OF WASTE PLASTIC IN BITUMINOUS MIX

¹Parth H. Sadadiwala, ²Prof. Purvi P. Patel

^{1,2} Department of Civil Engineering, Alpha College of Engineering & Technology, Gujarat Technological University, Ahmedabad, (India)

ABSTRACT

Solid Waste Management is the threatened area. Of this various waste materials, plastic waste and municipal solid waste are of great concern. On the other side, the load bearing capacities of the road are to be increased due to enormously increasing traffic intensity. This present work helps in taking care of both these aspects. Plastic waste; consisting of carry bags, cups and Thermo-molecules can be used as a coating over aggregates and this coated stone can be used for road construction. By doing this process, a road of 1 Km length and 3.375M width of single lane can consume 10, 00,000 carry bags and even the road strength can be increased by 100% and no pot hole can be found. The mix polymer coated aggregates have shown higher strength. Use of this mix for road construction helps to use plastic waste. Once the plastic waste is separated from municipal solid waste; the organic matter can be converted into manure and used. The main object of paper is to analyse & study how waste plastic will be effectively utilized in construction of flexible pavement as a binder material for replacing the content of bitumen & its successful application.

Keywords: *Bitumen, Flexible Pavement, Plastic, Solid Waste Management.*

I INTRODUCTION

Generally, for two types of road; materials used are concrete for rigid pavement roads and bitumen for flexible pavement roads. For economical road construction; new techniques and new material must be used. The steady increase in traffic intensity and a significant variation in seasonal temperature made a demand in improvement of road characteristics with the improvement in property of binder. Bitumen is a useful binder for road construction and grades of bitumen available on the basis of their penetration values are 30/40, 60/70, 80/100.

Since, the plastic materials have become part and parcel of daily life, its availability is enormous. They either get mixed with Municipal Solid Waste or thrown over land area, If not recycled; their disposal is either carried out by land filling or by incineration leaving a certain impact on the environment. Under such circumstances, an alternate use for the waste plastics is needed.

Because of rapid urbanisation, the demand of bitumen has increased tremendously due to its use as binder & water proofing material for construction of roads and pavements. The emerging need can be achieved by enhancing the durability of existing road surface resulting in the reduction of maintenance & resurfacing operations. Hence, the modification of bitumen to meet the required performance standards of the pavement appears to be logical & economical approach. As compared to bitumen; crumb-rubber & fly-ash are economical ideal modifiers. So, conventional bituminous materials, if designed & executed properly, perform quite

satisfactory. Though stiffer mixes possess larger fatigue resistance & deformation resistance; it throws out drawbacks as high susceptibility to temperature variations, tendency to crack less, etc. resulting in failure of bituminous pavement under adverse climatic & traffic conditions.

Through the investigations carried out in India and other countries; it has been revealed that properties of bitumen and bituminous mixes can be improved with the incorporation of certain blend additives known as “Bitumen Modifiers” and the bitumen premixed with these modifiers is known as “Modified Bitumen” which gives higher life of surfacing (up to 100%) depending upon degree of modifications and type of additives used and even the time period for next renewal may be extended by 50%. Full scale performance studies carried out under the aegis of Ministry of Road Transport and Highways & Central Road Research Institute, New Delhi; Highway Research Station, Chennai; Rubber Board, Gujarat Engineering Research Institute, Vadodara; and Kerala Public Works Department revealed that when life-cycle cost is taken into consideration, the use of Modified Bitumen in construction and maintenance of bituminous roads is cost effective. Ultimately, the renewals would be using ordinary bitumen and it would be modified bitumen for prevailing traffic and climatic conditions.

II PROCEDURE

2.1 Selecting waste Plastic polythene

Plastic is all pervasive in modern day lifestyle. It is used for packing, protecting, serving, etc. Polythene & polypropylene are more useful than any other kinds of plastics. In India, commonly polyethylene materials are used for packaging of drinking water in small pouches. This pouches costs low and are available generally everywhere. People throw these unwanted pouches in the surroundings that cause environmental pollution to the cities and road side areas. The disposal of this non-decaying and non-biodegradable waste polythene is a menace for the present society.

2.2 Selection of Bitumen Grade

For the study, we shall select bitumen grade as 60/70 (penetration & softening point test) generally used as a Paving Grade Bitumen suitable for construction of bases and wearing courses of flexible pavements with superior properties as thermoplastic property causing the material to soften at high temperatures and to harden at lower temperatures. This unique temperature/ viscosity relationship is important while determining the performance parameters of bitumen.

III SAMPLING PROCESS

3.1 Segregation

Plastic waste must be separated from other waste having maximum thickness of 60 micron.

3.2 Cleaning Process

The separated polythene wastes are washed, cleaned and dried and then shredded into tiny pieces to avoid formation of lumps when mixed with hot bitumen. The smaller the size of the polythene; more proper is mixing done with formation of good blend.

3.3 Shredding Process

Different types of plastic wastes are mixed together and shredded or cut into small piece.

3.4 Collection Process

The plastic waste retaining in 2.36 mm is collected.

3.5 Mixing Process

Two processes as under:

3.5.1 Wet Process

Bending of waste plastics by direct mixing of shredded plastics with hot bitumen is done at 160°C with proper cooling while adding stabilizers. Mechanical stirrer is needed as mixing is difficult because of difference in viscosities of molten polymer and bitumen.

3.5.2 Dry Process

The aggregate is heated to 170°C in the Mini hot Mix Plant with addition of shredded plastic in equal proportion coating it uniformly over the aggregates. Immediately, the Bitumen heated at 160°C is added with the mixture and is transferred to the road to be laid.

1-PENETRATION TEST:-

AIM- To find out hardness or softness of the bitumen.
(IS:1203-1978)

OBSERVATION TABLE:

% of plastics	Penetration mm
0	95
2	90
3	80
5	85
10	NIL

PLOTTING CURVE-

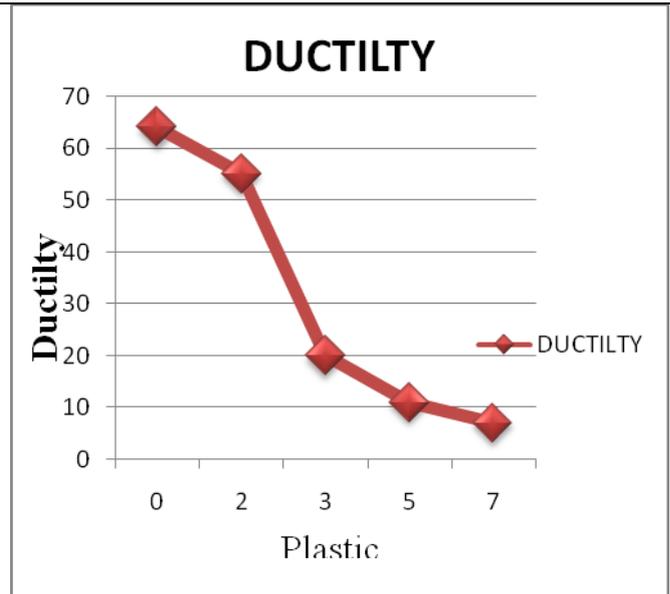
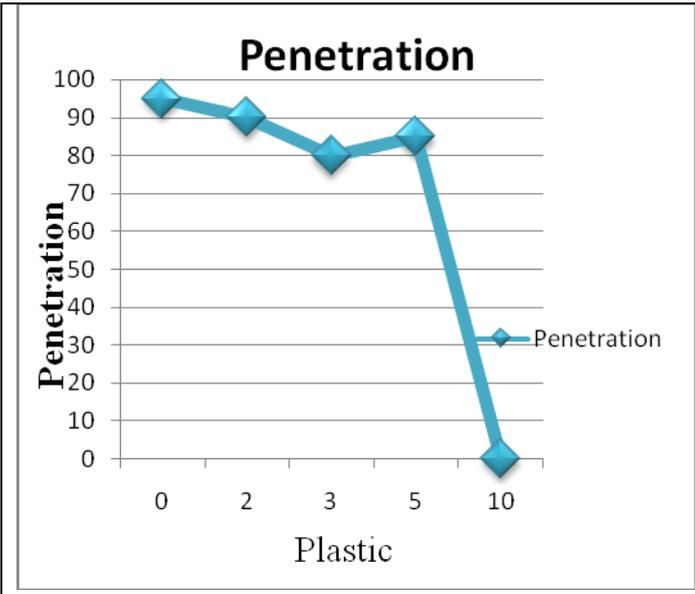
2- DUCTILITY TEST:-

AIM- To measure the ability to stretch of the bitumen. (IS:1208-1978)

OBSERVATION TABLE-

% of plastics	Ductility cm
0	65
2	55
3	20
5	11
10	07

PLOTTING CURVE-



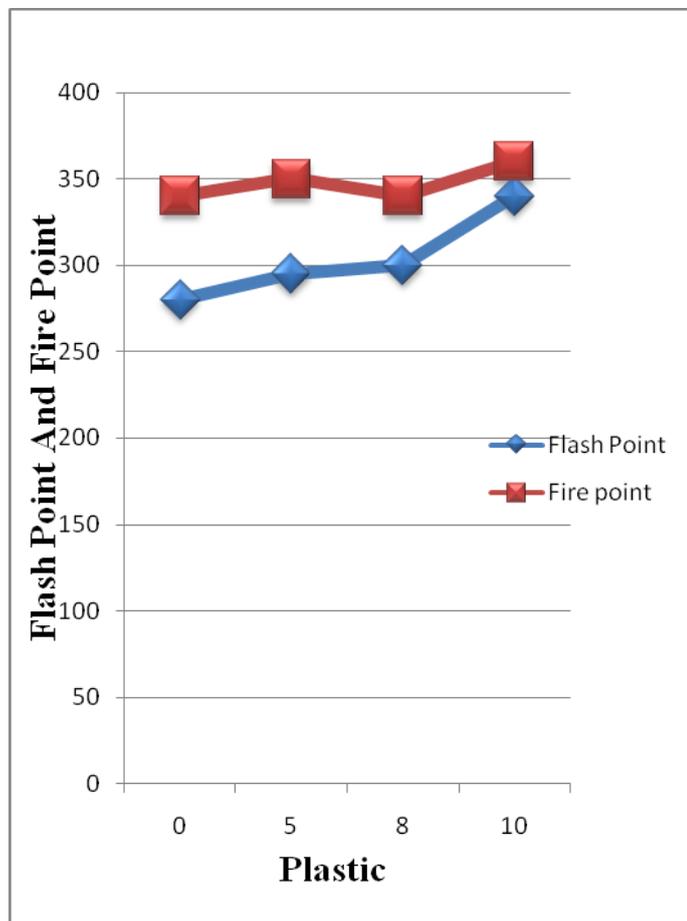
3- FLASH AND FIRE POINT TEST

AIM- To find out flash and fire point of bitumen.(1209-1978)

OBSERVATION TABLE :

% of plastic	Flash point	Fire point
0	280	340
5	295	350
8	300	340
10	340	360

PLOTTING CURVE :



4- MARSHAL STABILITY TEST

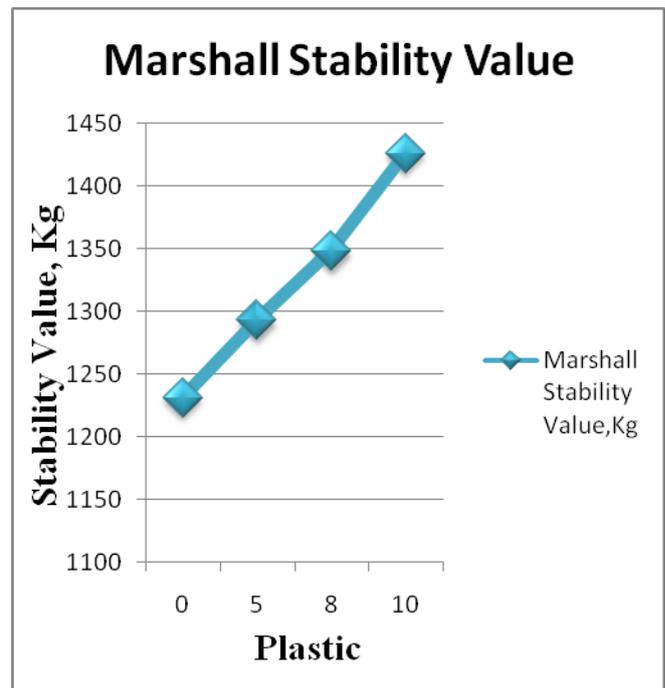
AIM : a) To determine the density-voids analysis for given bituminous mix.

b) To determine the strength and flexibility for given bituminous mix.

OBSERVATION TABLE :

Parameters	0	5	8	10
Plastic content, %	0	5	8	10
Stability value ,kg	1231	1293	1348	1426
Flow value in 0.25 unit	8.22	8.59	8.93	9.41
Unit Wt. gm/cm ³	2.28	2.28	2.36	2.51
V _v %	7.70	6.34	5.58	5.02
V _{fb} %	76.46	78.93	80.82	81.93

PLOTTING CURVES :



IV CONCLUSION

- Improved property of the mixtures with increase in Marshall Stability Value for the mix with 10% of waste plastics.
- The Marshall Stability; a strength parameter shows increasing trend with a maximum increase of 17.63%.

- The use of higher percentage of waste plastic is not preferable.
- The formation of pot holes at early stages which will be heated by waste plastic bitumen blend due to its higher binding property and better resistance against stripping.

Sr. No.	Properties	Modified Mix	Conventional Mix
1.	Marshall Stability Value	More	Less
2.	Blinding Property	Better	Good
3.	Softening Point	Increase	Low
4.	Penetration value	Decrease	High
5.	Flash & Fire Point	Increase	Low
6.	Stripping	No	Yes
7.	Durability of the Roads	Better	Good
8.	Bleeding	Less	More
9.	Rutting	Less	More

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ENERGY GENERATION BY USING GRAVITY WEIGHT BALANCE MECHANISM : A NEW APPROACH

Mr. Rakesh S .Ambade¹, Mr. Satish B.Chawale² , Mr.V.V.Bhojar³ , Mr.
A.G.Padgelwar⁴ , Mr. S.S.Gaddamwar⁵

^{1,2,3,4,5} Asst. Prof. Department of Mechanical Engineering, J.D.I.E.T Yavatmal, Maharashtra,(India)

ABSTRACT

*Recent days man has been in pursuit of energy to meet his ever increasing demand. Nowadays the society has woken up to the great perils of pollution and global warming caused by fuel based energy sources. The problem of generating power is recent quest, so everyone should think gravity be the option in non conventional energy sources. Because gravity is available all over in abundant quantity. Since gravity is present all over from beginning of universe. Sir Issac Newton discover phenomenon of gravity near 400 year ago. All over it is abundant. It is consistent i.e. 24 X 7. Comparing to chemical, thermal and other energy source gravity is weak, is scalable. This weakness is primarily due to the uniformity, or steady state, of our interactions with gravity. As gravity is weak it cannot be efficiently be converted into electrical energy or in other form .In this paper we have designed a methodology wherein gravitational energy is further amplified in terms of its magnitude by using mass unbalancing mass. It can be successfully be transformed into usable electrical energy. When compared to other sources of energy like hydal, thermal, tidal, wind, nuclear etc. it's present all over 24*7 consistently. Concept of gravity power generation is simple.It is when a body goes downward from higher altitude to lower one its potential energy get converted into kinetic energy through linear motion. Dynamo generates electricity converting this linear motion into circular motion.*

Keywords: *Dynamo, Electrical Energy ,Gravitational Energy, PMDC Generator ,Unbalance Mass*

I. INTRODUCTION

In recent times due to effects of pollution and global warming there is a need for generating power from renewable sources. The reason for generating power using gravity is that it is available all over the Earth, abundant and can be utilized at any place on the Earth. Energy demand is increasing day by day with rapid growth in industrial as well as house hold utilization. But the energy resources are gradually decreasing at a higher rate, with this scenario the energy resources would come to an end within a few years and hence there will be scarcity of fuel (coal, wood, water, etc.) for power generation. The other sources like solar, wind, biomass, etc., are available only for a particular duration of time during the day and the night. Therefore it is the time to look for other resources, or to find a new method to generate power in order to fulfill our Energy demands and requirements.

Power generation is done through various methods, some of which uses Renewable energy sources and some use Non Renewable Energy Resources. But all this methods can be used to produce the Electrical energy only for some extent. The energy generated from Renewable sources is also not continuous throughout the day for 24 hrs. Therefore a source through which energy can be harvested continuously for 24hrs is to be found. Gravity is the force that is present on the earth at every instant of time; hence with suitable mechanism it can be used as a source to generate Electrical energy. An arrangement is made in such a way that the Kinetic Energy of a body due to the gravitational force is converted into electrical energy.

This mechanism is based on the simple principle i.e., when an object is placed on a higher level ground then due to the gravitational force it experiences a pull towards the lower level and gain kinetic energy. This kinetic energy can be utilized in a precise manner in which it can be transformed into electrical energy.

There are many ways to convert gravitational energy into electrical energy. Gravia Lamp is one of the mechanisms.



Fig.1: Procedure For Power Generation.

When a body is at certain height from the ground, it possesses potential energy. Due to gravitational pull the body falls down. In this process, potential energy is converted to kinetic energy in the form of torque. This converted into electrical energy using generator. The electrical energy is supplied to the LEDs, where electrical energy is converted into light energy. Gravia lamp and Gravity Generator follow the same mechanism.

II. LITERATURE REVIEW

David Hatcher Childress[May,1990] has apparently devised mechanism whereby static gravitational pull can be harnessed to generate useful energy. The claim is that the energy required to turn the small motor is much less than the energy gained from the imbalanced larger wheel turning a generator.

Martin Riddiford and Jim Reeves, [1998]London based designers who have spent 4 years developing Gravity Light as an off-line project. They are using a tried and tested manufacturer who has the right expertise to make Gravity Light. They had some links to partner organizations in Africa and need to do the same for India. Gravity Light is a revolutionary new approach to storing energy and creating illumination. It takes only 3 seconds to lift the weight which powers Gravity Light, creating 30 minutes of light on its descent.

Russian inventor, Mikhail Dmitry on January[2001] has been working on various iterations over the years. In those activities a small motor at about the 2-o'clock location spins a deflector mechanism clockwise. The deflectors push

dangling weights to the right. Being on a counter-clockwise ratchet, this causes those evenly-spaced weights to stay outward long enough to cause the larger wheel to be imbalanced and thus turn clockwise.

III. EXPERIMENTAL METHODOLOGY

The primary objective of the present mechanism is to provide gravity power generation mechanism which can be continuous and stable operation to continuously convert the gravity potential energy into the kinetic energy and then to convert the kinetic energy into the electrical energy, so as to perform a long time, effective and stable energy output.

This mechanism utilized the gravity energy conversion unit to convert the gravity potential energy into the kinetic energy. The gravity energy conversion unit produce positive torques by adapting outward –spreading single directional swing arm (crank) and reduce the negative torques by co-operating with folding action of the single direction swing arms, so as to perform a long time, effective and continuous energy conversion of converting gravity potential energy into the kinetic energy. Next, the kinetic energy will be transmitted to a power generating unit to perform another energy conversion of converting the kinetic energy into the electrical energy. And finally, a power supply system used to transmit the electrical energy out.

By such arrangements, the gravity power generation mechanism not only has the advantages, such as more simplified in structure, higher conversion ratio, and more environments –friendly but only need a little of starting energy to perform a long-time power conversion. More particularly, the gravity is more stable, so the present mechanism is more stable than the wind power generation and solar power generation systems and can place at arbitrary position without being affected by the outside environment.

The secondary advantage of this mechanism is that it can generate independently electricity and also able to generate electricity in connection with wind power and solar power system. Because of that initial energy to the mechanism is provided by motor run on wind or solar energy and provide a little start to the mechanism, then this mechanism can self output the energy for a long time.

The single direction pivot slip only allow the respective single direction swing arms to be pivotally folded to 70° in opposite direction to the transmitting member, and the respective single direction arms can freely rotate within a horizontal and vertical angle with respective the transmitting member.

The transmitting member and the wheel members of gravity energy conversion unit can be design as: it provides a co-operation of stand and couple of pulley, and a co-ordination between belt and pulleys so that it handles weight as well as no slip of belt on pulley occur. The single direction swing arm contain a crank, crank pin, and load at the top of the crank. It connected on the belt and having equal distance. The outer end of crank (swing arm) is fixed and inner end fixed with crank pin which allow 70° moments as side restriction having in the clip. Due to design of single direction swing arms the gravity member at the outer end of the swing rod will produce a larger positive torque. And continuous rotation of mechanism occurs.



Fig. 2: Experimental methodology



Fig. 3: Experimental methodology

The gravity energy conversion unit can be parallel connected to multiple gravity energy conversion units to produce a much larger positive torque for driving a power generating unit with much more capacity. The power generating unit can be parallel connected to at least one mechanical structure to increase the positive torque which the power generation requires. This rotational energy (torque) can be directly converted electrical energy PMDC generator of voltage: 6.8 -7.4 volt current: 0.2-0.5 amp gears: sintered type gear ratio: 1:6, Speed: 200-400 rpm.

IV.RESULT & DISCUSSIONS

When working with number of angular pipes on the ring

The number of angular pipe containing water attached on the ring are having mechanism which allow the water to move downward in the pipe from left to right when ring move in a clockwise direction. This moment of water provide its kinetic energy to act in that direction which increased the force act in that direction as compare to other direction and because of that the ring is move in higher force direction . During working initially starting torque are given to the ring which makes the ring to rotate. Then this rotation is continuous by unbalance force which is come by movable water as explain above.

Observations

This is taken after giving one rotation to the ring.

4.1 When there are four pipes on the ring



Fig.4. Four pipes on the ring

SR.NO	NUMBER OF ROTATION
1	15
2	14
3	13
4	14
5	15

Average 14

Table 1:- Observation when there is four pipes on ring.

$$1. \text{Ngen}_4 = 6 * N = 6 * 14 = 84$$

$$\text{Torque} = r * wt = 0.28 * 480 = 134.40 \text{ N-m}$$

$$\text{Given, } r = 28 \text{ cm } \text{ Wt} = 480 \text{ gm,}$$

$$V_4 = \pi DN_4 / 60$$

$$= 10.26 \text{ m/s}$$

$$\text{Given, } D = 14 \text{ mm, } N = 14 \text{ RPM,}$$

$$P_4 = \frac{2\pi N_4 T}{60} = 197.040 \text{ Watt}$$

$$\text{K.E} = \frac{1}{2} Mv^2$$

$$= 247842.04 \text{ N/m}$$

$$\text{Pact} = (P_4 - \text{Pin}) = (197.040 - 0.628)$$

$$= 196.412 \text{ watt}$$

4.2 When there are three pipes on the ring



Fig.5 Three pipes on the ring

SR.NO	NUMBER OF ROTATION
1	16
2	15
3	13
4	14
5	16

Average 15

Table 2:- observation when there are three pipes on the ring.

2. $N_{gen_5} = 6 * N = 6 * 15 = 90$

Torque = $r * wt = 0.28 * 480 = 134.40 \text{ N-m}$

Given, $r = 28 \text{ cm}$ $Wt = 480 \text{ gm}$,

$V_5 = \pi DN_5 / 60$

$= 10.99 \text{ m/s}$

Given, $D = 14 \text{ mm}$, $N = 15 \text{ RPM}$,

$P_5 = \frac{2\pi N_5 T}{60} = 211.115 \text{ Watt}$

$K.E = \frac{1}{2} Mv^2$

$= 284364.6674 \text{ N/m}$

$P_{act} = (P_5 - P_{in}) = (211.115 - 0.628)$

$= 210.48 \text{ watt}$

4.3 When there are two pipes on the ring



Fig.6. Two pipes on the ring

SR. NO	NUMBER OF ROTATION
1	15
2	17
3	15
4	17
5	16

Average 16

Table 3:- observation when there are two pipes on the ring

$$N_{\text{gen } 3} = 6 * N = 6 * 16 = 96$$

$$\text{Torque} = r * wt = 0.28 * 480 = 134.40 \text{ N-m}$$

$$\text{Given, } r = 28 \text{ cm } \quad Wt = 480 \text{ gm,}$$

$$V_6 = \frac{\pi DN_6}{60}$$

$$= 11.70 \text{ m/s}$$

$$\text{Given, } D = 14 \text{ mm, } N = 16 \text{ RPM,}$$

$$P_6 = \frac{2\pi N_6 T}{60} = 225.189 \text{ Watt}$$

$$\text{K.E} = \frac{1}{2} Mv^2$$

$$= 323948.724 \text{ N/m}$$

$$\text{Pact} = (P_6 - P_{\text{in}}) = (225.189 - 0.628)$$

$$= 224.56 \text{ watt}$$

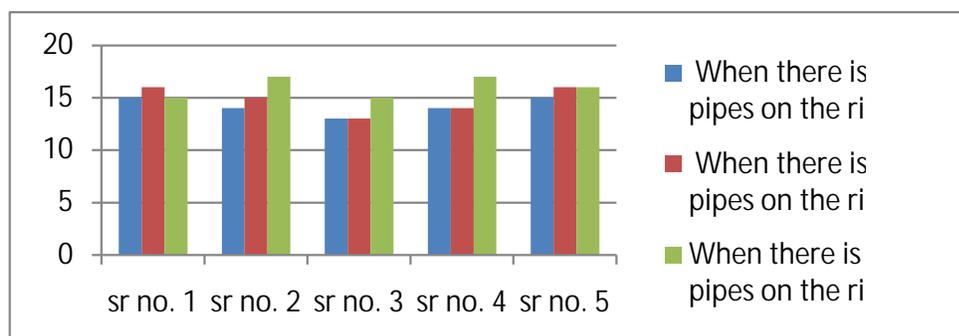


Fig.7:- The graph between number of rotation and sequential number of reading when there are four, three & two pipes attached on the ring.

Taking an average speed of all

$$\text{Now, power output } P = \frac{2\pi NT}{60} = 225.188 \text{ watt}$$

$$\text{Torque } T = \text{weight} * \text{perpendicular distance. } T = 96 \text{ N-m}$$

$$\text{Number of rotation } N = 16 \text{ rpm.}$$

Hence, output power $P = \frac{2 \square NT}{60} = 225.188$ watt

And input power = $P_{in} = \frac{2 \square NT}{60} = 0.628$

Initially number of rotation is $N_{in} = 6$

Now, power output $P = \frac{2 \square NT}{60} = 224.56$ watt.

V. CONCLUSION

The project work completed and it executes the expected result keeping in mind the eco-friendly behaviour of working. This project work and uses gravitational energy that is wasted any way. Thus future approach of this project seems to be encouraging and bright.

When compared to other sources of energy like hydro, thermal, tidal, wind, nuclear etc. Gravity is more abundant and available everywhere on the earth. Moreover it is eco-friendly. The output of the equipment depends on specifications of the generator, disk, electric circuit, battery. So, by increasing the specifications of the components we can improve the power output.

The project completed is of one module of whole electricity generator by using gravity. If we install number of such module in a series at various places will generate sufficient energy to be consumed locally. Thus the project will serve at its extreme level to the globe. The future of the project work seems to be great and promising.

The power of gravity here is renewable. This technique is such that we harness the energy derived from the motion of a device in both upward and downward direction. No consumption of fuel. Just pure renewable source of power - gravity. Other positive aspects of gravity power include;

Moreover it is eco-friendly. The output of the equipment depends on specifications of the generator, clamping arrangement, unbalancing weight, and pulley. So, by increasing the specifications of the components and solving a problem of continuous rotation we can improve the power output.

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ENERGY EFFICIENT CLUSTERING TECHNIQUES FOR MOBILE DATA GATHERING IN DISTRIBUTED WSN

Mrs. Rashmi KR.¹, Mr. Shivakumar AB.², Mr. Ananda Babu J.³

^{1,2} M.Tech. (CSE) Scholar, Kalpataru Institute of Technology, (India)

³ CSE, Assistant Professor, Kalpataru Institute of Technology, (India)

ABSTRACT

Now a days the “big data” emerged as a hot topic because of the tremendous growth of the Information and Communication Technology (ICT). The key contributors of the big data in the networks is the distributed Wireless Sensor Networks (WSNs). The data generated by an individual sensor node may not appear to be significant, the overall data generated across numerous sensors in the densely distributed WSNs can produce a significant portion of the big data. The researchers introduces a data-gathering technologies for large-scale wireless sensor networks by introducing mobility into the network. An M-collector (mobile data collector) starts the data-gathering tour periodically from the static data sink, polls each sensor while traversing its transmission range, then directly collects data from the sensor in single-hop communications, and finally transports the data to the static sink. We mainly focus on the problem of minimizing the length of each data-gathering tour and refer to this as the single-hop data-gathering problem (SHDGP). We have a data-gathering algorithm where multiple M-collectors traverse through several shorter sub tours concurrently to satisfy the distance/time constraints. Simulation results will try to demonstrate that the proposed data-gathering algorithm can greatly shorten the moving distance of the collectors and significantly prolong the network lifetime.

Keywords : Data Gathering, Energy Harvesting, Life Time, WSN.

I. INTRODUCTION

A wireless sensor network (WSN) consists of sensor nodes. These sensor nodes collect information from the environment and communicate with each other via wireless transceivers. The data collected by these sensor nodes will be delivered to one or more sinks, generally via multi-hop communication. The sensor nodes operate with batteries. These sensor nodes are deployed to not-easily accessible or hostile environment, sometimes in large quantities. It can be difficult or impossible to replace the batteries of the sensor nodes. On the other hand, the sink is typically rich in energy. Since the sensor energy is the most important resource in the WSN, The communications in the WSN has the many-to-one property in that data from a large number of sensor nodes tend to be concentrated into a few sinks. Since multi-hop routing is generally needed for distant sensor nodes from the sinks to save energy. The sensor nodes near a sink can be burdened with relaying a large amount of traffic from other nodes. Sensor nodes are resource constrained in term of energy, processor and memory and

low range communication and bandwidth. Limited battery power is used to operate the sensor nodes and is very difficult to replace or recharge it, when the nodes die. This will affect the network performance. Energy conservation and harvesting increase lifetime of the network. Optimize the communication range and minimize the energy usage, we need to conserve the energy of sensor nodes. Sensor nodes are deployed to gather information and desired that all the nodes works continuously and transmit information as long as possible.

This address the lifetime problem in wireless sensor networks. Sensor nodes spend their energy during transmitting the data, receiving and relaying packets. Hence, designing routing algorithms that maximize the lifetime until the first battery expires is an important consideration. Designing energy minimized algorithms increase the lifetime of sensor nodes. In some applications the network size is larger so we need scalable architectures. Energy conservation is the primary objective of wireless sensor networks, however for efficient working of wireless sensor networks it includes other objectives like scalable architecture, routing and latency.

The WSN is built of nodes from a few to several hundreds or even thousands, where each node is connected to one or more sensors. Components of sensor nodes are as follows: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. A sensor node might vary in size from that of a shoebox down to the size of a grain of dust, although functioning "motest" of genuine microscopic dimensions have yet to be created. The cost of sensor nodes is similarly variable, ranging from a few to hundreds of dollars, depending on the complexity of the individual sensor nodes. Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and communications bandwidth.

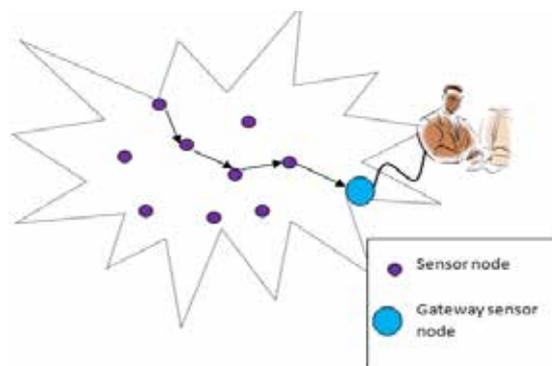


Fig 1: Multihop wireless sensor architecture

Collecting the large volume and variety of the sensed data is indeed, difficult as a number of important domains of human endeavor are becoming increasingly reliant on these remotely sensed information. For example, in smart-houses with densely deployed sensors, users can access temperature, humidity, health information, electricity consumption, and so forth by using smart sensing devices. In order to gather these type of data, the WSNs are constructed whereby the sensors relay their data to the "sink". In case of widely and densely distributed WSNs for e.g. in schools, urban areas, mountains, and so forth, there are two problems in gathering the data sensed by millions of sensors. First, the network is divided in to some sub-networks because of the limited wireless communication range. For example, sensor nodes deployed in a building may not be able to communicate with the sensor nodes which are distributed in the neighboring buildings. Therefore, limited communication range may raise a challenge for data collection from all sensor nodes. Second, the wireless

transmission consumes the energy of the sensor nodes. Even though the volume of data generated by an individual sensor is not significant, each sensor node requires a lot of energy to transmit the data generated by surrounding sensor nodes. Especially in dense WSNs, the life time of sensor nodes will be very small because each sensor node transmits a lot of data generated by tremendous number of surrounding sensors. To solve these problems, we need an energy-efficient method to gather large volume of data from a large number of sensors in the densely distributed WSNs. To achieve energy-efficient data collection in densely distributed WSNs, there have been many existing approaches. For example, the data compression mechanism is capable of shrinking the volume of the transmitted data. Although it is easy to be implemented, the data compression mechanism requires the nodes to be equipped with a big volume of storage and high computational power. In addition, the topology control mechanism can evaluate the best logical topology and reduce redundant wireless transmissions.

When the redundant wireless transmissions are minimized, the required energy for wireless transmissions can be also minimized. Furthermore flow control and routing can choose the path which consists of nodes having high remaining energy. However, these technologies are not able to deal with the divided networks problem. To deal with both the divided sub-network problem and the energy consumption issue, the mobile sink technology have received great attention in literature. In such schemes, the data collector, referred to as the “sink node” or simply the sink is assumed to be mobile such as Vehicle, Unmanned Aerial Vehicle (UAV), and so on. As the sink node moves around the sensing location, the sensors send data to the sink node when the sink node comes in their proximity. Thus, energy consumption can be minimized by reducing the amount of transmissions in the WSN. Since the mobile sink schemes aim to reduce wireless transmissions, the trajectory of the sink node is decided based on the sensor nodes’ information (e.g., location and residual energy). The sink node divides the sensor nodes into a number of clusters based on a certain condition. Then, the sink node roams around in these clusters.

II. LITERATURE SURVEY

W. Heinzelman, A. Chandrakasan, and H. Balakrishnan proposed Energy efficient communication protocol for wireless microsensor networks [1] in Jan. 2000. Distributed wireless sensor network will enable the reliable monitoring of a variety of environments for both civil and military applications. In communication protocols, which can have significant impact on the overall energy dissipation of these networks. The conventional protocols of direct transmission, minimum-transmission-energy, multihop routing, and static clustering may not be optimal for sensor networks, we propose LEACH (Low-Energy Adaptive Clustering Hierarchy), a clustering-based protocol that utilizes randomized rotation of local cluster base stations to evenly distribute the energy load among the sensor nodes in the network.

N. Li, J. Hou, and L. Sha proposed Design and analysis of an MST-based topology control algorithm[2] in May 2005, They introduced a Minimum Spanning Tree (MST) based topology control algorithm, called Local Minimum Spanning Tree (LMST), for wireless multi-hop networks. In this algorithm, each node builds its local minimum spanning tree independently and keeps only on-tree nodes that are one-hop away as its neighbors in the final topology.

T. Khac and C. Hyunseung proposed Connectivity-based clustering scheme for mobile ad hoc networks [6] in July 2008. This describes several new clustering algorithms for nodes in a mobile ad hoc network. The main

contribution is to generalize the cluster definition and formation algorithm so that a cluster consists of s all nodes that are at distance at most k hops from the cluster head. They also describe algorithms for modifying cluster structure in the presence of topological changes. They also introduced a unified framework for most existing and new clustering algorithm where a properly defined weight at each node is the only difference. They studied node connectivity and node ID as two particular weights, for $k = 1$ and $k = 2$. Finally, they introduces a framework for generating random unit graphs with obstacles.

K. Miyao, H. Nakayama, N. Ansari, and N. Kato proposed LTRT: An efficient and reliable topology control algorithm for ad-hoc networks [7] in Dec. 2009. Transmission is a costly operation in the context of ad-hoc networks, and thus topology control has been introduced to achieve efficient transmission with low interference and low energy consumption. By topology control method, each node optimizes its transmission power by maintaining network connectivity in a localized manner. Local Minimum Spanning Tree (LMST) is the topology control algorithm, which has been proven to provide satisfactory performance.

S. He, J. Chen, D. Yau, and Y. Sun proposed Cross-Layer optimization of correlated data gathering in wireless sensor networks [8] in Jun. 2010. They consider the problem of collecting correlated sensor data by a single sink node in a wireless sensor network. They assume that the sensor nodes are energy constrained and design efficient distributed protocols to increase the network lifetime. Many existing approaches focus on optimizing the routing layer only, but in fact the routing strategy is often coupled with link access in the MAC layer and power control in the physical layer.

III. EXISTING SYSTEM

The Existing System of this project is energy minimized clustering algorithm by using the Expectation-Maximization (EM) algorithm for 2-dimensional Gaussian mixture distribution. This system aims to minimize the sum of square of wireless communication distance since the energy consumption is proportional to the square of the wireless communication distance. Moreover, we first focus on the “data request flooding problem” to decide the optimal number of clusters.

The data request flooding problem refers to the energy inefficiency that occurs when all the nodes broadcast data request messages to their respective neighboring nodes. This problem wastes energy, particularly in the high density WSNs. Previous research work advocates increasing the number of clusters to reduce the data transmission energy. However, in this method, we point out that an excessive number of clusters can result in performance degradation, and therefore, we adopt an adequate method for deriving the optimal number of clusters.

IV. PROPOSED SYSTEM

The aim of this project is to achieve energy efficient Data Collection in densely distributed Wireless sensor networks using Mobile Collector. The K-medoids algorithm is used for the clustering. In this proposed system new data-gathering mechanisms for large-scale sensor networks when single or multiple M-collectors are used. In our data-gathering scheme with multiple M-collectors, only one M-collector needs to visit the transmission range of the data sink. While the entire network can be divided into sub networks. In each sub network, an M-

collector is responsible for gathering data from local sensors in the subarea. Once in a while, the M-collector forwards the sensing data to one of the other nearby M-collectors, when two M-collectors move close enough. Finally, data can be forwarded to the M-collector that will visit the data sink via relays of other M-collectors. All data are forwarded to M-collector 1 from other collectors, and then, M-collector 1 carries and uploads data to the data sink.

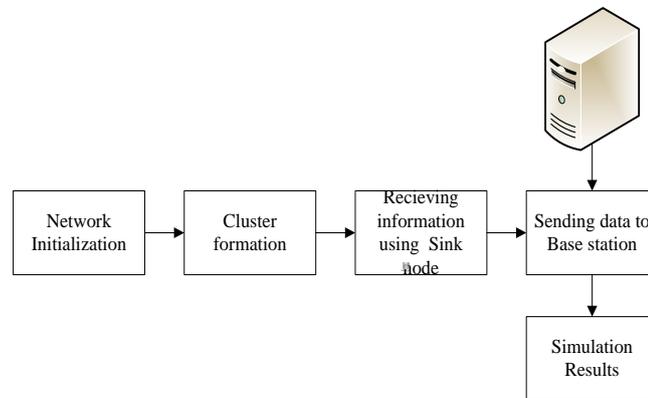


Figure 2: Architecture of proposed System

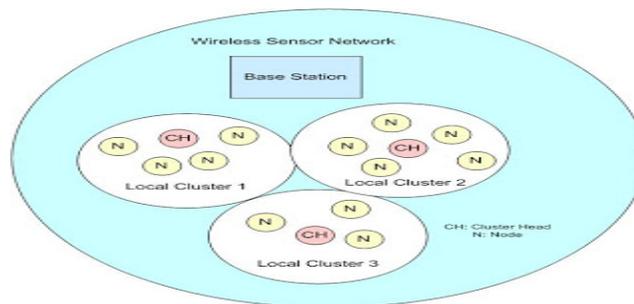


Figure 3: Cluster formation

V. CONCLUSION

The mobile data-gathering scheme for large-scale sensor networks increases the performance of the network . The concept mobile data collector, called an M-collector, which works like a mobile base station in the network. An M-collector starts the data gathering tour periodically from the static data sink, traverses the entire sensor network, polls sensors and gathers the data from sensors one by one, and finally returns and uploads data to the data sink. In addition, it can prolong the network life time significantly compared with the scheme that has only a static data collector and scheme in which the mobile data collector can only move along straight lines.

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POWER QUALITY IMPROVEMENT USING HYBRID FILTER

ChamandeepKaur

Assistant Professor, Department of Electrical Engineering

Bhutta Group of Institutions, (India)

ABSTRACT

The electricity supply would, ideally, show a perfect sinusoidal voltage at every point of the power network. In reality, it is almost impossible to accomplish such desirable conditions. Voltage and current waveforms deviate massively from a sinusoidal. These waveform deviations are described by the use of waveform distortion and usually called harmonic distortion. Even if harmonic distortion is a quite old phenomenon it today presents one of the main concerns for public utilities, distribution system operators as well as their end customers. Already in the first years of operation of power distribution networks, there were first disturbances. The major concern at this time was the effect that harmonic distortion had for the electric machines itself. Another well-known issue was interference in the telephone lines. But in general it can be said that harmonic distortion in former times did not have the same dangerous potential like it has today. This paper presents the design and formulation of hybrid filter to lower the harmonics and improve the power quality..

Keywords: Shunt Passive Filter, Series Active Filter, Hybrid Filter

I LITERATURE BACKGROUND

Enjeti et al., 1992), entitled “Analysis and design of an active power filter to cancel harmonic currents in low voltage electric power distribution systems”, presents active power filter design considerations used for improving current quality in low voltage electric power distribution systems. Among various types of filters, shunt active filter is used for current harmonics removal and improves the power quality in electric power distribution system.

(Hirofumi Akagi et al.,1998), entitled “The unified power quality conditioners: the integration of series-active and shunt-active filters”, In this paper the main purpose of a UPQC is to compensate for voltage flicker/imbalance, reactive power, negative sequence current, and harmonics. In other words, the UPQC has the capability of improving power quality at the point of installation on power distribution systems or industrial power systems. This paper discusses the control strategy of the UPQC, with a focus on the flow of instantaneous active and reactive powers inside the UPQC.

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Singh, Bhim Al-Haddad et al., 1998), entitled “Harmonic elimination, reactive power compensation and load balancing in three-phase, four-wire electric distribution systems supplying non-linear loads” In this paper, a new control scheme of a three-phase active power filter (APF) is proposed to eliminate harmonics, to compensate reactive power and neutral currents and to remedy system unbalance, in a three-phase four-wire electric power distribution system, with unbalanced non-linear loads. The APF is realized using three single phase IGBT based PWM-VSI bridges with a common dc bus capacitor.

(Bhimsingh et al., 1999), entitled “ A review of active filters for power quality improvements”, presents in this paper presents a comprehensive review of active filter (AF) 21 configurations, control strategies, selection of components, other related economic and technical considerations, and their selection for specific applications. It is aimed at providing a broad perspective on the status of AF technology to researchers and application engineers dealing with power quality issues.

(Fujita et al., 2000), entitled “A hybrid active filter for damping of harmonic resonance in industrial power system”, explains the feature of passive filter and active filter in a combined way called hybrid filter for the elimination of harmonic resonance in industries. In a hybrid filter, active filter works for the elimination of voltage harmonics and passive filter is used for the elimination of current harmonics.

(Adil M. and Al-Zamil et al., 2001), entitled “A Passive Series, Active Shunt Filter for High Power Applications” This paper presents a hybrid series passive/shunt active power filters system for high power nonlinear loads. This system is comprised of a three-phase shunt active filter and series ac line smoothing reactance installed in front of the target load. The proposed system significantly reduces the required shunt active filter bandwidth. The space-vector pulse width modulation (PWM) controller is based on a dead-beat control model. It is implemented digitally using a single 16-bit microcontroller. This controller requires only the supply current to be monitored, an approach different from conventional methods.

II. INTRODUCTION TO HYBRID FILTER

The hybrid filter, which is a combination of an active series filter and passive shunt filter. It is quite popular because the solid-state devices used in the active series part can be of reduced size and cost (about 5% of the load size) and a major part of the hybrid filter is made of the passive shunt $L-C$ filter used to eliminate lower order harmonics. It has the capability of reducing voltage and current harmonics at a reasonable cost.

Series active filter and parallel passive filter topology shown in fig. 1, An active power filter is implemented with a three-phase pulse width modulation (PWM) voltage-source inverter operating at fixed switching frequency. When this equipment is connected in series to the ac source impedance it is possible to improve the compensation characteristics of the passive filters in parallel connection. In order to allow current harmonic compensation, parallel LC filter must be connected between the nonlinear loads and the series transformers. It is well known that series active power filters compensate current system distortion caused by non-linear loads by imposing a high impedance path to the current harmonics which forces the high frequency currents to flow through the LC passive filter connected in parallel to the load. The high impedance imposed by the series active power filter is created by generating a voltage of the same frequency that the current harmonic component that needs to be eliminated. Current

harmonic and voltage unbalance compensation are achieved by generating the appropriate voltage waveforms with the three phases PWM-source inverter.

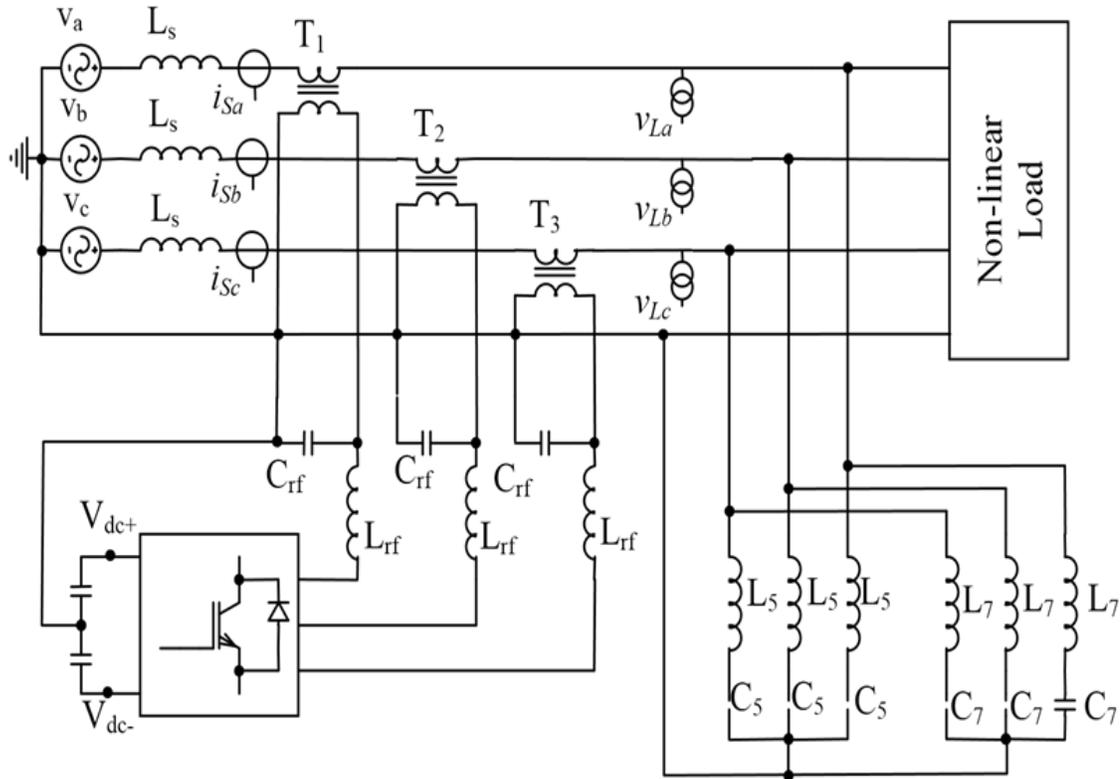


Figure 1. Series active filter and shunt passive filter topology

III CONTROL STRATEGIES

3.1 The Dual Instantaneous Reactive Power Theory

3.1.1 SRF Controller

The synchronous reference frame theory or d-q theory is based on time-domain reference signal estimation techniques. It implements the operation in steady-state or transient state as well as for generic voltage and current waveforms. It allows controlling the active power filters in real time system. Another important characteristic of this theory is the simplicity of the calculations, which involves only algebraic calculation. The basic structure of SRF controller consists of direct (d-q) and inverse (d-q)- park transformations as shown in fig 2. These can be valuable for the calculation of a specific harmonic component of the input signals.

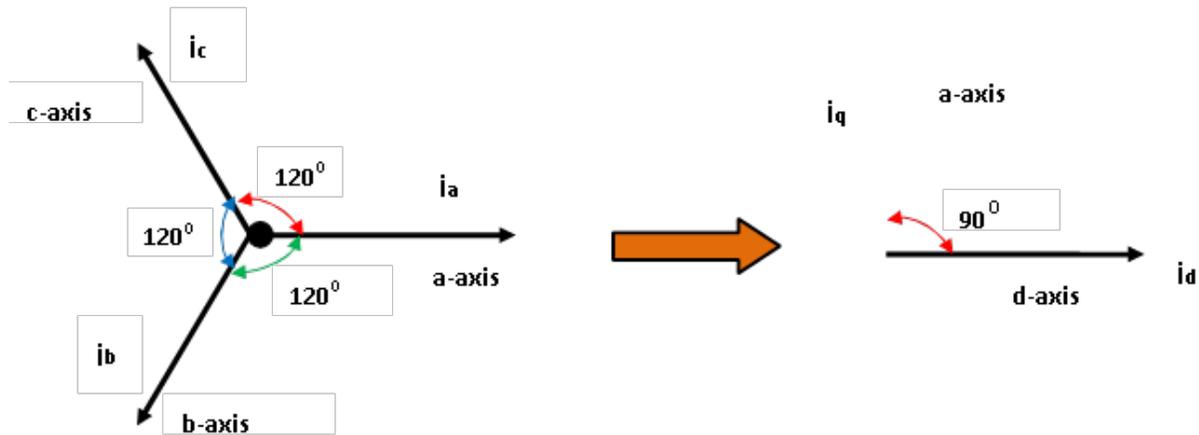


Figure 3. Transformation from the phase reference system (abc) to the (0αβ) system.

Instantaneous reactive power theory (IRPT) uses the park transform, to generate two orthogonal rotating Vectors (α and β) from the three phase vectors (a, b and c). This transform is applied to the voltage and current and is given by eqn 2,3

$$\begin{bmatrix} v_0 \\ v_\alpha \\ v_\beta \end{bmatrix} = \frac{1}{\sqrt{3}} \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} & 1/\sqrt{2} \\ 1 & -1/2 & -1/2 \\ 0 & \sqrt{3}/2 & -\sqrt{3}/2 \end{bmatrix} \begin{bmatrix} v_a \\ v_b \\ v_c \end{bmatrix} \quad (2)$$

$$\begin{bmatrix} i_0 \\ i_\alpha \\ i_\beta \end{bmatrix} = \frac{1}{\sqrt{3}} \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} & 1/\sqrt{2} \\ 1 & -1/2 & -1/2 \\ 0 & \sqrt{3}/2 & -\sqrt{3}/2 \end{bmatrix} \begin{bmatrix} i_a \\ i_b \\ i_c \end{bmatrix} \quad (3)$$

By looking at instantaneous powers, the harmonic content can be visualized as a ripple upon a DC offset representing the fundamental power. By removing the DC offset and performing the inverse park transform the harmonic current can be determined. The supply voltage and load current are transformed into $\alpha\beta$ quantities. The instantaneous active and reactive powers p and q are calculated from the transformed voltage and current.

IV THREE PHASE SYSTEM WITH HYBRID FILTER

The system is shown in figure 4 has been simulated in the Matlab Simulink platform to verify the proposed control. Each power device has been modelled using the SimPowerSystem toolbox library. Figure 4 shows the Simulink diagram of hybrid filter. It is constituted by a series active filter and shunt passive filter connected in parallel with the load. The power circuit is a three phase system supplied by a sinusoidal balanced three phase 415v source, 50hz frequency with a source inductance of 5.8mH and a source resistance 3.6Ω. An active power filter consists of a three phase pulse width modulation PWM voltage source inverter. When this equipment is connected in

series to the ac source impedance it is possible to improve the compensation characteristics of the passive filters in parallel connection. The inverter consists of an Insulated Gate Bipolar Transistor (IGBT) bridge. An LC filter has been included to eliminate the high frequency components at the output of the inverter. This set is connected to the power system by means of three single-phase transformers having rated power 1000VA and frequency 50 Hz with a turn ratio of 1:1. Also passive LC filter are connected in parallel with nonlinear load to eliminate the 5th & 7th order harmonics. The parameters of passive elements are $L_5=13.5\text{mH}$ $C_5=30\mu\text{F}$ $L_7=6.75\text{mH}$ $C_7=50\mu\text{F}$. The passive filter is designed only to compensate source current harmonics, the reactive power was not considered. The nonlinear load is a three phase diode rectifier having snubber resistance 500Ω and snubber capacitance $250\mu\text{F}$. The APF series control based on the instantaneous reactive theory is used. In fact, the instantaneous reactive power here is defined from a dot product; this results in a remarkable simplification in the implementation of the reference generation method. The final development allows any compensating strategy to be obtained among them, unity power factor. The strategy is applied to a three phase system with balanced loads. The simulation results used to verify the theoretical behavior are presented

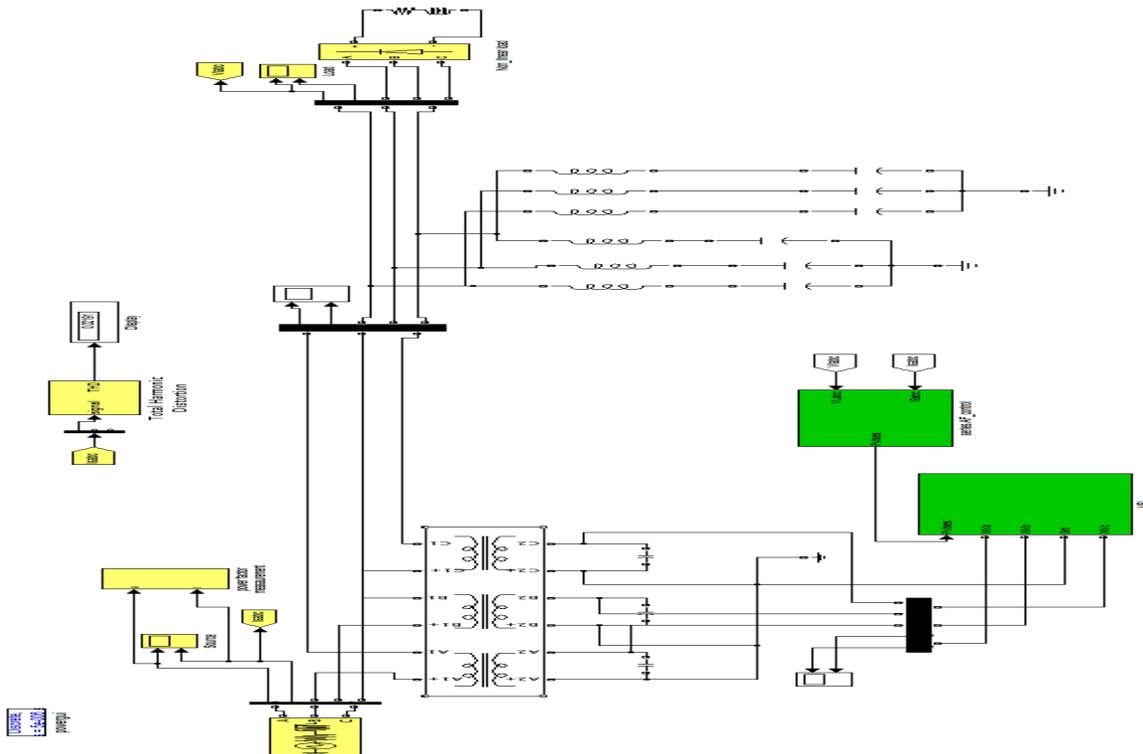


FIGURE 4 Simulink Diagram of Three Phase System Using Hybrid Filter

V SIMULATION RESPONSE

The system parameters considered for the study of Hybrid Filter is given below in Table 1.

COMPONENTS	SPECIFICATIONS
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AC Source	$V_s=415\text{v}$, $f=50\text{HZ}$, $R_s=3.6\Omega$, $L_s=5.8\text{Mh}$
Non Linear Load	$R_L=40\Omega$, $L_L=50\text{mH}$
Passive Filter	$L_5=13.5\text{mH}$ $C_5=30\text{F}$, $L_7=6.75\text{mH}$ $C_5=50\text{F}$

5.1 Simulation Response without Filter

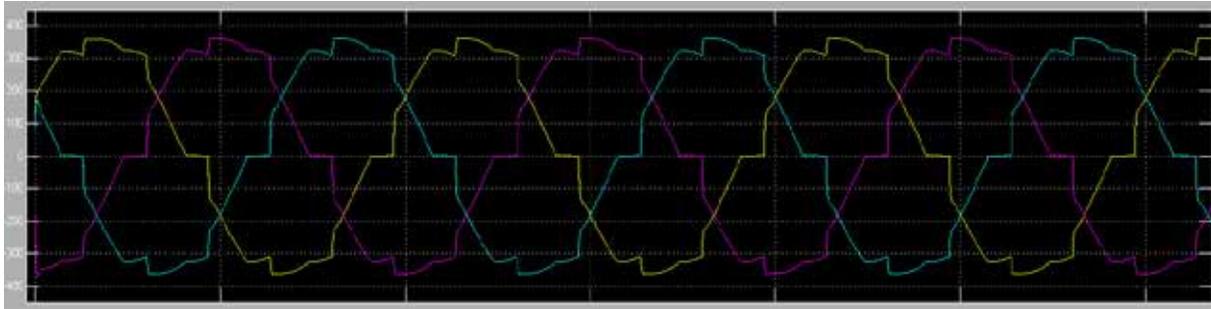


Figure-5 Waveforms of source voltage without filters

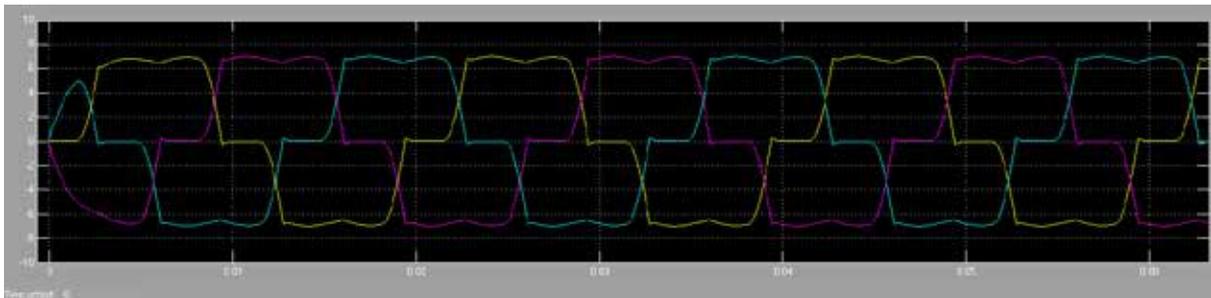


Figure-6 Waveforms of source current without filters

5.2 Simulation Response with Hybrid Filter

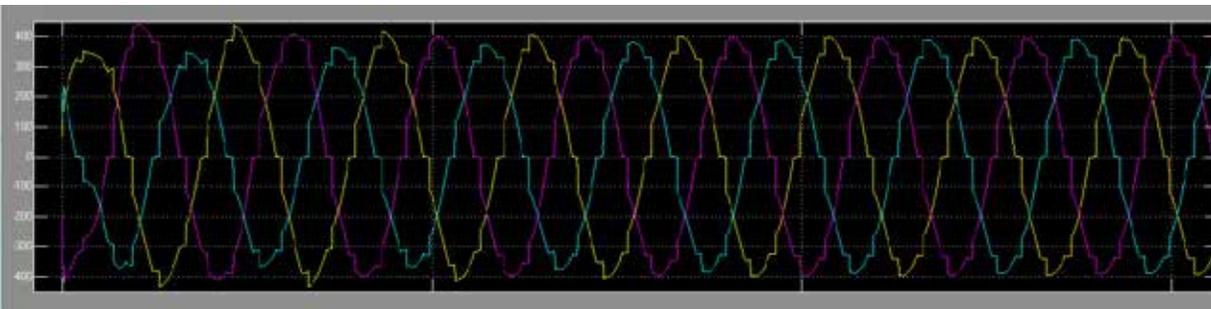


Figure-7 Waveforms of load voltage with hybrid filter

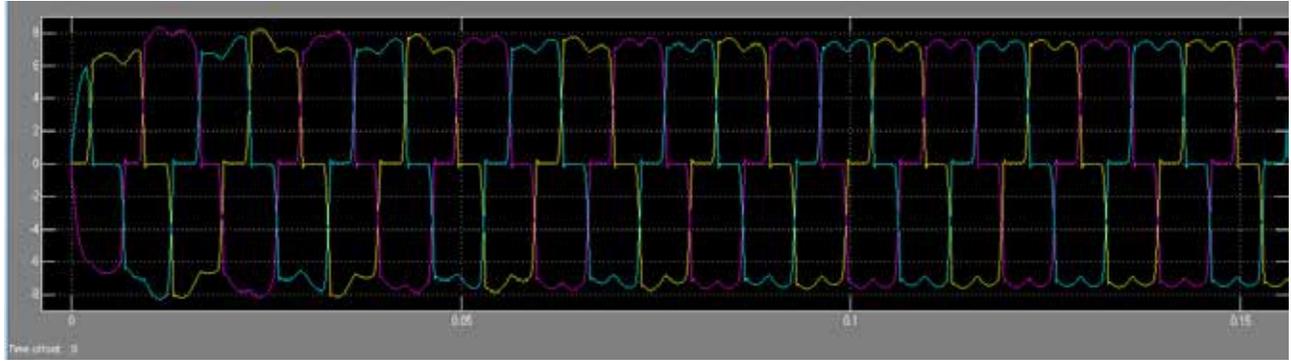


Figure 8 Waveforms of load current with hybrid filter

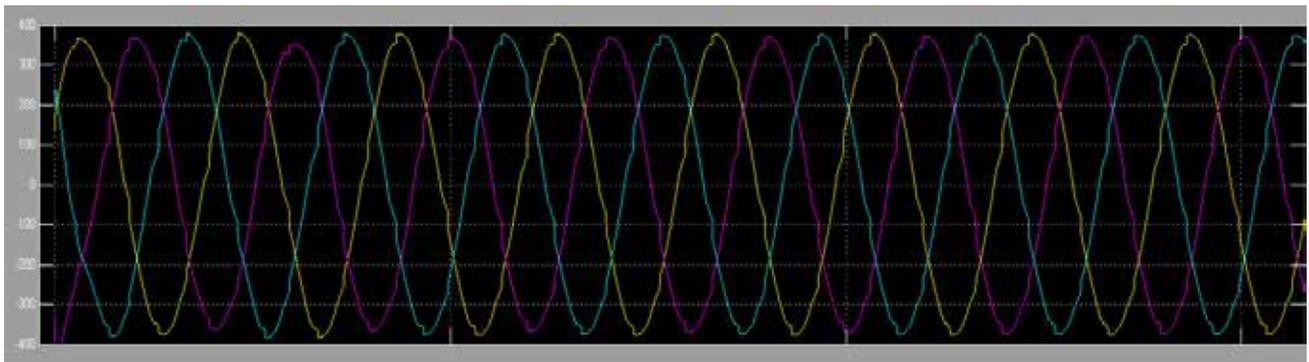


Figure 9 Waveforms of source voltage with hybrid filter

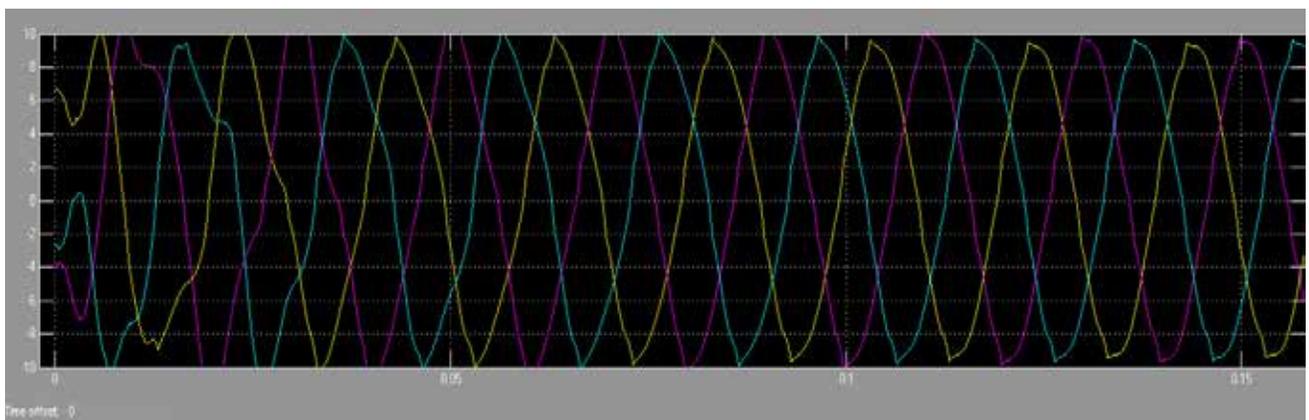


Figure 10 Waveforms of source current with hybrid filter

When the series active filter is connected, the THD of the source current falls to 2.1%. The waveform is shown in Fig. 10. Now, the power factor rises to 0.998. This allows us to verify the proposed control improvement in the compensation characteristic of the passive filter and it practically achieves unity power factor. Figure 7 and 8 shows the waveforms of load voltage and current.

VI CONCLUSION

This paper proposed hybrid filter design to enhance the power quality in transmission and distribution system.

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BIOGRAPHY

Name - Chamandeepkaur

Designation-Assistant Professor in Bhutta College of Institutions, India

Department of Electrical

Qualification-Btech (Electrical Engg) from Guru Nanak Dev Engineering College

Mtech(power Engg) from Guru Nanak Dev Engineering College

Phone no-8968334007

PERFORMANCE ANALYSIS OF THE TECHNIQUES EMPLOYED ON VARIOUS DATASETS IN IDENTIFYING THE HUMAN FACIAL EMOTION

Usha Mary Sharma¹, Jayanta Kumar Das², Trinayan Dutta³

¹Assistant Professor, ^{2,3}Student, Department of CSE and IT,

Assam Don Bosco University, Assam, (India)

ABSTRACT

The technique of recognizing emotion using facial expressions is a central element in human interactions. Human emotion can be easily detected with the help of facial expressions. Understanding human emotion accurately is one of the challenging tasks in the present world. Automatic emotion recognition through facial expression provides lots of flexibility in many research areas like medicine, psychology as well as in computer science. By developing systems that can detect and understand emotions, we can enhance the Human Computer Interaction. There are various types of feature extraction techniques as well as standard datasets have been developed for recognising emotion through facial expression. Through this paper our main motive is to review the performances of all feature extraction techniques as well as the datasets which have been used for various types of automatic emotion recognition research works.

Keywords: Automatic emotion recognition, Human Computer Interaction, facial expression

I. INTRODUCTION

Facial expressions help human perception system in understanding one's emotions, opinions as well as intentions in an effective way. Inter-personal human communication includes not only spoken language but also non-verbal clue such as hand gestures, facial expressions and tone of the voice, which are used to express feeling and giving feedback[1]. The human emotions can be classified into six types: surprise, fear, disgust, anger, happiness and sadness [2]. Facial motion plays a major role in expressing these emotions. Facial expressions give important clues about human emotions. Therefore, several approaches have been proposed to classify human affective states. The features used are typically based on local spatial position or displacement of specific points and regions of the face. Emotion recognition and affective intervention are nowadays well recognized desired features of Intelligent Tutoring Systems, with primary focus on such learner affective states as flow, boredom or frustration. Other areas of affective computing methods applications include: Testing driver stress, psychological diagnosis and training, neuron-biofeedback, emotion expression with avatars and more[3]. Now a day's realistic picture of Human Computer Interaction is more in demand. The main motive of this survey paper is to study the enhancement of the HCI (Human Computer Interaction) in more effective way. The generic block diagram of emotion recognition through facial expression is given below.

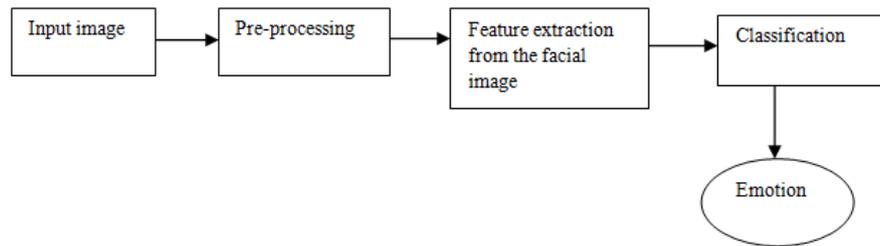


Fig. 1: Block Diagram of the Facial Emotion Recognition System.

II. BACKGROUND & RELATED WORKS

Detection of human emotion plays a vital role in Human Computer Interaction (HCI). Thus from the past few decades many researchers have tried to develop efficient techniques to detect human emotions. For this purpose they have to go through various phases. The first and important phase is preprocessing, where the image is cropped for reducing the dimension and after that elimination of noises like Gaussian, Poisson Noise, Salt and Pepper Noise etc. is done. Histogram Equalization is one another important factor in this phase.

For detecting human emotion efficiently researcher mainly focused on some standard datasets like Japanese Female Facial Expression (JAFFE) [1],[3],[11], FEEDTUM [2],[4], Cohn-Kande [3], Audio/Visual Emotion Challenge 2011 (AVEC2011)[4],[5] Face Recognition Technology (FERET)[6]. These datasets contain still images from various origins. In [1],[11] JAFFE dataset is used which has still images of women from Japanese origins. In Cohn-Kande dataset images are from American origin.

There are various feature extraction techniques through which we can extract the features of human face very easily and result will be highly efficient. Different methods such as Principle Component Analysis (PCA) [1],[9], Edge Detection [2], Anisotropic Inhibited Counter Map (ACM) [4], Back propagation [5], 2D-DCT [14],[15] are used by many researchers. Every technique has its own significance. For example in PCA (Principle Component Analysis) by taking eigen values one can reduce the feature vector very easily and it will take only distinguished features of the human face.

After feature extraction phase, training of the machine is done through efficient classifier and this phase is named as classification phase. Researchers used various types of classifiers in their work like ANN (Artificial Neural Network), HMM (Hidden Markov Model) [4], SVM (Support Vector Machine) [6], etc.

In recent years, researchers used many new datasets along with new feature extraction techniques and classifiers. For example, researchers are now using Skin Color Segmentation [10] as a feature which is taken from live video. After that by including Bezier Curve [10] Algorithm in LBP (Local Binary Pattern) [8] method they will try to get the emotions. One new technique Weber's Law Descriptor (WLD) [12] is also used which is based on Weber's Law. This is a very technique. By using this technique implementation will be done on mobile application for detecting emotion. Hybrid [9],[13] classifier is another new classifier used for detecting mixed emotion like happy and surprised etc. As we can see that for emotion recognition there are numerous techniques but as stated in [7] it is very hard to use a particular method for identifying emotion because of its complexity and variability.

III. ANALYSIS OF RESULT AND DISCUSSION

In this survey, it was seen that various types of features extraction techniques were used by the researcher. They also used various types of classifiers with this features extraction techniques. Through this classifier they were able to easily train the system for getting desired output. The researcher were very much concern about their datasets. For most of the cases they used the standard dataset as an input for the system which was trained by different training algorithm in later phases. There are many standard datasets are present for emotion recognition. Those are mainly Ekman's [2], where each of the seven universal emotional states was represented by images from several individuals.

In JAFFE (Japanese Female Facial expression), there are 213 images of the same seven universal expressions across 10 individuals [1]. The JAFFE database is of Japanese origin and therefore all faces used in this database occupy Asian face characteristics. Again in Cohn-Kande database it was seen having used 52 individuals displaying all seven universal emotions [3]. Another dataset that came across during the review was FEEDTUM datasets from Munich. The FEEDTUM database contains video recordings of some individuals and captures real time reactions from outside environment [4]. Next dataset was AVEC2011 (Audio/Visual Emotion Challenge 2011) here the author has proposed maximal representation and local histograms to generalize anisotropic inhibition and used HMM (Hidden Markov Model) which is more efficient and the efficiency is approximately 83% [5]. Finally we studied the FERET dataset. It gave 90% accuracy.

This whole process was accomplished within two different phases. In first phase, the researchers gave more concentration on how to feed the database into the system for getting more accurate result. It is seen that various types of classifiers were used. Through this classifier researchers were able to classify the datasets and later the datasets were easily trained in to the system. So we can name this phase as training phase [6]. In later phase researcher mainly focus on how the standard dataset were evaluated for getting more accurate and specific output which was is in the form of five emotions that was already mentioned within introductory part of this paper. The experimental results carried out in the papers mentioned above shows that in most of the cases, Principal Component Analysis (PCA) method proves to be best only when the frontal face image is considered with no head orientation [13]. PCA is considered as one of the premium method through which Dimension of the image will be reduced very easily when feature set of the image was extracted. The experimental result gives us the recognition rate which is almost approximately 95% when PCA is used as a feature extraction technique. In [9] another author used PCA and ANN combination along with her own database of image and the overall recognition rate is 93.5% for ideal image. When noises are include the rate decreases as 91.0%, 87.8%, 78.8% for Poisson, Gaussian, Salt & Pepper respectively. Now on analysis of the above results one summarized view is given below.

DATASET	METHOD	CLASSIFIER	ACCURACY	FUTURE SCOPE
JAFFE	PCA	ANN	95%	To be tested on large dataset
FEEDTUM	Edge Detection	ANN	85%	To be tested on complex emotional state
Cohn-Kanade	PCA	SVM	80%	To be tested on videos
AVEC2011 database	ACM (anisotropic inhibited counter map)	HMM	83%	Fuzzy logic membership function will be added

FERET	Back propagated NN	ANN	90%	proposed local histograms
Facial database[9]	PCA	ANN	93.5%	Reducing preprocessing computation time.

Table 1: Accuracy Measurement Table.

On basis of above discussions and analysis of the tabular result it is seen that PCA andANN combination is one of the best combinations for emotion detection with the help of facial expression, where PCA act as a feature extraction technique and ANN as a classifier. If we implement a system in which emotions can be detected then we would consider this combination.

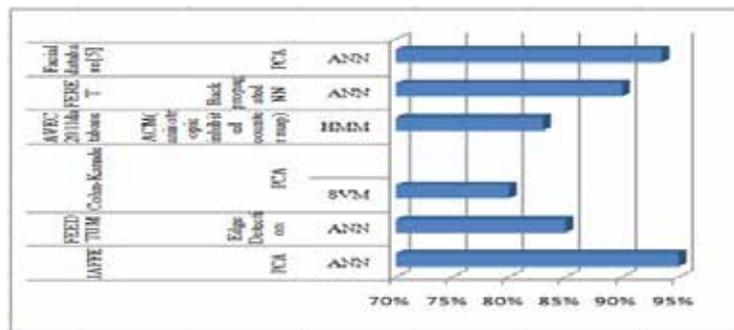


Fig.2: Accuracy Results of Various Combinations Of Classifiers, Datasets And Techniques.

IV. CONCLUSION

In this paper performance analysis has been done on various techniques employed by different researchers for identifying facial emotions. The systems basically included pre-processing, feature extraction, classification and facial emotion recognition. Different techniques are used for recognition. Higher the accuracy of the techniques better is the performance. Detection of facial emotion is a universal issue as it causes difficulties due various psychological and cultural variances of the individuals. Thus the research in this field will be going on for the years to come as many of the anomalies have to be corrected to create an ideal user interface for detection of emotions.

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