

DETECTION OF HUMAN BEINGS UNDER BUILDING RUBBLE

Rajavenkatesan.T¹, Chinnadhurai.R², Gowthamguhan.K.S³,
Sangeetha.J⁴, Vijayasudha.A⁵

¹Assistant Professor, ^{2,3,4,5} UG Students, Dept., of EIE,
K.S. Rangasamy College of Technology, Tiruchengode, (India)

ABSTRACT

“Thousands of people killed as an effect of building disaster”. The above words are not the headlines of the newspaper but such news come after the disaster destroyed the field. It was said if survivors has been found and rescue earlier the numbers of victims have been lower. Existing systems to detect the human being are the dogs, optical devices and acoustical life detectors and the rescue robot. Acoustical detectors such as geophones require quite working environments, a condition difficult to reach especially in critical situations the other methods such as, rescue robot can navigate deep into rubble to search for victim by the use of temperature sensor but they are unable to trap once they go out of range. The microwave life detection system is developed for the search and rescue of victims trapped under the rubble of collapsed building during the earthquake or other disasters. Comparing with the existing systems, the proposed life detection system has an advanced microwave beam the reflected wave from the human will be modulated by human being movements, which includes breathing and heartbeat. Hence the efficiency is increased and reduces the time taken for the rescue process which leads to reduction in death rate.

Keywords: *Microwave sensor, PIC Microcontroller, ZigBee, MPLAB, RS 232*

I. INTRODUCTION

In this global criterion natural calamities are unaccounted and are not easily solvable crate. Those unusual happenings result in human lives being left forever. Taking this portion of saving those suffered under this bondage, a new revolutionary microwave life detection system which is used to locate human beings buried or trapped under earthquake rubble has been designed. This system operating at particular frequency can remotely detect the breathing and heart beat signals of human beings buried under this rubble. By proper processing of these signals, the status of the human being under trap can be easily obtained. The entire process takes place within a few seconds as the system is controlled by a PIC Microcontroller unit.

Information about the location of buried person would be of great value for the rescue personnel, since it would help to reduce the time of operation and thus, help to save more lives. There is a need to construct a life detection system which can detect buried victims under earthquake or building debris most efficiently and as possible in short time. Such kinds of problems have been efficiently solved considering continuous waves which offer good localization and spatial accuracy.

In rescue mission and also in some surveillance operations there is not only the need of detect life signals but also the identification of people in a given area, to help rescue side operations in case of emergencies. This job can be complied with through wall surveillance techniques.

II. LITERATURE SURVEY

[1] Human detection in an unmanned area can be done only by an automated system. The system uses ultrasonic sensors and camera to trace, convey and analyze conditions of human body. In order to detect a human body, an independent robot must be equipped with a specific set of sensors that provide information about the presence of a person in the environment around. This effort describes an independent robot for rescue operations. Ultrasonic sensor is used in order to detect the existence of living humans and a low-cost camera in order to acquire a video of the scene as needed. Having detected a hint of a living human, the ultrasonic sensor activates the camera to show live picture. The video is then exhibited on the screen. This approach requires a fairly small number of data to be acquired and processed during the rescue operation. The detection depending on a number of factors such as the body position and the light intensity of the scene.

[7] Doppler Effect based methods for detection of live human beings, however, they are not able working effectively under realistic conditions, for example, when attenuation of sounding signals is so large that the signal reflected from the wall exceeds significantly (by factor of many orders) the signal scattered by a target behind the wall. Besides, the need of weak signal detection under presence of strong signal reflected by the wall and other objects brings also considerable difficulties. For the above and some other reasons the known systems are useless for solving the problem of Through Wall Detection and Recognition.

III. PROPOSED METHOD

This section includes detail description of block diagram of Detection of human beings under building rubble. Also with this there is explanation of various parts of microwave system.

3.1 Principle of Working

The principle of detection is firstly, microwave is sent through rubble to detect vital signs of life. Microwave would reflect back from some objects. These objects include humans. When the beam hits the body, the signal reflected with an additional modulation created by movement of heart and lungs. So, the reception of modulated signals shows the presence of alive human inside the rubble. With the modulated signal there are some signals, which are reflected from the immobile object such as rubble or debris. Thus in order to maintain a high sensitivity for this application, the wave reflected from the rubble or the surface of the ground has to be cancelled as thoroughly as possible. A microwave life detection system operated on the radio frequency was proposed in the 1985. This system detects the body oscillations occur due the breathing and heartbeat fluctuations. The system includes the additional subsystem to cancel the unwanted signals receive from the motionless objects such as rubble.

3.2 Frequency Bands

The microwave life detection system can works on different range of frequencies from L-band (2GHz) to X-band (10GHz). But X- band microwave is unable to penetrate deep into the building rubble. It can penetrate

building rubble up to 1.5 ft in the thickness (5 layers of bricks). while L- band can enter the rubble of about 3 ft in thickness (10 layers of bricks).

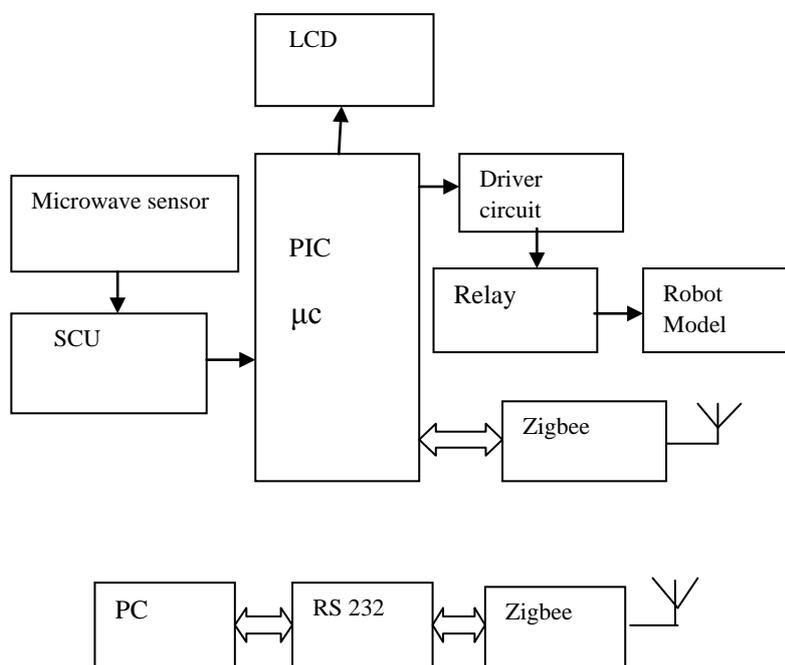


Fig 1. Transmitter and receiver side block diagram

Due to the fact that lower frequency will be more capable of detecting vital signs through very solid rubble, so frequency of an electromagnetic wave needs to be in the L-band or S-band range, For this cause, the microwave life detection system which operates on the L-band frequency. This system is supposed to quite efficient to trap the breathing and heartbeat signals of victims who are completely trapped and too weak to respond.

3.3 Driver Circuit

A driver circuit has its own 12V power supply making it self contained but the power supply portion can be left out if an external supply will be used. The output from the power supply shown by the circuit, can be used to power other devices but it should be noted that the supply is unregulated and not particularly powerful with the parts declared. The 12V DC output is appropriate for powering a few LEDs or low voltage lights but should not be used to power other electronic boards or motors.

3.4 Signal Conditioning Unit (SCU)

The signal conditioning unit accepts input signals from the analog sensors and gives a conditioned output of 0-5V DC corresponding to the entire range of each parameter. This part also accepts the digital sensor inputs and gives outputs in 10 bit binary with a positive logic level of +5V. The calibration voltages* (0, 2.5 and 5V) and the health bits are also generated in this part. Microcontrollers are widely used for control in power electronics. They offer real time control by processing analog signals obtained from the system. An appropriate isolation interface needs to be designed for interaction between the control circuit and high voltage hardware. It provides necessary interface between a high power grid inverter and a low voltage controller unit.

3.5 Zigbee

The specification is a combination of Home RF Lite and the 802.15.4 specification. The specification runs in the 2.4GHz (ISM) radio band - the similar band as 802.11b normal, Bluetooth, microwaves and some other devices. It is skilled in connecting 255 devices per network. The design supports data transmission rates of up to 250 Kbps at a range of up to 30 meters. ZigBee's tools is slower than 802.11b (11 Mbps) and Bluetooth (1 Mbps) but it consumes significantly less power. ZigBee is an established set of specifications for wireless personal area networking (WPAN), i.e. digital radio connections between computers and related devices.

WPAN Low Rate or ZigBee provides specifications for devices that have low data rates, low power consumption and are thus characterized by long battery life. ZigBee creates possible complete network homes where all devices are able to communicate and be controlled by a single unit. ZigBee designed to enable two-way interactions, not only will the consumer be able to monitor and keep track of domestic utilities usage, but also supply it to a computer system for data analysis.

3.6 Rs-232

It is a standard for serial binary data interconnection between a *DTE* (Data terminal equipment) and a *DCE* (Data Circuit-terminating Equipment). It is frequently used in computer serial ports. Electrical signal characteristics such as voltage levels, timing and slew-rate of signals, short-circuit behavior and maximum stray capacitance. The general standard does not define elements such as character encoding (for example, ASCII, Baudot), or the enclosing of characters in the data stream (bits per character, start/stop bits, parity). The general standard does not define protocols for error detection or algorithms for data compression. The general standard does not define bit rates for transmission, although the general standard says it is intended for bit rates lower than 20,000 bits per second. Many recent devices can exceed this speed (38,400 and 57,600 bit/s being common, and 115,200 and 230,400 bit/s making special appearances) while using RS-232 compatible signal levels. Details of character format and broadcasting bit rate are controlled by the serial port hardware, frequently a single integrated circuit called a UART that converts data from parallel to serial form. A usual serial port includes focused driver and receiver integrated circuits to convert between internal logic levels and RS-232 compatible signal level.

3.7 Relay

It is an electrically operated switch. The flow of current through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The current from the coil can be on or off so relays have two switch positions and they are double throw switches. A relay normally allows one circuit to switch a second circuit which can be completely separate from the first. The relay coil passes a relatively large current, usually 30mA for a 12V relay, also it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the accepted 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

3.8 Pic 16f877

Various microcontrollers offer different kinds of memories. Among EEPROM, EPROM, FLASH etc. FLASH is the most recently developed. Methodology that is used in pic16F877 is flash technology, so that data is

maintained even when the power is switched off. Easy Programming and removing are other features of PIC 16F877.

3.9 Mplab Ide

MPLAB provides development engineers with the flexibility to develop and debug firmware for various Microchip devices. It is also a Windows-based Integrated Development Environment for the Microchip Technology Incorporated PIC microcontroller (MCU) and dsPIC digital signal controller (DSC) families.

MPLAB SIM is a discrete-event simulator for the PIC microcontroller (MCU) families. It is incorporated into MPLAB IDE. The MPLAB SIM correcting tool is designed to model operation of Microchip Technology's PIC microcontrollers to assist users in debugging software for these devices.

IV. CONCLUSION

A new sensitive life detection system using microwave radiation for locating human beings buried under hidden various barriers have been designed. This system operating either at L (or) S band (or) UHF band can detect the breathing and heart beat signals of human beings through earthquake rubble and this technique stands better rather than searching in depth to the core to obtain relevant information and diagnosing it. This analyzing method proves to be an efficient solution and can be implemented with an ease of build and doesn't require any skilled labour for its usage.

In future, depending upon the development of technology, we can enhance the system so that it will able to detect number of victims buried under the respective rubble. Then rescuer will desire area with more number of victims. Eventually, our system can save more lives.

V. ACKNOWLEDGEMENTS

We wish to express our sincere gratitude to our honourable correspondent **Lion Dr. K. S. RANGASAMY, M.J.F.**, for providing immense facilities in our institution.

We are proudly rendering our thanks to our Principal

Dr. K. THYAGARAJAH, M.E., Ph.D., SMIEEE, MISTE, for the facilities and the encouragement given by him to the progress and completion of our project.

We proudly render our immense gratitude to the Head of the Department **Prof.P.PREMKUMAR, M.E., (Ph.D.)**, for his effective leadership, encouragement and guidance in the project.

We express our wholehearted thanks to our **Prof.E.V.SIVAKUMAR M.E.**, Department of Electronics and Instrumentation Engineering for his motivation towards completion of this course of work.

We would like to thank our project co-ordinator Assistant Professor. **Mr.R.SRINIVASAN, M.E.**, Department of Electronics and Instrumentation Engineering, for his valuable support and guidance to our project.

We are highly indebted to provide our heart full thanks to our Guide Assistant Professor **Mr.T.RAJAVENKATESAN, M.E.**, for his valuable ideas, encouragement and supportive guidance throughout the project.

We wish to extend our sincere thanks to all faculty members of our Electronics and Instrumentation Engineering Department for their valuable suggestions, kind co-operation and constant encouragement for successful completion of this project.

We wish to acknowledge the help received from various Departments and various individuals during the preparation and editing stages of the manuscript.

REFERENCES

- [1]. Chen, K. M., D. Misra, H. Wang, H. L. Chueng, et al., 'X-band M/W life-detection system,' IEEE Trans. Biomedical Eng., Vol. BME-33, 697–701, July 1986.
- [2]. Aggelopoulos, E. G., E. Karabetsos, Constantinouan N. Uzunoglu, et al 'Robot for detection of trapped human beings,' Measurement: Journal of the International Measurement Confederation, Vol. 18, No. 3, 117–183, July 1996.
- [3]. Arai, I. ; Univ. of Electro-Commun., Tokyo, Japan et al 'Human detection using Doppler radar,' Measurement: Microwave Conference, APMC, Asia-Pacific Vol. 2, 2001
- [4]. Aspirant Lesya Anishchenko et al, 'Non-contact Remote Bio-Radiolocation' presented at Bauman Moscow State Technical University, January 2004.
- [5]. S.I. Ivashov, V.V. Razevig, A.P. Sheyko, I.A. Vasilyev, et al, 'Detection of human breathing and heartbeat by remote radar', Progress in Electromagnetic Research Symposium, Pisa, Italy, March 28 – 31, 2004.
- [6]. Kun-Mu Chen ; Dept. of Electr. & Comput. Eng., Michigan State Univ., East Lansing, MI, USA ; Yong Huang ; Jianping Zhang ; Norman, A et al ' Microwave detection', Biomedical Engineering, Volume:47, Issue: 1 , April 2006.
- [7]. Konstantin Lukin and Vladimir Konovalov, et al, 'Through wall detection and recognition of human beings using noise radar sensors', National Academy of Sciences of Ukraine, June 2007.
- [8]. Sevgi Zübeyde Gürbüz et al, 'Radar Detection And Identification Of Human Signatures Using Moving Platforms' presented at Georgia Institute of Technology, December 2009.

HIERARCHICAL CLUSTERING BASED MULTI-DIMENSIONAL POLYGON REDUCTION ALGORITHM FOR LARGE SPATIAL DATA

Dr. Mamta Dahiya

Department of Computer Science & Engineering, Apeejay Stya University, Gurgaon (India)

ABSTRACT

In this paper, a Hierarchical Clustering based multi dimensional polygon reduction algorithm for large spatial data sets is proposed. The concept of hierarchical clustering to produce a hierarchy of clusters by considering density and distance as a core parameters are used. It applies agglomerative approach of hierarchical clustering to a set of clusters produced until a termination condition is satisfied. The advantage of this algorithm is to reduce polygon edges with polygon reduction method that helps to save memory as there is exponential growth of data in spatial datasets. In this approach memory would be very less than the matrix approach contains reduction line as explained in our earlier algorithm pronounced as 3DCCOM. This algorithm takes into account the problem of clustering in the presence of physical obstacles while modeling the obstacles by Reentrant Polygon Reduction Algorithm for better performance.

Keywords: *Polygon Reduction, Reentrant Polygon, Hierarchical Clustering, Spatial Data*

I. INTRODUCTION

Extraction of meaningful information out of spatial data sets assumes importance especially when these voluminous data sets are growing at an exponential rate. Therefore, spatial data mining has become a potential area for researchers in the last one and half decade. Data mining uses clustering for discovering unknown patterns occurring in the data. Clustering is widely used for pattern recognition [1, 2, 3], data analysis [4], image processing [5, 6] and machine learning [7] etc. It is a core activity associated with spatial data mining carried out with a view to segregate data objects into smaller groups based on some proximity measure. That is, *clustering* is a process in which similar data objects fall under one group (cluster) such that similarity between the data points in one group (cluster) is very high and similarity between two data points of two different groups (clusters) is negligible. This clearly indicates that for quality clusters the similarity measure must be robust. Estimating similarity between two data points depends entirely on the choice of distance metric.

Also, the current research work in the field of spatial clustering is focused more on multi- dimensional datasets. Data points become sparser in higher dimensions [8, 9] thus are making the task of clustering tedious. The two data points in two dimensions may appear very close to each other so as to form a part of the same cluster but when same data points are represented in higher dimensions they appear much farther so as not to be a part of the same cluster. The exponential growth in data and databases used in various fields like GIS, medical science, business, astronomical sciences etc. has generated the requirement of tools that can be employed for churning

useful and previously unexplored information and knowledge automatically. Moreover, with the abundance of such datasets it has become practically impossible to make them free of noise or outliers. The existing algorithms for clustering expect parameter tuning and provide clusters of arbitrary shapes. These algorithms provide expected results in case of two-dimensional and three-dimensional data sets. Many clustering approaches ignore handling obstacles and facilitators present in spatial datasets, especially GIS that results in inefficient and irrelevant clusters. There are some approaches of spatial data include 3DCCOM [11], COD-CLARANS [13], AUTOCLUST+[10], DBCLUC [15] and DBRS+[16] that can handle obstacles and facilitators together but not their possible combination. Also, the outliers (noise element) in the dataset are determined only as residues (by-products) of the clustering processes. Polygon Reduction clustering algorithm in presence of obstacles, facilitator and constrains which is abbreviated as PRC further extended as a 3DCCOM (Three Dimensional Clustering with Constraints and Obstacle Modelling). 3DCCOM [11] takes into account the problem of clustering in the presence of physical obstacles while modelling the obstacles by Reentrant Polygon Reduction.

As this time, proposed algorithm adopts hierarchical idea to cluster spatial data space in presence of obstacles [12]. It divides the whole data space into multiple regions by keeping two parameters of distance and density parallel without obstacle by raster extension line of obstacle polygon boundary. The presence of obstacles results in the meaningless and impractical spatial cluster result which shows in Fig.1. The problem of spatial clustering in presence of obstacles, facilitators and constrains is highly interested recently. Fig.1 (a) shows Original Dataset with obstacles water body and highway etc. (b) formation of cluster with considering obstacles, and (c) showing cluster when ignoring obstacles. In the presented work, the following issues have been significantly addressed:

- Compress/reduce the obstacles i.e. polygons by using set theory.
- Perform clustering without any parameter tuning and human interaction.
- Clustering in the presence of obstacles and facilitators by using concept of hierarchical data mining.

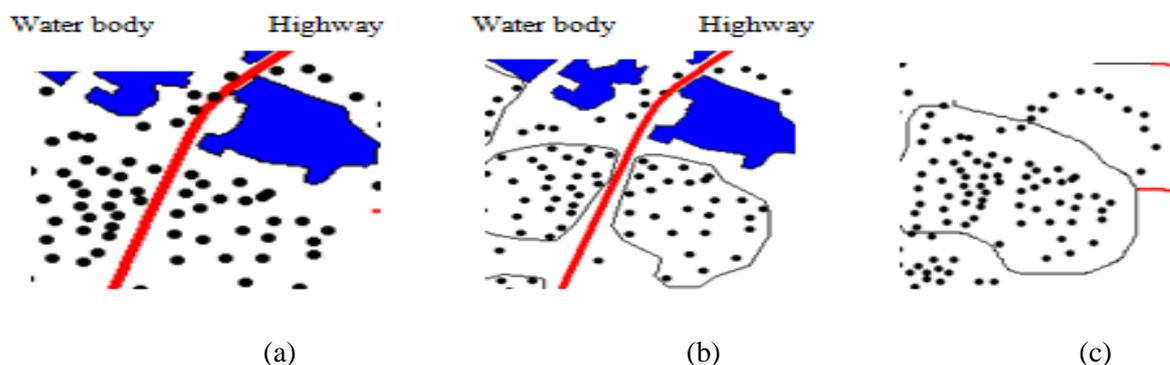


Figure 1 (a) Original Dataset with obstacles water body and highway etc. (b) Cluster with considering obstacles, (c) cluster when ignoring obstacles

So, a polygon reduction mechanism has been developed to address the challenges stated above.

II. LITERATURE REVIEW

In literature, various approaches like AutoClust+ [14], COD-CLARANS [13], DBCluC [15], DBRS_O [16] are available that consider the concept of obstacles in the dataset but not many approaches [18] that consider the presence of facilitators also. A facilitator is an object that connects two data objects such as a bridge over a river,

a subway under a highway. Conceptually, an obstacle increases the distance between objects while a facilitator decreases the distance. Also, there may be situations in real datasets where two obstacles are intersecting or an obstacle and a facilitator is intersecting or any other possible combination is occurring. The clustering approach must also be able to handle such situation to provide most efficient and relevant clusters.

In COD-CLARANS [13], the authors have represented obstacles through visibility graph and thus computed the obstructed distance between data objects. Also, it detects mostly spherical shaped clusters and depends on user-defined parameters. AutoClust+ [14], which is a graph-based approach, the dataset is modeled through Delaunay structure. DBCluC [15], an extended form of DBSCAN [17], models obstacles using polygons and these polygons are reduced to minimum number of line segments called as obstruction lines that does not compromise with the visibility space. The Fig. 2 shows the obstacle modeling in DBCluC [15]. This approach handles facilitators also, using the concept of entry and exit points.

In [19], a spatial clustering approach in the presence of obstacles based on genetic algorithms and k-medoids has been proposed. Authors have handled obstacles using polygons and visibility graph and thus computed obstructed distance. In [20], a density based clustering with constraints and an obstacle modeling has been proposed. This algorithm uses the concept of polygon reduction but reduction or compressed edges are stored in form of matrix values.

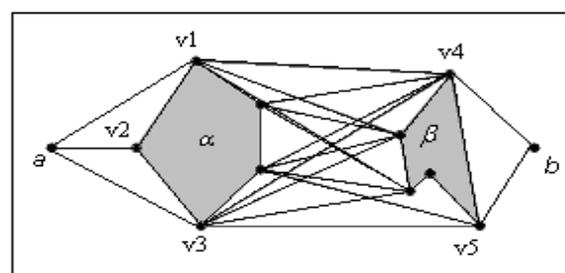


Figure2. The visibility graph of two data objects a and b having obstacles α and β modeled using polygons.

But in proposed algorithm, compress polygon values are stored using set theory so that use of memory can be more efficient as there is exponential growth in spatial database. We are also using two important parameters: distance and density parallel so that efficient clusters can be formed specifically for demographic data assessment.

2.1 Hierarchical Clustering

Hierarchical method: This method creates a hierarchical decomposition of the given set of data objects [16]. The agglomerative also called bottom-up approach starts with each object forming a separate group and successively merges the objects close to one another, until all of the groups are merged into one or some termination condition holds. The divisive also called top-down approach starts with all objects in the same cluster and a cluster is split up into smaller clusters until each object is in one cluster or until a termination condition holds.

2.2 Density Based Clustering

The key idea behind the density based clustering is that for each point of a cluster, the neighborhood of a given radius (Eps) has to contain at least a minimum number of points ($Minpts$) i.e. the density of the neighborhood has

to exceed some threshold. Following are some definitions to formalize the notion of cluster and noise in the density based clustering.

Definition 2.1 Eps-neighborhood of a point

The Eps-neighborhood of a point p denoted by $N_{Eps}(p)$, is defined as: $N_{Eps}(p) = \{q \in D \mid \text{dist}(p,q) \leq Eps\}$

Where D is a database of points or objects. Density based clustering require that for each point of a cluster, there should be at least a minimum number of points $Minpts$ in the Eps-neighborhood of that point.

Definition 2.2 Directly-density-reachable

A point q is directly-density-reachable from a point p wrt Eps and $Minpts$ if

1. $q \in N_{Eps}(p)$ and
2. $|N_{Eps}(p)| \geq Minpts$

The data points can be divided core points and border points, where core points satisfy density criterion and exist in the core of the dataset, while border points don't satisfy density criterion and exist on the borders of the dataset. Eps-neighborhood of a border point contains significantly less number of points than that of a core point. Density based algorithm general idea is to continue growing the given cluster as long as the density in the neighborhood exceeds some threshold i.e. for each data point in the cluster; the neighborhood of a given radius has to contain at least a minimum number of points

Definition 2.3 Density-reachable

A point p is density-reachable from a point q wrt Eps and $Minpts$ if there exists a chain of points p_1, p_2, \dots, p_n and $p_1 = q, p_n = p$, such that p_{i+1} is directly-density-reachable from p_i .

Definition 2.4 Cluster

Let D be a database of points. A cluster C wrt Eps and $Minpts$ is a non-empty subset of D satisfying the following conditions:

1. Maximality: $\forall p, q \in D$, if $p \in C$ and q is density-reachable from p wrt Eps and $Minpts$, then $q \in C$.
2. Connectivity: $\forall p, q \in C$, p and q are density-connected to each other wrt Eps and $Minpts$.

Definition 2.5 Noise

Let C_1, C_2, \dots, C_k be the clusters created from the database D wrt Eps and $Minpts$, then noise is the set of points in the database not belonging to any cluster i.e.

$$\text{noise} = \{p \in D \mid \forall i: p \notin C_i, 1 \leq i \leq k\}$$

2.3 Dbscan Algorithm

The algorithm *DBSCAN (Density Based Spatial Clustering of Applications with Noise)* is designed to discover the clusters and the noise in a spatial database in the absence of obstacles according to definitions given above. Ideally, we would have to know the appropriate parameters Eps and $MinPts$ of each cluster and at least one point from the respective cluster. To find a cluster start with an arbitrary point p and retrieve all points density

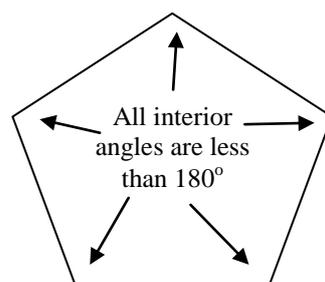
reachable from p wrt Eps and $MinPts$. If p is a core point, this procedure yields a cluster wrt Eps and $MinPts$ (Lemma 2).

If p is a border point, no points are density-reachable from p and DBSCAN visits the next point of the database. Since we use global values for Eps and $MinPts$, DBSCAN may merge two clusters according to definition 2.4 into one cluster, if two clusters of different density are “close” to each other. Let the *distance* between two sets of points $S1$ and $S2$ be defined as $dist(S1, S2) = \min \{dist(p,q) \mid p \in S1, q \in S2\}$. Then, two sets of points having at least the density of the thinnest cluster will be separated from each other only if the distance between the two sets is larger than Eps .

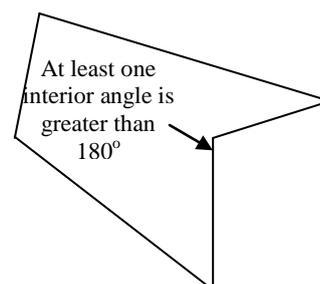
Consequently, a recursive call of DBSCAN may be necessary for the detected clusters with a higher value for $MinPts$. This is, however, no disadvantage because the recursive application of DBSCAN yields an elegant and very efficient basic algorithm. The most important function used by DBSCAN is `ExpandCluster` for large dataset. Region queries can be supported efficiently by spatial access methods such as R^* -trees or SR trees which are assumed to be available in a $SDBS$ for efficient processing.

2.4 Obstacle Modeling

Almost all physical obstacles like rivers, hills, and highways etc. can be modelled using simple polygons. All the polygons can be divided into two types: simple polygons and crossing polygons. A simple polygon is the polygon in which every edge in the polygon is not intersected with any other edge in the polygon and a crossing polygon is the polygon in which at least one edge is intersected with any other edge in the polygon. Simple polygons can be further divided into two types: convex and concave as shown in figure 3(a) (b). A polygon is a convex polygon if all vertices of the polygon make the same directional turn whether clockwise or anticlockwise. Suppose a polygon P does not follow the claim. It then is obvious that P is not a convex. All other polygons, which don't satisfy this condition, are said to be concave. In order to test a turning direction for 3 consecutive vertices, the sign of the triangle area of 3 points is examined via a determinant. As a result, the sign of the determinant evaluates the turning direction either a clockwise or a counter clockwise.



(a) Convex polygon



(b) Concave/ Reentrant polygon

Figure 3(a) in convex polygon all interior angles are less than 180 degree; (b) in concave polygon at least one interior angle is greater than 180 degree.

Note that we assume that all points in a polygon are enumerated in an order either clockwise or a counter clockwise. Hence, we can easily identify a type of a polygon as well as a type of each vertex from the polygon in a linear time $O(n)$, where n is the number of points in a polygon.

III. REETRANT POLYGON REDUCTION ALGORITHM

In any clustering algorithms, when obstacles are considered, the visibility of data objects with each other is checked via the line segments or edges of the obstacle. The number of line segments to check is the number of edges of the polygons, which is large in number for a large data space. The number of lines to check can be reduced to actual one by our proposed polygon-edge reduction algorithm but memory would be much less than the matrix approach contains reduction lines. We are here to going to use set of reduction lines. Let us call the reduced number of lines as reduction lines. The algorithm assumes the following definition of a polygon.

Definition 3.1: Polygon

A simple polygon is denoted by an undirected graph $P(V, E)$ where V is a set of k vertices: $V = \{v_1, v_2, \dots, v_k\}$ and E is a set of k edges: $E = \{e_1, e_2, \dots, e_k\}$ where e_i is a line segment joining v_i and v_{i+1} , $1 \leq i \leq k$, $i+1=1$ if $i+1 > k$. First all the convex vertices of the polygon are extracted because only convex vertices are considered to find the visibility between two data objects. Assume that a polygon $P(V, E)$ of n convex vertices is stored in the form of adjacency matrix A of order $n \times n$ where $A[I, J] = 1$ if edge (I, J) exists between vertices I and J i.e. $(I, J) \in E$.

$$A[I, J] = 0 \text{ if } (I, J) \text{ not } \in E.$$

The algorithm returns the output ordered set O .

$$O = \{(I, J) : I, J \in V, \text{ pair } (I, J) \text{ is a reduction line}\}$$

It first identifies the convex vertices in the polygon by turning direction approach and by checking the triangle area of three consecutive points via its determinant. After finding all the n convex vertices, a matrix A of order $n \times n$ stores the link information about polygon. The entries in the upper half of matrix 'A' are checked so as to avoid the repetition because the polygon is undirected graph.

Algorithm: Reentrant_poly_red (P)

//P is given polygon with V vertices and E edges

//Output: A set of obstruction lines (I, J) in ordered set O . Identify the convex and concave vertices. Let convex vertices be n ; Store the link information of convex vertices in A taking them in order;

Flag=0; k=0;

FOR (I=1; I<=n; I++) {

 FOR (M=0; M<=k; M++) { // k is always <=n

 IF (I = B [M])

 { // B is matrix for storing row numbers

 Flag: =1;

 }

 FOR (J=I; J<=n; J++)

 {

 IF((A[I,J]= 1) OR ((A[I,J]= 0) AND ((I,J) is interior to P)))

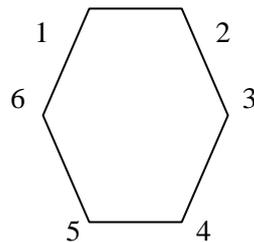
 {

```

    Push (O, I, J); // Insert (I, J) into ordered set O
    B[k]:=J; k++;
}
IF (Flag == 1)
{
    A [I, J]:=0;
} }
Flag:=0;
} }
    
```

Return O i.e. Reduction Lines L; // END

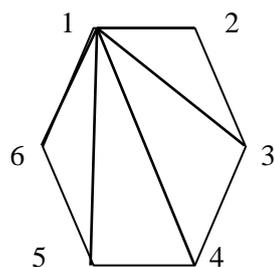
All reduction lines should be interior to polygon P and each convex vertex should've at least one reduction line from it. The number of reduction lines must be at least equal to the number of convex vertices to allow the correct visibility between the data points. Take the example convex polygon shown in figure 4(a) that has six convex vertices and six edges. Corresponding to these six convex vertices, the input matrix A becomes as shown in figure 4(b). As a result of the application of the polygon reduction algorithm, the output ordered set O is shown in figure 4(d). The output-reduced polygon is constructed according to output ordered set O and is shown in figure 4(c), which contains five instead of six reduced lines.



	1	2	3	4	5	6
1	0	1	0	0	0	1
2	1	0	1	0	0	0
3	0	1	0	1	0	0
4	0	0	1	0	1	0
5	0	0	0	1	0	1
6	1	0	0	0	1	0

(a) Input Polygon

(b) Input matrix A(with replicated values)



Set(O)={ (1,2) (1,3) (1,4) (1,5) (1,6) }

(c) Output Matrix

(d) Output ordered set O

Figure 4 (a) Input Polygon, (b) Input Matrix A having replicated data, (c) Output Matrix, (d) Output ordered set O with no replicated data

This is the case where significant improvement is not achieved but in the case of concave polygons, a remarkable improvement can be obtained. So, in a large dataset, where the number of obstacles can be large in number and hence the number of edges to test is also large in number, the polygon reduction algorithm can be applied to reduce the number of lines to test during the clustering procedure.

IV. PROPOSED ALGORITHM

PROPOSED HIERARCHICAL CLUSTERING BASED MULTI DIMENSIONAL POLYGON REDUCTION ALGORITHM FOR LARGE SPATIAL DATA SETS IS BASED ON 3DCCOM (3 DIMENSIONAL CLUSTERING WITH CONSTRAINTS AND OBSTACLE MODELLING)[11] PRONOUNCED AS 3DCCOM TAKES INTO ACCOUNT THE PROBLEM OF CLUSTERING IN THE PRESENCE OF PHYSICAL OBSTACLES WHILE MODELLING THE OBSTACLES BY POLYGON REDUCTION. THE ALGORITHM ALSO USING CONCEPT OF DENSITY BASED CLUSTERING. IT APPLIES AGGLOMERATIVE APPROACH OF HIERARCHICAL CLUSTERING TO A SET OF CLUSTERS PRODUCED UNTIL A TERMINATION CONDITION IS SATISFIED. DISTANCE AND DENSITY ARE TWO KEY PARAMETER FOR PROPOSED ALGORITHM. TO BETTER HAVE AN UNDERSTANDING OF THIS, WE HAVE ANOTHER DEFINITION TO FIND THE DISTANCE BETWEEN THE TWO CLUSTERS.

Definition 4.1 Distance between two clusters

Let $C = \{c_1, c_2 \dots c_k\}$ be the set of clusters produced by any clustering algorithm. The distance between two clusters c_i and c_j is defined as: $\text{dist}(c_i, c_j) = \text{Min} \{ \text{dist}(p, q) \mid p \in c_i \text{ and } q \in c_j \}$.

The distance function takes all the points from two clusters and finds the distance, which is the distance between two nearest neighbors respectively from two clusters as Fig. 5 below shows.

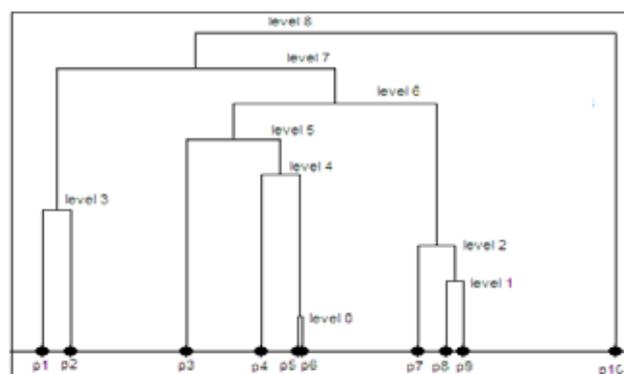


Figure 5. Hierarchical version of proposed algorithm

The threshold distance D_{min} is taken to have an upper bound on the acceptable distance between two clusters. Two clusters can be merged at a subsequent step if the distance between the two clusters is no more than D_{min} but we also keep density of cluster as an important parameter. The clusters at subsequent steps are merged together until the current clustering at a stage becomes similar to the clustering at the previous stage i.e. the number of clusters is same at two stages; this forms the termination condition for the proposed algorithm.

Proposed_algorithm (Database D, obstacles O, D_{min})

// D_{min} is the minimum threshold distance between two clusters c_1 and c_2 ; $D_{min} > \text{Eps}$

//Output: A hierarchy of Clusters with distance and density parameter

C: = 3DCCOM (D, O); //Start clustering as in 3DCCOM

DO

FOR (D=DT; D<= Dmax; D=D+DT)

FOR (random c_i and c_j e set of clusters C) do

IF ($D_{c_i} \leq D$) AND ($D_{c_j} \leq D$) AND ($\text{dist}(c_i, c_j) \leq D_{\text{min}}$) // **D is aligned threshold density**

Pts: =merge (c_i, c_j);

ClusterId:= assign_next_Id(pts,ClusterId);

Density of ClusterId= $D_{c_i} + D_{c_j}$

Add ClusterId to C' ;

Remove c_i, c_j from set of clusters C;

END IF;

ELSE

Remove c_i, c_j from set of clusters C;

Add c_i, c_j to C' ;

END ELSE;

END FOR;

END FOR;

Write ClusterIds of clusters in C' to C;

WHILE //(no more change from previous clustering);

RETURN// hierarchy of clusters;

One example illustrating this idea, in this figure 5= {p1, p2... p10} is the original clustering produced by the clustering algorithm wrt Eps and Minpts and is at level 1. Further merging of clusters result at level 2. In this way process goes up to level 8, which may be similar to level 9, where process of hierarchical clustering stops.

V. EXPERIMENTAL RESULTS AND ANALYSIS OF PROPOSED ALGORITHM

Basically, proposed Hierarchical Clustering based multi dimensional polygon reduction algorithm for large spatial data sets is a combination of density based and hierarchical clustering algorithm. DBCLUC is the mostly acceptance density-based clustering algorithm in presence of obstacle. To demonstrate the advantage of proposed algorithm, it will compare with DBCLUC and 3DCCOM in this experiment. To facilitate the comparison between algorithms, the real data set is used and compares it with new dataset. For simplicity, the synthetic spatial data set is 3-dimesional spatial data. The data set and obstacles are showed as Fig.6 (a). The best results of algorithms with a broad range of parameter settings are selected. Clustering result of this spatial data space is showed by Fig.6 (b), (c), and (d) when the obstacles, facilitator, outliers are present or ignored. The simulated results are shown with help of ArcGIS tool. The different cluster of data space is described by different color as following.

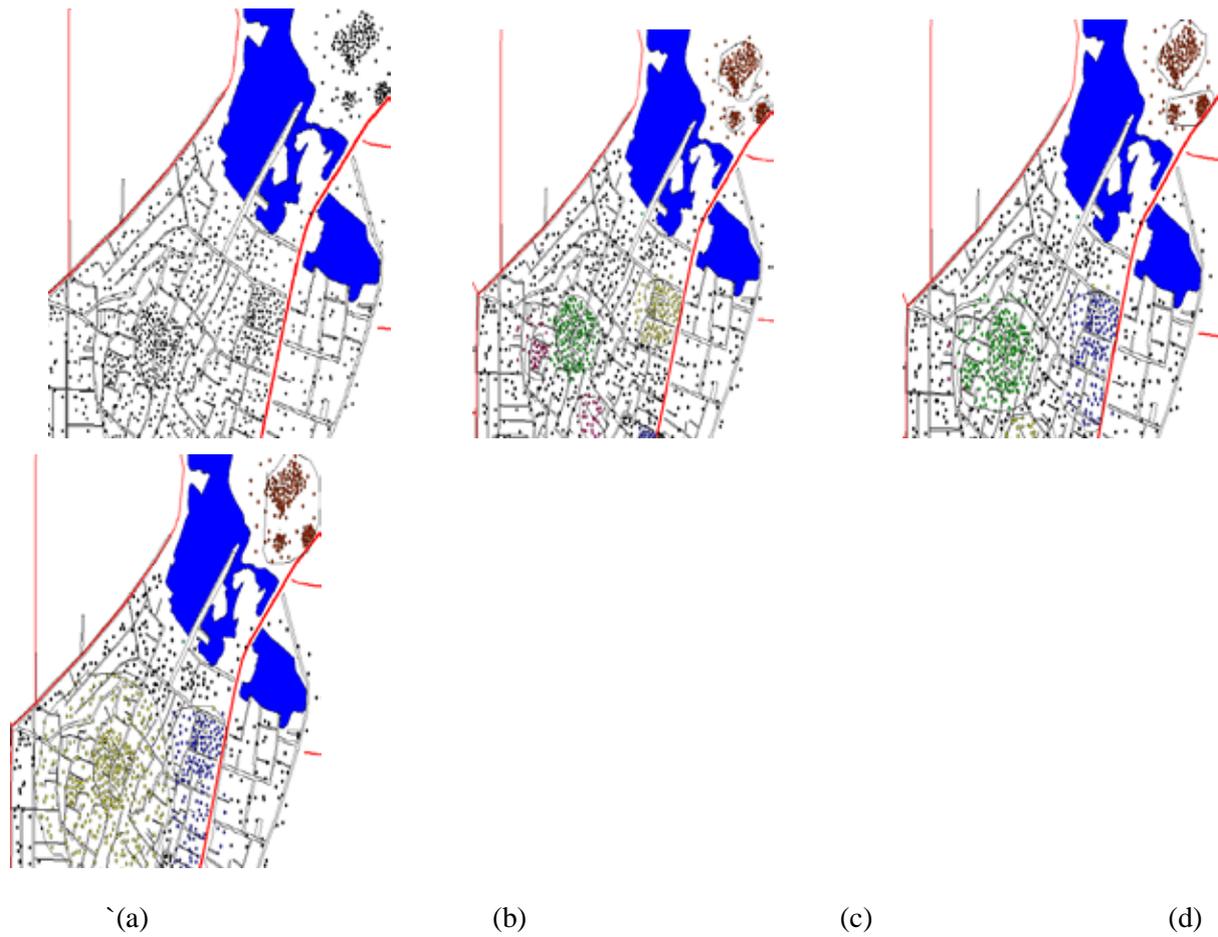


Figure 6 (a) Population distribution considering obstacles and facilitators of Rohat Village, Sonapat, India, (b) Population Clusters with a fixed densities, (c) Population clusters with proposed Algorithm at level 3 and (d) clusters at level 4

Hierarchical Clustering based multi dimensional polygon reduction algorithm gives result at different levels by keeping density and distance are core parameter. For example suppose we want to query population of different part of country as per area by taking distance and their density. We can find out heterogeneous or homogeneous population distribution per capita by ignoring or considering different obstacles and facilitators. Here with proposed algorithm Cluster results in presence of obstacles and constrains are showed by Fig 6 (b) Population Clusters with a fixed densities, fig 6(c) Population clusters at level 3, and fig 6 (d) Population clusters with proposed algorithm at level 6 in the Presence of obstacles and facilitators. Through comparison and analysis of cluster results of two algorithms, the conclusion is that proposed algorithm can get better cluster result in presence of facilitator and obstacles than DBCLUC. DBCLUC can cluster spatial data space with obstacles, but the process of obstacles in arbitrary shape is ideal insufficiently.

We can find out heterogeneous or homogeneous population distribution per capita by ignoring or considering different obstacles and facilitators. Here with proposed algorithm Cluster results in presence of obstacles and constrains are showed by Fig 6 (b) Population Clusters with a fixed densities, fig 6(c) Population clusters at level 3, and fig 6 (d) Population clusters with proposed algorithm at level 6 in the Presence of obstacles and facilitators. Through comparison and analysis of cluster results of two algorithms, the conclusion is that proposed algorithm can get better cluster result in presence of facilitator and obstacles than DBCLUC. DBCLUC can cluster spatial

data space with obstacles, but the process of obstacles in arbitrary shape is ideal insufficiently. There are many scattered meaningless cluster in the final cluster result of DBCLUC.

Algorithm proposed in this paper inherits advantage of polygon reduction and density cluster algorithm and it can operate obstacle polygons and find clusters in arbitrary shape to avoid scattered meaningless cluster in final result. So the cluster result of proposed algorithm is more accurate and more practical. At the same time, the execution space-time cost of this algorithm is very less than DBCLUC because of the adoption of reentrant polygon reduction strategy using set theory.

There are a number of areas into which the proposed work can be extended or improved. The work shows how to consider obstacles in the clustering process and how to model the physical obstacles using the reduction algorithm, but no indexing scheme is used for obstacles. In the absence of any indexing scheme, all produced reduction lines are checked for visibility of a data point. By using an indexing scheme, only lines in the neighborhood of a particular data point can be checked instead of all the lines. With such a scheme, the complexity can be reduced to $O(N \log N)$ which would be a significant improvement over the proposed algorithm.

VI. ACKNOWLEDGMENT

The authors would like to thank the Apeejay Stya University to support me in research and allow me to use laboratory for various software.

REFERENCES

- [1] Yeung K. Y., Fraley C., Murua A., Raftery A. E., and Ruzzo W. L.(2001): Model-based clustering and data transformations for gene expression data. *Bioinformatics*, 17(10):pp.977–987.
- [2] Law M. H. C., Topchy A. P., and Jain A. K.(2004): Model-based clustering with soft and probabilistic constraints. Technical report, Michigan State University.
- [3] Zhong S. and Ghosh J.(2003), A Unified Framework for Model-based Clustering Data Analysis. In *Journal of Machine Learning Research*, pp. 1001-1037 .
- [4] Hui F., Chengxiang Z., Lei L., and Jiong Y.(2004): Subspace Clustering for Microarray Data Analysis: Multiple Criteria and Significance Assessment. In *Proc. of the 2004 IEEE Computational Systems Bioinformatics Conference (CSB 2004)*
- [5] Yixin C., James Z., Wang and Robert K.(2005): CLUE: Cluster-based Retrieval of Images by Unsupervised Learning. *IEEE Transactions on Image Processing*, vol. 14, no. 8, pp. 1187-1201.
- [6] Schmid P.(2001): Image segmentation by color clustering, <http://www.schmid-saugeon.ch/publications.html>.
- [7] Zhang Y.F., Mao J.L., Xiong Z.Y.(2003), An efficient clustering algorithm. In *Proc. of Intl. Conf. On Machine learning and Cybernetics*, pp. 261-265, Vol. 1.
- [8] www-users.cs.umn.edu/~kumar/papers/high_dim_clustering_19.pdf
- [9] www.ucl.ac.be/mlg/index.php?page=PartTop&WhichTop=5
- [10] V. Estivill Castro, I. J. Lee, 2000 “AutoClust+: Automatic Clustering of Point-Data Sets in the Presence of Obstacles,” *Int. Workshop on Temporal, Spatial and Spatio-Temporal Data Mining*, pp. 133-146.

- [11] Mamta Malik, Dr. Parvinder Singh, and Dr.A.K.Sharma, “3DCCOM Polygon Reduction Algorithm in Presence of Obstacles, Facilitators and Constraints” in International Journal of Computer Applications 29(7):6-12, September 2011. Published by Foundation of Computer Science, New York, USA.
- [12] Yue Yang, Jian-pei Zhang, Jing Yang, 2008, Grid-based Hierarchical Spatial Clustering Algorithm in Presence of Obstacle and Constraints” at International Conference on Internet Computing in Science and Engineering.
- [13] Tung A.K.H., Hou J., and Han J.(2001): Spatial Clustering in the Presence of Obstacles. In Proc. of Intl. Conf. on Data Engineering (ICDE'01), Heidelberg,Germany, pp. 359-367.
- [14] Estivill-Castro V. and. Lee I.J.(2000): AUTOCLUST+: Automatic Clustering of Point-Data Sets in the Presence of Obstacles. In Proc. of the Intl. Workshop on Temporal, Spatial and Spatial-Temporal Data Mining, Lyon, France., pp. 133-146.
- [15] Zaïane O. R., and Lee C. H. (2002): Clustering Spatial Data When Facing Physical Constraints. In Proc. of the IEEE International Conf. on Data Mining, Maebashi City, Japan, pp.737-740.
- [16] Wang X. and Hamilton H.J.(2004): Density-based spatial clustering in the presence of obstacles. In Proc. of 17th Intl. Florida Artificial Intelligence Research Society Conference (FLAIRS 2004), 312-317, Miami.
- [17] Wang W.,Yang J., Muntz R.R.(1997): STING: A statistical information grid approach to spatial data mining. In Proc. of 23rd Conference on VLDB, 186-195, Athens, Greece.
- [18] Wang X., Rostoker C., .Hamilton H.J.(2004): Density-Based Spatial Clustering in the Presence of Obstacles and Facilitators. In Proc. of the 8th European Conference on Principles and Practice of Knowledge Discovery in Databases (PKDD 2004), Italy, pp.446-458.
- [19] Tung A.K.H., Han J., Lakshmanan L.V.S. and Ng R.T.(2000): Geo-Spatial Clustering with User-specified Constraints. In Proc. of the Intl. Workshop on Multimedia Data Mining(MDM/ KDD'2000) , Boston, USA.
- [20] Neelam Duhan, A.K.Sharma(2011): DBCCOM: Density Based Clustering with Constraints and Obstacle Modeling. In IC3 2011, CCIS 168, pp. 212-228, 2011, Springer- verlag Berlin Heidelberg.

USING CST AND VOCABULARY LIST APPROACH FOR MULTI DOCUMENT SUMMARIZATION

Mr.Wadghule Yuvraj¹, Miss.Dashpute Kshitija², Miss.Gaikwad Kalyani³

^{1,2,3} SND COE & RC Yeola Savitribai Phule, Pune University (India)

ABSTRACT

Multi-document summarization refers to the process of automatic extraction of text from multiple sources which belong to same topic. With the intensification of internet huge amount of data has been engendered day by day. It is quite difficult for everyone to distinguish and summarize this vast information gathered from various sources. Multi document text summarization has solution for this problem. Multi document summarization congregate information from different sources and summarizes the information up to necessary length. Firstly, with the help of cross document structure theory (CST) which is a part of multi document summarization, cross document relations are identified from unprocessed text. After tracking CST relations, sentences are scored by using scoring model and dictionary approach. Experimental results are shown for pre-processing, feature extraction.

Keywords: *Multi Document Summarization, CST Relations, and Unprocessed Text.*

I. INTRODUCTION

For text summarization plenty of research studies have been presented in last few decades [1][2]. The text summarization is considered as indicative when it is intimately linked with user's question, or can be informative describing precisely about entire contents of document [3]. In addition to this text summarization can be extractive or abstractive. Abstractive type of summarization collects original sentences from source documents process them and then the sentences are incorporated in absolute summary preserving the relevance of information. The study described by Gupta-lehal[1] and Kumar et.al.[2] takes into consideration extractive summarization in which key sentences are recognized and incorporated in summary. That means absolute summary is considered which comprises of sentences that are originally from the source documents [2]. Key sentences are determined by statistical as well as linguistic features of sentences. For example, the input text document may contain the word "Apache" many times, so count the number of occurrences of the word 'Apache' and that is considered to be word frequency which is commonly computed by TF-IDF. In news editorial if for any incidence time and date is specified then that can be considered as statistical information. A further issue for summarization is the amount of information that is going to be processed. For example, in Ultimate Research Assistant text mining is carried out on internet search results to summarize, assist and categorize them and make it simple for the user to do online research [4]. Thus there is need for MDS (multi document summarization) for gathering multiple source text into a small, precise text. By considering the fact that if the documents are topically related then the documents have semantically associated information. Based on this fact CST relations among the texts are identified. D. R. Radev proposed that multi document summarization can be smoothly progressed by analysis of relevant documents using CST model [5].

CST model can be represented as a cluster. Clusters of multi-documents are characterized by two data structures multi document cube and by multi document graphs. These data structures are defined at different levels such as word, phrase, and paragraph and document level. Gen-eral process of multi document summarizations is described in fig.1

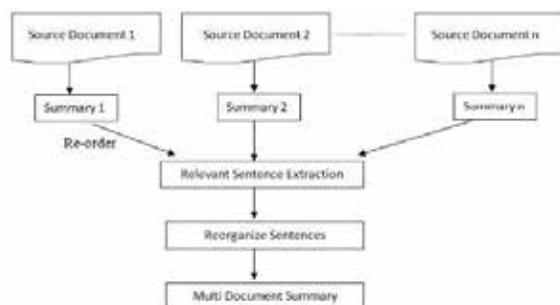


Fig. 1. General Architecture of MDS

In the proposed work, first pre-processing algorithms to preprocess the document are described. Pre-processed document is then used as input to feature extraction. Feature extraction is the process of identifying keys in the document which is done with the help of six different features. In next module, CST relations are identified by using dictionary based approach. Then based on identified CST relations scoring model is described to include highly relevant sentences into final summary.

II. RELATED WORKS

An original notable effort in the area of automatic text summarization is by H. P. Luhn (1958). H. P. Luhn projected that number of occurrences of specific word in a source document is a helpful measure of relevance for text summarization on single document. Edmundson included two methods to generate summary [1969]. First method makes use of Superficial approach uses little linguistic knowledge to produce summaries. This approach usually has low cost and is more robust, but it produces poor results. On the other hand, deep approaches use more linguistic knowledge to produce summaries. number of occurrences of word i.e. word frequency and second method deals with the heading of source document. The key sentences were scored by these features to incorporate them into summary. Jing presented a sentence diminution system for eliminating unrelated idiom like prepositional phrases, clauses from sentences [2000]. Hsun-Hui Huang proposed fuzzy-rough approach by examining features of sentence from conceptual space and then applying fuzzy-rough logic to identify significant sentences [6]. Depending upon this conceptual space various features of sentences are defined. These features are used to form feature space in which every sentence will be treated as an entity. Conceptual relationship is articulated by natural languages are intrinsically fuzzy, fuzzy approximation space is formed by rough theory and fuzzy set. Significant sentences are identified by computing sentence membership to the estimation of source texts. CPSL and LESM are two methods which are proposed by Md. Mohsin Ali. CPSL method is a mixture of MEAD and SimWithFirst methods [7]. MEAD is the extractive summarizer based on centroid and sentence scoring is done with the help of sentence level and inter-sentence level features. The features used in this method are centroid, position, length. In SimWithFirst method, every sentence is checked for similarity with first sentence. The second method, LESM comprised of CPSL

and LEAD. LEAD allocates a score of $1/n$ to each sentence, where n is the number of sentence in specific document. Sentences with least value are not included in summary. Other than very clear distinction in text input size, numerous other factors make the complication in MDS than single document summarizer. For example different source document comes from number of locations, from different authors and having different styles, even if they are relevant to the topic. Another fact that is to be considered as different source documents can be from different time frames or they may reflect the information which conflict-ing from each other. So multi document summarizer must deal with all these issues. Therefore summarizer must be designed in different way than the single document summarizer. Radev [2000] proposed the CST theory showing that CST can be a basis for cross document relations. And also CST relations are presented, based on RST (Rhetorical Structure Theory) RST is typically used for individual document. 24 CST relations are described having linking at different levels such as word (W), phrase (P), paragraph (PR) and document level (DOC). Fig 2 shows different levels of summarization. Out of the 24 CST relations identity, subsumption, overlap and description are considered in [2] as it covers most of other relations. The quality of extractive summary is affected by CST relationships into consideration. Different kinds of CST relations have different effects on final summary [8]. As de-scribed in introduction, the cross document relations which are present amongst relevant documents are defined by CST model. Considering this fact, advantages of CST relations for summarization are addressed by numerous researchers. Zhang et al. stated that, the effect of enhancing CST is dependent on which CST relation is added into summary [8]. Jorge and Pardo scrutinized summarization based on CST. Methods based on content selection are proposed to generate inclination based and basic summary [9]. Major constraint of the mentioned researches are human experts are needed to manually identify the CST relations. In the proposed work, this constraint is delighted by recognizing the relations amongst the sentences from the source texts. Scoring model is used to rank sentence which is based on cross-document relationship recognition. Z. Zhang et al [10] proposed boosting classification algorithm based on text in English, in which CST relations among sentences are recognized. But the classifier demonstrates the approximate average values of 46% precision, 33% recall and 36% F-measure showing poor performance in classification. As final result of the system is based on performance of classifier, the performance of classifier must be capable enough to see its effect in summarizer.

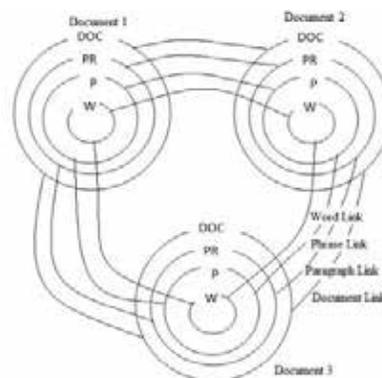


Fig. 2. MDS at different levels

III. IMPLEMENTATION DETAILS

A. Block Diagram

Fig. 3 shows system architecture of the proposed system

B. Document Pre-processing

Pre-processing of the document means executing a set of operations on the source documents. Various algorithms can be applied for document pre-processing. In the proposed work, affix algorithm is used as it does not rely on look-up table. Affix, the idiom, refers to either prefix or suffix. At the very first step source documents are segmented into sentences. Common words are removed from the sentences like 'the', 'a', 'an' etc. Stemming algorithm is applied to obtain stem of words. Further tokenization is performed on the sentences for which common words are separated. Tokenization is the procedure in which stream text is broken into axioms, words, or into some significant words called tokens and this token list is considered to be input for further processing.

C. Feature Extraction

As the input information is too huge to be processed, the input information is transformed into a condensed representation of vector or the set of features. This process of converting input information into a set of features is named as feature extraction. For the feature extraction process, six different features are taken into consideration [11]. The vector $[f_1, f_2, \dots, f_6]$ is considered for these six features. The feature selection plays a vital role in deciding the variety of sentences that will be chosen in final summary.

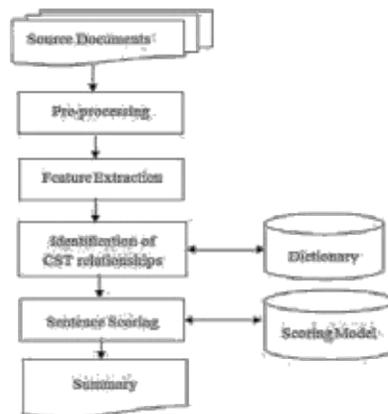


Fig. 3. System Architecture of Proposed System

"Paragraph follows title" feature describes that the very first paragraph in any document is important as it contains relevant information to the title of the document. Feature 2 i.e. "Location of paragraph in document" and feature 3 i.e. "Location of sentence in paragraph" describes the relevance of the sentence and the paragraph respectively. This relevance is described according to the location of the sentence and the paragraph in the document. Generally the first sentence in a paragraph is considered to be important, this fact is described by feature 4 viz. "First sentence in paragraph". "Length of sentence" is assumed as important feature because long sentences contain more information than short sentences

D. CST Relation Identification

Cross document relations are identified to include highly relevant sentences into summary. Four types of CST relations are considered viz. description, partial equivalence, subsumption and identity as these relations cover other relations in CST model. Cross document relation identification with the help of manually annotated text can require time period and resources. Inspired by this fact, a dictionary based approach is proposed in this work which

Feature	Description
F1	
F2	Location of Paragraph in Document
F3	Location of Sentence in Paragraph
F4	First Sentence in Paragraph
F5	Length of Sentence
F6	No. of Thematic Words in Sentence

automatically identifies four above mentioned relations to assist MDS task. Table 2 describes CST relations used in proposed system. Sentence pairs are generated and features are described with the help of these sentence pairs. Cosine Similarity- similarity between two sentences is measured by cosine similarity. Word vectors with its tf-idf value (j) are used to represent sentence [2].

$$\cos(p_1; p_2) = \frac{\sum_{j=1}^p p_{1;j} p_{2;j}}{\sqrt{\sum_{j=1}^p p_{1;j}^2} \sqrt{\sum_{j=1}^p p_{2;j}^2}} \quad (1)$$

Word Overlap: number of overlapping words is measured with the help of this feature. Word order does not matter in this measure [2].

$$\text{overlap}(p_1; p_2) = \frac{|\text{overlapping words}(p_1; p_2)|}{(|\text{words}(p_1)| + |\text{words}(p_2)| - |\text{overlapping words}(p_1; p_2)|)}$$

Length Type: lengths of two sentences are calculated and this feature gives length type of first sentence [2].

$$\begin{aligned} \text{LengthType}(p_1) &= 1 \text{ if } (\text{length}(p_1) > \text{length}(p_2)) \\ &= 0 \text{ if } (\text{length}(p_1) = \text{length}(p_2)) \\ &= 1 \text{ if } (\text{length}(p_1) < \text{length}(p_2)) \end{aligned} \quad (3)$$

NP Similarity: Noun phrase similarities among two sentences are represented using this feature. The similarity is calculated according to Jaccard coefficient [2].

$$\text{NP}(p_1; p_2) = \frac{|\text{NP}(p_1) \cap \text{NP}(p_2)|}{|\text{NP}(p_1) \cup \text{NP}(p_2)|} \quad (4)$$

NP (p₁) NP (p₂)

S

VP Similarity: Verb phrase similarities among two sentences are represented using this feature. The similarity is calculated according to Jaccard coefficient [2].

	VP (p ₁)	VP (p ₂)	
VP (p ₁ ; p ₂) =	(p ₁)	^T VP (p ₂) +	(5)
		S	

E. Sentence Scoring

As stated earlier, we are taking into account four CST relations namely description, partial equivalence, Subsumption and identity. Adjacency matrix is calculated from all these four relations. The role of adjacency matrix is to find initial score of the sentence. Final score of sentence is calculated from the two rules. These two rules are based on Description and Subsumption CST relation as these relations are having 1-way directionality.

Rule 1: Subsumption Rule: If first sentence (p1) contains all information in second sentence (p2) including additional information which is not in second then score of p1 must be updated.

Rule 2: Description Rule: If first sentence (p1) describes an entity in second sentence (p2) then score of p2 must be updated as relevant information is in p2.

When the final score for all sentences are calculated, re-ordering of sentences is done using updated score of sentences. Up to the needed summary length, high ranking sentences are included in summary

F Cross-document Structure Theory

Radev (2000) proposed CST model with a set of 24 relations for multidocument treatment in any domain. Table 1 lists these relations. The established relations may have (or not) directionality, e.g., the equivalence relation (which states that two text segments have similar content) has no directionality while the historical background relation (which states that a segment provides historical information about other) has. Figure 4 shows examples of these two relations among sentences from different sources.

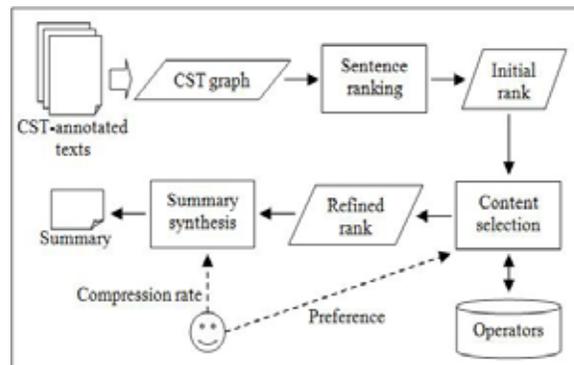


Fig 4: CST Summ architecture

Equivalence relation

Sentence 1: Nine people died, three of them children, and 25 others were wounded last Monday in a blast at a market in Moscow, police said.

Sentence 2: Nine people died, including three children, and 25 others were injured last Monday in an explosion that happened at a market in Moscow, police of Moscow informed.

Historical background relation (directionality: from Sentence 2 to 1)

Sentence 1: An airplane accident in Bukavu, east of Democratic Republic of Congo, killed 13 people this Thursday in the afternoon.

Sentence 2: Congo has a history of more than 30 airplane tragedies.

IV. RESULTS

Implementation is carried out on first two modules which are document pre-processing and feature extraction. In the first module, segmentation is performed to break the entire document into sentences based on the separators. Step 2 is to remove unnecessary words from every document. Unique words are again calculated from these processed documents. Unique words are the words which are synonyms or may be duplicate words in a document. Stemming algorithm is applied to remove these words. Number of occurrences of word is calculated by stemming. Weight of every word is calculated from the stemmed words. Depending on this weight of the sentence is calculated. In module 2 of feature extraction, six numbers of features are extracted; user can select number of features to be extracted from particular document or from all the documents.

TABLE III. AN EXAMPLE OF FEATURE EXTRACTION FOR NO. OF DOCUMENTS

Document	No.of Sentences	No. of Filtered Sentences
Doc 1	18	12
Doc 2	31	28
Doc 3	38	34
Doc 4	8	5

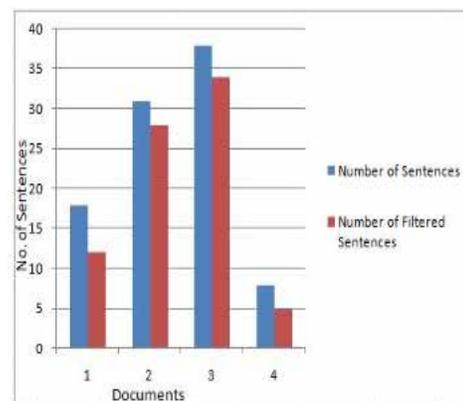


Fig. 5. Graph Showing Result of Feature Extraction

Here, four files are taken as input and results are shown for number of sentences versus filtered sentences for each document.

V. CONCLUSION AND FUTURE SCOPE

This paper provides a summarization for multiple documents. At this point, a system which performs pre-processing on the multiple documents from various sources using affix algorithm is being designed. Graph is shown

for number of sentences versus number of filtered sentences. The effort is to enhance the performance in terms of time and to obtain better precision in the system. It has been found that identifying the documents from the same topic is quite difficult task because CST relations consider only the documents from the same topic.

The system is required to be trained on different documents from multiple domain or topic. In future the system can be implemented for more than 4 CST relations to improve the quality of summary.

REFERENCES

- [1] V. Gupta and G. S. Lehal, "A survey of text summarization extractive techniques," *Journal of Emerging Technologies in Web Intelligence*, vol. 2, pp. 258-268, 2010.
- [2] Yogan Jaya Kumar, Naomie Salim, Albaraa Abuobieda, Ameer Tawfik, Multi Document summarization based on cross-document relation using voting technique., *International conference on computing, electrical and electronic engineering (ICCEEE)*, 2013.
- [3] Y. J. Kumar and N. Salim, "Automatic multi document summarization approaches," *Journal of Computer Science*, vol. 8, pp. 133-140, 2011.
- [4] http://en.wikipedia.org/wiki/Ultimate_Research_Assistant
- [5] D. R. Radev, "A common theory of information fusion from multiple text sources step one: cross-document structure," presented at the *Proceedings of the 1st SIGdial workshop on Discourse and dialogue Volume 10, HongKong, 2000*
- [6] Hsun-Hui Huang, Horng-Chang Yang, Yau-Hwang kuo, A Fuzzy- Rough Hybrid Approach to Multi-document Extractive Summarization. , *Ninth International Conference on Hybrid Intelligent Systems*, 2009
- [7] Md. Mohsin Ali , Monotosh Kumar Ghosh, and Abdullah-Al-Mamun, Multi-document Text Summarization: SimWithFirst Based Features and Sentence Co-selection Based Evaluation., *International Conference on Future Computer and Communication*, 2009
- [8] Z. Zhang, S. Blair-Goldensohn, and D. R. Radev, "Towards CSTenhanced summarization," presented at the *Eighteenth national conference on Arti-ficial intelligence*, Edmonton, Alberta, Canada, 2002
- [9] M. L. d. R. C. Jorge and T. A. S. Pardo, "Experiments with CST-based multidocument summarization," presented at the *Proceedings of the 2010 Workshop on Graph-based Methods for Natural Language Processing*, Uppsala, Sweden, 2010
- [10] Z. Zhang, J. Otterbacher, and D. Radev, "Learning crossdocument structural relationships using boosting," presented at the *Proceedings of the twelfth international conference on Information and knowledge management*, New Orleans, LA, USA, 2003.
- [11] Rajesh S.Prasad, Dr. U.V.Kulkarni, Jayashree R.Prasad, A Novel Evolu-tionary Connectionist Text Summarizer (ECTS)., published in *proceedin-gASIDe09 Proceedings of the 3rd international conference on Anti-Counterfeiting, security, and identification in communication*, IEEE Press Piscataway, NJ, USA, 20 Aug 2009

VOLTAGE SAG/SWELL AND LOAD REACTIVE POWER COMPENSATION USING UPQC

Prasad P.Kulkarni

Assistant Professor, Department of Electrical Engg. SETI, Panhal,(India)

ABSTRACT

This paper explains the new method of optimal utilization of unified power quality conditioner (UPQC). The series inverter of UPQC is controlled to perform simultaneous voltage sag/swell compensation and load reactive power sharing with the shunt inverter. The active power control approach is used to compensate voltage sag/swell and is integrated with theory of power angle control (PAC) of UPQC to coordinate the load reactive power between the two inverters.

Keywords: PAC, UPFC, UPQC

1.INTRODUCTION

The power quality problems are mainly seen in power distribution systems. The main source for increased current and voltage harmonics is large use of nonlinear loads. The use of renewable energy sources in power system is imposing new challenges to the power industries. To maintain power quality regulations at distribution levels, UPQC is the solution. The basic block diagram of UPQC is as shown in fig.1.

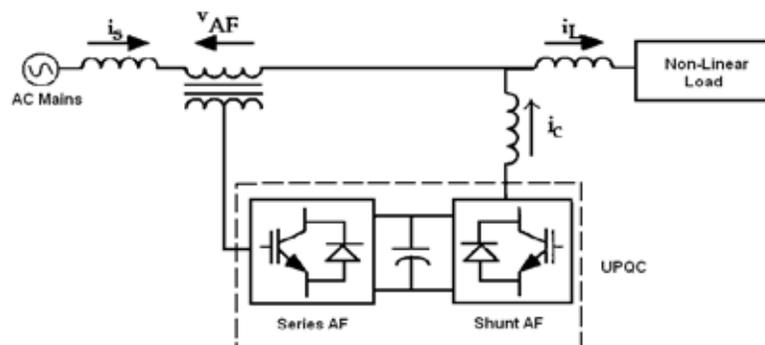


Fig.1 Unified Power Quality Conditioner

The block diagram consists of two voltage source inverter connected back to back using a common DC link capacitor. The main power quality problems on the system are voltage sag/swell. This problem can be compensated using a series active filter, dynamic voltage restorer, UPQC, etc. Among these the UPQC is having a better sag/swell compensation capability. The sag on the system can be controlled by three different approaches namely: 1) active power control approach; 2) reactive power control approach; and 3) a minimum VA loading approach. In this paper UPQC-VAmin approach is used. In a minimum VA loading approach, the series inverter voltage is injected at an

optimal angle with respect to the source current. By using PAC concept, a part of load reactive power demand is also supported with proper control of series inverter voltage thereby reducing the required VA rating of shunt inverter. The reactive power flow control can also be done with UPFC. A UPFC is utilized in a power transmission system whereas a UPQC is used in power distribution system to perform the shunt and series compensation simultaneously. The modified approach of UPFC is UPQC; in this compensation of voltage sag/swell is done by sharing the load reactive power between two inverters.

II. PROPOSED PROJECT

- 1) The series inverter of UPQC-S is utilized for both voltage sag/swell and load reactive power compensation with shunt inverter.
- 2) The prime focus is to minimize the VA loading of UPQC during voltage sag condition by using the available VA loading to its maximum capacity.

2.1 Voltage SAG/SWELL compensation using UPQC-P and UPQC-Q

V_L^* -Ref. load voltage, V_L^P - load voltage(UPQC-P), V_L^Q -load voltage(UPQC-Q), V_{sr}^P -Series voltage(UPQC-P), V_{sr}^Q -Series voltage (UPQC-Q), V_s' -sag voltage, V_s'' -swell voltage

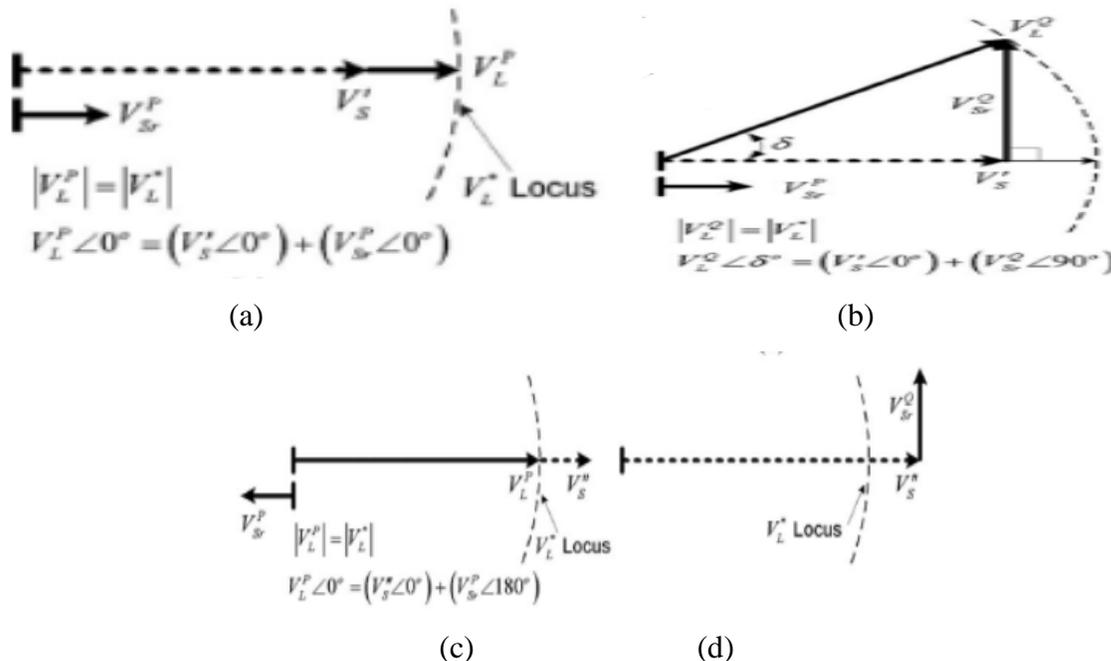


Fig.2. (a) Voltage Sag (UPQC-P). (b) Voltage Sag (UPQC-Q). (c) Voltage Swell (UPQC-P). (d) Voltage Swell (UPQC-Q).

Fig.2(a & b) shows the phasor representations for voltage sag compensation using active power control as in UPQC-P and reactive power control as in UPQC-Q. Fig.2 (c & d) shows the compensation capability of UPQC-P and UPQC-Q to compensate a swell on the system.

2.2 PAC Approach under Voltage SAG Condition

(a) Series Inverter Parameter Estimation under Voltage Sag

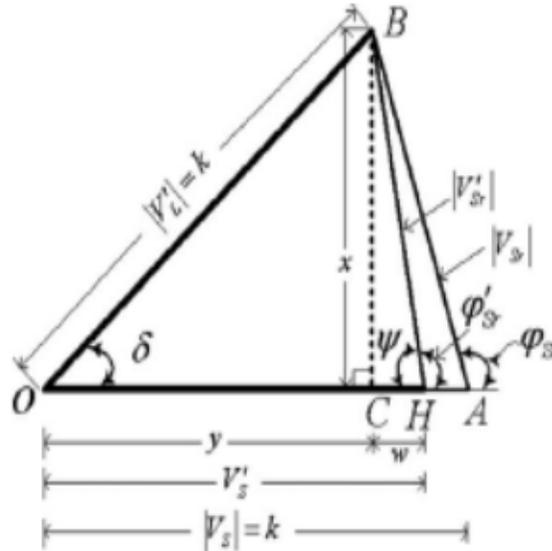


Fig.3 Phasor diagram to determine the series inverter parameters for the UPQC-Sunder voltage sag condition.

In this section, the required series inverter parameters to get simultaneous load reactive power and voltage sag compensations are computed. The fig.3 shows calculation of the magnitude and phase of series injection voltage.

The voltage fluctuation factor k_f is given by,

$$k_f = \frac{V_s - V_s^*}{V_s^*} \quad (1)$$

Equation (1) represents sag condition under PAC

$$k_f = \frac{V_s - V_s^*}{V_s^*} = \frac{V_s - k}{k} \quad (2)$$

Let us define

$$1 + k_f = n_p \quad (3)$$

To compute the magnitude of V_{sr} from ΔCHB in Fig. 3

$$w = l(ch) = n_p k - y \quad (4)$$

$$|V_{sr}'| = k \sqrt{(1 + n_p^2) - 2n_p \cos \delta} \quad (5)$$

To compute the phase of

$$\angle CHB = \angle \Psi = \tan^{-1} \frac{x}{w} = \tan^{-1} \left(\frac{\sin \delta}{n_p - \cos \delta} \right) \quad (6)$$

$$\angle \Psi_{sr}' = 180^\circ - \angle \Psi \quad (7)$$

Equation (5) & (7), give the required magnitude and phase of series inverter voltage of UPQC-S.

b) Shunt Inverter Parameter Estimation under Voltage Sag

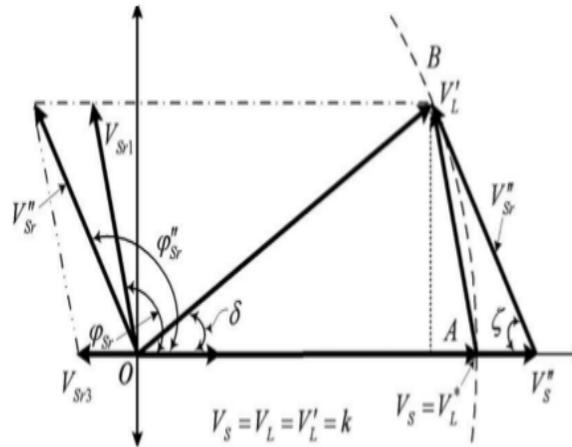


Fig.5. Phasor representation for PAC of UPQC-S during a voltage swells on the system.

For voltage swell compensation using active power control approach

$$\vec{V}_{Sr3} = \vec{V}_L'' - \vec{V}_S'' \quad (16)$$

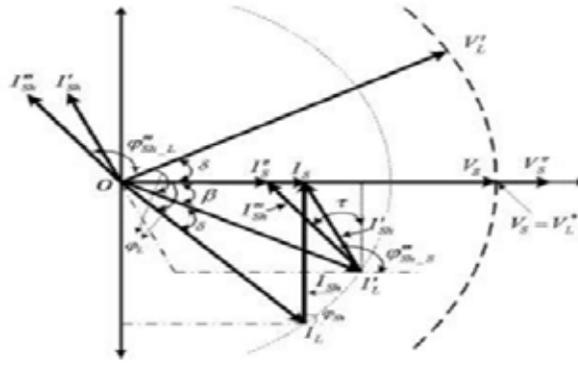


Fig.6. Phasor representation for different currents under PAC of UPQC-S under a voltage swells condition.

Under voltage swell condition.

$$V_{Sr3} \angle 180^\circ = V_L'' \angle 0^\circ - V_S'' \angle 180^\circ \quad (17)$$

For simultaneous load reactive power and voltage swell compensations

$$\vec{V}_{Sr} = \vec{V}_{Sr1} + \vec{V}_{Sr3} \quad (18)$$

For series inverter

$$|V_{Sr}''| = k\sqrt{1 + n_0^2} - 2n_0 \cos \delta \quad (19)$$

$$\angle CLB = \angle \xi = \tan^{-1} \left(\frac{\sin \delta}{n_0 - \cos \delta} \right) \quad (20)$$

$$\angle \Psi_{Sr}'' = 180^\circ - \angle \xi \quad (21)$$

$$I_{Srh}'' = I_L'' \sqrt{1 + k_0^2 \cos^2 \Psi_L''} - 2k_0 \cos \beta \cos \Psi_L'' \quad (22)$$

$$\zeta = \tan^{-1} \left(\frac{\cos \beta - k_0 \cos \Psi_L}{\sin \beta} \right) \quad (23)$$

$$\angle \Psi_{S_{h,L}} = (\angle \zeta + 90^\circ) - \delta \quad (24)$$

Equation (12) & (15) sag, (22) & (24) for voltage swell compensation utilizing the PAC of UPQC are similar.

d) Active–Reactive power flow through UPQC

(i) Series Inverter of UPQC-S

For active power

$$P'_{SI} = V'_{SI} I'_S \cos \Psi'_{SI} \quad (25)$$

The increase or decrease in the source current magnitudes during the voltage sag or swell condition, is represented by-

$$I'_S = I_S - k_0 I_L \cos \Psi_L \quad (26)$$

Therefore,

$$P_{SI,PAC} = P'_{SI} = -k_0 (n_0 - \cos \delta) (P_L) \quad (27)$$

For reactive power

$$Q'_{SI} = V'_{SI} \sin \Psi'_{SI} \quad (28)$$

Therefore,

$$Q_{SI,PAC} = Q'_{SI} = k_0 (\sin \delta) (P_L) \quad (29)$$

Equation (27) & (29) are used to determine the active and reactive power flow through series inverter of UPQC-S during voltage sag/swell.

(ii) Shunt Inverter of UPQC

The active and reactive power handled by the shunt inverter as seen from the source side is determined as follows

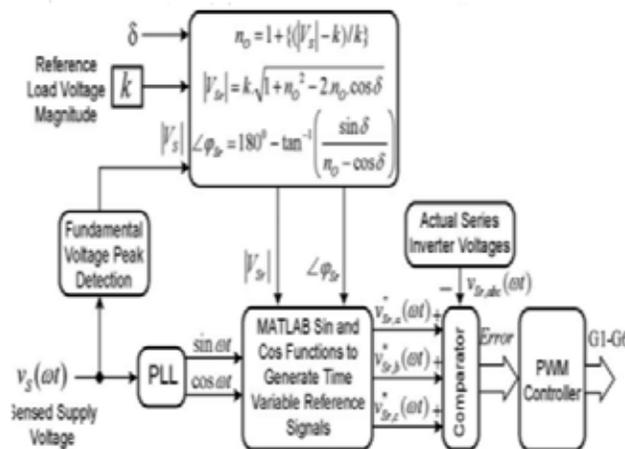


Fig.7. Reference voltage signal generation for the series inverter

For active power,

$$P'_{sh} = V'_s I'_{sh} \cos \Psi'_{sh_s} \quad (30)$$

$$P'_{sh} = n_o k I'_{sh} (-\sin \rho) \quad (31)$$

$$P_{sh,PAC} = -\frac{(kI_s)(\cos \beta - k_o \cos \Psi_s)}{k_o} \quad (32)$$

For reactive power

$$Q'_{sh} = V'_s I'_{sh} \sin \Psi'_{sh_s} \quad (33)$$

$$Q'_{sh} = n_o k I'_{sh} \cos \rho \quad (34)$$

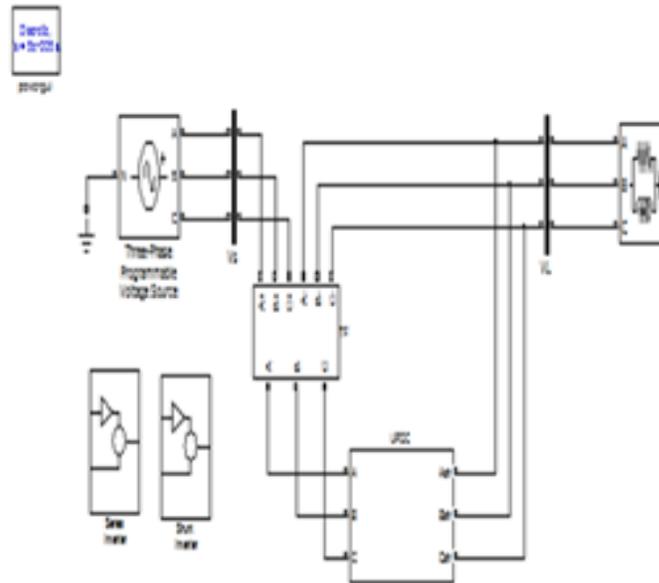
$$Q_{sh,PAC} = \frac{(kI_s)(\sin \beta)}{k_o} \quad (35)$$

Equation (32) & (35) are used to calculate the active and reactive power flow through shunt inverter of UPQC-S during voltage sag/swell condition and also to determine the overall UPQC VA loading.

(Iii) UPQC Controller

The power angle δ is maintained at constant value under different operating conditions. Thus, the reactive power shared by the series inverter and by the shunt inverter changes as per the equations.

III.MATLAB CIRCUITS



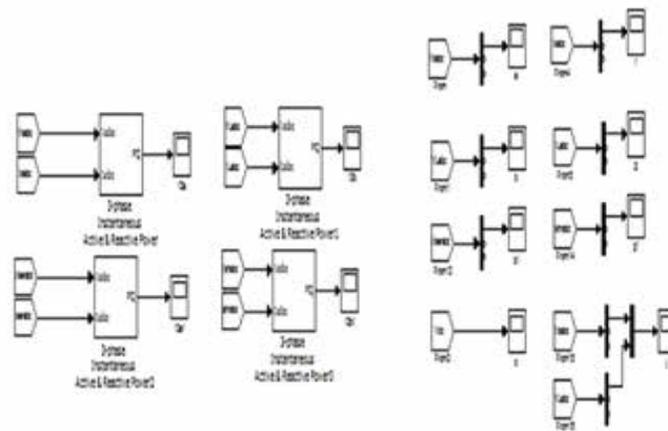


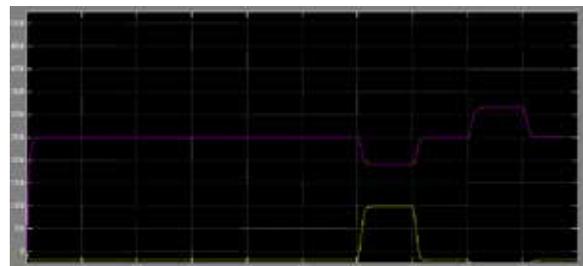
Fig.8. Simulink Diagram of Proposed Method

IV.RESULTS

Following fig.9 shows the Performance of the proposed UPQC approach under voltage sags and swells conditions.



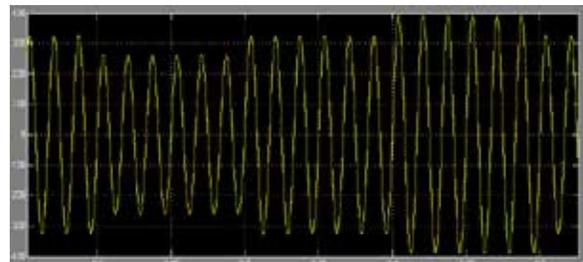
a) Source P & Q



d) Shunt Inverter P and Q



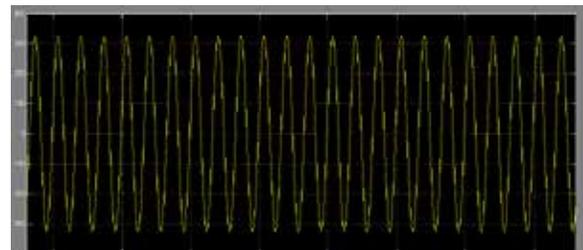
b) Series Inverter P and Q



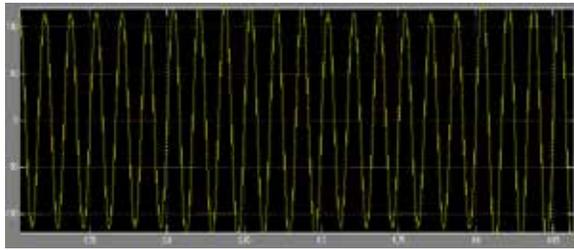
e) Supply Voltage



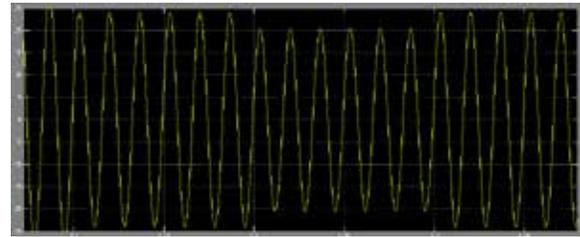
c) Load P and Q



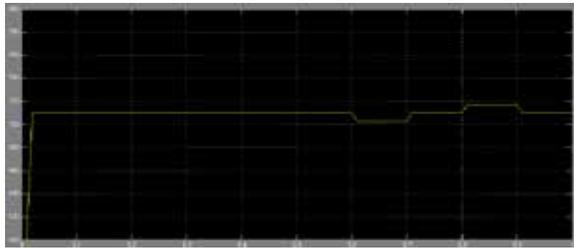
f) Load Voltage



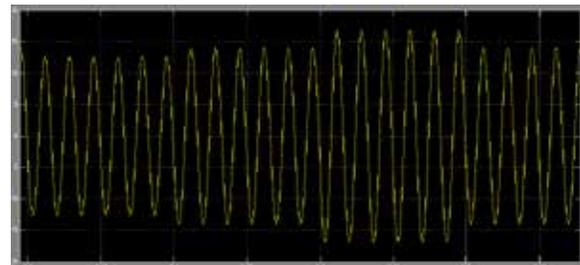
g) Series inverter injected voltage



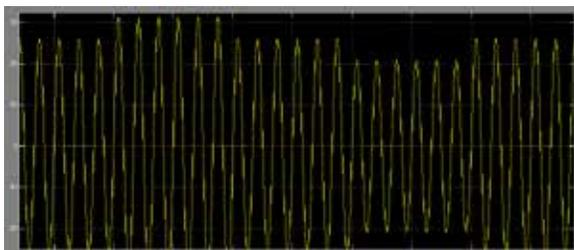
j) Load Current



h) Self-supporting dc bus voltage



k) Shunt inverter injected current



i) Supply current

REFERENCES

- [1] Hirofumi Akagi, Trends in Active Power Line Conditioners, IEEE Tran. Power Electronics, vol. 9, no.3, May 1994, pp. 263-268.
- [2] Janko Nastran, Rafael Cajhen, Matija Seliger, and Peter Jereb, Active Power Filter for Nonlinear AC Loads, IEEE Trans. Power Electronics, vol.9, no.1, Jan. 1994, pp. 92-96.
- [3] E. Destobbeleer and L.Protin, On the Detection of Load Active Currents for Active Filter Control, IEEE Trans. Power Electronics, vol. 11, no.6, Nov. 1996, pp. 768-775.
- [4] Mauricio Aredes, Jorgen Hafner, and Klemens Hermann, Three-Phase Four-Wire Shunt Active Filter Control Strategies, IEEE Trans. Power Electronics, vol.12, no.2, Mar. 1997, pp. 311-318.
- [5] Hideaki Fujita and Hirofumi Akagi, the Unified Power Quality Conditioner: The Integration of Series- and Shunt-Active Filters, IEEE Tran. Power Electronics, vol. 13, no.2, Mar. 1998, pp.315-322.
- [6] Fang Zheng Peng, George W. Ott Jr., and Donald J. Adams, Harmonic and Reactive Power Compensation Based on the Generalized Instantaneous Reactive Power Theory for Three-Phase Four-Wire Systems, IEEE Trans, Power Electronics, vol.13, no.6, Nov. 1998, pp. 1174-1181.

- [7] Kishore Chatterjee, B.G. Fernandes, and Gopal K.Dubey, An Instantaneous Reactive Volt Ampere Compensator and Harmonic Suppressor System, IEEE Trans. Power Electronics, vol. 14, no.2, Mar.1999, pp. 381-392.
- [8] Po-Tai Cheng, Subhashish Bhattacharya, and Deepak D. Divan, Line Harmonics Reduction in High-Power Systems Using Square-Wave Inverters-Based Dominant Harmonic Active Filter, IEEE Trans. Power Electronics, vol. 14, no.2, Mar. 1999, pp. 265-272.
- [9] Shyh-Jier Huang and Jinn-Chang Wu, A Control Algorithm for Three-Phase Three-Wired Active Power Filters Under Nonideal Main Voltages, IEEE Trans. Power Electronics, vol. 14, no. 4, Jul. 1999, pp. 753-760.
- [10] Ambrish Chandra, Bhim Singh, B.N.Singh, and Kamal Al-Haddad, An Improved Control Algorithm of Shunt Active Filter for Voltage Regulation, Harmonic Elimination, Power-factor Correction, and Balancing of Nonlinear loads, IEEE Trans. Power Electronics, vol. 15, no.3, May 2000, pp. 495-507.
- [11] Moleykutty George, Modeling and simulation of a current controlled three-phase shunt active power filter using MATLAB/PSB, AIUB Journal of Science and Engineering, vol. 3, no.1, Aug. 2004 issue, pp. 11-18.
- [12] M. George, C.L. Seen, Modeling and control of zero-sequence current of parallel three-phase converters using Matlab/power system blockset, IEEE Power Systems Conf. and Exp. 2004, PSCE 2004, vol. 3, pp. 1440-1443.
- [13] Hyosung Kim, Sang-Joon Lee, and Seung-Ki Sul, A calculation for the compensation voltages in dynamic voltage restorers by use of PQR power theory, 19th Annual IEEE Applied Power Electronics Conf. and Expo. 2004, APEC '04, vol. 1, pp. 573-579.
- [14] J. G. Nielsen, M. Newman, H. Nielsen, and F. Blaabjerg, Control and testing of a dynamic voltage restorer (DVR) at medium voltage level, IEEE Trans. on Power Electronics, vol. 19, issue 3, May 2004, pp. 806-813.
- [15] E. K. K. Sng, S. S. Choi, and D. M. Vilathgamuwa, Analysis of series compensation and DC-link voltage controls of a transformer less self-charging dynamic voltage restorer, IEEE Trans. Power Delivery, vol. 19, issue 3, Jul. 2004, pp. 1511-1518.
- [16] M. J. Newman, D. G. Holmes, J. G. Nielsen and F. Blaabjerg, A dynamic voltage restorer (DVR) with selective harmonic compensation at medium voltage level, IEEE Trans. Ind. Application, vol. 41, issue 6, Nov.-Dec. 2005, pp. 1744-1753.

FUTURE TRENDS IN AUTOMOBILES: AIR POWERED VEHICLES

Sapkal Vishal K.¹, Bhamare Punam A.², Patil Tanvi P.³,
Sayyad Munija S.⁴, Shrikant U. Gunjal⁵.

^{1,2,3,4} U. G. Student, ⁵Asst. Prof., Department of Mechanical Engineering,
Sandip Foundation's- SITRC, Mahiravani, Nashik, Maharashtra, (India)

ABSTRACT

The latest trend in the automotive industry is to develop light weight vehicles. Light utility vehicles are becoming very popular means of independent transportation for short distances. Every automotive industry is looking to reduce the weight of the vehicle as it helps in the better handling of the vehicle and increases the efficiency of the vehicle. Today, the heavy vehicles are run on the basically petrol & diesel, which producing a large amount of harmful gases like CO₂, SO₂ etc. which act as the major source for global warming. The Cost and pollution with petrol & diesel vehicles is very high manufacturers to develop vehicles fueled by alternative energies. So research is going on to find a light weight vehicle which does not pollute the environment. One of the alternatives is the use of compressed air to generate power to run an automobile. Due to the unique and environmental friendly properties like compressed air for storing energy is a method that is not only efficient and clean, but also economical. So the air is considered as one of the future fuels which will run the vehicles. This paper provides an overview of air power vehicles in brief and emphasizes the potential advantages and disadvantages of the compressed air technology. And assure that the compressed air is the alternative fuel for the vehicles.

Keywords: *Air powered vehicles, Alternative Sources of Energy, clean & highly efficient, Compressed air, light weight, Nonpolluting.*

I. INTRODUCTION

Compressed air is the air kept under a pressure that is greater than atmospheric pressure. It serves many domestic and industrial purposes. We know that our world is facing fuel crises now. All kinds of conventional source of fuels are the verge of exhaustion. Gasoline which has been main source of fuel for history of cars is becoming more and more expensive and impractical. These factors are leading car manufactures to develop cars fuel alternative energies. Two hybrid cars took to the road in 2000 & in three or four years fuel-cell-powered cars will roll on to the world's highways. While gasoline prices in the United States have not yet reach their highest point. But cost is not only problem with using gasoline as our primary fuel [1]. It is also damaging to the environment, and since it is not a renewable resource, it will eventually run out. One possible alternative is the AIR POWER VEHICLES. It is hard to believe that compressed air can be used to drive vehicles. However that is true and "air vehicles" as it popularly knows has caught the attention of research worldwide. It has zero

emission and is ideal for city driving condition. MDI (Motor Development International) is one company that holds the international patents for compressed air car.

Compared to fuels like petrol and diesel, compressed air is favorable because of a high energy density, low toxicity, fast filling at low cost and long service life. These issues make it technically challenging to design air engines for all kind of compressed air driven vehicles. To meet the growing demand of public transportation, sustainable with environmental consciousness, people are in the search for the ultimate clean car with zero-emissions. Many concept vehicles were proposed that run on everything from solar power to algae, but most of them are expensive and require hard-to-find fuels. Compressed air vehicle project in the form of light utility vehicle (LUV) (i.e., air car in particular) has been a topic of great interest.

II. NEED OF THE TECHNOLOGY

Today fossil fuels are widely used as a source of energy in various different fields like power plants, internal & external combustion engines, as heat source in manufacturing industries, etc. But its stock is very limited and due to this tremendous use, fossil fuels are depleting at faster rate. So, in this world of energy crisis, it is inevitable to develop alternative technologies to use renewable energy sources, so that fossil fuels can be conserved. One of the major fields in which fossil fuels are used is Internal Combustion Engine. An alternative of IC Engine is **“AIR POWERED ENGINE”**. It is an engine which will use compressed air to run the engine. It is cheap as it uses air as fuel, which is available abundantly in atmosphere. There are several technical benefits of using this engine, like as no combustion takes place inside the cylinder, working temperature of engine is very close to ambient temperature. This helps in reducing wear and tear of the engine components. Also there is no possibility of knocking. This in turn results in smooth working of engine. One more technical benefit is that there will not be any need for installing cooling system or complex fuel injection systems. This makes the design simpler. Here air is compressed using compressor which in turn uses electricity, to run, which is cheaper and widely used. This adds value to its economic benefits [2]. Also, as discussed earlier, as no combustion takes place which results in smooth working of the engine with minimum wear and tear, this will require less maintenance. So these are some of its economic benefits.

One more interesting thing is that the exhaust temperature of this engine will be slightly less than the atmospheric temperature. So this will help in cooling the environment and if this technology is widely used than it will help in controlling global warming. These are some green bytes associated with this technology. Exhaust gases leaving the engine will be only air having low temperature. So this will eliminate the problem of harmful emissions, in conventional engines. This gives us environmental benefit of using this engine. Also as there will be no thermal radiations produced, radar can't detect these vehicles. So this will help our army too. Also the components used in this are: conventional SI engine, air vessel to store compressed air, and timing circuit are economical. These economical and readily available components make the technology easily adaptable.

III. WORKING PRINCIPLE OF AIR POWER VEHICLES

The principle of compressed-air propulsion is to pressurize the storage tank and then connect it to something very like a reciprocating steam engine of the vehicle. Instead of mixing fuel with air and burning it in the engine to drive pistons with hot expanding gases, compressed air vehicles (CAV) use the expansion of compressed air to drive their pistons. Thus, making the technology free from difficulties, both technical and medical, of using ammonia, petrol, or carbon disulphide as the working fluid. Manufacturers claim to have designed engine that is 90 percent efficient. The air is compressed at pressure about 150 times the rate the air is pressurized into car tyres or bicycle. The tanks must be designed to safety standards appropriate for a pressure vessel. The storage tank may be made of steel, aluminum, carbon fiber, kevlar or other materials, or combinations of the above. The fiber materials are considerably lighter than metals but generally more expensive. Metal tanks can withstand a large number of pressure cycles, but must be checked for corrosion periodically [3]. A company has stated to store air in tanks at 4,500 pounds per square inch (about 30 MPa) and hold nearly 3,200 cubic feet (around 90 cubic meters) of air. The tanks may be refilled at a service station equipped with heat exchangers, or in a few hours at home or in parking lots, plugging the vehicle into an on-board compressor.

IV. ENGINE WORKING

To convert a conventional IC engine into an Air Powered one, few components are to be replaced. First of all replace the **spark plug** with a **pulsed pressure control valve** which can create required pressure. Now the pulsed air firing in this valve is controlled by controlling the supply of electrical signal to the plunger [5]. For this we require an electronic timing circuit which can control the flow of electrical supply to the plunger of this valve. This can be achieved by using PLC circuit. Now speed of the engine will be controlled by controlling this input signal.

Now **fuel tank** is to be replaced with **air vessel**, as it requires pressurized air as input. And two things are to be taken care while designing air vessel:

- 1) First is its strength to withstand high internal pressure, which exists due to compressed air. For this outer body of it should be made of a material, having high strength, like carbon fiber.
- 2) Second is its capacity to store air and its weight.

Now replace **cam** with a **modified cam**. This is to be done, so that both the inlet and outlet valves open and close at the same time. Main advantage of doing this is to achieve better scavenging system. Also this will result in conversion of 4 stroke engine into 2 stroke air engines, which in turn gives us the benefit of low mean effective pressure requirement in addition to other operational benefits.

V. DETAIL WORKING OF ENGINE

The normal 4 stroke SI engine is shown as:

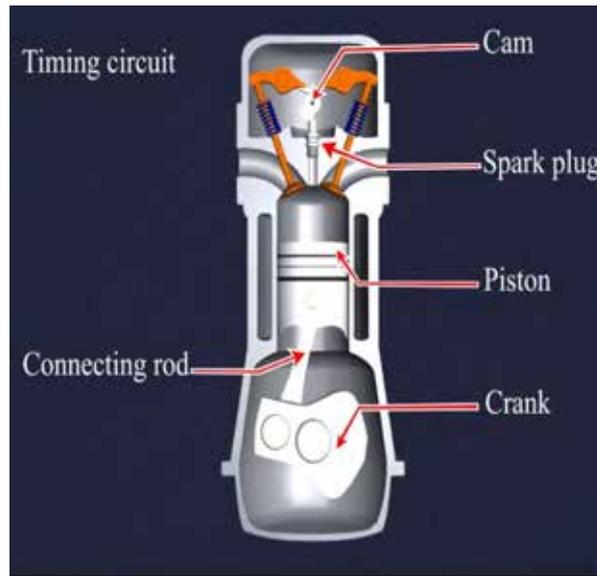


Fig. 1: Stage 1 of Operation

OPERATION:

Initial torque is supplied from the DC exciter motor, and then the engine operation starts.

STAGE 1: When the piston is in the TDC, compressed air is injected through the pulsed air firing valve, which pushes the piston to BDC.

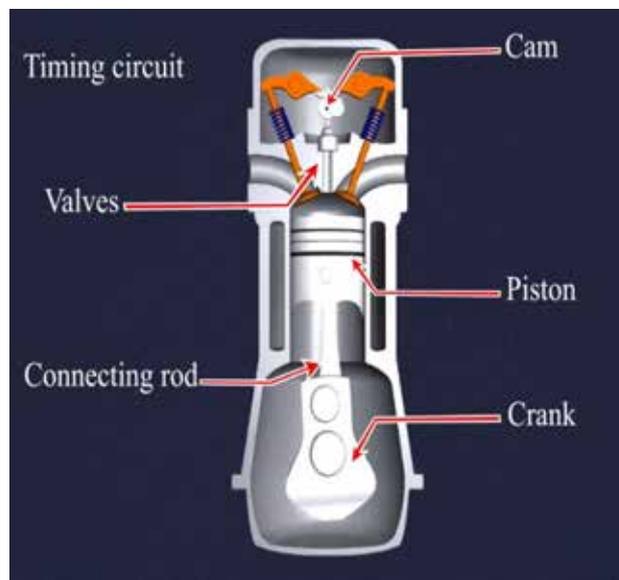


Fig. 2: Stage 2 of Operation

STAGE 2: Due to the motion of the engine and its inertia, the piston moves back to TDC, pushing the air out of the valves.

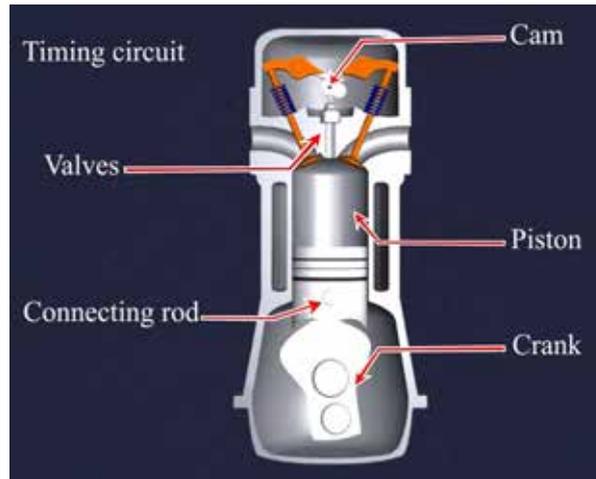


Fig. 3: Stage 3 of Operation

The plunger of the pulsed firing valve is controlled by a timing circuit which is specifically a PLC programmed circuit [5, 6]. It supplies the electronic signals by which the plunger moves so that it opens and closes the pulsed firing valve.

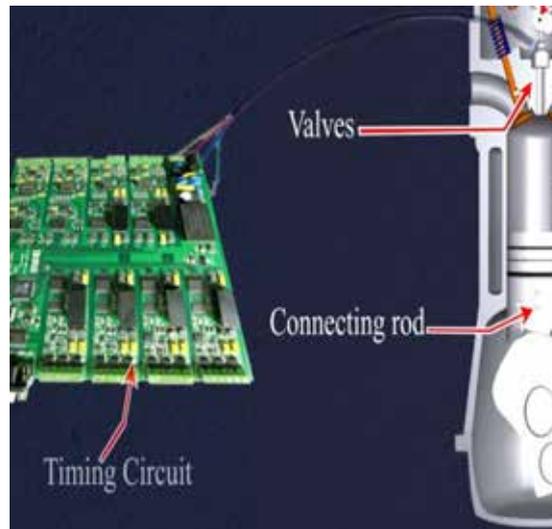


Fig. 4: Electric Control of Crank Shaft

On comparing it with the working of normal SI 4 stroke engine, we can say that:

- “**Stage 1**” of the air engine comprises of the combined operation of “Suction stage” and “Power stage” of the normal 4 stroke SI engine.
- “**Stage 2**” of the air engine comprises of the combined operation of the “Compression stage” and “Exhaust stage” of the normal 4 stroke SI engine.

VI. LAYOUT OF THE ACTUAL WORKING

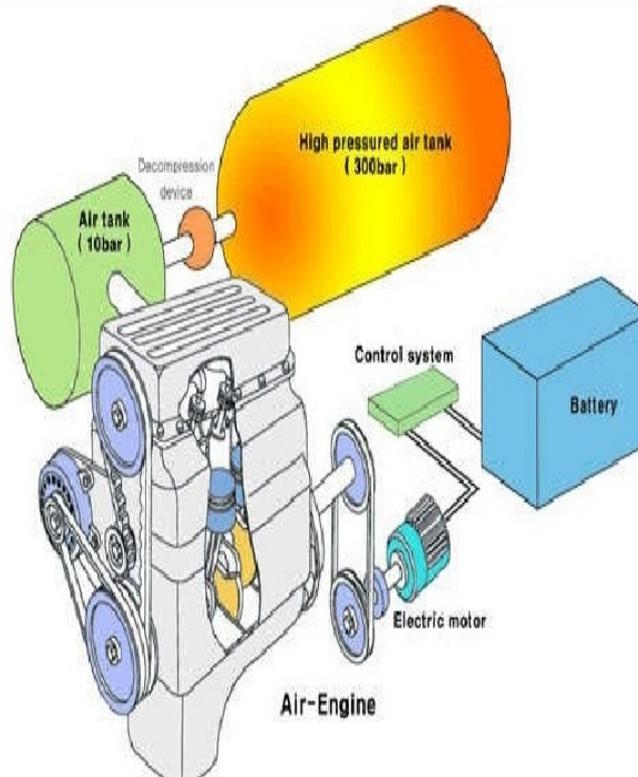


Fig. 5: Layout of Working of Engine

VII. WORKING DETAILS FOR 2 WHEELER

To develop the air powers bike first is to convert a regular scooter to a compressed air moped shown in Fig. 6



Fig. 6: Arrangement of Air Engine on 2 Wheels

This has been done by equipping the scooter with a compressed air engine and air tank. The air bike is created by strapping two high-pressure tanks onto the side of his Puch moped. The tanks are basically scuba tanks. He uses the electricity from his house to fill the tanks. The power is then "stored" there, much like a battery, ready for use. The tanks used are carbon-fiber tanks of the sort used by firefighters for oxygen. But still, they're far cheaper than even the lead acid battery used in cars now. Of course, the compressor works on electricity, so that's not always a clean power source but recharging options at night or off peak will enhance the chances to use the power that would be wasted otherwise. The top speed is about 18 mph, and it can only go 7 miles before the

air pressure runs out and a lot more power could probably be pulled by tweaking his configuration. A small gear on the end of the air drill, connected to the chain of the bike would make a much more elegant solution.

Several companies [5] are investigating and producing prototypes, and others plan to offer air powered cars, buses and trucks. The compressed air is stored in carbon-fiber tanks that are built into the chassis. As the air is released, the pressure drives pistons that power the engine and move the car, and the pistons compress the air into a reservoir so that the process continues. After making a revolution by producing the world's cheapest car-Tata nano, India's largest automaker (Tata Motors) is set to start producing the world's first commercial air-powered vehicle. The "Air Car" will make use of compressed air, as opposed to the gas-and oxygen explosions of internal-combustion models, to push its engine's pistons. Zero Pollution Motors (ZPM) (USA) [1] also expects to produce the world's first air-powered car for the United States by 2010. An earlier version of the car is noisy and slow, and a tiny bit cumbersome but then this vehicle will not be competing with a Ferrari or Rolls Royce and the manufacturers are also not seeking to develop a Formula One version of the vehicle. The aim of air powered vehicles is the urban motorist: delivery vehicles [8], taxi drivers, and people who just use their vehicles to nip out to the shops. The latest air car is said to have come on leaps and bounds from the early model. It is said to be much quieter, a top speed of 110 km/h (65 mph), and a range of around 200 km before you need to fill the tanks up with air.

VIII. WORKING DETAILS FOR 4 WHEELER

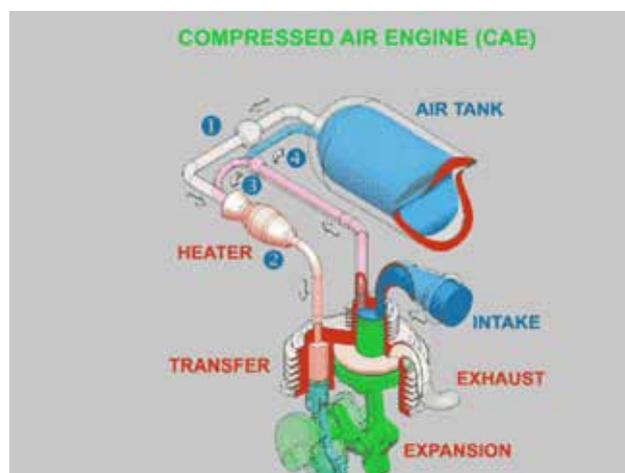


Fig. 7: Working of Engine in Car

Air powered car is worked on the compressed air instead of gasoline. Since the car is working on air there is no pollution. A two cylinder compressed air engine, powers the car. The engine can run either on compressed air alone or act as an internal combustion engine. The compressed air is stored in the fiber or glass fiber tanks at a pressure 4351 pounds per square inch. The air is fed through an air injector to the engine and flows into a small chamber, which expands the air. The air pushing down on the piston move the crankshaft, which gives the vehicle power

The car is also working on a hybrid version of their engine that can run on the traditional fuel in combustion with air [7]. The change of energy source is controlled electronically. When the car is moving at a speed below 60kph, it runs on the air and at a higher speed it runs on a fuel such as gasoline diesel or a natural gas. Air tank

is fixed to the underside of the vehicle can holds about 79gallons (300liters) of air. This compressed air can fuel the car up to 200kms at a top speed of 96.5kmh. When the tanks near empty it can be refilled at a nearest air pump. The car motors requires a small amount of oil 0.8liters worth that have to change just every 50,000kms.

IX. COMPONENTS OF AIR POWERED VEHICLES

9.1 Compressed air tank

An **Air powered vehicle** is powered by an air engine, using compressed air, which is stored in a tank. Instead of mixing fuel with air and burning it in the engine to drive pistons with hot expanding gases; compressed-air vehicles use the expansion of compressed air to drive their pistons. One manufacturer claims to have designed an engine that is 90 percent efficient.

9.2 Brake power recovery

It uses one mechanism that stops engine when the car is stationary (at traffic light, junctions etc...), which recover 13% of power used.

9.3 Air filter



Fig. 8: Air Filter

A particulate **air filter** is a device composed of fibrous materials which removes solid particulates such as dust, pollen, mould, and bacteria from the air. A chemical air filter consists of an absorbent or catalyst for the removal of airborne molecular contaminants such as volatile organic compounds or ozone [7]. Air filters are used in applications where air quality is important, notably in building ventilation systems and in engines.

9.4 Electrical system

Only one cable connects all electrical parts i.e. headlight, dashboard light, light inside the car. The electrical system of the car is easy for installation and easy for repair.

9.5 Chassis



Fig. 9: Chassis of Car

A **chassis** consists of an internal framework that supports a man-made object in its construction and use. It is analogous to an animal's skeleton. An example of a chassis is the under part of a motor vehicle, consisting of the frame (on which the body is mounted). If the running gear such as wheels and transmission, and sometimes even the driver's seat, are included then the assembly is described as a rolling chassis.

9.6 Engine



Fig. 10: Air Engine

To convert a conventional IC engine into an Air Powered one, few components are to be replaced. First of all replace the **spark plug** with a **pulsed pressure control valve** which can create required pressure. Now the pulsed air firing in this valve is controlled by controlling the supply of electrical signal to the plunger. For this we require an electronic timing circuit which can control the flow of electrical supply to the plunger of this valve. This can be achieved by using PLC circuit. Now speed of the engine will be controlled by controlling this input signal.

9.7 Body



Fig. 11: Body of Air Car

The body is made up of fiber glass and injected foam [7]. It is slightly costly but does not cut like steel and aluminum. It does not rust and light weighted.

X. ADVANTAGES

10.1 In Comparison To Petrol Or Diesel Powered Vehicles “Air Powered Vehicles” Have Following Advantages

- Air, on its own, is non-flammable, abundant, economical, transportable, and storable and most importantly nonpolluting.
- Compressed air technology reduces the cost of vehicle production by about 20%, because there is no need to build a cooling system, fuel tank, spark plugs or silencers.
- High torque for minimum volume. The mechanical design of the engine is simple and robust.
- Low manufacture and maintenance costs as well as easy maintenance. Lighter vehicles would mean less abuse on roads, thus, resulting in longer lasting roads. The price of fueling air powered vehicles will be significantly cheaper than current fuels. When the air is being compressed at reasonable speeds, it heats up. The heat given off during compression could be reclaimed for space heating or water heating, or used in a stirling engine.
- Transportation of the fuel would not be required due to drawing power off the electrical grid. This presents significant cost benefits. Pollution created during fuel transportation would be eliminated.

10.2 In Comparison To Electric Vehicles “Air Powered Vehicles” Have Following Advantages

- Compressed-air vehicles are unconstrained by the degradation problems associated with current battery systems.
- Much like electrical vehicles, air powered vehicles would ultimately be powered through the electrical grid which makes it easier to focus on reducing pollution from one source, as opposed to the millions of vehicles on the road.
- Compressed-air tanks can be disposed of or recycled with less pollution than batteries.

- The tank may be able to be refilled more often and in less time than batteries can be recharged, with refueling rates comparable to liquid fuels.
- The tanks used in a compressed air motor have a longer lifespan in comparison with batteries, which, after a while suffer from a reduction in performance.

XI. LIMITATIONS

- Very little is known about air powered vehicles thus far.
- Compressed air vehicles likely will be less robust than typical vehicles of today. This poses a danger to users of compressed air vehicles sharing the road with larger, heavier and more rigid vehicles.
- Compressed air has a low energy density comparable to the values of electrochemical lead-acid batteries. While batteries can somewhat maintain their voltage throughout their discharge and chemical fuel tanks provide the same power densities from the first to the last liter, the pressure of compressed air tanks falls as air is drawn off.
- When the air is expanded in the engine, it will cool down *via* adiabatic cooling and lose pressure thus its ability to do work at colder temperatures. It is difficult to maintain or restore the air temperature by simply using a heat exchanger with ambient heat at the high flow rates used in a vehicle, thus the ideal is thermic energy capacity of the tank will not be realized.

XII. APPLICATIONS

FAMILY CARS

VANS

TAXIS

PICK-UPS

MINI-CATS

BIKES

XIII. CASE STUDY

The case study of the air powered vehicles is that the **TATA MINICAT** is developed. The **TATA Motors** is get **collaboration** with the **MDI** (Motor Developments International).The **TATA MINICAT** is get launched on or before **2016**, the price of that car is around **6.50-7.50 lakhs**.



Fig. 12: TATA MINICAT

Also the company PEUGEOT CITROEN in France has doing the work on the air car, its prototype is ready and the car is come in the market in 2016. The MDI is working on air car from 2008.

XIV FUTURE SCOPE

The future scope of the air powered vehicle is that when we driving the car on the road the aerodynamic is affected on the car, if we have done the arrangement on the car that utilizes that air and send it to the air compressor and send to the air engine, so the car does not stop for the reason of refueling.

XV CONCLUSION

Air powered vehicles is a realization of latest technology in automobile field. The air vehicles are a clean, easy to drive, light in vehicles and performance vehicles. It eliminates the use of non-renewable fuels and thereby preventing pollution and step to a healthier environment.

Compressed air for vehicle propulsion is already being explored and now air powered vehicles are being developed as a more fuel-efficient means of transportation. Some automobile companies are further exploring compressed air hybrids and compressed fluids to store energy for vehicles which might point the way for the development of a cost effective air powered vehicles design. Unfortunately there are still serious problems to be sorted out before air powered vehicles become a reality for common use but there is a hope that with the development in science & technology well supported by the environmental conscious attitude and need to replace costly transportation methods, air-powered vehicles will definitely see the light of the day.

REFERENCES

- [1] Sullivan, M. World's First Air-Powered Car: Zero Emissions by Next Summer, Popular Mechanics http://www.popularmechanics.com/automotive/new_cars/4217016.html (June 2014),
- [2] Harley, M.; Ford, G.M. Considering Joint Engine Development, <http://www.autoblog.com/2008/08/04/ford-gm-considering-jointengine-development>, (accessed Aug 2008).
- [3] From Wikipedia, the Free Encyclopedia. Compressed-Air Car, http://en.wikipedia.org/wiki/Air_car (accessed August 2014).
- [4] Bonser, K., HowStuffWorks, How Air-Powered Cars Will Work, <http://auto.howstuffworks.com/air-car.htm> (accessed Dec. 2014).
- [5] Haliburton, M.-S. Pure Energy Systems News, Engineair's Ultra- Efficient Rotary Compressed-Air Motor, http://pesn.com/2006/05/11/9500269_Engineair_Compressed-Air_Motor/ (accessed June, 2008).
- [6] Richard, M.G. The Air-Powered Motorcycle by JemStansfield, <http://www.instructables.com/id/Air-powered-bicycle> (accessed Feb. 2015).
- [7] Richard, M.G. The Air-Powered Motorcycle by JemStansfield, <http://www.instructables.com/id/Air-powered-bicycle> (accessed March 2015).
- [8] R.S.Khurmi, J.K. Gupta "A Text Book of Theory of Machines", S.Chand.

DESIGN AND SIMULATION OF INTEGRATOR USING THIN FILM TRANSISTOR BASED OPERATIONAL AMPLIFIER

Prabhakaran.G¹, Kannan.V²

¹Research Scholar, Faculty of Electronics Engineering, Sathyabama University Chennai, (India)

²Principal, Jeppiaar Institute of Technology, Chennai, (India)

ABSTRACT

An Operational Amplifier is a basic building block of many analog and mixed signal systems. It is a high gain differential amplifier which can be used as summer, integrator, differentiator etc., and designed to operate at low voltage 3V DC. To design an Op-Amp, various electrical characteristics such as gain, bandwidth, slew rate, CMRR, output swing offset, etc., have to be taken in to account. Frequency compensation is necessary for closed loop stability since the op-amps are designed to be operated on negative feedback. An Integrator is an essential circuit component in many analog circuits that performs mathematical operation of Integration particularly in solving differential equation and can be used as a storage element in analog computing circuits. It is used where initial condition is of great importance and which affects the future calculations. The present research work proposes the basic use of integrator circuits in engineering design and simulation using Thin Film Transistor based Operational Amplifiers. This work also investigates the design of integrator circuit and the applications of the integrator. The designed circuits are very suitable for integrated circuit and implementation. The circuit performance is obtained through HSpice simulations and the results are compared with the existing theoretical work showing good agreement.

Keywords: *Hspice, Integrator, Low Voltage, Operational Amplifier, Thin Film Transistor,.*

I INTRODUCTION

Thin Film Transistor is popularly known as TFT, which are presently demanding more attention amongst the most common electronic devices. Since they introduced in the modern electronic industry and applications, TFTs have undergone extensive evolution, development and refinement. TFTs are three terminal devices, which belongs to IGFET family. TFT differs from a typical MOSFET in that it is composed of very thin layer deposited on an insulating substrate, whereas most MOSFETs are formed from a semiconductor wafer. TFTs are gaining more interest in large area electronics such as flexible displays, RFIDs, sensors, switching systems, solar cells, RAMs, low cost computer logic, flat panel for image crystallization etc.. They draw more attention towards the application of different types of TFTs, Mainly a-Si, and Poly-Si, increases need for an accurate and efficient material to simulate the circuits used on these devices.

Recently amorphous silicon TFT (a-Si TFT) and Poly Si TFT have become essential devices in many applications especially in low cost ICs and large area integration. In this, a-Si TFT represent as mainstream technology for active matrix liquid crystal displays. Their advantages compared to crystalline MOSFETs are

having low price and high capability of large area integration. These advantages compensates for low speed of a-Si TFT which is its main disadvantage. Although, Poly Si TFT have many more of the same applications as a-Si TFT its main advantages are both displays/switching and driver circuitry can be fabricated on the same chip and preferred in applications necessary for high speed. As their intended uses began from switching systems to low cost computer logic to flat panel display, addressing new materials, structures and fabrication techniques were introduced. A-Si TFT is the most widely used active layer material while Poly Si is increasingly pursued as a next generation TFT technology.

This paper is organized into the following sections. The detailed introductions about TFT is explained in Section I. The Section II, introduces the structures and modelling aspects of thin film transistor. Section III, dealt with the TFT Operational Amplifier circuit. Detailed design on TFT based Integrators and their analysis are discussed in section IV. Finally in section V, the result has been discussed and concluded in section VI.

1.1 Thin Film Transistors

Both in microelectronics and in low cost integrated circuits, Poly Silicon Thin Film Transistors (Poly-Si TFT) have become essential device due to its low temperature process. A leakage current (I_{on} , off current) present inconsistently in the device, is the problem of Poly Si TFT and this current is depend strongly on the bias and temperature which has been generated from grain boundary defects near the drain. It is very important to research on leakage current of Poly Si TFT and its reduction, because abnormal leakage current is the main deficiency of Poly Si TFT which is due to the field-assisted generation mechanism.

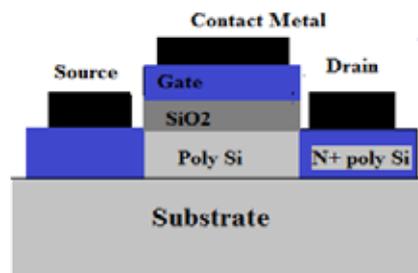


Fig. 1. Poly-Si Structure with Different Layers.

Fig.1 shows the structure of Poly Si TFT which is a kind of three terminal device; its substrate is floating just like SOI MOSFET. The modelling of Poly Si TFT is the effective medium of approach which treats the non-uniform poly silicon sample with grain boundaries as some uniform effective medium with effective material properties. The increase of drain current in saturation caused by the floating body effect. This short channel devices show a significant decrease of the sub-threshold idealistic factor with increasing drain voltage. By using the model, the relations of leakage current between terminal voltages, temperature of the TFT can be obtained.

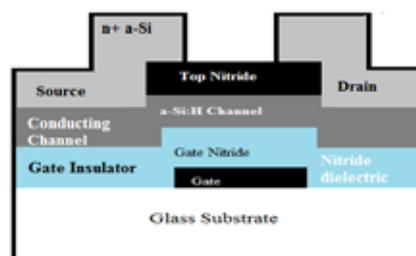


Fig. 2. Bottom Gate Structure of an a-Si:H TFT.

Fig.2 shows the bottom gate structure of a-Si:H TFT, also a three terminal device. The operation of a-Si TFT is quite different from that of crystalline MOSFETs. In the sub-threshold region the drain current is a poor function of the gate voltage dictated by large trap density in the material as in crystalline MOSFETs. Above the threshold, most of the induced charge in a-Si:H TFT are trapped and only a small fraction enters the conduction band. This fraction increases as the gate voltage increases. The field effect mobility increases with the gate voltage.

II OPERATIONAL AMPLIFIERS

2.1. Related Work

The CMOS OPAMP is widely used as analog building block for mixed signal circuits. Many OPAMP design is simple and robust, providing good values for its functional parameters. Palmisano, et al^[1], explained about CMOS Op-Amp design procedure. This procedure has conditionally allowed using the compensation capacitor for limited range. In this design, C_c is the compensation capacitor greater than a parasitic capacitor C_{gs5} of TFT in the Op-Amp. The design procedure that allows the C_c a wider range and it would provide a higher degree of freedom in the trade-off between noise and power consumption which have been improved by Mahattanakul and Chutichatuporn^[2]. A design procedure of multistage Op-Amp for settling time minimisation with low power is proposed by Pugliese, et al.^[3]. When an Op-Amp is necessary to be operated at a high frequency, several limitations have come into the forefront in the existing approaches. The Op-Amp designed to work at a low voltage and low power has been improved by R. Kr. Baruah^[4]. Although the simulation (Ehsan Kargaran, et al.)^[5] done in HSPICE shows an operation at a low voltage and it consumes very low power, but an increase is observed in the UGF which is not noteworthy to be considered. The multi-stage designed proposed by Anshu Gupta, et al. 2010^[6], leads to the decrease of the phase margin and UGF, but it improves the gain and settling time. It is very difficult that the transistors are in saturation condition when the supply voltage decreases (R. Gonzalez, et al.)^[7]. In this research work an Op-Amp has been designed which exhibits high UGF for optimized balancing of gain, speed, power, phase margin, noise and load. Here, the proposed method is to set a higher UGF of the Op-Amp working at a low voltage supply. This permits the value of each circuit element of the amplifier i.e., transistor aspect ratios, bias current and compensation capacitor etc.. Frequency compensation is essential for two-stage and multi-stage Op-Amps and it has been analysed as done by Zushu Yan, et.al^[8].

2.2. Ideal Operational Amplifier

An Op-Amp is the core component of surprisingly larger application in modern electronic era and undoubtedly one of the most useful mixed signal circuitry. The Op-Amp is usually, a single-ended output with a differential input of an electronic voltage amplifier of high gain. Its differential input is either NMOS input or PMOS input. Many operational amplifier systems are incorporating MOSFET transistors in design. This is true in low power and low voltage CMOS Op-Amp analog applications and act as functional core elements of mixed analog and digital Nano VLSI circuits and systems.

The main challenges of Op-Amp are a high dc gain and a high bandwidth with a high output swing depending on the applications. To achieve a higher gain, multi-stage Op-Amp can be used by cascading the stages^[9]. If the

gain is increased the bandwidth will be considerably reduced, which is the drawback of the two stage Op-Amp. However, it is difficult to compensate and hard to stabilize for the two- stage Op-Amp, which is widely used in many applications^[10].

Frequency compensation technique is necessary to avoid closed loop instability. The easiest method for compensation is to connect a capacitor between input and output of the second stage^[11]. This method gives high closed loop stability with lower bandwidth and results in splitting the poles. The Cascade compensation technique has been introduced to improve the stability in performance^[12]. This technique improves the settling performance and the output swing is limited to certain range^[13]. Single Miller Feed Forward Compensation technique is proposed and this technique improves stability and limits the bandwidth reduction^[14]. However, this method suffers from compressed gain bandwidth problem because of very high gain of the first stage^[15].

The circuit approach for the implementation of CMOS Op-Amp in the two stage configuration shown in Fig.3.

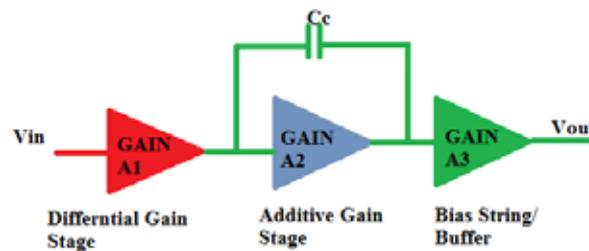


Fig. 3. Two Stage CMOS Op-amp.

It is designed to provide moderate gain and a relatively low UGF. The differential gain stage includes the input of the Op-Amp and provides the overall gain to improve off-set and noise performance. The additive gain stage improves its gain additionally and to allow maximum output swing. The final stage provides proper biasing and act as a buffer to convert impedance to low output impedance of additive gain stage and improves the current gain.

2.3. TFT Based Op-Amp

TFT have higher pinch-off voltage as compared with almost all the types of FETs. The TFT acts as a switching device in most of the applications. The switching is closed in microseconds and opened it in milliseconds. Like CMOS device characteristics, TFTs are having high immunity to noise, operates on low power voltage and low static power consumption.

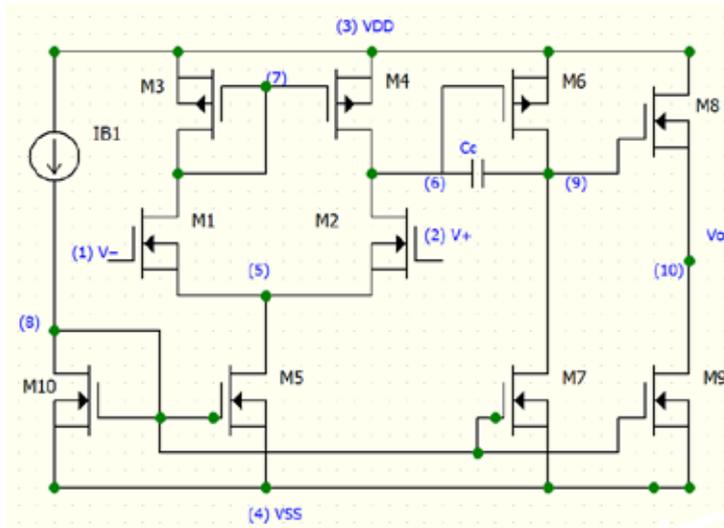


Fig. 4. Two Stage Hybrid Op-Amp with n-channel Input Stage

As MOSFET, significant power is drawn only when TFT device is switching between on and off states and it is not producing much heat as other forms of logic. These devices also allow a high density of logic functions on a chip. TFTs operate on low power voltage and low static power consumption like MOSFET and CMOS, but they are highly immunity to noise. When TFT device is switching between on and off states, it draws less power. Also, they are not producing much heat as MOSFETs. These TFT devices also allow a high density of logic functions on a chip.

In our previous work ^[16-21], we designed an Op-Amp using a-Si TFT and Poly-Si TFT. Also, we discussed about the design constraints which leads to a well-designed Op-Amp and explained the reason for using two types of TFT devices such as amorphous Si TFT and Poly-Si TFT. Our proposed design of a two stage TFT based Op-Amp circuit is shown in Fig.4. Simulations are carried out on the design of both the TFTs as well as CMOS based Op-Amps. In TFT based Op-Amp, TFTs are used as n-type MOSFET while p-type MOSFET are used as complementary devices.

2.4. Detailed Designed Procedure

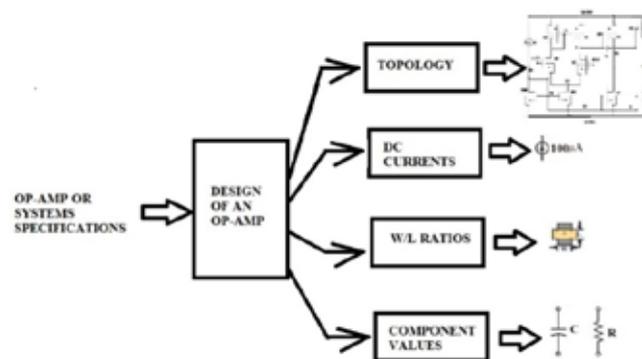


Fig.5.Design Procedure of an Op-Amp

The design procedure of proposed Op-amp is described in Fig.5, with required basic fundamental data shown in Table.1 for procedural technique to design an Op-amp. The design procedure carried out for the Op-amp using both TFTs and CMOS. The design specification used for calculation is shown in Table.1. The designed

Op-Amps have been simulated using HSpice Circuit Simulator and the final design specifications have been shown in Table.2. The performances of Op-Amps are shown in Table.3 obtained from the recorded values.

III INTEGRATOR USING TFT OP-AMP

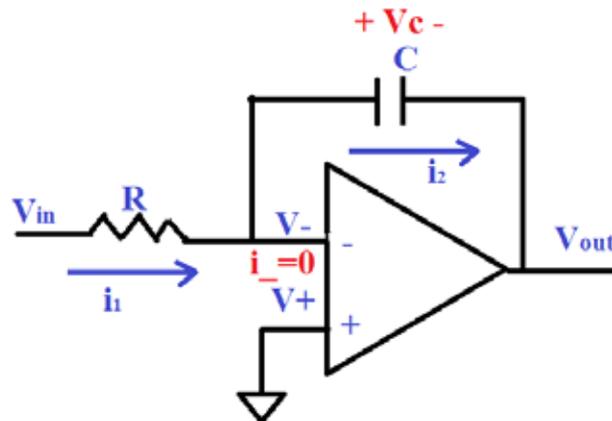


Fig.6.Ideal Inverting Integrator Circuits using an Op-Amp

The Integrator is a circuit using OP-AMP which performs the mathematical operation of Integration. The integrator acts like a storage element with respect to time, that produces an output voltage which is directly proportional to the integral of voltage applied in the input. In other words, the magnitude of the signal output is calculated by the duration of time an input voltage is present as the current flows through the capacitor which is required for negative feedback. The circuit shown in Fig.6 is an ideal inverting integrator, since the input is applied to the inverting input of the Op-Amp. Mixed Mode signal is used for the simulation of the integrator. Since the circuit uses the inverting configuration, we conclude that the circuit transfer function is:

$$G(s) = \frac{V_{out}(s)}{V_{in}(s)} = \frac{Z_2(s)}{Z_1(s)} = - \frac{1/sC}{R} = \frac{-1}{sRC} \quad (1)$$

In other words, the output signal is related to the input as:

$$V_{out}(s) = \frac{-1}{RC} \frac{V_{in}(s)}{s} \quad (2)$$

It means that the output signal is proportional to the integral of the input signal. We can prove that the circuit integrates the input by taking the inverse Laplace Transform:

$$V_{out}(s) = \frac{-1}{RC} \int_0^t V_{in}(t') dt' \quad (3)$$

If the input is: $V_{in}(t) = \sin \omega t$ ----- (4)

$$\text{Then the output becomes } V_{out}(t) = \frac{-1}{RC} \int_0^t \sin \omega t' dt' = \frac{-1}{RC} \frac{-1}{\omega} \cos \omega t = \frac{1}{\omega RC} \cos \omega t \quad (5)$$

The same result may be obtained using Fourier analysis also:

$$G(\omega) = \frac{V_{out}(\omega)}{V_{in}(\omega)} = \frac{Z_2(\omega)}{Z_1(\omega)} = - \frac{1/j\omega C}{R} = \frac{j}{\omega RC} \quad (6)$$

Thus, the magnitude of the transfer function is:

$$|G(w)| = \left| \frac{j}{wRC} \right| = \frac{1}{wRC} \text{----- (7)}$$

And since: $j = e^{j(\rho/2)} = \cos(\rho/2) + j \sin(\rho/2)$ ----- (8)

The phase of the transfer function is:

$$\angle G(w) = \rho / 2 \text{ radians} = 90^\circ \text{----- (9)}$$

Also also the same result may be determined using time domain analysis. From the Fig.6, the voltage across the

capacitor is: $V_c(t) = \frac{1}{C} \int_0^t \dot{I}_2(t') dt'$ ----- (10)

And from the circuit: $V_c(t) = V(t) - V_{out}(t) = -V_{out}(t)$ ----- (11)

Therefore, the output voltage is: $V_{out}(t) = -\frac{1}{C} \int_0^t \dot{I}_2(t') dt'$ ----- (12)

There by it is proved that by using any one of the method we can determine the same result. The practical Integrator is shown in Fig.7. When $V_{in} = 0$, the integrator gives open loop gain because capacitor acts as a open circuit for DC voltage, which means that the input offset voltage of the Op-Amp which produces voltage at the output is an error. Therefore to acquire output voltage without error, a resistor is connected in parallel with the feedback capacitor. The various applications of Op-Amp Integrator are available in the industry. In this paper, we described the Ramp Generator and analyzed its performance.

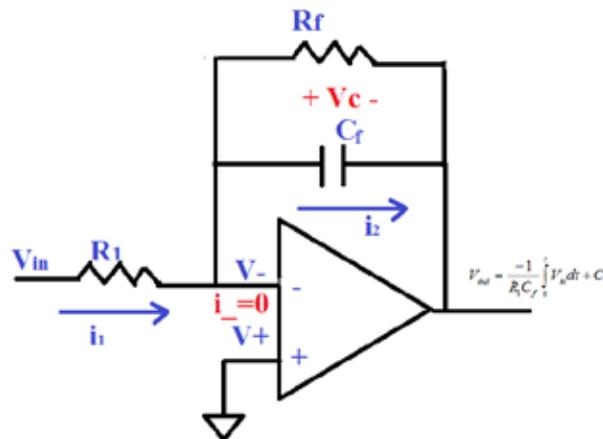


Fig.7. Practical Inverting Integrator Circuits using an Op-Amp

3.1. Ramp Generator

The integrator integrates the current I across capacitor C_1 when the same current I is flowing through resistor R_1 . The voltage across C_1 is called as output voltage V_{out} . One of the great application of the integrator is that the ramp voltage is generated by it. This can be generated by placing a fixed voltage at V_s that develops a constant current through R_1 . The capacitor then integrates this current and generates a ramp voltage. The circuit essentially integrates the input current $I_s = V_s / R_1$ across capacitor C_1 . The output

voltage is realized as capacitor voltage after a time interval T, described by: $V_{out} = \frac{-1}{C_1} \int_0^T \frac{V_S}{R_1} dt$. When a

constant input voltage is applied at V_S , the output ramp voltage increases steadily. The output voltage

(ramp) at any time T can be predicted by the simplified equation: $V_{out} = \frac{-1}{C_1} \times \frac{V_S}{R_1} \times T$

The response of generating ramps can be increased or decreased than the original circuit by changing the value of V_S , R_1 or C_1 . From the principles of integration, it describes that voltage across the capacitor is equal to ratio of the charge on the capacitor to its capacitance, ie., Q/C . Then the voltage across the capacitor is output V_{out} therefore: $-V_{out} = Q/C$. The rate of change of voltage across the capacitor due to charging and discharging of the capacitor, is given as:

$$V_C = \frac{Q}{C}, \quad V_C = V_X + V_{out} = 0 + V_{out}, \quad - \frac{dV_{out}}{dt} = \frac{dQ}{Cdt} = \frac{1}{C} \times \frac{dQ}{dt} \dots \dots \dots (13)$$

Where dQ/dt is an electric current. Since inverting input terminal of integrating Op-Amp is zero, $X = 0$, the input current I_{in} is flowing through the input resistor R_{in} is given by the equation:

$$I_{in} = \frac{V_{in} - 0}{R_{in}} = \frac{V_{in}}{R_{in}} \dots \dots \dots (14)$$

The current flowing through the capacitor C is given by the equation:

$$I_{in} = C \frac{dV_{out}}{dt} = C \times \frac{dQ}{Cdt} = \frac{dQ}{dt} = C \frac{dV_{out}}{dt} \dots \dots \dots (15)$$

Assuming that input impedance of the Op-Amp is infinite as an ideal Op-Amp, no current flows into the Op-Amp terminal. Therefore, the nodal equation at the inverting input terminal is given by the equation:

$$I_{in} = I_f = \frac{V_{in}}{R_{in}} = C \frac{dV_{out}}{dt}, \quad \setminus \frac{V_{in}}{dV_{out}} \frac{dt}{R_{in}C} = 1$$

From which we derive an ideal voltage output for the Op-Amp used in the Integrator as:

$$V_{out} = \frac{-1}{R_{in}C} \int_0^t V_{in}(t) dt \dots \dots \dots (16)$$

This equation can also be re-written as:

$$V_{out} = \frac{-1}{j\omega RC} \times V_{in} \dots \dots \dots (17) \text{ Where } j\omega = 2\pi f$$

and the output voltage V_{out} is a constant $1/RC$ times the integral of the input voltage V_{in} with respect to time. The minus sign (-) indicates a 180° phase shift, because the input signal is connected directly to the inverting input terminal of the op-amp. In this paper, we investigate the performances of ramp generator by using TFT based Op-Amp and the circuit is simulated in HSpice Circuit Simulator and the output is shown in Fig.7a, Fig.7b and Fig.7c.

IV RESULTS AND DISCUSSIONS

Table-1: Design Parameters

DESIGN AND SPICE PARAMETERS			
Parameter	Poly Si TFT	a-Si TFT	CMOS
V_{DD}	+3V	+3V	+3V
V_{SS}	-3V	-3V	-3V
A_o	≥ 1000	≥ 1000	≥ 15000
$GB = 2\pi(X)$	1.5MHz	20KHz	5MHz
SR (V/ μ S)	5	2.2	10V/ μ S
PM	$>80^\circ$	$>85^\circ$	$>60^\circ$
R_o	$\leq 3.5K$	$\leq 1.5K$	$\leq 1.46K$
λ	0.04	0.04	0.02
V_{eff}	2.25V	1.8V	2.25V
$K_n(\mu A/V^2)$	2.62	1.35	40
$K_p(\mu A/V^2)$	48.74	48.74	15
CMR	$-2.5 \leq, \leq 1.2$	$-2.65 \leq, \leq 0.65$	$-2.5 \leq, \leq 1.75$
C_c	1pF	1pF	1pF

The design and Spice parameters used for calculation of various parameters of the proposed design of Op-Amp using Poly Si TFT, a-Si TFT and CMOS is shown in Table 1. After the calculation, values are obtained to be used in simulation which is shown in Table-2, for all the three Op-Amps. From the Table-2, we observed that the size of the Poly Si TFT Op-Amp is 0.57% smaller than CMOS Op-Amp. Also the current consumed in the CMOS Op-Amp is $3.37\mu A$ more than Poly Si TFT Op-Amp. Using HSpice circuit simulator, the result has been summarized in the Table -3 for comparison of both the Operational Amplifiers. From the Table-3, the Gain A_{VO} of CMOS Op-Amp is more than 10 times of Poly Si TFT Op-Amp and Slew rate and Unity gain bandwidth are almost 3 times better than Poly Si TFT Op-Amp. But the Phase Margin is almost near to 90° in Poly Si TFT Op-Amp and considerably less in CMOS Op-Amp. Output Resistance is double in Poly Si TFT Op-Amp than CMOS Op-Amp. CMRR of Poly Si TFT Op-Amp is considerably less than CMOS Op-Amp. These Op-Amps are used in the proposed Integrator design and specifications are shown in Table-4. The performances of all the three integrators in the form of graph after simulation are shown in Fig.7a, Fig.7b, and Fig.7c. The output of a-Si TFT is slightly degraded from the output of Poly Si TFT and CMOS based Integrators.

Table -2: TFT Based Op-Amp Design Specification

($L=6.6\mu m$ and $L_{eff}=5.6\mu m$ are used)

PAR	Poly Si TFT Op-Amp			a-Si TFT Op-Amp			CMOS Op-Amp		
	I (μA)	W/L	W (μm)	I (μA)	W/L	W (μm)	I (μA)	W/L	W (μm)
M1	3.315	6.33	35.5	0.962	18.85	105.9	5	6.53	36.6
M2	3.315	6.33	35.5	0.962	18.85	105.9	5	6.53	36.6
M3	3.315	0.625	3.5	0.962	1.11	6.2	5	0.96	5.4
M4	3.315	0.625	3.5	0.962	1.11	6.2	5	0.96	5.4
M5	6.63	5.36	30.0	1.924	37.5	210.0	10	5.36	30

M6	30	6.32	35.4	12.03	14.5	81.2	30	5.79	32.4
M7	30	14.8	83.0	12.03	21.2	118.8	30	16.07	90
M8	100	156	873.6	75.33	2742.7	15359.1	100	156	873.6
M9	100	53.57	300	75.33	166.6	933.0	100	53.33	300
M10	100	53.57	300	100	166.6	933.0	100	53.33	300

TABLE- 3: Op-Amp Performance

Parameters	Simulation Results		
	Poly Si TFT	a-Si TFT	CMOS
Gain	1.2496K	15.1003K	16.7618K
UGB	1.35 MHz	120.17 KHz	5.45 MHz
CMRR	253.638	1.3317K	34.182K
Slew Rate (V/ μ S)	6.92	3.94	7.93
Dc Offset Voltage (μ V)	740.7155	-688.75	197.62
Power Dissipation (m.Watts)	1.4354	1.1357	1.4690
Output Resistance (K Ω)	3.7118	10.1345	1.3919
Phase Margin	80°	83.16°	54°
Open loop Gain Margin (dB)	84.5	83.6	84.5

TABLE- 4: Integrator Specification

Parameters	Integrator Using		
	Poly Si TFT	a-Si TFT	CMOS
V _{DD} (V)	3	3	3
V _{SS} (V)	-3	-3	-3
Resistance R ₁ (Ω)	50K	450K	50K
Resistance R ₂ (Ω)	1MEG	1MEG	1MEG
Capacitor C _f (μ F)	0.017	0.001	0.010
Resistance R _L (Ω)	50K	50K	50K
DC Voltage Gain (dB)	20	2.22	20

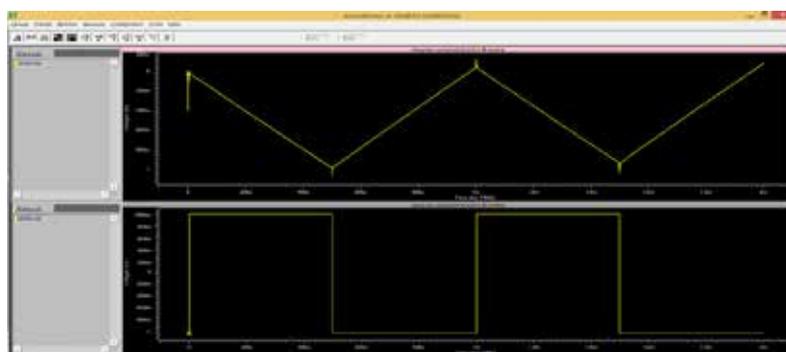


Fig.8a. Input and Output of Poly Si TFT Op-Amp.

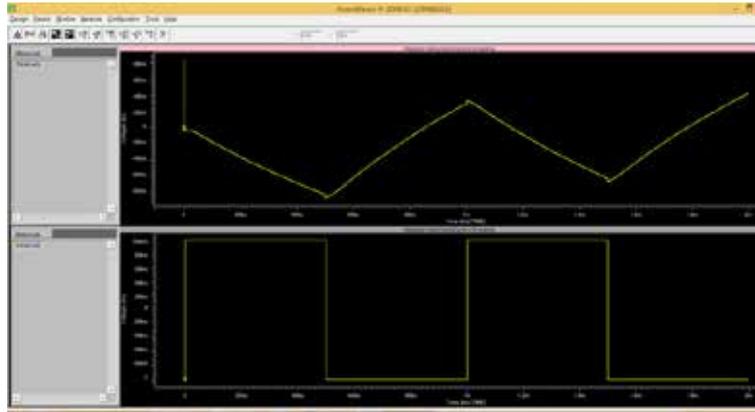


Fig.8b. Input and Output of a-Si TFT Op-Amp.

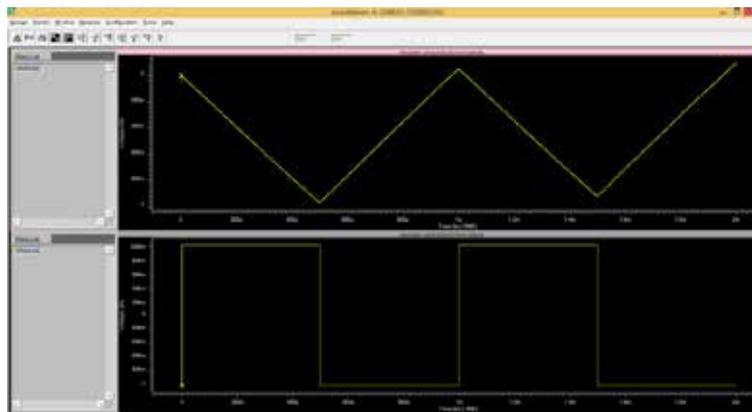


Fig.8c. Input and Output of CMOS Op-Amp.

V CONCLUSION

Poly Si TFT based Op-Amp is performing well as compared to CMOS Op-Amp. Though Gain, Slew rate, and frequency of operation of CMOS Op-Amp is better performing than Poly Si TFT Op-Amp, but Poly Si TFT Op-Amp have better stability and robustness to failure, because of high phase margin and double the output resistance. The TFT and CMOS Op-Amp, used for the Integrators design are generating the Ramp signal output which agrees with the existing theoretical and practical work. But the a-Si TFT based Integrators slightly degraded than Poly Si TFT and CMOS based Integrators which are suitably agreed with the theoretical and existing research works^[22]. When $v_{in} = 0$, the integrator gives open loop gain because capacitor acts as an open circuit for DC voltage. Input offset voltage of the Op-Amp which produces an error voltage at the output. To obtain error free output voltage resistor R_2 is connected in parallel with the feedback capacitor. The error is almost reduced in all the three Integrators output. But the CMOS Integrators are produced excellent output with least error output voltage compared to TFT based Integrators. DC output gain of Poly Si TFT and CMOS based Integrators are 10 times more than a-Si TFT based Integrators. This paper concludes that the characteristics of Op-Amp limits the performance of the Integrators as the characteristics of the transistors used in the Op-Amp decides its performance. All the three Op-Amps are suitable for any applications as seen from the results.

REFERENCES

- [1] Palmisano, G., Palumbo, G., and S. Pennisi, (2001). *Design Procedure for Two-Stage CMOS Transconductance Operational Amplifiers: A Tutorial*. Analog Integrated Circuits and Signal Processing, Volume 27, Issue 3, pp 179-189, May 2001. DOI 10.1023/A: 1011229119071. ISSN: 0925-1030

- [2] Mahattanakul, J. and Chutichatuporn, J., (2005). *Design Procedure for Two- Stage CMOS OPAMP with Flexible Noise-Power Balancing Scheme*. IEEE Transaction on Circuits and Systems-I: Regular Paper vol. 52, no. 8, pp. 1508-1514. DOI: 10.1109/TCSI.2005.851395.
- [3] Pugliese, A , Cappuccino, G. and Cocorullo, G., (2008). *Design Procedure for Settling Time Minimization in Three-Stage Nested Miller Amplifiers*. IEEE Transaction on Circuits and Systems-II Volume 55, Issue 1, pp. 1-5, Jan 2008. DOI: 10.1109/TCSII.2007.906086.
- [4] Baruah, R. Kr., (2010). *Design of A Low Power Low Voltage CMOS Opamp*. International Journal of VLSI Design & Communication Systems, Volume 1, Number 1, March 2010. DOI: 10.5121/vlsic.2010.1101.
- [5] Ehsan Kargaran, Hojat Khosrowjerdi and Karim Ghaffarzadegan, (2010). *A 1.5 V High Swing Ultra- Low-Power Two Stage CMOS OP-AMP in 0.18 μ m Technology*. 2nd International Conference on Mechanical and Electronics Engineering (ICMEE 2010). IEEE Catalog Number: CFP1016K-PRT, ISBN: 978-1-4244-7479-0. Published in International Journal of Science and Research (IJSR), India, Volume 2 Issue 3, March 2013. DOI:10.1109/ICMEE.2010.5558594.
- [6] Anshu Gupta and D.K. Mishra, R. Khatri, (2010). *A Two Stage and Three Stage CMOS OPAMP with Fast Settling, High DC Gain and Low Power Designed in 180nm Technology*. Computer Information Systems and Industrial Management Applications (CISIM), 2010 on 08-10, Oct 2010, pp. 448 – 453, Nov.2010. DOI: 10.1109/CISIM.2010.5643497.
- [7] Gonzalez, R., B.M. Gordon, M.A Horowitz, (1997). *Supply and Threshold voltage scaling for low power CMOS*. IEEE journal of solid state Electronics, Vol 32, No 8, August, 1997, DOI: S 0018-9200(97)05302-X.
- [8] Zushu Yan, Pui-In Mak, and Rui P. Martins, (2011). *Two-Stage Operational Amplifiers: Power-and-Area-Efficient Frequency Compensation for Driving a Wide Range of Capacitive Load*. IEEE Circuits and Systems Magazine, 1531-636X/11/\$26.00©2011, DOI: 10.1109/MCAS.2010.939783.
- [9] Ramirez-Angulo, J (2007). *Low-voltage, low-power rail-to-rail two stage op-amp with dynamic biasing and no Miller compensation*. In the Proceeding of the 50th Midwest Symposium on Circuits and Systems, MWSCAS, pp:25-28, Aug. 5-8, 2007, Quebec, Canada. ISBN: 978-1-4244-1175-7, DOI:10.1109/MWSCAS.2007.448853.
- [10] Rosario, M., P. Gaetano and P. Salvatore (2003). *Design Guidelines for Reversed Nested Miller Compensation in Three-Stage Amplifiers*. IEEE Transactions on Circuits and Systems—II: Analog and Digital Signal Processing, 50(5): 227-233, 2003. DOI: 10.1109/TCSII.2003.811437.
- [11] Amana, Y (2012). *A Review Paper on Design and Synthesis of Two-Stage CMOS Op-Amp*, International Journal of Advances in Engineering and Technology, 2(1): 677–688, 2012, ISSN: 2231-1963.
- [12] Singh, R. and G. Anu (2011). *Design on Fully Differential Op-amp for High Stability*. In the Proceedings of the International Conference on Electric and Electronic, pp: 1–5, Coimbatore, India, 2011.
- [13] Vaibhav, K. and C. Degang (2009). *Design Procedure and Performance Potential for Operational Amplifier using Indirect Compensation*. In the Proceedings of the 52nd IEEE International Midwest Symposium on Circuits and Systems, pp: 13-16, Aug. 2-5, 2009, Cancun, Mexico. ISBN: 978-1-4244-4479-3 DOI: 10.1109/MWSCAS.2009.5236165

- [14] Pugliese, A., F.A. Amoroso, G. Cappuccino and G. Cocorullo (2008). *Settling-time-oriented design procedure for two-stage amplifiers with current-buffer Miller compensation*. In the Proceeding of the 4th European Conference on Circuits and Systems for Communications, pp: 114-117, Jul. 10-11, 2008, Bucharest, Romania. DOI:10.1109/ECCSC.2008.4611658
- [15] Gupta, A. (2010). *A two stage and three stages CMOS OPAMP with fast settling, high DC gain and low power designed in 180nm technology*. In the Proceedings of the International Conference on Computer Information Systems and Industrial Management Applications (CISIM), pp: 448-453, Oct. 8-10, 2010, Venice, Italy. DOI:10.1109/CISIM.2010.5643497.
- [16] Prabhakaran, G., and V. Kannan (2011). *Analysis and Modelling of Hybrid Operational Amplifiers Using Amorphous Silicon Thin Film Transistor*. CiiT International Journal of Programmable Devices Circuits and Systems, Vol 3, No 12, September 2011, DOI: PDCS092011007.
- [17] Prabhakaran, G., and V. Kannan (2013). *Design and Analysis of Hybrid Operational Amplifiers Using Poly-Si Thin Film Transistor for Low Voltage Applications*. Proceedings of International Conference on Global Innovations in Technology and Sciences -4th to 6th April, 2013. Published in International Journal of Scientific & Engineering Research (IJSER), Volume 4, Issue 8, August 2013, ISSN 2229-5518.
- [18] Prabhakaran, G., and V. Kannan (2014). *Low Voltage Application of Hybrid Op-Amp Using Thin Film Transistor In Summing Amplifier*. Published in Vol. 29 (no 7, Year 2014) of Ciencia e Tecnica Vitivinicola journal (ISSN:0254-0223). URL: <http://ciencia-e-tecnica.org/cien/index.php/archive/part/29/7/1/?CurrentVol=29¤tissue=7>.
- [19] Prabhakaran, G., and V. Kannan (2014). *Design Configuration of Circuit and Comparison of Hybrid TFT Op-Amp with its CMOS Counterpart*. Presented in Second National Conference On Advancements And Future Trends in VLSI Design (NCVD'14) in Kalasalingam University on 26 Sep 2014, Proceedings pp-1-9. And Published in International Journal of Digital Communication and Networks (IJDCN), Vol 1, Issue 3, September 2014, ISSN: 2345-9850. URL: <http://ijdcn.co.in/issuecategory/volume-3-september-2014>.
- [20] Prabhakaran, G., and V. Kannan (2015). *Design and Analysis of Thin film Transistor Based Operational Amplifier*. Published in Vol. 159, Issue. 1 of Sylwan journal (ISSN: 0039-7660), Jan 2015.
- [21] Prabhakaran, G., and V. Kannan (2015). *Comparative Analysis of Thin film Transistor Based Operational Amplifier*. Presented in Second International Conference on Green Technologies for Power Generation, Communication & Instrumentation (ICGPC'15) on 26th and 27th Jan 2015, St. Peter's University, Chennai.
- [22] Pratibhadevi Tapashetti, Ankur Gupta, Chandrashekhar Mithlesh, A.S Umesh, (2012). *Design and Simulation of Op Amp Integrator and Its Applications*. International Journal of Engineering and Advanced Technology (IJEAT), Volume-1, Issue-3, pp 12-19, February 2012, ISSN: 2249 – 8958.



First A. Prof. G Prabhakaran Research Scholar from Sathyabama University. He received his Bachelor s degree from Institution of Engineers (India), Kolkatta, Master degree in VLSI Design under Electronics and communication engineering from Sathyabama University of Chennai, Tamil Nadu. His research interests, on Design and Analysis of Op-amp using Thin Film Transistor. He is an Member of Institution of Engineers (India), Kolkatta and Graduate Member in Aeronautical Society of India. He served in Indian Air Force as AIR WARRIOR for 18 years with the specialization on Avionics. Presently working in Jeppiaar Engineering College, Chennai, India.



Second A. Prof. Dr. V.Kannan was born at Ariyalur on 11th of April 1970. He received his Bachelors of Electronics and Communication Engineering from Madurai Kamaraj University, Madurai, Master Degree from Birla Institute of Technology and Science, Pilani and Ph.D degree from Sathyabama University, Chennai. He is currently functioning as Principal of Jeppiaar institute of Technology, Sriperumpudur, Chennai. He has more than 190 publications - in international/national journals, proceedings, reports etc., to his credit. He produced 5 Ph.D's in the field of Electronics and also guided more than 100 students for the M.Tech. and M.E degrees in the field of Electronics. He became a life member of ISTE in 1994. His research interest pertains to High Speed Devices, Opto electronic Devices, VLSI Design, Digital Signal Processing, Digital Image Processing and Nano Electronic Devices.

COMPARATIVE ANALYSIS OF POWER REDUCTION IN SRAM 6T AND 4T

Neeta Sharma¹

*Student, Department of Electronics and Communication Engineering, School of Engineering and
Technology, Poornima University, Jaipur (India)*

ABSTRACT

Static Random Access Memory (SRAM) to be one of the most fundamental and vitally important memory technologies today. Because they are fast, robust, and easily manufactured in standard logic processes, they are nearly universally found on the same die with microcontrollers and microprocessors. Due to their higher speed SRAM based Cache memories and System-on-chips are commonly used. Memories are an integral part of most of the digital devices and hence reducing power consumption of memories as well as area reduction is very important as of today to improve system performance, efficiency and reliability. Most of the embedded and portable devices use SRAM cells because of their ease of use as well as low standby leakage.

Keywords: Static Random Access Memory, DSTN, Cmos Technology, Dynamic Voltage Scaling, Static Noise Margin

I. INTRODUCTION

The scaling of CMOS technology has significant impacts on SRAM cell random fluctuation of electrical characteristics and substantial leakage current. Exponential increase in VLSI fabrication process has resulted in the increase of the densities of Integrated Circuits by decreasing the device geometries. But devices with such high densities are susceptible to high power consumption and run time failures. Apart from such concerns, other factors such as a growing class of portable devices like PDA, cellular phones, portable multimedia devices etc have given designers a motivation to look into low power design and today, not only device geometries are a technology focus, but also reducing the existing topologies keeping the functionality intact is also a major area. Recent surveys indicate that roughly 30 % of the worldwide semiconductor business is due to memory chips. Over the years, technology advances have been driven by memory designs of higher and higher density. Circuit designers usually state memory capacities in terms of bytes (8 bits); each byte represents a single alphanumeric character. Very large scientific computing systems often have memory capacity stated in terms of words (32 to 128 bits). Each byte or word is stored in a particular location that is identified by a unique numeric address. Due to device scaling there are several design challenges for nanometer SRAM design. A SRAM cell must meet the requirements for the operation in submicron/nano ranges.

1.1 Static Random Access Memory (SRAM) operation

It consists of two cross-coupled inverters and two access transistors. The access transistors are connected to the word line at their respective gate terminals, and the bit lines at their source/drain terminals. The word line is used to select the cell while the bit lines are used to perform read or write operations on the cell. Internally, the cell holds the stored value on one side and its complement on the other side. For reference purposes, assume that node q holds the stored value while node holds its complement. The two complementary bit lines are used to improve speed and noise rejection properties.

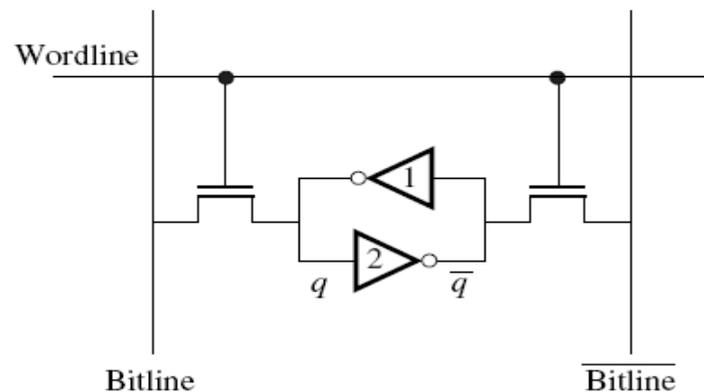


Fig.1 Static Memory Operation

The power consumption is major concern in Very Large Scale Integration (VLSI) circuit design and reduce the power dissipation is challenging job for low power designers. International technology roadmap for semiconductors (ITRS) reports that “leakage power dissipation” may come to dominate total power consumption. The sub-threshold leakage power is the main reason to increase the leakage power. So there are some techniques to reduce this leakage power:-

II. POWER REDUCTION TECHNOLOGY

The power consumption is major concern in Very Large Scale Integration (VLSI) circuit design and reduce the power dissipation is challenging job for low power designers. International technology roadmap for semiconductors (ITRS) reports that “leakage power dissipation” may come to dominate total power consumption. The sub-threshold leakage power is the main reason to increase the leakage power. So there are some techniques to reduce this leakage power:-

- Ø Memory partitioning.
- Ø Sleep stacks technique.
- Ø Adaptive sleep technique.
- Ø Dynamic voltage scaling.
- Ø Quiet bit line architecture.
- Ø Drowsy back bias technique etc.

Power reduction scheme that is tailored for RT and application in a dual-power-supply SRAM is proposed. In order to reduce the active mode power, a BL power calculator (BLPC) is proposed to estimate the BL power for level optimization. Furthermore, a digitally controllable retention circuit (DCRC) is employed to reduce the control power of the standby mode generator. A digitally controllable retention circuit regulates in the standby mode with small control power. These circuits are implemented in a dual-power-supply SRAM in 28-nm CMOS technology.

III. COMPARISION OF SRAM 4T VERSUS 6T

There are various trade-offs between 4T SRAM cells which use four bulk transistors (and have poly resistor or TFT loads) and 6T SRAM cells which use six bulk transistors (and use bulk PMOS loads). 4T SRAM cells have dominated the stand-alone SRAM market since first introduced in the 1970's, but 6T SRAM cells have been dominant for on-chip storage in advanced microprocessors and other logic circuits. However, recently there has been a resurgence of interest in 6T cells for stand alone SRAM applications. While 4T cells are typically smaller, they generally require a more complex process, and have poorer stability, especially at low voltage.

IV. METHODOLOGY USED BY RESEARCHERS

[Geetika Srivastava, et-al, 2012] has presented limiting effects technology scaled down on power reduction strategies. The power reduction strategy utilize the property of standby circuit power reduction by reducing voltage swing available to cell by replacing ground and supply nodes by virtual ground and virtual supply nodes respectively. Important precaution to be taken in this method is complete charge removal from virtual nodes before next operation. The ever increasing dimension reduction is imposing challenges to cell stability and leakage. Analysis of sub-threshold design has focused on logic design with proper leakage power management. Since SRAM consumes a significant percentage of total area and total power for many digital chips], so it's always a major concern to optimize SRAM in order to improve overall performance of system. The 6T SRAM and its modified versions have been simulated in 32nm, 45nm, 65nm, 90nm and 120nm feature size. The relative leakage power dissipation has been compared for architectures discussed. Sub-threshold SRAM provides great advantage in terms of on-chip memory energy consumption. Conventional 6T SRAM cell alone cannot function in sub threshold as its bit-line leakage put limitation on number of bit-cells on a bit-line. A bit-cell with reduced leakage dissipation in nanometer range solves this problem to greater extent.

[Budhaditya Majumdar, et-al, 2011] has presented a novel CMOS 6-transistor SRAM cell for different purposes including low power embedded SRAM applications and stand-alone SRAM applications. In conventional six-transistor (6T) SRAM cell, read stability is very low due to the voltage division between the access and driver transistors during read operation. In existing SRAM topologies of 8T, 9T and higher transistor count, the read static noise margin (SNM) is increased but size of the cell and power consumption increases relatively. Exponential increase in VLSI fabrication process has resulted in the increase of the densities of Integrated Circuits by decreasing the device geometries. Extending this operating scheme also allows us to propose a single bit line design that achieves a relatively smaller area while retaining all of the power saving

advantages. In the proposed technique, the SRAM cell operates by charging/discharging of a single bit-line (BL) during read and write operation, resulting in reduction of dynamic power consumption to only 40% to 60% (best case / worst case) of that of a conventional 6T SRAM cell. The power consumption is further decreased if the switching operational voltage of the bit-line lies between 0.25VDD to 0.5VDD. All simulations are done using 0.18 μ m Technology.

[S.S.Rathod, et-al, 2011] has presented Investigation of Stack as a Low Power Design Technique for 6-T SRAM Cell. This paper evaluates SRAM cell with and without introducing stacking in nanometer regime. Overall leakage in a stack of transistors reduces due to modification of gate to source voltage, threshold voltage and drain induced barrier lowering. The self-reverse bias effect can be achieved by turning off a stack of transistors. Turning off more than one transistor in a stack raises the internal voltage (source voltage) of the stack, which acts as reverse biasing the source. The voltages at the internal nodes depend on the input applied to the stack. From various simulations carried out it is found that stack technique helps in the reduction of leakage current that further reduces power consumption and hence it can be used for the design of ultra low power SRAM circuits. Full stack obviously behaves better than the half stack. This reduction of power consumption is at the cost of increased silicon area and propagation delay. Other issues like SNM, increase in stack and variation in length are also discussed.

[Rajani H.P, et-al, 2011] has presented a novel stable SRAM for ultra low power deep submicron cache memories. This paper explores a novel circuit level approach to reduce power in the SRAM cell during active mode of operation as well as standby mode by incorporating NMOS-PMOS pair in each pull down path. Dynamic frequency and voltage scaling (DFVS) and adaptive voltage scaling (AVS) are techniques that reduce voltage or frequency, on the fly. Power gating switches off power to portions of the chip that are not in use. Body biasing or "back biasing" is a leakage reduction technique that uses substrate bias to raise voltage thresholds. Better stability is also reported with large variations in temperature when compared to the standard 6-T SRAM cell and other representative low leakage power SRAM cells due to self controlling feedback. This novel cell achieves excellent active mode power minimization (which is usually not addressed in SRAM designs which achieve standby mode power minimization) along with good leakage power reduction.

[Jae-Ho Ryu, et-al, 2010] has presented a Low-Power Accessless SRAM Macro in Logic CMOS Technology. This paper approached a novel low-power SRAM based on 4-transistor (4T) latch cell is described. The memory cells are composed of two cross-coupled inverters without access transistors. To achieve higher reliability and longer battery life for portable applications, the design of low-power SRAM array is highly desirable. Reducing the swing voltage on the high capacitive signal buses is an effective way to save the operating power. To demonstrate the concept of the proposed SRAM, a 16 kbit SRAM prototype has been designed and fabricated with 0.18 μ m logic CMOS technology using microphotograph. In consequence of small voltage swing on high capacitive bitlines, datalines and wordlines, the new SRAM saves 30~40 % of the total active power compared with the conventional 6T SRAM. The measured and simulated results have confirmed that the small-swing 4T SRAM might be effective in realizing low-power embedded memory for mobile applications.

V. SRAM CIRCUITS, PARAMETERS AND RESULTS USED BY RESEARCHERS

Table1: SRAM Circuits, Parameters and Results used by Researchers

S. no.	Solution approaches	Circuit Parameters	Software used	Results
1.	✓ Stacked sleep technique	✓ $V_{sb}=0v$	✓ H spice	✓ Supply voltage =0.9v
	✓ Sleepy keeper technique	✓ Temperature= 70c	H spice	✓ Saving in leakage power.
	✓ adaptive sleep approach	✓ $(V_{th})=200mV$	H spice	✓ It gives best results with high accuracy.
	✓ Full & half Stack tech. for 6T SRAM cell.	✓ Channel length 90-180n	H SPICE	✓ Reduction of power consumption but increased silicon area and delay.
2.	✓ Memory partitioning	✓ $V_{gs}=0$	✓ Tanner	✓ Higher accuracy
	✓ Memory organization	✓ High/Low V_t (45 and 32 nano meters)		✓ Reduced SRAM leakage power.
3.	✓ Data-retention voltage technique	✓ $DRV_{max}=190$ mv	✓ Tanner	✓ Reduced leakage power when device is idle
	✓ Data voltage scaling	✓ maximum empirical correlation= 3.5%	✓ Tanner	✓ Reduces power per bit by 12-46%.

VI. SIMULATION AND RESULT

Objective: - To design and draw the schematic layout of an inverter. The design specification as given as follows.....

VII. INVERTER CIRCUIT OPERATION

Complementary metal-oxide semiconductor (cmos) technology for constructing integrated circuits. CMOS circuits are constructed in such a way that all PMOS must have an input from the voltage source or from another PMOS transistor. Similarly, all NMOS transistors must have either an input from ground or from another NMOS transistor.

The composition of a PMOS transistor creates low resistance between its source and drain contacts when a low gate voltage is applied and high resistance when a high gate voltage is applied. On the other hand, the composition of an NMOS transistor creates high resistance between source and drain when a low gate voltage is

applied and low resistance when a high gate voltage is applied. CMOS accomplishes current reduction by complementing every nMOSFET with a pMOSFET and connecting both gates and both drains together. A high voltage on the gates will cause the nMOSFET to conduct and the pMOSFET to not conduct while a low voltage on the gates causes the reverse. This arrangement greatly reduces power consumption and heat generation. However, during the switching time both MOSFETs conduct briefly as the gate voltage goes from one state to another. This induces a brief spike in power consumption and becomes a serious issue at high frequencies.

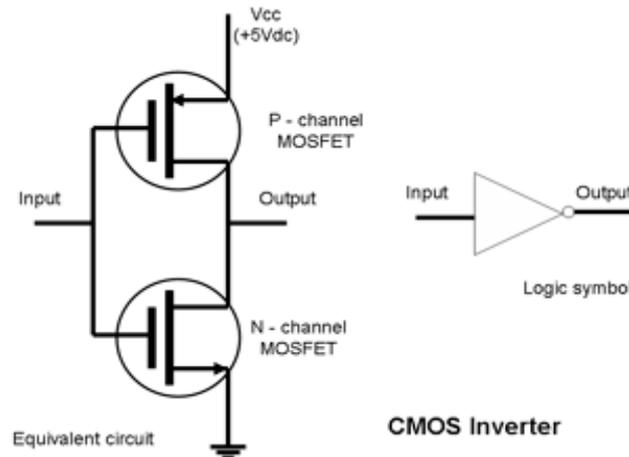


Table2: Inverter circuit parameters

IS. No.	Circuit Parameters	Value
1.	Voltage(v _{in})	5 v
2.	Frequency(f)	5 meg
3.	Width(w)	2.5 u
4.	Length(L)	250n

Inverter module file

```
workspace loadfrom -path .
cell open -design INVERTER -cell Cell0 -type schematic -newwindow
window move -left 224 -top 224 -width 1300 -height 573 -undock -max
window fit -x0 -890 -y0 -1464 -x1 3351 -y1 1133 -units iu
workspace dockinglayout load -file {.\dockinglayout.xml}
source open.design -relativeto user
source open.design -relativeto design
```

Results: - An experiment is performed using TANNER tool. A PMOS and NMOS are connected together by a wire. Both devices are connected and have same input voltage supply

Vdd=5v DC. Frequency applied at the input level power analysis and a 5 volt input pulse for transient analysis is considered for the experimentation. The output waveform is simulated under the process of VTC transient analysis for two different lengths and widths.

Schematic layout design: - This design gives a representation of the elements of a system using abstract, graphics symbols rather than realistic pictures. When designing a layout there are four basic steps;

- Ø Design the schematic in S-EDIT.
- Ø Simulate the schematic to make sure it behaves as you expect using T-SPICE.
- Ø Layout schematic in L-EDIT.
- Ø Perform an LVS schematic.
- Ø Simulate the layout using T-SPICE with a high-level spice model.

Fig.1 shows the basic CMOS inverter which has two transistors of NMOS and PMOS transistor. These two transistors are connected with each other by a wire. Both devices are connected and have same input voltage supply Vdd=5v DC. Input voltage and input frequency is applied at the transistors to calculate the output for two different (W/L) ratios. CMOS circuit layout is described for two same width and length W1= 2.5u, L1= 250n and W2= 2.4u, L2= 250n. With the noise factor NF=1 CMOS inverter realizes the output as high value (1) if we apply the low inputs (0) and gives low output if we apply the high input.

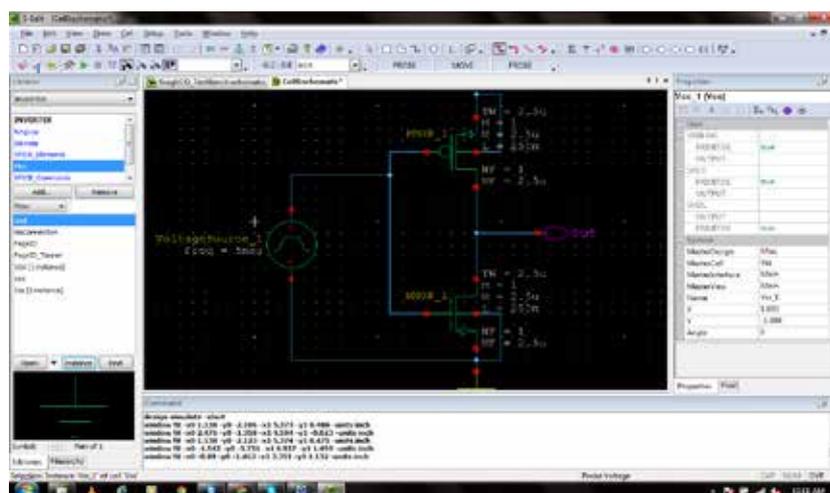


Fig. 1 Schematic layout of an inverter

Fig.2 shows the VTC analysis of an inverter. Voltage Transfer Curve (VTC), which is a plot of input vs. output voltage. From such a graph, device parameters including noise tolerance, gain, and operating logic-levels can be obtained. Ideally, the voltage transfer curve (VTC) appears as an inverted step-function - this would indicate precise switching between *on* and *off* - but in real devices, a gradual transition region exists. The VTC indicates that for low input voltage, the circuit outputs high voltage; for high input, the output tapers off towards 0 volts. The slope of this transition region is a measure of quality - steep (close to -Infinity) slopes yield precise switching. In VTC analysis the input voltage is set to approx 1V. To calculate the noise margin two input voltages are applied to CMOS circuit i.e. lower input voltage $V_{IL} = 0.756$ and lower output voltage $V_{OL} = 0V$. Lower input noise margin is given by the difference of lower input voltage and lower output voltage i.e. $NM_L = V_{IL} - V_{OL}$. Higher input noise margin is given by the difference of higher output voltage $V_{OH} = 2.5$ and lower output voltage $V_{OL} = 1.26$. $NM_H = V_{OH} - V_{OL}$.

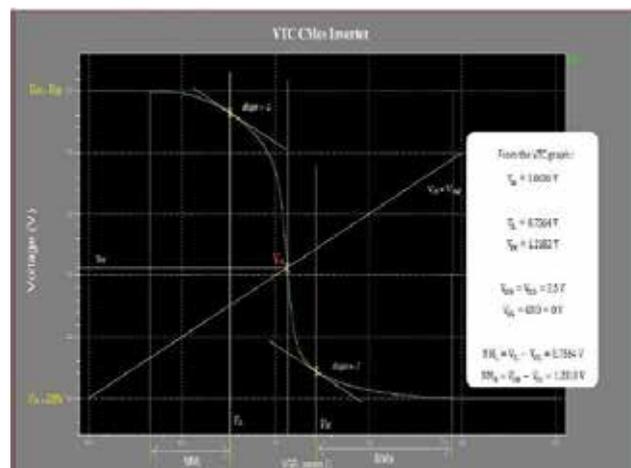


Fig2 VTC analysis curve of an inverter

VIII. CONCLUSION

The main intention of all paper is to provide good power consumption by using many techniques. In static random access memory many related issues like power minimization, reduce switching, size scaled down can be solved by using different Technologies like Advanced Stacked sleep technique, forward bias technique and pre-charge technique, quiet bit line technology and many more technologies has been proposed.

T-Spice simulations used to validate the proposed method show significant power reduction during test (~50%). SRAM cell with dual VDD technique show a reduction of 96% in total leakage power. A novel SRAM 6T cell operates by charging/discharging of a single bit-line (BL) during read and write operation, resulting in reduction of dynamic power consumption to only 40% to 60% (best case / worst case) of that of a conventional 6T SRAM cell.

IX. ACKNOWLEDGEMENT

I would like to express my deep gratitude and thanks to **Prof. Mahesh Bundele (Coordinator, Research), Poornima University** for giving me an opportunity to work under his guidance for review of research papers and his consistent motivation & direction in this regard. I would also express my sincere thanks to **Mr. Dipesh Patidar (Asst.Professor, PIET), Poornima University** for their guidance and support.

REFERENCES

- [1] Agarwal, K.; Sylvester, D.; Blaauw, D., " Utilization of Low Power SRAM Techniques for Handheld Products," *Computer-Aided Design of Integrated Circuits and Systems, IEEE Transactions on* , vol.25, no.5, pp.892,901, May 2006.
- [2] Aswatha, A.R.; Basavaraju, T., "Fundamental Data Retention Limits in SRAM Standby – Experimental Results," *Semiconductor Electronics, 2008. ICSE 2008. IEEE International Conference on*, vol., no., pp.82, 86, 25-27 Nov. 2008.
- [3] Banerjee, K.; Mehrotra, A., "Optimum Organization of SRAM-based Memory for Leakage power reduction," *Computer-Aided Design of Integrated Circuits and Systems, IEEE Transactions on* , vol.21, no.8, pp.904,915, Aug 2002.
- [4] Coulibaly, L.M.; Kadim, H.J., "Leakage Current Reduction in 6T Single Cell SRAM at 90nmTechnology," *Circuits and Systems, 2004. MWSCAS '04. The 2004 47th Midwest Symposium on*, vol.1, no., pp.I, 457-60 vol.1, 25-28 July 2004.
- [5] Coulibaly, L.M.; Kadim, H.J., " SRAM Memory Cell Leakage Reduction Design Techniques in 65nm Low Power PD-SOI CMOS," *Circuits and Systems, 2005. ISCAS 2005. IEEE International Symposium on*, vol., no., pp.1254, 1257 Vol. 2, 23-26 May 2005.
- [6] Choudhary, A.; Maheshwari, V.; Singh, A.; Kar, R., "Novel stable SRAM for ultra low power deep submicron cache memories," *Semiconductor Electronics (ICSE), 2010 IEEE International Conference on*, vol., no., pp.153, 157, 28-30 June 2010.
- [7] Datta, M.; Sahoo, S.; Kar, R., "Investigation of Stack as a Low Power Design Technique for 6-T SRAM Cell," *Devices and Communications (ICDeCom), 2011 International Conference on*, vol., no., pp.1, 5, 24-25 Feb. 2011.
- [8] Davis, J.A.; Meindl, J.D., "Effect of Technology Scale-Down on Power Reduction Strategies", *Electron Devices, IEEE Transactions on*, vol.47, no.11, pp.2078, 2087, Nov 2000.
- [9] En-Xiao Liu; Er-Ping Li; Le-Wei Li; Zhongxiang Shen, " Reduction of leakage-power in CNTFET sram cell using stacked sleep technique at 32nm technology," *Magnetics, IEEE Transactions on* , vol.41, no.1, pp.65,71, Jan. 2005.
- [10] Gomi, S.; Nakamura, K.; Ito, H.; Okada, K.; Masu, K., "Differential transmission line interconnect for high speed and low power global wiring," *Custom Integrated Circuits Conference, 2004. Proceedings of the IEEE 2004*, vol., no., pp.325, 328, 3-6 Oct. 2004.
- [11] Halder, A.; Maheshwari, V.; Goyal, A.; Kar, R.; Mandal, D.; Bhattacharjee, A.K., "A Low-Power SRAM Design Using Quiet-Bitline Architecture; Raman Spectroscopy and Morphological Study,"

- Computer Science and Software Engineering (JCSSE), 2012 International Joint Conference on*, vol., no., pp.164, 167, May 30 2012-June 1 2012.
- [12] Hong You; Soma, M., "Zig-Zag Horizontal and Vertical Sleep Transistor Sharing to Reduce Leakage Power in On-Chip SRAM Peripheral Circuits," *Circuits and Systems, IEEE Transactions on* , vol.37, no.8, pp.1019,1026, Aug 1990.
- [13] Ilumoka, A.A., "Leakage-Conscious Architecture-Level Power Estimation for Partitioned and Power-Gated SRAM Arrays," *Electrical Performance of Electronic Packaging, 2000, IEEE Conference on* , vol., no., pp.87, 90, 2000.
- [14] Junmou Zhang; Friedman, E.G., " SRAM Leakage Suppression by Minimizing Standby Supply Voltage," *Circuits and Systems, 2004. ISCAS '04. Proceedings of the 2004 International Symposium on*, vol.2, no., pp.II, 529-32 Vol.2, 23-26 May 2004.
- [15] Kavicharan, M.; Murthy, N.S.; Rao, N.B., "SRAM Leakage Suppression by Minimizing Standby Supply Voltage," *Advances in Computing, Communications and Informatics (ICACCI), 2013 international Conference on*, vol., no., pp.1358, 1362, 22-25 Aug. 2013.

ICE-MAKING MACHINE ON THE PRINCIPLE OF PELTIER EFFECT

**Sargar V J¹, Inamdar N P², Bhattam G M³,
Jamadar S B⁴, Anuse S A⁵, Khot A T⁶**

*¹Assistant Professor, ^{2,3,4,5,6} Student, Department of Mechanical Engineering,
AITRC, Vita (India)*

ABSTRACT

Now days use of refrigeration unit by using refrigerants increases rapidly. But using these units ozone layer depletion problems also increases. So it is necessary to overcome this problem. Therefore our aim is to design and manufacture the refrigeration unit without use of any refrigerants. So we are going to manufacturing a compact thermoelectric based refrigeration system, which is portable and eco-friendly.

Although there are a variety of applications that use thermoelectric devices, all of them are based on the thermoelectric principle. When designing a thermoelectric application, it is important that all of the relevant electrical and thermal parameters be incorporated into the design process. Once these factors are considered, a suitable thermoelectric device can be selected based on the guidelines presented in this article. We have studied the ice cube production in function of the thermal resistance of the hot side heat dissipater and the voltage supplied to the Peltier module, using a computational model and experimental data.

Keyword: Peltier Module, Refrigerants, Refrigeration System, Thermoelectric Principle, Voltage

I INTRODUCTION

Now days mostly refrigerating and air conditioning devices uses refrigerants such as R-22, R-134a etc. These refrigerants produce very hazardous effects on environment. Due to leakage of these gases ozone layer depletion, global is warming such environmental problems going to increase. Also the cost of these gases is relatively high. So we are going to produce refrigeration effect without these gases i.e. by using Peltier effect.

The reverse of the Seebeck effect is also possible: by passing a current through two junctions, you can create a temperature difference. This process was discovered in 1834 by scientist named Peltier, and thus it is called the Peltier effect. This may sound similar to Joule heating described above, but in fact it is not. In Joule heating the current is only increasing the temperature in the material in which it flows. In Peltier effect devices, a temperature difference is created: one junction becomes cooler and one junction becomes hotter. Although Peltier coolers are not as efficient as some other types of cooling devices, they are accurate, easy to control, and easy to adjust. Peltier effect devices are used coolers for microelectronic devices such as microcontrollers and computer CPUs. This use is very common among computer hobbyists to help them in over-clocking the microprocessors for more speed without causing the CPU to overheat and break in the process.

A single Peltier element can be used to produce electrical power (via the Seebeck effect) or to pump heat (via the Peltier effect). In either application, the power output of a single Peltier element is generally not sufficient for realistic situations. To increase their power, commercial Peltier devices are composed of many n-type and p-type semiconductor Peltier elements. The individual elements are connected in series using metallic junctions. As a result of this, the junctions between the semiconductors do not form a barrier potential, as they would do in a p-n diode, and charge carriers flow freely in both directions. In a Peltier device, the individual elements are arranged so that the n- and p-type heat flow in the same direction.

From above we have concluded that it is possible to create system using Peltier effect for making ice with minimum time.

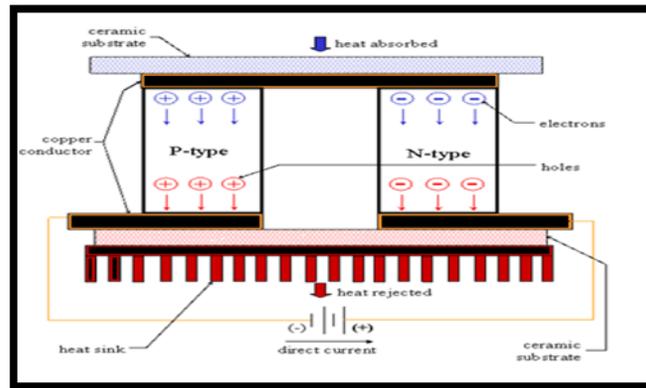


Fig. 1: Peltier Effect

II OUTLINE OF PROPOSED WORK

2.1 Scope

The scope for this study would focus all necessary activities for benchmarking the existing application with the current performance level and performance standards to be set for arriving at the objectives of the dissertation work. Recommendation of best alternative use for refrigerant refrigeration systems.

2.2 Methodology

2.2.1 Objectives

1. To design the system.
2. To select material as per design.
3. To analyze the efficiency and power consumption of system theoretically.
4. To make assemble the system practically as shown in Fig.2.
5. To find out what is actual time for making ice in our system.

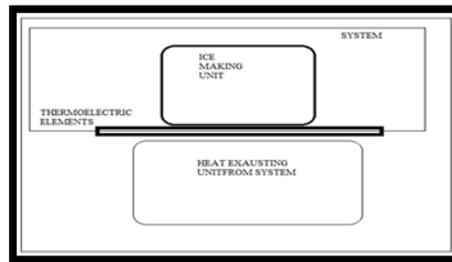


Fig. 2: Proposed experimental setup

2.3 Thermoelectric Principle of Operation

The typical thermoelectric module is manufactured using two thin ceramic wafers with a series of P and N doped bismuth-telluride semiconductor material sandwiched between them as shown in Figure (2.3.1). The ceramic material on both sides of the thermoelectric adds rigidity and the necessary electrical insulation. The N type material has an excess of electrons, while the P type material has a deficit of electrons. One P and one N make up a couple, as shown in Figure (2.3.2). The thermoelectric couples are electrically in series and thermally in parallel. A thermoelectric module can contain one to several hundred couples.

As the electrons move from the P type material to the N type material through an electrical connector, the electrons jump to a higher energy state absorbing thermal energy (cold side). Continuing through the lattice of material; the electrons flow from the N type material to the P type material through an electrical connector dropping to a lower energy state and releasing energy as heat to the heat sink (hot side). Thermoelectric can be used to heat and to cool, depending on the direction of the current. In an application requiring both heating and cooling, the design should focus on the cooling mode. Using a thermoelectric in the heating mode is very efficient because all the internal heating (Joulian heat) and the load from the cold side is pumped to the hot side. This reduces the power needed to achieve the desired heating.

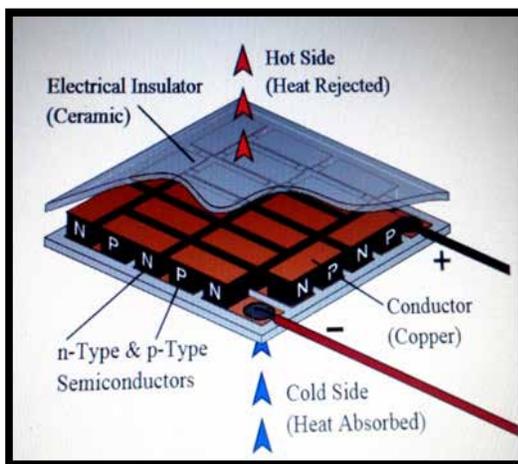


Fig. 2.3.1: TEC Principle of operation

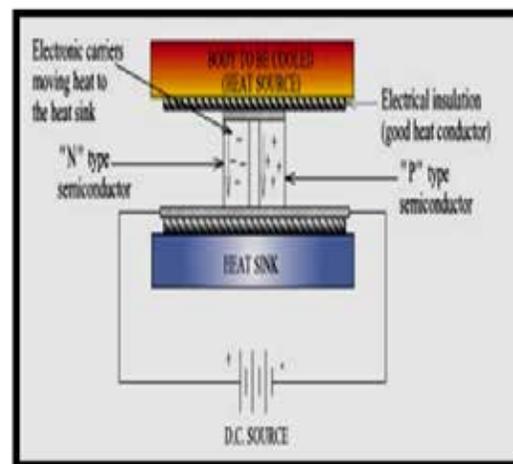


Fig. 2.3.2: Cross section of a thermoelectric cooler

III DESIGN AND DEVELOPMENT OF SYSTEM

According to specification of TEC1-12706 from Hebei I.T. (Shanghai) Co., Ltd.

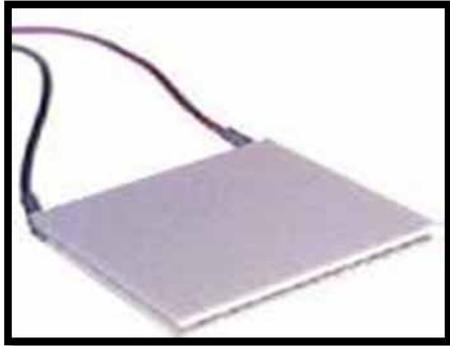


Fig (3.1):- Peltier Element

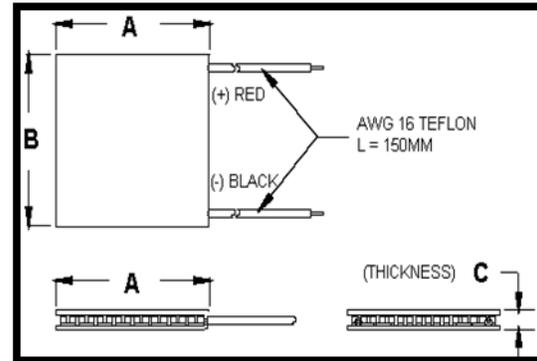


Fig (3.2):- Peltier Dimensions

Ceramic Material: Alumina (Al₂O₃)

Solder Construction: 138°C, Bismuth Tin (BiSn)

3.1 Size table

Table 3.1

A	B	C
40	40	3.9

3.2 Performance Specifications

Table 3.2

Hot Side Temperature (°C)	25°C	50°C
Q _{max} (Watts)	50	57
Delta T _{max} (°C)	66	75
I _{max} (Amps)	6.4	6.4
V _{max} (Volts)	14.4	16.4
Module Resistance (Ohms)	1.98	2.30

3.3 Dimensions of copper cube used to make ice from water

L=30mm = 0.03m, W=30mm = 0.03m, H=10mm = 0.01m

Volume available for freezing = 30 × 30 × 10 = 9000 mm³ = 0.009 lit = 9 × 10⁻⁶ m³

Area of freezing = 0.03 × 0.03 = 0.0009 m²

Mass of Water = ρ × V = 1000 × 9 × 10⁻⁶ m³ = 0.009 Kg

3.4 Data

Mass of water= $m=0.009\text{Kg}$

Specific heat of water= 4.18 kJ/kg. K

Required Temperature difference from Performance curves.

We get $\Delta T (^{\circ}\text{C}) = 50^{\circ}\text{C}$

Hot side Temperature of element= 50°C

Cold side Temperature of element = 10°C

Water Temperature = 30°C

3.4.1 Heat required removing from system

$$Q = m \times C_p \times \Delta T$$

$$Q = 0.009 \times 4.18 \times (30-10)$$

$$Q = 0.075\text{kJ}$$

$$Q = 0.075/60 = 0.0012\text{ kW}$$

$$Q = h \times A \times \Delta T$$

$$h = 0.069\text{ kW/m}^2\text{K}$$

3.4.2 How to find time required making ice?

Area of surface= $30 \times 30 = 900\text{mm}^2$

Volume of copper cube = $9 \times 10^{-6}\text{ m}^3$

1) Checking system is lumped accepted or not.

Now,

$$\text{Biot no.} = \text{Bi} = h \times L_c / k$$

Where,

h = heat transfer coefficient = $0.069\text{ kW/m}^2\text{K}$

L_c = Characteristic length = Volume/ Area = 0.01 m .

K = Thermal conductivity = $0.7 \times 10^{-2}\text{ kW/m. K}$

$$\text{Bi} = 0.099$$

Hence Biot no. is less than 0.1 hence lumped systems is accepted

$$\text{Now, } T = 15^{\circ}\text{C}$$

$$T(S) = 9^{\circ}\text{C}$$

$$T(\infty) = 30^{\circ}\text{C}$$

$$\frac{\theta}{\theta_i} = \frac{T - T(\infty)}{T(S) - T(\infty)} = \exp(-\text{Bi } t)$$

From above equation we get time,

$$t = 4.1\text{min}$$

IV CONCLUSION

The process of making ice on the principle of peltier effect is fully depend on the supplied current and voltage proportion. from that project we will concluded that it is possible to make ice without use of refrigerant that means

by using peltier module with refrigeration unit and electrical circuit of proper current and voltage by absorbing heat from water at cold side and this heat is rejected by hot side in heat sink making ice at cold side (peltier module).

Generally for making ice we must need refrigerant but this refrigerant produce very hazardous effects on environment. cost of this refrigerants are also high so we are going to produce refrigeration effect without these gases i.e. by using Peltier effect which is environment friendly and compact. It require less space and having effect of cooling rate is more as compare to other systems. For making ice it requires just four minutes and this is less time as compared to other system.

V ACKNOWLEDGMENT

Gratitude is the hardest emotion and often one doesn't find adequate words to convey all that feels.

It is our foremost duty to express our deep sense of gratitude and respect to the guide Prof. Sargar V J Sir for his uplifting tendency and inspiring us for taking up this project work completely successful.

We are also grateful to the whole staff of Department of Mechanical Engineering for providing all necessary facilities to carry out the whole project work and whose encouraging part has been a perpetual source of inspiration.

Last but not the least we are thankful to all of our friends and those helped us directly or indirectly throughout the project work.

REFERENCES

- [1] L. Onsager. (1931), Reciprocal relations in irreversible processes. Phys. Rev. 37:405, pp1931- 2265.
- [2] Charles A. Domenicali. (1953) Irreversible thermodynamics of thermoelectric effects in inhomogeneous, anisotropic media. Phys. Rev. 92, pp877-881.
- [3] G. W. Burns and M. G. Scroger. (1989) Nist measurement services: The calibration of thermocouple and thermocouple materials. NIST Spec. Publ., pp 250-35.

DOES CONSULTATION OF MEDIA AND CREATIVE DEPARTMENT IS DEPENDENT ON NATURE AND EXPERIENCE OF THE AGENCY?

Dr. Yashmin Sofat¹, Monika Jindal², Pardeep Mittal³

^{1,2}Assistant Professor, Department of Commerce, A.S. College, Khanna.(India)

³Student , Department of Commerce, A.S. College, Khanna (India)

ABSTRACT

Today's in this competitive environment, strategies are the wealth of an organization, which can help it in achieving its goals. It is of paramount importance for the success of any organization. Advertising agency is no exception to this. Advertising media and creativity has become the focus center of attention in advertising agency circle because of its contributions. The media strategy and the creative strategy are very much interwoven. The media vehicles selected depend a lot on the copy and creative work. On the other hand, the type of creative prepared depends a lot on the media selected. This paper attempts to know the fundamental understanding of the media department and the persons involved in and its relationship with creative department for decision making in indian advertising agencies. media and creative department is also used for evaluating the cumulative effect of advertising campaigns. In India, media and creative department originated with advertising agencies. It also highlights how media department is divided and stages of person involved in organizational structure of advertising agencies and how the agencies verify the reliability of the information given by the clients. Lastly, how the advertising agencies make strategy regarding media department in advertising to its effectiveness in some form or the other and the challenges involved for this. So, with the adoption of the strategies, the overall effectiveness of the business will improve.

I.INTRODUCTION

An important part of the advertising job consists of deciding an optimum media mix for carrying the advertising message to the target audience. Multi – media planning poses complex problems both for the advertising managers and media specialists when the objective of management is to place advertising messages in the media reaching maximum number of projects with the greatest effectiveness at the lowest cost.

The media structure of Indian advertising has become more complex and media choices are much more varied. Efficient media selection is a tedious process. There is no single best media strategy or media decision which applies to every situation even to similar situations. This is so because no two advertising situations are ever exactly alike. Even if two advertising situations, factors and

considerations were almost identical, there would still be an opportunity and pressing need or the exercise of executive judgment.

The task of building an advertising programme involves the consideration of several problems. One of the problem areas relating to advertising that is of immense significance to an advertiser is the selection and use of advertising media. It is very important part of the advertising job to decide on the best channels for carrying the advertising message to the target audience. The other important problem is the selection and use of media depends upon the intended audiences' media habits, the media's effectiveness in presenting the product or an idea, the relative costs of other factors.

Media planning has now become a very sophisticated art and science. It is a scientific act because here the planner deals with a lot of hard data. Media selection is the one area in advertising where advanced mathematical methods have received much attention for practical break through. The diversity of mathematical approaches involves the use of three major types of models (linear – programming, high assay and simulation) in the selection or improvement of media plans. Both the linear programming and the high assay models are of the optimizing type. The simulation model, on the other hand does not profess to find the 'best' media plan but rather to estimate the exposure value of any given media platform. Each of the models suffers from major limitations and contains a number of artificialities. They provide no panacea for guaranteeing the selection of most effective media mix. As a result where of, mathematical media selection models are thought of as an aid rather than substitute for executive judgment. The media plan could better be a joint product of the model's ultra logical reasoning and executive imagination, skill, experience and judgement.

Media planner has two choices. Either to include a medium or drop it from his media plan. Further more, in judging any alternative the media planner is faced with the problems of reach, frequency and continuity and dominance. In developing alternative plans, a specific media plan providing the desired coverage, frequency and impact at the lowest cost is selected to minimize waste to advertising money. The problem is to select from among various media alternatives the best set and allocate advertising appropriations to various media. Media specialists of advertising agencies in India place heavy reliance on media materials from abroad. Although planning is importantly dependent on media analysis and research, media planners in agencies were found complaining about the low status of media research.

By far the largest part of the budget is allocated to media. Amount allocated to media according to agency respondents normally takes over 80 percent of the total advertising budget. The rest of the fund goes to administrative overhead, cost of mechanical production and research. Although exact advertising expenditure by media is not available it is estimated that the total expenditure in various types of media in 1989 was no less than Rs. 1,500 crores.

Each media decision has to be made in the light of particular requirements of a particular situation. Even competitors presenting nearly the same products or ideas to nearly the same market or audiences employ different media strategies. He seeks to maximize the return on his advertising investment by selecting those media that will deliver his message most efficiently and effectively to greatest number of people of desired characteristics. Advertising agencies handle the problem of media selection for the advertisers company. The client expects that the agency will place its

advertising message in the media reaching maximum number of prospects with greatest effectiveness at the lowest cost. The problem before the agency is to select from among various media alternatives the best set. But the budget is a restraint. Alternative include not only media but specific choice within a medium as well. Thus choices available include all media vehicle as capable of carrying an advertisement most efficiently and effectively.

Media decisions in the advertising agency are based primarily on the creative strategy established for the campaign. The planners then decide upon the most cost effective television and radio programmes, magazines, newspapers, or any other media vehicle to convey the message. They also take into consideration the editorial climate of the vehicle, its prestige, the visual and audio qualities in relation to the requirements of the message and the audience.

The media are then evaluated on the basis of efficiency and cost, then the best medium or media combination is recommended. This media plan forms the basis for the media schedule which is a diary for the proposed insertions or appearances in the media. i.e., the size, frequency and continuity with costs as the basis for the schedule. The plan and schedule form the media persons' recommendations in which are also explained why the particular media/media combination were selected and why the other media were not preferred. This is sent along with the advertising strategy to the client for approval. Once approved, the plan is handed over for operations.

A successful media plan always takes into consideration specific marketing facts like the size and direction of market and brand share, the nature of the product, the method and level of distribution, seasonal patterns, if any, the competitive environment and the client status. Once the media plan is approved, the media buyer negotiates with the concerned medium/ media for the purchase of time or/and space. The skill of the buyer lies in getting the preferred space or time at the lowest rates possible. It is the buyer's job to see that the insertions are made on schedule. He then prepares the media bill to be sent to the client after the release of the advertisement. The size of the agency and its structure determine whether these jobs of planning, scheduling and buying are performed by one or more persons. For successful implementation it is necessary that the agency has good media relations and this is also looked after by the media persons, i.e., public relations for the agency with the media.

In India agencies are still many years behind the agencies of the advanced countries where media planning is concerned. In the agencies media planners were previously not needed to be present during the brainstorming session, but today he needs to be a part and parcel of the agency planning team. So, the roll of the media planner starts from the media advertising planning stage itself, he has to be familiar with all the strategies being developed by the agency. This knowledge will help him in planning media better. Today media planner must be very comfortable with number, with the use of models, computers, etc.

II. REVIEW OF LITERATURE

The review of literature provided a road map to identify that how the media structure of the indian advertising agencies act as a basis for strategy formulation and implementation for them which varies with their nature, age and size. Some of the important studies by various authors relevant to

this paper are as follow:

Chawla Suren (1981), Selvabaskar S. (2004) and Arathoon Marion (2008) describe the scope and problems involved in the selection of media and how it influences the planning and policies of the advertising agencies. **Zeithaml Valarie A., Parasuraman A. and Berry Leonard L. (1985), Sudarshan R. and Jyothi K. Arun (2002) and Brownstein Marc (2007)** talked about how advertising agencies formulate their strategies and implement it on the basis of socio, cultural and psychographic dimensions of advertising and talked about problems and strategies in service marketing. **Cagley James W. (1986), Wackman Daniel B., Salmon Charles T and Salmon Caryn C (1986), Aaker and Stayman (1990)** gave their views on the strategy of advertising agency regarding their selection factor of media that influence the success of the agency client relationship. **Hite and Fraser (1988) and Nathan S V (1991) and Trivedi Divya (2008)** reported on international advertising strategies of multinational corporations. The researchers found that majority of the firms (66%) who advertise internationally utilized the following strategies: a combination of localized and standardized advertising; all localized advertising and all standardized advertising and were more likely to use foreign advertising agencies. **Michell Paul C.N. (1988), Davis Linden A. (1989) Shanker Ravi (1995) and Holak Susan L. and Tang Y. Edwin (1990)** talked about the emerging trends in Indian Advertising industry that these agencies are changing with the changing scenario and account loyalty in the advertising agencies. According to author, larger accounts are more loyal and the smaller agencies that have smaller accounts are less loyal and these accounts switch more as compared to larger one due to media structure into agencies. **Connor, Willemain, Machachlan (1996)**, gave brief idea on one of the strategies of advertising agencies regarding cost with the help of gross model and the strategy is related with developing advertising campaigns. **Gronstedt Anders and Thorson Esther (1996) and Kaushik Rishi (2001)** focused on the organizational structures and restructuring of a number of advertising agencies that have undertaken the move toward integrated communications. **Mathur and Mathur (1996)** examined whether initiating new relations with advertising agencies results in a change in the market value of the firm and according to authors it provides positive results. Extrapolating from the results of Henke (1995) and Michell (95), it was suggested that the wealth effects for the clients firms may be influenced by the size and prestige of advertising agencies. **Malhotra Mukta (2000) Pareek Vivek (2000) and Vranica Suzanne (2001) and Bose Partap (2007)**, asserted that the Indian advertising agencies need to grab the emerging opportunities. According to the author, advertising agencies need to work out innovative strategies in media and operation department to attain their goals. **Agnihotri Amit and Gupta Nikhil (2003) and Razdan Aarti and Balakrishnan Ravi (2006)** investigate that advertising industry grows at 12 percent. Further, the author analyzed that the print to grow faster than television and growth in television to continue and their strategy is changing with the changing demand of the market. **Pruthi Vandna (2003) Shukla Archana (2004), Gabriellson Peter, Gabriellson Mika and Gabriellson Hannele (2008) and Srinivasan Lalitha (2009)** focused stresses that advertising agencies create and implement the right strategy at right time to improve the quality to capture the FMCG market.

The present study considers the advertising agencies in different ways that how the working has

changed with the passage of time. There has been relatively little research focusing on the working and strategic approach of the advertising agencies, which are unique and different than the others. It was therefore, observed that carrying out such a diagnostic study would be timely and appropriate. The study aims to explore some of the basic issues related to the changing strategies of the advertising agencies. The study will explore the analysis of competitive environment, in terms of formulation and implementation of the advertising agencies. The related literature has been reviewed as to make this study meaningful. The review of literature has gone a long way in making this study in the right direction

III.OBJECTIVES OF THE STUDY

- To know how advertising agencies formulate and implement their strategies in media department.
- To examine the challenges and problems those have been faced by the advertising agencies by changing their strategies.
- To study the impact of the changing strategies in media and operation department on the performance of the advertising agencies.
- To study the overall performance of advertising agencies.
- To provide suggestions for better strategies to be adopted and implemented by advertising agencies.

IV.HYPOTHESES OF THE STUDY

To achieve the above stated objectives, three hypotheses have been set up with respect to experience and nature which are presented in Tables 2.1 and 2.2 respectively. Following are the various hypotheses of the study:-

- There is no difference in the strategies of fully and provisionally accredited advertising agencies in India.
- The number of years of establishment has no impact on the strategies of advertising agencies in India.

V.SELECTION OF THE SAMPLE

The addresses of the advertising agencies were selected from “The Press and Advertiser’s Year Book” and “Indian Newspaper Society” (INS)”. The selection of agencies was based on the following steps which are clear from the Tables 1.1, 1.2 and 1.3:

- All agencies which were accredited either provisional or fully with “Indian Newspaper Society” (INS) of INDIA were selected, i.e.775.
- Only those advertising agencies, which had their head offices in all four regions of INDIA, were selected which include five metropolitan cities i.e. MUMBAI, NEW DELHI, KOLKATTA, CHENNAI and BANGLORE.

- 500 agencies were identified which fulfilled the conditions listed above.
- Out of those 500 agencies, to have best sample as against to total population in each category of fully and provisional accredited advertising agencies, only 10 percent of fully and 25 percent of provisionally accredited advertising agencies were finally selected for the sample.i.e.65 agencies.
- Out of these 65 agencies, 40 were Fully Accredited and 25 were Provisionally Accredited.

Table 1.1**Region wise Distribution of Advertising Agencies' Head Offices**

Location of Head Offices	Number of Agencies	
	Fully Accredited	Provisionally Accredited
North	172	81
East	61	25
West	192	62
South	132	50
Total	557	218

Source: INFA & INS YEAR BOOK

Table 1.2**Metropolitan City - wise Universe Distribution Stratified Random Sample**

Geographic Location	Agency Accredited	Total	
	Fully Accredited	Provisionally Accredited	
Delhi	129	43	172
Kolkatta	48	12	60
Mumbai	144	24	168
Chennai	48	7	55
Banglore	35	10	45
Total	404	96	500

Source: INFA & INS years Books

Table 1.3
Sample Size within Strata

Geographical Location	Agency Accreditation		Total
	Fully Accredited	Provisionally Accredited	
Delhi	13	11	24
Kolkatta	5	3	8
Mumbai	14	6	20
Chennai	5	2	7
Banglore	3	3	6
Total	40	25	65

VI.PROFILE OF THE AGENCIES IN THE SURVEY

This part of the study describes profile of the advertising agencies which helps in further study of how these agencies formulate their strategies. Accordingly, the profile/nature is studied in terms of years of establishment, accreditation period, location of agencies and their subsidiaries, type of ownership in advertising agencies etc. To conduct this research, the researcher took a sample of as many as 65 advertising agencies. The responses were obtained from the top/middle level executives of these agencies. The frequency distribution of respondents selected from top and middle level of management.

The experience of an executive influences the firm's strategies. Hence, the respondents need to be classified on the basis of their experience. The distribution of respondents according to the length of their experience in the line of advertising is that a large majority (77.5%) of the respondents belonging to fully accredited agencies had more than 15 years of experience in the advertising agencies. Similarly, in case of provisionally accredited agencies, 64 percent of respondents had more than 15 years of experience. In contrast to this, the table also shows that 10 percent fully accredited and 16 percent provisionally accredited advertising agencies had 10–15 years of experience in the field of advertising. On further analysis, it was found that only 5 percent fully and 8 percent provisionally accredited advertising agencies had less than 5 years of experience. At the overall level, as high as 72.31 percent respondents had more than 15 years of experience and only 9.23 percent and 12.31 percent had experience of 5-10 years and 10-15 years respectively. Thus, the respondents were having adequate experience of working with advertising agencies.

The age of advertising agencies also influences the firm's strategies. Hence, the age/experience of agencies need to be categorized on the basis of year of establishment which is clear from Table 2.1.

Table 2.1

Type	Fully Accredited		Provisionally Accredited		Total	
	No. of Agencies	Percentage	No. of Agencies	Percentage	No. of Agencies	Percentage
Below 20 years	21	52.5	24	96	45	69.23
20 - 40	8	20	1	4	9	13.85
40 - 60	9	22.5	0	0	9	13.85
Above 60	2	50	0	0	2	3.07
Total	40	100	25	100	65	100

__Source: Primary Data

Table 2.1 which presents classification of advertising agencies according to their age, indicates that 52.5 percent fully accredited agencies and 96 percent provisionally accredited agencies had less than 20 years of life. The advertising agencies having age between 20–40 years constituted 20 percent, 4 percent and 13.85 percent respectively of the sample units amongst the fully, provisionally and over all accredited agencies respectively. However, only 3.07 percent of advertising agencies had age of above 60 years life in India. Thus, on the whole, major proportion of sample agencies had below 20 years age.

The surveyed sample further classified on the basis of their nature in Table 2.2.

Table 2.2

Type	Fully Accredited		Provisionally Accredited		Total	
	No. of Agencies	Percentage	No. of Agencies	Percentage	No. of Agencies	Percentage
Accredited	40	100	25	100	65	100
Non–Accredited	0	00	0	00	0	0
Total	40	100	25	100	65	100

__Source: Primary Data

VII. CLASSIFICATION OF RESPONDENTS ACROSS ACCREDITATION

Table 2.2 depicts that the sample comprised only those advertising agencies which were accredited with the Indian Newspaper Society. The agencies under sample (65 agencies) were comprised of 40 fully accredited and 25 provisionally accredited advertising agencies.

VIII. PERFORMANCE OF ADVERTISING AGENCIES IN INDIA

The second objective of the present research study is to evaluate the overall performance of the advertising agencies in India. The performance of advertising agencies and surveyed sampled agencies is studied in terms of amount of capitalized billing and growth over the previous year in Table 3.1 and Table 3.2 respectively.

Table 3.1

Overall Capitalized Billing of Accredited Advertising Agencies in India

Year	No. of Agencies	Average Capitalized Billings (Rs. Crore)	Year on Year Growth Rate (in percentage)
2000	750	44.24	-----
2001	757	49.43	11.73
2002	761	53.81	8.86
2003	770	58.65	8.99
2004	771	64.39	9.78
2005	775	70.76	9.89
2006	776	79.54	12.41
2007	778	89.88	12.99
2008	778	99.58	10.79

Source: INFA and INS

Table 3.1 exhibits that the capitalized billing of accredited advertising agencies in India had risen to rupees 99.58 crore in 2008 from rupees 44.24 crore in the year 2000. The amount of billing registered the maximum growth in the year 2007 (12.99%) followed by that in the year 2006 (12.41%). The year on year increase in the amount of billing remained limited to single digit during 2002 – 2005. On the whole, the advertising business continued to grow at a frenetic pace, making it resemble the Californian gold rush.

Table 3.2

Overall Capitalized Billing of sampled Advertising Agencies

Year	Average Capitalized Billings (Rs. Crore)	Year on Year Growth Rate (in percentage)
2000	3.81	-----
2001	4.24	11.28
2002	4.59	8.25
2003	4.95	7.8
2004	5.43	9.69
2005	5.93	9.21
2006	6.66	12.31
2007	7.51	12.76
2008	8.78	16.91

Source: Primary Data

Table 3.2 describes that the average capitalized billing of the sampled advertising agencies in India had risen to rupees 8.78 crore in 2008 against rupees 3.81 crore in 2000. The table shows that advertising agencies have gradually increased their capitalized billing. The year on year growth reflect that it increased in 2008 with marvelous percentage (16.91%) against previous record.

The classification of advertising agencies according to the size of capitalized billing is given in Table 3.3.

Table 3.3

Categorization of Advertising Agencies according to Amount of Capitalized Billing

Capitalized Billing Amount (Rs.)	No. of Agencies	Percentage
Below 1crore	20	30.77
1 crore – 50 crore	30	46.15
Above 50 crore	15	23.08
Total	65	100

Source: Primary Data

Table 3.3 indicates that 30.77 percent of sampled advertising agencies reported their capitalized billing up to rupees 1 crore and they are termed as small sized advertising agencies. On further analysis, it was found that 46.15 percent of advertising agencies fall in the category of billing from rupees 1 crore to rupees 50 crore and the same are termed as medium sized advertising agencies. The remaining 23.08 percent of advertising agencies had capitalized billing above rupees 50 crores and they are termed as large sized agencies. (Source: A&M, agency Report,1998 - For dividing line.)

IX.ANALYTICAL TOOLS USED

For analysis purposes, the agencies have been classified into fully accredited and provisionally accredited advertising agencies, also into old and new on the basis of experience and small, medium and large across size. The present study used percentage and chi – square test for analysis purpose. The chi- square test is used to test whether two or more attributes in fully, provisionally, old and new, small, medium and large size advertising agencies are associated or not in the present study. The chi- square test is one of most widely used non- parametric tests in statistical work.

X.FINDINGS

Advertising agencies have various departments and each department has their own strategy to capture the client and market share to grow. An Advertising agency business may be either a one– man show or there may be hundreds and thousands of people working together, forming part of huge multi- national corporations. Accordingly, their services also vary in range and depth as they have many departments varying with their services. It is interesting, therefore, to look into how they formulate the strategies of the advertising agencies. Media planning and operation are normally separate activities and planning is done by specialists. In practice, table 4.1 and 4.2 shows how the agencies really have their media department operated.

Table 4.1
How the media dept. is divided

Division of the dept.	Fully Accredited	Provisionally Accredited		
	No. of agencies	Percentage	No. of agencies	Percentage
Media planning & operations separately	17	42.5	1	4
Media (combined)	19	47.5	13	52
No separate Media dept.	4	10	11	44
Total	40	100	25	100

$\chi^2 = 15.9943$ and $Tab = 5.991$ D.F. = 2 at 5% level of significance.

Source: primary data.

Table 4.2
How the media dept. is divided

Division of the dept.	Old agencies	New agencies		
	No. of agencies	Percentage	No. of agencies	Percentage

Media planning & operations separately	2	18.18	16	29.63
Media (combined)	7	63.64	20	37.04
No separate Media dept.	2	18.18	18	33.33
Total	11	100	54	100
$\chi^2 = 2.6686$ and $\text{Tab} = 5.991$ D.F. = 2 at 5% level of significance.				

Source: primary data.

Table 4.1 and 4.2 depicts that 47.5 percent fully, 52 percent provisionally accredited, 63.64 percent old and 37.04 percent new advertising agencies have combined media planning and operations. Whereas 42.5 percent, 4 percent, 18.18 percent and 29.63 percent of fully, provisionally accredited, old and new advertising agencies respectively, do have separate personnel who specialize in media planning and have separate media planning and operations separately as large sized agencies have very strong and sound financial position and to make the advertising campaign more effective. But, 10 percent fully, 44 percent provisionally accredited, 18.18 percent old advertising agencies and 33.33 percent new advertising agencies did not have any separate media department at all. The work is done either by their top management or client servicing group of decisions in respect there of are taken by clients and some agencies said that they do not able to afford it due to financial or lack of resources problem.

In order to examine whether the media department is divided either by media planning and operation separately or combined or don't have separate department depends on the nature and experience of advertising agencies,

media department is dependent on nature but not on experience of the agency. Thus, all the two types of advertising agencies whether fully accredited and provisionally accredited formulate their strategies differently but old and new advertising agencies formulate same strategies in accordance with division of media department.

The media strategy and the creative strategy are very much interwoven. The media vehicles selected depend a lot on the copy and creative work. On the other hand, the type of creative prepared depends a lot on the media selected. But when the agencies were asked whether there were consultations between the two departments, they gave the following replies, as show in table 5.1 and 5.2.

Table 5.1
Consultations between media and Creative

Do they consult creative?	Fully Accredited	Provisionally Accredited		
	No. of agencies	Percentage	No. of agencies	Percentage

Yes	24	60	8	32
No	16	40	17	68
Total	40	100	25	100
$\chi^2 = 4.8308$ and Tab = 3.841 D.F. = 1 at 5% level of significance.				

Source: primary data.

Table 5.2
Consultations between media and Creative

Do they consult creative?	Old agencies		New agencies	
	No. of agencies	Percentage	No. of agencies	Percentage
Yes	10	90.91	32	59.26
No	1	9.09	22	40.74
Total	11	100	54	100
$\chi^2 = 3.9983$ and Tab = 3.841 D.F. = 1 at 5% level of significance.				

Source: primary data.

It is clear from the tables 5.1 and 5.2 that even though 60 percent of fully, 32 percent of provisionally accredited, 90.91 percent of old and 59.26 percent of new advertising agencies said that there were discussions between the two. On the other hand, remaining advertising agencies said no. This means that there is not much coordination between the two departments. In order to examine whether the consultation of media and creative department depends on the nature of advertising agencies, χ^2 test of advertising agencies shows that the consultation of media and creative department is dependent on nature and experience of the agency. Thus, whether it's fully, provisionally accredited, old and new advertising agencies do not affect the strategy of Indian advertising agencies.

The media planners should be involved right from the advertising planning stage. When asked whether the agencies involve their media persons in the planning of advertising efforts, 83 percent did not reply in the affirmative as indicated in Table No 6.1 below:

Table 6.1
Involvement of Media Persons

Stage of involvement	Fully Accredited	Provisionally Accredited		
	No. of agencies	Percentage	No. of agencies	Percentage
Briefing sessions (with clients)	3	7.5	1	4
Advertising planning	6	15	5	20
Only Media strategy	33	82.5	19	76
Total	42*	105	25	100
$\chi^2 = 2.0981$ and $Tab = 5.991 = 2$ at 5% level of significance.				

Source: primary data.

(* Since two agencies (5%) included their media dept. in briefing as well as advertising planning the totals is coming to 2 extra).

Table 6.2
Involvement of Media Persons

Stage of involvement	Old agencies	New agencies		
	No. of agencies	Percentage	No. of agencies	percentage
Briefing sessions (with clients)	2	18.18	9	16.67
Advertising planning	3	27.27	12	22.22
Only Media strategy	8	72.73	33	61.11
Total	13*	118.18	54	100
$\chi^2 = .03132$ and $Tab = 5.991 = 2$ at 5% level of significance.				

Source: primary data.

(* Since two agencies (18%) included their media dept. in briefing as well as advertising planning the totals is coming to 2 extra).

Table 6.1 and 6.2 gives information regarding the involvement of media persons under different stages. The table depicts that approximately 7.5% fully accredited and 4% provisionally accredited agencies, 18.18 percent old and 16.67 percent new advertising agencies involve their media people right from the briefing stage. 15 percent of fully, 20 percent of provisionally accredited, 27.27 percent old and 22.22 percent new advertising agencies, do involve them from the advertising planning stage. But the majority, over 4/5th, does not involve them at all and the media planners have to plan in isolation reflecting on their media plans. The same is confirmed by the results of χ^2 test applied to examine whether the nature, and experience have no impact on the strategy of agencies regarding the involvement of media persons. Thus, all the four types of advertising

agencies whether old, new, fully and provisionally accredited agencies formulate the same strategies.

XI.CONCLUSION

In a nutshell, there is a tremendous amount of leeway required to be made up in order to obtain realistic standard of media planning and efficient formulation of media mix. This is an area that needs a lot of improvement to raise the overall level of agency operations by focusing more on this area so to make effective strategy so as to captures the market share and able to improve their efficiency.

REFERENCES

- [1] Chawla Suren, 'Selection of Media: Scope and Problems'; *Vidura*; 1981; pp. 149 – 155.
- [2] Selvabaskar S., 'Media Fragmentation – Issues and Challenges'; *Indian Journal of Marketing*; 34(7); July 2004; pp.20 – 22.
- [3] Zeithaml Valarie A., Parasuraman A. and Leonard L. Berry, 'Problems and Strategies in Services Marketing'; *Journal of Marketing*; (49); Spring 1985; pp. 33 – 46.
- [4] Sudarshan R. and Jyothi K. Arun, 'Socio, Cultural and Psychographic Dimensions of Advertising – A Conceptual Frame – Work'; *Indian Journal of Marketing*; December 2002, pp.3 – 5.
- [5] Aaker, David A., and Douglas M. Stayman, 'Measuring Audience Perceptions Of Commercials And Relating Them To Ad Impact' ,*Journal of Advertising Research*, 30,August,1990,pp. 7-17.
- [6] Hite E.R., Fraser C., 'International Advertising strategies of multinational corporations', *Journal of Advertising Research*, 28(4), 1988, pp. 9-17.
- [7] Nathan S V, 'Expert Advertising Agency'; *Vikalpa*; 16(1); January – March 1991; pp. 51 – 62.
- [8] Srinivasan Lalitha, "Global Ad Majors Fine-tune Recession Strategies", *The Financial Express*, 8th April 2009.
- [9] Michell Paul C.N., 'Point of View: Advertising Account Loyalty – A segment approach'; *Journal of Advertising Research*; January 1988; pp. 61 – 67.
- [10] Davis Linden A., 'Challenges facing Mid – Sized Agency Research'; *Journal of Advertising Research*; 28 (6); January 1989; pp. RC-10 – RC-11.
- [11] Holak Susan L. and Tang Y. Edwin, 'Advertising's Effect on the Product Evolutionary Cycle'; *Journal of Marketing*; 54; July 1990; pp.16 – 29.

- [12] Connor Gina Colarellio', Willemain Thomas R. and Maclachlan James, 'The Value of Competition among Agencies in Developing Ad Campaigns: Revisiting Gross's Model'; *Journal of Advertising*; 15(1); 1996; pp. 51 – 62.
- [13] Gronstedt Anders and Thorson Esther, 'Five Approaches to Organize an Integrated Marketing Communications Agency'; *Journal of Advertising Research*; March – April 1996; pp.48 – 58.
- [14] Kaushik Rishi, 'Restructuring of advertising agencies in India'; unpublished data; Indian Institute of Mass Communication; 2001.
- [15] Mathur Lynette and Mathur Knowles Ike, 'Is Value Associated with Initiating New Advertising Agency – Client Relations?'; *Journal of Advertising*, 25(3), 1996, pp.1 – 12.
- [16] Malhotra Mukta, 'Gearing up to face challenges'; *The Indian Express*; 1 September 2000.
- [17] Pareek Vivek, 'New Frontiers – Agency Report'; *A and M*; 12(11); September 2000; pp.48 – 50.
- [18] Vranica Suzanne, 'Ad for an ad: Ad agencies start promoting selves'; *The Economic Times*, New Delhi; 23 August 2001.
- [19] Bose Partap, 'Is advertising India's next BPO opportunity?'; *Business Standard* , July 11, 2007
- [20] Agnihotri Amit and Gupta Nikhil, 'Advertising Outlook 2003: Who is running fast, Who is coming last'; *Pitch*; 2(4); October 2003; pp. 34 – 43.
- [21] Razdan Aarti and Balakrishnan Ravi, 'India Unbound'; *Economic Times: Brand Equity*; 1 February 2006.
- [22] Pruthi Vandna, 'Changing Face of Marketing Strategies in India'; *Effulgence*; 1(1); July – December 2003; pp. 65 – 70.
- [23] Shukla Archana, 'AD – D some, Gain most; Special Report'; *The Economic Times*, New Delhi; 2nd May 2004; pp. 9 –10.
- [24] Gabrielsson Peter, Gabrielsson Mika and Gabrielsson Hannele, 'International Advertising Campaign in Fast Moving Consumer Goods Companies originating from a SMOPEC Country'; *International Business Review*; 17(6); December 2008; pp.714 – 728.

BOOKS:

- Aakar D.A. and Myers J.G., *Advertising Management*: Prentice Hall of India Pvt. Ltd., New Delhi; 2005.
- Agarwal P.K., *Advertising Management- An Indian Perspective*; Pragati Prakashan, Meerut; 1998.
- Bansal S.P., *Marketing Management*; Kalyani Publishers, Ludhiana; 2004.
- Barry Day, "Introduction" in Torin Douglas, *The Complete Guide to Advertising*, London: Guide

Publishing; 1985, pp.6-9.

- Bogart Leo, Strategy in Advertising, NTC Business Books, Illinois, USA; 1996.
- Brewster Arthur Judson, Palmer Herbert Hall and Ingraham Robert G., Introduction to Advertising, McGraw Hill Book Company, Inc., New York; 1954.
- Brierley Sean, The Advertising Handbook, Routledge, London; 2002.
- Burke John D, Advertising in the Market Place; Gregg Division/McGraw Hill Book Co, New York; 1973.
- Burns A.C. and Craverns D. W., Readings and Cases in Marketing Management ; Richard D Irwin Inc; Illinois ; 1987.
- Chrichton John–‘Advertising agencies’ The Encyclopedia of Management, Van Hostrand Reinhold Co., New York;1973,p.11.
- Chunawala S. A., Kumar K.J., Sethia K. C., Subramanian G.V. and Suchak V.G., Advertising Theory and Practice; Himalaya Publishing House, Mumbai; 2004.
- Chunawala S. A. and Sethia K. C., Foundation of Advertising and Practice; Himalaya Publishing House, Bombay; 2000.
- Cohen Dorothy, Advertising, John Wiley and Sons, New York.
- Comanor W S and Wilson T A, Advertising and Market Power Harvard University Press, Cambridge, Massachusettes; 1974.
- Craverns D W, Strategic Marketing; Richard D Irwin Inc., Homewood Illinois; 1987.
- Driver J C and Foxall G R, Advertising Policy and Practice; Holt Rinehart and Winston Ltd., East Sussex; 1984.
- Evans W.A., Advertising Today and Tomorrow; George Allen and Unwin Ltd., London; 1974.
- Frith Katherine Toland; Advertising in Asia; IOWA State University Press, USA; 1996.
- Gardner Herbert S, Advertising Agency Business; Crain Books, Chicago; 1976.
- Hower Ralph M., The History of an Advertising Agency; Harvard University Press, Cambridge, Massachusettes; 1949.
- Jefkins Frank, Introduction to Marketing, Advertising and Public Relations; Macmillan Press, London; 1982.

- Jewler A. Jerome and Drewniany Bonnie L., Creative Strategy in Advertising; Wadsworth Thomson Learning, USA; 2001.
- Jones John Philip, Advertising Organizations and Publications: A Resource Guide; Sage Publications, Inc., London; 1998.
- Kazmi Azhar, Strategic Management and Business Policy, McGraw Hills Co., New Delhi; 3rd Edition, 2008.
- Kleppner Otto, Advertising Procedure; Prentice Hall Inc., Englewood Cliffs; 1974.
- Kloss Ingomar, Advertising Worldwide: Advertising conditions in selected countries, Springer, New York; 2001.
- Kotler Philip, Marketing Management: Analysis, Planning and Control; Prentice Hall of India Pvt. Ltd. New Delhi; 2005.
- Lucas John T. and Gurman Richard, Truth in Advertising, American Management Association, Inc., 1979.
- Malovan Sheila Chevalliar, Advertising ; Cassel Ltd., East Sussex; 1980.
- Mathur Navin, Advertising and Consumer Reaction in India; Printwell Publisher, Jaipur; 1986.
- Mayor Martin, Madison Avenue U S A; Penguin Harmondsworth ; 1961.
- McDonough John, The Advertising Age: Encyclopedia of Advertising; Fitzroy Dearborn New York; London; 2002.
- Mohan Manendra, Advertising Management: Concept and Cases; Tata McGraw Hill Publishing Co. Ltd, New Delhi; 1998.
- Morgan Eric, Choosing and Using Advertising Agencies; Business Books, London; 1974.
- Norris J S, Advertising; Prentice Hall of India Pvt. Ltd., New Delhi; 1986.
- Ogilvy David - 'Ogilvy on Advertising', Prion Books Ltd., London; 1999.
- Ogilvy David - 'Ogilvy on Advertising', New York: Crown; 1983, p.16.
- Pope Daniel, The Making of Modern Advertising; Basic Books Inc., Publishers, New Delhi; 1983.
- Rathor B S, Advertising Management; Himalaya Publishing House, Bombay; 1984.
- Rosser Reeves; Reality in Advertising; Alfred A. Knopf; New York; 1961.
- Rothschild Michael L., Advertising; D. C. Heath and Co., Lexington; 1987.

- Rotzol K B, Heafner J E and Sandage C H, Advertising in Contemporary Society: Perspectives Towards Understanding: Grid Inc., Ohio; 1976.
- Sontakki C N, Advertising and Sales Management; Kalyani Publishers, Ludhiana ; 2003.
- Thorson Esther, Advertising Age : The Principles of Advertising at Work N T C Business Books, Illinois ; 1989
- Warner Malcolm- ‘Advertising Campaigns’, in International Encyclopedia of Business and Management, Routledge Publisher, 1996, vol.1, pp.186-187.
- Webster Eric Advertising for the Advertiser; John Murray, London; 1969.
- Wells William, Burnett John and Moriarty Sandra, Advertising; Principles and Practices; Prentice Hall International, Inc., London; 2001.
- Young James Webb - ‘A Technique for Producing Big Ideas’, Chicago: Crain Books, 1995, pp.53-54.

OTHERS:

- INFA PRESS and ADVERTISERS Year Book – 2002 – 03, 05 – 06: New Delhi: India News and Feature Alliance, 2003.
- The Indian Newspaper Society Press; INS; Year Book 2004 – 05, 2005 – 06.
- Advertiser’s Handbook – 2004, New Delhi: Indraprastha Prakashan Pvt. Ltd., 2004.

JOURNALS:

- Aaker, David A., and Stayman Douglas M., ‘Measuring Audience Perceptions Of Commercials And Relating Them To Ad Impact’, *Journal of Advertising Research*, 30, August, 1990, pp. 7-17.
- Abratt Russell and Cowan Deanna, ‘Client–Agency Perspectives of Information needs for Media Planning’; *Journal of Advertising Research*; November – December 1999; pp.37 – 52.
- Adams Anthony J, The Role of Research in the Future : Transcripts Proceeding : Advertising 2010 ; The next 25 years ; *Advertising Research Foundation*; New York ; 1986 pp 211-217.
- Adler Lee, Greenberg Allan and Lucas B. Darrell, “What Big Agency Men Think of Copy Testing Methods”; *Journal of Marketing Research*; Vol. 2; November 1965, pp. 339 – 345.
- Agnihotri Amit and Gupta Kanishk, ‘Advertising Outlook 2005: How Marketers Rate Media?’; *Pitch*; 2(4); January 2005; pp. 35 – 54.
- Agnihotri Amit and Gupta Nikhil, ‘Advertising Outlook 2003: Who is running fast, Who is coming last’; *Pitch*; 2(4); October 2003; pp. 34 – 43.

- Arunachalam S, Indian Research and Development : An Index of Mediocrity; *Business and Political Observer*, New Delhi ; July 19, 1991, Special feature.
- Banerjee, A., ‘Transnational Advertising Development And Management: An Account Planning Approach And A Process Framework’; *International Journal of Advertising*; 13(2);1994.
- Bargotra Ranjan, ‘The Changing Face of Indian Advertising’; *Indian Management*; March 1997, pp.19 – 23.
- Banerjee A., ‘Transnational Advertising Development And Management: An Account Planning Approach And A Process Framework’; *International Journal of Advertising*; 13(2); 1994.
- Banerjee Subrata, ‘The Advertising Agency – A New Service’; *Economic and Political Weekly*; Review of Management; May 1968; pp. M-19 – M-23.

AUTOMATIC WHEELCHAIR USING EYEBALL SENSOR

**Rajavenkatesan.T¹, Nagalakshmi.S², Ram Prasath.K.P³,
Venkataramanan.S⁴**

¹Assistant Professor, Dept., of EIE, K.S.Rangasamy College of Technology, Tiruchengode, (India).

^{2,3,4} UG Students, Dept., of EIE, K.S.Rangasamy College of Technology, Tiruchengode, (India)

ABSTRACT

An automatic wheel chair is a mobility-aided device for persons affected by moderate, severe physical disabilities, and chronic diseases as well as elderly. Many people with disabilities do not have the ability to control the powered wheel chair using joystick and hand movements as it is tougher for the person to move and it is software oriented. The proposed method consists of hardware which eliminates the individual's work using eyeball sensor. The proposed model uses an eye ball movement tracking system to control electronic wheel chair. Once the movement has been processed and it is given to the microcontroller. The microcontroller process depends upon the feed coding and the output is gives in to the driver circuit. Also, the obstacle detection sensors will be connected to give necessary feedback for proper operation of the wheelchair system. All four wheel will be connected to driving circuit that will move to wheelchair based on eye ball movement.

Keywords: DC motor, Eyeball sensor, IR sensor, Micro controller.

I. INTRODUCTION

There are patients who have lost control of both arms and legs, as a result of higher level spinal cord injury or brain and nervous system disorder. These kinds of patients can't use the standard wheelchair which depends on the arms muscular force to move the wheelchair. At the same time, they can't use the electrically powered wheelchair which is controlled by joystick. So these types of patients still want the help of another person to move their wheelchair from one place to another. Many researchers have proposed different methods to control the wheelchair. One of the possible solutions for them is to use their eye ball movement to control the wheelchair. The control of the wheelchair is depends upon the eye ball sensor, which will do the functions like right, left, forward and reverse operations.

The wheel chair is designed in such a way that it can move freely without external support or dependency. Through this feature the patients can enable movements of their wheelchair as per their desire.

II. LITERATURE SURVEY

There were many pervious works carried out on electronic Wheelchairs. These are a few of them which helped us to get ideas for our current prototype.

In [1] "touch screen based wheelchair system," This method is very much user free and requires very less muscle movement form the user. Touch screen is used as input device and LCD displays the user's gesture

correctly when recognized. An IR obstacle detection unit can be used which is fixed to the wheelchair to avoid possible accident. A resistive touch screen will be best suited for this application as it is low cost and has greater lifespan compared to other types of touch screens available. From the screen, user can either select a predefined path or can create their path in real-time. The drawback of this method is that, it is less accurate in the turning of wheelchair.

In [2] "voice and Gesture Based Electric-Automatized Wheelchair Using ARM", this method is very greatly user free and comfortable for elders with limbs impairments. The benefit of this method is to people who are unable to perform simple movements with their hands. This technique is used language and hence can be considered universal. A voice recognition IC is interfaced with a microcontroller. This IC accepts the input from the user as voice commands which are then converted to digital signals that a microcontroller can process. It will produce the desired output which controls the wheelchair.

In [3] "automatic Wheelchair Controlled using Hand gesture", an EMG Sensor, and guide Signal Separation' can be used in this method. A system is designed which uses an IR sensitive camera to identify the gesture shown by the user. The capture images of the gesture are given to the microprocessor which does further processing. The drawback of this method is that it cannot be used by the persons who are suffering from nerve disorder and stroke etc.

III. HARDWARE IMPLEMENTATION

3.1 Eyeball sensor

The basic principle of this direction sensing is the color of the eyes. There are two main colors in the human eyes, i.e., black and white. The infrared light rays pass to the eye and measure the white portions.

The Infrared sensors are placed on either side of the sensor. The eye ball sensor is connected to the microcontroller. It will perform the analysis, processing and amplification of the signals from the sensor's eye-ball movements. The eye ball movement is an analog signal which can be converted into a digital signal. Depending upon the movement of the eye ball and controller provides the output. It can be passed through driver circuit to their direction of right, left, forward, reverse directions.

The sensor output is based on the eye ball. If the eye ball is large then the accuracy is more. If the eye ball is small then the accuracy is low.



Figure 1: The Eyeball Sensor on goggles

3.2 Motors

The Geared type dc motor with 12V power supply and 45rpm motor is used to move the wheelchair. DC motors are available from 15W through 6,0kW. These motors are high torque, continuous S1 or S3 periodic-duty products suitable for a wide variety of applications ranging from pumps to propulsion. The motors operate on battery power or generated “pure” DC power. The motor will take input from the driver circuit, depending upon input the motor move in the directions of right, left, forward, reverse.

Motor 1		Motor 2		Direction
Input 1	Input 2	Input 1	Input 2	
0	1	0	1	Forward
1	0	1	0	Reverse
0	1	0	1	Right
1	0	0	1	Left

Table1: Truth Table Representing the Working of the Motor

The two motor is connected to the driver circuit and it will move the wheelchair based on the input signal from the circuit, the truth table becomes as shown in table2

Input One	Input Two	Output
0	1	Forward
1	0	Backward
1	1	Stop
0	0	Stop

Table2: Truth Table for Controlling Two Wheels Simultaneously

3.3 Motor Driver

L293D is a dual H-Bridge motor driver with one IC interface two DC motors which can be controlled in both clockwise and anti-clockwise direction. L293D has output current of 600mA and it can be amplifies the input signal form controller. This device is suitable for use in switching application at frequencies up to 5 kHz. The output supply (VCC2) has a wide range from 4.5V to 12V, which is suitable for low speed operation.

3.4 Microcontroller

The ATmega8 contains 8K bytes On-chip In-System Reprogrammable Flash memory for program storage. It is mainly used for a small speed application.

It has 3 ports such as port B, port C, and port D. The port B is connected to the eye ball sensor. As inputs, Port B pins that are outwardly pulled low will source current if the pull-up resistors are started. The Port B pins are tri-stated when a reset condition is on, even if the clock is not running. Depending on the clock pulse, PB6 can be used as input to the inverting amplifier and input to the internal clock operating circuit. Depending on the clock selection pulse, PB7 can be used as output from the inverting amplifier. The port C is connected to the driver circuit for motor input. Port C is a 7-bit bi-directional I/O port with internal tell off resistors (selected for each bit).

Block Diagram

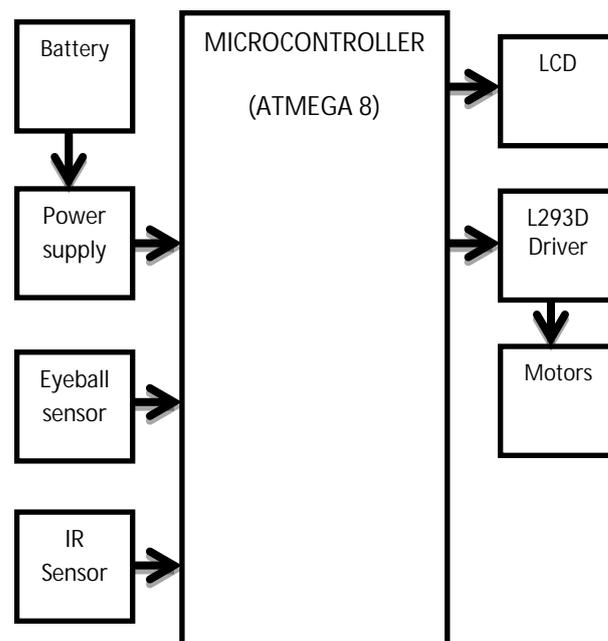


Figure 3. Block diagram of the project

The Port C output buffers have balanced drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are started. The Port C pins are tri-stated when a reset condition is on, even if the clock is not running. The port D is connected to the driver circuit for motor output. The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running. The controller is processed depending upon the coding.

3.5 Obstacle Sensor

The obstacle sensor is placed at the front of the wheelchair. It is used to provide information on the objects in the direction of the wheelchair. It consists of transmitting and receiving sections. The IR signal is passed through in the direction and it can be received. If any obstacle in the direction of wheelchair, it will send 5V supply to controller, then wheelchair is stopped. Otherwise 0V supply is given to the controller.

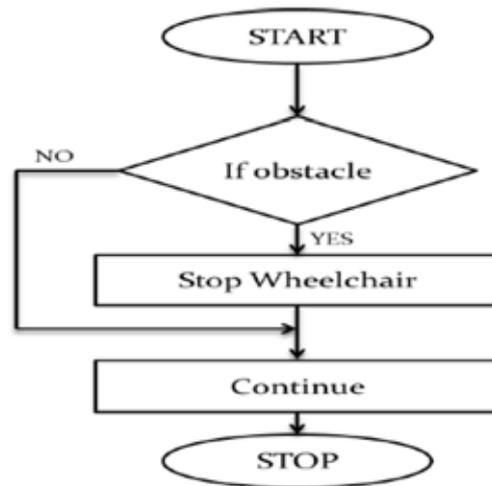


Figure 4. Flow chart of obstacle sensor

IV. KEIL C COMPILER AND FLASH MAGIC BURNER

We are using the Keil C Compiler software to program the microcontroller in Embedded C codes.[7] The Keil C51 C Compiler for the ATmega8 microcontroller. It provides more features than any other 801151 C compiler available nowadays. The C51 Compiler allows you to write 8051 microcontroller application in C that, once compiled, have the efficiency and speed of gathering language. Language extensions in the C51 Compiler give you full access to all capital of the 8051. Flash Magic Burner is an application for programming microcontrollers. The program will routinely verify the chip after the Hex file is loaded to it.

WORKING

The eye ball sensor sensing the position of the eye and given to the microcontroller. It will convert input to digital signal and send to the driver circuit. The output of the controller is digital signal. It has L293D IC which converts digital to 12V analog signal. The obstacle sensor is also connected to the controller. The motor will move depending upon eye ball movements.

V.CONCLUSION

The system is designed in such a way that it is simple, cost effective and easy to operate so that it aids the physically challenged people. However, the efficiency of the system mostly depends on the controller program, as the human eye move more to sudden changes in the system, rather than a normal change. Hence system should be designed in such a way fast to measure eye ball movement and more efficient to process. Obstacle sensor is used to detect object in the undesired condition such as dark areas, glass wall or stones, smoke area, and etc

VI.FUTURE WORK

This system can also extended for the blind people that instead of eyeball sensor, Google maps can be used to move the wheelchair.

REFERENCE

- [1] K. Sudheer, 'Voice and Gesture Based Electric-Automated Wheelchair Using ARM', International Journal of Research in Computer and Communication technology, IJRCCT, ISSN 2278-5841, Vol 1, Issue 6, November 2012.
- [2] Luis A. Rivera, Guilherme N. DeSouza, et al, and Senior member, 'A Automatic Wheelchair Controlled using Hand Gestures, IEEE, University of Missouri on April 2010.
- [3] Ituratte, J. Antelis, J. Minguez, 'Synchronous EEG brain-actuated wheelchair with automated navigation,' Kobe, Japan, May 2009.
- [4] Bong-Gun Shin, Taesoo Kim, Sungho Jo, et al, 'Noninvasive brain signal interface for a wheelchair navigation', International Conference on Control, Automation and Systems, Gyeonggi-do, Korea, October 2010.
- [5] Ana C. Lopes, Gabriel Priez, Luís Vaz, Urbano Nunes, et al, 'Wheelchair navigation assisted by human - machine shared - control and a P300 - based brain compute interface', International Conference on Intelligent Robots and Systems, San Francisco, CA, USA, September 2011.
- [6] M. Palankar, K.J. De Laurent's, R. Alqasemi, E. Veras, R. Dubey, Y. Arbel, and E. Donchin, et al, Control of a 9-DoF wheelchair-mounted robotic arm system using a P300 brain computer interface: Initial experiments. In Robotics and Biomimetics, 2008. ROBIO 2008. IEEE International Conference on, pages 348–353. IEEE, 2008.
- [7] Fahad Wallam, Muhammad Asif, et al, 'Dynamic finger movement tracking and voice commands based smart wheelchair', International Journal of Computer and Electrical Engineering, August 2011.
- [8] Kohai Arai, Ronny Mardiyanto, et al, 'Electric wheelchair controlled by human eye only with obstacle avoidance', International Journal of Research and Computer Science, December 2011.
- [9] Vasundhara G Posugade, Komal K Shedge, Chaithali S Tikhe, et al 'Touch screen based wheelchair system', International Journal of Engineering Research and Application, March – April 2012.
- [10] Ito, Nara, 'Eye movement measurement by picture taking in and processing via video capture card, an Institute of Electronics', Information and Communication Engineers Technical Report, ISSN 31-36, April 2002.