SPECIAL FEATURE

Face Recognition Attendance System

Silicon

...beyond teaching

The Science & Technology Magazine

Digital Digest

Silicon Institute of Technology Vol. 16 • Issue 4 • December 2017 - February 2018

Our Vision: "To become a center of excellence in the fields of technical education & research and create responsible citizens"

Carbon Capture Mechanisms

Global warming is a burning issue. In the not too distant past, some salient aspects of it were discussed in this forum expounding on our insatiable need for energy and our escalating Carbon Footprint. After CO2 (the main agent responsible for the enhanced Greenhouse effect, leading to Global warming) levels in the atmosphere reached the dreaded 400 ppm mark a few years ago, substantial efforts have been put into devising ingenious mechanisms of 'capturing' back some of the CO2 emitted by fossil fuel burning. Last year, approximately 40 billion tons of this gas was vented into the earth's atmosphere. It is about time that some of these carbon capturing ideas are implemented to prevent our planet from becoming cataclysmically unstable with rapidly melting polar ice-caps and rising oceans.

There are numerous ways of capturing, sequestering and storing CO2 and only some of those will be highlighted. Carbon Capture and Storage (CCS) along with Renewable Energy are the two most important pillars on which sustainable energy technology rests; both are necessary to meet the climate change targets like the ones set in the Paris Agreement of 2015.

Once emitted from the combustion of fossil fuels, point source trapping of CO2 is perhaps the simplest - occurring in the power-plant itself and typically accomplished by installing an adsorber or a carbon-scrubber in the exhaust flue. The CO2 then is either bound to a solid adsorbent or goes into solution, for further processing. Much more ambitious is the Geo-Sequestering technique, whereby the carbon dioxide is injected, in supercritical form, into underground geological formations like oil and gas fields, coal seams and other somewhat porous rock strata. Saline aquifers and the ocean floor also have the capacity to store large volumes of CO2, but further investigations are necessary to allay safety concerns regarding the involvement of such reservoirs.

One very promising technology called air-to-fuel, plucks CO2 out of the air, puts it into a solution and makes Calcium Carbonate pellets out of it. Subsequently, these pellets are used to make synthetic fuels which can be used to propel cars, trucks and even airplanes. The company, Carbon Engineering, founded by a Harvard professor is pioneering this process, and a plant to capture one million tons of carbon dioxide per year has been setup in Canada. This technology, called Direct-Air-Capture (DAC) has two tangible benefits - extraction of the greenhouse gas CO2 thus reducing its concentration in air, and saving the limited reserves of fossil fuels we have by producing synthetic fuels.

Another technology, termed artificial photosynthesis, also has much potential and is an area of active research. To mimic what nature does is the name of the game. Such a system has to be able to harvest sunlight, split water molecules and turn the CO2 to carbohydrates. The bottleneck is the splitting of water as this is the energy-intensive part of the process; moreover, for the process to be fruitful, the product has to be hydrogen or methanol instead of oxygen. The water-splitting process is typically a catalyzed one - either using cobalt oxide or titanium oxide. This technology has benefits over the direct conversion of solar energy into electricity via photovoltaic (PV) cells, because the performance of the PV process depends a great deal on the time of day and the weather, and is affected by the variable and unpredictable nature of sunlight. However, in the artificial photosynthesis process, a storable fuel may be generated which offsets the time and availability vagaries of solar energy.

Awareness of the magnitude of the problem of dumping billions of tons of CO2 into our atmosphere is the first step; the next phase is to dig deep to come up with technology which will utilize this excess carbon dioxide and benefit humanity. Go Green!

Dr. Jaideep Talukdar
Professor, Dept. of BSH.

Face Recognition Attendance System

Abstract : *The system is developed for deploying an easy and secure way of taking attendance. It first captures the images of all the authorized persons and stores the information in the database. The system then stores the image by mapping it into a face coordinate structure. Next time whenever the registered person enters the premises, the system recognizes the person and marks his attendance along with the time. If the person arrives late than his reporting time, then the system responds "you are x minutes late! Do not repeat this". The software can be used for security purposes in organizations and in secured zones. The software stores the faces that are detected and automatically marks attendance. It is convenient and secure for the users as it saves time and efforts.*

I. INTRODUCTION

Uniqueness or individuality of an individual is his/her face. In this research face of an individual is used for the purpose of taking attendance automatically. Attendance of the student is very important for every college, universities and schools. Conventional methodology for taking attendance is by calling the name or roll number of the students and the attendance is recorded. For a class of 60 minutes, taking attendance takes around 5 to 10 minutes. Time consumption for this purpose is an important point of concern for every tutor. To stay away from these losses, an automatic process is used in this work which is based on image processing.

In this work face detection and face recognition is used. Face detection is used to locate the position of face region and face recognition is used for marking the understudy's attendance. The database of all the students in the class is stored and when the face of the individual student matches with one of the faces stored in the database then the attendance is automatically recorded.

II. FACE RECOGNITION

A facial recognition system is a computer application capable of identifying or verifying a person from a digital image or a video frame from a video source [1]. One of the ways to do this is by comparing selected facial features from the image and a face database. It is typically used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition systems [2]. Recently, it has also become popular as a commercial identification and marketing tool. It involves the following steps:

1. Face Detection
2. Feature Extraction
3. Face recognition

Face detection is the first task, that is, how to model a face. The way to represent a face determines the successive algorithms of detection and identification. For the entry-level recognition (i.e. to determine whether or not the given image represents a face), the image is transformed (scaled and rotated) till it has the same 'position' as the images from the database. In the feature extraction phase, the most useful and unique features of the face image are extracted [3]. With these obtained features, the face image is compared with the images from the database. This is done in the classification phase. The output of the classification part is the identity of a face image from the database with the highest matching score, thus with the smallest differences compared to the input face image. Also, a threshold value can be used to determine if the differences are small enough when a certain face is not present in the database.

III. LOCAL BINARY PATTERNS

There are several methods for extracting the most useful features from (preprocessed) face images to perform face recognition. One of these feature extraction methods is the Local Binary Pattern (LBP) method [4]. With LBP it is possible to describe the texture and shape of a digital image. This is done by dividing an image into several small regions from which the features can be extracted as shown in Figure 1.

Figure 1: *A preprocessed image divided into 64 regions*

These features consist of binary patterns that describe the surroundings of pixels in the regions. The obtained features from the regions are concatenated into a single feature histogram, which forms a representation of the image. Images can then be compared by measuring the similarity (distance) between their histograms. According to several studies [5, 6] face recognition using the LBP method provides better results, both in terms of speed and discrimination performance. Because of the way the texture and shape of images is described, the method seems to be quite robust against face images with different facial expressions, different lighting conditions, image rotation and aging of persons.

IV. PRINCIPLES OF LOCAL BINARY PATTERN (LBP)

The LBP operator works with the eight neighbors of a pixel, using the value of this center pixel as a threshold. If a neighbor pixel has a higher gray value than the center pixel (or the same gray value) then a one is assigned to that pixel, else it gets a zero. The LBP code for the center pixel is then produced by concatenating the eight ones or zeros to a binary code as shown in Figure 2.

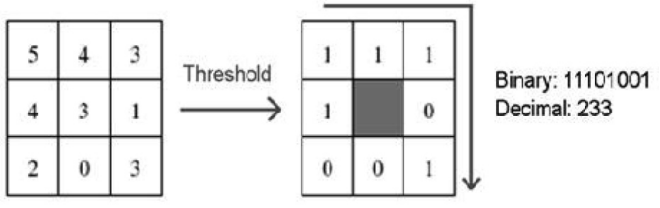


Fig. 2: *The Original LBP Operator*

Later the LBP operator was extended to use neighborhoods of different sizes. In this case a circle is made with radius R from the center pixel. P sampling points on the edge of this circle are taken and compared with the value of the center pixel. To get the values of all sampling points in the neighborhood for any radius and any number of pixels, interpolation is necessary. For neighborhoods the notation (P, R) is used. Figure 3 illustrates the three neighbor sets for different values of P and R.

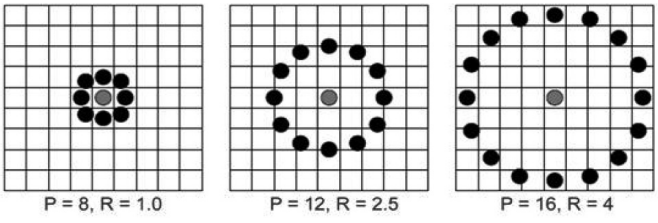


Fig. 3: *Circularly neighbor-sets for three different values of P and R*

If the coordinates of the center pixel are (xc, yc) then the coordinates of his P neighbors (xp, yp) on the edge of the circle with radius R can be calculated by using equation (1) and equation (2).

$$x_p = x_c + R\cos(2\pi p/P) \quad (1)$$

$$y_p = y_c + R\sin(2\pi p/P) \quad (2)$$

If the gray value of the center pixel is gc, and the gray values of his neighbors are gp, with p = 0, …, (P – 1), then the texture T in the local neighborhood of pixel (xc, yc) can be defined using equation (3). Once these values of the points are obtained it is also possible to describe the texture by subtracting the value of the center pixel from the values of the points on the circle. In this way the local texture is represented as a joint distribution of the value of the center pixel and the differences as given in equation (4).

$$\mathbf{T} = t(g_c, g_0, \ldots, g_{P-1}) \quad (3)$$

$$T = t(g_c, g_0 - g_c, \ldots, g_{P-1} - g_c) \quad (4)$$

Since t(gc) describes the overall luminance of an image, which is unrelated to the local image texture, it does not provide useful information for texture analysis. Therefore, much of the information about the textural characteristics in the original joint distribution is preserved in the joint difference distribution given in equation (5). Although invariant against gray scale shifts, the differences are affected by scaling. To achieve invariance with respect to any monotonic transformation of the gray scale, the signs of the differences are considered. This means that in the case a point on the circle has a higher gray value than the center pixel (or the same value), a one is assigned to that point, and else it gets a zero value as presented in equation (6). In the last step to produce the LBP for pixel (xc, yc) a binomial weight 2p is assigned to each sign s(gp − gc) and are summed using equation (7).

$$T \approx (g_0 - g_c, \ldots, g_{P-1} - g_c) \quad (5)$$

$$T \approx (s(g_0 - g_c), \ldots, s(g_{P-1} - g_c)) \quad (6)$$

Where,

$$s(x) = \begin{cases} 1, & x \geq 0 \\ 0, & x < 0 \end{cases}$$

$$LBP_{P,R}(x_c, y_c) = \sum_{p=0}^{p-1} s(g_p - g_c)2^p \quad (7)$$

The Local Binary Pattern characterizes the local image texture around (xc, yc). The original LBP operator in Figure 3 is very similar to this operator with P = 8 and R = 1, thus LBP8, 1. The main difference between these operators is that in LBP8, 1, the pixels first need to be interpolated to get the values of the points on the circle.

V. UNIFORM OF LOCAL BINARY PATTERNS

A Local Binary Pattern is called uniform if it contains at most two bitwise transitions from 0 to 1 or vice versa. In a matter of fact this means that a uniform pattern has no transitions or two transitions. Only one transition is not possible, since the binary string needs to be considered

circular. The two patterns with zero transitions, with for example eight bits, are 00000000 and 11111111. Examples of uniform patterns with eight bits and two transitions are 00011100 and 11100001. For patterns with two transitions are P (P −1) combinations possible. For uniform patterns with P sampling points and radius R the notion LBP is used.

Using only uniform Local Binary Patterns has two important benefits. The first one is that it saves memory. With non-uniform patterns there are 2P possible combinations. With LBP there are P (P − 1) + 2 patterns possible. The number of possible patterns for a neighborhood of 16 (interpolated) pixels is 65536 for standard LBP and 242 for LBPu2. The second benefit is that LBPu2 detects only the important local textures, like spots, line ends, edges and corners. Examples of different texture primitives detected by the LBP are presented in Figure 4.

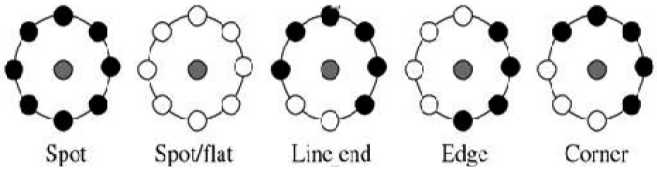


Fig. 4: *Different texture primitives detected by the LBP*

VI. FACE RECOGNITION USING LOCAL BINARY PATTERNS

The main idea in face recognition using LBP is that for every pixel of an image the LBP-code is calculated. The occurrence of each possible pattern in the image is kept up. The histogram of these patterns, also called labels, forms a feature vector, and is thus a representation for the texture of the image. These histograms can then be used to measure the similarity between the images, by calculating the distance between the histograms.

Figure 5 shows an image which is split in an image with only pixels with uniform patterns and in an image with only non-uniform patterns. These images are created by using the LBP operator. It occurs that the image with only pixels with uniform patterns still contains a considerable amount of pixels, namely 99% of the original image. So, 99% of the pixels of the image have uniform patterns. Another striking thing is the fact that, by taking only the pixels with uniform patterns, the background is also preserved. This is because the background pixels all have the same color (same gray value) and thus their patterns contain zero transitions. It also seems that much of the pixels around the mouth, the nose and the eyes (especially the eyebrows) have uniform patterns.

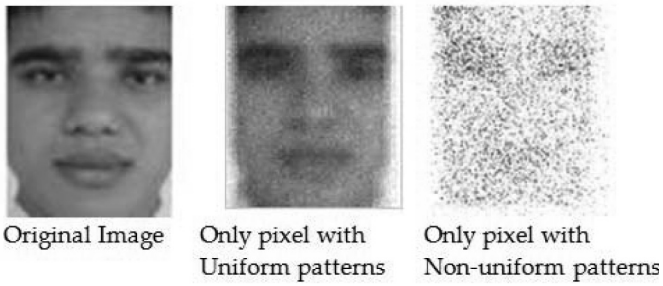


Figure 5: Face image split in an image with only pixels with uniform patterns and in an image with only non-uniform patterns, by using LBP

VII. FEATURE VECTORS

Once the Local Binary Pattern for every pixel is calculated, the feature vector of the image can be constructed. For an efficient representation of the face, first the image is divided into K2 regions. Figure 6 presents an example where a face image is divided into 64 regions. For every region a histogram with all possible labels is constructed. This means that every bin in a histogram represents a pattern and contains the number of its appearance in the region. The feature vector is then constructed by concatenating the regional histograms to one big histogram.

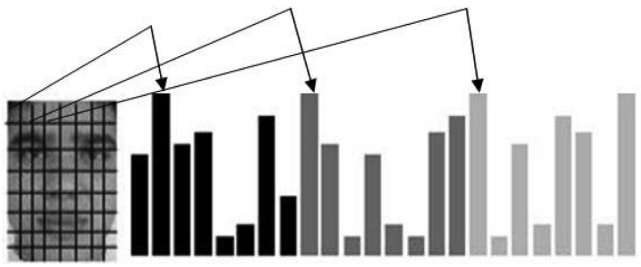


Fig. 6: *Face image divided into 64 regions*

The feature vector is effectively a description of the face on three different levels of locality: the labels contain information about the patterns on a pixel-level; the regions, in which the different labels are summed, contain information on a small regional level and the concatenated histograms give a global description of the face.

Face recognition is not a simple problem since an unknown face image seen in the extraction phase is usually different from the face image seen in the classification phase. Although local binary features have been extracted from the face image for face recognition but there are several face images in the database. The face image depends on viewing lighting and environmental conditions. In addition the face image changes according to the expressions.

VIII. RESULTS AND DISCUSSIONS

The performance of the LBP-method on different kind of face images is observed. Several parameters, like the LBP operator, non-weighted or weighted regions and the dividing of the regions, are varied to see the influence of these parameters on the performance. For this experiment a number of face images are collected. Based on the algorithm, the face image of an unknown identity is compared with face images of known individuals from a large database. Step by step explanation of the working system is shown below.

The user opens the app and is directed to the dashboard of the app which is the main interface page with which the user interacts. First page of the system is popped up on the screen as shown in Figure 7. It has two buttons named Capture and Attendance. The Capture button

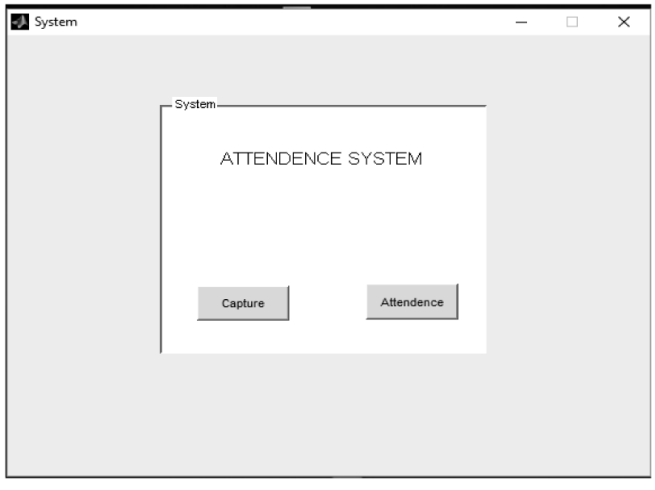


Fig. 7: *Dashboard Attendance System*

is to train images in the system i.e. enrollment phase. Once the user clicks on the Capture Button, the system is directed to a webcam portal. An image is captured by the webcam for Training Purpose. An example is presented in Figure 8. The captured image is then converted to gray scale image using LBP (Local Binary Patterns) method as shown in Figure 9. LBP code is calculated and corresponding 256 decimal values are stored in the database.

In the Attendance Phase an image is captured by the webcam and matching is done from trained images. If the matching is positive then attendance is given as shown in Figure 10. However, if the captured image is not matched with the available training images, a message is displayed as- "The person is not registered". The output for an unregistered student is presented in Figure 11. Therefore, no unregistered student can enter the class. A number of tests are conducted on both registered students

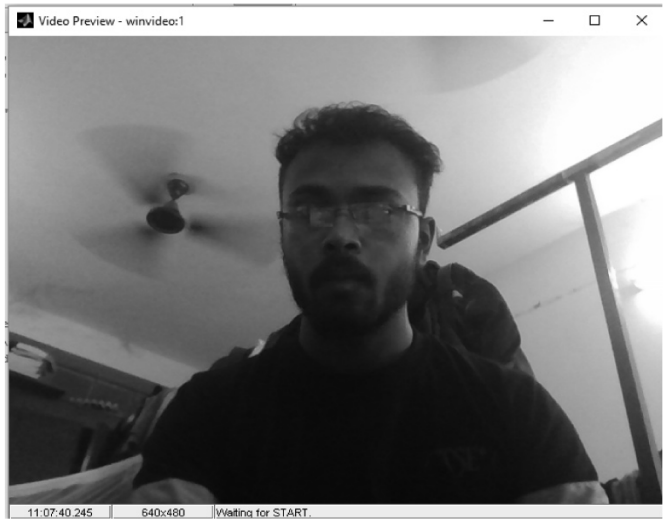


Fig. 8: *Image captured by webcam for training*

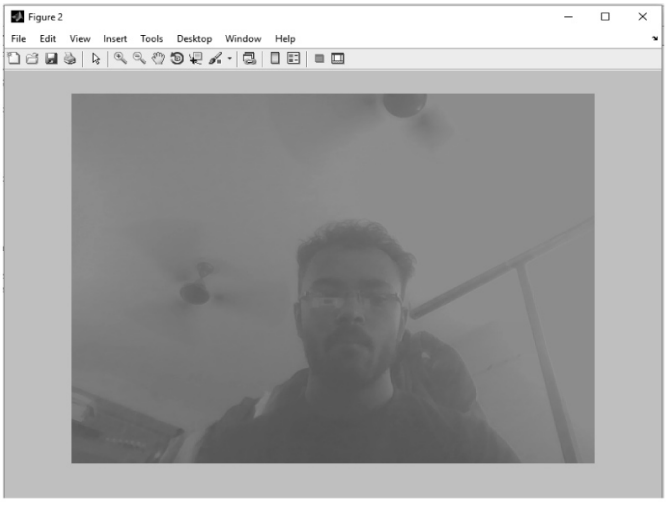


Fig. 9: *Captured image is converted to gray scale image*

and unregistered students. Good results are observed in this face recognition system. Table 1 shows the overall face recognition rate on the test data. The flow chart of the attendance system is presented in Figure 12.

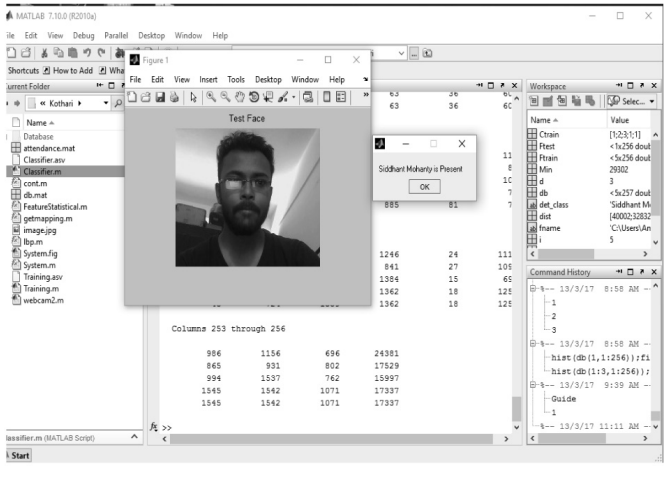


Fig.10: *Output for Image1 for Attendance Phase if a match is found*

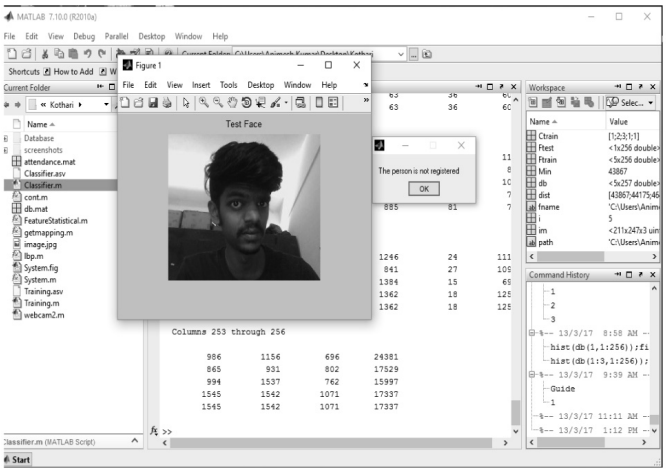


Fig. 11: *Output for Image 2 for Attendance Phase if a match is not found*

Table 1: Recognition rate of the Research

Number of face images stored in the database	Number of input face images compared with database	Recognized Image	Unrecognized Image	Recognition Rate
100	50	36	14	72%

IX. CONCLUSIONS

The face detection and recognition algorithms were tested by performing a number of tests on different varying condition images. For face detection LBP feature extraction algorithm is used. Attendance of the student are marked using the recognized face of every individual student and the data is stored in an attendance sheet. The attendance of every student marked automatically by recognizing their face with the face present in the data base.

ACKNOWLEDGEMENT

We express our sincere gratitude to our project guide Mr. Bikram Keshari Mishra of CSE department for guidance and encouragement in carrying out this research work.

REFERENCES

[1] T. Ojala, M. Pietik¨ainen and D. Harwood, "A comparative study of texture measures with classification based on feature distributions", Pattern Recognition, vol. 29, 1996.

[2] K. Etemad and R. Chellappa, "Discriminant Analysis for Recognition of Human Face Images", J. Optical Soc. Am., vol. 14, pp. 1724-1733, 1997.

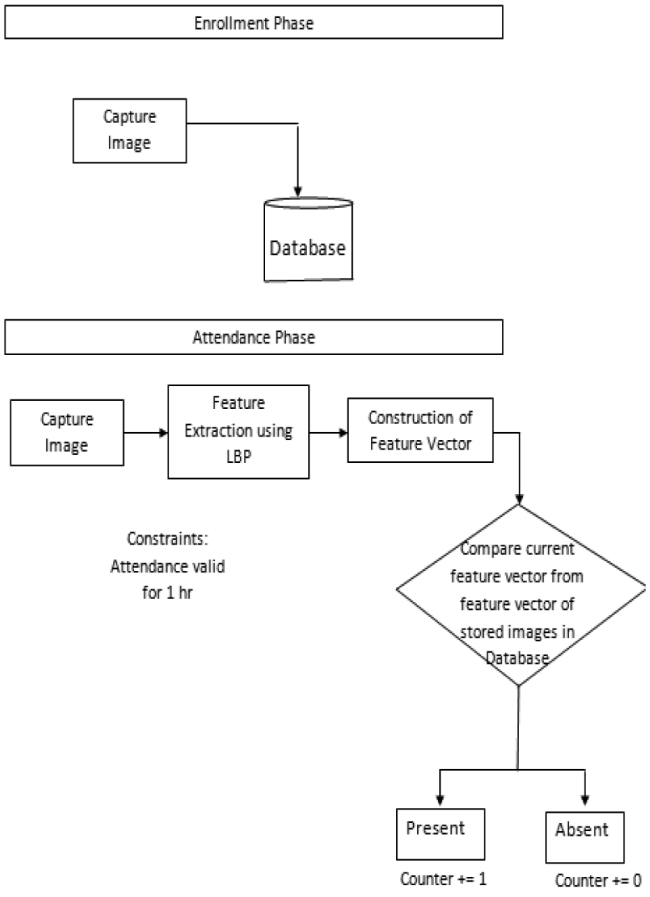


Fig.12: *Flowchart of the System*

[3] T. Ahonen, A. Hadid, and M. Pietika¨inen, "Face Recognition with Local Binary Patterns," Proc. Eighth European Conf. Computer Vision, pp. 469-481, 2004.

[4] G. Yang and T. S. Huang, "Human face detection in complex background", Pattern Recognition Letter, vol. 27, no.1, pp. 53-63, 1994.

[5] M. Kirby and L. Sirovich, "Application of the Karhunen-Loeve procedure for the characterization of human faces", IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 12, no. 1, pp. 103-108, 1990.

[6] W. Zhao, R. Chellappa, P.J. Phillips, and A. Rosenfeld, "Face Recognition: A Literature Survey," ACM Computing Surveys, vol. 35, no. 4, pp. 399-458, 2003.

Siddhant Mohanty,
Shailja Kumari,
Subham Kothari
8th Sem. CSE

Power Quality Improvement using Multilevel Unified Power Quality Conditioner

Abstract: *This article presents the utilization of Unified Power Quality Conditioner (UPQC) with Cascaded Multi-Level Inverter to improve the power quality in distribution systems. Power quality is a very important aspect in power system which aims at delivering power at constant voltage and constant frequency. The harmonics in power systems are produced by various electronic equipments, ASDs and other nonlinear loads. UPQC is a custom power device of the Flexible AC Transmission systems (FACTS) family which employs a combination of series and shunt active power filters to compensate for voltage unbalance, sag, and reactive power. Transformers and additional Filters is not necessary, when a multilevel UPQC topology is adopted through a CMLI employing Alternate Phase Opposition Disposition Pulse Width Modulation (APOD PWM) control scheme. The UPQC model was simulated using MATLAB/SIMULINK 2015a and the desired results were obtained.*

Keywords: UPQC, Multilevel Inverter, Voltage Sag, Voltage Unbalance, Power Conditioner, Power Quality

I. INTRODUCTION

Power Quality (PQ) related issues is of most concern nowadays. According to IEEE, Power Quality is the concept of powering and grounding sensitive equipment in a matter that is suitable to the operation of that equipment. Power Quality is the combination of voltage and current quality which aims at delivering power at constant frequency and magnitude. Increasingly the development of nonlinear loads is deteriorating power quality. These loads are simultaneously the major causes of power quality problems. Due to their nonlinearity, all these loads cause disturbances in the voltage waveform. Nowadays concern about voltage sag is far more than that of other power quality problems. The increased sensitivity of the vast majority of processes (industrial, services and even residential) to Power Quality(PQ) problems turns the availability of electric power with quality a crucial factor for competitiveness in every activity sector. The most critical areas are the continuous process industry and the information technology services. When a disturbance occurs, huge financial losses may happen, with the consequent loss of productivity and competitiveness. Although many efforts have been taken by utilities, some consumers require a level of PQ higher than the level provided by modern electric networks.

Custom power devices, such as Dynamic Voltage Restorer (DVR), Distribution Static Compensator (DSTATCOM), and Unified Power Quality Conditioner (UPQC) have been introduced in recent years for power quality improvement in electricity distribution. Advances in manufacturing of power semiconductor devices have led to better characteristics such as higher voltage and current ratings as well as increased switching frequency. Besides, the implementation of multilevel inverters has made high power and high voltage power quality conditioners much feasible. In this article, an UPQC employing cascaded H-bridge multi-level inverter is studied. This technique compensates voltage sag and unbalance. Using a multilevel UPQC prevents using filters and transformer for compensating voltage sag, unbalance and obtaining unity power factor. In addition, minimization of THD is another advantage of this method. The operation of the proposed UPQC will be verified through simulations with MATLAB/ SIMULINK software.[1]

II. LITERATURE REVIEW

The history of multilevel inverter began in mid 1970s, when the first patent describing an inverter topology capable of producing multilevel voltage from various DC voltage sources was published by Baker and Bannister (1975).Use of Shunt and Series APFs for mitigating power quality problems was given by Khadikar. Control strategy of UPQC was given by Dr. H. Akagi in 1984 to extract voltage and current reference Metin Keslar proposed that using SRF Control helps in improving the power quality at the point of common coupling (PCC) on power distribution system under unbalanced load conditions. The term power quality embraces all the aspects associated with amplitude, phase and frequency of the voltage and current waveform existing in the power circuit. Nowadays, power quality is more complex problem than in the past because the new loads are not only sensitive to power quality, but also significantly worse at the points where the loads are connected to the distribution grid. A single customer may cause significant reduction in power quality for many other customers. [2]

III. MULTILEVEL INVERTER

A multilevel inverter (MLI) is a power electronics based device which is capable of providing desired alternating voltage level at the output using multiple lower level DC voltages as input. Some salient features of MLI are :-

- They are suitable for medium to high power applications.
- They can generate output voltages with extremely low distortion and lower dv/dt.
- They draw input current with very low distortion.
- They are an ideal interface between a utility and renewable energy sources such as photovoltaic or fuel cells.
- Their efficiency is very high (>98%) because of the minimum switching frequency.
- Switching stress and EMI are low.
- Because of their modular and simple structure, they can be stacked up to an almost unlimited number of levels.

There are several topologies of multilevel inverters available. The difference lies in the mechanism of switching and the source of input voltage to the multilevel inverters.[3] Three most commonly used multilevel inverter topologies are:

1. Cascaded H-bridge multilevel inverters
2. Diode Clamped multilevel inverters
3. Flying Capacitor multilevel inverters

It is generally accepted that the performance of an inverter, with any switching strategies, can be related to the harmonic contents of its output voltage. Due to the great demand for medium-voltage high-power inverters, the cascade inverter has drawn tremendous interest ever since. The structure of separated dc sources is well suited for various renewable energy sources such as fuel cell, photovoltaic, biomass, etc. This multi-level inverter is made of several full-bridge inverters. The AC output of each of the different levels of full-bridge inverters are connected in series such that the synthesized voltage waveform is sum of the inverter outputs. The distance between each level is the same and equal to Vdc. Each full-bridge inverter product a three level waveform +Vdc, 0, -Vdc. so the number of levels is: N=2k+ 1, Where k is the number of dc sources.

To obtain a low distortion output voltage nearly sinusoidal, a triggering signal should be generated to control the switching frequency of each power semiconductor switch .In this paper the triggering signals to multi level inverter (MLI) are designed by using the Alternate Phase Opposition Disposition Pulse Width Modulation (APOD-PWM) technique. A three phase cascaded H-bridge Multi (Seven) Level Inverter has been taken. Fig.1 shows a three-phase Seven-level cascaded Multi Level Inverter. It requires a total of six D.C voltage sources.[4] The simulink model of multi-level inverter is shown in fig2 and the output is shown in fig 3.

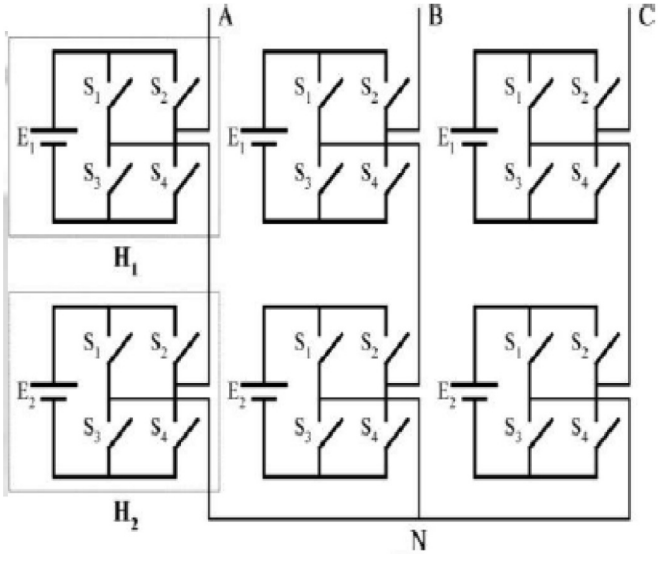


Fig 1: *Three phase asymmetrical 7-level cascaded MLI*

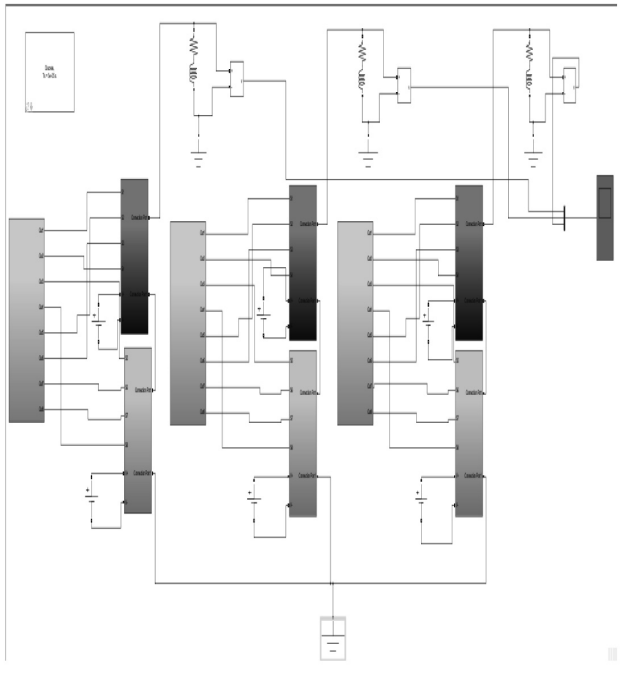


Fig 2: *Simulink Model Of Three phase asymmetrical 7-level cascaded MLI*

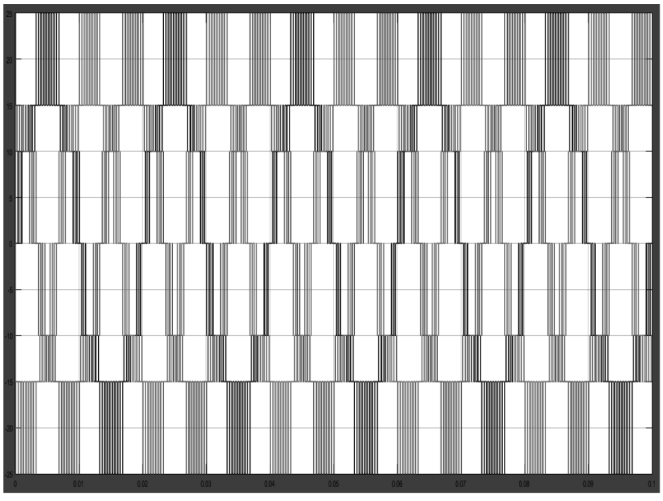


Fig 3: Output of 3-ϕ 7 level cascaded MLI

IV. POWER QUALITY

Power Quality is the concept of powering and grounding sensitive equipment in a matter that is suitable to the operation of that equipment according to IEEE Standard 1100. Power quality is mainly concerned with deviations of the voltage from its ideal waveform (voltage quality) and deviations of the current from its ideal waveform (current quality).Power quality phenomena can be divided into two types, they are 1)Variations 2)Events. Voltage and Current variations are relatively small deviations of voltage or current characteristics around their nominal or ideal values. The two basic examples are voltage magnitude and frequency. Events are phenomena which only happen every once in a while. The duration of the sag depends on the time taken by the circuit protection to clear the fault. High speed tripping is desired to limit the duration of sags[5].

1. Voltage Sag (or dip):

Description: A decrease of the normal voltage level between 10 and 90% of the nominal rms voltage at the power frequency, for durations of 0.5 cycle to 1 minute. Causes: Faults on the transmission or distribution network (most of the times on parallel feeders). Faults in consumer's installation. Connection of heavy loads and start-up of large motors.

Consequences: Malfunction of information technology equipment, namely microprocessor-based control systems (PCs, PLCs, ASDs, etc) that may lead to a process stoppage. Tripping of contactors and electromechanical relays. Disconnection and loss of efficiency in electric rotating machines.

2. Very Short Interruptions:

Description: Total interruption of electrical supply for duration from few milliseconds to one or two seconds.

Causes: Mainly due to the opening and automatic reclosure of protection devices to decommission a faulty section of the network. The main fault causes are insulation failure, lightning and insulator flashover.

Consequences: Tripping of protection devices, loss of information and malfunction of data processing equipment. Stoppage of sensitive equipment, such as Asychronous Drives(ASDs), PCs, Programmable Logic Controllers(PLCs).

Voltage Unbalance:

Description: A voltage variation in a three-phase system in which the three voltage magnitudes or the phase angle differences between them are not equal.

Causes: Large single-phase loads (induction furnaces, traction loads), incorrect distribution of all single-phase

loads by the three phases of the system (this may be also due to a fault).

Consequences: Unbalanced systems imply the existence of a negative sequence that is harmful to all three phase loads. The most affected loads are three-phase induction machines.

3. Harmonic Distortion:

Description: Voltage or current waveforms assume non-sinusoidal shape. The waveform corresponds to the sum of different sine-waves with different magnitude and phase, having frequencies that are multiples of power-system frequency.

Causes: Classic sources: electric machines working above the knee of the magnetization curve (magnetic saturation), arc furnaces, welding machines, rectifiers, and DC motors. Modern sources: all non-linear loads, such as power electronics equipment including ASDs, switched mode power supplies, data processing equipment, high efficiency lighting.

Consequences: Increased probability in occurrence of resonance, neutral overload in 3-phase systems, overheating of all cables and equipment, loss of efficiency in electric machines, electromagnetic interference with communication systems, errors in measures when using average reading meters, nuisance tripping of thermal protections.

4. Noise:

Description: Superimposing of high frequency signals on the waveform of the power-system frequency.

Causes: Electromagnetic interferences provoked by Hertzian waves such as microwaves, television diffusion, and radiation due to welding machines, arc furnaces, and electronic equipment. Improper grounding may also be a cause.

Consequences: Disturbances on sensitive electronic equipment, usually are not destructive, may cause data loss and data processing errors.

5. Overvoltage:

Description: An overvoltage is an increase in the rms ac voltage greater than 110% at the power frequency for a duration longer than 1 minute.

Causes: Switching off a large load and energizing a capacitor bank. Incorrect tap settings on transformers may causes over voltage.

Consequences: The most typical transient overvoltages are caused by the operation of powerful machines. However, the most destructive are caused by atmospheric discharges.

6. Undervoltage:

Description: An undervoltage is a decrease in the rms ac voltage to less than 90% at the power frequency for a duration longer than 1 minute.

Causes: A load switching on or a capacitor bank switching off can cause an undervoltage until voltage regulation equipment on the system can bring the voltage back to within tolerances.

Consequences: Undervoltages cause voltage fluctuation in households and industries, this inturn affects all the appliances connected in the house and industry.

V. MULTI-LEVEL UNIFIED POWER QUALITY CONDITIONER (UPQC)

The unified power-quality conditioner (UPQC) has been widely studied by many researchers as an ultimate device to improve power quality. It is a type of hybrid APF and is the only versatile device which can mitigate several power quality problems related with voltage and current simultaneously therefore is multi functioning devices that compensate various voltage disturbances of the power supply, to correct voltage fluctuations and to prevent harmonic load current from entering the power system. Unified power quality conditioners (UPQCs) consist of combined series and shunt active power filters (APFs) for simultaneous compensation of voltage and current disturbances and reactive power as shown in fig 4.The Series APF compensates source voltage disturbances such as harmonics, dips or overvoltages. The Shunt APF attenuates undesirable load current components such as harmonic currents and fundamental frequency components.

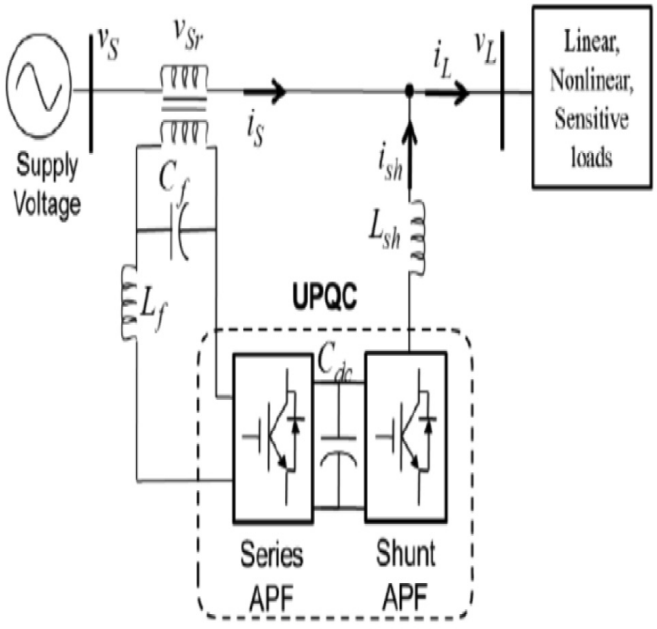


Fig 4: *General Circuit Diagram of UPQC*

In principle, UPQC is an integration of shunt and series APFs with a common self-supporting dc bus. The UPQC, like a UPFC, employs two voltage source inverters that are connected to a common dc energy storage capacitor. One of these two VSIs is connected in series with the ac line while the other is connected in shunt with the same line. Here we use multilevel inverter as voltage source inverters.The shunt inverter in UPQC is controlled in a current control mode such that it delivers a current which is equal to the set value of the reference current as governed by the UPQC control algorithm. Additionally, the shunt inverter plays an important role in achieving required performance from a UPQC system by maintaining the dc bus voltage at a set reference value. In order to cancel the harmonics generated by a nonlinear load, the shunt inverter should inject a current. Similarly, the series inverter of UPQC is controlled in a voltage control mode such that it generates a voltage and injects in series with line to achieve a sinusoidal, free from distortion and at the desired magnitude voltage at

the load terminal. In the case of a voltage sag condition, actual source voltage will represent the difference between the reference load voltage and reduced supply voltage, i.e., the injected voltage by the series inverter to maintain voltage at the load terminal at reference value. The proposed UPQC can be directly connected to the distribution system without series and shunt injection transformer, which struggle with core saturation and voltage drop as shown in fig 5.

ADVANTAGES

- UPQC can compensate both voltage related problems such as voltage harmonics, voltage sags, as well as current related problem like power factor correction, current and load unbalance compensation.
- using a multilevel UPQC prevents use of filters and transformer to compensate voltage sag, unbalance and obtaining unity power factor.
- It is a static device so less maintenance is required.
- No additional energy storage device required for sag compensation.

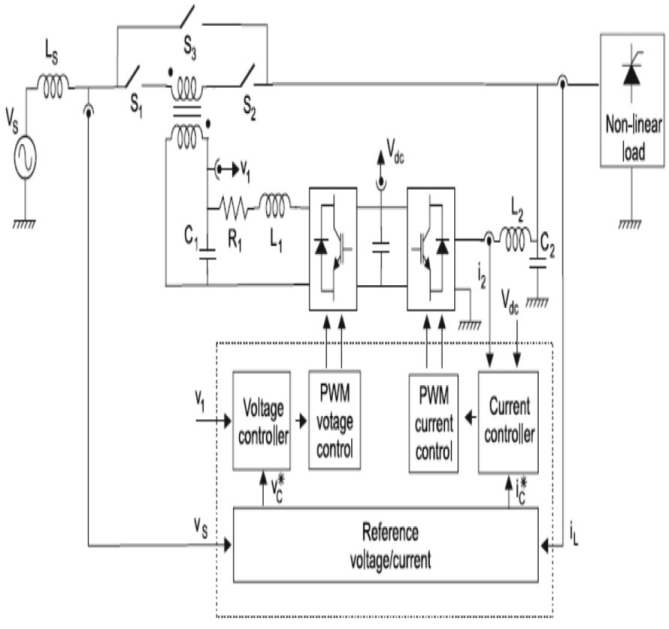


Fig 5: *General Block Diagram Of Project Model*

Application

- Power Quality Improvement
- Power Utility Industry to provide reactive power compensation for voltage regulation.
- To protect sensitive load in a distribution network.

VI. CONCLUSION

Seven level asymmetric cascaded multilevel inverter was implemented using APOD PWM technique in order to reduce the Total Harmonic Distortion (THD) and the basic configuration of a seven level UPQC was designed using MATLAB SIMULINK. UPQC with multilevel inverter can reduce Voltage sag and phase Unbalance problems with better efficiency.

ACKNOWLEDGEMENT

We would like to express our heartfelt gratitude to all those who provided us assistance in completing the project. We would like to acknowledge with much appreciation the crucial role played by Prof. Ipsita Pahi , who has invested her full effort in coordinating our project as well as achieving the goal. We would like to appreciate the guidance given by Dr. Priyanka Kar and Prof. Rabi Narayan Mishra for their valuable inputs and feedback.

REFERENCES

[1] Muhammad H. Rashid, Power Electronics circuits, devices, and applications. 2004 by Pearson Education Inc.

[2] A. Sanghamitra, T.Ramesh Kumar, Power Quality Improvement By Mitigating Voltage Sag and Unbalance By Using Multi-level UPQC, 2016 IJEDR | Volume 4, Issue 3 | ISSN: 2321-9939

[3] Víctor M. Moreno, Alberto Pigazo, Marco Liserre and Antonio Dell'Aquila, Unified Power Quality Conditioner (UPQC) with Voltage Dips and Over-voltages Compensation Capability, RE&PQJ, Vol. 1, No.6, March 2008

[4] L. M. Tolbert, F. Z. Peng and T. G. Habetler, "A multilevel converter-based universal power conditioner,"IEEE Transactions on Industry Applications, vol. 36, no 2, March/April 2000. pp. 596- 603

[5] P.Prasad , Md. Khaja Jainuddin, Y.Rambabu, V.K.R.Mohan Rao,Unified Power Quality Conditioner (UPQC) With Storage Device for Power Quality Problems, International Journal Of Engineering And Science Vol.3, Issue 8 (September 2013), PP 19-26

Amlan Ghose, Sanat Mohapatra, Rishabh Thakur, Lipsit Satpathy, Priyanka Priyadarshini
8th Sem., EEE

Density Based Traffic Signal System

Abstract-*The main objective of this traffic light controller is to provide sophisticated control and coordination to confirm that traffic moves as smoothly and safely as possible. This work makes use of LED lights for indication purpose and a microcontroller is used for auto changing of signal at specified range of time interval. LED lights gets automatically turns on and off by making corresponding port pin of the microcontroller "HIGH". The sensors and photo diodes are used in line of sight configuration across the loads to detect the density at the traffic signal. The density of these vehicles is measured in three zones i.e., low, medium and high, respectively – based on certain time duration allotted at respective zones, accordingly.*

1. INTRODUCTION

Traffic lights were first invented in the year 1868 at London's House of Commons where traffic light signals were placed at intersections of George and Bridge Street. Later the traffic lights were developed in the year 1914 by an American Traffic Signal Company, which fixed green and red lights at corners of the 105th street and Euclid Avenue in Cleveland, Ohio. During this period traffic lights were controlled either by timing or by switching manually [1,2]. Traffic lights are also named as stoplights, road traffic lamps, traffic signals, stop-and-go lights which are signaling devices placed at road crossings, everyday pedestrian crossings and other locations to control competing flows of traffic. Traffic lights have been fixed all over the world in many cities. Traffic light control assigns a right way to the road users by using lights in normal colors (red – amber/yellow – green).Traffic light control system uses a worldwide color code (a specific color order to enable color recognition for those who are color blind).So far we have given the introduction about traffic signals, and therefore a control system is necessary to control these lights in a specific manner. This traffic light control system can be achieved by using a microcontroller to make simple and low-cost system. The main objective of this traffic light controller is to provide sophisticated control and coordination to confirm that traffic moves as smoothly and safely as possible. This project makes use of LED lights for indication purpose and a microcontroller is used for auto changing of signal at specified range of time interval. LED lights gets automatically turns on and off by making corresponding port pin of the microcontroller "HIGH". The sensors used in this work Infrared sensors (IR sensors) and photo diodes are in line of sight configuration across the loads to detect the density at the traffic signal. The density of these vehicles is measured in three zones i.e., low, medium and high, respectively – based on certain time duration allotted at respective zones, accordingly [3,4]. The block diagram of the work shown in figure 1.The hardware components used are given in Table 1.

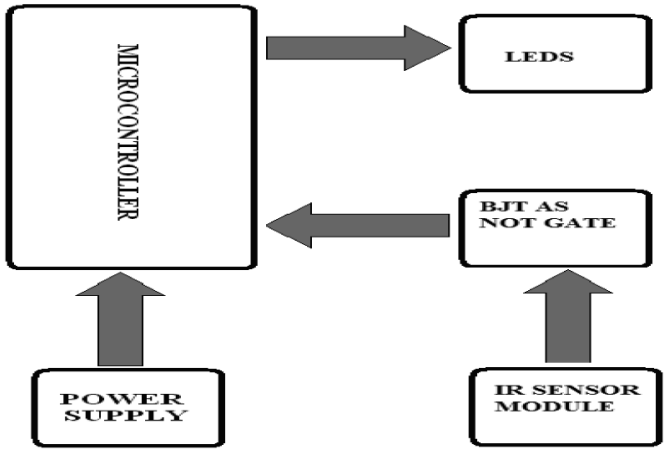


Fig 1.: *Traffic Light Controller using Microcontroller*

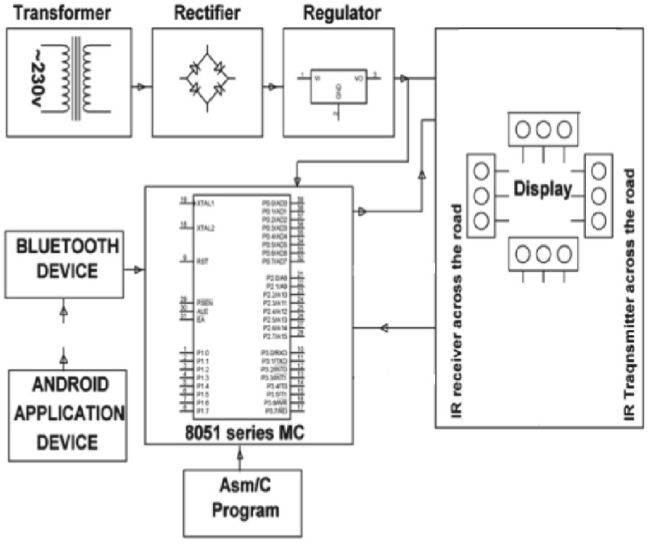


Fig 2.: *Circuit diagram of Traffic Signal Controller*

SI. No.	Name of the components	Type
1.	Transformer	Step down 230/12 V,50hz
7	Bridge Rectifier	Diode(TN4007)
3.	Filter	Capacitive (l000uF)
4.	Voltage Regulator	Zener(LM7805)
5.	Microcontroller	AT89S52
6.	IR Sensor	LED+Photo Diode
7.	Bluetooth	HC05
8.	Android Device	Any

Table 1: *Description of Hardware Components*

2. EMBEDDED SYSTEMS AND MICROCONTROLLERS

An Embedded system is a special-purpose computer-controlled system in which the computer is completely encapsulated by the device it controls. An embedded system has specific requirements and performs pre-defined tasks, unlike a general purpose personal computer. An embedded system is a computer-controlled system. The core of any embedded system is a microcontroller, programmed to perform few tasks (often just one task). Microprocessors and Microcontrollers are widely used in embedded products. Thus, an embedded product uses a microcontroller (or a Microprocessor) to do one task only. Although microcontrollers are the preferred choice for many embedded systems, as a microprocessor is inadequate for the task. For this reason, in recent years many manufactures of general purpose microprocessors, such as Intel, have targeted their microprocessors for the high end of embedded market. It must be noted that when a company targets a general-purpose microprocessor for the embedded market it optimizes the processor used for embedded systems. For this reason, these are often referred as the high-end embedded processors. Most Microcontrollers today based on the Harvard Architecture, which clearly defined the four basic components required for an embedded system. These include a CPU core, memory for the program (ROM or Flash Memory), memory for data (RAM), as well as I/O lines to communicate with external peripherals – all this in a single integrated circuit. The term "Microcontroller" generally refers to the general-purpose microprocessors such as the Intel's x86 family (8086, 8028 etc). These contain no RAM, no ROM, no I/O ports on the chip itself. For this reason, they are commonly referred to as general-purpose microprocessors. A system designer using a general-purpose microprocessor (such as the Pentium) must add RAM, ROM, I/O ports and timers externally to make them functional. Although the addition of external RAM, ROM, I/O ports make this system bulkier and much more expensive, they have advantages of versatility such that the designer can decide on the amount of RAM, ROM, I/O ports needed to fit the task at hand. But this is not the case with the microcontroller. The entire above are Embedded together on one chip. The fixed amount of on-chip RAM, ROM, I/O ports in a microcontroller makes it ideal for many applications in which cost, and space are critical. These microcontrollers have the power of bit-level control for certain I/O operations unlike microprocessor which mostly operate at the byte level. Hence these controllers are sometimes referred to as "itty-bitty processors". A microcontroller differs from a general-purpose CPU chip in that the former generally is quite easy to make in to a working computer, with a minimum of external support chips. The idea is that the microcontroller is placed in the device to be controlled, hooked up to power and any information it needs is provided and that's what it requires [5].

2.1 Microcontroller

The AT89C51 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set. The on-chip flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of flash memory, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a

six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The idle mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

2.2 Light emitting Diodes (LED)

Light-emitting diode (LED) is a semiconductor device that emits visible light when an electric current passes through it. The light is not particularly bright, but in most LEDs, it is monochromatic, occurring at a single wavelength. The output from an LED can range from red (at a wavelength of approximately 700 nanometers) to blue-violet (about 400 nanometers). Some LEDs emit infrared (IR) energy (830 nanometers or longer); such a device is known as an infrared-emitting diode (IRED). An LED or IRED consists of two elements of processed material called P-type semiconductors and N-type semiconductors. These two elements are placed in direct contact, forming a region called the P-N junction. In this respect, the LED or IRED resembles most other diode types, but there are important differences. The LED or IRED has a transparent package, allowing visible or IR energy to pass through. Also, the LED or IRED has a large PN-junction area whose shape is tailored to the application [6].

2.3 IR SENSOR:

Infrared technology addresses a wide variety of wireless applications. The main areas are sensing and remote controls. In the electromagnetic spectrum, the infrared portion is divided into three regions: near infrared region, mid infrared region and far infrared region. The basic concept of an Infrared Sensor which is used as Obstacle detector is to transmit an infrared signal, this infrared signal bounces from the surface of an object and the signal is received at the infrared receiver. Infrared sensors can be passive or active. Passive infrared sensors are basically Infrared detectors. Passive infrared sensors do not use any infrared source and detects energy emitted by obstacles in the field of view. They are of two types: quantum and thermal. Thermal infrared sensors use infrared energy as the source of heat and are independent of wavelength. Thermocouples, pyroelectric detectors and bolometers are the common types of thermal infrared detectors. Quantum type infrared detectors offer higher detection performance and are faster than thermal type infrared detectors. The photosensitivity of quantum type detectors is wavelength dependent. Quantum type detectors are further classified into two types: intrinsic and extrinsic types. Intrinsic type quantum detectors are photoconductive cells and photovoltaic cells. Active infrared sensors consist of two elements: infrared source and infrared detector. Infrared sources include an LED or infrared laser diode. Infrared detectors include photodiodes or phototransistors. The energy emitted by the infrared source is reflected by an object and falls on the infrared detector [7].

2.4 IR Transmitter

Infrared Transmitter is a light emitting diode (LED) which emits infrared radiations. Hence, they are called IR LED's. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye. There are different types of infrared transmitters depending on their wavelengths, output power and response time. A simple infrared transmitter can be constructed using an infrared LED, a current limiting resistor and a power supply [4,6].

2.5 IR Receiver

Infrared receivers are also called as infrared sensors as they detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors. Infrared Photodiodes are different from normal photo diodes as they detect only infrared radiation. The picture of a typical IR receiver or a photodiode is shown in figure 3. Different types of IR receivers exist based on the wavelength, voltage, package, etc. When used in an infrared transmitter – receiver combination, the wavelength of the receiver should match with that of the transmitter. It consists of an IR phototransistor, a diode, a MOSFET, a potentiometer and an LED. When the phototransistor receives any infrared radiation, current flows through it and MOSFET turns on. This in turn lights up the LED which acts as a load. The potentiometer is used to control the sensitivity of the phototransistor [5,7]. The circuit diagram of the traffic signal controller is shown in figure 2. The hardware model incorporating all the components is shown in figure 4.

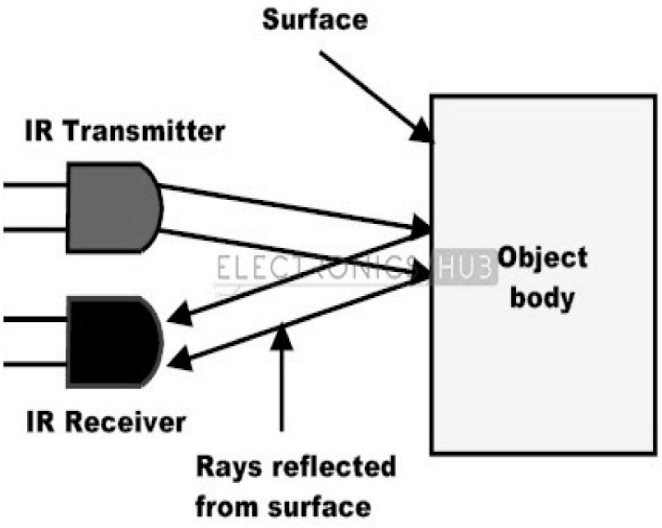


Fig 3: *IR transmitter and Receiver*

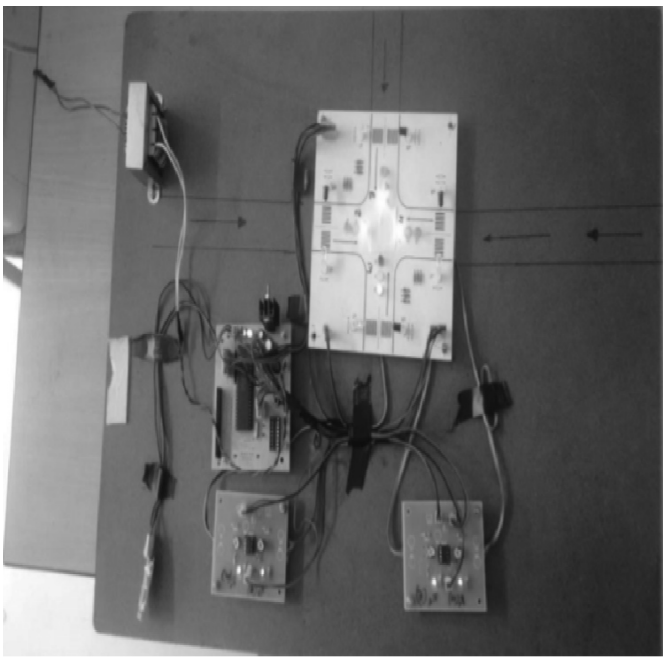


Fig 4: *Hardware Model for Traffic Light Control*

3. CONCLUSION

This work can be widely used in industries for wireless option. It can be used to control any device which is operated by AC or DC. The mother board relates to PC by USB protocol which is working properly. In the proposed system we tried to minimize the traffic waiting time at the intersection. Based on our study we found the biased nature of traffic towards a outgoing lane. To provide Greener light interval to such lane as well as allowing incoming traffic irrespective of their lane to cross the intersection simultaneously through a common outgoing lane, we proposed a Four Way Road Intersection Model. The evaluation results show that the proposed system is better than the existing one as it utilizes the Green light more efficiently by allowing more number of vehicles to cross the intersection in one signal cycle. Also, the proposed system frequently switches the Green light among four lanes, so it reduces the waiting time of traffic as well.

REFERENCES

1. Vivek Tyagi, Shivakumar Kalyanaraman, and Raghuram Krishnapuram, "Vehicular Traffic Density State Estimation Based On Cumulative Road Acoustics" IEEE Transaction on Intelligent Transportation System.Vol.23. No.3 September 2012
2. K.Thatsanavipas,N.Ponganunchoke ,et al., "Wireless Traffic Light Controller"2nd International Science, Social Science, Engineering and Energy Conference 2010:Engineering Science and Management.
3. Wanjing MA and Xiaoguang YANG "Design and Estimation of an Adaptive Bus Signal Priority System Base on Wireless Sensor Network "Proceeding of the 11th International IEEE Conference on Intelligent Transportation Systems.
4. Hikaru Shimizu, Masa-aki Kobayashi, Haruko," A Development of Deterministic Signal Control System in Urban Road Networks" in SICE Annual Conference 2008 The University of Electro-Communications Japan
5. Muhammad Hassam Malhi, Muhammad Hassan Aslam et al., "Vision Based Intelligent Traffic Management System" IEEE Computer Society 2011 Frontiers of Information Technology
6. H.R.Kashani and G.N.Saridis "Intelligent Control for Urban Traffic Systems" International Federation of Automatic Control Automatica, vol.19.
7. Umar Farooq, Hafiz Muhammad Atiqs, Muhammad Us man Assad et al.," Design and Development of an Image Processing Based Adaptive Traffic control System" IEEE Computer Society 2011Second International Conference on Machine Vision.

Kritty Simran, Madhup Satyam, Deepak Hembram.
7th Sem, AEI

Determination Of Market Clearing Price Of A Deregulated Power System Using Differential Evolution Algorithm

Abstract: *The main purpose of this work is to investigate how different kinds of Generation biddings are formulated and optimized such as the deterministic Market Clearing Price (MCP). The electricity market comprises of many activities which include Generation, Transmission, Distribution and Metering .In a Deregulated electric market, offering the appropriate amount of electricity at the right time with the right bidding price is of paramount importance for utility companies maximizing their profits. Mid-term Electricity Market Clearing Price (MCP) forecasting has become essential for resources reallocation, Maintenance Scheduling, Bilateral Contracting, Budgeting and Planning. This kind of scheduling, if implemented, could help the consumer regulate the cost while being beneficial for the distribution company in evening out the distribution of power without overloading the line.*

1. INTRODUCTION

Deregulation of the power market the electric supply in many countries has a natural monopoly without any limitations. This affects the consumers because the elec¬tric supply cost will not be in an optimized form. So it is necessary to define the electricity market models for bal¬ancing the prices, short-term forward transactions and spot. Restructuring of the power industry mainly aims at abolishing the monopoly in the generation and trading sectors, thereby, introducing competition at various levels wherever it is possible. But the sudden changes in the electricity markets have a variety of new issues such as oligopolistic nature of the market, supplier's strategic bidding, market power misuse, price-demand elasticity and so on. Theoretically, in a perfectly competitive market, supplier should bid at their marginal production cost to maximize payoff. However, practically the electricity markets are oligopolistic nature, and power suppliers may seek to increase their profits by bidding a price higher than marginal production cost. Knowing their own costs, technical constraints and their expectation of rival and market behaviour, suppliers face the problem of constructing the best optimal. With this process the total demand that can be met and the individual generations accepted loads supplied can be decided fairly easily . This is known as a strategic bidding problem. We often witness a high and non-uniform power requirement in a handful of hours in each day during the year, primarily during hot summer days. This often leads to frequent overloading and thereby power cuts and low voltage supply. This problem can be sorted out if the customers are encouraged to schedule their loads to make their power requirements uniform and more predictable. Differential Evolution is a very simple population based, stochastic function minimiser which is very powerful at the same time, it is easy for objective functions that are non-differentiable, non-continuous, non-linear, noisy, flat, multi-dimensional or have many local minima, constraints or stochasticity. The stepped bids in use are approximations of the true cost function of the generating units.[1]

1.2 Need for Restructuring of Power System:

- Reduction in Final cost of the Power Delivered
- Increased Efficiency in Power Generation, Transmission and Distribution
- Profit Maximization of Generating Companies
- Managerial Inefficiencies of the Regulating Companies
- Public and private sector Co-ordination for Increased Competition
- Customer-centric service and Innovation

1.3 Problems Involved In Deregulated Power System:

Deregulation is the process of removing or reducing state regulations. It is therefore opposite of regulation, which refers to the process of the government regulating certain activities. The basic idea of restructuring includes introducing competitive energy markets, unbundling electricity services and opening access to the network. The objective of restructuring is to provide better options for industrial contributors and to introduce revolutions with improved quality service and choice to the customers at economical prices. Energy prices are not regulated in these deregulated areas and consumers are not forced to receive supply from their utility [3]. Deregulation allows competitive energy suppliers to enter the markets. Deregulation gives consumers choice - the power of the buyer. A deregulated market allows you to choose your commodity supplier. Restructuring comprises different activities; changing existing companies corporation, privatization and dissociation.

1.3.1. Network Congestion

Transmission congestion occurs when there is insufficient energy to meet the demands of all customers. It happens when scheduled market transactions (generation and load) result in power flow over a transmission element that exceeds the available capacity for that element. Since grid operators must ensure that physical overloads do not occur, they will dispatch generation so as to prevent them. Attempting to operate a transmission system beyond its rated capacity is likely to result in

line faults and electrical fires, so this can never occur. The congestion is actually a shortage of transmission capacity to supply a waiting market, and the condition is marked by systems running at full capacity and proper efficiency which cannot serve all waiting customers. The deregulated market set up is shown in figure 1.

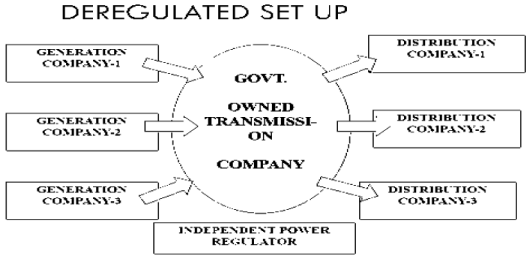


Fig 1: *De-regulated market set up*

2. PROBLEM STATEMENT

In this work, uncertainty of bid price of rivals uncertainty of demand distribution function which denotes probability that block 'i' will be sold if it was offered at price supplier must forecast the rivals bid price on previous data. Temporality is due to consumer response with price change. Consider a system consist of 'm' suppliers participating in a pool- based single-buyer electricity market in which the sealed auction with a uniform Market Clearing Price (MCP) is employed. Assume that each supplier is required to bid a linear supply function to the pool. The jth supplier bid with linear supply curve denoted by Gj(Pj) = aj + bjPj for j = 1, 2, . . .,m, where Pj is the active power output, aj and bj are non-negative bidding coefficients of the jth supplier.

The electrical loads are taken and we tried to minimize the cost if generation based bidding strategy is considered. Electrical loads are responsive as well as non responsive. Responsive loads are those which can be scheduled in order to minimize the cost. Non responsive loads cannot be scheduled, they have pre defined hours of operation.

Approach towards the problem:-

$$G_j(P_j) = \sum_{j=1}^{m} a_j + b_j$$

where P_j is the active power output, and

a_j & b_j are non-negative bidding coefficients of the jth supplier.

$a_j + b_j P_j$=R , j=1,2,3,…,m

$\sum_{j=1}^{m} P_j$ = Q(R)

$P_{min,j} \le P_j \le P_{max,j}$ j=1,2,3,…,m

Where R is the Market Clearing Price(MCP) of electricity to be determined, Q(R) is the aggregate pool load forecast as Q(R)=Q_0- KR

Where Q_0 is a constant number and K is a non-negative constant used to represent the load price elasticity

$$R = \frac{Q_0 + \sum_{j=1}^{m} (a_j/b_j)}{K + \sum_{j=1}^{m} (1/b_j)} \quad , \qquad P_j = \frac{R - a_j}{b_j}$$

j=1,2,3,…,m

MAX F(a_j , b_j)=R P_j-C_j(P_j)

$$C_j(P_j) = e_j P_j + f_j P_j^2$$

where e_j & f_j are cost coefficients. Pmin,j and Pmax,j are the generation output limits of the jth supplier. If the solution of the Eq. exceeds the maximum limit Pmax,j, Pj is set to Pmax,j. When Pj is less than Pmin,j, Pj is set to zero and relevant supplier is removed from the problem as a non- competitive participant for that hour. The jth supplier has the cost function denoted by Cj(Pj) = ejPj + fjPj2 , where ej and fj are the cost coefficients of the jth supplier. In a perfectly competitive market, aj = ej and bj = fj. The profit maximization objective of supplier j (j=1,2,…, m) in a unit time for building bidding strategy can be described by the maximized function F(aj, bj).

3 PROPOSED ALGORITHM:

3.1 Basic Operators of DE Algorithm:

- Reproduction: It is usually the first operator applied on population. Chromosomes are selected from the population of parents to cross over and produce offspring. It is based on Darwin's evolution theory of "Survival of the fittest". Therefore, this operator is also known as 'Selection Operator'.
- Cross Over: After reproduction phase, population is enriched with better individuals. It makes clones of good strings but does not create new ones. Cross over operator is applied to the mating pool with a hope that it would create better strings.
- Mutation: After cross over, the strings are subjected to mutation. Mutation of a bit involves flipping it, changing 0 to 1 and vice-versa. The flowchart is shown in figure2.

3.2 Basic Diffrential Evolution Algorithm:

- Step 1: Represent the problem variable domain as a chromosome of a fixed length, choose the size of a chromosome population N, the crossover probability pc and the mutation probability pm.
- Step 2: Define a fitness function to measure the performance, or fitness, of an individual chromosome in the problem domain. The fitness function establishes the basis for selecting chromosomes that will be mated during reproduction.

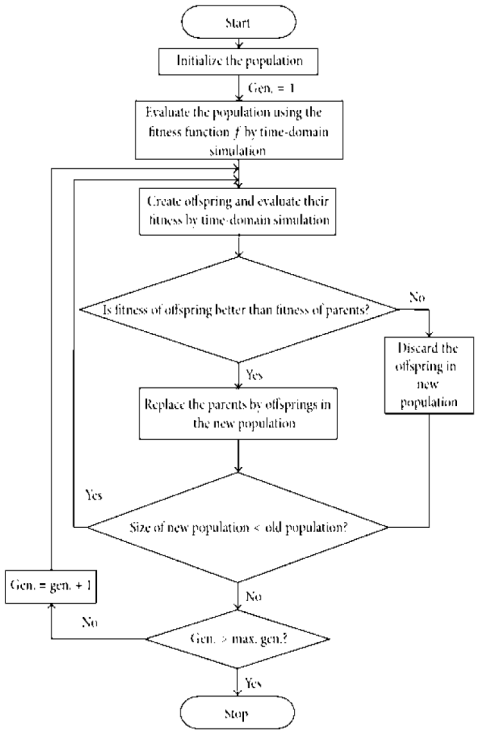


Fig 2: *Flowchart of Differential Evolution Algorithm*

Electricity charge for common Domestic consumer consuming 200 kwh per month with 2 kw load

	State	Latest Tariff revised on	Fixed Charge (Rs/KWH)	Energy Charge (Rs/KWH)	Total Charge (Rs/KWH)
1	Delhi	1.7.14	0.20	4.00	**4.33**
2	Uttar Pradesh	18.6.15	0.45	4.54	**4.99**
3	Haryana	7.5.15	-	4.14	**4.14**
4	Rajasthan	20.2.15	1.00	3.66	**4.66**
5	West Bengal - CESC	4.3.15	0.10	**6.46**	**6.56**
6	Andhra Pradesh	23.3.15	-	4.09	**4.09**
7	Maharashtra	26.5.15	0.20	3.13	**3.33**
8	Tamil Nadu	11.12.14	0.10	4.05	**4.15**
9	Bihar	28.2.14	0.50	3.18	**3.68**
10	Karnataka	2.3.15	0.35	3.55	**3.90**
11	Odisha	23.3.15	0.50	4.28	**4.78**
12	Chhattisgarh	23.5.15	-	3.08	**3.08**
13	Gujrat - Torrent	31.3.15	0.13	3.73	**3.85**
14	Gujarat-PGVCL	31.3.15	0.08	3.81	**3.89**
15	Punjab	5.5.15	0.52	5.33	**5.85**
16	Himachal Pradesh	10.4.15	0.25	3.84	**4.09**
17	Kerala	16.8.14	0.10	3.58	**3.68**
18	Assam	21.11.14	0.15	5.47	**5.62**
19	Uttrakhand	22.12.14	0.23	3.15	**3.38**
20	Madhya Pradesh	17.4.15	0.40	4.46	**4.86**
21	Goa	6.4.15	0.10	1.60	**1.70**
22	Sikkim	31.3.15	1.58	2.56	**4.14**
23	Tripura	25.6.15	0.25	5.31	**5.56**
24	Jhakhand	1.8.12	0.20	2.40	**2.60**
25	J&K	1.4.13	-	1.77	**1.77**

Table-1: *Electricity prices for different states of India*

- Step 3: Randomly generate an initial population of chromosomes of size N:

  x1, x2 , . . . , xN
- Step 4: Calculate the fitness of each individual chromosome:

  f (x1), f (x2), . . . , f (xN)
- Step 5: Select a pair of chromosomes for mating from the current population. Parent `chromosomes are selected with a probability related to their fitness.
- Step 6: Create a pair of offspring chromosomes by applying the genetic operators - crossover and mutation.
- Step 7: Place the created offspring chromosomes in the new population.
- Step 8: Repeat Step 5 until the size of the new chromosome population becomes equal to the size of the initial population, N.
- Step 9: Replace the initial (parent) chromosome population with the new (offspring) population.
- Step 10: Go to Step 4, and repeat the process until the termination criterion is satisfied.

Electricity is not economically storable and production is subject to rigid short-term capacity constraints. Since demand is highly variable, this means there will be times when there is plenty of capacity and the only incremental costs of producing electricity will be fuel and some operating and maintenance (O&M) costs. At other times, the capacity constraint will be binding, causing the incremental cost to increase greatly, and wholesale market prices to rise. Supply constraints are even more likely if sellers are able to exercise market power, understanding the volatility of wholesale prices. The result of this structure is that the wholesale price of electricity, reflecting the supply/ demand interaction, varies constantly. In most markets, the wholesale price changes every half-hour or hour. The end-use customer, however, sees the retail price, which typically is constant for months at a time. The retail price does not reflect the hour-by-hour variation in the underlying wholesale cost of electricity. A number of programs have been implemented or proposed to make the economic incentives of customers more accurately reflect the time-varying wholesale cost of electricity [2,4].

5. RESULTS AND DISCUSSION

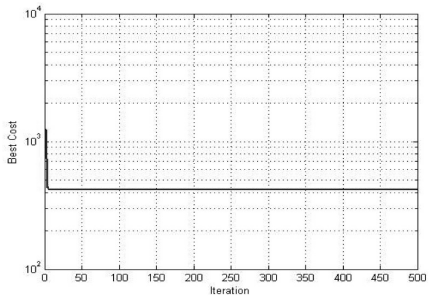


Fig 3: *Generation Bidding Optimized Plot*

Iteration 1: Best Cost = 1232.7405

Iteration 2: Best Cost = 1232.7405

Iteration 3: Best Cost = 435.313

Iteration 4: Best Cost = 435.313

Iteration 5: Best Cost = 435.313

Iteration 6: Best Cost = 422.876

Iteration 7: Best Cost = 422.876

Iteration 8: Best Cost = 422.876

Iteration 9: Best Cost = 422.876

Iteration 10: Best Cost = 422.876

Iteration 11: Best Cost = 422.876

Iteration 491: Best Cost = 421.875

Iteration 492: Best Cost = 421.875

Iteration 493: Best Cost = 421.875

Iteration 494: Best Cost = 421.875

Iteration 495: Best Cost = 421.875

Iteration 496: Best Cost = 421.875

Iteration 497: Best Cost = 421.875

Iteration 498: Best Cost = 421.875

Iteration 499: Best Cost = 421.875

Iteration 500: Best Cost = 421.875

Above optimized bidding coefficient will give the minimum cost of electricity generation for Gencos as shown in figure 3.

Presently, India is 6th largest among all countries in terms of power generation. The power sector in India is mainly governed by the Ministry of Power. There are three major pillars of power sector these are Generation, Transmission, and Distribution. As far as generation is concerned it is mainly divided into three sectors these are Central Sector, State Sector, and Private Sector. At the end of December 2012, the installed power generation capacity of India stood at 210951.72MW, while the per capita energy consumption stood at 733.54 KWh (2008-09). The Indian government has set an ambitious target to add approximately 78,000 MW of installed generation capacity by 2012. The total demand for electricity in India is expected to cross 950,000 MW by 2030. Electricity losses in India during transmission and distribution are extremely high, about 28.44% (2008-09). India needs to tide over a peak power shortfall of 13% between 5pm and 11pm by reducing losses due to theft and pilferage.. Due to shortage of electricity, power cuts are common throughout India and this has adversely effected the country's economic growth. Theft of electricity, common in most parts of urban India, amounts to 1.5% of India's GDP. The condition of utilities are not good either, cumulative loss of 110 power utilities are estimated as Rs 86,136 Crores which is expected to to rise to Rs 1,16,089 Crores by 2014-15. Despite an ambitious rural electrification program, some 400 million Indians lose electricity access during blackouts. While 84.9% of Indian villages have at least an electricity line, just 46 percent of rural households have access to electricity [5].

6. CONCLUSIONS:

This work presents a method to find out minimum cost of electricity for a upper middle class household. The rescheduling of generation and load resources and corresponding pricing have been added with a new dimension to the operation of power market as well as system operation after deregulation The determination of market clearing price of a deregulated power system has fast changing cyclic marginal prices and overcomes all the cons of the regulated system. The network constraints are added to the optimization problem so that the most economic nodal injection pattern is obtained without creating congestion. Bidding problem formulation depends upon the market model, type of bidding protocol, auction mechanism and estimation technique of rivals' bidding behavior. Using different algorithms optimized bidding co-efficient can be determined.

REFERENCES

[1] M.Prabavathi, R.Gnanadass "Bidding Strategies For Indian Restructured Power Market" (ICCPCT-2013), IEEE Transactions on Power Systems pp. 568-573,vol-7,2014.

[2] J.Vijaya Kumar, D.M. Vinod Kumar "Generation Bidding Stratergy In A Pool Based Electricity Market Using Shuffled Frog Leaping Algorithm", Elsevier(2014) 407-414.

[3] M. Prabavathi, R. Gnanadass "Energy Bidding Strategies For Restructured Electricity Market" Electrical Power And Energy Systems 64 (2015) 956–966

[4] R.K. Rajput, "A Textbook Of Power System Engineering",(2015) 258–339

[5] O.L.Elgerd, "Electric Energy Systems Theory",(2007) TMH Edition

Rajnish Ranjan Jha, EEE

Energy Efficient Routing Protocol For Heterogeneous Wireless Sensor Network

Abstract-*Wireless sensor networks are formed by a large number of sensor nodes. These nodes are effective in gathering information from the environment. In this work we have studied the impact of heterogeneity of nodes. We have assumed some of the nodes as cluster heads which transmit the data to the sink. We have taken some probability of the nodes having higher energy levels thereby creating a heterogeneous network. Heterogeneity results in unstable behavior of the network when one node dies. We have studied the Stability election protocol for heterogeneous network and implemented it with the help of hybrid of LEACH and PEACH.*

Keywords:- MEMS, LEACH,PEACH,SEP

I. INTRODUCTION

With recent advancements and developments in micro electro mechanical system (MEMS) technologies, low-cost low-power wireless micro sensor nodes have become popular. A sensor node has one or more sensors, a general purpose processor of limited computing power and memory, and a radio transceiver operating on battery. By deploying sensor nodes to compose a sensor network, one can remotely collect information on the behavior, condition, and position of the entities in the target area. A sensor network consists of a large number of tiny autonomous sensor nodes. The basic components of a sensor node are sensing unit, processing unit, radio unit, and power unit. The data collected by the sensor nodes are sent to the base station (BS) through wireless communication. The base station summarizes the collected data and presents them to the user or sends them to the remote host. Classical algorithms like Direct Transmission [3] and Minimum Transmission Energy [4] do not ensure an efficient network. In DT at the same time all the nodes transmit their information to the sink. This implies that the nodes present far away from the sink will die first. In MTE data is transmitted over low cost routes. Here nodes which are present close to the sink act as relays and die first. A proposed [5] solution called LEACH ensures uniform consumption of energy. As per LEACH information is transmitted through cluster heads. Here we have implemented a more energy efficient solution which uses PEACH [6] and LEACH both for a Heterogeneous Wireless Sensor Networks (WSN).

II. HETEROGENEOUS MODEL

A heterogeneous model unlike a homogeneous model has few of its nodes at different energy levels. This can be achieved by installing batteries of different values. For this purpose, we have considered 'm' fraction of nodes to be having 'a' times more energy than the normal nodes. These more powerful nodes are being referred as 'Advanced' nodes.

The energy model

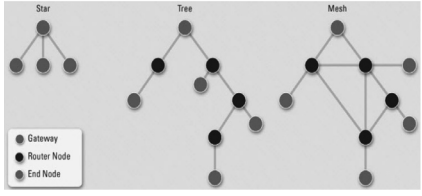


Fig. 1.: *WSN Network for radio communication*

According to the radio energy dissipation model illustrated in Figure 1, to achieve an acceptable Signal-to-Noise Ratio (SNR) in transmitting an L−bit message over a distance d, the energy expended by the radio is given by [1]:

$$E_{Tx}(l,d) = L.E_{elec} + L.\epsilon_{fs}.d^2 \text{ Where } d \leq d_0$$

where E_elec is the energy dissipated per bit to run the transmitter or the receiver circuit, ϵ_{fs} depend on the transmitter amplifier model we use, and d is the distance between the sender and the receiver by equating the two expressions at $d = d_0$, we have

$$d_0 = \sqrt{\frac{\epsilon_{fs}}{\epsilon_{mp}}}$$

Assume an area $A = M \times M$ square meters, and n the number of nodes that are uniformly distributed over that area. For simplicity, assume the sink is located in the center of the field, and that the maximum distance of any node to the sink is ≤ d0. Thus, the energy dissipated in the cluster head node during a round is given by the following formula:

$$E_{CH} = L.E_{elec}\left(\frac{n}{k} - 1\right) + L.E_{DA}.\frac{n}{k} + L.E_{elec} + L.\epsilon_{fs}.{d_{toBS}}^2$$

where k is the number of clusters, E_{DA} is the processing (data aggregation) cost of a bit per signal, and d_{toBS} is the distance between the cluster head and the sink. The energy used in a non-cluster head node is equal to:

$$E_{nonCH} = L.E_{elec} + L.\epsilon_{fs}.d^2{}_{toCH}$$

Where d_{toCH} is the distance between a cluster member and its cluster head. If the nodes are uniformly distributed, it can be shown that:

$$E[d^2{}_{toCH}] = \iint (x^2 + y^2)\rho(x,y)d_x\, d_y = \frac{M^2}{2.\pi.k}$$

Where ρ (x, y) is the node distribution.

The energy dissipated in a cluster per round is the following:

$$E_{cluster} \approx E_{Ch} + \frac{n}{k}E_{nonCH}$$

The total energy dissipated in the network is equal to:

$$E_{tot} = L.(2n.c + n\, E_{DA} + \epsilon_{fs}(k.d_{toBS}{}^2 + n\frac{M^2}{2.\pi.k}))$$

The cluster head selection step

In the set-up phase a fixed portion of sensors stochastically select themselves as cluster-heads as described in [6, 7], have analyzed the cluster-head population problem in wireless sensor network. To select the cluster-heads each node determines a random number between 0 and 1. If the number is smaller than a threshold, the node becomes a cluster-head for the current round. The threshold of node n, T(n), is set as follows:

$$T(n) = \frac{p}{1 - p \times (rmod\frac{1}{p})}$$

With P as the probability of being a cluster-head, r as the number of the current round, and G as the set of nodes that have not been a cluster-head in the last 1/P rounds. This algorithm ensures that every node becomes a cluster-head exactly once within 1/P rounds.

Each node electing itself as a cluster-head for the current round broadcasts an advertisement message to other nodes. The non-cluster-head nodes must keep their receivers on during this step of set-up phase to hear the advertisements from the cluster-heads.

The main cluster head selection step

After the cluster-head selection step is over, the main cluster-head selection step is started to select a cluster-head communicating with the BS. The main cluster-head is the one with the smallest distance to the BS among the cluster-heads. If any two cluster-heads have the same distance to the BS, the one with the larger remaining energy is selected.

The proxy node creation step

A proxy node is selected using the NP (node position) and RE(remaining energy) value of the received response messages. A proxy node is selected if the RE of cluster-head is smaller than the threshold. The cluster-head elects a node as a proxy node which has the smallest NP and largest RE among the member nodes of the cluster. Each cluster-head receives the messages from the nodes that would like to be included in the cluster. Based on the number of nodes in the cluster, the cluster-head creates a TDMA schedule telling when each node can transmit the data. The TDMA schedule may differ between the clusters since it depends on the number of member nodes in the cluster. To accomplish the TDMA transmission, all nodes must be perfectly synchronized in time. The schedule and identification of the proxy node are broadcast to the nodes in the cluster [3,4].

When the energy of a particular cluster head drops less than a specific value a proxy node has to be deployed to replace. The specific value of called the Threshold value. This is calculated as

K=nm

$$E_{CH} = E_{elec} \times k + \epsilon_{amp} \times k \times d_{CH}{}^2$$

III. RESULTS

A. Homogeneous Network

As we can see clearly from the figure 2 that after 900 rounds, nodes start dying which means their battery starts getting dead.

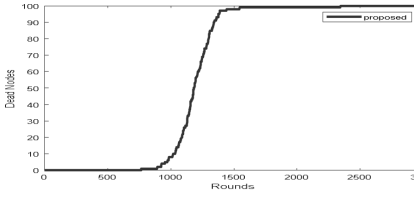


Fig 2: *Dead nodes around 900th round*

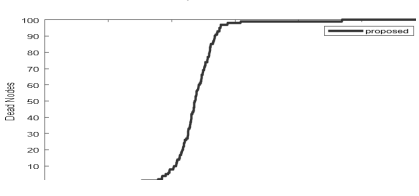


Fig 3: *Application of PEACH PROTOCOL*

We can see from the figure3, due to the application of PEACH protocol there is an uniformity in the number of packets of information sent to the base station from the cluster head. PEACH ensures that when a cluster head dies it is replaced by another cluster head.

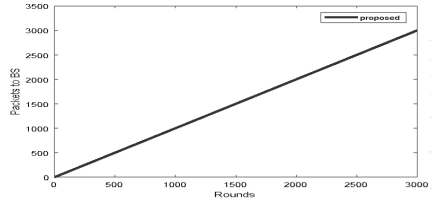


Fig 4: *Decrease of cluster heads*

Since here we haven't applied PEACH protocol to the normal nodes, we can clearly see that packets sent to the cluster head decreases with the number of rounds as the number of normal nodes die as shown in figure 4.

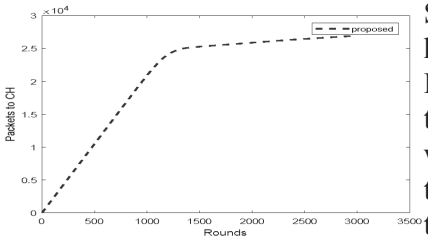


Fig 5: *Decrease in packets*

Since here we haven't applied PEACH protocol to the normal nodes, we can clearly see that packets sent to the cluster head decreases with the number of rounds as the number of normal nodes die shown in figure 5.

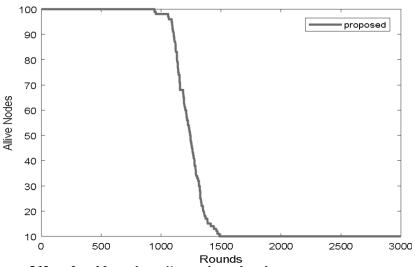


Fig 6: *Deah of nodes in heterogenous networks*

As we can see clearly from the above graph that after 1000 rounds, nodes start dying which means their battery starts getting dead as shown in figure 6.

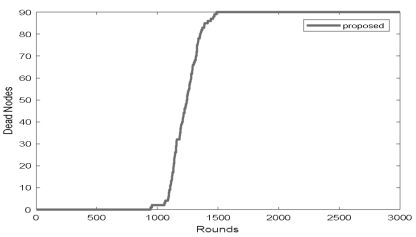


Fig 7: *Alive nodes uto 1000 rounds*

Upto 1000 all the nodes are alive, therefore the number of dead nodes are zero. At round number 1500 all the nodes are dead as shown in figure 7.

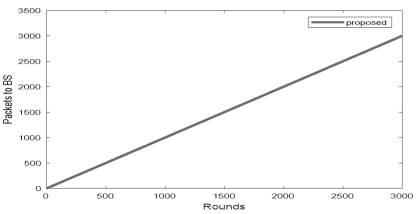


Fig 8: *Application of PEACH PROTOCOL*

We can see from the figure, due to the application of PEACH protocol there is an uniformity in the number of packets of information sent to the base station from the cluster head. PEACH ensures that when a cluster head dies it is replaced by another cluster head as shown in figure 8.

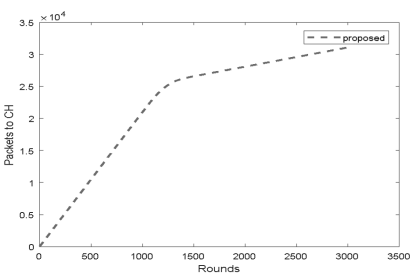


Fig 9: *Decrease in cluster head*

Since here we haven't applied PEACH protocol to the normal nodes, we can clearly see that packets sent to the cluster head decreases with the number of rounds as the number of normal nodes die as shown in figure 9

IV. CONCLUSION

We have proposed a more energy efficient solution for data transmission in a heterogeneous wireless sensor network. Our proposed scheme takes help of existing protocols like LEACH and PEACH and takes the help of SEP (stable election protocol) for its purpose. We have done a comparative analysis of Homogeneous and Heterogeneous networks and proved Heterogeneous network to be more energy efficient.

REFERENCES

1. N. Javaid, T. N. Qureshi, A.H. Khan, A. Iqbal, E. Akhtar, M. Ishfaq, "EDDEEC: Enhanced Developed Distributed Energy-efficient Clustering for Heterogeneous Wireless Sensor Networks", International Workshop on Body Area Sensor Networks (BASNet-2013), pp. 1877-0509, 2013.
2. Georgios Smaragdakis Ibrahim Matta Azer Bestavros, "A stable election protocol for heterogeneous wireless sensor networks", Technical Report BUCS, March 2004.
3. W. R. Heinzelman, A. Chandrakasan, and H. Balakrishnan. Energy-efficient communication protocol for wireless micro sensor networks. In Proceedings of the 33rd Hawaii International Conference on System Sciences (HICSS-33), January 2000.
4. T. J. Shepard. A channel access scheme for large dense packet radio networks. In Proccedings of ACM SIGCOMM, pages 219–230, September 1996.
5. W. R. Heinzelman, A. P. Chandrakasan, and H. Balakrishnan. An application-specific protocol architecture for wireless microsensor networks. IEEE Transactions on Wireless Communications, 1(4):660–670, October 2002.
6. K.T. Kim and H.Y. Youn, "PEACH: Proxy-Enable Adaptive Clustering Hierarchy for Wireless Sensor network", Proceeding of The 2005 International Conference On Wireless Network, pp. 52-57, June 2005.
7. L.M. Feeney, "An Energy-Consumption Model for Performance Analysis of Routing Protocols for Mobile Ad Hoc Networks," ACM J. Mobile Networks and Applications, vol. 3, pp. 239-249, March 2001.

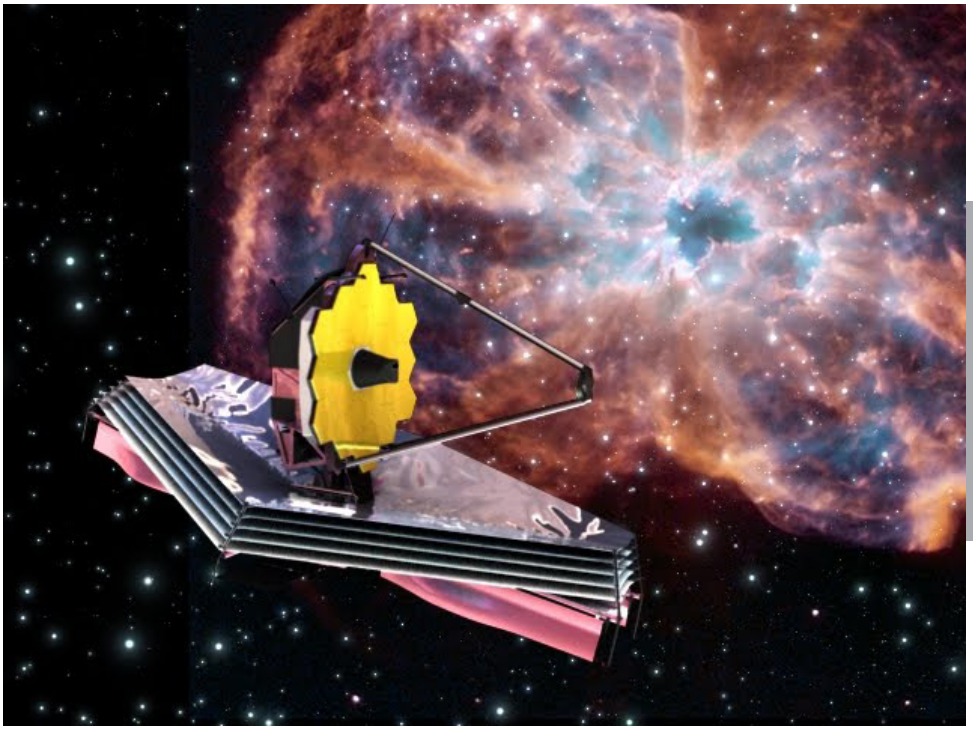
Ashutosh Pathy, Deelip Kumar, Anshuman Badapanda, Debi Prasad Ojha, Bhabani Rath and Soumya Ranjan Samal,
ETC

Youyou Tu was born on 30th December, 1930, on China's east coast which was filled with rich culture and over seven thousand years of history. Her father worked in a bank, while her mother looks after Tu along with her four brothers. She attended the best schools in the Ningbo region, which was her local region. She went to Ningbo Chongde Primary School for her primary education at the age of six. Later, she went to Ningbo Maoxi Primary School for two years and then to Qizheng Middle School followed by Ningbo Yongjiang Girls' School, which were also in the locality.At the age of 16, Tu unfortunately contracted tuberculosis and had to take a two-year break in 1946. After two years of complete treatment, she resumed her schooling from Ningbo Xiaoshi High School and later went on to Ningbo High School. At the age of 21, Tu was determined to pursue a career in medicine.

In the December of 1954, China Academy of Chinese Medical Sciences (CACMS) completed 60 years. In the next year, Tu was hired by the Institute of Chinese Material Medica. Her first research project was on a traditional Chinese medicine, Lobelia chinesis. It is used for the treatment of Schistomiasis, a disease caused by flat worms. She also co-authored a report on Lobelia with her mentor, Lou Zhicen. Later on she also did a study on Radix Stellarie, which was used to treat fevers. By this time, malaria has become a life-threatening disease. It was effectively treated and controlled by chloroquine and quinolines till the late 1960s.Then the development of drug-resistant plasmodium falciparum became a huge threat. In order to eradicate malaria globally, various measures were being taken. In early 1969, the Institute of Chinese Materia Medica appointed Tu to head and build a 'Project 523' research group, whose primary objective is to find a cure for malaria among Chinese medicines.

After going through a rigorous no. of books, collecting a large no. of herbs and going through a no. of animal prescriptions, on October 4, 1971, Tu and her team observed sample number 191 being 100% effective against the malaria parasites. After separating the toxic acidic portion, finally the clinical trial was done in Hainan province between August and October 1972, which was success treating 21 people.

Tu was honoured with a lot of achievement awards, such as National Scientific Discovery Award, the Invention Award, Highest Honorary Award of China Academy of Traditional Chinese Medicine. She was also the winner of Prince Mahidol Award, as well as Lasker-DeBakey Clinical Medical Research Award. In 2015, she won the Nobel Prize in Physiology or Medicine as co-recipient.



James Webb Space Telescope

All of us must have heard about the Hubble Space Telescope. It takes splendid images of deep space. It's been 28 years since its launch on April 1990. Our technology has advanced a lot from the time when Hubble's construction had begun in the 1970s. So as a successor the James Webb Space Telescope (JWST) has been developed by NASA in collaboration with the European Space Agency and Canadian Space Agency. This will provide unrivalled resolution and accuracy that is far greater than that of Hubble and will help in astronomy and cosmology.

The task of JWST is to observe stellar and cosmic events in deep space. Cosmologists will be using this advanced telescope to study the formation of early galaxies and nebulas. These early events have never been observed before as our current telescopes cannot reach such distances.

JWST is named after James Edwin Webb, a NASA administrator from 1961 to 1968 and worked in the Apollo program. The development of this telescope began in 1996. The design of this telescope is a unique honeycomb structure. The primary mirror is a combination of eight small hexagonal mirrors and as a whole is 6.5 meters in diameter. The mirror is made of beryllium over which a layer of gold is coated. The telescope is covered with a large sun protector consisting of five sheets of silicon and Kaptonmade of aluminium for protecting the scientific instruments inside the JWST. This sunshield will maintain the temperature of the components below -22^{o}C.

The JWST will capture long wavelength visible spectrum through the mid-infrared (0.6 to 27 μm) range. This spectrum will help JWST to capture redshift objects that are primitive and at a large distance.

The construction of JWST was completed on December 2016. The long and strenuous testing of Webb at NASA's Johnson Space Center in Houston came to an end in 18th November 2017. The JWST was planned to launch from Kourou, French Guiana, on March 2019. After many delays NASA scheduled the launch to 30th March 2021 at the same site. This delay was done after taking suggestions from an Independent Review Board over a problem faced by the sunshield during a practice deployment. The JWST will be deployed at the L2 Lagrangian point in the Earth-Sun orbit.

The James Webb Space Telescope will be a state of the art space observatory for the next decade. It will enable us to better understand the secrets of formation of galaxies. It will help us in finding new stars and planets and enable us to see the unseen.

Performance Analysis of NANO MOS Devices

In recent years the double-gate (DG) MOS technology has emerged as one of the most potential candidate to extend CMOS technology to overcome the short channel effects; however the continuous down scaling of SiO2-based gate dielectrics give rise to large leakage current which degrades the performance of DG-MOSFETs. In this regard the Graded Channel Gate Stack (GCGS) DG-MOSFET structure with asymmetric channel doping and gate stack structure can be considered in sub-micron regime in which gate leakage and SCEs are greatly improved.Gate oxide stack with high-K materials such as TaO2, TiO2, HfO2, Al2O3 with excellent thermal and chemical stability can be considered for replacement.The gate-stack also improves SCEs, Drain Induced Barrier Lowering (DIBL) and hot carrier effects. Similarly the Graded channel (GC) structures are an asymmetric channel device which is incorporated to reduce the inherent parasitic bipolar effects in SOI MOSFETs. The addition of step profile doping concentration improves the breakdown voltage and improves the cut-off frequency. Further the non-quasi-static approach (NQS) was implemented with respect to different high K materials for the Graded channel Gate stack (GCGS) DG MOSFET structure to extract different intrinsic parameters.

In analog and RF circuits, good noise performance is one of the important factors as it limits the minimum level of the signal that the circuit can process with tolerable quality. Among all the noise sources the flicker (1/f noise) and thermal noise plays an important role. In CMOS based design the PMOS design play equal importance with respect to NMOS design. The analysis of flicker and thermal noise for P-type Underlap DG-FinFET was performed with respect to different device parameters. A decrease in flicker noise is observed for increase in frequency, which satisfies that the device can be used for wide range of frequency application. However, the noise power spectral density for the proposed device is very low, which will be very supportive for the low-noise analog RF design at low power supply voltage.

MOSFETs are being aggressively scaled as per Moore's Law to sub-20-nm dimensions, which makes it more complex to maintain the necessary device performance. Thus there is a necessity to examine channel materials and new device structures that would reduce power consumption with enhanced device performance. High mobility III-V semiconductors have a significant transport advantage, and are thus being extensively

researched as channel materials for upcoming highly scaled CMOS applications. However it is observed that due to several defects in GaN material different types of traps arises which eventually give rise to leakage current and phenomenon like current collapse may exist, thus there is need to find alternatives to overcome these leakages with some novel device structures and materials. Hence addition of the gate dielectric to High Electron Mobility Transistor (HEMT) structure gives rise to a modified structure known as the Metal-Oxide Semiconductor High Electron Mobility Transistor (MOS-HEMT) to supress the leakage current. In this devicee In GaN layer is introduced in the intension to raise the conduction band of GaN buffer with respect to GaN channel so that there is an improvement in the carrier confinement and at the same time witnessed excellent high frequency performance in the proposed AlInN/AlN/GaN MOS-HEMT device. The effect of InGaN back barrier on device performances of 100 nm gate length AlInN/AlN/GaN metal oxide semiconductor high electron mobility transistor (MOS-HEMT) device was performed and a wide comparison was established .

Dr. Sanjit Kumar Swain
Dept. ECE

SUPER GREENHOUSE EFFECT

A change that is believed to be permanently changing is the Earth's climate. So the average temperature of Earth's atmosphere and its oceans is gradually increasing. Over the past 100 years the average temperature of the Earth has risen between 0.4 and 0.8 °C.Researchers says that, for each degree kelvin of temperature rise on Earth, specific humidity (the ratio of water vapour to total air content) increases by about 7%. Earth's greenhouse atmosphere with gases like carbon dioxide (CO_2), water vapour (H_2O), methane (CH_4) and others that trap heat which is radiated up from the surface. A hot surface, evaporate more which adds to the greenhouse gasses and as a result the atmosphere traps more heat. So it becomes a feedback loop.A super-powered feedback loop exists in tropical ocean regions. This regions traps heat effectively as the high convective storms push the large amount of water vapour into atmosphere. This effect is called as super greenhouse effect (SGE). This effect export extra heat outside the regions by further convective storms and heavy rainfalls. SGE regions occur because of building of water vapour in the upper troposphere. SGE regions are equatorial ocean areas, such as the western Pacific Ocean near Indonesia.

Super greenhouse effect gases are F- gases. Common F-gases include chlorofluorocarbons (CFC), hydrochlorofluorocarbons (HCFC) and hydrofluorocarbons (HFC). Each molecule of a F-gas actually heats the surface of the earth much more strongly than a molecule of carbon dioxide (CO_2).Hence HFCs traps extra emitted heat and thus warming the planet. Greenhouse gases are useful for sustaining habitability in a planet such as in Mars. But in earth the effect is depleting the ozone layer, absorbing more UV rays, trapping extra heat and making sustaining inhabitable. This leads to high sea levels and extreme storms together with global warming. So it is time to ban or minimise emission of SGE gases.There are ways to reduce the amount of greenhouse gases such as reduce-reuse-recycle, reduced use of air conditioning, less and smart driving, use of lesser hot water, use of 'OFF' switch, and the most important is to plant a tree. Campaigns should be held to spread the awareness and share the process and precautions of SGE. Act before the regional change transmitted globally.

Publication Cell

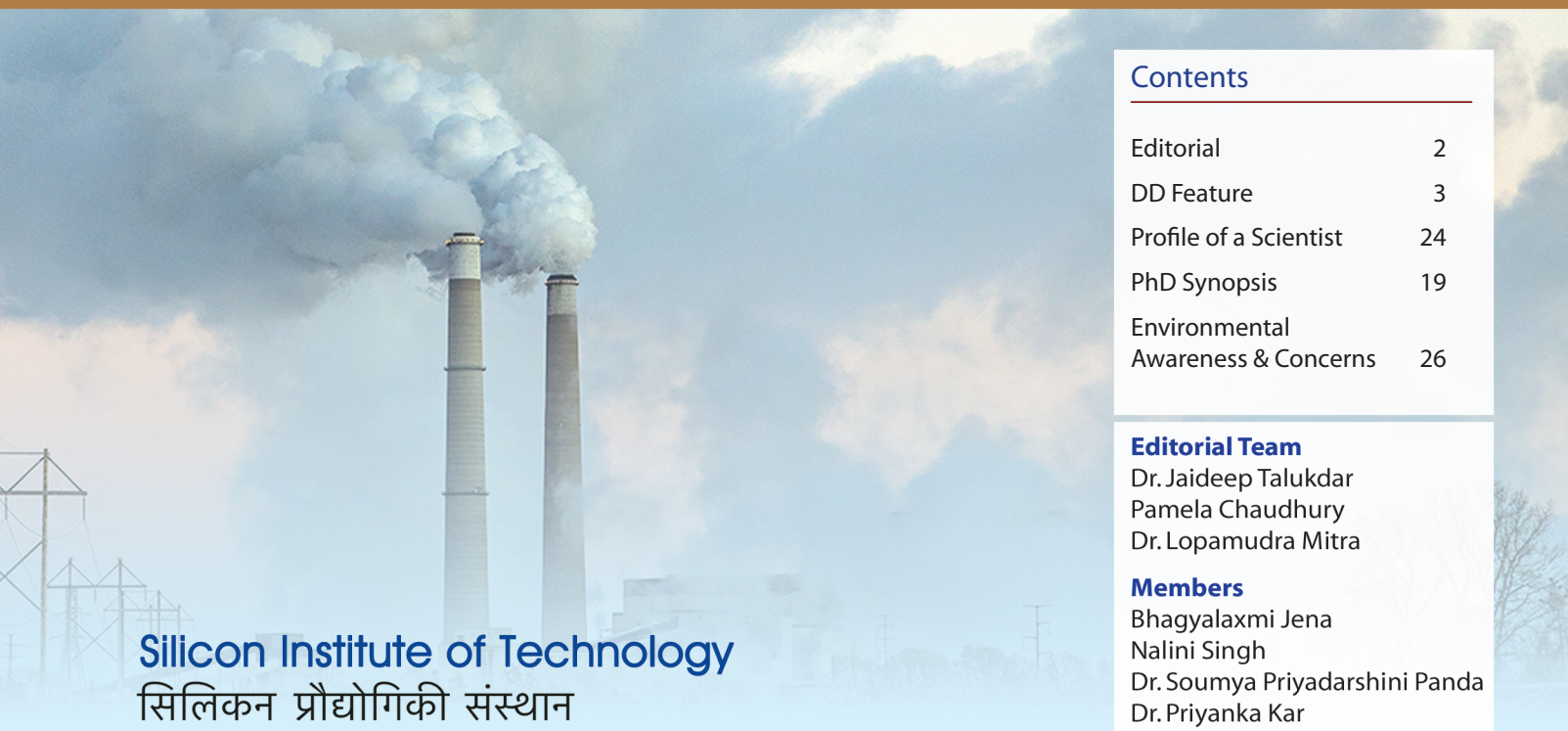
Tel: 99372 89499 / 8260333609
Email: publication@silicon.ac.in

www.silicon.ac.in

The Science & Technology Magazine

Digital Digest

SILICON INSTITUTE OF TECHNOLOGY



Silicon Institute of Technology
सिलिकन प्रौद्योगिकी संस्थान

Bhubaneswar Campus
An Autonomous Institute
Silicon Hills, Patia
Bhubaneswar - 751024

Sambalpur Campus
An Affiliated Institute
Silicon West, Sason
Sambalpur - 768200

Contents

Make your submissions to:
publication@silicon.ac.in