SPECIAL FEATURE

Underground Cable Fault Detection using Arduino

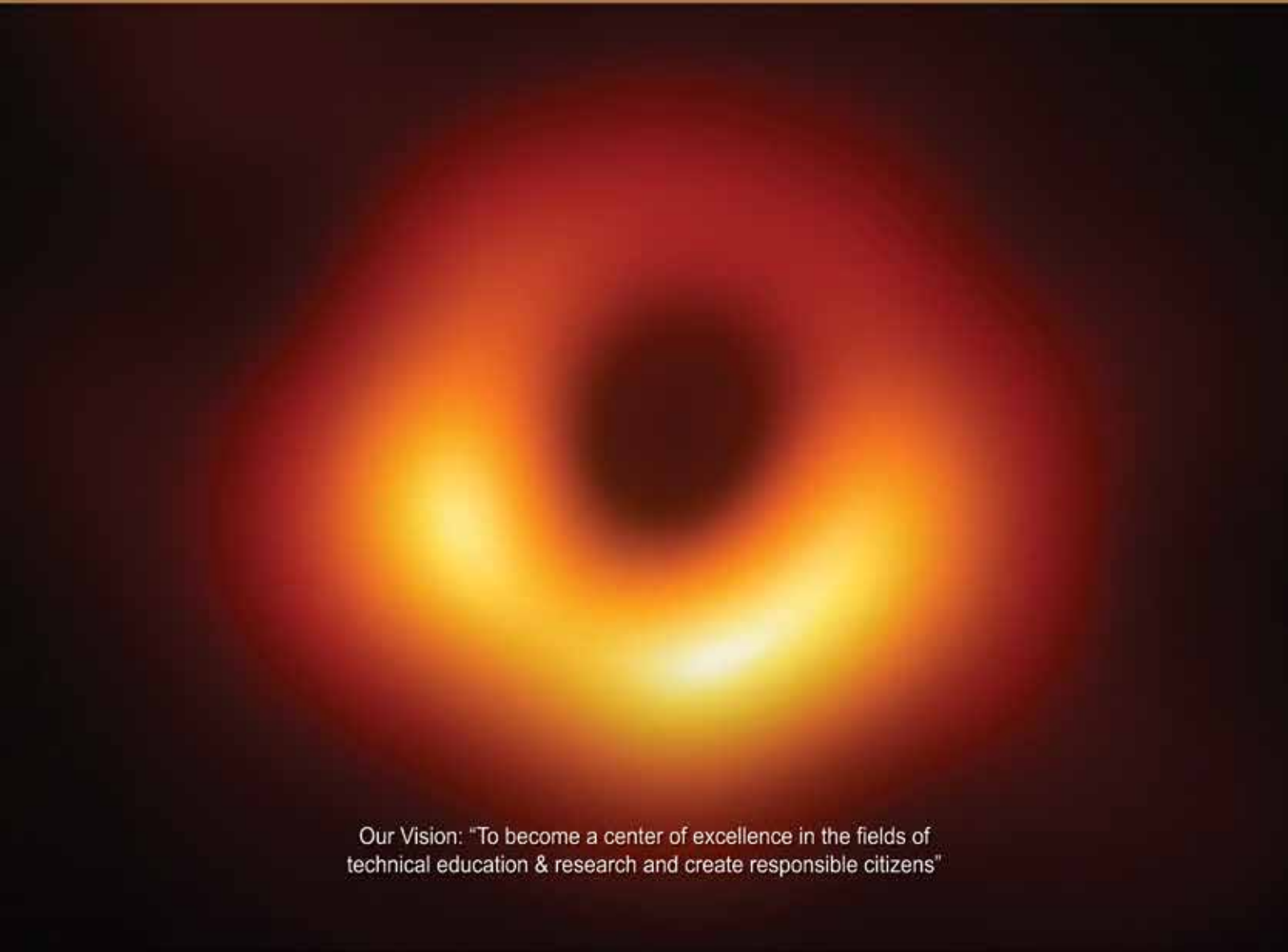
Silicon

...beyond teaching

The Science & Technology Magazine

Digest

Vol. 20 • March 2019 - May 2019



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

The Elusive Black Hole…

Black holes conjure up bizarre and unusual images in people's minds. Notions about a black hole vary from the realm of science fiction to something very esoteric, related to the general theory of relativity. The truth is reality is somewhere in-between - till very recently, no one had ever seen or photographed a black hole. All that changed in April of 2019 when a collaborative effort known as the Event Horizon Telescope (EHT, actually a global network of radio telescopes spanning the entire earth!) zeroed in on the center of the nearby Messier 87 galaxy. Also known as M87, the Messier 87 galaxy is said to harbor a super massive black hole containing the mass of about 7 billion suns. What finally emerged is the first photograph of the silhouette of a black hole, surrounded by the background glow of radiation from our own galaxy. Incidentally, this 'nearby' galaxy located in the Virgo Cluster is about 55 million light years away from earth.

By definition, black holes comprise a region in space where the gravitational pull is so extreme that neither matter nor light can escape. That is why black holes are so elusive and were only conjectured to exist by observing movements of surrounding stars that were seemingly spiraling in towards an unknown object with an exceptionally strong gravitational pull. Because no light is emitted from them, black holes really cannot be seen by conventional means. Black holes can also come in a variety of sizes - tiny, around the size of an atom, big stellar mass black holes the size of several suns and super-massive black holes that have masses of more than a million suns. Stellar black holes are formed when giant stars collapse due their own gravitational pull, after their radioactive fuel has burned out; such events are characterized by a Super Nova, where the outer shell of gases belonging to the star ejects into space in an extraordinary display of galactic fireworks, as the core collapses on itself.

This paradigm-shifting photograph of a black hole at the center of M87 is a staggering scientific and technological achievement. Over a period of two years, a phenomenal amount of data was collected from the radio telescopes of the EHT (the name of the telescope, Event Horizon, also refers to the region around a black hole - once matter or light goes beyond the event horizon, there is no escape!). The scientists' challenge was to store the 5000 terabytes of data captured from the synchronized telescopes on hundreds of hard drives, and process the data using a supercomputer. They had to come up with new approaches and new algorithms to process the data such that a 'true' image could be reconstructed. This photograph is indeed a real image, not one generated by a mathematical model in a computer simulation.

And now for the grand finale of this drama - is this image another conclusive proof of Einstein's General Theory of Relativity? Absolutely and unerringly Einstein's theory once again corroborated the observations of the M87 Black hole. The General Theory was able to give an accurate description of the nature of space time and gravity near this black hole; around the center of the black hole, the speeds of matter was close to that of light, as predicted by the General Theory. The next relevant task for astrophysicists is to look for similar black holes, possibly lurking in the centers of other galaxies!

Dr. Jaideep Talukdar
Professor, Dept. of BSH.

Real Implementation of Synchronous Boost Converter with Controller for Power Factor Correction

Abstract : *Power factor and harmonics are primary factors in electrical distribution network. Harmonics are generated by the non-linear and irregular loads at end users. High harmonics in devices draws the large amount of current which results in poor power factor. Hysteresis control technique is one of the techniques in power factor converter topologies. Switching losses, low power factor and high harmonic distortion factors have been observed in present topology. To overcome these problems, synchronous PFC boost converter with controller has been proposed. This control scheme improves power factor and minimizes current harmonics. Advantages of proposed control technique includes low switching losses, low harmonic distortion, nearly unity power factor and bidirectional power flow. This conceptually built low cost synchronous PFC boost converter with controller has been tested and demonstrated for its functionality*

Keywords: Power Factor Correction (PFC), Insulated Gate Bi-Polar Transistor (IGBT), Metal Oxide Semiconductor Field Effect Transistor (MOSFET), PFC boost converter, Synchronous PFC Boost Converter, Hysteresis Control Technique (HCT).

I. INTRODUCTION

The growth of per capita energy consumption has increased the demand for energy. Therefore, it is crucial to use power conversion devices for efficient use of electrical energy. However these devices increases the usage of energy but decreases the power quality. Extensive use of power conversion devices such as computers, mobiles and driver circuit produce non-sinusoidal line current in electrical distribution system. These devices consists of rectifier which rectifies AC line voltage, filtered by capacitors. Cumulative effect of these non-liner loads results in harmonics. Harmonics are multiples of fundamental frequency present in system which is measured by Total Harmonic Distortion (THD) factor. The net effect of harmonics are poor power factor, high switching losses, fluctuations in voltage and current at the AC input resulting in poor performance of distribution network. Many international standards have been imposed to reduce harmonic distortion connected to distribution network [1].

This project concentrates on power factor correction for reduction of harmonics in line current. Power Factor Correction (PFC) circuits are used to get back the sinusoidal shape of the input current which will be in phase with input voltage. Different control techniques for power factor correction have been proposed [2-4]. Power factor correction techniques are of two types namely passive and active PFC techniques. Active PFC technique is been used in this paper to improve the power factor. There are several control topologies available in active PFC techniques. Among all control techniques a sampling approach of hysteresis control technique has been selected. The two control modes in this control techniques are hysteresis control and peak current control modes.

In this project, the control scheme of hysteresis control technique has been proposed. The performance of this technique is enhanced by synchronous boost converter in place of boost converter. In synchronous PFC boost converter diode is replaced by a MOSFET switch. This scheme makes the input current follows input voltage. Detailed design, simulation has been carried out to achieve desired power factor and low harmonic distortion.

II. HYSTERESIS CONTROL TECHNIQUE

A block diagram of the hysteresis control technique is shown in Fig.1. It has voltage amplifier, rectifier and converter. Output voltage is regulated by comparing the actual output voltage with a DC reference voltage using a voltage error amplifier. The error signal is fed to the multiplier, where it is multiplied with the rectified sinusoidal input voltage to generate a reference current profile IV, ref... IP, ref and IV, ref are two sinusoidal current references of the inductor. In this scheme, S-R flip-flop generates the pulses with respect to the current

flowing in inductor (IL). If the IL is less than the IV, ref then the switch S is 'ON'. When IL is greater than the IP, ref then the switch S is 'OFF'. Therefore a pulse train is generated for the gate driving circuit of MOSFET [7-8].

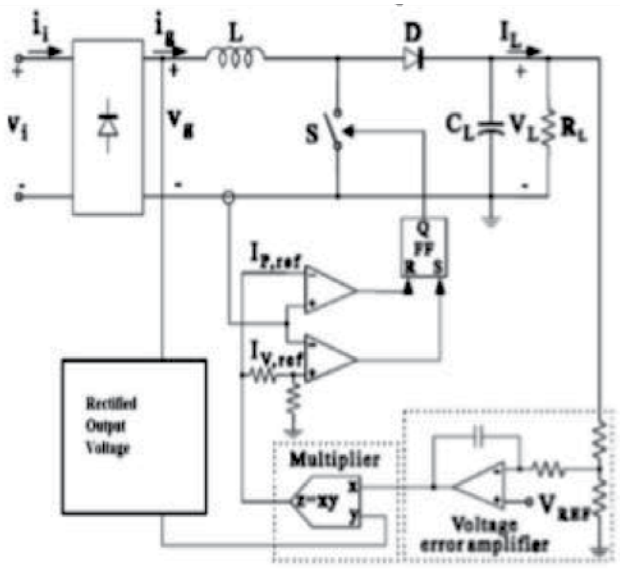


Fig.1.Block Diagram

III. PROPOSED TECHNIQUE

Synchronous PFC boost converter with controller has been proposed based on the hysteresis control technique which involves synchronous boost converter, in which diode is replaced by the switch which increases the efficiency of the converter [5]. Identified blocks for modification in hysteresis control technique are voltage error amplifier and diode. Voltage error amplifier and diode are replaced by PI controller and MOSFET respectively.

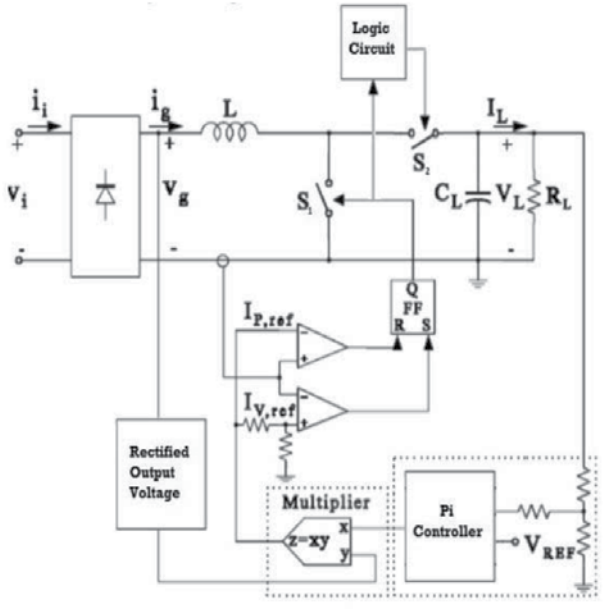


Fig.2.Block Diagram of Synchronous PFC boost converter

The proposed converter is shown in Fig.2. The rectified voltage Vg is boosted by replacing a switch S2 [MOSFET switch] in place of diode. A PI controller in feedback loop processes the output voltage VL with respect to reference voltage VREF. The generated error signal from the PI controller is fed to the multiplier which multiplies the two voltages. Multiplied voltage signal is proportional to the two current references IP, ref and IV, ref. This two references are compares with the actual inductor current IL and generates a signal. This signal drives the SR flip-flop which drives the switches S1 and S2. Finally, this control scheme regulates the voltage and makes the power factor to unity.

IV. CONTROL SCHEME

The detailed block diagram of control scheme is as shown in Fig.3. Here,V0* and V0 are the reference and actual voltages of boost converter. The difference of two voltages given to voltage controller (PI controller). Reference current signal (Is) is output of PI controller, which is proportional to voltage error. Full wave rectifier voltage is multiplied with the current signal (Is) and produces the reference current Is*.

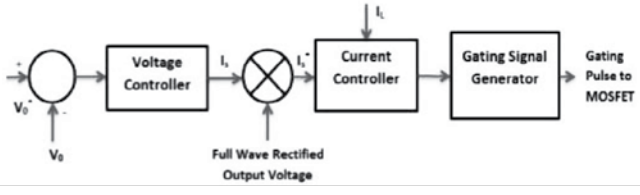


Fig.3. Control Scheme for Synchronous PFC Boost Converter

In Fig. 3. current controller processes the combined signals of Is* and inductor current IL and generates the gate signals. Current controller acts a hysteresis controller, so that current will be within the specified limits. If the reference signal Is* is greater than the actual current then the switch is 'ON'. When the reference signal Is* is less than the actual current then the switch is 'ÓFF'. However switching action takes place in order

to follow the reference current, so that resultant input current is approximately sinusoidal with less harmonic content and less THD. Hence the power factor of the supply can be improved. The output from the switch (R-S flip flop) has given to the gate terminal of MOSFET switch. In this block diagram, diode is replaced with a MOSFET switch S2. Logic circuit was developed based up on the generated gate pulses. The output of the logic circuit has given to gate terminal of MOSFET switch S2. Hence ripple content in the output voltage as well as in the line current is reduced. The synchronous PFC boost converter with the designed controller scheme is implemented in simulation and hardware to achieve desired PF and low switching losses.

V. SIMULATION RESULTS

The proposed technique is implemented in MATLAB/ Simulink which is shown in Fig. 4. In this model, output voltage of bridge rectifier is connected to the boost converter. Logic system has been developed in such a way that it generates the gate pulses to the MOSFET switches in boost converter.

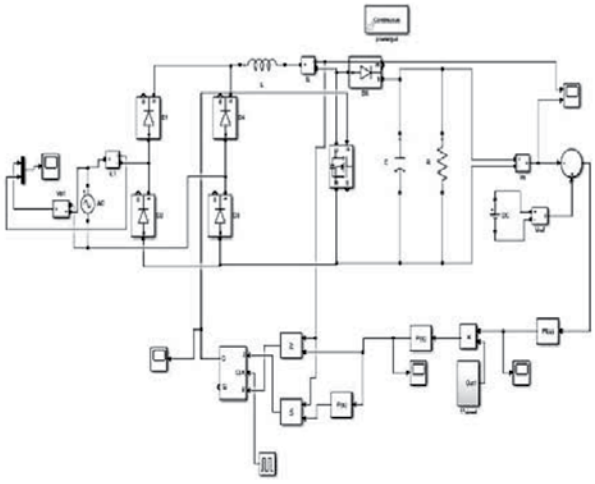


Fig.4. Simulink Model of Implemented PFC Technique

Now generally after the implementation of the Simulink model we obtained the graphs as shown in the fig. 5, for the following parameters so that we could justify the result obtained:

As we can see that the input voltage and the current are obtained in phase as the result of which the power factor has improved.

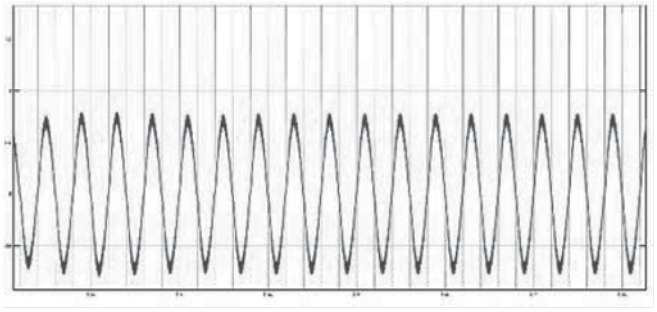


Fig.5.Input voltage and Input Current of the Synchronous Boost Converter

VI. CONCLUSIONS

The main idea of the work is to improve the input power factor with reduction of input current harmonics in distribution system. In this project, a design has been implemented in simulation platform. Finally, the elementary rectifier circuits without and with PFC circuit has been demonstrated. The changes in the input current waveform is observed and analyzed.

VII. REFERENCES

[1] Grace Miu-Lai CHU,"Modeling and Design of Power –Factor- Correction Power Supplies.

[2] L. Rossetto, G. Spiazzi, P. Tents, "Control Techniques for Power Factor Correction Converters".

[3] Ahmet Karaarslan, "Hysteresis Control of Power Factor Correction with a New Approach of Sampling technique", IEEE Proc, 2008.

[4] Sukanta Kumar Sahoo, Hitesh R. Jariwala,"A New Power Factor Correction Technique Using PFC Boost Converter", IEEE Proc, 2012.

[5] Y.-J. Woo, G.-H. Cho and G.-H. Cho, "Power-efficient gate control of synchronous boost converters with high output voltage", Electronics Letters ,Vol 43, 1st February 2013,

[6] Sridevi,J. "A New Active Power Factor correction controller using Boost controller", Research journal of Engineering Sciences, Vol.2 (8), 711, August 2013.

Surabhi Nanda, Rohan Singh,
Tejaswani Samantroy, Siddhant Behera,
Jyotirmayee Sahoo
Dept. of ECE

In Conversation with Prof. Saroj Rout on the new VLSI chip developed in Advance Lab of Silicon Institute of Technology

Prof. Saroj Rout is currently Senior. Associate Professor, EEE and Chief Mentor, VLSI Group in Silicon Institute of Technology, Bhubaneswar. He received the B.E. degree in Instrumentation and the M.E. degree in Microelectronics from Birla Institute of Technology and Science (BITS), Pilani, India, in 1996 and 1998, respectively. He received the Ph.D. degree in Electrical Engineering from Tufts University, Medford, MA, in 2016, where he worked on terahertz meta-materials for his doctoral dissertation. He is the founder and principal engineer at Mixignal Innovations LLC, an analog IC design consulting firm which provides turnkey integrated circuit solutions to semiconductor companies. He has 7 patents and is the author of several publications in the area of CMOS circuit design and terahertz meta-materials.

Pamela: Tell us something about the new VLSI chip developed under the project Rev. A0?

Dr. Rout : The VLSI chip was designed from specification to mask-sets at Advance VLSI Laboratory in Silicon Institute of Technology. The chip was fabricated using a 0.6 micro-meter CMOS technology from one of our foundry partners, X-FAB, Germany. This is the first chip completely designed inhouse without any external collaboration showcasing our ability to design full turnkey solutions that only few universities in the world can claim. Along with our faculty members, 12 undergraduate students were part of the project putting us in a very exclusive group not only in India but globally as well.

The chip contains a serial SRAM, a memory accessed via industry-standard Serial Peripheral Interface (SPI) and Inter-IC Communication (I2C) protocol. This memory unit was completely designed from specification by a group of 12 undergraduate students putting them in exclusive club of having chip design experience at an undergraduate level. The chip also contains an innovative temperature-independent voltage reference and a temperature sensor that is standard intellectual property (IP) block in most commercial integrated circuits (IC). This block is designed to be the lowest power and smallest area of its category and designed to industry-grade quality that can be used in any commercial IC.

Pamela: What is the innovative feature of this VLSI chip?

Dr. Rout : The memory was designed to be completely synchronous with the serial access protocol without any internal clock or phase-locked loop (PLL) which typically consumes significant power. This design will allow system designers to scale the clock and accordingly scale power and hence can be used in wide variety of products from very low power to high speed products without sacrificing performance.

The temperature independent voltage reference, known in the industry as Bandgap Reference (BGR), is designed to consume the lowest power (~ 3 micro-watts) with one of the smallest footprints (~ 0.015 square-millimeter) in the industry with voltage variation of only 10 ppm/C (parts per million per degree centigrade).

We also integrated a temperature sensor to characterize the chip in an innovative test method where the sensor will be used to sense the internal chip temperature. This will allow us to use very cheap method to heat the chip and do temperature characterization without the need of expensive temperature environment chamber.

Pamela : Where can this VLSI chip be used?

Dr. Rout : The memory can be used any electronic system that requires low-power and serial accessible memory especially in IoT systems where the speed is not a concern, but power is. The voltage reference and the

temperature sensor are standard blocks in any integrated circuit and our circuit is especially appealing to small and medium size digital chips that are very cost sensitive and looking for a medium-performance reference which is compact and consumes very little power.

Pamela : How was the chip fabricated and whether there were any challenges faced during the fabrication stage?

Dr. Rout : Typical process for fabrication is to convert the electrical circuits into set of polygons, called layout, that are drawn according to design rules set by the fabrication company for example X-FAB. These set of polygons, for many different layers, are used by the fabrication company to process plain silicon discs to the designed chip. Because there is only choice of few integrated devices available to the circuit designer, it posses a lot challenges when designing the circuit.

Below are some of the images shared by Prof. Saroj Rout of the recent VLSI chip developed in the Advance VLSI lab at Silicon Institute of Technology, Bhubaneswar.

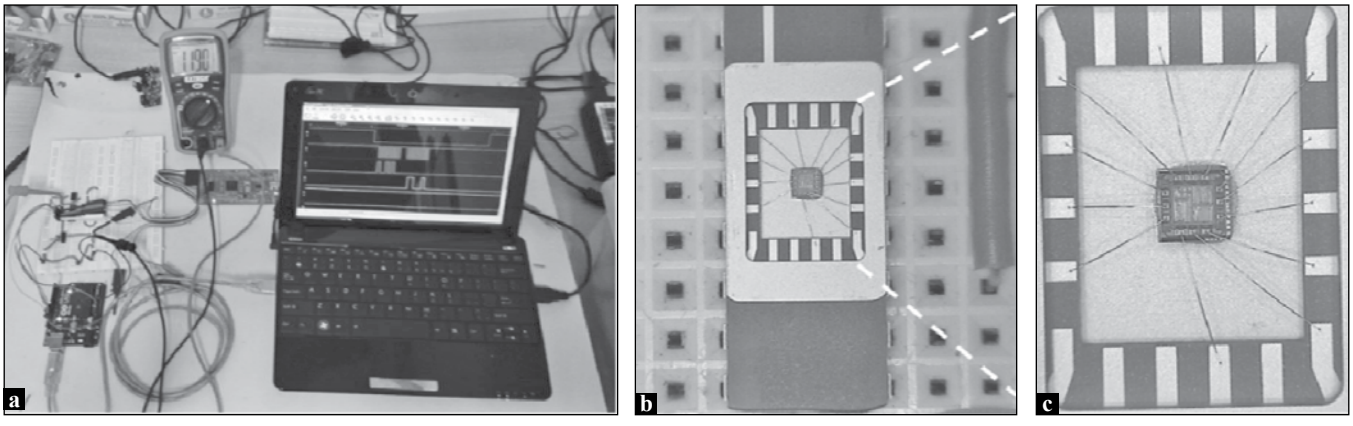


***Figure** 1: **(a)** Testl setup: DMM showing 1.19V output of the voltage reference and logic sniffer showing the signal capture of the memory access. **(b)** Microscope picture without the cap showing the chip inside package **(c)** Another zoomed in picture of the chip inside the package. Chip size: 1.2mm x 1.2mm*

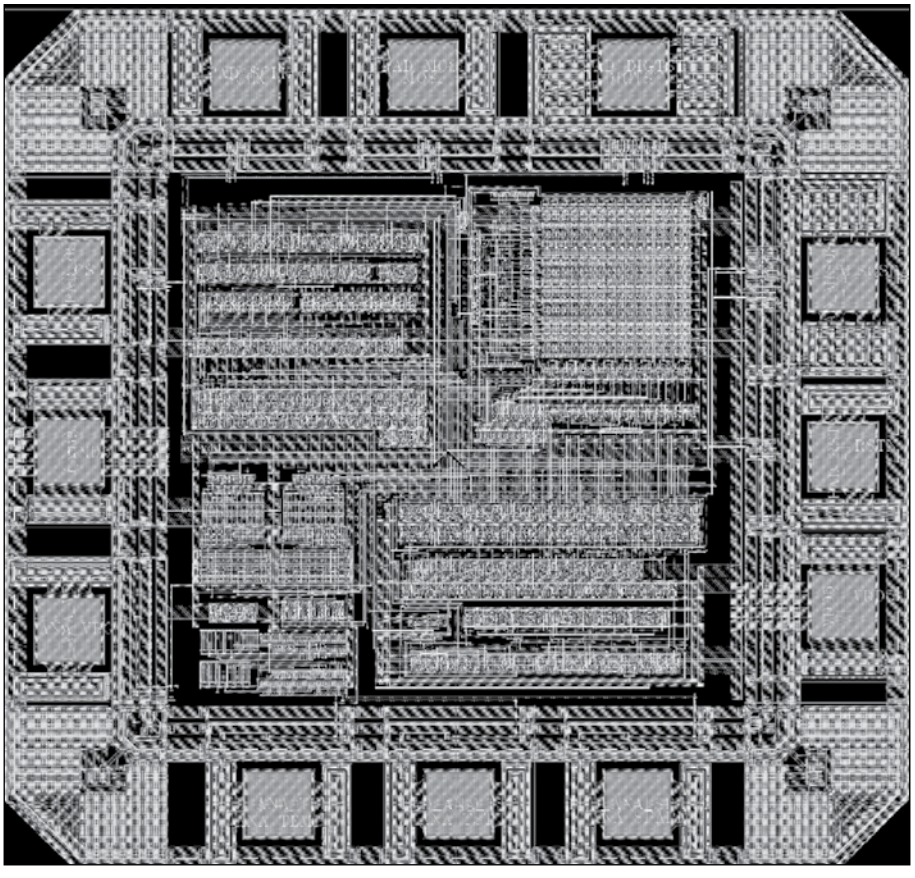


***Figure 2:** Layout of the fabricated and tested chip (Size: 1.2mm X 1.2mm)*

Protein Function Prediction Using Protein-Protein Interaction (PPI) Network

Abstract : *Proteins are responsible for all biological activities in a living object. With the advent of genome sequencing projects for different organism, large amounts of DNA and protein sequence data is available. Whereas the biological data is still un-annotated in most of the cases. Predicting protein function is most challenging problem in post-genomic era. Using sequence homology, phylogenetic profiles, gene expression data, and function of un-annotated protein can be predicted. Based on the concept that a protein performs similar function like its neighbor in protein function from protein interaction network using neighborhood properties. The method we implemented uses intelligent neighborhood approach, distance based approach and common neighbor approach. One is an intelligent technique which applies heuristic knowledge to find densely connected region for better prediction accuracy.*

Keywords: Protein interaction network, protein function prediction, functional group

I. INTRODUCTION

Proteins are the most versatile macromolecules in living systems and serve crucial functions in essentially all biological processes [1]. With successful sequencing of several genomes, the challenging problem now is to determine the functions of proteins in post genomic era. Determining protein functions experimentally is a laborious and time-consuming task involving many resources. Therefore, research is going on to predict protein function using various computational methods. These methods are based on sequence and structure, gene neighborhood, gene fusion, cellular localization, protein-protein interactions etc. In this work, an approach to predict protein functions based on protein interaction network is presented. The objective of the work is to assign un-annotated function proteins to different functional groups. Discussions are presented in computational techniques that use protein interaction data. Protein functionality can be predicted by neighborhood property which suggests that the PPI network, neighbors of particular protein have similar function.

In this regard, many approaches have been discussed but in neighbourhood approach, applying a heuristic in finding densely connected region and thereby computing neighbourhood ratio may improve the prediction accuracy. Motivated by this fact, this work focuses on two neighbourhood approaches where protein's functions are predicted based on the functions of direct neighbours and indirect neighbours. Considering the unctions of direct and indirect neighbours of a protein with un-annotated function, the function of those neighbours is assigned to that protein of interest whose proportion in numbers is higher for a particular function.

II. PROTEIN INTERACTION NETWORK

Protein-protein interactions occur when two or more proteins bind together, often to carry out their biological function. Many of the most important molecular processes in the cell such as DNA replication are carried out by large molecular machines that are built from a large number of protein components organized by their protein- protein interactions [2]. These protein interactions form a network like structure which is known as Protein interactions network. Here protein interaction network is represented as a graph Gp which consists of a set of vertex (nodes) V connected by edges (links) E. Thus Gp = (V,E). Here each protein is represented as a node and their interconnections are represented by edges.

Sub graph: A graph G'p is a sub graph of graph Gp if the vertex set of G'p is subset of the vertex set of Gp and if the edge set of G'p is subset of the edge set of Gp.

Level-1 neighbourhood: In G'p, the directly connected neighbours of a particular vertex are called level-1 neighbours.

Level-2 neighbourhood: In G'p, level-2 neighbours are those which are directly connected neighbours of level-1 neighbours of that particular vertex.

Neighborhood Ratio: The neighborhood ratio is defined as the ratio of no. of level-1(or level-2) neighbors (K) corresponding to a functional group Oi and total no. of level-1(or level-2) neighbors (P).

III. PROPOSED WORK

Here, two approaches Method-I and Method-II are considered for the prediction of protein function exploiting neighbourhood properties of interaction network. P10i(=1..15), P20i(=1..15), are used for

assigning the unknown protein to a particular functional group by means of selecting higher neighbourhood ratio whereas, in the second method, same technique is applied in densely connected sub graph using a heuristic to get better prediction accuracy.

A. Method-1

In this method, level-1 and level-2 neighbours for each un-annotated protein are counted from protein interaction network. Then the neighbourhood ratio of each functional group is computed in each level. Among these ratios the highest neighbourhood ratio decides the functional group of the un-annotated protein.

Given G'p, a sub graph of protein interaction network, consisting of proteins as nodes associated with any element of set O = {O1 ,O2, . . . , O15} where Oi represents a particular functional group, this method maps the elements of the set of un-annotated protein U to any element of the set of Q. Steps associated with this method is described below and the Sub graph G'p of Protein YALOO3w and its level-1 and level-2 neighbours are presented in Figure (1).

Step 1: Take any protein as an element from set U.

Step 2: Count Level-1 and Level-2 neighbours of that protein in G'p associated with set O.

Step 3: Compute $P^{1(=1,2)}_{0i(=1..15)}$,

Step 4: $P^{l}_{0K} = \text{Max}\ [(\max(P^{1}_{0i(=1..15)}), (\max(P^{2}_{0i(=1..15)})\ ]$

Step 5: Assign un-annotated protein form the set U to functional group Ok.

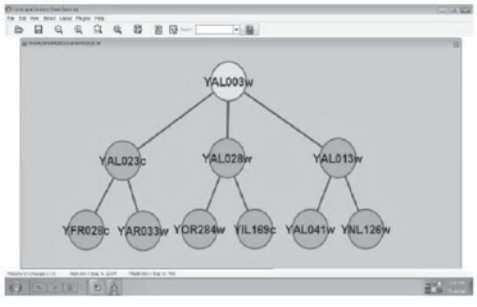


Fig. 1: *Sub graph G'p of Protein YALOO3w and its level-1 and level-2 neighbours*

B. Method-II

Unlike the method-I, method-II considers level-1 and level-2 neighbours in reduced densely connected sub-graph instead of searching them in sub-graph G'p. Using a heuristic that higher neighbourhood ratio may exist in densely connected sub-graph may restrict the computation of neighbourhood ratios in less promising search it he basis of the method. In this densely connected sub-graph, same technique is performed as being followed in Method-I. Here, all branched emerging from unknown protein are not considered for computing neighbourhood ratio of all neighbours. Initially, level -1 and level-2 neighbours of different functional groups are counted. At level-1, neighbour of particular functional group having maximum level-2 neighbours, at that sub-graph, is retained. Other level-1 neighbours of other functional group having less number of neighbours are ignored. In this way, less promising branches are rejected and most promising branch is explores in computation of neighbourhood ratio. At level-2, the neighbours of these nodes only are examined. Given G'p , a sub graph of protein interaction network for any unknown protein P, this method maps the element of the set of un-annotated protein set U to any element of set O. Steps associated with this method is described below and the Sub graph G'p of Protein YCLOO3w and its level-1 and level-2 neighbours is presented in Figure (2).

Step 1: Take any protein as an element from set U.

Step 2: Count Level-1 and Level-2 neighbours of that protein in G'p associated with set O and accept Level-1 neighbours as densely connected sub-graph whose number of neighbours is maximum compared to other level-1 neighbours. Reject other level-1 neighbours and obtain densely connected sub-graph G"p.

Step 3: $Pl0K = \max(P^{2}_{0i(=1..15)})$

Step 4: Assign un-annotated protein to functional group .

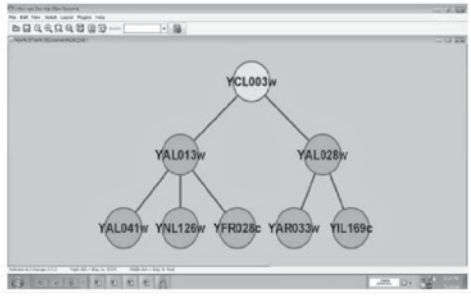


Fig. 2: *Sub graph G'p of Protein YCLOO3w and its level-1 and level-2 neighbours*

C. Working of the Prediction Function

Predict Function (N (PA, PU, E), δ)

Input: N(PA, PU, E) : protein-protein interaction network. PA is the set of annotated proteins, PU is the set of un-annotated proteins, and E is the set of interactions between proteins.

δ: the maximum number of functions

Output: the function of proteins in PU;

1: for each function $F_t \in F$ $(1 \le t \le M)$

2: estimate the prior probability of function F_t;

3: let $S_t \subseteq PA$ be the set of proteins annotated with function F_t;

4: for each pair of proteins $\{(P_j, P_k) | P_j, P_k \in PA, P_j, P_k \in St\}$

let X_{tjk} be the number of common neighbors between P_j and P_k ;

5: estimate the mean μt+ and the variance σ2t+ for Ft based on X_{tjk} ;

6: for each pair of proteins $\{(P_j, P_k) | P_j, P_k \in PA, P_j \in St, P_k \notin S_t\}$

let Y_{tjk} be the number of common neighbors between P_j and P_k ;

7: estimate the mean μt- and the variance σ2t- for Ft based on Y_{tjk};

end for

8: for each protein $P_i \in PU$

9: let Fi be the set of functions possessed by the annotated proteins with at least one common neighbor with Pi ;

10: for each function $F_t \in F_i$ compute the functional score log(λt) using Formula 6;

11: sort the values of λt in the descending order;

12: assign Pi with a maximum of δ functions with the highest scores;

13: let PA = PA ∈ { Pi }, $PU = PU - \{P_i\}$;

end for

14: if PU = ∈ or no Pi has been annotated in this round then return

else Predict Function(N (*PA*, P*U*, E), δ)

end if

end method

IV. RESULTS AND CONCLUSIONS

In this paper, two methods are implemented using different PPI Networks. The match rate for the method and the improvement percentage are presented in Table (1).

Table.1: *Results obtained*

FUNCTIONAL GROUPS	MATCH RATE(%) METHOD-I	MATCH RATE(%) METHOD-II	IMPROVE-MENT(%)
PROTEIN FOLDING	67.82	90.67	22.85
CELL POLARITY	77.63	88.75	11.12

Example output screen shorts of the implementations are presented in Figure (3) and Figure (4).

Fig.3: *Output screen short-1*

Fig.4: *Output screen short-2*

The future scope of the work may be to implement all the methods using the same PPI network. The challenge of taking a single complex PPI network for all the methods may also be overcome.

ACKNOWLEDGEMENT

We express our sincere gratitude to our project guide Mrs. Mukti Routray of CSE department for her guidance and encouragement in carrying out this work.

REFERENCES

[1] Deng, M., Zhang, K., Mehta, S., Chen, T., and Sun, F. Prediction of protein function using protein-protein interaction data. In Proceeding of IEEE Computer Society Bioinformatics Conference, pages 197–206, 2002.

[2] Letovsky, S. and Kasif, S. Predicting protein function from protein/protein interaction data: a probabilistic approach. Bioinformatics, 19:i197–i204, 2003.

Sumit Purohit, Ashutosh Sahoo, Rajeeb Sahoo
8th Sem. CSE

Image Enhancement Using Local Gamma Correction

Abstract: Gamma correction is widely employed in many image enhancement applications. However, this technique is able to enhance a particular range of intensity level. An image with very bright and dark region can't be enhanced simultaneously using a single gamma value. To overcome this problem, an adaptive local gamma correction method is proposed. In this method, the gamma factor is varied locally as per the mean intensity of a neighborhood. As a result, the gamma value for the local dark regions would be different from the gamma value of local bright region for effective contrast manipulation in an image. Experimental results show the proposed scheme gives better performance than many of the existing schemes in terms of subjective measure.

Index Terms: Image enhancement, gamma correction, MATLAB functions, Edge Detection, Image processing

I. INTRODUCTION

We live in a world consisting of many wonderful things. We invented camera sensors to capture them. As time passed by the capability of the camera sensors also increased. With the advancement of camera sensors, we use these sensors for multiple purposes. These sensors are used for monitoring process, military surveillance purposes, low light imaging etc. These sensors can greatly enhance our ability to monitor our surroundings. But there are certain limitations of these sensors. For example, in certain lighting condition the sensors can't produce desired output. Thus, with the help of gamma correction, local gamma correction and homo-morphic filter we can enhance the output data produced by the sensors to a great extent [1].Here we focus on correcting gamma values locally and applying homo-morphic filter to the images and videos. The sources of images or videos are like Visual Cameras, Low light Night Vision Cameras, Infrared Cameras and X-RAY images. These images (or videos) generated from these different sensors have different characteristics, providing different and complementary information[2]. Thus, the procedure of local gamma correction and applying homo-morphic filter can enable one to perceive features that are impossible to perceive with any individual type sensor.

II. LITERATURE REVIEW

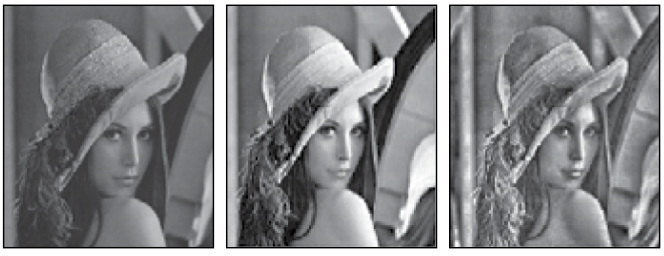
Various techniques has been adopted to compensate the low-light visibility, lighting conditions, over-brightness, etc. Some widely used techniques have been described below with a brief analysis. To enhance the contrast of an image, Histogram equalization (HE) is one of the widely used technique. It is not necessary that contrast will always increase in this [3,4] There may be some cases were histogram equalization can be worse. In that cases the contrast is decreased.

Some results have been shown below for the images of coffee seeds, Korean model and Lena.

Fig.1(a) *original images and* ***(b)*** *histogram equalization of the original images.*

As you can clearly see from the images that the new image contrast has been enhanced and its histogram has also been equalized. There is also one important thing to be note here that during histogram equalization the overall shape of the histogram changes, where as in histogram stretching the overall shape of histogram remains same[5, 6].Ordinary HE tends to over-amplify the contrast in near-constant regions of the image, since the histogram in such regions is highly concentrated. As a result, HE may cause noise to be amplified in near-constant regions. Contrast Limited Adaptive Histogram Equalization (CLAHE) is a variant of adaptive histogram equalization in which the contrast amplification is limited, so as to reduce this problem of noise amplification.

Yet there are cases, as shown in figure 2, where HE gives better performance than CLAHE. This makes both these methods ungeneralised as they alternately gives better results depending upon the contrast and lighting conditions of an image.Given below is a comparison of HE and CLAHE where HE yields better performances.



(a) Original (b) HE (c) CLAHE

Fig.2 *Comparison of HE and CLAHE*

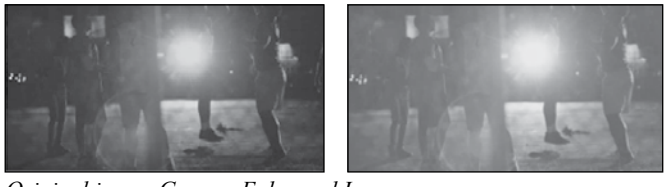
It operates on small regions in the image, called tiles, rather than the entire image and the noise can be reduced only while maintaining the high spatial frequency content of the image by applying a combination of CLAHE, median filtration and edge sharpening. Though it mitigates the over-amplification but it is quite complex and expensive.

III. IMPLEMENTATION OF GAMMA CORRECTION METHOD

Another widely used technique for image enhancement is Gamma Correction Method. Gamma correction, or often simply gamma, is a non-linear operation used to encode and decode luminance in image systems. Gamma correction is, in the simplest cases, defined by the following power law expression:

$$Y=AI^{\gamma}_{\text{input}}$$

Where, the non-negative real input value is raised to the power and multiplied by the constant A, to get the output value. In the common case of A = 1, inputs and outputs are typically in the range 0–1.Given below is a result which shows how gamma correction method enhances an image into a visually pleasing one. In figure 3 we can clearly see the change in luminance with different gamma value.



Original image Gamma Enhanced Image

Fig.3 *Gamma Correction Method*

It is a widely used method for image enhancement. However this technique is able to enhance a particular range of intensity level [7]. An image with very bright and dark region can't be enhanced simultaneously using a single gamma value.Some other methods are also proposed ranging from traditional gamma correction to more complex methods utilizing depth image histogram, pixel contextual information, etc., for analysing image context and pipelining of different stages to speed up the process. In general, most of the contrast enhancement techniques fail to produce satisfactory results for diversified images such as dark, low-contrast, bright, mostly dark, high-contrast, mostly bright ones. From the above discussion, it is evident that the available techniques for enhancing the contrast of an image might not be applied for all types of images. A technique producing good results for some images may fail on some other images. To solve this problem, we propose a computationally simple method utilizing an automatic image classification mechanism along with a suitable enhancement method for each of the image classes.

IV. PROPOSED METHOD

We have proposed two methods for the above problem statement. The methods are explained below with a detailed analysis [8].

(A) Multiple Gamma Correction (Proposed Method – 1)

The main objective of the proposed technique is to transform an image into a visually pleasing one through maximizing the detail in formation. This is done by increasing the contrast and brightness without incurring any visual artifact. To achieve this , we propose an multiple gamma correction method which dynamically determines an intensity transformation function according to the characteristics of the input image .

Multiple gamma correction is a process of combining the relevant information with different gamma values in a single image where the resultant image consists of different gamma values in different parts of the same image

By this the part of the images with high intensities are enhanced to one with the low contrast one by decreasing its intensity. And for the parts of the images with very low intensity are enhanced into a visually pleasing one by increasing the contrast of that part of image.

In this paper we use local gamma correction for its assumption on evaluation; higher sharpness represents better perception and its simplicity. The proposed method blends different gamma values locally in the images according to the sharpness evaluation of that part. So by using local gamma correction method image

can be enhanced more appropriately as compared to the existing method [9].

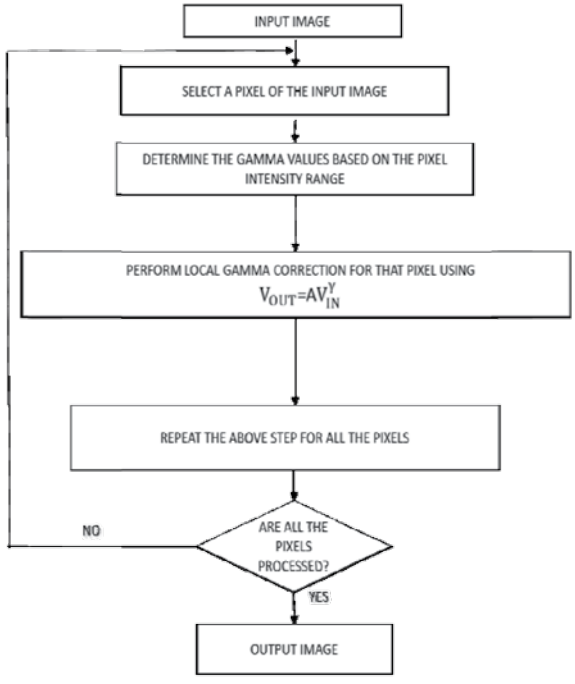


Fig. 4: *Flow chart of proposed method-1.*

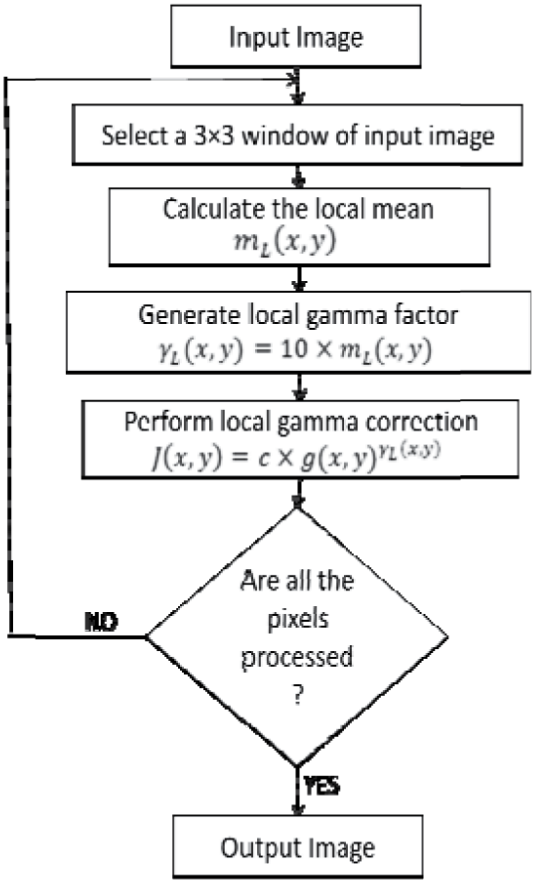


Fig. 5: *Flow chart of proposed method-2.*

(b) Local Mean Gamma Correction Method / Adaptive Gamma Correction Method (Proposed Method – 2)

The main objective of the proposed technique-2 is to transform an image into a visually pleasing one through maximizing the detail in formation. This is done by increasing the contrast and brightness without incurring any visual artifact. To achieve this, we propose an mean gamma correction method which dynamically determines an intensity transformation function according to the characteristics of the input image [10].

Local mean gamma correction is a process of altering the relevant information for a given pixel by taking the mean of the pixel intensities of the neighboring pixels and this is done for all the pixels of the entire image. The gamma valueis predicted by this mean values. This method maintains a linearity in the intensity and contrast of the image and thereby avoids formation of patches as we have seen it in the proposed method -1.

V. RESULTS, SIMULATION AND ANALYSIS

The first image shows original image. Then we have applied different gamma values region by region by looking at the histogram and proposed method 1 was obtained. Since we have observed that in proposed method 1, a patch formation was obtained, so to overcome this problem we went for proposed method 2 in which the mean of the neighboring pixels were taken in addition to that, it also predicts the gamma value and finally the gamma value was applied to the original image, thus forming a resultant image which shows more relevant information and shows better contrast.

a. Original image

b. proposed method- 1

c. proposed method- 2

d. histogram equalization

e. global gamma method

f. image fusion method

Fig.6: *Analysis of our proposed method.*

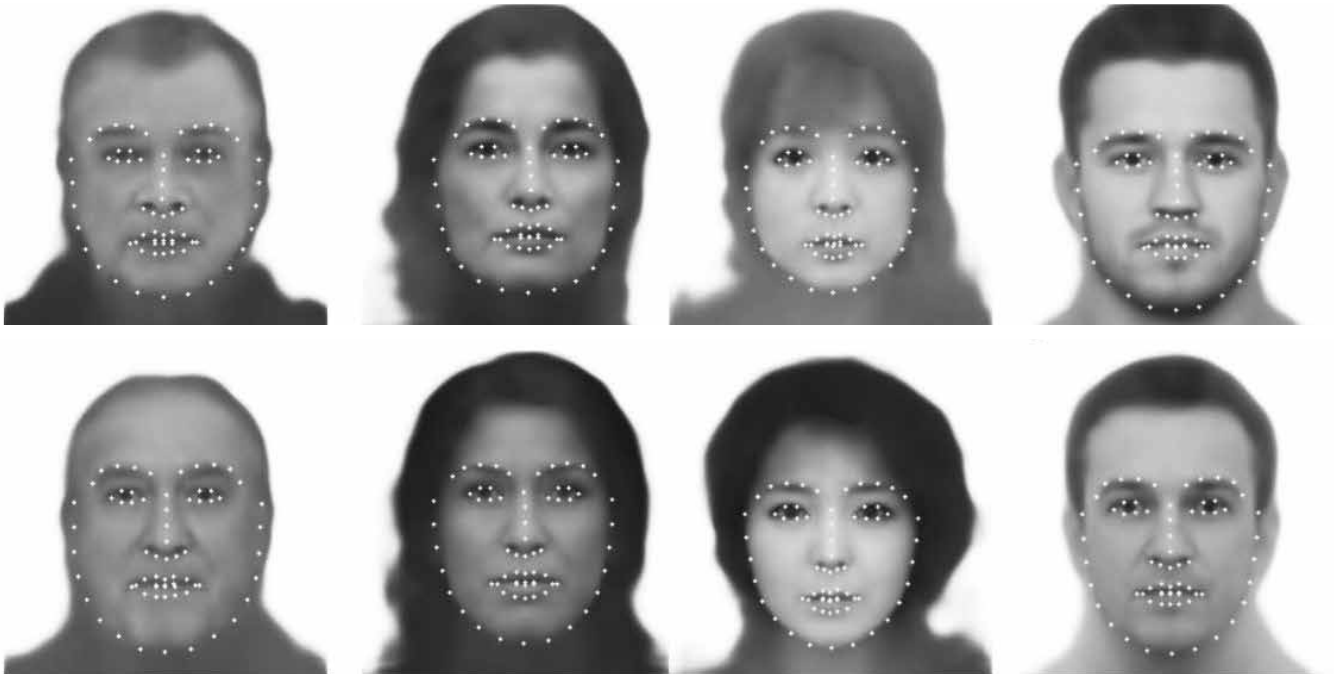
VI. CONCLUSIONS

In this work, we have proposed a simple, efficient, effective technique for contrast enhancement called Local Gamma Correction. This method generates visually pleasing enhancement for different types of images. Unlike most of the methods, Local Gamma Correction dynamically changes the values considering different parameters of the method. Performance comparison with other state-of-the-art enhancement show that our proposed method achieves the most satisfactory contrast enhancements in different illumination conditions. It is also inferred that the proposed method can be incorporated in several application areas such as digital photography, video-processing, medical fields, military purposes, and other applications in consumer electronics.

REFERENCES

1. Kim, Yeong-Taeg. "Contrast enhancement using brightness preserving bi-histogram equalization." IEEE transactions on Consumer Electronics 43.1 (1997): 1-8.
2. Pizer, S. M., Amburn, E. P., Austin, J. D., Cromartie, R., Geselowitz, A., Greer, T., ...&Zuiderveld, K. (1987). Adaptive histogram equalization and its variations. Computer vision, graphics, and image processing, 39(3), 355-368.
3. Stark, J. Alex. "Adaptive image contrast enhancement using generalizations of histogram equalization." IEEE Transactions on image processing 9.5 (2000): 889-896.
4. Wang, Yu, Qian Chen, and Baeomin Zhang. "Image enhancement based on equal area dualistic sub-image histogram equalization method." IEEE Transactions on Consumer Electronics 45.1 (1999): 68-75.
5. Chen, Soong-Der, and Abd Rahman Ramli. "Minimum mean brightness error bi-histogram equalization in contrast enhancement." IEEE transactions on Consumer Electronics49.4 (2003): 1310-1319.
6. Reza, Ali M. "Realization of the contrast limited adaptive histogram equalization (CLAHE) for real-time image enhancement." Journal of VLSI signal processing systems for signal, image and video technology 38.1 (2004): 35-44.
7. Setiawan, Agung W., et al. "Color retinal image enhancement using CLAHE." International Conference on ICT for Smart Society. IEEE, 2013.
8. Guo, Hongwei, Haitao He, and Mingyi Chen. "Gamma correction for digital fringe projection profilometry." Applied optics 43.14 (2004): 2906-2914.
9. Liaw, Ming-Jiun, Ho-Hsin Yang, and Yuh-RenShen. "Automatic gamma correction system for displays." U.S. Patent No. 6,593,934. 15 Jul. 2003.
10. Lumelsky, Leon, et al. "Look-up table based gamma and inverse gamma correction for high-resolution frame buffers." U.S. Patent No. 5,196,924. 23 Mar. 1993.

Lal Chand Nayak, M Haraprasad,
Chinmay Kumar Panigrahi, A VenkatGiri
8th Sem. ECE



Generation of people's faces by Artificial Intelligence

Artificial intelligence (AI) can now do that, generating a digital image of a person's face using only a brief audio clip for reference.

Named Speech2Face, the neural network — a computer that "thinks" in a manner similar to the human brain — was trained by scientists on millions of educational videos from the internet that showed over 100,000 different people talking.

From this dataset, Speech2Face learned associations between vocal cues and certain physical features in a human face, researchers wrote in a new study. The AI then used an audio clip to model a photorealistic face matching the voice.

The findings were published online May 23 in the preprint journal ArXiv and have not been peer-reviewed.

Thankfully, AI doesn't (yet) know exactly what a specific individual looks like based on their voice alone. The neural network recognized certain markers in speech that pointed to gender, age and ethnicity, features that are shared by many people, the study authors reported.

"As such, the model will only produce average-looking faces," the scientists wrote. "It will not produce images of specific individuals."

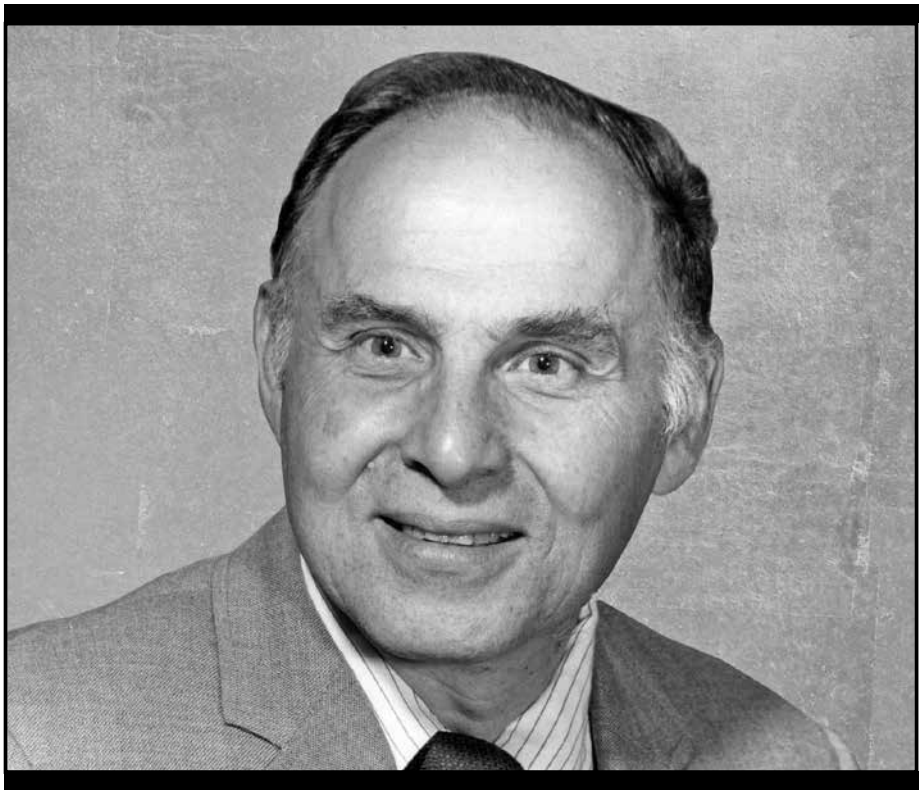
AI has already shown that it can produce uncannily accurate human faces. The faces generated by Speech2Face — all facing front and with neutral expressions — didn't precisely match the people behind the voices. But the images did usually capture the correct age ranges, ethnicities and genders of the individuals, according to the study.

However, the algorithm's interpretations were far from perfect.

Speech2Face demonstrated "mixed performance" when confronted with language variations. For example, when the AI listened to an audio clip of an Asian man speaking Chinese, the program produced an image of an Asian face. However, when the same man spoke in English in a different audio clip, the AI generated the face of a white man, the scientists reported.

Sources: Live Science

Arthur Ashkin



Arthur Ashkin (born September 2, 1922) is an American scientist and Nobel Achiever, who worked at Bell Laboratories and Lucent Technologies. Ashkin has been considered by many as the Father of optical tweezers, for which he was awarded the Nobel Prize in Physics 2018 at age 96, becoming the oldest Nobel Laureate. He authored many research Paper over the years and holds 47 patents. By awarding a 96 year old man with Nobel, the Nobel society proved that there is no age limit to success and to invention. Not only this, Ashkin attained the rating in the Optical Society of America (OSA), the American Physical Society (APS), and the Institute of Electrical and Electronics and Engineers (IEEE). Awarded by Harvey Prize in 2004. He was elected to the National Academy of Engineering in 1984 and to the National Academy of Science in 1996.

Arthur Ashkin was born in Brooklyn, New York, in 1922 to a family of Ukrainian-Jewish background. His parents were Isadore and Anna Ashkin. He had two siblings, a brother, Julius (also a physicist) and a sister, Ruth. Ashkin graduated from Brooklyn's James Madison High School in 1940. Ashkin finished his course work and obtained his B.S. degree in Nuclear Physics at Columbia University in 1947, received his Ph.D. degree at Cornell University in 1952 and then went to work for Bell Labs at the request

Optical Tweeter are scientific instruments that use a highly focused laser beam to provide an attractive or repulsive force (typically on the order of piconewtons), depending on the relative refractive index between particle and surrounding medium, to physically hold and move microscopic objects similar to tweezers(small tools used for picking up objects). They are able to trap and manipulate small particles, typically order of micron in size including dielectric and absorbing particles.

Ashkin started his work on manipulation of micro particles with laser light in the late 1960s which resulted in the invention of optical tweezers in 1986. He also pioneered the optical trapping process that eventually was used to manipulate atoms, molecules, and biological cells. The key phenomenon is the radiation pressure of light; this pressure can be dissected down into optical gradient and scattering forces

Ashkin was able to use the radiation pressure of light to move physical objects, which is an old dream of science fiction. At Bell Labs, Ashkin worked in the microwave field until about 1960 to 1961, and then switched to laser research. His research and published articles at that time pertained to nonlinear optics, optical fibers, parametric oscillators and parametric amplifiers. Also, at Bell Labs during the 1960s, he was the co-discoverer of the photorefractive effect in the piezoelectric crystal.

Tanmaya Bal
4th Sem. ECE

Electronic toll Collection System

Abstract: *In this work a Radio Frequency Identification (RFID) technology based Electronic Toll Collection (ETC) System is discussed as a solution to solve the traffic problems and also to maintain transparency of the toll collection system. The objective is to make a digital toll collection system which will be less time consuming and automatic. The proposed RFID system uses tags that are mounted on the windshields of vehicles, through which information embedded on the tags are read by RFID readers; the proposed system eliminates the need for vehicle owners and toll authorities to manually perform ticket payments and toll fee collections, respectively. For this purpose a website and an user friendly android app is also developed to enable a more efficient toll collection system that reduces traffic and eliminates possible human errors.*

Keywords: Radio Frequency Identification, Electronic Toll Collection System

I. INTRODUCTION

Transportation is the backbone of any country's economy. Improvement in transportation systems result into a good lifestyle in which extraordinary freedom for movement, trade of manufactured goods and services, as well as higher rate of employment levels and social mobility can be achieved. In fact, the economic condition of a nation has been closely related to efficient ways of transportation [1]. Increasing number of vehicles on the road, result into number of problems such as congestion, accidents, air pollution and many others. All economic activities for different tasks use different methods of transportation. For this reason, increasing transportation has an immediate impact on productivity of nation and the economy. Reducing the cost of transporting resource at production sites and transportation of completed goods to markets is one of the important key factors in economic competition. Automatic toll collection is a technology that allows the automated electronic collection of toll costs [2]. As it is studied by researchers and also applied in various expressways, bridges, and tunnels. ETC is capable of determining if the vehicle is registered or not, and then informing the management centre about process violations, debits, and participating accounts. The most advantageous use of the ETC system is that it is capable of eliminate congestion in toll plaza, especially during those seasons when traffic seems to be higher than normal.

II. BACKGROUND OVERVIEW

There are two methods of collecting tax presently used. The First one is the traditional manual method where one person collects money and issues a receipt [3]. The second method is the Smart Card method, where the person needs to show the smart card to the system installed at the toll tax department to open the Gate [4]. In this existing method the user have to enter the data through manual process and collect the required amount from the traveller and give the correct balance amount to the traveller which may take few minutes. This process makes other travellers to wait in the queue for long time and consumption of petrol also increases. Both the above mentioned methods for collecting tax are time consuming [5] [6]. Chances of escaping the payment of tax are there which leads to queuing up of following vehicles [7].

III. PROPOSED SYSTEM

This work presents a simplified procedure to passengers to pay toll at toll booths by making them automated, detecting vehicle theft, avoidance of signal breaking, tracking over speeding vehicles, etc. All these activities are carried using a single RFID tag thus saving the effort of carrying money and records manually. The RFID Readers mounted at toll booth will read the prepaid RFID tags fixed on vehicles windshield and automatically respective amount will be deducted. If the

tag is removed from the windshield then cameras fixed at two sites at toll plaza take snaps of the front and back number plates. Since every vehicle registration ID is linked to users account, toll can be deducted from the account bank directly.

Whenever the matter of integration of systems comes to the mind, a system should support few important features. The presented work also supports a number of important features as discussed below:

Accuracy: All the functionally bonded logical dependencies are integrated.

Efficiency: The whole system works under all circumstances and in long run it work efficiently irrespective of their proprietary format.

Cost Effectiveness: As the proposed model do not require any special software for implementation hence is less costly as compared to other existing system.

Any Prerequisite for the use: As the existing systems are not altered, and integration is done in the background, there is no need for any training.

The Electronic Toll Collection System is a new toll system designed to enhance convenience for drivers by enabling cashless toll collection and thus reducing congestion at high way toll gates. This work is also extended to develop an user friendly android app through which the vehicle owners can visit their accounts and see their details. There they can add money in the wallet which will be deducted when the vehicle passes through the toll plaza.

IV. METHODOLOGY AND WORKING PRINCIPLE

Whenever any person buys a vehicle, first he/she needs get his/her vehicle registered in the RTO office. RTO people will assign a number plate to it along with it they will give a RFID enabled smart card. This card will have a unique ID to be used with that vehicle only [6]. They will also create an account for that particular smart card and maintain transaction history in database. Owner of the vehicle needs to deposit some minimum amount to this account. Every time a registered vehicle approaches the toll booth, first the Infrared sensors will detect the presence of the vehicle which in turn activate the RFID circuit to read the RFID enable smart card fixed on the windscreen of the vehicle. Transaction will begin, depending upon the balance available toll will be deducted directly or the vehicle will be directed towards another lane to pay tax manually. The software further updates the details in the centralized database server. It also triggers mechanism to generate the bill which will be sent to the user as an Email. On the other hand, whenever any vehicle owner registers a complaint at the RTO office regarding theft of the vehicle, respective entry is made in the database. Any vehicle arriving at toll booth with same ID as already present in stolen vehicle category will be easily identified as the ID assigned with it is unique. All the toll plazas will be connected to each other along with a centralized server in the form of LAN. Updates of any sort of transaction will be immediately updated to local database and centralized server.

The proposed model is designed in such a manner that it will be very easy and comfortable to use for all. In front of toll plaza there will be a display where it will show a welcome message. After a vehicle enters to the bridge he/she will go ahead to the toll plaza. Servo motor helps the gate to open when it gets

the signal from Arduino. Arduino will only send the signal to servo motor if the actual toll is given for that vehicle. There will be RFID tag in every vehicle by which they can easily be detect. This RFID will also be used for a registration of each car. All the vehicles will have an account as a general where certain amount of money needs to deposited to used at the bridge every time. This account will be internally connected through each vehicles registration respectively. So that when ever that vehicle will pass only that vehicle will be allowed. When a traveller pays toll with his registered card then the amount of his/her toll will be deducted from his account. After that an Email will be sent to his phone that how much toll he has paid and the remaining amount in his account. So there will be no issue of over changing or wastage of time in changing the money. The passenger also need not worry for the receipt as the message will be automatically sent to their mails when toll will be deducted from the account of passenger. As the passenger pays the toll he/she will be allowed go. Figure (1) shows the proposed system for RFID toll tax collection. Figure(2) presents the use case diagram for the model and the work flow is presented in Fig (3).

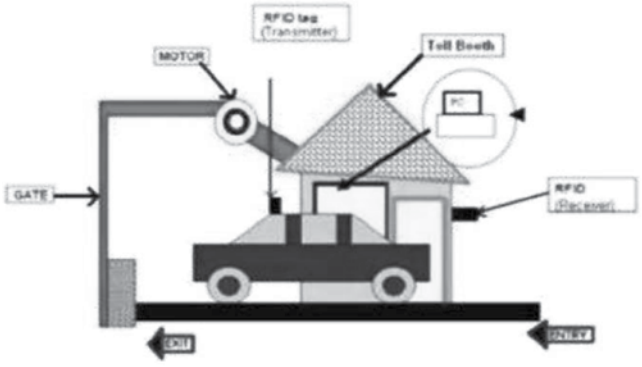


Fig. 1: *The Proposed System of RFID toll tax collection*

Here as soon as the vehicle enters the toll booth post, the reader attached at the toll booth tries to catch the signals from the RFID reader that is attached along with the vehicle. As soon as reader receives the signal from the RFID tag that is attached with the vehicle, it sends the signal information to the database server. The server access information of the vehicle from its database and on the basis of the pre-stored information it identifie the vehicle.

On the basis of this data, the tax for the vehicle is calculated and thus the same amount is deducted from the users account. If the users account has the sufficient balance, then it is deducted and the barrier is lifted thus allowing the vehicle to pass through. Also the user receives an e-mail for the transaction. If the account doesn't have the sufficient balance then the barrier will not lifted and a message blinks for the insufficient balance thereby informing the person at the toll gate to collect it manually. Once the tax is collected manually the barrier is lifted and the user is allowed to pass through. Here also an email is sent to the user about the transaction and also alerting him/her to refill his payment wallet. The hardware connection details are presented in Table (1).

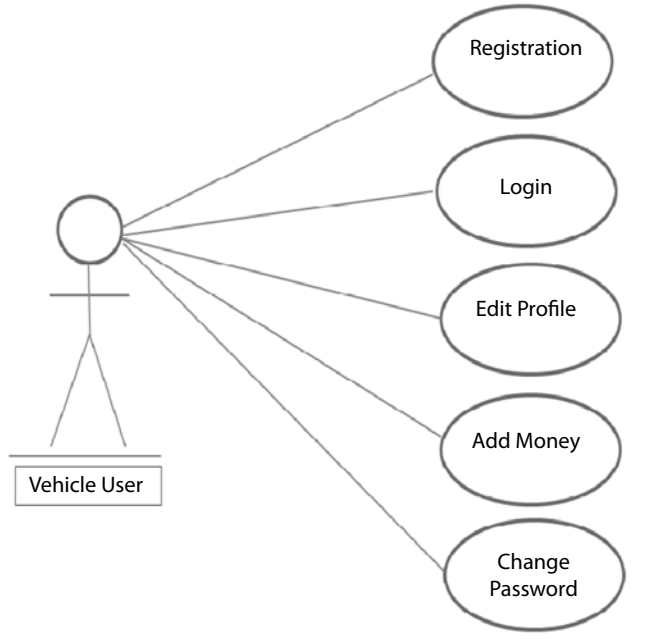


Fig. 2: *Use Case diagram*

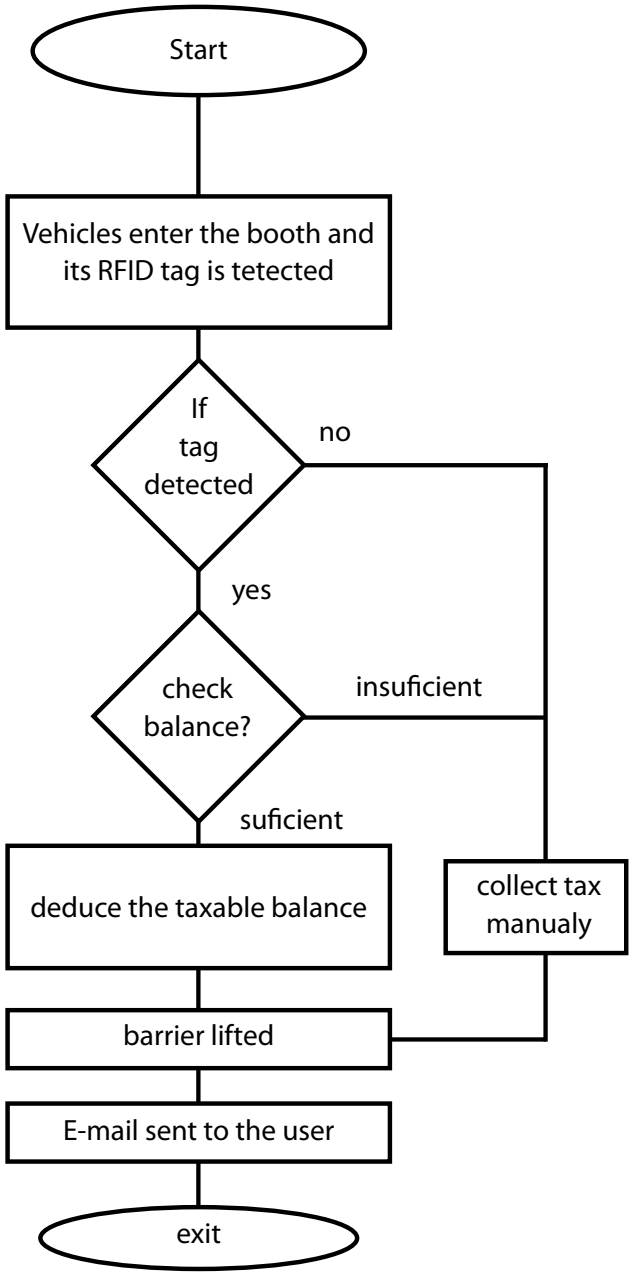


Fig. 3: *Work flow diagram*

Table 1: *Hardware Connections*

RFID	MODEMCU
SDA	D8
SCK	D5
MOSI	D7
MISO	D6
IRQ	NOT CONNECTED
GND	GND
3.3V	3.3V
RST	GND

SERVO MOTOR	NONDEMCU
ORANGE	D4
RED	3.3V
BROWM	GND

IR SENSOR	NODEMCU
3.3V	3.3V
GND	GND
OUTPUT	D1

V. CONCLUSIONS AND FUTURE SCOPE

Time is changing and even this manual technique for taxation at toll station has to change and seeing a change in minds set of every individual this technology would also be taken whole heartedly. And paying Toll at the Toll station won't be that time consuming and much accurate and preferred across every nook and corner of the globe wherever there would be a toll station. Based on the advantages provided by the presented system, it's not that far when this technology will be used in India and in terms benefiting the whole society as well as the company which is involved in Toll taxation.

RFID is a powerful technology, and it is likely to see world-wide deployment within the coming years. Continuous technological advancements of RFID have resulted in reduced cost of installation and maintenance of devices across different market segments. Comparing advantages and limitations of the presented system it can be concluded that it will be beneficial for daily travellers and Toll station authorities to lessen the burden. Also, while RFID may seem to be a fairly simple and innocuous technology on the surface, a wide range of issues and choices need to be explored and resolved for its successful, wide-scale deployment. We are seeing great promise and signs that the RFID and future upcoming sensor network technologies will help to change the way we think about our manufacturing processes and the interactions with the people and customers. This work may further be extended by designing an enhanced database and image processing system. The payment system may be made more accurate by allowing the user to directly transfer from his bank account through card payment or UPI payment. New features may be added that will allow the government cars to pass through without collecting their tax.

ACKNOWLEDGEMENT

We express our sincere gratitude to our project guide Mrs. Suchismita Rout of CSE department for her guidance and encouragement in carrying out this work.

REFERENCES

[1] A. A. Laghari, M. Sulleman Memon, A. Pathan, "RFID Based Toll Deduction System", I. J. Information Technology and Computer Science, April, 2012

[2] S. Bhosale, D. N. Wavhal. "Automated Toll Plaza System using RFID" IJSETR, Vol 2,Issue 1, Jan 2013.

[3] F.Don,"Electronic Toll Collection: An Introduction and Brief Look at Potential Vulnerabilities," in SANS Institute infoSec Reading Room, 1.4b ed. 2004.

[4] G. K. Andurkar and Vidya R. Ramteke, "Smart highway Electronic Toll Collection system", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 3, Issue 5, May 2015

[5] A. Kumawat, K. Chandramore, "Automation Toll Collection System Using RFID", Vol. 2, Issue 2, April-June 2014.

[6] M. Ayoub Khan, S. Manoj and R. B. Prahbu "A Survey of RFID Tags", International Journal of Recents Trends in Engineering, vol 1, no 4, May 2009.

[7] P. Sharma and V. Sharma ,"Electronic toll collection technologies: A state of art review" ,an nternational Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 7, July 2014.

Shashwat Kumar Muduli,
Subhasanket Satapathy,
Soumya Sourav Kar
8th Sem. CSE

BIOMATERIALS

Now-a-days the most important substances in the medical fields are Biomaterials. Biomaterial can be defined as a substance that can be engineered to interact with living components or biological systems which deals with a wide range of application in medical, biology, material science and many more. The term `biomaterial' first came into picture in the year 1960, biomaterial can be explained as the material of natural or synthetic origin in contacts with tissue or blood intends to use in prosthetic, diagnostic, therapeutic without adversely affecting the living organisms. Biomaterial includes metals, ceramic, glass etc.

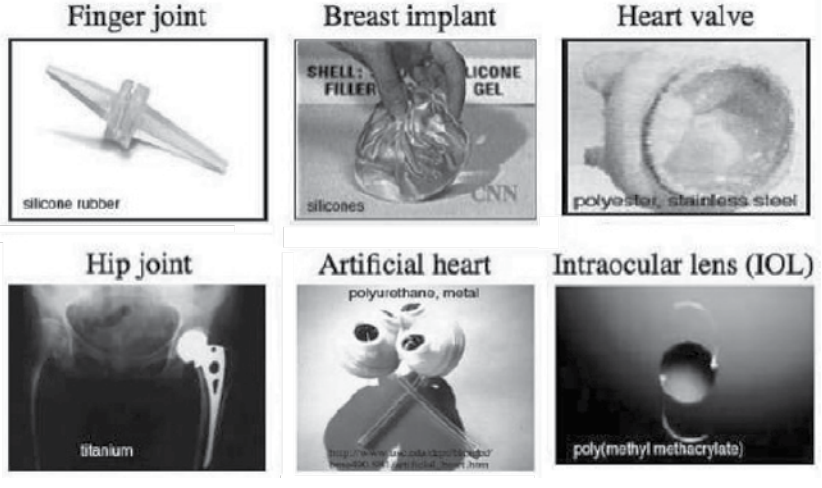
Biomaterials are found in the things such as contact lens, pacemakers, heart- values and much more. When millions of patient all around the world suffers from tissue failure, then, it made biomaterial to come into the picture. A huge amount is spent on the treatment of this particular disease every year. There are around 8 million different surgical procedure for the treatment of this disease i.e. blood material interaction, acute inflation & chronic inflation.

Based on application in the medical field biomaterials are classified into 4 types: Metals and Alloys Biomaterials; Ceramics; Polymer; Composite Biomaterials.

1. Metals and alloys are used as biomaterial due to their excellent electrical and thermal conductivity and mechanical properties. Examples of metals and alloys are cobalt, titanium etc. ASTMF -136 is an alloy which is used in dental application for making screws wire artificial teeth.
2. Ceramics are used as biomaterial due to their high medical strength and biocompatibility. Examples of Ceramic are AL2O3 and SIO2.AL2O3 and SIO2 is used to make femoral head. Alumina is used as orthopedic. Porous alumina used in teeth roots.
3. Bimolecular are the macromolecules (protein, nucleic acids and polysaccharides) formed in nature during the growth cycles of all organism.
4. Composite is usually reversed for those materials in which the distinct phases are separated on a scale. Applications of Composite biomaterial are in dental filling composites and orthopedic implants with porous surfaces.

Variation in the eye length can disturb the power of the refractive index of the eye, cornea and interior lens to focus the light image correctly on the retina, resulting in blurred vision. In order to correct such abnormalities, lenses such as spectacles and contact lenses are added to the front of the cornea to adjust the light reflection. Contact lenses which are placed up on the cornea can be made of biomaterial.

These biomaterials are also important aspects of medical field, i.e., replaces of diseased or damaged part like artificial hip joint, improves the function of cardiac pacemaker, intraocular lens, correct functional abnormality of cardiac pacemaker & aid to diagnosis, aid to of drains.



Biomaterial will become an emerging industry for the coming generation of medical implants and therapeutic modalities and it will interface the biotechnology and traditional engineering. Biomaterials are going to be the one of multi-billion-dollar industry in next 15 years.

Rohit Kumar Nayak
4th. Sem. ECE

Underground Cable Fault Detection using Arduino

Abstract: *The main objective of this project is to detect the faults and abnormalities occurring in underground cables using an Arduino. The basic idea behind the working of this project is ohme's law. At the feeder end,when a DC voltage is applied, based on the location of fault in the cable,the value of current also changes. So in case of a short circuit fault like L-G or L-L fault the change in voltage value measured across the resistor is then fed to the in-built ADC of the Arduino.This value is processed by the Arduino and the fault is calculated in terms of distance from the base station.This value is sent to the LCD interfaced to the Arduino board and it displays exact location of the fault from the base station in kilometers for all the three phases.This project is arranged with a set of resistors which represent the length of the cable.At every known kilometer fault switches are placed to induce faults manually.Finally the fault distance can be determined.*

I INTRODUCTION

A bundle of electrical conductors used for carrying electricity is called as a cable. An underground cable generally has one or more conductors covered with suitable insulation and a protective cover. Commonly used materials for insulation are varnished cambric or impregnated paper. Fault in a cable can be any defect or non-homogeneity that diverts the path of current or affects the performance of the cable. So it is necessary to correct the fault [1,2,3].

Power Transmission can be done in both overhead as well as in underground cables. But unlike underground cables the overhead cables have the drawback of being easily prone to the effects of rainfall,snow,thunder, lightning etc. This requires cables with reliability,increased safety,ruggedness and greater service. So underground cables are preferred in many areas especially in urban places. When it is easy to detect and correct the faults in overhead line by mere observation,it is not possible to do so in an underground cable. As they are buried deep in the soil it is not easy to detect the abnormalities in them. Even when a fault is found to be present it is very difficult to detect the exact location of the fault. This leads to digging of the entire area to detect and correct the fault which in turn causes wastage of money and manpower. So it is necessary to know the exact location of faults in the underground cables. Whatever the fault is the voltage of the cable has the tendency to change abruptly whenever a fault occurs. We make use of this voltage change across the series resistors to detect the fault.

II. FAULTS IN UNDERGROUND CABLES

A. Open Circuit Faults

These faults occur due to the failure of one or more conductors. The most common causes of these faults include joint failures of cables and overhead lines, and failure of one or more phase of circuit breaker and also due to melting of a fuse or conductor in one or more phases.Open circuit faults are also called as series faults. These are unsymmetrical or unbalanced type of faults except three phase open fault.

B. Short Circuit Faults

A short circuit can be defined as an abnormal connection of very low impedance between two points of different potential, whether made intentionally or accidentally. These are the most common and severe kind of faults, resulting in the flow of abnormal high currents through the equipment or transmission lines. If these faults are allowed to persist even for a short period, it leads to the extensive damage to the equipment. Short circuit faults are also called as shunt faults. These faults are caused due to the insulation failure between phase conductors or between earth and phase conductors or both. The various possible short circuit fault conditions include three phase to earth, phase to phase, single phase to earth, two phase to earth and phase to phase [3,4,5]. In single line to ground fault,fault occurs between any one of the three lines and the ground. In double line to ground fault, fault occurs between any two of the three lines and the ground. In line to line fault,fault occurs between any two lines. When fault occurs there is an abrupt change in voltage. This change in voltage may cause serious damages to the system if not corrected in time. So immediate step of fault correction is isolation of the faulty part from the rest of the system [6, 7, 8].

C. Earth Fault

An earth fault is an inadvertent contact between an energized conductor and earth or equipment frame. The return path of the fault current is through the grounding system and any personnel or equipment that becomes part of that system.

III. FAULT DETECTION METHODS

A. Onlline Method

This method utilizes and processes the sampled voltage and current to determine the fault points. Online method for underground cable are less common than overhead lines [9, 10].

B. Offline Method

In this method special instrument is used to test out service of cable in the field.This offline method can be divided into two methods.They are tracer method and terminal method.

• Tracer Method
In this method fault point is detected by walking on the cable lines. Fault point is indicated from audible signal or electromagnetic signal. It is used to pinpoint fault location very accurately.

• Terminal Method
It is a technique used to detect fault location of cable from one or both ends without tracing. This method locate general area of fault, to expedite tracing on buried cable.

IV. PROPOSED SYSTEM

The circuit as shown in fig. 1 consists of a power supply, 4 line display, arduino and resistance measurement circuit.To induce faults manually in the kit,fault switches are used.About 12 fault switches are used which are arranged in three rows with each row having 4 switches.The 3 rows represent the 3 phases namely R,Y and B.The fault switches:have 2 positions-No fault position(NF) and fault position(F).Main component of the underground cable fault detection circuit is low value resistance measurement. It can measure very low value resistance as the cables have around 0.165 Ohm/meter resistance. For 10 meter cable resistance becomes 1.65 Ohm. This circuit can measure resistance up 50 Ohm, Maximum cable length it can check up to 8 kilometers.

So starting from the reference point 4 sets of resistances are placed in series.These 4 sets of resistances represent the three phases and the neutral.Short circuit faults,Symmetrical and unsymmetrical faults can be determined by this method. This project uses three set of resistances in series (ie)R10-R11-R12-R12,R17-R16-R14R21,R20-R19-R18-R25 one for each phase. Each series resistor represents the resistance of the underground cable for a particular distance and so here four resistances in series represent 1-8kms.Value of each resistance is 330kΩ.

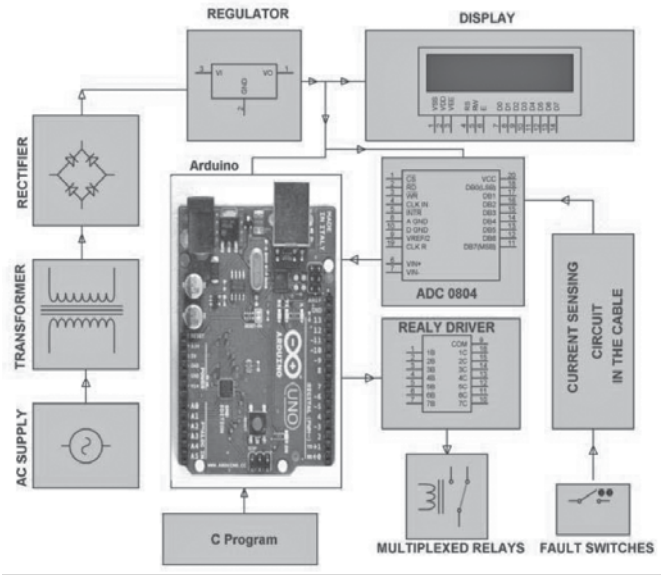


Fig -1: *Block Diagram*

One relay for each phase R,Y and B a three relays are used and the common points of the relays are grounded and the NO points are connected to the inputs of R17,R21 and R25 and being the three phase cable input.As supply needed for the relays is higher than that of the arduino, Relay driver is used to boost the supply and provide it to the relays.A 230V AC supply is applied to the transformer from where it is stepped down to 12V AC.From the transformer the alternating current gets converted into direct current when it passes through a Bridge wave rectifier.The 12V DC then goes to the voltage regulator where it gets converted from 12V DC to 5V DC.Voltage regulator is used also converts the variable DC supply into constant DC supply.This 5V DC is used to supply power to the arduino and the LCD.Power supply to the LCD is given from the voltage regulator.

When fault is induced by operating any of the 12 switches,they impose conditions like LG,LL,LLG fault

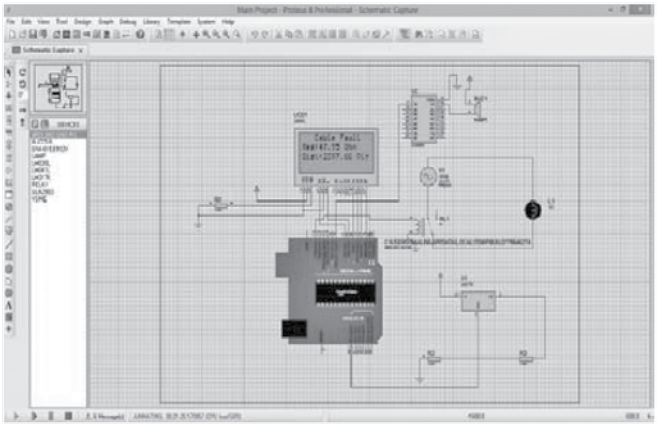


Figure.2.*Simulation Diagram with Fault*

as per the switch operation.As a result of the fault,there is a change in voltage value.This voltage value measured across the resistance is fed to the ADC of the Arduino. Using this value,the Arduino computes the distance. Finally the distance of the fault from the base station is displayed in kilometers and the SMS will sent to the registered Mobile number using the GSM Technology. Fig. 2 shows the simulation diagram.

A. Power Supply

The power supply circuit consists of step down transformer which is 230v step down to 12v.In this circuit 4diodes are used to form bridge rectifier which delivers pulsating dc voltage and then fed to capacitor filter the output voltage from rectifier is fed to filter to eliminate any a.c. components present even after rectification. The filtered DC voltage is given to regulator to produce 12v constant DC voltage.

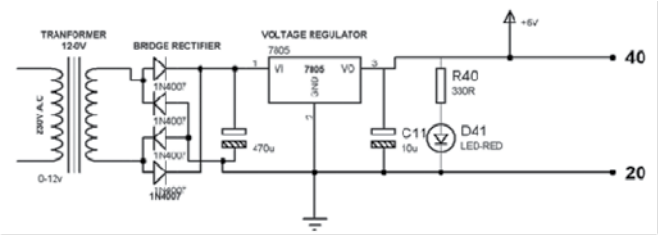


Fig -3:*Power Supply Diagram*

B. Rectifier

The rectifier circuit is shown in Fig. 3. The output from the transformer is fed to the rectifier. It converts A.C. into pulsating D.C. The rectifier may be a half wave or a full wave rectifier. In this project, a bridge rectifier is used because of its merits like good stability .The circuit has four diodes connected to form a bridge. A rectifieris an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification.

Rectifiers have many uses, but are often found serving as components of DC supplies and high-voltage direct current power transmission systems. Rectification may serve in roles other than to generate direct current for use as a source of power.

C. LCD

Liquid crystal display are interfacing to microcontroller 8051.Most commonly LCD used are 16*2 and20*2 display. In 16*2 display means 16 represents column and 2 represents rows. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

D. Voltage Regulator

A voltage regulator shown in Fig. 4 is an electrical regulator designed to automatically maintain a constant voltage level. In this project, power supply of 5V and 12V are required. In order to obtain these voltage levels, 7805 and 7812 voltage regulators are to be used. The first number 78 represents positive supply and the numbers 05, 12 represent the required output voltage levels. The L78xx series of three-terminal positive regulators is available.

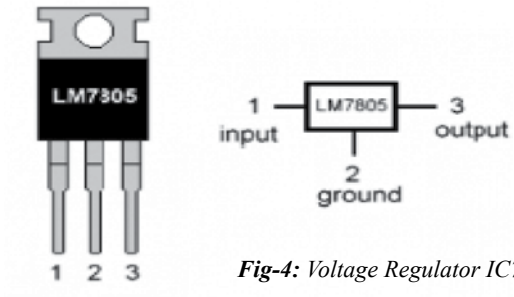


Fig-4: *Voltage Regulator IC7805*

E. Arduino

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.

F. Relay

Relay is sensing device which senses the fault and sends a trip signal to circuit breaker to isolate the faulty section.

A relay is an automatic device by means of which an electrical circuit is indirectly controlled and is governed by change in the same or another electrical circuit. There are various types of relay: Numerical relay, Static relay and electromagnetic relay. Relay are housed in panel in the control room. Here three mini power relays are used each for one of the three phases.The relays periodically scan the three phases and send the signal to the Arduino controller. The rating of each of the relays is about 12V.

G. Relay Driver ICRELAY DRIVER IC

Driver Circuit is used to boost or amplify signals from micro-controllers to control power switches in semi-conductor devices. Driver circuits take functions that include isolating the control circuit and the power circuit, detecting malfunctions, storing and reporting failures to the control system, serving as a precaution against failure, analyzing sensor signals and creating auxiliary voltages.In this project,ULN2003 is used as the relay driver circuit.It is an uninterrupted circuit which functions as the relay driver and boosts up the supply going to the relay.

H. GSM(Global System Of Mobile)

A GSM is an open, digital cellular technology which accepts a SIM card and operates over a subscription to a mobile operator, it works just like mobile phone. In this paper GSM is also used when user is at long distance, where the fault occurs this information is sent in the form of message via GSM.

V. CONCLUSIONS

Thus the project on Underground cable fault detection using Arduino was done and the distance of the fault from the base station in kilometers was displayed for the three individual phases R,Y and B. Circuit can be tested with different resistor values to simulate various fault conditions In this project faults upto a distance of 4 km can be detected.When the fault switches are operated to fault condition then the phase corresponding to that particular switch is considered as the faulty phase. So the faulty section can easily be located.

REFERENCE

[1] Anurag. D. Borkhade, "Transmission Line Fault Detection Using Wavelet Transform", International Journal on Recent and Innovation Trends in Computing and Communication, Volume. 2 Issue. 10.

[2] Xia Yang, Myeon-Song Choi ,Seung-Jae Lee, Chee-Wooi Ten, and Seong-Il Lim, "Fault Location of Underground power cable usiNg Distributed parameter approach", IEEETransactions on Power Systems, Vol. 23, No. 4, November 2008.

[3] Pooja P.S and Lekshmi M, "Fault Detection Technique to pinpoint Incipient Fault for Underground Cables", International Journal of Engineering Research and General Science, Volume 3, Issue 3, May-June, 2015.

[4] Yu Xiang and Joseph F.G. Cobben, "A Bayesian Approach for Fault Location in Medium Voltage Grids With Underground Cables", IEEE Power and Energy Technology Systems Journal, Volume 2, No. 4, December 2015.

[5] Abhishek Pandey and Nicolas H. Younan, "Underground cable fault detection and identification via fourier analysis", International Conference on High Voltage Engineering and Application, 11-14 Oct. 2010.

[6] H. Shateri, S. Jamali, "Impedance Based Fault Location Method For Phase To Phase And Three Phase Faults InTransmission Systems", IEEE 2010.

[7] Abhishek Pandey, Nicolas H. Younan, "Underground Cable Fault Detection and Identification via Fourier Analysis", IEEE2010.

[8] A.Ngaopitakkul,C.Pothisarn,M.Leelajindakrairerk, "Study of Characteristics for Simultaneous Faults in Distribution Underground Cable using DWT", IEEE2011.

[9] Yuan Liao, Ning Kang, "Fault-Location Algorithms Without Utilizing Line Parameters Based on the Distributed Parameter Line Model", IEEE Transactions on Power Delivery, VOL. 24, NO. 2, April 2009.

[10] S. Navaneethan, J. J. Soraghan, W. H. Siew, F. McPherson, P. F. Gale,"Automatic Fault Location for Underground Low Voltage Distribution Networks", IEEE Transactions on Power Delivery, Vol. 16, no. 2, April 2001.

Rajib Kumar Nayak, Soumya Ranjan Pattnaik,
Iswar Chandra Sahoo,Chitranjan Kumar,
Mohit Mohanty, Srijeet Pradhan
Dept of ECE

ICT Infrastructure and Decision Support System for Precision Agriculture

Agriculture in India has a significant history. Today, India ranks second worldwide in farm output. The economic contribution of agriculture to India's GDP is steadily declining with the country's economic growth. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India. Now days the recent technological adaptation in the field of agriculture is gradually increasing. Precision Agriculture presents the most innovative results emerging from research in the field of agriculture. This work also aims to provide farmers with a wealth of information to build up a record of their farm, improve decision-making, foster greater traceability, enhance marketing of farm products, improve lease arrangements and relationship with landlords, enhance the inherent quality of farm products.

Precision agriculture technology (PA) is designed to provide information and data to assist farmers when making Site-Specific Management (SSM) decisions. By making more informed management decisions, farmers can become more efficient, lower costs, and become more profitable. However, little is known about how farmers use PA to make management decisions, identify production problems, and about the relative magnitude of benefits and costs of PA on individual agricultural land. Therefore, research is needed to find answers to questions surrounding the adoption, uses, and the potential management benefits of PA in India.

This proposed method can be utilized for the monitoring and control of soil fertility using energy efficient Information and Communication Technology (ICT) and wireless sensor network (WSN) environment. The purpose of the methodology is to provide a cost effective solution for the farmers to get adequate information regarding their land productivity and prediction of efficient irrigation using Wireless Sensor Network (WSN) technology. An efficient routing technique is also required to collect error free soil information from the field. This real-time data will be suitable to predict future farming for better productivity of the agricultural land.

Similarly, irrigation is a crucial practice in several agricultural cropping systems in semiarid and arid areas, and also useful water applications and management are key concerns. The efficiency and uniformity of irrigation could be maintained from the complex and diverse information based systems by considering weather, soil, water, and crop data. There are models developed which uses the remotely sensed data to profile the soil moisture.

Dr. Ambarish Mohapatra

RAIN WATER HARVESTING

India, the second largest population in the world, is facing a water crisis with over 600 million people facing acute water shortage. LET'S SAVE THE RAIN by Rainwater Harvesting (RWH) which will improve water supply. RWH is a strategy of collection and storage of rainwater into natural reservoirs or tanks. Water insecure households or individuals in rural areas will benefit the most from RWH systems as it supplements the water sources such as groundwater or municipal water connections. High quality water - pure, free of chemicals can be available to the end users. This also reduce flood flows and hence reduced topsoil loss. This system can be implemented in individual homes, colonies, apartments, institutions, schools /colleges /universities, clubs, hospitals, industries, slums, everywhere. It consists of the following components:

1. Catchment from where water is captured and stored or recharged.
2. Conveyance system that carries the water harvested from the catchment to the storage.
3. First flush that is used to flush out the first spell of rain.
4. Filter used to remove pollutants.
5. Storage tanks and/or various recharge structures.

Normally the roof top is used as the catchment for RWH where it needs intensive filtration to make the storage water safe for drinking. To reduce the measure of contamination, Rain Sower which looks like an upside down umbrella can be used as the catchment to collect rain straight from the sky. The saved rain water can be utilised for drinking, cooking, bathing (potable quality) , toilet flushing, washing clothes, irrigation, livestock requirements etc. Tamil Nadu is the first Indian state to make RWH mandatory. The other states cannot afford it as this system can be limited by the amount of rainfall and the size of the catchment area and storage reservoir. The cost of rainwater catchment systems is almost fully incurred during initial construction. Rainwater quality may be affected by air pollution, animal or bird droppings, insects, dirt and organic matter. However proper filtering can remove the impurities. Water is a precious resource and RWH can surely help us to conserve this resource.

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

www.silicon.ac.in

The Science & Technology Magazine

Digest

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