

# Medical Image Fusion using Undecimated Discrete Wavelet Transform for Analysis and Detection of Alzheimer's Disease

T.Tirupal, T.K.Naga Vaishnavi, K.Anitha, K.Lavanya and E.H.Sandhya  
Department of ECE, G.Pullaiah College of Engineering and Technology, Kurnool, India

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## ABSTRACT

A novel algorithm for effectively fusing Alzheimer's effected medical images is proposed in this paper. Fusing is done in the Undecimated Discrete Wavelet Transform (UDWT) domain. Firstly, the RGB images are converted in to NTSC images and then UDWT is applied. In UDWT domain, Low frequency subbands are fused using maximum selection rule and high frequency subbands are fused according to the Modified Spatial Frequency (MSF). Lastly, fused image is obtained by inverse UDWT. The fused NTSC is again converted in to RGB image for fused RGB image. Superiority of the proposed method is presented and justified. Fused image quality is verified with various quality metrics i.e., Peak Signal to Noise Ratio (PSNR), Entropy, Spatial Frequency (SF) etc.,

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## Introduction

Alzheimer's disease is the most common form of dementia [1,2,3] in people. Alzheimer's disease (AD) [4, 5, 6] is an irreversible disease of the brain that affects a person's memory, thinking, and other abilities. The disease is named after Dr.Alois Alzheimer. In 1906, Dr. Alzheimer noticed changes in the brain tissue of a woman who had died of an unusual mental illness. Her symptoms included memory loss, language problems, and unpredictable behaviour. After she died, he examined her brain and found many abnormal clumps (now called amyloid plaques) and tangled bundles of fibers (now called neurofibrillary, or tau tangles). Figure 1 shows the brain affected image by Alzheimer's disease.



Figure 1. Brain affected by Alzheimer's disease

### Types of Alzheimer's disease [7, 8]

**Early-onset Alzheimer's:** This type happens to people who are younger than age 65. Often, they're in their 40s or 50s when they're diagnosed with the disease. It's rare -- up to 5% of all people with Alzheimer's have early-onset. People with Down syndrome have a higher risk for it.

**Late-onset Alzheimer's:** This is the most common form of the disease, which happens to people age 65 and older. It may or may not run in families. So far, researchers haven't found a particular gene that causes it. No one knows for sure why some people get it and others don't.

### Classification of Alzheimer's disease [9, 10, 11]

**Sporadic:** It is caused due to genetic and environmental risk

factors. 90-95% of cases are recorded under sporadic. 50% cases are related to age 85. Only 1% cases are related to 60-65 age.

**Familial:** It is caused due to mutations in gene. 5-10% cases are recorded under familial. More than two people from a family must have Alzheimer's disease to fall under this kind.

### Stages of Alzheimer's disease [12, 13, 14]

**Stage 1: normal:** There are no symptoms at this stage but there might be an early diagnosis based on family history.

**Stage 2: normal aged forget fullness:** The earliest symptoms appear, such as forgetfulness.

**Stage 3: mild cognitive impairment:** Mild physical and mental impairments appear, such as reduced memory and concentration. These may only be noticeable by someone very close to the person.

**Stage 4: mild Alzheimer's:** Alzheimer's is often diagnosed at this stage, but it's still considered mild. Memory loss and the inability to perform everyday tasks is evident.

**Stage 5: moderate Alzheimer's:** Moderate to severe symptoms require help from loved ones or caregivers.

**Stage 6: moderately severe Alzheimer's:** At this stage, a person with Alzheimer's may need help with basic tasks, such as eating and putting on clothes.

**Stage 7: severe Alzheimer's disease:** This is the most severe and final stage of Alzheimer's. There may be a loss of speech and facial expressions.

### Symptoms of Alzheimer's disease [15, 16, 17, 18]

Everyone has episodes of forgetfulness from time to time. But people with Alzheimer's disease display certain ongoing behaviours and symptoms that worsen over time. These can include:

- Memory loss affecting daily activities, such as an ability to keep appointments
- Trouble with familiar tasks, such as using a microwave
- Difficulties with problem-solving
- Trouble with speech or writing

# Fast and Accurate Content Based Image Classification and Retrieval using Gaussian Hermite Moments applied to COIL 20 and COIL 100

Dr B Chandra Mohan  
Professor & Head  
Department of ECE  
Bapatla Engineering College  
Bapatla, India  
[chandrabhuma@gmail.com](mailto:chandrabhuma@gmail.com)

T Krishna Chaitanya  
Assistant Professor  
Department of ECE  
Bapatla Engineering College  
Bapatla, India  
[tkrishna479@gmail.com](mailto:tkrishna479@gmail.com)

Dr T Tirupal  
Associate Professor  
Department of ECE  
G. Pullaiah College of Engg & Technology  
Kurnool, India  
[tirutalari@gmail.com](mailto:tirutalari@gmail.com)

## ABSTRACT

Image retrieval based on content is gaining popularity due to the rapid progress in the usage of image data over mobile and internet. Fast and accurate retrieval of the images is always essential in particular when the bandwidths are scarce. Many CBIR algorithms are available in the literature for various databases. This paper proposes a CBIR algorithm for improving the retrieval accuracy from COIL 20 and COIL 100. Both the databases are basically shape based ones. Even though many shape based descriptors are available image moments play an important role in the description of the shape. Some moments which are extensively used are Hu's moments, Fourier Mellin Moments, Zernike Moments, Legendre Moments, Gaussian Hermite moments, Chebycheff moments. In this work, an algorithm using Gaussian Hermite moments and SVM is proposed. Medium Gaussian kernel is used in the SVM. A cross validation of 10 fold is used for the simulations for COIL 20 database. 25% hold out validation is used for COIL 100 database due to its large size. Performance metrics used are precision and recall in addition to the average retrieval efficiency. An average retrieval accuracy of 100% is obtained for COIL 20 database. For COIL 100, the maximum average retrieval accuracy is 99.5%. 100% precision and recall are obtained for both the databases. Results are obtained with few features, the proposed algorithm is fast compared to many algorithms. Proposed algorithm is compared with the state of the art algorithms available in the literature.

## Keywords

Content Based Image Retrieval, Support Vector Machine, Gaussian Hermite Moments, COIL – 20, COIL – 100.

## I. INTRODUCTION

Retrieval of images from large databases based on the content is an important issue in the image search engines. Image retrieval using content, known as Content Based Image Retrieval (CBIR) is an important research area in image processing. There are many applications of CBIR in various diversified fields including finger print recognition, crime detection and cataloguing. A major parameter or metric in CBIR is the retrieval efficiency which is an indicator of how effectively the algorithm is able to retrieve the relevant image from the database based on the input query image. The higher the retrieval efficiency, the better the algorithm is. There are three fundamental steps in CBIR. The first step identifies the key features of the image (query or database) for recognition. Color, texture, and shape are the prominent features considered in CBIR. Nature of the database under consideration in general decides the feature(s) so that the selected feature(s) must uniquely represent the image effectively.

## II. RELATED WORKS

In this work, COIL-20 (Columbia Object Image Library) and COIL-100 databases are used for experimentation. Shape description or representation is an important issue both in image recognition and classification. The selected shape descriptor must be affine invariant, robust, compact, and easy to derive. The two prominent and widely used shape descriptors are contour-based and region-based shape descriptors. In contour-based shape descriptors, the boundary information is only considered and the interior content of the shape is neglected. In region-based shape descriptors, interior pixels of shape are considered and hence complex shapes can be effectively represented.

Many techniques such as chain code, polygonal approximations, curvature, Fourier descriptors, radii method and moment descriptors have been proposed and used in various applications. The region based shape descriptors, viz. Moment Invariants (MI), Zernike Moments (ZM), Fourier Mellin Moments, Charlier Moments, Pollackzek Moments, Gaussian Hermite Moments (GHM), Gagenbauer Moments, Chebycheff Moments, and Legendre Moments (LM) are used to represent the shape content of an image. MI is non-orthogonal and hence is not suitable for image representation. LM and ZM [3] are orthogonal and are useful in CBIR. Zernike moments are rotation invariant but are computationally complex compared to Legendre Moments. With proper normalization scale invariance can be achieved. Exact Legendre Moments (ELM) [2] represents the image effectively. Histogram of edge directions are used to represent the shape which are not normalized to scale. Although Zernike moments are better in describing the visual content of the image, it is computationally expensive. Some of the authors have used Relief Features [6, 7] for feature extraction and ACO for optimal selection of features.

Hosny et al., [1] proposed a fast and accurate method for computation of exact Gaussian Hermite Moments (GHM) for gray level images. A set of 2D Gaussian Hermite moments are computed exactly by using a mathematical integration of Gaussian Hermite polynomials and then, a fast algorithm is applied for reduction of computation complexity. In [18], the authors proposed a shape based image retrieval using lower order Zernike Moments. The proposed algorithm was tested on COIL-100. A CBIR system for image Gallery Search application has been proposed by Nicole Tham Ley Maiet. al. [19]. They have applied their algorithm to several shape based image databases including COIL 100. They got an accuracy of 99.9% for COIL 100. The proposed work is targeted for improving the classification accuracy to 100%, subsequently 100% precision and recall can be achieved. With appropriate selection of type of moment, order of moment and parameters in the moment characterization ( $\sigma$ ). Proper selection of the classifier with appropriate hyper parameters in the Kernel is also important for better accuracy. We have demonstrated that

## Type-2 Fuzzy Set based Multimodal Medical Image Fusion

T.Tirupal<sup>1</sup>, B.Chandra Mohan<sup>2</sup> and S.Srinivas Kumar<sup>3</sup>

<sup>1</sup>Department of ECE, G.Pullaiah College of Engineering and Technology, Kurnool 518002

<sup>2</sup>Department of ECE, Bapatla Engineering College, Bapatla 522101

and

<sup>3</sup>Department of ECE, JNTUA, Ananthapuramu 515002

Presenting Author: T.Tirupal, Email: [tirutalari@gmail.com](mailto:tirutalari@gmail.com)

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### Abstract

The main objective of image fusion for multimodal medical images is to retrieve valuable information by combining multiple images obtained from various sources into a single image suitable for better diagnosis. In general, the visibility of structural details in medical images is difficult to interpret. Soft computing techniques have been applied to enhance the images and to extract the details from the images. Fuzzy sets are more suitable for medical images since the images have more uncertainties. A fuzzy set approach is proposed in this paper. Type-2 fuzzy sets are used in this work. The efficiency of the proposed method is demonstrated by applying the algorithm on several pairs of medical images. The fused image is analyzed qualitatively using the attributes like spatial frequency, entropy, and edge information preservation. Simulated results are also compared with the existing works in the recent literature like non-fuzzy, Type-1 fuzzy and intuitionistic fuzzy sets.

**Keywords:** image fusion; diagnosis; fuzzy sets; type-2 fuzzy sets; spatial frequency.

### 1 Introduction

Multimodal medical image fusion is the process of uniting two multimodal medical images to increase the excellence of output image. In combining medical image pairs such as CT-MRI (computed tomography-magnetic resonance imaging), MRI-MRA (magnetic resonance imaging - magnetic resonance angiography), Xray - VA (Xray - vibroacoustography), MRI-PET (magnetic resonance imaging - positron emission tomography), and MRI-SPECT (magnetic resonance imaging - single photon emission computed tomography) [1-3], image fusion is gradually attaining significance in healthcare and modern medicine. These sets of images are used for extracting clinical facts that are complementary in nature. For example, CT image embeds with a lesser amount of distortion and delivers details regarding condensed structures like bones, MRI provides neurotic soft fleshy tissue information, MRA senses easily brain defects, X-ray detects fractures and aberrations in bone position, VA provides deepness and wideness of disease object, PET and SPECT provide functional and metabolic information of human brain. Therefore, we can say that not a single image will provide all significant information and hence multimodal medical image fusion is essentially necessary to achieve all possible complete information in a single merged image called fused image.

Several existing techniques of fusing images comprise pixel averaging, a simplest image fusion method which takes pixel by pixel average of the two images but leads to contrast reduction. Principal component analysis (PCA) [4], degrades the performance of the fused image. Pyramid decomposition methods fail to introduce spatial orientation selectivity in the decomposition process and

cause undesired edges in the fused image. Multiresolution techniques like wavelet transforms [5], do not provide shift invariance in the coefficients and this can be overcome by using a redundant wavelet transform (RWT) [6]. The major drawback of RWT is increased computational complexity since the wavelet is undecimated and all these methods are weak in boundary detection of a disease (in a medical image) present in the fused image.

Fuzzy sets play a significant role in image processing to eliminate the ambiguity and vagueness present in images. Fuzzy sets take uncertainty in the form of a membership function which lies in the interval  $[0, 1]$  where 0 represents no membership and 1 represents full membership. The Fuzzy set theory proposed by Zadeh [7] in 1965 is not able to directly model uncertainties. The generalized form of fuzzy set theory introduced by Atanassov [8] in 1986 is intuitionistic fuzzy set (IFS) which takes two uncertainty parameters – the membership degree and non-membership degree (due to hesitation degree). The non-membership degree gives vague knowledge and solves adequately real time problems. Many uncertainties exist in every phase of the image processing and using IFSs these uncertainties can be removed and the image is enhanced in terms of contrast of the image.

There are different sources of uncertainties in Type-1 fuzzy sets [9]; they are inaccurate measurements, disagreement of the membership values with the accurate membership values of the data, uncertainty in the location, shape or other parameters. Type-1 fuzzy sets are not able to directly model such uncertainties because their membership functions are totally crisp. The intuitionistic fuzzy set algorithms like Yager's IFS, Sugeno's IFS [10,



## Enhanced Approach of Non-Smart to Smart Devices using IOT Techniques

T.Tirupal<sup>1</sup>, V.Karthik<sup>2</sup>, B.Jayanth<sup>3</sup>, H. Jawaharlal<sup>4</sup>, SK. Abdul Musaddif<sup>5</sup>

<sup>1</sup>HOD and Associate Professor, Head of ECE, G. Pullaiah College of Engineering and Technology, Kurnool, Andhra Pradesh, India

<sup>2,3,4,5</sup>Student, Department of ECE, G. Pullaiah College of Engineering and Technology, Kurnool, Andhra Pradesh, India

Corresponding author: tirutalari@gmail.com

### ABSTRACT

With the progression of innovation and more reliance of individuals on cell phones and expanding requests of a simple and brisk method for tackling everyday life task, it has acquired critical to have an innovation which can consultant over the domiciliary, industrial applications using internet of things (IoT). This paper is based on the implementation of new cost-effective methodology based on IoT to remotely controlling of appliances i.e. ON and OFF. IoT conceptualizes the idea of remotely connecting and monitoring real-world objects (things) through the internet. The IoT can be designed at different scales for different uses. It can start from our homes with simple lightning or appliance control. Today the increase in demand for service over the internet necessitated the data collection and exchange an efficiently. In this sense Internet of Things (IoT) has promised the ability to provide the efficient date storage and exchange by connecting the physical devices via internet. The IoT has created the revolution all over the world and fascinatingly it has become integral part of life. The IoT involves extending internet connectivity beyond standard devices such as desktops, laptops, smartphones, and tablets, to any range of traditionally dumb or non-internet enabled physical devices and everyday objects. Embedded with technology, these devices can communicate and interact over the internet, and they can be remotely monitored and controlled. The uniqueness of IoT design elements in their ability to sleep when not in use.

**Keywords--** Domestic, IOT, Internet, Monitoring, Technology

### INTRODUCTION

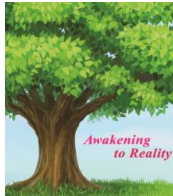
Today the expansion in demand for service over the internet required the information range and trade-in productive way. In this sense Internet of Things (IoT) has guaranteed the capacity to give productive information storage and trade by interfacing the physical gadgets through

the internet [1]. The IoT has made the revolution everywhere throughout the world and fascinatingly it has become an essential part of life. The IoT includes expanding internet network beyond standard gadgets, for example, computers, cell phones, and tablets, to any scope of generally idiotic or non-web empowered physical gadgets and ordinary items. Embedded with technology, these devices can communicate and interact over the Internet, and they can be remotely monitored and controlled. The uniqueness of IoT design elements is their ability to sleep when not in use.

The internet of things is an arrangement of interrelated processing gadgets, mechanical and advanced machines are given unique identifiers (UIDs) and the capacity to move information over a system without expecting human-to-human or human-to-PC collaboration. The meaning of the Internet of things has advanced because of the assembly of various innovations, continuous investigation, artificial intelligence, ware sensors, and embedded systems. Customary fields of remote systems, embedded systems, control frameworks, automation (including home and building) [1], and others all add to empowering the Internet of Things. There are a few genuine worries about threats in the development of IoT, particularly in the regions of protection and security. To address these industry and government sectors have started moving to take care of these.

The principal objective of this paper is to structure a home mechanization framework with an Android application that can be controlled remotely. Family unit Appliances are associated with the web. We can control savvy home gadgets including lights, switches, fans, doors ,and windows utilizing our Google Assistant [2]. We need not get up to turn-on or switch-off the gadget while viewing a film or accomplishing some work. The Assistant on Google Home can likewise recognize one voice from another, and it can be used personally for any application.

In-home, some people are tired that they think that it is difficult to move once they land on their love seat, couch, or bed. In this way, any little gadget/innovation that would assist them with turning their lights on or off [2], or play their preferred music, and so forth on a go with their



## Efficient Attendance Management Using Multiple Face Recognition

T.Tirupal, EVN Sai Praneeth, P.Srihari, K.Sai Kiran and Md Kaleel Pasha

Department of ECE, G.Pullaiah College of Engineering and Technology, Kurnool, India.

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### ABSTRACT

Nowadays, classroom attendance of a student is a very important task and if taken manually wastes a lot of time. There are many automatic methods available for this purpose i.e., biometric attendance. All these methods waste time, waiting in a queue to detect their thumb, palm, face or iris in front of the scanning device. This paper describes the efficient algorithm that automatically marks attendance without any human intervention and waste of time. The algorithm works with images of multiple faces. Firstly, the images are captured by using a camera placed on the top of the blackboard. The captured images are processed for noise removal using a median filter. Then the faces are detected using the detection algorithm. Lastly, the detected face is recognized by comparing the faces in the database and the attendance is marked. A Graphical User Interface (GUI) is designed for calculating the percentage of the match of faces.

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### Introduction

In recent years, biometric-based techniques [1, 2, 3, 4] have emerged as the most promising option for recognizing individuals. These techniques examine an individual's physiological and behavioral characteristics to determine and ascertain their identity instead of authenticating people and granting them access to physical domains by using passwords, PINs, smart cards, plastic cards, tokens or keys. Passwords and PINs are hard to remember and can be stolen or guessed easily; cards, tokens, keys and the like can be misplaced, forgotten, purloined or duplicated; magnetic cards can become corrupted and unreadable. However, an individual's biological traits cannot be misplaced, forgotten, stolen or forged. Face recognition is one of the least intrusive and fastest biometrics compared with other techniques such as finger print [5, 6] and iris recognition. For example, in surveillance systems [7], instead of requiring people to place their hands on a reader (finger printing) or precisely position their eyes in front of a scanner (iris recognition), face recognition systems [8, 9] unobtrusively take pictures of people's faces as they enter a defined area. There is no intrusion or capture delay, and in most cases, the subjects are entirely unaware of the process. People do not necessarily feel under surveillance or their privacy being invaded.

Owing to its use in several applications, face recognition has received substantial attention from both research communities and the market, and there has been an emerging demand for robust face recognition algorithms that can deal with real-world facial images. A general statement of the automatic face recognition problem is simply formulated as follows: given still or video images of a scene, identify or verify one or more persons in the scene using a stored database of faces.

In other words, the face recognition system generally operates under one of two scenarios: verification (one-to-one) or identification (one-to-many), wherein the verification scenario, the similarity between two face images is measured and a determination of either match or non-match is made.

Although, in the identification scenario, the similarity between a given face image (i.e. probe) and all the face images in a large database (i.e. gallery) is computed.

### Literature Review

Maintaining attendance is very important in all the institutes for checking the performance of students. Every institute has its method in this regard. Some are taking attendance manually using the old paper or file-based approach and some have adopted methods of automatic attendance using some biometric techniques. But in these methods students have to wait for a long time in making a queue at the time they enter the classroom. Many biometric systems are available but the key authentication is the same is all the techniques. Every biometric system consists of the enrolment process in which unique features of a person are stored in the database and then there are processes of identification and verification. These two processes compare the biometric feature of a person with a previously stored template captured at the time of enrollment. Biometric templates can be of many types like Fingerprints, Eye Iris, Face, Hand Geometry, Signature, Gait, and voice. Our system uses the face recognition approach for the automatic attendance of students in the classroom environment without students' intervention. Face recognition consists of two steps, in first step faces are detected in the image and then these detected faces are compared with the database for verification. Several methods have been proposed for face detection i.e. AdaBoost algorithm, the Float Boost algorithm, Neural Networks [10], the S-AdaBoost algorithm, Support Vector Machines (SVM) [11], and the Bayes.

### Existing Methods for Face Detection [12]

During the last decade, several promising face detection algorithms have been developed and published. Among these three stands out because they are often referred to when performance figures etc. are compared. This section briefly presents the outline and main points of each of these algorithms.

## REVIEW ARTICLE

## Multimodal Medical Image Fusion Techniques – A Review

T. Tirupal<sup>1\*</sup>, B. Chandra Mohan<sup>2</sup> and S. Srinivas Kumar<sup>3</sup>

<sup>1</sup>Dept., of ECE, G. Pullaiah College of Engineering and Technology, Kurnool, AP, India; <sup>2</sup>Department of ECE, Bapatla Engineering College, Bapatla, Andhra Pradesh, India; <sup>3</sup>Vice-Chancellor, JNTUA, Ananthapuramu, Andhra Pradesh, India

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**Abstract:** The main objective of image fusion for multimodal medical images is to retrieve valuable information by combining multiple images obtained from various sources into a single image suitable for better diagnosis. In this paper, a detailed survey on various existing medical image fusion algorithms, with a comparative discussion is presented. Image fusion algorithms available in the current literature are categorized into various methods known as (1) morphological methods, (2) human value system operator based methods, (3) sub-band decomposition methods, (4) neural network based methods, and (5) fuzzy logic based methods. This research concludes that even though there exist a few open-ended creative and logical difficulties, the fusion of medical images in many combinations assists in utilizing medical image fusion for medicinal diagnostics and examination. There is a tremendous progress in the fields of deep learning, artificial intelligence and bio-inspired optimization techniques. Effective utilization of these techniques can be used to further improve the efficiency of image fusion algorithms.

**Keywords:** Image fusion, multimodal, diagnosis, morphological, neural network, fuzzy logic.

## 1. INTRODUCTION

With the recent advancements in the field of technology, digital image processing systems have turned into a reality in developing the number of fields, for example, machine vision and medical imaging, remote sensing [1] and military applications. The consequence of the utilization of these strategies is a remarkable increase in the amount of data available. To extract all the valuable information from the source images and to reduce the increasing volume of data, a powerful method is used in image processing called image fusion. The main aim of image fusion is to produce new images that are more appropriate for human/machine perception.

Image fusion is the process of combining multiple images of a scene into a single composite image that contains all the important features from each input image. The subsequently fused image delivers extra reliable and exact information about a scene than any of the individual source images. The fusion of redundant and complementary data increases the accuracy and decreases the overall uncertainty of multimodal medical images. Medical image fusion algorithms involve two stages. They are (a) Image registration and (b) Fusion of significant features from the registered images. A basic image fusion model is presented in Fig. (1).

Information attained in the clinical track of events gained from two source images is generally complementary. Appropriate

incorporation of valuable information achieved from the individual images is frequently chosen. The initial phase in this fusion procedure is to bring the modalities associated with spatial alignment and this happens with a technique called registration [2, 3].

The registration of the images requires a method to correct the spatial misalignment between the different image data sets that often involve compensation of variability resulting from scale changes, translations, and rotations. After registration, a fusion step is required for the integrated display of the data involved. In general, fusion scheme should satisfy the following requirements [4]:

- It should recognize the most important features in the source images and transfer them without the loss of detail into the fused image.
- The image fusion process should not introduce any artifacts or inconsistencies which mislead or divert a human observer for further processing tasks.
- It should be robust, reliable, and suppress the irrelevant parts of the image and noise.

Multimodal medical images [5-10] provide different types of information: Computed Tomography (CT) image provides details of dense structures, such as bones, Magnetic Resonance Image (MRI) affords information about pathological soft tissues, Magnetic Resonance Angiography (MRA) easily detects abnormalities in the brain, X-ray detects fractures and abnormalities in bone positions, Vibro-Acoustography (VA), provides the depth and thickness of the disease

\*Address correspondence to this author at the Dept., of ECE, G. Pullaiah College of Engineering and Technology, Kurnool, AP, India; E-mail: tirutalari@gmail.com

# Resolution Invariant Iterative Image Matching

**D. Rajasekhar<sup>1</sup>, T. Tirupal<sup>2</sup>, R. Sumalatha<sup>3</sup>, S. Subbalakshmi<sup>4</sup>**

1. Associate Professor, Department of Electronics and Communication Engineering, G.Pullaiah College of Engineering & Technology, Kurnool, Andhra Pradesh, India-518002
2. Associate Professor, Department of Electronics and Communication Engineering, G.Pullaiah College of Engineering & Technology, Kurnool, Andhra Pradesh, India-518002
3. Associate Professor, Department of Electronics and Communication Engineering, Vardhaman College of Engineering, Hyderabad-501218
4. Ph.D Scholar, Department of Computer Science and Engineering, JNTUA Anantapur, Ananthapuramu, Andhra Pradesh, India-518501

## Abstract

Image matching is a critical and challenging task in many mission critical applications. Especially with the developments in domain of Computer Vision, the need for better image matching algorithms are ever increasing. The critical nature of many applications demands that image matching algorithms be robust and fast. This paper presents the design of one such algorithm which can deliver an accurate performance in the presence of different resolution of the image. The results have been validated and presented. The results delivered by the proposed approach has been compared and found to be better than the matching done by ASIFT. The result indicates the high degree of accuracy of the image matching algorithm and its reduced computational complexity makes it extremely suitable for real time application.

Keywords: Image Matching, Computer Vision, Affine, ASIFT

## 1. Introduction

One of the most important aspects in digital photogrammetry is image matching. It finds its application in automated modeling and mapping [1] where it is used for identifying corresponding pixels in two or multiple images [2, 3]. Most of the existing image matching algorithms have been created over the past 50 years; these include many empirical techniques as well. Even though wide variety of approaches can be found in the literature, there is no universal method that is generic for most of the image matching applications. It's important to that different attributes of the images under study influence the type of image matching approach that has to be adopted. The matching algorithm has to take in to account the following important features in an image a) Scale: this concept arises when at least two elements of the set of images have different scales, b) Occlusions: this happens when interference happens in the 2D projected image plane for two objects that are spatially separated in the 3D world. For example in the case of object recognition occlusion is a problem which has to be specifically tackled, it necessitates the use of more robust algorithms, c) Orientation: this occurs when image views are rotated at a particular angle in relation to each other. For most of the algorithms to perform a reliable match a maximum orientation of 30° is a typical maximum value, d) Object to be matched: this defines the characteristics of the object to be matched, if the object is a planar, textured or an edgy object, e) Clutter: this implies the conditions of the image background. When the image has a cluttered background it is difficult for the algorithm to identify the boundaries of the object of interest and f) Illumination: variation in illumination also presents a critical problem for

# Multimodal Medical Image Fusion Based on Fuzzy Sets with Orthogonal Teaching–Learning-Based Optimization



T. Tirupal, B. Chandra Mohan and S. Srinivas Kumar

**Abstract** The purpose of an image fusion for medical images is to associate a number of images gained from many bases to a solitary image appropriate for better analysis. The vast majority of the best in class image fusing systems are based on non-fuzzy sets, and the fused image so obtained lags with complementary information. Fuzzy sets are strong-minded to be more appropriate for medical image processing as more hesitations are considered compared with non-fuzzy sets. In this paper, a procedure for efficiently fusing multimodal medical images is presented. In the proposed method, images are initially converted into intuitionistic fuzzy images (IFIs), and another target work called intuitionistic fuzzy entropy (IFE) is utilized for membership and non-membership capacities to accomplish the finest estimation of the bound. Next, the IFIs are compared using the fitness function, entropy. Then, orthogonal teaching–learning-based optimization (OTLBO) is introduced to optimize combination factors that change under teaching phase, and learner phase of OTLBO. Finally, the fused image is achieved using optimal coefficients. Simulations on several pairs of multimodal medical images are performed and matched with the current fusion approaches. The dominance of the proposed technique is presented and justified. Fused image quality is also verified with various quality metrics, such as peak signal-to-noise ratio (PSNR), universal quality index (UQI), structural similarity (SSIM), correlation coefficient (CC), entropy (E), spatial frequency (SF), edge information preservation ( $Q^{AB/F}$ ), and standard deviation (SD).

**Keywords** Image fusion · Diagnosis · Fuzzy sets · IFI · OTLBO  
Spatial frequency

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T. Tirupal (✉) · S. Srinivas Kumar  
JNTUK, Kakinada, India  
e-mail: tirutalari@gmail.com

S. Srinivas Kumar  
e-mail: samay\_ssk2@yahoo.com

B. Chandra Mohan  
Bapatla, India  
e-mail: chandrabhuma@gmail.com



# A Miniature Rectangular Patch Antenna Using Defected Ground Structure for WLAN Applications

Kakani Suvarna<sup>1, \*</sup>, Nallagarla R. Murty<sup>2</sup>, and Dupakuntla V. Vardhan<sup>3</sup>

**Abstract**—The purpose of this work is to miniaturize a rectangular patch antenna which resonates at 2.4 GHz. To achieve this, we present a new geometry of a pi-shaped slot with three annular rings as a Defected Ground Structure (DGS). DGS is a periodic etched structure or aperiodic sequence of configurations, and it has been used to switch the resonance frequency from starting value 13 GHz to an ending value at 2.4 GHz without any changes in the areas of the actual rectangular microstrip patch antenna (RMPA). The proposed antenna is structured on an FR-4 substrate with thickness 1.6 mm and permittivity 4.4. The general size of the ground plane is  $34 \times 34 \text{ mm}^2$ . Using the optimal position and dimension of the pi-shaped slot on the ground, the resonant frequency is reduced to 2.4 GHz, which signifies an 81.53% decrease. Proposed antennas with and without DGS are simulated by using High-Frequency Structure Simulator (HFSS) and Advanced Digital System (ADS) Agilent technology, fabricated, and measured for Wireless Local Area Network (WLAN) application.

## 1. INTRODUCTION

Ku-band is broadly utilized for satellite communications [1]. Fundamentally wireless communication plays an important role in everyday life. It has created a huge need in the design of Microstrip Patch Antennas (MPA) for different applications. The main attributes of MPA are low profile, light weight, achievability in expense, and simple fabrication [2], but MPA also has some disadvantages, such as low efficiency, low return loss, low gain, and narrow bandwidth. These drawbacks can be overcome by using various techniques like array configuration [3], different feeding [4], and double L and U-slots in a patch with proper placement [5, 6]. We use notches and slits on the microstrip patch antenna with distinct shapes [7, 8], fractal geometry [9], and metamaterial [10]. A combination of different methods can also be used for acquiring miniaturized antenna, such as Earlier Photonic Band Gap (PBG) [11], Defected Microstrip Structure (DMS) [12], Defected Ground Structures (DGS) [13], and Electromagnetic Band Gap (EBG) [14]. When a defect is introduced in the metallic ground plane of planar transmission lines (e.g., Coplanar, microstrip, and conductor-backed coplanar waveguide), it disturbs the current shield distribution [15, 16], and due to this, there is an adjustment in attributes of a transmission line such as inductance and capacitance [17]. The patch antenna equivalent circuit is a parallel resonant RLC circuit, and the values of capacitance and inductance parameters are calculated by electromagnetic fields of the antenna [18].

DGS is primarily utilized in microstrip antenna design for several applications, for example, harmonic suppression, cross-polarization reduction, and antenna size reduction. It is an easy method which has been introduced to miniaturize the patch antennas, and DGS consists of simple and difficult shapes etched off in the ground plane for gaining better performances. Fig. 1 presents different configurations of DGS etched off in the ground plane [19, 20]. The DGS is implemented by an equivalent

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\* Corresponding author: Kakani Suvarna (kakanisuvarena@gmail.com).

<sup>1</sup> JNTUA, Ananthapuram, AP, India. <sup>2</sup> G.Pullaiah College of Engineering and Technology, Kurnool, AP, India. <sup>3</sup> JNTUA College of Engineering, Ananthapuram, AP, India.

# Optimizing the Effect of Cropping and Rotation Attacks on Watermarked Images using Back Propagation Neural Network in DWT Domain

Dr. N. Ramamurthy, Dr. K. C. T. Swamy, Gude Ramarao, H. Shravan Kumar

**Abstract;** *Hiding an image in another image is the technique used for copy write protection. In this proposed work, the watermark is inserted into blue plane of the cover image, In this watermark extraction and embedding process, the back propagation neural network in conjunction with biorthogonal wavelets is utilized to improve the efficiency. The performance is tested by normalized correlation coefficient. The imperceptibility of the watermark is tested by cropping and rotation attacks effectively.*

**Keywords;** *Watermark, Wavelets, neural network, rotation, compression.*

## I. INTRODUCTION

Due to the quick and large development of transmission and additionally the widespread use of information superhighway, there is a want for economical, powerful and effective techniques to protect data [1]. Completely different watermarking techniques are developed in special and remodel domain strategies, however, in recent years; the watermarking techniques supported remodel domain are developed to produce higher lustiness and physical property.

Digital Image watermarking techniques classified as private, semi private and public watermarking techniques. In private watermarking technique the knowledge of cover image and secret key required to recover the watermark from the cover image [2]. In semi-private or semi blind watermarking technique each the secret key and also the watermark needed to extract the inserted watermark. In blind or public watermarking technique solely the secret key's enough to extract the watermark [3]. Private watermarking techniques have high robustness than the other two techniques. But the drawback of private watermarking techniques is that they require original information to extract the watermark. The main necessities of any watermarking technique embody hardness, visibility, and capability. hardness is that the strength of the watermark in order that it will stand up to totally different image process attacks like cropping, rotation and compression, etc[4]. Visibility of the watermark related to imperceptibility so that the appearance of the watermarked image may not be degraded by the presence of the watermark.

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**Dr. N. Ramamurthy**, Professor, Department of Electronics and Communication Engineering, G. Pullaiah College of Engineering and Technology, Kurnool (A.P) India. E-mail: [eceramamurthy@gpcet.ac.in](mailto:eceramamurthy@gpcet.ac.in)

**Dr. K. C. T. Swamy**, Associate Professor, Department of Electronics and Communication Engineering, GPCET, Kurnool, (A.P) India. E-mail: [eceketswamy@gpcet.ac.in](mailto:eceketswamy@gpcet.ac.in)

**Gude Ramarao**, Associate Professor, Department of Electronics and Communication Engineering, GPCET, Kurnool, (A.P) India. E-mail: [eceramarao@gpcet.ac.in](mailto:eceramarao@gpcet.ac.in)

**H. Shravan Kumar**, Associate Professor, Department of Electronics and Communication Engineering, GPCET, Kurnool, (A.P) India. E-mail: [shravanece@gpcet.ac.in](mailto:shravanece@gpcet.ac.in)

The capacity of the watermark defined as the amount of data carried by it.

The technique of digital image watermarking is used to embed copyright information into multimedia content. Generation of watermark, watermark insertion, detection of watermark and attacks on watermarked image are the different steps in digital image watermarking. There are four essential factors which include robustness; imperceptibility, capacity, and blindness used to determine the quality of the watermarked image[5]. If the presence of the watermark is not destroying the imperceptibility of the cover image, then the technique is said to be more imperceptible. The blind watermarking technique cannot require the cover image to detect the watermark. The non-blind watermarking technique needs the cover image to detect the watermark. If the secret key and watermark bit sequence are required to detect the presence of the watermark, then the technique is referred to as semi-blind watermarking [6].

The watermarking techniques classified as spatial domain and transform domain techniques based on the domain of watermark insertion. In these techniques the location and luminance of the image pixels are processed directly and the drawback of this method is that the lossy compression can easily destroy these bits. In transform domain methods, special transformations are used to process the coefficients in frequency domain to hide the watermark [7]. In transform domain methods the watermark is inserted in to frequency coefficients of the host image. Low frequency coefficients are not selected to embed watermark, because they suppressed by filtering as noise. The transform domain method provides much better robustness against compression, filtering, rotation, cropping and noise attack compared to spatial domain technique[8].

Wavelets also process an image from low to the high resolution sequentially so that the missing data can be detected at another level [ 9]. The watermark must be embedded in high frequency coefficients for better imperceptibility, while low frequency coefficients must be selected for high robustness. Hence the watermark coefficients must be embedded in middle frequency coefficients to achieve the balance between robustness and imperceptibility [10]. . In blind or public watermarking technique solely the secret key's enough to extract the watermark . Private watermarking techniques have high robustness than the other two techniques. But the drawback of private watermarking techniques is that they require original information to extract the watermark.

# Interpolation of the Histogrammed MR Brain Images for Resolution Enhancement

A.Charles Stud, N.Ramamurthy

**Abstract:** *Magnetic resonance imaging (MRI) is an incredible testing method which provides appropriate anatomical images of the body. For the diagnosis, high resolution MR images are essential to extract the detailed information about the diseases. However, with the measured MR images it's a challenging issue in extracting the detailed information associated to disease for the posterior analysis or treatment. Usually to improve the resolution of the MR image, histogram equalization process has to be applied. In this paper, interpolation method is applied to improve the resolution of MR brain images for the histogram-ed images. And for the assessment of the skillfulness of introduced method, performance metrics such as peak signal to noise ratio (PSNR) and absolute mean brightness error (AMBE) are measured. The peak of signal for the enhanced images through interpolation will be much better and may have the good variation to the mean brightness error. With this there can be potential to the artificial intelligence for better diagnosis in complex decisive instances.*

**Keywords:** *Histogram Equalization, Interpolation, MR images, Resolution Enhancement.*

## I. INTRODUCTION

Magnetic Resonance Imaging (MRI) of the brain is an effortless risk-free custody test that uses a strong magnetic field gradients and radio waves to generate detailed (careful) images of the brain and the brain stem. MRI machines are supportive for patients with simple phobia. In medical image processing, to accent the important features for posterior analysis or for image display it is essential to perform the operations like contrast improvement and resolution enhancement because of medical images distinctly suffers from high level of noise, geometric contortions and mien of imaging artifacts. To incur high contrast in the image, intensity equalization method has to be done and high resolution images are essential to obtain absolute anatomical information to watch over the maturity of human brain. Usually different Histogram Equalization methods are used to have better resolution of the images like Histogram equalization (HE), adaptive histogram equalization (AHE) etc.

### A. Histogram Equalization

Histogram equalization (HE) is applicable when the distribution of pixel values is resembles throughout the image (Abdullah Al et al., 2013; David M et al., 2007; Fernandez G

C et al., 2013; Chen C et al., 2015; G. Senthamaraiand K et al., 2015; Rubina Khan et al., 2012; Senthikumar N et al., 2014;) Particularly when the regions are lighter or darker for those regions the contrast will not be adequately enhanced. With the help of non-linear function, re-distribution of intensity values of the pixels will be implemented. This can be achieved with the help of the cumulative distribution function (CDF). With CDF, the intensities are almost uniformly distributed. Hence, without changing its median value the dynamic range of the histogram is increased.

Unlike HE, in adaptive histogram equalization (AHE) rather applying on complete image, separately it is performed on sub images i.e. each pixel is altered based on the pixels that are in a contextual region (Rajulath B A.K et al., 2015). But it is very expensive as it takes more time for calculations. So, interpolation process is applied to improve resolution of MR brain image after the adaptive histogram equalization.

### B. Interpolation

Histogram intensity equalization is discrete in nature so it is difficult to represent an analytic function to these set of data measurements. Therefore Interpolation is a utility function for the measurements for which the data is discrete in nature. Interpolation is the logical estimation of an unknown arbitrates value within the data range. Interpolation is a process in which a new pixel can be generated by analyzing the surrounding pixels. Interpolation may be deterministic interpolation or statistical approximation. In deterministic, interpolation is based on the assumption of definite variability between the samples where as in statistical it depends on the approximation of signals by reducing the estimation error. As statistical approach is computationally inefficient, deterministic approach is implemented in the proposal. However, while interpolating an image it is necessary to take finite number of samples and these can be selected in three ways: (1) Nearest neighbor Interpolation, (2) Linear interpolation and (3) Cubic B-spline interpolation. Best adapted interpolation will result in best quality of the image. The choice of good interpolation method is based on finding an optimal counterbalance between three unsuitable artifacts: edge halos, blurring and aliasing. It is important to note that for interpolation it should have finite support region.

A commonly used function which fulfills all the requirements of the interpolation is B-spline function (Bn), There 'n' is order. The zero<sup>th</sup> order B-spline (B0) function is used to represent the nearest neighbor interpolation which covers two numbers of pixels i.e. inter-pixel distance is 1. Linear interpolation is described by, B1 which covers the three number of pixels -1, 0, +1. Cubic B-spline interpolation function, B3 covers five number of pixels -2, -1, 0, +1, +2 and is more preferable when image does not have high frequency

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\* Correspondence Author

A.Charles Stud\*, Research Scholar, ECE department, JNT University Anantapur, Ananthapuramu, Andhra Pradesh, India. Email: mightystud727@gmail.com

N.Ramamurthy, Professor of ECE department, G.Pullaiah College of Engineering & Technology, Kurnool, Andhra Pradesh, India. Email: ramamurthy1006@gmail.com

# GSM Based Wireless Electronic Notice Board Using Arduino

V.Swetha<sup>1</sup>, G.Srilakshmi<sup>2</sup>, M.Yatisha<sup>3</sup>, R.Veena Madhuri<sup>4</sup>

Final Year, B.Tech(E.C.E), Department of Electronics & Communication Engineering, G.Pullaiah College Of Engineering & Technology, Kurnool, A.P, India.

K.Anil Kumar<sup>1</sup>, Assistant professor.

Department of Electronics & Communication Engineering, G.Pullaiah College Of Engineering & Technology, Kurnool, A.P, India.

**Abstract-**This project deals with an interesting and innovative manner of displaying messages on an electronic display board using wireless technology using Arduino. Our main aim is to reduce paper work and time. Notice boards are one of the basic things in any organisation or public utility places like hospitals, airports, bus stations, railway stations, shopping malls, parks. It is time consuming and tedious process to manually write down the different notices every now and then. To overcome the problem, the idea of wireless digital display board has been proposed in this paper. In this project we have tried to implement our system in such a way that, the GSM module which is located at Digital notice board receives the message from authorized user and displays on notice board making it fast, easy and power consumption also less. Today GSM has been widely used for calling and SMS messages. Thus, the authentic users can send messages from any corner of the world to be displayed on the notice board using GSM technology.

## I. INTRODUCTION

### A. Overview

The GSM based notice board is aimed at the colleges and universities for displaying day-to-day information continuously or at regular intervals during the working hours. Being GSM-based system, it offers flexibility to display flash news or announcements faster than the programmable system.

GSM-based campus display system can also be used at other public places like schools, hospitals, railway stations etc., A GSM receiver and a display toolkit which can be programmed from an authorized mobile phone. It receives the SMS, and displays the desired information after necessary code conversion. It can serve as a notice board and display the important notices instantaneously thus avoiding the latency. Being wireless, the GSM based is easy to expand and allows

the user to add more display units at any time and at any location in the campus depending on the requirement of the institute

### B. Objectives

- To develop a GSM based notice board whose contents can be updated through an SMS which realized through an embedded system with microcontroller.
- To design a project simple, easy to install, user friendly system, which may receive and display notice in a very specific manner.
- SMS based notice board incorporating the widely used GSM to facilitate the communication of displaying message on notice board via user's mobile phone.
- SIM 900A GSM modem with a SIM card is interfaced to the ports of the Arduino with the help of AT commands.
- The messaged is thus fetched into the Arduino.

### C. Broadcast

A term to describe communication where a piece of information is sent or transmitted from one point to all other points. One of the most common examples is broadcast through a cellular network service. This serves multiple end users at different locations in a simulcast fashion. Practically every cellular system has some kind of broadcast mechanism. This can be used directly for distributing information to multiple mobiles, the most important use of broadcast information is to set up channels for one to one communication between the mobile Trans-receiver and the base station. This is called paging. The details of the process of paging vary somewhat from network to network, but normally we know a limited number of cells where the phone is located (this group of cells is called a location area in the GSM system). This project aims at integrating the expansiveness of a wireless cellular network and the ease of information which transfers through notice boards in campus.

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# Improvement of GPS DOP Variants with NavIC Constellation for Indian Users

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Mohammed Abdul Farida ; K.C.T. Swamy ; S. Towseef Ahmed **All Authors**

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## Abstract

### Abstract:

GPS, a standardized and matured satellite based navigation system, having a broad range of applications. It is widely preferred due to its fast and better performances. The accuracy of a GPS system is an important issue in PNT service to all the dependents, which is limited by geometry of visible satellites. With the advent of multiple constellations, research work is continuing to combine different constellations to get

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# Application of Navigation with Indian Constellation (NavIC) Signals for Ionosphere Irregularities Measurement

K.C.T.Swamy, M.A. Farida, M. Jyothirmai, S. Towseef Ahmed

**Abstract:** *Soon Indian's mobile phones and cars are to be installed with new and indigenous satellite technology, i.e. Navigation with Indian Constellation (NavIC) developed by ISRO. After successful completion of NavIC, India has become fifth nation in the sequence of countries with independent navigation technology/system. The NavIC technology will be used mainly for terrestrial, aerial and marine navigation along with tracking and disaster management. Here we are proposing the application of NavIC signals for measuring and monitoring ionosphere layer behaviour leading accuracy degradation of satellite based navigation and communication systems. This paper presents the computation of ionosphere parameters such as TEC, ROTI and scintillation index ( $S_4$ ) using pseudo range and Carrier to Noise density ratio ( $C/N_0$ ) measurements of NavIC  $L_5$  and S-band signals. ROTI and  $S_4$  results revealed that the impact of ionosphere irregularity is more on  $L_5$  than that of S-band signals.*

**Keywords :** NavIC, ROT, ROTI,  $S_4$ .

## I. INTRODUCTION

Navigation with Indian Constellation (NavIC) is an indigenous satellite navigation system planned and implemented by the Indian Space Research Organization (ISRO) for position, navigation and time (PNT) applications with a limited service region. It is fully operational with three Geostationary orbital (GEO) satellites and four Geosynchronous orbital (GSO) satellites, details are given in Table 1. The arrangement of satellites in the orbits was planned in such a way that users from the Indian subcontinent

could receive signals from atleast four satellites. The NavIC satellites transmit navigation signals, based on Code Division Multiple Access (CDMA) on  $L_5$  (1176.45MHz) with a Binary Phase-Shift Keying (BPSK (1)) modulation for standard positioning service (SPS) users. Restricted service user get signals with a Binary Offset Carrier (BOC(5,2)) modulation on S-band( 2492.028 MHz) [1].

The ionosphere, a propagation medium for the satellite based communication and navigation systems affects signals in terms of refraction, absorption, Faraday rotation, scintillation, propagation time delay, Doppler frequency shift, etc. Moreover, Ionosphere scintillations are hazardous to the wide range of radio frequencies and is therefore of great practical interest. In the beginning, researchers have been published the reviews of ionospheric scintillations [2]-[5]. Further, Global Positioning System (GPS) signals were used to study the irregularities of ionosphere. Swamy et al. (2013) & Sarma et al. (2014) studied ionospheric scintillations and developed mathematical models for predicting ionospheric scintillations over the Indian region using GPS signals [6]-[7]. Pi et. al., (1997) introduced a parameter, Rate of TEC Index (ROTI) to study ionosphere irregularity, later the relation between ROTI and  $S_4$ -index (ROTI/ $S_4$ ) was analyzed by Basu et al. (1999) [8]-[9]. Sujimol and Shahana (2017) have done a preliminary study on the amplitude scintillation effect of NavIC signals and found frequent loss of lock on  $L_5$  signals at Delhi station [10].

**Table 1: NavIC satellites details** (<https://www.isro.gov.in/launchers/pslv>)

	Satellite	Orbit	Longitude	Orbit Inclination	Launch Date	Status
1	IRNSS-1A	GSO	55 <sup>0</sup> E	29.0 <sup>0</sup>	Jul 01, 2013	Clocks Failed
2	IRNSS-1B	GSO	55 <sup>0</sup> E	31.0 <sup>0</sup>	Apr 04, 2014	Operational
3	IRNSS-1C	GEO	83 <sup>0</sup> E	-	Oct 16, 2014	Operational
4	IRNSS-1D	GSO	111.75 <sup>0</sup> E	30.5 <sup>0</sup>	Mar 28, 2015	Operational
5	IRNSS-1E	GSO	111.75 <sup>0</sup> E	28.1 <sup>0</sup>	Jan 20, 2016	Operational
6	IRNSS-1F	GEO	32.5 <sup>0</sup> E	-	Mar 10, 2016	Operational
7	IRNSS-1G	GEO	129.5 <sup>0</sup> E	-	Apr 28, 2016	Operational
8	IRNSS-1H	-	-	-	Aug 31, 2017	Launch Failed
9	IRNSS-1I	GSO	55 <sup>0</sup> E	29 <sup>0</sup>	Apr 12, 2018	Operational

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**Dr. K.C.T.Swamy\***, Department of Electronics and Communication Engineering, G.Pullaiah College of Engineering & Technology, Kurnool, India. kctswamy@gmail.com

**Mohammed Abdul Farida**, Department of Electronics and Communication Engineering, G.Pullaiah College of Engineering & Technology, Kurnool, India. mafarida01@gmail.com

In this paper the availability of NavIC dual frequencies ( $L_5$  and S-band) was taken as the advantage to compute ionosphere medium irregularities over an Indian low latitude station. Signals from a typical IRNSS-1B satellite were used to compute a parameter, Total Electron Content (TEC) which is the indicator of ionosphere condition. Then, critical analysis of ionosphere



# Estimation and Analysis of Scintillations Induced Tracking Jitter for NavIC L5-band(1176.45MHz) and S-band(2492.028MHz) Signals

1.Y.Vijaysai , J.Vishnu, D.Kiran Kumar, Electronics and Communication Engineering Department,  
G Pullaiah College of Engineering and Technology, Kurnool, AP.

2.K.C.T.Swamy,M.A.Farida,S.Towseef Ahmed, Electronics and Communication Engineering Department  
G Pullaiah College of Engineering and Technology, Kurnool, AP.

**Abstract**—NavIC (Navigation with Indian Constellation) satellite system is being implemented in mobile phone chipsets, the release of chipsets will help adoption of NavIC by smartphone OEM (Original Equipment Manufacturer), thus eventually making NavIC a standard feature in upcoming handsets, processors etc. It will also enhance geolocation capabilities of smartphones within the service region. But, the ionospheric scintillation is a practical challenge to the low latitude users which can degrade the signal quality by introducing jitter while tracking the signal. Severe scintillations result in “loss of lock” of receiver PLL (Phase Locked Loop). In this paper, we present the estimation of ‘Amplitude scintillation ( $S_4$ )’ due to ionosphere irregularities and ‘tracking jitter ( $\sigma_{\theta_j}^2$ )’ for L5-band and S-band of NavIC by using carrier-to-noise density ratio ( $C/N_0$ ) and spectral parameters ‘ $p$ ’ (slope of phase PSD) and ‘ $T$ ’ (spectral strength of the PSD at 1 HZ). The results revealed that L5-band signal was more affected by ionosphere irregularities than that of S-band signal. Thus, the jitter was more while tracking the L5-band signal.

**Keywords** — NavIC, scintillations, tracking jitter ( $\sigma_{\theta_j}^2$ ), spectral parameters (P, T)

## I. INTRODUCTION

NavIC is an independent regional satellite navigation system developed by the Indian Space Research Organization (ISRO), India. It provides location services to the users in India and also the region extending up to 1500 km from its boundary. The total number of satellites in NavIC constellation are 7, out of which 4 are placed in two geosynchronous orbits and 3 are placed in geostationary orbits. All of them transmit signals on L5-band and S-band<sup>[1]</sup>

Working bands: L5-band (1176.45 MHz)

S-band (2492.028 MHz)

The term "scintillation" usually refers to rapid amplitude and phase variations in the electromagnetic wave received from the satellites. The scintillations are mainly due to small scale ionosphere irregularities.<sup>[2]</sup> But it is severe and regular phenomena of low latitude equatorial regions during the post sunset hours. Phase scintillation is more prominent than amplitude scintillation in high latitude (polar and auroral) regions and can occur at any time of day, especially during geomagnetic storms. Amplitude and phase scintillations are negligible in mid-latitude areas.

These scintillations have a negative impact on the GNSS/ NavIC observables so that the position accuracy degrades by introducing jitter in receiver PLL. It may also lead to cycle slips and even loss of carrier’s phase lock under severe scintillation conditions. This results error in navigation or navigation failure. For that reason, it is needed to alleviate the scintillation effect. This can be done by modifying hardware of the receiver (e.g., to make the tracking of the phase more robust) or by software means. The latter may need either leaving the satellites out in the calculation of positioning whose paths to the receiver were severely affected by the scintillation<sup>[3]</sup> or weighting all the satellites in the positioning calculation inversely according to the scintillation present on the respective satellite to receiver paths.<sup>[4]</sup>

So far, several studies related to ionospheric scintillations have been conducted. Swamy et al., studied the ionosphere irregularities over the Indian region and proposed a method for GPS signal scintillations forecasting<sup>[5,6]</sup>. Conker and Arini modelled the effects of ionospheric scintillation on the GPS / SBAS and receiver performance of user, and then built a receiver model with scintillation effects on the tracking process<sup>[7]</sup>. The Global Ionospheric Propagation System (GISM) was introduced by Béniguel., uses a technique for Multiple Phase Panel (MPS), based on parabolic equation resolution (PE). The statistical properties were given for the signal transmission, including the scintillation index, the fade duration, and so on. By using GISM, the group of Béniguel studied the effects of ionospheric scintillation on many aspects including signal tracking and accuracy of the position<sup>[8,9]</sup>. New algorithms and approaches were developed by CALIBRA projects in Brazil funded by European Commission to tackle the effects of ionospheric scintillations on Professional GNSS in Latin America (CIGALA) and to counter the GNSS high accuracy application Limitations due to Ionospheric scintillation. The projects have developed a network-based database on eight GNSS stations and have tested precision agriculture approaches, Veetil and Marcio focused on Latin America, particularly Brazil, based on CIGALA and CALIBRA. They modelled the ionospheric scintillation and

# Estimation and Comparison of DOP in MultiGNSS

Basireddy Harshini<sup>1</sup>, Kalluri Harisa Sulthana<sup>2</sup>, Dudekula Ameena<sup>3</sup>, Valamakil Anjum<sup>4</sup> and M.A. Farida<sup>5</sup>

*Department of Electronics and Communication Engineering, G. Pullaiah college of Engineering and Technology, Kurnool, Andhra Pradesh.*

<sup>1</sup>basireddyharshini1999@gmail.com

<sup>2</sup>harisa.kalluri@gmail.com

<sup>3</sup>ameena09786@gmail.com

<sup>4</sup>valamakilanjum@gmail.com

<sup>5</sup>mafarida01@gmail.com

**ABSTRACT**-Position estimation using GNSS has drawn more interest these days mainly due to its accuracy in most of the applications. Position accuracy of a user is contributed by GDOP and UERE. GDOP is satellite geometry of the constellation. GNSS based systems receive signals for its position computation from GPS, Galileo, GLONASS, Beidou until now. The upcoming Satellite constellation by India, NavIC is ready for user utilization. A minimum of four signals are required for position estimation and the geometry of these satellites should be good enough to provide minimum value. Lower the GDOP value better the accuracy value. The feasibility of visible satellites for position accuracy is high in multi constellation as this increases the number of satellites visible. But this in turn increases the computational time. Further the comparison of GDOPs between various combinations of constellation is provided. The analysis clearly depicts that combination of GPS and Beidou provides better value with optimum computational time because of wide range of elevation angles of satellites.

**Keywords**- GNSS, NavIC, DOP

## I. INTRODUCTION

The global satellite navigation system (GNSS) has worldwide Earth satellite coverage. GNSS is generally effective if an object or target is to be found on Earth. In fact, the precise location of the target is difficult to locate. The GNSS is especially the Global Positioning System (GPS) which explores the optimum measurement selection issue. This problem appeared to be solved by the Dilution of Precision principle (DOP). An efficient, fast and commonly used method to assess possible measures effectiveness is the DOP principle. According to users of the Loran-C navigation system the concept of precision dilution (DOP) emerged. Many external channels add GPS errors. The configuration or geometry of the collection of satellites from which signals are obtained constitutes an important element in determining positions accuracy. The satellite configuration in the atmosphere influences the exact location of the GPS. The optimal solution is for one satellite immediately overhead (from the lowest of four satellites), three others often scattered close to the horizon (above the angle of the mask). If two or more satellites appear to have the same location associated, then exact position will be difficult to obtain. The location achieved may even be as high as 150 meters or even 200 meters. Since satellites are grouped in the atmosphere, the GPS co-ordinates are measured with dilution of precision, an uncertainty factor that multiplies User equivalent range error (UERE).

The satellite navigation system has evolved a great deal since its conception, together with GPS, GLONASS, Galileo, BEIDOU, QZSS and IRNSS / NavIC, by introducing new global and regional constellations. The Asia-Oceania region receives signals from a higher number of satellites in comparison to another part of the world [1]. Users are more interested in using multiple systems together to take advantage of such situations rather than using a single system. As an example, for a GPS user in India there could be around 8–9 satellites in use at any time while the number rises to 13–14 in the GPS+GLONASS hybrid service. It increases the probability of better satellite geometry and lower PDOP. Discussions on India's satellite geometry in GPS+GLONASS, GPS+GLONASS+Galileo and the hybrid





# DETECTION OF SEVERITY OF OPTICAL NERVE HEAD DAMAGE USING OCT IMAGES

<sup>1</sup>S.Fowzia Sultana, <sup>2</sup>B.Shireesha, <sup>3</sup>K.Shivani, <sup>4</sup>A.Mounika, <sup>5</sup>P.Naga Rani

<sup>1</sup>Assistant Professor, Department of Electronics and Communication Engineering,

G. Pullaiah College of Engineering and Technology, Kurnool, A.P, INDIA, Email:sowdagarfowzia@gmail.com,

<sup>2</sup>Dept. of ECE, GPCET, Kurnool,A.P, INDIA,Email:shirishabheemal@gmail.com, <sup>3</sup>Dept. of ECE, GPCET, Kurnool,A.P, INDIA,Email:kshivani11111@gmail.com, <sup>4</sup>Dept. of ECE, GPCET, Kurnool,A.P, INDIA,Email:mounikaakepogu2@gmail.com, <sup>5</sup>Dept. of ECE, GPCET, Kurnool,A.P, INDIA,Email:perapogunagarani24@gmail.com

**Abstract:** One of the major sensory organ of a human body is eye. Optic Nerve is the part of the eye that carries visual information from eye to brain which is located at the very back of the eye. It is a part of an eye that gets injured when eye pressure rises, if left untreated the patient may lose vision. This work aims at developing a system which will recognize the presence of Optical Nerve Head damage, identifies the area of damage and finally the percentage of damage in the nerve head by utilizing the OCT image of an eye of a person. The main reason for using OCT images is that these images give us in depth information about the eye, when compared to other methods.

**Index Terms –** Optic Nerve, Optical Nerve Head damage, Optical Coherence Tomography, Glaucoma.

## I. INTRODUCTION

An eye has Retina, lens, and iris. The retina is the sensory part of the eye and has layers of photoreceptors, nerves, and supporting cells. The important ones include the photoreceptor layer, which is found further out, and the ganglion nerve layer which lies most inward. For light to reach the photoreceptor it must pass through many layers. After, it reaches the photoreceptors the visual signal propagates back up to the ganglion nerves. These ganglion nerves, in turn, course along the surface of the retina toward the optic disk and form the optic nerve running to the brain. Glaucoma is eye disease which is the second most common cause of blindness worldwide. The characteristic of glaucoma is high eye pressure, loss of vision gradually which can cause blindness and damage to the structure of retina. The damages which may occur are structural form changes of the Optic Nerve Head (ONH) and Retinal Nerve Fiber Layer (RNFL) thickness. Quantitative analysis of RNFL via image processing of “Optical coherence tomography(OCT)” images plays a major role in its early detection. The project plays a major role in the field of medical science in early detection of Glaucoma and one can avoid loss of vision by taking preventive measures. An Optic Nerve is the part of the eye that carries visual information from eye to brain which is located at the very back of the eye. It is a part of an eye that gets injured when eye pressure rises, if left untreated the patient may lose vision. In Optic Nerve there is a small crater like depression seen at the front of ONH. This depression is known as cup. Its diameter is less than diameter of Optic Nerve. The nerve head look like a cup on a disc. The method implemented in this project mainly deals with finding the area of the damage and percentage of damaged area. The methodology implemented in this project is using different MATLAB image processing functions like a Gaussian filter, RGB to gray scale conversion, gray scale to binary image conversion and then identifying lesion in the image. This work aims to develop a system which will recognize the presence of ONH damage by the changes in the OCT image of an eye of a person and automatically quantify the defect using image processing techniques which aid in the diagnosis of glaucoma disease.

## II. THE DETECTION OF DAMAGE IN THE IMAGE

The aim of the work is to analyze the damage to optical nerve head by using optical coherence tomography images. With developing effective algorithm, we determined the damage part in eye by using image processing tool. Various methods are implemented to analyze thickness which are pre-processing, noise removing methods and filtering process as shown in flow diagram.

## Wireless Secured Data Transmission using Cryptographic Techniques

Author 1: P.Siva Sai Kumar, Dept. of ECE, Student, GPCET, Kurnool, A.P., INDIA,

Author 2: A.Va mshi Krishna, Dept. of ECE, Student, GPCET, Kurnool, A.P., INDIA,

Author 3: E.Venkatasai Praneeth, Dept. of ECE, Student, GPCET, Kurnool, A.P., INDIA,

Author 4: Pesala Sumanth, Dept. of ECE, GPCET, Student, Kurnool, A.P., INDIA.

Author 5: .S.Fowzia Sultana, Assistant Professor, GPCET, Department of ECE

G. Pullaiah College of Engineering and Technology, Kurnool, A.P., INDIA,

**Abstract**-DNA cryptography is proposed for a secure end to end communication due to the vast parallelism Current issue in modern world as popularity of internet, e-commerce and communication technologies has emerging and they became the medium to security threats. The need to protect the data disturbances and unauthorized access in communication has led to development of several cryptographic algorithms DNA cryptography is proposed for a secure end to end communication due to the vast parallelism Due to advancement in cryptographic techniques the DNA technique is a new crypto algorithm to encrypt and decrypt data. It consists of two stage encryption based on DNA sequence enhances the data security compared to conventional methods. In encryption process the former stage will encrypt the data (plain te xt ) with a random key generated by random DNA sequence generator. Latter and final stage the encrypted data is re -encrypted with DNA t ranslation to generate cipher. The cryptographic techniques (symmetric algorithm) is designed and simulated using Xilinx

**Keyword**- encryption, decryption, DNA sequence.

1.

### INTRODUCTION

Security is essential factor during communication among the people and in e-commerce for the internet user applications such as private communication, password protection and secured e-commerce . The need of secure communication i.e., with Cryptography techniques provides high security like internet banking, ATM's and Satellite transmission etc. Cryptography concept provides the security to store secret and sensitive data, to transmit to receiver by sender and vice versa .Cryptography is the concept of mixing the complex mathematics and logical functions for the process of encryption and decryption of the message. The degree of security is dependent on the key and strength of the algorithm which are used to encrypt and decrypt the plaintext (message).the cryptography is classified into mainly two types and they are based on the key. Two types of cryptography namely secret (symmetric) and public (asymmetric) key cryptography and the following Fig 1 shows the classification

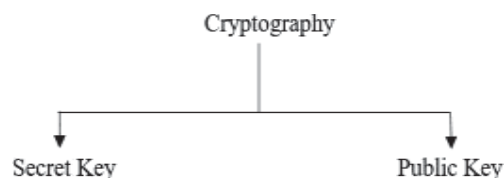


Fig1: Classification of Cryptography

- A. **Secret key Cryptography**: in this process we use same key to encrypt and decrypt data of the message i.e., the symmetric key hence it is also termed as symmetric key cryptography.
- B. **Public key Cryptography**: in this process we use different keys for encrypt and decrypt data of the message i.e., the asymmetric key hence it is also termed as asymmetric key cryptography.

Among the both cryptography techniques secret key cryptography is the widely used technique due its implementation and other factors comparing to public key cryptography. Present day scenario Cryptography plays a major role in providing security for at mos t people in the world who are using internet and online shopping etc. the main issue comes is the security at payment gateway communication between online transaction and banking sites.For developing and acquiring algorithm in VLSI we use Verilog HDL and for simulationpurpose

# LoRa Communication between two Arduino using LoRa Module SX1278

<sup>1</sup>G.RamaRao, <sup>2</sup>A.Bhavya, <sup>3</sup>V.Kavya Janaki, <sup>4</sup>S.Farheena Begum, <sup>5</sup>S.Farheen

<sup>1</sup> ECE Department, GPCET (affiliated to JNTUA, Anantapur), Kurnool, India

<sup>2</sup> ECE Department, GPCET (affiliated to JNTUA, Anantapur), Kurnool, India

<sup>3</sup> ECE Department, GPCET (affiliated to JNTUA, Anantapur), Kurnool, India

<sup>4</sup> ECE Department, GPCET (affiliated to JNTUA, Anantapur), Kurnool, India

<sup>5</sup> ECE Department, GPCET (affiliated to JNTUA, Anantapur), Kurnool, India

<sup>1</sup>eceramarao@gpcet.ac.in

<sup>2</sup>bhavya.ankadala@gmail.com

<sup>3</sup>kavyavaskoty@gmail.com

<sup>4</sup>sfarheenabegum23@gmail.com

<sup>5</sup>shaikfarheen666@gmail.com

## ABSTRACT

There are number of correspondence progressions available for relationship between IOT contraptions today, and the most notable ones are Wi-Fi and Bluetooth. In any case, the issue with Wi-Fi and Bluetooth advancement is high power usage. They in like manner have various obstructions like confined range, obliged ways, etc. ESP8266 module is the most notable Wi-Fi module used in IOT devices.

Cell orchestrates moreover have comparable issues of higher power Consumption and both LAN and Cellular Network are exorbitant to cover a wide area. The LOT ventures introduced some portion of advances, yet none of them was ideal for LOT contraptions, as they needs to transmit information to noteworthy separation without using a great deal of force, until the LoRa development was introduced. LoRa development can perform amazingly long range transmission with low power use. At the present time, will interface SX1278 LoRa module with Arduino and establish LoRa correspondence between two Arduino UNO sheets.

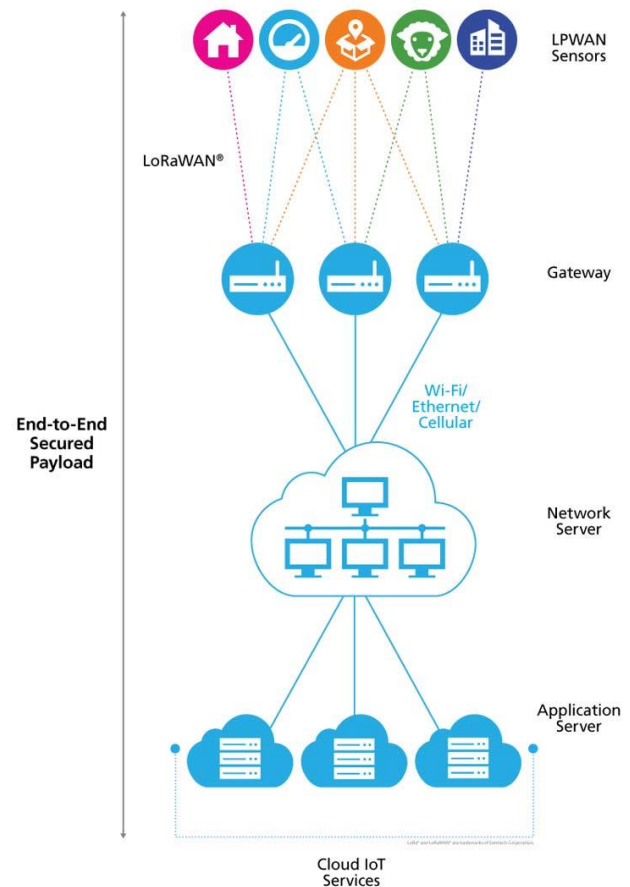
**Key Words:** LoRa network, Low Power Networks.

## INTRODUCTION

LoRa (Long Range) is a remote innovation that offers long-run, low force, and secure information transmission for M2M (Machine to Machine) and IoT applications. LoRa is a spread range regulation innovation that is gotten from tweet spread range (CSS) innovation. LoRa can be utilized to interface sensors, passages, machines, gadgets, and so on remotely.

LoRa was presented by an organization called Semtech. LoRa Technologies works in various recurrence groups in contrast entnations: In the USA it works in the 915 MHz band, in Europe locale, it works in the 868 MHz band and in Asia district it works in the 865 to 867 MHz, 920 to 923 MHz band. Working of LoRa is increasingly sim

ilar to a cell communication. LoRa correspondence square outline is demonstrated as follows. The sign starting with one LoRa Node ventures then onto the next Node through a LoRa Gateway. System server gets signal from LoRa Gateway and sends it to the end-client through Application server. As per the authority information, LoRa can accomplish a separation of 715km when there is no obstruction between the Node and Gateway.



# OBJECT IDENTIFICATION USING MATLAB

<sup>1</sup>G.RamaRao, <sup>2</sup>S.Md. Abdullah, <sup>3</sup>S.N.Tejeswar, <sup>4</sup>S.Muralidhar, <sup>5</sup>T.Nagendra yadav

<sup>1</sup> ECE Department, GPCET (affiliated to JNTUA, Anantapur), Kurnool, India

<sup>2</sup> ECE Department, GPCET (affiliated to JNTUA, Anantapur), Kurnool, India

<sup>3</sup> ECE Department, GPCET (affiliated to JNTUA, Anantapur), Kurnool, India

<sup>4</sup> ECE Department, GPCET (affiliated to JNTUA, Anantapur), Kurnool, India

<sup>5</sup> ECE Department, GPCET (affiliated to JNTUA, Anantapur), Kurnool, India

[ramaraog19@gmail.com](mailto:ramaraog19@gmail.com)

[abdullahshaik9849@gmail.com](mailto:abdullahshaik9849@gmail.com)

[tejeshreddy016@gmail.com](mailto:tejeshreddy016@gmail.com)

[murlidharfunboy143@gmail.com](mailto:murlidharfunboy143@gmail.com)

[nagendrayadav0476@gmail.com](mailto:nagendrayadav0476@gmail.com)

## ABSTRACT

This project is based on image processing technology. Image recognition is one of the most important fields of image processing and computer vision. Object image classification is a unique branch of image recognition problem. Classification of images is very challenging since the dataset of images is highly non-linear. In this project we proposed a method that can classify categories with images.

We used convolutional neural network to classify food images. The CNNs are a very effective class of neural networks that is highly effective at the task of image classifying, object detection and other computer vision problems. We classified a dataset consisting different categories.

The method of our task classifying images consisting of four processes:

- Select an image dataset
- Image Pre-processing
- Train dataset using deep learning algorithm
- Classification of images

Our dataset was divided into three parts: training, validation and evaluation. We used training and validation parts of the dataset while training the model and we used evaluation part of our dataset during the evaluation of our model. The system is implemented and simulated on MATLAB and performance is tested on real images.

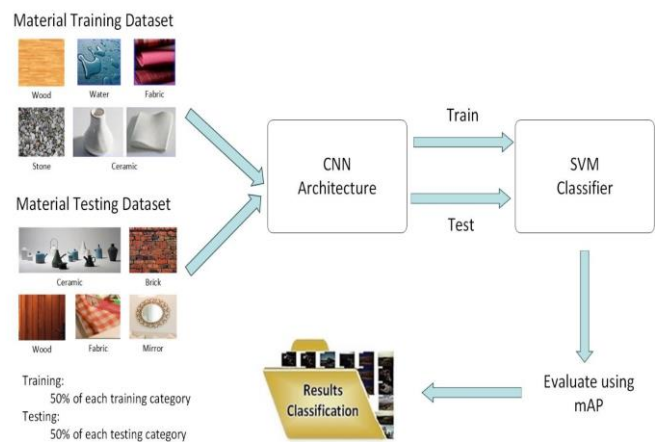
**Key Words:** Image recognition, Neural Networks.

## INTRODUCTION

The complex process of identifying the type of materials in diverse tasks linked to image-based scene perspectives has taken advantage of the combination of machine

learning techniques applied to the up-to-date development of neural networks. This outlines the challenging problem of material classification due to the variety of the definite features of materials. The state-of-the-art solutions rely massively on the attention that Computer Vision systems have received, which led to a series of algorithms being developed and images being collected in datasets.

People are able to recognize the environment they are in as well as the various objects in their everyday life no matter the influence on the item's features or if their view is obstructed, as this is one of the very first skills we learn from the moment we are born. Computers, on the other hand, require effort and powerful computation and complex algorithms to attempt to recognize correctly patterns and regions where a possible object might be. Object detection and recognition are two main ways that have been implemented over multiple decades that are at the center of Computer Vision systems at the moment. These approaches are presented with challenges such as scale, occlusion, view point, illumination or background clutter, all issues that have been attempted as research topics that provided functionality that led to the introduction of Neural Networks and Convolutional Neural Networks (CNN).



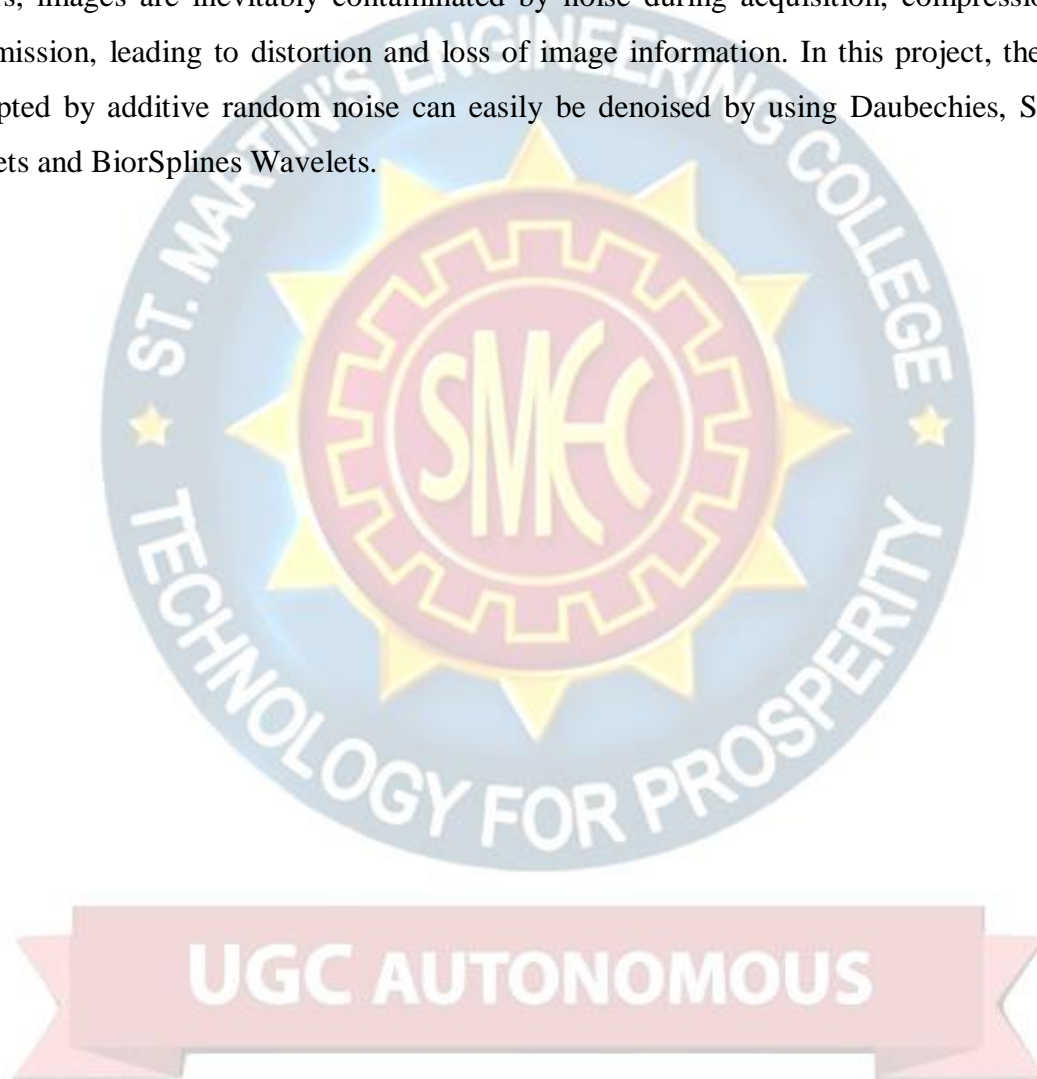


**AN EFFICIENT IMAGE DENOISING BY DAUBECHIES,  
SYMLETS, COIFLETS AND BIORSPINES WAVELETS**

Dr.N.Ramamurthy#1, G.Ramarao\*2,  
G.Pullaiah College of Engineering and Technology, Kurnool, Andhra Pradesh, INDIA

**Abstract:**

During transmission and the influence of environment, transmission channel, and other factors, images are inevitably contaminated by noise during acquisition, compression, and transmission, leading to distortion and loss of image information. In this project, the image corrupted by additive random noise can easily be denoised by using Daubechies, Symlets, Coiflets and BiorSplines Wavelets.





# INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

## Biometric based quorum implementation using LabVIEW and GSM

<sup>1</sup>B. Geetha Rani, <sup>2</sup>E. Sai Samhitha, <sup>3</sup>V. Sandhya Rani, <sup>4</sup>Y. Ruby Swaroopa Rani, <sup>5</sup>K. Rachana  
<sup>1</sup>Assistant Professor, <sup>2</sup>Student (B.Tech), <sup>3</sup>Student (B.Tech), <sup>4</sup>Student (B.Tech), <sup>5</sup>Student (B.Tech)

<sup>1</sup>G. Pullaiah College of Engineering and Technology,

<sup>2</sup>G. Pullaiah College of Engineering and Technology,

<sup>3</sup>G. Pullaiah College of Engineering and Technology,

<sup>4</sup>G. Pullaiah College of Engineering and Technology,

<sup>5</sup>G. Pullaiah College of Engineering and Technology

**Abstract :** Quorum (Attendance) is one of the work ethics which is valued by most employers. In educational institutions also, attendance and academic success are directly associated. Therefore, right attendance management systems must be in vicinity. Most of the educational institutions and government agencies in growing countries still use paper based attendance method to monitor the attendance. Fingerprint based totally automated identity gadget based are gaining popularity due to unique nature of fingerprints. Using the fingerprints we can get each and every element of any individual. Through this, the records acquired can be used in many applications along with Airport Security System, Voting System, and Employee login System, in locating the thieves etc. We in our undertaking have implemented in attendance System. A unique software program called SFG is used right here to keep finger prints for further use. In this we use the additives which include GSM (sim900A). The coding here is in accomplished in a Graphical Programming language named LabVIEW in which the execution of any application is carried out in a sequential manner or little by little in keeping with the records acquired.

**Keywords:** Biometrics, Fingerprint module, LabVIEW, GSM.

### I. INTRODUCTION

The term biometrics has been derived from Greek roots “bios” meaning existence and “metrics” that means dimension. Biometric era uniquely identifies an individual primarily based on certain characteristics which can be physiological or behavioural. There are in particular nine biometric techniques which can be widely used inclusive of face, fingerprint, hand vein, hand geometry, iris, retinal sample, voice print, signature and facial thermograms[1]. These strategies use records that is particular to the individual and remains so during one’s lifetime. Fingerprints are rising because the maximum popular biometrics technology because of its uniqueness, stability, permanence and simplicity of acquisition.

Presently in most of the instructional institutes, the attendance of college students is taken via traditional method wherein instructor calls the number and marks his attendance. There are disadvantages to this approach which includes paper based attendance registers aren't uploaded to any centralised gadget consequently the information isn't available for evaluation, effective lecture time receives affected due to the time taken for statistics series and the machine also can be cheated with the aid of college students. Biometrics technology can remedy these problems and proposed fingerprint based attendance gadget might be best for implementation in universities for identification and also via organizations for attendance monitoring in their personnel. Proposed device is designed using Lab View and GSM module.

Attendance Management falls into two classes specifically: Conventional and Automated techniques. Conventional strategies consist of time sheet, attendance check in and time clock. Time sheets are files, electronic or in any other case that record what time became spent by means of the employee on what duties. Attendance check in is an authentic list of individuals who are present at an institution or employer. Automated methods consist of Barcode device attendance machine, magnetic stripe attendance machine, Radio Frequency Identification (RFID) and the biometric attendance system.

In biometric Attendance system, there is attendance software this is paired with a time clock for personnel which makes use of biometric generation for authentication functions. Other advantages consist of elimination of the cost previously incurred in getting the employees cards.

Paper is prepared as follows. Section II affords a assessment of work carried out inside the area of biometric attendance systems. Proposed fingerprint attendance machine using LabVIEW and GSM is described with its block diagram, running and software design in Section III. Testing of the machine and consequences are mentioned in Section IV. Finally end is presented in Section V.

# LABVIEW BASED MONITORING AND CONTROLLING OF PROCESS VARIABLES

By

Author 1 : C.VINODH ,Dept. of ECE ,GPCET, Kurnool, A.P., INDIA, Email : chakalivinodh@gmail.com

Author 2 : K. SURYA ,Dept. of ECE, GPCET, Kurnool, A.P., INDIA, Email : suryakanike1@gmail.com

Author 3 : D . SUMANTH KUMAR, Dept. of ECE, GPCET, Kurnool, A.P., INDIA, Email : sumanth891939@gmail.com

Author 4 : K . VINAY KUMAR, Dept of ECE, GPCET, Kurnool, A.P.,INDIA, Email : vinaykaluva@gmail.com

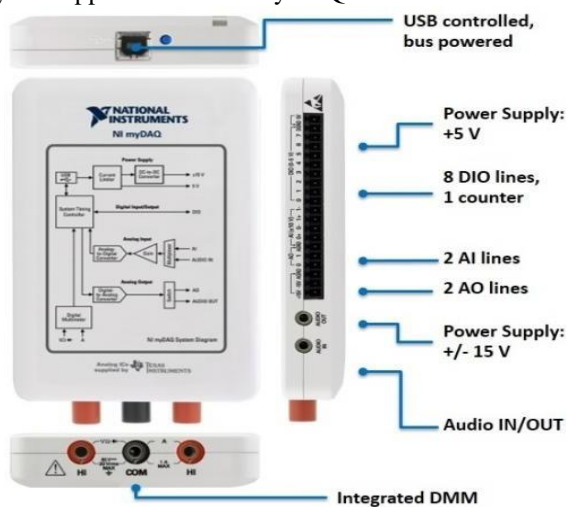
Author 5 : B . GEETHA RANI, Assistant Professor, Department of Eletronics and Communications Engineering, G. Pullaiah College of Engineering and Technology, Kurnool ,A.P ., INDIA, Email : billakantigeetha@gmail.com

**Abstract**—The NI myDAQ component consists of input and output ports. To sense the temperature is necessary at a many places for example kitchen, refrigerators, air conditioners, storage rooms etc. At these spaces to sense the temperature and its appropriate hint is required since it can basis serious complications otherwise. For example, if the temperature in the food room room is greater than an accustomed threshold, it will be damaging for all of the food objects. We can similarly consider “Fire Alarm” which is an example of temperature sensor. This paper offers the evidence about how to use the Labview for LM35 temperature sensor using NI myDAQ

**Keywords:** NI, myDAQ, Labview, Fire Alarm, LM35.

## I. INTRODUCTION

NI short for National Instruments, the NI myDAQ is one of Labview component which is low cost portable device and DAQ shorts for data acquisition. The NI myDAQ is used to amount and examine real world signals which is the software devices. NI myDAQ is ultimate for travelling electronics and attractive sensor quantities. Collective with NI LabVIEW on the Personal Computer/Laptop, students can investigate and practice acquired signals and control humble processes anytime, anywhere. The figure 1 shows the physical appearance of NI myDAQ device.



**Fig. 1.** The appearance of NI myDAQ

The major parts of NI myDAQ are:

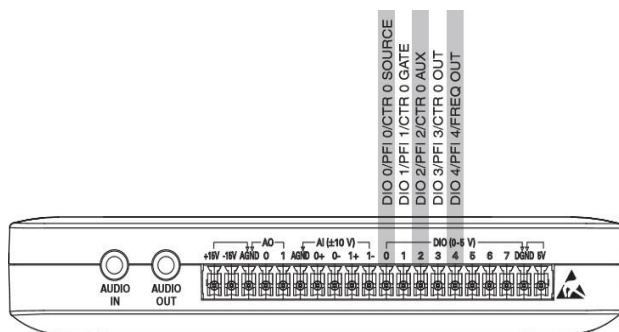
- Analog input - AI
- Analog output - AO
- Digital input and output - DIO
- Audio
- Power supplies and
- Digital multi meter (DMM) functions in a compact USB device.

NI myDAQ permits for existent engineering and, when united with NI LabVIEW and Multisim, provides operator the power to sample systems and examine circuit's exterior of the allocation. Eight of the corporate engineering devices mounted with the NI ELVISmx hardware driver.

Signal Name	Reference	Direction	Description
AUDIO IN	—	Input	<b>Audio Input</b> —Left and right audio inputs on a stereo connector
AUDIO OUT	—	Output	<b>Audio Output</b> —Left and right audio outputs on a stereo connector
+15V/-15V	AGND	Output	+15 V/-15 V power supplies
AGND	—	—	<b>Analog Ground</b> —Reference terminal for AI, AO, +15 V, and -15 V
AO 0/AO 1	AGND	Output	Analog Output Channels 0 and 1*
AI 0+/AI 0-; AI 1+/AI 1-	AGND	Input	Analog Input Channels 0 and 1
DIO <0..7>	DGND	Input or Output	<b>Digital I/O Signals</b> —General-purpose digital lines or counter signals
DGND	—	—	<b>Digital Ground</b> —Reference for the DIO lines and the +5 V supply
PFI 0/ CTR 0 SOURCE	—	—	Digital I/O, line 0; PFI 0, Default function: Counter 0 Source
PFI 1/ CTR 0 GATE	—	—	Digital I/O, line 1; PFI 1, Default function: Counter 0 Gate
PFI 2/ CTR 0 AUX	—	—	Digital I/O, line 2; PFI 2, Default function: Counter 0 Aux
PFI 3/ CTR 0 OUT	—	—	Digital I/O, line 3; PFI 3, Default function: Counter 0 Out
PFI 4/ FREQ OUT	—	—	Digital I/O, line 4; PFI 4, Default function: Frequency Output
5V	DGND	Output	5 V power supply

**Table 1:** Screw Terminal Signal Descriptions.



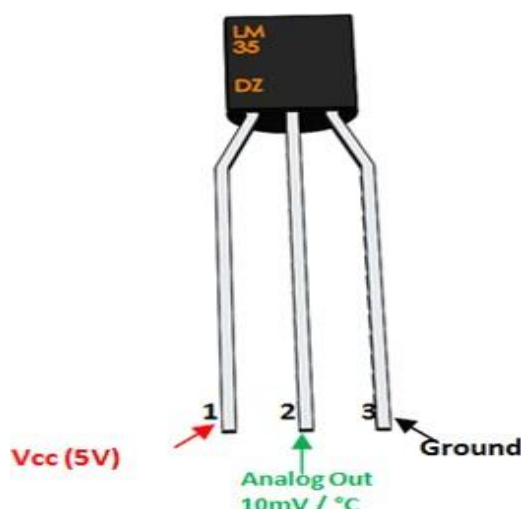


**Fig. 2. NI myDAQ 20-Position Screw Terminal I/O Connector.**

The 20-Position Screw Terminal I/O Connector of NI myDAQ shown in figure 2. This figure 2 consists of various parts that are audio, AI, AO, DIO, GND, and power signals retrieved through the 3.5mm audio port and screw terminal connections. Table I, shows the screw terminal explanation of NI myDAQ.

**II. LM35 TEMPERATURE SENSOR**

Temperature control is significant for parting and return processes, and temperature must be preserved within restrictions to safeguard safe and reliable task of process apparatus. The temperature sensor is endangered from the process resources to check intervention with correct sensing and to remove impairment to the sensor. Thus, selected physically solid, chemically resistant fence occurs between the process and sensor.



**Fig. 3. LM35 Temperature sensor.**

The LM35 succession are precision united circuit temperature strategies with a voltage of output directly proportional to centigrade temperature. The LM35 temperature sensor component shown in below figure 3, the leading benefit over linear temperature devices standardized in Kelvin, as the user is not essential to remove an enormous nonstop voltage from the output to get suitable centigrade mounting. The LM35 does not need any peripheral adjustment or decoration to deliver classic accuracies of  $\pm 1/4$  °C at room

temperature and  $\pm 3/4$  °C over a full -55 °C to 150 °C temperature choice.

LM35 sensor consists of 3 pins, pin1 is connects to Vcc for power supply from the NI myDAQ +15v, pin2 is connects to the analog pin A0 of the NI myDAQ and third pin (pin3) is connects to the ground of the NI myDAQ.

**III. NI MYDAQ AUDIO EQUALIZER METHODS**

**A. DAQ Assistant Express VI**

It consists of Creates, edits, and runs tasks using NI-DAQmx. Denote to the NI-DAQmx Readme for a whole listing of devices NI-DAQmx supports.

**Block Diagram Inputs**

Parameter	Description
<b>data</b>	Contains samples to write to the task. <b>data</b> is an output for measurement tasks and an input for analog and digital output tasks. <b>data</b> does not appear for counter output tasks.
<b>error in</b>	Describes error conditions that occur before the Express VI runs.
<b>number of samples</b>	Specifies the number of samples to acquire or generate for each channel in a finite task. For finite tasks, this VI ignores all settings for the input other than the initial input. For example, if you use the VI in a loop, specifying a new value in each iteration. NI-DAQmx ignores all values other than the one specified in the first loop iteration. If you want to run multiple finite operations in a loop, such as to generate multiple pulse trains, each with a varying number of pulses, generate code for the VI. For continuous tasks, NI-DAQmx uses the value to <a href="#">determine the buffer size</a> and the number of samples to read from the buffer. This input does not appear for all channel types and sample timing types.
<b>rate</b>	Specifies the <a href="#">acquisition rate</a> in samples per channel per second. This input does not appear for some channel types and sample timing types. If you use an external source for the Sample Clock, set this input to the maximum expected rate of that clock.
<b>stop</b>	Specifies to stop the task and release device resources when the Express VI completes execution. For continuous tasks, this input is FALSE by default, meaning the task continues to run until the application stops. To stop the task you can use the device again in the same application, wire this input to the same stop control you wire to the conditional terminal of the while loop. For single-point and finite tasks, this input is TRUE by default, meaning the task stops after all samples are acquired. To optimize single-point performance when using this Express VI in a loop, wire the input to the same stop control you wire to the conditional terminal of the while loop.
<b>timeout</b>	Specifies the amount of time in seconds to wait for the VI to read or write all samples. The VI returns an error if the time expires. For input operations, the VI also returns any samples read before the time expires. The default timeout is 10 seconds. If you set <b>timeout</b> to -1, the VI waits indefinitely. If you set <b>timeout</b> to 0, the VI tries once to read or write the samples and returns an error if unsuccessful. NI-DAQmx performs a timeout check only if the VI must wait to read or write samples. This input does not appear for all channel types and sample timing types.

**Block Diagram Outputs**

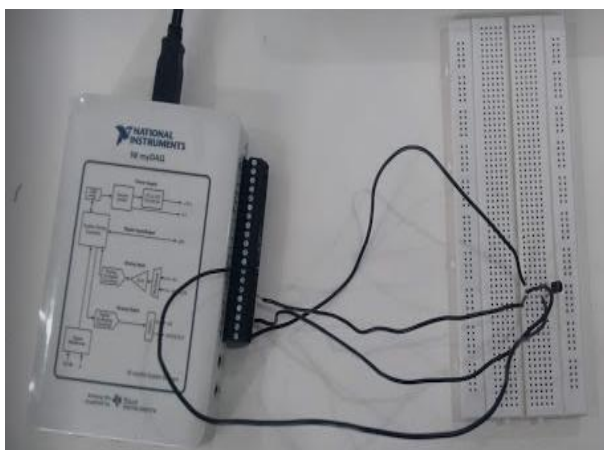
Parameter	Description
<b>data</b>	Contains samples read from the task. <b>data</b> is an output for measurement tasks and an input for analog and digital output tasks. <b>data</b> does not appear for counter output tasks.
<b>error out</b>	Contains error information. If <b>error in</b> indicates that an error occurred before the Express VI ran, <b>error out</b> contains the same error information. Otherwise, it describes the error status that the Express VI produces.
<b>stopped</b>	Indicates whether the task stopped. The task stops if the <b>stop</b> input is set to TRUE or an error occurs. This output appears for continuous or hardware-timed single-point tasks only.
<b>task out</b>	Contains a reference to the task after this VI completes execution. Wire this output to other NI-DAQmx VIs to perform other operations with the task.

**IV. NI MYDAQ CONNECTION PROCEDURE AND THE RESULT ANALYSIS**

Here, we are using LM35 temperature sensor, the LM35 temperature sensor production voltage varies linearly by temperature, and is directly proportional to temperature. The characteristics of LM35 sensor are:

1. Measureable range is -55<sup>0</sup> to 150<sup>0</sup>
2. Linear with 0.5<sup>0</sup> certified accuracy at +25<sup>0</sup>
  - In this project, we are used +Vs used is 15 V
  - The production at 36 deg.C is 0.36V and the production at 21<sup>0</sup> is 0.21 V
  - The upstairs calculations help as the strategy equalities for the block diagram of LABVIEW.





The Labview interfacing with NI myDAQ shown in below figure 4. The NI myDAQ external setup that is hardware and software setup shown in below figure 5. After regarding the path as shown in the figure 5, the output of Analog is working by AI0 channel of myDAQ, the source voltage to LM35 is assumed from the static voltage +15V from myDAQ.



Fig. 5. Hardware and Software setup.

After joining the exterior hardware, then plan the interior programming of LabVIEW. First design the front panel. On the Front Panel, residence two Numeric Indicators (Temperature Reading) and a Thermometer (Temperature Measurement) and one Round LED (Indication). The temperature measurement minimum range 0 and maximum range 100. Figure 6 shows the proposed front panel design.

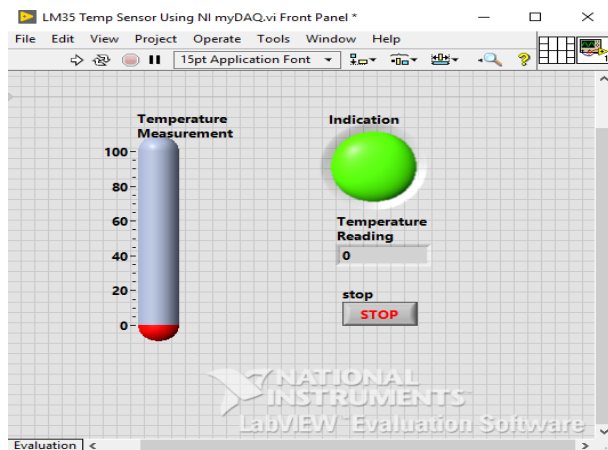
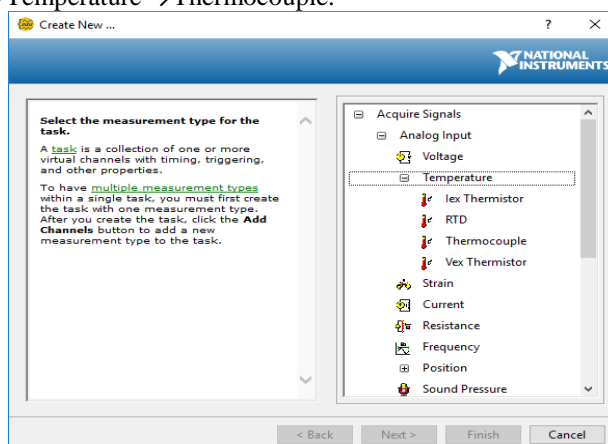


Fig. 6. Front panel design.

After completion of front panel design, we can carry on to plan its block diagram for consecutively the program, that we used a loop structure. On block diagram panel, right click on the block diagram → Express → Input → DAQ Assist. Double click on the DAQ Assistant. The Create New Express Task window will be opened. Select Acquire Signals → Analog Input → Temperature → Thermocouple.



Select the Thermocouple. In this select the ai0, the important of this channel is to read the data from. This look like to one of the screw terminal connections on the device. Finally Click the Finish button. The DAQ Assistant dialog box will displayed on the screen.

After the decision of interface with NI myDAQ, using Labview, the input of analog data of DAQ is managed and standardized to display the accurate temperature by multiplying the DAQ Assistant production with a numeric constant '100'. When the temperature is less than 40°, green color light will be observable in labview front panel as shown figure 9. When the temperature more than 40°, red color light will be observable in labview front panel and a negotiation box looks as shown in the figure 10, which indicating 'DANGER!!!!!!'.

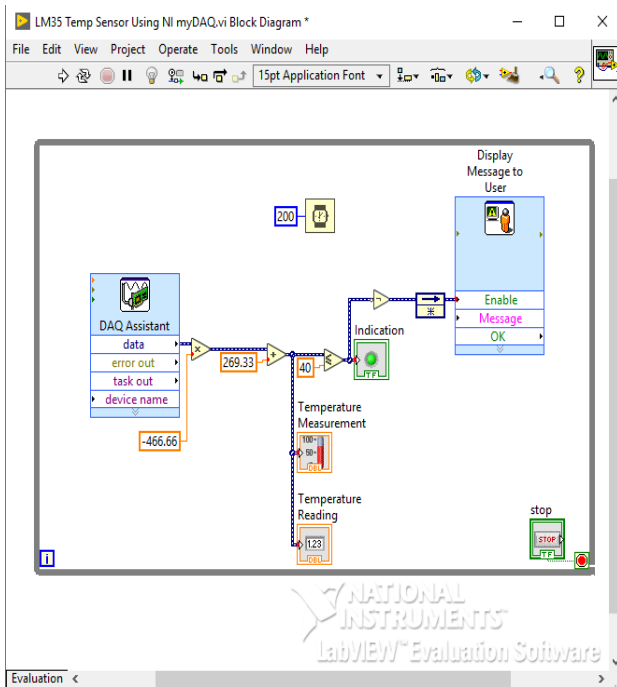


Figure 7: block diagram panel design.

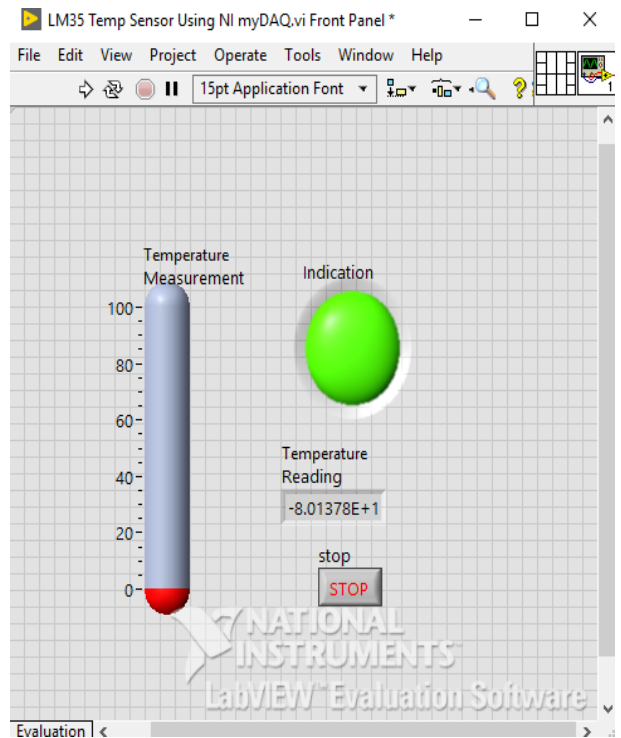


Figure 9: Result of the program running when the temperature is < 40 deg.C.

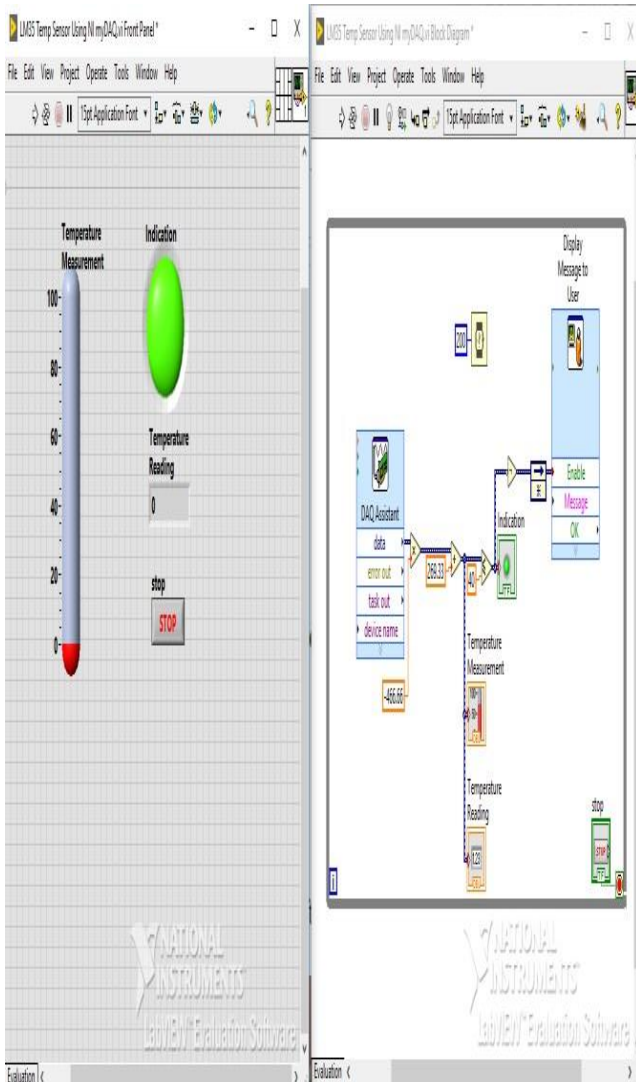


Figure 8: Front panel and block diagram panel design.

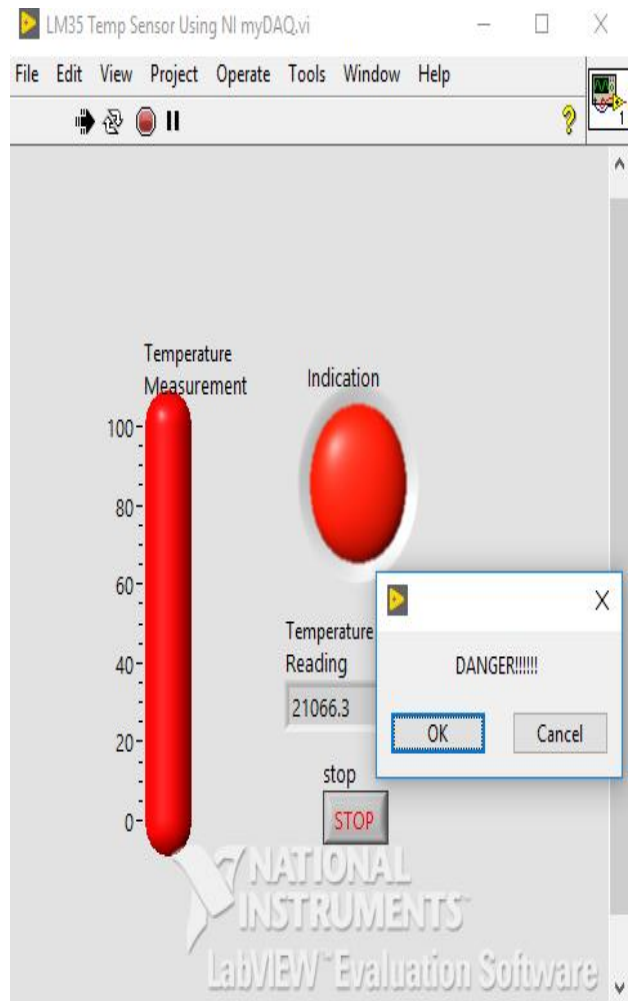


Figure 10: Result of the program running when the temperature is > 40 deg.C.

**CONCLUSION :**

Here we used LM35 sensor ,when the temperature is less than 40 deg., the green light turned on and the temperature is greater 40 deg., the red light turned on. The red light indicates the 'DANGER!!!!!!'. The main important application of LM35 is temperature and output voltage are directly proportional relation. This temperature sensor mainly used in home application, oil exploration, hot air balloons, GPS devices and battery systems.

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# VLSI Implementation of Configurable Linear Feedback Shift Register in VHDL

K.VINOD KUMAR<sup>1</sup>, A.PARVATHI<sup>2</sup>

<sup>1,2</sup> Assistant Professor

<sup>1,2</sup> Department of Electronics & Communication Engineering

<sup>1,2</sup> G. Pullaiah College of Engineering & Technology (Autonomous), Kurnool, AP

*Abstract*—This paper focus on the implementation of configurable linear feedback shift register (CLFSR) in VHDL and evaluates its performance with respect to logic, speed and memory requirement in FPGA. Behavioral implementation of CLFSR in VHDL is configurable in terms of number of bits in the LFSR, the number of taps, positions of each tap in the shift register stage and seed value of LFSR. The target device used for implementation of CLFSR is Xilinx Virtex-4 FPGA. For simulation and synthesis of CLFSR Xilinx ISE 9.2i tool is used. The output waveforms and timing report are also discussed.

*Keywords:* Linear Feedback Shift Register; Maximum Length Feedback Polynomial; Shift Register; FPGA; VHDL

## I. INTRODUCTION

A linear feedback shift register is a combination of series of flip flop and XOR or XNOR logic gates. Its output is pseudo randomly cycle through a sequence of binary values after certain number of clock cycle . The repetition of random output depends on the number of stages in the LFSR. Therefore, it is an important component in communication system where, it play important role in various application such as cryptography application, CRC generator and checker circuit, gold code generator, for generation of pseudorandom sequence, for designing encoder and decoder in different communication channels to ensure network security, Design for Test (DFT) and Built in Self Test design (BIST).

A linear feedback shift register is linear in the sense that its input bit is a linear function (XORing or XNORing) of LFSR previous state .

The LFSR feedback in the shift register chain is a function of taps numbers and taps positions. The feedback to LFSR is XOR or XNOR of these taps. However, it is this feedback that causes the random output to start repeating after certain clock cycles.

The LFSR works as shift register, if there is no input tap to register bits.

In literature several papers discuss the various applications and implementation of LFSR in VHDL or Verilog. In application of LFSR for testing of IP cores

is discussed. Implementation of built in self test capability using LFSR technique in UART is presented in [4]. The comparative study of FPGA implementation of two 16-bit PN sequence generator is presented. A new pseudo-random bit sequence generator implementation and its results are discussed . In design of multi bit LFSR pseudo-random sequence generator and its performance comparison on FPGA using VHDL is discussed.

Though VHDL or Verilog implementation of LFSR have been reported in past, but the detail VHDL implementation of configurable LFSR is rare. In this paper, we have discussed the implementation of CLFSR in VHDL where various LFSR parameters are configurable. The LFSR design is configurable in the sense that we need not required writing VHDL code every time for evaluating the performance of LFSR having different numbers of stages, taps numbers, taps positions and seed value of LFSR. These parameters are declared as generic or input signal in behavioral style of VHDL description of CLFSR . We only needed to change the different parameters value to verify LFSR performance.

For faster prototype development of any logical function, FPGA is the best choice. The main advantage of using FPGA is its flexibility that we can reconfigure the design any number of times and check the input-output results and verify these results on-chip for comparison purpose. Therefore, it is necessary to implement CLFSR on FPGA to verify its performance for different parameter values.

Configurable LFSR is a linear feedback shift register having several configurable parameters [9–11]. Various configurable parameters are:

1. Number of bits or stages in the LFSR.
2. Number of taps in the feedback path.
3. Each tap positions in the shift register stage. Maximal length feedback polynomial is the combination of taps and their position. A few basic properties of the maximal length feedback polynomial used to describe LFSR are:
  - a. The output and input taps should always be connected to the last and first taps of the shift register respectively.
  - b. The last tap of the shift register is the leading '1' in the maximal length feedback polynomial.
  - c. The length of the shift register is the exponent of the highest order term in the maximal length feedback polynomial.



# An Efficient Design of 8 Bit MAC Unit using Vedic Multiplier

Ms. Parvathi.A<sup>1</sup>, M. Tarunanjan<sup>2</sup>, T. Srinivasulu<sup>3</sup>, V. Sreenath Reddy<sup>4</sup>, E. Vamsi Krishna Goud<sup>5</sup>,<sup>1</sup>Assistant Professor,<sup>2,3,4,5</sup> UG Scholars,<sup>1,2,3,4,5</sup> G. Pullaiah College Of Engineering and Technology, Kurnool, Andhrapradesh.

**Abstract**—Multiply and Accumulate (MAC) is one of the primary operations used widely in dsp and other applications. Multiplier is the fundamental component of Digital Signal Processors (DSP's). Its parameters such as power, LUT utilization and delay decide the performance of a DSP. So, there is a need to design a delay efficient multiplier. In this paper, an 8-bit MAC unit is designed using an 8-bit Vedic multiplier. The existing 8-bit Vedic multiplier using UT sutra is noted in delay related to previous Wallace tree multiplier. The entire design is implemented in Verilog HDL. Synthesis and simulations were done using Xilinx ISE Design Suite 14.5 and Vivado 2018.2. The proposed design achieves significant improvement in delay.

**Index Terms**—MAC unit, Vedic mathematics, Verilog HDL.

## INTRODUCTION

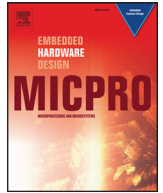
LOW power plays a prominent role in today's current trends of VLSI. Power dissipation has become a major optimization objective due to increased demand for low-power digital signal processors. There are numerous techniques and extension circuits employed to achieve low power in VLSI designs. In a "Digital Signal Processor" (DSP) [1], the commonly used operations are "multiply and accumulate" (MAC), convolution and "Fast-Fourier

Transforms" (FFT) etc. The multiplier is considered as an essential block for the above operations. Power consumption in a DSP hugely depends on MAC unit. MAC unit consists of a multiplier, an adder for adding its partial products and an accumulator for storing the obtained results. Hence for improving the speed of MAC unit, speed of the multiplier should also be improved. A carry save adder is used for this purpose and ancient Vedic mathematics is used for achieving reductions in power. This work emphasizes on designing an 8-bit MAC unit with an 8-bit Vedic multiplier using Urdhvatiryakbhyam (UT) sutra. The rest of the paper presents related work followed by a brief introduction of Vedic mathematics.

## RELATED WORK

As multiplication is termed as a widely used arithmetic operation, the research has always been aiming to design fast multipliers either by showing improvement in delay. In a MAC architecture proposed using an optimized multiplier delay parameter is calculated for 8-bit MAC unit. The authors proposed a MAC using Vedic sutras and implemented in 90nm technology showing improvement in delay in 8-bit MAC units respectively.

An architecture for designing an 8-bit Vedic multiplier using Urdhva



# Improved performance of impulse active noise control using active function threshold with absolute harmonic variable step-size algorithm

Suman Turpati<sup>a,\*</sup>, Venkatanarayana Moram<sup>b</sup>

<sup>a</sup> Research Scholar, Department of ECE, JNT University, Ananthapuramu 515002, A.P., India

<sup>b</sup> Professor & Dean of CRI, ECE Department, KSRM College of Engineering (Autonomous), Y.S.R. Kadapa 516003, A.P., India

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## ABSTRACT

The Standard (conventional) adaptive algorithms exhibits low convergence rate and minimum noise suppression, or else the system becomes unstable under Gaussian and non-Gaussian (impulsive noise  $S\alpha S$  distributions) noise environments. In order to overcome the drawback of traditional algorithms (i.e., to eliminate unwanted noise), the popular algorithm Filtered Cross Minimum Square (FxLMS) is used in Active Noise Control (ANC), not only to improve its efficiency but also to improve its performance. In this paper, we proposed two improvements: first, we proposed a novel method Active threshold function FxLMS (ATFxLMS) being employed in ANC in the paths of primary (reference) and error signals; a second proposal is employing the Variable Step-Size based on Absolute Harmonic Mean (AHMVSS) of error signal. The idea behind this method is that the step-size of the algorithm varies depending on the harmonic mean of error signal obtained from the error location. In comparison to the fixed step-size algorithm, the proposed ATF-AHMOVSS provided an improved convergence rate for the desired ANC efficiency. Moreover computational complication of the proposed method was examined as it was found that the proposed algorithm provided stable condition for ANC systems. Computer simulation results are revealed that the proposed (AT & AHMOVSS-FxLMS) algorithm have attained excellent performance in terms of convergence speed, noise reduction and minimum steady state error as compared to other existing algorithms under different noise inputs. The results obtained from the proposed algorithm show outperformance compared to traditional adaptive algorithms.

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## 1. Introduction

In present era, Due to the advancements in technology, the sound disturbances problems are increases in environment due to noise pollution from industries, airplanes, motor vehicles, railways, trade areas and building activity [1]. Besides musical instruments and household applications such as fans, refrigerators and motors etc. The increased noise disturbances are dangerous to human health, especially for children's, aged persons and also effects on wildlife.

Basically, two types of noises are there in nature, viz. Broadband Noise and Narrow band noise. For controlling such noises, the researchers have introduced two techniques: Passive Noise Control (PNC) and ANC. In PNC systems, the sound pollutions are reduced

by using absorbable substances and suitable for sources of high frequency. It has disadvantages like rich in cost and size, and also inefficient for low frequency applications [2–3]. To overcome such problems, we developed an ANC concept to suppress the unwanted sound, especially in the applications of small frequency analysis. The concept ANC is performed based on the electro-acoustic destructive theory by generating a suitable artificial (anti-noise) signal to add noise signal. The idea destructive interference takes place between two signals of amplitude (similar) and phase (opposite) results in the cancellation of both to make noise free environment [2–6]. The physical concept of ANC as shown in Fig. 1. In the advancement evolution of adaptive filters and hardware of DSP's had given victorious results in practical application of ANC system viz, air ducts, car cabin, aircrafts and headphones [6–12].

The application of practical ANC is depending on the type of area zone to make silence. A number of applications found in active noise cancelation devices. In that the reduction of noise implies that the sound is cancelled at a source, for example from a loud speaker. Therefore the effect works well with headphones, as

\* Corresponding author.

E-mail addresses: [turpatisuman87@gmail.com](mailto:turpatisuman87@gmail.com) (S. Turpati), [narayanamoram@gmail.com](mailto:narayanamoram@gmail.com) (V. Moram).

# An Efficient Simulink Model for Active Noise Control using Filtered-x Adaptive Algorithms

*Suman Turpati, Research Scholar, ECE Department, JNTUA, Ananthapuramu, India.  
(Email: turpatisuman87@gmail.com)*

*Dr. Venkatanarayana Moram, Professor & Dean CRI, ECE Department, K.S.R.M College of Engineering, Y.S.R.Kadapa, India.  
(Email: narayanamoram@gmail.com)*

**Abstract---**In modern technologies, the problem of acoustic noise is increasing day to day with lightweight materials used in automobiles, industries, household and other applications. In order to protect human health from this problem, several kinds of Active Noise Control (ANC) techniques have been proposed for the last two decades. It is working based on homogeneity and additive principle. I.e. The acoustic noise can be minimized by producing a controllable secondary signal having similar magnitude and frequency but with opposite phase sign. In this paper, a MATLAB, Simulink model for the ANC is proposed with different Filtered x-Adaptive Algorithms (FxAA). The performance of the model has been evaluated under different Acoustic Noise cases using modified algorithms. Subsequently, the performance metrics have been estimated such as Signal to Noise Ratio (SNR), Mean Square Error (MSE), Mean Noise Reduction (MNR), Convergence rate and Power spectral density (PSD). It is observed that noise level cancellation using Filtered x Sign Error Least Mean Square (FxSELMS) algorithm is outperformed when compared with other Filtered x-Adaptive Algorithms (FxAA).

**Key words---**Adaptive Filters, MSE, PSD, FxLMS, FxSELMS, Simulink

## I. INTRODUCTION

In the prevailing scenario of the usage of automobiles to a very larger extent, the production of acoustic sound noise level has scaled up due to the increase in the number of automobiles as well as the immense speed of cars. Besides these, noise produced by the railways, and airplanes also leads to noise pollution. The usage of industrial equipment in the firms, trading, construction in various sectors has further added to the enhancement of unwanted noise pollution.

Coming to general appliances of acoustics in living areas, we hear interrupting and unpleasant noises in neighborhood, noise made from household appliances, musical instruments, public phone booths, and lawn mowers, etc. The acoustic noise produced from day to day chores of modern life is more noticeable. Hence to produce a noise-free environment, we need to minimize acoustic noise. In the present era of technology, the heavy use of fans, air ducts, chimneys, stacks, transformers, blowers etc. is abundantly seen which is one of the most significant reason behind the production of acoustic noise. Basically the acoustic noise is broadly dividing; two types of noises: i) Broadband noise and ii) Narrowband noise.

ANC is a system to lessen the undesired noise by producing secondary noise signal through secondary sources. The ANC [4] [8] [11] structure comprises an electro-acoustic signal generator which suppresses the dominant noise by producing a secondary noisy sound of similar amplitude adequacy and inverse stage leading to the suppressing of both primary and secondary noises when added acoustically [7]. The ANC systems are proved to be more effective in attenuates low-frequency noise, smaller in size and cost less where passive techniques are ineffective, very cost and large in size. ANC's is mostly used because it shows progress in noise control, with many additional benefits [9]. The weights of the FIR filters are adjusted with suitable Fx-Adaptive algorithms (FxAA) are preferred in ANC systems.

The FxAA algorithm can achieve greater results in terms of good convergence process and stability of ANC. In which the reference signal is filtered via an Estimated Secondary Path (ESP). The algorithm FxLMS is primarily and frequently preferred in adaptive algorithms to update the weights and cancellation of noise [1-2].

The remaining paper arranged as: Section II explains the implementation of ANC System with Fx- adaptive algorithm and its path sensing devices, whereas Section III deals with the proposed Simulink model of ANC with



## A NOVEL METHOD OF LOW INTERFERENCE UPLINK & DOWNLINK MAC PROTOCOL FOR FULL-DUPLEX WI-FI NETWORKS

<sup>1</sup>KALVA PUSHPAKALA, <sup>2</sup>K.UMA MAHESWARI

<sup>1</sup>Asst. Professor, Department Of Electronics And Communication Engineering, G Pullaiah College of Engineering & Technology, Kurnool; A.P, India.

<sup>2</sup>Asst. Professor, Department Of Electronics And Communication Engineering, G Pullaiah College of Engineering & Technology, Kurnool; A.P, India.

### ABSTRACT

A Full-duplex MAC protocol provides a greater reception opportunities to clients with low interference and to reduce the interference between uplink and downlink transmissions at the AP. Full-duplex access points can potentially support simultaneous uplink and downlink flows. However, the atomic three-node topology, which allows simultaneous uplink and downlink, leads to inter-client interference. In this project, we propose a random-access medium access control protocol using distributed power control to manage inter-client interference in wireless networks with full-duplex capable access points that serve half-duplex clients. Our key contributions are two-fold. First, we identify the regimes in which power control provides sum throughput gains for the three-node atomic topology, with one uplink flow and one downlink flow. Second, we develop and benchmark PoCMAC, a full 802.11-based protocol that allows distributed selection of a three-node topology. The proposed MAC protocol is shown to achieve higher capacity as compared to an equivalent half-duplex counterpart, while maintaining similar fairness characteristics in single contention domain networks.

### I. INTRODUCTION

Recent work has demonstrated in-band full duplex capability, i.e., the ability to transmit and receive simultaneously in the same band through self-interference cancellation using multiple antennas. In fact, the ability to suppress self-interference below the noise floor has been demonstrated, thereby enabling near-ideal full-duplex capability. To take advantage of full-duplex capability in a multi-node network, it is essential to have new medium access control (MAC) protocols, because full-duplex leads to new interference patterns compared to current half-duplex communication networks.

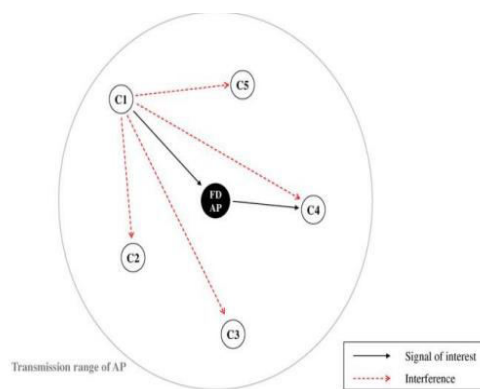


Fig.1.Uplink (C1→AP) and Downlink (AP→C4) Network with Full-Duplex AP and Half-Duplex Clients.

The key challenge for the full-duplex MAC is to coordinate multiple simultaneous transmissions, which are made possible by the new in-band full-duplex capability. Fig. 1 shows the key challenge of inter-client interference with simultaneous up/downlink in





# Local Ionospheric TEC Maps for DGPS Applications

E. Upendranath Goud<sup>(✉)</sup> and K. C. T. Swamy

Department of Electronics and Communication Engineering,  
G. Pullaiah College of Engineering Technology (Autonomous),  
Kurnool 518452, Andhra Pradesh, India  
upendranathece@gpcet.ac.in, kctswamy@gmail.com,  
kctswamyece@gpcet.ac.in

**Abstract.** This research work focuses on the ionospheric error correction in Differential Global Positioning System (DGPS) applications over the Indian region by using GAGAN TEC station data. In DGPS, it is assumed that the ionosphere over the reference station and rover is same, reference station computes ionospheric corrections of its own and transmits to the rover. Since the ionosphere over low latitude is active/dynamic spatially, corrections computed by the reference station are not sufficient. Hence, we are proposing instantaneous TEC maps generated by reference station for correcting rover ionospheric errors. In this paper, the local ionosphere variability is predicted using a polynomial model with first order and TEC maps were generated within the latitude and longitude region of  $20 \times 20$ . The results show that the first order polynomial is capable of approximating TEC within a DGPS service region.

**Keywords:** DGPS · TEC · TEC maps · GAGAN

## 1 Introduction

Differential Global Positioning System (DGPS) is a standard method to improve the positioning accuracy of GPS receiver. In DGPS operation, the reference station (Dual frequency receiver) computes differential corrections and transmit to the rover (single frequency GPS receivers) to eliminate satellite clock error and to reduce the other correlated errors due to orbit, ionosphere and troposphere (Fig. 1). Spatial and temporal decorrelation of ionospheric corrections can degrade the performance of DGPS users. Because the separation between the receiver and the reference station increases significantly. Park et al. found that the ionospheric error has the largest effect due to the decoration of differential corrections between reference stations and user [1].

In DGPS scenario, the decorrelation of ionospheric correction was less understood in equatorial and low latitude regions [2]. Hence, it is necessary to understand and provide better solution for improving the accuracy of the DGPS user receiver. Aris et al. studied Spatial and Seasonal Ionospheric corrections variation for DGPS users over the Malaysian region [3]. In this paper a new method is proposed to minimize ionospheric corrections decorrelation impact for DGPS users over the Indian region.



## IONOSPHERIC TEC MAPS

<sup>1</sup>E. Upendranath Goud, <sup>2</sup>A.V.N.Sai Pavani, <sup>3</sup>T.Supriya, <sup>4</sup>E.Yashaswini, <sup>5</sup>E.Vignatha.

<sup>1</sup>Assistant professor, <sup>2</sup>Student, <sup>3</sup>Student, <sup>4</sup>Student, <sup>5</sup>Student

<sup>1</sup>Electronics And Communication

<sup>1</sup>G Pullaiah College Of Engineering And Technology, Kurnool, India

**Abstract :** This project deals with the ionospheric error correction in Differential Global Positioning System (DGPS) applications over the Indian region by using GAGAN TEC station data. In DGPS, it is assumed that the ionosphere over the reference station and rover is same, reference station computes ionospheric corrections of its own and transmits to the rover. Since the ionosphere over low latitude is active /dynamic spatially, corrections computed by the reference station are not sufficient. Hence, we are proposing instantaneous TEC maps generated by reference station for correcting rover ionospheric errors. In this paper, the local ionosphere variability is predicted using a polynomial model with first order and TEC maps were generated within the latitude and longitude region of  $2^0 \times 2^0$ . The results show that the first order polynomial is capable of approximating TEC within a DGPS service region.

### INTRODUCTION

#### A.Overview

The Global Positioning System (GPS) provides the position and location of the object on the earth and it is a satellite based navigation and this technology uses a stand alone receivers and it even includes a constellation of 24 satellites and extra backup purpose. It uses a timely signals generated by satellites revolving around the earth.

A **Differential Global Positioning System (DGPS)** is an enhancement to the Global Positioning System (GPS) which provides improved location accuracy, in the range of operations of each system, from the 15-meter nominal GPS accuracy to about 1-3 cm<sup>1</sup> in case of the best implementations.

Each DGPS uses a network of fixed ground-based reference stations to broadcast the difference between the positions indicated by the [GPS satellite](#) system and known fixed positions. These stations broadcast the difference between the measured satellite [pseudoranges](#) and actual (internally computed) pseudoranges, and receiver stations may correct their pseudoranges by the same amount. The digital correction signal is typically broadcast locally over ground-based transmitters of shorter range.

A similar system which transmits corrections from orbiting satellites instead of ground-based transmitters is called a Wide-Area DGPS (WADGPS).

#### B.Objectives

Our main objectives are to know the exact location of the object and this can be detected by using first order of the polynomial model with the generation of TEC maps of latitude and longitude region and to rectify the errors to get the more accuracy of the object.

#### C.Errors

GPS is a satellite based navigation system. It provides PNT services to the users all over global. But its accuracy is limited by various errors. The various errors are broadly classified into 3 type

1. Satellite based error
2. Medium based errors (propagation errors)
3. Receiver based errors



# RECOGNITION AND TRACKING OF MOVING OBJECTS

<sup>1</sup>E. Upendranath Goud, <sup>2</sup>C. Naga Anusha, <sup>3</sup>T. Saraswathi, <sup>4</sup>J. Sai Sudheera, <sup>5</sup>R. Sireesha.

<sup>1</sup>Assistant professor, <sup>2</sup>Student, <sup>3</sup>Student, <sup>4</sup>Student, <sup>5</sup>Student

<sup>1</sup>Electronics And Communication

<sup>1</sup>G Pullaiah College Of Engineering And Technology, Kurnool, India

**Abstract :** Now-a-days, it's becoming very important to know about any information in a digital way in order to avoid crimes and other mischief activities. Conventional methods that are used now do have limited advantages as we have to check for every minute information in a thorough way. By using this method, we need not put strenuous hours over monitors, instead it gives the complete information about what, how and when that happened over there.

The problem of motion-based object tracking can be divided into two parts:

1. Detecting moving objects in each frame
2. Associating the detections corresponding to the same object over time.

**Index Terms** - Information, Crimes, Conventional methods, Limited advantages, Strenuous, Detecting

## I. INTRODUCTION

The area of automated surveillance systems is currently of immense interest due to its implications in the field of security. Surveillance of vehicular traffic and human activities offers a context for the extraction of significant information such as scene motion and traffic statistics, object classification, human identification, anomaly detection, as well as the analysis of interactions between vehicles, between humans, or between vehicles and humans. A wide range of research possibilities are open in relation to visual surveillance and tracking.

Automatic tracking of objects can be the foundation for many interesting applications. An accurate and efficient tracking capability at the heart of such a system is essential for building higher level vision-based intelligence. Tracking is not a trivial task given the non-deterministic nature of the subjects, their motion and the image capture process itself. The goal of the work is

(a) To set up a system for automatic segmentation and tracking of moving objects in stationary camera video.

(b) To make significant improvements in commonly used algorithms.

## II. EXISTING SYSTEM

In the existing system the algorithm is completely depends on the image processing techniques and it will be restricted to the detection of only some objects in the images and also mainly depends on the colour of the object and it will have the huge amount of noise because it doesn't have any intelligent system running and we have to take some extra steps to avoid this noise and it makes the algorithm more complicated and we have to write another new program for different object and if we tune it to be more precise also we cannot guarantee a precise output. Only video can be taken by using the present systems or conventional methods. Sometimes this feature becomes disadvantageous when we need to count the number of incomings and outgoing. In those cases, it becomes highly difficult and strict manual interaction is needed in order to know what that actually happened over a given location.

# DESIGN AND TESTING OF COMBINATIONAL LOGIC CIRCUITS USING BUILT IN SELF TEST SCHEME FOR FPGAs

A Vamshidhar<sup>1</sup>, E Tarun Kumar<sup>2</sup>, K Sandeep Reddy<sup>3</sup>, B Yalla Raju<sup>4</sup>, K Vinod Kumar<sup>5</sup> M.tech,

Assistant Professor<sup>5</sup>, B.Tech scholars<sup>1,2,3,4</sup>

Department of Electronics and communication Engineering<sup>1,2,3,4,5</sup>

G.Pullaiah College of Engineering and Technology, Pasupula(V)<sup>1,2,3,4,5</sup>  
Kurnool, Andhra Pradesh, India.

**Abstract**— In Very Large Scale Integration (VLSI), while manufacturing IC, Test time and cost plays a very significant role. If faulty components find during IC manufacture, then cost increases. So it is essential to minimize test time and cost. In this paper Built inSelf-Test (BIST) architecture is designed for testing combinational logic circuits and fault models like stuck at one and stuck at zero are tested, simulated and validated using Spartan 6 FPGA and Xilinx ISE 14.2 tool. BIST architecture with fault and without fault in circuit under test is compared for the parameters such as area, memory, delays time and device utilization.

**Keywords**— BIST; LFSR; MISR; CUT; S-A-1; S-A-0;

## I. INTRODUCTION

With the ever-increasing complexity and density of present day integrated circuits, the cost of testing has become a significant part of the overall product. Thereby, Built-In Self-Test (BIST) has been proposed as a powerful design for testability technique for addressing the highly complex testing. BIST design includes on-chip/board circuitry to provide test patterns and to analyze output responses. It can perform the test internal to the chip so that the need for complex external testing equipment is greatly reduced. Using BIST many of the traditional testing problems (low accessibility of internal nodes that increases the test complexity) can be overcome [1].

Another interesting feature of BIST strategies is that it allows rapid testing of the circuit. The test is performed at the nominal operation frequency without resorting to an external high speed tester that represents an expensive Automatic Test Equipment (ATE) and which additionally does not always have a timing accuracy comparable to the IC internal speed on the boards.

BIST reduces testing costs. In order to understand why, consider the example of a 1 GHz microprocessor on a chip with 800 pins. For reliable stuck-fault and limited transition-delay fault testing, we should conduct the test at the rated clock speed. This forces us to use the Advantest Model T6682 1 GHz ATE, which can sample circuit outputs at this rate. The Tester costs  $800 \text{ pins} \times \$6,000 \text{ per pin} = \$4,800,000$ , but there is no chip area cost due to testing, because we do not use on-chip BIST hardware. BIST reduces testing costs. In order to

understand why, consider the example of a 1 GHz microprocessor on a chip with 800 pins. For reliable stuck-fault and limited transition-delay fault testing, we should conduct the test at the rated clock speed. This forces us to use the Advantest Model T6682 1 GHz ATE, which can sample circuit outputs at this rate. The tester costs  $800 \text{ pins} \times \$6,000 \text{ per pin} = \$4,800,000$ , but there is no chip area cost due to testing, because we do not use on-chip BIST hardware.

Therefore, there is a huge initial capital cost for the ATE, but there is no recurring chip area cost on each chip for test hardware. If, instead, we provide BIST hardware, then the need for a very high-speed ATE is eliminated, except to test the wires from the circuit pins to the Input MUX, and from the circuit outputs to the output pins. The number of tests for that is very short, say perhaps 7 or 8 patterns and measurements per pin, and the cost of this can be safely ignored in this analysis. Therefore, with BIST doing all stuck-fault and transition delay fault testing, we need a 1 GHz signal oscillator to clock the chip, and we need the ATE only to provide DC command signals to tell the microprocessor to perform BIST. Finally, we need an ATE to read out the success or failure DC signal for BIST from a circuit pin. In this case, we can use an inexpensive, 20 MHz ATE that costs roughly \$391 per pin, so our cost is  $800 \text{ pins} \times \$391 \text{ per pin} = \$312,800$ , a savings of \$4,487,200. This example is hardly far-fetched. On-chip clock rates are expected to rise above 1 GHz, and at present, no ATE exists to test a circuit above 1 GHz [2].

## II. BIST ARCHITECTURE

Built in self test is a design for testability (DFT) technique in which testing is carried out using built in hardware features. Advantage of this methodology is that the test patterns are not applied by external Automatic Test Equipments (ATEs) but generated by inbuilt testing circuit. It saves the memory requirement during test. A typical BIST architecture consists of a test pattern generator (TPG), usually implemented as a linear feedback shift register (LFSR), a test response analyzer (TRA), implemented as a multiple input shift register (MISR), and a BIST control unit (BCU), all implemented on the chip as shown in Figure 1[2]. This approach allows applying-at-speed



# VLSI Implementation of Configurable Linear Feedback Shift Register in VHDL

K.VINOD KUMAR<sup>1</sup>, A.PARVATHI<sup>2</sup>

<sup>1,2</sup> Assistant Professor

<sup>1,2</sup> Department of Electronics & Communication Engineering

<sup>1,2</sup> G. Pullaiah College of Engineering & Technology (Autonomous), Kurnool, AP

*Abstract*—This paper focus on the implementation of configurable linear feedback shift register (CLFSR) in VHDL and evaluates its performance with respect to logic, speed and memory requirement in FPGA. Behavioral implementation of CLFSR in VHDL is configurable in terms of number of bits in the LFSR, the number of taps, positions of each tap in the shift register stage and seed value of LFSR. The target device used for implementation of CLFSR is Xilinx Virtex-4 FPGA. For simulation and synthesis of CLFSR Xilinx ISE 9.2i tool is used. The output waveforms and timing report are also discussed.

*Keywords:* Linear Feedback Shift Register; Maximum Length Feedback Polynomial; Shift Register; FPGA; VHDL

## I. INTRODUCTION

A linear feedback shift register is a combination of series of flip flop and XOR or XNOR logic gates. Its output is pseudo randomly cycle through a sequence of binary values after certain number of clock cycle . The repetition of random output depends on the number of stages in the LFSR. Therefore, it is an important component in communication system where, it play important role in various application such as cryptography application, CRC generator and checker circuit, gold code generator, for generation of pseudorandom sequence, for designing encoder and decoder in different communication channels to ensure network security, Design for Test (DFT) and Built in Self Test design (BIST).

A linear feedback shift register is linear in the sense that its input bit is a linear function (XORing or XNORing) of LFSR previous state .

The LFSR feedback in the shift register chain is a function of taps numbers and taps positions. The feedback to LFSR is XOR or XNOR of these taps. However, it is this feedback that causes the random output to start repeating after certain clock cycles.

The LFSR works as shift register, if there is no input tap to register bits.

In literature several papers discuss the various applications and implementation of LFSR in VHDL or Verilog. In application of LFSR for testing of IP cores

is discussed. Implementation of built in self test capability using LFSR technique in UART is presented in [4]. The comparative study of FPGA implementation of two 16-bit PN sequence generator is presented. A new pseudo-random bit sequence generator implementation and its results are discussed . In design of multi bit LFSR pseudo-random sequence generator and its performance comparison on FPGA using VHDL is discussed.

Though VHDL or Verilog implementation of LFSR have been reported in past, but the detail VHDL implementation of configurable LFSR is rare. In this paper, we have discussed the implementation of CLFSR in VHDL where various LFSR parameters are configurable. The LFSR design is configurable in the sense that we need not required writing VHDL code every time for evaluating the performance of LFSR having different numbers of stages, taps numbers, taps positions and seed value of LFSR. These parameters are declared as generic or input signal in behavioral style of VHDL description of CLFSR . We only needed to change the different parameters value to verify LFSR performance.

For faster prototype development of any logical function, FPGA is the best choice. The main advantage of using FPGA is its flexibility that we can reconfigure the design any number of times and check the input-output results and verify these results on-chip for comparison purpose. Therefore, it is necessary to implement CLFSR on FPGA to verify its performance for different parameter values.

Configurable LFSR is a linear feedback shift register having several configurable parameters [9–11]. Various configurable parameters are:

1. Number of bits or stages in the LFSR.
2. Number of taps in the feedback path.
3. Each tap positions in the shift register stage. Maximal length feedback polynomial is the combination of taps and their position. A few basic properties of the maximal length feedback polynomial used to describe LFSR are:
  - a. The output and input taps should always be connected to the last and first taps of the shift register respectively.
  - b. The last tap of the shift register is the leading '1' in the maximal length feedback polynomial.
  - c. The length of the shift register is the exponent of the highest order term in the maximal length feedback polynomial.

## Accident Detection and Prevention in Subterranean Collieries Using Labview

P. Vishnu Kumar<sup>1</sup>, V.Keerthi<sup>2</sup>, D. Ambika Devi<sup>2</sup>, Y. Geethika Sashi<sup>2</sup>, J. Hari Priya<sup>2</sup>

<sup>1</sup>Associate Professor, <sup>2</sup>Students

Electronics and Communication Engineering, G Pullaiah College of Engineering and Technology, Kurnool, India

\*Corresponding Author: vishnukumarece@gpcet.ac.in

### ABSTRACT

Most of the mine disasters occur due to explosion and fire. This proposed system consists of a Compressed Natural Gas (CNG) sensor, a driver circuit & a Blower which are operated with the help of LabVIEW where methane gas concentration present in subterranean coal mine can be tracked, examined and the generation of a signal by LabVIEW. If the concentration of the methane gas reaches (5-15%), the Blower pumps the atmospheric air into the subterranean coal mine which helps to dilute the methane gas. In a critical situation, the emergency signal will be sent to the fire and police department with the help of the GSM network and through mailing

(Gmail) using Lab VIEW.

**Keywords--** CNG, Driver Circuit, GSM, Mailing, Lab view.

### INTRODUCTION

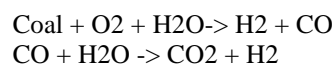
Indian history of coal mining from 220 years starting 1774 by M/s Sumner and Heatly of East India Company in the Raniganj. From the beginning of coal mining, the major issue faced by the miners is Safety. According to the statistics produced by the Indian Ministry of Coal, around 455 thousand miners are undergoing serious accidents. Table 1 shows the accidents that took place in the Indian coal mines [1].

*Table 1: Statistics of Accidents from 1975 to 2018.*

Time frame	Av. Fatal Accidents		Av. Serious Accidents		Av. Fatality Rate		Av. Serious Injury Rate	
	Accident	Fatalities	Accident	Injuries	Per Mill. Te	Per 3 Lac Manshifts	Per Mill. Te	Per 3 Lac Manshifts
1975-79	157	196	1224	1278	2.18	0.44	14.24	2.89
1980-84	122	143	1018	1065	1.29	0.3	9.75	2.26
1985-89	133	150	550	571	0.98	0.3	3.7	1.15
1990-94	120	145	525	558	0.694	0.3	2.7	1.19
1995-99	98	124	481	513	0.5	0.29	2.06	1.14
2000-04	68	82	499	526	0.28	0.22	1.8	1.47
2005-09	60	80	328	339	0.22	0.25	0.92	1.04
2010-14	56	62	219	228	0.138	0.23	0.49	0.8
2015-18	36	45	112	117	0.08	0.19	0.21	0.49

### EXISTING SYSTEM

The majority of the coal mine disasters occur through explosion, fire, and suffocation. These explosions occur by a process of Coal Gasification. Coal gasification is the process by which coal reacts with oxygen and moisture present inside the coal mines to produce Syngas which is the combination of Hydrogen and Carbon monoxide "GASIFICATION". Carbon monoxide reacts with the moisture, in turn, produce carbon dioxide and hydrogen [2].



Hydrogen from above both reactions combines with carbon monoxide which forms the highly toxic Methane Gas along with moisture and a large amount of Energy. The methane gas which thus obtained by combustion with an oxidizing agent such as O<sub>2</sub>, H<sub>2</sub>O<sub>2</sub>, F<sub>2</sub>, Cl<sub>2</sub>, N<sub>2</sub>O, etc becomes highly explosive, if Methane Concentration level reaches 5-15%.

## Self-Governing Robot Using Labview and Node MCU

P. Vishnu Kumar<sup>1\*</sup>, N. Sravani<sup>2</sup>, N. Vasundhara<sup>2</sup>, G. Sowjanya<sup>2</sup>, K. Prabhavathi<sup>2</sup>  
<sup>1</sup>Assistant Professor, <sup>2</sup>Student

Electronics and Communication Engineering, G. Pullaiah College of Engineering and Technology, Kurnool, India

\*Corresponding Author: vishnukumarece@gpcet.ac.in

### ABSTRACT

In this paper an autonomous Vehicle design is presented. The automatic robot which can reach any corner of the security region without alarming the enemy. It can employ for suspicious threat detection etc. which is quite risky for soldiers in the war field or border security region. This vehicle equipped with different board sensors, actuators, cameras, and Node MCU to accomplish the security activity. Node MCU monitors the controlling action of the robot which is programmed with LabVIEW (Laboratory Virtual Instrument engineering workbench) for efficient interaction and presentation.

**Keywords--** Framework, Node MCU, Robot, Self-Governing.

### INTRODUCTION

In light of the proficiency of the security frameworks, the wellbeing of life is dependant. So a vigorous security arrangement will assume a fundamental job in the present period. The security frameworks have been improving with the improvement of science and innovation. This innovative unrest can likewise be found in a nation's Defense framework nowadays [1]. Certain innovations like weapons, tanks, and military aircraft have just been accomplished and known to the world. However numerous other mechanical headway is as yet going on in the territories of radar and sonar innovation, in private test fields and military labs with most of the residents unacquainted with the advancement. Mechanical technology is one such present-day that has expanded their examination of the use of robots in war [2].

### PROPOSED TECHNIQUE

The proposed prototype has all of the following integrated modules:

#### Node MCU

Hub MCU is an open-source firmware for which open-source prototyping board plans are accessible. The NodeMCU is a mix of hub and MCU. The name NodeMCU alludes to the firmware as opposed to the related advancement packs [3].

#### Ultrasonic Sensor

An ultrasonic sensor is a gadget that can quantify the separation to an article by utilizing sound waves. The Ultrasonic sensor is grouped into three sections: one is a transmitter, next is recipients and the other is a handset. Transmitters are utilized to change over electrical signs into an ultrasonic sign, recipients are utilized to change over ultrasonic sign into electrical signs, and handsets are utilized for both transmit and get sound waves [4]. It is utilized in a framework that recognizes the objective by knowing the reflected signals or reverberation. It chips away at 5V DC of static current under 2A. It recognition separation 2-450cm with 2mm precession Fig 1.



Figure 1: Ultrasonic Sensor.

#### Battery

The battery is used for the required power supply needed for operating the different components in the robot. Here we used a 12v dry cell Re-chargeable battery for the purpose. Lithium-Polymer (Li-Po) Battery, 3 Cell (3S) 11.1V 2200MAH, Very small in size and weight, Connector Plug: XT60 connector [5].

#### LabVIEW

Laboratory Virtual Instrument Engineering Workbench (LabVIEW) in sort it called Virtual instrument. It is possible to design

# Industrial Automation System using MSP430 & Wi-Fi

P. Vishnu Kumar<sup>1</sup> K. Venkata Siva Reddy<sup>2</sup>

<sup>1,2</sup>Assistant Professor

<sup>1,2</sup>Department of Electronics and Communication Engineering

<sup>1</sup>GPCET, Kurnool, India <sup>2</sup>RCEW, Kurnool, India

**Abstract**— This paper presents an industry management system. To protect the industry from the outsider's entry and provide the automation is very important now-a-days. This project mainly focusing on these issues, to do this project, we are using the MSP430G2553 microcontroller. To measure the several emergency parameters and the weather parameters, we are using the different sensors. The power consumed by the loads in the industry was measured by the energy meter and the total number of units is also displayed on the LCD. The GSM modem is used to send the alert messages to the user if any of the sensors value goes beyond the threshold level. All the sensor levels and the total number of units consumed were sent to the predefined web page by using the Wi-Fi module. The Wi-Fi module was interfaced to the controller through the UART port. The emergency switch provided was to get the status of all the sensors values in the form of SMS.

**Key words:** MSP430G2553, LCD, GSM, Wi-Fi, UART, SMS

## I. INTRODUCTION

Our system consists of an industry controller system, community management system, and cloud server platform. The industry controller system comprises network connections, digital input and output (DIO) lines through which the industry controller system can integrate physical and conversion sensors and be extended to enable security settings, energy reporting, and scenario control. The community management system not only provides community and industry management services and third-party services that enable communication with the cloud service platform but also integrates a central monitor and control system, surveillance system.

Therefore, the community management system forms a location-based, integrated eco broker system. The core management on the cloud service platform focuses on the management and maintenance of communities and industry's and provides remote control and data analysis functions to fixed carriers and mobile carriers.

This study first proposed a hierarchical, industry-service architecture, which employed standard interface devices at the industry end to separate the logic and user interfaces, and achieving multiple in-industry displays.

Moreover, this study applied a community broker role to integrate industry services such as managing environment deployment operations, reducing the manual labor required of community management personnel, providing electronic information services, supporting diverse services, and extending the community's integration with the surrounding environment. Therefore, a complete and integrated industry system can be achieved. In addition, integrating cloud-based services with community services provided location-based services.

## II. OBJECTIVE

The main aim of this project is to protect the industry from the outsider's entry and provide the automation is very important now-a-days. This project mainly focusing on these issues, to do this project, we are using the MSP430G2553 microcontroller.

### A. AIM

The main aim of this project is to develop a industry management with sensor interface device is essential for sensor data collection of wireless sensor networks (WSN) in mobile environments.

## III. BLOCK DIAGRAM

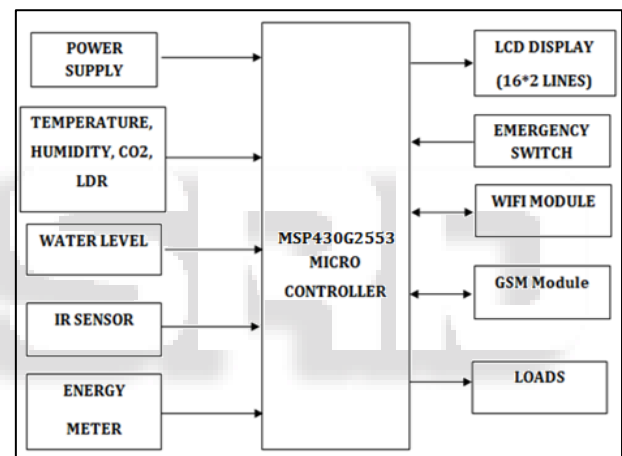


Fig 1: Block Diagram of Proposed System

The MSP430G2553 microcontroller is based on a 16-bit MSP430CPU that combine the microcontroller with embedded high-speed flash memory 16kb. Serial communications interfaces UARTs, SPI, I2C-bus and on-chip RAM make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 16-bit timers, 10-bit ADC, PWM channels and 16 fast GPIO lines with up to edge sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems.

### A. Power Supply

The input to the circuit is applied from the regulated power supply. The A.C input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating D.C voltage. So in order to get a pure D.C voltage, the output voltage from the rectifier is fed to a filter to remove any A.C components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant D.C voltage.