# MATRIX 360°-2017

A Technical Magazine


July'16 –May' 17 Volume:1 Issue:1 ISBN:978-1-62314-474-6

Contents:



Department of Electronics and Communication Engineering

SRI INDU COLLEGE OF ENGINEERING & TECHNOLOGY

HYDERABAD

**Sri. R. Venkat Rao, M.A,B.Ed.**

**CHAIRMAN**

## Message from Chairman

It gives me joy unspeakable to affirm that Sri Indu group of institutions, having completed 39 years successfully, has grown into one of the best institutions in the one of the leading Groups in Hyderabad, Telangana. Our Institute is an Autonomous Institutions under UGC, Recognized under 2(f) and 12(B) of UGC Act 1956, approved by the All India Council of Technical Education (AICTE), NBA Accredited, NAAC in pipeline and An ISO 9001 : 2000 Certified College and Permanently Affiliated to JNTUH.

As everyone is aware of the fact that there is unprecedented advancement in the academic research and industry. Without an iota of doubt, it is to be admitted that the field of engineering and technology has undergone radical changes. That the sound engineering education is synonymous with a better standard of living has become a catchy adage of the day. Besides the acquisition of technical skills, the need of getting oneself familiarized with soft skills like communication skills, organizational skills, crisis management skills, public relations skills, etc., has gained appreciable momentum.

I am quite sure that Sri Indu is not only getting the students prepared for the potential job market but also instilling in them much needed enthusiasm even to work for the nation to meet the social aspirations of our country. I strongly believe that the engineers of today, by their innovation ideas, with their problem-solving attitude and of course, with the humanitarian bent of mind, can establish a better world where people of all nations may live in harmony and peace. By and large, I express my deep sense of commitment for the overall developments of the student community of my institute.

## About Chairman

---

- A dedicated and dynamic personality.

- Pioneer to introduce novel Scholastic methods in the school and the hearts of parents and public.
- He is in Education field since 1979.
- Foresees a “Vision Ahead”. Always struggles to impart better education.
- Awardee by the Govt. of Andhra Pradesh in 1992
- Recipient of “Bharath Jyothi “ Award by his excellency, the President of India,Sri Gnani Zail Singh in 1994.
- Chairman of V.V.Info Business Service (India) Ltd., Hyderabad.

Sri. R. Anup Chakravarthy

**SECRETARY & CORRESPONDENT**

## Message from Secretary

It is my personal observation that the students are perhaps at the most difficult crossroads of their life after their intermediate examinations. The decision they make at this juncture is going to have a long lasting impact on their future life and career. A competent, qualified, experienced and responsible head of the institute can only operate with a vision towards development of an institution.

It is an much instrumental as the engine of train. Our well-equipped laboratories such as laboratories with the computers having high-end configuration, the internet facility, Wi-fi enabled Campus state of the art library with national and international journals and magazines certainly create a congenial ambience for an ideal engineer in the making to grow.

I am really happy that despite slowdown of economy, Sri Indu has succeeded in bringing various good companies to its campus for placements. All in all, more than 589 students have been placed through campus placements till date during the academic year 2017-18.

Sri Indu Group believes in Bridging Gap between Industry & Research of the students who joined so as to make them apt for facing the challenges of industry and society.
I invite you to join Sri Indu and begin your journey to successful and secured future.

## About Secretary

---

- The present Secretary & Correspondent of the Sri Indu Group of Educational Institutions.

- He is an young and energetic personality.
- Obtained his Masters in Electrical & Electronics Engineering from U.K.
- He has learnt managerial skills from his father Sri.R.Venkat Rao

# VISION

**To be a premier Institution in Engineering & Technology and Management with competency, values and social consciousness.**

# MISSION

**IM1: Provide high quality academic programs, training activities and research facilities.**

**IM2: Promote continuous Industry-Institute interaction for employability, entrepreneurship, leadership and research aptitude among stakeholders.**

**IM3: Contribute to the economical and technological development of the region, state and nation.**



## DEPARTMENT OF
## ELECTRONICS & COMMUNICATION ENGINEERING

### DEPARTMENT VISION

**To be a centre of excellence in Electronics and Communication Engineering Education and to produce professionals for ever-growing needs of society.**

### DEPARTMENT MISSION

**DM1: To promote and facilitate student- centric learning.**

**DM2: To involve in activities that enable overall development of stakeholders.**

**DM3: To provide holistic environment with state-of-art facilities for students to develop solutions for various social needs.**

**DM4: Organize trainings in embedded systems with Industry interaction**

### PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO 1: Higher Degrees & Professional Employment:
Graduates with ability to pursue career in core industries or higher studies in reputed institution.

PEO 2: Domain Knowledge:
Graduates with ability to apply professional knowledge/skills to design and develop product or process.

PEO 3: Engineering Career:
Graduates with excellence in Electronics and Communication Engineering along with effective inter-personnel skills.

PEO 4: Lifelong Learning:
Graduates equipped with skills in recent technologies and be receptive to attain professional competence through life-long learning.

### PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Basic Electronic and communications knowledge:
Apply basic knowledge related to electronic circuits, VLSI, communication systems, signal processing and embedded systems to solve engineering/societal problems.

PSO 2: Design Methods:
Design, verify and authenticate electronic functional elements for different applications, with skills to interpret and communicate results.

PSO 3: Experimentation & Communications:
Engineering and management concepts are used to analyze specifications and prototype electronic experiments/projects either independently or in teams.

| POS | PROGRAM OUTCOMES STATEMENTS |
|---|---|
| **PO1** | **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| **PO2** | **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| **PO3** | **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| **PO4** | **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| **PO5** | **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| **PO6** | **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| **PO7** | **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| **PO8** | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| **PO9** | **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| **PO10** | **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| **PO11** | **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and |

| | |
|---|---|
| | in multidisciplinary environments. |
| **PO12** | **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

## RESEARCHERS VIEWS AND DIRECTIONS

# CBIR USING DCT AND HTF BASED ON TEXTURE WATERMARKS

***Abstract*—In image processing, computer vision and pattern recognition, the Image retrieval is a most popular research area. In this paper, performance of various CBIR systems, based on combined feature that is color texture and shape, are compared*. Content-based image retrieval (CBIR) is one of the most exciting and fastest-growing areas in the field of multimedia technology., Content Based Image Retrieval (CBIR) has become the most active area in image retrieval system. The fields of application of CBIR are becoming more and more exhaustive and wide. Most traditional image retrieval systems usually use color, texture, shape and spatial relationship. At present texture features play a very important role in computer vision and pattern recognition.Haralick Texture Feature (HTF) based image retrieval system is proposed in this paper.In this Letter, we apply the watermarking technique into the retrieval system and propose a novel approach for JEPG image retrieval.*Further brief discussion has been done on content based image retrieval which is included with feature extraction methods based on color, texture and shape.At the end of this paper comparative study between various content based image retrieval techniques has been done.***

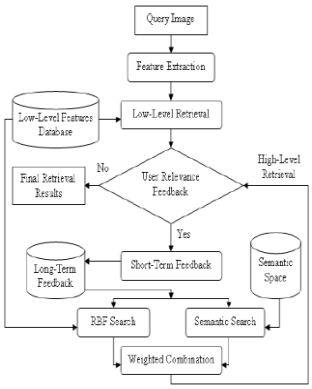
***Index Terms***
***Content-based image retrieval (CBIR),Haralick Texture Feature(HTF),***

### 1. Introduction

Content-Based Image Retrieval (CBIR) is a technique to search and index images in a large collection database based on their visual contents like colors, textures, shapes or spatial layouts instead of using tags or other descripting metadata keywords that might associate with the images in the database .Typically, most CBIR systems work by extracting one or more multi-dimensional vectors from each image in the database, this process is done in a posterior step to start retrieving. At query time, the same vectors are usually extracted from the query image and a similarity based function is used then to quantify the amount of difference between the query image vector and other images vectors in the database. Images that have similar vectors to the query one are finally retrieved as a result. Content Based Image Retrieval finds its applications in many domains such as medical diagnostics, GIS and military applications, pattern recognition, computer vision and many others. However, in most

applications CBIR systems are basically depending on extracting some features, *i.e.* characteristics that can capture certain visual properties of an image either globally for the entire image or locally for its regions and deciding the features that can effectively discriminate images and help in matching the most similar ones is the most challenging issue in CBIR systems. Color features are widely used in CBIR systems as they are independent of image size and orientation . They are usually extracted from different color spaces, e.g. RGB, HSV, YCbCr, by computing the color histogram, color moments or dominant colors. Zhang *et al.* calculated the color histogram in the HSV color space then he quantized the Hue and Saturation into eight bins while the Value channel was quantized into four bins. Color histograms don't capture the spatial relationships of color regions, so they don't robustly match similar image regions.Stricker and Orengo suggested using the first three color moments (mean, variance and skewness) for each color channel of the HSV color system in order to store each image as a color vector with features. This technique proved its efficiency in matching similar images better than calculating the color histogram.Liu *et al*. extracted the dominant colors by segmenting images into regions, obtaining the histogram for every region and taking the bin with the maximum size as a dominant color for this region.

In this paper, we decomposed the HSV images using the Discrete Wavelet Transform (DWT) and then quantized the resulted approximation sub band to extract a set of dominant coefficients to form the color vector. Extracting the color vectors are easy to compute and don't take long processing time. However, depending on them as a sole factor for deciding the images similarity will usually result it retrieving images with similar color distributions regardless their contents similarity. So extracting texture vectors, which represent the spatial arrangement of pixels in the grey level beside the color ones, becomes an essential step to retrieve more accurate results.




**1 Block Diagram of CBIR Process**

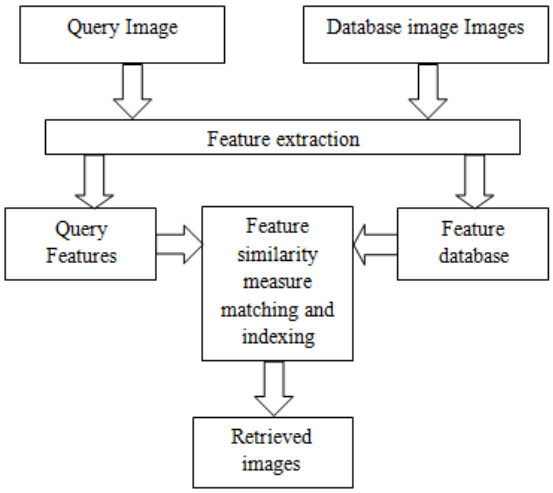
## 2 PROPOSED IMAGE RETRIEVAL SYSTEM

The proposed image retrieval system is designed based on the CBIR framework. The system consists of two main phases, offline process and online retrieval process. The offline process serves as a preprocessing operation for the image retrieval system. Its function is to form the watermarked image database, which contains the feature extraction and the data embedding. First,features such as color, texture, shape and spatial relationships are extracted from the input JPEG image. In this Letter, we test three kinds of feature vectors, seven moment invariants, the edge point histogram and the combined features (including color, shape and texture features). The extracted features are embedded into the image in the form of watermark, generating the watermarked image data base On the other hand, the online retrieval serves as the user interface. Since the features have been embedded into the

image data, here we only directly extract the water mark .

The strategies proposed for image retrieval systems basically approach content-based image retrieval algorithms by utilizing the similarity between the image in the database and the query image. It is proposed to implement "Content – Based Image Retrieval using different Features. The proposed system will produce the output as images which are relevant to the query Image. Any CBIR system involves at least four main steps: - Feature extraction and indexing of image database according to the chosen visual features, which form the perceptual feature space, e.g., color, shape, texture or any combination of the above.

- Feature extraction of query image (s).
- Matching the query image to the most similar images in the database according to some image-image similarity measure. This forms the search part of the CBIR
- User interface and feedback which governs the display of the outcomes, their ranking, the type of the user-interaction with possibility of refining the search through some automatic




## 3 Discrete Cosine Transform

DCT forms one of the popular techniques that are used for feature extraction. Other than DCT there are various techniques which are applicable for the same. Traditional techniques used FFT (Fast Fourier Transform). The major drawback of using FFT is that it is not optimal for image coding whereas DCT is shift variant. It decomposes the spatial frequency depending on the position of the features in the image. Also it affords high energy compaction. . The proposed work applies DCT on the image to retrieve one of the features

$C(U,V)=[\alpha(U)\alpha(V)\sum\sum f(x,y)\cos\pi(2x+1)u/2N)\cos(\pi(2y+1)u/2N)]$

$(u) = 1/N, for\ u=0\ /2N, ru\neq 0$

where,

u -denotes regular frequency spatially,

v- denotes perpendicular frequency spatially,

f(x, y) - is the pixel value at (x, y),

C(u, v) -DCT coefficient at (u, v).

The steps in applying DCT to an image as follows:

*Step 1: Image is partitioned into 8x8 blocks.*

*Step 2: Each block is applied DCT to acquire DCT coefficients.*

*Step 3: On applying DCT repeatedly on DC image, the image size is reduced to 8x8.*

*Step 4: Desired features are then extracted by applying DCT on this block.*

*Step 5: Now the resultant DCT image is stored in the feature database*

The major impact of the above said process is that the magnitude changes when there is a shift

with the features to a different position. Here the processing involves magnitude value less than 10.

**4 Feature extraction:**

Feature of an image can be shape, color and texture. The proposed work uses shape as a feature to extract from SRM and DCT. Initially it analyzes the image by using SRM where it detects the boundary and stores it as a feature database. Then it applies DCT on the image and stores the DCT images as another feature database.Finally it applies sobel on the DCT images thus obtained and stores it as another feature database. Thus the processing takes place in three feature databases.

***4.1Color Feature Extraction***

One of the most straightforward visual features of an image is the color because human eye is sensitive to colors. Color features are the basic characteristic of the content of images. Using color features, human can recognize most images and objects included in the image. Several methods for retrieving images on the basis of color similarity have been proposed, but most are variations on the same basic idea. Each image added to the database is analyzed to compute its feature. Two traditional approaches have been used. Global Color Histogram (GCH) is used for representing images by their histograms and the similarity between two images will be determined by the distance between their color histogram. This approach does not represent the image adequately. Furthermore, this approach is sensitive to intensity variations, color distortions, and cropping. Local Color Histograms (LCH) divide images into blocks and obtain the histogram for each block individually. So, an image will be represented by these histograms. To compare between two images, each block from one image will be compared with another block from the second image in the same location. The distance between these two images will be the sum of all distances. This approach represents the image more deeply and enables the comparison between image regions .

*4.2* ***Texture Feature Extraction***

Texture is one of the crucial primitives in human vision and texture features have been used to identify contents of images. Examples are identifying crop fields and mountains from aerial image domain. Moreover, texture can be used to describe contents of images, such as clouds, bricks, hair, etc. Both identifying and describing characteristics of texture are accelerated when texture is integrated with color, hence the details of the important features of image objects for human vision can be provided. One crucial distinction between color and texture features is that color is a point, or pixel, property, whereas texture is a local-neighborhood property. The main motivation for using texture is the identifying and describing characteristics of texture feature. Since the power of texture increases when combined with color, the content-based retrieval system provides techniques for querying with respect to texture and color in an integrated manner.

**5 Feature Computations**

In order to compute the features of the JPEG format image,we must decompress the image and obtain the original RGB pixels. Generally speaking, similarity between images is measured by computing the difference between their

features such as color, shape, texture and spatial properties. This Letter concentrates on three traditional image content descriptors ,seven moment invariants , edge histogram descriptor and the combination of color, shape, and texture descriptors. The feature vectors are all extracted based on the RGB color space .Shape features of objects or regions have been used in many content-based image retrieval systems. Classical shape representation used a set of moment invariants. If the object Ris represented as an image, then the central moment of order $p+q$ for the shape of the object R is defined as,This central moment can be normalized to be scaling invariant.

The edge histogram descriptor (EHD) describes the edge distribution of five types of edges in each area called a subimage. The sub-image is defined as an image block of size128×128. The edges in sub-images are categorized into vertical, horizontal, 45-degree diagonal, 135-degree diagonal and nondirectional edges. Thus, the histogram for each sub-image represents the relative frequency of occurrence of these 5 types of edges in the sub-image. According to the template of each direction (described in MPEG-7), edge detection is performed on each subimage and then the edge points of each sub-image are recorded..The last kind of features presented in this paper are the combination of color, shape, and texture descriptors. The first two attributes are color invariants. The contrast (or inertial moment of the main diagonal), the energy and the entropy are used to describe the texture features. Two invariant moments presented above express the shape characteristic

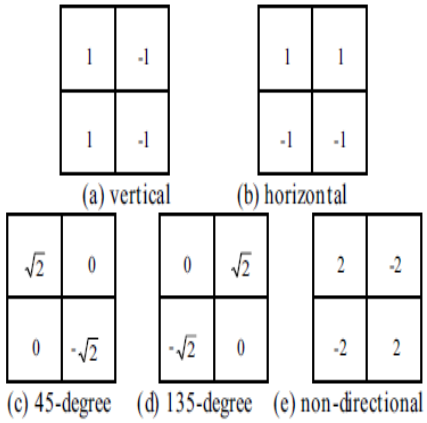


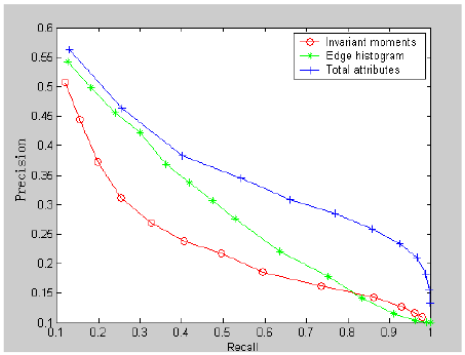

Figure 3. Filter coefficients for edge detection.

## 6 EXPERIMENTAL RESULTS AND DISCUSSION

The proposed system has been implemented using VisualC++ 6.0 software. In our experiment, we use a standard image Database including 1000 miscellaneous JPEG images ofsize 384 □256 or 256 □384, which are classified into ten classes, each class including 100 images. Euclidean distance is employed as the similarity measure. Two most common evaluation measures used in image retrieval are precision and recall, usually presented as a precision *vs.* recall graph (P-R graph). Wechoose 100 images at will and compute the average P-R values,which provides the retrieval performances of three kinds of features. In the P-R curve, we only test 15points, which correspond to 15 similarity thresholds we can see that the combination of the features characterize the image best. Our scheme improves the retrieval speed,It is obvious that the direct watermark extraction-based retrieval scheme is faster than the direct feature extraction based retrieval scheme in terms of the initialization time and the algorithm time. In our experiment, because we

use watermarking techniques to invisibly embed into the image. The storage space is also saved.

***Comparisons of the two kinds of features based on the same quer example***




P-R performance comparisons of the three kinds of features.

## 7 Conclusion

This paper proposed a novel content-based image retrieval system. One fundamental difference between this new image retrieval method and general image retrieval methods is that features are embedded in the images for later matching. Our experimental results demonstrated the effectiveness of the proposed retrieval scheme. In addition, the system embeds the features in the images, and we need no extra space to save the feature data. Therefore, the storage space is saved. Future work will concentrate on how to protect the security of the data base together with the retrieval function .we have compared different color, texture and shape feature extraction methods that are most popularly used in image understanding studies. Our comparison shows that there is considerable performance variability between the various feature extraction methods. One of the features of this study is the use of a publicly available benchmark that further studies can use.

# QOS BASED DWDM SYSTEM WITH OPTIMUM FWM PARAMETERS FOR FTTH APPLICATIONS

***Abstract:*** The integration of optical networks is a potential solution for the increasing capacity and mobility. The bandwidth hungry applications like Video-on-Demand [VoD], Games on Demand [GoD], 3G/4G Mobile services are putting burden on the fiber-optic trunk lines for the transmission rate of Peta bits per second. The increasing user's data traffic increases number of wavelengths which necessitates Dense Wavelength Division Multiplexing (DWDM), a cost effective method to increase the capacity of existing fibers without replacement. Nonlinearities arises as a limiting factor as light intensity inside a fiber is getting increased. Among various nonlinearities Stimulated Raman Scattering (SRS), Four Wave Mixing (FWM) and Stimulated Brillouin Scattering (SBS) in DWDM are dealt in this paper. The effect of dispersion and wavelength spacing on FWM are analyzed. This research aims at optimizing the dispersion, channel spacing and spectral width values for minimizing the FWM, thereby increasing the overall capacity of fiber optic trunk line. The growing importance of high-speed communication is creating a demand for ever faster information transfer rates, particularly in fiber-optic communication systems. Dense Wavelength Division Multiplexing (DWDM) can both significantly enhance transmission capacity and provide more flexibility in optical networks design.

***Keywords***- DWDM; Four Wave Mixing; Opt iSystem; Simulation; Bit Error Rate; FTTH.

## I. INTRODUCTION

The expansion and advancements in the field of communication has resulted in the need for an efficient design of communication systems. The huge amount of data transfers leads to the necessity of a large bandwidth with high efficiency without compromising the cost. Fiber optic communication has changed the world with its ability to meet the rising demands for fast internet connection, video-based multimedia, peer to peer communication, file transfer, HD gaming etc [4]. The fiber technology has played a vital role in medical field with its reliability, high data rate and lower attenuation rates. FTTH (Fiber To The Home) or also known as FTTP (Fiber To The Premises) is where the communication between the transmitter and receiver takes place with fiber optical cables till the building or premises of the end user [2]. FTTH is capable of delivering digital data, telephony, video etc. at high data rates. A fiber can carry more than 2.5 million phone calls simultaneously whereas it is 6 calls in the case of the conventional coaxial cables.

The concept of WDM allows data to be multiplexed in to different wavelengths such that it can be transmitted through a single mode fiber. Dense Wavelength Division Multiplexing has significantly increased the number of wavelengths to be transmitted through a single fiber by multiplexing more number of wavelengths through a single fiber. This has given rise to nonlinear effects in the fiber. The nonlinear effects are SRS (Stimulated Raman Scattering), SBS (Stimulated Brillouin Scattering) [7], SPM (Self

Phase Modulation), XPM (Cross Phase Modulation) and FWM (Four Wave Mixing) [2]. Four Wave Mixing plays a very important role in the fiber nonlinearities in a DWDM system. FWM has to be reduced so that the system designed becomes efficient so as to be implemented [5].

In this paper, a DWDM system is simulated and the FWM and Q-factor are analyzed by varying the input power, optical gains, number of channels and channel spacing [1]. An efficient system is designed by choosing the optimum parameters obtained from the analysis and is implemented on an FTTH system and simulated to analyze the FWM and Q-factor.

The paper is organized into three sections. Section I deal with the introduction to fiber optic communication, FTTH, WDM and DWDM. Section II deal with the block diagrams of the DWDM system as well as the FTTH system. Section III includes the results obtained from analyzing the parameters by varying the input power, optical gains, number of channels and channel spacing. It also includes the results obtained from the analysis of the FTTH system along with the optical spectrum and eye diagrams. The paper concludes with the result obtained from the analysis of the DWDM system and its implementation in an FTTH system.

***Study on Proposed Research:***

A proper node architecture design capable to support different network protocol enhances the data transport capability of a DWDM system. In this research a simple node architecture model has been analyzed to simulate the node throughput based on media access control protocols for bursty data traffic of variable time slot duration and data rate, an appropriate mathematical model has been derived to evaluate different types of traffic reservation protocols used in DWDM networks. The Observations from the work done in this research was that the network performance is well controlled through implemented protocols and network design parameters.

Dense Wavelength division multiplexing (DWDM) can both significantly enhance transmission capacity and provide more flexibility in optical network design. Through the use of EDFAs (Erbium doped fiber amplifiers), it is possible to build long-distance transport optical transmission links without electrical regenerators. In such systems, fiber nonlinearities are likely to impose a transmission limit due to increased total interaction length.

There are a number of optical nonlinear effects in optical fibers, such as stimulated Raman scattering (SRS), stimulated Brillouin scattering (SBS), and four-wave mixing (FWM). Out of these SRS and FWM are the dominant effects. This research work also consists of an algorithm to study the effect of FWM. It has been found from literature survey that to maximize the signal-to-noise ratio of the transmitted signal in a DWDM system FWM noise needs to be reduced as this is the dominant noise factor; it also shows the dependency of capacity, system performance in terms of node throughput of the network with Optical signal-to-noise ratio which is affected by fiber nonlinearities.

The main objective of this research is to analyze the FWM (Four Wave Mixing) efficiency for different fiber lengths and channel spacing and nonlinear Schrödinger equation solution. In this thesis, I have

simulated the FWM design for two and three waves.

I have also analyzed the influences of non-linear refractive index on the four-wave mixing (FWM) characteristics in semiconductor optical amplifiers (SOAs).It has been shown that the generated FWM signal characteristics can be modified due to the variation of non-linear refractive index of the SOA's medium. The wave propagation in the SOA has been modeled using the nonlinear Schrodinger equation. Simulation of Schrödinger equation is carried out using split step Fourier method. The FWM design was simulated with the OPTISYSTEM tool and analyzed using the eye pattern method with respect to bit error rate and Q factor. In this paper, FWM efficiency is analytically simulated for two wave and three wave fiber transmission. The results obtained show that the efficiency decreases with the increase of both the frequency spacing and the fiber length, which can be explained using the phase-matching condition. All the efficiency and power equations have been numerically simulated in MATLAB. The FWM efficiency is also analyzed for variation in chromatic dispersion and the results show that the chromatic dispersion should be high for FWM effect to be less.

## II. PILOT PROJECT AND ARRANGEMENTS

Here the Dense WDM System as well as the FTTH system is simulated in OptiSystem and the simulation results is depicted.

### *A. Simulation of Dense Wavelength Division Multiplexing Experiment*

PRBS (Pseudo-Random Bit Sequence) is used to represent the data transmitted. The data is represent using a NRZ (Non Return To Zero) coding. A CW (Continuous Wave) laser operating at 193.1 THz is used as carrier. The PRBS along with a continuous laser is multiplexed using a Mach-Zehnder modulator. The PRBS, continuous wave laser and the Mach-Zehnder modulator represents the transmitter block. Figure 1 depicts the transmitter block diagram for the NRZ line-coding technique.

The optical span consists of SMF (Single Mode Fiber), DCF (Dispersion Compensated Fiber), amplifiers etc. to account for the losses that occur during the transmission of through the fiber. The EDFA amplifiers are used; as they do not require an opto-electric conversion to amplify the signals instead they can be done in the optical domain itself. The optical gain is varied at this point to account for the four wave mixing. A typical optical span block diagram is represented in figure 2.

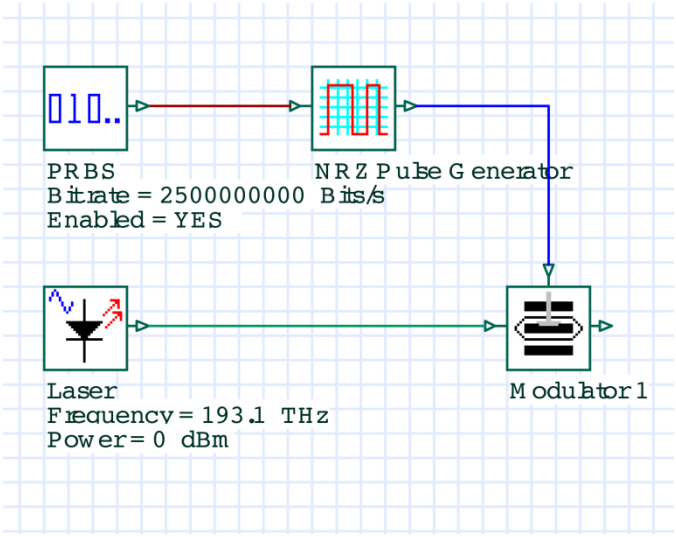



**Fig 1. Transmitter Block diagram of NRZ Line Coding**

SMF stands for single mode fiber [10]. DCF stands for dispersion compensation fiber [7]. The length of fiber in one loop is 50 +10=60km. the DCF length is 10 km.

The gain of EDFA placed after a fiber is such that it compensates the losses of the preceding fiber [6] [3].

Let the length of SMF be L km, the attenuation be A dB/km. The Gain of the first EDFA be $G_1$, that of the second be $G_2$. The above-mentioned parameters have to be selected such that the values satisfy the following conditions. The values are chosen based on the conditions given below. Gain of first EDFA $G_1 = L * A$, gain of the second EDFA in the simulation $G_2 = L_2 * A_2$ and that of the gain of the third EDFA is $G_3 = L_1 * A_1$.

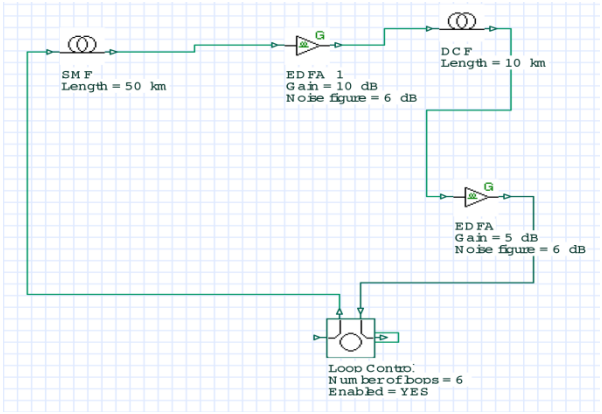



**Fig 2. The Block Diagram of a Typical Optical Span**

A sample calculation of the parameters is given below. Let us take L=10 km, A=0.2 dB/km, $L_2$=10 km and $A_2$=0.5 dB/km. [1]

The attenuation due to SMF at 50 km is calculated to be 50 *0.2=10 dB

This is neutralized by gain G1=10 dB

The receiver is an optical receiver used at the end taken from the output of a de-multiplexer. The receiver is connected to the BER analyzer. Figure 3 depicts the block diagram of the receiver.

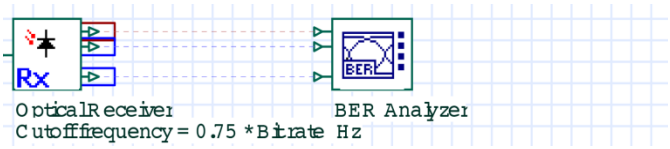



**Fig 3. Receiver Block Diagram**

Figure 4 depicts the subsystem block diagram of a DWDM system. The transmitter is made into a subsystem that is expanded as shown in figure 1.

The bitrate for the simulation setup has been fixed at 2.5 Gbps, sequence length of 128 bits and sample per bit 64.

The input power is varied in the transmitter block for input powers 0 dBm and -10dBm. The optical gain has been taken as 10dB and 5dB for the first instance and 15 dB and 6 dB for the second instance with a noise figure of 6 dB in both the cases. The simulation has been carried on for a 3 channel and an 8-channel DWDM system. A channel spacing of 100 GHz and 110 GHz has been for the above simulation setup depicted in figure 4.

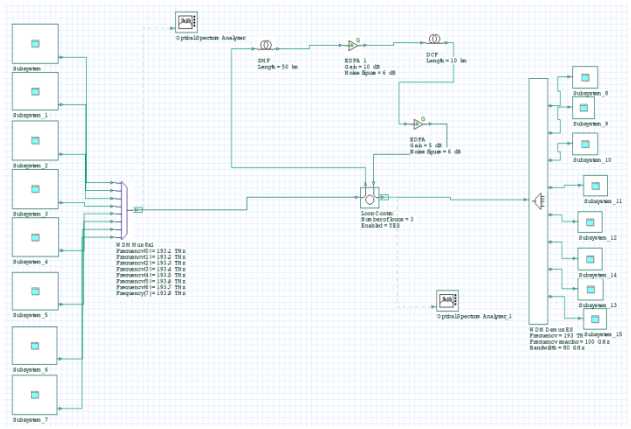


**Fig 4. Subsystem layout**

### *B. Simulation of Fiber To The Home (FTTH System)*

The FTTH system consists of the transmitter, the optical span and the receiver. Figure 1 represents the transmitter and figure 2 represents the optical span.

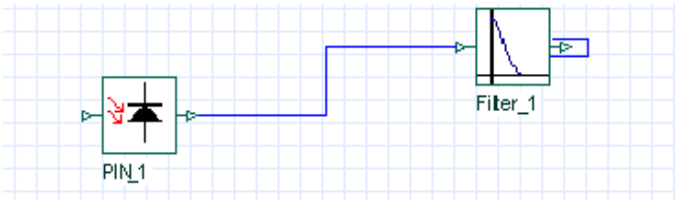



**Fig 4. FTTH Receiver layout**

Figure 5 represents the receiver block diagram for the FTTH system. The receiver consists of a PIN photodiode along with a low pass filter with cut off frequency that of 0.75*Bitrate. This setup ensures that the end user gets the signal in the optical domain.

## III. EXPERIMENTAL RESULTS AND ANALYSIS

The eye diagram and optical spectrum has been obtained to validate the results obtained through simulation. Figures 6 and 7 depicts the eye diagram and optical spectrum respectively of an 8 channel DWDM system with 0 dBm input power, EDFA amplifier gain of 10 dB and 5 dB respectively with a noise figure of 6 dB and channel spacing of 100 Ghz. Figures 8 and 9 depict the eye diagram and optical spectrum respectively of an 8-channel DWDM system obtained by varying the input power to -10 dBm. On comparing the results obtained by varying the input power from 0 dBm to -10 dBm in the transmitter layout, it is clearly observed that the Q factor has reduced from 10.5316 to 5.328 as shown in figures 6 and 8.

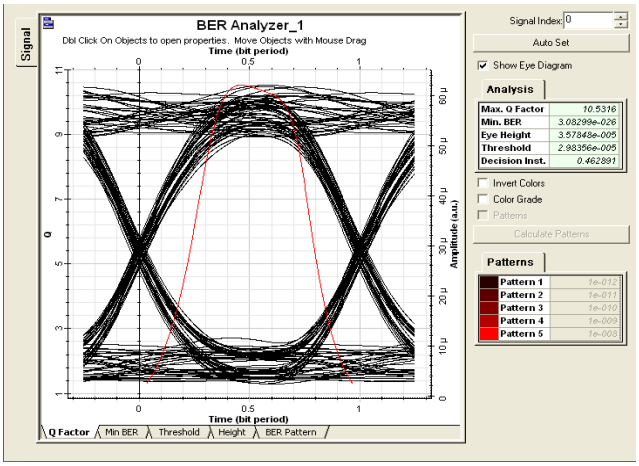



**Fig 6. Eye Diagram for 0 dBm input power (8 channel)**

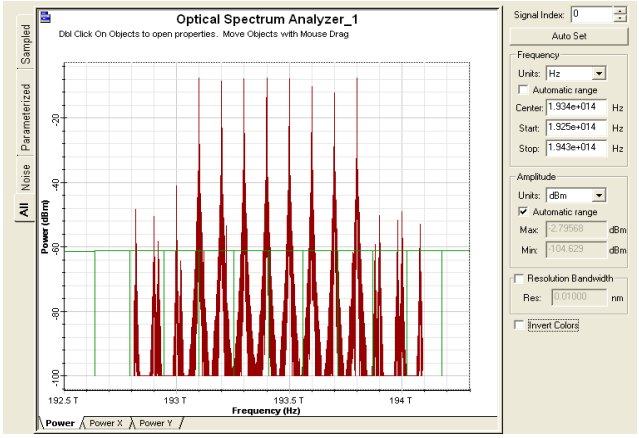



**Fig 7. Optical Spectrum Analyzer for 0 dBm input power (8 channel)**

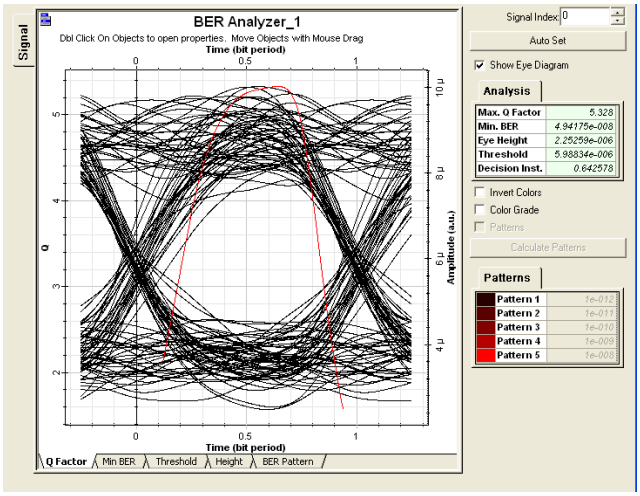



**Fig 8. Eye Diagram for -10 dBm input power (8 channel)**

The FWM, which was initially observed in -48 dBm in the optical spectrum analyzer in

figure 7, has now come down towards -68 dBm to -70 dBm ranges.

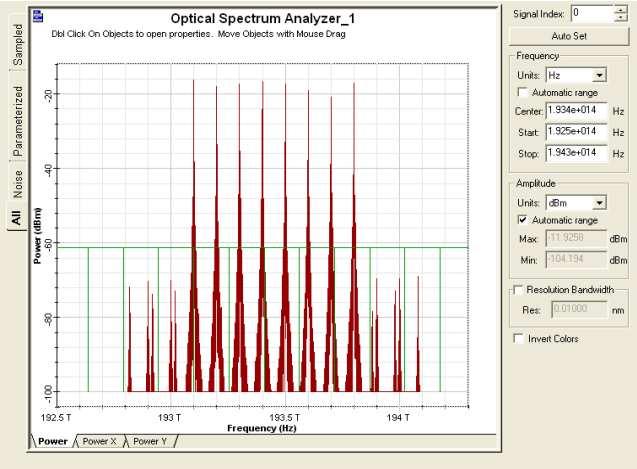



**Fig 9. Optical Spectrum Analyzer for -10 dBm input power (8 channel)**

Figures 10 and 11 depicts the eye diagram and optical spectrum respectively for the varying the EDFA amplifier gain to 15 dB and 6 dB with a noise figure of 6 dB. On comparing the eye diagrams in figure 6 and 10, on varying the optical gain from 10 dB to 15 dB for EDFA 1 and 5 dB to 6 dB for EDFA 2 there occurs a slight increase in the Q factor from 10.5316 to 12.9877.

An Efficient DWDM system is designed by keeping the input power -10db with 100GHz channel spacing and the optical gain 12dB and 6dB respectively with a noise figure of 6dB each. The above designed system is also implemented in an FTTH system.

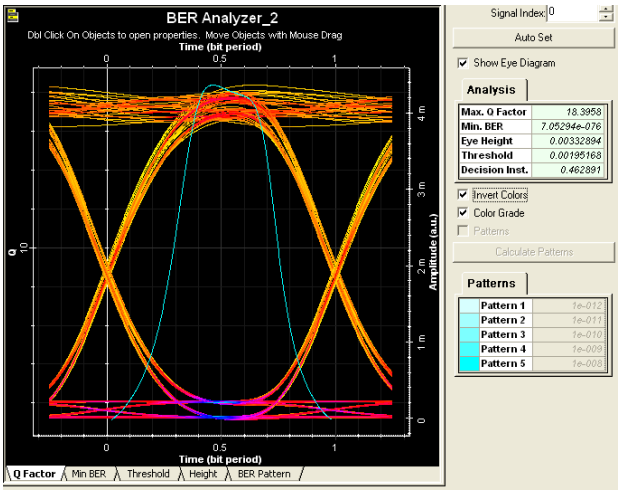



**Fig 10. Eye Diagram for Efficient FTTH system**

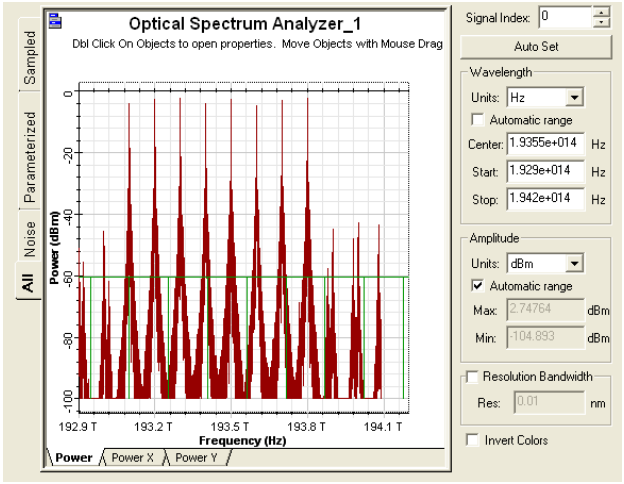



**Figure 11. Optical Spectrum Analyzer for Efficient FTTH system**

It is also observed from experimental results, FWM occurs below -68dBm in the FTTH system whereas it occurs at -40dBm in the DWDM system. The implemented FTTH system has been optimized with lower rates of FWM.

## IV. CONCLUSION

The phenomenon where an undesirable nonlinear effect gives significantly degraded system performance, and becomes the major drawback for optical communication systems is known as Four wave mixing. In order to achieve affordable BER and Q-factor, a

comparison of a DWDM system with equal and unequal channel spacing is performed. The result of the channel spacing can be verified using opt-sim 7.0. A channel allocation method, based on the optimal Golomb ruler, that allows the reduction of FWM effect while maintaining bandwidth efficiency, is presented. The two algorithms i.e. Exhaust algorithm and Search algorithm to construct the Golomb ruler sequences are presented here. The result of these two algorithms is compared using Matlab9. Two different modulation techniques are also implemented, i.e, low level FWM reduction and high level FWM reduction. The performance of these two factors is calculated by noting BER, Q-Factor and power of the generated FWM products. The eye diagrams of these processes are also plotted using Optisystem 7.0. The calculation of BER, Q-factor and power of generated FWM products are calculated for different lengths of fibers(50 km, 75 km and 100km). Later a comparative analysis is done between both low level reduction technique and high level reduction technique.

In the Dense Wavelength Division Multiplexing system (DWDM) the nonlinear effects plays an important role. DWDM system carries different channels, hence power level carried by fiber increases, which generates nonlinear effect such as SPM, XPM, SRS, SBS and FWM. Four Wave Mixing (FWM) is one of the most troubling issues. The FWM gives crosstalk in DWDM system whose channel spacing is narrow. By using the fiber with proper amount of dispersion and by unequal spacing between channels it is possible to suppress FWM crosstalk. In this research I design DWDM system and simulate the parameters, which lead to generation and enhancement of FWM using OptiSystem software. The above designed DWDM system with optimum FWM parameters is implemented for FTTH applications.

The simulation for analysis of FWM by varying input power, optical gain, number of channels and channel spacing is analyzed using Optisystem. On varying the input power, it is concluded that on reducing the input power the Q factor is lowered drastically but the FWM component has reduced slightly. Increasing the EDFA gains in the optical span for the 6 loops results in slight increase in the Q factor but the FWM component has increased with the increase in the optical gain.

On analyzing for different number of channels in the transmitter side, it is found that the Q factor increases and the FWM components also decreased. On varying the channel spacing the Q factor reduces by a slight amount as well as the FWM components are also reduced. The efficient DWDM system has been designed and implemented in FTTH system with reduced FWM.

# STUDENT ACHIEVEMENT

## PLACEMENT ACTIVITIES

| S.No. | Student Name | Student ID/No. | Employer name | Employer Website | Date of offer / Appointment |
|---|---|---|---|---|---|
| 1 | A. HEMANI | 13D41A0404 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 2 | B. VEERENDER | 13D41A0424 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 3 | B. PRUTHVI RAJ | 13D41A0426 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 4 | CH. SURESH BABU | 13D41A0445 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 5 | G. LOKESH KUMAR | 13D41A0464 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 6 | I . SATHYA PRIYA | 13D41A0468 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 7 | K. NIKHITHA | 13D41A0474 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 8 | K. SINDHUJA | 13D41A0482 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 9 | K. SAI LOKESH | 13D41A04A1 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 10 | K. NAGA RAJU | 13D41A04A4 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 11 | M. SHIVA GANESH | 13D41A04B0 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 12 | S. MANOJ KUMAR | 13D41A04B4 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 13 | N. PRANATHI REDDY | 13D41A04C8 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 14 | P. B. SAICHARAN | 13D41A04E2 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 15 | S. RANGA REDDY | 13D41A04F3 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 16 | P. SRINIVAS | 13D41A04G7 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 17 | T. DEEKSHA | 13D41A04H1 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 18 | T. PRUDHVI | 13D41A04H5 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 19 | V. SUSHMA | 13D41A04K2 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 20 | ABHISHEK CHALLA | 13D41A04K9 | TRIBRO | http://www.triprotech.net/ | 16.01.2017 |
| 21 | A. MANISHA | 13D41A0401 | TATA | https://www.tataltd.in/ | 21.03.2017 |
| 22 | C. KRANTHI | 13D41A0440 | TATA | https://www.tataltd.in/ | 21.03.2017 |
| 23 | D. SUDHEER | 13D41A0449 | TATA | https://www.tataltd.in/ | 21.03.2017 |
| 24 | P. VARUN REDDY | 13D41A04E7 | TATA | https://www.tataltd.in/ | 21.03.2017 |
| 25 | B. SANTOSH REDDY | 13D41A04F8 | TATA | https://www.tataltd.in/ | 21.03.2017 |
| 26 | T. TEENA | 13D41A04H9 | TATA | https://www.tataltd.in/ | 21.03.2017 |
| 27 | G. YOGESH SINGH | 13D41A0459 | TATA | https://www.tataltd.in/ | 21.03.2017 |

| | | | | | |
|---|---|---|---|---|---|
| 28 | A. ANUSHA | 13D41A0408 | TATA | https://www.tataltd.in/ | 21.03.2017 |
| 29 | K. ANANTH | 13D41A0412 | TATA | https://www.tataltd.in/ | 21.03.2017 |
| 30 | B. NAVEEN | 13D41A0427 | TATA | https://www.tataltd.in/ | 21.03.2017 |
| 31 | K. DEVI | 13D41A0494 | TATA | https://www.tataltd.in/ | 21.03.2017 |
| 32 | MOHD KASIM | 13D41A04C1 | TATA | https://www.tataltd.in/ | 21.03.2017 |
| 33 | S. PRASHANTH | 14D45A0403 | TATA | https://www.tataltd.in/ | 21.03.2017 |
| 34 | P. RAJU | 14D45A0405 | TATA | https://www.tataltd.in/ | 21.03.2017 |
| 35 | P. SEKHAR | 14D45A0407 | TATA | https://www.tataltd.in/ | 21.03.2017 |
| 36 | K. MALATHI | 13D41A04A2 | EIQ | http://www.eiq.net/ | 11.01.2017 |
| 37 | P. ANVESH | 13D41A04D7 | EIQ | http://www.eiq.net/ | 11.01.2017 |
| 38 | K. SINDHUJA | 13D41A0482 | EIQ | http://www.eiq.net/ | 11.01.2017 |
| 39 | A. ANIL | 13D41A0416 | EIQ | http://www.eiq.net/ | 11.01.2017 |
| 40 | K. SAI MAHENDRA | 13D41A0485 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 41 | L. HARSHA NAVEEN | 13D41A0476 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 42 | K. DIVYA | 13D41A0493 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 43 | E. MOUNIKA | 13D41A04C2 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 44 | MD. MUSTAFA | 13D41A04B9 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 45 | K. MADHURI | 13D41A0499 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 46 | J. KUMAR | 13D41A0470 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 47 | G. PRIYANKA | 13D41A0463 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 48 | D. SANTOSH KUMAR | 13D41A0452 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 49 | NARESH CHOWDAY | 13D41A0446 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 50 | B. AKHILA | 13D41A0438 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 51 | B. NAVYA SRI | 13D41A0423 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 52 | A. SREEJA | 13D41A0413 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 53 | N. SREEKANTH | 13D41A04D3 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 54 | R. YAWANTH | 13D41A04F0 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 55 | P. RANJITH KUMAR | 13D41A04E1 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 56 | T. SAI KUMAR | 13D41A04H2 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 57 | S. PRADEEP | 13D41A04G5 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 58 | V. AKHIL KUMAR | 13D41A04K3 | COGNIZANT | http://www.cognizant.net/ | Nil |
| 59 | T. SANTHOSH | 13D41A04H0 | CYIENT | https://www.cyient.com/ | 29.06.2017 |
| 60 | K. AKHIL | 13D41A0495 | CYIENT | https://www.cyient.com/ | 29.06.2017 |
| 61 | M. SAI KUMAR | 13D41A04B6 | CYIENT | https://www.cyient.com/ | 29.06.2017 |
| 62 | G. SANDHYA | 13D41A0460 | CYIENT | https://www.cyient.com/ | 29.06.2017 |
| 63 | M. MOUNIKA | 13D41A0444 | CYIENT | https://www.cyient.com/ | 29.06.2017 |
| 64 | B. SHUSHMA | 13D41A0433 | CYIENT | https://www.cyient.com/ | 29.06.2017 |

| | | | | | |
|---|---|---|---|---|---|
| 65 | YOGESH SINGH GADWAL | 13D41A0459 | FACETECH | http://www.facetech.in/ | 02.02.2017 |
| 66 | S. RANGA REDDY | 13D41A04F3 | FACETECH | http://www.facetech.in/ | 02.02.2017 |
| 67 | P. ROHITH | 13D41A04E6 | FACETECH | http://www.facetech.in/ | 02.02.2017 |
| 68 | N. SAI CHARAN | 13D41A04D0 | FACETECH | http://www.facetech.in/ | 02.02.2017 |

## LIST OF STUDENTS AWARDED IN TECHNICAL EVENTS

| S. No | Date | Name of the event | Venue | Name of the student | Awards |
|---|---|---|---|---|---|
| 1 | 12-02-2017 | TECHNOTSAV -2K16 | SICET | G.MADHURI | FIRST PRIZE |
| 2 | 12-02-2017 | TECHNOTSAV -2K16 | SICET | K.SRAVYA | FIRST PRIZE |

## LIST OF STUDENTS AWARDED IN PAPER/POSTER PRESENTATION

| S. No | Date | Name of the event | Venue | Name of the student | Awards |
|---|---|---|---|---|---|
| 1 | 04-03-2017 | Poster Presentation | Sicet, Ibp | V.Manish Kumar | First Prize |
| 2 | 04-03-2017 | Poster Presentation | Sicet, Ibp | V.Nithin | First Prize |
| 3 | 04-03-2017 | Poster Presentation | Sicet, Ibp | P. Vishnu | Second Prize |
| 4 | 04-03-2017 | Poster Presentation | Sicet, Ibp | T. Kavya | Second Prize |

## ACTIVITIES CONDUCTED

| S. No | Event Name | Event Type | Date | Resource Person with designation |
|---|---|---|---|---|
| 1. | TECHNOTSAV 2K17 | TECHNICAL | 12-02-2017 | R. VENKATA RAO CHAIRMAN OF SICET |
| 2. | GENIUS | PERSONALITY DEVOLOPMENT | 18-3-2017 | Dr. BR. SHAFI |
| 3. | MATLAB - 9.0 | WORKSHOP | 13-4-2017` | Mr.A.SRINIVAS CHARY, PROFESSIONAL SESSION FROM CAPRICOT. |
| 4. | GRADUATE TRIANING PROGRAM | TECHNICAL | DEC.2016 TO MAR 2017 | SABITHA, UDAY RAHUL FROM LEARNING CURVE |

| FACULTY PUBLICATIONS | | | |
|---|---|---|---|
| **S NO** | **NAME OF THE FACULTY** | **NO OF PUBLICATIONS** | **PAPER DETAILS** |
| 1 | V PRATHYUSHA | 1 | A LONG TERM EVOLUTION BASED WALSH-HADAMARD PRECODING FOR CIRCULAR FBMC SYSTEM, IJARTET, ISSN 2394-3777, VOL. 4, ISSUE 3, MARCH 2017. |
| 2 | B SANDHYA | 1 | ICI MITIGATION IN OFDM/OQAM SYSTEM WITH A NOVEL NORMALIZED<br><br>MMSE SUB CHANNEL DECISION FEEDBACK EQUALIZER, IJARTET,<br><br>ISSN 2394-3777, VOL. 4, ISSUE 3, MARCH 2017. |
| 3 | P UDAYASRI | 1 | NOVEL APPROACH TO REDUCE POWER DROOP DURING SCAN-BASED LOGIC BIST, IJARTET, ISSN 2394-3777, VOL. 4, ISSUE 3, MARCH 2017. |
| | | 2 | MEASUREMENT OF SPECIFICATIONS OF ULTRACAPACITOR,<br><br>IJRTER,ISSN 2455-1457, 2017 |
| 4 | SURESH BALLALA | 1 | ONLINE MONITORING AND CONTROLLING OF SMART DRIP IRRIGATION SYSTEM USING RASPBERRY PI, IJSETR, ISSN 2319-8885, AUG-16. |
| | | 2 | WIRELESS DATA TRANSFER AND PRINTING UTILIZING RASPBERRY PI, IJARES, ISSN 2347- 9337, JUN-16 |
| | | 3 | EYE-SENSE MEASURED INDEPENDENT & COST EFFECTIVE SYSTEM TO EXCLUDE THE NEED OF THE SUPPORT, IJSETR, ISSN 2319-8885. AUG-16. |
| | | 4 | AN EFFICIENT PROPOSAL FOR MANAGING OF AUTOMATED DEVICES BY AN ONLINE SOCIAL NETWORK, IJARES, ISSN 2347- 9337 JUN-16. |
| | | 5 | TRAVOLUTION-ROAD SAFTEY FOR PASSENGER CAR, IJATIR, ISSN 2348–2370 VOL.08,ISSUE.09. AUG-16 |
| | | 6 | LOW COST HOME AUTOMATION BY ZIGBEE AND VOICE COMMANDS USING RASPBERRY PI2 (B+), IJATIR, ISSN 2348–2370, VOL.08,ISSUE.10. AUG-16. |

| | | | |
|---|---|---|---|
| | | 7 | AUTOMATIC TOLL E-TICKETING SYSTEM FOR TRANSPORTATION SYSTEMS, IJEECSE, VOLUME 4, ISSUE 5. OCTOBER, 2017. |

## LIST OF FACULTY REGISTERED FOR Ph.D

| S.NO | AY OF ADMISSION | NAME OF THE FACULTY | NAME OF THE UNIVERSITY | NAME OF THE SUPERVISOR |
|---|---|---|---|---|
| **1** | **2016-2017** | **K. RAMMOHAN RAO** | **OSMANIA UNIVERSITY** | **DR. N.V. KOTESWARA RAO** |
| **2** | **2016-2017** | **S. NARSIMULU** | **OSMANIA UNIVERSITY** | **DR. NIRANJAN PRASAD** |

## PRODUCTS DEVELOPED

| S.NO | PRODUCT DEVELOPMENT | LIST OF COMPONENTS | SPONSORED BY | GRANTS (IN RS.) |
|---|---|---|---|---|
| 1 | INTERACTIVE PAINTING CONSOLE | INTERACTIVE PAINTING CONSOLE CAMERA | SICET | 25,000 |
| 2 | AUTOMATED INDUSTRIAL 3D PRINTED ROBOTIC ARM | ARDUINO BOARD, SERVO MOTORS, FLEX SENSORS, | SICET | 30,000 |
| 3 | OXYGEN LEVEL TESTING USING UNDER WATER ROV | ARDUINO MEGA, TOGGLING SWITCHES, DC FANS, | SICET | 30,000 |
| 4 | DIY DRONE 2.0 | DRONE PROPELLERS, CONTROL SYSTEMS, | SICET | 15,000 |
| 5 | RF CONTROLLED FIRE FIGHTING ROBOT WITH HIGH PRESSURE WATER SPRINKLER | RF TRANSCEIVERS, DC MOTORS, WATER MOTORS. | SICET | 20,000 |
| 6 | VEHICLE TRACKING SYSTEM USING GPS & GSM | RF TRANSCEIVERS, DC MOTORS, GSM MODULE | SICET | 15,000 |
| 7 | AUTOMATED INDUSTRIAL ROBOTIC ARM | DC MOTORS, ARDUINO BOARD, BLUETOOTH HC-05 MODULE | SICET | 25,000 |
| 8 | IMPLEMENTATION OF RF CONTROLLED ROBOTIC BOAT TO TRAVEL IN WATER | RF TRANSCEIVERS, DC MOTORS, WATER PUMPING MOTORS. | SICET | 15,000 |

## LIST OF MAJOR PROJECTS CARRIED OUT

| Batch No | ROLL NUMBER | NAME OF THE STUDENT | TITLE OF THE PROJECT | INTERNAL GUIDE | Designation |
|---|---|---|---|---|---|
| 1 | 13D41A04H5 | T.Prudhvi | Auotmtaic vehicle accident detection and messaging system using GSM and GPS Modem | K. Rammohan Rao | Associate Professor |
| | 13D41A04H6 | T.Shashi Kumar | | | |
| | 13D41A04K9 | CH.Abhishek | | | |
| | 13D41A04L1 | M.Prashanth | | | |
| 2 | 13D41A04J1 | T.Akhil | Weather station | B. Neeraja | Associate |

| | | | | | |
|---|---|---|---|---|---|
| | 13D41A04J4 | V.Naveen | monitoring over IOT | | Professor |
| | 14D45A0402 | CH.Mahender | | | |
| | 14D45A0408 | C.Raja shekar | | | |
| 3 | 13D41A04J5 | V.Mohan Kashyap | Supervisory control and data acquistion system using GSM modem | B. Sandhya | Associate Professor |
| | 13D41A04K1 | V.Rajesh kumar | | | |
| | 12D41A0473 | G.Sreenu | | | |
| | 13D41A0410 | Ramesh | | | |
| 4 | 13D41A04G7 | P.Srinivas | Design and development of Activation and controlling of home automation system via sms through microcontroller | P. Srinivas | Assistant Professor |
| | 13D41A04H2 | T.Sai Kumar | | | |
| | 13D41A04H3 | T.Ganapathi Karthikey | | | |
| | 13D41A04H4 | T.Anil Kumar | | | |
| 5 | 13D41A04K8 | P.Ram chandra Reddy | Tollgate traffic monitoring and analyser using IOT | A. Venugopal | Assistant Professor |
| | 14D45A0405 | P.Raju | | | |
| | 14D45A0407 | P.Shekar | | | |
| | 14D45A0409 | V.Baskar Naik | | | |
| 6 | 13D41A04J3 | U.Susharika | Automatic room light control with visitor counting for power saving applications and monitoring over IOT | D. Thirumal Reddy | Assistant Professor |
| | 13D41A04H1 | T.Deeksha | | | |
| 7 | 13D41A04J8 | V.Ganesh | SMS based wireless electronic notice board using GSM/CDMA/3G mobile phone | B. Srinivas | Associate Professor |
| | 13D41A04K0 | V.Shashin koushik sharma | | | |
| | 14D45A0403 | Seetha Prashanth | | | |
| | 14D45A0404 | Hemanth | | | |
| 8 | 13D41A04H0 | T.Santhosh | Head movement controlled car driving system to assist the physically challenged | P. Ramadevi | Assistant Professor |
| | 13D41A04J7 | V.Laxmi Narayana | | | |
| | 13D41A04L0 | CH.Jayakrishna | | | |
| | 14D45A0412 | G.Sanjeev | | | |
| 9 | 13D41A04H8 | T.Pooja | College bus tracker based on Arduino and android | B. Neeraja | Associate Professor |
| | 13D41A04H9 | T.Teena | | | |
| | 13D41A04K5 | V.Venkatesh | | | |
| 10 | 13D41A04G9 | S.Sai teja | Live cam cast based on Rasberry Pi | K. Ashok Babu | Professor & HOD |
| | 13D41A04H7 | T.Vijay kumar | | | |
| | 13D41A04K3 | V.Akhil Kumar | | | |
| 11 | 13D41A04G8 | S.Bhavani | Smart glove controller for wheel chair | V. Sunitha | Assistant Professor |
| | 13D41A04K2 | V.Sushma | | | |

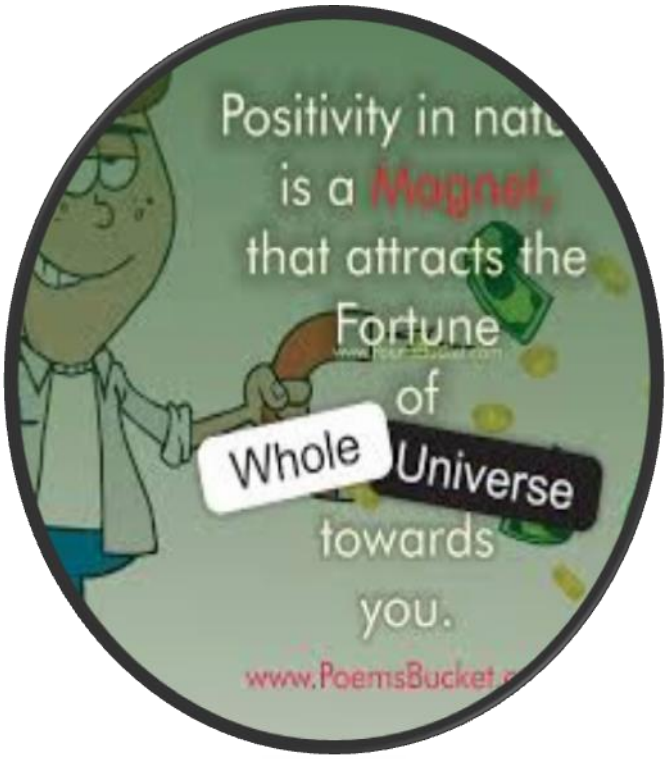
| | | | | | |
|---|---|---|---|---|---|
| | 13D41A04K7 | Y.Supraja | navigation | | |
| | 14D45A0406 | G.Akhila | | | |
| 12 | 13D41A04G6 | Sonika | 3D printed bionic hand upgraded | S. Narsimulu | Associate Professor |
| | 13D41A04J0 | Tejasiwini | | | |
| | 13D41A04J2 | Sandhya | | | |
| 13 | 13D41A0431 | B.Arun Kumar | Mini ATM machine using Arduino | B. Deepika Rathod | Associate Professor |
| | 13D41A0448 | D.Prassana Laxmi | | | |
| | 13D41A0449 | D.Sudheer | | | |
| | 13D41A0452 | D.Santosh Kumar | | | |
| 14 | 13D41A0435 | B.Sindhu Bhavani | Interactive painting console | B. Sandhya | Associate Professor |
| | 13D41A0443 | CH.Mounika | | | |
| | 13D41A0441 | CH.Chitralekha | | | |
| | 13D41A0433 | B.Sushma | | | |
| 15 | 13D41A0411 | A.Deepthi Sai | Smart Key | B. Neeraja | Associate Professor |
| | 13D41A0420 | B.Tejasree | | | |
| | 13D41A0413 | A.Sreeja | | | |
| | 13D41A0408 | A.Anusri | | | |
| 16 | 13D41A0410 | A.Sai Teja | Ion thruster | K. Rammohan Rao | Associate Professor |
| | 13D41A0419 | B.Sai Krishna | | | |
| | 13D41A0440 | C.Kranthi Kumar | | | |
| | 13D41A0436 | B.Krishna Kumar | | | |
| 17 | 13D41A0430 | B.Sourabh Parashasr | Automated industrial 3D printed robotic arm | P. Prashanth | Associate Professor |
| | 13D41A0434 | B.Nitish Kumar | | | |
| | 13D41A0427 | B.Naveen | | | |
| | 13D41A0439 | C.Ravi Kumar | | | |
| 18 | 13D41A0401 | A.Manisha | Smart glove controller for wheel chair navigation | V. Prathyusha | Associate Professor |
| | 13D41A0404 | A.Hemani | | | |
| | 13D41A0425 | B.Sneha | | | |
| | 13D41A0444 | M.Mounika | | | |
| 19 | 13D41A0442 | CH.Varun | power consumption meter based on arduino and android | P. Ramadevi | Assistant Professor |
| | 13D41A0445 | CH.Suresh Babu | | | |
| | 13D41A0450 | D.Vamshidhar | | | |
| | 13D41A0451 | D.Sai Kumar | | | |
| 20 | 13D41A0423 | B.Navya sree | Integrated cubesat | M. Narendra Prasad | Assistant Professor |
| | 13D41A0438 | B.Akhila | | | |

| | | | | | |
|---|---|---|---|---|---|
| | 13D41A0453 | E.Bhargavi Reddy | | | |
| | 13D41A0454 | E.Laxmi Prasanna | | | |
| 21 | 13D41A0409 | A.Akhil Reddy | Safety health band using arduino and android | B. Hemavathi | Assistant Professor |
| | 13D41A0407 | A.Vishnu Vardhan | | | |
| | 13D41A0422 | B.Vinay | | | |
| | 13D41A0416 | A.Anil | | | |
| 22 | 13D41A0414 | A.Hari Kumar Reddy | Oxygen level testing using under water ROV | E. Parusha ramu | Assistant Professor |
| | 13D41A0421 | B.Praveen | | | |
| 23 | 13D41A0403 | A.Vijay Kumar | Petrol in 2.0 enabled with android app | S. Narsimulu | Associate Professor |
| | 13D41A0432 | B.Anil Kumar | | | |
| | 13D41A0437 | D.Dharma Rao | | | |
| 24 | 13D41A0402 | A.Raghotham | DIY Drone 2.0 | K. Ashok Babu | HOD & Professor |
| | 13D41A0415 | A.Sesha Sai | | | |
| | 13D41A0412 | K.Ananth | | | |
| | 13D41A0446 | Naresh Chowdary | | | |
| 25 | 13D41A0405 | A.Sandeep Kumar | Cell tower EM interference detector | A. Khaja Pasha | Assistant Professor |
| | 13D41A0406 | A.Ravi | | | |
| | 13D41A0418 | B.Parasharamudu | | | |
| | 13D41A0424 | B.Veerendar | | | |
| 26 | 13D41A0417 | B.Dhinakar | Gesture based automation | B. Kondalu | Associate Professor |
| | 13D41A0426 | B.Pruthvi Raj | | | |
| | 13D41A0429 | B.Manoj Kumar | | | |
| | 13D41A0455 | E.Naveen | | | |
| 27 | 13D41A0459 | G.Yogesh singh | Data Acquisition system for weather station and air quality monitoring | K. Maheshwari Devi | Associate Professor |
| | 13D41A0490 | Kodanda Shiva | | | |
| | 13D41A0492 | Kolipaka Swamy | | | |
| | 13D41A0494 | Kondapur Bala tripura sundari devi | | | |
| 28 | 13D41A0472 | K.Harika | Development of digital controller for electro mechanical actuating system | B. Srinivas | Associate Professor |
| | 13D41A0473 | K.Meena | | | |
| | 13D41A0479 | K.Sravya | | | |
| | 13D41A0499 | K.Madhuri | | | |
| 29 | 13D41A0475 | K.Srilatha | Design & Development | K. Rammohan | Associate |

| | | | | | |
|---|---|---|---|---|---|
| | 13D41A0480 | K.Deepika | of rectangular microstrip patch antenna using circular polarization. | Rao | Professor |
| 30 | 13D41A0457 | E.Arun Teja | Accessing memory on Embedded softcore processor for PMRS | K. Ashok Babu | Professor & HOD |
| | 13D41A0489 | K.S.S.D.Mani Sandeep | | | |
| 31 | 13D41A0491 | K.Sowmya Sree | Design & Development of series and shunt configuration of SPDPN pin Diode switch covering the frequency range of 0.5-2GHZ | P. Udayasri | Associate Professor |
| | 13D41A0496 | K.Shirisha | | | |
| 32 | 13D41A0469 | J.Rakshitha Reddy | Intelligent autonomous six legged Robot to operate on uneven surfaces | T. Nagaveni | Associate Professor |
| | 13D41A04A9 | M.Ashish | | | |
| | 13D41A04B0 | M.Shiva Ganesh | | | |
| 33 | 13D41A0456 | E.Avinash | RF Controlled fire fighting robot with high pressure water sprinkler | B. Satyanarayana | Assistant Professor |
| | 13D41A0471 | J.Naga Raju | | | |
| | 13D41A0476 | K.Harsha Naveen | | | |
| | 13D41A04A5 | K.Anudeep | | | |
| 34 | 13D41A0460 | G.sandhya | foot step power generation system for rural energy application to run AC &DC loads | G. Rajkumar | Assistant Professor |
| | 13D41A0463 | G.Priyanka | | | |
| 35 | 13D41A0467 | G.Raghu Prasad | Head movement controlled car driving system to assist physically challenged | B. Deepika Rathod | Associate Professor |
| | 13D41A0477 | K.Kalyan Kumar | | | |
| | 13D41A0486 | K.Raju | | | |
| | 13D41A04A4 | K.Naga Raju | | | |
| 36 | 13D41A0464 | G.Lokesh Kumar | Hall Automation | E. Parusha Ramu | Assistant Professor |
| | 13D41A0468 | I.Sathya Priya | | | |
| | 13D41A04A3 | K.Chandra mouli | | | |
| 37 | 13D41A0474 | K.Nikitha | Hand Gesture Based Wheel Chair navigation | D. Thirumal Reddy | Assistant Professor |
| | 13D41A0493 | K.Divya | | | |
| | 13D41A0498 | K.Sachin | | | |
| | 13D41A04A8 | L.Manisha Reddy | | | |
| 38 | 13D41A0485 | K.Sai Mahendra | Vehicle tracking system using GPS & GSM | P. Ravinder | Assistant Professor |
| | 13D41A04A0 | K.Hari Krishna | | | |
| | 13D41A04A1 | K.Sai Lokesh | | | |

| | | | | | |
|---|---|---|---|---|---|
| 39 | 13D41A0465 | G.Praneeth | Smart Car Tyre | E. Parusha ramu | Assistant Professor |
| | 13D41A0466 | G.S Nikhil Yadav | | | |
| | 13D41A0470 | J.Kumar | | | |
| | 13D41A04A6 | K.Dinesh | | | |
| 40 | 13D41A0458 | G.Prudhvi raj | Balloonsat | D. Sandhya Rani | Assistant Professor |
| | 13D41A0478 | K.Vinay kumar | | | |
| | 13D41A0488 | K.Lakshmi Kalyani | | | |
| | 13D41A0495 | K.Akhila | | | |
| 41 | 13D41A0461 | G.Alekhya | Automated industrial Robotic Arm | M. Nikitha | Assistant Professor |
| | 13D41A0483 | K.Srilekha | | | |
| | 13D41A0484 | K.Niharika | | | |
| | 13D41A04A7 | K.Anusha | | | |
| 42 | 13D41A0481 | K.Bharath kumar | Implementation of RF Controlled Robotic Boat to Travel in Water | K. R. Rajitha | Assistant Professor |
| | 13D41A0482 | K.Sindhuja | | | |
| | 13D41A0487 | K.Mahesh | | | |
| | 13D41A04A2 | K.Malathi | | | |

# GOOD THOUGHTS




# EDITORIAL TEAM