IOT BASED SELF CONFIGURATION & SMART BINDING CONTROL SYSTEM

DR. ARVIND KUNDU[1], V. NAGAMAHESH[2], GORANTLA KRISHNA THEJA[3]
[1]HOD, Dept of ECE, Scient Institute of Technology, Ibrahimpatnam , Hyderabad, India,
[2]Assistant Professor, Dept of ECE, Scient Institute of Technology, Ibrahimpatnam , Hyderabad, India,
[3]PG Scholar, Dept of ECE(VLSI & ES), Scient Institute of Technology, Ibrahimpatnam , Hyderabad, India.

Abstract: The main of the project is to build Self configuration and Smart binding control system by using IOT and Zigbee technologies. In this project we design a system which builds a self configuration system that integrates IOT and Zigbee technology using a switch. That is we can control the lighting in two modes : IOT and ZigBee technology with the help of a switch. Zigbee Technology is used for a large range of fields, providing communications and sensing with low power consumption, high reliability, and multi-node networking. Whereas Bluetooth technology is used in short range applications. Thus this paper proposes a 'Self-Configuration and smart Connection System' that integrates the IOT and ZigBee technology, and confirms its feasibility in both theory and practice. Lighting control systems with sensors are constructed with Self-configuration and smart lighting control. The system configures lighting based on Received Signal Strength Indicator (RSSI) information of reference points, and provides information about lighting RSSI for controlling devices, facilitating reference alignment. The increasing prevalence of smart devices in recent years has supported new applications of the IOT .

Index Terms: ZigBee, IOT, Auto-configuration, Smart binding, WSN, RSSI.

I. INTRODUCTION

The initial rapid development of wireless communications technology was motivated by the need for military detection applications. Since then, ZigBee technology has been extensively used in a large range of fields, providing communications and sensing with low power consumption, high reliability, and multi-node networking. Today, this technology is extensively used in such applications as process monitoring in industry, consumer products for health testing, home electronic devices for monitoring or detecting intruders, medical sensing, elderly care, the collection of patients' information, such as blood pressure, heartbeat, and pulse, and environmental applications such as the detection of pollution water, air and soil using sensors. The popularity of smart devices has resulted in new applications of WSN, the new IOT and ZigBee technology. With respect to the consumer market, ZigBee-related technologies have been available for a long time but not yet universally so. For example, the costs, installation and operational complexity of such technologies still affect the acceptance by consumers. Developments that make wireless technologies seamlessly bind to all types of home appliances; eliminate cumbersome setting, and cause users to feel that using a remote controller is as simple as using a cell phone may provide new opportunities in the IOT. This paper proposes a 'Self-Configuration and smart Connection System' that integrates WSN, the IOT and ZigBee technology, and confirms its feasibility in both theory and practice. Lighting control systems with sensors are constructed with Self-configuration and smart lighting control. The system configures lighting based on RSSI information of reference points, and provides information about lighting RSSI for controlling devices, facilitating reference alignment. Moreover, this work proposes the concept of sub-area regional configuration, changing sub-area range by setting RSSI error, to increase controlling in lighting numbers and to enhance the effectiveness of automatic control.

II. BLOCK DIAGRAM AND MODULES DESCRIPTION

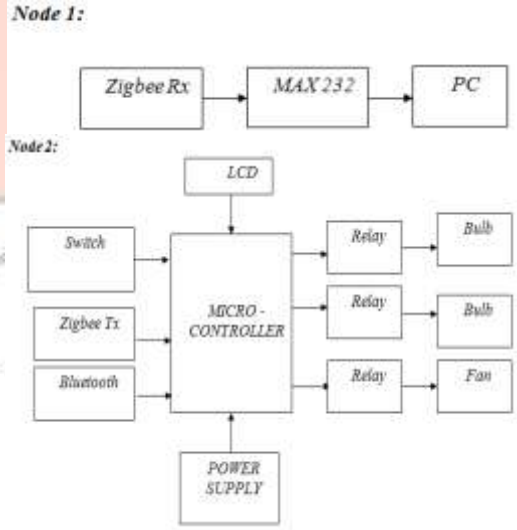

Fig.1. Block Diagram

A. Modules and Description

1. Regulated Power Supply

The power supplies are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each of which performs a particular function. A DC power supply which maintains the output voltage constant irrespective of AC mains fluctuations or load variations is known as "Regulated DC Power Supply". The 5V regulated power supply system as shown below:

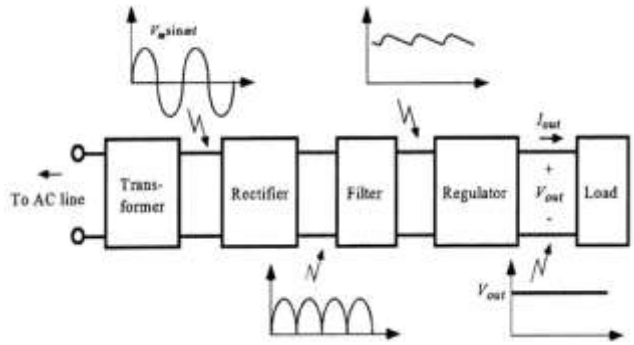

Fig.2. Components of a typical linear power supply

2. ARM LPC2148 Microcontroller

The LPC2148 microcontroller is based on a 32/16 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC21418 is ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. A blend of serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTS, SPI, SSP to I2Cs and on-chip SRAM of 8 kB up to 40 kB, 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 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical applications.

Features:

- 16/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
- 8 to 40 kB of on-chip static RAM and 32 to 512 kB of on-chip flash program memory.128-bit wide interface/accelerator enables high speed 60 MHz operation.
- In-System/In-Application Programming (ISP/IAP) via on-chip boot-loader software. Single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1 ms.
- Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high speed tracing of instruction execution.
- USB 2.0 Full Speed Compliant Device Controller with 2 kB of endpoint RAM. In addition, the LPC2146/8 provide 8 kB of on-chip RAM accessible to USB by DMA.
- One or two (LPC2141/2 vs. LPC2144/6/8) 10-bit A/D converters provide a total of 6/14 analog inputs, with conversion times as low as 2.44 µs per channel.
- Single 10-bit D/A converter provide variable analog output.
- Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.
- Low power real-time clock with independent power and dedicated 32 kHz clock input.
- Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus (400 Kbit/s), SPI and SSP with buffering and variable data length capabilities.

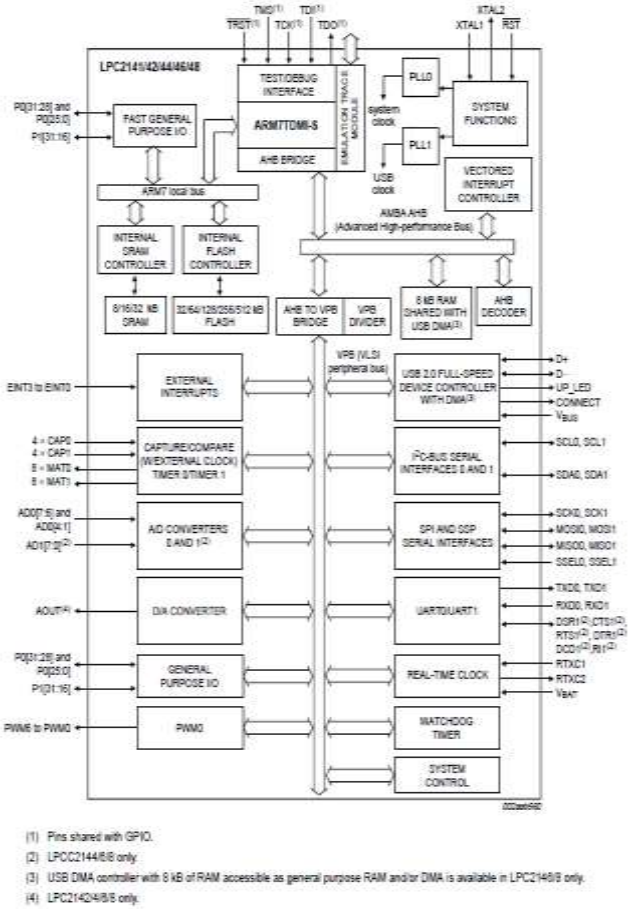

Fig.3. Block diagram of ARM LPC2148

Architectural Overview:

The LPC2148 consists of an ARM7TDMI-S CPU with emulation support, the ARM7 Local Bus for interface to on-chip memory controllers, the AMBA Advanced High-performance Bus (AHB) for interface to the interrupt controller, and the VLSI Peripheral Bus (VPB, a compatible superset of ARM's AMBA Advanced Peripheral Bus) for connection to on-chip peripheral functions. The LPC2148 configures the ARM7TDMI-S processor in little-endian byte order. AHB peripherals are allocated a 2 megabyte range of addresses at the very top of the 4 gigabyte ARM memory space. Each AHB peripheral is allocated a 16 kB address space within the AHB address space. LPC2148 peripheral functions (other than the interrupt controller) are connected to the VPB bus. The AHB to VPB bridge interfaces the VPB bus to the AHB bus. VPB peripherals are also allocated a 2 megabyte range of addresses, beginning at the 3.5 gigabyte address point. Each VPB peripheral is allocated a 16 kB address space within the VPB

address space. The connection of on-chip peripherals to device pins is controlled by a Pin Connect Block. This must be configured by software to fit specific application requirements for the use of peripheral functions and pins.

3. Liquid Crystal Display (LCD)

Fig.4. Liquid Crystal Display

Liquid crystal displays (LCD s) have materials which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal. An LCD consists of two glass panels, with the liquid crystal material sand witched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to maintain a defined orientation angle. One each polarizeris pasted outside the two glass panels. These polarizers would rotate the light rays passing through them to a definite angle, in a particular direction. When the LCD is in the off state, light rays are rotated by the two polarizers and the liquid crystal, such that the light rays come out of the LCD without any orientation, and hence the LCD appears transparent. When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned in a specific direction. The light rays passing through the LCD would be rotated by the polarizers, which would result in activating / highlighting the desired characters. The LCD's are lightweight with only a few millimeters thickness. Since the LCD's consume less power, they are compatible with low power electronic circuits, and can be powered for long durations.

The LCD s won't generate light and so light is needed to read the display. By using backlighting, reading is possible in the dark. The LCD's have long life and a wide operating temperature range. Changing the display size or the layout size is relatively simple which makes the LCD's more customer friendly. The LCD s used exclusively in watches, calculators and measuring instruments is the simple seven-segment displays, having a limited amount of numeric data. The recent advances in technology have resulted in better legibility, more information displaying capability and a wider temperature range. These have resulted in the LCD s being extensively used in telecommunications and entertainment electronics. The LCD s has even started replacing the cathode ray tubes (CRTs) used for the display of text and graphics, and also in small TV applications.

4. Seat Belt Sensor (Switch)

Fig.5. Seat Belt Sensor (switches).

Slide switches are mechanical switches using a slider that moves (slides) from the open (off) position to the closed (on) position. They allow control over current flow in a circuit without having to manually cut or splice wire. This type of switch is best used for controlling current flow in small projects. There are two common internal designs of slide switches. The most common design uses metal slides that make contact with the flat metal parts on the switch. As the slider is moved it causes the metal slide contacts to slide from one set of metal contacts to the other, actuating the switch. The second design uses a metal seesaw. The slider has a spring that pushes down on one side of the metal seesaw or the other. Slide switches are maintained-contact switches. Maintained-contact switches stay in one state until actuated into a new state and then remain in that state until acted upon once again. Depending on the actuator type, the handle is either flush or raised. Choosing a flush or raised switch will depend on the intended application.

5. MAX 232 Serial Line Drivers

The pin-out diagram of MAX 232 is shown below.

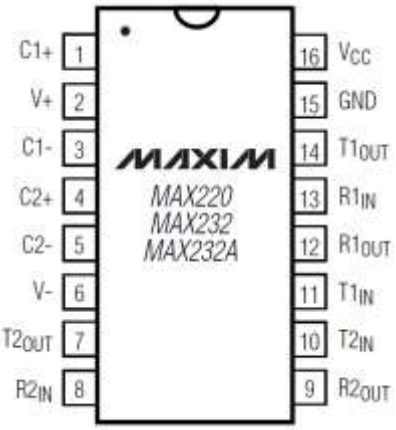

Fig.6. MAX 232 dual driver/receiver

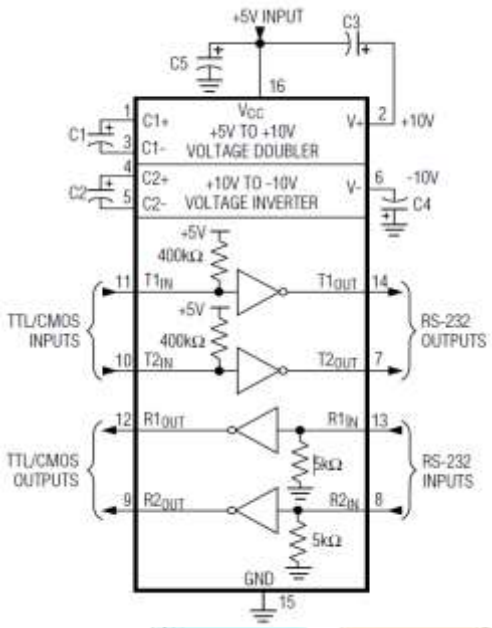

Fig.7. MAX 232 Operating Circuit

The Pin 11, 10 form the dual inputs with TTL logic whereas 14, 7 form the outputs for RS 232 logic, and the 12, 9, 13, 8 form the vice versa inputs and outputs as shown in figure. The inputs and outputs of the drivers and receivers are shown in fig above.

6. Zigbee Module

The explosion in wireless technology has seen the emergence of many standards, especially in the industrial, scientific and medical (ISM) radio band. There have been a multitude of proprietary protocols for control applications, which bottlenecked interfacing. Need for a widely accepted standard for communication between sensors in low data rate wireless networks was felt. As an answer to this dilemma, many companies forged an alliance to create a standard which would be accepted worldwide. It was this Zigbee Alliance that created **Zigbee**. Bluetooth and Wi-Fi should not be confused with Zibgee. Both Bluetooth and Wi-Fi have been developed for communication of large amount of data with complex structure like the media files, software etc. Zigbee on the other hand has been developed looking into the needs of communication of data with simple structure like the data from the sensors.

Fig.8. Zigbee Module

Zigbee is a low power spin off of WiFi. It is a specification for small, low power radios based on IEEE 802.15.4 – 2003 Wireless Personal Area Networks standard. The specification was accepted and ratified by the Zigbee alliance in December 2004. Zigbee Alliance is a group of more than 300 companies including industry majors like Philips, Mitsubishi Electric, Epson, Atmel, Texas Instruments etc. which are committed towards developing and promoting this standard. The alliance is responsible for publishing and maintaining the ZIgbee specification and has updated it time and again after making it public for the first time in 2005. Most of the recent devices conform to the Zigbee 2007 specifications has two feature sets– Zigbee and Zigbee Pro. The manufacturers which are members of the Alliance provide software, hardware and reference designs to anyone who wants to build applications using Zigbee.

7. Relay

What is a Relay

It's a electrical device that functions something like a wired remote control switch. Instead of having the switch you push/flip/whatever do the work of supplying power to whatever you wanted it to, you have it control a relay which then does the real on/off switching work. A mechanical relay does this through the use of an electromagnet - a magnet that is only "on" when there's power running through it - that pulls a set of spring loaded contacts to make or break the connection and achieve the on-off effect. This is called the "coil" or trigger wire - the other wire coming out of the coil is connected to ground. Whenever you apply power to the other coil wire (the trigger), the relay is on. As soon as power to this trigger is turned off, the relay turns off. Simple, huh? There are also "solid state" relays that achieve the same effect through transistors. Either one functions the same way, the solid state stuff just has no moving parts to wear out, but they tend to be more expensive and not as readily available since the regular mechanical ones are inexpensively and readily available as very high quality, durable units.

Why is this useful?

For one big reason - some devices use a lot of power and that means large wires and heavy duty contacts inside all of the switches and connectors are needed. And you want to use as little wire (in length/distance) as possible. It's more expensive and heavier that smaller low-power wires and it's harder to work with. If the wire develops a short, it's a much bigger problem - and the longer the wire involved, the more chances you have for something to go wrong. Additionally, heavy-duty switches are large, cumbersome, and generally have a very poor "feel" to them. By "feel", I mean the tactile sensation you get from using the switch - is it a smooth silky operation with a nice delicate "click" to tell you what's happening, or is it more like Igor straining to flip a massive and cumbersome switch to turn on the power to bring Dr. Frankenstein's creature to life? You get the idea. It's easier and cheaper to make a low power switch in the quality you would expect in a fine automobile. And it will last longer. That's a good thing, A relay alleviates this by using a single relatively small and low power wire to control the on-off of electrical flow. You mount the relay near

the device it controls, and run a simple large power wire to the relay. Then you run a small wire back to the switch. The switch you flip just supplies power to the relay coil and functions as a trigger - if the coil has power, the magnet energizes and the relay contacts move to make (or break - it can work both ways) the high power connection to your device.

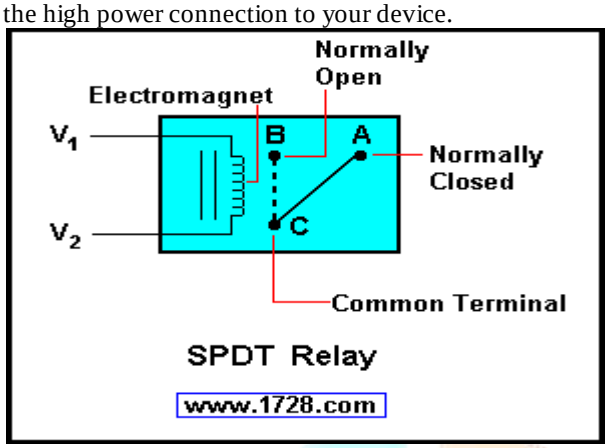

Fig.9. Relay

III. RESULTS

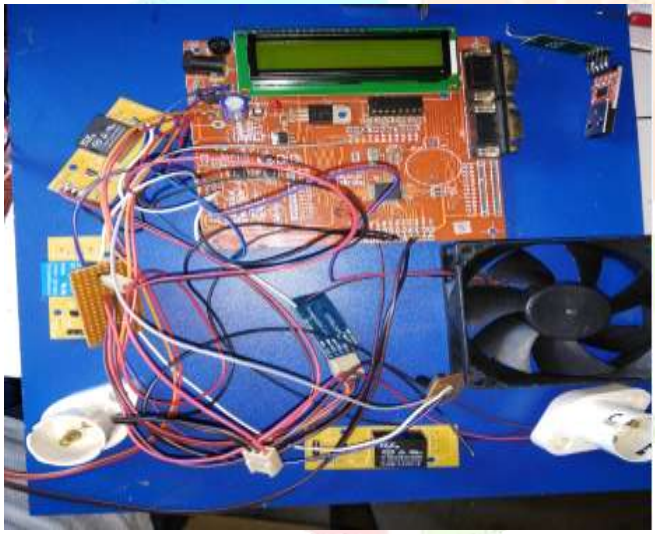

Fig.10. Hardware Kit.

Fig 11

Fig12

IV. CONCLUSION and FUTURE SCOPE

CONCLUSION:

The project Self-Configuration and Smart Binding Control on IOT Applications has been successfully designed and tested. With respect to the consumer market in ZigBee-related technologies have existed for a long time but are not yet universally used. With regard to smart families as an example, costs, system installation and operational complexity affect consumer acceptance. The seamless binding of wireless technologies to all types of home appliances, elimination of the cumbersome setting, and causing users to feel that using a remote control is as simple as using a cell phone may provide new opportunities related to the IOT. In this work, the 'Selfconfiguration and Smart Connection System' is developed its feasibility verified. The results of verification of its major functions, Self-configuration, indicate that the system provides self-configuration for multi-lighting, with an RSSI value variation within -3dBm, and regional configuration in each sub-area validated. Finally we conclude that Smart Configuration System For Smart Environment is an emerging field and there is a huge scope for research and development.

FUTURE SCOPE:

By adding GPS to this we can also find the location where the devices may control

V. REFERENCES

[1] Wen-Kuei Hsieh, Wen-Hsu Hsieh, Jiann-Liang Chen, Chun-Yi Lin, "Self-Configuration and Smart Binding Control on IOT Applications", Jan. 31 ~ Feb. 3, 2016 ICACT2016.
[2] M.C. Shie, P.C. Lin, T.M. Su, P. Chenand and A. Hutahaean, "Intelligent Energy Monitoring System Based on ZigBee-Equipped Smart Sockets, "Proceedings of the IEEE Intelligent Green Building and Smart Grid (IGBSG), pp.1-5, 2014.
[3] C. Perera, P.P. Jayaraman and A. Zaslavsky, "Sensor Discovery and Configuration Framework for the Internet of Things Paradigm,".
[4] Proceedings of the IEEE World Forum on Internet of Things, pp. 94-99, 2014.
[5] J. Bahi, A. Makhoul and A. Mostefaoui, "Localization and Coverage for High Density Sensor Networks," Proceedings of the IEEE Conference on Pervasive Computing and Communications Workshops, pp. 295–300, 2007.
[6] P. Corke, T. Wark, R. Jurdak, H. Wen, P. Valenci and D. Moore,"Environmental Wireless Sensor Networks," Proceedings of the IEEE Invited Paper, pp. 1903-1917, 2010.
[7] C. Gezer and C. Buratti, "A ZigBee Smart Energy Implementation for Energy Efficient Buildings," Proceedings of the IEEE 73rd Vehicular Technology Conference (VTC Spring), pp.1-5, 2011.
[8] D.M. Han and J.H. Lim, "Smart home energy management system using IEEE 802.15.4 and ZigBee," Proceedings of the IEEE Transactions on Consumer Electronics, vol.56, issue 3, pp.1403-1410, 2010.
[9] J. Han, C.S Choi, W.K Park, I. Lee and S.H Kim, "Smart Home Energy Management System Including Renewable Energy Based on ZigBee and PLC," Proceedings of the IEEE JOURNALS Consumer Electronics, IEEE Transactions on Volume: 60, Issue: 2, pp.198-202, 2014.
[10] K. Kaemarungsi, R. Ranron and P. Pongsoon, "Study of Received Signal Strength Indication in ZigBee Location Cluster for Indoor Localization," Proceedings of the IEEE International Conference (ECTI-CON), pp.1-6, 2013.
[11] A. Golestani, N. Petreska, D. Wilfert and C. Zimmer, "Improving the Precision of RSSI-based Low-Energy Localization Using Path Loss Exponent Estimation," Proceedings of the IEEE Positioning, Navigation and Communication (WPNC), pp.1-6, 2014.
[12] Y. Cho, M. Ji, Y. Lee and S. Park, "WiFi AP position estimation using contribution from heterogeneous mobile devices, "Proceedings of the IEEE Position Location and Navigation Symposium (PLANS), pp. 562–567, 2012.

Author's Profile:

Dr. Arvind Kundu, He did B. Tech from H.P. University (SHIMLA) in Electronics & Communication. He did M.Tech from M.D.University (ROHTAK) in Electronics & Communication Engineering. He did Ph.D from Ranchi University and area of research is Adhoc Networks, Embedded System, Cryptography, Message authentication Protocol, Image Processing, Routing protocol etc. He is working as HOD ECE Department at Scient Institute of Technology, Ibrahimpatnam, Hyderabad, India.

Mr. V Nagamahesh, received the Master Of Technology degree in Electronics And Communication from the JNTU Hyderabad, he received the Bachelor Of Engineering degree from JNTU Hyderabad. He is currently working as Assistant Professor in ECE Dept with Scient Institute of Technology, Ibrahimpatnam, Hyderabad, India.

Gorantla Krishna Theja, PG Scholar, Dept of ECE(VLSI & ES), from Scient Institute of Technology, Ibrahimpatnam, Hyderabad, India.