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Energy Efficient Intruder Dection and Alert (Eeida) System Using Wireless Multimedia Sensor Networks

Raveendra.k[1], Sukumar.Puli[2]

1PG Scholar, Annamacharya Institute of Technology & Sciences, Rajampet, AP, India

2 Assistant Professor, Annamacharya Institute of Technology & Sciences, Rajampet, AP, India

ABSTRACT*:* In this project we have proposed simple, low cost, low power consumption and an energy efficient image capturing novel method for implementing the intruder security using ZigBee (802.15.4) standard and also a security protocol for detecting and localizing identity based attacks in the system. It consists of PIR sensor node, cmos camera deployed in the location as well as the doors/ windows of the shopping malls, railway station together with the zigbee modules which act as end devices that monitor continuously and send the security status of each location to the coordinator node connected to a PC which acts as the master. It sends/informs over sms to the concerned department in case of most wanted person detection.The software has been implemented using Embedded c and application program for image authentication using Matlab.

KEYWORDS*:* ARM, ZigBee, PIR, GSM modem, CMOS camera**.**

I. INTRODUCTION

Last decade of 20thcentury saw exponential growth for wireless system users. It is expected that this number will continue to grow. When a network supports lot of users and provides services to them, it becomes imperative to provide requisite service without any noticeable interruption. Proper management of resources is needed. Mismanagement of resources can lead to loopholes in the system that can make system vulnerable. Security has always been an associated problem. Broadcasting information is easily accessible not only by the intended user but also to any other potential eavesdropper.

Today Intruder detection everywhere in public places railway stations shopping malls essential requirements for everyone nowadays due to the high rate of crimes. People are intended to take certain measures to detect and prevent this intrusion.A smart Intruder detection based upon WSN deploys sensors around some places in the particular area to provide precise monitoring. This provides a cost effective solution to detect intrusion and prevent burglary at the owner's/person in his absence.

II. RELATED WORK

The alert system at the server side is also not proper and most importantly it requires 24hr monitoring of thevideo even no human at the vicinity which is a high workload for the human so monitoring is done manually and cctv cameras are wired which is high cost.

III. SCOPE OF RESEARCH

The system consists of different parts as shown in fig 1

Working: The PIR sensor continuously monitors the area and sends regular security status reports using end device XBEE radio to the coordinator (XBEE connected to the PC). Whenever any human motion is detected at the specific

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location, the sensor senses it and the security status sent to coordinator node which detects intrusion and generates an alarm using the buzzer which is implemented using NPN BC547 transistor with 1K resistor.

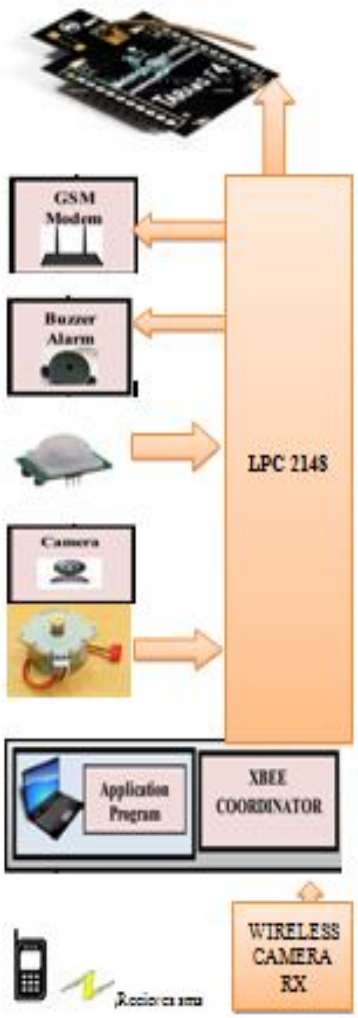

Figure 1.Block diagram of system

The coordinator XBEE is connected to the PC using USB Serial Port. This informs the owner of the house that some intrusion occurred in the specific location where the sensor node has been placed. Thus, we are able to locate the exact position of intruder. Also, a text message may be send to the owner's mobile and local police station using the GSM Module.

The Surveyance System (Remote PC, buzzer and CMOS cameras)

The Surveyance system is basically the event monitoring and capturing system. Our Surveyance system consists of a remote PC that is connected to a coordinator XBEE via USB Serial cable. Each sensor node (PIR) sends the regular security status reports to the coordinator which analyses them carefully. Surveillance Wireless camera receiver is connected to the PC via USB. It has a database that contains the record of all the information/images captured. We have written the application program using Matlab. Whenever an intrusion is detected by the sensors, the security status is set to 1/A (no intrusion security status is 0/N) and the data is send to the coordinator which confirms the intrusion,

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generates an alarm using the buzzer connected to the end device from where the intrusion report has been received and sends SMS to the owner and local police station via GSM modem. Thus, it helps in detecting as well as localizing the intruder. Also, the camera is used to capture all the pictures and videos during intrusion. This can be shown in figure 1.

IV. PROPOSED METHODOLOGY AND DISCUSSION

A. LPC 2148 PROCESSOR

This is a 32-bit ARM7-TDMI-S microcontroller with 32kB of on-chip static RAM and 512 KB of on-chip flash memory. It has 128-bit wide interface/accelerator that enables 60MHz of operation. Also has In-System Programming using on-chip boot loader software, 400ms of full chip erase and 256 B of programming in 1ms. For interfacing of sensors, it has 10-bit ADC with 8 analog inputs and a conversion time as low as 2.44µs per channel. CPU operating voltage is 3V to 3.6V so that the proposed system requires only lower power consumption as the same mentioned before. The Architecture is based on RISC principles and its simplicity yields in a high instruction throughput and real-time interrupt response form a small and cost effective processor core. It also has another architectural strategy such as 16-bit Thumb instruction along with 32-bit ARM instruction set which will enhance the code density in restricted memory conditions while returning most of the ARM's performance.

B. ZIGBEE™ NETWORKS

ZigBee™ networks are basically based on IEEE 802.15.4standard and physical layers for low rate wireless personal area networks (LR-WPAN). The XBEE Pro Series1 consists of 20 pins. These are configured accordingly to make them as end devices, router and coordinator.The DIO pins are used for communication without any change in the hardware and are configured using X-CTU software.

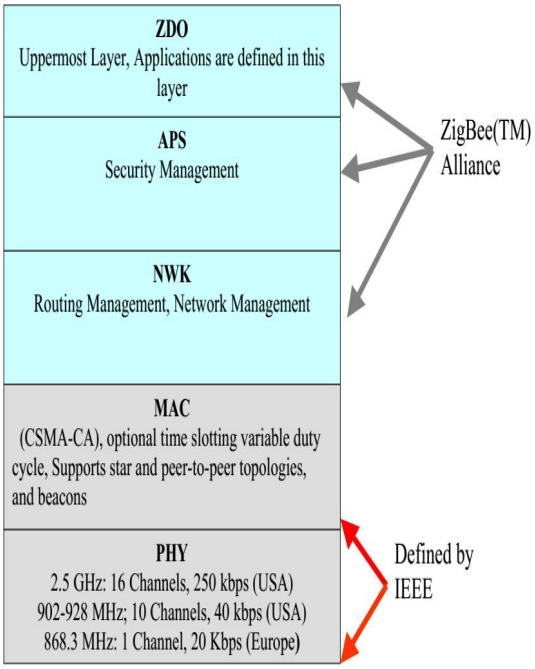

Figure 2.ZigBee(TM) Stack

Figure 2 shows the ZigBee™ stack. A low power and large network size is the mainfeature of ZigBee™.
Figure 3 shows the comparison of ZigBee™ network with contemporary wireless technologies like Wi-Fi™ etc.

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Market Name Standard	ZigBee™ 802.15.4	GSM/GPRS CDMA/1xRTT	Wi-Fi™ 802.11b	Bluetooth™ 802.15.1
Application Focus	Monitoring and Control	Wide Area Voice and Data	Web, E-mail, Video	Cable Replacement
System Resources	4KB-32KB	16MB+	1MB+	250KB+
Battery Life (days)	100-1000+	1-7	.5-5	1-7
Network Size	Unlimited (2^{64})	1	32	7
Bandwidth (kBps)	20-250	64-128+	11,000+	720
Transmission Range (meters)	1-100+	1000+	1-100	1-10+
Success Matrices	Reliability, Power, Cost	Reach, Quality	Speed, Flexibility	Cost, Convenience

Figure 3 comparison of ZigBee™ network

The schematic diagram for XBEE Pro series1 is given below in fig 4.

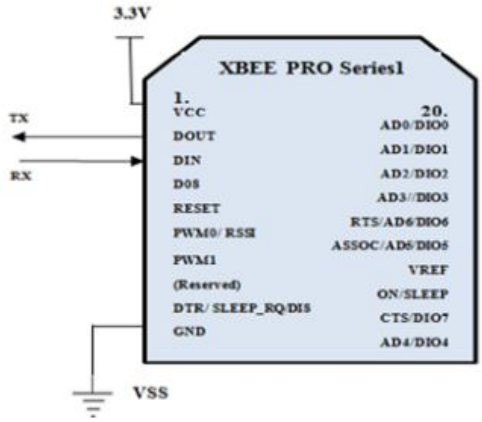

Figure 4: Schematic diagram for XBEE

C. PIR SENSOR

Passive infrared sensor is used in order to detect thehuman at the certain distance as human emits heat at a wavelength of 8 to 12 micro meters the sensor detects thehuman.

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The Pyroelectric sensor develops an electrical signal when it detects a change in thermal radiation. The human body emits some radiation (heat) and whenever someone passes by the sensor, it detects some change in thermal radiations and confirms intrusion in that locationPIR sensor uses the Fresnel lens (compact lens) that captures light obliquely, providing a greater range of Infrared rays to the sensor. The pin diagram for PIR sensor is given in Figure 5.

Parameters	Values
Operating voltage	4.5V to 20V DC
Voltage level output	High 3.3 V, low 0V
Delay time	5s-200s (adjustable)
Blocking time	2.5s
Max detection angle	110 degrees solid angle
Max detection distance	Adjustable between 3m and 7m
Trigger	L can't be repeated, H can be repeated
Quiescent Current	<50uA
Operating temperature	-15 to +70 degrees
Lens size	Default diameter: 23 mm

Specifications of pir sensor

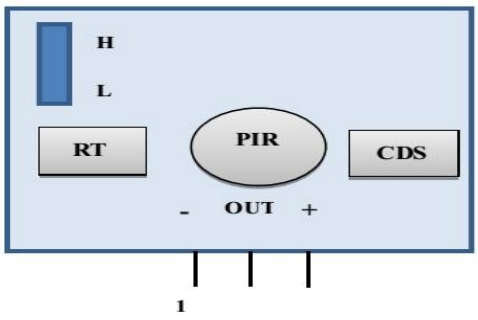

Figure 5: Pin diagram for PIR sensor

D. GLOBAL SYSTEM FOR MOBILE COMMUNICATION (GSM)

GSM is a digital mobile telephone system that is widely used in Europe and other parts of the world. GSM Time Division Multiple Access (TDMA) is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA) and operates in the 900 MHz, 1800 MHz, or 1900 MHz frequency bands.

It is composed of following information:
1. An international mobile subscriber identity (IMSI), that uniquely identifies a subscriber within GSM.
2. A secret subscriber authentication key (Ki).
3. A cryptographic algorithm A3, which provide security functions for authenticating the SIM.
4. Temporary network related data: temporary mobile subscriber identity (TMSI), Location Area Identity (LAI) and Kc.

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SOFTWARE IMPLEMENTED

The programming is done in embedded c for the movement of the surveillance unit and for the movement of the camera .coding is written in such a way that when the PIR sensor detects the human is would rotate in clock wise or anti-clock wise direction and even transfer the control to the human who is monitoring the unit.

V. EXPERIMENTALRESULTS

Figure 6 shows terminal window in which we can watch update status of sensor at monitoring section which is placed at remote area.

- ❖ Also total experimental setup shown below consists of embedded unit along with wireless camera mounted on stepper motor that rotates clockwise and anticlockwise to capture images and video when the Human had detected
- ❖ It wirelessly transmits image/video to remote host/PC where wireless receiver grabs image and matches input image with database images.
- ❖ If the image match with database it shows Authenticated otherwise Non-Authenticated on Matlab application.
- ❖ The acknowledgment from remote host is sent through character command as A for authenticated and N for non-authenticated through ZigBee to monitoring unit to take necessary actions

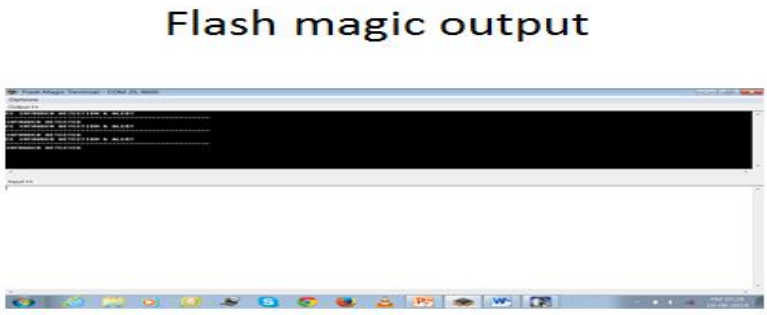

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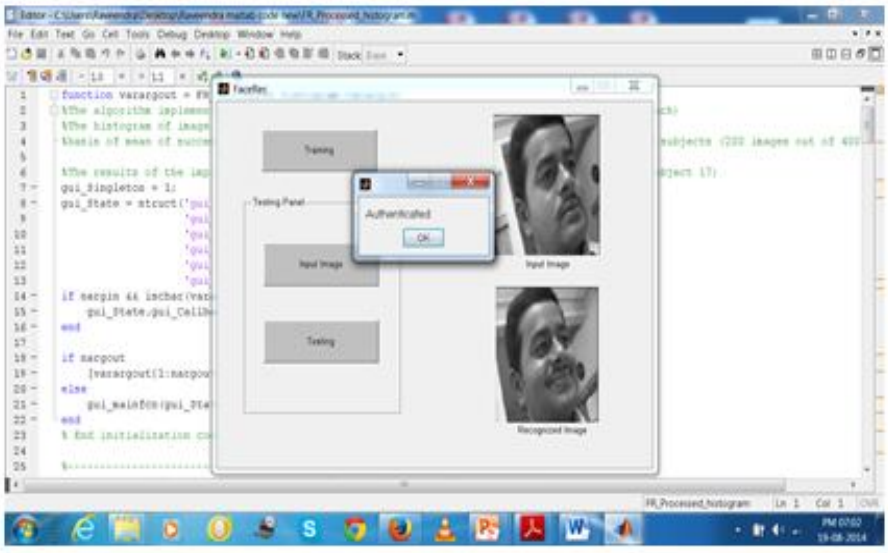
Figure 6 Experimental Setup

RESULTS authenticated



From the above result the person input image matches with internal database that shows authenticated.

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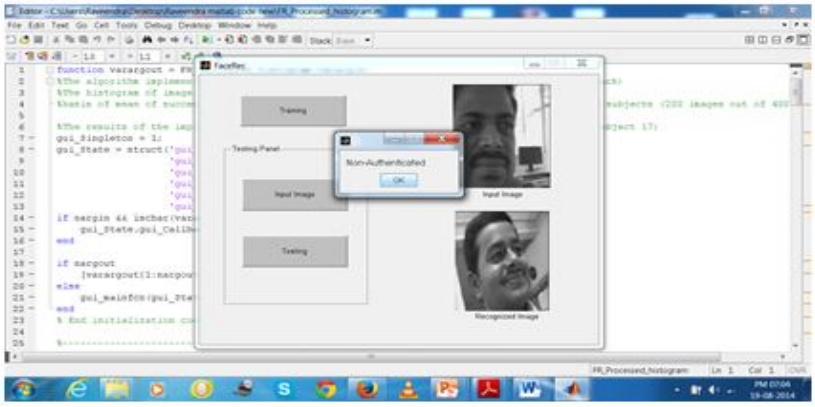
RESULTS non authenticated



From the above result the person input image doesn't matches with internal database that shows non-authenticated.

VI. CONCLUSION

The use of Zigbee makes it a low cost, low power scheme which gives it an edge over the traditional schemes that use Bluetooth or Wi-Fi for communication. Also we have shown energy efficient power saving scheme by stopping rotation of stepper motor when there is no human in front of the PIR sensor and also until unless acknowledgement from remote PC whether person is detected or not. A GSM SIM-900 module has been embedded to the system so that messages can be send to the owner's/police mobile regarding the security status in case of intrusion.

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BIOGRAPHY

Raveendra.kotaguntareceived B.Tech Degree from JNTU Hyderabad and pursuing M.Tech (Embedded Systems) in Annamacharya Institute of Technology and Sciences, Rajampet, Kadapa, Andhra Pradesh, India. Areas of interests are, Microprocessors, Microcontrollers & Interfacing, embedded systems and Communication systems.

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Sukumar.Puli, received B.Tech Degree from JNTU Hyderabad and M.Tech (CSE) degree from ANU Guntur and M.Tech (DECS) in JNTU Ananthapuramu. Currently working as Assistant Professor in the Department of E.C.E., Annamacharya Institute of Technology and Sciences, Rajampet,Kadapa, Andhra Pradesh, India. Areas of interests are, Microprocessors & Interfacing, embedded systems and Real Time Operating System.