International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.in

Vol.4., Issue.1., 2016
(Jan-Feb)

REVIEW ARTICLE

ISSN: 2321-7758

SURVEILLANCE SYSTEM USING EMBEDDED SYSTEM

JAGRITI S. PATIL[1], Prof. V. S. PATIL[2]
[1]M.E. Student, [2]Associate Professor
E& TC, R. C. P. I. T., Shirpur, India

ABSTRACT
Security systems are necessary during any emergencies that occur at banks, houses etc. Hence in this paper, a security system with a feature of motion and password detection is implemented. We evaluate the development of a Low-cost security system using small PIR (Pyroelectric Infrared) sensor built around a microcontroller. The low-power PIR detectors take advantage of pyroelectricity to detect a human body that is a constant source of Passive Infrared (radiation in the infrared region). The system senses the signal generated by PIR sensor detecting the presence of individuals not at thermal equilibrium with the surrounding environment. Detecting the presence of any unauthorized person in any specific time interval, it triggers an alarm & sets up a call to a predefined number through a GSM modem. This highly reactive approach has low computational requirement, therefore it is well-suited to surveillance, industrial applications and smart environments. Tests performed gave promising results.

Keywords—fresnel lens, GSM, infrared, PIC, PIR module, pyroelectricity.

I. INTRODUCTION

Security and safety is one of the most talked of topics in almost every facet like surveillance, industrial applications, offices, and in general, in smart environments. To secure it against theft, crime, fire, etc. a powerful security system is required not only to detect but also pre-empt hazards. Conventional security systems use cameras and process large amounts of data to extract features with high cost and hence require significant infrastructures. This paper proposes a PIR sensor based low cost security system for home applications in which Passive Infrared (PIR) sensor has been implemented to sense the motion of human through the detection of infrared radiated from that human body. PIR device does not emit an infrared beam but passively accepts incoming infrared radiation.

ARM7 architecture based LPC2148 microcontroller from Atmel is used to implement this project. Microcontroller acts as the heart of the project, which controls the whole system. It contains 64k Flash, 2 UART, 48 GPIO's, ISP programming support etc. KEIL IDE is used to program the microcontroller and the coding will be done using Embedded C.

Fig. 1 shows the block diagram of the system. PIR sensor detects the presence of human in the home and generates pulse which is read by the microcontroller.

According to the pulse received by microcontroller, a call is established to mobile station through a GSM modem and thus warns the presence of human in the home to owner-occupier. On the other hand, this security system remains in idle position and performs nothing if no one is in the home. This paper is organized into eight sections, including this section. Section II discusses some related works and section III presents an overview of PIR sensors and detection process. Circuit diagram and operation details are in section IV and V respectively. The application flowchart is given in section VI. Section VII discusses the experimental results of the implemented prototype system. Finally, future improvements and the conclusions are presented in section VIII.

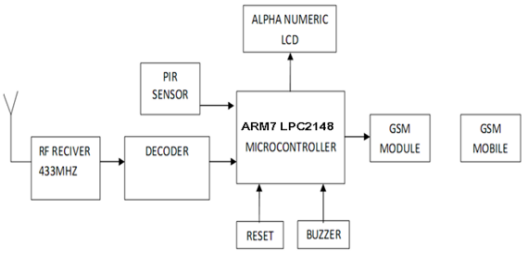


Figure 1. System block diagram

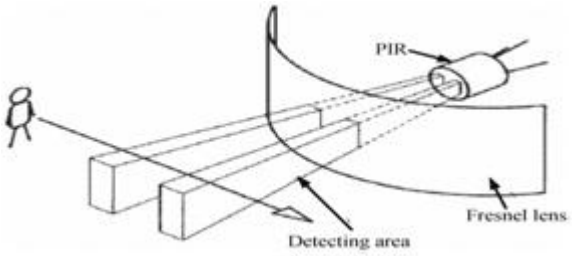
II. RELATED WORKS

Today's indoor security systems built with various sensors such as ultrasonic detectors, microwave detectors, photoelectric detectors, infrared detectors etc. Each of these systems has its own limitations. As an example, photo-electric beam systems detect the presence of an intruder by transmitting visible or infrared light beams across an area, where these beams maybe obstructed. But the drawback lies within it if the intruder is aware of the presence of this system. Despite of having strong dependence on surrounding environmental status, pyroelectricity has become a widely used detection parameter because of simplicity and privilege of interfacing to the digital systems. N ow, it is extensively used for intruder detection, smart environment sensing, and power management applications. Several works have been conducted in various applications. Intelligent fireproof and theft-proof alarm system [1], GSM (Global System for Mobile) network based home safeguard system [2], human tracking system [3] and intruder detection systems [4] are some notable works done previously based on pyroelectricity sensing technique. Our work introduces a low-cost security system solution. Utilization of existing cellular network to alert and inform the system owner about the security breach is made to cope up with ever increasing demand for cheap but reliable security system.

III. PIR SENSOR

PIR is basically made of Pyroelectric sensors to develop an electric signal in response to a change in the incident thermal radiation. Every living body emits some low level radiations and the hotter the body, the more is emitted radiation. Commercial PIR sensors typically include two IR-sensitive elements with opposite polarization housed in a hermetically sealed metal with a window made of IR-transmissive material (typically coated silicon to protect the sensing element). When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or an animal passes by, it first intercepts one half of the PIR sensor which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected. In order to shape the FOV, i.e. Field Of View of the sensor, the detector is equipped with lenses in front of it. The lens used here is inexpensive and lightweight plastic materials with transmission characteristics suited for the desired wavelength range. To cover much larger area, detection lens is split up into multiple sections, each section of which is a Fresnel lens. Fresnel lens condenses light. Providing a larger range of IR to the sensor it can span over several tens of degree width. Thus total configuration improves immunity to changes in background temperature, noise or humidity and causes a shorter settling time of the output after a body moved in or out the FOV. Along with pyroelectric sensor, a chip named Micro Power PIR Motion Detector IC has been used. This chip takes the output of the sensor and does some minor processing on it to emit a digital output pulse from the analog sensor. Schematic of PIR sensor output

waveform is shown in Fig. 2. For triggering purpose, there are three dedicated pins in the PIR module: HIGH, LOW and COMMON. When connecting up LOW and COMMON pins, the output turns on and off every second or so when moving in front of it. That is called "non-retriggering" and shown in Fig. 2(a). When connecting up HIGH and COMMON pins, the output stay on the entire time that something is moving. That is called "retriggering" and shown in Fig. 2(b).



(a)

(b)

Figure 2. PIR sensor output waveform

V. WORKING CIRCUIT

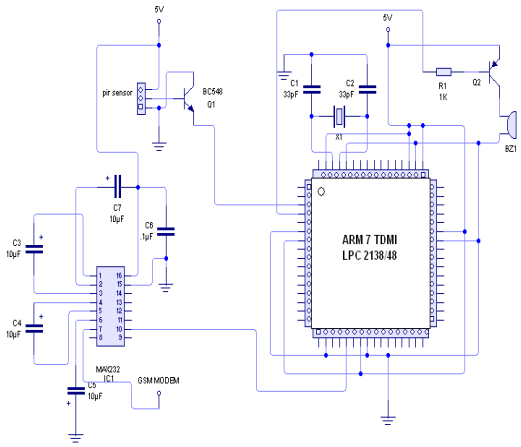


Figure 3 circuit diagram of the system.

The total system can be divided into three segments: A. Sensor and signal processing segment: This segment is shown in the Fig.3 This segment consists of PIR sensor module: The PIR sensor module is fed from the output of fixed output voltage regulator IC LM7805. PIR positive input terminal is fed with a +5V supply and negative terminal is grounded. PIR sensor module output pin is connected to ARM7 pin. For re-triggering purpose, a jumper (JP) is attached on the COMMON (C) pin and HIGH (H) pin.

Switch: This is a mechanical switch which is of NO (Normally Open) type. One end of the switch is connected to the +5V supply and the other end is connected to one of the arm7 input pins. For practical use, electronic remote controlled switch is a better option to secure the system operation. - MCU: For this system, AT89C51 is used as the MCU, i.e. Microcontroller unit. It has built-in UART module which is necessary for passing AT commands to the GSM modem. The PIR sensor module output is tied to the pin 3. 12 MHz crystal is connected between OSCI and OSC2 pins. This crystal detentions the clock speed of the ARM7 operation.

GSM Modem interfacing segment: This segment is shown in Fig. 3. As GSM modem uses serial communication to interface with other peripherals, an interface is needed between MCU and GSM modem. This segment consists of four parts: -DB9 male connector: The serial port used here is a 9 pin DB9 male connector as the GSM modem side uses a female connector. Pin no 7 of MAX232 are connected to pin 2 DB9 respectively. Pin 5 of DB9 is grounded. - MAX232: This particular IC is necessary for increasing the voltage swing at the outputs. It takes OV and +5V inputs and makes it a + 12V and -12V output voltages. This increased voltage swing is a requirement for serial communications. Two 1 /IF capacitors are connected between pins 4, 5 and 1, 3 of MAX232. V+ and V- pins are fed from VCC and GNO, i.e. Ground through two 1 /IF capacitors. Between VCC and GNO pins, one 10 /IF capacitor is placed. - GSM modem: GSM modem is connected through a DB9 female connector to the interfacing circuit. MCU: The VCC, i.e. power pin, TTL input and TTL output pins of MAX232 are connected to the pins RCO, RCI and RC2 of MCU respectively.

VI. CIRCUIT OPERATION

Sensor and signal processing segment: As the jumper of PIR sensor module is placed between C and H, the output will stay on the

entire time something is moving. Prior to any operation, external interrupt I disabled in software of MCU. When the mechanical switch is closed, pin 3 gets an input voltage. This sets the system to run. After activation of the system, if there is any movement on that place within the coverage region of the PIR sensor module, it outputs a pulse which is taken as input by arm7 . arm 7 then waits a pre defined time and checks for that signal again. This is done for avoiding false triggering.

GSM Operation: MCU makes HIGH on RCO which in tum activates MAX232 Ie. Then MCU starts sending AT commands to the GSM modem through the pins TX. The commands are sent through the interface to the modem. The modem receives the commands and sets up a call to a pre-defined number. The call is not disconnected until the call time - up or the recipient disconnects the call. After the call is disconnected, MCU goes to SLEEP, i.e. low power consuming mode. Before going into SLEEP, MCU enables the external interrupt in software. When the mechanical switch is open, an interrupt occurs and MCU is brought out of SLEEP mode.

VII. SOFTWARE

For developing or testing an embedded system application, a particular development cycle is followed which consists of several stages. An Integrated Development Environment (IDE) allows for implementation of all such steps of a development cycle.

Typically, a development cycle has following steps:

a. The code is written/edited in an Editor program.
b. The Compiler/Assembler/Linker programs generate relevant support files like .hex, .obj etc.
c. The code is loaded into Simulator/Debugger program.
d. The code is analyzed by Simulation or Debugging.
e. If an error occurs, the code is re-edited and the whole cycle is repeated.

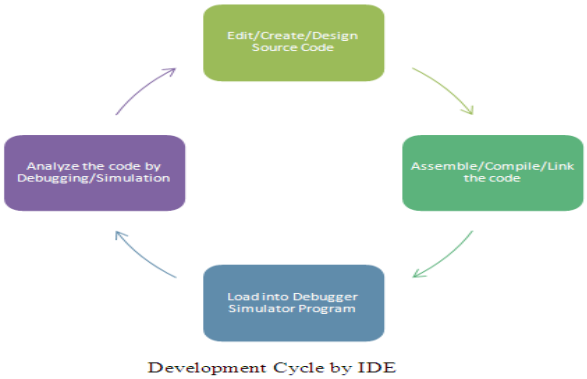


Figure 4. Development cycle by IDE

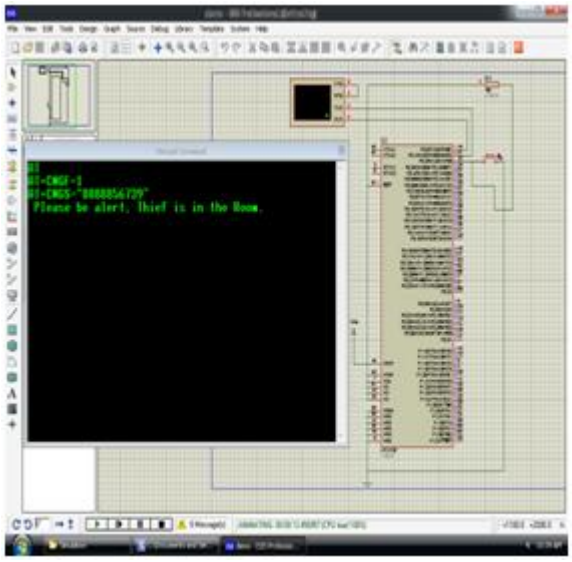


Figure 5 Proteus simulation without detection

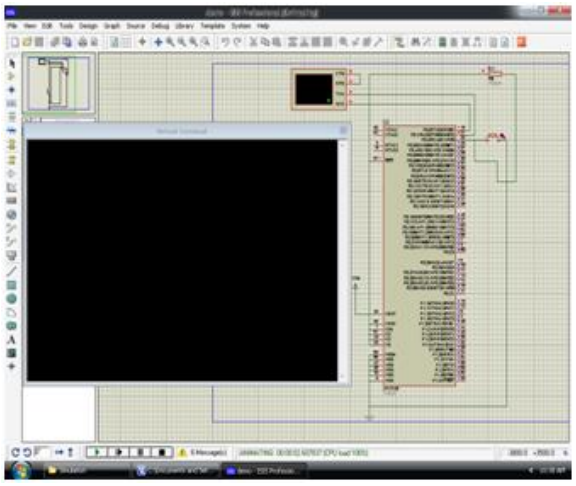


Figure 6 Proteus simulation with detection

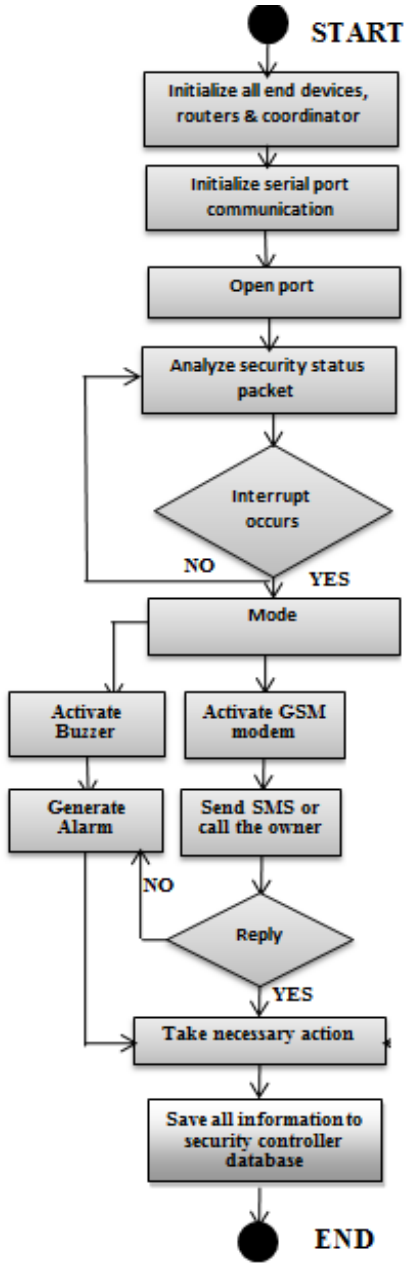


Figure 7. Flowchart of the system

VIII. RESULT & DISCUSSION

The proposed prototype system is implemented and tested for the desired functionalities. The function of mechanical switch is done manually through a connecting wire. The system made 3 massage to a pre-specified cell phone number in 3 test runs which yields a hundred percent success rate. The whole test procedure is done in a laboratory having the mentioned criteria for optimal performance. Based on several experiments conducted under various conditions, it is verified that this system can resolve the presence of any warm body within the coverage area and execute subsequent actions. In order for a PIR sensor to work well most of the time, it is designed with certain limitations. A PIR sensor cannot detect a stationary or very slowly moving body. If the sensor was set to the required sensitivity, it would be activated by the cooling of a nearby wall in the evening, or by very small animals. Similarly, if someone walks straight towards a PIR sensor, it will not detect them until they are very close by. Moreover, the PIR sensors are sensitive to exposure to direct sunlight and direct wind from heaters and air conditioners Precaution is required if there are pets in the house. PIR's are sensitive enough to detect dogs and cats. There are special lens available or a tape can be put on lower part of the existing lens, so as to avoid detection close to the ground. At the same time, it should be kept in mind that the intruder can also crawl and avoid detection. So placement and subsequent testing of PIR sensor modules' is a must to avoid false alarms. These factors need to be kept in mind to ensure the proper operation of this system.

IX. FUTURE WORK & CONCLUSION

In this security system PIR sensor has been used which is low power, and low cost, pretty rugged, have a wide lens range, and are easy to interface with. This security system can be implemented in places like home, office, shop etc. The sensitivity range for detecting motion of the system is about 3 to 4 feet. It can be raised up to 20 feet through careful use of concentrating optical lenses as future development. In addition to this, this system can be equipped with glass break detectors to enhance the level of protection. Use of multi-sensor data fusion and complex algorithm can be used to increase the effective FOV for larger spaces. In order to enhance the location accuracy and to enhance the method of processing the PIR sensor signal, use of more advanced techniques such as probabilistic theories and soft computing is left open for the future.

ACKNOWLEDGEMENT

This is the great opportunity to get paper prationtation for doing and from stating of project undertaking this was a great Learning Experience. I certainly encountered difficulties at various stages of implementation. However, by challenging and achievement that filled us so completely after overcoming all the awe-inspiring odds is inexplicable in words. The unending guidance, inspiration and support that we received from various quarters are truly what actually kept me going. With deep sense of gratefulness, I hereby take this opportunity to give my genuine and hearty thanks to all the people who helped me realize this.

REFERENCES

[1]. Z. Zhi - hui, L. Hui, L. Yin, C. Jia – jia Design of the intelligent firep roof and theft - proof alann system for home", JOURNAL OF HENAN POLYTECHNIC UNIVERSITY, vol. 28,no. I, pp. 207-210, Feb. 2009.

[2]. Q. Qu, Z. Guohao, W. Baohua, "Design of Home Safeguard System Based on GSM Technique", Electronic Engineer, vol. 32, no. I I, pp. 76- 78, Nov. 2006.

[3]. M. Shankar, 1. Burchett, Q. Hao, B. Guenther, "Human-tracking systems using pyroelectric infrared detectors", Optical Engineering, vol. 10, no. 45, pp. 106401 (01-10), Oct. 2006.

[4]. M. Moghavvemi and C.S. Lu, "Pyroelectric infrared sensor for intruder detection," in Proc. TENCON 2004 Conf., pp. 656-659.

[5]. Renewable Energy UK. (2010, Aug.). Find out how to integrate PIR (passive infrared) sensors into renewable energy applications.[Online].Available: http://www.reuk.co.uklPIR-Sensors.htm

[6]. BISSOOOI Datasheet. [Online]. Available: http://cdn.shopity.com/s/files/

[7]. Schneider Electric. PDL PIR Sensor Technical Guide. [Online]