Passive Infrared (PIR) Sensor Based Security Control System using Microcontroller using 89C51

B.R. Shwetha, M. Nitesh and C.K. Abhishek

Abstract--- *This paper evaluate the development of low cost security system in the area where there is need of continuous monitoring using PIR (pyroelectric infrared) sensor. A special type of human sensor PIR is used to detect the human being around 20 feet distance. This sensor uses the concept of Black Body Radiation. If anyone tries to cross the area means the sensor detects and it sends a signal to the Microcontroller which switches on the camera which displays the imageon TV monitor and also transmits a signal to the near security station. The receiver circuit is used toreceive the signal from the area, so that a person at the control room can take a vision of what actually going on the area. After sensing the image, it searches for RFID tag to match. If RFID doesn't match then the Microcontroller activates the relay driver which drives the load such as automatic function alarm, Intruder message on display. Set up a message to predefined number using GSM modem. This project is very advanced and good accuracy with other specifications.*

Keywords--- *PIR Sensor, Microcontroller, GSM Modem, Alarm, LCD Display, Camera*

I. INTRODUCTION

A PIR (passive infrared) detector coupled with an electric light is now widely used for intruder protection. PIR are also available as stand-alone units which usually have a switched output for controlling external loads. To enable the PIR detector to work in daylight also, you have to cover the internal light/darkness sensor (usually an LDR).The PIR detector used in this circuit reacts to fast temperature variationscaused by the movement of people or animals in an enclosed space.

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When somebody moves from one zone into another, there is a change in temperature which is collected by the lens as a variation in radiant energy. At the focus of the lens is a pyroelectric sensor which reacts to such a change by generating a small electric signal. That signal is processed and used to actuate the alarm installation. According to pulse received by microcontroller, a camera is turned on the image of the human is displayed on TV monitor in a control room, and also searches for RFID tag matching and call setup to a predefined number using GSM modem.

II. RELATED WORKS

Today's indoor security system built with various sensors such as ultrasonic detectors, microwave detectors, photoelectric detectors, infrared detectors etc. Each of these systems detects the presence of intruder by transmitting visible or infrared light beams across an area, where these beams may be obstructed. But the drawback lies if the intruder is aware of the presence of 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.Now, it extensively used for intruder detection, smart environments sensing, and power management applications. Several works has been conducted in various applications. Intelligent fire proof and theft-proof alarm system[1], GSM network based home security system [2], human tracking system [3], intruder detection system [4] are some notable works done using PIR sensingtechniques. This work introduces a low cost security system.

Block Diagram Description

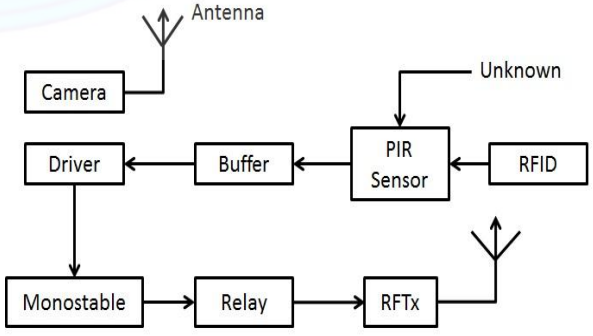

Fig. 1(a): Shows Transmitter Side

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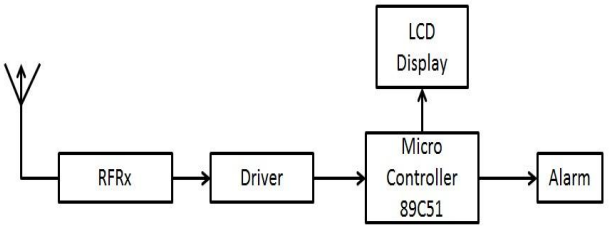


Fig. 1(b): Shows Receiver Side

Fig 1 shows the block diagram of PIR sensor based security control system. It mainly consists two parts that is transmitter and receiver sides. The transmitter side mainly consists of PIR sensor, wireless camera and RF transmitter. The transmitter side of the security control system as shown in fig 1(a).

The receiver side of security control system as shown in fig 1(b). It mainly consists of RF receiver and microcontroller 89C51 with LCD display and alarm.

PIR Sensor

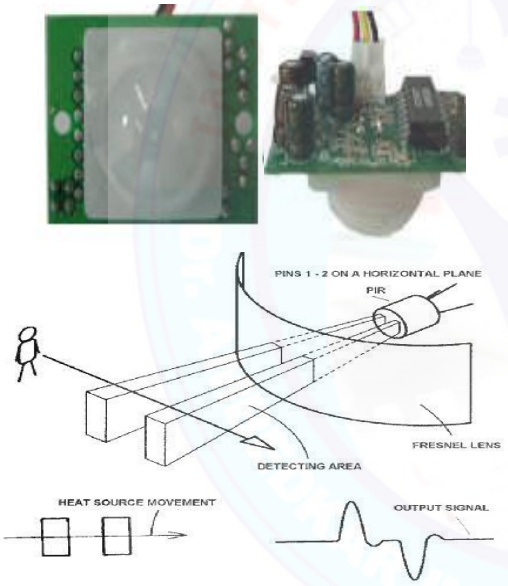


Fig. 2: Shows PIR Sensor Module

PIR is basically made of Pyroelectric sensor to develop an electric signal in response to a change in the incident thermal radiation. Every living body emits some low level radiation.PIR sensors typically include twoIR-sensitive elements with opposite polarization housed in a hermetical sealed metal with a window made of IR-transmissive material (typically coated silicon to protect the sensing element). PIR (passive infrared) detector coupled with an electric light is now widely used for intruder protection. The radiant energy is picked up by a Fresnel lens, at the focus of which is a double differential pyroelectric sensor. PIR sensor module as shown in Fig 2.

The detector is largely unaffected by other electrical radiation. Also, it does not react to movement outside the guarded space. To cover much large area, detection lens is split up into multiple sections, each section of which is a Fresnel lens. Fresnel lens condenses light. Providing a large 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 body moved in or out the field of view. Along with pyroelectric sensor, a chip named Micro power PIR Motion Detector IC has been used. This chip takes the output of sensor and does some minor processing on it emit a digital output pulse.

III. WORKING CIRCUIT

Sensor and processing segment: PIR sensor module: This segment is shown in Fig 2.PIR sensor positive input terminal is fed with a +5V supply and negative terminal is grounded. PIR sensor output pin is connected to MCU pin.

Features and Electrical Specification of a sensor:

- (Compact size: (28 x 38 mm).
- Supply current: DC5V-20V (can design DC3V-24V).
- Current drain :< 50uA (Other choice: DC 0.8V-4.5V; Current drain: 1.5mA-0.1mA).
- Voltage Output: High/Low level signal：3.3V (Other choice: Open-Collector Output).
- TTL output.
- High sensitivity.
- Delay time：5s-18 minute.
- Blockade time ：0.5s-50s (acquiescently 0 seconds).
- Operation Temperature: -15oC -70Oc.
- Infrared sensor: dual element, low noise, high sensitivity.

A. Microcontroller Unit (MCU)

The microcontroller unit contains full implementation of a standard MICROPROCESSOR, ROM, RAM, I/0, CLOCK, TIMERS, and also SERIAL PORTS. Microcontroller also called "system on a chip" or "single chip microprocessor system" or "computer on a chip" A microcontroller is a Computer-On-A-Chip, or, if you prefer, a single-chip computer. Micro suggests that the device is small, and controller tells you that the device' might be used to control objects, processes, or events. Another term to describe a microcontroller is embedded controller, because the microcontroller and its support circuits are often built into, or embedded in, the devices they control.

The AT89C51 is a low power, high performance CMOS 8 bit microcomputer with 8kB of flash programmable and erasable read only memory (EPROM). The device is manufactured using Atmel's high density non-volatile memory technology and is compatible with the industry standard 80C51 and 80C52 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed

in-system or by a conventional nonvolatile memory programmer. By combining a versatile an 8 bit CPU with flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer which provides a highly flexible and cost effective solution to many embedded control applications.Fig. 3 shows Microcontroller with LCD display in PIR based security control system.

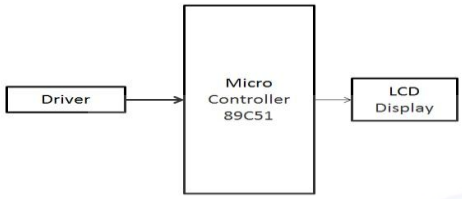


Fig. 3: Shows Microcontroller with LCD Display

B. Alarm Segment

Fig. 3: Shows PIR Motion Sensor Alarm

Fig 3 shows PIR motion sensor alarm. A motion detectionalarm circuit using PIRsensor motion detection, if the sensor produces small electric signal by sensing movement of a human. Then buffer is used to pass the signal to the next stage with unity and driver is used to drives the relay. The driver IC consists of Darlington pair in its IC chip. The output of driver makes relay turn ON and alarm signal is generated.

C. GSM Modem Interfacing Segment

The GSM modem interfacing segmentas shown in Fig 4. As GSM modem uses serial communication to interface with other peripherals, an interface is needed between MCU and GSM modem. This segment contains 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 14 and 13 of Max232 are connected to pin 2 and 3 of DB9 respectively. Pin 5 of DB9 is grounded.

MaX232: This particular IC is necessary for increasing voltage swing at the outputs. It takes 0V and 5V input and gives it a +12V and -12V output voltages.

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.

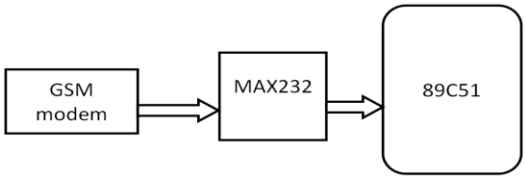
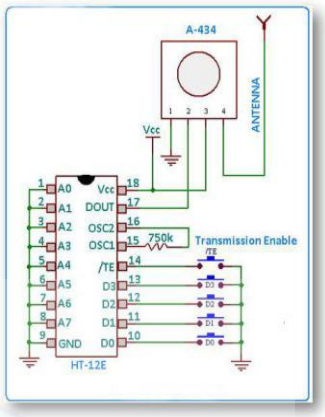


Fig. 4: shows GSM Modem Interfacing Segment

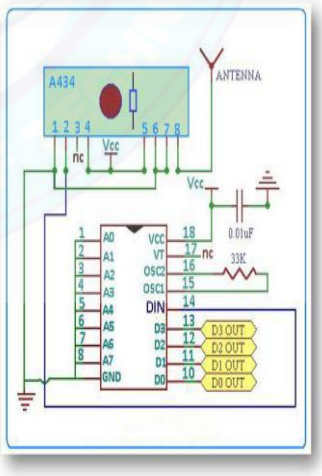
D. RF Transmitter Sst-433



The SST-433 is ideal for remote control application where low cost and longer range is required. The transmitter operates from a 1.5-12v supply making it ideal for battery-powered applications. The transmitter employs a stabilized oscillator, ensuring accurate frequency control for best range performance .Output power and harmonic emissions are easy to control, making FCC and ETSI compliance easy. The manufacturing-friendly SIP style package and low-cost make the STT_433 suitable for high volume applications.

E. RF Receiver str-433

The STR-433 is an idle for short-range remote control applications where cost is a primary where cost is a primary concern. The receiver module requires no external RF components except for the antenna. It generates virtually no emission, making FCC and ETSI approval easy. The super-regenerative design exhibits exceptional sensitivity at a very low cost.



IV. CONCLUSION

In this security system PIR sensor has been used which is low power, low cost, pretty rugged, have a wide lens range, and are easy to interface with Microcontroller and other devices. This security system can be implemented in places

like where there is need of continuous monitoring.The sensor which senses the change by generating small electrical signal which turn ON camera and processor calls for RFID tag to match. If it is not get matched then it display a message as "INTRUDER" and also alarm signal is generated.The sensitivity range for detecting motion of the systemis about 3 to 4 feet. This method of security control system reduces man interference in security monitoring and it can also implement in border area and prohibited areas.

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