

Smart Surveillance System Using PIR Sensor Network and GSM

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Abstract— Surveillance is most important security systems in home, industrial, office and public places. In this security system is based on the embedded system along with GSM and sensor networks. The human movement is detected using the PIR sensors. In this time, the system triggers an alarm detecting the presence of person in a specific interval of time and simultaneously sends the how many persons are intruder via message to the SMS through GSM Modem. When the security system is activated, the CCTV camera is activated. This highly reactive approach has low computational requirement. Therefore it is well suited for home surveillance system. This surveillance security system implemented using PIC micro controller, camera, gsm and sensors.

Index Terms— PIR Sensor; GSM; PIC microcontroller; Camera.

I. INTRODUCTION

Surveillance is most important field in security system. Surveillance is the monitoring of the behavior, activities, or other changing information, usually of people for the purpose of influencing, managing, directing, or protecting them. surveillance systems are habitually used in home, office, factory or vehicle monitoring and image identification, but this system requires a high performance core, which works against some advantages of embedded systems, such as low power consumption and low cost. Surveillance is very helpful to governments and law execution to maintain social control, recognize and monitor threats, and prevent/investigate criminal activities.

Home/office security systems have grown in popularity in recent years, a home/office owner's look for ways to protect their personal space and enhance their home values. It is necessary for every home owner to considering adding a home security system, as burglaries, thefts and murders have become routine in big cities.

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PIR sensor are 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 radiation from that human body. PIR device does not emit an infrared radiation but passively accepts incoming infrared radiation. PIR sensor notice the presence of human in the home and generates signal which is read by the microcontroller. According to the signal received by microcontroller, a call is acknowledged to mobile station through a GSM modem and thus alert the presence of human in the home to owner-occupier.

Designed an advanced GSM based electronic security system for home applications using infra red motion detectors and RISC based Micro controller using embedded C language. Infra red motion detectors will sense any intruder with 10 feet and alert the Owner of house or police control room by sending SMS through GSM modem about the intruder.

In section II, existing system are discussed. In section III, proposed system are discussed. In section IV, discuss about hardware specifications. In section V, discuss about conclusion of this project.

II. EXISTING SYSTEM

A. Video Cameras

Security and crime control concerns are the motivating factors for the deployment of video surveillance cameras. Closed-circuit television (CCTV) is the use of video cameras to transmit a signal to a specific place, on a limited set of monitors. This technique just uses the cameras to do surveillance. It needs a command and control center to monitor all the activities using cameras. All the cameras are connected to the command center and send their data directly to the central location. All the activities which are happening in the organization or inside the building can be viewed live from the command center.

B. RFID

Radio Frequency Identification (RFID) use radio waves to automatically identify person or objects. There are many methods of identification, but the most general is to store a unique serial number that identifies a human or object on a microchip that is attached to an antenna. The combined antenna and microchip are called an "RFID transponder" or "RFID tag" and work in combination with an "RFID reader".

An RFID system consists of a reader and one or more tags. The reader's antenna is used to transmit radio frequency (RF) energy. Depending on the tag type, the energy is "harvested" by the tag's antenna and used to power up the internal circuitry of the tag. The tag will then modulate the electromagnetic waves generated by the reader in order to transmit its data back to the reader. The reader receives the modulated waves and converts them into digital data. In the case of the Parallax RFID Reader Module, correctly received digital data is sent serially through the SOUT pin.

III. PROPOSED METHOD

In this proposed system, the home based smart surveillance system which evaluates the development of a very Low-cost security system using PIR (Pyroelectric Infrared) sensors and video cameras built around the PIC(Peripheral Interface Controller) microcontroller. the human movement is detected using the PIR sensors. In this time, the system triggers an alarm detecting the presence of unauthorized person in a specific interval of time and simultaneously sends a message to the SMS through GSM Modem. When the security system is activated, the CCTV camera is activated. This highly reactive approach has low computational requirement. Therefore it is well suited for home surveillance system.

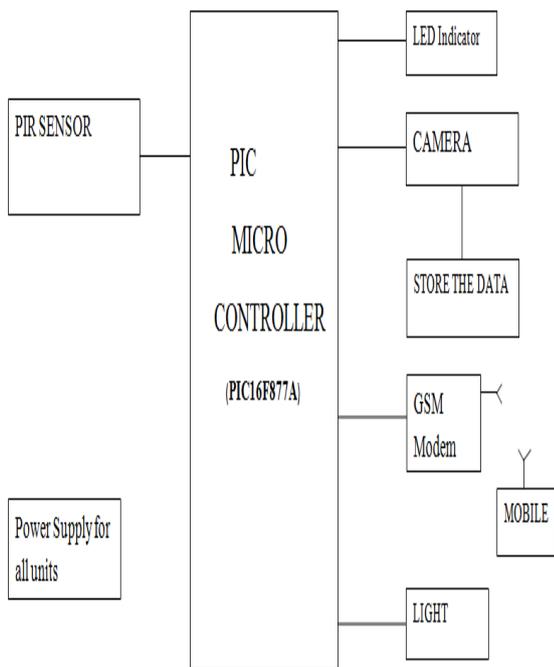


Fig 3.1 System Architecture

IV. HARDWARE SPECIFICATIONS

A. PIR Sensor

A Pyroelectric Infrared Sensor (PIR sensor) is an electronic sensor, in that type of sensor measures the infrared (IR) light radiating from objects or human in its field of view. The normal sensor emits the radiation but in this sensor detects the radiation.

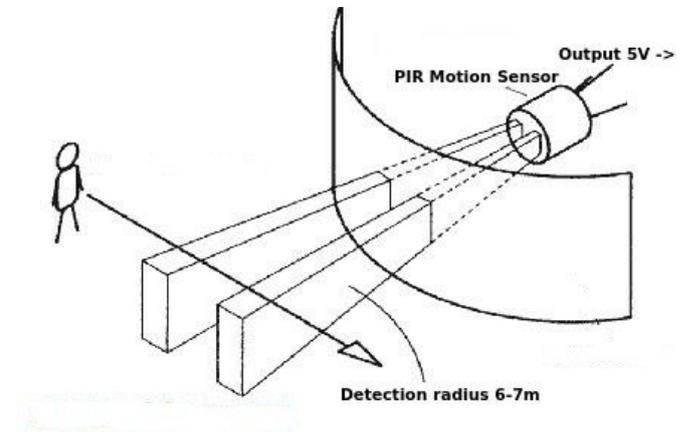


Fig 4.1 PIR Sensor

All the objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually this radiation is not visible by human eye because it radiates at infrared wavelengths, but in this infrared can be detected by electronic devices designed for detecting the human movement.

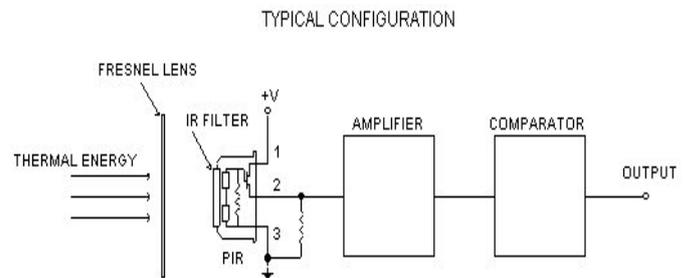


Fig 4.2 Internal structure of PIR

The PIR Sensor has a range of approximately 20 feet (6 meters). The sensor is designed to identify the slowly changing conditions that would happen normally as the day progresses and the environmental condition changes, but it responds by making its output when sudden changes occur, such as when there is motion. This device is designed mainly for indoor use. Operation outside or in very high temperatures may affect stability negatively. Due to the high sensitivity of PIR sensor device, it is not recommended to use the same condition like rapid environmental changes and strong shock or vibration and also in not working in direct sun light or direct wind from a heater or air condition.

TABLE1. Pin representation of PIR sensor

Pin	Name	Function
1	+V	Power supply
2	Ground	Reference
3	Ground	Reference

-	GND	Connects to Ground or Vss
+	V+	Connects to Vdd (3.3V to 5V) @ ~100uA
OUT	Output	Connects to an I/O pin set to INPUT mode (or transistor/MOSFET)

B. PIC Microcontroller

PIC is a family of modified Harvard architecture microcontroller made by Microchip technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. The name PIC is referred to as "Peripheral Interface Controller". PICs are popular with both industrial developers and hobbyists due to their low cost, wide availability, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

Microchip introduced the new PIC32MX family of 32-bit microcontrollers operates at 2.3V to 3.6V supply voltage with 80 MHz frequency. The initial device line-up is based on the industry standard MIPS32 M4K Core. The device can be programmed using the Microchip MPLAB C Compiler for PIC32 MCUs.

PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory. The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count.

The main advantage of CMOS is that it has immunity to noise than other fabrication techniques. Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877.

TABLE 2. Various PIC Microcontrollers

PIC MCU device	PIC MCU No. of Pins	PIC MCU Flash memory
12F675	8	1k
16F88	18	4K
16F877A	40	8K

C. GSM

The GSM stands for Global System for Mobile Communications. In this technology is used to the communication purpose; it operates at a baud rate of 9600bps in standard UART model through AT Commands. This GSM Modem can accept any of the 2G or 3G network operator SIM card and act like as mobile phone with its unique phone number.

Advantage of using this GSM modem will be that it can use RS232 port to communicate and develop embedded security applications or any other applications.

This modem used to SMS Control, data transfer, remote control and logging can be developed easily. The modem can either be connected to PC serial port directly or microcontroller. It can be mainly used to send and receive SMS or make/receive voice calls. This GSM modem is a highly flexible for plug and play quad band GSM modem for direct and easy integration to RS232 applications.

AT commands are also noted as Hayes AT commands. There are many views to understand the meanings of "AT". Some call it "Attention telephone", whereas others understand as "Attention Terminal" commands. AT commands giving instructions to both mobile phone and normal landline telephones.

The AT commands are sent to the phone's modem, which can be a GSM modem or PC modem. Different producer may have different sets of AT commands. Luckily, many AT commands are the same commands. Mobile phone manufactures may also provide with attention to operators to allow or not to allow some commands on phones. List of AT commands are listed in TABLE 3.

TABLE 3. AT commands

AT command	Meaning
AT+CMGS	Send message
AT+CMSS	Send message from storage
AT+CMGW	Write message to memory
AT+CMGD	Delete message
AT+CMGC	Send command
AT+CMMS	More messages to send

D. CCTV camera

Closed-circuit television (CCTV) is the use of video cameras to transmit a signal to a specific place, on a limited set of monitors. It differs from broadcast television in that the signal is not openly transmitted, though it may employ point to point (P2P), point to multipoint, or mesh wireless links.

E. Keypad

Keypad is used for multiple purpose .It can be used for automatic time setting, manual time setting ,activation and deactivation of sensors at particular duration of time.

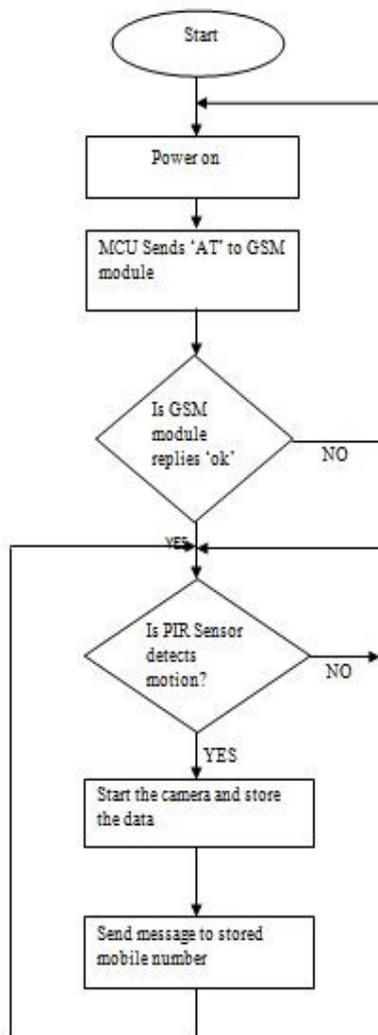


Fig 4.1 Flowchart representation

V. CONCLUSION

In this surveillance security system PIR sensor has been used which is low power, and low cost. It have a wide lens range, and are easy to interface with microcontroller. This

security system can be implemented in places like home, office, shop etc. The sensitivity range for detecting motion of this system is 3to 4 feet. It can be raised up to 20 feet through careful using the 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.

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