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Implementation of Industrial Security System using Motion estimation and Visual identification

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Abstract: 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. In this paper we design a home embedded surveillance system which evaluates the development of a Low-cost security system using small PIR (Pyroelectric Infrared) module and piezo sensor built around microcontroller. Presence of individual is detected when the system senses the signal generated by many sensors and image capturer. The system triggers an alarm detecting the presence of unauthorized person in a specific interval of time and simultaneously sends a message to the MS through GSM Modem. When the embedded 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. Test performed gave promising results.

Keywords: PIR Module, piezo sensor, GSM Modem, CCTV Camera, ATMEGA 32, Fresnel lens, wiring system.

I. INTRODUCTION

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.

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.

Pyroelectric device, such as the PIR sensor, have an element made of a crystalline material that generates an electrical change when exposed to infrared radiation. The changes in the amount of infrared striking the element changes the voltage generated, which are measured by an amplifier. The device contains a special filter called a Fresnel lens, which focuses the infrared signal into the element.

A person entering a monitored area is detected when the infrared energy emitted from the intruder's body is focused by a Fresnel lens and this output is given to the microcontroller thus an Buzzer is on to indicate someone is near the device.

Piezoelectric sensor is a device that uses Piezoelectric effect to measure pressure, force and acceleration by converting them to an electrical charge.Used wiring systems for outdoor properties like gas cylinders, two wheelers to protect against theft of these items. The communication between the user and the home is established by the SMS (Short Message Service protocol.

A GSM modem is connected to the home automation system. The communication between the home automation system and the GSM modem is carried out by the AT (Attention) commands.

Organisation of the Paper

Session 1 gives the brief introduction of Block diagram and its working .Session 2 Gives an explanation of each and every Block. Results are explained in Session 3. Conclusion and future scope is explained in Session 4.

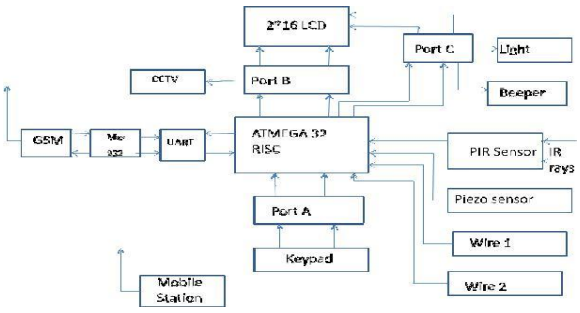

Figure1: Block diagram of surveillance system using PIR, Piezo sensor.

Designing this system for home Embedded Surveillance.as shown in fig 1 contains following components.

ATMEGA 32 RISC Processor,PIR Sensor, Piezo sensor, 2*16 LCD display, Keypad, GSM Modem, Beeper, LED Mobile Station, CCTV Camera and wiring system.

This work uses ATMEGA 32 RISC Microcontroller which has 4 identical inbuilt ports namely PORTA, PORTB, PORTC and PORTD. The sensors, keypad and wiring system are the inputs connected which can be connected to any of the ports.

II. WORKING OF SYSTEM

Port A (PA7….PA0): Port A serves as the analog inputs to the A/D Converter. Port A also serves as an 8-bit bi-directional I/O port, if the A/D Converter is not used. (PC7….PC0):

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Port B (PB7….PB0): Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit).

Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. Port D (PD7….PD0): Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit).

Pir Sensor: PIR Sensor is an electronic device which measures infrared light radiated from objects present in its vicinity. PIR Sensor is also known as motion detector.PIR is basically made of Pyroelectric sensors to develop an electrical 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. The Pyroelectric sensor is made of a crystalline material that generates a surface electric charge when exposed to heat in the form of infrared radiation. When the amount of radiation striking the crystal changes, the amount of charge also changes and can then be measured with a sensitive FET device built into the sensor. The sensor elements are sensitive to radiation over a wide range so a filter window is added to the TO5 package to limit detectable radiation to the 8 to 14mm range which is most sensitive to human body radiation. Typically, the FET source terminal pin 2 connects through a pull down resistor of about 100 K to ground and feeds into a two stage amplifier having signal conditioning circuits. The amplifier is typically bandwidth limited to below 10Hz to reject high frequency noise and is followed by a window comparator that responds to both the positive and negative transitions of the sensor output signal. A well filtered power source of from 3 to 15 volts should be connected to the FET drain terminal pin 1.It has a Single bit Output.ItsSmall size makes it easy to conceal.It is Compatible with Parallax Microcontroller.It operates in the range of 3.3V & 5V with <100µA current draw.

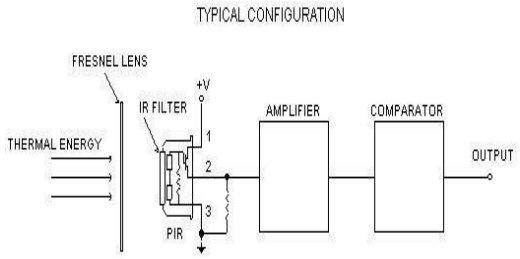

Figure 3: Internal structure of PIR

The PIR325 sensor has two sensing elements connected in a voltage bucking configuration. This arrangement cancels signals caused by vibration, temperature changes and sunlight. A body passing in front of the sensor will activate first one and then the other element whereas other sources will affect both elements simultaneously and be cancelled. The radiation source must pass across the sensor in a horizontal direction when sensor pins 1 and 2 are on a horizontal plane so that the elements are sequentially exposed to the IR source. A focusing device is usually used in front of the sensor.

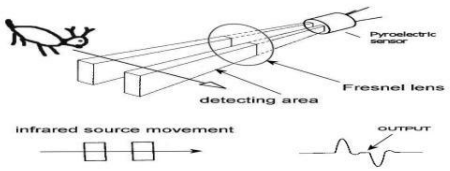

Figure 4: Detection of IR rays using PIR Piezo Sensor.

Piezosensor is a pressure base sensor. Piezo sensoris a device which uses piezoelectric effect to measure pressure, acceleration, force by converting then to electrical charge. Piezo electric effect is one in which electric charge gets accumulated in solid materials (ceramic, quartz crystal) on applying mechanical stress. Based on piezoelectric technology various physical dimensions can be measured, the most important include pressure and acceleration. For pressure sensors, a thin membrane with known dimensions and a massive base is used; assuring that an applied pressure specifically loads the elements in one direction.zener diode for regulation of voltage.

LCD: The Hitachi LM018L is a 40 character x 2 line reflective type Liquid Crystal character display module. It includes a built-in LSI controller HD44780 which provides a range of features, including Display Clear, Cursor Home, Display On/Off, Cursor On/Off, Character Display Blink, Cursor Shift, Display Shift. The module can be directly interfaced to a 4-bit or 8-bit MPU.

Interfacing Of LCD with Atmega 32

Here to interface LCD with Avr, a 4 bit data bus is required. In addition we need 2 bit control bus for write only mode or 3 bit control bus for Read plus write mode. Connect pin 1 of the LCD module to ground, pin 2 to positive supply. Connect a Pot (2 to 5 K Ohm) across the supply and ground. Connect the middle pin of the pot to pin3 of LCD module. If want to light up the back light, connect the –LED pin to ground. Connect the +LED pin of the LCD to the positive supply using a resistor.

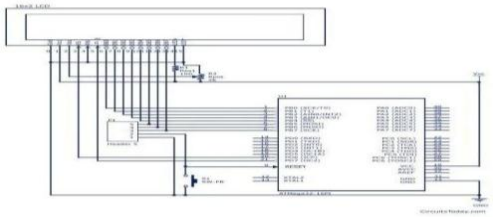

Figure 6: Interfacing of LCD with MC

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.

CCTV systems may operate continuously or only as required to monitor a particular event.

GSM MODEM: Global System for Mobile communications (GSM: originally from Group Special Mobile) is the most popular standard for mobile phone in

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the world. GSM/GPRS Smart Modem is a multi-functional, ready to use, rugged and versatile modem that can be embedded or plugged into any application. The Smart Modem can be customized to various applications by using the standard AT commands. The modem is fully type-approved and can directly be integrated into your projects with any or all the features of Voice, Data, Fax, SMS, and Internet etc.

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.

III. RESULTS

The proposed prototype system is implemented and tested for the desired functionalities. The LEDs and the alarm are employed to indicate the to indicate the presence of unauthorized person . The system made 5 calls to a pre-specified cell phone number in 5 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. This system yielded efficient result.

General Settings:
Parent = [1x1 videoinput]
Selected = on
SourceName = input1
Tag = [0x0 string]
Type = videosource

Device Specific Properties:
Backlight Compensation = on
Brightness = 0
Contrast = 10
Exposure = -4
FrameRate = 30.0000
Gamma = 130,Saturation = 4
Sharpness = 4, White Balance = 6500.

IV. CONCLUSION AND FUTURE SCOPE

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 3to 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.

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BIOGRAPHY

Mirza Hafez Baig is pursuing Masters degree in Electronics and Telecommunication Engineering from Shreeyash College of engineering Aurangabad.