

Conceptual Study of Pyroelectric Infrared (PIR) based Security System with Minimum Power Consumption

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Abstract -The working of the Room Monitoring System Using PIR Sensor depends upon the infrared Radiation. The house security system becomes the best solution to overcome house intrusion problem when user is not in house. The infrared motion detector is capable to detect the motion while the PIR is capable to control the whole operation of the security system. Pyroelectric infrared (PIR) Sensor Module for human body detection circuit. High sensitivity and low noise output is a standard 5volt active low output signal. Module provides an optimized circuit that will detect motion up to 6 meters away and can be used in burglar alarms and access control system. Inexpensive and easy to use, it's ideal for alarm systems, motion – activated lightning, holiday props, and robotics applications. The output can be connected to microcontroller pin directly to monitor signal or a connected to transistor to drive DC loads like a bell, buzzer, siren, relay. The PIR sensor and Fresnel lens are fitted on to the PCB. This enables the board to be mounted inside a case with the detecting lens protruding outwards.

Key Words: PIR Sensor, Energy Saver, PCB

1. INTRODUCTION

Automatic switch means the switch will turn on and turn off itself and no need to control manually by human. Most of the automatic switch will be controlled by electronic devices such as sensor. In this project PIR Sensor act as switch, when a person enter the monitored area the infrared energy emitted from the intruder's body will detected by the PIR and turn on the light and vice versa when the person leave the monitored area. Automatic switch is needed to overcome electricity wastage due to negligence by user to turn off the electrical equipment in addition automatic switch also save human energy and make our life easier.

Room monitoring system is a system where the monitored area controlled or watched from other room or place which is known as monitored room. Room monitoring system is needed in huge places such as UMP that need constant monitoring to find out unused and used lecturer hall so that users will not have manually check the entire area. In this project when the intruder enter the room and

the PIR where activated a signal will be send to monitoring room using the radio frequency wave and the LED in monitoring room will turn on to indicate the presence of intruder in monitored area. By having this system lecturer and student can save their time and energy.

2. COMPONENT DETAILS

2.1 RESISTERS:

A Resistor is a heat-dissipating element and in the electronic circuits it is mostly used for either controlling the current in the circuit or developing a voltage drop across it, which could be utilized for many applications. There are various types of resistors, which can be classified according to a number of factors depending upon:

- I. Material used for fabrication
- II. Wattage and physical size
- III. Intended application
- IV. Ambient temperature rating
- V. Cost

Basically the resistor can be split in to the following four parts for the construction viewpoint.

- (1) Base
- (2) Resistance element
- (3) Terminals
- (4) Protective means.

The following characteristics are inherent in all resistors and may be controlled by design considerations and choice of material i.e. Temperature co-efficient of resistance, Voltage co-efficient of resistance, high frequency characteristics, power rating, tolerance & voltage rating of resistors. Resistors may be classified as

- (1) Fixed
- (2) Semi variable
- (3) Variable resistor.

In our project carbon resistors are being used.

2.2 CAPACITORS

The fundamental relation for the capacitance between two flat plates separated by a dielectric material is given by:-

$$C=0.08854KA/D$$

Where: - C= capacitance in pf.

K= dielectric constant

A=Area per plate in square cm.

D=Distance between two plates in cm

Design of capacitor depends on the proper dielectric material with particular type of application. The dielectric material used for capacitors may be grouped in various classes like Mica, Glass, air, ceramic, paper, Aluminum, electrolyte etc. The value of capacitance never remains constant. It changes with temperature, frequency and aging. The capacitance value marked on the capacitor strictly applies only at specified temperature and at low frequencies.

2.3 LED (Light Emitting Diodes)

As its name implies it is a diode, which emits light when forward biased. Charge carrier recombination takes place when electrons from the N-side cross the junction and recombine with the holes on the P side. Electrons are in the higher conduction band on the N side whereas holes are in the lower valence band on the P side. During recombination, some of the energy is given up in the form of heat and light. In the case of semiconductor materials like Gallium arsenide (GaAs), Gallium phosphide (Gap) and Gallium arsenide phosphide (GaAsP) a greater percentage of energy is released during recombination and is given out in the form of light. LED emits no light when junction is reversing biased.

2.4 TRANSISTORS

A transistor consists of two junctions formed by sandwiching either p-type or n-type semiconductor between a pair of opposite types. Accordingly, there are two types of transistors namely: -

- (1) n-p-n transistor
- (2) p-n-p transistor

2.5 TRANSFORMER

The transformer is a static electro-magnetic device that transforms one alternating voltage (current) into another voltage (current). However, power remains the same during the transformation. Transformers play a major role in the transmission and distribution of ac power.

2.6 RELAY

In this circuit a 12V magnetic relay is used. In magnetic relay, insulated copper wire coil is used to magnetize and attract the plunger. The plunger is normally connected to N/C terminal. A spring is connected to attract the plunger upper side. When output is received by relay, the plunger is attracted and the bulb glows.

3. SETUP

The Passive Infrared Sensor PIR will, under typical conditions, detect human being moving around within approximately 10 meter from the sensor. This is an average value as the detection range is between 5m and 12m. From Fig 1, the performance of the sensor is determined primarily by environmental conditions. No guarantees can be offered regarding the detection range. However the range is typically sufficient for the majority of interior spaces. Some garages may be large enough that one sensor cannot cover that whole area.

The sensor has a horizontal 110° vertical 60° field of view. The main blind spots are above below or behind the sensor itself. Typically the ideal placement in an environment is the upper corner of a room, facing slightly towards the ground. Try to cover typical paths through the room focusing particularly or likely entry and exit points. If the room has several entry points try to cover as many of this as practicable. Try to mix it up a bit. Do not install the PIR sensor in direct sun light or near any device which needs heat or cold such as air conditioners, refrigerators, ovens, heaters, microwaves or other electronic equipment's which generates heat as a by-product of operation. Replace the batteries in the units regularly.



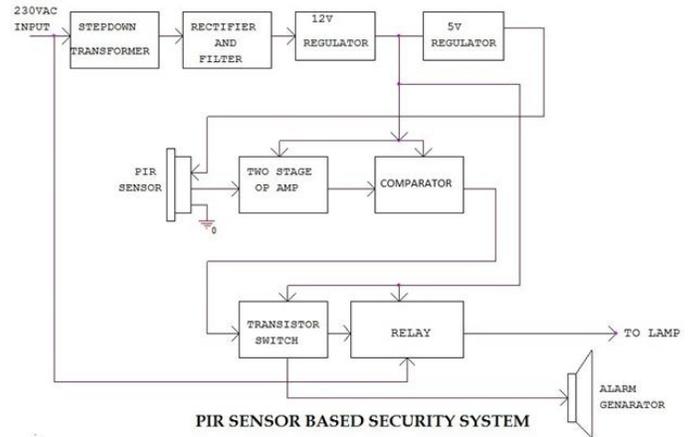
Fig.1 PIR Sensor

3.1 TECHNICAL PARAMETERS

- Power I/P supply: 5 to 12V DC ,31 mA maximum
- Static current: ≤100 mA
- Transmission currents: ≤20mA
- Frequency: 16-433MHZ
- Transmission distance: 1 to 80m
- Detection speed: 0.2 to 7 m/s(0.6 to 23ft/second)
- Detective distance: 5-12M
- Detective range: Horizontal 110° vertical 60°
- Operating temperature: -10°C to 50°C
- Sensor type: Dual Rectangular, low noise ,high sensitivity
- Coverage 110°(standard): 10.6m X 10.6m (35ft X 35ft)
- Lens: 2nd Generation Fresnel lens, LODIFF®, segments
- Alarm output: N.C 28V DC 0.15A
- Strtup: 35second
- Alarm Indication: Green LED ,constant light for 3seconds
- Humidity: 95% maximum.

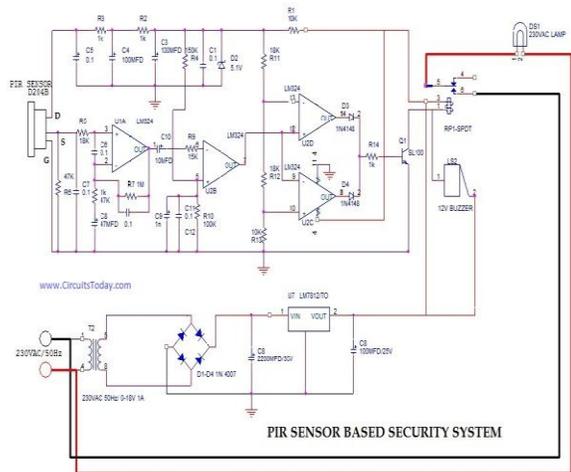
3.2 BLOCK DIAGRAM

The Block Diagram of the PIR based security system is given below:

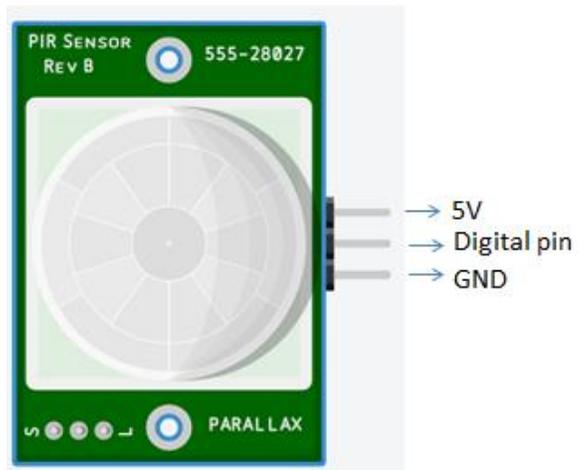


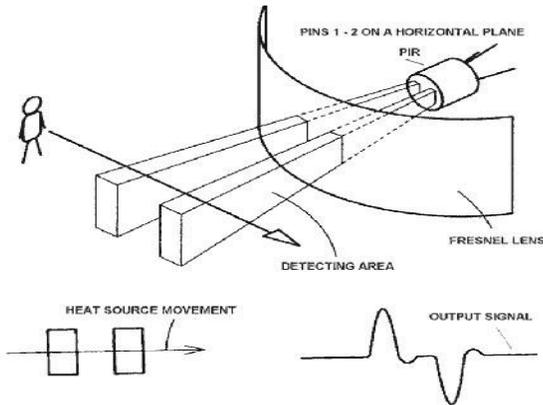
3.3 CIRCUIT DIAGRAM

The circuit diagram of PIR sensor based security system is:



4. WORKING OPERATION OF PIR

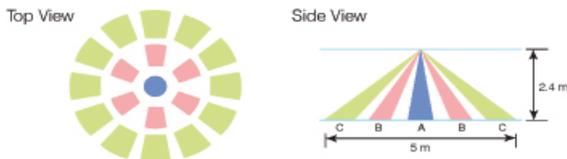




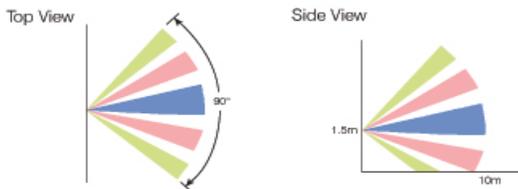
The PIR motion sensor is a passive infrared motion sensor, meaning it detects infrared radiation rather than projecting it (unlike a security camera with infrared night vision, which is active infrared). All objects emit this “black body radiation” and the infrared sensor looks for any of this radiation which moves. The PIR motion sensor is not infallible-in particular; it can’t detect objects/people which are the same temperature as their background. So a human being moving about on an extremely hot day might go unnoticed. Also, a security camera with active infrared night vision in the same vicinity as the infrared sensor may give false alarm.

4.1 PLACING THE PIR MOTION SENSORS:

Ceiling Mount



Wall Mount



The PIR motion sensor has an effective range of between 16ft/5m and 50ft/15m depending on the specific conditions of the environment. Typically, the sensor will have a longer range in colder conditions or in evenly heated environment.

4.2 ADVANTAGE

- A PIR Sensor is a Passive Infrared Sensor which controls the switching on/off of the lighting load when it detects a moving target.
- The built in sensor turns on/off the connected lighting load when it detects motion in the coverage area. It has different working principle during the day time and the night time.
- During the day, the built in photocell sensor saves electricity by deactivating the lighting load connected to the sensor.
- During the night the connected lighting load is turned on by adjusting the luminosity knob (LUX).
- An adjustable time knob lets you select how long the light stays on after activation.

4.3 DISADVANTAGE

- Any obstacles in between the sensor & the target will limit the sensor’s coverage area& not give the desired result.
- Any kind of moving object will trigger the sensor.

4.4 FUTURE DEVELOPEMENT

- At large these systems not only help us but our neighbourhoods and society also, as it reduces the wastage of water by cutting down any further overflows than what you need.
- This system can also help in saving the electrical energy by making automatic switching of electrical motor when there is no water in main pipeline or when water overflows.

5. RESULT & CONCLUSION

This chapter will briefly discuss on the results and discussions of the hardware development. There are three major modules in developing the hardware structure which are the active infrared motion detector circuit, keypad module circuit, and the most important; the PIR circuit. The hardware development of the active infrared motion detector system is divided into two parts, which are the infrared emitter circuit and the infrared detector component. During the project we learned many electrical and electronics components as well as to work in groups. We are now able to understand the need for proper planning and organized actions and we hope that this project will help us in our near future.

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6. REFERENCES

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