International Journal of Engineering Research and Development
e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com
Volume 12, Issue 5 (May 2016), PP.23-28

PIR Sensor Based Robot With HMH Applications

Kankata Venkateswara Rao[#1], Ponnuru Koteswara Rao[#2], B Ravi[#3]

[#1,2,3]*Assistant Professor, Dept.of ECE, SRK Institute of Technology, Enikepadu, Vijayawada*

[1]kankata.venkat@gmail.com, [2]kosw.10@gmail.com,[3]rathodegec@gmail.com

Abstract: Until now we have come across many types of sensors which are being employed in almost all the fields separately (viz., entertainment, safety). To witness the world that a single sensor can be used in multiple applications namely security, safety, user-friendly, rescue which is called PIR (Passive Infrared) sensor which detects the reflected Infrared rays from Humans as the temperature of Humans is different. So when temperature is detected then a buzzer, LCD, GSM, Virtual Keyboard are activated depending on the applications. Here we have three applications using PIR sensors likeHMH **(**Home, Military and Hotel)where at home it is used for detecting humans and then switch ON the lights & fans. In Military applications the robot is used at borders to detect enemies and then warn us about enemies using buzzer& send a message to us using GSM. In Hotels it is used as a steward to carry the things and then go and detect customers and give the thing present on it, and when it is taken from it again it goes back to its position. A menu card will be present on it with items having a defined numbers and customers just need to press the number using virtual keyboard and it will be displayed on LCD and then it goes back to its position and then next order will be taken. User friendly applications are like keeping things on it and then sending to the persons present somewhere in the home or any other work place. This application can be used during disasters like earth quakes, cyclones to rescue humans who are trapped under destroyed buildings.

I. INTRODUCTION

A passive infrared (PIR) sensor measures infrared light emitted from objects that generate heat, and therefore infrared radiation, in its field of view. Crystalline material at the centre of a rectangle on the face of the sensor detects the infrared radiation. The sensor is actually split into two halves so as to detect not the radiation itself, but the change in condition that occurs when a target enters its field. These changes in the amount of infrared radiation on the element in turn change the voltages generated, which are measured by an on-board amplifier. When motion is detected the PIR sensor outputs a high signal on its output pin, which can either be read by an MCU or drive a transistor to switch a higher current load.

What is actually detected is the broken field for a"normal" temperature. The field does not have to be broken by an object with a different temperature in order to register change, as highly sensitive sensors will activate from the movement alone. Designed for use at ambient temperatures of 15°C to 20°C, at higher temperatures the field of view narrows, and if below 15°C, the field of view widens and small or distant objects can activate the sensor.

All objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually this radiation is invisible to the human eye because it radiates at infrared wavelengths, but it can be detected by electronic devices designed for such a purpose. The term *passive* in this instance refers to the fact that PIR devices do not generate or radiate any energy for detection purposes. They work entirely by detecting the energy given off by other objects. PIR sensors don't detect or measure "heat"; instead they detect the infrared radiation emitted or reflected from an object. A PIR-based motion detector is used to sense movement of people, animals, or other objects. They are commonly used in burglar alarms and automatically-activated lighting systems. They are commonly called simply "PIR", or sometimes "PID", for "passive infrared detector".An individual PIR sensor detects changes in the amount of infrared radiation impinging upon it, which varies depending on the temperature and surface characteristics of the objects in front of the sensor. When an object, such as a human, passes in front of the background, such as a wall, the temperature at that point in the sensor's field of view will rise from room temperature to body and then back again. The sensor converts the resulting change in the incoming infrared radiation into a change in the output voltage, and this triggers the detection.

II. BLOCK DIAGRAM

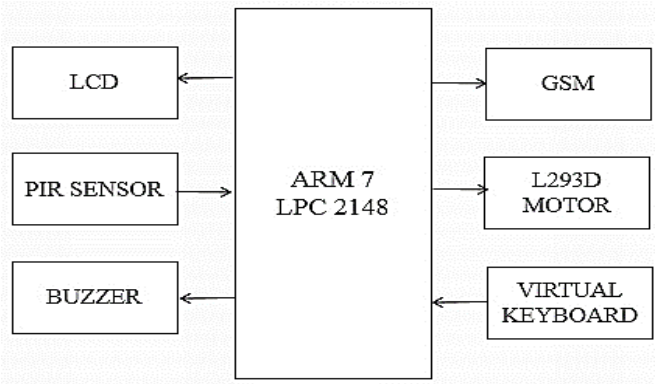

Fig: Block Diagram (Components & Modules)

III. Real Time Applications

Commonly used in security lighting and alarm systems in an indoor environment, PIR sensors have a range of approximately 6 meters, depending on conditions. The sensor adjusts to slowly changing conditions that occur normally within the environment, but shows a high-output response when a sudden change takes place.

Fig: Military & Rescue Purpose

Generally speaking, PIR sensors are small, inexpensive, low power, rugged, have a wide lens range, are easy to interface with, and are easy to use. Their best feature is that they don't wear out. While they may be easy to use, they are also fairly complex, since many variables that can change the sensor's input and output must be considered.

Fig: User-Friendly Purpose

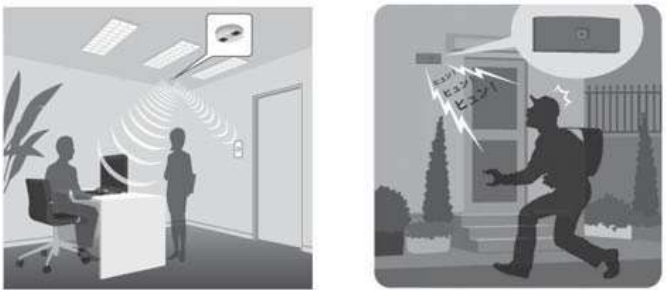

Fig: Home & Offices purpose

The PIR sensor is a solid state device made of ¼ inch pyroelectric material as a thin film. The pyroelectric material may be Gallium nitride (GaN), Cesiumnitrate(CsNO3), Cobalt phthalocyanine, Lithium tantalite (LiTaO3) etc. They show both piezoelectric and pyroelectric properties. The sensor is made as part of the integrated circuit having 1 – 4 pixels of pyroelectric material. The paired pixels are connected to the inputs of a differential amplifier. The differential amplifier cancel each other the PIR measurements and the average temperature in the field of view is removed from the electrical signal. So that the IR energy on the sensor will not trigger the alarm. This prevents false triggering when exposed to flashes of light. The differential amplifier also minimizes the common mode interference from electric fields.The circuit in the PIR sensor can be connected to a relay switch and the sensor resets at power on and remains standby.

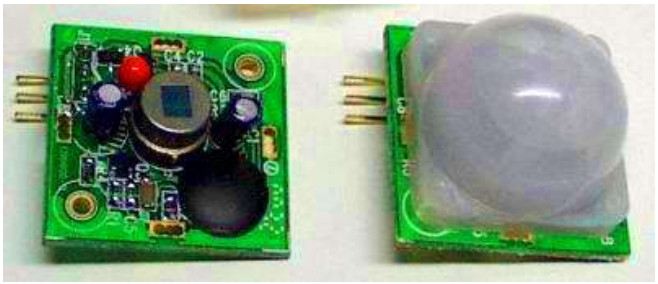

Fig: PIR Sensor

When a person enters within the range of the Sensor, The Fresnel lens focus the IR energy into the sensor which had previously sensed the cooler area. This change in energy level makes the sensor warmer and makes a hot spot in it. The Module then gives around 3 volts (Check the output. In some makes, output is active low).

If the person tries to mask the sensor with some shield, the sensor develops a cold spot which also activate the alarm. Thus the PIR sensor is fail proof.

Fig: At Hotels

3.1 Working of PIR Sensor based Security Alarm System:

1. Switch on the circuit initially.
2. The PIR sensor is powered and it detects the IR rays emitted from any human.
3. This PIR sensor has a range of 5meters. One can adjust the pot provided for the sensor to vary this distance.

4. When any human is detected, this PIR sensor outputs a logic high value i.e. voltage of 3.5v to 5v.
5. This voltage is applied as input to the siren generator IC.

Fig: In Rescue Applications

The GSM used here is SIM 900 Module which is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications.The SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption.

This GSM is used during Military Applications as a Defense purpose, where when an enemy is detected at the border then automatically the PIR sensor detects Human and then sends the message using GSM to caution them that enemy is being entered in their region.

Fig: GSM Module

The LCD Module used here is LM016l which is a 16x2 LCD, used at Hotels to display the message & ordered Item number by the customers present in Hotel , and this PIR based Robot detects Humans present at tables and then serves them the items which have been ordered using the Menu card kept on the Robot.

Fig: LCD 16x2 LM016L

3.2 ADVANTAGES:

- Small in size&User-friendly.
- Less cost.&Low power consumption.
- Wide Lens range approximately 6 meters.
- The system is single ended, unlike light beam/laser barriers, which require aligned transmitters and receivers.
- The system is passive: Intruders can't detect the presence and location of the detectors.
- The detectors consume less power than IR- or radar-based units.
- They are unaffected by light, with the detectors working equally well day or night.
- Precision optics enable detectors to cover narrow areas accurately.
- The detectors complement cameras, allowing fewer cameras to cover the area.
- Small size and unobtrusive design help the detectors blend in with their surroundings.

3.3 DISADVANTAGES:

- Incapable of distinguishing between objects that irradiate similar thermal energy levels.
- Insensitive to very slow motions or the object (i.e. a body) in standing mode.
- Doesn't work well when the ambient temperature is 7°C below body temperature (30°C), as the detector reacts to the contrast between moving objects and a stationary background.

3.4 APPLICATIONS:

- This can be used in the museums to protect the valuable things.
- This can also be used as an automatic doorbell circuit that rings the bell when human is detected.
- This can be used in defence applications to detect the humans in war field.
- This can be used in Hotels for serving purposes.
- This can be used in Rescue purposes to find humans during Natural Disasters.

REFERENCES

[1]. http://en.wikipedia.org/wiki/Passive_infrared_sensor
[2]. http://www.instructables.com/id/PIR-Motion-Sensor-Tutorial/
[3]. http://electronics-lab.com/projects/sensors/012/index.html
[4]. http://www.electronicshub.org/pir-sensor-based-security-alarm-system/
[5]. http://www.codekoala.com/posts/pir-motion-sensor-lcd-screen-arduino-uno/
[6]. http://www.circuitstoday.com/pir-sensor-based-security-system
[7]. https://www.elprocus.com/pir-sensor-basics-applications/
[8]. http://www.engineersgarage.com/articles/gsm-gprs-modules
[9]. https://embeddedcenter.wordpress.com/ece-study-centre/display-module/lcd-16x2-lm016l/
[10]. http://en.wikipedia.org/wiki/Projection_keyboard
[11]. http://www.dailymail.co.uk/news/article-2261767/Robot-Restaurant-Robots-cook-food-wait-tables-Harbin.html

K.Venkateswara Rao, was born in 1985 in Andhra Pradesh, India.He received his B.Tech, from SSIET under the control of JNTU, KAKINADA in 2006 and MTech-VLSI Design degree from Aditya Engineering College in 2012.Now he is working as an Assistant professor of ECE department in SRK Institute of Technology, Vijayawada,Andhra Pradesh, India. His research area of interest includes VLSI Design and Antenna and wave propagation.

P.Koteswara Rao, was born in 1988 in Andhra Pradesh, India. He received his B.Tech, from Vignan's Engg.College under the control of JNTU, KAKINADA in 2009 and M.Tech-VLSI & EMBEDDED SYSTEMS degree from Sri Vasavi Engineering College in 2011.Now he is working as an Assistant professor of ECE department in SRK Institute of Technology, Vijayawada, Andhra Pradesh, India. His research area of interest includes VLSI Design and Embedded Systems.

B.Ravi, was born in 1982 in Andhra Pradesh, India. He received his B.Tech, from V R Sidhartha Engg.College under the control of ANU, GUNTUR in 2003 and M.Tech-DECS degree from Gudlavalleru Engineering College in 2009.Now he is working as an Assistant professor of ECE department in SRK Institute of Technology, Vijayawada, Andhra Pradesh, India. His research area of interest includes VLSI Design and Embedded Systems.