

Human Detection Robot using PIR Sensors

Saravana Kumar K , Priscilla P, Germiya K Jose , Balagopal G

Abstract: Human Detection Robot is a robot that can detect the presence of human; it sends the signal from the transmitter side to the receiver side and notifies it to the user by continuous buzz. Robot can move in all direction to increase the space of detection. The robot is automated to move in left, right, forward and backward directions based on the obstacles it encounters.

Keywords— Infrared Signals, PIR sensor, Obstacle sensor, Radio Frequency Transmitter and Receiver, SONAR.

I. INTRODUCTION

In these days there are lot of robberies happening, so we need more security. The security system commonly used is ordinary surveillance camera it provides visual images but the ordinary surveillance camera cannot notify the user instantly about unauthorized presence. To overcome robbery and to notify the user as quickly as possible we developed a robot that can detect human. As the robot can detect the human it is named Human Detection Robot.

This robot can be used in jewelry stores, banks, etc. to provide security after hours. It can also be used in earthquake areas to find victims and also in army to detect the opponent.

II. RELATED WORK

Detecting the presence of human can be done in different techniques and methodologies. One such technique is using a PIR sensor to find the direction of movement by the concepts of polarization [1]. Another technique by using PIR sensors along with Symbolic Dynamic Filtering on seismic waves, from these seismic waves the features were extracted using SDF and checked if presence is of vehicle or animal/human. After classifying, it is further classified between human or animal along with their movement type (running, walking) [2]. There is a technique which focus on use of PIR sensors to detect human beings. Once the result obtained, the features can be extracted using wavelet packet entropy (WPE), the features are classified using LS-SVM (Least Square-Support Vector Machine), which classified between human and non-humans [3]. Another module is the movement of the robot that can be done manually [4] [5] or automatically [6] [7].

III. WORKING PRINCIPLE

The Robot has two sides, receiver side and the transmitter side. The transmitter side consists of ATMEGA328 microcontroller (Arduino Uno); the inputs to the microcontroller are PIR sensor, and an Obstacle sensor. The outputs are RF transmitter and L293D motor drive module, to which a DC motor is connected.

A DC motor is used to move the robot in left, right and forward and backward directions. L293D motor drive module controls the DC motor to move in the direction. The direction of the

movement is decided from the signals given by the obstacle sensors.

Obstacle sensor uses infrared signal to find if there are any obstacles present in front of it, its range is up to 5 cm. The obstacle sensors are placed in front, right and in left directions. If any sensors sense any obstacle it changes to the direction where there is no obstacle. This makes the robot move automatically without external source controlling it.

Human can be detected using a PIR sensor. A PIR sensor is a sensor that produces passive infrared signals, these signals can detect heat. Human being produces heat which is detected using this sensor. Human being produces 9 to 10 microns of heat. A PIR sensor's angle of detection is restricted to 180° i.e. except the area below the robot it can sense in all the other directions. The distance up to which PIR sensor can detect is restricted within 12 ft. As the sensor's range is less, the sensor is mounted to a robot that can move automatically. If the sensor detects the human, it sends the signal to the RF transmitter to produce Radio Frequency signals. Radio Frequency signals can travel up to 200 ft. The diagram below shows the connectivity for the transmitter side.

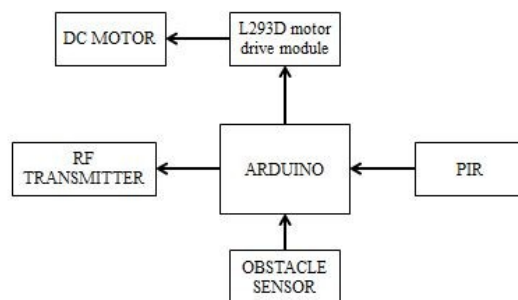


Fig.1 Transmitter Side (Robot Side)

The Receiver Side consists of ATMEGA328 microcontroller (Arduino Uno). Its input and output are Radio frequency receiver and a buzzer respectively. Once the signal from the transmitter is received by the RF receiver it notifies the Arduino. Arduino in turn sends a signal to the buzzer, which triggers the buzzer to produce continuous beeps. This continuous beep indicates that there is a presence of a human to the user. The diagram below shows the connectivity for the receiver side.

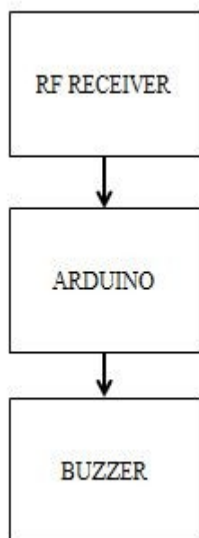


Fig.2 Receiver Side

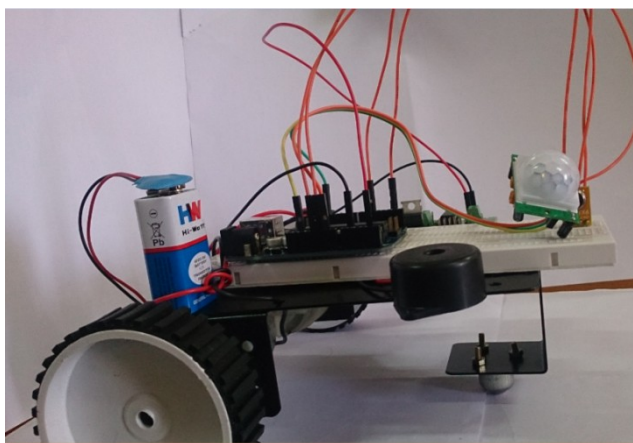


Fig.3 Human Detection Robot

IV. COMPONENTS

PIR sensors:

PIR sensors are used to detect any object that radiates heat. It can detect humans, animals and other objects. Fresnel lenses are used in PIR sensors which increase the range of detection. These lenses are made up of translucent which capture the radiation from visible spectrum of light.



Fig.4 PIR sensor

Obstacle detection sensors:

The robot has obstacle sensor which can detect obstacles and helps in navigating without crashing. These sensors produce Infrared signals, if these signals hit any obstacles, the signals bounce back to the IR receiver, indicating it has found an obstacle.

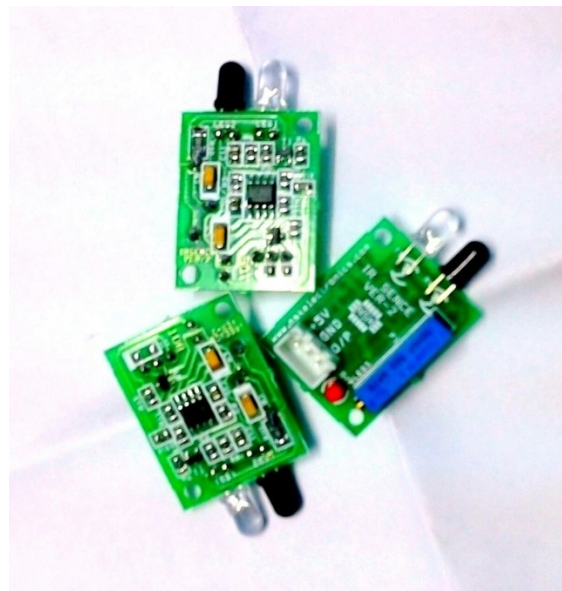


Fig.5 IR sensors

Buzzer:

A buzzer is an audio signaling device.



Fig.6 Buzzer

Radio Frequency transmitters:

The radio frequency transmitters transmit the radio frequency signals.

Radio Frequency Receivers:

The RF Receivers receive the radio frequency signals and demodulate it.

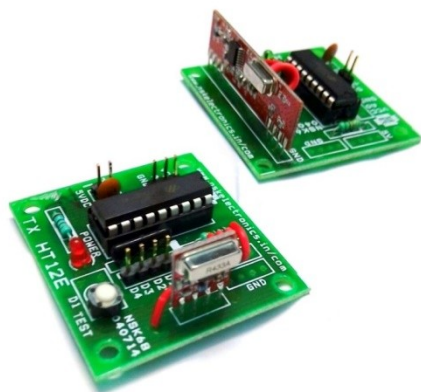


Fig.7 RF transmitter and receiver

ATMEGA328 microcontroller:

It's a high performance 8-bit AVR RISC microcontroller. It consists of a 32KB ISP flash memory, and it also consists of a read while write capability.

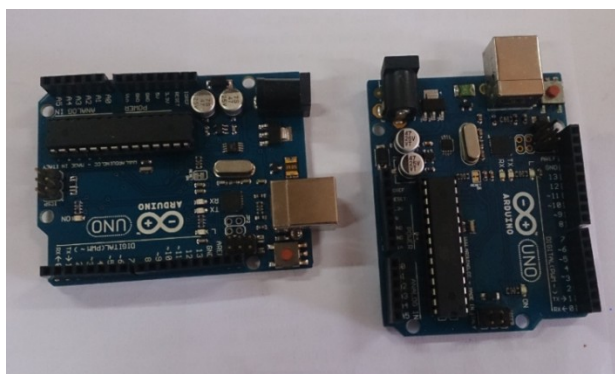


Fig.8 Arduino Uno

DC motor:

DC motor is an electric motor which converts the electrical energy into mechanical energy.

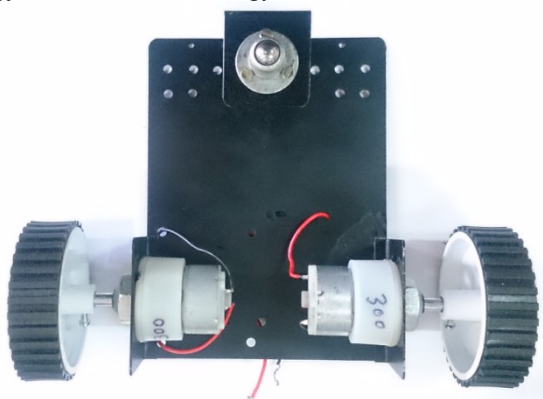


Fig.9 DC motor

L293D motor drive module:

L293D motor drive module is a motor driver which acts as a current amplifier. They take low current signals and then convert it into high current signal.

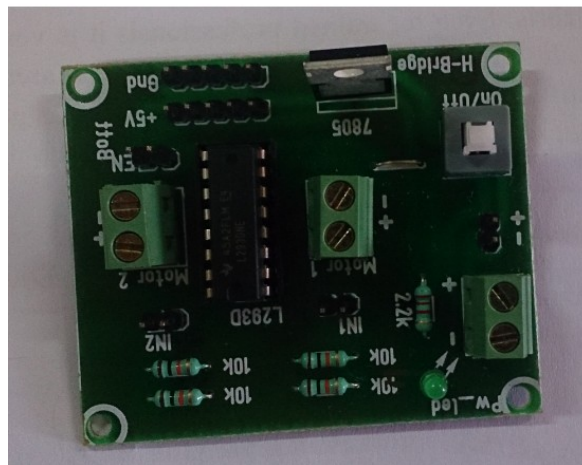


Fig.10 motor drive module

Batteries:

Battery is used to power the robot. The batteries used are 9 volts of battery.

The circuit diagram is given below:

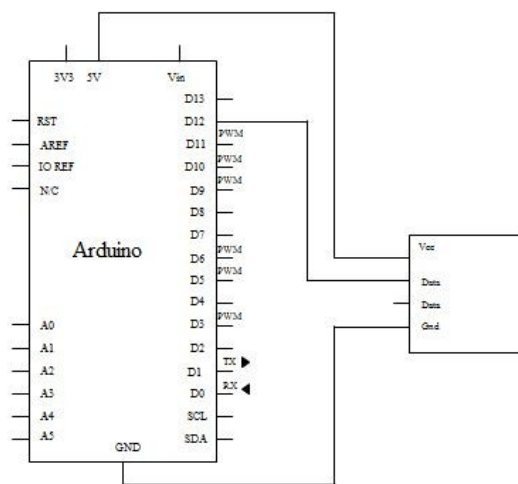


Fig.11 Receiver Side

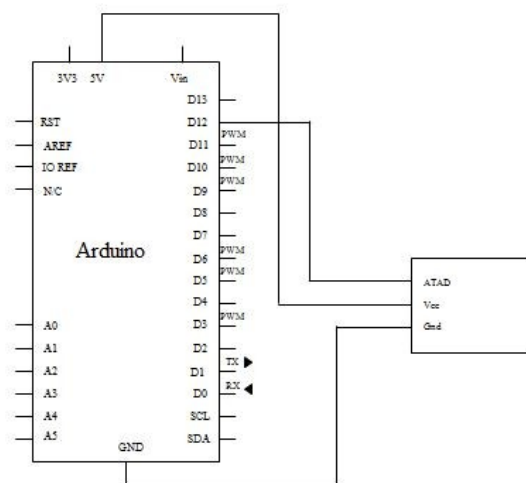


Fig.12 Sender Side

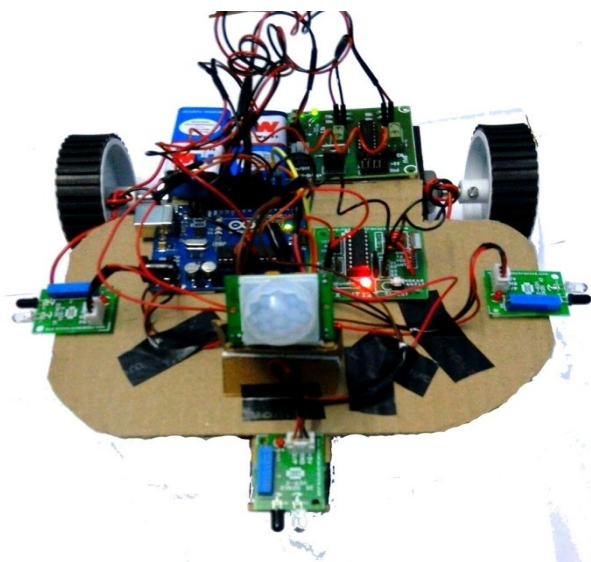


Fig.13 Robot while detecting the human.

V. EXPERIMENT AND RESULT

The Robot has to be tested under closed environment where the presence of sunlight is less, so the test was performed inside a room. The testing phase had two parts, the first one is testing for detecting a human and the second test is detecting any obstacle.

To test the robot for detection of human, it has to succeed the test conditions. The Robot was tested for its range by placing 5ft away from the human and the robot detected the presence of the human. Hence the first test was successful. The second test was checking the boundary conditions by placing the robot at 11ft and 12ft away from the human. It detected the presence of human being in both the ranges. The final test was to place the robot 13ft away from the human, where detecting is not possible and the Robot didn't detect it. Hence the phase of checking the range was successful. Second phase was to test the obstacle sensor. The robot was made to move in a room. If it sensed any obstacle in front of it, it robot moves in backward direction about 1ft and chooses to move in left or right direction. If any obstacle is sensed in right side then the robot changes its direction to left side and vice versa. The robot worked perfectly, without crashing itself.

VI. CONCLUSION

Human detection Robot is to provide more security for the users to protect their belongings from robbers. The robot can move in all the directions automatically without controlling it, which makes the system more effective to use. As the Robot can move, it covers lot of distance that reduces the use of many sensors or many robots. When the Robot finds a human it can notify the users by producing continuous beeps.

The Robot can be modified further by attaching a visual camera where the image of the intruder can be notified. If the robot is attached with SONAR (Sound Navigation And Ranging) it can determine the distance between the human and can detect the IR image of the object.

1. Associate Professor, Department of Computer Science, Christ University, Bangalore-560029.
2. Project student, II MCA, Department of Computer Science, Christ University, Bangalore-560029.
3. Project student, II MCA, Department of Computer Science, Christ University, Bangalore-560029.
4. Project student, II MCA, Department of Computer Science, Christ University, Bangalore-560029.

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,Sarmistha Mondal , ManasKr. Parai B.Tech students, Dept. of ECE, Siliguri Institute Of Technology, Sukna ,Darjeeling-734009(W.B), India