Human Detection using Robotic Surveillance with PIR Sensor

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***Abstract*— In general, security is an important crisis for every department all over the world. Security has become a major threat due to technological evolution. The security issues can be more vulnerable in departments like defense arbitary. It will result in risking the lives of soldiers. To avoid the security issues regardless of sectors, it is important to introduce security and safety system based on robotics. In this project, the designated robot continuously monitors the environment and provides the count of humans present in the surveillance area. It also transmits data to the server using IoT and through that the robot can be controlled. The robot also performs various processing techniques to obtain the humans with the help of WIFI camera.**

***Keywords* – security, robotics, surveillance, Iot, Wifi.**

I. INTRODUCTION

All objects and living things emits infrared rays above absolute zero temperature. This infrared rays are not visible to human beings by naked eyes, but this radiation can be detected by electronic devices designed for such a purpose. PIR sensors are called passive devices as they do not emit any energy to detect the presence of objects. They work entirely by detecting infrared radiation emitted by or reflected from objects. Due to their property of detecting infrared rays they are mostly used to detect motion of humans. They are having small, inexpensive, low-power, easy to use properties also they don't wear out. For that reason, they have become more common in home appliances and gadgets used businesses. They are also known by names like PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors. All objects radiate energy as function of their temperature relative to absolute zero which is in form of black body radiation rays. This black body radiation is detected by PIR sensors. The sensor responds to infrared radiation in the wavelength of 10μm. This is the approximate body temperature of people and animals. The word “passive” in the term “passive infrared” refers to principle nature of sensor. Proximity sensors must generate their own infrared radiation actively, which is interrupted or reflected by nearby objects whereas PIR doesn’t need to generate or emit any type of radiation. The PIR, or passive infrared, detectors are most commonly used in intruder alarm systems. A PIR is more likely to a remote thermal sensor. These infrared sensors/detectors are the secret inside motion sensor security lights that illuminate driveways when someone approaches. Infrared is outside our eyes’ light-detecting abilities.

II. IMPLENTATION

A. Proposed system

In the proposed system, we are overcoming the major drawback from the existing system by using the ultrasonic sensor to find any obstacle present in the path of the robot.

The Pir sensor is used to identify the presence of human in that area. The details from the sensors are continuously fed to the microcontroller and from there the details will be uploaded to the server through Iot module. The Iot module is used to control the robot.In addition to that Wifi camera is fixed at the top of the robot to capture the videos of the area and upload to the server.

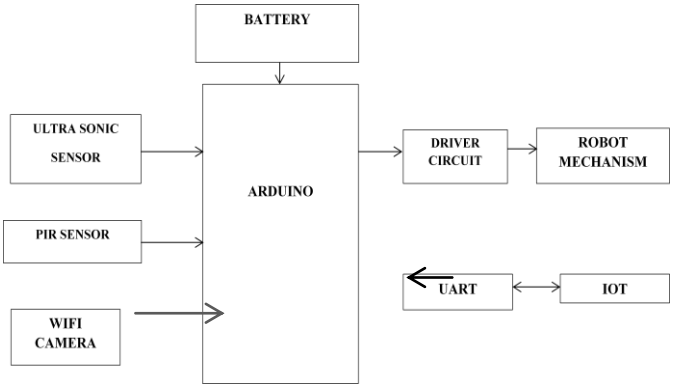

Fig. 1 Block Diagram

III. HARDWARE AND SOFTWARE COMPONENTS

A. Battery

A battery is a device that converts chemical energy directly to electrical energy. It consists of a number of voltaic cells; each voltaic cell consists of two half

cells connected in series by a conductive electrolyte containing anions and cations. In the redox reaction that powers the battery, cations are reduced (electrons are added) at the cathode, while anions are oxidized (electrons are removed) at the anode. Here, we use a 12V lead acid 1.3Ah Battery as it is found to be compatible.

B. Ultrasonic sensors

Ultrasonic sensors generate high-frequency sound waves and evaluate the echo which is received back by the sensor. Measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. Here, we use a 360' 5V 2mA high precision sensor which can detect the obstacles in all directions.

C. Dc Motor

A DC motor is designed to run on DC electric power. Two examples of pure DC designs are Michael Faraday's homo polar motor (which is uncommon), and the ball bearing motor, which is (so far) a novelty. We in our project are using brushed DC Motor, which will operate in the ratings of 12V DC 0.6A 1000rpm which will drive the flywheels in order to make the robot move.

Fig. 2 Dc Motor

D. Driver Circuit

The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays. It consists of seven NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diode for switching inductive loads. The collector-current rating of a single Darlington pair is 500mA. The Darlington pairs may be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED gas discharge), line drivers, and logic buffers. The ULN2003 has a 2.7kW series base resistor for each Darlington pair for operation directly with TTL or 5V CMOS devices

E. Pir Sensor

All objects emit what is known as black body radiation. It is usually infrared radiation that is invisible to the human eye but can be detected by electronic devices designed for such a purpose. The term *passive* in this instance means that the PIR device does not emit an infrared beam but merely passively accepts incoming infrared radiation. "Infra" meaning below our ability to detect it visually, and "Red" because this color represents the lowest energy level that our eyes can sense before it becomes invisible. Thus, infrared means below the energy level of the color red, and applies to many sources of invisible energy. The detection range is up to 20 feet away. Product size makes it easy to conceal Compatible with BASIC Stamp, Propeller, and many other microcontrollers.

- Power requirements: 3.3 to 5 VDC; >3 mA (may vary)
- Communication: Single bit high/low output
- Operating temperature: 32 to 122 °F (0 to 50 °C)
- Dimensions: 1.27 x 0.96 x 1.0 in (32.2 x 24.3 x 25.4 mm)

Fig. 3 Pir Sensor

F. IoT

The Internet of things (IoT) is the network of everyday objects — physical things embedded with electronics, software, sensors, and connectivity enabling data exchange. Basically, a little networked computer is attached to a thing, allowing information exchange to and from that thing. Because of low-cost, networkable microcontroller modules, the Internet of things is really starting to take of.

Fig. 4 IoT

G. Embedded C

Embedded C is designed to bridge the performance mismatch between Standard C and the embedded hardware and application architecture. It extends the C language with the primitives that are needed by signal-processing applications and that are commonly provided by DSP processors.

H. Arduino

Arduino consists of both a physical programmable circuit board and a piece of Software or ide used to write and upload code to the physical board.

I. Wifi Camera

They can be used for transmitting a video or audio signal to a wireless receiver through a radio band and operating at about 6-12V,15mA with a frequency range upto 5.5Khz

IV. WORKING PRICIPLE

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 ultrasonic sensor.The outputs are ULN2003 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. ULN2003 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 ultrasonic sensors. ultrasonic sensor uses sound signal to find if there are any obstacles present in front of it, its range is up to5 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 20 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 microcontroller to produce signals. The Receiver Side consists of ATMEGA328 microcontroller (Arduino Uno). Its input and output are signal and a wifi camera respectively. Once the signal from the transmitter is received , it notifies the Arduino. Arduino in turn sends a signal to the Iot server, which triggers the camera to produce continuous tracking.

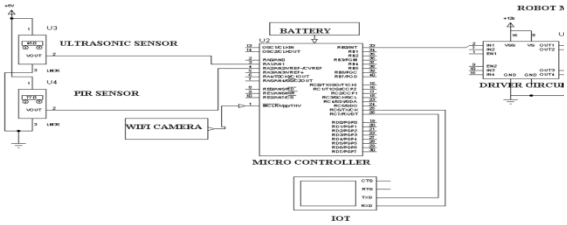

Fig. 5 Connection Diagram

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. First the base model has to be created. Here the robot mechanism involves movement of the fly wheels. The direction of movement of the wheels depends on the signal coming out from the ultrasonic sensors. the microcontroller coding s done using Embedded C language. The base rover model has been created. Testing of components has been established and they are found to be in proper working condition withstanding the required current and voltage. After the complete connections are properly given ,the robot can be tested for efficiency. The test can be conducted by placing the human at distances ranging from 1 to 20 ft and above 20ft.It can be found that the sensors can detect the presence of human upto 20ft only. The second test involves detecting of obstacles by the robot. Here the efficiency of ultrasonic sensors come into effect. If the obstacle is present to the left ,the robot comes back for some distance and moves towards the right and vice versa. By virtue of these tests,we can prove the working of the robot.

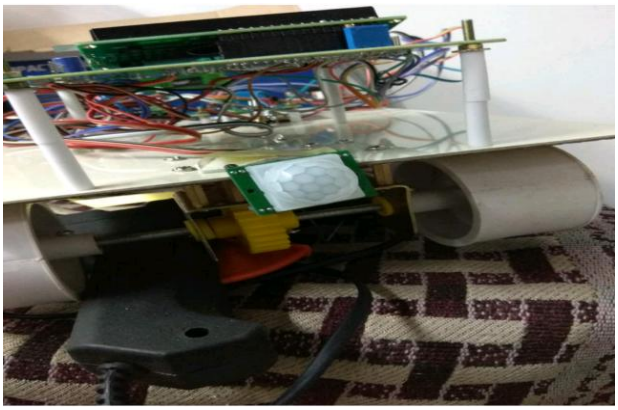

Fig. 6 Base Robot Model

VI .CONCLUSION

Thus a human detection system can be made using pir sensor in a robotic mechanism if proper planning is made. The paper can be used for designing of a system that can be very useful security and surveillance in disaster prone areas and loss of lives can be minimized.

VII. REFERENCES

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