

HUMAN DETECTION ROBOT

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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.

This project aims to give a practical design to build the first and simplified version of a rescue robot which has to be active within disaster areas like collapsed buildings where rescue teams cannot operate due to a lot of technical difficulties. Human detection for rescue purpose is normally carried out by humans in such conditions, but when there is a risk of collapse or hazardous environment it will better to utilize some high tech equipment to achieve that mission rapidly and effectively.

1 INTRODUCTION

The demonstration requires the robot to portray abilities to move in either directions, sensor prediction, and interfacing with the operator as it searches for the victims. The main objective of the project is to detect humans in need of help who are unable to move in disastrous area. the objective of the project depicts a very simple idea detection which flows a rescuer operation.

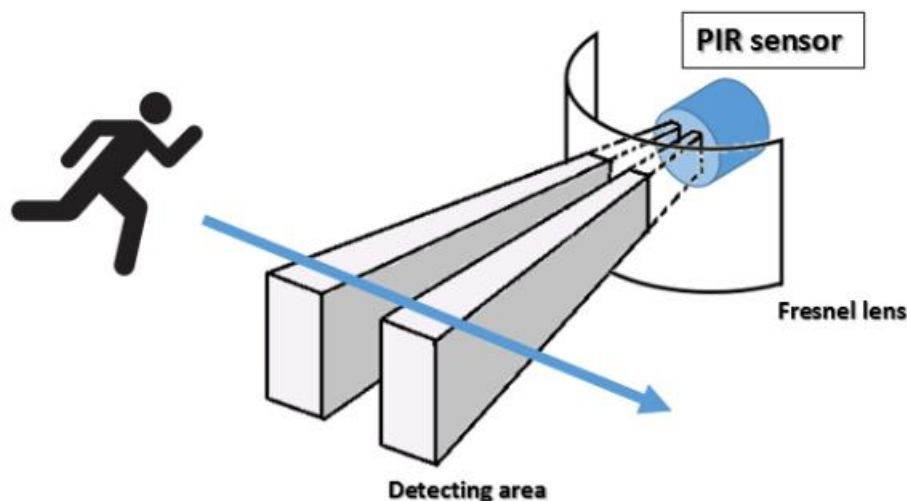


In these days there are lot of robberies happening, so we need more security. The security system commonly used is ordinary surveillance camera it provides visual images but the ordinary surveillance camera cannot notify the user instantly about unauthorized presence. To overcome robbery and to notify 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. Detecting the presence of human can be done in different techniques and methodologies.

**Human
detection
robot**



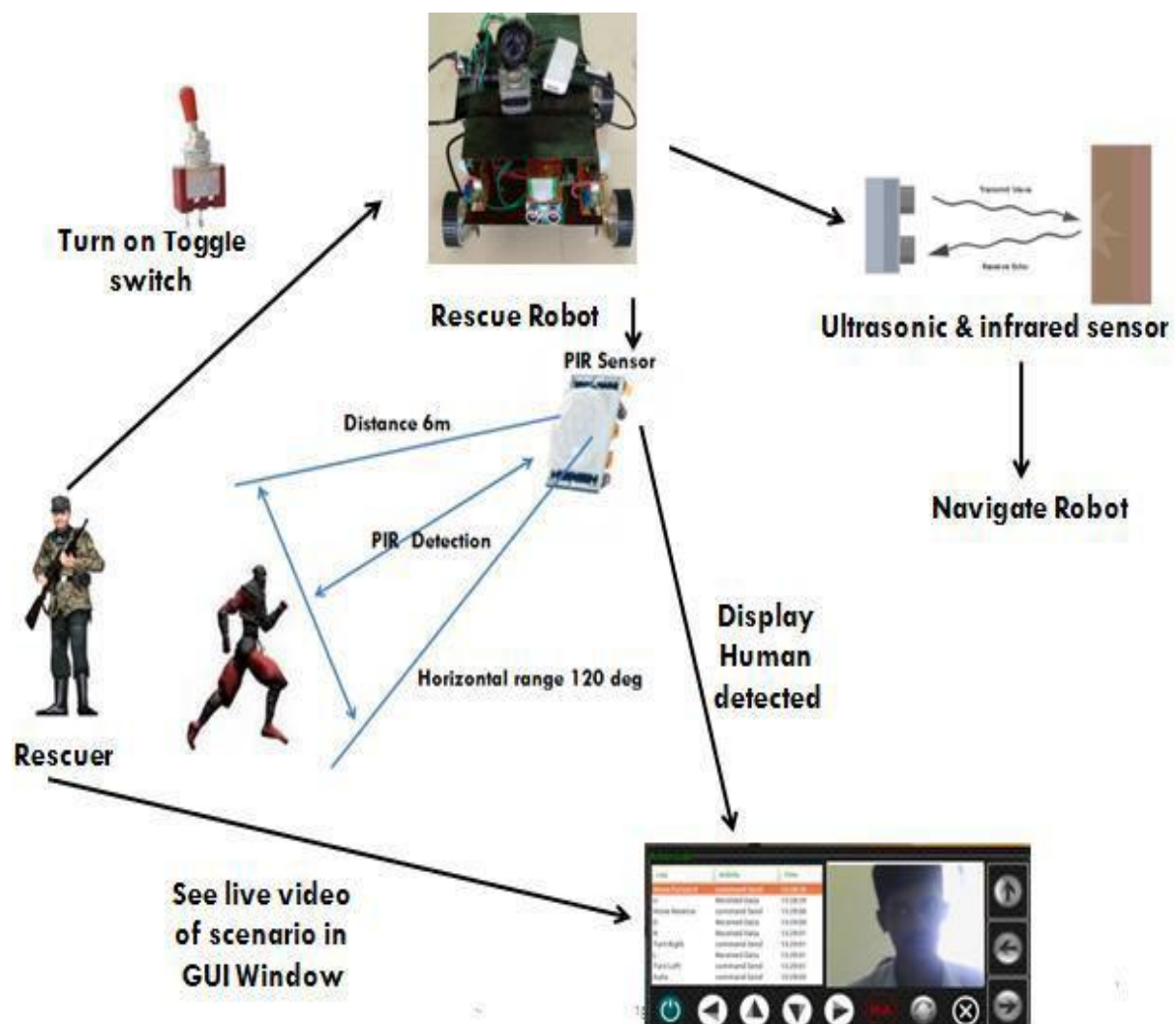
One such technique is using a PIR sensor to find the direction of movement by the concepts of polarization. Another technique by using PIR sensors along with Symbolic Dynamic Filtering on seismic waves, from these seismic waves the features were extracted using SDF and checked if presence is of vehicle or animal/human. After classifying, it is further classified between human or animal along with their movement type (running, walking). 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 nonhumans. Another module is the movement of the robot that can be done manually or automatically.



1.1 CONCEPT

A PIR is utilized in the project which emits infrared rays in order to detect live humans. As an alive human (body) emits thermal radiation. This thermal radiation is detected by the PIR sensor in order to detect live humans. This PIR (Passive infrared) sensor is placed in front of the moving robot that can move in all the directions. The robot moves in

either direction with the rotation of the geared dc motor for optimum torque and minimum speed and motor derives with relays for turning and movement in forward and reverse directions with accuracy. The motor derive is a two wheel geared drive with DC motors attached to perform movements in either forward or reverse directions. On a contrary note Detection of alive human by designated rescue workers is tiring, reliable but very time consuming. Therefore, achieving our aim will enable us to make a robot capable of autonomously human detection from earthquake and other disastrous areas.



In this project instead of metal detector and other previously used sensors that are used much too often a PIR sensor is used which makes the system much effective and an advanced system. It holds a great advantage over others because of the PIR sensor helps to detect the Human (Body) radiations emitting from a live human being. With that it also supports a videos transmitting feature which not only enables the receiver to locate but have a better understanding of the surroundings, as it moves around the disastrous and earthquake prone areas and any other field desired, it helps reducing the work in the field as it already detects and locates the person to be rescued, Manually checking a person if alive one must check the pulse, heart beat but with the help of this robot, itself checks whether the person is alive or not. The main principle of the circuit is to detect the human using human detecting sensor. The wireless technology robot is operated manually using PC. The wireless technology used here is Radio Frequency technology. The data is transmitted to receiver through RF. Using the received data, robot is operated and controlled.

1.2 PROBLEM DEFINITION

The question that arises in research an implementation of the project is as follows:

- How much efficient a robot can be made to detect live human from disastrous areas autonomously.
- An autonomous robot must be capable of avoiding obstacle and take its own decisions regarding its further proceedings, when it encounters with an obstacle.

- For the disaster prone areas it is unlikely to be a bright site or on other hand if performing operation in the night in addition to sensor how a robot can have a sight of view.
- How user friendly is the robot, GUI (graphical user interface) is to made easier to user, which hides irrelevant on-screen information on the user side.
- How effective a communication system is to be established between a receiver and the transmitter side which communicates without any interference of the surrounding frequencies which may result in obstruction or complete annihilation of channel.

1.3 OBJECTIVES OF THE WORK

The main objective of the circuit is to detect the human using human detection sensor. The wireless robot is operated manually using PC. The wireless technology used here is Radio Frequency technology. The data is transmitted to receiver through RF. Using the received data, robot is operated and controlled. A human detection robot is used to detect the humans present around especially during the rescue regimes after a natural calamity such as earthquake, landslide, storms etc. Though the detection is done by rescue teams but it is also important to find the stuck humans within right time. The human detection robot will help at large extent for such rescue operation.

The Human detection robot circuit principle is to detect the humans by using the circuit such as detection sensor (a PIR sensor). The robot can be handled manually via PC. The wireless technology used here is Radio Frequency (RF) signals. The communication is established using a RF transmitter and a RF receiver. All objects with a temperature

above absolute zero emit heat energy in the form of radiation. Usually this radiation isn't visible to the human eye because it radiates at infrared wavelengths, but it can be detected by electronic devices designed for such a purpose.

A PIR (Passive Infrared Sensor) is utilized in the project which emits IR (Infrared Rays) in order to detect humans. As a human(body) emits thermal radiation. This thermal radiation is detected and manipulated accordingly by the IR sensor in order to detect the humans. Upon detection the person in need of help is located, at the receiver side it immediately provide an audio alert(buzzer) visual and image alerts to the concerned authorities so that the person in need of help whether buried or unable to move can be reached abruptly. This PIR sensor is placed in front of the moving robot that can move in all directions. The robot moves in either direction of the geared dc motor for optimum torque and minimum speed and motor derives with relays for turning and movement in forward and reverse directions with accuracy. The motor derive is a two wheel geared drive with DC motors attached to perform movements in either forward or reverse directions. On a contrary note Detection of human by designated rescue workers is tiring, reliable but very time consuming; therefore using the human detection robot for earthquake and other disastrous areas is much more beneficial for detection which is then followed by a rescue operation upon detection.

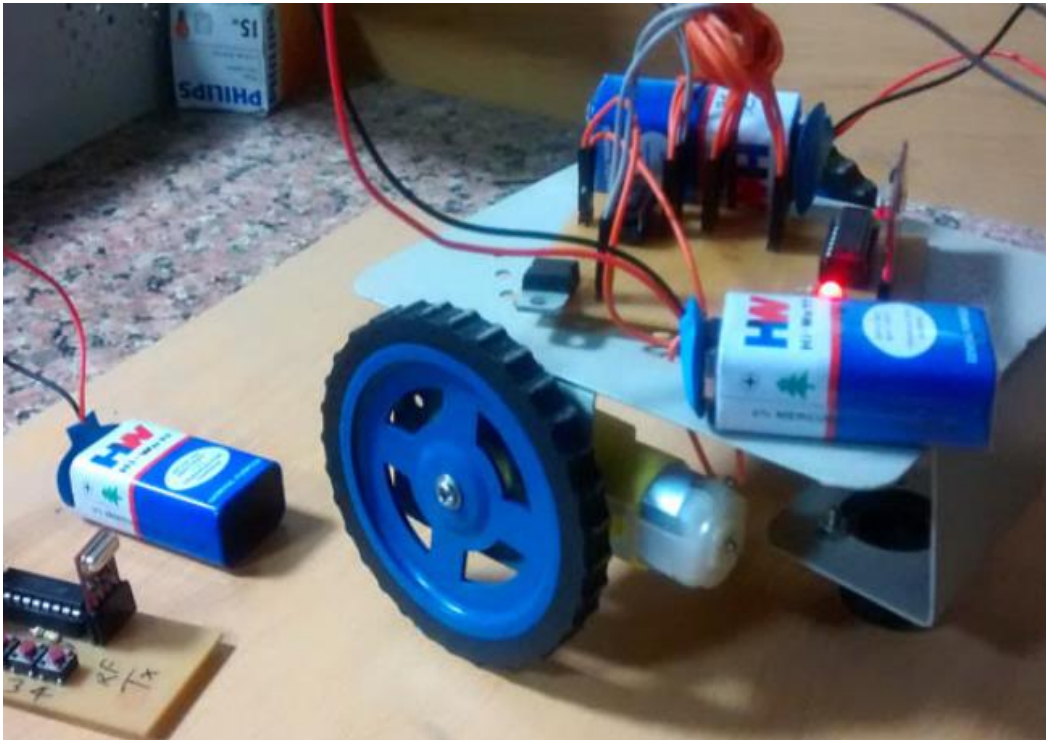
2.1 METHODOLOGY

The Human detection robot circuit principle is to detect the humans by using the circuit such as detection sensor (a PIR sensor). The robot can be handled manually via PC. The wireless technology used here is Radio Frequency (RF)

signals. The communication is established using a RF transmitter and a RF receiver.

The Robot has two sides, receiver side and the transmitter side. The transmitter side consists of AT89s51 microcontroller; the inputs to the microcontroller is PIR sensor. The outputs are 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 human. Human can be detected using an IR 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 180o i.e. except the area below the robot it can sense in all the other directions. The distance up to which IR sensor can detect is restricted within 12 ft.

The Receiver Side consists of AT89S51 microcontroller. 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 microcontroller. Then microcontroller 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. Once the human is detected its video and image are transmitted to PC, or laptop using the Matlab Programming. The diagram below shows the connectivity for the transmitter and receiver side.



2.1.1 CIRCUIT PRINCIPLE

The Human detection robot circuit principle is to detect the humans by using the circuit such as detection sensor (a PIR sensor). The robot can be handled manually via PC. The wireless technology used here is Radio Frequency (RF) signals. The communication is established using a RF transmitter and a RF receiver.

2.1.2 WORKING PRINCIPLE

All objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually this radiation isn't visible to the human eye because it radiates at infrared wavelengths, but it can be detected by electronic devices designed for such a purpose.

2.1.3 CONSTRUCTION

Infrared radiation enters through the front of the sensor, called as the 'sensor face'. At the core of a PIR sensor is formed of solid state sensor or set of sensors which is made from pyro-electric materials—the materials which generate energy when exposed to heat. In general, the sensors are approximately 1/4 inch square (40 mm²), and take the form of a thin film. A PIR sensor is formed of materials like cesium nitrate (CsNO₃), gallium nitride (GaN), polyvinyl fluorides, derivatives of phenyl pyridine, and cobalt phthalocyanine. The sensor is often manufactured as part of an integrated circuit.

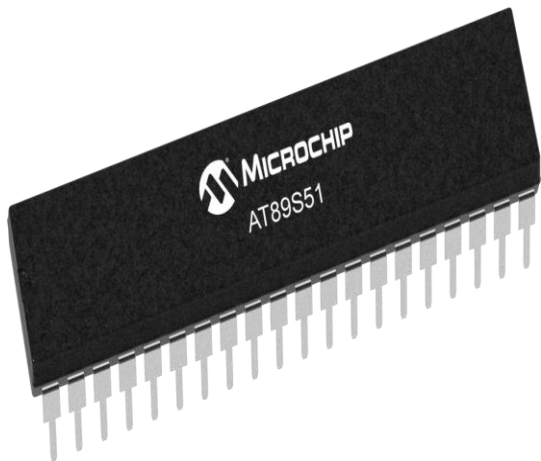
The term passive in this context refers to the fact that PIR devices do not generate or radiate energy for detection purposes. The PIR sensors only detect infrared (IR) radiation emitted by or reflected from objects. They cannot detect or measure "heat".

2.1.4 Circuit Components

- AT89s51 microcontroller.
- PIR sensor.
- 9V battery.
- Motors
- L293D IC.
- PC
- RF transmitter and receiver.
- Robot chassis.
- Max232 IC.

AT89S51 MICROCONTROLLER

The AT89S51 is a low-power, high-performance CMOS 8-bit microcontroller with 4K. bytes of In-System Programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout.



PIR sensor

Passive Infra-Red (PIR) sensor plays a primary role in the circuit that is detecting the human being. PIR sensors work on the principle that every human being emits infra-red radiations of very low wave length. Thus this sensor senses these radiations and outputs a logic high value. This sensor can sense the human within the range of 20 feet. PIR sensor can be connected to the Port1 of the micro controller. Its operation range is 2.2V – 5V.



L293D

L293D is a motor drive IC. This IC is required to drive the motor and also eliminates back EMF generated. This IC internally has H-bridge circuit. The IC has 16 pins out of which 4 input pins drive the motor. Enables are used to enable these input pins. A 5v power is supplied at the 16th pin to operate the IC and 8th pin is applied to 12 Volts power supply. For the reason that voltage L293D can bear is 36V, we can supply a voltage range of 2.4V – 36V to the 8th pin of IC.



Circuit design is divided into two parts: transmitter part and a receiver part

TRANSMITTER SIDE AND ITS CONNECTIONS

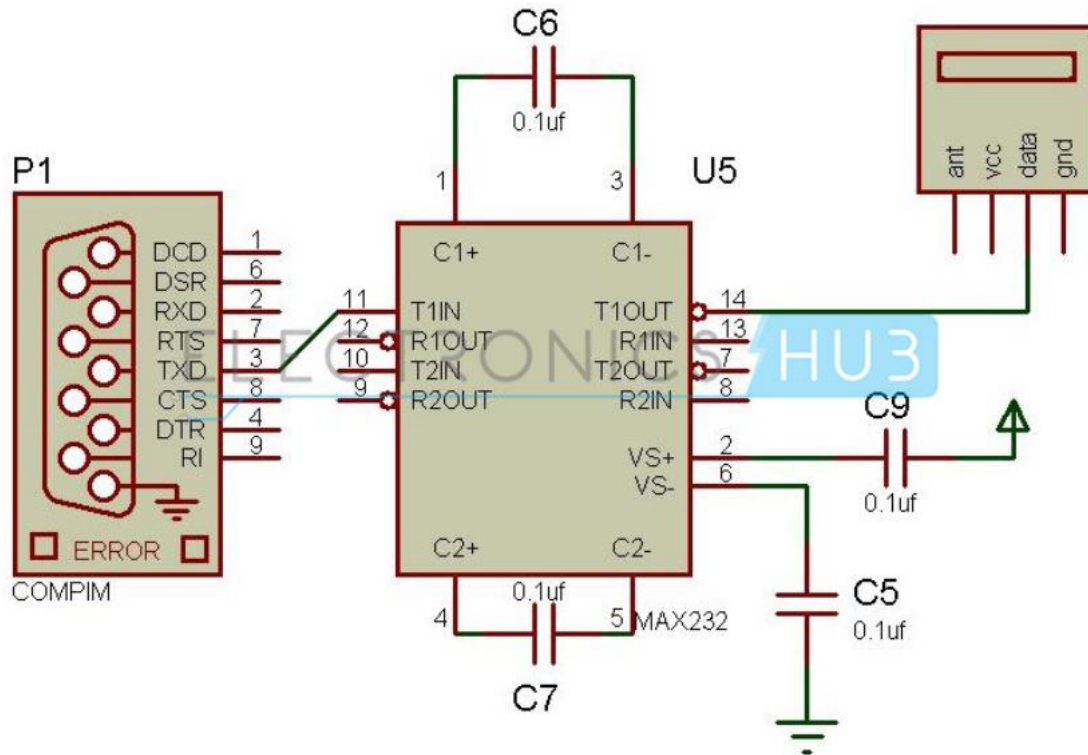
The transmitter part includes a PC, MAX232 IC, DB9 connector, RF transmitter, the transmitter section is going to be on the robot chassis. The commands for operating the robots are transmitted using PC. PC transmits the data to the RF transmitter through max232. PC logic levels are in the range $\pm 3v$ to $\pm 15V$, while the RF module logic levels are TTL Compatible. Max232 converts the logic levels. This is also called level converter .The T1in pin of the MAX232 is connected to receive pin of the DB9 which further connected to the PC. The output pins are connected to the RF transmitter.

Radio frequency is the wireless technology used to transmit the data. The modules are available at frequencies such as 433.92 MHZ,315MHZ ,868MHZ,915MHZ,2400MHZ. Here the RF modules uses a frequency of 433 MHZ. T1out pin of MAX232 is connected with the DATA pin of RF transmitter. Maximum voltage of 5V is applied to the RF transmitter.

Max232 converts the logic levels. The logic levels of PC are in the range $\pm 3v$ to $\pm 15V$, while the logic levels of RF module are compatible with TTL. In order to convert this voltage MAX 232 is used. This is also called level converter. The T1in pin of the MAX232 is connected to the receive pin of the DB9 which is in turn connected to the PC. The output pins are connected to the RF transmitter. Radio frequency is the wireless technology used here to transmit the data.

Several carrier frequencies were used in available modules such as 433.92 MHZ,315MHZ ,868MHZ,915MHZ,2400MHZ . Here the RF modules uses a frequency of 433 MHZ. The DATA pin of the RF transmitter is

connected to the T1out of the MAX232. A Vcc of 5v is applied to the RF transmitter.



RECEIVER SECTION AND ITS CONNECTIONS

The receiver part includes AT89S51 microcontroller, L293D motor driver IC, RF receiver, motors of the robot, PIR sensor.

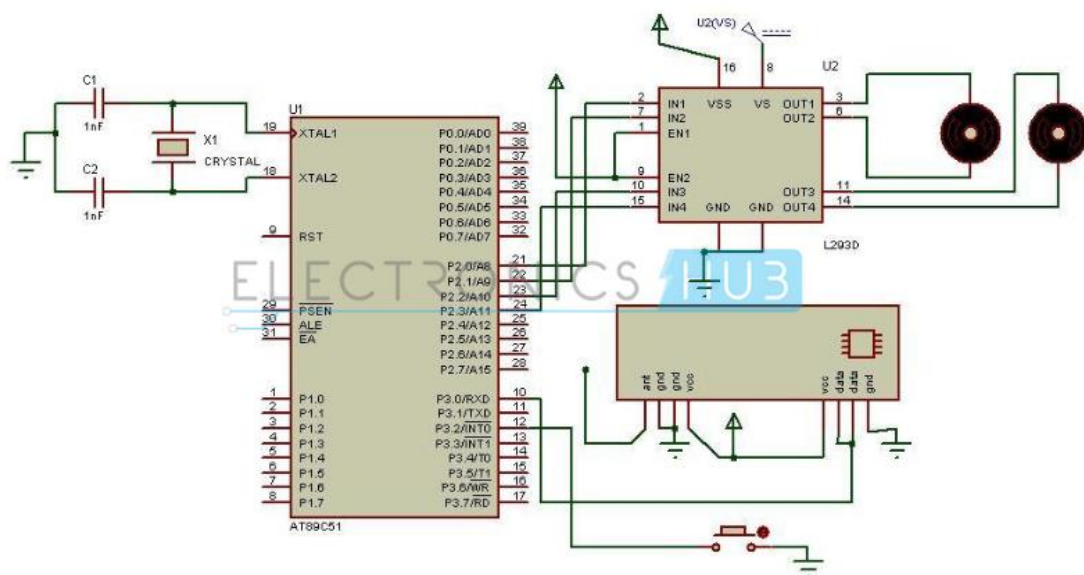
The RF receiver module is connected to the port3 of the microcontroller and the Data pins of RF receiver are connected to the receiver pin of the micro-controller. The two VCC pins are shorted and connected to 5V power supply. GND pins are shorted and connected to ground. The receiver module receives the data and transmits it to the micro-controller.

PIR sensor plays a main role in the circuit. This is used to detect the human beings. The PIR sensor is nothing but Passive Infra-Red sensor. These sensors work on the principle that every human being emits infra-red radiations of very low wave length. Thus, this sensor senses these radiations and outputs a logic high value. This sensor can sense the human within the range of 20 feet. PIR sensor is connected to the Port1 of the microcontroller. L293D is a motor drive IC. This IC is required to drive the motor and also eliminates back EMF generated.

This IC internally has H-bridge circuit. This has 16 pins out of which four input pins are used to drive two motors.

Enables are used to enable these input pins. A supply voltage of 5V is applied at the 16th pin to operate the IC. 8th pin is applied with a voltage of 12V required to drive the motors.

The L293D IC can drive voltages up to 36V. That is 8th pin can be applied with a voltage ranging from 2.4V to 36V.



REQUIREMENTS

- To Design and implement the robot (vehicle).
- Co-ordination of Dc motor and motor drive controls.
- Design and implementation of the receiver side circuit.
- Design and implementation of the transmitter side circuit.
- Programming and synchronization of the micro-controller with other electronic equipment's.
- Design and implementation wireless video transmission and other instructions (control).

2.2 LITERATURE REVIEW:

- <http://ijsetr.org/wp-content/uploads/2015/03/IJSETR-VOL-4-ISSUE-3-492-496.pdf>

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.

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. 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.

➤ http://www.kscst.iisc.ernet.in/spp/40_series/SPP40S/01_Seminar%20Projects/084_40S_BE_0815.pdf

Disaster sites may be complex and hazardous to be reached for rescue and there are a great threat and risk linked to rescue workers and survivors trapped in such accidental sites. Natural disasters include floods, storms, cyclones, bush fire earthquakes etc. whereas human induced disasters include transportation accidents, industrial accidents, major fires etc. Hence in this project, we focus on a system named as “human detection robot” which will work in disaster environments of manmade structures like collapsed buildings, war fields etc. It can be assisted for firemen, police, and disaster agencies with appropriate reconnaissance, site evaluation, human detection etc.

An IR (Infrared Sensor) is utilized in the project which emits IR (Infrared Rays) in order to detect humans. As a human(body) emits thermal radiation. This thermal radiation is detected and manipulated accordingly by the IR sensor in order to detect the humans. Upon detection the person in need of help is located, at the receiver side it immediately provides an audio alert(buzzer) visual and image alerts to the concerned

authorities so that the person in need of help whether buried or unable to move can be reached abruptly.

- https://www.researchgate.net/publication/307871465_Human_detection_robot_ROHSAR

The project aims to give a practical design to build the first and simplified version of a rescue robot which has to be active within disaster areas like collapsed buildings where rescue teams cannot operate due to a lot of technical difficulties. Human detection for rescue purpose is normally carried out by humans in such conditions, but when there is a risk of collapse or hazardous environment it will better to utilize some high-tech equipment to achieve that mission rapidly and effectively.

The unique passive Infrared sensor is used in our design that emits infrared rays to detect humans. As a human body emits thermal radiation it will be received and manipulated by the PIR (Passive infrared sensor). Once a human target is located the system has to give an alert which may help to localize the victim location as soon as possible.

- <http://ijsrcseit.com/paper/CSEIT17218.pdf>

In this paper, a new approach for detecting alive human beings in natural and man-made disasters using a specific set of sensors, ATMEGA16 Microcontroller, existing GSM technology and PLC systems. Many areas of world are getting affected due to sudden natural calamities like earthquakes, floods, wild-fires, storms and human induced disasters industrial and transportation accidents and one of the threatening to humans that is terrorists' attacks.

This robot follows which is drawn over the surface. Here we are using PIR Sensor for detect the human. This project is mainly used in the earth quake rescue operation. Internally is consists of IR Sensors. The infrared sensors are used to sense the live person. Once the people are located it immediately gives audio alert visual alert to the authorities so that help can reach the live person faster. All the above systems are controlled by the microcontroller.

➤ <http://ijarece.org/wp-content/uploads/2016/04/IJARECE-VOL-5-ISSUE-3-775-778.pdf>

Many areas of the world get affected by natural calamity. Disasters are unstoppable and leave behind a great loss of life. Disasters like earthquake, floods, etc. cause mass destruction and often lives get buried or trapped in debris. In such situations detection by rescue workers becomes time consuming and due to the vast area, that gets affected it becomes more difficult. Hence, we are proposing a human detection robot which can detect alive humans in debris so that timely help can be made available to the victims. The robot is equipped with a PIR sensor to detect live human

Hence many lives can be saved by using this autonomous vehicle during a disaster in a short duration which becomes time consuming and unaffected if done manually. The application of wireless sensor network will improve the saving of many lives by using mobile rescue robot in disaster prone area. In this paper we design an effective & safe system to ensure that there is no human left behind in rescue operation.

2.2 MODELLING

Infrared radiation enters through the front of the sensor, called as the 'sensor face'. At the core of a PIR sensor is formed of solid state sensor or set of sensors which is made from pyroelectric materials—the materials which generate energy when exposed to heat. In general, the sensors are approximately 1/4 inch square (40 mm²), and take the form of a thin film. A PIR sensor is formed of materials like caesium nitrate (CsNO₃), gallium nitride (GaN), polyvinyl fluorides, derivatives of phenyl pyridine, and cobalt phthalocyanine. The sensor is often manufactured as part of an integrated circuit.

The term passive in this context refers to the fact that PIR devices do not generate or radiate energy for detection purposes. The PIR sensors only detect infrared (IR) radiation emitted by or reflected from objects. They cannot detect or measure "heat".

FLOWCHART

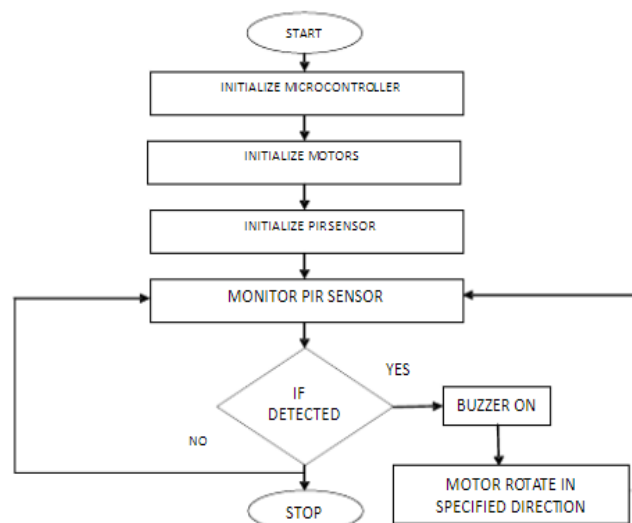
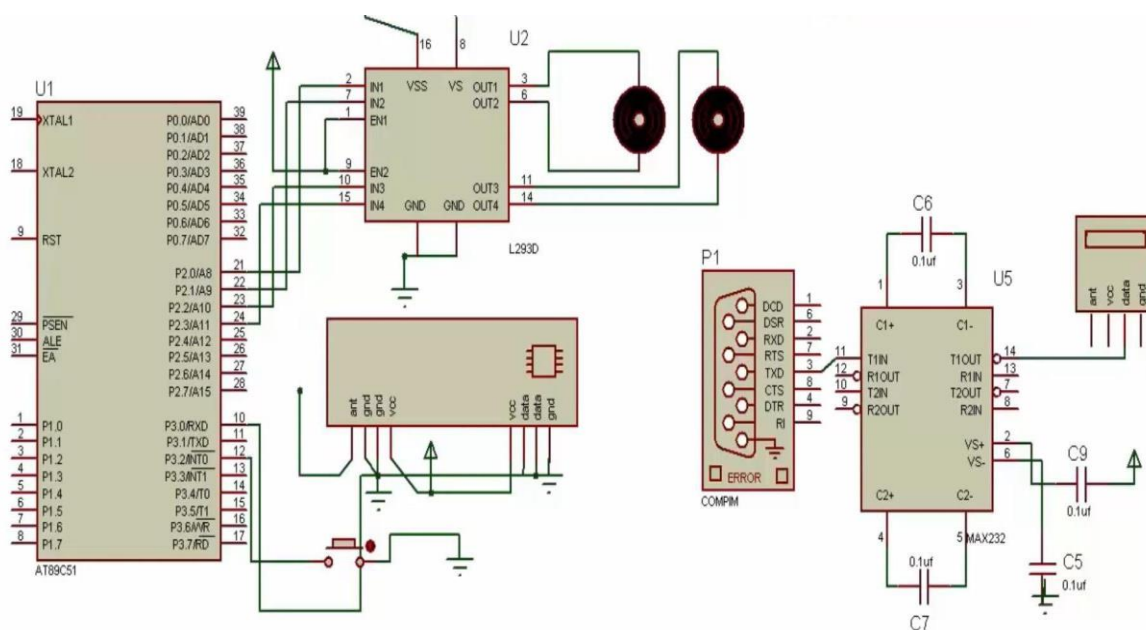


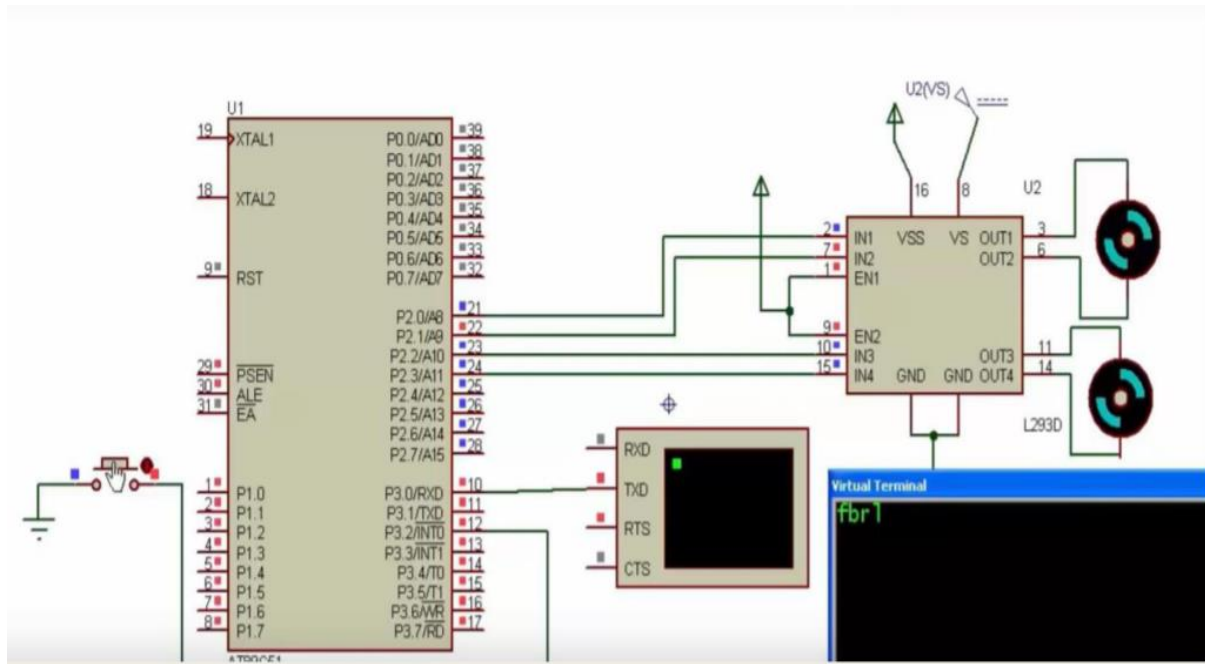
Fig. 3 Algorithm Flow Chart

2.3 EXPERIMENTAL PROCEDURE

- Initially burn the code into the micro controller.
- Arrange the robot chassis.
- Connect the transmitter and receiver circuits as shown in the circuit diagram.
- Now arrange the transmitter to the robot.
- Connect the receiver to the PC.
- Enter the character F in the hyper terminal of the PC.
- This makes the robot to move in forward direction.
- Now enter the character B to move the robot in reverse direction.
- Enter L and R to move the robot in left and right directions.
- While the robot is moving if any human detected by the PIR sensor robot stops moving and a buzzer is switched on.

SIMULATION





2.4 APPLICATIONS

1. In rescue operations after natural calamities.
2. War Fields.
3. In Museums and Jewellery shops to maintain security.

2.5 LIMITATIONS

These proto-type wheels are design to move in smooth surface, but in advance type we have to design which are suitable for trough and terrain surfaces.

- Motors are not very strong to load the heavy weight of tires and high volt battery.
- Robot performs turning and movement not exactly at the same time which slows the speed of robot.
- Changes in environment, like as temperature, pressure, humidity, affect ultrasonic response, so it shows a need for better one when robot is working in real field.
- PIR sensor detect only in the front field of 180 degree, it must be Fresnel PIR which work at 360 degree.
- All circuitry are open and displayed for supervisor point of view but it must be closed in secure box for hard environment.
- On this robot only front view camera is used, it must be rotating which help to minimize the time.

2.6 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. 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). 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 nonhumans. Another module is the movement of the robot that can be done manually or automatically.

3 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 one part i.e. testing for detecting a human. 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.

3 DISCUSSION

The primary aim of this project was to give an overview of promising techniques for visual people detection. In recent years the field has been moving rapidly thereby continuously improving detection performance. Given today's state-of-the-art in visual people detection it is clear however that the currently achievable performance is often neither sufficient nor satisfactory for many applications. Motion cues. It is clear that human motion is an important cue for people detection. It clearly demonstrates the potential gain when using motion information for visual people detection. However, we strongly believe that the current approaches still leave room for further improvement.

Integration of detection and tracking. Both detection and tracking people are challenging problems. People detectors have been shown to be able to locate pedestrians even in complex scenes, but false positives have remained frequent. Tracking methods are able to find a particular individual in image sequences, but are severely challenged by real-world scenarios such as crowded scenes.

4.1 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.

4.2 FUTURE WORK

In this report, we have introduced our primitive idea to make a rescue robot using primitive sensor like PIR. This vehicle may be improved by

using high range sensors (laser, ultrasound or powerful thermal camera). GPS and motors of high capacity, Long distance telecommunication protocols will be also proposed in any future version of this robot. Final goal is to develop a full autonomous rescue robot.

The Robot can be modified further by 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.

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