

# Human Detection using Unmanned Ground Vehicle

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## ABSTRACT

A human detection remote-controlled ground vehicle is employed to detect the humans around during the rescue regimes when a natural calamity occurs, to avoid losing lives of humans. This project aims to build a robot that is active in disaster areas to create a rescue mechanism that needs to move at intervals, wherever rescue groups cannot operate due to loads of technical difficulties. A unique passive Infrared sensing element is employed in our project that emits infrared rays to sense humans. As an individual's body emits thermal radiation it will be received and manipulated by the PIR (Passive infrared sensor) and when the target is found the system will provide an associate degree alert which can be used to facilitate to localize the victim location in time. Human Detection using Unmanned Ground Vehicle is an attempt at creating an intuitive application which is capable of being used by people during war zones, disaster areas, and surveillance in jewelry shops.

**Keywords :** Human Detection, Arduino Uno, GPS Module, Solar Panel, PIR Sensor

## I. INTRODUCTION

A unique passive Infrared device is employed in our design that emits infrared rays to discover humans. As a person's body emits thermal radiation it will be received and manipulated by the PIR (Passive infrared sensor). Once the target is found the system should offer alert which can facilitate to localize the victim's location as shortly as potential. The main module of automation consists of 'Human Detection Module' carried by a robot platform sufficiently small to wander round the space and do its search activity. The GPS module is used to track the accurate position of the robot at any instance of time and it is also equipped with solar panel for external battery backup. Human detection unmanned ground vehicle may be carried to

anyplace within the world and might be assembled in a few hours for quick search and rescue operations. The planning is easy with the most affordable budget. We make use of an android application to rover the vehicle and it is equipped with a Bluetooth module to communicate with the android phone which in turn will give directional instructions to the vehicle. Human Detection using Unmanned Ground Vehicle is an attempt at creating an intuitive application which is capable of being used by people during War Zones, Earthquakes, and surveillance in the Jewellery Shops. This model consists of a PIR sensor, Arduino Uno, Buzzer, GPS Module, Node MCU, Solar panel. PIR sensor is used for sensing the motion of humans in a certain range. PIR sensor senses the motion and sends the information to the Arduino board. Arduino Uno is

a microcontroller that calculates the value which is received from the PIR sensor. If the PIR sensor senses motion it will send the values to the Arduino board and the buzzer will beep notifying the user.

Bluetooth Module is connected to the Arduino board and sends directions to the car chassis. Arduino Bluetooth Controller is an app which is used to control the chassis, Bluetooth module is connected to the Arduino controller, we can control the chassis by giving the commands on the app. These commands are transferred to the Bluetooth module and send to the Arduino board. Arduino board takes up the commands from the Bluetooth module and acts accordingly by moving the chassis front, back, left, or right. Bluetooth is connected to the Arduino controller with a unique password. GPS module is used for tracking the model and the Blynk app is used for viewing the model. Node MCU is used as an intermediate between GPS module and Blynk app, Node MCU is an inbuilt Wi-Fi module that can be connected over the internet and transfers the data with the help of a web socket. GPS module is used to calculate the longitude and latitude of the model and sends the calculation to Node MUC using a Wi-Fi connection. This degree can be viewed on your Blynk app with the help of maps. Solar panels are used as a power backup and the batteries which are present on the model are re-Chargeable battery. The solar panel can be connected directly to the battery for them to charge.

## II. RELATED WORKS

In [1] paper the author tells us about Pyroelectric infrared (PIR) sensors that are used to sense a simple however powerful individual's presence and triggers, e.g., automatic lighting systems. Especially, by alternating the effective polarization of the sensing parts throughout a PIR sensing element, it's attainable to figure out the relative direction of the movement of an object moving on the motion plane of the PIR sensing element. throughout this paper, there is a very

distinctive methodology of detection of relative direction of human movement (in eight directions uniformly distributed) with 2 pairs of PIR sensors whose sensing parts are orthogonally aligned. They have developed a data assortment unit with four twin detector PIR sensors with changed lenses, and picked up knowledge set from six subjects walking in eight directions and with the collection of PIR signals, they performed classification analysis with documented machine learning algorithms, together with instance-based learning and support vector machine. The findings show that with the information set captured from 2 orthogonally aligned PIR sensors with changed lenses, they were able to produce an accurate result. And additionally, it was found that with the reduced feature, set composed of 3 peak values for every PIR sensing element, and were able to achieve 89%–95% recognition accuracy consistent with machine learning algorithms.

In [2] paper, author has briefly explained to that the system contains PIR device, sound device, proximity device and temperature device. The purpose of this project is to sight the human beings buried within the buildings. Firstly the automaton browses the information from all the sensors then all the information is sent to the  $\mu$ Atmega328 that the human being is detected, through Bluetooth module (HC05). Once the person is detected, a visual confirmation is sent to the application, this helps the authorities reach the person in time. This PIR device is placed on an automaton that may move within the earthquake prone areas. The automaton is driven on an intermeshed dc motor to provide required force and low speed, stepper motor for turning accuracy thus the precise management of position is monitored. The automaton consists of a three wheeled intermeshed drive with DC motors connected to perform restricted movements (Forward-right; left, Reverse-right; left). Since detection by rescue employees is time consuming; the automaton makes the entire operation easier.

In paper [3] by M. Sathish Kumar, S Rajini, Smart Surveillance System Using PIR Sensor Network, Surveillance is the most important security system in housing, industrial sectors and public places. The security system consists of an embedded system which is grouped along with GSM and sensor networks. The PIR sensor is used to detect the movement of human beings. And the system triggers an alarm detecting the presence of a person in a specific interval of time and simultaneously sends the information as to how many persons have intruded via Short Message Service (SMS) through GSM Modem. The CCTV camera is activated upon the activation of the security system. This highly reactive approach has low computational requirement. Therefore, it is well suited for home surveillance system. This surveillance security system is implemented using PIC micro controller, camera, GSM and sensors. Home/office security systems have grown in popularity in recent years, home/office owner's look for ways to protect their personal space and enhance their home value.

In paper [4] the author explores the fabrication of human detection robot. It basically focuses on detection of the humans in Earthquake areas and detects if the person is alive or not. It uses a camera which continuously observes the field to give the live view of the terrain. A PIR Sensor has been installed for detection purpose and mercury Sensor for detection of vibration in Earthquake condition. As soon as the human is detected, a signal is sent through the RF module. Hence, the system detects the human in the field and detects whether the human is alive or not. A wireless robot is implemented which can be controlled through the PC using RF module and it basically navigates around the disaster areas spotting the humans who need help but also taking the terrain into consideration. The robot must have the abilities to move in various directions, should make use of sensors for prediction, or interfacing with the operator as it searches for the victims. The main objective of the

project is based on a very simple idea that is detection which follows a rescuer operation.

In paper [5] they have briefly explained the IR (Infrared Sensor) which is utilized in the project which emits IR (Infrared Rays) in order to detect humans. As a human (body) emits thermal radiation. Thermal radiation is basically detected and analysed by the IR sensor in order to detect the human beings in various situations. Once detected the person in need of help will be located, at the receiver side it immediately provide an audio alert and a visual image alert to the concerned authorities so that the person in need of help whether buried or unable to move can be reached as soon as possible. This IR sensor is basically placed in front of the moving robot that can move in all directions such as forward and reverse. The robot moves in either direction of the geared DC motor for optimum torque and minimum speed and motor drive with various relays for movement in forward and reverse directions with accuracy. The motor drive consists of two wheels and DC motors which is attached to perform movements in both forward and reverse directions. Detection of human by human rescue workers is tiring, and time consuming, hence it is better to use the robot.

### III. PROPOSED SYSTEM

This application proposes a system to overcome the above-mentioned drawbacks and meet the requirements. Human Detection using Unmanned Ground vehicle project consists of a PIR sensor, Arduino Uno, Buzzer, GPS Module, Node MCU, Solar panel, Bluetooth module. GPS module is used to calculate the longitude and latitude of the model and sends the calculation to Node MUC using a Wi-Fi connection. GPS modules do their calculation based on a technique called as triangulation. The GPS receiver triangulates by measuring distance using radio signal's travel time and it must be very accurate. And towards the end it calculates the delays and clock differences

that the signal experiences throughout starting from the satellites to the GPS receiver. This degree can be viewed on your Blynk app with the help of maps. It overcomes one of the main drawbacks that is power backup, Solar panels are used as a power backup and the battery which are present in the model are re-Chargeable battery. The solar panel can be connected directly to the battery providing the feature of recharging if they run out of charge.

#### IV. METHODS AND MATERIAL

The main components which are included in the implementation are:

**1.Arduino Uno:** As the name suggests it is a complete and bread-board friendly microcontroller board supported by ATmega328P. And it has fourteen digital input/output pins (Out of that vi may be used as PWM outputs), vi analog inputs, a sixteen MHz quartz, a USB affiliation, an influence jack, Associate in Nursing ICSP header and a push button. It contains everything required to support the microcontroller; merely connect it to a laptop with a USB cable or power it with an AC-to-DC adapter or battery to induce started.

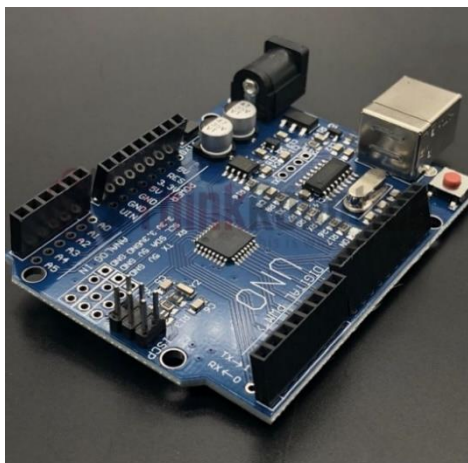


Figure 1. Arduino UNO

**2.PIR sensor:** The thermal radiation emitted by a person's body are received and manipulated by the PIR sensing element and it provides the output by detecting the humans. PIR sensor is used for sensing the motion of humans in a certain range. PIR sensor senses the motion and sends the information to the Arduino board. It operates at 5V DC the PIR (Passive Infra-Red) sensing element could be a pyroelectrical device that detects activity changes within the infrared.



Figure 2. PIR Sensor

**3.Buzzer:** The piezo buzzer is a type of device that is used to produce an alarm or any sort of tone. It has a very simple construction. It is lightweight and is typically a low-cost product. The working principle of the buzzer is that whenever an electric potential is applied, there is a variation in the pressure, and this makes the buzzer go off. Piezo buzzers are mainly used in alarm circuits.



Figure 3. Buzzer

**4. Bluetooth Module:** In this project we make use HC-05, it is a Bluetooth module which is used for wireless communication. It mainly has 6 pins and they are Key/EN, VCC, GND, TXD, RXD, State. It communicates with devices via a serial communication and finds its applications mainly in wireless products such as wireless mouse, wireless keyboard, game controllers etc. The range of the Bluetooth modules is usually less than 100 metres, and this is dependent upon various factors such as the transmitter, receiver and other geographic conditions.



Figure 4. Bluetooth Module

**5. Solar Panel:** This Arduino board module is equipped with two components and they are: solar array and Li-Ion battery, this will power your Arduino project in 2 ways: the first is by connecting your Arduino board to the module and then the module to its star panel; the second is by connecting the Li-Ion battery to the star module then the star module to your Arduino board via a bunch of five V wires. You will be able to charge your Li-Ion battery from the solar array or from a USB cable connected to your PC. Hence this component provides a power backup making the project more efficient and effective.



Figure 5. Solar Panel

**6. GPS Module:** GPS satellites circle the planet doubly every day in a very precise orbit. Every satellite transmits a novel signal and orbital parameters that permit GPS devices to decrypt and calculate the precise location of the satellite. GPS receivers use this information and trilateration to calculate a user's precise location. Basically, the GPS receiver measures the space to every satellite by the quantity of the time it takes to receive a transmitted signal. With distance measurements from various additional satellites, the receiver will verify a user's position and display the same.



Figure 6. GPS Module

**7. Node MCU:** The ESP8266 comes under the list of low-priced Wi-Fi semiconductor devices, with a full TCP/IP stack and various microcontroller capabilities, and it is manufactured by Express Systems in Shanghai, China. The chip first came to the eye of Western manufacturers in August 2014 with the ESP-01 module, created by a third-party manufacturer who is widely known as the Ai-Thinker. This tiny

module allows microcontrollers to attach to a Wi-Fi network and create easy TCP/IP connections. Node MCU is used as an intermediate between GPS module and Blynk app, Node MCU is an inbuilt Wi-Fi module that can be connected over the internet and transfers the data with the help of a web socket.



Figure 7. Node MCU

#### IMPLEMENTATION:

Bluetooth module used for providing communication between the Bluetooth signals will travel up to two hundred linear units and control the robot. PIR sensor can sense the motion and send the information to the microcontroller to alert the user. The PIR sensor find the human beings inside a radius of approximately ten feet and therefore the buzzer gets triggered whenever a motion is detected. Arduino Uno– receiver unit consists of input and output. Bluetooth module is the input end of the project and the buzzer is the output end. The PIR device will be placed at the sides to detect the obstacles and program it to avoid them, facilitating obstacle avoiding action and providing the output mistreatment the Buzzer. The GPS module is employed to keep track of the location of the robot.

The system is divided into 2 major modules:

- a) Human Detection Module
- b) GPS Module

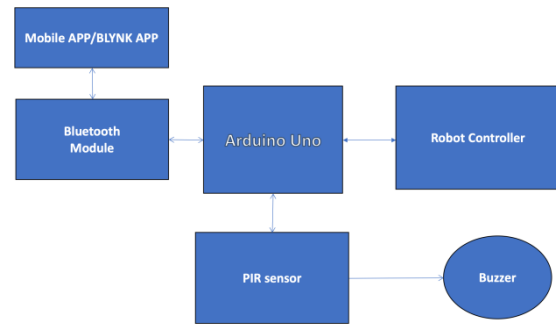


Figure (a). Human Detection Module

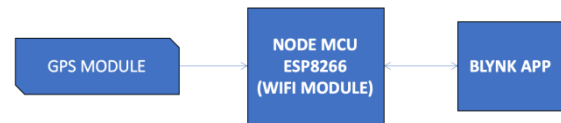


Figure (b). GPS Module

#### V. RESULTS AND DISCUSSION

Human Detection using Unmanned Ground Vehicle is an attempt at creating an intuitive application which is capable of being used by people in War Zones, Surveillance Purposes and Disaster areas. The idea is to design the application by keeping in mind the limitations it would present when being used by the given method. Human Detection using Unmanned Ground vehicle (IoT) project must be kept simple and intuitive with not a lot of effort made to assemble the model. This model consists of a PIR sensor, Arduino Uno, Buzzer, GPS Module, Node MCU, Solar panel. PIR sensor is used for sensing the motion of humans in a certain range. PIR sensor senses the motion and sends the information to the Arduino board. Arduino Uno is a microcontroller that calculates the value which is received from the PIR sensor. If the PIR sensor senses motion it will send the values to the Arduino board and the buzzer will beep notifying the user. Bluetooth Module is connected to the Arduino board and sends directions to the car chassis. Arduino Bluetooth Controller is an app which is used to control the chassis, Bluetooth module is connected to the Arduino controller, and we can control the chassis by





## VI. CONCLUSION

This project aims to give a practical design of a simplified version of a rescue robot that can be deployed in active warzones, jewelry stores for surveillance purposes and most importantly in areas where natural calamity such as earthquake has occurred. The proposed project will be able to operate in areas where rescue teams cannot operate due to technical difficulties. Human detection for rescue purpose is often administrated by humans in such conditions, however once there's a risk of collapse or dangerous setting it will be better to utilize some high-tech equipment to attain that mission quickly and effectively. A human detection remote-controlled ground vehicle is employed to detect the humans present around particularly throughout the rescue regimes when a natural disaster like earthquake, landslide, storms etc to save the lives of human. This can also be used to detect humans within the war field. This can also be used for security purposes to detect human presence. The ease of the message conveyance is the main advantage of the system. By implementing this system, a simple device for paralyzed or disabled people can be achieved without using any complex form of inputs. The prototype which we have made is operational for small areas. Hence, the system successfully proves that it is one of the best approaches that can be implemented in disaster areas and warzones with ease.

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### Cite this article as :

Mrs.Rafega Beham, Anusha D Singh, Bharani Prabhakaran, Joshua Linton J, "Human Detection using Unmanned Ground Vehicle", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN : 2456-3307, Volume 6, Issue 3, pp.304-311, May-June-2020. Available at doi : <https://doi.org/10.32628/CSEIT206373> Journal URL : <http://ijsrcseit.com/CSEIT206373>