Iot Based Robot For Mine And Trespassers Detection In Defence Field

Shyni S.M, Abitha Memala W, Bhuvaneswari C, D.N.S Ravi Kumar

Abstract: In defence fields the army people are facing many difficulties that even cause danger to their life. Considering the security of human and to reduce human efforts, a robot is developed using Internet of Things (IoT) technology. The proposed robot has the capability to detect the buried mines and also can find the trespassers with special sensors. The robot can move in all directions with the help of wheels controlled by H- Bridge module. It identifies the obstacles, detects the position of obstacles, and stores the information in cloud. With the IoT concept awareness is created to the nearest person by means of an alert. The robots mobility for surveillance is a boost for the visitor to move freely in the remote areas. The hardware is designed in such a way to communicate and monitor the army camp. This IoT based wirelessly controlled robot has the practical benefits of the detecting the position of obstacles and reducing the number of causalities of army people.

Keywords: Internet of Things (IoT), Mine detection, Human detection, GPS

1 INTRODUCTION

The attacks on the armed personal have increased exponentially and have raised a major concern for the officials working in the remote areas. The attacks vary from illegal intrusion into campus of army men and planting landmines causing huge unrest for human life. Introduction of robotics brings innovatory changes in this world. Which means a robot can be introduced to detect the intrusions and hidden landmines present over the remote area and to enhance human security. Thus the objective of the work is to reduce the complexity in monitoring the army camp, to develop a better way of communication between robot and crew, to maintain security in operation of robot and to achieve high accuracy during implementation. The day to day life activities of human are getting easier with the introduction of cloud based IoT technology. Now, the design of an IoT based wirelessly controlled robot for mine and human detection is a challengeable task. A robot is been proposed to detect the buried mines and humans to avoid human casualties without man power. This robot acts like an observer, present objectively in the real environment safeguards human life. The proposed robot has multi sensors that detect and locate the underground mines and avoid obstacles, without human contribution through wireless control. Here, the information is stored in server and incase of any threat it gives alert to the concerned person. In automotive applications, the distance of the vehicle from the ground is measured by means of ultrasonic sensor [2]. Working with a single metal detector sensor, landmines are detected [1]. Introducing the concept of using multiple sensors, a robot is designed for wireless communication [3]. The wheels meant for the movement of robots are modeled and perturbations due to skidding and slipping are analyzed [4]. The control of robot wheels and the balance of the body of the robot are ensured in [5].

- *Shyni S.M, Abitha Memala W, Bhuvaneswari C, D.N.S Ravi Kumar*
- *Department of Electrical and Electronics Engineering*
- *Sathyabama Institute of Science and Tecnology*
- *Chennai, India*

Here, a six legged robot is controlled by an operational space inverse dynamics control law. But the operation of robot is very slow. Hence a wirelessly controlled mines detection robot was proposed in [11]. The robot is equipped with special wheels controlled by H-Bridge module, allowing it to move in all possible directions. But the robot communication system is one way and if there is any sudden power failure all data gets erased from the controller and again the program has to be installed once again in the controller. MS An automated landmine detection system is proposed and is installed at the borders of a minefield for buried and surface detection [8]. The method is strictly image-based and does not depend on any thermal model. Any rough terrain and sparse vegetation will affect the system. Hence, mine detection robot system is developed to focus outdoor field task like rough terrain navigation and obstacle interferences [9]. Introduction of IoT makes the system more reliable and also improves the accuracy of the system. A multiple sensors robot is connected to internet for communication purpose [6] which ensures safety. The mobility of the robot in remote areas is controlled using Internet of Things (IoT) technology [7]. But, the features are limited to some extent. The IoT based intrusion detection system is used to detect the human passing the remote areas in [10]. Here, PIR sensor is used to detect motion and ZigBee to create a wireless network. In case of an intrusion being detected an alert text will be send to the concerned person through GSM module, enhancing safety. In the proposed work an IoT based robot has been introduced to detect intrusions and landmines present over remote areas. The robot has two wheels, so that it can move in all directions. It is integrated with cloud technology, which enhances security and a better way of communication between the robot and crew. The paper is summarized as follows: Section II deals with the architecture of IoT based robot. Section III explains the four modes of simulation analysis when a human or metal is detected. Section IV explains the step by step working procedure of the robot with hardware setup. The summary of the work is concluded in section V.

2 ARCHITECTURE OF IOT BASED ROBOT

The architecture of IoT based wirelessly controlled robot used for mine and human detection is shown in figure 1. The robot is equipped with multiple sensors which are connected to the pic microcontroller. A sensor is used to sense the

environmental condition and update it to the pic microcontroller. The sensors used for the operation of the robot are metal detector, PIR sensor, temperature sensor and ultrasonic sensor. The PIR sensor detects the presence of human over the defence areas. The temperature sensor gives the real time environmental conditions of the area. If the temperature rises above the normal temperature in case of fire accidents, the personal can be alerted and saved from damage. The ultrasonic sensor converts sound energy to electrical energy. The ultrasonic sensor avoids unnecessary collisions preventing the robot from damage. The metal detector is employed to detect the metal buried in that area. Global Positioning System (GPS) is used to track the location. A Wifi module is used to connect the robot with the security through IoT. IoT based technology provides effective communication through cloud. The wirelessly controlled robot has a dc motor drive with two wheels which helps to rotate the robot in all directions, either clockwise or counter clockwise. The coding will be uploaded in the pic microcontroller and commands are given to the robot to work accordingly. Whenever on patrolling, if the robot detects a metal or intrusion of crew it immediately uploads the data through cloud which is accessed by the security personal, making them alert. The detection of human or metal will be displayed on the LCD display as “PIR DETECT” and “METAL DETECT”. The location of obstacles can be tracked by the GPS. Here the robot can be controlled through cloud using web server and assure safety for human.

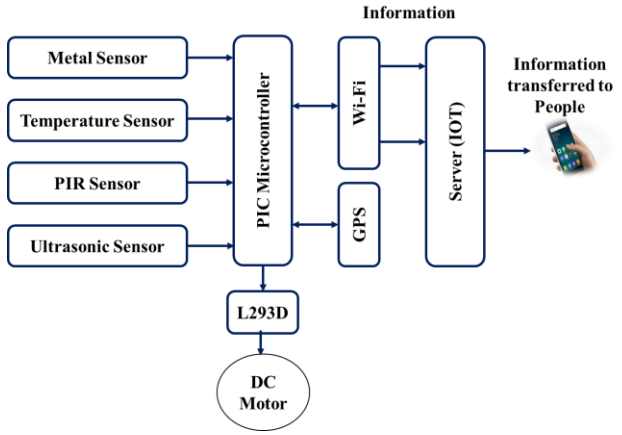


Fig. 1. *Architecture of IoT based Wirelessly Controlled Robot.*

3 SIMULARION ANALYSIS

The simulation analysis of proposed robot is carried out using proteus software. This tool is used to test microcontroller designs before implementing in real time. The metal sensor, PIR sensor, temperature sensor and ultrasonic sensor are connected to the pic microcontroller. Two dc motors are connected for the operation of wheels. GPS tracks the location of obstacles. The Wifi module interconnects the robot with the control room. In case of any danger an alert will be given to the patrol to protect them self from danger. The proposed simulation circuit for the IoT based robot is shown in figure 2. Different modes of operations can be performed based on detection of obstacles which may be human or metal or high noise. Here four modes of operations are performed, which are discussed below. The LCD displays the detection of human and metal. It displays the message “METAL DETECT” when metal is detected and “PIR DETECT” when human is detected.

A. Mode 1: Metal not detected and PIR not detected

In mode 1 there is no obstacles, means no human or metal is detected. The simulation results of IoT based wirelessly controlled robot during the absence of metal and human is shown in figure 3. Here, the LCD displays the message as “METAL NOT DETECT / PIR NOT DETECT”. The temperature sensor shows the real time operating temperature of that area. In case of high noise the ultrasonic sensor gets activated.

B. Mode 2: Metal detected and PIR not detected

If there is a presence of metal in the area where robot is roaming then mode 2 is activated. The metal sensor detects the metal and alerts the security, so that necessary steps can be taken to safeguard from danger. The simulation result of detection of a metal is shown in figure 4, which is indicated in the LCD display as “METAL DETECT / PIR NOT DETECT”. Here no person is detected by the PIR sensor. The temperature sensor and ultrasonic sensor does its work as usual.

C. Mode 3: Metal not detected and PIR detected

Here the PIR sensor detects the presence of human around the robot. The simulation results of IoT based wirelessly controlled robot in the presence of a human is shown in figure 5. Once the person gets detected, LCD displays the message “METAL NOT DETECT / PIR DETECT”. Both the ultrasonic and temperature sensor sense the sound and temperature of the area respectively.

D. Mode 4: Metal detected and PIR detected

When a metal and a human are detected then it activates mode 4. The metal sensor indicates the presence of metal whereas the PIR sensor indicates the presence of human. The simulation results of robot in the presence of metal and person is shown in figure 6. The LCD displays the message “METAL DETECT / PIR DETECT”. Once the obstacles are detected an alert will be given to the control room, thus creating awareness among the army people.

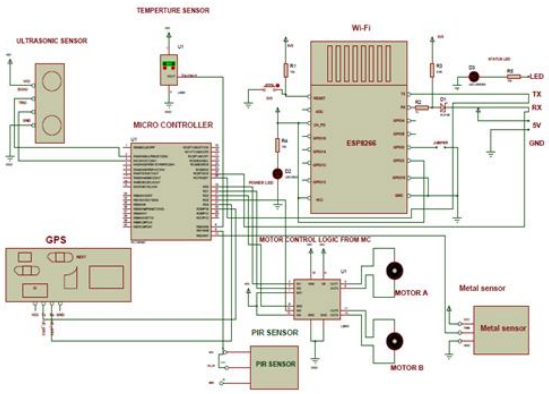


Fig. 2. *Simulation Circuit of Robot.*

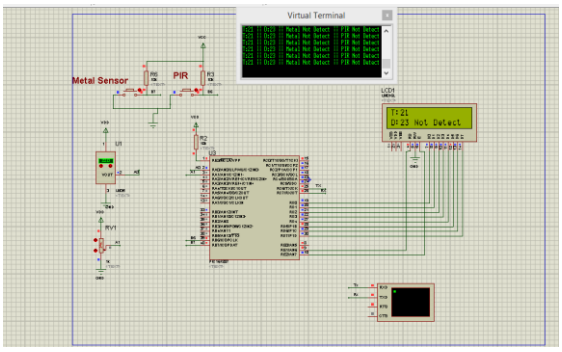


Fig. 3. *Metal not detected and PIR not detected.*

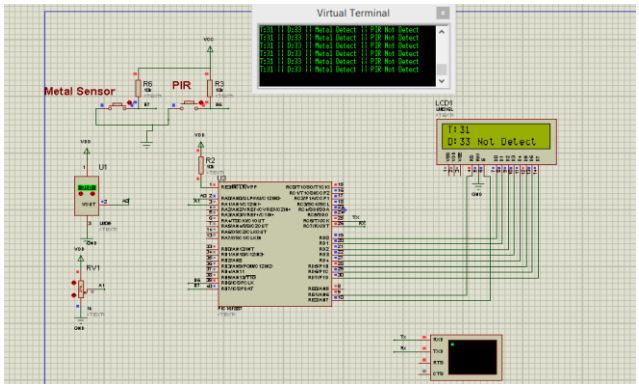


Fig. 4. *Metal detected and PIR not detected.*

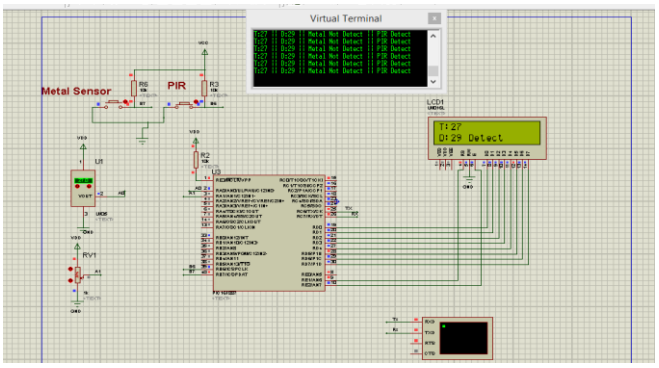


Fig. 5. *Metal not detected and PIR detected.*

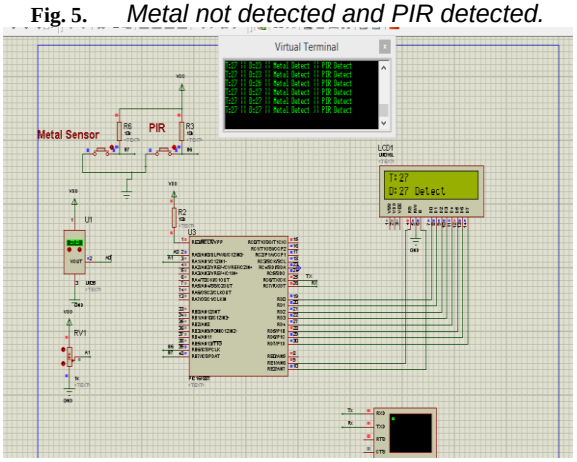


Fig. 6. *Metal detected and PIR detected.*

4 HARDWARE IMPLEMENTATION

The power supply is given to the robot and it starts working. Initially the pic microcontroller and the Wfi module have to be reset. Using start button present in the microcontroller one can reset it. And the Wifi module is booted once to make it reset. Now the Wifi module is connected with the PC through which internet is provided to the robot. The hardware setup of IoT based wirelessly controlled robot for mine and human detection is shown in figure 7. The step by step procedure for the operation of the robot is shown in figures 8, 9 and 10. Initially the robot is connected to our device, that may be mobile or PC. Then the web page is opened and the network SSID and password is entered. Next the webpage of cloud is opened, where the necessary details of our project can be checked as in figure 8. One can check the status of the robot working through cloud and also control it through the commands from cloud. The commands used for controlling the robot are 'F' for forward direction, 'B' for backward direction, 'R' for right hand side direction, 'L' for left hand side direction and 'S' for stop. The forward direction command is given as example in figure 9. As per the direction fed to the robot, it starts moving. The data's of temperature, location of robot, status of metal, PIR and ultrasonic sensors will be uploaded in the cloud as per the date and time. A part of the manipulated data is shown in figure 10. If the data exceeds its range then an alert will be given to the control room, so that necessary steps can be taken.

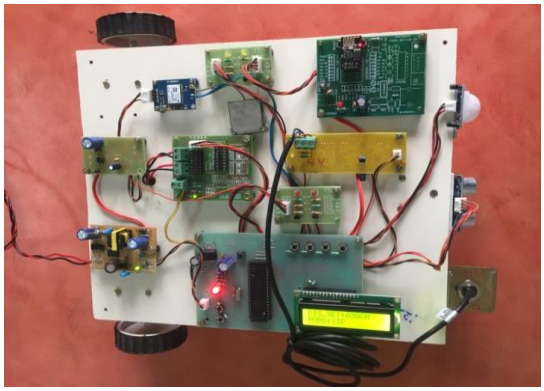


Fig. 7. *Hardware Setup of Robot.*

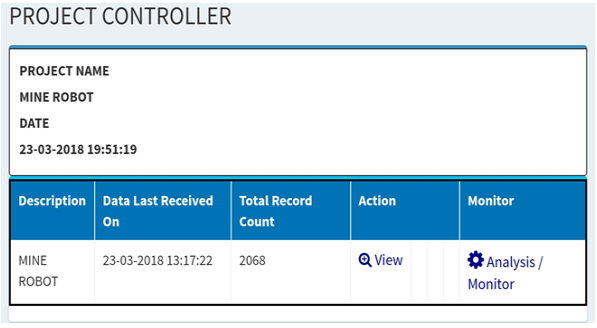


Fig. 8. **Project Controller Screen.**

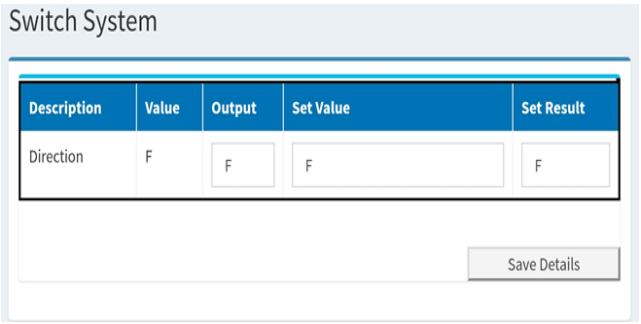
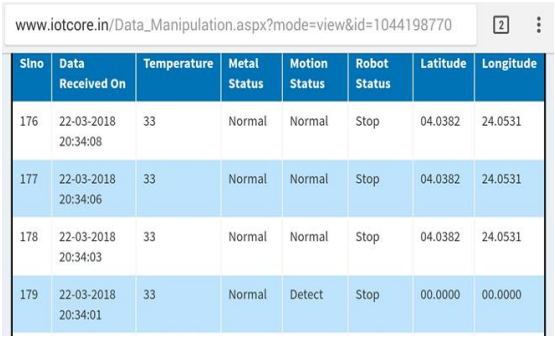


Fig. 9. *Motion Control Panel.*



Slno	Data Received On	Temperature	Metal Status	Motion Status	Robot Status	Latitude	Longitude
176	22-03-2018 20:34:08	33	Normal	Normal	Stop	04.0382	24.0531
177	22-03-2018 20:34:06	33	Normal	Normal	Stop	04.0382	24.0531
178	22-03-2018 20:34:03	33	Normal	Normal	Stop	04.0382	24.0531
179	22-03-2018 20:34:01	33	Normal	Detect	Stop	00.0000	00.0000

Fig. 10. *Data uploaded in Cloud.*

5 CONCLUSION

An IoT based robot is designed and implemented in this paper. It can be employed in defence fields where illegal intrusions and mines are planted. The robot is equipped with various sensors, so that it can alert the crew, which in turn focuses on the safety of the human. The IoT based robot has reduced the human effort and causalities. This robot is highly efficient in detection and also collisions can be avoided. The location and status of mines can be stored and monitored throughout the working period. If any unwanted intrusions or metal is detected, it alerts the crew patrolling the area. The real time monitoring is possible, making it an efficient robot. It can also be employed around buildings for security purposes. As this robot is employed for security purposes, a camera can be added to take real time pictures of the remote area as future scope.

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AUTHORS PROFILE

S.M. Shyni, received her M.E Applied Electronics in the year 2012. Currently, she is working as an Assistant Professor in the Department of Electrical and Electronics Engineering, Sathyabama Institute of Science and Technology, Chennai. She has more than 8 years of experience in teaching field. She is undergoing her research in Utilization of Renewable energy in the department of Electronics Engineering, Sathyabama Institute of Science and Technology, Chennai. Her current research area focuses on Soft Computing Techniques.

Abtiha Memala.W has completed her B.E (2003) and M.E (2005) degree under the department of Electrical and Electronics Engineering in Karunya Institute of Science and Technology, Coimbatore. She has completed her PhD under Faculty of Electrical Engineering in Anna University, Chennai in the year 2018. Her research interests are condition monitoring, renewable energy, power electronics, smart grid, fault diagnosis, signal processing and IoT.

C. Bhuvaneswari has obtained her B.E. Degree in Electrical and Electronics from Madras University. She has obtained her M.E. Degree in Power Electronics and Industrial Drives from Sathyabama University. She has more than 8 years of experience in teaching field. Presently she is doing her research work in the area of DC-DC Converters. Her areas of interest include Power Electronics, Power Converters and its applications.

D.N.S Ravi Kumar has completed his M.Sc.(Applied Electronics) in the year 2003 from Bharathiyar University Coimbatore ,India and M.E ((Applied Electronics) in the year 2006 from Sathyabama Institute of Science & Technology Chennai India.He is pursing PhD in the field of Vehicular Communication (Distributed Embedded Systems) from Sathyabama Institute of Science and Technology since 2015,Chennai India.His field of intrests includes Embedded Systems ,Vehicular Communication and Robotics. He is currently working on Smart car Technology (V2V).Apart from research an innovator to spark startup ideas to implementation .