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# Wireless Robo-Pi for Landmine Detection using Voice Control

P. Indhu Mathi[1], P. Saranya[2], R. Susmitha[3], L. Jiban Priya Devi[4]
[1,2,3]*Student, Dept. of Electronics and Communication Engg.,, Sri Muthukumaran Inst. of Tech., Chennai, India*
[4]*Asst. Prof., Dept. of Electronics and Communication Engg.,, Sri Muthukumaran Inst. of Tech., Chennai, India*

***Abstract*: Using the speech as the interface for processes became more important with the improvements of artificial intelligence. Speech is the most important way of communication for people. In this project, it is implemented to control a robot with speech commands. Speech commands were taken to the computer by the microphone, the features were extracted with The Mel Frequency Spectral Coefficients algorithms and they were recognized by the help of Artificial Neural Networks. Finally, the comments have converted the form in which the robot can recognize and move accordingly. Our proposed system aim to detect the landmine without any physical contact with landmine detector by a robotic vehicle operated by human speech commands. The system operates with the use of an android device which transmits voice commands to raspberry pi to achieve this functionality. The transmitter consists of the android phone Bluetooth device. The voice commands recognized by the module are transmitted through the Bluetooth transmitter. These commands are detected by the robotic vehicle in order to move it in left, right, backward and front directions. The Bluetooth receiver mounted on raspberry pi is used to recognize the transmitted commands and decode them. The controller then drives the vehicle motors to move it accordingly. This is done with the use of a driver IC used to control the movements. The Bluetooth technology used to transmit and receive data allows for remotely operating the system within a good range. Voice operated robot is used for one moving object is developed such that it is moved as per commands are given by the voice recognition module and that command is received by robot and robot is matched the given command with stored program and then set the command as per voice using wireless communication.**

***Keywords*: RaspBerrypi, Bluetooth, Metal Detecter Sensor, IoT.**

## 1. Introduction

According to official figures, more than 100 million landmines lie buried around the world. To help stop the destruction, the scientific community must develop effective humanitarian demining. The goal of military demining is to clear enough mines quickly to allow troops through a particular land area. The goal of humanitarian demining, in contrast, is to clear enough mines to permit normal civilian use of the land. To aid scientific inquiry into mine detection, this paper reviews the major current and developing technologies for mine detection. Robotic technology has flourished tremendously over time. The capability of a robot to track and follow a mobile human subject is of high interest as this ability can be used in numerous applications. On the other hand, the risk accompanied with their existence should be always an alarming fact to people living near the suspected area. According to the 'International Campaign to Ban Landmines Networks', more than 4,200 people, of whom 42% are children, have been falling victims to landmines. Other than direct injury for humans, mines deprive humans from the usage and exploitation of important land resources such as fertile land for agriculture or any usage. Thus this system allows us to detect the landmine using voice controlled robot.

## 2. Objective

The main objective is to operate the robotic vehicle by human speech commands for the purpose of landmine detection. This system operates with the use of an android device which transmits voice commands to raspberry pi to achieve its functionalities.

## 3. Literature survey

R. M. Sahu, Mamatta. S. Sawant designed a wireless detection of landmines using GPS and GSM .If a metal is detected it sends the signal data to controller and with the help of GPS it indicates the latitude and longitude of the exact position. GSM indicates attention command and send the information in the form of SMS. If the robot detects the land mine, it sends the radio signal by FM transmission. However the GSM fails to work, When the sky bears air masses. When there is no provision of GSM networks it is difficult for communication.

M.Hines and C.Rappaport proposed the localisation of anti-personal landmines using ground penetrating RADAR. In this Finite Difference Time Domain spatial resolution is used. Temporal resolution is used for the purpose of modelling GPR. Time of flight is determined by correlation of target signal. Ground penetrating radar is used for humanitarian demining to detect and localize the metal mines. The drawbacks of the system are that the plastics mines are hard to detect especially in the presence of scrap metal or explosive residue. It can be implemented only in the case of single type of metal.

Maki K. Habib designed the Coordinated Multi Robotic System for Demining Activities. Here the behavioural phase of

robot motion is employed here. This phase is use to generate a zigzag motion that is suitable to search the lanes of an assigned sector. The zigzag motion enables the robot to execute effective search for mines and avoid possible detected obstacle within any lane the robot is negotiating at the time. However, it cannot detect the dead locks and it does not give the exact longitudinal and the latitudinal location of mine.

Khaled M.S. Foda, Mohamed H. Wahdan, Khaled A. Al-Ameri proposed the Controlling a Robot Arm Using Exoskeleton for Land-Mines Disposal. Here this system comprises of exoskeleton system to measure the angles of each joint of human arm. It controls the movement of vehicle that holds the robot arm. Vision system is used to transmit video from the mobile camera and the user can see the surrounding area. Due to large size of the equipment exploring the mine is difficult and there exists a delayed communication between the user and the robot interface.

Vidyashree K. P, Aishwarya Mine detection robot and related humanitarian technology. In this is a portable robotic device was developed for humanitarian demining purposes. In this system Arduino board is used. Metal detecting VLF sensor is implemented to detect land mine. Here active RF sensors are used to detect RF tags. The main drawbacks of the existing it has reduced communication range for the control of the robot. It does not allow real time control simultaneously of two of the four Degrees of Freedom (DoF) available.

## 4. Methodology

The robotic vehicle consists of a dc motor which is used for the movement of the vehicle. It also consists of a metal detector sensor which is placed at the bottom of the vehicle. A buzzer is present as an alarm system if the metal detector sensor detects the landmine present under the ground. When voice command is given by the android user the vehicle starts moving. Here the voice commands are converted to text then it is transferred via Bluetooth module. This conversion of voice to text is done by conversion engine. If the landmine is detected the exact latitude and longitude position of the landmine is captured and updated to the cloud via Wi-Fi module. Thus the landmine can be detected using voice control.

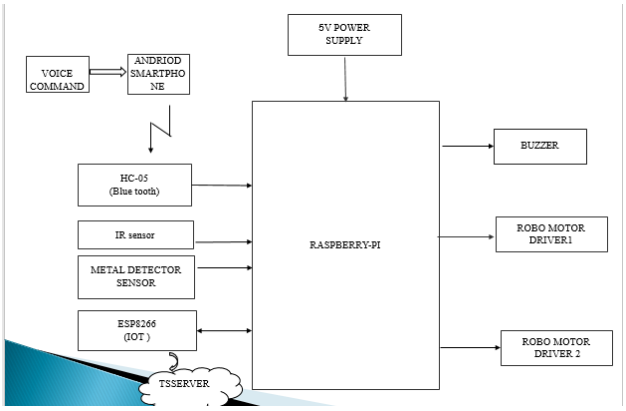


Fig. 1. Block diagram of the system

## 5. Components

*Raspberry Pi:* The raspberry pi is a System On Chip board. It has a programmable processor, an on-chip memory, an accelerating function hardware (e.g. GPU) and analog components. It uses RISC Architecture and hence draws low power. There are Two USB 2.0 ports in Rpi to enable the connection of external devices. It also helps us to connect with networks via the Ethernet port present in it. The frequency bands of operation are 2.4GHz, 5GHz.

Fig. 2. Raspberry Pi

*Bluetooth:* A bluetooth device uses radio waves instead of wires or cables to connect to a phone or computer. A Bluetooth product, like a headset or watch, contains a tiny computer chip with a Bluetooth radio and software that makes it easy to connect. When two Bluetooth devices want to talk to each other, they need to pair. Communication between Bluetooth devices happens over short-range, ad hoc networks known as piconets. The Bluetooth module is a MASTER/SLAVE module. The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC to your embedded project, etc.

Fig. 3. Bluetooth module

*Wi-Fi:* Wi-Fi allows the person in order to get access to web any place in the actual provided area. The Wi-Fi cards will read the signals and create an internet connection between user and network. Here the Wi-Fi module is used to implement the IoT technology. This helps us to know the exact location of the mine anywhere anytime. It is completely safe and it will not interfere with any network.

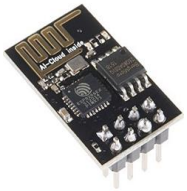

Fig. 4. Wi-fi module

*Metal detector sensor:* The metal detector sensor is used to monitor the presence of landmine present underground. These sensors generate a magnetic field from their detection faces. This effect triggers the sensor's output. Since a current in the target is needed for detection, inductive proximity sensors are uniquely suited for detection of all types of metals. A shielded inductive proximity sensor can be embedded flush in its mounting material without affecting the sensor's field of detection. Whenever a detectable object moves into the sensor's field of detection, Eddy currents build up in the target and dampen the sensor's magnetic field.


Fig. 5. Metal detector sensor

*IR sensor:* The IR sensor is interfaced with the controller in order to monitor and detect any kind of obstacles that obstruct the robot vehicle. The IR sensor can be modulated to cover better distance with greater immunity. Easy addressing and granular control can be exercised using this IR sensor obstacle that obstruct the robot vehicle. The IR sensor can be modulated to cover better distance with greater immunity. Easy addressing and granular control can be exercised using this IR sensor.

Fig. 6. IR sensor

*DC motor:* The dc motor used here is implemented to drive the wheels of the robot vehicle. It converts direct current (electrical energy) into mechanical energy. This mechanical energy used to drive the wheels in a particular direction.

Fig. 7. DC motor

*Motor Driver:* A motor driver is a little current amplifier. The function of motor drivers is to take a low-current control signal and then turn it into a higher-current signal that can drive a motor.

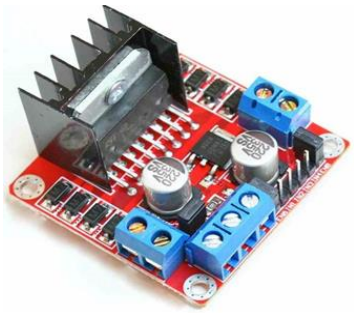

Fig. 8. Motor driver

### *A. Advantages*

- It's a complete remote controlled system.
- With the help of GPS we can detect the exact latitude and longitude position of the detected mine.
- Location of the detected landmine can also be accessed by mobile phones via GPS and IoT.
- Use of mobile phones for robotic control can overcome the disadvantage of limited frequency range operation.
- The system can be used both indoor and outdoor navigation.

### *B. Disadvantages*

- The system developed here is a moderate budget for landmine detection using voice control.
- Minimization in cost leads to compensation in performance.

### *C. Applications*

- Safer and more efficient as they provide a safe route for the soldiers through mine fields.
- Speed data transferring and transmission quality to improve central unit destination that is based on web server and a data base server application to store data regarding navigational field for current mapping and detection or future investigation purpose.

## 6. Future scope

The system can be supplemented with a drone. Size can be reduced and it can be used for spying. Robot arms can be implemented for demining and deactivating purposes.

## 7. Conclusion

It has been successfully proven through the prototype that the proposed theory and concept for land mine exploring the platform works perfectly. The detection of the burried mine is done by using metal detectors since most landmine contain metal components. The prototype is capable of detecting the burried metal piece, marking the exact location, and most importantly the prototype is controlled wirelessly by the operator from a safe distance. Thus the proposed design for

landmine detection and marking module had opened up a new area of the researches to explore.

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