Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 9 Issue 09, September-2020

# Design of Shoes Against Landmines

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***Abstract* – The landmine detecting devices are designed to cover maximum possible area of landmine field for detection of landmines. The detected landmines along with scanned and leftover area are represented on a visual map with accuracy in millimetres. This project presents a prototype model of land mine detecting shoes that are powerful yet low cost and easily controllable. To detect landmines metal detector sensor is used. The NEO-6M device is used in order to obtain location of land mine spot. ThingSpeak Cloud Server is used to log data of obtained co-ordinates of landmines. Local as well as remote alert indication mechanisms would be employed in this system. The graphical user interface for the remote server provides the effective analysis of the data logged by the shoes. TTGO TCall is used as a microcontroller as it has an inbuilt SIM800L GSM module which would be used for logging data via internet. The system is simple but powerful and intelligible to achieve the required results.**

***Key Words: Landmine Detecting Shoes, Landmine Detection, Metal Detector Sensor, NEO-6M, ThingSpeak Cloud Server, TTGO TCall.***

## 1. INTRODUCTION

A landmine is an explosive device which is bury under or on the ground and designed to destroy enemy targets, vehicles and tanks, as they pass over or near it depending upon its type. Landmines basically works on the pressure when individual or thing steps or passes by. Mines can cause direct damage or sometimes with splinters. There exist two types of mines, namely anti-personnel and anti-vehicle. These landmines can be dangerous and can harm ourselves if not taken out at appropriate time. With pressure from various campaign groups organised through the International Campaign to Ban Landmines, a global movement to prohibit their use led to the 1997 Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Antipersonnel Mines and on their Destruction, also known as the Ottawa Treaty. To date, 162 nations have signed the treaty.

**Anti-Tank mines**: They are designed to destroy vehicles and their occupants. In U. S. military terminology destroying the vehicles is referred to as a tragic kill while only disabling its movement is referred to as a mobility kill. Anti-tank mines are typically larger than anti-personnel mines and require more pressure to explode. The trigger pressure, normally requires 100 kilograms (220 lb) prevents them from being set off by infantry or smaller vehicles of lesser importance.

**Anti-personnel mines**: These mines are basically designed to kill or injure people. They are mostly used to injure rather than kill in order to increase pressure on the opposing force. Under the Ottawa Treaty, the Parties agreed not to use, produce, stockpile or transfer anti-personnel mines and ensure their destruction. In 2016, 162 countries have joined the Treaty. Thirty-six countries, including the People's Republic of China, the Russian Federation and the United States.

Fig -1: Anti-Tank mines

Fig -2: Anti-personnel mines

### *1.1 PROBLEM DEFINITION*

To develop a system which is capable of performing following actions:

- Landmine detection using metal detector.
- Location Tracking where the land mines are placed.
- Alert indication to the shoe user.
- Location data upload to ThingSpeak cloud server.
- Alert indication to the admin.
- Monitoring of recent locations of Land Mines at admin level.

## 2. LITERATURE SURVEY

There are many works on landmine detection which are available in the literature. In this topic, surveys of related works on the above fields are discussed.

**Bharath J, Automatic Land Mine Detection Robot Using Microcontroller.** In this paper we can see total 70 countries faced problem because of landmines. So by designing the robot prototype which is capable of detecting buried landmines and changing their locations, while enabling the operator to control the robot wirelessly from a distance we can remove the problems of landmine. in this technology the metal detector circuit is used in a robot to search the landmines to detect the metallic components used in landmines. The metal detector circuit is interfaced with the robot and it is left on the required search area. In this project the cost of making robot is very low and it is more efficient. And this is the main advantage of this project.

**Michael YU. Rachkov, Lino Marques, Anibal T. De Almeida.** It is described in the paper the advanced multi sensor demining robot. By using pneumatic drive element, the transport of the robot system is based. The robot can carry equipment's up to 100kg over rough terrains. The robot can adjust working position of the demining sensors because of the adaptive possibilities of precipitators to obstacles while searching for mines. The design of the robot is robust. There is metal detector, an infrared detector and chemical explosive

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sensors are used in detection block. An on-board processor is used to control the robot and by an operator remote station in an interactive mode. Results of the transport, control, and detection systems of the robot are presented. The weight factor due to the overloading sensor is high and it is the disadvantage of this robot.

**Seong Pal Kang, Junho Choi, Seung-Beum Suh, Sungchul Kang, Design of mine detection robot for Korean mine field**. in this paper we can see the critical design constraints of mine detection robots for Korean minefield. The environment of Korean minefield was investigated because of demining robot development project, and as per the requirements for suitable robot design were determined. Lots of landmines were buried close to the demilitarized zone (DMZ) in Korean minefield more than half of a century ago. since the Korea War areas have not been urbanized, and the vegetation covered all the potential locations of the explosives by military tactics. because of this at the initial stage of the demining robot system development, the target areas were investigated and the suitable design for Korean minefield terrain was determined. in this design it is includes a track type main platform with a simple moving arm and a mine detection sensor (which consists of a metal detector and a GPR at this stage), distance sensing technique for terrain adaptability was developed to maintain the effective distance between the landmine sensors and ground surface. and briefly introduced in this paper. By considering the speed, the overall design of this robot was determined.

## 3. FIRMWARE

**Hardware's**

- TTGO TCALL Microcontroller
- GSM SIM Card
- NEO-6M GPS Tracker
- Metal Detector Module
- Lithium Polymer Battery
- TP4056 Battery Charging Module
- Jumper Wires
- USB Cable

**Software's**

- ARDUINO IDE
- THINGSPEAK CLOUD

## 4. METHODOLOGY

The project is based on TTGO T Call microcontroller. The TTGO T Call microcontroller is based on ESP32 board and has a SIM800L module inbuilt on it. The device will consist of TTGO T Call microcontroller, Metal Detector Module, NEO-6M GPS Locator and a Lithium Polymer battery to powered these devices. The metal detector will determine the landmines hidden in the ground and provide a signal to the micro controller. A local alert will be given to the user at the same instant. The microcontroller will then demand for the location co-ordinates from the NEO-6M device. Once the location co-ordinates are obtained a link will be created by the microcontroller. The SIM800L module will then be used to access this link by the microcontroller. Once the microcontroller accesses this link then data regarding the location will be written on the ThingSpeak cloud server. The admin can login into the ThingSpeak to view the data logged by the device.

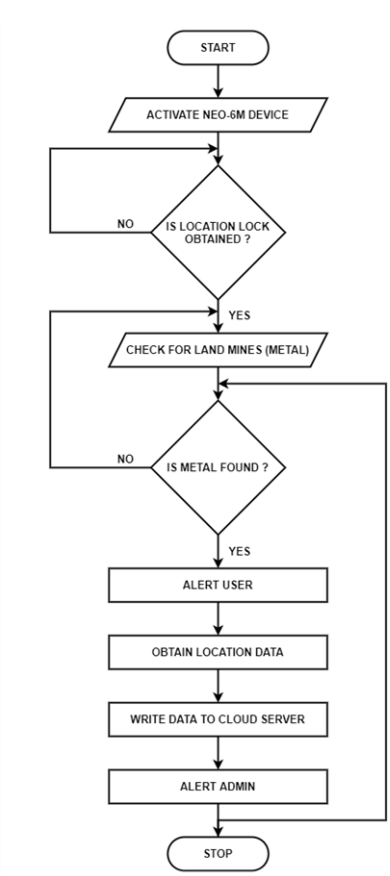


Fig -3: Flowchart

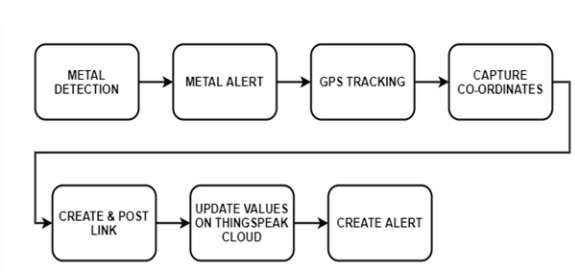


Fig -4: Design process

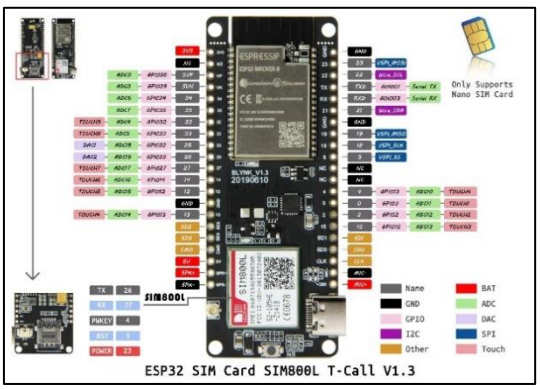


Fig -5: TTGO TCall Pinouts

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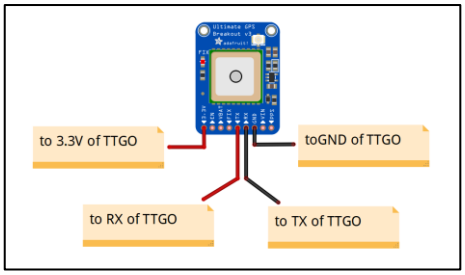


Fig -6: NEO-6M Location Tracker Section

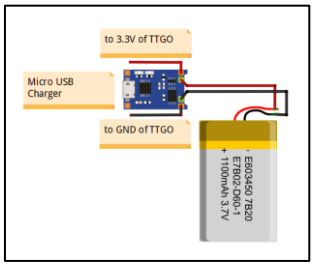


Fig -7: Power Supply Section


Fig -8: Metal Detector Module Section

## 5. WORKING

The project is based on TTGO T Call microcontroller. The TTGO T Call microcontroller is based on ESP32 board and has a SIM800L module inbuilt on it. The device consists of TTGO T Call microcontroller, Metal Detector Module, NEO-6M GPS Locator and a Lithium Polymer battery to powered these devices. The metal detector determines the landmines hidden in the ground and provides a signal to the micro controller. A local alert is given at the same instant to the user if a landmine(metal) is found. The microcontroller then demands for the location co-ordinates from the NEO-6M device. Once the location co-ordinates are obtained a link is created by the microcontroller. The SIM800L module is then used to access this link by the microcontroller. Once the microcontroller accesses this link then data regarding the location is written on the ThingSpeak cloud server. The admin can login into the ThingSpeak to view the data logged by the device. This action takes place in a loop once the device is switched on. The device sends co-ordinates for all the spots detected. These co-ordinates are stored in the cloud server. The co-ordinates can be accessed by exporting the data in the cloud server into an excel spreadsheet. Time at which the data was logged is also noted in the cloud server and can be found in the exported data too.

## 6. CONCLUSIONS

This project has described overall design for shoes for land mine detection purpose and implementation. The shoes are less expensive, robust and they are a helpful tool in military for surveying and monitoring purpose. The shoes can be monitored locally as well as remotely for any alerts thus making them highly efficient. Moreover, changes can be done in order to make the system less bulky and easy to fit into regular shoes.

### *6.1 FUTURE SCOPE*

- The system can be completely made on a Printed Circuit board.
- Size of the system can be reduced in further versions.
- Cold start time of the system can be reduced.

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