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Landmine Detector Robotic Vehicle

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ABSTRACT
Nowadays, in countries such as Afghanistan and Iraq, land mines are posing a major danger to the lives of civilians. These mines are explosive devices that are designed to disable or destroy enemy targets and are typically hidden beneath the surface of the ground. Most land mines are placed just below the ground and are triggered by pressure or trip-wires. They typically contain a number of metallic components, which can be used to detect them. The mines that are set up during times of war may remain undetected for extended periods. The term "Metal Detector" implies that it can be done from a distance, allowing for a safer approach to locating landmines. Using a mine detection robot, soldiers can traverse mine-ridden areas without entering them, providing a secure and efficient way of landmine detection. Other methods, such as radar bullets, biological methods, and mechanical methods, are much risky and put soldiers' lives at risk. The Landmine Detection Robot, which utilizes both IoT and GPS technology, is a much safer option.

Keywords: *Metal Detector, Wi-Fi module, Global Position System (GPS), Global System for Mobile Communication (GSM), IoT, Solar Panel, LCD, Motor Driver.*

1.INTRODUCTION

In warfare, buried landmines cause a significant number of casualties, even after a conflict has ended. These unexploded landmines possess a dangerous characteristic: they can remain active and functional for an extended period of time. Consequently, the risk of fatal damage and death from landmines is ever-present. Due to their affordability and ease of construction, landmines have become an effective weapon. They typically consist of explosives and a triggering mechanism, often activated by weight. Different types of landmines exist, each requiring a specific weight to trigger them. These mines are strategically buried at shallow depths in the soil, making them difficult to detect with the naked eye [2]. Unaware individuals may unintentionally step on them, resulting in severe injuries or death due to the ensuing explosion. Landmines can be deployed in specific patterns to impede enemy movements. For instance, a zigzag pattern can slow down advancing enemies, while mines strategically placed can force the enemy to alter their path, leading them into an ambush. These characteristics make landmines highly effective, as they can be easily deployed and remain undetected and fully functional for extended periods. This project provides a comprehensive review of existing and advanced techniques developed for landmine detection, with electronics playing a crucial role in the development and efficient utilization of some of

these methods. The discussed techniques include the use of metal detectors and mechanical methods, outlining their functionality, advantages, and limitations [3]. The detection system's performance can be enhanced by employing multiple techniques simultaneously.

2.DESCRIPTION

The automated control system consists of GPS module, GSM Modem, Microcontroller, Metal detector sensor Motor Driver L298, DC Motor. The unit is expressed in figure below:

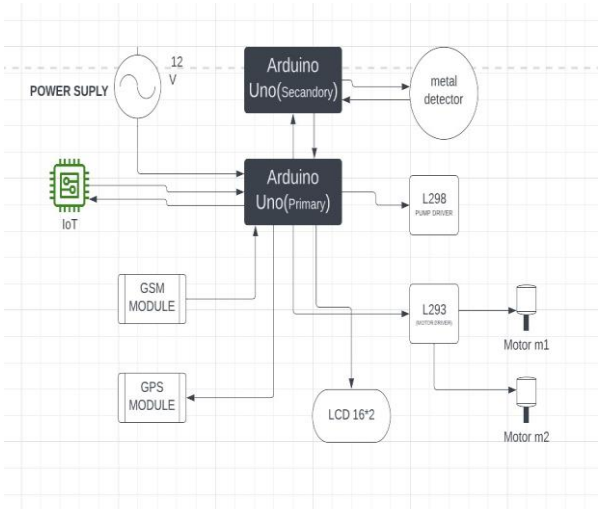

Fig.1 Block Diagram

Arduino UNO- The Arduino Uno, developed by Arduino.cc and released in 2010, is a microcontroller board that utilizes the Microchip ATmega328P microcontroller. It operates as an open-source platform and offers a range of digital and analog input/output (I/O) pins for connecting with expansion boards (shields) and other circuits. With 14 digital I/O pins (including six capable of PWM output) and 6 analog I/O pins, it can be programmed using the Arduino IDE (Integrated Development Environment) through a type B USB cable. Power can be supplied via a USB cable or a barrel connector, accommodating voltages between 7 and 20 volts, such as a rectangular 9-volt battery. It bears similarities to the Arduino Nano and Leonardo models. The hardware reference design is shared under a Creative Commons Attribution Share-Alike 2.5 license and can be accessed on the Arduino website, along with layout and production files for certain hardware versions.

GPS Receiver with Active Antenna- GPS satellites broadcast signals from space, which are utilized by GPS receivers to provide precise three-dimensional location (latitude, longitude, and altitude) along with accurate time information. These receivers offer reliable positioning, navigation, and timing services to users across the globe, regardless of weather conditions, time of day, or location on or near Earth. Sunroom's GPS receiver stands out with its exceptional performance in challenging environments and poor signal conditions. Equipped with an active antenna and high sensitivity, it can acquire GPS signals from 65 satellite channels and deliver highly accurate position data. With a tracking sensitivity of 160dBm, this receiver ensures uninterrupted position coverage in nearly all application environments. The output of the receiver is in the form of serial data, transmitted at a standard baud rate of 9600, adhering to the NMEA 0183 v3.0 protocol. This protocol provides industry-standard data messages and

a user-friendly command interface for seamless integration with mapping software and embedded devices.

GSM- The acronym GSM stands for Global System for Mobile Communication, which refers to an open and digital cellular technology widely employed for mobile communication. GSM operates on four distinct frequency bands: 850 MHz, 900 MHz, 1800 MHz, and 1900 MHz It utilizes a combination of FDMA (Frequency Division Multiple Access) and TDMA (Time Division Multiple Access) for efficient communication.

Motor driver- There are two motor driver options available: the L298N and the L293D. The L293D is a basic integrated chip (IC) used for motor driving, allowing control over the direction and speed of a DC motor. This 16-pin IC features 8 pins on each side, providing the necessary interface for motor control. With a single L293D, it is possible to operate up to two DC motors. This IC incorporates two H-bridge circuits, which are simple circuits designed for changing the polarity across the connected load. On the other hand, the L298N Motor Driver Module is a powerful motor driver module suitable for both DC and Stepper Motors. It consists of an L298 motor driver IC and a 78M05 5V regulator. The L298N module offers the capability to control up to 4 DC motors, or 2 DC motors with directional and speed control.
Power supply unit- On-board 12V rechargeable battery is used to drive dc motors &PIC16F877 &AT89C51. We require 3.3V and for various sensors and we require 5V to drive RF module, etc. So, to do this we will have to build power supply unit using voltage.

WORKING
The metal detector is equipped with copper coils that can detect the presence of any metal. It consists of two Arduino one is primary the power supplier to the whole system and the other is secondary which is coupled with detector coil and commands the whole system after the metal is detected. When metal is detected, the information signal is transmitted to the controller. By utilizing GPS, the system is able to determine the latitude and longitude coordinates of the detected position. The GSM module, operated through Attention Command, sends an SMS. The motor driver L298D is used in this system because it only requires a +5V power supply, while the motor itself requires +12V to operate. The L298D has the capability to rotate the motor even when the input power supply is +5V.

The system consists of two main modules: the control station, which runs on a smart phone, and the remotely controlled robot. The control station consists of three integrated modules: the metal detector coil, the GPS & GSM, and the remote-control component. While these three components function as a single system, the main components operate as independent systems simultaneously. The remote-control system utilizes a radio frequency transmitter, while the control system on the computer or laptop uses the parallel port and control relays to remotely control the robot with the help of an app “Wi-Fi Controller ESP8266”. The GPS transmits the robot's location through a IoT module data connection. The GPS control software is coupled with the metal detector coil and the controller. Although these three components act as a unified system, the main system components function as independent systems simultaneously.

The GPS component of the control software reads NMEA data through the communication port of the computer or laptop. The software decodes the NMEA data and uses the robot's location mapping as the GIS software, providing GIS layers to the developed software. As soon as the robot detects the landmine it sends a text message that "THE LANDMINE IS DETECTED" with the coordinates of the detected location through GSM module. Also, with the help of spray it marks that location.

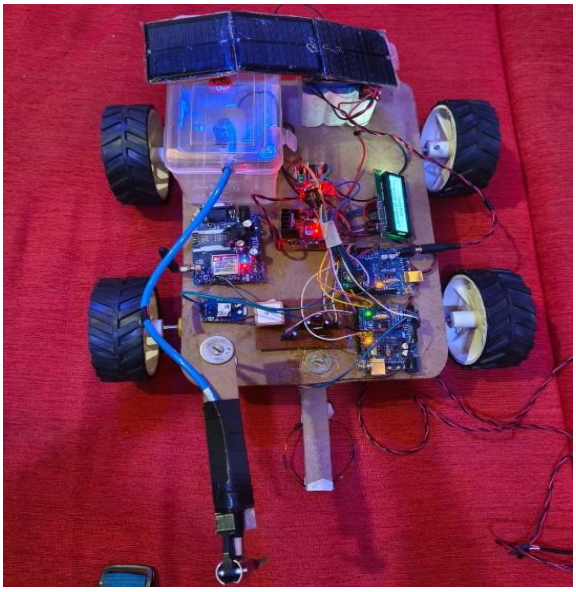

Fig.2 Working model

ADVANTAGES

• Completely operated through remote control.
• GPS enables us to obtain latitude and longitude coordinates of the identified position.
• The locations of detected landmines can be accessed through mobile phones using GPRS and SMS.
• Wireless-controlled robots typically employ RF circuits, which have limitations such as restricted working range, limited frequency range, and limited control capabilities. Utilizing a mobile phone for robotic control can overcome these drawbacks.
• This approach offers the benefit of robust control, allowing for a working range as extensive as the coverage area provided by the service provider. Additionally, it avoids interference with other controllers and supports up to twelve controls.

CONCLUSIONS

The paper introduces an innovative solution and a novel approach to remote sensing using metal detectors to detect metallic landmines in the El Alamein region. The proposed advanced solution addresses three key challenges: a) the lack of maps indicating the locations of landmines planted during World War II in the Egyptian western desert, b) limited funds available for addressing the issue, and c) the restricted utilization of technology.

To overcome these challenges, the solution integrates various technologies, including wireless communications, cellular technologies, and packet-oriented mobile data services. This integration enables the landmine monitoring team to maintain complete control over the process from a safe distance, particularly in fenced minefields or suspicious areas. The solution combines several components such as GSM sound trackers, GPS trackers, smart cellphones, advanced applications, and

RC truck equipment to accomplish three primary tasks related to metal landmines: a) tracing, b) detecting, c) pinpointing the location coordinates, and d) marking the location.

The paper presents a cutting-edge solution that leverages integrated technologies, wireless communication, and mobile data services to detect metallic landmines in the El Alamein region. By addressing the absence of maps, financial limitations, and technological constraints, this approach offers a comprehensive and efficient method for remote sensing and monitoring of landmines.

FUTURE WORK

In future this project can be used to detect the landmines that are hidden inside the earth surface. While, our current project is all about the detecting the landmines and with the help spray we are able the mark the detected place. Also, with the help of GSM & GPS module we'll be able to send the coordinates of the detected mine through a text message and also a notification to the app. In future, we'll be attaching a IR camera to send the images of the detected place. We'll also work on minimizing the error rate of the coordinates that are sent by GPS by 10-15cm. In future we will modify this project such that it'll be able to mark the safe path for humans to reach the mine and deactivate it.

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