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Landmine Detection Robotic Vehicle Using Arduino

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ABSTRACT: In the present world, numerous nations are developing various technologies. Consequently, protecting soldiers and army personnel who battle for their respective countries' national security. Unmanned ground vehicles called landmine detecting robotic vehicles are created to find and indicate the locations of landmines for later neutralisation or removal. When a landmine is found, the vehicle employs GPS and GSM technologies to indicate its location so that a human specialist may remove it safely. Robotic vehicles for landmine detection offer a safer and more effective way to clear areas of landmines, lowering the possibility of human harm or death.

KEYWORDS: Ultrasonic Sensor, Metal Detector, GPS Monitoring, Arduino Atmega 328

I.INTRODUCTION

In order to encounter above problems a robot prototype is prepared which is capable of detecting buried landmines as well as sending the location hence while enabling the operator to detect landmines precisely. A metal detector which uses the concept of Electromagnetic Induction (EMI) based sensors can detect metal mines. As the landmine is detected the robotic vehicle stops at that position and GPS module is activated. The GPS data is extracted to get the latitude and longitude information of a particular location.

II.EXISTING METHOD

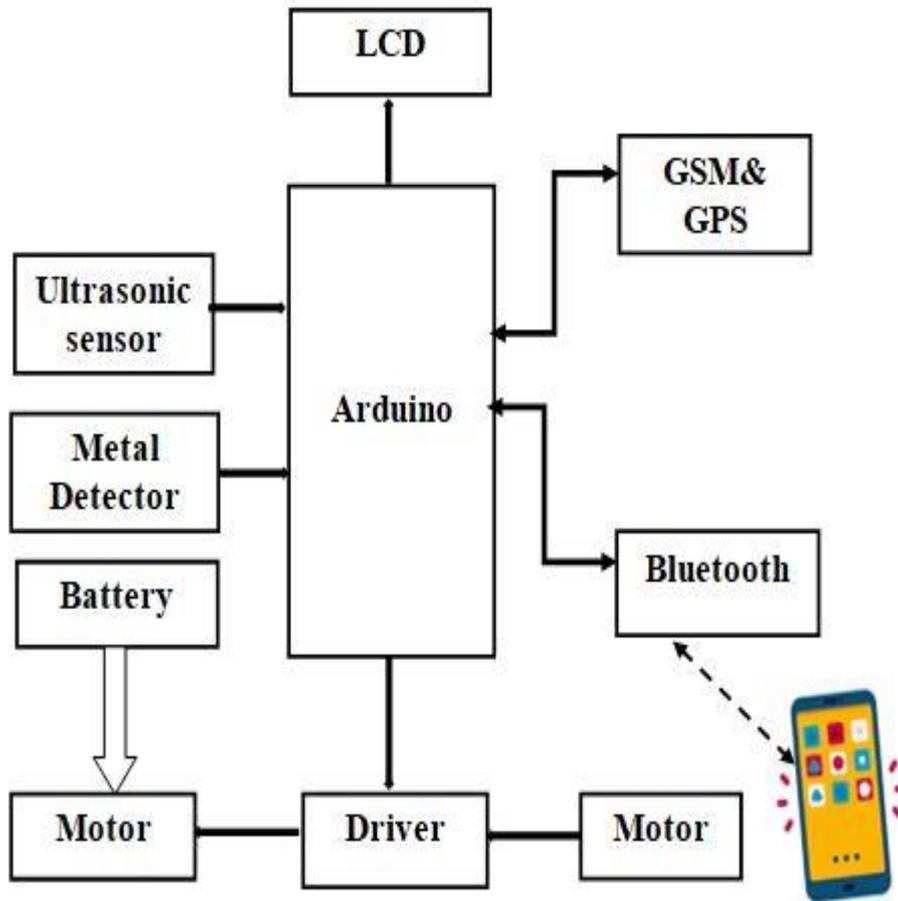
In the current system, electromagnetic induction-based sensors, which have been researched and used, are the most popular way for detecting metal mines. The mine casing determines the mines' electromagnetic properties. Human intervention is necessary for landmine detecting methods. A soldier must always have a metal detector on them to locate mines. The existing systems have restrictions on the frequency at which electromagnetic sensors can be used.

III.PROPOSED METHOD

The design of a land mine detection robot is required for use in operations, peacekeeping, and the cleanup of damaged areas. The robot is controlled with the aid of a bluetooth with gsm module for the operator's safety. A permanent ultrasonic sensor on the robot helps it find and avoid obstacles. Latitude and longitude data from the GPS sensor can be used to find the mine. A material that can withstand blasts up to a particular threshold was used to construct the robot structure. The robot uses a buzzer attached on it to emit a warning notice for the nearby personnel. High-powered DC motors supported by a h bridge circuit are used to actuate the robot. The proposed system block diagram is displayed in Fig. 1 below



IV.BLOCK DIAGRAM



V.HARDWARE & SOFTWARE REQUIREMENTS

Hardware Requirements	Software Requirements
Metal Detector	Arduino Atmega 328
Ultrasonic Sensor	
GPS	
Battery	
GSM	
Bluetooth DC Motors	



V. COMPONENTS USED

ARDUINO BOARD:

The ATmega328 from Microchip has a 32KB flash-type programme memory and an 8-bit, 28-pin AVR microcontroller with RISC architecture. It features a 1 KB EEPROM memory and a 2 KB SRAM memory, and it may be found on the Arduino UNO, Arduino Pro Mini, and Arduino Nano boards. Port A (PA0-PA7) is made up of eight pins that are used for ADC operations. Three built-in timers are also included, two of which are 8-bit and one is 16-bit. Figure 3.2.1 depicts the ATMEGA 328's picture. The FTDI USB-to-serial driver chip is absent from the Uno, setting it apart from all earlier boards. Instead, it has an Atmega16U2 that has been configured to act as a USB-to-serial converter.

VI.METAL DETECTOR

Metal Detector with speaker and TTL output. A metal detector is an electronic instrument which detects the presence of metal nearby. Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. This small metal detector unit can detect metal and have a inbuilt speaker for signal, also it provides digital output for microcontroller.

VII. ULTRASONIC SENSOR

The UTR (Ultrasonic Transmitter/Receiver) is a hybrid circuit that enables the implementation of an ultrasonic detector by using only a small number of external components. The amplitude variation of the received ultrasonic signal (40 KHz), caused by the movement of an object, provides the basis for detection. Thanks to "Thick film hybrid" technology, it exhibits stable electric characteristics. An acoustic transducer that vibrates at ultrasonic frequencies is used in ultrasonic sensors. A cone-shaped beam of the pulses is directed at the target item. Echoes are the result of the target reflecting pulses back to the sensor. To precisely calculate the sensor-to-target distance, the device measures the interval between each pulse that is emitted and the corresponding echo.

HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module.

VIII.GLOBAL POISTIONING SYSTEM

The Global Positioning System (GPS) is a space-based navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil, and commercial users around the world. The United States government created the system, maintains it, and makes it freely accessible to anyone with a GPS receiver.

The L80 is a small patch antenna-integrated GPS module. The high performance MTK positioning engine offers the lowest power consumption, highest sensitivity, accuracy, and TTFF (Time to First Fix) in a small-footprint lead-free device. L80 can acquire and track satellites in the shortest amount of time even at low signal levels inside because to its 66 search channels and 22 tracking channels.

The L80 is a patch antenna that is contained in a GPS POT (Patch on Top) module that is incredibly small (15.0 x 15.0 x 4.0mm). L80 is the ideal module for the little gadgets because of its compact design. L80 offers remarkable performance in both acquisition and tracking thanks to its integration with a patch antenna and adoption of the LCC package. EASYTM (Embedded Assist System), a cutting-edge AGPS, and the tried-and-true Always Locate™ technology are combined.

IX.BLUETOOTH

An accessible Bluetooth SPP (Serial Port Protocol) module, the HC-05 is made for setting up transparent wireless serial connections.

A fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps modulator with a full 2.4GHz radio transceiver and baseband is available as a serial port Bluetooth module. It makes use of the CMOS-enabled CSR Bluecore 04-External single chip Bluetooth system with AFH (Adaptive Frequency Hopping Feature). Its footprint measures just 12.7 mm by



27 mm. I hope it will make the design and development cycle more straightforward.

It is a class-2 Bluetooth module that has a Serial Port Profile and may be set up as either a Master or a Slave. a transparent, drop-in substitute for wired serial connections. It can be used as a simple serial port substitute to link an MCU, PC, embedded project, and other devices.

X. GSM

GSM stands for **Global System for Mobile Communication**. It is a standard developed by the **European Telecommunication Standards Institute (ETSI)** to describe protocols for 2G networks. It acted as a replacement for 1G cellular networks. GSM is basically an open, digital cellular radio network and operates in almost all the countries. It is not only used for voice calls but also for data computing and text messages. While CDMA (Code Division Multiple Access) doesn't support calls and data computing at the same time.

XI. BATTERY

The earliest kind of rechargeable battery is the lead-acid battery. The cells' capacity to supply strong surge currents allows them to maintain a very high power-to-weight ratio despite having very low energy-to-weight and energy-to-volume ratios. They are appealing for use in providing the high current because of these qualities and their inexpensive price.

XII. DC MOTOR

The direct current motor, often known as a DC motor, has many uses in today's engineering and technological fields. DC motors are used in all small- or medium-sized motoring applications, ranging from an electric shaver to car parts. Additionally, numerous functional varieties of dc motors are offered on the market for a variety of needs due to its broad application. The DC motor in our project is utilised to move the car forward, backward, left, and right. This motor has a 12Vdc, 30RPM speed.

XIV. CONCLUSION

Robotic landmine detecting techniques can reduce the danger of loss of life and lower the cost of detection. Due of their failure to identify them, the majority of soldiers have lost their lives or body parts during times of conflict, where they play a crucial role. A landmine can be precisely marked in the field or located using a metal detector. This information has been found in an effort to protect the lives of our soldiers, local residents who may be at risk from landmines, and our national economy. It is a national project that saves lives by preventing human intervention with landmines and allows only robots to find and deactivate potentially lethal landmines.

XV. RESULTS AND DISCUSSION

There are mainly two parts in this project i.e, electronics part and mechanical part. In the electronics part the simulation of all the electronics part like arduino, ultrasonic sensor, dc motors etc are done using the software. The two planetary geared DC motor are connected to the output pins (9,13), of the microcontroller board. The ultrasonic sensor is connected to the input pins (10, 11) to avoid the obstacles. The metal detector sensor are connected to the input pins (12, 13), for detecting of the mines. The LCD display connections are connected to the output pins (2, 3, 4, 5, 11, 13). For simulation, Arduino Uno have to import first to display and then sensors and motor has to imported. As pin configuration is stated above the connections are made in software. Fig 1 represent the GSM Module sending GPS co-ordinates via SMS to Smartphone, Fig 2, Output of GPS Module, Fig 3 represent the When metal gets detected GPS co-ordinates are sent to Smartphone and Fig 4 the exact location where metal got detected.



FIG 1: GSM Module sending GPS via SMS to Smartphone

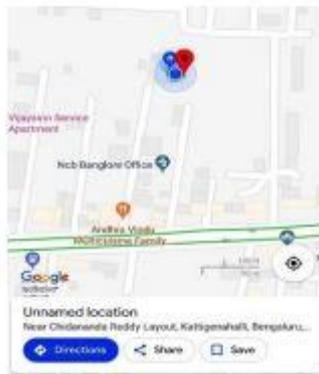


FIG 2: Output of GPS Module



FIG 3: When metal gets detected GPS Co-ordinates are sent to Smartphone

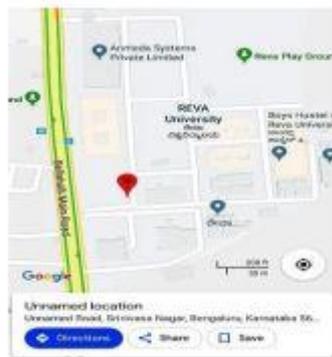
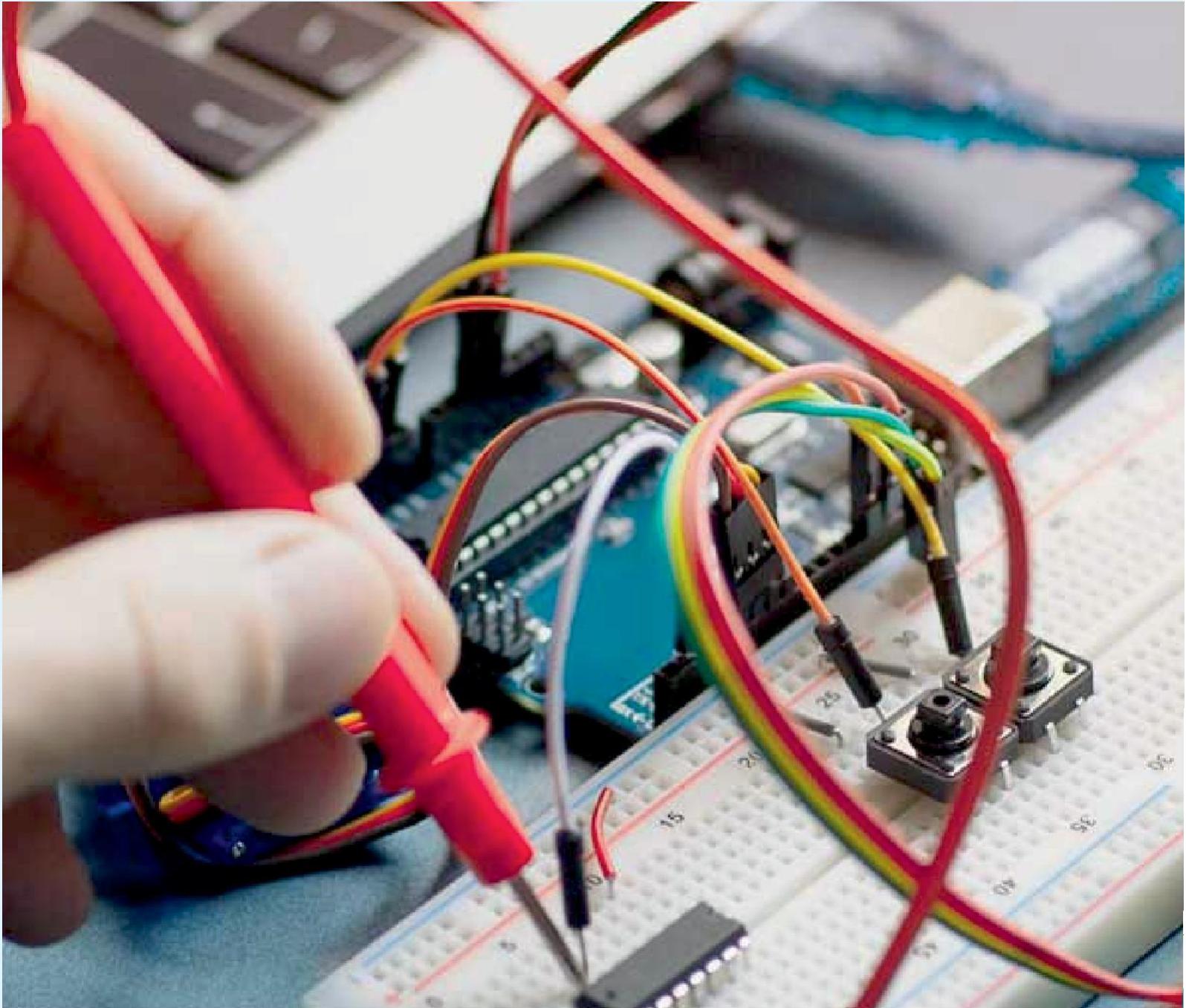


FIG 4: The exact location where metal got detected



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