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# Development Of Mine Detection Machine Using Metal Detector Sensor

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**Abstract:-** Some of the most prominent problems facing the world today are lad Mining and Insurgency. Governments and scientists across the globe are working day and night in order to bring these problems under control. Billions of dollars are spent by nations for the research of new mining systems which are capable of safeguarding citizens from over lapping of rocks during mining. Nowadays with major advancements in the field of vehicle automation, several dangerous and crucial counters for mining operations are being handled by sophisticated machines which are not only more efficient but are also responsible for saving several human lives. Our project "Unmanned Ground Vehicle" is built to undertake missions like mine detection as a standalone unit for metal detection as well as in coordination with human beings (manual) wirelessly and it is free of charging because of inbuilt solar panel for battery charging system. A person from a remote place can comfortably control the motion of the robot wirelessly and in situations where manual control is not prudent, the vehicle is capable of reaching the pre-programmed destination on its control. This robot would be installed with an automatic Metal detection (metal detection sensor) and GPS, GSM system to detect the location and send's the signal to the registered mobile number.

**Keywords**: Automatic Robot, Changing Place of Landmine, Landmine Detection, Micro-controller-based Robot.

## 1. INTRODUCTION

An unmanned ground vehicle (UGV) is a military type acro-bot used to augment the soldier's capability.

This type of robot is generally capable of operating outdoors and over a wide variety of terrain, functioning in place of humans.

UGVs have counterparts in aerial warfare (unmanned aerial vehicle) and naval warfare (remotely operated underwater vehicles).

Unmanned robotics is actively being developed for both civilian and military use to perform dull, dirty, and dangerous activities.

There are two general classes of unmanned ground vehicles:

1. Tele-operated
2. Autonomous

We are implementing this project mine detection for surveillance and detection purpose.

In order to demine the affected areas, several techniques have been developed to detect these threats. Since electromagnetic induction (EMI) based sensors can detect metal mines at a low cost, this method has been explored, and uses the electromagnetic characteristics of the mines or the mine casing [1]. Several techniques such as GPR, infrared imaging, acoustic methods, etc. have already been explored which have proven to be less efficient and more expensive.

The present systems use wireless-controlled Robots that operate with the help of RF and IR technology, which have limited working range, frequency range and control. The use of

electromagnetic sensor in the existing systems is extended to incorporate GSM technology, which overcomes the limitation of restricted frequency and working range as the GSM provided a worldwide range with no interference with other controller. This project aims at designing a landmine detecting robot that uses GSM technology and is controlled by the 89C51 microcontroller. With the help of mobile keys, we can move the robot in desired direction as per our requirement [2]. The system allows the operator to stay at a safe distance by enabling him to control the robot wirelessly or remotely.

The process of detecting landmines is technically termed as minesweeping and process of removing or defusing the mines is known as demining or mine clearance. Minesweeping was earlier done using trained animals like dogs and rats but modern methods include metal detectors and various tooled attached to the vehicles. But any manual intervention of a human is always dangerous. Robots are used for various applications in industrial area.

Robot performs various activities and is becoming more advanced. That's the reason nowadays Landmine Detection Robotic Vehicles and unmanned robots are used to detect the landmines. Robots are always reliable in terms of perfection in detection and no human life is endangered in the process [3]. The detection of the buried mine is done by using metal detectors since most land mines contain metal components. The robot will travel in a zig zag path [4]. The system allows the operator to stay at a safe distance by enabling him to control the robot wirelessly or remotely.

## 2. EXISTING SYSTEM

GPR has been considered as the most promising subsurface sensing technique for landmine clearance operations in combination with a metal detector. This is because of its ability to detect both metallic and non-metallic landmines. Furthermore, the capability for imaging and post processing of data enables the identification of detected objects. A system combining GPR and a metal detector is commonly called a dual sensor. The system uses the metal detector as the primary sensor for the detection and localization of metal-containing objects, after which it switches to GPR as the secondary sensor for target identification. GPR for landmine detection commonly employs relatively high frequencies in order to detect and/or image small objects near the surface and also to reduce the size of the antennas for easier handling and higher mobility. With high frequencies, GPR becomes more sensitive to the heterogeneity of the media surrounding the object, which results in unwanted scattering in the data. The unwanted scattered waves are commonly referred to as clutter. Clutter degrades the quality of the GPR data and makes their analysis and interpretation difficult. In the case of landmine detection, a false analysis or interpretation of the data may lead to an accidental detonation.

## 3. PROPOSED SYSTEM


**Fig. 1** - Proposed Model

In our proposed system a robot with a wheel which performs mine detection. Because there are many personnel mines remaining from wars, it is desirable to provide a safe, inexpensive tool which civilians can to detect the mines. The robot has a capability to detect the path of going forward and backward. The movement can be done with the motor which has been turn easily. Normally the wheel conducting vehicle facing hard to turn left or right but our robot does not create those issue. It is common to evaluate the performance of a metal detector by calculating the probability of detection.

**Fig. 2** – Available Model

**Fig. 3** – Available Model

A metal detector is an electronic instrument which detects the presence of metal nearby. Metal indicators are valuable for discovering metal incorporations covered up inside items, or metal articles covered underground. They regularly comprise of a handheld unit with a sensor test which can be cleared over the ground or different articles. In the event that the sensor draws close to a bit of metal this is demonstrated by a changing tone in headphones, or a needle proceeding onward a marker. Generally, the gadget gives some sign of separation; the closer the metal is, the higher the tone in the headphone or the higher the needle goes. Another normal kind are stationary "stroll through" metal indicators utilized for security screening at passages in jails, town halls, and distinguish hid metal weapons on an individual's body.

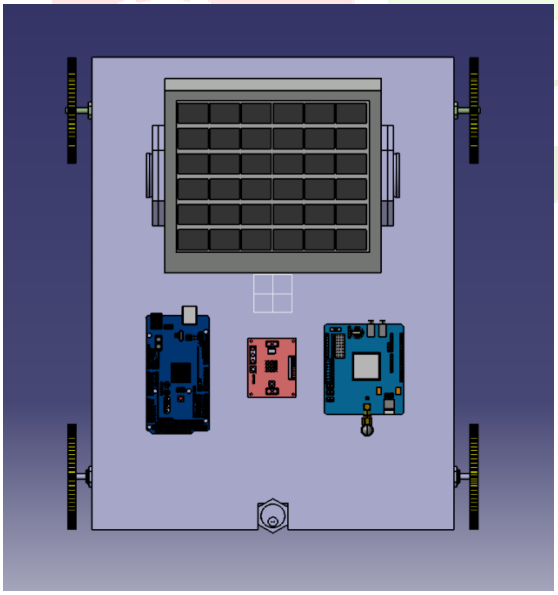

**Fig. 4 –** Actual Model Design

## 4. ATMEL89S52

Low-power, high-performance CMOS 8-bit microcontroller with 8KB of ISP flash memory. The device uses Microchip high-density, non-volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. On-chip flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. This powerful microcontroller is suitable for many embedded control applications.

Arduino Board are able to read inputs Like- light on a sensor, a finger on a button, or a Twitter message – and turn it into an output activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board.

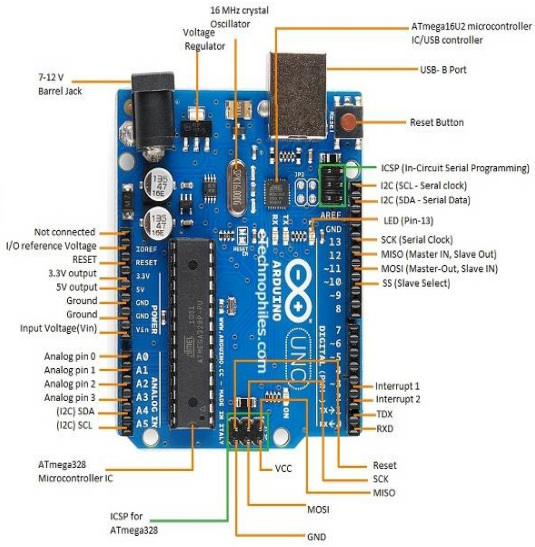


**Fig. 5** – Arduino Board

### ➢ 4.1 AT89S52 Microcontroller

The AT89S52 comes from the popular 8051 family of Atmel Microcontrollers. It is an 8-bit CMOS microcontroller with 8K as Flash memory and 256 bytes of RAM. Since it is similar to the trust worthy 8051

architecture these microcontrollers are as per industry standard. It has 32 I/O pins comprising of three 16-bit timers, external interrupts, full-duplex serial port, on-chip oscillator and clock circuitry. The Microcontroller also has Operating mode, Idle Mode and Power down mode which makes it suitable for battery operated applications. Few considerable drawbacks of the microcontroller are that it does not

However, you can utilize external modules for the same.

➢ **4.2ProgrammingAT89S52 Microcontroller**

Atmel microcontroller can be programmed with different software's that is available in the market. Arduino, Keil u Vision is the most used platforms to name a few. If you are planning on serious programming and expansion with community support then Keil is recommended. In order to program the Atmel microcontroller, we will need an IDE (Integrated Development Environment), where the programming takes place.

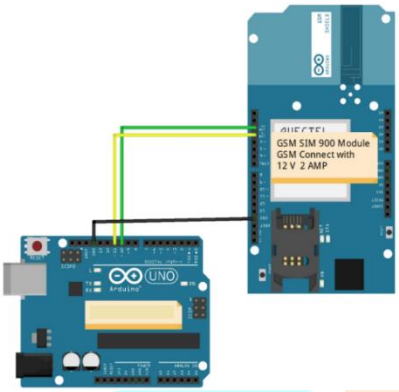


**Fig. 6 –** Programming Controller

A compiler, where our program gets converted into MCU readable form called HEX files. An IPE (Integrated Programming Environment), which is used to dump our hex file into our MCUs.

**Fig. 7 –** Lora Controller

➢ **To select Atmel Microcontroller** Microchip provides a vast variety of Microcontrollers from PIC family and Atmel Family. Their collection has just piled up after Microchip has acquired Atmel.

Each MCU has its own advantage and disadvantage. There are many parameters that one has to consider before selecting a MCU for his/her paper. The below points are just suggestions which might help one to select an MCU.

• If you are a beginner who is learning Microcontroller then, selecting a MCU that has good online community support and wide applications will be a good choice.

For Atmel AT89S52 or ATmega328 will be a good choice.

• Consider the operating voltage of your system. If they are 5V then select a 5V MCU some sensors or devices work and communicate on 3.3V in such case a 3.3V MCU can be selected

• If size and price is a limitation then you can choose small 8-pin MCUs like Attiny1614. These are also comparatively cheaper.

• Based on the sensors and actuators used in your paper, verify which modules you might need in for MCU. For example, is you are reading many Analog voltages then make sure MCU has enough ADC channels and supportive resolution. The details of all modules are given in the table above.

• If your paper involves communication protocols like UART, SPI, I2C, CAN etc make sure you MCU can support them. Some MCU can support more than one module of the same protocol

➢ **Applications**

• Multiple DIY Papers

• Very good choice if you are learning Atmel

• Papers requiring Multiple I/O interfaces and communications

• Replacement for Arduino Module

• Ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications.

## 5. HARDWARE IMPLEMENTATION

### 5.1 NODE MCU

Microcontroller Node MCU is an open source IoT stage. It incorporates firmware which keeps running on the ESP8266 Wi-Fi Scow from Expressive Systems, and equipment which depends on the ESP-12 module. The expression "NodeMCU" as a matter of course alludes to the firmware as opposed to the advancement packs. The firmware utilizes the Lau scripting language. It depends on the Eula venture, and based on the Expressive Non-OS SDK for ESP8266. It utilizes many open-source ventures, for example, Lau-cjson, and spiffs.

**Fig. 8 -** Node MCU Controller

Specifications of Node MCU It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language.

CPU: ESP8266 (LX106)

Developer: ESP8266 Open-source Community

Type: Single-board microcontroller

### 5.2 Motor Driver

The Motor Driver is a module for motors that allows you to control the working speed and direction of two motors simultaneously. This Motor Driver is designed and developed based on L293D IC. L293D is a 16 Pin Motor Driver IC.

This is designed to provide bidirectional drive currents at voltages from 5V to 36V.

**Fig. 9** - Motor Driver

### 5.3 Metal Detector Sensor

A metal locator is an electronic instrument which recognizes the nearness of metal close-by. Metal identifiers are valuable for discovering metal considerations covered up inside articles, or metal items covered underground. They frequently comprise of a handheld unit with a sensor test which can be cleared over the ground. In the event that the sensor draws close to a bit of metal this is demonstrated by a changing tone in. Normally the gadget gives some sign of separation; the closer the metal is, the higher the tone in the headphone or the higher the needle goes. Another basic sort are stationary "stroll through" metal indicators utilized for security screening at passageways in detainment facilities, town halls, and airplane terminals to identify covered metal weapons on an individual's body.

**Fig. 10** - Metal Sensor

The easiest type of a metal identifier comprises of an oscillator creating an exchanging current that goes through a loop delivering a rotating attractive field. In the event that a bit of electrically conductive metal is near the loop, vortex flows will be actuated in the metal, and this delivers its very own attractive field. On the off chance that another curl is utilized to gauge the attractive field (going about as a magnetometer), the adjustment in the attractive field because of the metallic item can be distinguished.

### 5.4 DC Motors

**Fig. 11** - DC motor

A DC engine is any of a class of turning electrical machines that changes over direct flow electrical vitality into mechanical vitality. The most widely recognized sorts depend on the powers delivered by attractive fields. About a wide range of DC engines have some interior system, either electromechanical or electronic, to intermittently alter the course of current stream in part of the engine.

Specifications

- RPM (Revolutions every moment)- DC engine with a RPM of 24,000 is substantially more fast than an engine which has 2400RPM. RPM is imperative when you need the engine to turn a specific number of times in a given timeframe.
- No-load Speed-The no-heap speed of a DC engine is the speed that the DC engine will turn when nothing is joined to its pole.
- The DC engine isn't stacked with an article Stall Torque-Stall torque is the torque delivered on an engine when the yield rotational speed is zero. It slows down the pole of the engine, with the goal that it longer twists and has rotational movement.
- Maximum Current-The most extreme current detail of an engine is the greatest measure of current that an engine can withstand going through it without being harmed or crushed.

## 5.5 Global Positioning System (GPS)


**Fig.12** - Global Positioning System (GPS)

The Global Positioning System (GPS), initially Nav star GPS, is a satellite-based radio route framework possessed by the United States government and worked by the United States Air Force [2]. It is a worldwide route satellite framework that gives geo area and time data to a GPS recipient anyplace on or close to the Earth where there is an unhindered observable pathway to at least four GPS satellites.

Obstructions, for example, mountains and structures hinder the generally feeble GPS signals. The GPS does not require the client to transmit any information, and it works autonomously of any telephonic or web gathering, however these innovations can upgrade the convenience of the GPS situating data. The GPS gives basic situating abilities to military, common, and business clients around the globe. The United States government made the framework, looks after it, and makes it uninhibitedly open to anybody with a GPS receiver.

## 6. BLOCK DIAGRAM

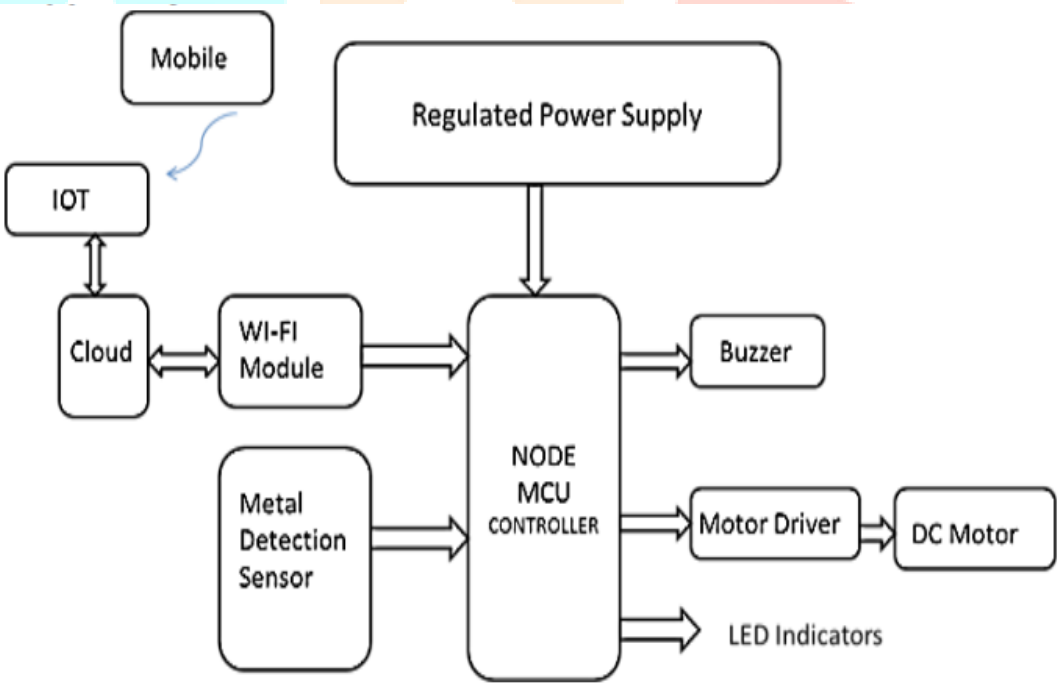


**Fig. 13 –** Block Diagram Showing Parameter and Control of Model

## 7. SCEMATIC DIAFRAM

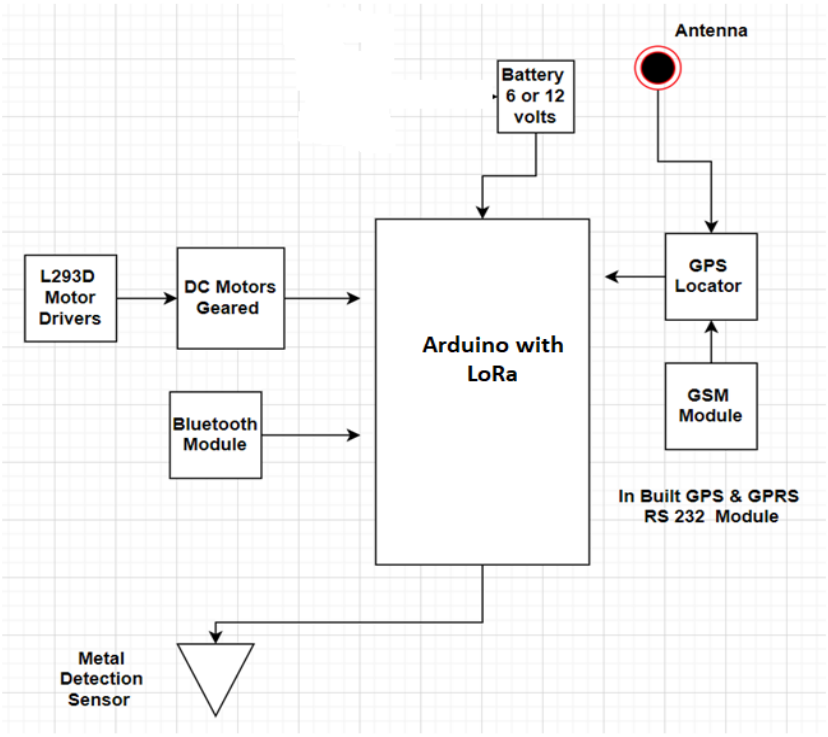


**Fig. 14 –** Flow Chart how Machine will be Control

## 8. RESULT

The performance of the mine detection sensor is evaluated experimentally by measuring the output voltage of the detection circuit at different cases of targets. The results corresponding to the different cases of depths and areas of the target are shown. That results show the variation of the output voltage of the detection circuit against the depth of the target for three values of the metal areas ( 9 $cm^2$, 6.25 $cm^2$, 4 $cm^2$) respectively. The robot complete structure is shown in fig.15. The experimental results of the prototype mine detector and extractor robot show that the designed robot is able to detect and extract the personal mines. The whole system can follow the designed path and terrain irregularities. The tests are carried out with the prototype assures the success of the robot design. However, in order to make the rotary wheel be able to extract mines of different sizes, it is necessary to introduce an adaptive capability for varying the size of the rotary wheel in accordance to the size of buried mine.

### 8.1 ADVANTEGES

- User friendly system with authorized controls
- Small in size
- IoT based system gives live report
- GPS System gives live location of the system on Google map
- Wide range to system

## 9. CONCLUSION

In conclusion, the use of robots for automatic landmine detection has numerous benefits over traditional methods. While there are still limitations to the technology, ongoing research and development can improve the effectiveness and efficiency of landmine detection using robots. As the technology continues to evolve, it has the potential to save lives by reducing the risk of injury or death to human deminers, and by enabling the safe removal of landmines from affected areas.

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