**Demining Using Unmanned Ground Vehicle**

**A PROJECT REPORT**

*Submitted in partial fulfillment of the*

*Requirement for the award of the degree*

*of*

**BACHELOR OF TECHNOLOGY**

*in*

**ELECTRONICS & COMMUNICATION ENGINEERING**

Submitted by

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**DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

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**(INDIA)**

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**CANDIDATE’S DECLARATION**

We hereby certify that the work being presented in this project titled “**Demining** **using Unmanned Ground Vehicle**” in partial fulfillment for the award of the **Bachelor of Technology** in **Electronics & Communication Engineering**, submitted to the **Department of Electronics & Communication Engineering, Graphic Era University Dehradun** is an authentic record of our original work carried out under the guidance of **Dr.Chandni Tiwari**. Further, we declare that this work has not been submitted for the award of any other degree.

Ekant Arora(2014052)

B.Tech ECE

This is to certify that this project is the result of original and sincere effort made by the candidates. All the statements made above are true to the best of my knowledge.

Date: Supervisor

The project examination is held on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Last but not the least I thank all those who have helped me directly or indirectly at various stages of this project.

**ABSTRACT**

In this world full of peace when it comes to a countries security or threat then we have always suffered from a death of an army men while diffusing or detecting metal or non-metal Land Mines. It is a really very much important concern to look after the detection or diffusion techniques.

Detection and removal of landmines is an important worldwide concern. A huge number of landmines have been deployed over the last twenty years and demining will take several more decades, even if no more mines were deployed in future. An adequate mine-clearance rate can only be achieved by using new technologies such as improved sensors, efficient manipulators and mobile robots.

The designed ‘Unmanned Ground Vehicle’ is capable of detecting a buried mine. The detection of the buried mine is done by using metal detectors since most land mines contain metal components. Landmines are a type of inexpensive weapons widely used in the pre-conflicted areas in many countries worldwide. The two main types are the metallic and nonmetallic (mostly plastic) landmines.

They are most commonly investigated by magnetic, ground penetrating radar (GPR), and metal detector (MD) techniques. These geophysical techniques however have significant limitations in resolving the non-metallic landmines and wherever the host materials are conductive.

The 3-D electric resistivity tomography (ERT) technique is evaluated as an alternative and/or confirmation detection system for both landmine types, which are buried in different soil conditions and at different depths. This can be achieved using the capacitive resistivity imaging system, which does not need direct contact with the ground surface. Synthetic models for each case have been introduced using metallic and non-metallic bodies buried in wet and dry environments.

KEYWORDS: Arduino board, Metal detector Sensor, PIR Sensor, Ultrasonic Sensor, GSM GPS Modules, Servo Motors, DC Motors, Motor Controller, Transmitter, Reciever.

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**CHAPTER 1**

1. **Introduction**

The project presented here is landmine detection using unmanned ground vehicle system. In a situation where there are land mines are placed like in such as boarder areas, there is need for better security system.

It is much safer to have a system that monitors and communicates to the device owner without putting human life to risk. This tends to utilize the availability of GSM network, mobile phone and electronics circuit to achieve an automated system which is programmed to work as a thinking device to accomplish this purpose.



*Figure (1.1) Landmines*

Blasting of land mines is one of the main concerns of many countries in such border area and also in public places. Many times we have heard about the blasting of the land mines and some have faced such situations.

**DIFFERENT TYPES OF LANDMINES**

* **BLAST MINES:-** These are buried into the ground and detonate when someone steps on them.

****

*Figure (1.2) Blast Mines [ref 9]*

* **DIRECTIONAL FRAGMENTATION MINES**

These are designed to be positioned in the direction the enemy is likely to advance

From. This mine can be victim activated by a tripwire or command detonated. Once triggered, it projects metal fragments in a specific directions.

****

*Figure (1.3) Directional Fragmentation Mines[ref 9]*

* **BOUNDING FRAGMENTATION MINES**

These are buried in the ground and triggered by either a tripwire or by stepping on them. Once triggered, they jump into the air and detonate, spreading metal fragments in a 360-degree arc.



*Figure (1.4) Bounding Fragmentation mines [ref 9]*

* **OMNI-DIRETIONAL FRAGMENTATION MINES**

These are hidden above ground in vegetation and triggered by a tripwire it spreads metal fragments in a 360-degree arc.

****

*Figure (1.5) Omni directional fragmentation mines[ref 9]*

* **ANTI-VEHICLE MINES**

This is designed to be placed under, on or near the ground or the other surface area and to be exploded by the presence, proximity or contact of vehicle as opposed to a person.



*Figure (1.6) Anti-Vehicle Mines [ref 9]*

Main intention of this project is to avoid such situation. This project is designed and developed by taking into consideration the problem mentioned above. In land mine detection robotic system, we have to use the metal detector sensor to detect the land mine in underground.

The landmines are usually buried 10mm to 40mm below the soil and requires about minimum pressure of 9Kg to detonate them. The face diameters of these AP mines ranges from 5.6 to 13.3cm.Landmines are broadly categorized into two types of landmines Anti-Personnel and Anti-Tank landmines. We have developed a robot whose movement and directions can be controlled remotely using GSM modem. A metal detector circuit with buzzer is implemented and Arduino is used to regulate the complete operation.

If the metal detected at certain level then this sensor gives a particular signal to the microcontroller. Also it can be detect the presence of the human beings where it will be alive by using PIR sensor.



*Figure (1.7) Landmine detection Using UGV*

If it detected then this sensor gives a particular signal to the AT mega microcontroller. Then the AT mega microcontroller turn on the buzzer and send message to the user. The fuel detector involves hardware and software parts construction and the integration of both parts to create the system.

Landmines are weapons or explosives which are buried under the soil that are activated by pressure, and may kill or cause harm when stepped upon it, and also cause long term physiological effects.

Landmines pose a serious threat to soldiers and civilians worldwide and also provide major challenges to agriculture, infrastructure and road development in post-conflict regions.

* 1. **PROBLEM STATEMENT**

Landmines have adverse consequences both socially and economically for civilians around the world. They obstruct agricultural and inhabited areas of land and hinder the lives of local people. The detection and safe removal of landmines to prevent civilian deaths and restore living conditions remains a global issue. This thesis will study the use of ground penetrating radar (GPR) as a landmine detection method in the presence of clutter and false targets as a solution to this problem.

* 1. **EXISTING PROBLEM**
* These geophysical techniques however have significant limitations in resolving the non-metallic landmines and wherever the host materials are conductive.
* The areas contaminated with mines directly and indirectly impact the surrounding community.
* The landmine with dimension and burial depth of one electrode separation unit is over estimated while the spatial resolutions decrease as the burial depth and noise percentage increase.
  1. **TECHNICAL PROBLEM**
* In highly conductive soil the electromagnetic waves diffuse quickly therefore the GPR, which utilize high frequency waves is not able to see deeply into the ground.
* The application of metal detector for the landmine detection sometimes fails when the mines are composed of non-metallic materials and/or the soil contains high concentrations of ferruginous minerals.
* There is a strong need for applying another nondestructive surface technique, which is neither completely affected by the landmine materials nor by the EM properties of the soil.
* These requirements could be satisfied by using the electrical resistivity tomography (ERT) technique, particularly the capacitive resistivity (CR) dynamic system. The CR system is similar to the well-known conventional DC resistivity system.
  1. **MOTIVATION**

The triad that exists to ensure the success of troops being launched into any conflict is based on technology, tactics and training. Many years ago Richard Simpkin in his famous book ‘ Race to the Swift’ talked about the fifty-year cycle when a decisive weapon or technology changed the nature of the battlefield and led to transformative changes in tactics and ushered in a revolution in military affairs. It has happened since the beginning of the conflict and recent weapons can be the machine guns, tanks, aircraft and helicopters all that led to victories for the armies that were able to adapt to the then-emerging technologies.



*Figure (1.8) Defence Parade (New Delhi) 2019*

The truth is that today there are a large number of analysts who feel that the Indian Army is not grasping the emerging technologies and is more focused on infantry in spite of the reassurances by both the CDS and Army Chief regarding the future of warfare and technology. And that technology will become the key driver for future conflicts. There is no doubt that warfare in future needs the latest technology and technical oriented personnel to manage the complex systems be it missiles, tanks, guns, aircraft and ships. There is also no doubt that the cycle of fifty years is fast reducing and obsolesce in technologies are taking place faster. At the other end, you have to have access to this technology and finally the money to buy it. So, to simply say that we as an Army are not focused on technology is untrue. Moreover, having been part of a Project handling the induction of new technology while in Service, the issues of availability of commercial technology and the same being ruggedised and adapted to function effectively across all terrains with adequate secrecy was always a challenge.

* 1. **Demining Concepts :-**

Demining is the process of detection and removal of buried landmines. There are two distinct types of demining; military demining and humanitarian demining.

**1.5.1 Military Demining:-**

The target of military demining is to detect and remove a sufficient number of landmines to create a safe corridor for troops and/or vehicles to move through. Armed forces can accept some losses as an expected part of the conflict. Therefore, a fail machine, which has an 80% clearance success rate, can be used. This sort of clearance operation is not suited for humanitarian demining.

**1.5.2 Humanitarian Demining:-**

The target of humanitarian demining is to free the entire land area from landmines. The United Nations (UN) has specified a landmine clearance standard of 99.6% for humanitarian demining.

* 1. **Landmine Detection Techniques:-**

There are several techniques that can be used for the detection of buried landmines. Biological Detection Biological sensors or biosensors such as dogs, some rodents, honey bees, some types of plants and some types of bacteria depend on the possibility of direct sensing of explosive compounds. The used animals must be kept healthy, have fixed duty cycles, and a degree of effort is needed to keep them undistracted.

Dogs

Rodents

Bees

Plants

**LANDMINE**

**DETECTION**

**TECHNIQUE**

Bacteria

MD

GPR

MWR

MMWR

EIT

IR

Visible Light

LIDAR

NQR

Neutron Based

Sound

A/S

Inst prodder

Clear Machine

*Figure (1.9) Landmine detection technique*

* + 1. **Dogs :-**

One of the most efficient sensors for landmine detection is the dog. The dog can be used either in a free-ranging mode to find landmines or in conjunction with a vehicle mounted air sampler to provide area detection. Dogs are perhaps more reliable than other animals and are used routinely in demining operations. They can follow the smell of explosives in a landmine buried in the ground at a depth of 60 cm.



*Figure (1.10) Landmine detection with Dog*

* + 1. **Rodents :-**

Researchers at the University of Antwerp have trained the African giant pouch rats to detect landmines. The rats are trained using food rewards to signal the presence of explosives by scratching the ground surface with their feet. Canines work exceptionally well in different scenarios and under different environmental condition.



*Figure (1.11) Landmine detection with rodent*

* + 1. **Honey Bees:-**

The recent research by the University of Montana has revealed that honey bees, with minimal training, can be used to detect landmines. The bees are trained by feeding them on points, where the soil immediately around has been impregnated with explosive chemicals like TNT. The bees keep sense of the smell and have the ability to connect the smell of explosives with food. Training the bees takes only 3 or 4 days. Honey bees can provide higher accuracy and far higher clearance rates than dogs or rats, and they could search a relatively large area in a short time. The disadvantage of using bees is their ability to work under limited environmental and weather conditions, only.

* + 1. **Plants:-**

The mustard arabidopsis thaliana is one of the most studied plants in the world. This plant normally turns red under harsh conditions. Using a combination of natural mutations and genetic manipulations, researchers have created a strain that only changes color in response to the nitrous oxide that leaks from landmines and other explosives. The main advantage of this technique is that the plants could either be sown from an aircraft, so they can cover a large area in a short time. The disadvantage is the high false alarm rates.



*Figure (1.12) Landmine detection with Plants*

* + 1. **Bacteria:-**

Landmine detection with bacteria involves spraying an engineered strain of bacteria on the landmine affected area, possibly using an airborne system. The bacteria would be allowed to grow for several hours. The bacteria fluoresces under ultraviolet light after exposure to TNT material. Then, a survey team would return to search for fluorescent signals. This method produces relatively quick results, and could be used over different terrains. Bacteria can detect even small amounts of TNT and can cover a large area in a short time. Unfortunately, bacteria are highly sensitive to environmental conditions, and no strain of bacteria is capable of detecting RDX, which is a common explosive. Bacteria may not be visible under desert conditions and the fate and transport of explosives in the subsurface limit the performance potential of this method.

* + 1. **Electromagnetic Detection:-**

Landmine detection using electromagnetic radiation is based on the difference between the electromagnetic properties of the target and the ground. Several versions of the electromagnetic techniques are currently employed or envisioned to detect buried landmines. These versions typically differ in the operating frequency, the employed bandwidth of the electromagnetic spectrum, the type of the transmitted signals, the interpretation of the reflected signals, or the type of transmitter and receiver. Metal detector (MD), ground penetrating radar (GPR), microwave radar (MWR), millimeter wave radar (MMWR), electrical impedance tomography (EIT) and infrared (IR) techniques are common electromagnetic detection techniques.



*Figure (1.13) Landmine detection using Metal Detector*

* + 1. **Ground Penetrating Radar:-**

The GPR detection operates by transmitting an electromagnetic signal into the soil and detecting the reflected signal at the receiver. The transmitter emits a pulsed wave or a continuous wave with a given frequency. The receiver collects the waves backscattered by the discontinuities in permittivity. Discontinuities can be caused by both the buried objects like landmines (useful signal) and the natural discontinuities in the soil (clutter). The main advantage of this technique is its ability to detect plastic objects buried in the ground; as a result, it can be used to find landmines with different types of casing. It can also provide information about the target depth.



*Figure (1.14) Landmine detection with the GPR*

* + 1. **Microwave Radar:-**

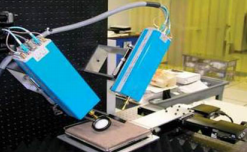
This technique is based on the transmission of short radio and microwaves radiation pulses from an antenna into the ground and measuring the time for reflections to return to the same antenna. Reflections occur at the boundaries between materials of different dielectric constants that are normal to the incident radiation. Figure below shows a system designed for landmine detection using the microwave radar. Transmitting high frequencies provides high resolution images, but it is subject to high attenuation in the soil. Thus, high frequencies are suitable for the detection of small shallow objects.



*Figure (1.15) Landmine detection with microwave radar*

* + 1. **Millimeter Wave Radar:-**

Recently, a novel active MMWR scanning system was developed for the detection of buried landmines. It is a hyper spectral system that collects images at different MMW frequencies (from 90 to 140 GHz) using a vector network analyzer that collects backscattering MMW radiation from the buried sample. Figure below shows a system designed for landmine detection using the MMWR. A multivariate statistical method using principal component analysis (PCA) is applied to extract useful information from the obtained images with this technique.

**

*Figure (1.16) Landmine detection with millimeter Wave reader*

* + 1. **Infrared:-**

IR radiation is a portion of the electromagnetic spectrum lying between the visible rays and microwave region with wavelengths between 0.75 lm and 1 mm. Figure below shows a system designed for landmine detection using IR radiation. The concept of using IR thermo graphy for landmine detection is based on the fact that the landmines might have different thermal properties from the surrounding materials. This technique is safe, uses lightweight equipment, and can scan large areas.

**

*Figure (1.17) Landmine detection using Infrared*

* + 1. **LIDAR:-**

The LIDAR is an optical technology that works in the visible and infrared regions of the electromagnetic spectrum. LIDAR instruments send out pulses of coherent radiation, a fraction of which is reflected back by surface laid objects. LIDAR sensors measure both the traveling time of the reflected pulses and the difference between the transmitted and the reflected energy, which are used to calculate the distance to the target and its general reflectivity or absorption.



*Figure(1.18) Landmine detection using LIDAR*

* + 1. **Nuclear Quadrupole Resonance:-**

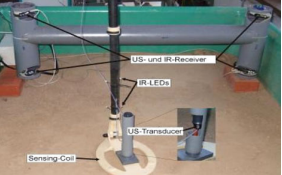
The NQR technique is a radio frequency technique, in which the observed frequencies depend on the interaction between the electric quadrupole moment of the nucleus and the electric field gradient generated at the nuclear site by external charges. All common high explosives contain a quadrupole nucleus, which generates three sets of resonance frequencies, providing an unequivocal method for detecting and identifying the explosive. This technique is a derivative of the nuclear magnetic resonance, which is used without the need for an external magnetic field.



*Figure (1.19) Landmine detection using NQR*

* + 1. **Ultrasound (US):-**

The US detection consists of the emission of a sound wave with a frequency higher than 20 kHz into a medium. This sound wave will be reflected on the boundaries between materials with different acoustical properties. The sound propagates as a mechanical disturbance of molecules in the form of waves. When a sound wave propagates through a medium, the wave consists of the molecules of the medium oscillating around their equilibrium positions, but there is no propagation of the material, just a transmission of disturbance and propagation of only the sound energy. The main advantage of this technique is the ability of the US wave to have a good penetration through very wet soils. Swept acoustic systems have also been proposed to look for landmine signatures resonances in a simple and inexpensive way. The US wave propagates well in humid or underwater conditions. US systems encounter problems at the interface between the air and the ground, which greatly attenuate the US.



*Figure (1.20) Landmine detection using Ultrasound*

* + 1. **Acoustic to Seismic:-**

The A/S technique is used for the detection of landmines by vibrating them with acoustic or seismic waves that are generated and received by non-contact (acoustic) and contact (seismic) transducers, respectively. This detection technique is based on the mechanical properties that can differentiate the acoustic response of landmines from other objects buried in the ground. The A/S landmine detection system consists of a transmitter, which generates the acoustic waves and a receiver, which measures the vibrations.



*Figure (1.21) Landmine detection using A/S technique*

* + 1. **Instrumented Prodder :-**

The standard prodder relies on the dexterity of the operator. With instrumentation, the prodder could make acoustic or electromagnetic measurements during insertion. The echo would give information about the mechanical impedance of the material near (or in contact with) the tip, making discrimination between rock, wood, plastic and metal possible. Such a device has been under development with considerable success. The probing is an established step in the manual demining. Improved probes could decrease the risks to de-miners by providing feedback about the nature of the object being investigated.



*Figure (1.21) Landmine using Instrument Prodder*

* + 1. **Mine Clearing Machines:-**

When there is not enough time for an army to clear a minefield, it will often use certain machines to roll through and clear a safe path. Military forces employ several kinds of mine clearing machines to clear out or detonate mines as shown in Fig. 23 [12]. Some machines are specifically designed for the task of mine clearance, while tanks can also be fitted with certain mine clearing devices. There are several types of mine clearing machines. New machines are remote controlled, which minimizes the risk to personnel. This technique is quick and efficient. There is less chance of people getting injured during demining. It leaves the area virtually destroyed, and the machines can easily miss mines. This technique cannot achieve the humanitarian demining accuracy and safety standards and it is environmentally not friendly. The machines often do not destroy all mines in a contaminated area; a landmine may be pushed on one side or buried deeper or partly damaged making it more dangerous, so that the probability of detection is low.



*Figure (1.22) Mine Clearing Machine*

**CHAPTER 2**

* 1. **CONSTRUCTION OF UNMANNED GROUND VEHICLE**
     1. **Ground-based unmanned systems for detecting landmines**
* Cargo :- Cargo Unmanned Ground Vehicles (Cargo UGVs or CUGVs) are designed for autonomous use in convoys that combine manned and unmanned vehicles.  An operator in another vehicle supervises one or more unmanned vehicles, which drive autonomously in convoy formation day and night, in all weather, and when dust and smoke limit visibility.
* Sensor package :- Unmanned Ground Vehicles consists of many of sensor packages in it. for example- PIR sensors, Ultrasonic Sensors, GPR etc. Sensors are the main source or the main package inside the UGV.
* Communications package :- For communication FSi6 Transmitters & Receiver is used to transmit the PWM signals from transmitter end to the receiver end.
* Weapon systems :- These systems are generally to actuate or to activate the the weapon attached with UGV, there is a relay battle switch which get connected with the weapon system to actuate it.
  + 1. **Why UGVs?**
* “Dull, dirty, and dangerous” jobs :- The various task is done by UGV, one of the major task is to detect landmine from the ground using landmine detection technique
* Size / weight constraints :- The compatibility is the most important thing which has to be keep in mind while constructing the UGV. We all know that landmines are weight dependent explosives, so we need to be precise while making UGV.
* Endurance requirements :- The endurance or efficiency of any kind of systems depend upon the input power provided.
* Speed :- It depends on the motors which is used inside UGV the higher the current the higher the speed of the motor will be, the average speed of the UGV is 10 km/hr.
* Cost :- Some components are cheaper which can be easily available and some of the components are bit much expensive but for only one time investment for the expensive components.
  1. **AUTOMATION REQUIREMENT**
* Reduce human operator burden and drag on human elements in tactical environments
* Common to Unmanned Aerial domain
* Allow rapid reaction to changing tactical situations without taking a human operator “out of the fight”.
* Allow highly aggressive maneuvers beyond human perceptual and control capabilities.
  1. **COMPONENTS REQUIREMENTS FOR UGV**
* **FSi6- 6 Channel Transmitter and Receiver** :- The FlySky FS-i6 is a great low cost entry level 6-channel 2.4 GHz Transmitter and Receiver that uses solid and reliable Automatic Frequency Hopping Digital System (AFHDS) spread spectrum technology. The FlySky FS-i6 has both a nice quality look and feel, while the programming is simple to use. It also comes with a FS-iA6 6-channel receiver. Suitable for controlling Quad-copters, Multi-rotor, Heli, and Airplane, the FlySky FS-i6 is a superb budget computer radio for both new pilots and experienced pilots alike.
* **Electronic motor controller 20 amp** :- Electronic motor controller or ESC is generally used to control the speed of the motor to move in a particular direction accordingly.
* 4 **Nylon customized wheels** :- Four nylon customized wheels are required for the movement of the UGV
* **20 mm Nylon sheets** :- To design a precise and a compact UGV it is required to go with the 20 mm Nylon sheets which will give the support to save the electronic components installed when it get crashed or demolished.
  1. **COMPONENT DESCRIPTION**
* **2.4.1 FSi6- 6 Channel Transmitter and Receiver**

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*Figure (2.1) FSi6 Transmitter & Receiver [ref. 18]*

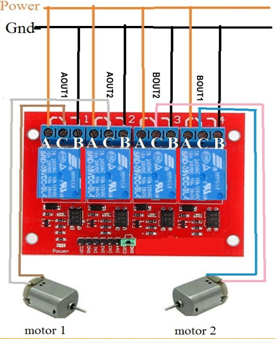
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The ultra slim case design ergonomically fits your hands leading to less hand fatigue especially during long flights. Digital trims, backlit LCD screen, and simple programming give the FS-i6 a modern feel with all the features you want. With a low profile antenna, the FS-i6 is easy to store and no worries about breaking it. Adjustable length sticks, and a loop for attaching a neck strap round out the list of comfort features this radio offers. For changing flight modes or multiple flap position options, the FS-i6 has a 3-position switch, as well as two adjustable knobs.

Expand the capabilities of your models or just know what is going on with the optional telemetry receivers and variety of sensors. Normally you would have to spend hundreds of dollars to get a transmitter with this capability. Not so with the availability of the FS-i6.

**FEATURES:-**

* Entry level 6 channel 2.4GHz radio with telemetry capability
* Dual Rate/Trims/Gear/Flap/Gyro Gain Adjust/Flight Mode/Throttle Hold/Hover Pitch Switches
* Easy to use Programming & Navigation Buttons
* Supports Heli /Standard Wing/ Elevon/V-Tail
* 20 Model Memory
* 8 Character Model Name
* Trainer and charging ports
* Backlit LCD Screen displays real-time transmitter and receiver voltage
* 4 Stick Mode Selectable
* Mode 2
* Comes with receiver
* **2.4.2** **ELECTRONIC MOTOR CONTROLLER**



*Figure (2.2) Electronic motor controller [ref. 17]*

A **relay** is an [electrically](https://en.wikipedia.org/wiki/Electric) operated [switch](https://en.wikipedia.org/wiki/Switch). Many relays use an [electromagnet](https://en.wikipedia.org/wiki/Electromagnet) to mechanically operate a switch, but other operating principles are also used, such as [solid-state relays](https://en.wikipedia.org/wiki/Solid-state_relay). Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal.

The first relays were used in long distance [telegraph](https://en.wikipedia.org/wiki/Electrical_telegraph) circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit.

Relays were used extensively in telephone exchanges and early computers to perform logical operations.

**CHAPTER 3**

**3.1 CONSTRUCTION OF LANDMINE DETECTOR WITH UGV**

**3.1.1 BLOCK DIAGRAM**

**Power Supply**

**GSM/GPS Module**

**Arduino UNO**

**Buzzer**

**Ultrasonic Sensor**

**PIR Sensor**

**GPR Sensor**

**Motor 2**

**Motor 1**

*Figure (3.1) Block Diagram of Landmine detection technique*

The implementation of proposed system mainly involves three sensors, which are PIR sensor, Ultrasonic sensor, Metal detector sensor of Land mine detection robot using Arduino uno board. The block diagram of the system is shown in Figure.

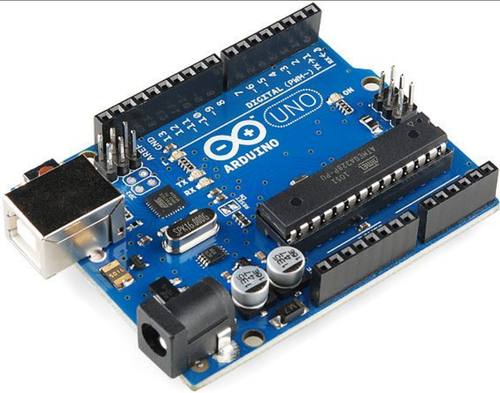
1. **POWER SUPPLY UNIT (BATTERY)**

While with the electronics, you always must have one basic thing that is Power. In every electronic zone power supply is required. The proper operation of each and every component, it is important to supply the sufficient amount of voltage and current to the circuitry. If the power excelled its limit, it can be pernicious. It is possible to supply the power to complete robot with the only one 12v battery for the Arduino Uno board as well as for servo driver boards.

*Figure (3.2) Li-Po rechargeable battery*

1. **ARDUINO UNO 328**

The Arduino Uno is a microcontroller board which is based on the ATmega328. It consists of 14 digital input/output pins, 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.



*Figure (3.3) Arduino Board [ref. 16]*

1. **PIR Sensor**

PIR sensor stands for passive infrared sensor. It is an electronic appliance measures infrared radiation from objects in generated field by PIR detector. Sometimes it called PID – Passive Infrared detector.

It detects changes in amount of IR radiation, which is depends upon the outside characteristics and temperature of the objects in front of detector.

It means if human being or animal will come in range of detector it will detect the movement of body because live body eliminates warm energy in form of IR radiation. So it will give you signal by light or alarm when any live object in front of PIR.

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*Figure (3.4) PIR Sensor [ref. 15]*

1. **ULTRASONIC SENSOR**

Ultrasonic sensor also called transducers that convert ultrasound waves to electrical signals or vice versa. Those that both transmit and receive may also be called ultrasound transceivers; many ultrasound sensors likewise being sensors are some or the other way transceivers because they can both sense and transmit. These devices work on a principle of transducers used in radar and sonar systems, which evaluate traits of a target by deciphering the echoes from radio or sound waves, respectively. It is also used for measure the distance between obstacle and user so it also called ultrasonic range finder. Its range is minimum 2Cm and maximum range is 4m. While the distance between range [40-70] cm then alert signal very fast. when the obstacle near from the person then alert signal become very fast and give to the instruction to the user.

**ELECTRIC PARAMETER:**

1. Working Voltage DC 5 V

2. Working Current 16mA

3. Working Frequency 50Hz

4. Max Range 5m

5. Min Range 2cm.

6. Measuring Angle 15 degree.

7. Trigger Input Signal 10uS TTL pulse.

8. Dimension 45\*20\*15mm.

****

*Figure (3.5) Ultrasonic Sensor [ref. 1]*

1. **GPS (LS20032)**

LS20030~3 series products are complete GPS smart antenna receivers, including an embedded antenna and GPS receiver circuits, designed for a broad spectrum of OEM system applications. The GPS smart antenna will acquire up to 66 satellites at a time while providing fast time-to-first-fix. It can provide you with admirable sensitivity and performance even in urban valley and dense vegetation environment. Its farreaching capability meets the sensitivity requirements of location-based applications.

**SPECIFICATION:**

1) Arbitrate high sensitivity solution

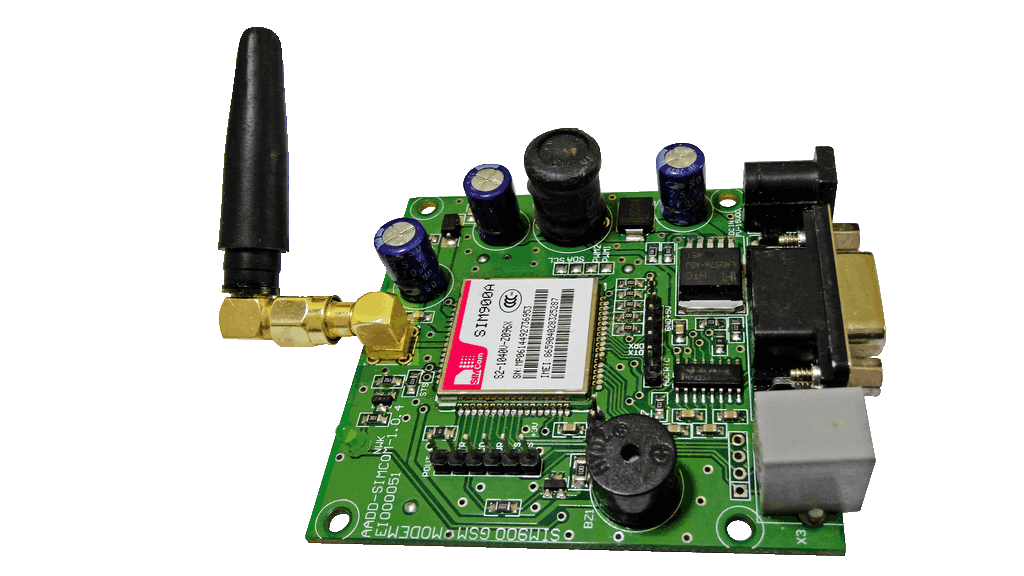
2) Support 66-channel GPS

3) Support AGPS

4) Up to 10 Hz update rate

5) Capable of SBAS (WAAS, EGNOS, MSAS)

6) LED indicator for GPS fix or not fix (not in LS20033).

****

*Figure (3.6) GSM LSP20032 Module [ref. 13]*

1. **BUZZER :-**

A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on [breadboard](https://components101.com/misc/breadboard-connections-uses-guide), Perf Board and even on PCBs which makes this a widely used component in most electronic applications. There are two types are buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beeeeeeppp.... sound, the other type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it. But, the one shown here is most widely used because it can be customized with help of other circuits to fit easily in our application.

**FEATURES**

1) operating power: 3-6V DC / 25mA

2) extremely compact, ultrathin construction

3) no electrical noise

4) low current consumption yet high sound pressure level

**SPECIFICATIONS**

1) operating voltage: 3-6V DC

2) rated voltage: 5V DC

3) current consumption: 25mA

4) oscillator frequency: 3.2kHz

5) sound level: 87DB

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*Figure (3.7) Buzzer [ref. 11]*

1. **GROUND PENETRATING RADAR (GPR)**

Ground-penetrating radar (GPR) is a geophysical method. It will uses radar pulses to image the subsurface. This nondestructive method uses electromagnetic radiation in the microwave band such as UHF/VHF frequencies of the radio spectrum, and detects the reflected signals from subsurface structures.

GPR can have applications in a diversity of medium, including rock, soil, ice, fresh water, pavements and structures. In the right conditions professionals can use GPR to detect subsurface objects, changes in material properties, and voids and cracks.

* Low quiescent current: 200µa
* 5v regulator for external circuits
* V ref for sensor excitation:xtr116: 4.096v
* Low span error: 0.05%
* Low nonlinearity error: 0.003%
* Wide loop supply range: 7.5v to 36v



*Figure (3.8) Ground Penetrating Radar [ref. 10]*

1. **DC Motor**

DC motors are generally more powerful than servos in terms of speed and torque. Microcontroller could not accurately control DC motors without a motor controller. So, motor Controllers are must needed.

An encoder is use to get feedback from the DC motor. In real life, though, DC motors will always have more than two poles (. In particular, this avoids "dead spots" in the commutate. We can imagine how with our example two pole motor, if the rotor alignment is exactly at the middle of its rotation it will get stuck there.

**Specifications**:

* Input Voltage:4.8/35V
* Maximum output current:15A/13.8V per channel

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*Figure (3.9) DC Motor[ref. 12]*

**CHAPTER 4**

**WORKING**

* The above proposed work is that it takes advantages of mine workers to protect from different hazardous conditions and hazardous gas present in the mine environment.
* The above two circuits gets combined and form a precise as well as a compact structure UGV
* The power supply can be achieved by using rechargeable battery. The system needs 5V supply for all the sensors, controller and DC motors GPS/GSM modules.
* Firstly the UGV is connected with the above components as I have shown in fig (2) .
* Then the UGV needs an input voltage which has to be transmitted by a lithium polymer battery.
* The control of UGV is operated by using fsi6 6 channel receiver which has to be operated by a person from some distance away from the UGV.
* Receiver section is mounted inside the UGV which ranges up to distance of 200 m.
* A motor controller inside the UGV control the stability of the UGV to move it in the other direction using wheels.
* A transmitter allows the driver to send commands to a receiver inside the UGV.
* There are also other cheaper solutions, such as radios adapted from toys, wireless gamepads, and transceiver circuits.
* we must guarantee that these low-cost systems will have enough power to avoid signal loss when the UGV is on field, as well as implement fail safe features in all channels.
* An antenna present at the receiver coducts electrical conductor or system of conductors to send/receive RF signals
* Transmission - radiates electromagnetic energy from transmitter end to receiver end
* Reception - collects electromagnetic energy from transmitter which is transmitted
* In two-way communication, the same antenna can be used for transmission and reception
* A receiver is the component responsible to demodulate the radio-transmitted signals and direct the commands to servos and other electronic circuits.
* A typical receiver is pictured to the right, a Futaba 75MHz. They come in several sizes and weights.
* UGV can be driven by any of the person because of remote ease so keeping in mind that it has to detect a landmine a person who is driving should be more careful while driving it.
* The efficiency of the UGV depends on the input power or the battery which is mounted inside the UGV.
* Lastly the UGV which has to be under weight because it has to detect the landmine which is buried inside the ground so with the help of GPR which is mounted on the UGV.
* The person who is operating UGV has to be more careful while operating it, keeping in mind that it can look up to as much as area possible which is in the range of transmitter.
* The control or the movement of the UGV is totally in the hand of operator who operates it. while operating the transmitters, one should check the power of the transmitter and recheck if the receiver is working properly or not.
* To move the UGV transmitters must be patched with receiver section otherwise it will not operate properly
* The forward movement of the UGV is done by moving the left joystick in the forward direction, so when the joystick is moved in the forward direction the transmitters send a PWM signal to the receivers.
* After sensing the received signal from the transmitters, the receiver at its end send the signal to the motor controller and then with the help of the relay attached at the motor controller starts operating and signals the connected motor to move in the forward direction.
* For detection when any metal object comes under the UGV it start detecting by blowing the buzzer present in the circuit.
* With the help of GPR (Ground Penetrating Radar) which senses the metal object by a electromagnetic wave penetrating the ground able to detect the metal object buried in the ground.

**CHAPTER 5**

**5. CONCLUSION**

The primarily aim is that study of various types of land mines, also study about detecting sensors. This project will demonstrate the successful implementation of promote technology innovative to achieve a reliable and efficient outcome from the various instruments. The result will show that the robot has been used for detecting the landmine and then it will send the message to the predefined number or user. With a common digitalized platform, these latest instruments will enable increased flexibility in control, operation, expansion and eventually benefit the human life with improved services, reliability and increased convenience.

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