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Landmine Detection Using GSM

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ABSTRACT: So many techniques are present for the detecting of a landmine in a different types of environments. Various present landmine detection technologies are Remote sensing technology, ground penetrating radar (GPR), nuclear quadrupole resonance (NQR), Electromagnetic induction (EMI), Ultrasound, Explosive vapor detection (EVD) and Infrared detectors (IR). A self-governing robotic system in a minefield is a popular method as it decreases the hazards in manual detection. For the detection of landmines using robots the components consist of a control unit that contains a controller or processor and various sensors. Such robots can be used at Warfield for the detection of landmines and also for surveillance purposes at the border areas. This paper gives you a overview of landmine detection using an unmanned robotic vehicle. The purpose is to give a summary of the landmine detection techniques by using robots that are capable of exploring and detecting semi-buried and also buried landmines and mark their location.

1.INTRODUCTION

In warfare most of causalities are done by buried landmines. The unexploded landmines take several lives even after end of a conflict. Brutal properties of mines is once it is active, it can function for a very long time. Hence there is always a risk of fatal damage and injury causing death. Landmines became effective weapon in warfare because it was cheap and easy for building. Basically, it consists of explosives along with some triggering mechanism. Triggering may be caused by weight. There are different types of landmines depending upon weight it needed to get triggered. When ready, they are buried at low depth in soil and hence not easily get spotted with bare eyes [2].

Someone not aware of presence of mine can step over it causing itself fatal damage because of the explosion. Landmines

can be buried in certain pattern to restrict enemy movements. Zigzag pattern slows down advancing enemy; or mines can be deployed causing enemy to diverge their path and leads them in to middle of an ambush. Because of these many characteristics they are found to be very effective weapon as they can be deployed easily and they remain undetected, fully functional for very long time.This project presents a review of all the existing and latest techniques devised for the detection of landmines. Electronics has paid an important role in the development and efficient use of some of these techniques.

Few methods that are discussed here includes the working of metal detectors, mechanical methods. Working, advantages and limitations of each technique are discussed [3].Performance of the detection system can be enhanced by using multiple techniques.

Landmines are activated by victims for explosive traps, whose intended target can be a human or a vehicles. A mine consists of a specific quantity of explosive, placed within some form of casing , and a fusing technique to denote the main explosive charge. Some buried under the ground, while some are placed on post or poles or are fixed to objects on the land. This can activate by a variety of methods including pressure, trip wire, electrical command or magnetic influence. Some modern mines can even get initiated using other form of electronic sensors. Landmines have significant hazards like manufacture and removal requires considerable amount of time, material, tools, transportation and man power. Landmines if not vacated, can cause loss to friendly forces and noncombatants as well as limit friendly movement.

Landmines same as weapons, normally buried, that start explode when someone stepped on it and are invented to damage or kill, by leaving very long-term psychological effects and posing a financial loss to community [1]. Colombia ranked second in victims from the landmines [2]. since 1990 to April 2011, Colombia have records of 9.2777 victims, and 22.688% of them are in Antioquia [3], which is the most affected department. Colombia is badly affected by this because landmines are currently used by groups outside the law to protect coca plantations and to counter the army [4].

Colombian mines are usually includes some elements that complicate wounds caused by explosion, as feces, glass and plastic scrap, which caused infections due to fragments that are not detected by x-rays [4]. Also, these mines are enclosed

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in casings of various shapes, materials and the sizes , that may contains more explosive: while conventional mines contain from 30 gram to 520 gram, mines in Colombia usually contain from 250 grams to 4 kilogram, and some found with more than 20 kilogram [4]. Due to the government controls, the mines of the illegal groups rarely contains military explosives, instead they also contain Ammonium Nitrate or Fuel Oil [5] to which some products, like coffee or paint, are added for avoiding canine detection. Due to the characteristics of Colombian landmines mentioned , these are called improvised explosive devices (IEDs) [6].

A crucial step to prevent further victims from landmines and IEDs is to detect them and destroy them. Today, detecting IEDs is a problem in Antioquia due to the characteristics of these devices and of the land where they are buried. Here, a review of landmine detection technologies is made, in order to orient future research in the topic.

II.CLASSIFICATION OF LANDMINES

There are two types of landmines –
1.Anti-Vehicle
2.Anti-Personnel.

The anti-vehicle or anti-tank mines are activated under pressure but are designed such that the footstep of a person does not detonate them. Most anti-tank mines require a pressure of 348.33 pounds i.e. 158 kg to 745.16 pounds i.e. 338 kilos in order to denote. Most tanks and other military vehicles can apply that kind of heaviness.

Anti-personnel landmines intended particularly to reroute or drive back foot soldiers from a geographic area. These antipersonnel mines can even kill their victims and generally get activated by pressure or by tripwire i.e. a wire stretched close to the ground or by remote detonation.

1.1 PROBLEMS OF LANDMINES

There are nearly 50 million unexploded landmines in 60 countries around the world.These landmines causes approximately 10,000 deaths per year.Large portions of land goes unused due to fear of mines. Landmines kill and maim long after the war is over 90% of those killed are civilians.It costs ~$3 for placing a mine It costs $300 to $1000 to detect it and remove it.Many victims are children. Modern mines are constructed with plastics and composites.The low metal content of mines makes detection extremely difficult.

III.RELATED WORK

[1]**Majd Ghareeb, et.al. proposed a method for detecting landmines using Robotics,** communication and data analysis. The system mainly consists of raspberry pi, camera board, metal detector circuit and GPS shield. A raspberry pi based moving unit for detection, data collection and transferring to the central unit that will be later investigating the received data. Metal detector circuit is used for metal detection. GPS shield used to detect the exact location of the detected object. Type of detector and camera resolution capacity has to be considered to increase the performing ability of the system. [1]

[2] **S. Sasikumar, et.al, proposed a multi utility based landmine detecting robotic vehicle** which uses metal detector as a complementary tool to detect landmines. The system consists of GPS, metal detector, microcontroller ATmega328. GPS system finds the position of landmine and sends its position to a web server with help of IOT.

A

Metal detector with driver circuit is implemented using ATmega328P microcontroller to regulate the complete operation. The main use of this project is that it accurately detects the latitude and longitude position using GPS module hence it is easy to point out the position of the landmine. Also this model provides decreased complex structure and reduces cost to build landmine detecting robot. [2]

[3] **J. Bharath presented a robot design,** which is capable of detecting buried landmines and change their locations, while the robot can also be controlled wirelessly from a distance. This technology requires the metal detector circuit present in robots to search the landmines. The metal detector circuits that are interfaced with robots, are left on the search area to detect metallic components used in landmine production. It detects the uneven landmines present under the ground and generates an alarm to user and can consequently change the place of landmine by taking it safely from one place to another, without risk of detonation. [4]

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[4] **Mohammad A. Jaradat, et.al, implemented a robot structure,** equipped with strong capabilities that allow it to navigate in the minefields freely without any constrain on its steering. The wheeled locomotion type in the robot has the advantage over other types in its stability, simplicity, and less control effort, while the Bogie suspension has good response over the other types of suspension. Also the force angle measure of tip-over stability margin is programmed inside the robot controller to alert it before any tip-over.[7]

[5] Kuo-Lan Su, et.al, implemented a multi robot-based landmine-detection system that contains a landmine detection mobile robot and a following mobile robot, the landmine detection mobile robot goes ahead which uses a landmine detector to find landmines and the GPS module to track the location. It records the coordinates and transmits it to the following mobile robot via a wireless RF interface. The following robot records the position and orientation of the landmine detection robot and the coordinates of the landmines in the region.

[6] Pedro F. Santana, et.al, proposed a roadmap for the application of robotics for humanitarian demining. A portable demining kit to handle urgent situations in remote locations is used, which consists of a low cost four-wheel steering robot with a biological locomotion control. Advantage of this work was having a low-cost robot with locally available components like bicycle wheels, using low mechanical and energetic stress with the use of virtual components and simple sensory and computational equipment. [10]

[7]V. Abilash and J. Pal Chandran Kumar implemented a Landmine Detecting Robot controlled by ardunio. This system consists of Arduino UNO microcontroller, ultrasonic sensor, buzzer, metal detector and GPS. Metal detector for detecting of mine, buzzer for warning alert, the robot is controlled with help of the computers using zig-bee module, ultrasonic sensor fixed to it inorder to locate and avoid obstacle, robot actuation is done with the high powered DC motors supported by H bridge circuit which allows robot to move in any direction, GPS sensor for latitude and the longitude detection. The advantage of wheeled robot proposed is less expensive, robust and it is very helpful tool in military for the surveying and for monitoring purpose.

[8] Yuvaraj Ganesh, et.al, implemented a surveillance drone for landmine detection. The system consists of a quadcopter, metal detector circuit, IR camera, RF Transmitter and Receiver, Ardunio Uno, GPS module and GSM module. GPS module provides location of the detected mine in terms of latitude and longitude. GSM module is used to send the location via text message to the user. Wireless communication is achieved using RF Transmitter and Receiver. Ardunio Uno used for processing the algorithm and interfacing the GPS, GSM, metal detector and IR Camera. Disadvantage comprises in terms of operating range of drone and the implementation cost. [5] Kishan Malaviya, et.al proposed a Autonomous landmine detecting and mapping robot.

[9] Williaam Ben and Stanisslao Laurria proposed a model for robot navigating control basing on monocular imaging using image processing algorithm. Using color segmentation against a selected floor plane to distinctly separate obstacles from traversable space was implemented this is then supplemented with canny edge detection to separate similarly coloured boundaries to the floor plane. In the resultant binary map, white identifies an obstacle-free area and black identifies an obstacle. This was then processed by fuzzy logic to control the robot's next movements. As per the output, this image processing algorithm performed strongly on solid coloured carpets, wooden, and concrete floors but had difficulty in separating colours in multicoloured floor types such as patterned decorative carpets.[8]

IV.METHODS

Electromagnetic method

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 the transmitter and receiver.

Metal Detection Method- Metal detectors attempt to obtain information on buried mines by emitting into the soil a time-varying magnetic field to induce an eddy current in metallic objects; which in turn generates a detectable magnetic field. Ground Penetrating Radar 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.

Thermography- The use of thermography for land mine detection has become a topic of great interest in recent years. The underlying principle of all dynamic thermography based techniques is the idea that the thermal signature of the soil is altered by the presence of shallowly buried objects.A common method of detecting explosives is through trained dogs. Dogs can reliably detect 10-15g of explosives. Although dogs can effectively detect presence of mines, they cannot determine a mine's precise location.

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Rodents:- The rodents are lighter, and easier to educate, transport and feed than dogs. This can work longer periods than dogs. The main limitation for the use of rodents is that rats can only work under certain environmental and weather conditions and they have troubles getting down working in the morning.

Optical method

Visible Light- Visible light detection involves capturing light waves of visible wavelengths using an image formation optical system. A visual imagery gathers a beam of light from an object point and transforms it into a beam that converges towards or diverges from other points on a focal plane, thereby producing an image.

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 travelling time of the reflected pulses and the difference between the transmitted and the reflected energy, which are useful to calculate the distance to the target and its general reflectivity or absorption.

Mechanical method

Instrumented Prodder- The standard proder relies on the dexterity of operator. With the instrumentation, the proder can make acoustic or electromagnetic measurement during insertion. The echo will give information about mechanical impedance of the material near the tip, making discrimination between rock, wood, plastic It involves use of extremely sensitive sensor equipments to provide near real-time data and rapid spatial scans in three dimensions.

V.RESULTS AND DISCUSSION

Microcontroller based monitoring and control system has designed and implemented to measure several parameters in greenhouse and generate required signal to control the environmental parameters according to crop growing requirements in greenhouse. Such a system allows the farmer to monitor and control required variables in selected greenhouse using web technology and smart phones. We utilize engine driver L298D on the grounds that we give just +5v control supply and +12v is required to turn the engine so just L298D has the property to pivot the engine regardless of whether the information control supply is +5v.S The control station comprises of three coordinated modules comprising of Metal recognizing segment, GPS information gathering segment and Remote control segment.

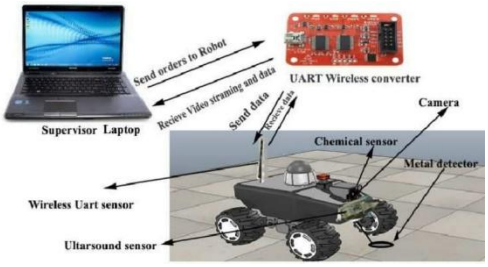

Fig.1 : Sending signals and receiving messages

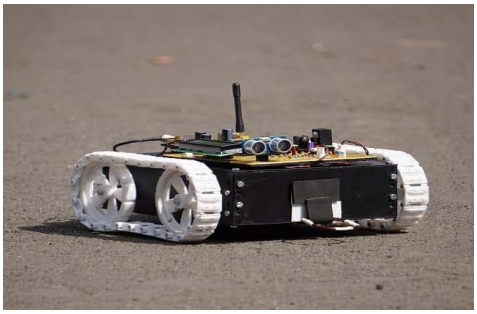

Fig.2 Robot vehicle

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VI.CONCLUSION

A microcontroller based monitoring and control system has manufactured and executed for measuring many parameters in the greenhouse and to generate wanted signal for controlling the environmental parameters according to crop growing requirements in greenhouse. Those system allows the farmer to observe and change required variables in selected greenhouse using web development technology and smart devices.

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