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Landmine Detection Robot Using Arduino Microcontroller

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Abstract:-- **This project demonstrates the problem and effects of landmines in defence fields. We are proposing a robot that has the aptitude to detect the buried mines and lets user to control it wirelessly to avoid human causalities. The main objective of the project is on the safety of humans by well equipped and designed robot with special range sensors that help in avoiding obstacles in the field by specifically detecting the position of obstacles. For the fabricating the project, a special type of prototype made of lightweight temperature resistant metal is used to carry all the objects. A Global Positioning System (GPS) sensor is added to the robot which identifies and broadcasts the present location of the robot. Microcontroller commands the robot. This technique has the practical benefit of reducing the number of causalities. After the implementation of the techniques, the robot can be controlled efficiently and it robustly determines the position of the obstacles. Here, we can use the Arduino microcontroller as the brain of the robot. The robot system is embedded with metal detector capable of sensing the landmine and buzzer from producing a warning alarm to the nearby personnel in that area. The locomotion of the robot is carried out by the DC motor. The robot is interfaced with the pc with help of a ZigBee device. Thus, user can identify the position of the landmines which is designed using the proteus 8 software and the programming is done using Arduino software.**

Key words: **Robot mechanism, ultrasonicsensor, metaldetector, Ardunio microcontroller**

I. INTRODUCTION

A land mine is an explosive device concealed under or on the ground and designed to destroy the or disable enemy targets, ranging from combatants to vehicles and tanks, as they pass over or near it. Such a device is typically detonated automatically by way of pressure when a target steps on it or drives over it, although other detonation mechanisms are used. A land mine may cause damage by direct blast effect, by fragments that are thrown by the blast, or by both. The name originates from the ancient practice of military mining, where tunnels were dug under enemy fortifications or troop formations. These killing tunnels were first collapsed to destroy the targets

located above, but they were later filled with explosives and detonated in order to cause even greater devastation. Nowadays, in common parlance, land mines generally refer to devices specifically manufactured as anti-personnel or anti-vehicle weapons. Though many types of improvised explosive devices ("IEDs") can technically be classified as land mines, the term land mine is typically reserved for manufactured devices designed to be used by recognized military services, whereas IED is used for makeshift devices assembled by paramilitary, insurgent or terrorist groups. The use of land mines is controversial because of their potential as indiscriminate weapons. They can remain dangerous many years after a conflict has ended, harming the economy and civilians. With pressure from a number of campaign groups organised through the International Campaign to Ban Landmines, a global movement to prohibit their use led to the 1997 Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction, also known as the Ottawa Treaty. To date, 162 nations have signed the treaty. Land mines are generally classified into two types based on the type of detonation that has to be initiated,Anti-Tank minesThey are designed to immobilize or destroy vehicles and their occupants. In U. S. military terminology destroying the vehicles is referred to as a catastrophic kill while only disabling its movement is referred to as a mobility kill. Anti-tank mines are typically larger than anti-personnel mines and require more pressure to detonate. The high trigger pressure, normally requiring 100 kilograms (220 lb) prevents them from being set off by infantry or smaller vehicles of lesser importance. More modern anti-tank mines use shaped charges to focus and increase the armour penetration of the explosives.Anti-personnel minesAnti-personnel mines are designed primarily to kill or injure people, as opposed to vehicles. They are often designed to injure rather than kill in order to increase the logistical support (evacuation, medical) burden on the opposing force. Some types of anti-

personnel mines can also damage the tracks or wheels of armoured vehicles. Under the Ottawa Treaty, the Parties undertake not to use, produce, stockpile or transfer anti-personnel mines and ensure their destruction. As of early 2016, 162 countries have joined the Treaty. .
Thirty-six countries, including the People's Republic of China, the Russian Federation and the United States, which together may hold tens of millions of stockpiled antipersonnel mines, are not yet party to the convention.

II LITERATURE SURVEY

There are many works on land mine detection robot, monitoring using ZigBee, robots which are available in the literature. In this chapter, surveys of related works on the above fields are discussed. The authors research on land mine detection robots,

***Bharath J, Automatic Land Mine Detection Robot Using Microcontroller*.** This paper describes the problems faced by the Land mines that are faced in 70 countries. This purpose of this paper to eliminate the problems of land mine. The purpose of this paper is to design a robot prototype which is capable of detecting buried land mines and changing their locations, while enabling the operator to control the robot wirelessly from a distance. This technology interfaces the metal detector circuit in a robot to search the land mines. The metal detector circuit is interfaced with the robot and it is left on the required search area in order to detect the metallic components used in the landmines. The main advantage in this project is that we can make this robot at low cost and more efficient,

***Michael YU. Rachkov, Lino Marques, Anibal T. De Almeida*.** The paper describes an advanced multi-sensor demining robot. The robot transport system is based ona simple structure using pneumatic drive elements. The robot has robust design and can carry demining equipment up to 100 kg over rough terrains. Due to the adaptive possibilities of pedipulators to obstacles, the robot can adjust the working position of the demining sensors while searching for mines. The detection block consists of a metal detector, an infrared detector, and a chemical explosive sensor. The robot is controlled by means of an on-board processor and by an operator remote station in an interactive mode. Experimental results of the transport, control, and detection systems of the robot are presented. The main disadvantage of the robot is weight factor due to the overloading of sensor, **Seong Pal Kang, Junho Choi, Seung-Beum Suh, Sungchul Kang, Design of mine detection robot for Korean mine field.** This paper presents the critical design constraints ofmine detection robots for Korean minefield. As a part of a demining robot development project, the environment of Korean minefield was investigated, and the requirements for suitable robot design were determined. Most of landmines in Korean minefield were buried close to the demilitarized zone (DMZ) more than half of a century ago. The areas have not been urbanized at all since the Korea War, and the potential locations of the explosives by military tactics have been covered by vegetation. Therefore, at the initial stage of the demining robot system development, the target areas were investigated and the suitable design for Korean minefield terrain was determined. The design includes a track type main platform with a simple moving arm and a mine detection sensor (consists of a metal detector and a GPR at this stage). In addition, in order to maintain the effective distance between the landmine sensors and ground surface, a distance sensing technique for terrain adaptability was developed and briefly introduced in this paper. The overall design of this robot was determined by considering the speed.

III PROPOSED METHOD

A land mine detection robot is needed to be designed to employ in peace support, operations and in the clearance of contaminated areas. For the safety of the operator, the robot is controlled with help of computers using the zigbee module. The robot has an ultrasonic sensor fixed to it in order to locate and avoid the obstacle. The mine can be located with help of latitude and the longitude from the gps sensor. The robot structure is made with a material that can resist blasts up to certain limit. The robot produces warning alert to the personel nearby with help of a buzzer that is mounted on the robot. The robot actuation is done with high powered DC motor supported by h bridge circuit that allows robot to move in any direction.

3.1 Block Diagram

An Overall block diagram is shown in Fig 3.1 and 3.2 and the system consists of various electronic parts. The system includes the brain of the robot, Arduino UNO microcontroller, Ultrasonic sensor GPS sensor, buzzer for warning alert, DC motors for actuation, ZigBee for controlling through PC, Metal detector for detection of mine. These entire components are mounted on the robot mechanism.

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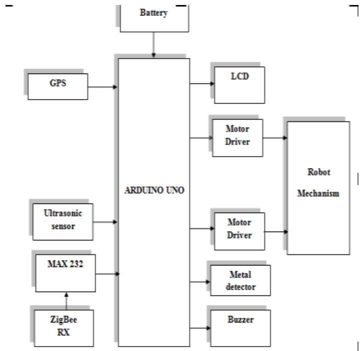

Figure 3.1:Transmission section of the robot

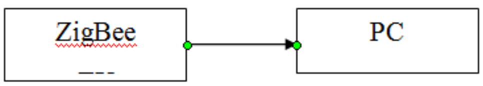

Figure 3.2 :Receving section of the robot

V RESULTS AND SIMULATION

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 proteus 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 dector sensor are connected to the input pins (12, 13), for detecting of the mines. The LCD display are connections are connected to the output pins (2, 3, 4, 5, 11, 13).

For simulation, Arduino Uno library 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 the software. Later the program is loaded in microcontroller for simulation. The simulation is shown in figure 5.1 and 5.2 The pin 0 of the microcontroller is connected to the transmitting pin in the GPS transmitter and the interfacing is shown above in figure 5.2

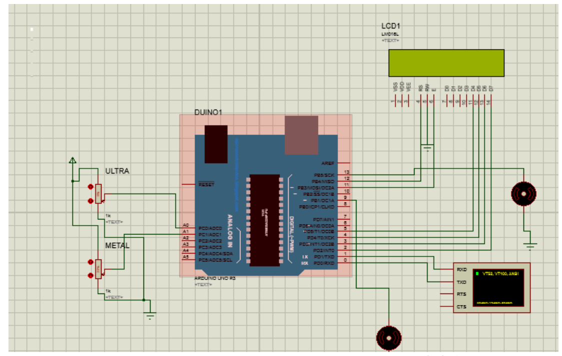

Figure 5.1 Simulation of electronics part

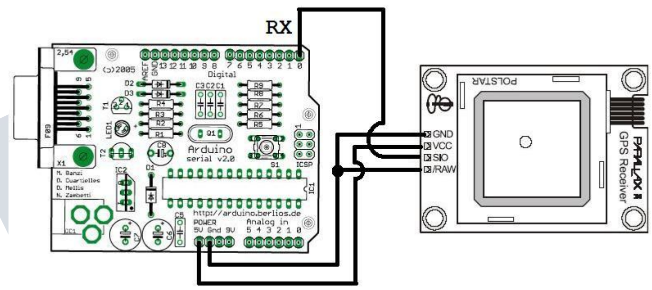

Figure 5.2 Simulation of gps

The conceptual design of wheeled robot is done through CATIA software. The dimensions are considered as per the components included in the block diagram. A 2D schematic view of the robot in front view, side view and top view are shown in figure 5.3 respectively. All dimensions are in mm.

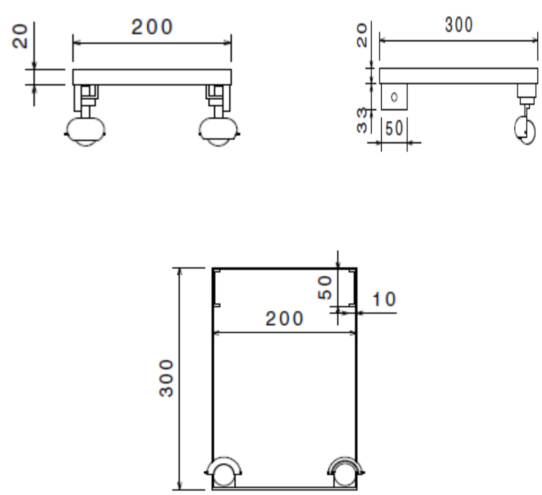

Figure 5.3 : 2D view of wheeled robot

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Later a 3D model is developed and 3 views of the robot are shown in Figure 5.4.

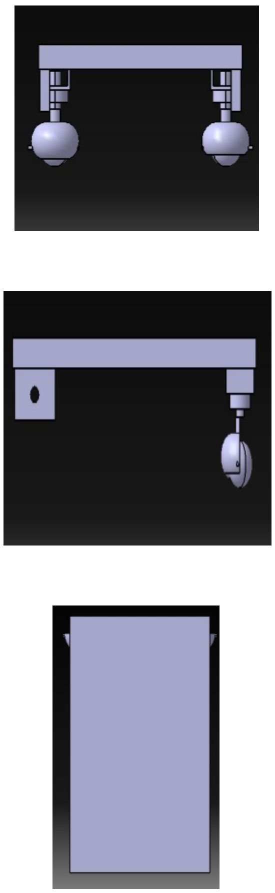

Figure 5.3 : 3D view of wheeled robot

VI CONCLUSION AND FUTURE SCOPE

This paper has described overall design for wheeled robot for land mine detection purpose and implementation. The wheeled robot is less expensive, robust and it is a helpful tool in for military for surveying and monitoring purpose. The future scope is concentrated on the improvement of the body designs by placing suspension system to over shock from the uneven surfaces. The robot is equipped with a camera for monitoring the condition of the robot. The power system is developed by replacing the battery with the solar panels to produce continuous power. The robot is equipped with a robotic arm for the diffusion purpose.

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