ARDUNIO CONTROLLED LANDMINE DETECTION ROBOT

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Abstract: Land mine detection is most crucial during ware fare to deploy armed vehicle drive in the enemy territory. These armed vehicle or Main battle tanks are used to follow the path of pilot tank operated manually to avoid damage/distraction of the battle tank and defence causalities of defence crews. In addition post ware fare the mines planted during war can be detected and diffused by deploying a mine detection robot, which can save civilian life to avoid human causalities. This research work proposed to have a proto type model of a land-mine detection robot (LDR), which can be operated remotely using Wi-fi. technology. The safety of humans was addressed and designed robot with special range sensors employed to avoid obstacles. Fabrication of this project prototype was done using lightweight temperature resistant metal. A Global Positioning System (GPS) sensor is employed, which identifies and broadcasts the present location of the robot. Path planning, obstacle detection and avoidance algorithms were used to control accurately and to navigation of the proposed path by avoiding obstacles. Arduino microcontroller is employed in this 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 by deploying a ZigBee device. Robot can identify the position of the landmines which is designed using the Proteus 8™ software and the embedded programming using Arduino software.

KEYWORDS: *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 have 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. The purpose of this paper is 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 compoments are placed on the robot and the power is supplied to these with the help of a power supply unit. PC is used for detecting the mines and the position of the mines.

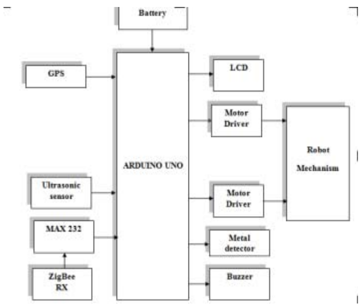

Figure 3.1: Transmission section of the robot

Figure 3.2: Receving section of the robot

The following components are used in the robot for the detection of landmines.

3.1.1 Ardunio Microcontroller: Arduino/Genuino Uno is a microcontroller board based on the ATmega328P .It has 14 digital input/output pins of which 6 can be used as PWM outputs, 6 analog inputs, a 16 MHz quartz crystal, a USB connection**,** a power jack, an ICSP header and a reset button. Atmega328p is the microcontroller we are using because,it is more efficient,less cost and easily progammable.

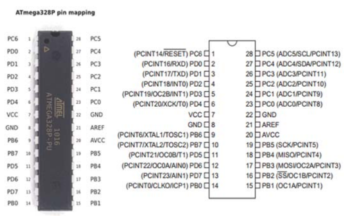

Figure 3.3: Arduino Microcontroller

3.1.2 Ultrasonic Sensor: Ultrasonic transducers are transducers that convert ultra-sound waves to electrical signals or vice versa. These devices work on a principle similar to that of transducers used in radar and sonar systems, which evaluate attributes of a target by interpreting the echoes from radio or sound waves, respectively. The HC-SR04 Ultrasonic Sensor is the perfect solution for any distance detection application in robotics.

Figure 3.4: Ultrasonic sensor

3.1.3 GPS sensor: The GPS system provides critical positioning capabilities to military, civil, and commercial users around the world. In our project we are using the GPS sensor module EM-406A, as it is new improved GPS Module with built-in antenna and memory back-up for OEM. This unit features low power consumption, high sensitivity. The unit is ideal for navigation systems, distance measurements, vehicle monitoring and recording, boating direction and location, together with hiking and cross country exploring.

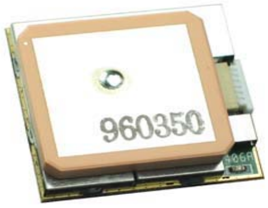

Figure 3.5: GPS sensor

3.1.4 Buzzer: The PS series are high-performance buzzers that employ unimorph piezoelectric elements and are designed for easy incorporation into various circuits. They feature extremely low power consumption in comparison to electro-magnetic units. In our project we are using the buzzer type PS19 type due to the fact, It has a low frequency tone of 2khZ and piezoelectric material is coated with water and dust resistant material.

Figure 3.6: Buzzer

3.1.5 DC Motor: A motor driver is a device or group of devices that serves to govern in some predetermined manner the performance of an electric motor. In This project we are using planetry geared DC motor model RMCS-2006 as it provides the required speed for the robot to move and provides high torque at the rated speed and current

Figure 3.7: DC motor

3.1.6 Zigbee RX: ZigBee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios. In our project we are using the Xbee module as it was developed to meet IEEE 802.15.4 standards and support the unique needs of low-cost, low-power wireless sensor networks. The modules require minimal power and provide reliable delivery of data between devices.

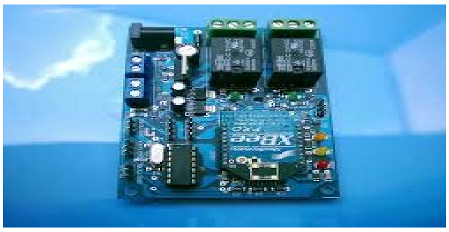

Figure 3.8: Zigbee RX

IV 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 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 4.2

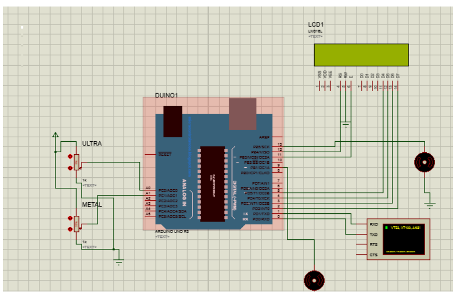

Figure 4.1: Simulation of electronics part

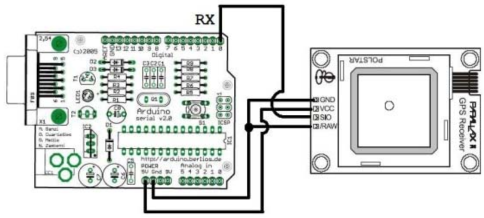

Figure 4.2: Simulation of gps

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 4.3 respectively. All dimensions are in mm.

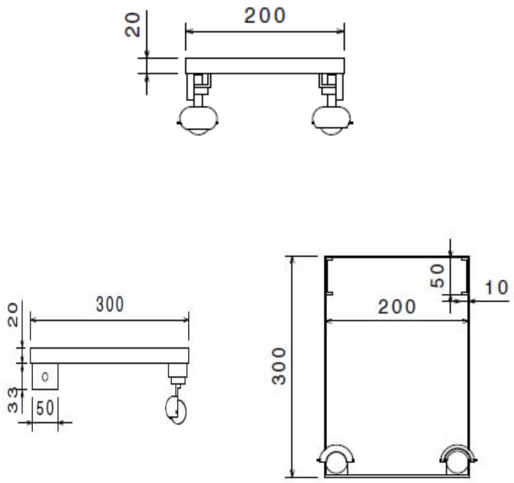

Figure 4.3: 2D view of wheeled robot

Later, a 3D model is developed and 3 views of the robot are shown in Figure 4.4.

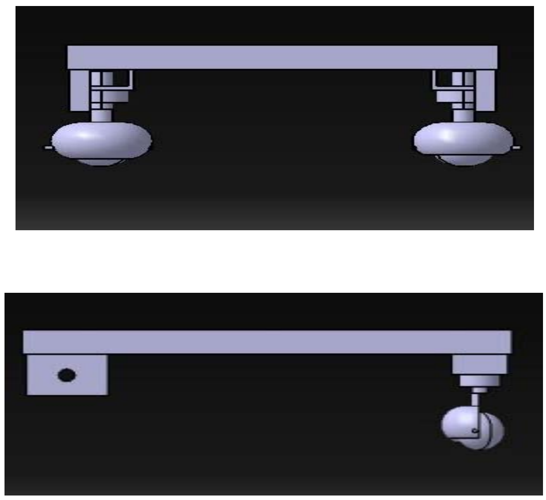

Figure 4.4: 3D view of wheeled robot

V PROJECT SNAPSHOTS

The snapshots of the final robot with all the components attached is shown below in the following figures in all the views

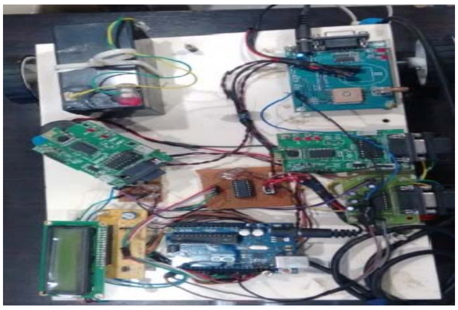

Figure 5.1 Top view

Figure 5.2 Front View

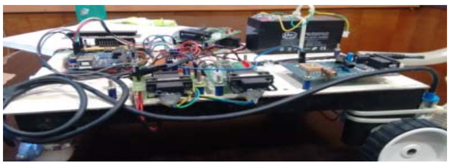

Figure 5.3 Side view

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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