DESIGN AND FABRICATION OF LANDMINE DETECTION ROBOT

[1]Balachandar.K,   [2]Gangadharan.J,   [3] Jeffrey Melvin.S, [4]Karthik.V,   [5]Arjun.S

[1]Assistant Professor,
[1]Department Of Mechanical Engineering,
Prathyusha Engineering College,
Aranvoyal kuppam,Thiruvallur.
Email - [1]balachandar3089@gmail.com
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Abstract: Landmines have been a threat for both humans and animals since the world wars. The number of casualties increases everyday all over the world. In order to clear the landmines in a more effective way that is cheaper and simple a robot is made which will detect landmines using a simple metal detector circuit. The Robot is a suspension arrangement called ROCKER AND BOGIE which enables it to move freely in all type of terrain. The mine is cleared using an electro magnet which is equipped with the robot. The whole process is controlled wirelessly from a remote place. The estimated cost is very much low.

Keywords: Rocker Bogie, Suspension, - Metal detector, Land Mines, Electro Magnet .

1. INTRODUCTION:

The landmine detection robot is constructed using the rocker and bogie suspension mechanism. The rocker bogie mechanism helps the vehicle to move in almost all terrains like desert, snow, rough surfaces. The main objective of this construction is to detect the land mines which are buried under ground and to minimize the loss of life. The mine is comprised of minerals that are metallic in nature hence a metal detector is induced in the system to determine the mines that are buried under the ground. The cart is controlled wirelessly with the help of a powerful Bluetooth module that can drive the cart to a longer distance. The cart motor functions are controlled by the use of the Arduino Uno circuit which is programmed with simple loop commands.

2. MATERIALS:

S.NO	MATERIAL	QUANTITY
1.	PVC Pipe	3 Meters
2.	90° Elbow	6
3.	45° Elbow	4
4.	300 RPM Motor	6
5.	3 Inch Wheel	6
6.	Arduino UNO	1
7.	Motor Driver Circuit	1
8.	12v DC Supply	1
9.	HC-05 Bluetooth Module	1
10.	Mobile Holder	1
11.	Bolts And Nuts	1

TABLE 1.1

3. METHOD:

LANDMINES

According to International Mine Action Standards (IMAS, a (land)mine is ammunition designed to be placed under, on or near the ground or other surface area and to be exploded by the presence, proximity or contact of a person or a vehicles . Mines can be either designed as 'anti-personnel' or 'anti-tank'. Anti-personnel (AP) mines are designed to be activated by people, whilst anti-tank (AT) mines are intended to defeat tanks or other armoured vehicles.

The clearance of mines by manual means (i.e. a man using a mine detector and a probe to find mines) is slow. If the   de-miner is not highly trained and stringently supervised, there is also considerable risk involved. This has led to a widespread interest in the application of new technology. Although this has provided some assistance it is, in general, only valuable when used to support manual demining techniques, which remain to this day the only means by which the desired standard of clearance can be achieved.

4. ROCKER AND BOGIE:

The Rocker and Bogie has no suspension springs. It enables the rover to climb obstacles like stones, rocks, and stairs. The Rocker and Bogie has been the predominant rover mechanism which has been employed in mars rover missions such as The Spirit and Opportunity, The Curiosity. The rocker and bogie robot frame consists of six wheel fixed with three wheels on each sides**. T**he rear consists of a fixed wheel on each side and the front portion consists of two wheels which are fixed in an inverted "V" shaped arm which is connected to the centre such that it can be moved to and froth. The chassis maintains the average pitch angle of both rockers. One end of a rocker is fitted with a drive wheel and the other end is pivoted to a bogie.

FIGURE1.1

These wheels are fixed to a middle ribcage that holds the cart together and serves as a platform for the battery, the motor driver circuits and the Bluetooth module.

The six wheels are driven individually by an electric drive. The Individual drives are necessary as the wheels are forced to drive over obstacles separately for effective movement of the rover over the obstacles.

FIGURE1.2

FIGURE1.3

FIGURE1.4

5. ARDUINO UNO:

Arduino UNO is a microcontroller used for the purpose of many programming purpose. In this project the Arduino is used as a controller circuit for the achievement of movement. It is powered by a 12 v, 0.5 Amps DC supply. It make use ATMEGA328 microcontroller IC. It is mounted on the rover along with the motor driver circuit. Four Digital Output pins are utilised for the required of movement. These Output pins are connected to the motor diver circuit (L293D).
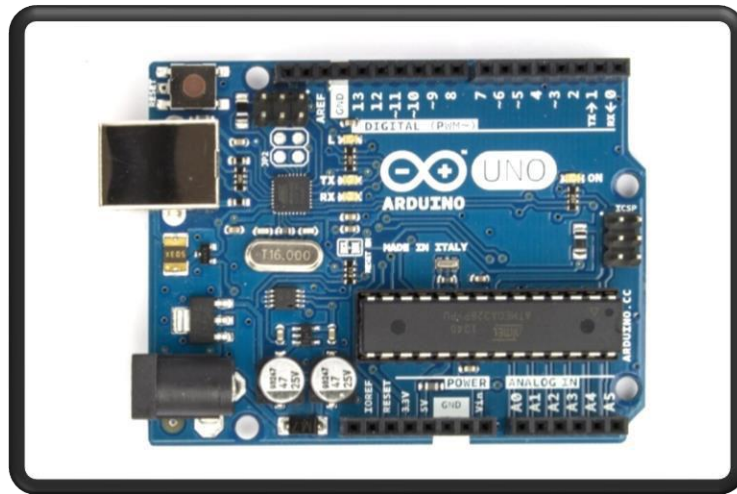
FIGURE 1.5

6. MOTOR DRIVE (L293D):

Furthermore the rover is powered by a 12 volt supply through a L293D motor diver. It is a 16 pin IC. The motor drive has a capacity of powering up motors having a maximum capacity of 36v.The motor drive is a H-bridge based circuit . It has four inputs and four outputs which means two inputs and two outputs for one set motor and another two inputs and two outputs for another motor. Motor drivers are nothing but current amplifiers; they take low current signal inputs and distribute high current signal outputs. The l293D is composed of two H-Bridge driver circuits. The pins 1 and 9 are enable pins, which means when they are HIGH they enable the IC to start the operation. The pins 4,5 and 12,13 are ground pins. The pin 8 is the supply voltage for the motors. The pin 16 is the supply for the IC. The input pins are 2,7 and 10,15 and the output pins are 3,6 and 11,14. The L293D is a cheap method of controlling the Motor drivers.

FIGURE 1.6

Based on the signal input given to the input pins the direction of the motor can be controlled

INPUT SIGNAL	OUTPUT PERFORMANCE
11	Start
00	Stop
01	Clockwise
10	Anti-Clockwise

TABLE 1.2

The direction of the motor is based on the terminal and output connection.

7. CONTROLLER:

The controller is a Android mobile. An application which contains the required Serial data is used .The mobile is connected to the rover with the help of a Bluetooth connection. A joypad interface screen is

opened using the app. The application sends the required serial data to the Arduino UNO through the HC-05 bluetooth module . Based on the input serial data the motors can be controlled

8. MODE OF MOVEMENTS:

The rover is controlled in such a manner that it is capable of moving in all possible directions. The rover can move particularly in the following directions

- Forward
- Backward
- Left
- Right
- Forward Left
- Forward Right
- Backward Left
- Backward Right
- Clockwise 360^0 Rotation
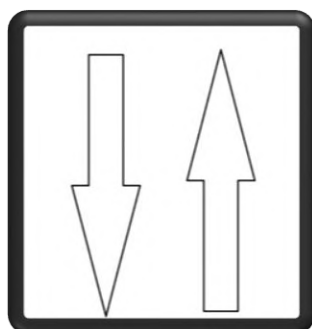- Anticlockwise 360^0 Rotation

The Drives in the rover are designated into two combinations, namely the left three motors and the right three motors. The movements are achieved by activating the set of drives in a systematic manner.
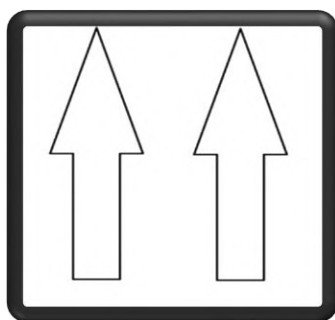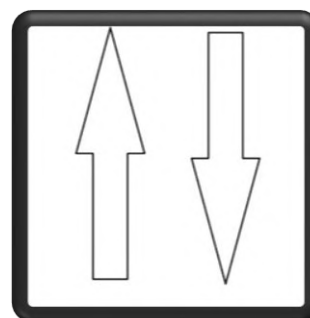

Forward
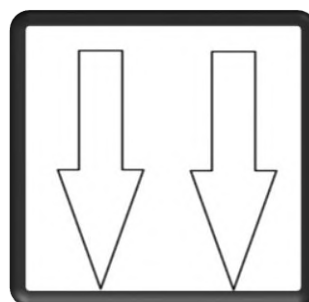
Backward

Right And Clockwise Rotation

Left And Anticlockwise Direction

9. METAL DETECTOR:

The proposed idea is to use a simple metal detector circuit which runs using a Arduino UNO microcontroller circuit and a BC547 Transistor. The metal detector is very cheap and simple to make. If any metallic object is found within the boundary limit the circuit will trigger an alarm which alerts the operator to execute a visual inspection on the area. Thereby the land mines can be verified using the metal detector. The metal detector coil is used in which it is suspended along the coil and the circuit. This suspended coil acts as a detector. When a metal object is inbound inside or near the coil, the beeper triggers an alarm

thereby denoting the presence of the explosive mines. This detected object is thereby verified by the use of a camera or any other human resources.

10. VIDEO INTERFACE:

As we don't know whether the detected entity is a Landmine or not a video interface is included in the rover. A mobile is used for this purpose . The mobile is held in a car mobile holder which is fitted in the rover . The mobile is connected to a laptop with the help of a wireless network . Using an Android application called IP Webcam the video interface is obtained in the laptop.

11. CLEARANCE METHOD:

The detected object is determined by the use of a camera, and when a mine is verified, the electromagnet which is suspended in the cart is lowered. The electromagnets are two in number separated by the distance for holding out the mine. This clearance reduces the loss of human life. The clearance method is to remove the mines placed and mobilizing it thereby it can be detonated at a safer distance.

12. FINDINGS:

The Rover's movement in the rough rocky surface is found to be excellent.The senstivity of the Metal detector is not as required. The range of the controller must be increased for a wide area. Instead of a PVC pipe body an Aluminium body can be used. The battery backup need to be increased

13. CONCLUSION:

- The setup is a cheaper way of landmine detection.
- It reduces the loss of human life.
- It is compact in sizeSmaller in size.
- It is portacble and light in weight
- It can be utilised in all terrain types
- Estimated Cost Rs.4000.

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