COPY RIGHT

ELSEVIER SSRN

Title **Mine detector & Fire fighter Robot**

Paper Authors

Prof. P. H. Rathod, Miss. Sakshi G. Chaudhari, Mr. Aditya P. Tathe , Mr. Darshan P. Wandhare, Miss. Sonu D. Meshram , Miss. Nikita R. Dethe., Mr.Yashas S. Ingole, Mr.Vishwanath N. Uike

USE THIS BARCODE TO ACCESS YOUR ONLINE PAPER

To Secure Your Paper As Per UGC Guidelines We Are Providing A Electronic Bar Code

Mine detector & Fire fighter Robot

Prof. P. H. Rathod*¹, Miss. Sakshi G, Chaudhari*², Mr. Aditya P. Tathe*³ , Mr. Darshan P. Wandhare*⁴, Miss. Sonu D. Meshram*⁵ , Miss. Nikita R. Dethe*⁶, Mr. Yashas S. Ingole*⁷, Mr. Vishwanath N. Uike*⁸.

*1Faculty, Department Of Mechanical Engineering, Jagadambha College Of Engineering And Technology, Yavatmal, India.
*2,3,4,5,6,7,8 Students, Department Of Mechanical Engineering, Jagadambha College Of Engineering And Technology, Yavatmal, India.

ABSTRACT

In this project we have combine Landmine Detector with Fire Fighter Robot. The goal of this project is the design, construction and development of a mine detector and a firefighting robot. Landmines are explosive devices used in times of war and conflict to destroy or disable enemy targets. Landmines are usually hidden underground and are usually triggered by pressure, causing them to explode whenever the target is crossed or overrun. A landmine detection robotic vehicle uses a sensor to detect landmines hidden beneath the earth's surface.

The fire robot can be used to control the fire. this robot can detect and control fire by itself throwing water. we use some sensors that can detect the fire and the robots can move there to shoot quench. So in this project we combine a land mine detector with a fire fighting robot and the goal of this the project is the design development of a landmine detector and a firefighting robot.

INTRODUCTION

1. Problem Statement

A landmine detector is to develop a device or system that can accurately and efficiently detect the presence of landmines in a given area, in order to reduce the risk of injury or death to humans and animals that may come into contact with them. The detector should be able to identify the location and type of the landmine so that it can be safely removed or disarmed.

And a firefighter is to develop strategies and technologies to prevent, control, and extinguish fires in order to protect people, property, and the environment. This involves designing fire-resistant materials and structures, developing early warning systems for detecting fires, and creating effective firefighting techniques and equipment to control and extinguish fires. The goal is to minimize the risk of injury and loss of life, and to limit the damage caused by fires.

2. Objectives

➢ To clear landmines from an area: Landmine detectors can be used in conjunction with other equipment and techniques to clear landmines from an area and make it safe for human habitation or use.

➢ To prevent accidental detonation: In addition to detecting landmines, detectors may also be used to prevent accidental detonation of landmines during clearance operations.

➢ To aid in the research and development of new detection technologies: Landmine detectors can also be used to aid in the research and development of new technologies and techniques for detecting landmines more accurately and efficiently.

➢ Fire suppression: The robot can be equipped with water or foam dispensing mechanisms to suppress the fire.

➢ Search and rescue: The robot can be used to search for and locate victims in a burning

building or other dangerous environment, and provide assistance in their rescue.

➢ Remote monitoring: The robot can be remotely operated to monitor the situation and provide updates to firefighters outside the danger zone, allowing them to adjust their tactics accordingly.

➢ Environmental monitoring: The robot can be equipped with sensors to monitor air quality and temperature, providing information to help determine the most effective firefighting strategies.

2. PROBLEM IDENTIFICATION

The problem identification of this system could be related to its effectiveness and reliability in detecting mines and fires. As the system uses a wireless 360-degree rotating camera to detect fires and a metal detector to locate mines, it is important to ensure that these sensors are accurate and sensitive enough to detect all possible threats. Additionally, the wireless communication between the robot and the Android app should be reliable and strong enough to operate in all environments, including areas with interference or obstacles. Another potential issue could be the water tank and pump system, which should be designed to provide enough water to extinguish fires effectively. Finally, the operator who receives the signal from the metal detector should be trained and equipped to safely de-mine the area, as landmines pose a significant danger. Therefore, ensuring the proper training and equipment for the operator is also critical to the success of this system.

3. COMPONENT

DC Motor:

These motors are simple DC Motors featuring gears for the shaft for obtaining the optimal performance characteristics. They are known as Center Shaft DC Geared Motors because their shaft extends through the center of their gearbox assembly.

These standard size DC Motors are very easy to use. Also, you don't have to spend a lot of money to control motors with an Arduino or compatible board.

The L298N H-bridge module with an onboard voltage regulator motor driver can be used with this motor that has a voltage of between 5 and 35V DC.

This DC Motor – 300 RPM – 12 Volts can be used in all-terrain robots and a variety of robotic applications. These motors have a 3 mm threaded drill hole in the middle of the shaft thus making it simple to connect it to the wheels or any other mechanical assembly.

Motor Driver:

The L298 is an integrated monolithic circuit in a 15-lead Multi watt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external
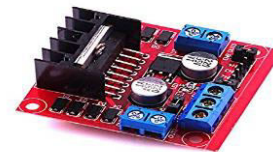
terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.

Relay:

We know that most of the high-end industrial application devices have relays for their effective working. Relays are simple switches which are operated both electrically and mechanically. Relays consist of an electromagnet and also a set of contacts.

The switching mechanism is carried out with the help of the electromagnet. There are also other operating principles for its working. But they differ according to their application. Most of the devices have the application of relays.

Battery:

It is necessary to store some of the energy produced. The most obvious solution is to use batteries. The batteries are used as a storage device for solar energy which can be further converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage, for small units with output less than one kilowatt. Batteries seem to be only technically and batteries are high in capital costs.

Bluetooth Module:

Bluetooth BLE module is a technology that acts as an interface that aids the wireless Bluetooth Low energy connection of any two devices and establishes a protocol for the communication of data between the devices. HC-05 has red LED which indicates connection status, whether the Bluetooth is connected or not. Before connecting to HC-05 module this red LED blinks continuously in a periodic manner. When it gets connected to any other Bluetooth device, its blinking slows down to two seconds.This module works on 3.3V. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator. As HC-05 Bluetooth module has 3.3V level for RX/TX and microcontroller can detect 3.3 V level, so, no need to shift transmit level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 module.The data transfer rate of HC-05 module can vary up to 1Mbps is in the range of 10 meters.
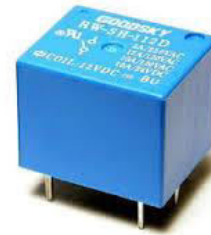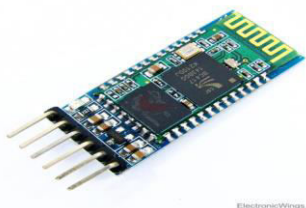
Camera:

A 360 camera, also known as an omnidirectional camera, has a 360-degree field of view so that it captures just about everything around the sphere. 360 cameras are needed when large visual fields need to be covered, such as shooting panoramas.

Water pump:

DC powered pumps use direct current from motor, battery, or solar power to move fluid in a variety of ways. Motorized pumps typically operate on 6, 12, 24, or 32 volts of DC power.

Cooling Fan:

This is a miniature-size exhaust cooling fan. This fan is as small as your palm. Its working voltage is 12V DC. It can work with a simple 12V battery without any difficulty. This mini fan has the ability to run at a speed of 6800 ~ 13000 rpm. The body of the fan is built from a combination of resin and plastic material. The combination provides strength and insulation to the fan. Due to its manufacturing, It is light in weight and strong enough to bear some falls on the ground. So if you are looking for a perfect combination of strength and insulation in a single fan, then you are in the right place.

other frames, making them less likely to warp or rot as a result. Aluminium also has a high strength-to-weight ratio, making them harder to dent.

Conveyor Belts:

A conveyor belt is a looped belt that is driven by and wrapped around one or more pulleys. It is powered by an electric motor and supported by a metal plate bed or rollers upon which the conveyor belt rests. The pulley that powers a conveyor belt is referred to as the drive pulley and has an unpowered idler pulley.

Wheels:

A wheel is a circular component that is intended to rotate on an axle bearing. The wheel is one of the key components of the wheel and axle which is one of the six simple machines. Wheels, in conjunction with axles, allow objects to be moved easily facilitating movement or transportation.Here we have mounted conveyor belts on wheels.


Aluminium Frame:

Durability. Aluminium Frame have can last up to 30 years. This is because, aluminium is considerably more resistant to the outside elements compared to

ARDUINO UNO
Introduction to Arduino UNO Development Board:
Arduino UNO

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, 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. The Uno differs from all preceding boards in that it does not use the FTDIUSB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.
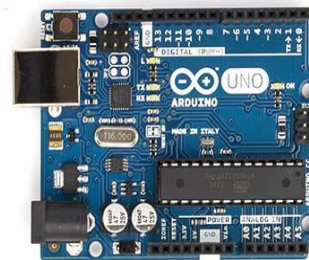
Metal detector Sensors:
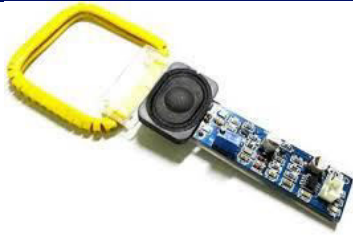
This is a metal detector with a speaker and TTL output. A metal detector is an electronic instrument which detects the presence of metal nearby. Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. So here we are using this to detects the landmines hidden under ground. Range of this mine detector is 1-10.

4. LAYOUT OF THE SYSTEM

The system layout for this project includes the following components and their interactions:

Wireless 360-degree rotating camera: This component detects and scans for fires within a certain radius.

Controller: The controller receives data from the camera and sends it to the receiver.

Receiver: The receiver has two parts - the Arduino Uno and the Android app. The Arduino Uno receives input from the camera to display video in the Android app. The Android app uses a Bluetooth module to establish a connection with the robot and sends commands to control its movement (forward, backward, left, right) and put out fires.

Robotic vehicle: The vehicle is equipped with a water tank and pump that is controlled via wireless communication to throw water at fires.

Metal detector circuitry: One metal detector circuitry is placed on the front of the vehicle, and prototype AP landmines are placed on the ground as a minefield. Whenever the robot or landmine detector crosses the minefield, a signal is given from the metal detector to an operator located outside the field to alert them of the presence of the landmines.

Overall, the system is designed to detect and extinguish fires and safely navigate through minefield.

5. CALCULATIONS

RPM of gear motors: 500 rpm
Pressure of water motor: 110 psi
Battery Type & Rating : Lead Acid (12V/5Amp)

Technical Specifications:

Power Consumption of Robot:

Current consumption of 4 gear motors: 4x50= 200 mA
Current consumption of water motor: 220mA
Current consumption of motor driver: 600mA
Current consumption of cooling fan: 170mA
Current consumption of arduino uno: 200mA

Total current consumption of system: 1390 mA
Applied Voltage: 24 Volt

$$Power (P) = I * V$$
$$P = 1.39 A * 24 V$$
$$P = 33.36 Watt$$

If we run system for 1 hour then power consumption is,
33.36 watt *1 hour = 33.36Wh (Watt-hour)

6. WORKING PRINCIPLE

The main brain of this project is the Arduino kit, here we combine the Mine Detector with the Fire Fighter Robot.

In order to locate and find the fire before it gets out of control, we used a wireless 360-degree rotating camera that can detect and scan all common video frequencies within a certain radius. Once a fire is detected, the controller sends data to the receiver. The receiver consists of two parts, the first part is the aurdino uno and the other is the Android app. Aurdino has input from the camera used to display video in the Android app. The Android application consists of a bluetooth module that is used to establish a connection between the robot and the Android application. Commands to move forward, left, right and to put out the fire are sent to the robot through the Android app. The robotic vehicle is filled with a water tank and a pump

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

that is controlled via wireless communication to throw water. Transmitting end using android app device, commands are sent to the receiver to control the movement of the robot either forward, backward and left or right etc. At the receiving end four motors are connected to the motor controller and the motor controller is connected to the arduino where they are all used for vehicle movement. Remote control is provided by any smartphone.

In this model, we also placed One metal detector circuitry on the front of the vehicle and have prototype AP landmines placed on the ground as a minefield. So basically the way this model works is that whenever a robot or a landmine detector crosses a landmine field, a signal is given from the

metal detector to an operator located on the outside of the landmine field, due to which the operator at the other end is alerted and can carefully de-mine the mine.

7. RESULT & CONCLUSIONS

[A] RESULT:
Nothing should be more important than the lives and safety of our country's army men who risk their lives for our safety from external enemies. There have been many cases of fatalities and injuries due to explosion of landmines. Till date a lot of research and
development has been done and different types
of landmine detection robots have been

developed each having its own advantages and disadvantages. The variation in these robots is based on the arduino or processor used, Metal Detector, android Application used.

In this project, an autonomous Firefighting Robot has been implemented which is capable of detecting fire and extinguishing them successfully. This robot can move forward, move left & right flawlessly. The motors and Arduino code work together to control the movement of the robot. The motor will start to rotate & move the robot to the danger point upon receiving a signal about the danger environment & start to pump the water with the help of servo motor. This process will be continued until the fire or smoke has been extinguished completely. Then it will display about the safe environment. After successfully building the project, the simulation was run and the desired

output was obtained. Proper snapshots of the results were attached. Thus, an autonomous firefighting robot has been built to achieve the objectives of this project successful.

[B] Advantages

- It can use in municipality for killing insects and mosquitoes.
- It is maintenance free device.
- It is easy to operate and portable. The solar operated sprayer will help the farmers of those remote areas of country where fuel is not available easily.
- They can perform their regular work as well as saves fuel up to large extent. At the same time they can do their pesticide spraying work with very less environmentpollution.

[C] CONCLUSION:

Nothing should be more important than the lives and safety of our country's soldiers who risk their lives for our safety from external enemies. There have been many cases of death and injury due to the explosion of landmines. So far, a lot of research and development has been done and different types of landmine detection robots have been developed, each with its own advantages and disadvantages. Variations of these robots are based on the controller or processor used, the sensor interface, the GPS tracking system, and the movement technique used.

And other applications of this robot Current firefighter,

This project presents the design and implementation of a fire fighting robot that moves towards a fire and pumps out water to extinguish the fire. The project explained how to connect the various components to the Arduino. The system could potentially be useful for accompanying firefighters and preventing outbreaks. The fire product has its uses in industries such as defense and fire service for the useful of our solders.

A system capable of navigating to a fire and then extinguishing it by pumping water was produced. Studies of various components and their interconnection techniques have been carried out.

Through this experience, we learned a lot about working on a large engineering project. In addition to learning a lot about the specific design and manufacturing elements that this particular project

required, there are a few overarching concepts that we took away from this project

[D] FUTURE SCOPE:

To enhance minefield surveillance, a potential approach is to equip the robot with a camera that provides real-time images to a user or human controller, enabling them to detect the precise location of the landmine and defuse it with ease.

Over the next few years, firefighting robots are poised to make significant strides. These robots are anticipated to grow more autonomous, enabling

them to operate in hazardous environments, detect and analyze fires, and take corrective measures to extinguish them.

8. REFERENCES:

- https://www.sciencedirect.com

- https://researchgate.net

- https://techatronic.com

- https://www.hindawi.com

- P.H. Chang and Y.H. Kang, et al., "Control Architecture Design

- Fire Searching Robot using Task Oriented Design Methodology", SICE-ICASE 2006, Oct. 2006.

- L. Robledo, M. Carrasco and D. Mery," A survey of land mine detection technology" International Journal of

- Remote Sensing Vol. 30, No. 9, 10 May 2009, 2399–2410

- Rasaq Bello, "Literature Review on Landmines and Detection Methods" Frontiers in Science

- "oscilloscope | Definition & Facts"

https://www.britannica.com/technology/oscilloscope

- J. MacDonald, J. R. Lockwood, J. McFee et al., "Alternatives for landmine detection," *Rand Corporation*, ch. 2, 2003.