"FABRICATION OF FIRE FIGHTING ROBOT"

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Abstract –
With the advent of technology, humans are replaced with robots in life-threatening situations.

We aim to design a robot capable of detecting and suppressing fires. By designing and implementing an autonomous robot capable of detecting and extinguishing flames, disasters can be avoided with minimal risk to human life. In this research, we illustrate an autonomous robot capable of detecting flames indoors and maneuvering towards the flame to extinguish it with the help of carbon dioxide. Detecting fire and extinguishing it is a dangerous job that puts the life of a firefighter at risk. There are many fire accidents in which firefighters have to sacrifice their lives in the line of duty each year throughout the world. Research and development in the field of artificial intelligence have given rise to robotics. Fire Fighter is a robot designed to be used in such extreme conditions. It can be operated and controlled by a remote user and has the ability to extinguish fire after locating the source of the fire.

***Key Words*:** fire sensors, fire extinguishing, Electric motor, Pump, fire robot

1. INTRODUCTION

In an era marked by escalating energy demands and the urgent need for sustainable solutions, innovative approaches to power generation have become paramount. Railway tracks, serving as the backbone of transportation networks globally, possess untapped potential to contribute significantly to the energy landscape. It refers to the sources of energy that are replenished naturally and are considered to have a lower environmental impact compared to traditional fossil fuels such bas coal, oil, and natural gas. These sources of energy have gained significant attention and importance due growing concerns over climate change, energy security and sustainable development.

Design and fabrication of power generation using railway track is involve in the reduction of the global effects by making the alternation of the power production using the railway track for sustainable energy. Design and fabrication of power generation systems using railway tracks. The concept of generating electricity from railway tracks revolves around the principles of disc and cam mechanism.

As the trains moves on the track, the flap placed at the track may pressed by the wheel of the train due to the weight, then the flap which was connected to the disc through the vertical shaft was pressed and the effort on the spring may make the vertical shaft to move up and down and used to rotate the disc and the connected horizontal shaft.

Furthermore, the environmental benefits of harnessing railway track power are significant. By utilizing this renewable energy source, we reduce reliance on fossil fuels, mitigate carbon emissions and contribute to the transition towards a cleaner, more sustainable energy landscape.

Methodology:a. Analysis of the current state of affairs and the precise nature of the issue at hand through dialogue in conjunction with the project guide
b. Study of process of different technologies used in the system.
c. With the help of the guide the specifications of the program were decided and then implemented in the project.
d. Use of sensor to interface the computer and control.
e. Testing, development and troubleshooting still underway to enhance user interface.

The aim of the experiment is to create an easier way /process for people as well as farmers for sustainable utilization of naturally obtained materials like air and water.

This process can be practiced at large scale as well as small scale like back yard farming etc. Through this way it can generate awareness among next generat

OBJECTIVE OF PROJECT

The objectives for this project are:

1. To design a robot which can search, detect and extinguish fire

immediately and develop a program using ARDUINO to control the movement of the robot automatically. Besides,

lean how to connect microcontroller and other sensors and actuators.

2. To design the robot that includes the flame sensor to detect the fire.

ion as well as existing. 3. To analyze how the robot performance to detect the fire in front of the robot and extinguish it by sprinkling water upon it..

SCOPE OF THE PROJECT

The main scopes are as follows:

1. Design an algorithm for working of the automatic fire fighting robot.
2. Select the suitable mechanisms and components to develop the robot.
3. The development of programming that is necessary to develop the

automation mechanism of the robot.

2.DESIGNING OF FIRE FIGHTING ROBOT

HARDWARE REQUIREMENT

COMPONENTSREQUIRED:-

1. Flame Sensor (IR Sensor):

Flame sensors are devices that use special optics to detect fires from long distances

with heat or smoke to get to the flame detector first. Hazardous industries and

Manufacturing plans require high-tech flame monitoring equipment to prevent fires.

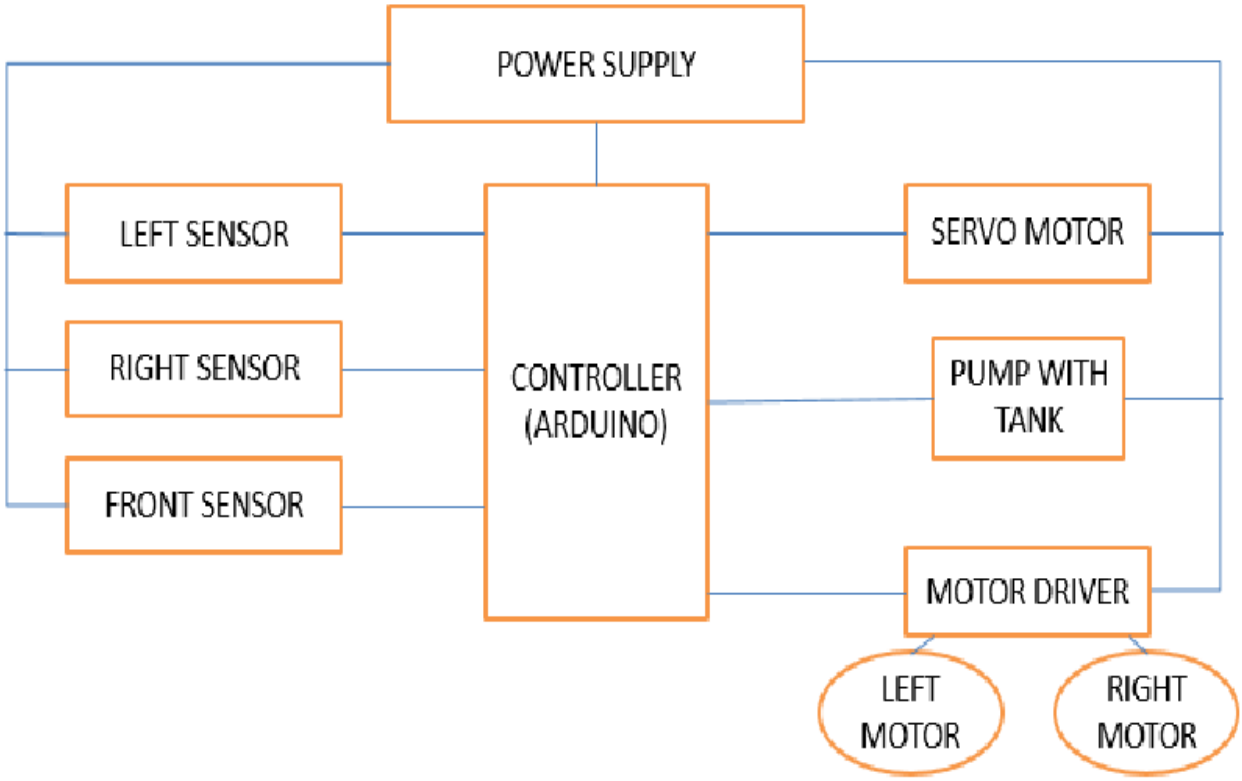
2. Temperature Sensor (LM35):

The LM35 series are precision integrated-circuit temperature sensors whose output is reliable and cheaper than other detectors on the market.

Voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracy of +L4°C at room temperature and £34°C over a full —55 to + 150°C temperature range.

Power LED Indicator

Just beneath and to the right of the word “UNO on your circuit board, there's a tiny LED next to the word ON"



(11). This LED should light up whenever you plug your Arduino into a power source. If this light doesn't turn on,. there's a good chance something is wrong; re-check your Circuti

TX RX LED'sTX is short for transmit, and RX is short for receive. These markings appear quite blink in electroics to indicate the pins responsible for serial communication In our case, there are two places on the Arduino UNO where TX and RX appear—once by digital pins G and 1, and a second time, near to the TX and RX indicator LED's (12). These LED's will give us some nice visual indications whenever our Arduino is receiving or transmitting data (like when we're loading a new program on the board).

Main IC

The black thing with all the metal legs is an IC, or Integrated circuit (13). Think of it as the brain of Arduino. The main IC on the Arduino is slightly different from the board to board . but is actually from the A-Tmega line of IC's from the ATMEL company. This can be important, as you may need to Know the IC type (along with your board type) before

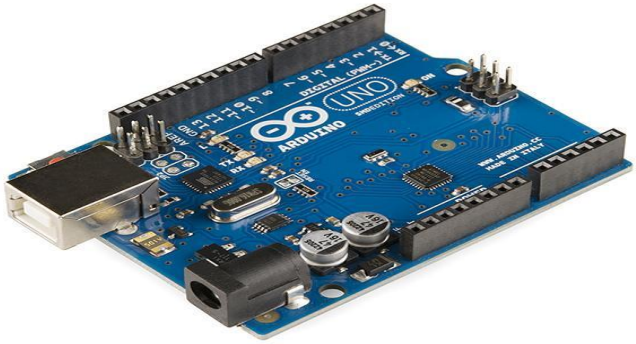
loading up a new program from the Arduino software, This information can usually be found in writing on the top side of the IC. If you want to know more about the difference between various IC's, reading the data sheets is often a good idea.

Voltage Regulator

The voltage regulator (14) is not actually something you can (or should) interact with on the Arduino. But it is potentially useful to know that it is there and what it's for. The voltage regulator does exactly what it says—it controls the amount of voltage that is linked into the Arduino board. Think of it as a kind of gatekeeper; it will turn off an extra voltage that might harm the circuit. Of course, it has its limits, so don't hook up your Arduino to anything greater than 20 volts.

The Arduino Family

Arduino makes several different boards and caches with different capabilities. In addition, being open source means that others can modify and produce derivatives of Arduino boards that provide even more features and functionality.



Servo Motor:

Servo motors have been around for a long time and these are utilized in many applications.

They are small in size but pack a big punch and are very energy-efficient. These features allow them to be used to operate remote-controlled or radio-controlled toy cars. robots and airplanes. Servo motors are also used in industrial applications, robotics, and in-line manufacturing., pharmaceutics and food services. The servo circuitry is built right inside the motor and has a positionable shaft, which usually is fitted with a gear.

Water Pump:

The water pump is used to artificially supply water for a particular task. It can be Electronically controlled by interfacing it with a micro controller, it can be triggered on or off by sending signals as required, The process of artificially supplying water is known as pumping. There are many varieties of water pumps used. This project employs the use of small water pump, which is connected to a H-Bridge, The pumping of water & a basic and practical! technique, far more practical than scooping it up with one's hands or lifting it in a hand-held bucket.

This is true whether the water is drawn from a fresh source, moved to a needed location, purified, or used for irrigation, washing, sewage ingestion, or for evacuating water from an undesirable location. Regardless of the outcome, the energy required to pump water is an extremely demanding component of water consumption, All other processes depend or benefit either from water descending from a higher elevation or some pressure plumbing system.

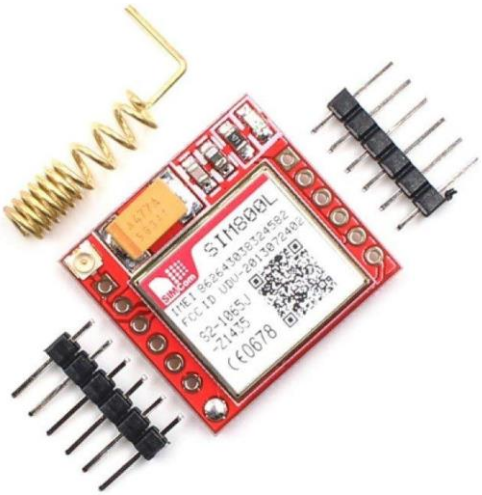
Motor Driver:

L293D is a typical motor driver IC which allows DC motor to drive on either diechon, L293D 8 is a 16 IC which can control a sel oftwo DC motors simultaneously any direction, it means that we can control two DC motors with a single [293D IC, Dual H- Bridge motor Dryer]

[ntegrated Circuit{ IC]. It works on the concept of H-bridge. H-bridge IC is a circuit which allows the voice to be flown in either direction, As you knew, voltage peed in its direction for being able to rotate the motor clockwise or in the opposite direction, Hence, H-bridge IC are used for drome ao DC motor. In a single L293D chip, there is an ovo h-Bridge circuit in the IC that can rotate hydromoter independently. Due to this, it is very much used in robotic applications for controlling OC moters. Given below is the pin diagram of a L299D motor controller

SIM 800L MODULE

The SIM800L is a GSM/GPRS module that is designed for communication over cellular networks. It allows devices to connect to the internet, send and receive SMS messages, make and receive calls, and perform other communication tasks using the GSM (Global System for Mobile Communications) network.



SMOKE SENSOR

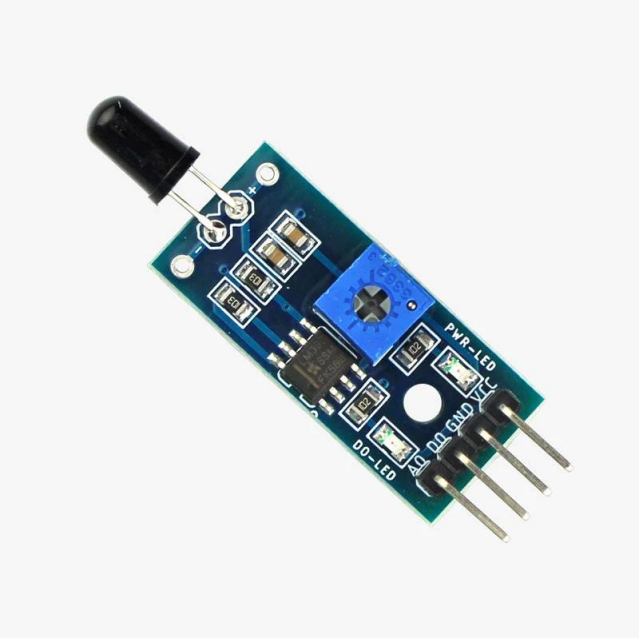
The MQ-2 gas sensor module is a metal oxide semiconductor (MOS) type sensor that is mainly used to detect gases like methane, butane, LPG, smoke, etc. It is known for its high sensitivity and fast response time.

The sensor works on the principle of change in conductivity of the sensing material present in it. This material is exposed to the surrounding air and when a target gas comes in contact with it, there is a change in its conductivity. This change in conductivity is then

converted into an output voltage that can be read by a microcontroller or other device.

FLAME SENSOR

A flame sensor is a device that detects the presence of a flame or fire. There are different types of flame sensors, but they all work by detecting some kind of energy that is given off by a flame, such as light, heat, or ultraviolet radiation.



3.SOFTWARE REQUIREMENT

1. Arduino Software (IDE):

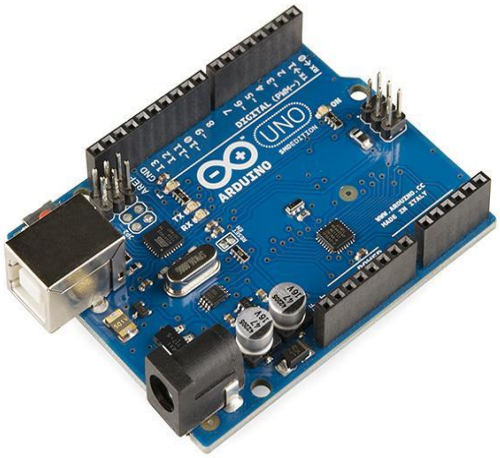
The open-source Arduino Software (JDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux, The environment is written in Java and based om Processing and other open-source software. This softener can be used with any Arduino board For at-risk safety interface link. https www. Arduino uno.ce/in/ Main' Software Arduino was born at the vrea Interaction Design Institute as an easy tool for fast prototyping. Aimed at students with or without a background in electronics and programming. Arduino 6 is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs (light on the sensor). a forward button of your message, and turn it into a output: achieving a motor, turning an LED. publishing something online and many more. You can tell your boss what to do by sending a set of instructions ta the microphone on the board, You use the Arduino programming language (based on Wiring) and the Arduino
Software, based on processing.
Inexpensive: Arduino boards are relatively inexpensive compared to other micro controller controller Platforms.
How to use Arduino IDE Tool
Steps for using Arduino IDE:
Step 1: Get an Arduino board and USB cable. In this paragraph, we assume you're using an
Arduino You also need a standard USB cable (A plug to B plug), the kind you would use to connect a USB printer, for example.
Step 2: Download the Arduino environment Download the fastest version from the download page. When the download finishes, unzip the downloaded file. Make
sure preserve the folder structure. Double-click the folder to open it. There should be a few files and sub-folders mick.
Step 3: Connect the board: The Arduino , Mega, Duemilanove and Arduino Nano Automatically draw power from either the USB connection to the computer or an external power source supply, If you're using an Arduino Diccimila, you'll need to make sure the board is configured to draw power from the USB connection. The power source is selected with a jumper. a small piece of plastic that holds two of the three pins between the USB and power jacks. Check that it's on the IO pins closest to the USB port. Connect the Arduino board to your computer using the USB cable. The arcen power LED (labelled F'WR) should go on.
Step 4: Install the drivers. Installing drivers for the Arduino with Windows?,
31, 10

Step 5: Launch the Arduino application. Double-click the Arduino application. (Note: if the Arduino software loads in the wrong language; you can change it in the preferences dialog. See the environment page for details
Step 6: Open the blink example Open the LED blink example sketch: File > Open
>Temp_and_ bumid.ine
Step 7: Select your board. You'll need to select the enmry in the Tools > Board menu that corresponds to your Arduino.
Step 8: Select your serial port. Select the serial device of the Arduino board from the Tools

Serial Port menu This is likely to be COM3 or higher (Command COMZ2 is usually reserved for hard-ware serial ports). To find out, you can disconnect the Arduino board and re-open the menu; the entry that disappears should be the Arduino board. Reconnect the board and select that serial port.

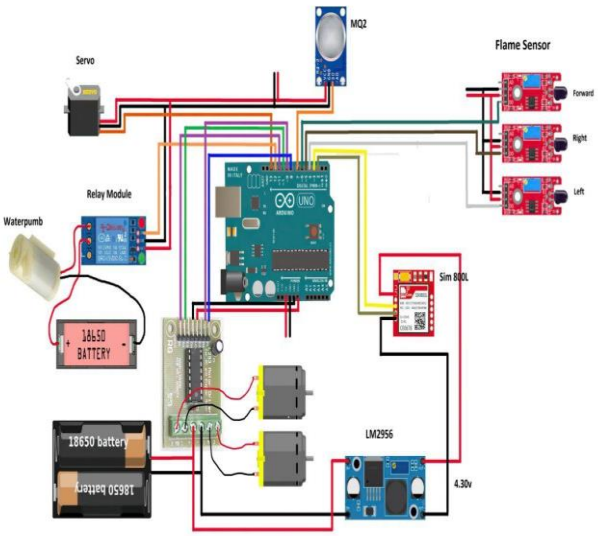
Step 9: Upload the program. Now, simply click the “Upload" button in the environment.

Wait few seconds; you should see the RX and TX LEDs on the board fleshing. [for the upload] In this situation, the message “Done uploading." will appear in the status bar.



4.FABRICATION

CIRCUIT DIAGRAM



When a fire occurred, the flame sensor became short circuit. So the inverting input terminal voltage is less than non inverting input terminal (reference voltage). Now the comparator output is +12V, which is given to the base of the switching transistor BC547. So the transistor is turned on. The zero voltage is given to the 7404 IC. Hence, a +5 supply is given to the micro controller.

Fire extinguisher: A fire extinguisher, or extinguisher , is an active fire protection device used to extinguish or control small fires, often in emergency situations. It is not intended for use on an out-of-control fire, such as one which has reached the ceiling, endangers the user (i.e., no escape route, smoke, explosion hazard, etc.), or otherwise requires the expertise of a fire department. Typically, a fire extinguisher consists of a hand-held cylindrical pressure vessel containing an agent which can be discharged to extinguish a fire.

The project is designed by following blocks fire sensor, Arduino board, line tracking sensor (2nos), Motor with driver circuit (2), Robot model, driver circuit with relay and Fire extinguisher. The flame sensor is used here to sense the fire. The flame sensor output is very low voltage so we give that signals to signal conditioning unit. The signal conditioning unit gives the signal to Arduino board. The Arduino board used is flash type re programmable controller. Therefore, it receives the signal from the signal conditioning unit and activates corresponding driver circuit. If the fire is sensed by the sensor it gives the signal to Arduino board. By which the robot movement is controlled artificially, the Arduino board activates the alarm driver circuits. So the alarm makes sound for indication of a fire. And at the same time, the Arduino board activates driver circuit for fire extinguisher. The keypad is used here to control the robot movements like as forward and reverse direction and left and direction control. The line tracking sensor is used to sense the line just below **Hardware Testing**

POWER ON TEST

This test is performed to check whether the voltage varies according to the requirement or not. We take a multi meter and put @ in voltage mode. Remember that This test is performed without a micro centrifuge. Firstly, we check the output of the transformer. where we get the required 12-volt AC voltage.

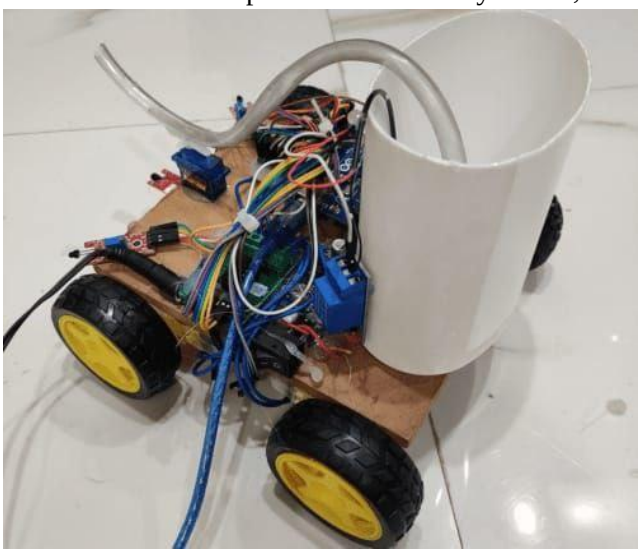
Then we apply this voltage to the power supply circuit, ensuring that we do this test without micro controller, because if there is any excessive voltage, this may lead to damaging the capacitor. We check for the input to the voltage regulator, i.e., are we getting an input of 12¥ and

an output of Sv. This 5¥ output is given to the micro controller's 40" pin. Hence we

Check the volume level at the 40° pin. we check for the other terminals for the required voltage. In this way, we can assure that the voltage at all the terminals is as per the requirement

CONTINUTY TEST:

In electronics, a continuous test & the checking of an electric circuit to see if current flows (that is, a complete circuit), A continuity test is performed by placing a smell voltage (wired in series with an LED or nose-producing component such as a piezoelectric speaker) across the chosen path. If electron is inhabited by broken conductors, damaged components, or excessive resistance, the circuit is “open”, Devices that can be used to perform continuous tests include multimeters, which measure current and specialized continuity testers, which



are cheaper, more bask devices. Generally, an a simple fight bulb lights up when current flows. An important application is the continuity test of a bundle of wires so as to find the two ends belonging to a difficult one of these wires, there will be a negligible resistance between the“right” ends, and only between the "right" ends.

The test is performed just after the hardware socketing and configuration have been completed. This test aims at finding any conductive open paths in the circuit after the soldering. Many times, the electrical continuity in the circuit was lost due to improper soldering or wrong and rough handling of the PCB, improper usage of the the soldering iron, component tilures and presence of bugs in the circuit diagram We use a multi meter to perform this test. We keep the multi meter in buzzer mode and connect the grown terminal of the multi meter to the ground. We connect both terminals across the pagrown seeds to be checked. If there are continuations, then you will bear the BC sound.

5. RESULTS

ADVANTAGES

Increased Safety: This is the biggest advantage. Firefighters face extreme dangers like high temperatures, toxic fumes, and collapsing structures. Robots can enter these hazardous environments first, taking the place of firefighters and reducing the risk of human injury or death.

Endurance and Strength: Firefighting robots can be designed to withstand extreme conditions for longer durations than humans. They can also be equipped with powerful arms and tracks to navigate through debris and uneven terrain that would be difficult or impossible for firefighters to traverse.

Improved Fire Detection and Accuracy: Firefighting robots can be equipped with advanced sensors that can detect fire, heat, and smoke more precisely than the human eye. This allows for faster response times and more targeted firefighting efforts.

Reduced Property Damage: By getting to the fire sooner and extinguishing it more effectively, firefighting robots can help to minimize property damage.

Data Gathering and Decision Making: Robots can be equipped with cameras and other sensors that can provide valuable data to firefighters about the fire scene. This information can be used to make better decisions about how to fight the fire and rescue people.

Versatility: Firefighting robots can be designed for various purposes. Some robots may be small and agile for searching collapsed buildings, while others may be large and powerful for breaching walls or extinguishing large industrial fires.

6. CONCLUSION

The automatic fire fighting robot was able to detect and extinguish the fire, Besides, it Is it okay to move manually with obstruction avoidance function? The robot was successfully fabricated and functioned as expected. The hardware was developed according to the initial design and modified based on current conditions and improvements. In addition, the input voltage port and ground port of the sensor, motor driver module, submersible pump and Two modules were connected and soldered on the PCH in series. This is because there are only one port of SV voltage supply from Arduino, and there are 8 components were required for the voltage supply for operation, Next, the coding was designed and developed using Arduino software. The completeness of the software library smooths the project's process with the help of real-time simulation. However, it was observed that the accuracy of the fire extinguisher can be further improved despite the firefighting robot designed and presented The concept of firefighting robots can be significant to humans and widely applied in various applications.

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