FIRE FIGHTING ROBOT

INDEX

ABSTRACT

Fire incidents are disasters that can potentially lead to the loss of life and property. It can also cause damage and permanent disability to the affected victim. Fire fighting is an important job but it is very dangerous occupation. Due to that, Robots are designed to find a fire, before it rages out of control. It could be used to work with fire fighters to reduce the risk of injury to victims .Firefighters are primarily tasked to handle fire incidents, but they are often exposed to high risks when extinguishing the fire, especially in a hazardous area. A one-stop solution for all fire-related accidents like fire outbreak, smoke and combustible gas leakage is hereby considered. This study presents the development of a fire extinguishing robot. It is designed to be compact for ease of movement into narrow spaces. The robot is equipped with an ultrasonic sensor to avoid collision with any obstacle and surrounding objects, while the flame sensor alongside a smoke sensor, was used to detect the fire. This developed autonomous system demonstrates the capabilities of identifying fire locations automatically and extinguishes the fire using the stored water in the container on it.

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Introduction to the Project

Robots can be defined as machine resembling a human being but the capable of performing complex assignments. In hazardous jobs like firefighting robots can beof significant service. Fire Fighting is an imaginary gameplay of fire fighter rescuing the victims and stopping the fire as soon as possible. Many of the time reaching fire mishaps commence due to small fire flame leading to the much more vandalization.The stated fire fighting robot is competent of detecting smoke raised in the air due to flame, with the help of smoke sensor MQ2. This robotintegrates the idea of natural fire detection and corresponding engine control. In order, the robot to be controlled bidirectionally, it makes use of the engine driver. With the assistance ofa controller the microcontroller, in each guidance for controlling movement is given to the robot. The use of fire-fighting robots has a several advantages over traditional fire fighting techniques. Likewise, in the presence of the fire can be detected by the robot with the flame sensors intact on the prototype robot. Fire detected gets douse with water from water tank mounted on the robot.The robot firefighter is designed to look for firein small houses of specificdimension.Water pump sprays water on the fire to stop it from further spreading. In addition tobeing able to be installed in homes,laboratories,stores, shops, etc., firefighting robot is easily portable and can be used only once it is installed.

1.2 ARDUINO UNO:

Arduino Uno is the most standard board available and probably the best choice for a beginner. We can directly connect the board to the computer via a USB Cable which performs the function of supplying the power as well as acting as a serial port.

The pin diagram of Arduino Uno (Fig 1.3)shown below:

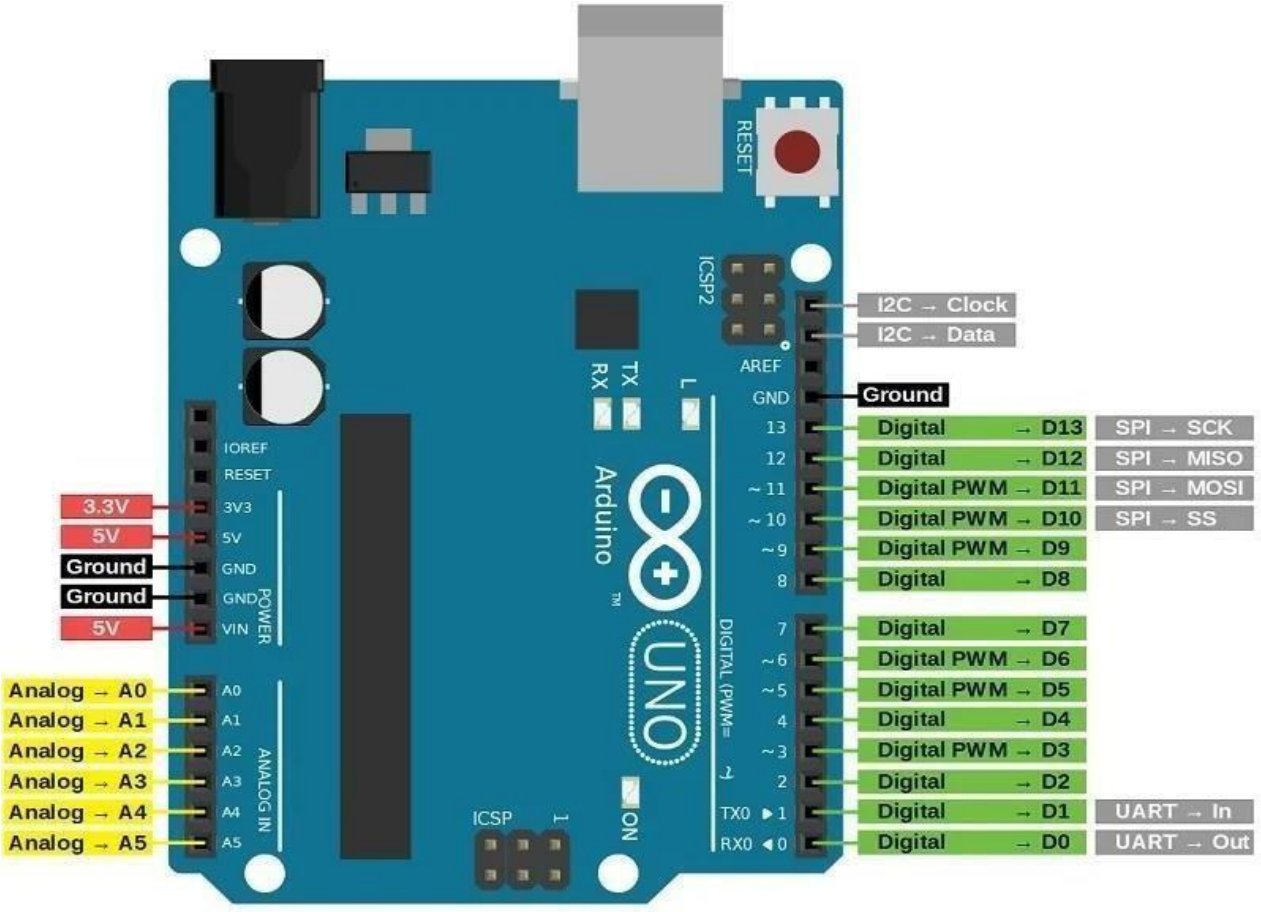


Fig 1.3 Pin diagram of Arduino Uno

1.2.1 Pin Description

Vin: This is the input voltage pin of the Arduino board used to provide input supply from an external power source.

5V: This pin of the Arduino board is used as a regulated power supply voltage and it is used to give supply to the board as well as onboard components.

3.3 V: This pin of the board is used to provide a supply of 3.3V which is generated from a voltage regulator on the board.

GND: This pin of the board is used to ground the Arduino board.

Reset: This pin of the board is used to reset the microcontroller. It is used to Resets the microcontroller.

Analog Pins: The pins A0 to A5 are used as an analog input and it is in the range of 0-5V.

Digital Pins: The pins 0 to 13 are used as a digital input or output for the Arduino board.

Serial Pins: These pins are also known as a UART pin. It is used for communication between the Arduino board and a computer or other devices. The transmitter pin number 1 and receiver pin number 0 is used to transmit and receive the data resp.

External Interrupt Pins: This pin of the Arduino board is used to produce the External interrupt and it is done by pin numbers 2 and 3.

PWM Pins: This pins of the board is used to convert the digital signal into an analog by varying the width of the Pulse. The pin numbers 3,5,6,9,10 and 11 are used as a PWM pin.

SPI Pins: This is the Serial Peripheral Interface pin, it is used to maintain SPIcommunication with the help of the SPI library. SPI pins include:

1. SS: Pin number 10 is used as a Slave Select
2. MOSI: Pin number 11 is used as a Master Out Slave In
3. MISO: Pin number 12 is used as a Master In Slave Out
4. SCK: Pin number 13 is used as a Serial Clock

LED Pin: The board has an inbuilt LED using digital pin-13. The LED glows only when the digital pin becomes high.

AREF Pin: This is an analog reference pin of the Arduino board. It is used to provide a reference voltage from an external power supply.

The Arduino Uno board is a microcontroller based on the ATmega328. It has 14 digital input/output pins in which 6 can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and a reset button. This contains all the required support needed for microcontroller. In order to get started, they are simply connected to a computer with a USB cable or with a AC-to-DC adapter or battery.It is featured by the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

In order to facilitate the access and use of electronic and programming Several students from the Institute of Interactive Design of Ivrea, Italy created it. They did it so that electronics students would have a cheaper alternative to the popular BASIC Stamp , boards which costs more than a hundred dollars in those days, So, not everyone could afford them.There hard work resulted an Arduino, a board with all the necessary elements to **connect peripherals to the inputs and outputs of a micro controller**, and which can be programmed in Windows as well as macOS and GNU / Linux.

1.2.2 FEATURES OF THE ARDUINO UNO BOARD:

- It is an easy USB interface. This allows interface with USB as this is like a serial device.
- The chip on the board plugs straight into your USB port and supports on your computer as a virtual serial port. The benefit of this setup is that serial communication is an extremely easy protocol which is time-tested and USB makes connection with modern computers and makes it comfortable.
- It is easy-to-find the microcontroller brain which is the ATmega328 chip. It has more number of hardware features like timers, external and internal interrupts, PWM pins and multiple sleep modes.
- It is an open source design and there is an advantage of being open source is that it has a large community of people using and troubleshooting it. This makes it easy to help in debugging projects.
- It is a 16 MHz clock which is fast enough for most applications and does not speeds up the microcontroller.
- It is very convenient to manage power inside it and it had a feature of built-in voltage regulation. This can also be powered directly off a USB port without any external power. You can connect an external power source of upto 12v and this regulates it to both 5v and 3.3v.
- 13 digital pins and 6 analog pins. This sort of pins allows you to connect hardware to your Arduino Uno board externally. These pins are used as a key for extending the computing capability of the Arduino Uno into the real world. Simply plug your electronic devices and sensors into the sockets that correspond to each of these pins and you are good to go.
- It has a 32 KB of flash memory for storing your code.
- An on-board LED is attached to digital pin 13 to make fast the debugging of code and to make the debug process easy.
- Finally, it has a button to reset the program on the chip.

1.2.3 USES OF THE ARDUINO UNO:

The Arduino UNO board is primarily used over other Arduino products because of the following reasons.

- As the board can be easily connected to the other computer system via USB port. The USB port fixed in the board serves two purposes. It can be used to supply the power supply to the board and can act as a serial device to connect the board to a computer system.

- The board is capable to get the power supply from DC adaptor having a voltage of 12V. The board can be charged from this external power supply.

- The microcontroller used in the board I.e. ATmega328 has the flexibility provided to the board. It means the controller chip can be replaced, removed from the board in case of damage or improper functioning of the chip. This flexibility functionality is not provided in other Arduino boards.

- The benefit of this setup is that serial communication is an extremely easy protocol which is time-tested and USB makes connection with modern computers and makes it comfortable.

- The board pins are capable of functioning for constant power supply of 5 v. The digital and analog pins are used to adjust the voltage supply in the board.

- As the board design is simple it can be used by multiple users and the community support for the Arduino UNO board.

- The Arduino UNO board has a list of several hardware components and has the capability to interact with those devices. The device includes Bluetooth, internet, motor control, and many more.

- The main use of the Arduino UNO board over other Arduino board is the price factor. The price of this board is lowest compared to other Arduino products. This is the main reason beginners prefer this board over other boards.

1.2.4 ADVANTAGES OF ARDUINO UNO:

1. **Open-Source Platform**: Arduino is an open-source platform, which means that the hardware and software designs are freely available for anyone to use, modify, and distribute. This fosters a large and active community of users and developers.

2. **User-Friendly**: Arduino is known for its user-friendly environment. The Arduino IDE (Integrated Development Environment) simplifies programming and is suitable for both beginners and experienced developers.

3. **Wide Hardware Compatibility**: Arduino boards are compatible with a wide variety of sensors, actuators, shields, and modules, making it easy to interface with a multitude of components.

4. **Low-Cost Hardware**: Arduino boards are relatively affordable, making them accessible to hobbyists and students. There are even cheaper Arduino-compatible clones available.

5. **Cross-Platform Compatibility**: The Arduino IDE is available for multiple operating systems, including Windows, macOS, and Linux, allowing users to work on their platform of choice.

6. **Educational Tool**: Arduino is frequently used in educational settings to teach electronics and programming. It provides a hands-on approach to learning.

7. **Prototyping and Rapid Development**: Arduino is excellent for prototyping, allowing you to quickly build and test your ideas before developing a final product.

8. **Scalability**: Arduino-based projects can be scaled up for more complex applications. You can move from a basic Arduino board to more powerful ones like the Arduino Mega when needed.

1.2.5 DISADVANTAGES OF ARDUINO UNO:

1. Limited Processing Power: Arduino boards are equipped with microcontrollers, which have limited processing power compared to full-fledged microprocessors. This can be a limitation for complex tasks and real-time applications.

2. Limited Memory: Arduino boards typically have limited RAM and program memory, which can restrict the size and complexity of programs that can be run on them.

3. Not Suitable for High-End Graphics: Due to their limited processing power and memory, Arduino boards are not well-suited for applications that require high-end graphics or video processing.

4. Lack of Multithreading: Arduino programming is primarily single-threaded, which can make it challenging to handle multiple tasks simultaneously. Real-time operating systems (RTOS) can be used, but they add complexity.

5. Limited Connectivity: While Arduino boards offer basic I/O capabilities, they may lack built-in connectivity options for Wi-Fi, Bluetooth, or cellular communication. Additional shields or modules are required for these features.

6. Power Consumption: Arduino boards are not optimized for low power consumption. They are often designed to be powered continuously, which may not be suitable for battery-powered applications without careful power management.

7. No Operating System: Arduino lacks a full operating system, which limits the capabilities for running concurrent processes or more advanced software features.

8. Compatibility Issues: Newer Arduino boards may not be fully compatible with older libraries and sketches, requiring updates and adjustments when upgrading hardware.

CHAPTER 2

PROJECT MODULES

2.1 CIRCUIT DIAGRAM:

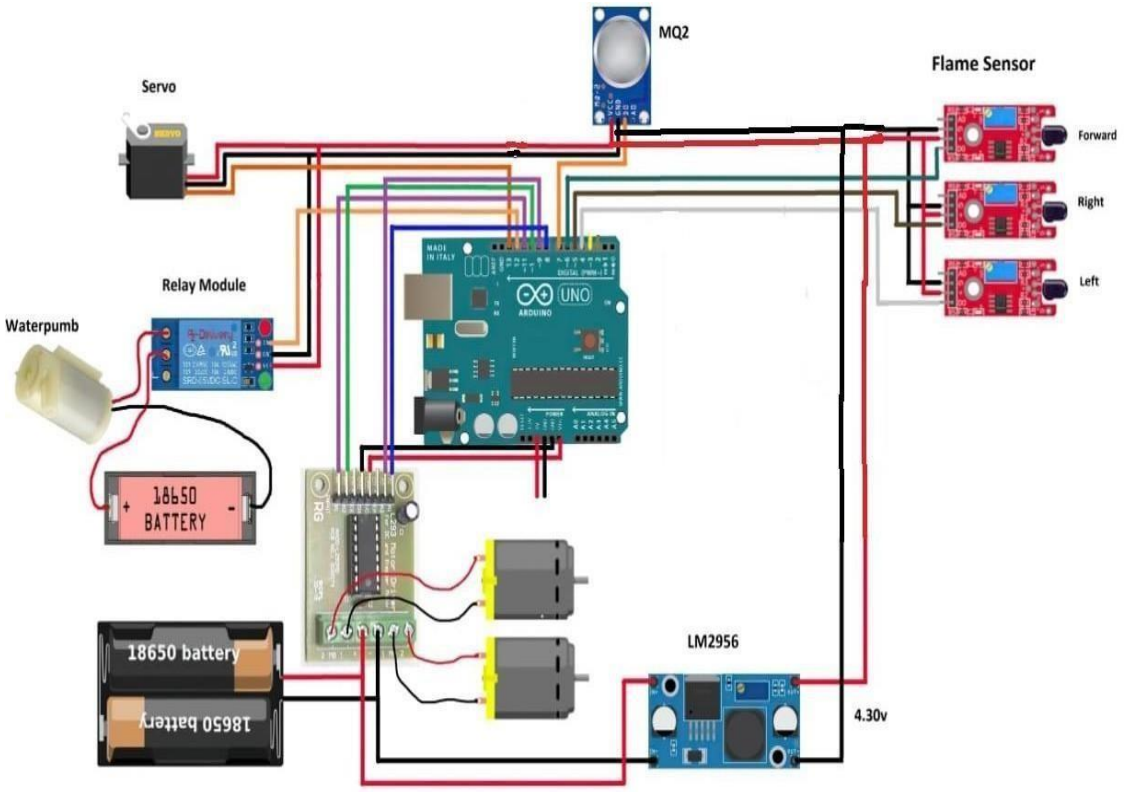


Fig 2.1 Fire Fighting Robot

Fig 2.1 includes **Reset Circuit Design:** The reset resistor is selected such that the voltageat the reset pin, across this resistor is at minimum of 1.2V and the width of thepulse applied to this pin is greater than 100 ms..

Arduino Uno Interfacing Design: The set of 3 flame sensor such as rights, left and forward is interfaced to pins 8,9,10 of the Arduino Uno.MQ2 sensor are interfaced to pin 3.L298N motor driver is interfaced to pins 4,5,6,7 of the Arduino Uno. Servo motor is interfaced to pin 11 and relay are interfaced to pin 12. Such that input pins are connected to flame sensor and MQ2 sensor pins.

2.2 SYSTEM COMPONENTS:

- Arduino uno
- Flame sensor
- MQ2 sensor
- L298N motor driver
- Buck converter
- 5V relay module
- Servo motor
- DC motor
- 5V water pump
- 12V battery

2.2.1 ARDUINO UNO:

The Arduino uno is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino uno board. Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits.The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms. The IDE is common to all available boards of Arduino.

The Arduino uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller (MCU) and developed by Arduino. cc and initially released in 2010. The microcontroller board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) andother circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, andis programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by a USB cable or a barrel connector that accepts voltages between 7 and 20 volts, such as a rectangular 9-volt battery. It has the same microcontroller asthe Arduino Nano board, and the same headers as the Leonardo board.The hardware referencedesign is distributed under a Creative Commons Attribution Share-Alike
2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

2.2.2 FLAME SENSOR:

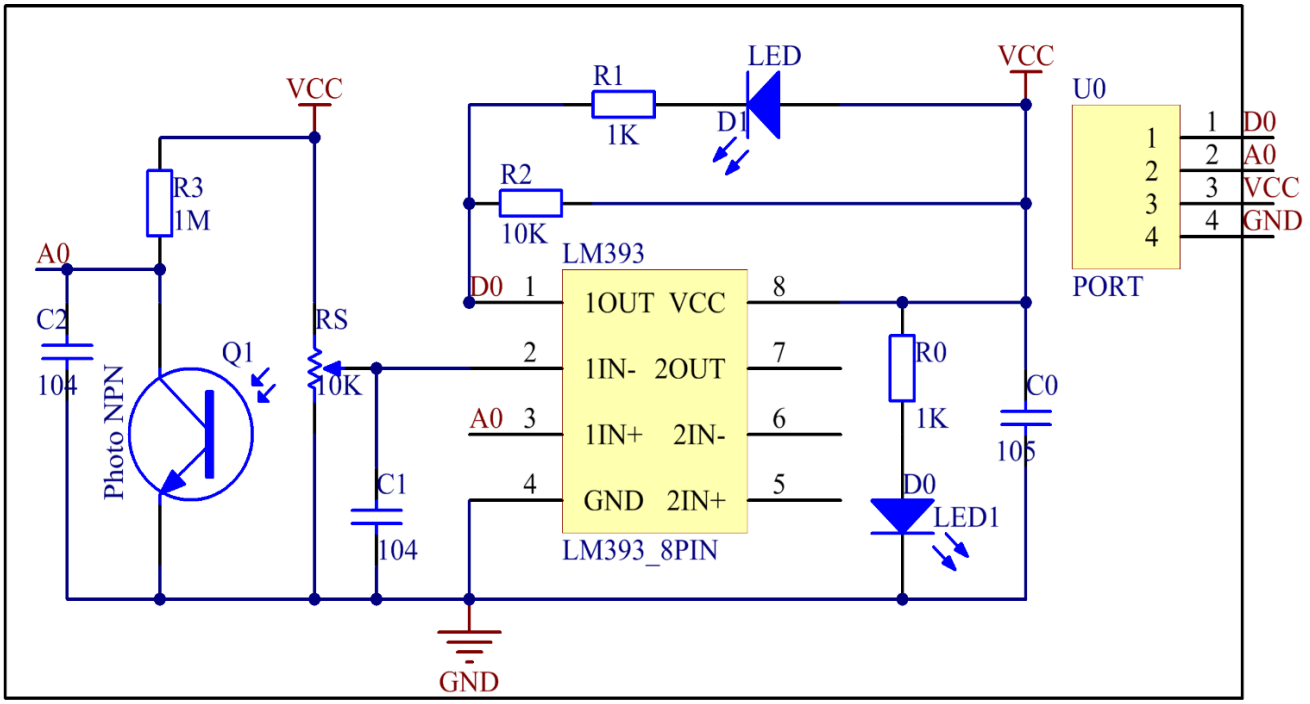


Fig 2.2 Flame Sensor

A flame-sensor is one kind of detector which is mainly designed for detecting as well as responding to the occurrence of a fire or flame. The flame detection response can depend on its fitting. It includes an alarm system, a natural gas line, propane & a fire suppression system. This sensor is used in industrial boilers. The main function of this is to give authentication whether the boiler is properly working or not. The response of these sensors is faster as well as more accurate compare with a heat/smoke detector because of its mechanism while detecting the flame.

Features & Specifications:

- Photosensitivity is high
- Response time is fast
- Simple to use
- Sensitivity is adjustable
- Detection angle is 600
- It is responsive to the flame range.

2.2.3 MQ2 SENSOR:

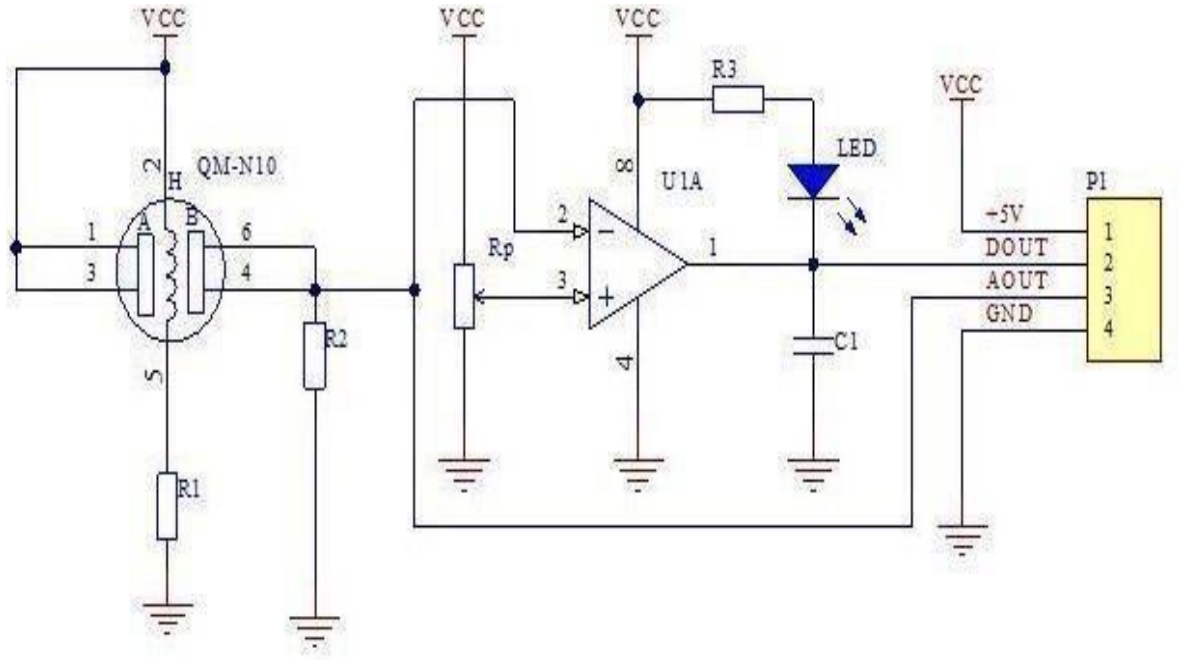


Fig 2.3 MQ2 Sensor

MQ2 gas sensor is an electronic sensor used for sensing the concentration of gases in the air such as LPG, propane, methane, hydrogen, alcohol, smoke and carbon monoxide.MQ2 gas sensor is also known as chemiresistor. It contains a sensing material whose resistance changes when it comes in contact with the gas. This change in the value of resistance is used for the detection of gas.MQ2 is a metal oxide semiconductor type gas sensor. Concentrations of gas in the gas is measured using a voltage divider network present in the sensor. This sensor works on 5V DC voltage. It can detect gases in the concentration of range 200 to 10000ppm.

Applications:

- These sensors are used to detect the presence of gases in the air such as methane, butane, LPG and smoke but they are unable to distinguish between gases. Thus, they cannot tell which gas it is.
- Module version of this sensor can be used without interfacing to any microcontroller and is useful when detecting only one particular gas. This can only detect the gas. But if ppm has to be calculated then the sensor should be used without module.

2.2.4 L298N MOTOR DRIVER:

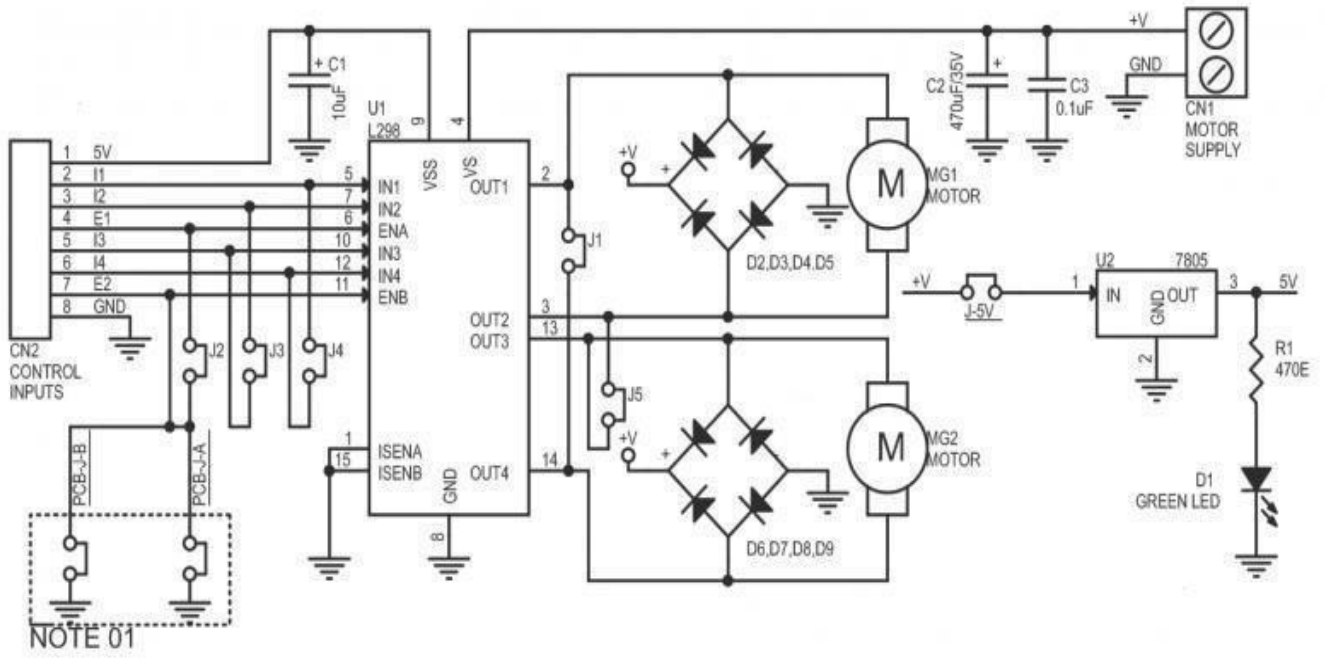


Fig 2.4 L298N Motor Driver

This L298N Motor Driver is a high power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator.L298N module can control up to 4 DC motors, or 2 DC motors with directional and speed control.

The L298N Motor Driver module consists of an L298 Motor Driver IC, 78M05 Voltage Regulator, resistors, capacitor, Power LED, 5V jumper in an integrated circuit.78M05 Voltage regulator will be enabled only when the jumper is placed. When the power supply is less than or equal to 12V, then the internal circuitry will be powered by the voltage regulator and the 5V pin can be used as an output pin to power the microcontroller. The jumper should not be placed when the power supply is greater than 12V and separate 5V should be given through 5V terminal to power the internal circuitry.

Applications:

- Drive DC motors.
- Drive stepping motors
- In Robotics

2.2.5 BUCK CONVERTER:

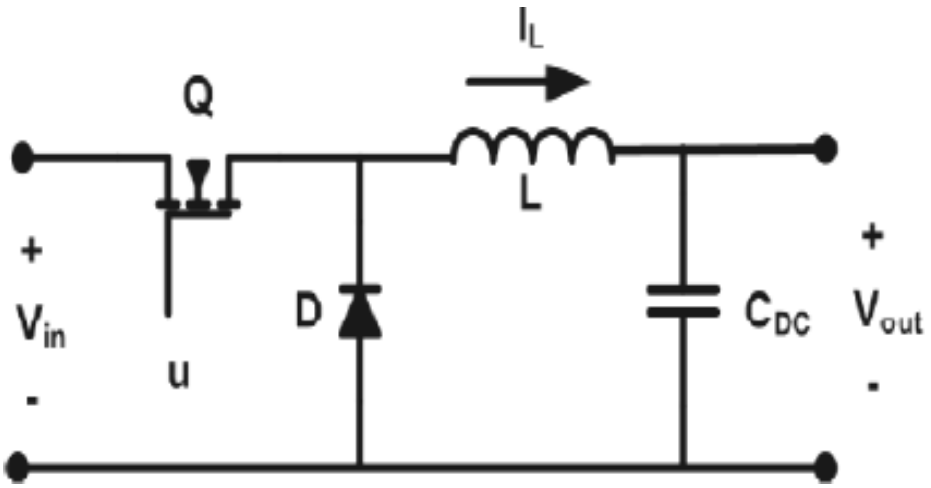


Fig 2.5 Buck Converter

A buck converter or step-down converter is a DC-to-DC converter which decreases voltage, while increasing current, from its input (supply) to its output (load). It is a class of switched-mode power supply. Switching converters (such as buck converters) provide much greater power efficiency as DC-to-DC converters than linear regulators, which are simpler circuits that lower voltages by dissipating power as heat, but do not step up output current. The efficiency of buck converters can be very high, often over 90%, making them useful for tasks such as converting a computer's main supply voltage, which is usually 12 V, down to lower voltages needed by USB, DRAM and the CPU, which are usually 5, 3.3 or 1.8 V.

Buck converters typically operate with a switching frequency range from 100 kHz to a few MHz. A higher switching frequency allows for use of smaller inductors and capacitors, but also increases lost efficiency to more frequent transistor switching.

The basic operation of the buck converter has the current in an inductor controlled by two switches. In a physical implementation, these switches are realized by a transistor and a diode, or two transistors (which avoids the loss associated with the diode's voltage drop).

2.2.6 5V RELAY MODULE:

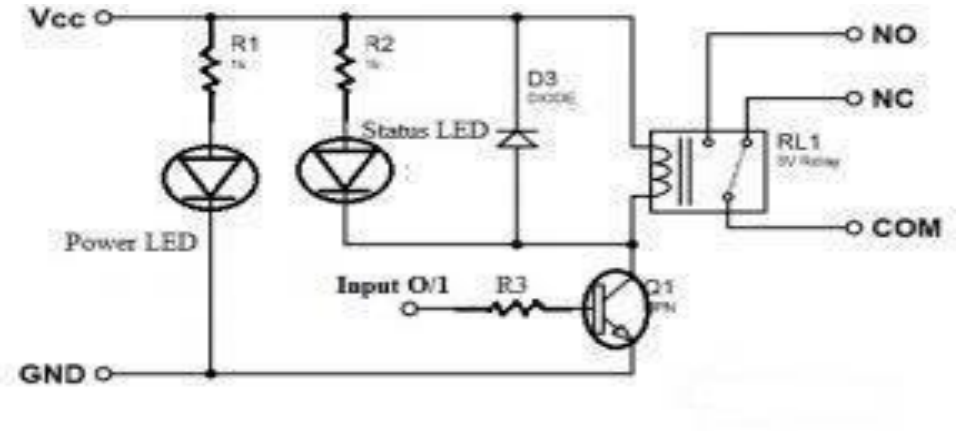


Fig 2.6 5V Relay Module

A 5v relay is an automatic switch that is commonly used in an automatic control circuit and to control a high-current using a low-current signal. The input voltage of the relay signal ranges from 0 to 5V.

The relay module with a single channel board is used to manage high voltage, current loads like solenoid valves, motor, AC load & lamps. This module is mainly designed to interface through different microcontrollers like PIC, Arduino, etc.

Applications:

- Used in over voltage/under voltage protection system
- Mains Switching
- Speed control of motors through start-delta converters
- Automatic electrical appliances
- Electrical isolation in between high & low power sources
- Lights
- AC voltage load switching using less voltage DC
- Delivery of Isolated power
- Home automation projects
- Switching with High Current

2.2.7 SERVO MOTOR:

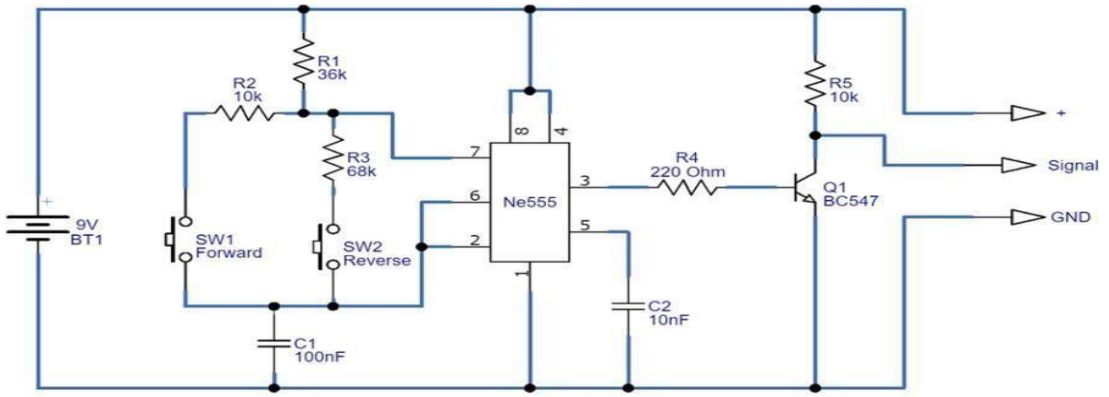


Fig 2.7 Servo Motor

A servo motor is a type of electric motor that can rotate or move to a specific position, speed, or torque based on an input signal from a controller. However, modern servo motors are capable of providing high performance and precision as main drives in various applications. servo motors are electric motors that allow for precise control of angular or linear position, speed, and torque. They consist of a motor, a sensor, and a controller that form a closed-loop feedback system.

Applications:

- Robotics: Servo motors are used to provide precise motion and force for robotic arms, legs, joints, grippers, etc. They enable robots to perform tasks such as picking, placing, welding, assembling, etc.
- CNC machinery: Servo motors are used to drive the axes of CNC machines such as lathes, mills, routers, etc. They enable CNC machines to perform accurate and complex machining operations such as cutting, drilling, engraving, etc.
- Medical equipment: Servo motors are used to operate various medical devices and instruments such as surgical robots, scanners, pumps, ventilators, etc. They enable medical equipment to perform precise and safe operations and treatments.

2.2.8 DC MOTOR:

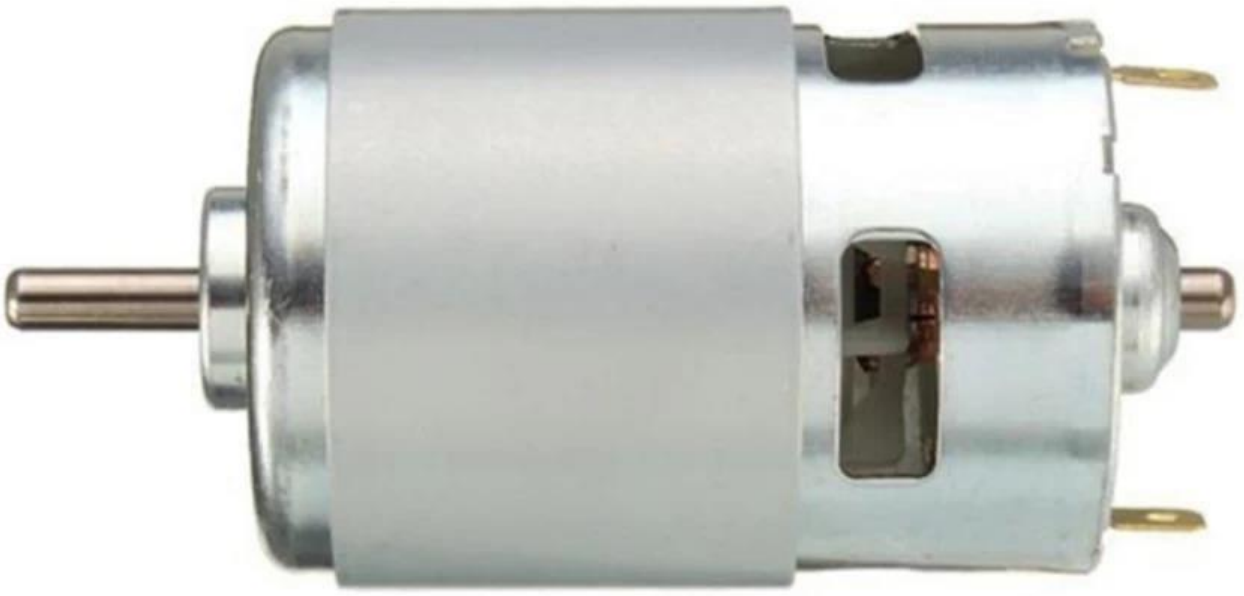


Fig 2.8 DC Motor

A DC Motor is an electrical device that converts electrical energy into mechanical energy. Going by the dc motor full form, the device uses Direct Current (DC) for its operation. A rotary component called an armature coil rests inside the motor's casing surrounded by strong permanent magnets. When a current is applied to the armature through a rotary electric switch called a commutator, the magnetic field created by the armature interacts with the magnetic field of the stationary magnet to apply a torque on the armature, causing it to rotate. It uses direct current (DC) to produce mechanical force. The most common types rely on magnetic forces produced by currents in the coils. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

Applications of DC Motor:

Shunt DC Motors:

- Centrifugal and reciprocating pumps
- Drilling machines
- Milling machines
- Machine tool

2.2.9 5V WATER PUMP:

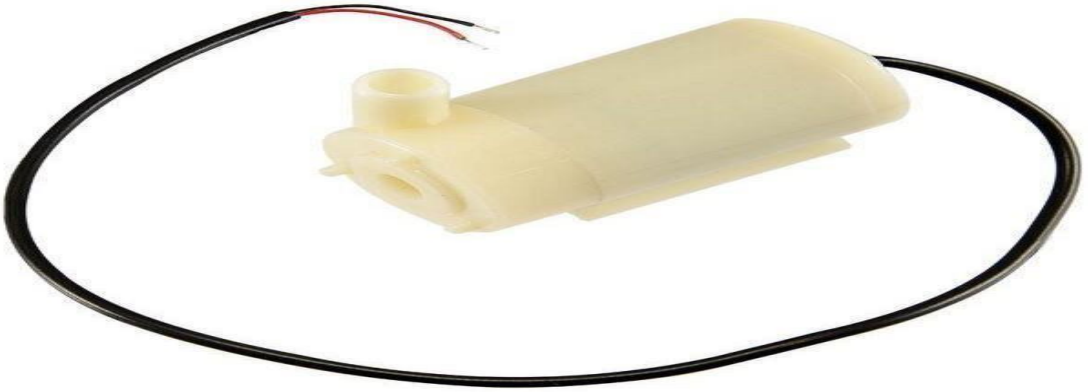


Fig 2.9 5V Water Pump

Small water pump suitable for small automation & IoT prototyping school modelling projects, mini aquaponics, hydroponics, aquarium water circulating pump. Must use with at least IRF520N N-channel MOSFET driver module or 1-Channel Relay Controller Module to control the water flow with Arduino, ESP8266 or other microcontroller systems.Flow rate of this pump is relatively small so it is easy to control, suitable for electronic starters.

Applications of Water Pumps:

- Water pumps are used for dewatering reasons decreasing the downtime from huge rain events. The common applications of these pumps include buildings, wells, boost application, circulation of hot water, sump pits, protection of fire systems, etc

- Thus, Water pumps which are frequently used in construction fields for removing surplus water as well as dewatering. Because of heavy rains, the flow of water can increase & water pumps let you supply the water rapidly to reduce downtime. These pumps are appropriate for applications like electric, hydraulic, gas-powered, and otherwise manual.

2.2.10 12V BATTERY:

Fig 2.10 12V Battery

A 12-volt battery is a kind of battery that is often used for various electrical gadgets and appliances. The 12-volt battery is distinct and different in its use, as it comes in different shapes and sizes.In some instances, they might be large and heavy or small and light.They may be cylindrical or square batteries. Furthermore, they are also used for transportation purposes in vehicles, boats and other gadgets. 12-volt battery sizes are often influenced by their uses and the amount of amp-hour they are built to produce. Therefore, a 12 V battery implies that a voltage of 12V is supplied within the nominal load by a battery.Vehicle Battery and Jumper Vehicle Batteries 12V battery, as the name suggests, runs on electric power input of 12 V. If you need to charge your computer, recreational vehicle, and other automobiles, you need a 12 V cell collection. It is basically used to create an electrical circuit's free flow of electrons.

The nine-volt battery, or 9-volt battery, is an electric battery that supplies a nominal voltage of 9 volts. Actual voltage measures 7.2 to 9.6 volts, depending on battery chemistry. Batteries of various sizes and capacities are manufactured; a very common size is known as PP3, introduced for early transistor radio. Most battery voltage testers and chargers that can also test nine-volt need another snap clip to hold the battery, while cylindrical batteries often share a holder that may be adjustable in size.

2.3 CIRCUIT CONNECTION:

The set of 3 flame sensor such as rights,left and forward are interface to pins 8,9,10 of the Arduino Uno.MQ2 sensor are interface to pin 3.L298N motor driver input pins are interface to pins 4,5,6,7 of the Arduino Uno and 4 motor are separate in two set 1st set in two motors in cross connection and another set also same connection in negative and positive wire are connected in output of L298N motor driver.servo motor are interface to pin 11 and relay are interface to pin 12 and Normally closed and common pins in relay are connected in 5V water pump.power supply will provide 12V on motor driver and convert 12V into 5V using buck converter provide a sensor,servo motor,relay and water pump.such that input pins are connected to flame sensor and MQ2 sensor pins.

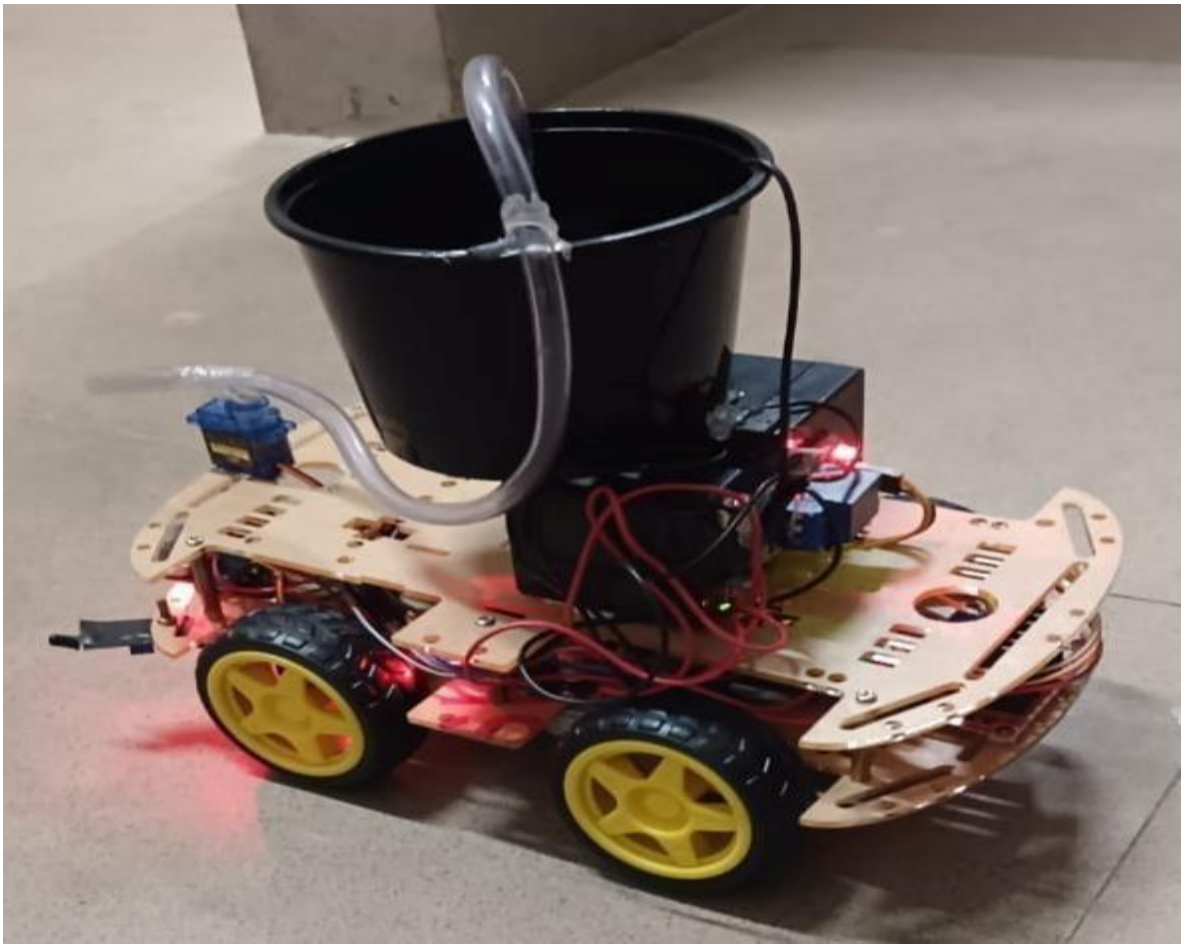
2.4 OPERATION:

There are we are using 3 flame sensor,MQ2 sensor which are continuously seeking for fire or flame,smoke. The Flame and MQ2 sensor sense the warm, smoke and heat from any body. and we coded this sensor that it can sense the flame around it. All three sensor always searching for fire. if any of the sensor will find it. the robot will turn and start walking toward the fire.

The flame and MQ2 sensor sense the fire and send the information to the Arduino which is the brain of this robot. The brain will take the action according to the condition and information getting from the sensor. Arduino will give the commands to the Motors to start in the walk in the desired direction. if left sensor give the information about the fire then the Arduino will run the motor in left direction and servo motor also turn in left direction. same for the front and right side motor.

The robot will stop near to the fire and start watering to it till the fire will be under the servo motor control.

2.5 OUTPUT:



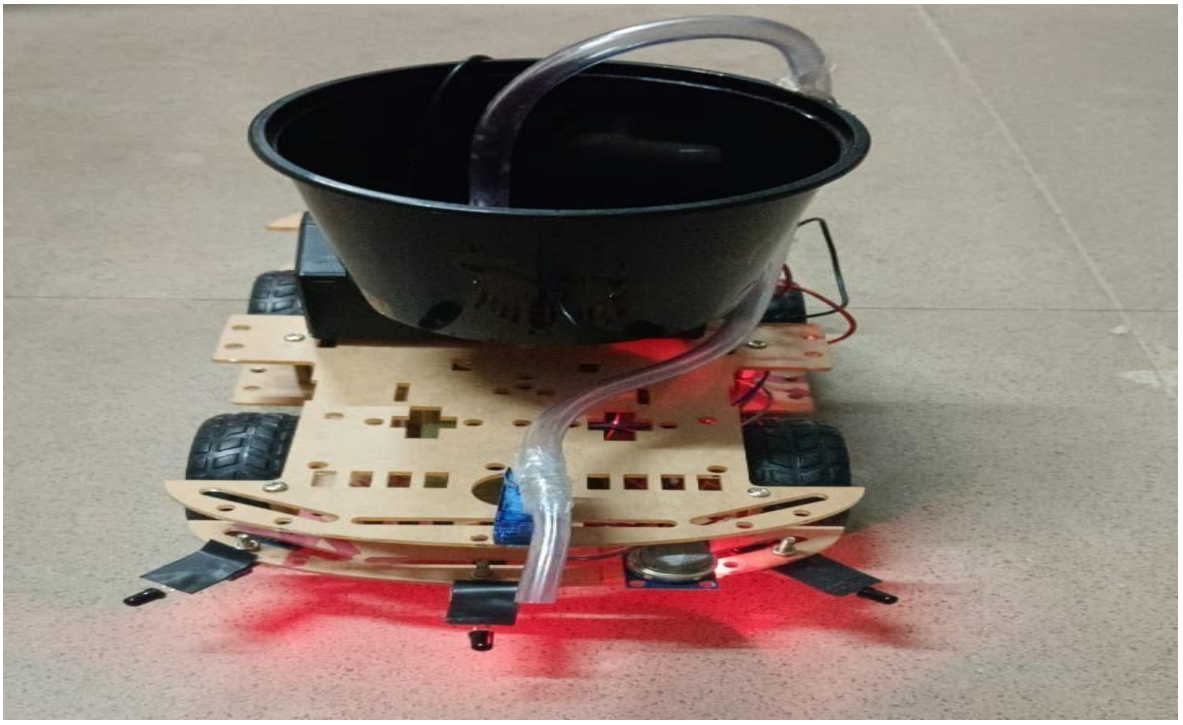


Fig 2.6 Input

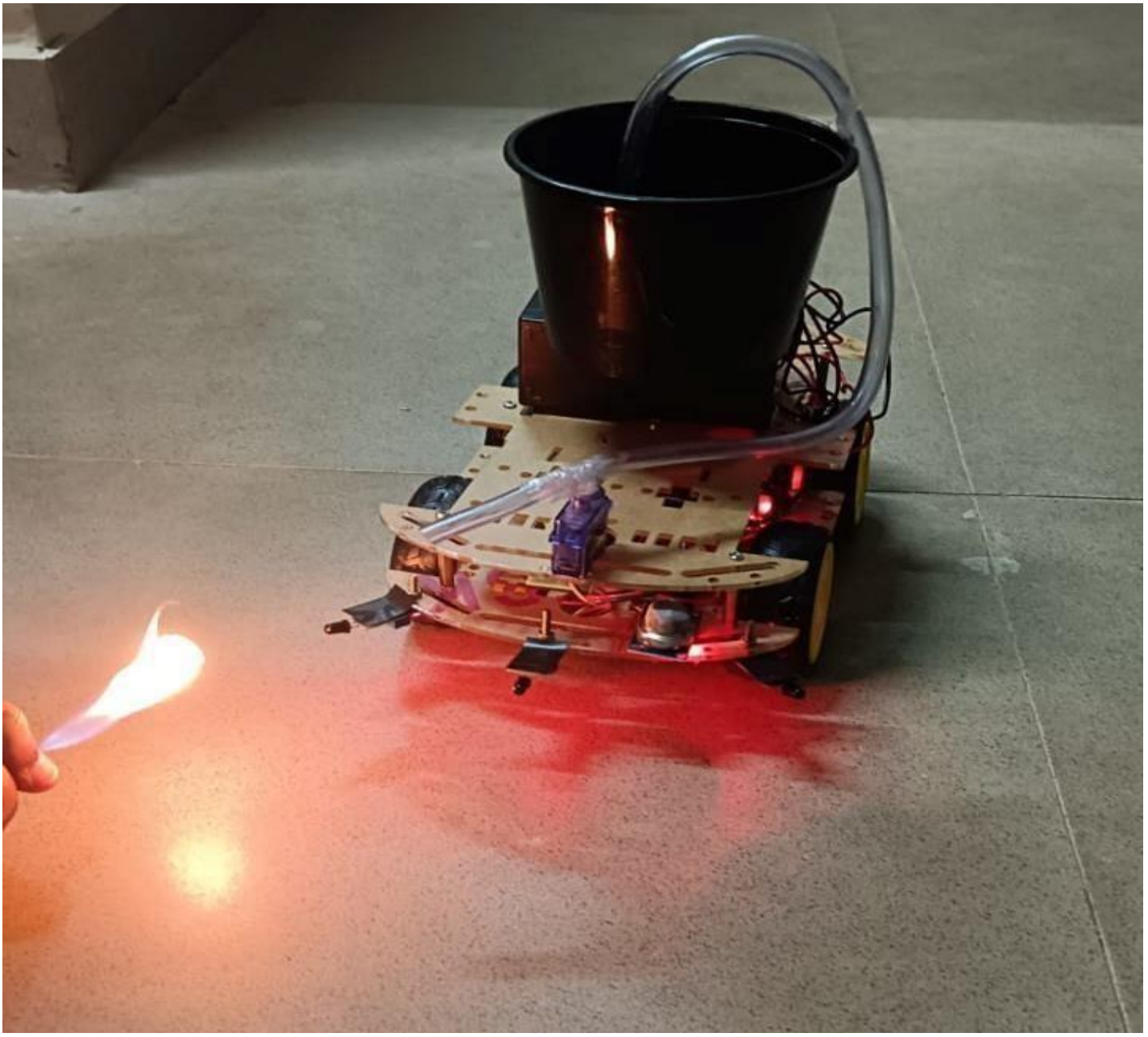


Fig 2.7 Shows When Fire turns ,Flame Sensor Senses the fire around it and buck convertor turns towards it.

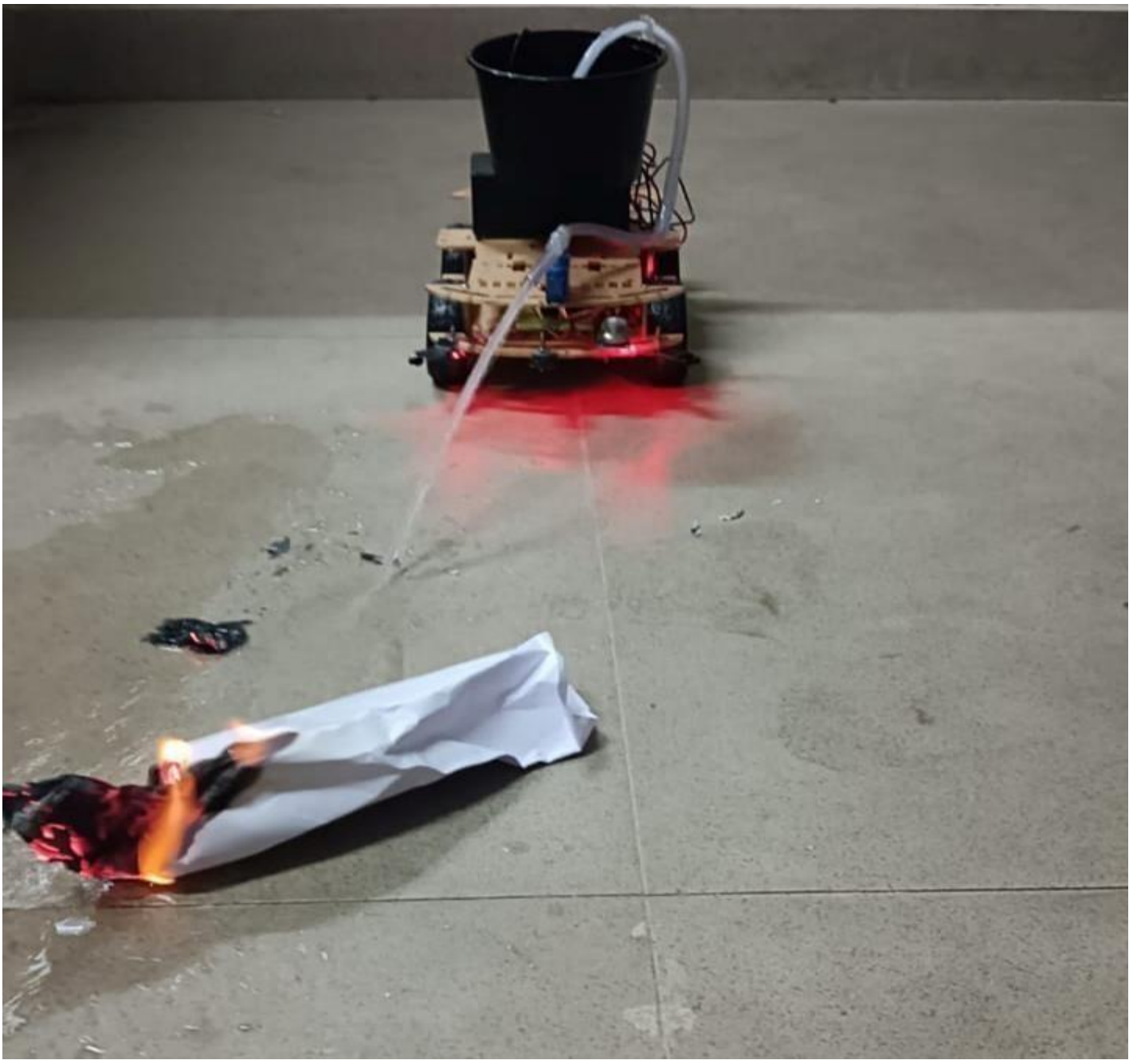


Fig 2.8 Shows After buck convertor turned towards the fire it sprays the water and prevents the fire from being spreaded.

CHAPTER 3

CONCLUSION

Hence this project can design the firefighting robot to promising new technology that has the potential to revolutionize the way fire fighters operate. It is capable of navigating through a burning building and locating the source of the fire and extinguishing it quickly and accurately. Its main advantage is that it can be used in hazardous environments where it would be too dangerous for humans to enter. It also has the potential to save lives, as it is capable of responding to fires more quickly than human firefighters. Therefore, the firefighting robot is an excellent tool to have in the firefighting arsenal.

Advantages of the project:

- **Reduces risk to human firefighters** – A fire fighting robot lessens danger for human firefighters by taking over tasks in hazardous situations.
- **Enhances firefighting efficiency** – They boost the effectiveness of firefighting by rapidly detecting and extinguishing fires, saving valuable time.
- **Minimizes fire damage potential** – By acting swiftly, they help to limit the potential destruction caused by fire, protecting property and lives.

Disadvantages of the project:

- **High cost of production** – Fire fighting robots can be expensive to produce, as they require high-tech components and advanced programming.
- **Limited battery life** – Their battery life is often limited, meaning they may not last through prolonged fire incidents.
- **Difficulty in complex terrains** – Navigating complex terrains like stairs or rubble can be challenging for these robots, limiting their effectiveness.

REFERENCE

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APPENDIX

```
#include <Servo.h>
int yt=0;
const int hBridgePins[] = {4, 5, 6, 7};
const int relayPin = 12;
const int servoPin = 11;
const int flamePins[] = {8, 9,10 };
const int MQ2Pin=2
Servo servo;
void setup()
{
Serial.begin(9600);
for (int i = 0; i < 4; i++)
{
pinMode(hBridgePins[i], OUTPUT);
}
pinMode(relayPin, OUTPUT);
servo.attach(servoPin);
for (int i = 0; i < 3; i++)
{
pinMode(flamePins[i], INPUT);
}
digitalWrite(relayPin, HIGH);
servo.write(50);
}

void loop()
{
```

```
int ax=analogRead(A0);
int flameValues[3];
for (int i = 0; i < 3; i++)
{
flameValues[i] = digitalRead(flamePins[i]);
}
delay(200);
Serial.println(ax);
Serial.println("**********");
int detectedFlames = 0;
for (int i = 0; i < 3; i++)
{
if (flameValues[i] == LOW)
{
detectedFlames=i+1;
    }
  }
 if ((detectedFlames == 0)&&(ax<100))
{
    digitalWrite(hBridgePins[0],   LOW);
    digitalWrite(hBridgePins[1],   LOW);
    digitalWrite(hBridgePins[2],   LOW);
    digitalWrite(hBridgePins[3], LOW);
 yt=0;
 }
 else
 {
   if(yt==0)
   {
```

```
    digitalWrite(relayPin, HIGH);
    digitalWrite(hBridgePins[0], LOW);
    analogWrite(hBridgePins[1], 130);
    digitalWrite(hBridgePins[2], LOW);
    analogWrite(hBridgePins[3], 130);
    delay(50);
    digitalWrite(hBridgePins[0], LOW);
    digitalWrite(hBridgePins[1], LOW);
    digitalWrite(hBridgePins[2], LOW);
    digitalWrite(hBridgePins[3], LOW);
   }
   digitalWrite(relayPin, LOW);
   yt=1;
 }
 if (detectedFlames== 1)
{
   servo.write(0);
 }
 else if((detectedFlames== 2))
 {
   servo.write(50);
   }
   else if(detectedFlames== 3)
 {
   servo.write(100);
   }
 detectedFlames=0;
}
```