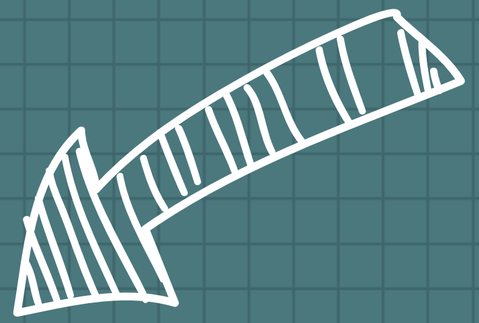
IEEE RAS
ROBOTICS & AUTOMATION SOCIETY
Zagazig student chapter

PROJECT "3"

FIREFIGHTING - ROBOT

OUR TEAM



Ahmed Essam

Tasnem Sabry

Islam Ramadan

Hager Ahmed

Eman Atef

Mostafa.M

INTRODUCTION

A firefighter robot is a specialized robotic device created to aid firefighting and rescue operations in hazardous environments. The robot is equipped with tools, sensors, and capabilities enabling them to perform tasks like fire suppression, search and rescue, reconnaissance, and handling hazardous materials. They operate in places where human firefighters might be at risk. the firefighting robot has two modes:

1 Manual Mode

The robot is directly controlled by us using a remote device like a mobile phone, laptop, or joystick. The operator provides real-time commands for the robot's movement, activation of firefighting tools, and other actions.

2 Autonomous Mode

Autonomous mode enables the robot to operate independently based on pre-programmed instructions and sensor feedback. In this mode, the robot's onboard computer processes data from sensors to make decisions autonomously, such as detecting fires, navigating to the fire location, and performing firefighting actions.

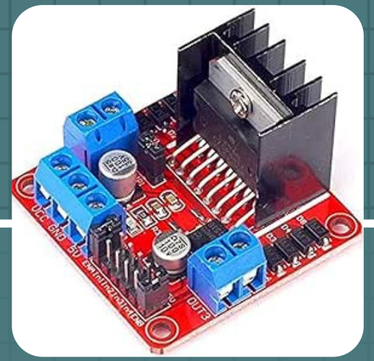
MATERIALS

4 DC-Motors

DC motors are essential for driving the movement of the robot. They provide locomotion by controlling the rotation of wheels or tracks, allowing the robot to navigate through different terrains during both manual and autonomous operation.

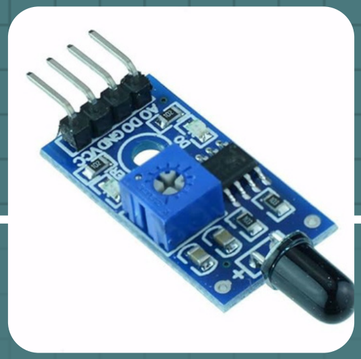
4 Wheels

wheels are integral to the functionality and effectiveness of a firefighting robot, providing mobility, versatility, stability, payload capacity, and ease of control in challenging firefighting environments.



H-Bridge

It is a crucial component for controlling the direction and speed of DC motors. It allows bidirectional control of the motors, enabling the robot to move forward, backward, turn left, and turn right during manual operation.



3 Flame Sensors

They are vital for autonomous firefighting capability. They detect the presence of flames and provide input to the microcontroller to initiate firefighting actions.

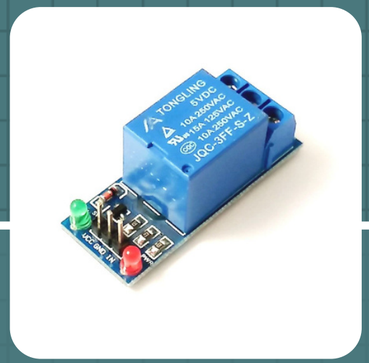
MATERIALS

Arduino Mega

It serves as the brain of the robot, processing sensor data, controlling motor movements, and coordinating firefighting actions. It executes the algorithms for both manual and autonomous operation modes.

Servo Motor

It is used for precise control of mechanisms such as the water pump nozzle or manipulator arm. In this design, it can be utilized to control the direction or angle of the water pump for effective firefighting.



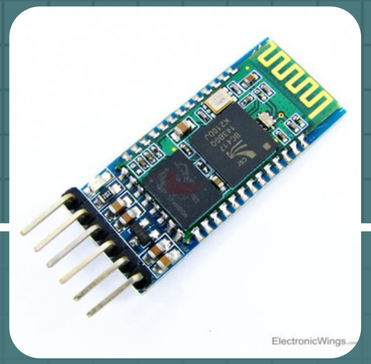
Relay module

It is is used to control high-power devices such as the water pump. It serves as a switch controlled by the microcontroller to turn the pump on or off based on firefighting requirements.

Pump 3-6 v

The pump is responsible for drawing water from the tank and spraying it onto the fire. It is a critical component for firefighting operations, and the specified voltage range ensures compatibility with the power source.

MATERIALS

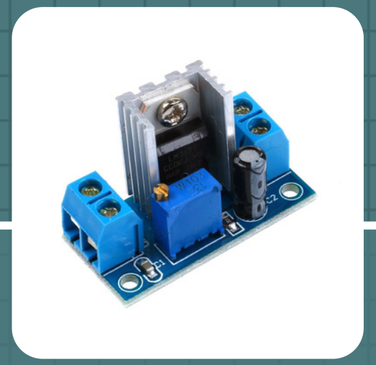


HC-05 module

Bluetooth module enable remote control of the robot in manual mode. It establish a wireless connection between the external device and the robot, allowing the user to send commands for movement and pump activation.

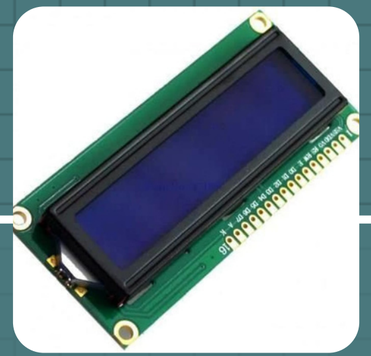
Lithium Batteries

Lithium-ion batteries provide the necessary power to operate the robot's components. They offer high energy density and rechargeable capability, ensuring long-lasting performance during firefighting missions.



LM317 Regulator

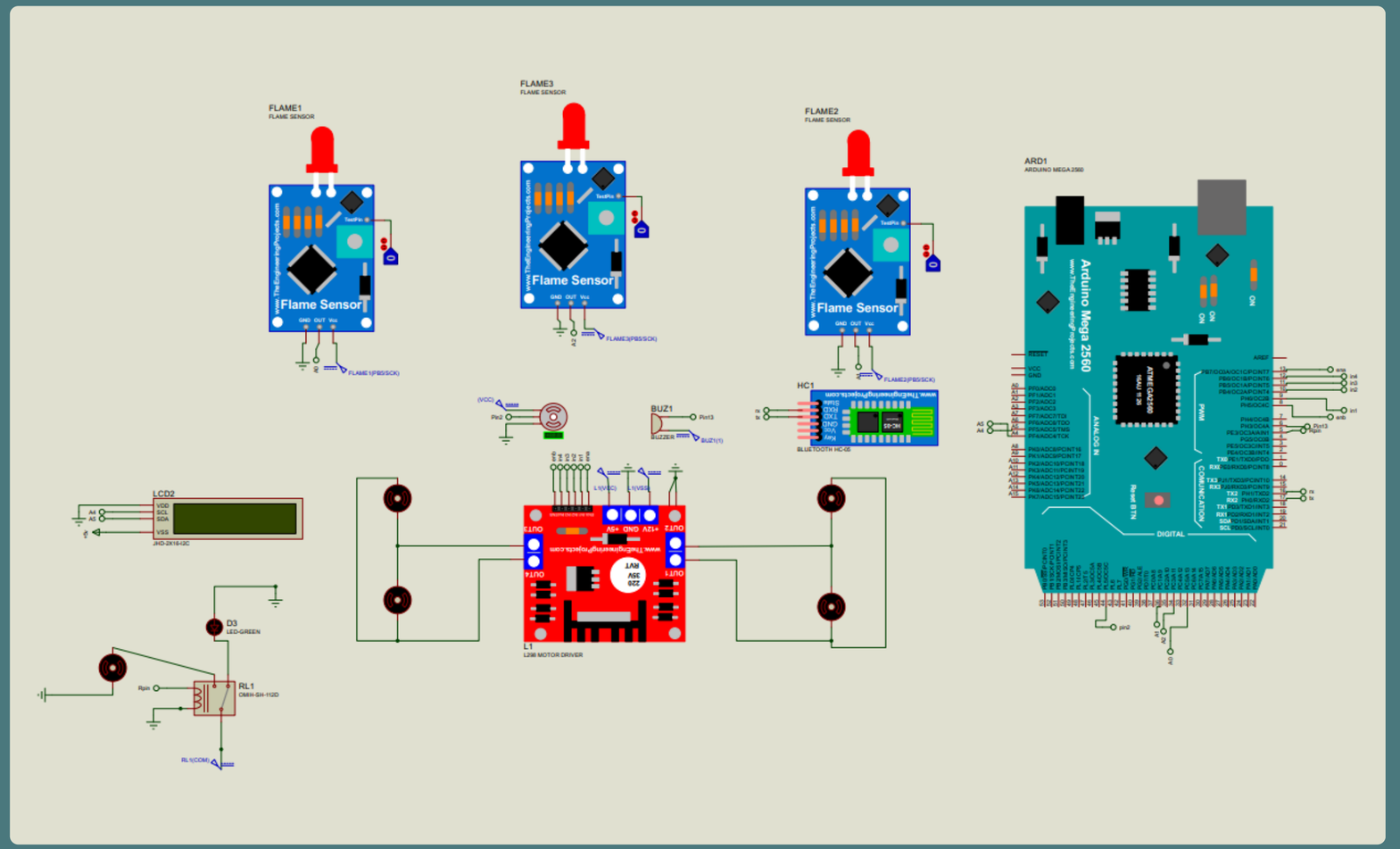
This component is used to regulate the voltage supplied to specific components if they require a different voltage level than the main power source. It ensures compatibility and optimal performance of all components in the system.



LCD

It serves as the user interface for manual control, displays data during autonomous firefighting, shows the state of water pump [ON/OFF].

SCHEMATIC


FLAME1
FLAME SENSOR
Flame Sensor
FLAME3
FLAME SENSOR
Flame Sensor
FLAME2
FLAME SENSOR
Flame Sensor
ARD1
ARDUINO MEGA 2560
Arduino Mega 2560
HC1
BLUETOOTH HC-06
BUZ1
LCD2
JHD-2X16-I2C
D3
LED-GREEN
RL1
OMRON-SH-112D
L1
L298 MOTOR DRIVER

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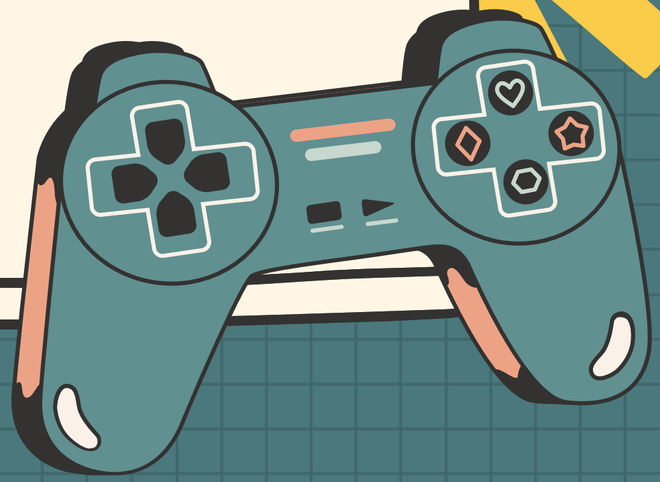
Manual Mode



FIRE FIGHTING ROBOT CODE

```
//manual mode
if (Serial.available()) {
  if (flag == 0) {
    switch (Serial.read()) {
      case 'F':
        moveForward();
        break;
      case 'B':
        moveBackward();
        break;
      case 'L':
        turnLeft();
        break;
      case 'R':
        moveRight();
        break;
      case 'S':
        stopp();
        break;
      case 'r':
        sweepServoRight();
        break;
      case 'l':
        sweepServoLeft();
        break;
      case 'P':
        activatePump();
        break;
      case 'A':
        flag = 1;
        break;
      default:
        break;
    }
  }
  if (flag == 1) {
    AutocheckFire();
  }
}
```

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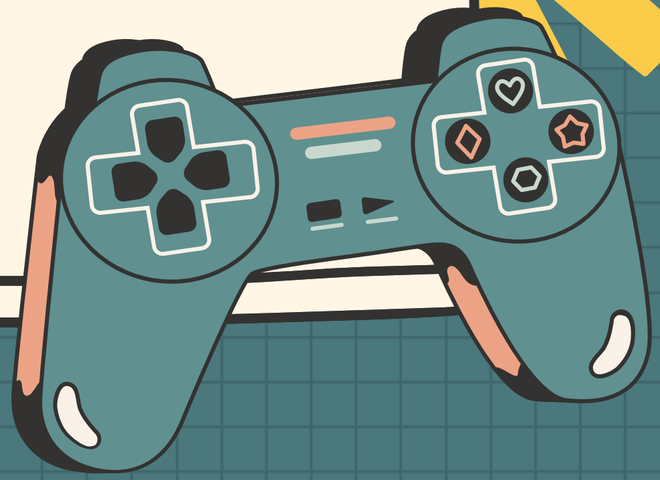
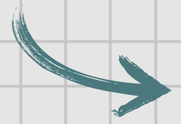
Autonomous Mode



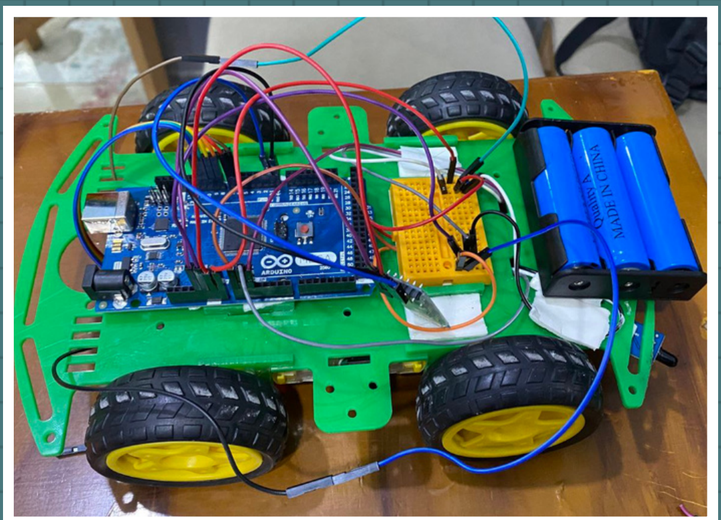
FIRE FIGHTING ROBOT CODE

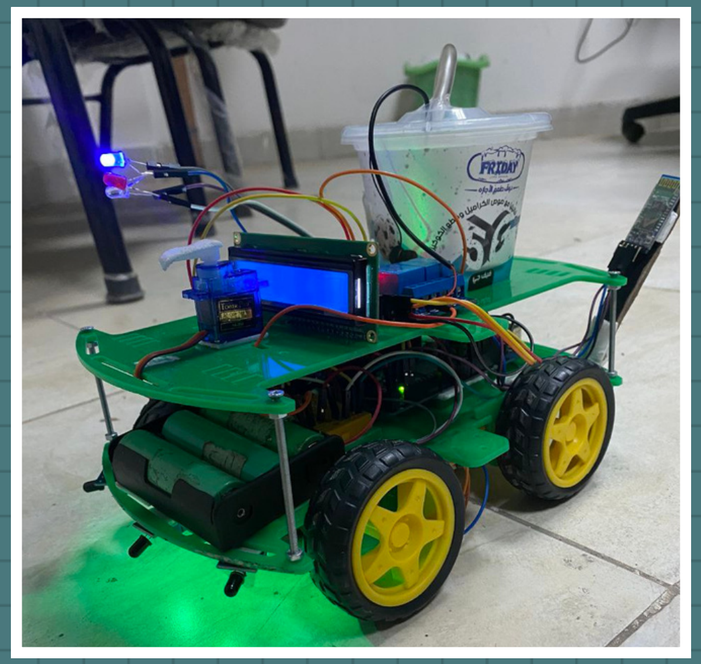
```
void AutocheckFire() {
  Serial.println("in AAAutoo");
  int rightSensor = digitalRead(RightSensorPin);
  int leftSensor = digitalRead(LeftSensorPin);
  int frontSensor = digitalRead(FrontSensorPin);

  if (rightSensor == 0 && frontSensor == 1) {
    turnRightUntilFrontSensor();
    activatePump();
    sweepServoRight();
  } else if (leftSensor == 0 && frontSensor == 1) {
    turnLeftUntilFrontSensor();
    activatePump();
    sweepServoLeft();
```

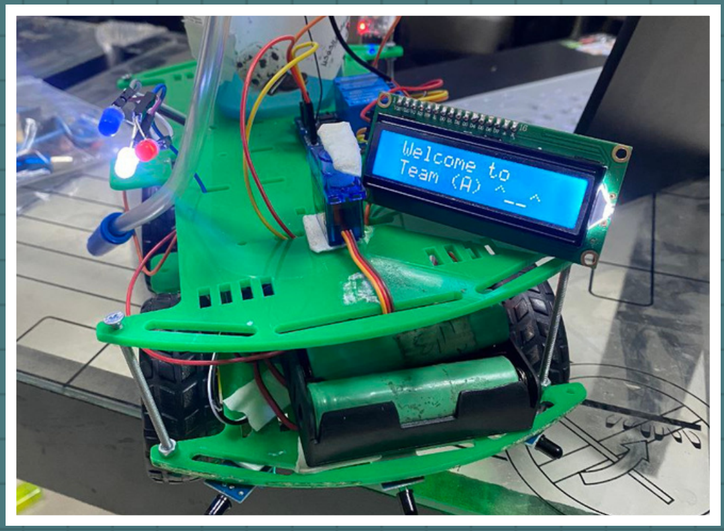


```
  } else if (rightSensor == 0 && leftSensor == 0 && frontSensor == 0) {
    stopp();
    activatePump();
    sweepServoRightToLeft();
  } else if (frontSensor == 0) {
    moveForwardUntilRightSensor();
    activatePump();
    sweepServoRightToLeft();
  } else if (Serial.available() > 0 && Serial.read() == 'M') {
    flag = 0;
  } else {
    digitalWrite(pumpPin, LOW); // Turn off the pump
    myservo.write(pos); // Set servo to 90 degrees
  }
```

PROTOTYPE







Thank You