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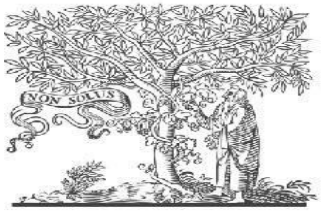

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FIRE FIGHTING ROBOT

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Abstract
The current project work is about a Fire-fighting robot. Enables to extinguish the fire. Now a days fire accidents are happening more in industries and as well as sophisticated buildings and many lives are dying in such situations so detecting this fire at initial stage itself is a important aspect hence we can extinguish it in initial stage therefore we can save the lives who are in that situation and also the lives of fire fighters who risk there lives to extinguish the fire. In this work a fire extinguishing robot has been proposed and designed which detects the fire location and extinguish the fire automatically using the following components like Gas sensor, Flame sensor, ultrasonic sensor, servo motor, water pump, 60- rpm 6v motors (2), LCD screen, L293D board for motor driver, L293D motor driver for water pump, Arduino board, a water tank and wheels.
The robot will be moving invariably in the closed room or in an industry and when there is a fire or smoke due to start of the fire at the initial stage itself it will be recognized by the fire sensor that there is fire and it gives the signals to the Arduino and from Arduino the signals will be passed to the water motor controller so the robot will stop and the water is sprayed on the fire to stop it and then the robot will move forward again.

Keywords: Robot, sensors, L293D board, Arduino board.

1. Introduction

A fire-fighting robot is an advanced technological innovation designed to combat fires efficiently and effectively. These robots are equipped with advanced sensors, cameras, and firefighting tools that enable them to navigate through smoke- filled environments and extinguish flames safely.
Firefighting robots come in various shapes and sizes, with some designed to maneuver through narrow spaces and others capable of traversing rough terrain. They are programmed to detect fire hazards and respond quickly to prevent fires from spreading, minimizing damage and saving lives.
Firefighting robots are particularly useful in situations where it is too dangerous for human firefighters to enter, such as chemical fires, explosions, and high-rise buildings. These robots can enter the danger zone and suppress the fire without putting human lives at risk.
Overall, firefighting robots are an essential tool for modern firefighting operations, and their use is rapidly growing in popularity due

to their effectiveness and safety. The most common reasons for searching for Fire Fighting Robots are to reduce robot effectiveness and minimize fire-related accidents. Identifying the source of the fire's lead and it is possible to decipher robot, smoke, and fire (thermal) reflections. The project intends to create a remotely controllable robotic fire extinguishing vehicle. Designing and implementing a firefighting robot, either automatically, is the project's major goal. We can use the robot's sensors to detect fire, smoke, and other obstructions in its route.[1]

Because of a lack of technical innovation, the profession of firefighting has long been one that is perilous, and there have been countless and catastrophic losses. Nevertheless, despite their intensive training, people are still prone to mistake and the existing firefighting techniques are ineffective and inefficient. Using robots rather than people to deal with fire threats is a recent idea that has gained popularity. This is mostly due to the fact that they might be deployed in circumstances that are too risky for for human to be involved in. In this project, we create a robot that can find and put out fire in a certain setting. On its travels, the robot navigates the terrain and avoids any impediments. Arduino board acts as a brain of the whole control circuitry.

Structure of robot:

Our prototype robot will look like a mini car or auto with two rare wheels and a single ball like supported structure at front bottom. A single fire sensor, ultrasonic sensor, gas sensor, and water sprinkler at front of the robot and works with help of Arduino uno as microcontroller, L293d motor drivers, two motors for rear wheels, a water motor and a tank to store water.

Hardware components and description:

Arduino Uno:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. The Arduino board is the main component of this platform, and it consists of a microcontroller, input/output (I/O) pins, and a USB interface for programming and communication with other devices.

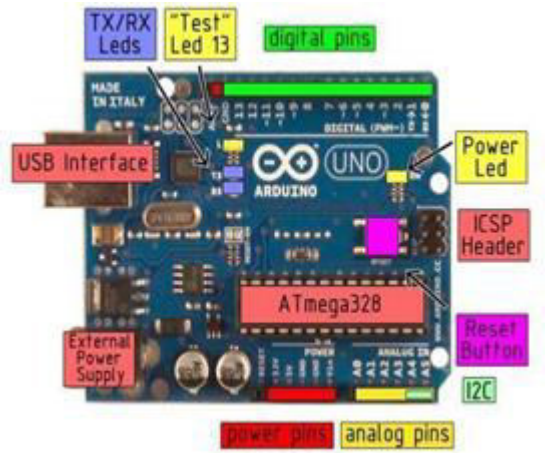
The microcontroller on the Arduino board is usually an Atmel AVR or a similar chip, and it serves as the brain of the system. It controls the inputs and outputs of the board, receives and processes data, and runs the code that defines the board's behavior. The input/output (I/O) pins on the Arduino board allow users to connect external devices such as sensors, lights, and motors to the board. These pins can be used as digital inputs or outputs, or as analog inputs for measuring voltages or reading signals from sensors.

The USB interface on the Arduino board allows users to upload code to the board from their computer, as well as communicate with other devices connected to the board. This interface is also used for powering the board and for debugging purposes.

One of the key features of Arduino boards is their ease of use. The Arduino software provides a simple and intuitive programming

environment, which allows users to write code and upload it to the board with minimal effort. Additionally, the vast library of pre-written code and hardware modules available online makes it easy to build complex projects using the Arduino platform.

Overall, the Arduino board is a versatile and user- friendly platform for building electronics projects, making it a popular choice for hobbyists, students, and professionals alike.[2]



L293d Motor Driver:

Basically an L293D is a device which is manufactured to provide drive currents in both directions at 600-mA at voltages between 4.5 V to 36V. As the motors we used are 6v-12v this board as a single unit can be used as a motor driver for both the motors. As we have an Arduino UNO to control the motor driver. To use the L293D, you will need to connect the motor to the output pins of the IC and provide power to the motor driver. The L293D also requires input signals to control the direction of the motor and the speed. You can use digital logic signals from a microcontroller to control the L293D.

The L2293D motor driver board can also be used for the pumping of the water from the tank, so we used another board exclusive for the water pump driver. [3][4]

Ultrasonic Sensor:

In this model a ultrasonic sensor is used to identify the obstacles in front of the prototype and pass the signals to Arduino so it changes the direction of the vehicle in order not to crash the prototype, It employs ultrasonic sound waves to gauge a distance to an item. An ultrasonic sensor transmits and receives ultrasonic pulses using a transducer to determine an object's proximity. [3][4]

Fire sensor:

A fire sensor is used to sense the fire and give feedback to the Arduino board so it moves near the fire and stops there and th e water motor will start and spray the water.

These detectors can distinguish between smoke that can start an open fire and smokeless liquid. Flame detectors, for instance, are frequently employed in boiler furnaces since they can detect heat, smoke, and fire. [4]

Gas sensor:

As in industry a gas leak or a smoke generated by the flames can rise we also included the gas sensor because our prototype is based on industrial purpose it detects the pressure difference in the atmosphere and compares with the standards and displays that there is a rise of smoke or harmful gaseous in the industry. So that they are able to detect and stop the concentration of different hazardous gases and vapors, such as volatile organic compounds, humidity, and odors, which are extremely dangerous to human life. [4] [5]

Servo motor:

A 180° servo motor is used in our prototype in order to create the trajectory of the water that is sprinkled on the fire and it helps the water pipe to oscillate to 180° ,the exact control of angular or linear position, velocity, and acceleration is made possible by servo motors, which are rotary actuators. It comprises of an appropriate motor connected to a position feedback sensor. [5][6]

Water pump:

This water pump will be kept submerged in the water that is inside the water container and when received the signals from the Arduino that there is a fire the pump will on and pump the water through the pipe and the servo motor will help to spread the water. But we should keep monitoring the water container because if when the water is completed the fire will not be extinguished.

Motors:

The motors are one of the main parts of the entire prototype this moves the prototype by the commands given by the Arduino to them they rotates invariable at 60rmp by takin minimum of 6v from the power bank and if there is any obstacle sensed by the ultrasonic sensor in front of the robot the power distribution is varied to the motors so the robot will take a turn towards right. Also gets the signals to stop

the robot if any fire is detected to spray the water the L293D motor driver helps for this actions to control through the Arduino connected.

Software requirement:

We should install the Arduino IDE in the laptop. The IDE comes with a compiler, a serial monitor, and other utilities. The program is created, built, and uploaded to the board using the IDE. The IDE allows you to choose from a number of Arduino boards with different controllers for all the gadgets, boards, or sensors linked to the Arduino, and the language is simple to learn.

code:

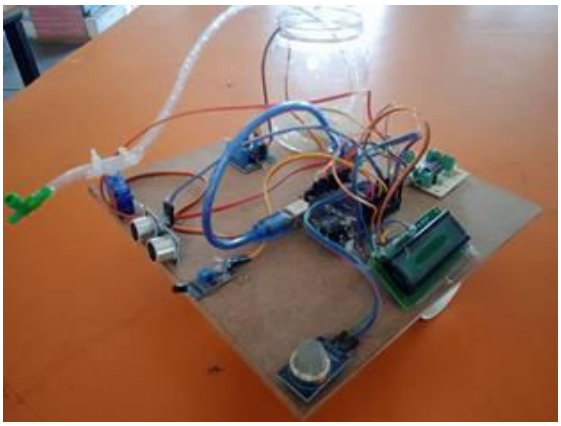
```
int state;
int flag=0;
void stp();
void fwd();
void left();
void right();
void back();
void motON();
void motOFF();
int mot=6;
#include Servo myservo;
int pos = 0;
void setup()
    {
     pinMode(2,OUTPUT);
     pinMode(3,OUTPUT);
     pinMode(4,OUTPUT);
     pinMode(5,OUTPUT);
     pinMode(6,OUTPUT);
     Serial.begin(9600);
     myservo.attach(A2);// Baud rate set to 9600bps
}
void loop()
{

for (pos = 0; pos <= 100; pos += 1) { // goes from 0 degrees to 180 degrees // in steps of 1 degree
myservo.write(pos); // tell servo to go to position in variable 'pos'delay(15);
if(Serial.available() > 0)
goto ss; // waits 15 ms for the servo to reach the position
}
for (pos = 160; pos >= 0; pos -= 1) { // goes from 180 degrees to 0 degrees
myservo.write(pos); // tell servo to go to position in variable 'pos'
delay(15); // waits 15 ms for the servo to reach the position
if(Serial.available() > 0)goto ss;
}
ss: if(Serial.available() > 0) // Ckeck for command Received
{
state = Serial.read();
Serial.println(state);
flag=0;
}
if (state == '1') // Checking Command from User
{
stp();
if(flag == 0){
```

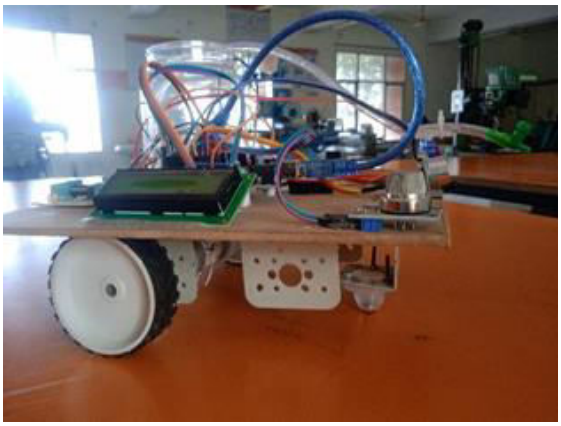
```
   Serial.println("Stop");
   flag=1;
   }
 }
else if (state == '2')
 {
 fwd();
 if(flag == 0)
{
 Serial.println("Forward");
 flag=1;
}
 }
else if (state == '3')
 {
 back();
if(flag== 0)
{
Serial.println("Backward");
 flag=1;
 }
 }
else if (state == '4')
 {
left();
if(flag== 0)
{
Serial.println("Left");
flag=1;
}
}
else if (state == '5')
 {
 right();
 if(flag== 0)
{
Serial.println("Right");
 flag=1;
 }
}
else if (state == '6')
 {
motON();
 if(flag== 0)
{
Serial.println("moton");
flag=1;
}
}
else if (state == '7')
{
 motOFF();
 if(flag== 0)
 {
Serial.println("motoff");
 flag=1;
 }
 }
 } //loop() ends here
void fwd() // Forward
{
digitalWrite(2,HIGH);
digitalWrite(4,HIGH);
 digitalWrite(3,LOW);
 digitalWrite(5,LOW);
 }
 void back() // Backward
{
digitalWrite(3,HIGH);
digitalWrite(5,HIGH);
digitalWrite(2,LOW);
 digitalWrite(4,LOW);
}
void left() //LEFT
 digitalWrite(2,HIGH);
 digitalWrite(3,LOW);
digitalWrite(4,LOW);
digitalWrite(5,HIGH);
```

```
}
void right() // Right
 {
digitalWrite(2,LOW);
 digitalWrite(3,HIGH);
digitalWrite(4,HIGH);
digitalWrite(5,LOW);
}
 void stp() // Robot Stops
 {
digitalWrite(2,LOW);
digitalWrite(3,LOW);
digitalWrite(4,LOW);
digitalWrite(5,LOW);
 }
 void motON()
 {
digitalWrite(6,HIGH);
}
void motOFF()
{
digitalWrite(6,LOW);
}
```

Conclusion and result:

The main aim of our project is to create a prototype of a fire-fighting robot which can sense the fire and as well as smoke in the surrounding environment of the prototype and extinguish it as soon as possible. A flame sensor that we installed can sense flames which are having wavelengths between 760 and 1100 nm and sensing ranges between 10 cm and 1.5 ft, depending on sensitivity. The prototype can also move to inaccessible places to humans in a short period of time, and it locates the fire and extinguishes it in minimal time possible. As expected our prototype is generated and working good. For the power supply to the Arduino and the motors we fixed a 10000 mah power bank as the Arduino takes 7v to 11v and the motors take 5v to 12v the maximum life of the battery is 3hrs, to increase this we can take a greater mah power bank. The prototype we thought and assembled will look like the following figure.





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