

**COURSE:**  
*Computer Architecture*

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PROJECT REPORT

FIRE FIGHTING ROBOT

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### Problem:

Rescue 1122 said the fire cases increased by 4.4% during 2019 when compared to 2018. It asserted that at least 18,379 fire incidents were reported in all 36 districts of Punjab in 2019 whereas some 17596 cases of fires were reported in 2018 with an increase of 4.4%. The overwhelming number of cases highlighted the high threat level of blaze emergencies that not only result in loss of lives but also destroy properties. Even though there are a lot of precautions taken for Fire accidents, these natural/man-made disasters do occur now and then. In the event of a fire breakout, to rescue people and to put out the fire we are forced to use human resources which are not safe.

### Solution:

With the advancement of technology especially in Robotics it is very much possible to replace humans with robots for fighting the fire. This would improve the efficiency of firefighters and would also prevent them from risking human lives. For this purpose, we build a Fire Fighting Robot using Arduino, which will automatically sense the fire and start the water pump. It could move towards the fire and pump out water around it to put down the fire.

### Material Required:

1. Arduino UNO
2. Fire sensor or Flame sensor (3 Nos)
3. Servo Motor (SG90)
4. L293D motor Driver module
5. Mini DC Submersible Pump
6. Small Breadboard
7. Robot chassis with motors (2) and wheels(2) (any type)
8. A small can
9. Connecting wires

### Working Concept of Fire Fighting Robot:

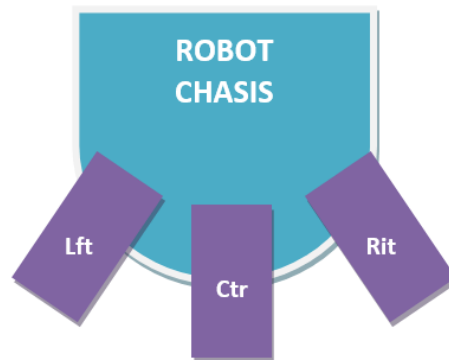
The main brain of this project is the Arduino, but in-order to sense fire we use the **Fire sensor module** (flame sensor) that is shown below.



These sensors have an IR Receiver (Photodiode) which is used to detect the fire.

How is this possible? When fire burns it emits a small amount of Infra-red light, this light will be received by the IR receiver on the sensor module. Then we use an Op-Amp to check for change

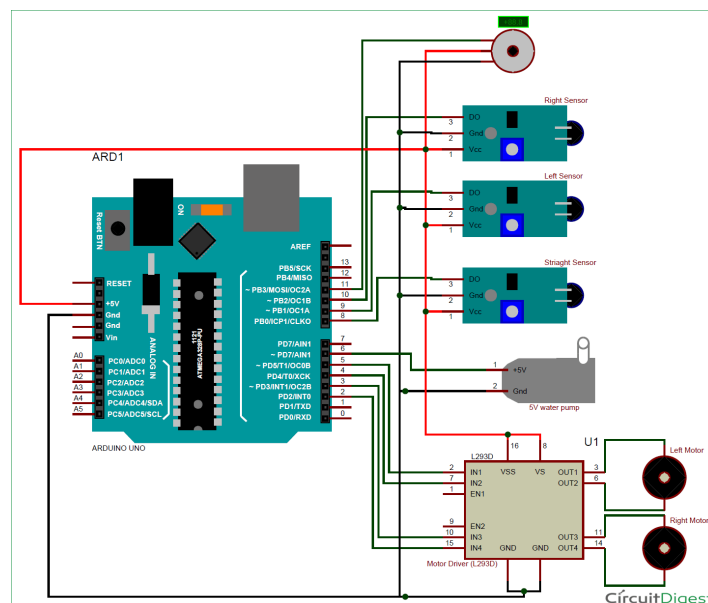
in voltage across the IR Receiver, so that if a fire is detected the output pin (DO) will give 0V (LOW) and if there is no fire the output pin will be 5V (HIGH). So, we place three such sensors in three directions of the robot to sense on which direction the fire is burning.



We detect the direction of the fire we can use the motors to move near the fire by driving our motors through the **L293D module**. When near a fire we have to put it out using water. Using a small container we can carry water, a 5V pump is also placed in the container and the whole container is placed on top of a **servo motor** so that we can control the direction in which the water has to be sprayed.

### Circuit Diagram:

The complete circuit diagram for this **Fire Fighting Robot** is given below



We used a small aluminium can (cool drinks can) to set the pump inside it and poured water inside it. We assembled the whole can on top of a servo motor to control the direction of water. The servo fin is attached to the bottom of the container using hot glue and has fixed the servo motor with chassis using nuts and bolts. We can simply place the container on top of the motor and trigger

the pump inside it to pump water outside through the tube. The whole container can then be rotated using the servo to control the direction of the water.

### Working of Fire Fighting Robot:

It is recommended to check the output of the robot in steps rather than running it all together for the first time. You can build the robot upto the servo motor and check if it is able to follow the fire successfully. Then you can check if the pump and the servo motor are working properly. Once everything is working as expected you can run the program below and enjoy the complete **working of the fire fighter robot**.



The maximum distance to which the fire can be detected depends on the size of the fire, for a small matchstick the distance is relatively less. You can also use the potentiometers on top of the modules to control the sensitivity of the robot. I have used a battery of 12V to power the robot you can use a power bank.

### Code

```
/*----- Arduino Fire Fighting Robot Code----- */
```

```
#include <Servo.h>
Servo myservo;
```

```
int pos = 0;
boolean fire = false;
```

```
/*-----defining Inputs-----*/
#define Left_S 9    // left sensor
#define Right_S 10   // right sensor
#define Forward_S 8 //forward sensor
```

```
/*-----defining Outputs-----*/
#define LM1 2    // left motor
#define LM2 3    // left motor
#define RM1 4    // right motor
#define RM2 5    // right motor
```

```

#define pump 6

void setup()
{
  pinMode(Left_S, INPUT);
  pinMode(Right_S, INPUT);
  pinMode(Forward_S, INPUT);
  pinMode(LM1, OUTPUT);
  pinMode(LM2, OUTPUT);
  pinMode(RM1, OUTPUT);
  pinMode(RM2, OUTPUT);
  pinMode(pump, OUTPUT);

  myservo.attach(11);
  myservo.write(90);
}

void put_off_fire()
{
  delay (500);

  digitalWrite(LM1, HIGH);
  digitalWrite(LM2, HIGH);
  digitalWrite(RM1, HIGH);
  digitalWrite(RM2, HIGH);

  digitalWrite(pump, HIGH); delay(500);

  for (pos = 50; pos <= 130; pos += 1) {
    myservo.write(pos);
    delay(10);
  }
  for (pos = 130; pos >= 50; pos -= 1) {
    myservo.write(pos);
    delay(10);
  }

  digitalWrite(pump, LOW);
  myservo.write(90);

  fire=false;
}

void loop()
{
  myservo.write(90); //Sweep_Servo();

```

```

    if (digitalRead(Left_S) ==1 && digitalRead(Right_S)==1 && digitalRead(Forward_S) ==1) //If Fire not
detected all sensors are zero
    {
        //Do not move the robot
        digitalWrite(LM1, HIGH);
        digitalWrite(LM2, HIGH);
        digitalWrite(RM1, HIGH);
        digitalWrite(RM2, HIGH);
    }

    else if (digitalRead(Forward_S) ==0) //If Fire is straight ahead
    {
        //Move the robot forward
        digitalWrite(LM1, HIGH);
        digitalWrite(LM2, LOW);
        digitalWrite(RM1, HIGH);
        digitalWrite(RM2, LOW);
        fire = true;
    }

    else if (digitalRead(Left_S) ==0) //If Fire is to the left
    {
        //Move the robot left
        digitalWrite(LM1, HIGH);
        digitalWrite(LM2, LOW);
        digitalWrite(RM1, HIGH);
        digitalWrite(RM2, HIGH);
    }

    else if (digitalRead(Right_S) ==0) //If Fire is to the right
    {
        //Move the robot right
        digitalWrite(LM1, HIGH);
        digitalWrite(LM2, HIGH);
        digitalWrite(RM1, HIGH);
        digitalWrite(RM2, LOW);
    }

    delay(300); //Slow down the speed of robot

    while (fire == true)
    {
        put_off_fire();
    }
}

```