

**PROJECT REPORT
ON
FIRE FIGHTING ROBOT BASED ON ARDUINO**



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CERTIFICATE



This is to certify that the term work carried out in the subject of TERM PROJECT and recorded in this report are bonafide by NISHA DESAI & DEVANGI DARJI, Roll No.: EC-023 & EC-020, Identity No.: 15ECUBS120 & 16ECUBG039 Respectively, of B.Tech semester 6th in the branch of ELECTRONICS & COMMUNICATION during the academic year 2018-2019.

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ABSTRACT

Nowadays , fire accidents are very common and sometimes it becomes very hard for a fireman to protect someone's life. It is not possible to appoint a person to continuously observe whether accidental fire has started where robot can do that. These robots are mostly useful in industries. The main requirement of this project is create a robot that is fully autonomous. This means that once the robot is started by the user. it navigates, searches for, and extinguishes the fire on its own, with no assistance or input from the user. In order to reach this goal, robot takes decisions on motors, sensors, fire extinguishing mechanical parts.

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CHAPTER 1

1.1 INTRODUCTION

Robot is defined as a mechanical design that is capable of performing human tasks or behaving in a human-like manner. Building a robot requires expertise and complex programming. It's about building systems and putting together motors, flame sensors, and wires, among other important components. A fire fighter robot is one that has a small fire extinguisher added to it. By attaching a small fire extinguisher to the robot, the automation put out the fire by human controlling. This report covers the design and construction of a robot that able to sense & extinguishing fire. This robot implements the following concept: environmental sensing, proportional motor control. This robot processes information from its various sensors and key hardware elements via arduino. It uses to detect the fire accident. A robot capable of extinguishes a simulated tunnel fire, industry fire and military application are designed and built.IR sensor will be used for initial detection of the flame.[1] Once the flame is detected, the robot drives toward the fire, the robot actuates an electronic valve realizing sprinkles of water on the flame. The project has to generate interests as well as innovation in the field of robotic while working toward a practical and obtainable solution to save lives and mitigate the risk of property damage.

Fire fighters face risky situations when a extinguishes fire and recuing victims , it is an inevitable part of being fire fighters, in contrast , a robot can function by itself or be controlled from a distance, which means fire fighting and rescue activities could be executed without putting fire fighters at risk by using robot technology instead. In other word, robot decreases the need for fire fighter to get into dangerous situation. This robot provides fire protection and when there is a fire in a tunnel or in an industry by using automatic control of robot by the use of arduino in order to reduced loss of life and property damage. This robot uses dc motors, wheels, arduino, sensors, pump and sprinkler. Arduino is the heart of the project. Arduino controls all parts of the robot by the use of programming. This robot as the fire sensor sense the fire, it sends the signal to arduino , since the signal of the sensor is very weak the amplifier is used so that it

can amplify the signal and send it to arduino. As soon as arduino receives the signal led of sensor will blink, which intimate the occurrence of a fire accidents. After that arduino actuates the driver circuit and it drives the robot towards fire place, as the robot reaches near the fire arduino actuates the relay and pump switch is made ON and water is sprinkled on the fire through the sprinkler.[2]

1.2 BLOCK DIAGRAM

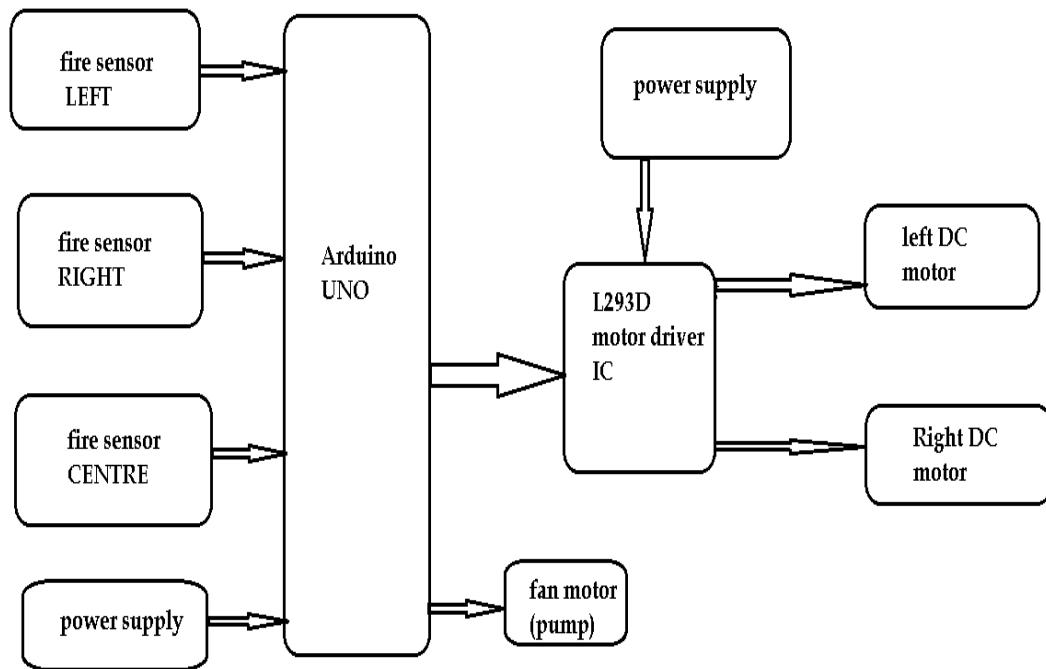


Fig 1.1 Block Diagram

As shown in fig 1.1 main part of robot is arduino uno. Robot has three flame sensors for three directions i.e left right & center. Arduino uno will get input from sensors as fire detects , gives output to l293d motor driver ic. This IC controls direction of left dc motor & right dc motor. Robot will be driven towards fire through these both dc motors. After that arduino will give output to pump to put off the water on the fire.

CHAPTER 2

USED DEVICES

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

1. Arduino UNO

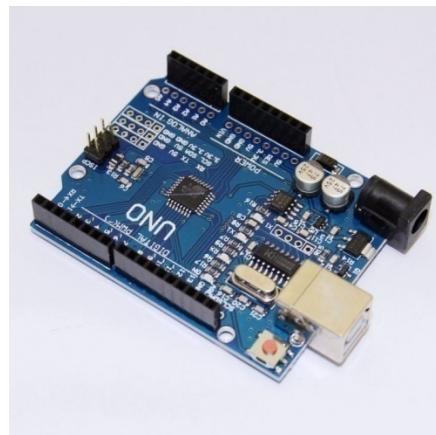


Fig 2.1 Arduino uno [4]

The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button.[4]

2. Flame sensor (3 Nos)

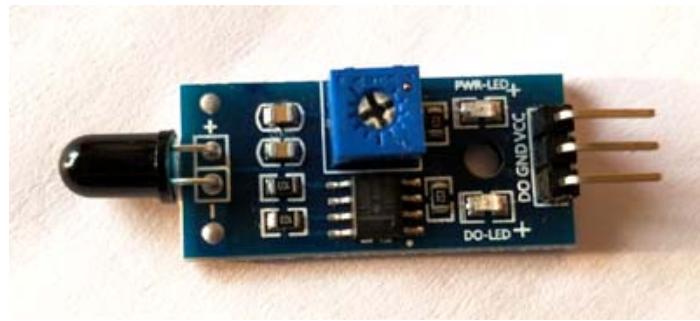


Fig 2.2 Flame sensor [5]

A flame detector is a sensor designed to detect and respond to the presence of a flame or fire, allowing flame detection. A flame detector can often respond faster and more accurately than a smoke or heat detector due to the mechanisms it uses to detect the flame. [5]

3. Servo Motor (SG90)



Fig 2.3 Servo Motor (SG90) [6]

Tiny and lightweight with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servos. It comes with a 3 horns (arms) and hardware. [6]

4. L293D motor Driver module

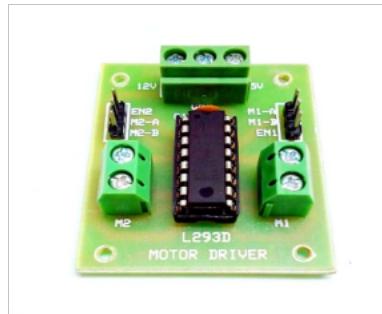


Fig 2.4 L293D IC Module [7]

L293D is a typical Motor driver or Motor Driver IC which allow DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC. [7]

5. relay



Fig 2.5 relay [8]

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuit as amplifiers[8].

CHAPTER 3

DESIGN

3.1 CIRCUIT DIAGRAM:

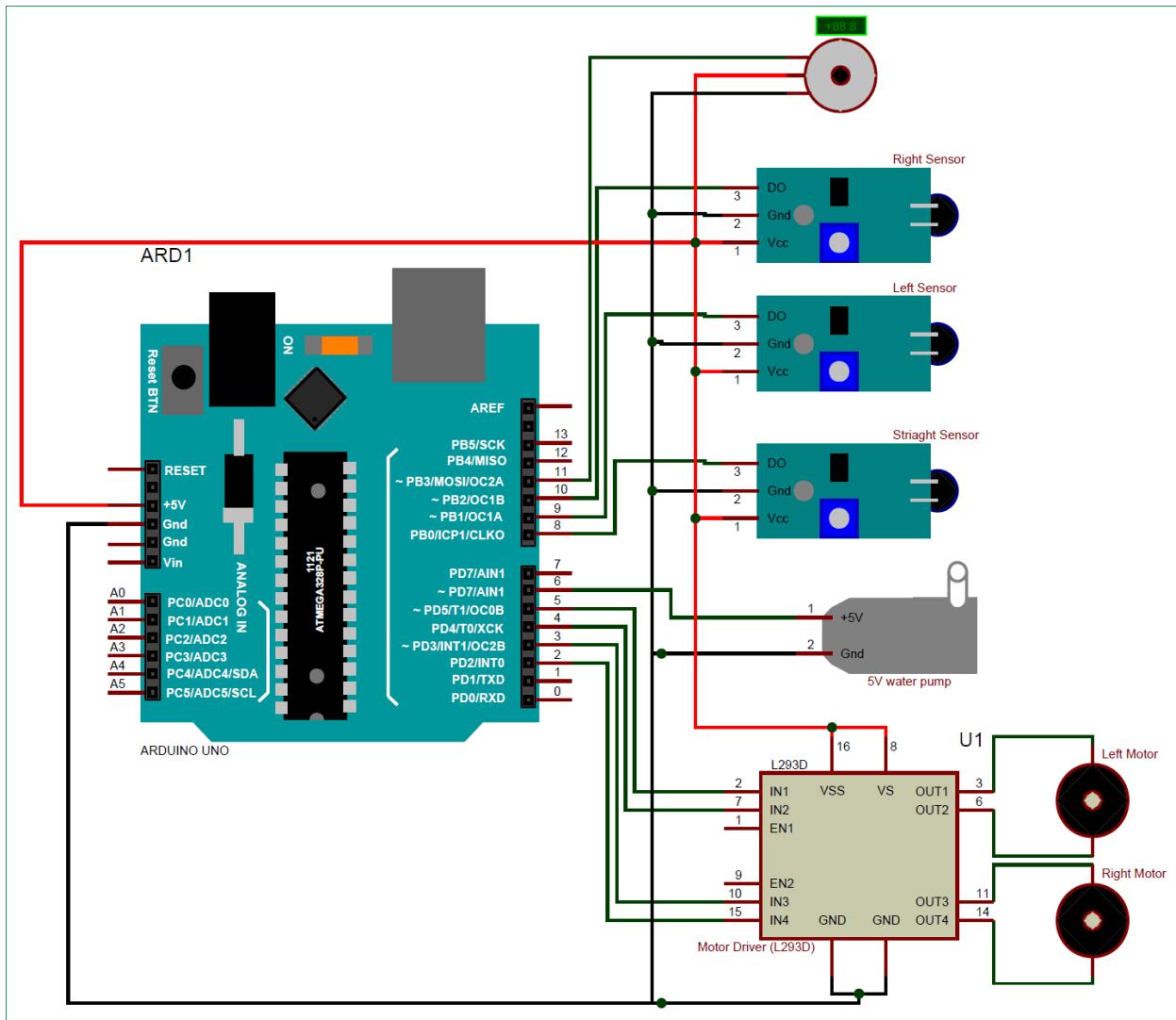


Fig 3.1 circuit diagram [1]

As shown in fig 3.1 digital output pins (DO) of three sensors are connected to digital input pins(8,9,10) of arduino. Pin no 2to 4 of arduino connected to L293D IC. Pin no 11 of arduino connected to servo motor and 6 to pump. Left and right Dc motors are connected to L293D IC.

3.2 WORKING

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

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

- Working of flame sensors:

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 it uses 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.

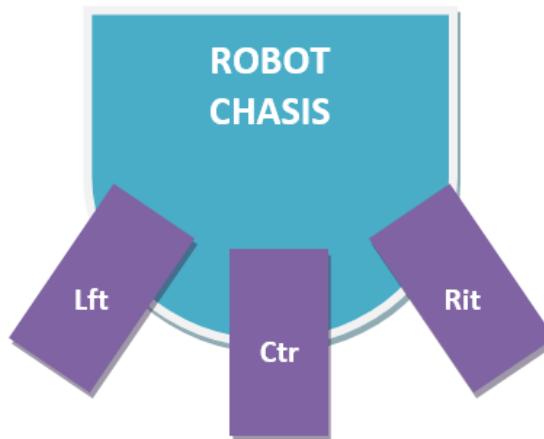


Fig 3.2 three directions of sensors [1]

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. We have used two dc motors.

When near a fire we have to put it out using water. In order to put off the water on fire we have used 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.

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.

3.3 PCB LAYOUT

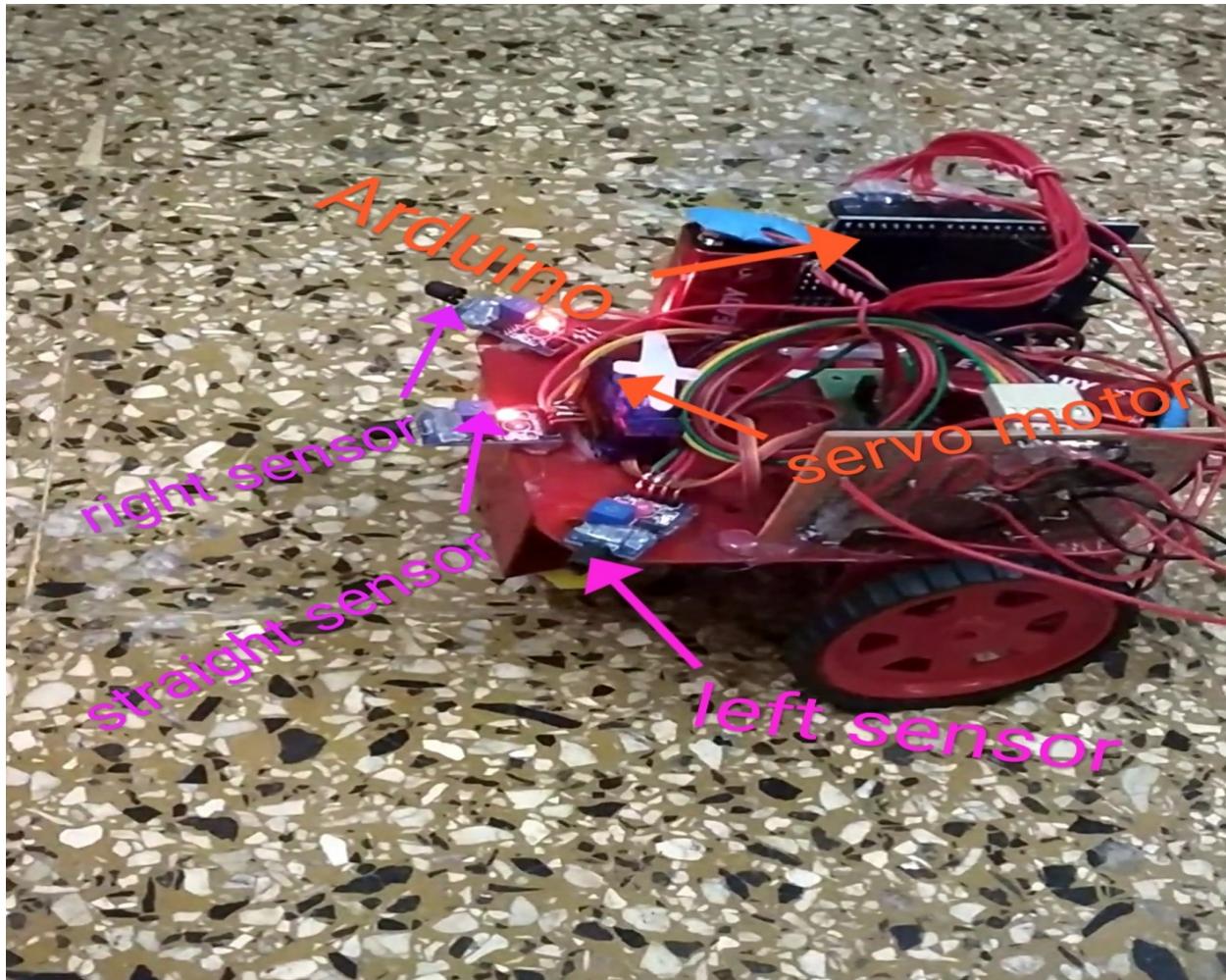


Fig 3.3 PCB layout without pumping

In fig 3.1 as we can see in the front part there are three flame sensors attached to the chasis. at center of chasis there is a servomotor. at back of the chasis there are three components which are arduino uno borad,I293d motor driver ic module and relay circuit



Fig 3.4 Final output

The final PCB layout of our robot is look like as shown in fig 3.4 we have attached pumping system to the robot as we can see in fig. we have put a glass of water on servo motor. We have attached sprikler to glass and there is 5v dc pump in the glass.

CHAPTER 4

APPLICATIONS

4.1 APPLICATIONS

- Can be used in record maintaining rooms where fire can cause loss of valuable data.
- Can be in server rooms for immediate action in case of fire
- Can be used in extinguishing fire where probability of explosion is high. For e.g. hotel kitchens, LPG/CNG gas stores etc.
- Every working environment requiring permanent operator's attention. -At power plant control rooms, -At captain bridges, -At flight control centers.

4.2 ADVANTAGES

- To detect the exact direction of the fire source.
- Capability of sensing accurately with increased flexibility
- Reduce human effort
- Reliable and economical
- Not sensitive to weather conditions.

4.3 DISADVANTAGES

- No monitoring system for vehicle
- No remote control for robotic movement
- It is not used to put out large fires

CHAPTER 5

FUTURE SCOPE

5.1 Future scope:

- The development of sensor networks and the maturity of robotics suggests that we can use mobile agents for tasks that involve perception of an external stimulus and reacting to the stimulus, even when the reaction involves a significant amount of mechanical actions. However, there has been research on many of these pieces in different contexts, e.g., coordination among mobile agents, techniques for detecting and avoiding obstacles. It will be both interesting and challenging to pull all this together into a practical, autonomous fire fighting service.
- As we all know that these days India is sick off massive fire tragedy, to avoid such disasters, technological power must exceed human power because "Human life and time are priceless".
- Extended to a real fire extinguisher by replacing the water carrier by carbon dioxide carrier.

CHAPTER 6

CONCLUSION

Proposed approach of modular design strategy was a good solution in implementing the fire fighting robot to help people at the critical condition. The proposed robot can move in forward, left, right and can stop also. It reduces human efforts and protect their property. Robot detects fire and extinguish the fire with the help of sprinkler pump. For extinguishing that fire robot has to reach up to there and it moves towards the target with the obstacle avoidance property. In this way robot can detects obstacle and avoid them also.

CHAPTER 7

REFERENCES

1. <https://circuitdigest.com/microcontroller-projects/arduino-fire-fighting-robot-code>
2. <https://www.slideshare.net/athmeg/fire-fighting-robot-ppt-56227281>
3. <https://www.slideshare.net/AmolGulhane2/firo-detector-and-extinguisher-robot>
4. <https://en.m.wikipedia.org/wiki/arduino>
5. <https://en.m.wikipedia.org/wiki/flamesensor>
6. <https://en.m.wikipedia.org/wiki/servomotor>
7. <https://en.m.wikipedia.org/wiki/motordrivermodule>
8. <https://en.m.wikipedia.org/wiki/relay>