

# Automatic Fire Extinguishing Robot Without Manual Control

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**Abstract** - This article presents the automatic fire control system by using robotics technology. This technology is more secure because it reduces the human efforts. The proposed fire fighter robot is implemented by using Arduino system. The sensors are used in Robot for sensing the fire and send the information about fire to the microcontroller, after that microcontroller pass the signal to the control circuitry for moving the robot in that particular fire zone for extinguishing the fire by using water pump or extinguisher.

**Key Words:** DC Motor, Arduino Board, Flame Sensor.

## 1. INTRODUCTION

Today robot is more commonly used to reduce the human efforts. The need of Fire extinguisher Robot that can detect and extinguish a fire on its own. Robotics is one of the fastest growing engineering fields of today.[1] Robots are designed to remove the human factor from labour intensive or dangerous work and also to act in inaccessible environment .With the invention of such a device, lives and property can be saved with minimal damage caused by the fire[4]. As an engineers we have to design a prototype that could autonomously detect the fire and extinguish it. The Fire Fighter Robot is designed to search for a fire in the house or industry for extinguish the fire.

This article illustrates the design of a small autonomous Fire Fighting Robot. The robot is designed to find the intensity of the fire and work first at place where the fire is more. The main and only work is to deploy the robot in a fire prone area and the robot will automatically work once it detects a fire breakout. This prototype helps in Rescue operations during fire accidents where the entry of service man is very-very difficult in the fire prone area.

Arduino board acts as a brain of the whole control circuitry .Robot consist of the three sensors that are interfaced in the control circuitry. Sensors are used to detect fire prone area and sends the data to the controller .According to the received data controller will take the action to move the robot and when the robot will reach in the fire zone then a pump/extinguisher is attached on the robot comes into action to extinguish the fire.

## 2. COMPONENT DETAILS

### • Geared dc motor

In this robot, 12V geared DC motors are attached to the wheels. Geared DC motors are available with wide range of RPM and Torque, which allow a robot to move based on the control signal it receives from the motor driver IC.

### • Fire Sensors

A Fire Detection Sensor is sensitive to the flame but also can detect ordinary light. It is usually used as a fire alarm. It detects a flame or a light source of a wavelength in the range of 760 nm to 1100 nm [3]. The range of the sensor is about 1 M to 2 M. IR receivers are used as fire detection sensors in the circuit. We have designed our own analog fire sensor where it makes use of the IR receiver. The analog pins of the Arduino are connected through the sensors which are in voltage divider configuration. The output of the voltage divider circuits is connected to pins A0, A1 and A2 of the controller board.



IR Receiver

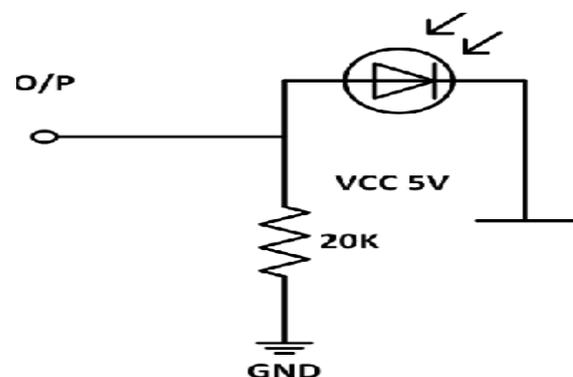


Fig -1: IR Receiver used as Fire Detection Sensor.

• **Arduino board**

Arduino UNO is one of the most popular prototyping boards. It is used frequently in robotic applications as it is small in size and packed with rich features. The board comes with built-in arduino boot loader. The controller used is Atmega 328 interfaced on Arduino which has 14 GPIO pins, 6 PWM pins, 6 Analog inputs and on board UART [2]. In this project, three analog input pins of the board are utilized to connect fire sensors and 6 GPIO pins are used to interface L293D motor driver ICs.

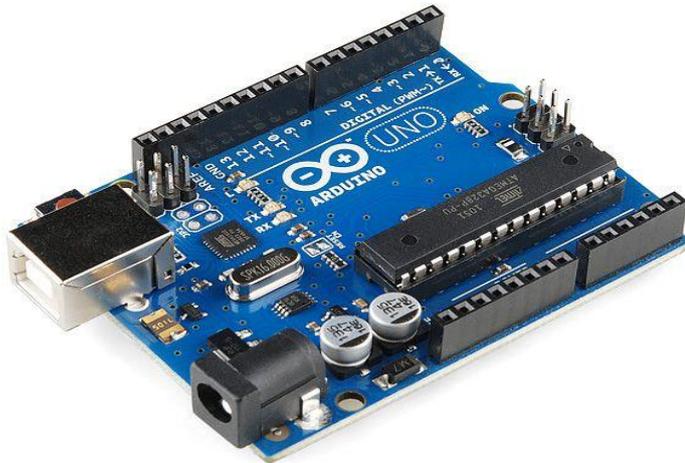


Fig -2: Arduino Board.

• **Motor driver IC (L293D)**

The L293D is a dual H-bridge motor driver integrated circuit (IC). The Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal [5]. This higher current signal is used to drive the motors. It has 16 pins. For robot's motion, there are two DC motors used.

**3. EXPERIMENTAL METHODOLOGY**

• **Fire fighting process**

This is a prototype that autonomously detect the fire and extinguish it. The robot has fire sensors interfaced in its control circuitry which senses the presence and intensity of fire and take the responsive action accordingly. The robot is designed to operate first where the intensity of fire is more. It is also an automatic robot as it does not need to be operated from any remote control. First and last work by human is to deploy the robot in a fire prone area and the robot will automatically start working once it detects a fire breakout. This Robot finds its applications in Rescue operations during fire accidents where the possibility for service men to enter the fire prone areas is very less. The robot circuitry is controlled through Arduino UNO. There are three fire sensors interfaced in the control circuitry in the

forward, left and right side of the robot. A water pump is attached on the robot to extinguish the fire. (A fire extinguisher can also be used in place of water pump).

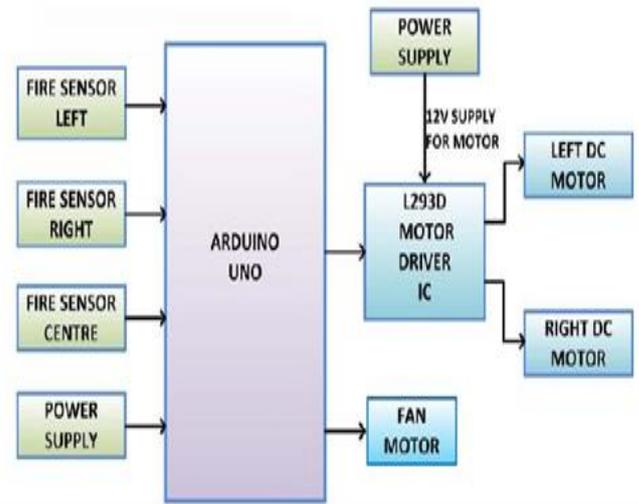


Fig -3: Block diagram

**4. SYSTEM WORKING**

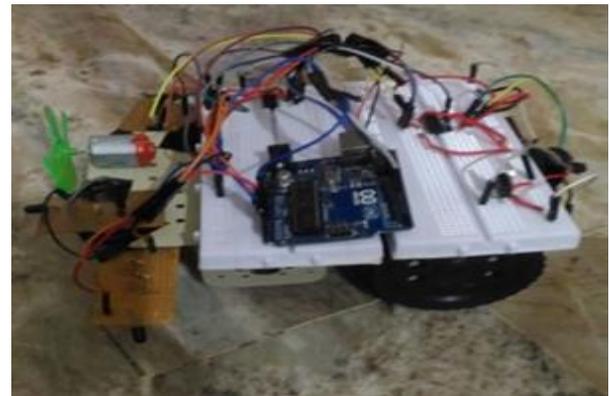


Fig -4: Prototype Model

The IR sensors used for fire detection are connected in voltage divider configuration with the analog input pins of the controller. When the light from the flames falls on the sensor then its resistance changes. Due to change in resistance of the IR receiver, the voltage varies between ground to VCC[4]. The analog voltage is read through the analog pins of the controller and converted to a digitized value using ADC channel of the controller. The controller is programmed in such a way to move the robot in forward, left or right direction according to the flames detected on the sensors. As the front sensor detects the fire it will move in the forward direction. As the robot moves towards the fire spot, the water pump attached to the robot is also activated.

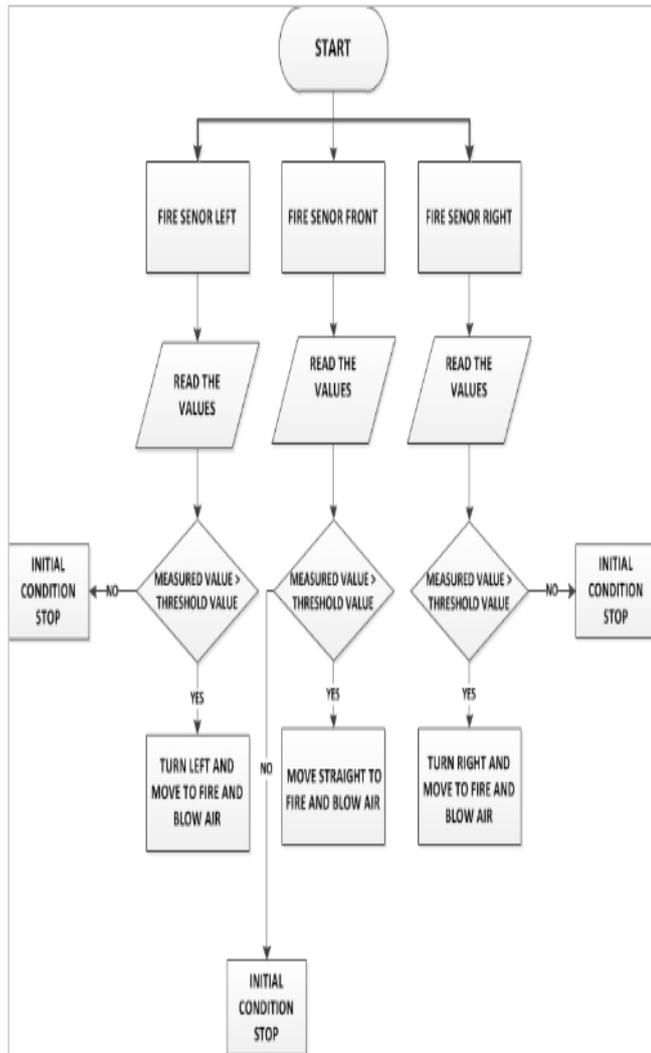


Fig -5: Arduino Robot's Fire Fighting Algorithm

## 5. CONCLUSIONS

The Arduino changes the digital output value at the input pins of the motor driver IC to control the motion of the robot. It turns left and moves forward to reach at the proper spot if fire is sensed by the left sensor. It turns right and moves forward to reach at proper spot if fire is sensed by the right sensor. It moves forward or backward until it reaches at proper spot if fire is detected by the front sensor. As a responsive action, pump gets started to extinguish the fire. The designed robot is a prototype. A production robot should have a fireproof body and proper precautionary equipments.

## 6. REFERENCES

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