

# A LOW COST SENSOR AND LOW POWER BASED AUTONOMOUS AND SEMI-AUTONOMOUS FIRE FIGHTING ROBOT USING ATmegaU4 MICROCONTROLLER

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**Abstract:** The utilization of robots in circumstances that can be as well risky for human intercessions is developing. Developing sensor furthermore, mechanical advances, out threats individuals from danger of flame risks. This paper displays a clever multi sensor based self-sufficient and semi-independent robot, which salvages from flame mishaps in like manner everyday life. The proposed robot can be emerged in all respects monetarily, which establishes six essential modules which incorporates its structure, snag shirking and driver framework, control framework administered by a microcontroller, fire recognition framework, remote administering framework, Global System for Portable correspondence module. In self-ruling mode, when compared with a smoke identifier, it accepts lead as it can extinguish the flame at its beginning than sitting tight for an item to seethe what's more, make smoke. It deliberately distinguishes, explores itself and douses fire with no human guide, accordingly sparing existences of numerous people. It likewise sends the crisis cautioning signal alarms to the security staff in the obligation and inside achieve fire station through the established GSM module. In semi-self-governing mode, this robot was intended to follow up on voice directions just as from a general UI created on the touch screen. This robot has included component of working in gatherings by imparting between them.

**Index Terms:** Autonomous and semi-autonomous robot, Global system for mobile communication module, Remote supervise system, man machine interface, general user interface.

## I. 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 paper covers the design and construction of a robot that is able to sense and extinguish fire.

This robot implements the following concepts: environmental sensing, proportional motor control. This robot processes information from its various sensors and key hardware elements via microcontroller. It uses thermistors or ultraviolet or visible sensors to detect the fire accident. A robot capable of extinguishing a simulated tunnel fire, industry fire and military applications are designed and built.

Ultraviolet sensors/thermistors/flame sensors will be used for initial detection of the flame. Once the flame is detected, the robot sounds the alarm with the help of buzzer provided to it, the robot actuates an electronic valve releasing sprinkles of water on the flame.

This robot provides fire protection when there is a fire in a tunnel or in an industry by using automatic control of robot by the use of microcontroller in order to reduced loss of life and property damage. This robot uses dc motors, castor wheel, microcontroller, sensors, pump and sprinkler. Microcontroller is the heart of the project. Microcontroller controls all the parts of the robot by the use of programming. In this robot as the fire sensor senses the fire, it sends the signal to microcontroller; since the signal of the sensor is very weak the amplifier is used so that it can amplify the signal and sends it to microcontroller.

As soon as microcontroller receives the signal a buzzer sounds, the buzzer sound is to intimate the occurrence of fire accident. After the sounding of the buzzer microcontroller actuates the driver circuit and it drives the robot towards fire place, as the robot reaches near the fire microcontroller actuates the relay and pump switch is made ON and water is sprinkled on the fire through the sprinkler. As Robotic advances, have advanced and swung out to be compulsory, individuals have endeavored to exchange human work with new mechanical self-sufficiency propels, especially where individuals can put in hazard while carrying out their responsibility.

Creating sensor what's more, mechanical advances, out perils individuals from danger of flame perils. This makes scope for robots to apply their abilities to substitute human's everyday exercises, enabling them to put their psyche on larger amount assignments.

Frequently, people work in generous or complex groups to determine troublesome situations consequence of some fiasco, anyway it would be progressively advantageous in the event that we enable robots to keep from serious flame risks, than to react after the event of flame calamity. The requirement for flame identification framework in a urban domain is required and this robot is intended to coordinate those fundamental metro condition needs. The key and fundamental system is to execute fire markers situated by assessing the scope of flame radiation[1], [2].

There are smoke identifiers and gas locators which are typically low in expense and formal answer for flame location. Late improvements incorporate the circulated fiber optic temperature sensors which are extensively used to douse fire [3-8]. In any case, these strategies require pre-establishment of sensors making it too much costly and difficult to cover colossal zone. To cover huge regions and to screen them, unique rehearses are required. One procedure is video preparing strategy utilizing shading video pictures [9-11].

Be that as it may, it can just perceive the fire and flame. It can't separate high temperature gas and hot material which are additionally the reasons for fire. In this way, another remote controlled crisis dealing with fire fighting robot is proposed, which can be utilized in commonsense conditions, has been structured on the reason of minimal effort. It can remarkably improve the security in working puts and is extensive in maintaining a strategic distance from setbacks and diminishing property harms. It can battle both Class An and C fires which were exceptionally visit in libraries, schools, and organizations. Above everything, it tends to be made up all around monetarily, summing exceptionally low cost with exceptional highlights.

## II. LITERATURE REVIEW

Humans will replace human labor with new robotics technologies, especially where humans can be placed in danger situations or task domains. Evolving sensor and robotic technologies allow the transfer of humans from mundane, dangerous or difficult tasks, leaving robots to apply their specific capabilities to replace human's daily routines or hazardous tasks. Commonly, humans work in teams to resolve difficult scenarios, such as the aftermath of some natural or man-made disaster. Communication between each and every team member is critical to resolve relief efforts or remediation, in most disasters. This research presents robotic technology developed to remediate the long lead time to re-establish or develop network infrastructure in the case of a disaster situation. The specific application and test domain of this research, is with fire fighting.

Finding a fire fast is crucial in firefighting. For risky situations, it would be idealistic to send a firefighting robot that could quickly and efficiently find the fire and suppress it. This paper introduces an algorithm developed for an intelligent firefighting mobile robot to find a fire efficiently by fusing long wave infrared camera, ultraviolet radiation sensor, and LIDAR. For its validation, an experimental test-bed was constructed with a hallway and two rooms, with one of the rooms containing a real size fire created by propane gas. The robot immediately calculates its path towards the fire, moves towards it avoiding obstacles, and ultimately finds the fire. When the fire is out, the robot returns to its original starting place.

## III. PROPOSED SYSTEM

In this, the system intended to implement a fire detection system with various detectors like smoke, temperature, flame, gas and spark sensor. Each type of detector is installed at relevant place. Each type of fire will initiate an independent relay and the relay output will initiate the independent fire extinguisher automation system. The block diagram of fire fighting robot is shown in below diagram.

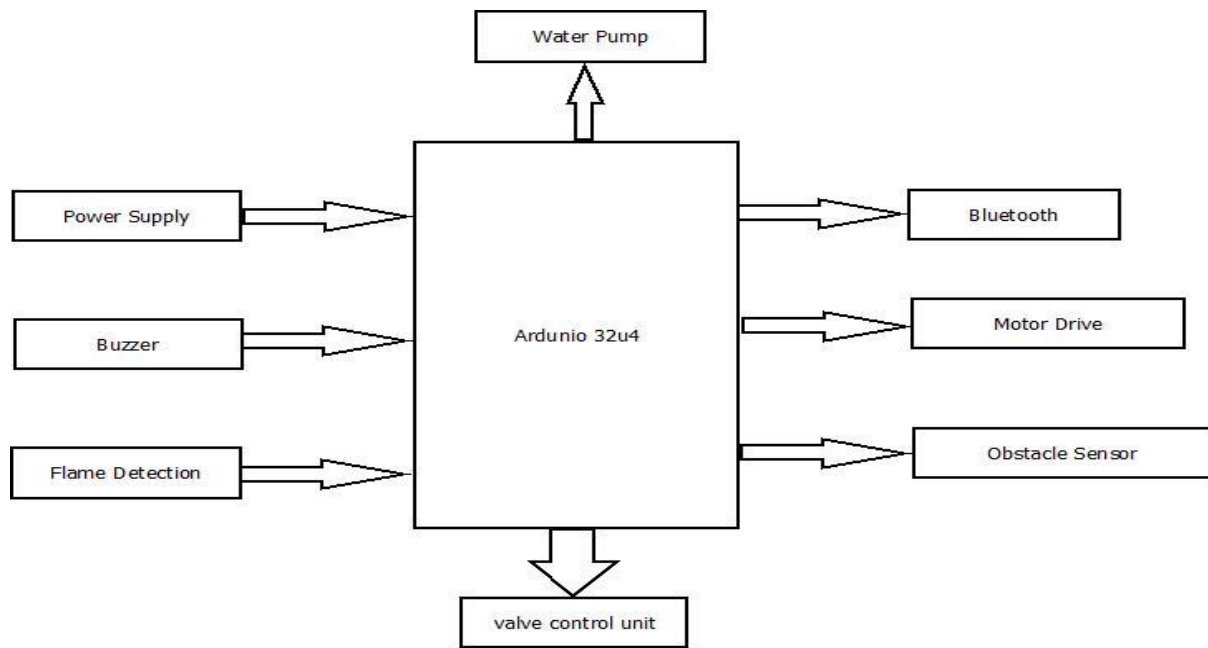


Figure. 1. Block Diagram of Proposed System

#### IV. DESIGN OF ROBOT

Proposed fire fighting squad robot consists of six integral components viz., 1) structure 2) Obstacle avoidance & Driver system, this robot stops automatically when there is any obstacle in its path and reroutes itself in the alternate possible shortest path, reaching its target zone 3) Control system, of this robot is governed by a microcontroller, which is used to send, receive information to the robot and is also employed to navigate it to the designated areas. 4) Fire detection system, it not only distinguishes fire in determined path, but has the capability to identify fire in the field outside its defined path. 5) Remote supervising system, it can stream data wirelessly to the remote terminal. 6) Global System for Mobile (GSM) communication module, is employed to send emergency alarm signals to the security officer in the duty and nearby fire station. The functional requirements are assembled and connected to control center ATmega328 as depicted in block diagram. The assembly constitutes of temperature sensor, IR & smoke sensor, GSM module, obstacle avoidance module, Bluetooth module, line follower module, fire extinguisher module and motor driver module. Couple of rechargeable Li-ion batteries of 3.7V/3000mAh are used to power the microcontroller and sensors in the robot.

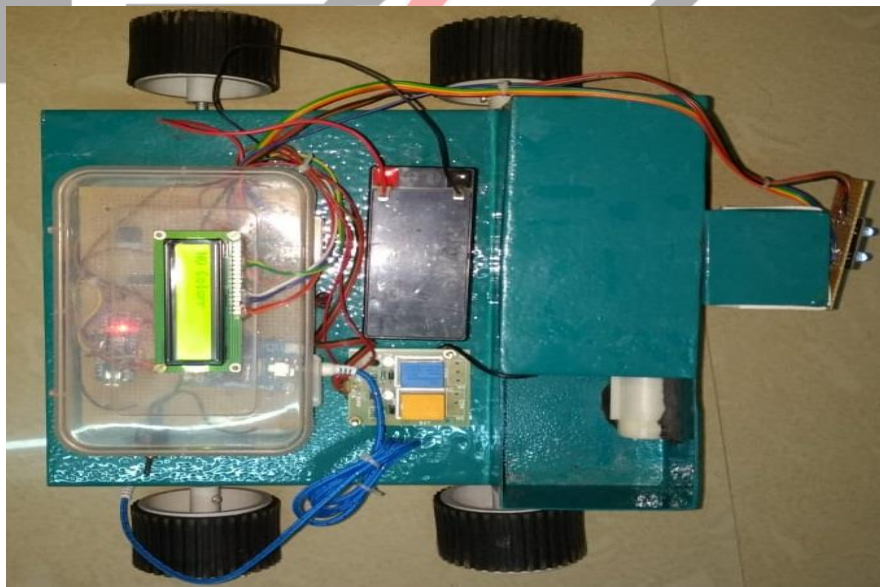


Figure. 2. Fire Fighter Robot

## V. HARDWARE DESCRIPTION

### 1 Arduino32U4

Arduino uno is the smallest board of the family, easy to integrate it in everyday objects to make them interactive The Micro is based on the ATmega32U4 microcontroller featuring a built-in USB which makes the Micro recognizable as a mouse or keyboard.

### 2 Power Supply

A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power.

### 3 Bluetooth

Bluetooth device is interfaced to the control unit on the robot for sensing the signals transmitted by the android application. This data is conveyed to the control unit which moves the robot as desired. An 8051 series microcontroller is used in this project as control device.

### 4 Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

### 5 Motor Drive

The electrical drive system is defined as the system which is use for controlling the speed, torque and direction of an electrical motor. Each electrical drive system is different from other electrical drive systems, but there are some common features associated with all electrical drive systems.

### 6 Flame Detection

The Flame detector Module can detect fire or anything with a wave length of 760 nm ~ 1100 nm light. It can be used to detect a flame from several feet away, it can also detect a ball with a special light source. So with this you can create a fire-fighter robot, or a soccer player.

### 7 Obstacle Sensor

A machine capable of carrying out a complex series of actions automatically, esp. one programmable by a computers is defined as a robot. And, Obstacle avoidance refers to the ability of a robot to detect obstacles in its way if there are any and thus make its own obstacle free path.

### 8 Valve Control Unit

An actuator is a component of a machine that is responsible for moving and controlling a mechanism or system, for example by opening a valve. In simple terms, it is a "mover". An actuator requires a control signal and a source of energy.

## VI. CONCLUSION

The setup utilizing ATmega328 as control focus, with the exact engineering alongside the sensors, executes the programmed flame alert. In correlation with the current firefighting robots, proposed firefighting squad robot has the following imperative highlights; minimal effort uncommon structured flame identification sensors, through the including Bluetooth module it can alarm local group of fire-fighters all the more absolutely, in this manner improving the capacities of putting out flames. The robot has a more grounded limit of adaptability to find fire naturally. Robot has a more grounded capacity to put out of flame within the sight of snags. This robot has a particular component to work with a gathering of comparable robots. In particular, it tends to be made up budgetary inviting, summing up negligible exertion with uncommon segments. On the reason of this design, an ongoing position of the robot showed on the screens and other extraordinary capacities can be included as expansions.

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