

# Fire Extinguisher Robot

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**Abstract:** *In the hazardous environment where most of the accidents occur. Accidents such as road accidents, forest fires, vehicle explosions, gas explosions, etc. To extinguish this fire, we made the Bluetooth-controlled fire extinguisher robot. The robot is controlled through an Arduino Uno microcontroller. The Arduino Uno coordinates various components, including an L298N motor driver, an HC-06 Bluetooth module, a servo motor, and a 5-9V water pump. The robot is controlled through an Android smartphone using the Bluetooth RC controller app.*

*This robot avoids human contact with fire, as all operations are performed through a smartphone, which wirelessly controls the robot. The movement of the robot is forward, backwards, left and right. It is managed through a dual-motor drive system, while the servo motor adjusts the direction of the water nozzle for spraying water. All these actions are occurred thorough a mobile application. It protects human beings from harm.*

**Keywords:** Arduino Uno, L298N Motor Driver, Bluetooth module, Servo Motor, BO Motor, 5-9v water pump.

## I. INTRODUCTION

Fire accidents cause damage to life and property. In many dangerous situations, it is difficult to reach toward the fire source due to the high temperature. To overcome this problem, the fire extinguishing robot plays a vital role in working in this hazardous situation. It is a low-cost and efficient solution for firefighting in small areas like homes, laboratories and workshops, etc. This robot provides safety and reduces risk to human beings. This robot is designed to solve problems and real time response.

The Bluetooth-controlled fire extinguisher robot is a robotic system designed to detect and extinguish fire using wireless Bluetooth communication. The robot is controlled through a smartphone application. The user can operate the robot from a safe distance.

The key components of this robot are Arduino Uno, BO motor, L298N Motor Drive, servo motors, buzzer and LED, HC-06 Bluetooth Module, 3-9v Water Pump, Li-ion battery. Buzzer and LED alerts the environment about fire. A Li-ion battery is the main source of current for the DC pump, which sprays the water over the fire. The servo motor allows 180degree movement to the pipe. Arduino Uno controls the movement of the robot and the nozzle. It also controls the suppression system. All these components are controlled manually through a mobile application.

## II. METHODOLOGY

“This fire extinguisher robot works in manual mode, so the operator can easily identify and extinguish the fire in different surroundings.”

### 1. Requirement Analysis

- Objective: The robot must be capable of identifying and extinguishing them in a given area.
- Purpose: The robot works in manual mode to suppress fire
- Tasks: Understand the environment where the robot will operate, such as residential buildings, industrial plants, or forests. The robot should be able to handle specific types of fires (electrical, chemical, wood, etc.)



- Size and mobility: Depending on the environment, the robot's size, mobility & ability to navigate should be defined.
  - Hardware Requirements: Study what components are used and why they are used.
  - Software Requirements: Analysing software tools, apps or websites to code and how it works.
- 2. Designing**
    - Chassis: Design a robust chassis to house components like sensors, actuators, and the fire extinguisher system. The chassis should allow for movement (wheeled or tracked).
    - Suppression system: Integrate a suitable unit, like a pump, based on fire type.
  - 3. Control System**
    - Develop a program to control the robot's movements, speed, and pump with the help of a Bluetooth module.
    - The app used to control movement is connected to the device. All movements are controllable from the phone
  - 4. Power Supply**
    - Battery: Select an appropriate power source, typically rechargeable lithium-ion batteries. Consider the robot's mobility, power consumption, and endurance.
    - Power Management: Ensure that the power supply can handle both the sensor system and the fire extinguisher without quick depletion.
  - 5. Testing**
    - Test Fire Detection: Test the sensors and algorithms in a controlled environment to ensure they accurately detect fires and ignore false positives.
    - Extinguisher Testing: Test the fire extinguisher system to ensure it effectively extinguishes fires. Depending on the fire type, testing with various extinguishing agents (water, etc.).
    - Software Testing: Ensuring the program does not have errors.
  - 6. Maintenance**
    - Regular Maintenance: Ensure that the fire extinguisher system is regularly checked, and the robot's sensors and mobility components are maintained.
    - Software Updates: Update control software as needed based on lessons learned in the field or feedback from operators.
  - 7. Safety considerations**
    - Emergency stop mechanism: include a manual or automated emergency stop
    - function to prevent accidents in hazardous situations.

### III. LITERATURE REVIEW

The robot successfully detected, navigated the environment, and extinguished flames. [1]

This project develops an autonomous firefighting robot that detects fire, navigates to its location, and extinguishes it automatically. [2]

A low-cost Bluetooth -controlled fire extinguisher robot uses an APK app, sensors, and a microcontroller to detect fire and spray water automatically, reducing human risk during fire emergencies. [3]

The paper presents a firefighting robot designed to detect and extinguish fires in hazardous areas, reducing the need for human involvement. [4]

The project focuses on a hardware-software integration that allows a user to control a firefighting unit via a



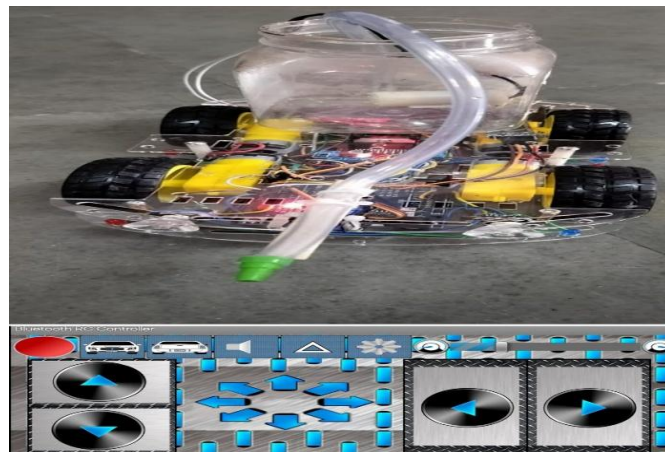
smartphone. Control Mechanism: Uses an APK application (Serial Bluetooth Terminal) to send commands via Bluetooth (HC-05/06) to the robot. Processing: Primarily utilises the Arduino Uno (ATmega328P) or ATmega48 (as noted in the hardware list) to process signals. Locomotion: Driven by DC motors interfaced through an L293D Motor Driver IC. Fire Suppression: Equipped with a flame sensor to detect the fire source and a water pump/sprinkler system triggered by a relay to extinguish it.[5]

The paper is a solid contribution to the field of assistive robotics. It successfully demonstrates a "safety-first" design by incorporating human detection and SMS alerting alongside standard firefighting capabilities. While the physical prototype is at a "proof-of-concept" stage, the architectural logic is sound.[6]

The paper presents a solid "proof-of-concept" that effectively bridges the gap between IoT monitoring and robotic action. Its primary contribution is the integration of human-safety sensors (PIR) alongside extinguishing hardware, making it more than just a fire-fighting tool.[7]

#### IV. RESULT

The development of Bluetooth control Fire Extinguisher Robot was successfully designed, assembled and tested under controlled fire conditions. The robot was controlled using a smartphone application HC-06. An application allowing the user to navigate the robot and extinguish the fire. Experiment testing showed that the Bluetooth module gave us a stable communication range up to 10 meters without signal loss. The robot responded to user commands with an average delay of less than 1 second. During fire tests, the robot was able to approach the fire source safely extinguisher fire using a water pump mechanism. The average time required to extinguish a fire was observed to be 6-10 second depending on the distance and intensity of the fire. Overall, fire suppression and safe operation without direct human involvement



#### V. DISCUSSION

The results confirm that Bluetooth-based control provides an effective and low-cost solution for operating a fire extinguisher robot remotely. The ability to control the robot from a safe distance significantly reduces the risk to human operators, making it suitable for homes, laboratories and small industrial environments. However, the system has certain limitations. Bluetooth communication is limited in range the robot relies on user intervention for fire detection and extinguishing. The extinguishing capacity is also limited to small fires due to the capacity of the water pump. The future work can focus on integrating automatic fire detection sensors along with Bluetooth control to create a hybrid system.



## **VI. CONCLUSION**

The robot fire extinguisher uses Bluetooth, which is a very practical and useful feature. The robot fire extinguisher is important in reinforcing that technology can and does improve fire safety by creating a more cost-effective and easier-to-use fire extinguisher. The robot fire extinguisher uses an Arduino Uno to control its interactions with other devices, such as a cell phone, to be able to control its movements, spray water, and control its nozzle direction. Therefore, it eliminates the risk of humans risking their safety by approaching fire flames or smoke, which can cause harm to their lives. It is easy enough to build and put together, which means it would make for a great student project or even a nice demo for the classroom! It is also extremely cheap to make and maintain, to boot, and has a broad range of uses for the indoors. Currently, the robot is only manually controlled, but it can still cope with most of the simple fire operations requirements. To make it more secure and reliable, it can include proper wiring methods that will provide protection for its electrical circuits, as well as an emergency stop feature that will allow complete shutdown of its functions when necessary.

## **VII. ACKNOWLEDGMENT**

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