Tuijin Jishu/Journal of Propulsion Technology
ISSN: 1001-4055
Vol. 44 No. 3 (2023)

# Development of an Automatic Fire Extinguisher

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**Abstract**

The work developed in this research article presents a comprehensive investigation into the development and implementation of an innovative fire suppression system. In a world where fire-related disasters continue to pose a significant threat to life and property, the need for more efficient and proactive fire safety solutions is paramount. This study delves into the design, construction, and testing of an automatic fire extinguisher system that leverages advanced sensors, artificial intelligence, and rapid response mechanisms. Through a series of controlled experiments and real-world simulations, the system's effectiveness in detecting and extinguishing fires is rigorously evaluated. The findings of this research contribute to the advancement of fire safety technology, offering a promising avenue to enhance early intervention, reduce fire-related damage, and save lives in both residential and industrial settings. The project “Automatic Fire Extinguisher Rover” presents an ingenious and dynamic approach to revolutionize fire safety systems. In the face of fire-related risks that endanger lives and property. This project introduces an autonomous rover-based fire extinguishing system capable of detecting and suppressing fires in various environments. The rover is equipped with fire and heat sensors, computer vision capabilities, and a robust fire suppression mechanism. Strategically deployed sensors enable the rover to detect sudden temperature spikes or the presence of smoke. Upon identifying potential fire incidents, the CAMERA will assess the situation, taking into account factors like fire size and environmental conditions. Once a fire is confirmed, the rover will go toward the area where the fire is detected and start the extinguishing process. The rover will maintain a reasonable distance from the fire with the help of an Ultrasonic sensor. The project's standout features include rapid response time, adaptability to diverse settings, and minimal or zero human intervention.

## Introduction

Fires pose a significant threat to life, property, and the environment, making fire safety a paramount concern in various settings. The Automatic Fire Extinguishing System project aims to design, develop, and implement a cutting-edge fire suppression solution to enhance fire safety measures in critical environments. This project seeks to leverage advanced technologies to provide rapid, efficient, and automated responses to fire emergencies, minimizing the risk of fire-related damages. Equipped with advanced sensors, the automatic fire extinguisher can detect smoke, heat, or flames at the earliest stages of a fire, ensuring early warning and immediate action.

An automatic fire extinguisher is a critical safety device designed to rapidly suppress fires without the need for human intervention. This innovative system operates by detecting the presence of a fire through various means, such as heat, smoke, or flames, and then deploying an extinguishing agent to smother the flames and prevent the fire from spreading. Typically installed in enclosed spaces or sensitive areas where fires can escalate quickly, these devices are essential for protecting property, preventing loss, and ensuring the safety of occupants.

When a fire is detected by the system's sensors, it triggers a release mechanism that activates the fire extinguisher. The extinguishing agent, which can vary depending on the system but often includes substances like dry chemicals or gas, is expelled with force to disperse it effectively over the fire source. This agent disrupts the fire triangle by either cooling the flames, removing oxygen, or interfering with the chemical reactions necessary for combustion. As a result, the fire is swiftly suppressed, minimizing damage and reducing the risk of harm to people in the vicinity.

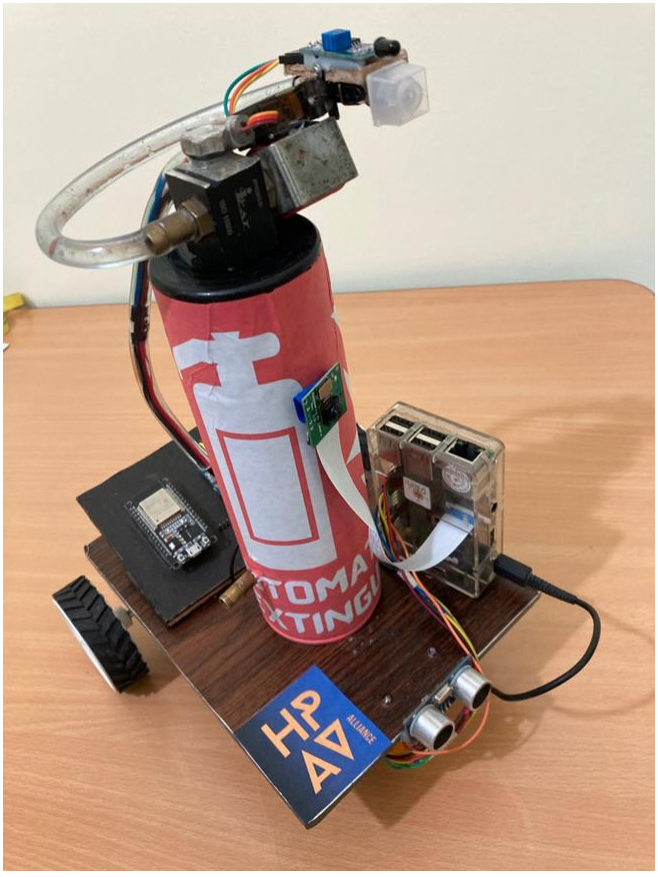

Fig. 1 : Fire controlling mobile robot arm – prototype developed

## Scopes & Objectives

In this section, we present the scopes & objectives of the developed project work.

**Scopes**

- Automatic fire extinguishers are designed to detect fires early on, often using sensors such as heat detectors, smoke detectors, or flame detectors.
- By detecting and suppressing fires early, automatic fire extinguishers help minimize property damage, equipment loss, and potential harm to occupants.
- Operate without human intervention, ensuring protection even in areas where people might not be present at all times

The scope of automatic fire extinguishers in contemporary fire safety is expansive and continues to grow as technology advances and awareness of their benefits increases. These innovative devices play a vital role in various settings, from residential homes to commercial and industrial facilities, offering a proactive and reliable means of fire suppression. In residential applications, automatic fire extinguishers are becoming increasingly popular as they provide an additional layer of protection, especially in areas where traditional fire extinguishers may not be readily accessible or practical, such as kitchens, garages, and laundry rooms. Their ability to quickly respond to fires, often before they escalate, enhances home safety and can reduce property damage.

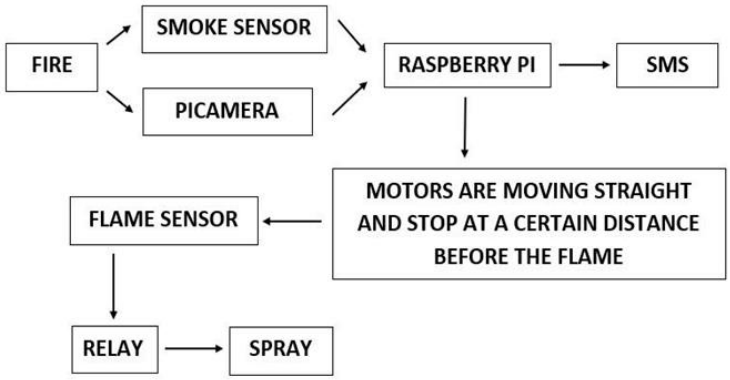


Fig. 2 : Overall block diagram of the proposed & developed fire-fighting extinguishing system

**Objectives**

- Detect fires at their incipient stages, often before they become large and uncontrollable. Early detection allows for swift response and minimizes the potential for extensive damage.
- The primary goal is to minimize property damage, equipment loss, and potential harm to human life
- Operate without human intervention, ensuring protection even in areas where people might not be present at all times.

**Proposed Methodology & Block Diagram**

Methodology 1 : Our team assembled and mounted all the components like motors, Ultrasonic sensor, ESP module, Raspberry pi, L298N module etc. on the ACP sheet

Methodology 2 : Then we wired all the sensors to connect them to the Raspberry pi.

Methodology 3 : The programming language used is C embedded and Python.

Methodology 4 : The components we used are Raspberry pi, MQ135, SIM800L, IR Flame Sensor, 2-way Toggle Switch, Lithium-ion battery, Solenoid Valve, L298N module and Buzzer.

Methodology 5 : Then we have fabricated a refillable cylinder including a solenoid valve to release the pressure inside it through a nozzle to spread liquid filled in it.

We used a servo motor which is a type of rotary actuator that is widely used in various applications. Here it is used to control the position of the fire extinguisher nozzle (130-degree angle of wide spray).

**Experimental results**

A more effective and reliable fire detection system. The outcomes of an automatic fire extinguisher system include increased safety, reduced property damage, swift response times, and minimized human intervention. These systems provide a proactive approach to fire safety, offering a valuable tool for preventing and mitigating fire-related risks. Many systems can be integrated with remote monitoring and alerting mechanisms. This allows operators or emergency responders to be notified in real-time about fire incidents, enabling them to take appropriate actions promptly. A system to safeguard lives, property, and critical assets against the devastating impacts of fire incidents.

**Advantages & Applications**

In this section, we present the advantages & applications of the developed project work.

**Advantages**

- To quickly detect fires using various sensors.
- Take real time information of fire
- It has safe and easy operations.
- System is integrated with fire alarms and also can be incorporated with message notifications.
- This system operates continuously as it is autonomous, providing round the clock protection even when no one is present in the area.

**Applications**

- To protect high-value assets, such as data centers, server rooms, art galleries.
- Used in industrial facilities to protect equipment and machinery from fire damage.
- And be able to collect information for making smart decisions.
- To protect families from the risk of fire.

**Conclusions**

The Automatic Fire Extinguishing System project presents a ground-breaking solution that revolutionizes fire safety practices. With its automated fire detection and suppression capabilities, adaptability, and user-friendly design, the system proves to be a crucial addition to safeguarding lives, property, and critical assets against the devastating impact of fire incidents. The project's successful outcomes lay the foundation for a safer and more resilient future in fire safety.

In conclusion, the research on the "Automatic Fire Extinguisher" underscores the potential of innovative technology to revolutionize fire safety measures. The developed automatic fire extinguisher system, incorporating cutting-edge sensors and artificial intelligence, has demonstrated its effectiveness in rapidly detecting and extinguishing fires. The rigorous testing and real-world simulations have substantiated its ability to provide early intervention and mitigate the devastating consequences of fires in both residential and industrial environments.

Furthermore, this research underscores the urgency of adopting proactive fire safety solutions in an era where fire-related disasters remain a persistent threat. The automatic fire extinguisher system presents a promising avenue to enhance fire prevention and containment strategies, ultimately safeguarding lives and preserving property. As we continue to refine and expand this technology, it holds the potential to become a vital component of comprehensive fire safety measures, contributing to a safer and more secure future for communities worldwide.

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