

# SENSATIONAL ANALYSIS OF FIRE EXTINGUISHING METHOD USING AI

Sujithgavaskar S<sup>1</sup>, Vairamani R<sup>2</sup>, A C Mariappan<sup>3</sup>, G Peter packiaraj<sup>4</sup>

<sup>1,2</sup>FINAL YEAR B.E MARINE CADET,PSN CET, TIRUNELVELI, TAMIL NADU

<sup>3,4</sup>ASSISTANT PROFESSOR,DEPARTMENT OF MARINE ENGINEERING,PSN CET,TIRUNELVELI, TAMIL NADU

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## ABSTRACT

The Digital Fire Extinguisher is an intelligent fire suppression system that integrates sensors. The system consists of a network of sensors that monitor temperature, smoke, and gas levels, alerting authorities in real-time. The AI-powered algorithm analyzes data to determine the type and size of the fire, selecting the most effective extinguishing agent and deploying it with precision. The system also provides real-time video feed and incident reports, enabling emergency responders to assess the situation remotely. The Digital Fire Extinguisher aims to reduce fire-related damages, injuries, and fatalities by providing a swift, efficient, and informed response to fire incidents.

This innovative system integrates Artificial Intelligence (AI), Computer Vision, and IoT technologies to create a cutting-edge fire suppression solution. The AI-powered Digital Fire Extinguisher detects fires through real-time video analysis, identifying potential hazards and alerting authorities.

## The AI algorithm

- Analyzes video feed to detect smoke, flames, and heat
- Classifies fire type (electrical, chemical, etc.) and severity
- Selects optimal extinguishing agent and deployment strategy
- Deploys targeted suppression, minimizing damage and environmental impact
- Provides real-time incident reports and video feed for emergency responders

**Key word:** digital fire extinguisher use AI

## INTRODUCTION

The maritime industry is no stranger to fire-related risks, with vessels carrying hazardous cargo, fuel, and electrical equipment. A single spark can ignite a destructive fire threatening life property and the environment. Traditional fire suppression methods on ships often rely on manual

activation, water-based systems, or chemical agents, which can be ineffective, damaging, or harmful. Imagine a more advanced solution – a Digital Fire Extinguisher System, specifically designed for ships, that leverages Artificial Intelligence (AI), sensor technologies, and optimized extinguishing agents to detect and suppress fires at an early stage.

This innovative system can be integrated into a vessel's infrastructure, providing real-time monitoring, swift response, and minimized damage.

By harnessing the power of AI and digital technologies, the Digital Fire Extinguisher System aims to revolutionize fire safety at sea, protecting lives, cargo, and the marine ecosystem. Safety at sea, protecting lives, cargo, and the marine ecosystem.

## Types

- **Water Extinguishers (Class A):** Effective against fire involving paper, wood, clothing, and garbage.
- **Foam Extinguishers (Class B):** Suitable for fires involving flammable liquids, such as oil, gasoline, or paint.
- **Dry Chemical Extinguishers (Class B and C):** Effective against fires involving flammable liquids and electrical equipment.
- **Dioxide (CO<sub>2</sub>) Extinguishers (Class B and C):** Ideal for fires involving electrical equipment and flammable liquids.
- **Halon Extinguishers (Class B and C):** Effective against fires involving electrical equipment and flammable liquids, but being phased out due to environmental concerns.
- **Wet Chemical Extinguishers (Class K):** Designed for kitchen fires involving cooking oils and greases.

## Using steps of fire extinguisher

- **Identify the type of fire**
  - Class A (ordinary combustibles)
  - Class B (flammable liquids)

➤ Class C (electrical fires)

➤ Class D (combustible metals)

### Choose the correct extinguisher

➤ Water (A)

➤ Foam (B)

➤ Dry chemical (B, C)

➤ Carbon dioxide (B, C)

➤ Halon (B, C)

### • Follow the PASS method

P-Pull the safety pin or ring

A-Aim the A -nozzle at the base of the fire

S-Press the handle to release extinguishing agent

S – Sweep the nozzle from side to side, covering the entire area

### • Evacuate and call for help

➤ Alert others and activate the ship's fire alarm

➤ Call for assistance from the ship's crew or emergency services

### • Use additional extinguishers if necessary

➤ If the fire is very large or spreading, use additional extinguishers

### • Follow ship-specific procedures

➤ Familiarize yourself with the ship's fire safety plan and equipment

### Location

•**Bridge:** Near the helm or navigation station

•**Engine Room:** Near the entrance, on bulkheads, or near machinery

•**Galley (Kitchen):** Near cooking appliances or exit doors

•**Accommodation Areas:** In corridors, near stairwells, or outside cabins

•**Cargo Hold:** Near access points or in cargo handling areas

•**Machinery Spaces:** Near equipment, such as pumps, generators, or compressors

•**Deck Areas:** Near hatchways, cranes, or winches

•**Lifeboat Stations:** Near emergency escape route

### Maintenance

**Monthly Inspections:** Check the extinguisher's pressure gauge, hose, nozzle, and handle for damage or wear.

**Annual Maintenance:** Inspect the extinguisher's internal components, clean the agent container, and replace the battery

**6-Year Maintenance:** Perform a thorough inspection, replace the hose and nozzle and recharge or replace the extinguishing agent.

**12-Year Hydrostatic Test:** Test the agent container's integrity and replace it if necessary.

### Inspection

**Visual Inspection:** Check for damage, corrosion or wear on the exterior and components. of the fire extinguisher

**Pressure Gauge Inspection:** make sure the pressure gauge is within the recommended limits.

**Weight Inspection:** Verify the extinguisher's weight is within the recommended range.

**Tag Inspection:** Check the inspection tag for the latest maintenance and inspection records **Digital Features**

**Automatic Alerts:** Receive notifications for maintenance, inspections, or issues.

**Remote Monitoring:** Track the extinguisher's status and maintenance needs remotely.

**Digital Inspection Records:** Store and access maintenance and inspection records digitally.

**DIGITAL FIRE EXTINGUISHER PICTURE**



**FIG 1 Digital fire extinguisher model**



**Fig 2 Digital fire extinguisher**

**The parts of digital fire extinguisher:**

- **Digital display** : shows fire extinguisher status pressure and maintenance alerts
- **Sensor** : monitor the extinguisher pressure ,temperature and other vital signs
- **Microcontroller** :the brain of the extinguisher processing data and controller operations
- **Alarm**: trigger audible and visual alerts in case of issues or maintenance need
- **Pressure gauge** : displays the internal pressure of the extinguishing agent
- **Agent container** : holds the extinguishing Medium (e.g., clean agent , water , or foam
- **Hose and nozzle** : directs the agent onto the fire
- **Handle** : carries the fire extinguisher and operates the nozzle

- **Inspection tag** : track maintenance and inspections
- **Battery(if applicable)**: power the digital components
- **Led indicators(if applicable)**: show status ,alerts, or maintenance need

**The working of fixed fire fighter system on digital in a table format:**

COMPONENTS	DISCRIPTION	WORKING
Sensors	Detects heat, smoke or flames	Sends signal to control panel
Control panel	Receives signal from sensors	Activates alarm and alerts
Actuator	Receives signal from control panel	Releases fire-suppressing agent
Fire -suppressing agent	Extinguishes or suppresses fire	Discharged through nozzles or pipes
Nozzles/pipes	Distributes fire-suppressing agent	Directed at specific areas or hazards
Power Supply	Provides power to system	Ensures continuous operation

**TIME GRAPH**



**Fig 3 Time difference between the digital and normal fire extinguisher**

### Fire Extinguisher

- Detection Time: 3 minutes (represented by 3 bars)
- Alarm Time: 2 minutes (represented by 2 bars)
- Discharge Time: 5 minutes (represented by 5 bars)
- Total Response Time: 10 minutes (represented by 10 bars)

### Digital Fire Extinguisher

- Detection Time: <1 minute (represented by 1 bar)
- Alarm Time: <1 minute (represented by 1 bar)
- Discharge Time: <2 minutes (represented by 2 bars)
- Total Response Time: <3 minutes (represented by 3 bars)

### The control system of a digital fire extinguisher typically include

- **Microcontroller** : the brain of the extinguisher, processing data and controlling operation
- **Sensor interface** :connects sensor to the microcontroller monitoring pressure, temperature and other vital signs
- **Alarm and notification system** :trigger audible and visual alerts in case of issues or maintenance needs
- **Pressure control system**: regulates the pressure of the extinguishing agent
- **Flow control system**:managethe flow rate of the agent during discharge
- **Valve control system** : opens and closes the valve to release the agent
- **Power management system** :manages battery life and power consumption
- **Communication interface**: allows for connectivity to building management system or monitoring station

**Software and firmware**: controls the extinguisher operation and provides updates

### These control systems work the fire extinguisher

- Always ready for use
- Properly maintained
- Functioning correctly
- Notified in case of issues

### Conclusion

The Digital Fire Extinguisher (DFE) revolutionizes fire safety management by integrating AI-powered detection, automated response, and real-time monitoring.

### Enhanced Safety

1. Rapid detection and response
2. Reduced false alarms
3. Improved emergency response times

### Increased Efficiency

1. Automated maintenance scheduling
2. Predictive analytics for proactive maintenance
3. Reduced downtime and costs

**This result in enhanced safety reliability and ease of use**

### BIOGRAPHIES



I am pursuing B.E final year marine engineering cadet at PSN College of engineering & technology, tirunelveli, tamilnad



I am pursuing B.E final year marine engineering cadet at PSN College of engineering and technology, tirunelveli, tamilnadu



Project guide cum assistant Engineering & technology, Tirunelveli, tamilnadu.also Having 15 years experience in oil and gas industries. Specialization in NDT and Project guide cum assistant



Professor PSN College of  
Engineering & technology,  
Tirunelveli, tamilnadu MEO  
Class-IV marine engineering  
And worked varies countries