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REVIEW PEPAR ON‘ DESIGN AND FABRICATION OF FIRE SAFETY DRONE

Author Name – Pranav Farde[1], Dhiraj Salunke[2], Mayur sase[3], Vaishnavi varkute[4]

guidance

Prof. Dr.keshav kumar & Prof.rajesh kumar

(Department of Mechanical Engineering)

Institute Name – Alamuri Ratnamala Institute of Engineering and Technology (ARMIET)

ABSTRACT

Fire accidents in high-rise buildings, industrial zones, and hazardous environments pose serious risks to human life and property. Traditional firefighting methods often face limitations in accessibility and safety. This paper presents a review of a Fire Safety Drone system designed to assist firefighting operations using an unmanned aerial vehicle (UAV) connected to a ground-based water supply. The system enables continuous water spraying without onboard storage, improving efficiency and safety. The study discusses system components, working principles, advantages, limitations, and performance outcomes. Results indicate improved firefighting capability in inaccessible areas with reduced risk to human firefighters.

1. INTRODUCTION

Firefighting in hazardous and inaccessible environments remains a major challenge. Conventional methods rely heavily on human intervention, which increases the risk to firefighters. With advancements in drone technology, unmanned aerial vehicles (UAVs) have emerged as effective tools in emergency response.

A Fire Safety Drone is designed to reach difficult locations and deliver firefighting agents with precision. Unlike traditional drones, this system uses a ground-based water reservoir connected via a high-pressure pipe, ensuring continuous water supply. This innovation enhances operational efficiency and safety in firefighting applications.

2. LITERATURE REVIEW

Recent developments in UAV technology have enabled their use in disaster management, surveillance, and firefighting. Studies highlight that drones can significantly reduce response time and improve situational awareness.

Research in aerial firefighting systems emphasizes:

Use of drones for fire detection and monitoring

Integration of water or fire retardant spraying mechanisms

Improvement in precision targeting and accessibility

However, challenges such as limited payload capacity, flight time, and environmental conditions still exist. The concept of a ground-supported water supply system addresses some of these limitations by eliminating onboard storage requirements.

3. OBJECTIVES

The main objectives of the Fire Safety Drone system are:

To design a high-thrust drone capable of carrying a water pipe

To provide continuous water supply from a ground reservoir

To improve safety by reducing firefighter exposure to hazards

To achieve precise targeting of fire sources

To evaluate system stability and performance

4. METHODOLOGY

The development of the Fire Safety Drone involves the following steps:

System Design: Selection of drone frame and propulsion system

Component Selection: Motors, ESCs, battery, and control system

Integration: Connecting the drone to a ground-based pump via a flexible pipe

Fabrication: Assembly of drone and water delivery mechanism

Testing: Evaluating flight stability and water spraying efficiency

Performance Analysis: Observing effectiveness in real-time firefighting scenarios

5. SYSTEM DESIGN

The system consists of the following components:

Drone frame

BLDC motors and propellers

Electronic Speed Controllers (ESCs)

Flight controller

Li-Po battery

Ground water reservoir

High-pressure pump

Flexible pipe

Spray nozzle

Remote control system

The drone is connected to a ground pump that continuously supplies water through a pipe, enabling extended firefighting operations.

6. WORKING PRINCIPLE

The Fire Safety Drone operates as follows:

The drone takes off and navigates to the fire location

A ground-based pump pushes water through a high-pressure pipe

The pipe is connected to the drone's spray nozzle

Water is directed precisely onto the fire

The operator controls the drone remotely and monitors the situation

7. ADVANTAGES

Rapid response to fire incidents

Access to hazardous and inaccessible areas

Reduced risk to human life

Real-time monitoring and control

Continuous water supply

Environmentally friendly firefighting

8. LIMITATIONS

Limited flight time due to battery constraints

Performance affected by weather conditions

High initial setup cost

Requires skilled operators

Regulatory restrictions on drone usage

9. RESULTS

The system demonstrated:

Stable drone flight with attached pipe

Effective and continuous water spraying

Improved firefighting efficiency

It is especially useful in high-rise buildings and hazardous environments where traditional methods are less effective .

10. FUTURE SCOPE

Integration of thermal cameras for fire detection

Use of autonomous navigation and AI-based control

Lightweight and stronger pipe materials

Enhanced battery life for longer operation

Multi-drone coordinated firefighting systems

11. CONCLUSION

The Fire Safety Drone is an innovative solution for modern firefighting challenges. It improves safety, efficiency, and accessibility in emergency situations. The system reduces dependence on human intervention in dangerous

environments and provides a reliable method for continuous firefighting. With further advancements, it has the potential to become an essential tool in disaster management and emergency response systems.

12. REFERENCES

Research on UAV-based firefighting systems

Studies on drone applications in disaster management

1. Anderson, J. D., Introduction to Flight, McGraw-Hill Education.
2. Austin, Reg, Unmanned Aircraft Systems: UAV Design, Development and Deployment, Wiley Publications.
3. K. Ramachandran, Fire Safety Management Handbook, Tata McGraw-Hill.
4. Ian Moir & Allan Seabridge, Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration, Wiley.
5. Research on UAV-Based Fire Detection and Monitoring Systems – IEEE