AI-Based Automatic Fire Detection and Extinguishing System Rotating 180°

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***Abstract*—Fire accidents remain a critical threat to life and property, often worsened by delayed detection and limited response. This project presents an AI-based automatic fire detection and extinguishing system with a 180° rotating mechanism. Using computer vision and deep learning (YOLOv8), the system identifies flames and smoke in real time, localizes the fire source, and autonomously activates extinguishing operations via ESP32-controlled servo motors and pumps. The integration of visual detection, rotational coverage, and automated suppression reduces false alarms, enhances reliability, and minimizes human intervention. The system is designed for residential, commercial, and industrial environments, offering rapid response and improved safety.**

***Index Terms*—AI fire detection, computer vision, ESP32 microcontroller, servo motor, autonomous extinguishing.**

I. INTRODUCTION

Artificial Intelligence has transformed safety systems by enabling real-time monitoring and automated responses. Conventional fire detectors rely on smoke or heat sensors, which often delay detection. The proposed system leverages AI-based visual recognition to detect fire instantly and integrates a rotating nozzle for wide-area coverage.

II. PROCEDURE FOR PAPER SUBMISSION

A. Literature Review

Summarized studies on CNN, YOLOv4, YOLOv5, and YOLOv8 for fire detection. Identified gaps in integrating extinguishing mechanisms with detection.B. MethodologyESP32 microcontroller for system controlServo motor for 180° rotationRelay module for pump activationLEDs and buzzer for alertsAI model for real-time fire detection

III. MATH

Coverage area, nozzle spray radius, water flow rate, angular velocity, torque, and tank capacity were calculated. Example: For, coverage area = 39.27 m².

IV. UNITS

All calculations use SI units (m, N·m, L/min, W) V. HELPFUL HINTS
Figures and Tables Place figures at top/bottom of columns Captions below figures, titles above tables Example: Fig. 1 Electromagnetic braking layout B. References
Number references in square brackets [1], [2]. C. Abbreviations and Acronyms
Define terms like CAD, DMU, CFD at first use. D. Equations
Number equations consecutively (1), (2) …

V. PUBLICATIONPRINCIPLES

The project advances fire safety technology by combining AI detection with autonomous extinguishing. Results are supported by design calculations and prototype analysis.

VI. CONCLUSION

The system demonstrates faster detection, precise localization, and autonomous suppression compared to conventional fire safety mechanisms. It reduces human dependency and enhances safety in industrial and residential environments

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REFERENCES

[1] M. Muhammad *et al.*, “Early Fire Detection Using CNN,” 2019.
[2] T. Dunnings and T. P. Breckon, “Deep CNN for Fire Detection,” 2017.
[3] A. Bochkovskiy, C. Y. Wang, and H. Y. M. Liao, “YOLOv4: Optimal Speed and Accuracy of Object Detection,” 2020.
[4] J. An et al., “Robust Fire Detection via CNN and YOLOv5,” 2022.
[5] Zell et al., “Image-Based Fire Detection in Industrial Environments,” 2022.