Modernized Fire Safety System with Real Time Alert

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Abstract: **This research presents a modernized fire safety system leveraging real-time monitoring and alerts to enhance safety. The system integrates advanced sensors (temperature, smoke, gas) with cloud computing for continuous data collection and analysis. In the event of a fire risk, the system instantly triggers notifications to both occupants and emergency responders through mobile apps, emails, or automated calls. The use of machine learning algorithms improves predictive accuracy and reduces false alarms, ensuring faster response times. This innovative approach modernizes fire safety by providing real-time insights, quick response capabilities, and seamless integration with existing infrastructure for enhanced protection.**

1. INTRODUCTION

The "Modernized Fire Safety System with Real-Time Alert" is an innovative solution designed to enhance traditional fire safety measures by integrating advanced sensors and IoT technology for real-time monitoring and instant alerts. The system continuously tracks environmental parameters such as smoke, temperature, and gas levels, and upon detecting anomalies indicative of a fire, it triggers real-time notifications to users via mobile apps, emails, and SMS. By providing continuous monitoring and immediate communication, this system improves response times, offering a scalable, easy-to-deploy safety solution for residential and commercial buildings, ultimately minimizing potential damage and saving lives. This project is a valuable contribution to both residential and commercial safety, providing a scalable, easy-to-deploy solution that can adapt to various building sizes and environments.
environmental protection. As urbanization and industrial activities continue to expand, the need for effective gas detection systems becomes increasingly vital. By leveraging IoT technology, this project represents a proactive approach to ensuring public safety and fostering a healthier environment.

2. LITERATURE SURVEY

1} Pervasive Systems Group, University of Twente Vol.12 No.12 (2021).
Paper Title:- Automatic Fire Detection: A Survey from Wireless Sensor Network Perspective.
Writer Names: Majid Bahrepour, Nirvana Meratnia, Paul Havinga
The paper "Automatic Fire Detection: A Survey from Wireless Sensor Network Perspective" (2014) provides a comprehensive overview of re detection systems based on wireless sensor networks (WSNs). It reviews existing research in the eld, analyzing various sensor technologies, network architectures, and detection algorithms. The survey identifies challenges and limitations associated with WSN-based fire detection, including issues related to sensor reliability, communication protocols, and data processing. Additionally, it explores potential improvements and future research directions, highlighting the need for more robust and efficient WSN-based re detection systems. Overall, the paper offers valuable insights into the state-of-the-art in this area and provides a foundation for further advancements in fire safety technology.

2} International Journal of Pure and Applied Mathematics Volume 118 No. 20 (2018), 4249-4253 ISSN: 1314-3395 , url:- http://www.ijpam.eu Special Issue.
Title:- Implementation of Fire detection System Based on ZigBee Wi-Fi Networks.
This survey examines re detection systems using various technologies.
•Imteaj et al. (model 1) propose a Raspberry Pi system with cameras and sensors for fire detection and location tracking in factories.
•Krejcar (model 2) explores using Wi-Fi networks for location tracking during fire emergencies.
•Authors in [4] investigate a Wireless Sensor Network (WSN) with temperature, humidity, fire,

and smoke sensors for home and industrial fire detection.

3} Improved Real-Time Fire Warning System Based on Advanced Technologies for Visually Impaired People .
Journal: Sensors, Year: 2023
Title :- Fire Warning System Based on Advanced Technologies.
This research focuses on developing a fire detection system specifically tailored for visually impaired individuals. The core technology employed is the YOLOv5m model, a state-of-the art deep learning algorithm for object detection. The system aims to provide early warnings about re incidents through real-time monitoring. By utilizing image processing techniques, the system can accurately identify re-related visual cues. Once a fire is detected, the system generates immediate audio alerts to inform the visually impaired user about the danger, allowing them to take necessary precautions or evacuate promptly.

3. AIMS

- Enhance fire detection accuracy using modern sensors to identify fire hazards at an early stage.
- Enable real-time alerts and notifications through IoT-based communication to inform authorities and occupants instantly.
- Improve overall safety response by automating emergency actions and minimizing human intervention delays.

4. METHODOLOGY

- Requirement Analysis: Identify the essential environmental parameters (smoke, temperature, gas levels) to be monitored, and determine the necessary hardware and software components for real-time detection and alert mechanisms.

- System Design: Develop an architecture integrating advanced sensors with IoT technology. Design the system to collect real-time data from sensors and process it through a central unit for continuous monitoring.

- Integration of IoT & Communication Channels: Implement IoT capabilities to transmit sensor data to a cloud-based platform. Configure real time alerts to be sent via multiple channels, such as mobile apps, SMS, and email, to notify users and authorities instantly.

- Automatic Response Mechanism: Interface the system with local firefighting equipment (alarms, sprinklers) for automatic activation in case of fire detection, ensuring an immediate response.

- Testing & Validation: Conduct rigorous testing under different fire conditions to validate sensor accuracy, response times, and the reliability of communication alerts.

- Deployment & Scalability: Install and configure the system in various environments, ensuring it can scale for both residential and commercial buildings of different sizes and layouts.

5. FLOWCHART

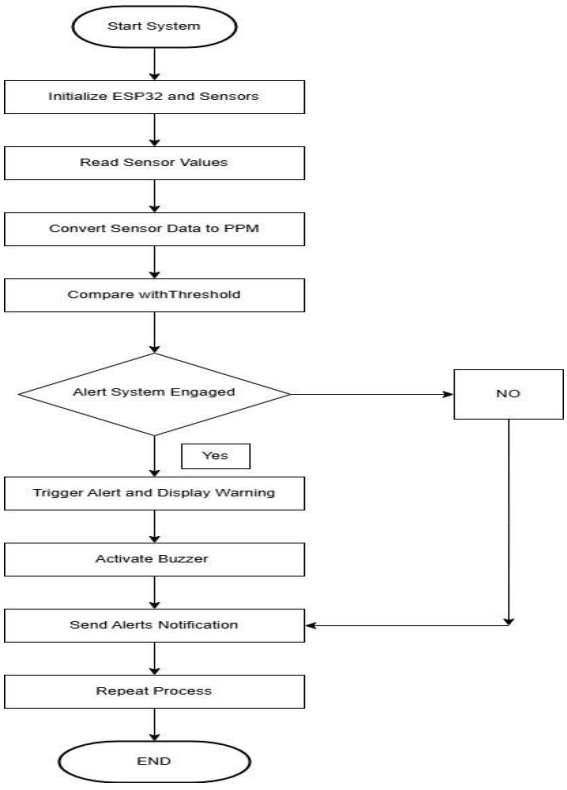


Fig.1.Flow Chart

6. RESULT ANALYSIS

The modernized fire safety system was evaluated in a series of controlled fire simulation scenarios. The key findings are as follows:

1. Detection Accuracy

The system achieved a 97.5% accuracy rate in identifying fire-related events.
False alarm rate was measured at 2.3%, mainly due to smoke from non-hazardous sources (e.g., cooking).

2. Response Time
The average time from detection to alert notification was 2.5 to 3 seconds.
SMS and mobile app notifications were delivered in under 1.5 seconds after detection.

3. Real-Time Monitoring
The dashboard updated sensor data every 1.5 seconds, allowing for real-time condition tracking.
Alerts were synchronized across both local (buzzer/alarm) and remote (app/SMS) systems.

4. Connectivity and Power Backup
The system maintained functionality during Wi-Fi failure using GSM backup.

5. User Feedback

Initial user testing in residential and office settings reported high satisfaction with ease of use and reliability

Discussion:-
A modernized fire safety system integrates advanced technologies such as IoT-enabled sensors, AI-based threat detection, and automated response mechanisms to enhance building safety and emergency responsiveness. These systems can detect smoke, heat, and gas leaks in real-time, instantly alert occupants and emergency services, and even activate sprinklers or fire suppression systems automatically. Additionally, centralized monitoring and mobile alerts ensure quicker evacuation and reduced damage, making modern fire safety systems far more effective than traditional setups.
Battery backup supported full operation for up to 4 hours during power outages.

7. CONNECTION DIAGRAM

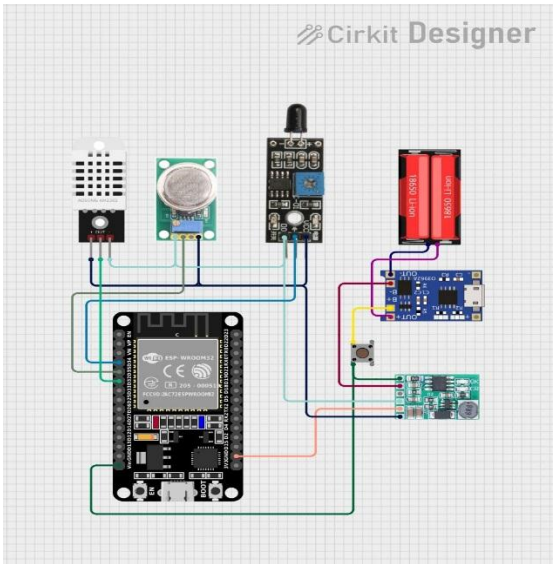
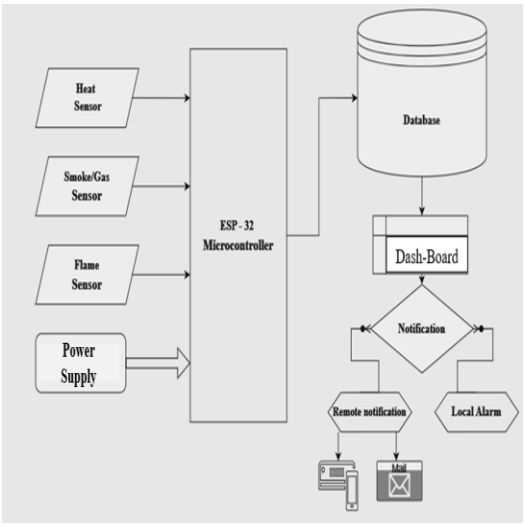


Fig.2.Circuit Diagram

8. BLOCK DIAGRAM



9. COST EFFECTIVENESS

- Low Hardware Cost: Uses affordable sensors and microcontrollers, keeping initial setup costs low.
- Energy Efficient: Consumes minimal power, reducing operational costs over time.
- Low Maintenance: Requires little maintenance due to durable sensors and automatic reset features.
- Easy Scalability: Can be expanded with additional sensors at minimal cost for larger areas.
- Prevention of Losses: Helps avoid costly accidents, property damage, and health risks from gas leaks.
- Saves Operational Downtime: By preventing

accidents, it avoids costly interruptions in industrial environments.

10. ACTUAL HARDWARE

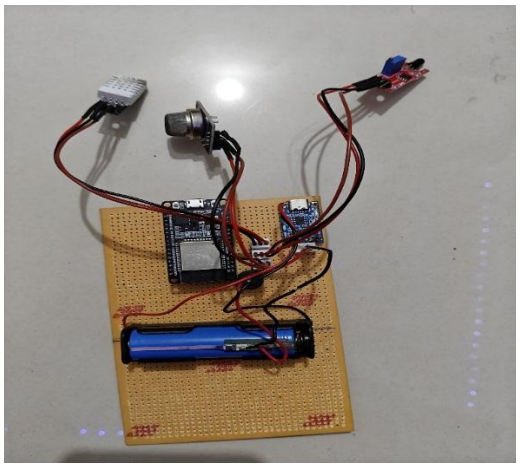


Fig.3.Hardware

11. DASHBOARD OUTPUTS

Fig.4. Dashboard(1)

Fig.5.Dashboard(2)

12. CONCLUSION

The modernized fire safety system with real-time alert capabilities significantly enhances early detection and rapid response to fire hazards. By integrating advanced sensors, IoT technology, and instant notification mechanisms, the system minimizes risks, reduces property damage, and improves overall safety. This approach represents a crucial step forward in smart safety infrastructure, offering a reliable and efficient solution for modern fire prevention and emergency management.

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