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A SMART FIRE DETECTION SYSTEM USING IOT WITH AUTOMATICWATER SPRINKLER

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Abstract

Fire detection is a critical aspect of ensuring safety in various environments, including homes, offices, and industrial settings. This project presents a fire detection system that integrates IoT, GPS, and GSM technologies using an Arduino board. The system is designed to detect fires using a flame sensor and send the location coordinates to emergency contacts via SMS using the GSM module. The GPS module provides real-time location tracking, enabling quick response and mitigation of fire hazards. The system's architecture consists of a flame sensor connected to the Arduino board, which processes sensor data and triggers the GSM module to send an SMS alert. The GPS module retrieves the current location coordinates, which are included in the alert message. The system is tested for its ability to accurately detect fires and transmit location information reliably. The system's low cost and ease of deployment make it suitable for various applications, including homes, offices, and industrial facilities. The project contributes to enhancing fire safety measures by providing a reliable and efficient fire detection and alerting system.

Keywords—*Nodemcu8266, buzzer, Air filter, DC Fan, Fire sensor, Android Application.*

I. INTRODUCTION

Fire safety is a critical concern in both residential and industrial environments, with the potential for devastating consequences if not properly addressed. Early detection of fires is key to minimizing damage and ensuring the safety of occupants. Traditional fire detection systems are often costly and complex, limiting their accessibility and deployment in various settings. The advancement of technology, particularly in the fields of IoT (Internet of Things), GPS (Global Positioning System), and GSM (Global System for Mobile Communications), offers new opportunities for improving fire detection systems. These technologies can be integrated to create a more efficient and cost-effective

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solution for early fire detection and alerting. This project focuses on the development of a fire detection system that utilizes IoT, GPS, and GSM technologies using an Arduino board. The system is designed to detect fires using a flame sensor and send the location coordinates to emergency contacts via SMS using the GSM module. The GPS module provides real-time location tracking, enabling quick response and mitigation of fire hazards. The project aims to address the limitations of traditional fire detection systems by providing a scalable and easily deployable solution that can be implemented in a variety of environments. By leveraging the capabilities of IoT, GPS, and GSM technologies, the system offers a more reliable and efficient method for detecting fires and alerting authorities. The implementation of the system involves the integration of hardware components, including the flame sensor, GPS module, and GSM module, with the Arduino board. The software component includes the development of code to process sensor data, trigger alerts, and communicate with emergency contacts. The project's significance lies in its potential to improve fire safety measures in a costeffective and scalable manner. By providing early detection and alerting capabilities, the system can help reduce the impact of fires and save lives. The following sections will detail the methodology, results, and implications of the project, highlighting its contributions to the field of fire safety and emergency response. The IoT integration allows for real-time monitoring and remote control of the system, enhancing its effectiveness and responsiveness. Overall, the project seeks to enhance fire safety measures by providing a proactive and efficient solution for fire detection and suppression in various environments.

A smart fire detection system using IoT technology with automatic water sprinklers is a modern solution that detects fires quickly and activates sprinklers automatically. It utilizes sensors to detect fires, connects them to a central control unit via IoT, and triggers alerts and sprinkler activation upon fire detection. This system offers early detection, automated response, remote monitoring, and reduced false alarms, making it an effective and efficient fire safety solution for various settings.

II. METHODOLOGY

Existed Method

Traditional fire detection and suppression systems typically operate with manual intervention, relying on occupants or trained personnel to activate fire alarms and sprinklers upon detection of a fire. These systems often function as standalone units with limited connectivity, hindering real-time monitoring and coordination. Consequently, delays in emergency response are common, allowing fires to escalate and cause more extensive damage before suppression measures are initiated. Moreover, the effectiveness of traditional systems heavily depends on human judgment and timely action, which can be influenced by factors such as panic or human error. Additionally, there is limited capability for

real-time data analysis to differentiate between genuine fire incidents and false alarms, leading to potential disruptions and unnecessary activation of suppression systems.

Proposed System:

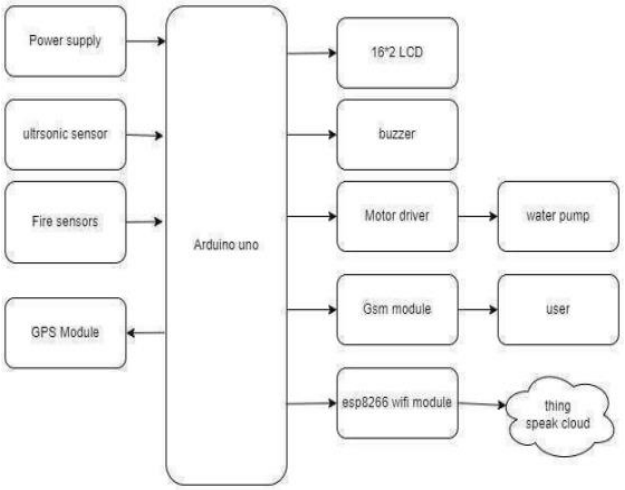

Fig 1:Block diagram for proposed system

A proposed system for fire detection and automatic water sprinkler using IoT would consist of various sensors and devices that can communicate with each other over a network. The system would include fire detectors and water sprinklers that are connected to a central hub or server through a wireless connection. The fire detectors would be installed in various locations throughout a building, and would constantly monitor for the presence of smoke or flames. When a fire is detected, the detectors would send a signal to the central hub, which would then trigger the water sprinklers to turn on automatically. The system would also be equipped with a control panel, which would allow building managers or fire fighters to monitor the status of the system and manually trigger the sprinklers if necessary. The system could also be programmed to send notifications to the relevant authorities or emergency services in case of a fire. Overall, an IoT based fire detection and automatic water sprinkler system would provide an efficient and reliable means of detecting and responding to fires, potentially saving lives and minimizing property damage.

Advantages:

Rapid Detection: The system employs advanced sensors and real-time data analysis to detect fires quickly and accurately, enabling swift response to emergencies.

Automated Response: Upon detection of a fire, the system automatically activates water sprinklers in

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the affected area without the need for manual intervention, minimizing response times and containing the fire before it can escalate.

Enhanced Connectivity: Leveraging IoT technology, the system integrates sensors, control units, and sprinkler systems into a unified network, enabling seamless communication and coordination between components. Remote Monitoring and Control: Building managers and emergency responders can remotely monitor the system's status, receive alerts, and take control actions if necessary, allowing for proactive management of fire emergencies from anywhere with an internet connection.

Reduced False Alarms: Real-time data analysis helps differentiate between genuine fire incidents and false alarms,minimizing disruptions and unnecessary activation of suppression systems, thereby improving system reliability.

Improved safety: The rapid response and automated nature of the system enhance overall safety by minimizing damage to property and reducing the risk to occupants during fire emergencies.

Integration with other Systems: The system can be integrated with other building automation systems such as HVAC and access control systems, enhancing overall safety and efficiency of building operations.

Efficient Resource Utilization: By automating the response process and minimizing false alarms, the system optimizes resource utilization and reduces maintenance costs associated with traditional system.

IV. RESULTS

The output of the project, referring to the system's functionality and deliverables, can be understood at various levels:

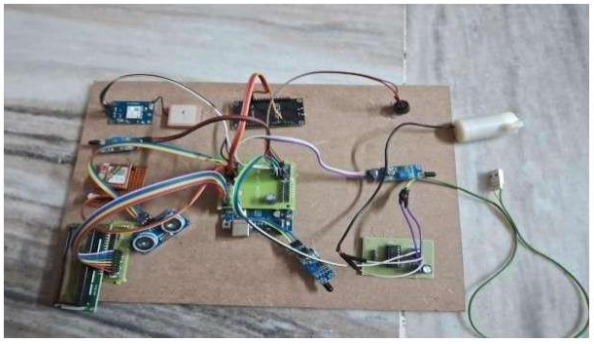

Fig 2: Circuit

1. Fire Detection: The primary output is the system's ability to detect fires accurately and promptly using advanced sensors such as smoke detectors, heat sensors, or flame detectors. Upon detecting a fire, the system generates alerts to notify stakeholders of the emergency.

2. Data Analysis: The system processes data collected from sensors in real-time, employing sophisticated algorithms to analyze the information and differentiate between genuine fire incidents

and false alarms. This ensures reliable and effective fire detection while minimizing disruptions caused by false alarms.

3. Automatic Sprinkler Activation: In response to a confirmed fire, the system automatically activates water sprinklers in the affected area to suppress the fire and prevent its spread. This rapid response mechanism helps minimize damage and risk to occupants and property.

4. Remote Monitoring and Control: Building managers and emergency responders can remotely monitor the system's status and receive alerts via a user interface accessible from anywhere with an internet connection. They can also take control actions if necessary, such as remotely activating or deactivating the sprinkler system.

Fig 3: Fire is not detected at location 1

• If the fire is detected at any place, then it displays “0” in the thing view application, alerts the people through buzzer, and sends an SMS to the nearby fire station, also automatically triggers the motor and water sprinkler gets ON.

• If the fire is not detected, it just displays “1”.

Fig 4:Fire is detected at location 2

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Fig 5:Fire is not detected at location 3

V. CONCLUSION

In conclusion, the proposed system demonstrates the feasibility of using IoT, GPS, and GSM technologies for fire detection and alerting. By leveraging these technologies, the system provides a cost-effective and efficient solution for early fire detection and rapid response. The system's simplicity and ease of deployment make it suitable for a wide range of applications, from residential homes to industrial facilities.

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