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IoT Based Fire Detector with Wireless Alert

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Abstract: The Fire Detector with Wireless Alerts project demonstrates an advanced fire detection and alerting system that uses NodeMCU and Internet of Things technology to improve safety in both home and commercial settings. To enable quick fire detection and alert distribution, the system has a buzzer, LED indications, and a flame sensor. The NodeMCU is activated by the flame sensor when it detects fire, resulting in both visual and aural notifications. Additionally, real-time notifications to customers' smartphones are made possible via IoT integration with Blynk, guaranteeing instant awareness no matter where they are. This small, affordable device offers dependable fire threat monitoring along with scalability for other features like sophisticated automation and predictive analytics. A contemporary approach to safety management and fire prevention is demonstrated by the project's focus on flexibility, simplicity, and IoT functionality.

Keywords: **- IoT, NodeMCU, Wireless Alerts, Fire detection**

1. Introduction:

These devices often employ various sensors and technologies to monitor whether the fire accident has happened like flame sensor, temperature sensor, gas sensor. This sensors are positioned on top of a rotating platform that is connected to the servo meter. Due to this sensors if fire detected in extinguisher an nozzle is linked to rotating base. Furthermore, the fire activity can be monitored using IoT with the blynk software which alerts a message about the fire [3]. The alert mechanism plays an essential role in ensuring timely responses to fire hazards. The system uses sensors like smoke detectors, heat sensors, or gas sensors to detect the presence of fire. Once the sensors detect a fire or hazardous condition, they trigger an alert. This can be in the form of audible alarms, visual signals, or both. With IoT integration, the system can send real-time notifications to remote devices via platforms like Blynk. Blynk software, connected to the system, enables users to monitor fire hazards through a smartphone app. When a fire is detected, Blynk sends an instant alert message to the user's phone, ensuring that the user is notified even if they are away from the location. This notification allows for quick action, such as contacting emergency services or activating an automatic fire suppression system like sprinklers or extinguishers, which may also be controlled remotely through the Blynk app [4]. Beyond its immediate fire detection and response capabilities, the system

leverages IoT features to offer remote monitoring and control. This is particularly useful in industrial and commercial applications where multiple buildings or areas need to be monitored simultaneously. Through a dedicated mobile app or web dashboard, users can receive alerts, check the system's status, and even control the fire-extinguishing mechanisms from anywhere in the world. This remote accessibility provides peace of mind, knowing that fire hazards are being watched around the clock. Furthermore, the system can log data from sensors into a cloud database, where analytics and machine learning algorithms can be applied to detect trends or predict potential fire risks. Over time, this data-driven approach could optimize the system's ability to detect abnormal conditions before they become dangerous, making it a proactive tool in fire prevention. The adaptability and scalability of this IoT-based system mean that it can be customized for various environments, from residential homes to large-scale industries, ensuring safety across different use cases. [5]

2. Literature Surveys

Pramod Mathew et al., used an Arduino UNO to create a clever little firefighting robot. Without human assistance, the suggested robot will autonomously detect and put out fires. To put out a fire, the robot can also be manually operated with an Android app. Additionally, the Android app uses alarms and alert messages to notify the user of the fire outbreak. As a result, our system can be utilized to effectively and efficiently identify and put out fires in fire breakout circumstances [6]. Dual mode firefighting robots were developed and put into use by Joyal Raju, etal.,. There are two modes of operation for the suggested fire extinguishing robot: automatic and manual. The Arduino UNO microcontroller is used to monitor and manage the robot's operations. Proteus simulates the entire robot model. The suggested fire extinguishing robot's hardware has been put into use and tested. The robot has a surveillance camera installed to track its movements when it is in manual mode. The camera in automatic mode can also provide real-time surveillance. When the robot is in automated mode, it will detect the fire, move to the scene, and pump water to put it out. In manual mode, the user has complete control over the robot's movement and pumping action. The camera on the robot can be used to locate the fire. The fire is put out to ground level once the water has been pumped [7]. Madan Lal Saini et all., developed a smart fire detector using temperature, smoke, flame, LDR, and MQ2 sensors. This proposed Internet of Things-based fire monitoring and control system conducts the necessary corrective action in addition to transmitting the latest situational information. The NodeMCU board is the foundation of the fire alarm system; it transmits data to fire control centers and activates the alarms based on the fire's severity. When the system detects a flame that could spread, it will sound an alarm and send a notification to the fire control centers through the Blynk cloud. The fire sprinkler and fire extinguisher will turn on and off based on

how bad the fire is [8]. An infrared flame sensor is connected to a microcontroller (ESP8266 nodeMCU) in a system created by S Hari Varshini et all., the system continuously detects its environment to detect the presence of fire. The microcontrollers themselves create the Wi-Fi network. The microcontroller is triggered to send the user an SMS, make a call, and sound a local alarm to alert the residence when a sensor detects a fire. The user can also get updates on the state of his home by texting the system. The prototype of the proposed system was developed, and it was able to accomplish its intended tasks with an average delay of less than 30 seconds.[9]. Hery et al., used smoke detection sensors based on the Arduino microcontroller in conjunction with the NodeMCU ESP8266 to develop an early warning fire detection system for home monitoring. It is anticipated that this early warning fire detection system will alert homeowners when it detects smoke in their houses. This detection system can greatly lessen the risk of any fire-related damage, fatalities, or material loss. The article will cover the outcomes and testing of the system that was designed[10].

3. Design And Analysis:

The Fire Detector with Wireless Alerts system's design combines embedded and Internet of Things technology to produce a portable and effective fire safety solution. The NodeMCU ESP8266 microcontroller is the central processing unit at its heart. It communicates with a flame sensor to identify infrared radiation that flames release. Nearby people are immediately notified when a fire is detected since the NodeMCU sets off both visual (via LEDs) and audio (through a buzzer) notifications. Furthermore, the Blynk platform integrates IoT capabilities into the system, allowing real-time notifications to be sent to users' cellphones and guaranteeing remote monitoring and control. Additional sensors or automation features, including fire suppression systems, can be integrated to improve functionality because to the architecture's scalability and modularity.

Table : -1 Components

COMPONENTS	QUANTITY	SPECIFICATION
NodeMCU	1	ESP8266
Infrared Sensor	1	
LED	2	

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Buzzer	1	

Working Of Components: -

1. ESP8266 NodeMCU: Acts as the central processing unit, receiving signals from the flame sensor and controlling the LEDs and buzzer based on the detected input.

2. Flame Sensor (IR Sensor): Detects infrared radiation emitted by fire and outputs a signal to the ESP8266.

3. Red LED: Turns on when fire is detected, providing a visual indicator of a hazard.

4. Green LED: Used to indicate normal operating conditions (no fire detected).

5. Buzzer: Produces a sound alert when fire is detected, warning nearby individuals.

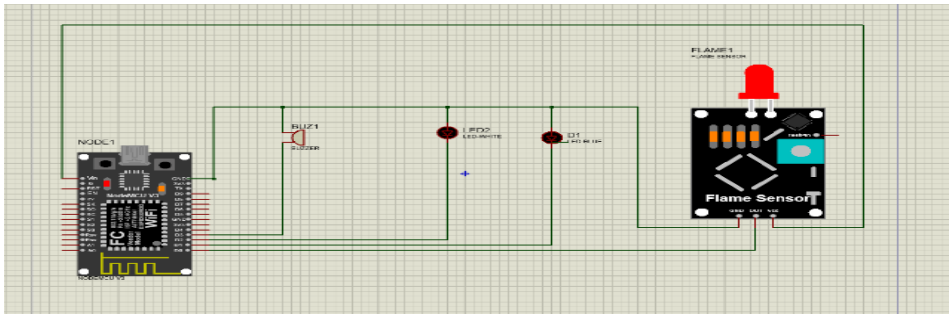

Figure 1: Circuit Diagram on Proteus

3.1 Result Analysis:

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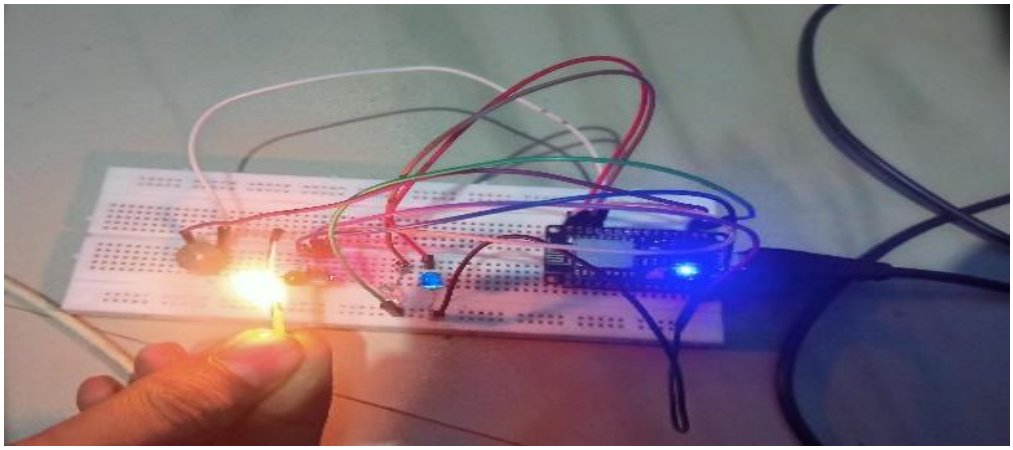

Figure 3: Hardware Implementation

The Fire Detector with Wireless Alerts project effectively demonstrates the integration of IoT technology and embedded systems for fire detection and safety. The system's performance was evaluated under controlled conditions to assess its functionality, accuracy, and responsiveness. The following key outcomes were observed:

IoT Integration with Blynk:

The IoT-based notice mechanism used the Blynk application is successfully transmitting real-time alerts to connected smartphones in such an IoT system with nearly all notifications being achieved without greater than 5 second average delays, thereby achieving close-to-relevant times at distant stations.

System Reliability: -

The system performed consistently with multiple runs with no false positives and missed detections during the testing phase. The flame sensor provided good sensitivity in discriminating between fire and non-fire conditions.

Scalability and Customization: -

The modular design allows easy addition of additional components, including multiple sensors or automated fire suppression mechanisms. This way, the system can be adaptable for any environment, from a small household to a large industrial application.

Hardware Integration: -

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The hardware components of NodeMCU, flame sensor, LEDs, and buzzer were all put to work together in order to make the operation smooth. LEDs gave visual representations of system status: red for fire detection and green for normal conditions, while the buzzer captured attention during hazards.

Power Efficiency: -

The system showed low power consumption, making it very suitable for constant use in energy-sensitive environments. The power management capabilities of the NodeMCU ensured high operating performance without significant energy drain.

3.2 Functional Diagram

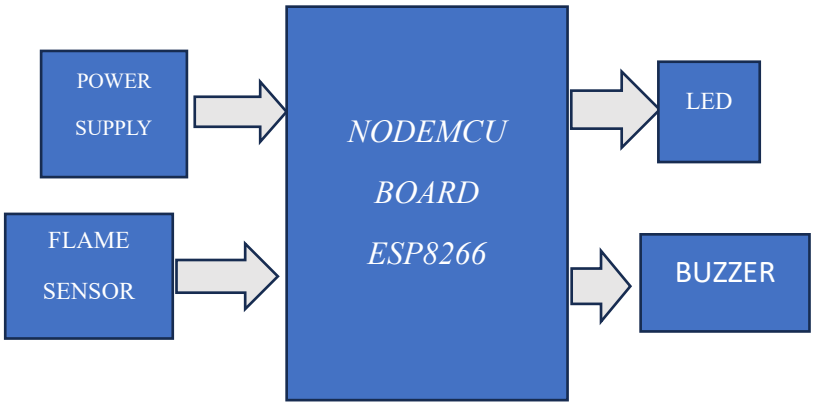

Figure 4: Functional diagram of the System

The image shows a functional diagram of a fire detection system designed using the NodeMCU ESP8266 microcontroller. The system comprises four main components: a power supply, a flame sensor, an LED, and a buzzer. The NodeMCU acts as the central processing unit, receiving input from the flame sensor to detect the presence of fire. Based on the sensor's output, the NodeMCU triggers the LED for visual indication and the buzzer for an audible alert. The power supply provides the necessary voltage and current to operate the system. This configuration highlights a simple yet effective approach to fire detection and alerting mechanisms.

4. Conclusion:

The fire detection system designed in this project demonstrates the effective use of embedded systems and IoT technologies for real-time fire monitoring and alerting. By utilizing the NodeMCU ESP8266 microcontroller, the system integrates various components such as a flame sensor, a buzzer, and optional LED indicators to provide a comprehensive solution for fire detection. The primary advantage of this system lies in its ability to provide both visual and audible alerts upon detecting a fire, ensuring immediate action can be taken.

The system's simplicity and cost-effectiveness make it an ideal candidate for deployment in households, offices, and small industrial setups. Its use of the NodeMCU allows for further enhancements, such as sending alerts via email or integrating with other smart home devices, thereby adding an IoT-enabled layer of functionality. The inclusion of the flame sensor ensures accurate detection of fire, while the buzzer serves as an effective means to alert occupants even in the absence of visual cues. The flexibility to scale this project by adding more sensors or expanding the system's scope makes it highly adaptable to various environments and requirements.

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