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Gas Detector: Smart Gas Leakage Detector

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ABSTRACT

The "Smart Gas Leakage Detector" is an innovative system designed to enhance safety in environments where gas leaks pose significant hazards. This project employs a combination of essential components, including a gas sensor, Arduino Uno, GSM module, relay, CPU fan, LCD display, and buzzer. Upon detecting gas, the sensor triggers the Arduino Uno to activate the relay, which subsequently powers the CPU fan and buzzer, providing immediate audio-visual alerts. Simultaneously, the GSM module sends a text message notification to designated mobile numbers, ensuring prompt awareness of the situation. The LCD display serves as a real-time interface, indicating the status of the system. This integrated approach not only improves response times to potential gas leaks but also promotes proactive safety measures in residential and industrial settings.

Keywords : Gas sensor, Arduino Uno, GSM module, Safety, Alerts.

I. INTRODUCTION

Gas leaks pose serious threats to both residential and industrial environments, potentially leading to health hazards, explosions, and fire accidents. Traditional gas detection methods often rely on human senses, which are unreliable and can result in delayed responses. The "Smart Gas Leakage Detector" system addresses these challenges by integrating IoT and automation for real-time monitoring and immediate alerts. Utilizing an Arduino Uno as the central controller, the system continuously monitors gas levels through a dedicated sensor. Upon detecting a leak, it activates a relay to power a CPU fan for ventilation and triggers a buzzer for an audible warning. Additionally, a GSM module sends alert messages to designated mobile numbers, ensuring timely action even when users are away. The LCD display provides real-time status updates, making the system user-friendly and efficient in preventing gas-related incidents.

An embedded system represents a category of computer systems explicitly designed to execute diverse tasks, including accessing, processing, storing, and controlling data in various electronics-based systems. These systems are an amalgamation of both hardware and software, with the software commonly referred to as firmware, intricately integrated into the hardware. An integral characteristic of embedded systems is their ability to deliver outputs within predefined time limits. They significantly contribute to enhancing precision and convenience in various applications. Embedded systems find widespread usage in both simple and intricate devices. Real-world applications encompass a range of devices, such as microwaves, calculators, TV remote controls, home security systems, and neighborhood traffic control systems, illustrating their pervasive impact in our daily lives.

II. LITERATURE SURVEY

A smart gas leakage detection system is an important technology that can detect the presence of dangerous gases and alert the users to take necessary action. In recent years, there has been a significant increase in research and development of smart gas leakage detection systems. In this literature survey, we will review some of the important works related to smart gas leakage detection systems.

1. This paper proposes a smart gas leakage detection system using wireless sensor networks. The system uses ZigBee wireless communication technology to transmit gas sensor data to the main control unit. The proposed system has a low power consumption and high accuracy in detecting gas leaks.[1]

2. gas leakage detection system based on wireless sensor networks. The system consists of a gas sensor node, a wireless communication module, and a main control unit. The system can detect gas leaks and send alerts to the users through SMS or email.[2]

3. This paper proposes a smart gas leakage detection system using the Internet of Things (IoT) technology. The system consists of gas sensors, a microcontroller, a Wi-Fi module, and a mobile application. The system can detect gas leaks and send alerts to the users through the mobile application.[3]

4. This paper presents a smart gas leakage detection system based on machine learning and the Internet of Things (IoT). The system uses gas sensors and a machine learning algorithm to detect gas leaks. The system can send alerts to the users through a mobile application or email.[4]

5. "A wireless gas leakage monitoring system based on IoT and cloud computing" by T. Yang et al. (2019) This paper proposes a wireless gas leakage monitoring system based on IoT and cloud computing. The system consists of a gas sensor, a microcontroller, and a wireless module. The data collected by the gas sensor is sent to the cloud for analysis and storage. The system also provides real-time alerts to users via a mobile app.[5]

6.This paper proposes a gas leakage monitoring system based on Zigbee wireless sensor network. The system consists of a gas sensor, a Zigbee wireless module, and a central monitoring unit. The data collected by the gas sensor is transmitted to the central monitoring unit for analysis and storage. The system also provides real-time alerts to users via SMS.[6]

7. This paper proposes a smart gas leakage detection system using machine learning algorithms. The system consists of a gas sensor, a microcontroller, and a machine learning algorithm. The data collected by the gas sensor is analyzed by the machine learning algorithm to detect gas leaks. The system also provides real-time alerts to users via a mobile app. [7]

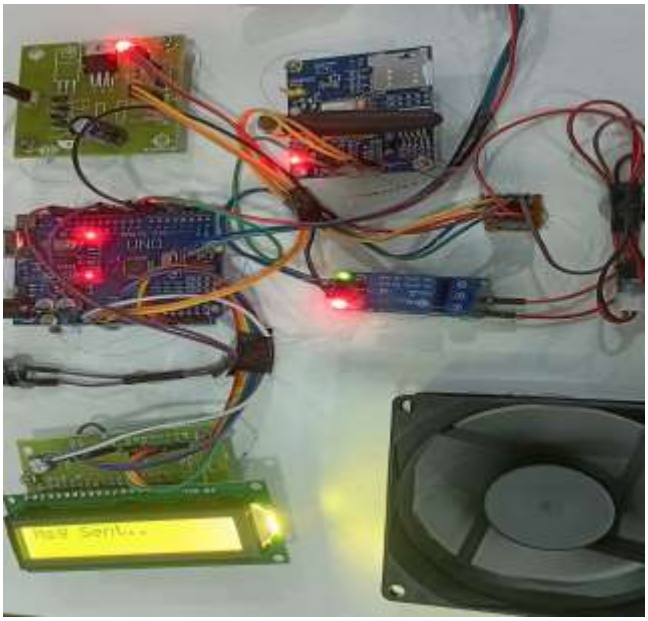
8. This paper proposes a novel gas leakage detection system using wireless sensor networks and cloud computing. The system consists of a gas sensor, a wireless sensor network, and a cloud computing platform. The data collected by the gas sensor is sent to the cloud for analysis and storage. The system also provides real-time alerts to users via a mobile app.[8]

In conclusion, smart gas leakage detection systems have been researched and developed using wireless sensor networks, Arduino and gas sensors. These systems provide real-time alerts to users and help prevent catastrophic incidents.

III. PROPOSED SYSTEM

A smart gas leak detection system is a crucial safety solution designed to prevent hazardous gas leaks in homes, businesses, and industrial environments. This system integrates both hardware and software to identify and notify users about gas leaks instantly. It typically includes gas sensors strategically placed throughout a building to monitor for leaks. These sensors, which can be either wired or wireless, are connected to a central control unit that sends out alerts when a leak is detected. The system provides timely warnings through alarms or notifications. To maintain its accuracy and reliability, regular inspections and maintenance are necessary to ensure all sensors work correctly. It is also important that the system is properly installed and configured by certified professionals. In summary, a smart gas leakage detection system enhances the safety and protection of spaces where gas is used for purposes such as heating or cooking.

Gas sensors are placed in areas where leaks are likely to happen. These sensors use different technologies such as electrochemical, infrared, or catalytic detection to sense the presence of gas in the air. The sensors send data to a microcontroller, which processes and analyzes it. If gas levels exceed a defined threshold, the microcontroller activates an alarm. It is also connected to a communication module, either wired or wireless depending on the setup, which sends this information to a central control system. The central unit evaluates the incoming data to confirm the presence of a leak. Once detected, it notifies relevant individuals like maintenance staff.



IV. RESULT AND DISCUSSION

The IoT-Based Gas Leakage Detector project was successfully completed and yielded excellent results during both the development and testing phases. The system effectively detected the presence of harmful gases like LPG and methane using the MQ gas sensor. Upon detecting gas concentrations beyond the safe threshold, the system promptly triggered a buzzer alarm and sent real-time alerts through the connected IoT platform. The integration of the

microcontroller (NodeMCU) with the gas sensor and Wi-Fi module worked seamlessly, enabling continuous monitoring and instant notifications to the user's mobile device or dashboard. The system was tested in controlled environments by simulating gas leakage scenarios, and it consistently responded with accurate and timely alerts.

The hardware components were correctly interfaced, and the software logic was implemented in a way that ensured reliable performance without false alarms. Additionally, the cloud-based monitoring feature allowed remote access to gas concentration data, which enhances the practical usability of the project in real-world applications.

Overall, the project met all its intended objectives. It demonstrated a strong understanding of IoT concepts, sensor interfacing, and safety system design. The prototype is cost-effective, scalable, and ready for further enhancements like SMS alerts, mobile app integration, and automatic shut-off mechanisms for gas supply.

V. CONCLUSION

The Smart Gas Leakage Detector project has been successfully designed, implemented, and tested, offering a robust and intelligent solution for detecting and responding to gas leaks in real time. The system integrates several components—Arduino Uno, MQ gas sensor, GSM module, relay, CPU cooling fan, LCD display, and buzzer—to create a reliable safety mechanism aimed at preventing hazardous incidents.

Upon detecting the presence of gas beyond a predefined threshold, the gas sensor triggers a chain of immediate responses. The buzzer activates to provide an audible alert, and the LCD displays the current gas levels, ensuring on-site awareness. Simultaneously, the GSM module sends an SMS notification to the user or concerned authority, enabling swift remote awareness and action.

To reduce the concentration of leaked gas and prevent further risk, the system also automatically powers on the CPU fan through a relay module. This proactive measure helps to ventilate the area, mitigating the risk of fire or explosion even before human intervention.

The system was tested under various simulated gas leakage conditions and consistently demonstrated accurate detection, fast response times, and reliable communication through SMS alerts. The automation of both alert and mitigation processes (buzzer + fan) significantly enhances safety by reducing human reaction delays.

This solution proves highly effective in residential kitchens, commercial gas storage areas, and small-scale industries, where early detection and response to gas leaks are critical. It not only lowers the risk of accidents but also instills a sense of security among users.

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