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Wireless Environment Safety Monitoring System using Gas Sensor and Sound Sensor

[1]A. Akhila, [2]M. Anjani, [3]N. Sri Nidhi, [4]Ganesh Reddy

[1,2,3] B.Tech students, [4]Assistant Professor

[1,2,3,4] Department of Electronics and Communication Engineering[1,2,3,4] Vignan's Institute of Management and Technology for Women, Kondapur (V), Ghatkesar (M), Medchal-Malkajigiri (D) – 501301

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ABSRACT:

The increasing levels of environmental pollution and industrial hazards pose serious risks to human health and safety. This project presents a Wireless Environmental Safety Monitoring System using Gas Sensor and Sound Sensor based on IoT technology. The system is designed to continuously monitor air quality and noise levels in real time and provide alerts when the measured values exceed predefined safety thresholds.The proposed system utilizes gas sensors (such as MQ series) to detect harmful gases and a sound sensor to monitor noise pollution levels. These sensors are interfaced with a NodeMCU (ESP8266) microcontroller, which processes the data and transmits it wirelessly to an IoT platform for remote monitoring. An LCD display is also used to show real-time sensor readings locally.

Keywords: Internet of Things (IoT), Environmental Monitoring, Gas Sensor, Sound Sensor, Node MCU (ESP8266).

I. INTRODUCTION

Environmental pollution and industrial hazards have become major concerns in recent years due to rapid urbanization and industrialization. The presence of harmful gases and excessive noise levels in the environment can lead to serious health issues, including respiratory problems, hearing loss, and other long-term effects. Therefore, continuous monitoring of environmental parameters is essential to ensure safety and maintain a healthy living and working environment.

To overcome these limitations, the proposed project introduces a Wireless Environmental Safety Monitoring System using Gas Sensor and Sound Sensor based on Internet of Things (IoT). The system integrates gas sensors to detect hazardous gases and a sound sensor to measure noise levels in the surroundings. A NodeMCU (ESP8266) microcontroller is used to process the sensor data and transmit it wirelessly to an IoT platform, enabling real-time monitoring from anywhere.

III. LITERATURE SURVEY

S.NO	PUBLISHED YEAR	TITLE	TECHNIQUE /MODEL USED	KEY COMPONENTS	APPLICATION AREAS
1.	2018	Raspberry pi controlled sound pollution monitoring system	IOT	DHT11 sensor	Smart cities
2.	2020	Pollution controlled using IOT	Embedded system	Raspberry pi	Industrial areas
3.	2015	IOT based smart environment monitoring using the Raspberry pi components	IOT	Raspberry pi	Residential areas
4.	2019	Recent trends in implementation of IOT	Cloud computing	Cloud platform	Healthcare
5.	2015	Easy development of COAP based IOT application with python	COAP	COAPthon library	Smart Homes

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IV. EXISTING METHOD

In existing environmental monitoring systems, the detection of hazardous gases and noise levels is typically carried out using standalone devices or manual monitoring techniques. Gas leakage detection systems generally use basic gas sensors connected to alarms, which trigger alerts only when gas concentration exceeds a fixed threshold. Similarly, noise monitoring systems use sound level meters to measure noise pollution, but these devices often require manual observation and recording.

V. PROPOSED METHOD

The proposed system presents a Wireless Environmental Safety Monitoring System using Gas Sensor and Sound Sensor integrated with IoT technology to overcome the limitations of existing methods. The system is designed to provide real-time monitoring, wireless communication, and instant alert mechanisms for improved environmental safety.

VI. SYSTEM ARCHITECTURE

The proposed system architecture consists of sensing, processing, communication, and output units integrated into a single framework. Gas and sound sensors are used to continuously monitor environmental parameters such as air quality and noise levels. The gas sensor detects harmful gases like LPG, carbon monoxide, and smoke, while the sound sensor measures noise intensity. These sensors generate analog signals, which are sent to the Arduino microcontroller for processing. The Arduino converts these signals into digital data using its internal ADC and analyzes them by comparing with predefined threshold values. A Wi-Fi module (ESP8266/Node MCU) is used to transmit the processed data to an IoT cloud platform for remote monitoring. This enables users to access real-time information through mobile or web applications. An LCD display is provided to show current sensor readings locally. When the detected values exceed safe limits, the system triggers an alert such as a buzzer. Thus, the architecture ensures real-time monitoring, wireless communication, and immediate safety response.

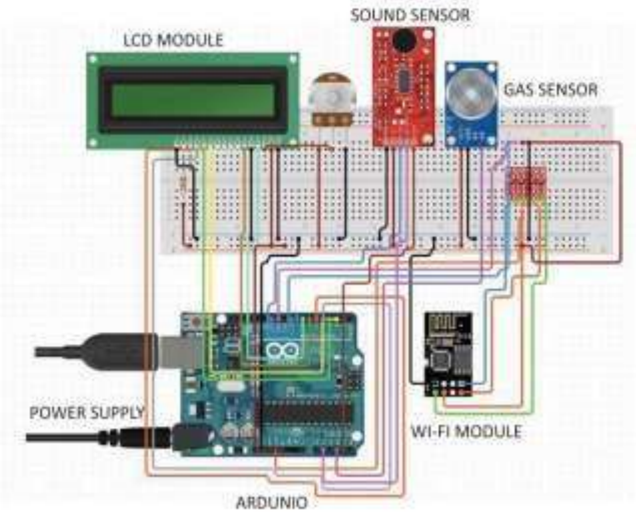

Fig. 1 Proposed Noise and Air Pollution Monitoring System Architecture

VII. WORKING METHOD

The working of the proposed Wireless Environmental Safety Monitoring System begins with the continuous sensing of environmental parameters using gas and sound sensors. The gas sensor detects the presence of harmful gases such as LPG, smoke, and carbon monoxide, while the sound sensor measures the noise levels in the surroundings. These sensors generate analog signals based on the detected values and send them to the Arduino microcontroller. The Arduino converts these analog signals into digital data using its internal ADC. It then processes the data and compares the values with predefined threshold limits. If the values are within safe limits, the system continues normal monitoring. The real-time sensor readings are displayed on an LCD screen for local monitoring. Simultaneously, the processed data is transmitted to an IoT cloud platform using the Wi-Fi module (ESP8266/Node MCU). This enables users to monitor the data remotely through mobile or web applications. If the gas or noise levels exceed safe limits, the system triggers an alert such as a buzzer to ensure immediate safety action.

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VIII. PROJECT IMPLEMENTATION

The implementation of the proposed Wireless Environmental Safety Monitoring System involves the integration of hardware components and software programming to achieve real-time monitoring. Initially, the gas sensor and sound sensor are interfaced with the Arduino microcontroller, which acts as the central processing unit. The sensors are connected to the analog input pins of the Arduino to capture environmental data. A 16×2 LCD display is connected to display real-time readings of gas concentration and noise levels. Additionally, a Wi-Fi module (ESP8266/Node MCU) is interfaced with the Arduino using serial communication to enable internet connectivity. The system is programmed using the Arduino IDE, where the code is written to read sensor values, process the data, and compare it with predefined threshold limits. Based on the conditions, the Arduino controls the output devices such as the LCD and buzzer. The Wi-Fi module is configured to send the collected data to an IoT cloud platform like Thing Speak or Blynk for remote monitoring. Proper power supply connections are ensured to provide stable operation of all components. After assembling the hardware and uploading the code, the system is tested under different environmental conditions to verify its performance and accuracy. Thus, the implementation results in a fully functional, real-time environmental safety monitoring system.

ADVANTAGES

1. Provides real-time monitoring of air quality and noise levels
2. Enables early detection of harmful gases and excessive noise
3. Supportswireless communication using IoT technology
4. Allows remote monitoring through mobile or web applications
5. Generates instant alerts (buzzer/notifications) for safety
6. Cost-effective and easy to implement using simple components
7. Offers low power consumption and efficient operation
8. Ensures continuous and automatic monitoring without manual effort
9. Scalable and flexible for different environments (industries, homes, cities)
10. Improves safety and health protection for users

APPLICATIONS

- Provides real-time monitoring of air quality and noise levels
- Enables early detection of harmful gases and excessive noise
- Supports wireless communication using IoT technology
- Allows remote monitoring through mobile or web applications
- Generates instant alerts (buzzer/notifications) for safety
- Cost-effective and easy to implement using simple components
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VIII. FLOW CHART

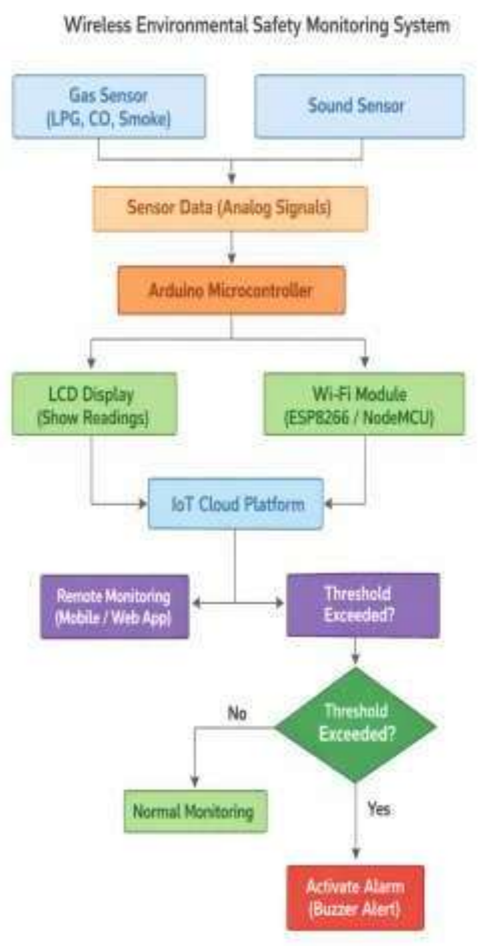

Fig 2. System Flowchart

IX. RESULT

Fig 3.

X. FUTURE SCOPE

The proposed Wireless Environmental Safety Monitoring System was successfully implemented and tested for real-time monitoring of air quality and noise levels. The gas sensor effectively detected harmful gases such as LPG, smoke, and carbon monoxide, while the sound sensor accurately measured noise intensity in the environment. The Arduino microcontroller processed the sensor data efficiently and displayed the readings on the LCD screen for local monitoring. The integration of the Wi-Fi module (ESP8266/NodeMCU) enabled seamless transmission of data to the IoT cloud platform, allowing users to monitor conditions remotely through mobile or web applications. The system responded promptly when the detected values exceeded predefined threshold limits by activating a buzzer alert. The overall performance of the system was reliable, accurate, and efficient. Hence, the project proved to be a cost-effective and practical solution for real-time environmental safety monitoring in various applications.

XI. CONCULISON

The proposed Wireless Environmental Safety Monitoring System using gas and sound sensors has been successfully designed and implemented to provide real-time monitoring of air quality and noise levels. The system efficiently detects harmful gases and excessive noise, processes the data using an Arduino microcontroller, and transmits it to an IoT platform through a Wi-Fi module for remote monitoring. It also provides immediate alerts through a buzzer when the measured values exceed safe limits, ensuring quick response to hazardous conditions. The inclusion of an LCD display allows users to view real-time data locally. The overall system is cost-effective, reliable, and easy to implement, making it suitable for applications in industries, homes, and public environments. Thus, the project demonstrates an effective solution for enhancing environmental safety and highlights the potential of IoT-based monitoring systems.

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AUTHOR PROFILES

1. A. Akhila

Akula Akhila is the primary developer and authority of this project, responsible for the design, implementation, and testing of the system. She has contributed to integrating hardware components such as gas and sound sensors with the Arduino microcontroller, as well as developing the IoT-based monitoring system using the Wi- Fi module. She is also responsible for programming, system configuration, data analysis, and ensuring the overall functionality and performance of the project.

2. M. Anjani

Medi Anjani serves as an authority/member in the development of this project and is responsible for contributing to the design, implementation, and testing of the system. The role includes interfacing hardware components such as gas and sound sensors with the Arduino microcontroller, assisting in programming using Arduino IDE, and supporting the integration of the Wi-Fi module for IoT-based communication. Additionally, responsibilities involve monitoring system performance, validating sensor data, and ensuring the proper functioning of the overall system.

3. N. Sri Nidhi

Nalapala Sri Nidhi is a key contributor to the project, involved in the design and development of the system. Responsibilities include assisting in interfacing gas and sound sensors with the Arduino microcontroller, supporting the coding and implementation using Arduino IDE, and contributing to the integration of the Wi-Fi module for IoT-based data transmission. Additionally, involvement includes testing the system under various conditions, analyzing sensor data, and ensuring the accuracy and reliability of the overall system performance.

4. G. Ganesh Reddy

G. Ganesh Reddy is working as an Assistant Professor in the Department of Electronics and Communication Engineering at Vignan's Institute of Management and Technology for Women. He has expertise in Embedded Systems, IoT, and VLSI Design. He has guided numerous undergraduate projects and is actively involved in research and academic development activities.

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