Iot Based Air pollution Monitoring And Purifying System

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***Abstract*— This project aims to create an innovative IoT-based air pollution monitoring and purifying system that can be connected to the internet and a web server for easy and remote access. This project aims to highlight the importance of monitoring air quality and taking measures to improve it for better health and well-being.**

Keywords- air pollution , Iot based, purifier,web server

1. Introduction

This project aims to create an innovative IoT-based air pollution monitoring and purifying system that can be connected to the internet and a web server for easy and remote access. The system will monitor the air quality by using sensors that can detect the presence of harmful gases, such as CO2, smoke, alcohol, benzene, and NH3. When the system detects that the air quality drops below a certain level, an alarm will be triggered, and the purifier will be activated to spray an anti-pollutant liquid in the surrounding area to purify the air. This project aims to highlight the importance of monitoring air quality and taking measures to improve it for better health and well-being. Poor air quality can lead to various respiratory and cardiovascular diseases, and by using this system, we can ensure that the air we breathe is of good quality. This project also demonstrates how technology can be used to improve our quality of life and promote a cleaner and healthier environment.

1.1 Motivation

Air pollution is a complex issue that affects not only the environment but also human health. Exposure to high levels of pollutants in the air can lead to respiratory diseases, cardiovascular problems, and even cancer. According to the World Health Organization (WHO), air pollution is responsible for an estimated 7 million deaths worldwide each year. To address this issue, governments and organisations around the world have been implementing measures to reduce air pollution. One such measure is the development of air monitoring and purifying systems. These systems are designed to measure the levels of pollutants in the air and remove them to improve the air quality.

1.2 Specification

Many existing air monitoring and purifying systems are expensive and complicated to use, making them inaccessible to many individuals and communities. This project aims to create a cost-effective, efficient and easy-to-use air monitoring and purifying system that can be used by anyone, anywhere. In addition, the system is connected to a web server that displays real-time air quality data on a web page. This allows users to monitor the air quality in their area and take necessary measures to protect their health.

1.3 Background Studies /Literature Survey

Air quality monitoring and purifying systems have been extensively researched and developed. Various sensors and microcontrollers have been used in the past for air quality monitoring. The ESP32 microcontroller is a popular choice due to its Wi-Fi capabilities and powerful processing capabilities.

The MQ135 sensor is a low-cost gas sensor that is commonly used for air quality monitoring. It can detect a wide range of gases, including carbon dioxide, ammonia, and other pollutants[5]. The sensor provides analog output, which can be processed by a microcontroller.

In addition to the hardware components, the air monitoring and purifying system also requires software to collect and analyse data from the sensors. The system can be programmed to continuously monitor the air quality and display the results on an LCD screen. The data can also be sent to a web server and displayed on a web page, providing real-time air quality information to the public.

1.4 Objectives

In order to achieve these objectives, the project will follow a structured methodology. The first step will be to gather information through background studies and literature surveys on existing air monitoring and purifying systems, as well as the ESP32 microcontroller, MQ135 sensor, buzzer, fan, and LCD.

After the design phase, the experimental setup and prototype testing will be conducted. The MQ135 sensor will be calibrated and interfaced with the ESP32 microcontroller. The fan and buzzer will also be integrated into the system. The prototype will be tested under various conditions to ensure that it can accurately monitor and purify the air

2. METHODOLOGY

The ESP32 microcontroller was used as the main processing unit for this project. It was chosen due to its powerful processing capabilities, built-in Wi-Fi capabilities, and low cost. The microcontroller was programmed using the Arduino IDE, which is an open-source software platform for creating and uploading code to microcontrollers.

The MQ135 sensor was used for air quality monitoring. It is a low-cost gas sensor that can detect a wide range of gases, including carbon dioxide, ammonia, and other pollutants. The sensor provides analog output, which can be processed by the microcontroller.

A buzzer was used as an alarm to notify users when the air quality falls below a certain threshold value. The buzzer produces a loud sound that alerts users to take action to improve the air quality.

A fan was used for air purification. When the air quality falls below a certain threshold value, the fan is turned on to purify the air. The fan draws air through a filter that removes pollutants and other harmful particles from the air.

An LCD was used for displaying the air quality data. The LCD displays real-time data, including the concentration of pollutants in the air and the current air quality index.

HTML, CSS, and JavaScript were used to create the web page for displaying the real-time air quality data. The web page was designed to be user-friendly and easy to navigate. Users can view the current air quality data and receive alerts when the air quality falls below a certain threshold value.

2.1Design Approach

To ensure that the system is working effectively, the prototype was designed and tested in a controlled environment. The experimental setup included the ESP32 microcontroller, MQ135 sensor, buzzer, fan, and LCD. The components were assembled on a breadboard and connected as per the schematic diagram. The MQ135 sensor was calibrated using a standard gas mixture to ensure accurate readings.

The prototype was tested by exposing it to different levels of air pollutants, including smoke and gases, and observing the readings on the LCD and the web page. The system successfully detected changes in air quality and activated the buzzer and fan when the air quality fell below a certain threshold value.

Based on the findings, the air monitoring and purifying system using ESP32, MQ135, buzzer, fan, and LCD was found to be effective in detecting changes in air quality and purifying the air when required. The results were displayed in real-time on the web page, providing a convenient and user-friendly interface for users to monitor the air quality.

The system's ability to detect and respond to harmful gases, including smoke, can help prevent health risks associated with breathing in polluted air. However, further improvements can be made to enhance the accuracy and reliability of the system. Future plans include conducting field tests in real-world environments and exploring the possibility of integrating the system with smart homes and buildings.With continued development and improvements, this air monitoring and purifying system has the potential to make a significant impact in promoting healthier living environments and improving overall air quality.

3.CHALLENGES AND REMEDY

3.1 Challenges Faced

Accuracy of Sensors: One of the main challenges in air quality measurement is ensuring that the sensors used are accurate and reliable. This is especially important as the accuracy of the data collected can impact the effectiveness of the system in identifying and addressing air quality issues.

Interference: The accuracy of the air quality measurement system can be affected by the presence of other environmental factors such as humidity, temperature, and electromagnetic interference. It is important to take these factors into account when designing the system.

Maintenance: Maintenance can be a challenge in air quality measurement systems, as sensors can become dirty or damaged over time, requiring regular cleaning or replacement[4]. Ensuring that the system is designed for easy maintenance can help to mitigate these challenges.

Calibration: Regular calibration of the sensors is necessary to ensure that the data collected is accurate and reliable. Calibration can be time-consuming and expensive, and ensuring that the system is designed for easy calibration can help to mitigate these challenges.

Cost: Air quality measurement systems can be expensive to develop and implement, which may make them less accessible to communities with limited resources. Ensuring that the system is designed to be cost-effective can help to mitigate these challenges.

Communication and Public Awareness: Communicating the results of the air quality measurements to the public can be a challenge, as it may require translating complex scientific data into understandable language. Ensuring that the system is designed to communicate data effectively can help to mitigate these challenges.

Overall, these challenges can have an impact on the effectiveness of an air quality measuring system, so it is important to take them into consideration during the design and implementation phases of the project.

3.2 Remedial Strategies

To ensure the accuracy of the MQ135 sensor, we calibrated it several times and adjusted the threshold levels to ensure accurate readings.During the development and testing phases of the air monitoring and purifying system, various challenges were encountered that needed to be addressed. To overcome these challenges, several remedial strategies were implemented.

One of the primary strategies was to use different libraries for the components and ensure their compatibility. This helped to resolve any compatibility issues between different components and ensured that they worked together seamlessly. In addition, we resolved programming and debugging issues, which helped to identify and fix any technical issues.

Lastly, the code was optimized to reduce processing time and improve the system's efficiency. This involved streamlining the code to ensure that it ran as quickly and smoothly as possible, which helped to improve the overall performance of the system. These remedial strategies proved to be effective in addressing the challenges faced during the development and testing phases of the project, and ultimately contributed to the success of the air monitoring and purifying system

4. Analysis and Discussion

The analysis of this system's performance would involve monitoring the air quality readings provided by the MQ135 sensor and the actions taken by the system in response to the readings. The ESP32 microcontroller processes the data from the MQ135 sensor and determines whether the air quality is below the threshold level. If the air quality is poor, the microcontroller activates the air purifying system to clean the air and reduce the levels of harmful gases, including smoke.During the detection of smoke, the MQ135 sensor will detect the presence of smoke particles in the air, and the microcontroller will trigger the air purifying system to remove the smoke particles from the air. This will improve the air quality and reduce the health risks associated with breathing in smoke.

The discussion on this system would involve the effectiveness of the air purifying system in removing smoke particles from the air and improving air quality. The system's ability to detect and respond to smoke particles is critical in preventing health risks associated with breathing in polluted air[6]. The system's performance can be evaluated based on its ability to consistently provide accurate air quality readings and effectively filter out harmful gases, including smoke, from the air.

Overall, an air monitoring and purifying system using ESP32, MQ135, a buzzer, an LCD with I2C is an effective tool for detecting and purifying the air of harmful gases, including smoke. The system's ability to detect and respond to smoke particles can help prevent health risks associated with breathing in polluted air, making it an essential tool for improving indoor air quality.

5. Overall Progress

The system has been successfully designed and built using the ESP32 microcontroller, MQ135 gas sensor, buzzer, and LCD screen with I2C interface. The system is capable of detecting smoke and other harmful gases and alerting users when the air quality drops below a certain level. When smoke is detected, the MQ135 sensor outputs a higher voltage than normal, indicating a higher concentration of pollutants in the air. The algorithm compares this voltage to a predefined threshold and triggers the buzzer if the voltage exceeds the threshold. At the same time, the LCD screen displays a warning message indicating that smoke has been detected and it has crossed the level

5. Conclusion

Overall, this smoke detecting system with added purifier and webpage will provide an effective and efficient solution for detecting smoke and protecting people from harmful pollutants. It will also provide a way to monitor air quality in real-time, which can be useful for people who are concerned about their health and safety.

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