IOT Based Air Quality Monitoring System

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Abstract

Air pollution has become a serious environmental problem today, adversely affecting human health and the ecosystem. Due to increasing industrialization, vehicle emissions, and urbanization, the amount of harmful gases in the atmosphere is continuously increasing. Therefore, regular monitoring of air quality has become extremely important.

This paper presents the development and operation of an Internet of Things (IoT)-based air quality monitoring system. The proposed system utilizes an ESP8266 NodeMCU microcontroller, an MQ135 gas sensor, and a DHT11 temperature and humidity sensor. The MQ135 sensor detects harmful gases in the atmosphere, while the DHT11 sensor measures temperature and humidity.

The collected data is processed by the ESP8266 microcontroller and displayed on a 16x2 LCD display. This data is also transmitted to the Internet via the Blynk IoT platform, allowing users to monitor air quality in real time using their smartphones.

The system categorizes air quality into Good, Moderate, and Bad categories. If air quality deteriorates, a fan is activated via a relay module to improve ventilation.

The proposed system offers low-cost, high-efficiency, and real-time monitoring. This system can be useful in homes, offices, industries, and public spaces.

Keywords

IoT, Air Quality Monitoring, ESP8266, MQ135 Sensor, DHT11 Sensor, Smart Environment, Environmental Monitoring

1. Introduction

Air pollution is one of the major problems facing modern society. Industrial activities, vehicle emissions, construction projects, and population growth are increasing the amount of pollutants in the air. Poor air quality can lead to serious health problems in humans, such as respiratory diseases, allergies, asthma, and heart disease.

Traditional air quality monitoring systems are expensive and are typically installed by government

agencies. These systems are available in limited locations and are not accessible to the general public.

With the development of Internet of Things (IoT) technology, it is now possible to develop smart systems that can monitor environmental conditions at low cost.

The primary objective of this research is to develop an IoT-based air quality monitoring system that can measure atmospheric conditions through sensors and transmit the data to the user via the internet.

Background of the Study

Over the past few years, IoT technology has been widely used in environmental monitoring. Systems are being developed using various sensors and microcontrollers that can collect data in real time.

Low-cost sensors like the MQ135 and DHT11 have now made environmental monitoring possible even on a small scale. IoT platforms like Blynk, ThingSpeak, and Firebase allow data to be stored in the cloud and displayed via mobile applications.

2. **Problem Statement**

Most air quality monitoring systems today are expensive and complex. It is difficult for ordinary people to monitor the air quality in their homes or workplaces.

To address this issue, there is a need to develop a low-cost, IoT-based air quality monitoring system that can provide real-time data and provide immediate information to the user.

Objectives of the Study

The main objectives of this research are:

1. Design and develop an IoT-based air quality monitoring system.
2. Detect atmospheric gases using the MQ135 sensor.
3. Measure temperature and humidity using the DHT11 sensor.
4. Process the data using an ESP8266 microcontroller.
5. Provide real-time data monitoring through the Blynk IoT platform.
6. Activate an automated ventilation system in case of poor air quality.

3. Research Questions

1. Can low-cost air quality monitoring be achieved using IoT technology?
2. Can the MQ135 and DHT11 sensors provide environmental data with sufficient accuracy?
3. Can an IoT-based system provide users with real-time air quality information?

4. Literature Review

Many researchers have conducted studies on air quality monitoring systems.

Sharma et al. (2019) developed an IoT-based air pollution monitoring system that used gas sensors and wireless communication technology.

Kumar and Singh (2020) proposed an Arduino-based air quality monitoring system that can detect various gases.

Patel et al. (2021) developed an IoT-based environmental monitoring system using an ESP8266 microcontroller that sends data to a cloud platform.

These studies demonstrate that IoT technology is extremely useful for environmental monitoring.

5. Research Gap

Although many studies have been conducted on air quality monitoring systems, most systems are either expensive or have limited real-time monitoring capabilities.

This research attempts to develop a simple, low-cost, and smart IoT-based system.

Methodology

6. Research Design

This study is based on an experimental research design that involves the development of both hardware and software.

1. Data Collection Methods
2. Data was collected using sensors:
3. MQ135 Gas Sensor
4. DHT11 Temperature and Humidity Sensor
5. Sample Size and Sampling Technique

In this study, sample data was collected from various environments, including a room, a laboratory, and an open environment.

Tools Used

The following devices were used in this project:

1. ESP8266 NodeMCU
2. MQ135 Gas Sensor
3. DHT11 Sensor
4. 16x2 LCD Display
5. Relay Module
6. Arduino IDE
7. Blynk IoT Platform
8. Results / Findings

During testing of the project, the following results were obtained:

1. The system accurately measured temperature and humidity.
2. The MQ135 sensor successfully detected the presence of gases in the atmosphere.
3. Sensor data was displayed on the LCD display.
4. The data was successfully sent to the Blynk application.
5. When poor air quality occurred, the fan was activated via the relay module.

7. Discussion

The results obtained demonstrate that an IoT-based air quality monitoring system can function effectively.

This system is more accessible and cost-effective than previous studies. Real-time data monitoring through the IoT platform is extremely useful for the user.

9. Conclusion

This research successfully developed an IoT-based air quality monitoring system.

The proposed system measures atmospheric conditions through sensors and transmits the data to the user via the internet. This system offers low cost, simple design, and real-time monitoring.

This system can prove extremely useful for monitoring air quality in homes, offices, and industries.

8. Future Scope

This system could be enhanced in the future in the following ways:

1. Additional gas sensors can be integrated into the system to detect a wider range of harmful gases present in the environment.
2. Cloud data analytics can be implemented to store and analyze the collected air quality data for long-term monitoring and trend analysis.
3. A mobile app-based alert system can be developed to notify users through notifications when the air quality exceeds safe limits.
4. The system can also be implemented in smart city projects to continuously monitor environmental pollution and improve urban air quality management.

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