



REAL-TIME MONITORING AIR PURIFICATION SYSTEM USING MQ2 SENSOR

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Abstract—The potential of the Internet of Things (IoT) to solve problems by gathering and processing information is evident. A vast network of interconnected devices can exchange processed data to help people reach conclusions about significant abstract factors. Air quality is one such factor, which is crucial to assess, given the high number of casualties attributed to polluted air in densely populated areas. Indoor air quality is particularly important to analyze, and there is an urgent need for an effective solution. While air purifiers can clean indoor air, there is no way for users to verify the consistency of the process or study the long-term behavior of the air they breathe. In this paper, a solution will be presented to enable users to monitor the air quality in real-time and over time, while simultaneously purifying polluted air. The solution involves measuring a range of pollutant concentrations and alerting users of the most harmful concentrations.

Keywords—Internet of Things (IoT), Air Purifier, MQ2 Sensor, real-time monitoring.

I. INTRODUCTION

Air is essential for all life on this planet and must maintain an unvarying quality for all living beings to stay healthy. Unfortunately, air pollution is increasingly prevalent, and there are no substitutes for clean air. In countries such as India, the current state of air quality is a matter of significant concern. The rise in population, urbanization, and other factors have contributed to the number of ways in which the air can become polluted. Coal and petroleum are two major sources of pollution, and there are no viable eco-friendly alternatives available to deploy on a large scale. In addition, many other factors contribute to poor air quality. Combating these issues requires knowledge of the various pollutants and their safe levels. It is not just one type of pollutant that harms air quality, but a combination of them that can cause significant health problems. Identifying the pollutants within safe levels and how many of them exceed safety levels is crucial to addressing this issue[1].

Despite the implementation of various preventive maintenance systems to combat air pollution, predictive

maintenance has gained more popularity and is considered more effective than the now outdated preventive methods. The Internet of Things (IoT) has the potential to alleviate the harmful effects of polluted air. This paper presents a solution to inform people about the quality of the air they breathe indoors, including its pollutants and concentrations. By providing timely information, health hazards can be avoided. The proposed solution relies on IoT to analyze and alert users of the air quality indoors, with real-time monitoring being a crucial aspect and purifying the harmful gases in the atmosphere[2].

II. RELATED WORK

A. Artificial Intelligence-based Air Quality Management

This work proposes the use of artificial intelligence (AI) techniques to manage air quality. The authors suggest that AI could be used to predict air pollution levels and develop policies to address them. Additionally, they propose using AI for optimizing the operations of air purifiers and HVAC systems[3].

B. Smart Air Purifier

This work proposes a smart air purifier that uses sensors to monitor indoor air quality and adjusts its operations accordingly. The authors suggest that this type of air purifier could be integrated with home automation systems to provide a more comprehensive indoor air quality management solution[4].

C. Mobile Air Quality Monitoring System

This work proposes a mobile air quality monitoring system that can be deployed in vehicles or carried by individuals. The system uses sensors to measure air quality and provides real-time information about the air quality of different locations. The authors suggest that this type of system could be used to avoid areas with poor air quality and to inform policy-making related to air quality management[5].

III. INDOOR AIR QUALITY PARAMETERS

Indoor air pollution is commonly referred to as Sick Building Syndrome, wherein occupants of affected buildings report subjective and vague health complaints due to poor air quality[6]. The quality of indoor air (IAQ) can be impacted by various gases such as carbon monoxide, carbon dioxide, radon, and volatile organic compounds, as well as particulate matter, microbial contaminants, and mass energy stressors. Deterioration in IAQ can lead to significant health problems[7].

In order to comprehend the ventilation efficiency of a building, computer models are utilized to simulate the airflow inside. The following paragraphs discuss some of the parameters that are typically measured and how they contribute to indoor air pollution[8]:

- Incomplete combustion of fossil fuels produces carbon monoxide, which is one of the most acutely toxic indoor contaminants. The time-weighted average (TWA) limit for indoor carbon monoxide concentration is 25 ppm, exceeding which can cause health issues such as nausea in humans.
- Carbon dioxide concentration indoors is directly related to human metabolic activity. The maximum acceptable indoor concentration of carbon dioxide is 1000 ppm.
- Volatile Organic Compounds (VOCs) are typically found in higher concentrations indoors than outdoors. They are produced by materials such as paints, lacquers, paint strippers, cleaning supplies, and pesticides.

IV. IMPLEMENTATION

The components of the system consist of lightweight, simple tools that are affordable and utilized in real-time for effective device utilization.

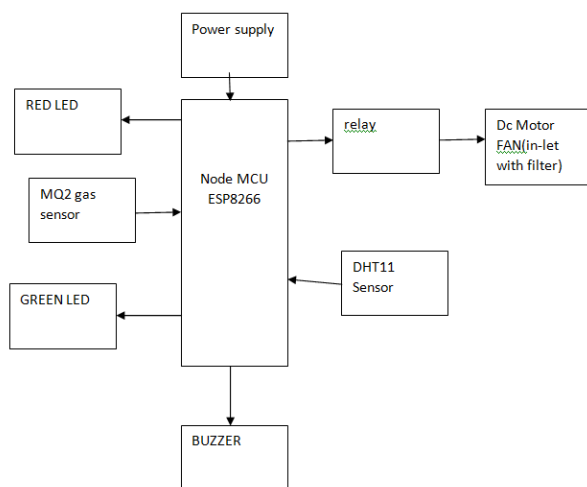


Fig. 1. Block Diagram

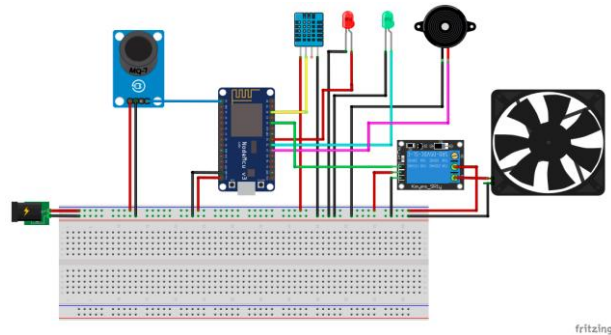


Fig. 2. Connection of Hardware Components

V. SYSTEM ARCHITECTURE

The components of the system consist of lightweight, simple tools that are affordable and utilized in real-time for effective device utilization.

An air quality and purification system using IoT typically consists of the following components:

- Sensors: Sensors such as gas sensors, particulate matter sensors, temperature and humidity sensors, and VOC sensors are used to monitor the air quality in real-time. These sensors can detect harmful pollutants and trigger the purification system when required.
- Microcontrollers: Microcontrollers such as Arduino or Raspberry Pi are used to control the sensors, monitor the data, and send commands to the purification system.
- Purification System: The purification system can be a combination of air filters, air purifiers, and HVAC systems. The purification system is triggered when the sensor data indicates poor air quality and is controlled by the microcontroller.

VI. APPLICATION ARCHITECTURE

1. The first layer of the application architecture for an Air Quality and Purification System using IoT is the sensors layer. This layer includes gas sensors, temperature and humidity sensors, which measure air quality parameters and transmit data to the next layer.
2. The network layer is responsible for the transmission of data from the sensors to the cloud platform or on-premise server. This layer uses different communication protocols such as Wi-Fi, Bluetooth, depending on the application requirements.
3. The cloud platform or on-premise server is the third layer of the architecture, which receives data from the network layer and processes it for analysis. This layer stores the data in a database, provides an interface for users to access and visualize the data, anomaly detection, and control logic for the purification system.

- The fourth layer is the application layer, which includes the user interface that allows the user to interact with the system. This layer provides real-time visualizations of air quality data, alerts the user about abnormal conditions, and allows the user to control the purification system remotely.
- The final layer is the purification system layer, which includes the hardware components which are DC motor fan, air filter. These components work in tandem with the application layer to control the air quality. The microcontroller receives signals from the application layer and operates the purification system as per the user's requirements.

VII. WORKING

The power supply connected to the microcontroller board activates various peripheral components, including the MQ2 sensor, relay modules, fans, and Arduino board. The MQ2 sensor constantly monitors the environmental air condition and sends signals to the microcontroller via the A0 pin. If the MQ2 sensor detects abnormal conditions, such as air contamination, the microcontroller examines the situation and commands the relay modules connected to DC motor fans. Two fans are employed, an exhaust fan and an air filter-equipped fan. When air contamination is detected, the exhaust fan operates for 10 seconds, facilitating the expulsion of the air from the room. Subsequently, the inlet fan with the filter switches on for 15 seconds, allowing filtered outside air to enter the room. The automated detection and air control system ensure that the air quality within the room is maintained at optimal levels, providing a healthy and safe environment for the occupants. This type of system is useful in environments where the air quality can be compromised, such as in industrial settings or areas with high levels of air pollution. The system offers an efficient and effective way to monitor and control indoor air quality, thereby reducing the risk of health issues caused by poor air quality.

VIII. RESULT

Once the air purification process is complete, you can check the results on the Blynk app. The app provides real-time readings on several parameters, including Gas, Humidity, and Temperature, as shown in Figure 3. The LED blinks with a 1-second delay between each blink to indicate that the app is currently collecting data. In case of any unusual readings, the Blynk app sends notifications and emails to the registered accounts to alert them of the situation as shown in figure 4.



Fig. 3. Blynk App

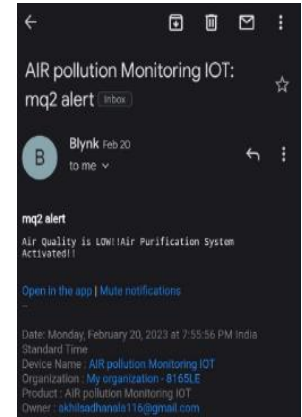


Fig. 4. Email Alert

After the air has been purified, you can observe the gauges on the app reporting normal conditions. This means that the gas levels are within safe limits, and the humidity and temperature are at optimal levels. The app's intuitive interface makes it easy to monitor these readings, and the community support ensures that you can get help with any issues that may arise during the process. Overall, the Blynk app provides a convenient and reliable way to monitor air quality and ensure a safe and healthy environment.

IX. CONCLUSION

Hence, By using this technology we can automatically control the air quality of a particular ICU room and developing the Air filtering and disinfecting device shows a significant importance with regards to keeping the environmental air safe and therapeutic not only to the patients in the hospital but also the hospital staff. Evaluating environmental effluence with the use of the Arduino Uno board and sensors also prove to be accurate in measure the Air Quality Index(AQI) of hospital rooms with regards to certain chemicals such as paint, cigarette smoke, and insecticides. This device can be utilized not only in hospitals but on other related industries.

X. FURTHER SCOPE

There are various potential areas for further development in the field of air quality monitoring and purification systems. These include integration with smart home systems that allow users to control their indoor air quality via voice assistants or smart devices. The Internet of Things (IoT) can also be leveraged for real-time analysis of air quality data to gain insights into regional trends, inform city-wide air



quality management, policy-making, and planning. In addition, artificial intelligence (AI) can be utilized for data analysis and prediction, as well as optimization of air purification systems to improve their efficiency. Furthermore, mobile air quality monitoring systems can be created for use in vehicles or carried by individuals, providing real-time information about air quality in different locations. Finally, integration with Heating, Ventilation, and Air Conditioning (HVAC) systems can offer a comprehensive solution for indoor air quality management.

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