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Air Quality Monitoring System: A Personal Air Quality Measuring System with Machine Learning

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ABSTRACT

An air quality monitoring system is a type of environmental monitoring system that measures and analyses the air quality in a particular area. The system typically consists of a network of sensors that are placed in different locations throughout the area of interest. These sensors can detect a range of pollutants such as particulate matter, nitrogen dioxide, sulphur dioxide, carbon monoxide, and ozone. The data collected from the sensors is then transmitted to a central server where it is analysed to determine the current air quality level. This information can then be used to generate real-time alerts or notifications to the public, local authorities, or businesses. Air quality monitoring systems are becoming increasingly important as air pollution levels continue to rise in many urban areas around the world. The data collected by these systems can be used to inform public policy, guide urban planning decisions, and help individuals make informed choices about their health and wellbeing. In summary, air quality monitoring systems play a vital role in promoting public health and safety by providing accurate and timely information about the air we breathe

Key Words: Air pollution, Air Quality Index (AQI), Internet of Things (IoT), Parts Per Million (PPM), Sensor (MQ135, MQ7, PMS5003, DHT22), Effects.

I. INTRODUCTION

Air pollution has become a significant problem in many parts of the world, leading to numerous health issues and environmental damage. Therefore, it is crucial to monitor air quality levels to identify the sources of pollution and take appropriate measures to mitigate its effects. In recent years, the development of low-cost air quality monitoring systems using Arduino and gas sensors has become increasingly popular due to their accessibility and affordability. This research paper aims to explore the use of Arduino and gas sensors for air quality monitoring systems, discussing their technical components, operation, and potential applications.

Technical Components and Operation of Arduino and Gas Sensor-Based Air Quality Monitoring System:

The Arduino microcontroller board is a popular platform for creating low-cost air quality monitoring systems. The board is easy to use and can be programmed to control a variety of sensors, including gas sensors. Gas sensors detect specific gases, such as carbon monoxide, sulphur dioxide, and nitrogen oxides, by measuring changes in electrical conductivity or optical properties.

The Arduino and gas sensors are typically combined with other components, such as an LCD screen, Wi-Fi or

Bluetooth module, and power source, to create a functional air quality monitoring system. The gas sensors measure the concentration of various pollutants in the air, and the Arduino board processes this data and displays it on the LCD screen or transmits it wirelessly to a remote server for further analysis.

Potential Applications of Arduino and Gas Sensor-Based Air Quality Monitoring Systems:

Arduino and gas sensor-based air quality monitoring systems have numerous potential applications. For example, they can be used to measure air quality levels in residential areas, industrial sites, or traffic-congested locations. The data collected can be used to inform public policy decisions and help individuals make informed decisions about their health and wellbeing. These systems can also be used to identify and track the sources of air pollution, such as factories, transportation, or natural sources, and take appropriate measures to reduce emissions.

II. PROBLEM STATEMENT

The proposed study aims for an Air Quality Monitoring System indicates the level of Pollution inside our homes and suggest precautionary measures.

III. LITERATURE SURVEY

Air quality monitoring systems are used to measure the concentration of pollutants in the air, such as particulate matter, nitrogen dioxide, and ozone. There have been numerous studies on this topic, ranging from the design and implementation of air quality monitoring systems to the analysis of the data collected by these systems. Here are some examples of literature on air quality monitoring systems:

"Development of a Low-cost Air Quality Monitoring System with Real-time Data Transmission for Smart Cities" by A. Tena-Cuenca et al. This study describes the design and implementation of a low-cost air quality monitoring system that can transmit real-time data to a central server. The system uses low-cost sensors to measure pollutants such as carbon monoxide, nitrogen dioxide, and ozone.

"A Review of Low-cost Sensors for Air Quality Monitoring" by P. Kumar et al. This review provides an overview of the various low-cost sensors that are used in air quality monitoring systems. The authors discuss the advantages and limitations of each type of sensor and provide recommendations for selecting the appropriate sensors for specific applications.

"Evaluation of an Air Quality Monitoring System for Traffic-related Air Pollution" by S. Wang et al. This study evaluates the performance of an air quality monitoring system that was deployed in a busy urban area. The authors compare the data collected by the monitoring system with data collected by a reference instrument and find that the monitoring system provides accurate measurements of particulate matter and nitrogen dioxide.

"Air Quality Monitoring using Wireless Sensor Networks: A Review" by M. Al-Fuqaha et al. This review provides an overview of the various wireless sensor network (WSN) technologies that are used in air quality monitoring systems. The authors discuss the advantages and limitations of each type of WSN and provide recommendations for selecting the appropriate WSN for specific applications.

"A Portable Air Quality Monitoring System for Personal Exposure Assessment" by S. K. Cho et al. This study describes the design and implementation of a portable air quality monitoring system that can be worn by individuals

to measure their personal exposure to pollutants. The authors demonstrate the feasibility of the system by conducting a pilot study with human subjects.

These are just a few examples of the many studies on air quality monitoring systems. The literature on this topic is vast and continues to grow as new technologies and techniques are developed for measuring and analysing air quality data.

IV. PROPOSED SYSTEM

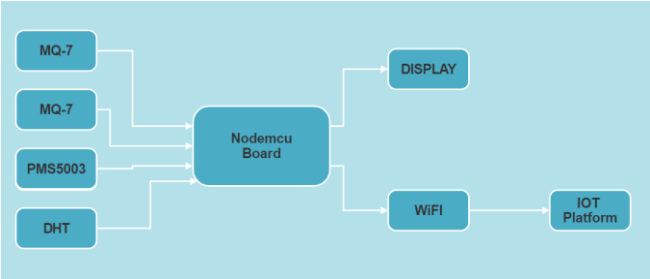

Fig -1: Architecture of IoT System

Define the scope of the project: Determine the type of air pollutants to be measured and the location of the monitoring system. This will determine the sensors to be used and the type of data collection to be implemented.

Choose the sensors: There are different sensors available for detecting different air pollutants such as carbon monoxide, nitrogen dioxide and particulate matter.Select the appropriate sensors based on the scope of the project.

Assemble the hardware: After selecting the sensors, connect them to the Nodemcu. You may need to use a breadboard to help connect the sensors properly. It is essential to ensure that the connections are correct and secure.

Write the code: Develop a code that allows the sensors to collect data and store it on the Arduino. The code should also include any calibration or compensation adjustments required by the sensors.

Store the data: We have created an algorithm in which we have used various sensor for particular features such as MQ7 and MQ 135 for gases in atmosphere (ppm values).DHT22 for humidity and temperature. PMS5003 for concentration of particulate matter in environment. The whole process works with the delay of 5 seconds for cooling down and taking appropriate values. Display the results: Use an LCD display or LEDs to show the air quality status in real-time.

Test the system: Test the system to ensure it is functioning correctly and obtaining accurate readings.

Install the system: Install the air quality monitoring system in the desired location and ensure it is secured properly.

Maintenance: Regular maintenance is required to ensure that the system is functioning correctly. This involves replacing the sensors when necessary, cleaning the sensors, and updating the code when required.

V. Test Cases

Sr	Test Case	Expected Result	Actual Results	Status
1	Connecting Arduino and Nodemcu with sensors	Show validation message	Arduino monitor will print values	Success
2	Checking internet connectivity of Nodemcu	Connection made message	Connection successful	Success

3	Checking AQI with formula	AQI PPM	Prints AQI value	Success
4	OLED Connection	OLED displaying message	Message displayed	Success
5	Sending Data to Google sheets	Spreadsheet with various data of sensors	Every row and column with data	Success

VI. CONCLUSION

In conclusion, Arduino and gas sensor-based air quality monitoring systems are an affordable and accessible solution for monitoring air pollution levels. They have the potential to provide real-time data on air quality levels, identify the sources of pollution, and inform public policy decisions. With continued development and improvement, these systems can play an essential role in promoting public health and environmental sustainability.

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