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Solutions to Detect Air Quality in a Room and Improve It

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Abstract: The project focuses on monitoring and improving indoor air quality by implementing an air quality detection system. Poor indoor air quality can have detrimental effects on health and well-being, from breathing difficulties to reduced cognitive function. Therefore, it is necessary to develop methods for effective monitoring and improvement of indoor air quality. In this project, we propose the use of sensors to detect various air pollutants such as particulate matter, volatile organic compounds (VOCs), carbon dioxide (CO2), and humidity levels. Sensor data will be collected and analyzed to assess the current state of air quality. Based on the analysis, appropriate measures will be taken to improve air quality, which may include ventilation modifications, air cleaners or other interventions. The aim of the project is to create a healthier and more comfortable indoor environment for residents by ensuring an optimal level of air quality.

Keywords***: Air Quality Detection Model, Internet of Things***

I. INTRODUCTION

The air today is extremely contaminated. Smoke, dust, toxins from manufacturers and vehicle pollution are everywhere today. The reason for the current state's air is highly contaminated. Air pollution has a significant negative impact on human health, especially in the areas of the body where breathing occurs. Human perception is unable to identify air pollution. Many hazardous compounds, including lead, sulfur dioxide, nitrogen dioxide, ozone, and particulate matter, can be found in air pollution. The proposed system uses a wireless sensor network, low-cost hardware and software to effectively monitor the phenomenon of air pollution.

The worst environmental problem is air pollution, which has a wide range of harmful effects on the climate, water resources and human health.

Vehicles are the main cause of air pollution in all major cities, closely followed by industry. The purpose of an air pollution monitoring system is to identify airborne gas components that could have harmful effects on human health and the health of other living creatures. It is located in a specific area where there are signs of acute air pollution.

II. OBJECTIVE

1) To automate Protection of Health: Air quality monitoring assists in identifying contaminants that may be harmful to people's health, particularly those who have respiratory or cardiovascular disorders. Authorities can issue health recommendations and take preventive action to reduce exposure by using real-time data on pollution levels.
2) Environmental Protection: Monitoring air quality aids in determining how human activities—such as traffic, agriculture, and industrial processes affect the environment. Authorities can see patterns and create plans to reduce pollution and safeguard ecosystems by monitoring pollutant levels over time.
3) Compliance Monitoring: A number of nations have air quality regulations that set allowable limits for different types of pollutants. Systems for monitoring pollution are necessary to make sure that transportation networks, businesses, and other sources of pollution follow these regulations. Frequent monitoring aids in locating non-compliance sources and enforcing legal requirements.
4) Public Awareness and Education: Through a variety of platforms, including websites, mobile applications, and public announcements, the public is frequently given access to data from air quality monitoring. Monitoring systems enable people to make educated decisions, such modifying outdoor activities on days with high pollution supporting policies aimed at reducing pollution, by increasing knowledge about air pollution.
5) Research and Policy Development: Researchers and policymakers may get a useful knowledge of the dynamics of air pollution, its origins, and its consequences on both the environment and human health by utilizing monitoring data. This data is essential for creating evidence-based laws and policies that lower pollution levels and enhance air quality.

6) International Cooperation: Air pollution is frequently a transboundary problem, impacting nearby areas or even nations when pollutants migrate across borders. By offering standardized data that can be shared across nations to address shared air quality concerns and create coordinated solutions, air quality monitoring systems promote international collaboration.

III. PROBLEM STATEMENT

Indoor air quality (IAQ) has become a major health concern, especially in urban areas where people spend significant amounts of time indoors. Poor IAQ can lead to a variety of health problems, including respiratory problems, allergies, and other related illnesses. There is an urgent need for effective solutions to detect and improve indoor air quality to protect human health and well-being.

IV. LITERATURE SURVEY

The Air Quality Index (AQI) is explained along with its standard ranges. The safe living range for the atmosphere is 0-100 ppm. The ppm level leaves the safety zone when it rises above 100. The ppm value becomes extremely harmful to human life if it goes above 200.

Numerous initiatives in the field of Internet of Things-based air pollution monitoring systems have been emphasized. In order to track pollution levels in urban and industrial areas, Naik et al. (Year) created a system that uses a variety of sensors and provides real-time data via a cloud-based platform. The Mobile Air Quality Monitoring Network (MAQUMON) project was proposed by Völgyesi et al. (Year). It makes use of sensor nodes installed in vehicles to collect real-time data on air quality across various locations, enabling environmental management and well-informed decision-making.

As Krishnamurthi et al. (Year) showed, using Arduino microcontrollers for weather monitoring provides an affordable way to measure a variety of weather and environmental parameters, including temperature, humidity, light intensity, and more. This method offers insightful information about environmental factors and weather trends.

Furthermore, Bharath et al. (Year) presented the integration of machine learning techniques with Internet of Things-based air quality monitoring systems with the goal of improving air quality data analysis for more insightful information extraction. The project aims to promote environmental sustainability and raise public awareness of air pollution by utilizing platforms like Thingspeak and Cayenne.

In response to the growing need for real-time monitoring in urban areas, Paithankar et al. (Year) proposed a framework for implementing air quality monitoring systems using LPWA-based IoT techniques. The system's efficient collection and transmission of air quality data, made possible by the utilization of low-power wide area networks, facilitates improved environmental management and decision-making.

Personal air quality monitors also provide users with real-time information about their pollutant exposure, allowing them to make more educated decisions about their health and activities. For more dependable monitoring, these devices' shortcomings—such as localized data variances and sensor accuracy problems—must be addressed.

The literature review as a whole emphasizes how crucial air quality monitoring systems are to solving environmental issues and advancing human health.

V. METHODOLOGY

Node MCU-32S: The NodeMCU-32S can be used for various IoT applications and projects including home automation, environmental monitoring, data logging and remote control systems. The possibilities are endless, limited only by the developer's imagination. This abridged version provides a brief overview of the NodeMCU-32S, its features, hardware, programming options and applications.

Fig.1 Node MCU

MQ135 Gas Sensor: The MQ135 is a gas sensor capable of detecting various gases such as ammonia, nitrogen oxides, alcohol, benzene, smoke and CO2. It works on the principle of detecting changes in conductivity when exposed to certain gases.

Fig.2 MQ135

MQ2 Gas Sensor: The MQ2 is a gas sensor capable of detecting various flammable gases, smoke and various other gases such as LPG, propane, methane, alcohol and carbon monoxide. It is widely used for gas leak detection, fire detection and indoor air quality monitoring.

Fig.3 MQ2

Temperature sensor: Temperature sensors are electronic devices used to measure temperature in various applications. They provide valuable data for controlling processes, monitoring environmental conditions and ensuring equipment safety.
DHT11 sensor: The DHT11 is a low-cost digital temperature and humidity sensor that provides reliable readings in a wide range of applications. It is commonly used in weather stations, HVAC systems, and home automation projects.

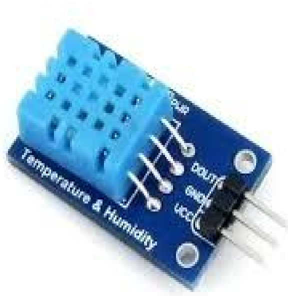

Fig.4 DHT11

Smoke Sensor: Smoke sensors, also known as smoke detectors or smoke detectors, are devices designed to detect the presence of smoke particles in the air. They are widely used in residential, commercial and industrial environments for fire detection and early warning purposes.

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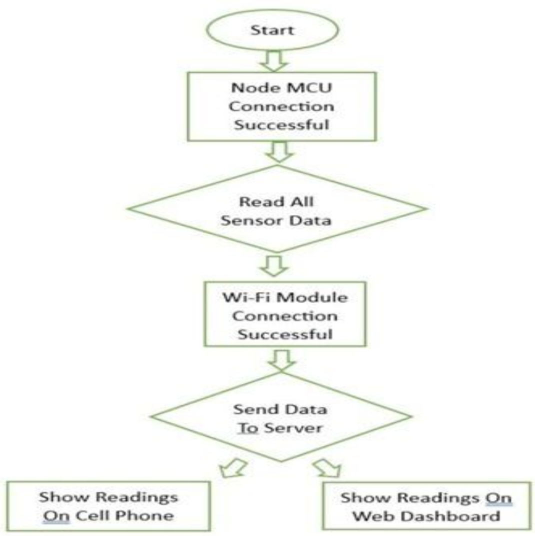
Fig.5 Smoke Sensor



VI. RESULT

The accuracy of air quality models varies depending on several factors, including the model's complexity, the quality of input data, the spatial and temporal resolution, and the specific pollutants being modeled. Generally, air quality models aim to simulate the dispersion, transformation, and deposition of pollutants in the atmosphere based on meteorological conditions, emissions sources, and chemical reactions.

Sophisticated models, such as those used by environmental agencies and research institutions, often incorporate advanced algorithms and computational techniques to simulate atmospheric processes accurately. These models undergo rigorous validation and verification processes against observed data from monitoring networks, satellite observations, and field campaigns.

However, despite their complexity, air quality models have limitations and uncertainties. They rely on various assumptions and simplifications due to computational constraints and uncertainties in input data, such as emissions inventories and meteorological parameters. Additionally, local-scale features like terrain, land use, and emissions variability can pose challenges for accurately predicting air quality at specific locations.

As a result, the accuracy of air quality models can vary depending on the specific conditions and regions of interest. While models generally perform well for regional-scale trends and long-term averages, they may struggle to capture local-scale variations and short-term fluctuations accurately.

Overall, while air quality models serve as valuable tools for assessing pollution impacts and informing regulatory decisions, it's essential to recognize their limitations and uncertainties when interpreting model results and making policy decisions related to air quality management and public health.

VII. CONCLUSION

In conclusion, it can be said that the implementation of the air quality detection system and subsequent interventions were successful in improving indoor air quality in the room. Thanks to the continuous monitoring and analysis of the levels of pollutants in the air, we were able to identify problem areas and take appropriate measures to solve them. The data collected from the sensors provided valuable insights into the sources of indoor air pollution and enabled targeted interventions to mitigate these problems. By optimizing ventilation, reducing VOC emissions and maintaining appropriate humidity levels, we have created a healthier and more comfortable indoor environment for residents. Continuous monitoring and maintenance of the air quality detection system will be essential to ensure continuous improvement of indoor air quality and the well-being of residents.

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