MAHENDRA INSTITUTE OF ENGINEERING AND TECHNOLOGY

AIR QUALITY MONITORING

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ABSTRACT:

Humans can be adversely affected by exposure to air pollutants in ambient air. Hence, health-based standards and objectives for some pollutants in the air are set by each country detection and measurement of contents of the atmosphere are becoming increasingly important. Careful planning of measurements is essential

One of the major factors that influence the representativeness of data collected is the location of monitoring stations the planning and setting up of monitoring stations are complex and incurs a huge expenditure.

An IoT-based real-time air pollution monitoring system is proposed to monitor the pollution levels of various pollutants. The geographical area is classified as industrial, Residential, and traffic zones this article proposes an IoT system that could be deployed at any location and store the measured values in a cloud database, perform pollution analysis, and display the pollution level at any given location.

Key Words: Internet of Things.

INTRODUCTION

Nowadays the air condition is very polluted. In recent years, car emissions, chemicals from factories, smoke, and dust are everywhere. That is the reason why now air condition is very polluted. The effect of air pollution is very bad for our health, especially for a place where the air in our body is taken for breathing.

Air pollution cannot be detected by human feelings. Air pollution may contain a lot of dangerous substances such as ozone, particulate matter sulfur dioxide, nitrogen dioxide, carbonmonoxide, and lead. This proposed system uses a wireless sensor network with low-cost sensors and hardware components along the necessary software to effectively monitor the air pollution phenomenon.

Air pollution is the worst environmental problem and it causes a multitude of adverse effects on human health, water bodies, and climate. The main source of air pollution in all major cities is due to vehicles and the second major source remains the industries. The air pollution monitoring system.

IOT(AIR QUALITY MONITORING)

IoT (Internet of Things) air quality monitoring is a technology-driven approach to measure and manage air quality in real-time using connected devices and sensors. It involves the deployment of sensors in various locations to continuously collect data on air pollutants and environmental conditions. This data is then transmitted to a central system or cloud platform for analysis and visualization. Here are some key aspects of IoT air quality monitoring:

Sensor Deployment:

Various types of sensors are used to measure different air quality parameters, including particulate matter (PM2.5 and PM10), gases (such as carbon dioxide, carbon monoxide, nitrogen dioxide, sulfur dioxide, and ozone), temperature, humidity, and air pressure. These sensors can be deployed in indoor and outdoor environments, such as homes, offices, factories, streets, and public spaces.

Data Collection:

Sensors collect data at regular intervals, often in real-time or near real-time, and transmit it to a central database or cloud platform. Data can be sent wirelessly using Wi-Fi, cellular networks, LoRaWAN, or other IoT communication protocols.

Data Analysis:

The collected data is analyzed to assess air quality conditions. This analysis may involve identifying trends, anomalies, and patterns in the data. Machine learning and AI algorithms can be applied to predict air quality levels or to detect pollution events.

Visualization:

To make the data more accessible and actionable, IoT air quality monitoring systems often provide visualizations through web-based dashboards, mobile apps, or other user interfaces. These interfaces can display real-time air quality readings, historical data, and trends.

Alerting and Notifications:

When air quality reaches unhealthy levels or exceeds predefined thresholds, the system can send alerts and notifications to relevant stakeholders. These alerts can be delivered through email, SMS, or mobile app notifications.

Integration:

IoT air quality monitoring systems can be integrated with other systems, such as HVAC (Heating, Ventilation, and Air Conditioning) systems, to enable automatic adjustments based on air quality conditions. They can also integrate with weather forecasting systems for better prediction of air quality changes.

Data Sharing:

Some projects and initiatives aim to make air quality data publicly available to raise awareness and inform the public. Open data initiatives and APIs are often used for this purpose.

Environmental Management:

IoT air quality monitoring can aid governments, businesses, and individuals in making informed decisions about environmental management. For example, it can help identify pollution sources, evaluate the effectiveness of air quality regulations, and assess the impact of urban development on air quality.

Research and Policy:

The data collected through IoT air quality monitoring can support scientific research on air quality and inform the development of environmental policies and regulations.

Environmental Health:

Monitoring air quality is crucial for public health. IoT systems can provide individuals with information about the air they breathe, helping them take precautions when air quality is poor.

IoT air quality monitoring has a wide range of applications, from ensuring healthy indoor air quality in homes and offices to monitoring pollution levels in cities and industrial areas. It plays a crucial role in environmental protection, public health, and sustainable urban development.

SURVEY OF AIR QUALITY MONITORING

Monitoring air quality is essential for understanding and managing environmental and public health risks associated with air pollution. Conducting a survey of air quality monitoring involves

several key steps and considerations:

Define Objectives and Scope:

Determine the purpose of the air quality survey. Is it for regulatory compliance, public health assessment, or research?

Define the geographic area and duration of the survey.

Select Monitoring Parameters:

Identify the specific pollutants or parameters you want to measure. Common pollutants include:

Particulate Matter (PM10, PM2.5)

Ground-level Ozone (O3)

Nitrogen Dioxide (NO2)

Sulfur Dioxide (SO2)

Carbon Monoxide (CO)

Volatile Organic Compounds (VOCs)

Heavy Metals (e.g., lead, mercury)

Air toxics (e.g., benzene, formaldehyde)

Choose Monitoring Methods:

Select appropriate monitoring methods and instruments for each parameter. This may involve using:

Continuous monitoring stations

Passive sampling

Remote sensing (e.g., satellite data)

Mobile monitoring (e.g., vehicles equipped with sensors)

Select Monitoring Locations:

Determine where to place monitoring stations or instruments. Consider factors like proximity to pollution sources, population density, and topography.

Data Collection:

Collect air quality data continuously or at regular intervals.

Ensure instruments are properly calibrated and maintained.

Record meteorological data (temperature, humidity, wind speed, etc.) to help interpret air quality measurements.

Data Analysis:

Analyze the collected data to assess air quality levels and trends.

Compare the data to air quality standards and guidelines set by regulatory agencies.

Data Visualization:

Create visualizations (e.g., maps, graphs) to communicate air quality information to the public, policymakers, and other stakeholders.

Reporting and Communication:

Prepare reports summarizing the survey findings.

Share results with the public through websites, public notices, or media outlets.

Communicate any health advisories or recommendations based on the data.

Quality Assurance and Quality Control (QA/QC):

Implement QA/QC procedures to ensure data accuracy and reliability.

Regularly check and maintain monitoring equipment.

Long-term Monitoring:

Consider the need for long-term monitoring to track air quality changes over time.

Regulatory Compliance:

Ensure that the survey complies with relevant environmental regulations and standards.

Public Engagement:

Engage with the community and stakeholders to raise awareness and gather input on air quality issues.

Adaptive Management:

Use survey results to inform policy decisions and make adjustments to air quality

management strategies as needed.

Air quality monitoring surveys are crucial for protecting public health, the environment, and for making informed decisions about pollution control and mitigation efforts. These surveys often involve collaboration between government agencies, research institutions, and environmental organizations to ensure comprehensive and accurate data collection and analysis.

LITERATURE SURVEY

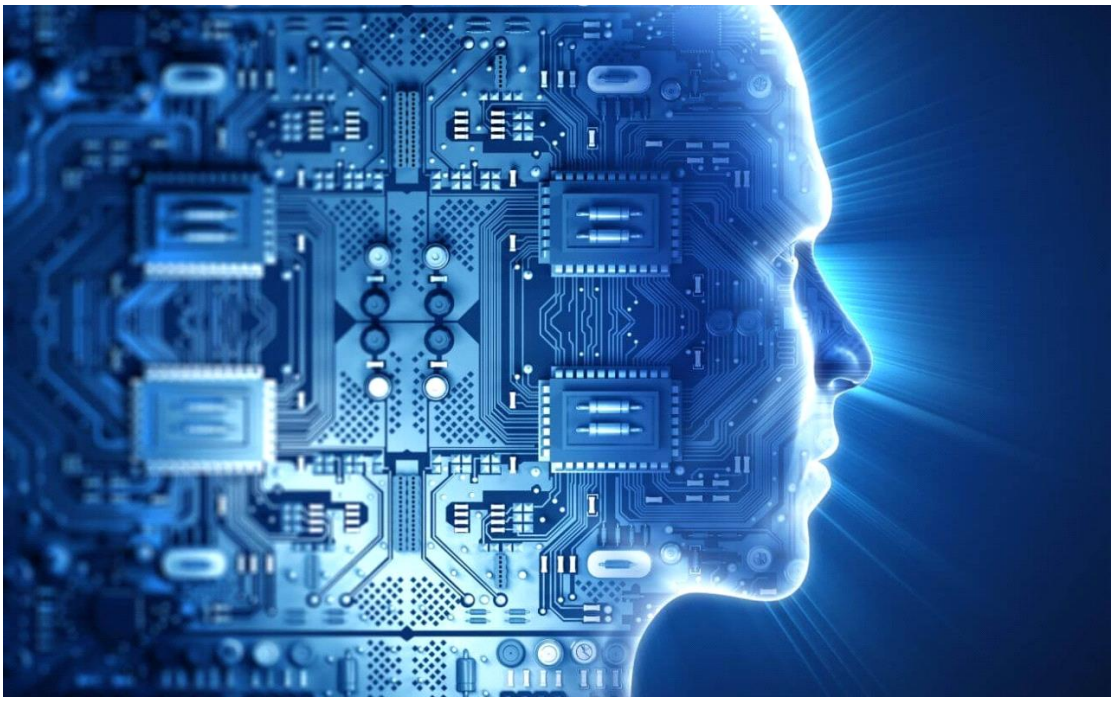
1 Air quality using ZigBee

This paper discusses a monitoring system that gives information about environmental conditions and briefly touches the technological advancements in monitoring the environment and bringing out the new scope in monitoring the current environmental problems

INFORMATION SYSTEMS

SICE develops environmental information systems for citizens (web, smartphone apps, variable message signs(VMS), etc.), with data obtained from monitoring stations.

These data are also supplied to Prediction Systems to provide information on changes to atmospheric contamination over time



Knowing beforehand that an incident could occur is a vital tool to protect the population and the environment, as it allows the implementation of preventative measures.

MONITORING STATIONS

Air Quality Monitoring Networks allow the measurement, operation and predictive analysis of the evolution of air pollution in different areas (urban areas, industrial areas, special nature conservation areas, etc.)

Monitoring stations have equipment to measure the following parameters:

- NOx, SO2, CO, O3, BTX, etc.
- Particulate matter (PM10 and PM2.5)

Some stations are equipped with meteorological sensors and/or noise level meters to measure noise level.

CONTROL CENTRE SOFTWARE

SICE has extensive experience in the operation and maintenance of Air Quality Monitoring Networks, which means it has a deep understanding of the various types of data management applications.

Furthermore, SICE has developed an interactive application for the management, administration and control of obtained data as well as the condition of measuring devices.

The user accesses the web application using a username and password, and its functionality responds to management operations (information log, modification and deletion, control operations, etc.).

HARDWARE EQUIPMENTS

Air quality monitoring requires specialized hardware to measure various pollutants and environmental parameters accurately. Here's a list of essential hardware components commonly used for air quality monitoring:

Particulate Matter (PM) Sensors: These sensors measure the concentration of airborne particles of different sizes, typically PM2.5 and PM10.

Gas Sensors:

Gas sensors detect specific gases like carbon dioxide (CO_2), carbon monoxide (CO), ozone (O_3), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and volatile organic compounds (VOCs).

Humidity and Temperature Sensors: These sensors provide data on temperature and humidity, which can affect air quality measurements.

EXSISTING SYSTEM

Air quality monitoring systems are crucial for assessing and managing air pollution levels and ensuring public health and environmental safety. These systems typically consist of various components and technologies that work together to collect, analyze, and disseminate air quality data.

Below is an overview of the components and technologies commonly found in existing air quality monitoring systems.

Sensors are at the heart of air quality monitoring systems. They measure various air pollutants and meteorological parameters. Common sensors include:

Particulate Matter (PM) Sensors: These measure the concentration of fine

particulate matter in the air, typically categorized as PM2.5 (particles with a diameter of 2.5 micrometers or less) and PM10 (particles with a diameter of 10 micrometers or less)

PROPOSED SYSTEM

A proposed system for air quality monitoring involves the use of various sensors, data collection methods, and data analysis techniques to continuously monitor and assess the quality of the air in a specific area. This system is crucial for tracking air pollution levels, ensuring public health, and making informed decisions regarding environmental policies and regulations. Here are the key components of a modern air quality monitoring system:

Sensor Network:

Deploy a network of air quality sensors at strategic locations throughout the target area. These sensors should measure various air pollutants, including:

Particulate matter (PM2.5 and PM10)

Ground-level ozone (O3)

Nitrogen dioxide (NO2)

Sulfur dioxide (SO2)

Carbon monoxide (CO)

Volatile organic compounds (VOCs)

Data Acquisition:

Collect data from the sensors in real-time or at regular intervals, depending on the specific application and monitoring goals.

Use data loggers or IoT devices to transmit data to a central database or cloud platform for storage and analysis.

Data Integration:

Integrate data from multiple sources, such as weather stations, traffic monitoring systems, and industrial emissions databases, to provide a comprehensive view of air quality and its influencing factors.