AIR QUALITY MONITORING PHASE-2

INTRODUCTION:

In this phase-2 of the air quality monitoring project we are going to explain what is meant by the quality air? What are the parameters of the quality air? And how we are collecting the historical air quality data and incorporate with this project to make a predictive model . After through the research and analysis ,we arrived at an innovative solution To solve the above problem as detailed in phase-1 of the project.

DEFINITON OF QUALITY AIR:

Air quality refers to the condition of the air in a particular location with respect to its effects on human health and the environment. Good air quality means that the air is clean and free from harmful pollutants, while poor air quality means that the air is contaminated with pollutants that can cause health problems and environmental damage. The quality of air can be affected by a variety of factors, including emissions from vehicles and industrial processes, natural sources such as dust and wildfires, and weather conditions such as temperature and wind speed. Air quality is monitored by government agencies and other organizations using specialized equipment to measure the concentration of pollutants in the air .

AIR QUALITY PARAMETERS:

1. **Particulate matter (PM)**: PM is a mixture of solid and liquid particles that are suspended in the air. These particles can be harmful to human health, especially if they are small enough to be inhaled.
2. **Ozone (O3)**: Ozone is a gas that is formed when nitrogen oxides and volatile organic compounds react in the presence of sunlight. It can cause respiratory problems and other health issues.
3. **Nitrogen dioxide (NO2)**: NO2 is a gas that is produced by burning fossil fuels. It can cause respiratory problems and other health issues.
4. **Sulfur dioxide (SO2)**: SO2 is a gas that is produced by burning fossil fuels. It can cause respiratory problems and other health issues.
5. **Carbon monoxide (CO)**: CO is a gas that is produced by burning fossil fuels. It can cause headaches, dizziness, and other health issues.
6. **Lead (Pb)**: Lead is a toxic metal that can be found in the air as a result of industrial processes and other human activities. It can cause developmental problems in children and other health issues

In this phase-2 we will be using the ESP32 micro controller as well as Arduino UNO both these suit the best for our project We chose this because we are going to predict particulate matter and carbon mono-oxide and post it to a public platform.

SOURCES FOR COLLECTING THE HISTORICAL DATA:

1. **Environmental Protection Agency (EPA)**: The EPA provides a variety of datasets related to air quality, including data on air pollution, emissions, and air quality trends. You can access these datasets through the EPA’s website.
2. **World Health Organization (WHO)**: The WHO provides data on air quality for countries around the world. You can access this data through the WHO’s website.
3. **OpenAQ**: OpenAQ is a non-profit organization that provides open data on air quality from around the world. You can access this data through OpenAQ’s website.
4. **National Oceanic and Atmospheric Administration (NOAA)**: The NOAA provides data on air quality and atmospheric conditions, including data on ozone, particulate matter, and other pollutants. You can access this data through the NOAA’s website.

From the above sources we get the air quality data in various formats such as excel sheet, CSV and Json file also we use the related sensors to collect the current air quality data From the various locations. The data includes information on air

quality parameters such as particulate matter, ozone, nitrogen dioxide, sulfur dioxide, and carbon monoxide.

SENSORS USED:

This project uses an ESP32 microcontroller, a PMS5003 Particulate Matter PM2.5 & PM10 Sensor, and a MQ-7 Carbon Monoxide Sensor to monitor and measure the PM2.5 & PM10 concentration and carbon monoxide levels in the air. The device can be used in homes, industries, schools, offices, and around crowded places.

WAY OF CONNECTIVIY:

Here we use Wi-Fi to establish a connectivity for our air quality monitoring device , which uses a ESP32 microcontroller to connect to the internet to share and export the data.

CLOUD CONNECTIVITY:

For storing and sharing the collected data to the public who use our device we use the cloud platform AWS(Amazon Web Service) for the cloud connectivity purpose.

PROTOCOL USED:

MQTT-A Light weight messaging protocol that is ideal for IOT application.

PREPROCESSING THE DATA:

1. **Clean the data**: The first step is to clean the data by removing any duplicates, missing values, or outliers. This will ensure that your data is accurate and representative of the problem you are trying to solve.
2. **Transform the data**: Once you have cleaned the data, you need to transform it into a format that can be used by machine learning algorithms. This involves converting categorical variables into numerical variables, normalizing the data, and splitting it into training and testing sets.
3. **Feature engineering**: The next step is to perform feature engineering on the data. This involves creating new features from existing ones that may be more informative for your predictive model.
4. **Dimensionality reduction**: If your dataset has a large number of features, you may need to perform dimensionality reduction to reduce the number of features while retaining as much information as possible.
5. **Data scaling**: Finally, you need to scale the data so that all features have similar ranges. This will ensure that no single feature dominates the others during model training.

EXPLORE THE DATA:

The next step is to explore the data to gain insights into the patterns and trends in air quality over time. You can use statistical methods and visualization tools to analyze the data.

There are many tools available for exploring data. Here are some of the most commonly used ones:

* Pandas
* Numpy
* Excel
* Matplotlib and more.

**Develop a predictive model:**

After exploring the data, we are going to develop a predictive model for air quality monitoring device. Here we use machine learning algorithms such as linear regression, decision trees, or neural networks to develop the model.

**Evaluate the model:**

The next step after developing a model is need to evaluate its performance using metrics such as accuracy, precision, recall, and F1 score. we can use cross-validation techniques to ensure that our model is robust and not overfitting the training data.

DEPLOY THE MODEL:

The last and the final step is to deploy our project this stage is divided into 6 steps they are:

1. **Choose an IoT platform**: The first step is to choose an IoT platform that is compatible with our device and programming language.
2. **Prepare the data**: Once we have chosen a platform, we need to prepare the data for deployment. This involves converting the data into a format that can be used by the platform.
3. **Train the model**: Next, we need to train the model on the prepared data. This involves using the same machine learning algorithm that we used during development.
4. **Deploy the model**: Once we have trained the model, we can deploy it on our IoT device. This involves uploading the model to the platform and configuring it to work with our device.
5. **Test the model**: After deploying the model, we need to test it to ensure that it is working correctly. we can use real-time data from our sensors to test the model’s predictions.
6. **Monitor and update**: Finally, we need to monitor the performance of our model and update it as necessary. This involves collecting feedback from users and making improvements to the model over time.

THANKYOU