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Air Quality Visualization

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Abstract - *With the advances of industry, air pollution is increasingly becoming serious, and most governments in the world have deployed many devices to monitor daily air quality. Predicting and visualizing air quality has also become an important issue to improve the quality of people's lives. As far as we know, bad air quality does not only affect the health of the respiratory tract, it may also even cause mental illness. Many researchers have investigated different approaches to work on air quality forecasts, and the visualization becomes important. In this project, we present an architecture for visualizing air quality. Data will be collected, analyzed, and preprocessed of collected data. We'll use an API, and finally we use the browser to get the data by predefined API and to present the visualization results with chart.js. It reveals that the visualization of the framework can work well for air quality analysis.*

***Key Words*: Air quality visualization, Air Quality Index, Machine learning, ReactJS, real-time, python.**

1. INTRODUCTION

Air pollution is a rapidly evolving concern in the past decades with the increase of pollution sources worldwide. According to the CPCB pollutants are released to the air from a wide range of sources including transport, agriculture, industry, waste management and households. Rapid urbanization and industrial growth exacerbate the problem and the pressure is felt severely in big cities. However, air pollution does not respect borders. Atmospheric pollutants and heavy metals are carried by the wind, polluting water and soil away from their source. Therefore, air pollution is a problem of industrial regions and a global burden which affects overall parts of society.

According to the World Health Organization (WHO), 92% of the population in our planet lives in the areas that exceed ambient air quality limits. In addition, the report states that air pollution is the largest environmental risk to health, being responsible for nine deaths per year. In addition, statistics show that external air pollution alone accounts for 3 million deaths a year. Depending on the duration of exposure to air pollution, type of pollutant and the toxicity level of the pollutant, it may cause different health issues to humans. The WHO presents air quality guidelines to explain in detail the health effects of various pollutants. It includes difficulty in breathing, nausea, skin irritation, cancer, etc. The most prevalent health effects observed in different studies include decreased pulmonary function, asthma attacks, development of respiratory diseases and premature death. Protecting the atmospheric environment, including air quality management, intervention policies, health impact and risk evaluation, as well as air pollution modeling would be impossible without quantitative description of air quality with measurable quantities.

The aim of the air quality visualization is to keep the ambient air clean enough so that it is safe for the public health and the environment. In order to assess the status of the air, current air quality must be monitored. Public awareness of air pollution can help reduce both emission levels and exposure. In addition, scientists, policymakers, and regional and national planners need information on air quality to make informed decisions.

Air quality monitoring provides a necessary scientific basis for developing policies, setting objectives and planning 10 enforcement actions. Despite the importance of measurements, in many cases, visualizing one may be insufficient for the purpose of fully defining population exposure in the environment. Therefore, monitoring should often be combined with other objective evaluation techniques, including modeling, customization and visualization of measurements. Traditionally air quality visualization is based on air quality stations operated by national environmental protection agencies. These stations provide very precise measurements; however, the coverage zone is limited. As a result, many new approaches are emerging to offer high-resolution air quality visualization.

1.1 Objective and Purpose

The main objective of this project is to implement a supervised algorithm for prediction of air quality index automatic and further classifying AQI into healthy, moderate and hazardous. Performing analysis of data to determine air quality index and then representing it in a graphical representation. The aim is to analyze the data and visualize the quality of air in the particular area. However, before performing visualization the information is exposed to different preprocessing procedures which finally give the desired optimized output. This will allow people to know the air quality in their area. This summarization also helps government organizations to work on areas where air quality is not good.

1.2 Background Study

Where pollution has become a major problem around the world, air pollution is the most dangerous, shocking and severe pollution among other pollution. Air quality visualization – the visualization of data – helps us understand the classification of air pollutants in the atmosphere. Visualized data created makes it easier to check air quality, and increasingly diverse colors can visually highlight the air quality level. Visualization of data has more resilient more images and more insight) than the original data table, which is favorable for further analysis of data.

2. PROPOSED SYSTEM

In our approach we are planning to analyze the data and visualize the quality of air in the particular area. However, before performing visualization the information is exposed to different preprocessing procedures which finally give the desired optimized output.

This will allow people to know the air quality in their area. This summarization also helps government organizations to work in areas where air quality is not good.

Features

1. Provides users to check whether a particular area has good or bad air quality.
2. Real time analysis is provided
3. Interactive web page is provided for users to visualize the air quality.

2.1 Model

A regression model is used to scrutinize the correlation between two or more variables and evaluates one variable based on the others. In regression analysis, variables can be independent, which can be used as the predictor or input and dependent, which are used as response variables. A **regressor** is the name given to any variable in a regression model that is used to predict a response variable. In this project we have used a random forest regression model.

Random Forest Regression is a supervised learning algorithm that uses a technique for regression. The technique used is **Ensemble learning** method which combines predictions from multiple machine learning algorithms to make a accurate prediction than a single model. A Random Forest utilize by constructing various decision trees during training time and generating the output by taking the mean of the classes as the prediction of all the trees.

Uses of random forest regression

1. A Random Forest Regression model is powerful and accurate.
2. It usually performs great on many problems, including features with non-linear relationships.
3. It has the ability to work on a large data set with higher dimensionality

2.2 Data Collection

We have collected the dataset from the Central Pollution Control Board (CPCB) which includes seven parameters which are PM2.5, PM10, NO2, NH3, CO, O3 and (Air Quality Index) AQI. The dataset will be used to train the model for Air Quality Index (AQI) prediction.

2.3 Data Preprocessing

Preprocessing is the technique of preparing raw data into a clean dataset and making it suitable for machine learning models. The raw data collected during data collection has many null values. To eliminate null values the mean function is used to fill all the null values.

2.4 Classification of Air Quality Index (AQI)

The Air Quality Index is an effective tool for communicating the state of air quality to people in simple terms. It converts aggregated air quality data of several pollutants into a single index value. Further the AQI is divided into six types. Each category corresponds to a different level of health concern. Each category also has a specific color. The color helps people to quickly determine air quality levels in their communities.

Levels of Concern	Values of Index	Description of Air Quality
Good	0 to 50	Air quality is satisfactory and air pollution no risk
Moderate	51 to 100	Air quality is acceptable
Unhealthy for sensitive groups	101 to 150	Members of sensitive groups may experience health effects
Unhealthy	151 to 200	Sensitive groups may experience more serious health effects
Very Unhealthy	201 to 300	The entire population is more likely to be affected.
Hazardous	301 and higher	Everyone may experience more serious health effects

Table 1: Classification of AQI

2.5 Implementation

To make predictions in real-time the data from API is fetched and then fed to the trained Machine Learning model. Then the predicted AQI and the pollution parameters are pushed into the Firebase Database. The frontend then fetches the real-time data from Firebase, and the data is visible to the end user.

Searching for specific pollutants, we can get to know the amount of that pollutant in every city in the form of a bar chart. Also searching for a particular city, we get to know the amount of each pollutant present in the city. In the map we can view the air quality index of every city.

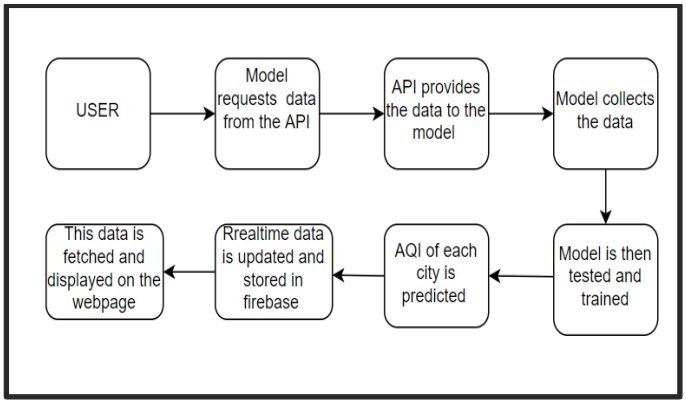

Fig 1: Working System

3. CONCLUSION

In this paper we have successfully created a regression model which will predict AQI based on parameters like PM2.5, PM10, NO2, SO2, O3, CO. We have selected these parameters as they have a major contribution to the numerical value of AQI. Since the model is capable of predicting the current data with 94% accuracy, it will successfully predict the upcoming air quality index of any particular data within a given region.

From the above analysis, we see that the majorly affected cities in India by air pollution. It helps users in monitoring the air quality.

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