Phase-1 Submission

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1. Problem Statement

Air pollution is a growing concern worldwide, especially in urban regions. Its adverse effects on human health, ecosystems, and climate make accurate forecasting of air quality a vital task. This project aims to leverage advanced machine learning algorithms to predict air quality levels (e.g., AQI), enabling authorities and citizens to make proactive decisions.

2.Objectives of the Project

- *Predict the Air Quality Index (AQI) based on environmental and meteorological parameters.*
- *Identify key contributors (e.g., pollutants) to air pollution.*
- *Generate insights to help government agencies, researchers, and the public.*
- *Optionally develop a web-based dashboard for real-time AQI forecasting.*

3. Scope of the Project

- ***Features:*** *PM2.5, PM10, NO2, SO2, CO, O3, temperature, humidity, wind speed.*
- ***Algorithms:*** *Regression models, Ensemble methods (e.g., Random Forest, XGBoost), possibly time-series models like LSTM.*
- ***Limitations:*** *Real-time data availability, data quality from sensors, and computational constraints.*

4.Data Sources

- ***Source:*** *Kaggle, UCI, OpenAQ API, Central Pollution Control Board (India).*
- ***Type:*** *Public datasets; both static (historical data) and dynamic (API-fed real-time data).*
- ***Format:*** *CSV, JSON.*
- ***Data source:*** *https://www.kaggle.com/datasets/waqi786/global-air-quality-dataset?resource=download*

5. High-Level Methodology

a. Data Collection

- *Download datasets from platforms like Kaggle/UCI.*
- *Use APIs (e.g., OpenAQ) for dynamic updates.*

b. Data Cleaning

- *Handle missing/null values.*
- *Remove duplicates and irrelevant features.*
- *Normalize pollutant concentrations.*

c. Exploratory Data Analysis (EDA)

- *Visualize pollutant trends, seasonal patterns, and location-wise variations using heatmaps, line plots, and box plots.*

d. Feature Engineering

- *Create pollutant ratios, categorize AQI levels, and add time-based features.*

e. Model Building

- *Test with Linear Regression, Random Forest, XGBoost, LSTM (if time-series).*
- *Optimize using GridSearchCV or RandomizedSearch.*

f. Model Evaluation

- *Use MAE, RMSE, and R^2 Score.*
- *Employ cross-validation.*

g. Visualization & Interpretation

- *Use graphs and dashboards to show pollutant levels, AQI trends, and predictions.*
- *Tools: Matplotlib, Seaborn, Plotly.*

h. Deployment (Optional)

- *Use Streamlit or Flask to create a web app for AQI prediction.*
- *Integrate with real-time API for live monitoring.*

6.Tools and Technologies

Category	***Tools & Technologies***
Programming Language	*Python*
IDE/Notebook	*Jupyter Notebook / Google Colab*
Libraries	*pandas, numpy, seaborn, matplotlib, scikit-learn, XGBoost, TensorFlow (optional)*
Deployment Tools	*Deployment Tools*

7.Team Members and Roles

Team Member Name	*Role/Responsibility*
Jeniliya	*Data Collection, Model Building,*
Aadharsh	*Visualization, Deployment*
Ashwinth	*Evaluation, Presentation*
Jeevanandan	*Documentation, EDA*
Ranjana sri	*Reporting, , Feature Engineering*