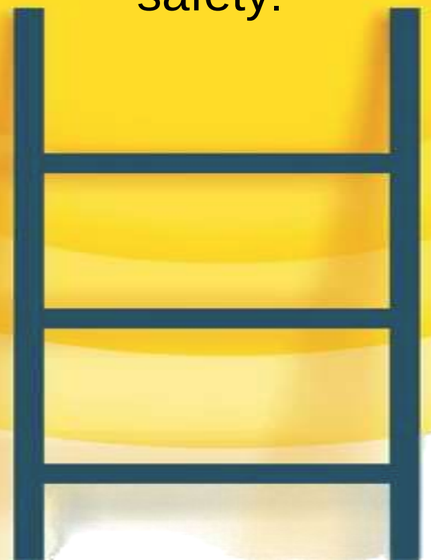
- **Air Quality Prediction & Monitoring**

GOAL

To develop a machine learning-based system that accurately predicts air pollution levels (specifically PM2.5) using real-time weather and provides an interactive and accessible platform for users to monitor and forecast air-quality, enabling early warnings, better decision-making, and contributing toward environmental awareness and public health safety.



🎯Learning Objectives:-

- Understand how Python can be used in real-world environmental applications.
- Learn to collect, analyze, and predict air quality data.
- Apply data science techniques to build a machine learning model.
- Visualize pollution levels using graphs and outputs.

Source : vaidehi23tech/Air-quality-predicter-project/

💻 Tools and Technology used:-

- **Programming Language & Libraries:-** Python, Pandas, Numpy, Scikit-learn,Matplotlib, Seaborn, Joblib.
- **Interface & Visualization:-** Streamlit (for web app UI)
- **Project Management:-** Git & GitHub (for version Control)
- **IDE:-** Visual Studio Code (VSCode)
- **Data Format:-** CSV files for sensor/weather data

🔎 Methodology

- **Data Generation:-**
  - Synthetic Data Simulating 100+ Days Of Real-world weather & Pollution Readings.

- **Preprocessing:-**
  - Handle Missing Values.
  - Select Relevant Features: Temperature, Humidity, Wind Speed

- **Model Training:-**
  - Regressor Trained To Predict PM2.
  - Model Saved As .Pkl Using Joblib

- **Deployment:-**
  - Built A Web App Using Streamlit For Easy Interaction
  - Hosted The Project Via Github And Streamlit Cloud

Problem Statements:

- Air pollution, especially “**PM2.5**”, poses serious health risks.
- Real-time prediction is crucial for “**early warnings**” and “**public safety**”.
- Manual monitoring is slow, inconsistent, and reactive.
- Need a ‘**predictive system**’ that helps authorities and individuals make informed decisions.
- Aim: Build a model to “**forecast pollution using weather**” features in advance.

Solution:

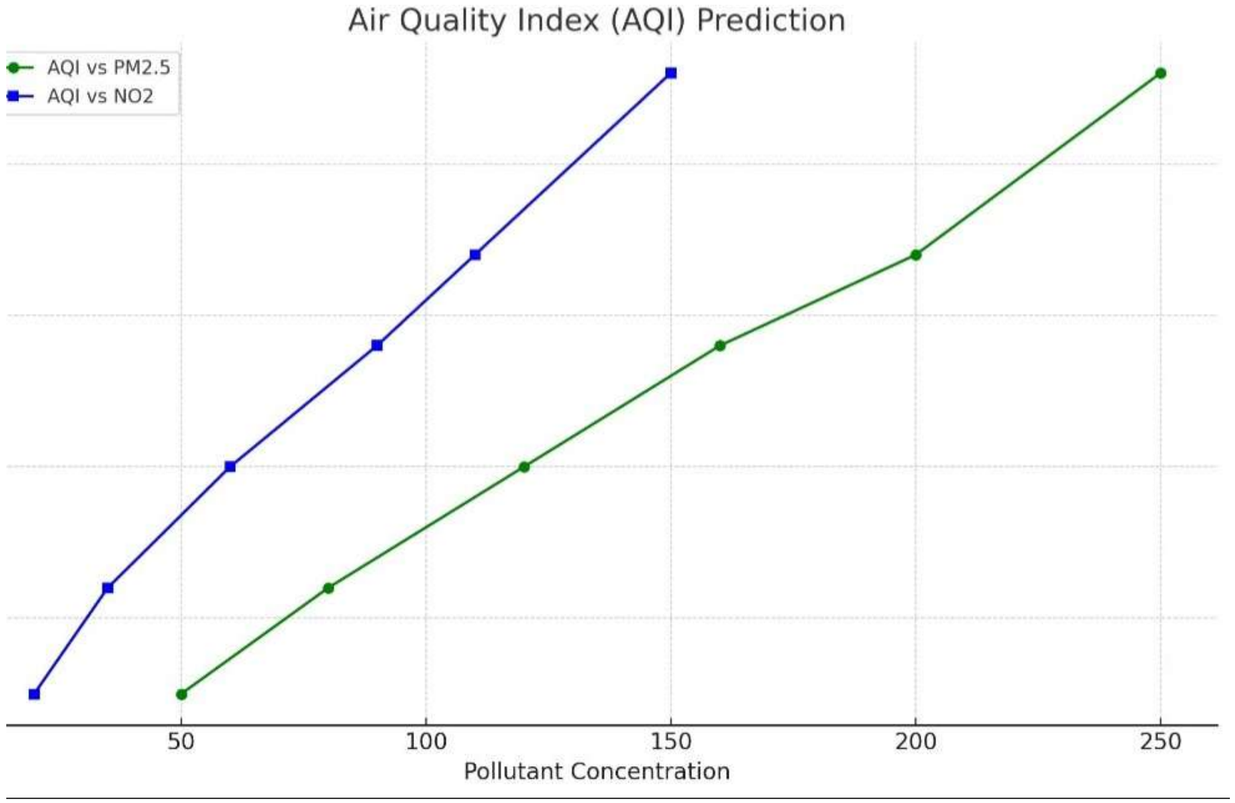
- **Developed a Machine Learning model:** It will forecasts PM2.5 based on real-time weather input.

- **Web-based tool allows**:

➢ User input: temperature, humidity, wind speed
➢ Output: Predicted PM2.5 value
➢ Used ‘Random Forest’ for high accuracy and performance.
➢ Model easily scalable with live APIs or hardware sensors in the future

Screenshot of Output:

```
mport pandas as pd
rom sklearn.linear_model import LinearRegression
rom sklearn.model_selection import train_test_split

 Load dataset
f = pd.read_csv('air_quality.csv')

 Select features and target
 = df[['PM2.5', 'NO2']]
 = df['AQI']

 Train-test split
_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_

 Model training
odel = LinearRegression()
odel.fit(X_train, y_train)

 Prediction
redictions = model.predict(X_test)
rint("Predicted AQI:", predictions[:5])
```



✓ Conclusion:

- Successfully built a functional model to monitor and predict air quality using Python.
- Understood the role of data science in solving environmental problems.
- Learned how to apply Python libraries for data handling, modeling, and visualization.
- Future scope: Can be extended into real-time monitoring using sensors and IoT.