Phase-2

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Github Repository Link:GITHUB LINK

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1. Problem Statement

Increasing air pollution levels threaten public health and the environment.

Existing monitoring systems often lack predictive capabilities for proactive measures. Need for a reliable machine learning model to predict air quality levels using historical sensor data.

2. Project Objectives

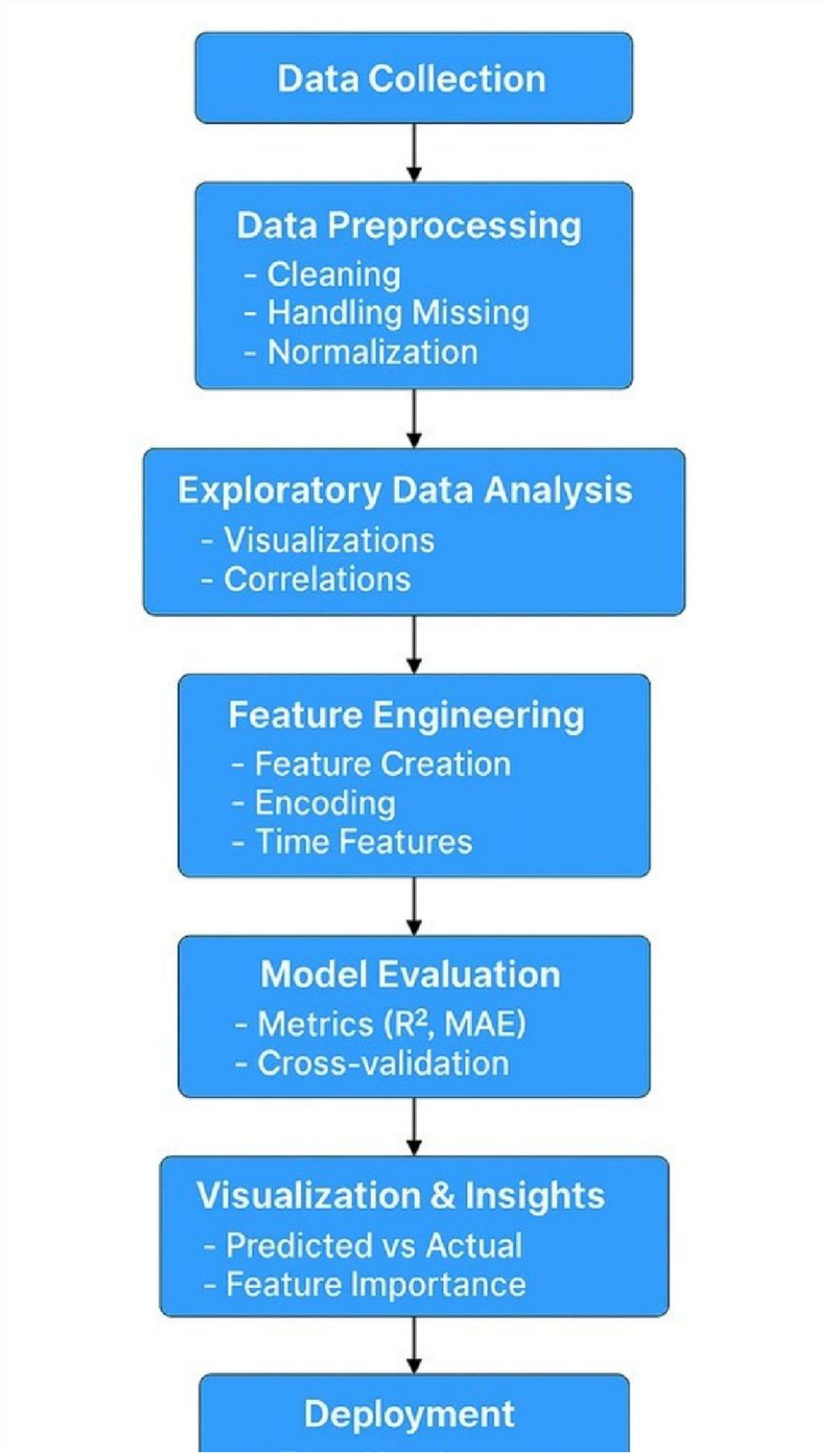
Co llect and preprocess air quality data from relevant sources.

Analyze and visualize air pollution patterns.

Develop predictive models using machines learning algorithms.

Evaluate and compare model performance.

3. Flowchart of the Project Workflow



4. Data Description

SOURCE:
OpenAQ, UCI ML Repository, or real-time sensors (DHT11, MQ-

135,etc..).

FEATURES:

- Timestamp
- PM2.5,PM10
- CO,NO2,O3,SO2
- Tempreture , Humidity
- AQI (Target variable)

5. Data Preprocessing

- Handling missing/null values (imputation or removal)
- Data type conversion (e.g., data-time parsing)
- Outlier detection and treatment.
- Data normalization or standardization.

6. Exploratory Data Analysis (EDA)

- Distribution of pollutants
- Temporal trends in AQI
- Correlation matrix between pollutants and AQI
- AQI levels by region and time of day

7. Feature Engineering

- Extraction of date-time features (hour, day, month, weekday).
- Creating pollutant interaction terms.

Encoding categorical features (e.g., location).

- Lag features for time-series modelling.

8. Model Building

- Train-Test split or TimeSeriesSplit
- Alogorithms used:

Linear Regressor

- Gradient Boosting (e.g.,XGBoost, LightGBM)

LSTM (if time-series)

- Hyperparameter tuning with GridSearchCV or Optuna.

9. Visualization of Results & Model Insights

- Predicted vs Actual AQI plots.
- Residual plots and error distribution.

Features important graph.

- SHAP values or LIME for model interpretability.

10. Tools and Technologies Used

- Programming Language: Python
- Libraries: Pandas, Numpy, Scikit-learn, Matplotlib, seaborn, XGBoost, LightGBM, SHAP.

Visualization: Tableau, Power BI, Plotly.

IDE/Notebook: Jupyter Notebook, VS Code.

Version Control: GitHub

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11. Team Members and Contributions

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Saleth harison J - Project Manager

- Defined problem scope, coordinated team, monitored progress.

- Thirupathi E - Data Scientist

Led data preprocessing, EDA, feature engineering, and model training.

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Mourish Kanna V - ML Engineer

Handled model selection, hyperparameter tuning, and optimization.

Sakthivel D - Visualization & Deployment

Designed visuals, created insights, and worked on front-end deployment.