Team Name : 101xDevs

Team Leader Name : Parth Pankaj Singh

Problem Statement(7): Developing an Algorithm for Air Quality Visualizer and Forecast App to generate granular, real-time, and predictive air quality information, especially in smaller cities or rural areas

Team Members

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Name:Naval Bihani
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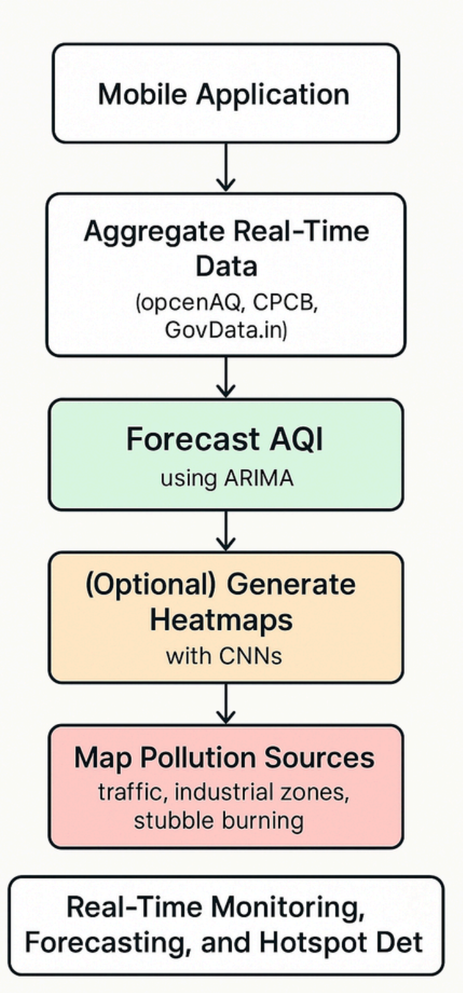
Brief about the Idea:

Most existing AQI forecasting platforms focus on metropolitan cities with readily available sensor data, ignoring rural areas that lack monitoring infrastructure

Our solution is a mobile-first application that addresses this gap by:

- **Aggregating real-time PM2.5/PM10 data from OpenAQ, CPCB, and GovData.in to build a unified dataset.**
- **Forecasting AQI using ARIMA/LSTM, a lightweight, interpretable model ideal for data-scarce rural regions.**
- **Using CNNs to learn spatial pollution patterns and generate heatmaps in unsensed areas.**
- **Mapping pollution sources like traffic, industrial zones, and stubble burning (via FIR/MODIS data).**

This ensures real-time monitoring, forecasting, and hotspot detection even in the most underrepresented regions.



Existing platforms (SAFAR, IQAir) focus on urban areas with fixed sensors or satellites — leaving rural regions underrepresented

Our Competitive Edge

Our solution is rural-first,using:

- **Specifically targets rural and under-monitored areas.**
- **Uses AI models (ARIMA) to predict AQI in sensor-deficient zones.**
- **LSTM to captures complex, non-linear patterns and long-term dependencies in AQI trends.**
- **Optionall merges ground station data with spatial modeling (CNN) to fill gaps in coverage without requiring new physical sensors.**
- **Builds an interactive, mobile-first heatmap + alert system for rural citizens and local governments.**

Our Unique Edge

Focus on Bharat, not just India — focused on rural and underserved regions.

- **Minimal Satellite Dependency — uses lightweight, interpretable models (ARIMA) for reducing reliance on continuous internet or satellite data streams.**
- **Predictive analytics**
- **Source tagging (e.g. stubble burning, traffic)**
- **Real-time & historical trends**
- **Scalable for national early warning & governance systems.**

Features:

Real Time AQI Monitoring

Displays live air quality data for rural and under-monitored areas.

AI-Based Forecasting (ARIMA + LSTM)

Predicts short-term and long-term AQI trends using hybrid models.

Historical Trend Visualization

Shows past AQI patterns to understand seasonal and temporal shifts.

Offline Forecasting Capability

Works even in low-connectivity zones using lightweight models.

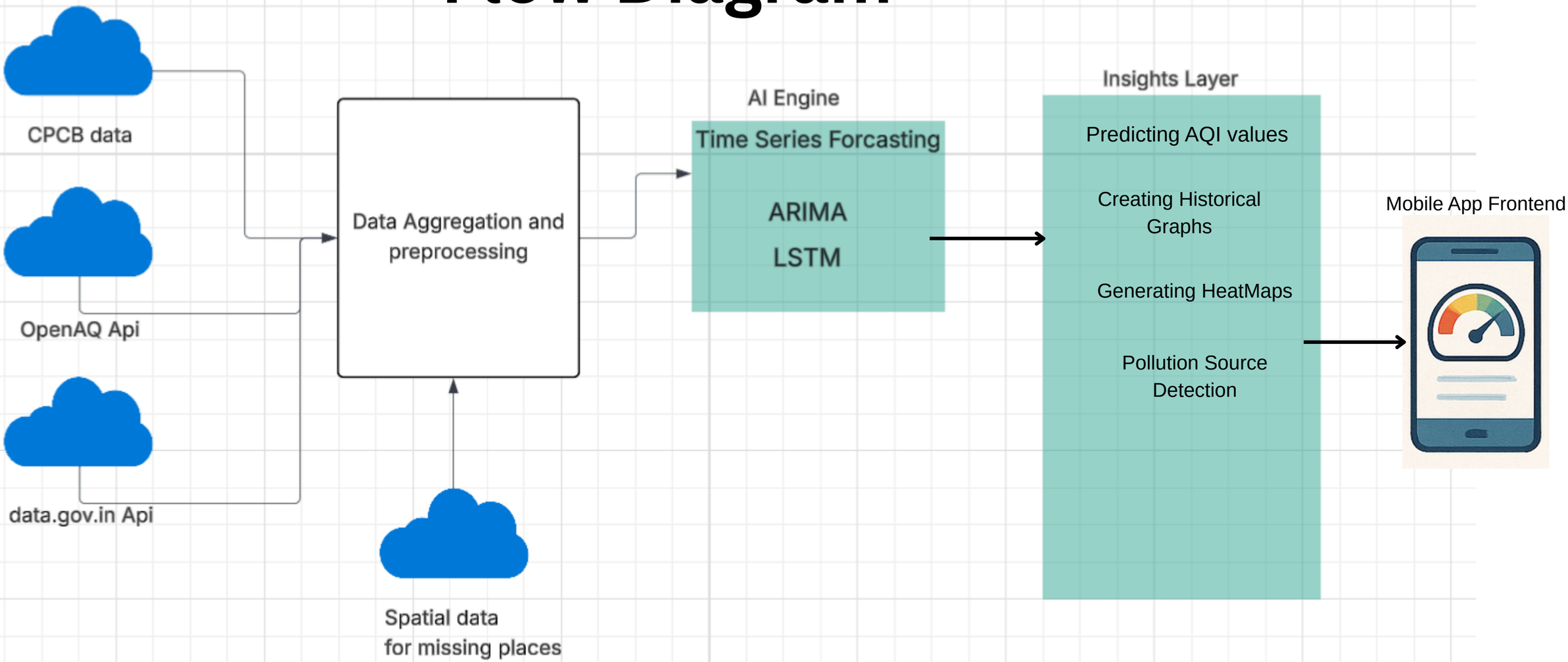
Pollution Source Mapping

Tags likely causes — traffic congestion, industrial activity, stubble burning.

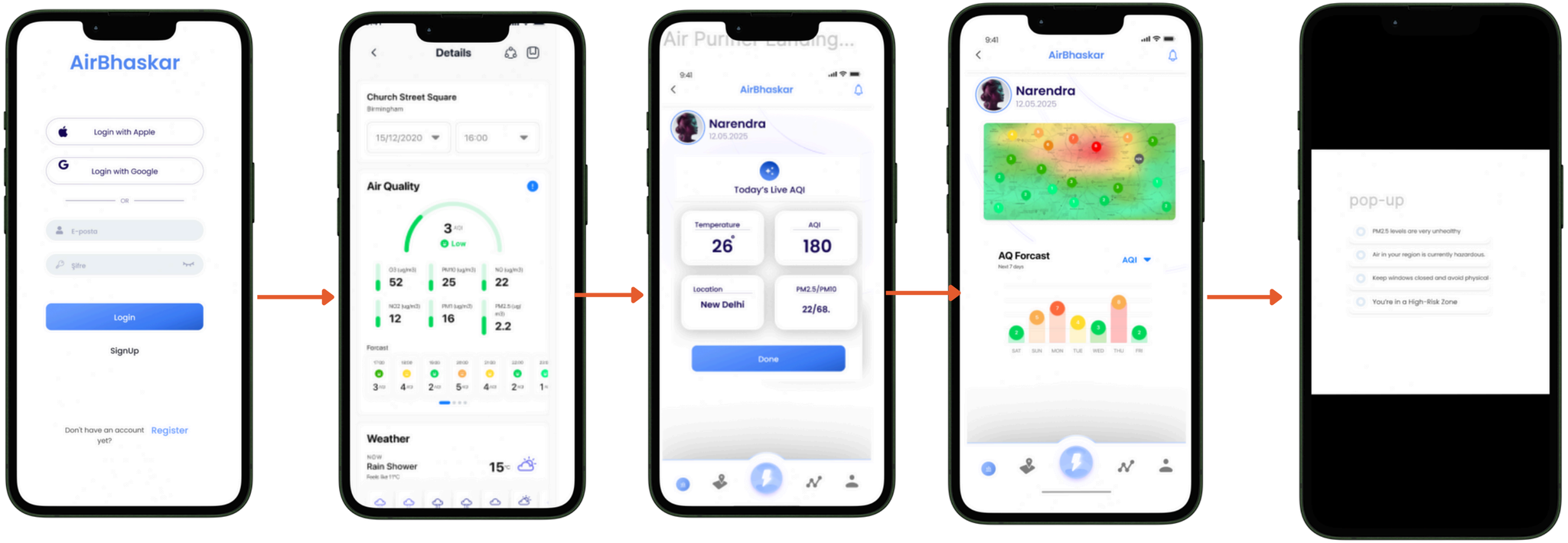
AQI Heatmap Generation

color-coded regional heatmaps for intutive AQI view

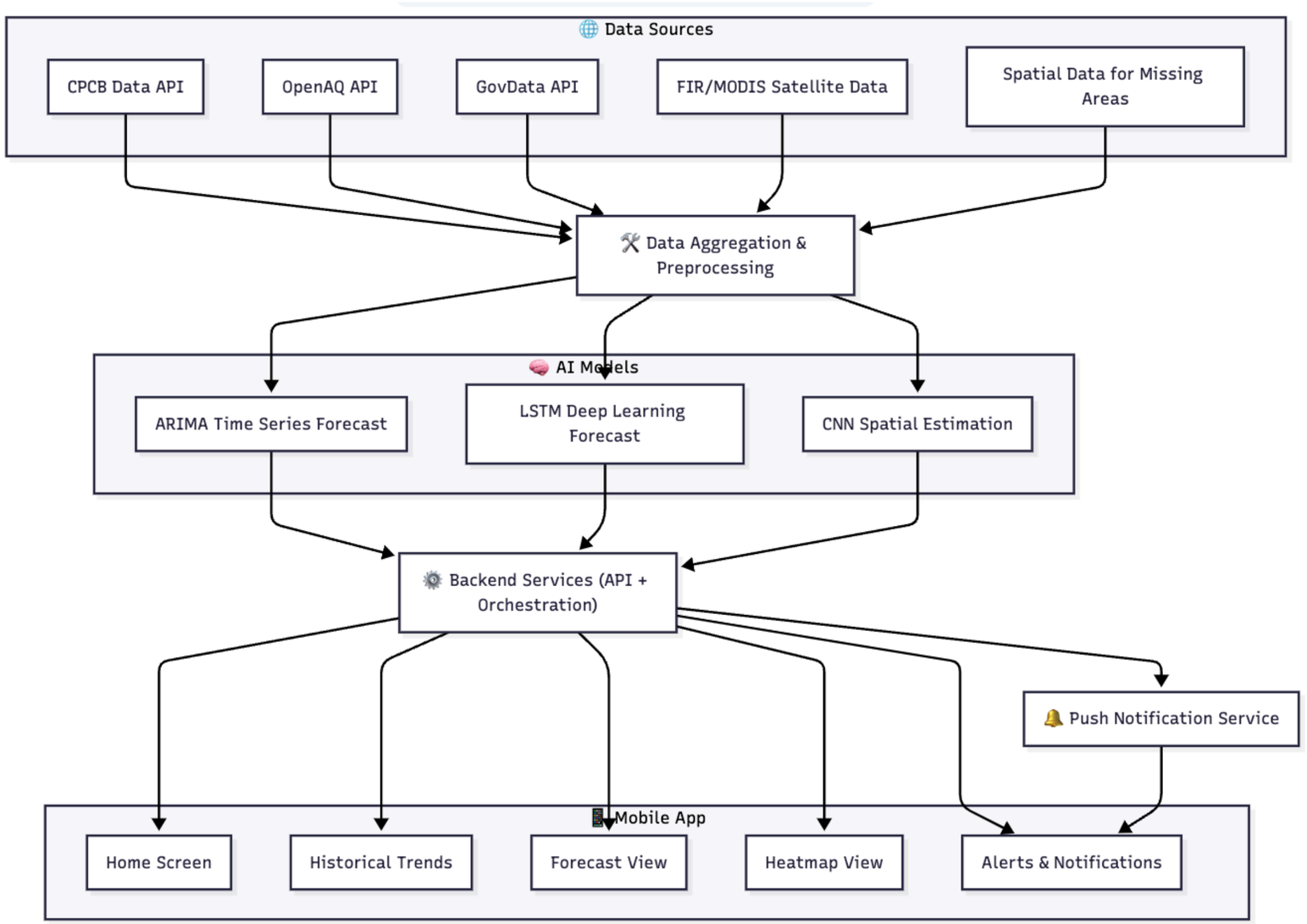
Flow Diagram



Wireframes of the proposed solution



Architecture diagram of the proposed solution



Technologies to be used in the solution:

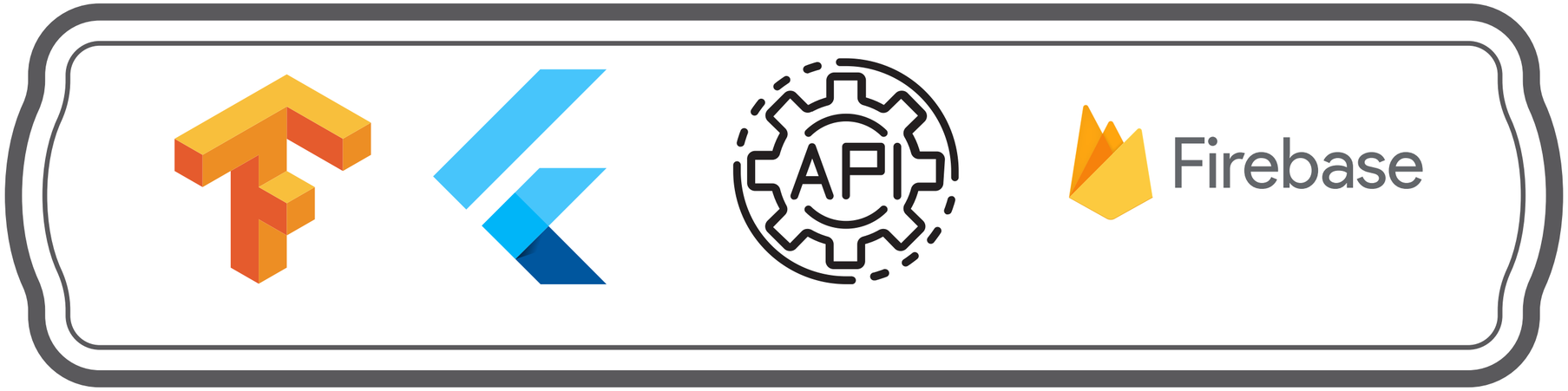
Mobile:
- **Flutter (Dart)**
- **Google Maps, fl_chart**
- **Firebase Cloud Messaging**

Backend:
- **Python (FastAPI/Flask)**
- **PostgreSQL**

AI Models:
- **ARIMA (statsmodels)**
- **LSTM (TensorFlow/Keras)**
- **CNN (PyTorch)**

Data Sources:
- **OpenAQ API**
- **CPCB API**
- **data.gov.in**
- **FIR/MODIS Satellite Data**

Infrastructure:
- **AWS**
- **Docker, GitHub Actions**



Estimated implementation cost :

- **Model: COCOMO (Semi-Detached)**
- **Scope: Core AQI Monitoring & Forecasting MVP**

- **Estimated KLOC: ~12K (Lines of Code)**
- **Effort: ~48 person-months**
- **Duration: ~10 months**
- **Team Size: ~4 developers**
- **Indicative Cost: ₹60–65 Lakhs INR**

- **Note: Using pre-trained models and minimal features to optimize cost and timeline.**

Suggestions out of scope of this hackathon:

Installing DIY AQI sensors in panchayats

Deploying full scale sensors to monitor air data in each district would increase cost, we can install DIY sensors in panchayats to fill gap in data.

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THANK YOU