

Team Name :	Spacematrix
Team Leader Name :	Raghav Kumar
Problem Statement :	AQI estimation and air pollution monitoring in unmonitored or difficult-terrain regions using satellite data and AI/ML.

Team Members

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Opportunity: Why VayuSethu?

Explaining differentiation, problem-solving approach, and USP of the proposed solution.

Different from existing ideas
Most AQI apps only display readings from existing ground stations. VayuSethu estimates AQI even where stations are absent by fusing satellite indicators, meteorology, wind behaviour, and ML.

How it solves the problem
For forests, mountains, border areas, rural belts, industrial outskirts, and disaster zones, the platform uses coordinates to fetch remote environmental features and predict AQI with source transparency.

USP of the solution
Wind-aware, satellite-backed AQI estimation for unmonitored locations, with confidence/missing-data warnings, manual fallback, map view, and nearby station comparison where available.

Core idea in one line

Extend air-quality intelligence beyond physical AQI stations by using ISRO-aligned Earth observation and AI.

Target beneficiaries: citizens, researchers, government agencies, environmental organisations, and disaster-management authorities.

List of Features Offered by the Solution

A practical feature set for location-based AQI estimation and public-facing insights.

- Location-based AQI prediction for monitored and unmonitored areas
- Satellite indicators: AOD, NO2, HCHO and related pollutant signals
- Meteorological analysis: temperature, humidity, wind, pressure, precipitation, PBLH
- Wind-aware pollution transport estimation from nearby regions
- AQI category, dominant contributor, confidence score, and health advisory
- Data-source transparency with safe fallback for missing parameters
- Interactive web dashboard with map-based location selection
- Manual prediction mode for demo/offline testing



Demo Screenshot: VayuSethu platform overview

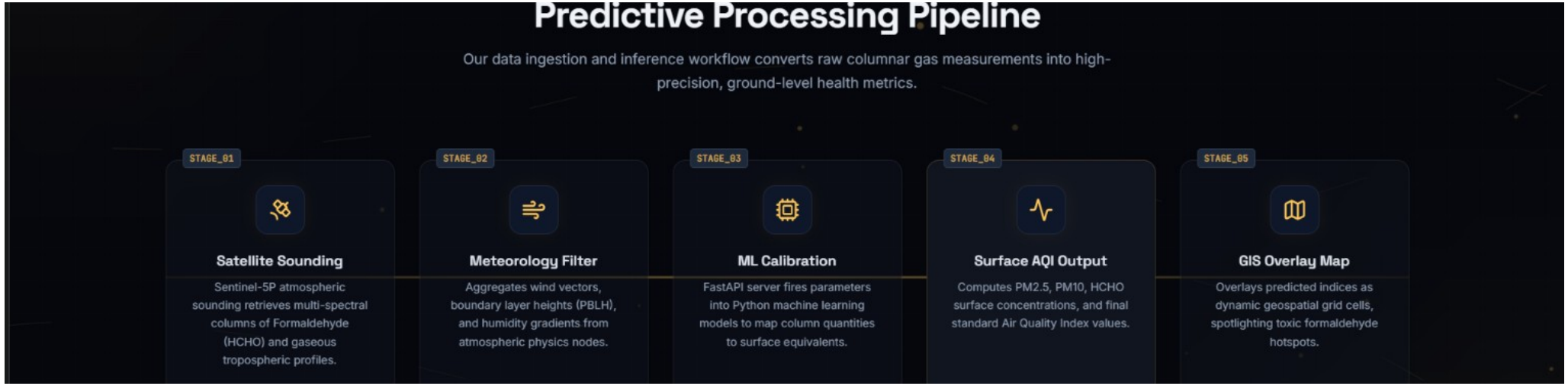
Feature direction

The platform starts from a place/coordinate and converts satellite + weather signals into an understandable AQI result.

Process Flow Diagram / Use-case Diagram

How user input moves through data retrieval, ML inference, and dashboard output.

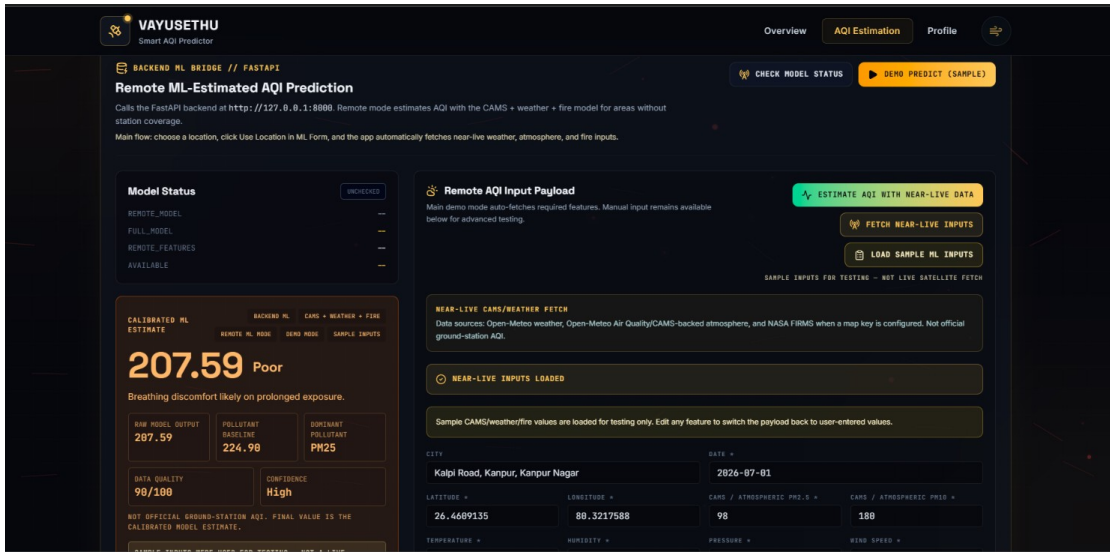
User selects location → **Fetch satellite + weather data** → **Nearby station reference** → **Feature cleaning & engineering** → **ML predicts AQI value** → **Dashboard shows AQI + insights**



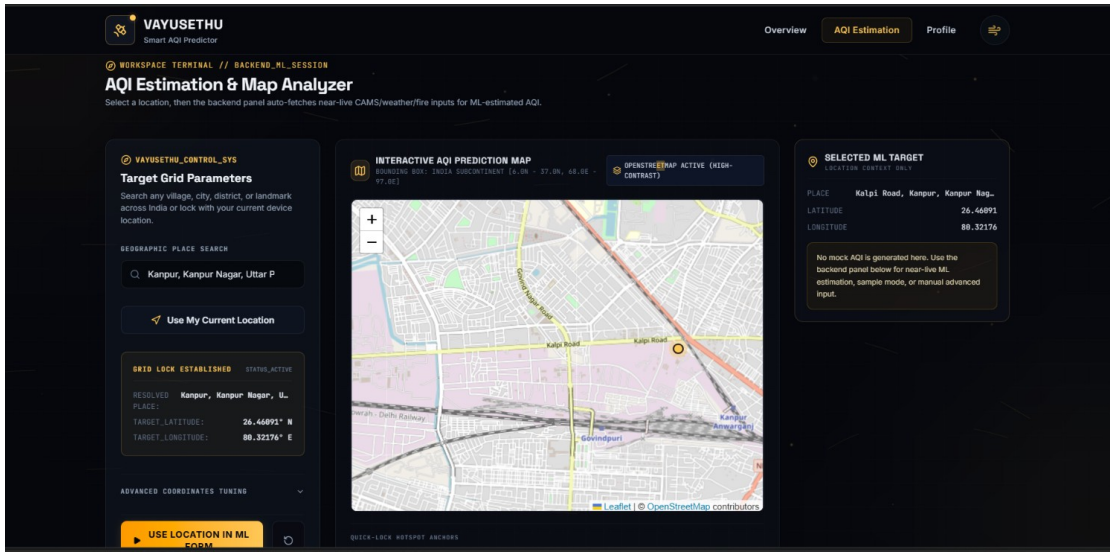
Workflow Visualization: predictive processing pipeline from satellite sounding to GIS overlay

Wireframes / Mock Diagrams of the Proposed Solution

Prototype screenshots showing location selection and final ML-estimated AQI output.



Model Output Demo: remote ML-estimated AQI prediction



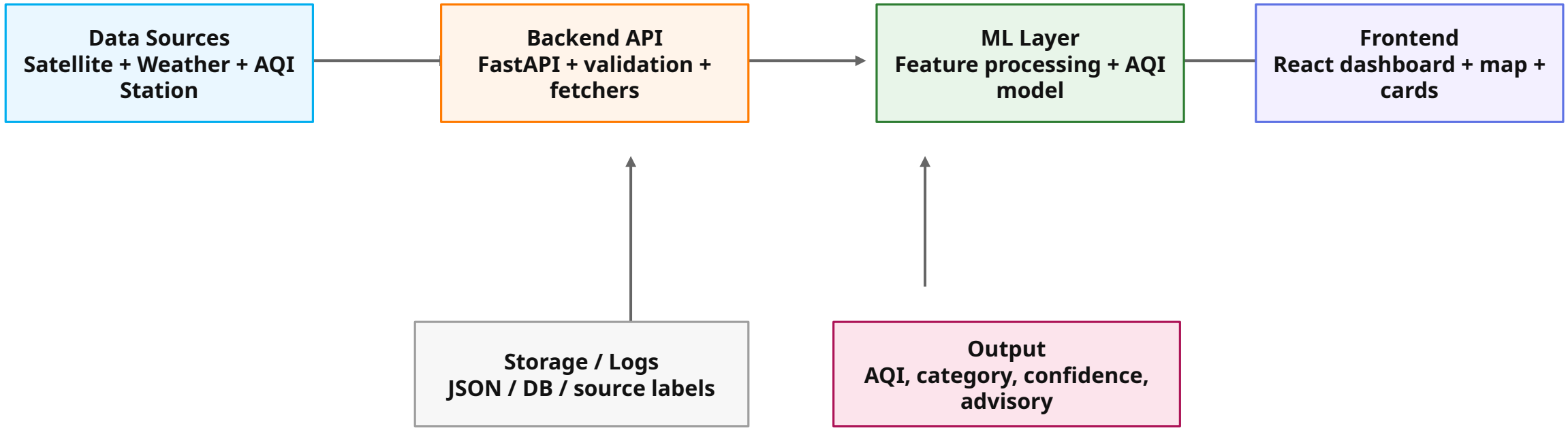
Prototype View: location-based AQI map analyzer

User journey
Search/place selection -> use location in ML -> backend fetches near-live inputs -> AQI/category/confidence displayed with warnings and source labels.

Submission relevance
These screenshots prove the idea is not only conceptual; it already has a working web prototype and prediction flow for demonstration.

Architecture Diagram of the Proposed Solution

Layered system design with independent frontend, backend, data sources, and ML inference.



Satellite/Remote sensing
AOD, NO2, HCHO, pollutant indicators

Meteorology
Temperature, humidity, wind, pressure, precipitation, PBLH

Prediction
ML model estimates AQI and severity category

Transparency
Sources, warnings, fallback values and confidence

Technologies to be Used in the Solution

Open-source and hackathon-friendly stack for MVP development and deployment.

Frontend
React.js
TypeScript / JavaScript
Tailwind CSS / CSS
Leaflet.js for maps

Backend
Python
FastAPI
Pydantic
Uvicorn
Requests / HTTPX

ML & Data
Pandas, NumPy
Scikit-learn
XGBoost / LightGBM
Joblib
Jupyter Notebook

Data Sources
Satellite / remote sensing
Open-Meteo / weather API
OpenAQ / CPCB references
ERA5 / reanalysis

Storage & Deploy
JSON / MongoDB
Git + GitHub
Vercel / Render / Railway
API-ready backend

MVP principle: keep the platform lightweight, reproducible, and deployable using mostly free/open-source tools.

Estimated Implementation Cost

Cost estimate for hackathon MVP and early prototype deployment.

Component	Estimated Cost	Notes
Development tools	Free	VS Code, GitHub, Python, React, FastAPI, open-source ML stack
Datasets / APIs	Free to low cost	Open satellite/weather/AQI datasets where possible; paid APIs only if scaling
Hosting for MVP	₹0 - ₹2,000	Free tiers or small cloud instance for backend/frontend demo
Database / storage	₹0 - ₹1,000	JSON/MongoDB/free-tier storage for prototype logs and results
Total MVP estimate	₹0 - ₹5,000	Depends on hosting, API usage, and demo scale

Future production cost
May include scalable cloud server, paid satellite/API quota, storage, monitoring, authentication, and long-term model-maintenance infrastructure.


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THANK YOU
Team Spacematrix