

ET AI HACKATHON 2026 · PROBLEM STATEMENT #5

VAYU AI

National Air Quality Intelligence

From reactive monitoring to proactive, evidence-based intervention — for every Indian city.

36

States & UTs

78

Cities

326

Localities

5 s

Live updates

6

AI Agents

AI-Powered Urban Air Quality Intelligence for Smart City Intervention

India monitors pollution. It doesn't act on it in time.



Dashboards show WHAT — never WHY

AQI numbers without causes, parameters, or a next step. Officials see a value, not a decision.



City averages hide street reality

One number for 12 million people. The junction at 320 and the park at 90 read as "city: 180".



Action comes days late

Agencies respond after an episode peaks. The intervention window — hours before — is missed.



Citizens have no verified voice

People see the burning and the dust first, but there is no channel that checks and uses their reports.

India doesn't lack air-quality data. It lacks air-quality **decisions**.

One command centre. Five levels. Three answers at every level.

At every level Vayu AI answers: **What is happening?** **Why?** **What should government do right now?**

INDIA

36 states & UTs ranked live · national AQI distribution

STATE

its cities sorted worst-first (UP: Kanpur 293 › Meerut › Lucknow...)

CITY

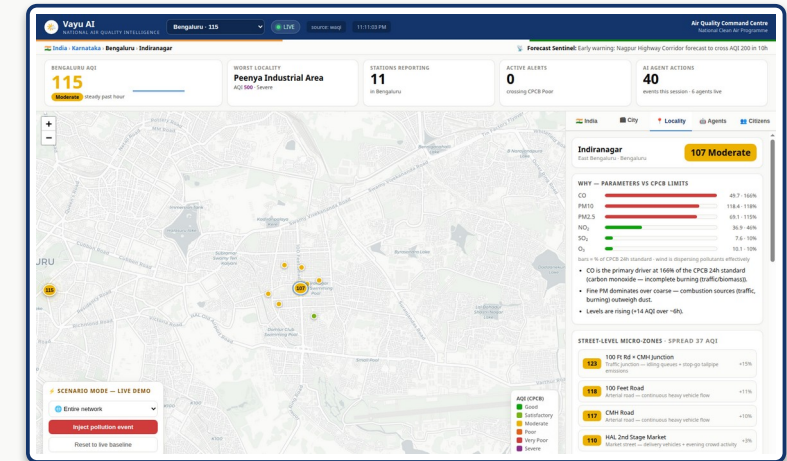
illustrated AI cause profile + explanation & actions for officials

LOCALITY

parameters vs CPCB limits · 24h forecast · source attribution · advisories

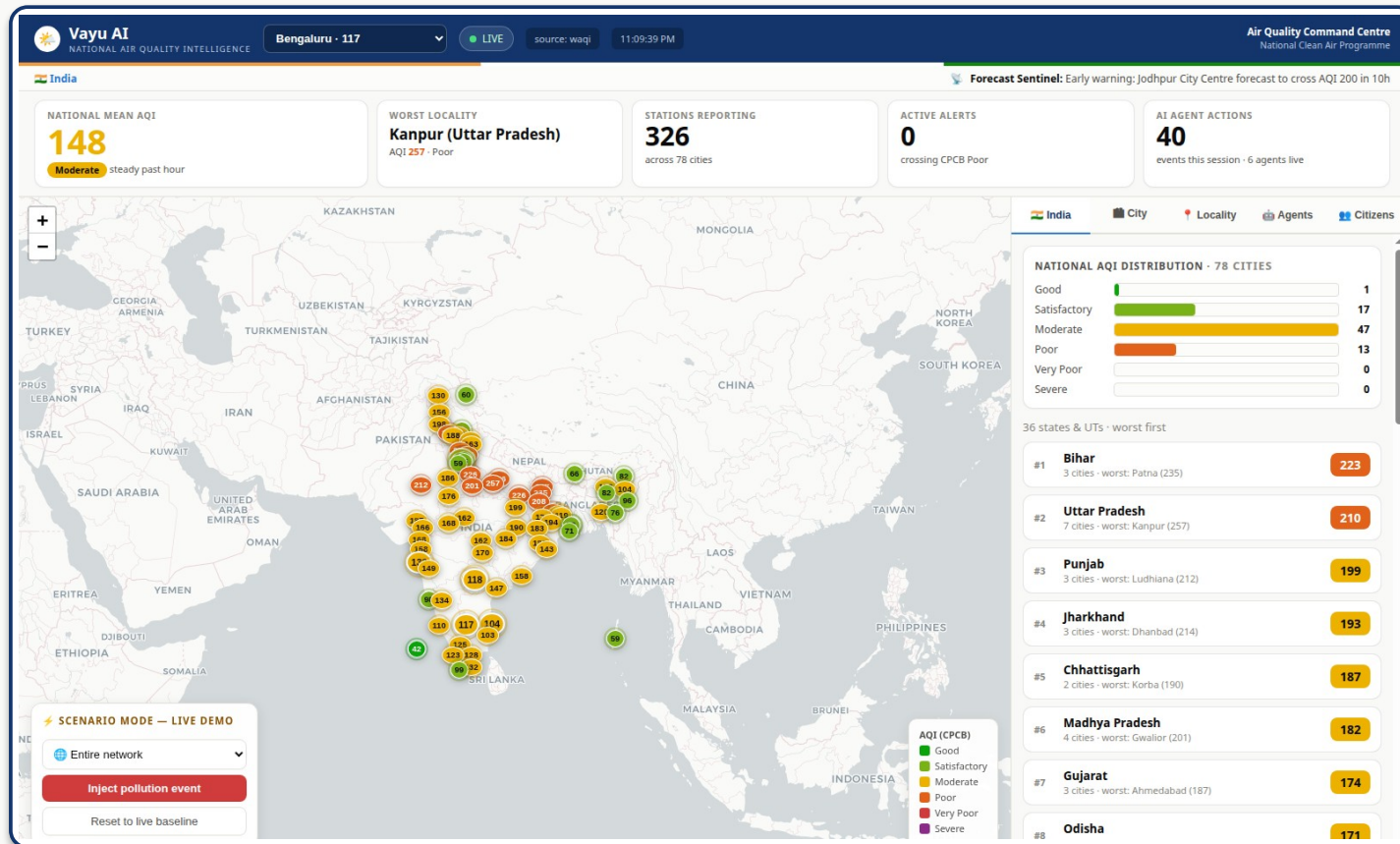
STREET

micro-zones ranked: 100 Ft Rd junction 123 vs Defence Colony Park 51



Live: Indiranagar street-level micro-zones

All of India, drill-down to the street — live every 5 seconds



Live: the national command centre — every city pinned and ranked

MONITORED LOCALITIES

326

across 78 cities

STATES & UTs

36

complete national coverage

DEEP-AI CITIES

5

Bengaluru · Delhi · Mumbai · Hyderabad · Chennai

UPDATE CADENCE

5 s

per-city WebSocket streams

Deep cities carry hand-curated real localities — Indiranagar's 100 Ft Road, CMH Road, Defence Colony Park.

How it works — the live pipeline

INGESTION

Live WAQI national data — ONE bounds sweep / 10 min covers the whole country. Physics-based synthetic fallback keeps it always-on & powers Scenario Mode.



STORE + STREAM

In-memory live store + SQL persistence (SQLite dev / MySQL 8 production). Per-city WebSocket streams — 5-second ticks to every screen.



COMMAND-CENTRE DASHBOARD

India → State → City → Locality → Street drill-down, KPI band, live map pins, agent console, citizen desk — exported to any govt. office screen.

FOUR ANALYTICAL ENGINES (between store and dashboard)

Forecast

24h AQI per locality: diurnal profile + anchored mean-reversion. Walk-forward backtested vs the persistence baseline.

Source Attribution

Pollutant-ratio chemistry (fine/coarse PM, NO₂, SO₂, CO, O₃) × locality prior × wind transport.

Cause Analysis

Every parameter vs CPCB 24h limits → ranked drivers → plain-language cause chain.

Hyperlocal

Street micro-zones from land-use dispersion (junction +18%, park −20%) + verified citizen nudges.

On top of the engines sits the **six-agent AI system** — Claude-powered reasoning with deterministic rule-engine fallbacks, so the platform never goes dark.

Six coordinated AI agents — the centrepiece



Mission Control

Orchestrates every agent; composes the intelligence brief for officials.



Source Detective

Root-cause: which parameters & sources drive the AQI right now, with evidence.



Forecast Sentinel

Watches all 326 forecasts; fires autonomous early warnings hours BEFORE CPCB 'Poor'.



Citizen Intelligence

Verifies citizen photo/text reports against live sensor chemistry → ✓ sensor-corroborated.



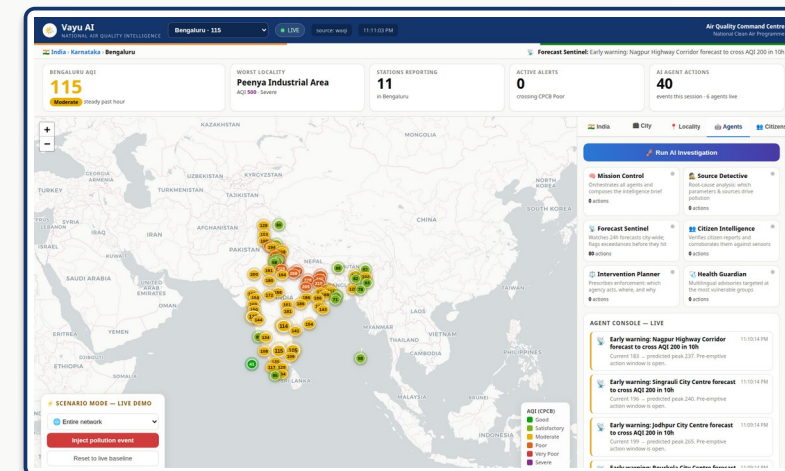
Intervention Planner

Prescribes WHICH agency acts (KSPCB / BBMP / Traffic Police), WHERE, and WHY.



Health Guardian

Advisories in Kannada · Hindi · Tamil · English, targeted at vulnerable groups.



Live: agent roster + autonomous early warnings

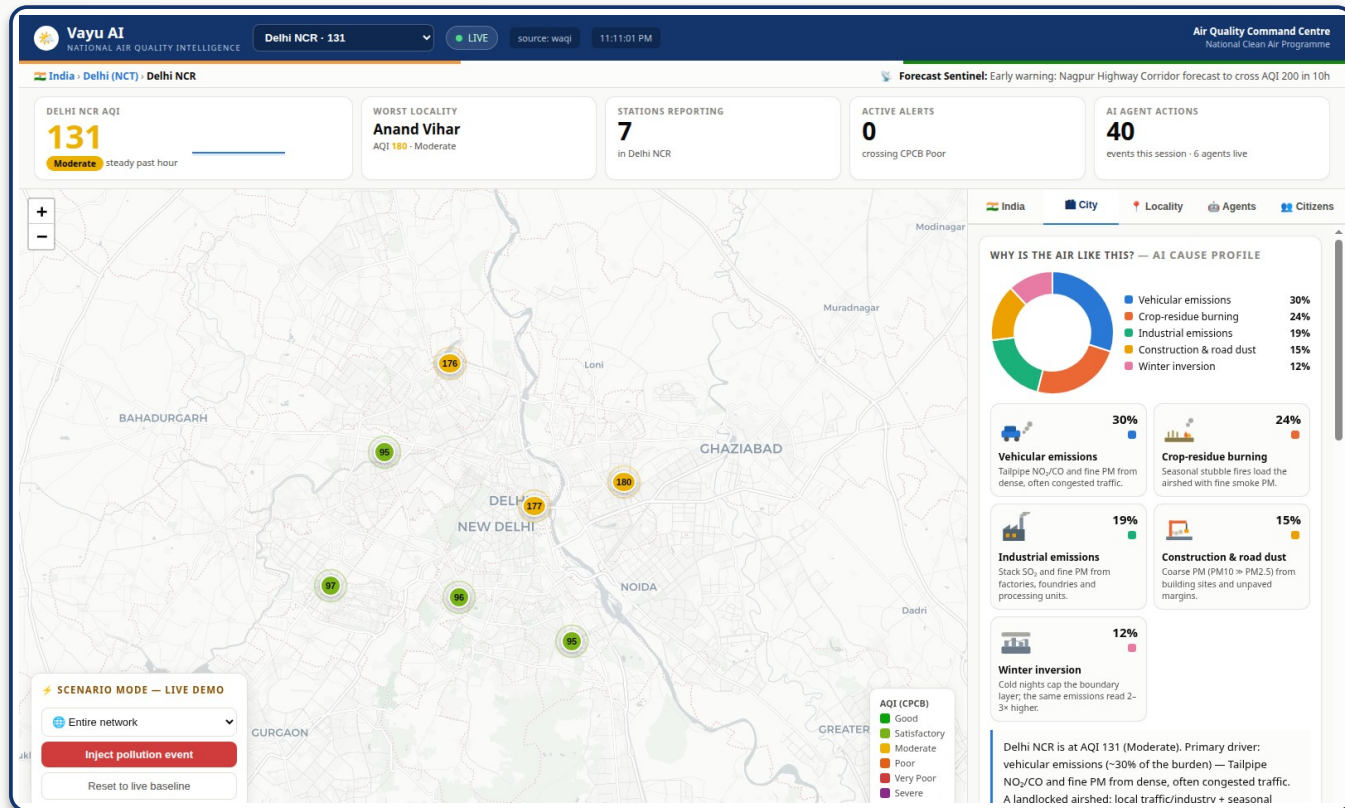
LIVE CONSOLE



Early warning: Jodhpur City Centre forecast to cross AQI 200 in 10h — pre-emptive action window is open

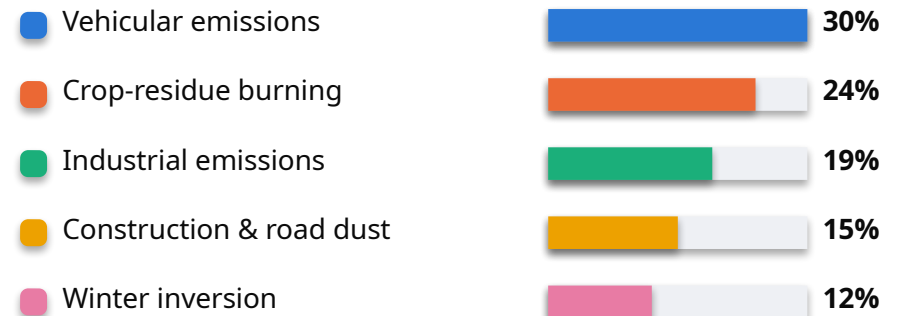
One click runs a full multi-agent investigation on any locality — every agent reports, Mission Control composes the brief, and every action streams to the console and the event log (SQL).

Explainable AI — every number comes with a WHY



Live: Delhi NCR — illustrated AI cause profile

CITY CAUSE PROFILE (Delhi NCR)



AI BRIEF FOR OFFICIALS

Why in 2 sentences → 3 immediate actions → 1 structural solution.
Written by Claude from the live cause profile; rule-engine fallback offline.

CAUSE CHAIN PM_{2.5} at 117% of CPCB limit → stagnant 3 km/h wind → rush hour → rising +14 AQI / 6h

Citizens as sensors — a verified feedback loop



Citizen reports

Photo + text: "heavy dust from a construction site near CMH Road"



AI classifies

Category + severity 1–5 + credibility, in seconds



Sensors cross-check

Does live pollutant chemistry agree? → ✓ sensor-corroborated



Maps get sharper

Verified reports nudge street-level micro-zone estimates



Citizens see impact

Their report appears on the official map — trust compounds

Closing the loop between people and instruments: **every verified report makes the street-level map more honest — and every citizen becomes part of the monitoring network.**

Proven, not promised

+63%

Forecast skill vs persistence baseline

Average RMSE improvement on a walk-forward backtest across ALL 326 localities — zero negative stations.

Round-trip

Attribution validated

Synthesize chemistry from a known source mix → invert it: industrial estates attribute industrial, residential zones residential, junctions traffic.

~1 second

Full-pipeline reaction

Scenario Mode injects a pollution event live: alert → attribution → advisory → agent warnings, in about a second.

Judges can verify every claim live: `/api/backtest` returns the walk-forward numbers, and Scenario Mode runs on stage against the running system.

Tech stack — demo in one command, deploy in one

CORE STACK

Python FastAPI

WebSockets

SQLAlchemy

SQLite dev / MySQL 8 prod

Anthropic Claude multi-agent

NumPy

Leaflet

Chart.js

PRODUCTION ARTIFACTS — BUILT & TESTED

- Docker Compose: app + MySQL 8 (image built, container smoke-tested)
- systemd unit with hardening for bare-metal government servers
- Admin-token guard on operational endpoints · CORS allow-list
- Prometheus /metrics + /api/health for ops dashboards
- DEPLOYMENT.md: full runbook + honest rollout checklist

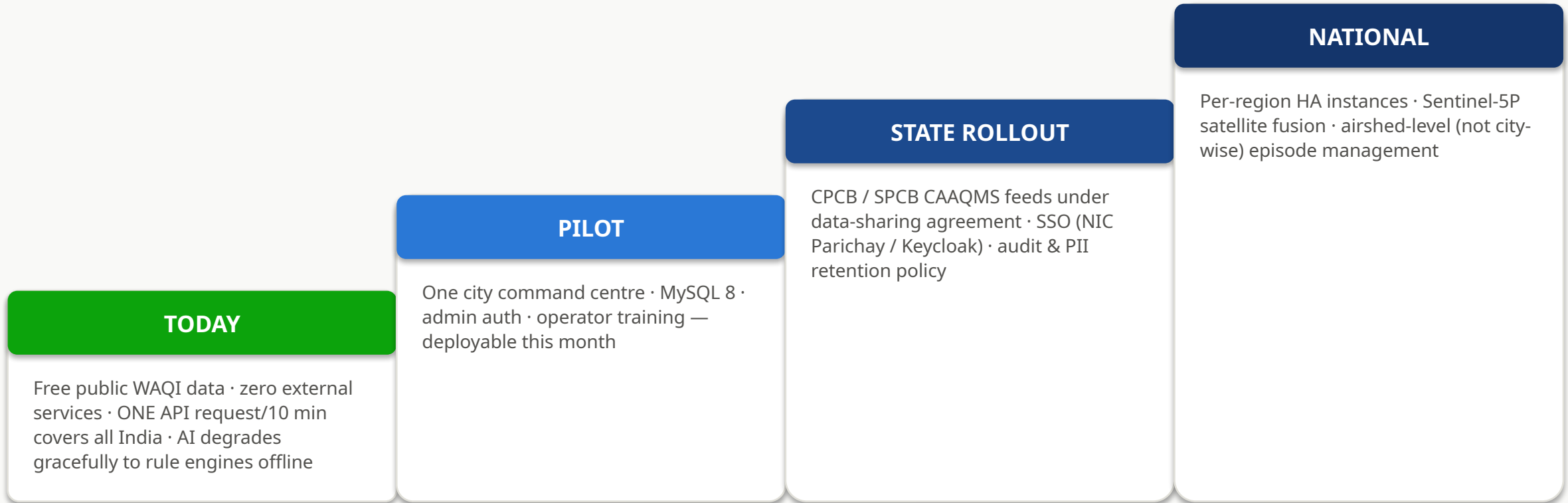
ONE COMMAND EACH

```
$ ./run.sh → live demo, offline, zero keys
```

```
$ docker compose up -d → production with MySQL 8
```

Fully self-contained: no external services required to demo. Live national data needs one free WAQI token; Claude key enables agent reasoning (rule engines otherwise).

Feasibility — runs today, scales honestly



Honesty is the design: each step lists exactly what it needs — that's how a pilot becomes a policy.

WHY VAYU AI WINS

- 1 All-India coverage with street-level drill-down — 36 states, 326 localities
- 2 Explains WHY — cause chains + illustrated AI cause profiles, never just a number
- 3 Prescribes WHO acts — agency-specific enforcement playbooks (KSPCB / BBMP / Police)
- 4 Citizens verified against sensors — participation with proof, not noise
- 5 Six coordinated AI agents with a live console — AI you can watch working
- 6 Deployable in a government office today — Docker, MySQL, metrics, runbook

“Monitoring tells you the air is bad. Vayu AI tells you **why, what to do, and who should do it** — before it happens.”