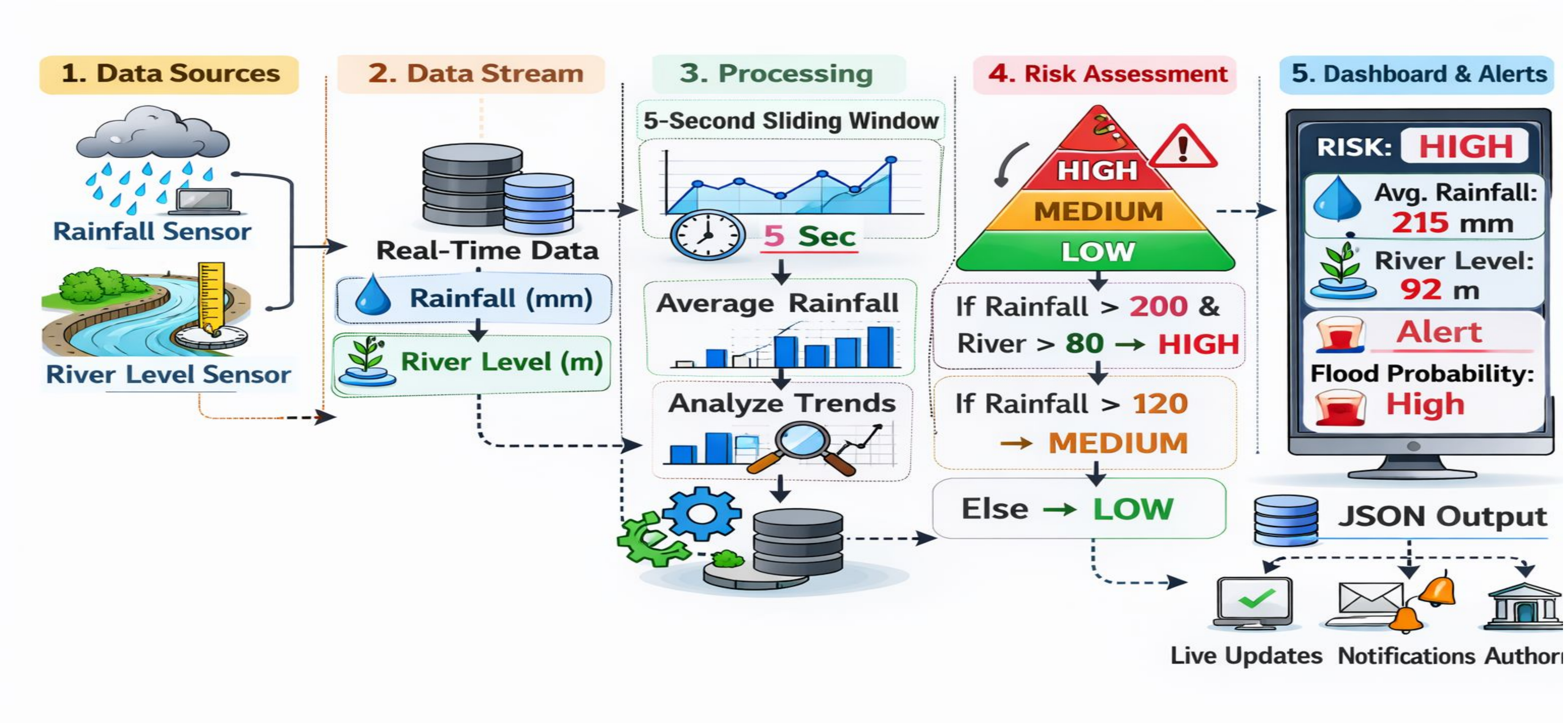
HACK FOR GREEN BHARAT

- **Problem Statement Title- EcoSentinel AI**
- **Team Name - COSMIC_CODERS**



COSMIC_ CODERS

Eco-Sentinel AI

Problem

Environmental disasters like floods require instant monitoring and intelligent decision-making.
Current systems:

- Process data with delays
- Use static thresholds
- Lack real-time trend analysis
- Provide no clear explanations
- Do not support proactive disaster response

Solution

We developed a streaming-based system that:

- **Collects Live Sensor Data**

Rainfall and river level streams are continuously processed.

- **Applies Sliding Window Analytics**

5-second rolling window detects rainfall trends in real time.

- **Calculates Dynamic Risk Levels**

Risk classification based on environmental thresholds.

- **Generates Explainable Alerts**

Each risk level is supported by clear reasoning.

- **Streams Results to Dashboard**

Live JSON-based frontend display.

- **Optional AI Enhancement**
- Retrieval-Augmented Generation (RAG) provides intelligent contextual explanations.

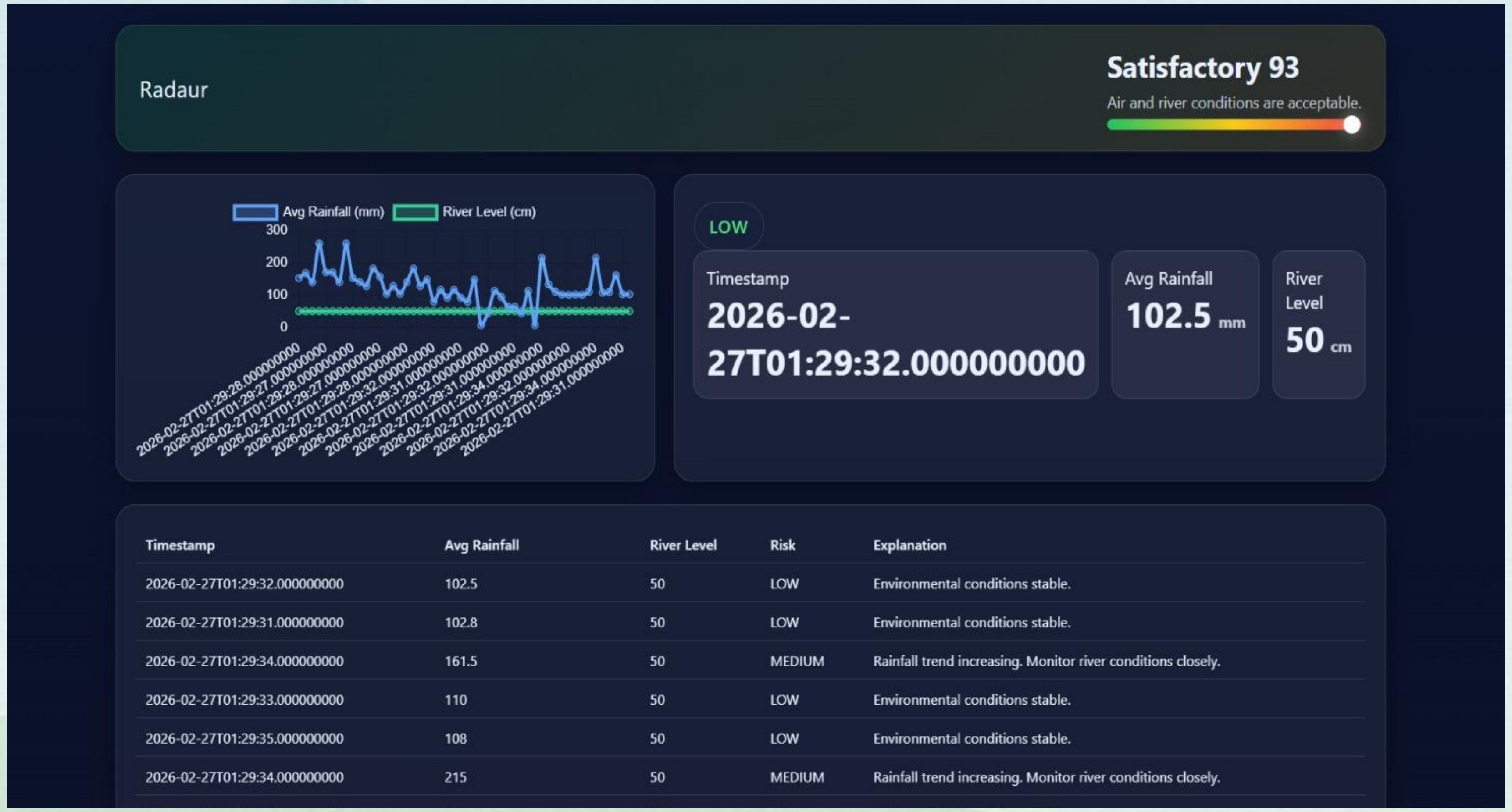
Innovation & Uniqueness

- Real-time risk detection
- Trend-based accurate alerts
- Explainable decision support
- Dashboard-ready monitoring
- Lightweight and scalable
- AI-enabled future expansion

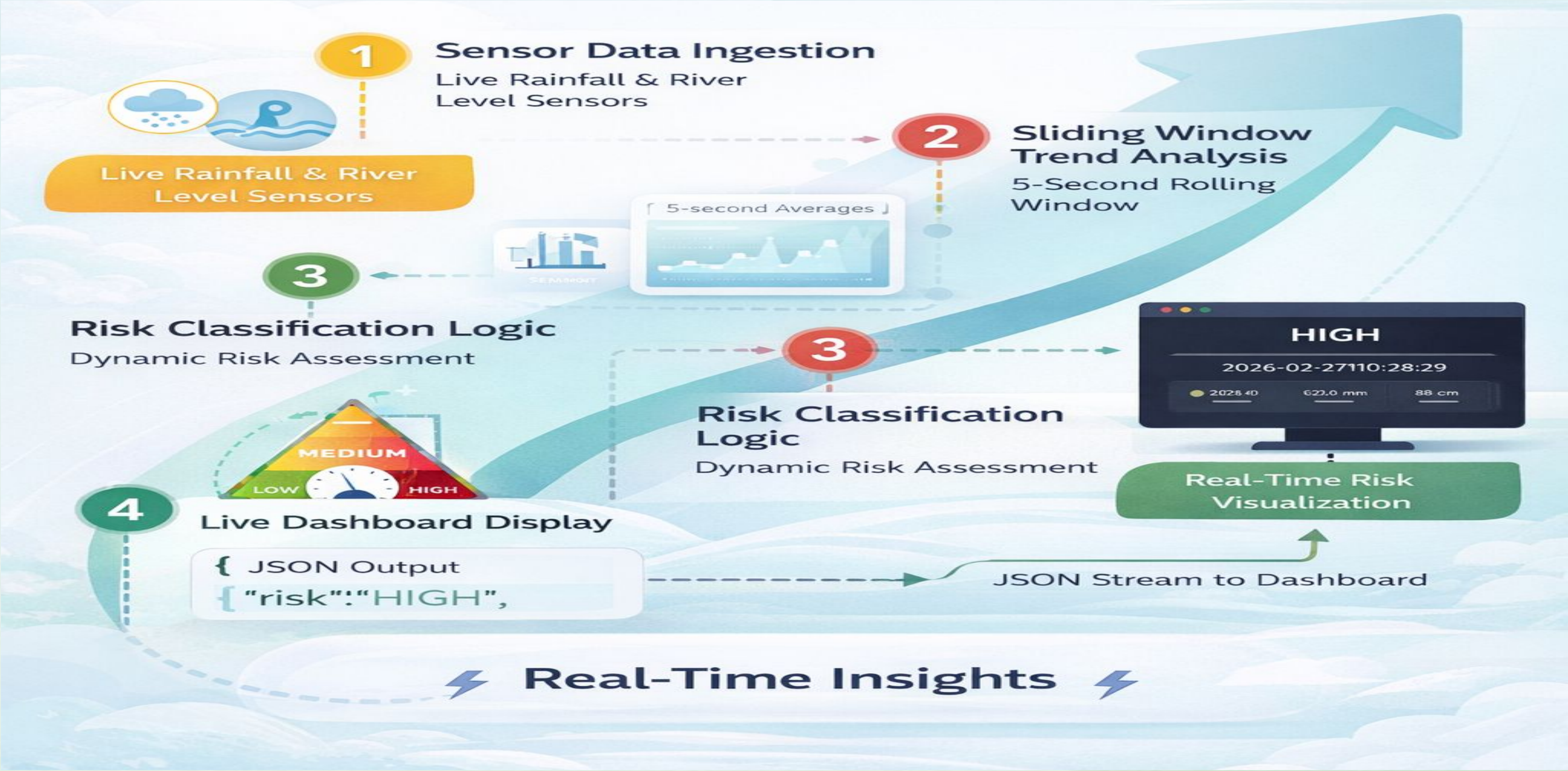
COSMIC_
CODERS

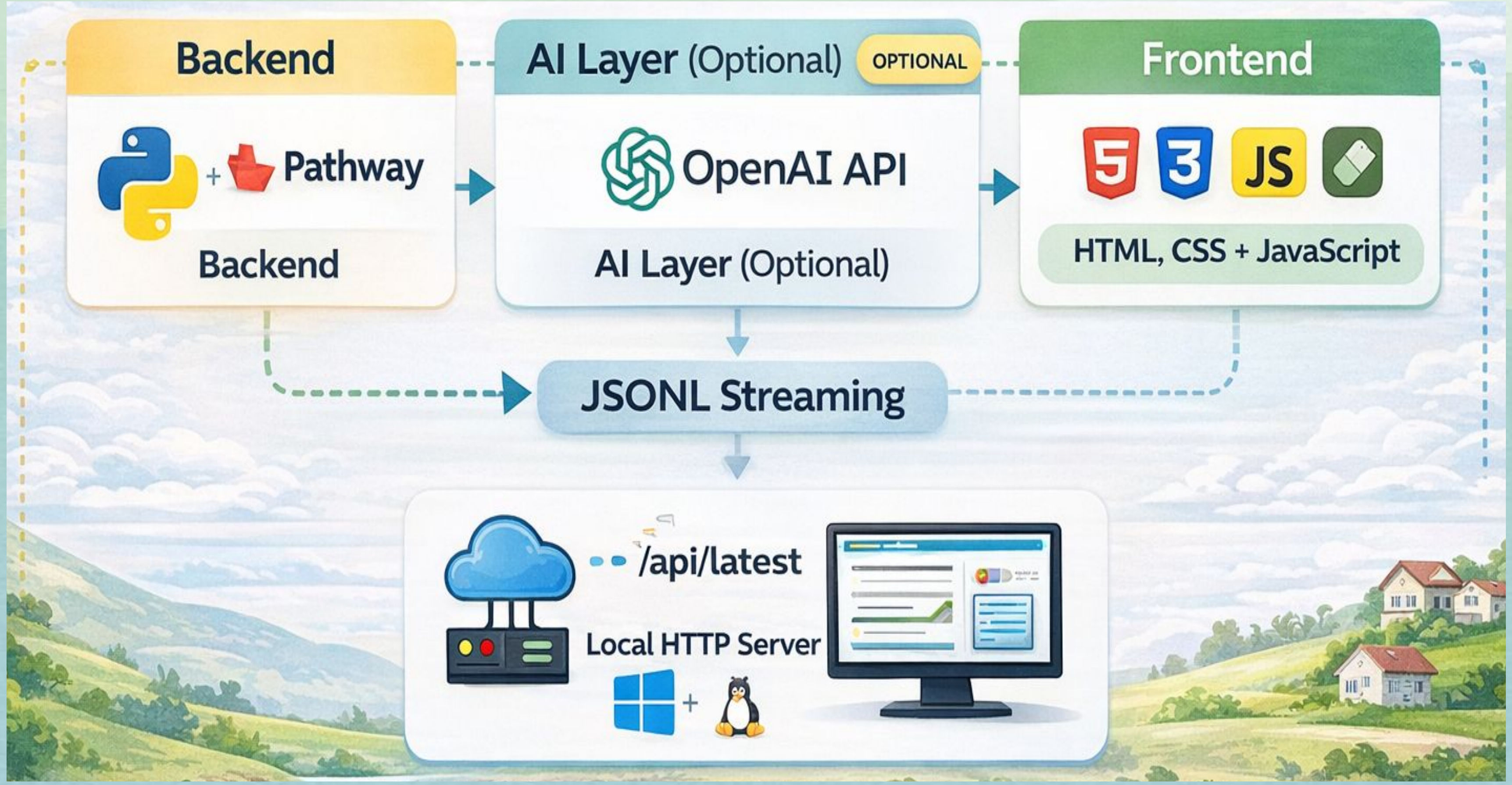
TECHNICAL APPROACH

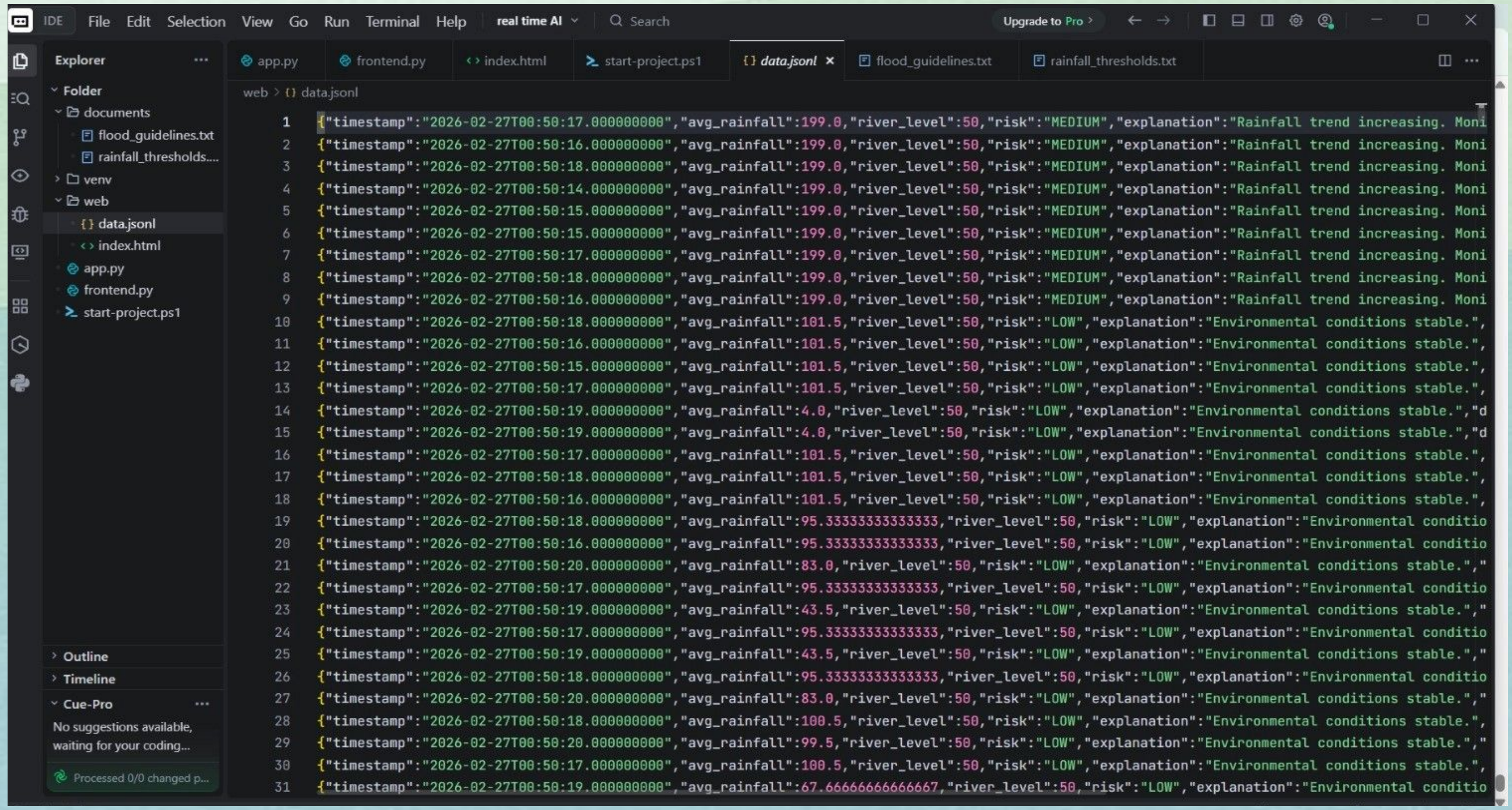
Demonstration of working prototype



Working







COSMIC_
CODERS

FEASIBILITY AND VIABILITY

Feasibility Analysis

- **Technically Viable:** Built using Pathway's real-time streaming framework with rule-based + AI risk scoring.
- **Data Available:** Public datasets from IMD, CPCB, CWC, NDMA & open environmental APIs.
- **Development Time:** Core prototype achievable within hackathon timeframe (24–48 hours).
- **Scalable Architecture:** Modular design: new data streams (AQI, temperature, traffic, etc.) can be easily added.
- **Real-World Applicability:** Direct alignment with Smart City & climate resilience initiatives.

Potential Challenges & Risks

- **Database API:** Public APIs may have delays or incomplete records.
- **Sensor/Data Gaps:** Inconsistent regional coverage in rural areas.
- **False Positives in Risk Detection:** Improper threshold tuning may trigger incorrect alerts.
- Latency in High-Volume Streams: Scaling to national-level streams requires optimization.

Mitigation Strategies

- Hybrid Risk Model: Combine rule-based thresholds + AI reasoning for better reliability.
- Data Validation Layer: Real-time anomaly detection & cross-source verification.
- Threshold Calibration: Dynamic adjustment using historical environmental data.
- Phased Deployment: Pilot implementation in selected districts before national rollout.
- Explainable AI Layer (RAG): Provide transparent reasoning behind each risk alert.

COSMIC_
CODERS

IMPACT AND BENEFITS

Social Impact

- **Early Disaster Alerts**: Real-time flood, heatwave & pollution risk notifications.
- **Citizen Accessibility**: Simple dashboard + multilingual advisories.
- **Farmer Support:** Actionable insights for irrigation & crop protection.
- **Transparency & Trust:** Live environmental data builds public confidence.
- **Community Empowerment:** Proactive warnings instead of reactive response.

Economic Impact

- **Reduced Disaster Losses:** Early risk detection lowers infrastructure & crop damage.
- **Optimized Resource Allocation:** Better water release & emergency planning.
- **Lower Policy Costs:** Automated monitoring reduces manual inspection overhead.
- **Agricultural Productivity Boost:** Climate-aware decision support.
- **Urban Cost Savings:** Smarter pollution & heat management strategies.

Policy and Governance

- **Evidence-Based Decision Making:** Real-time data-backed governance.
- **Monitoring & Compliance**: Continuous tracking of environmental thresholds.
- **Faster Reporting:** Automated alerts & live risk dashboards.
- **Adaptive Policy Simulation:** Scenario-based climate response planning.
- **Smart City Integration:** Scalable AI infrastructure for urban resilience.

Benefits

- Real-Time Monitoring
- Fast & Accurate Risk Alerts
- Intelligent Decision Support
- Cost-Effective Architecture
- Disaster Preparedness
- Authority Ready Output

COSMIC_
CODERS

RESEARCH AND REFERENCES

Research Sources:

- IMD (India Meteorological Department) – Official weather & rainfall datasets for climate risk modeling.
  https://mausam.imd.gov.in
- Central Pollution Control Board (CPCB) – National Air Quality Index (AQI) data & pollution monitoring.
  https://cpcb.nic.in
- Central Water Commission (CWC) – River level monitoring & flood forecasting datasets.
  https://cwc.gov.in
- NDMA (National Disaster Management Authority) – Disaster risk frameworks & flood/heatwave management guidelines.
  https://ndma.gov.in
- IPCC Climate Risk Reports – Global climate risk assessment methodologies & impact modeling.
  https://www.ipcc.ch

Pathway Framework Official Docs

- https://pathway.com/developers/user-guide/overview
- https://pathway.com/developers/user-guide/connect/connectors-in-pathway
- https://pathway.com/developers/user-guide/data-transformation/table-operations