

# SMART INDIA HACKATHON 2025



- **Problem Statement ID –25044**
- **Problem Statement Title-AI-Powered Crop Yield Prediction and Optimization**
- **Theme- Agriculture & Rural Development**
- **PS Category- Software**
- **Team ID- CodeSages**
- **Team Name - CodeSages**



**Proposed Solution:**

- AI platform predicting crop yield using historical yield data, soil health, and real-time weather.
- Provides crop-specific recommendations (irrigation, fertilizer, pest control).
- Web app in regional languages with voice support.

**How it Addresses the Problem:**

- Helps small farmers increase productivity & reduce input costs.
- Converts raw data into localized, simple advisory.
- Acts as a bridge between scientific research and grassroots farming.

**Innovation & Uniqueness:**

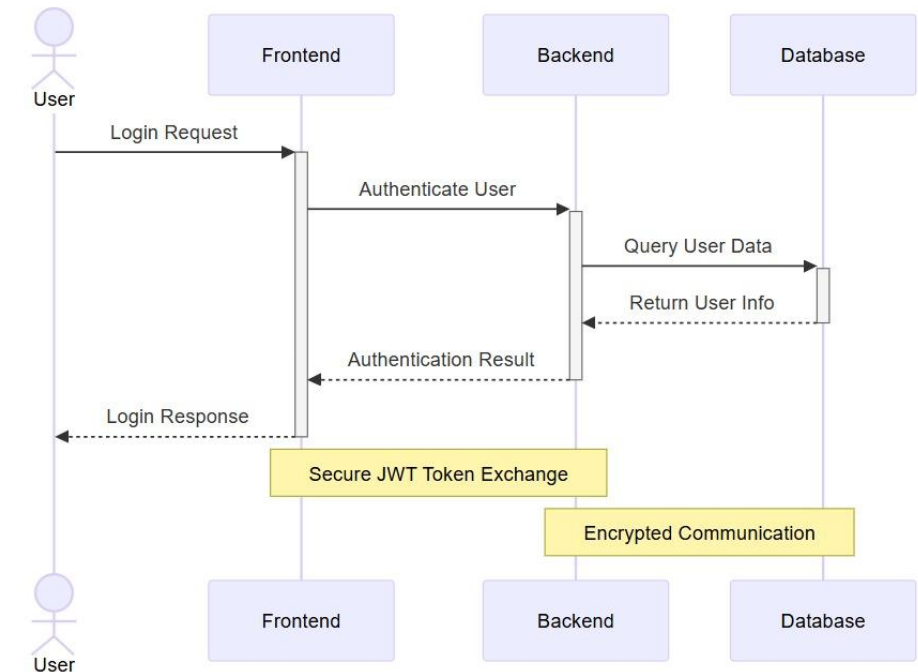
- Combines AI + real-time weather APIs + soil & satellite data (NDVI).
- Personalized yield forecasts + “What-If” simulations.
- Voice-enabled, multilingual platform for inclusivity.

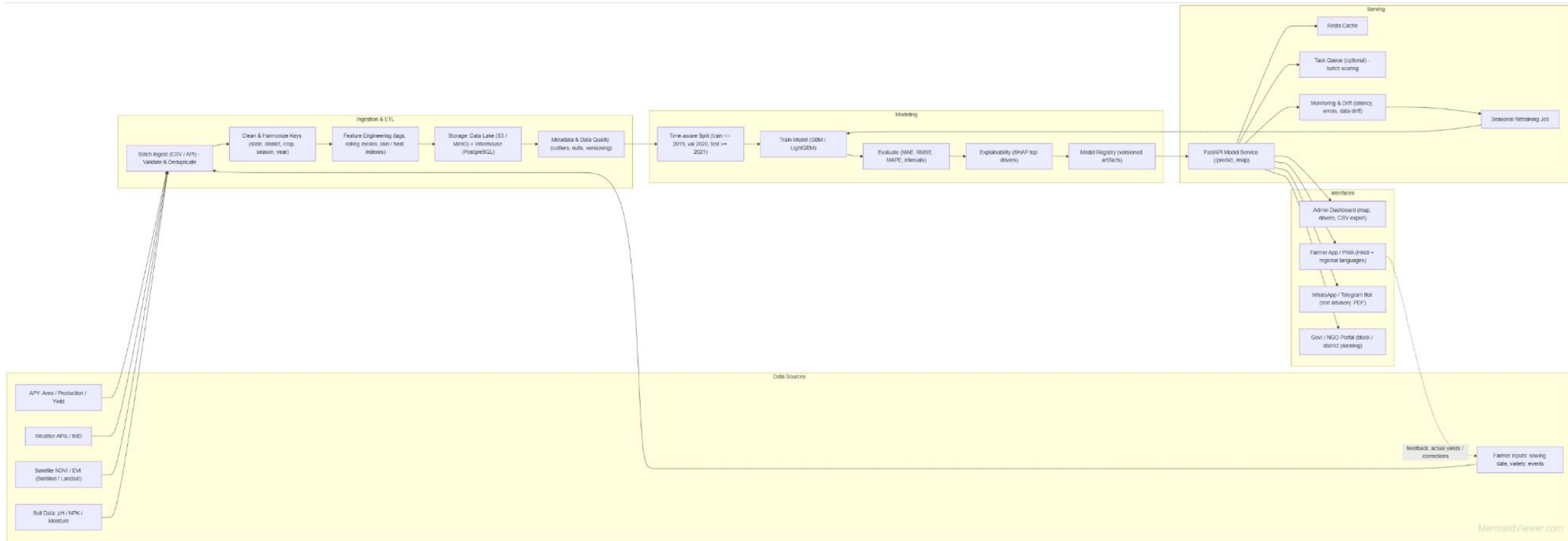
## Technologies Used:

- Backend: Node.js, Express.js, PostgreSQL
- Frontend: React.js (Web), React Native (Mobile), Tailwind CSS
- ML/AI: XGBoost, TensorFlow/PyTorch, SHAP (Explainability)
- APIs: OpenWeatherMap, SoilGrids, Sentinel/Landsat NDVI
- Deployment: Docker, Vercel/Render

## Methodology:

- Data Collection → Weather, Soil, Crop data
- Feature Engineering → Rainfall, NDVI, Soil fertility, Crop stage
- ML Models → Yield prediction (tons/hectare) + optimization engine
- Recommendation Engine → Irrigation, Fertilizer, Pest risk forecast
- Delivery → Multilingual app + SMS/Voice support
- Feedback Loop → Farmer input → Model retrain → Accuracy improves





## Feasibility:

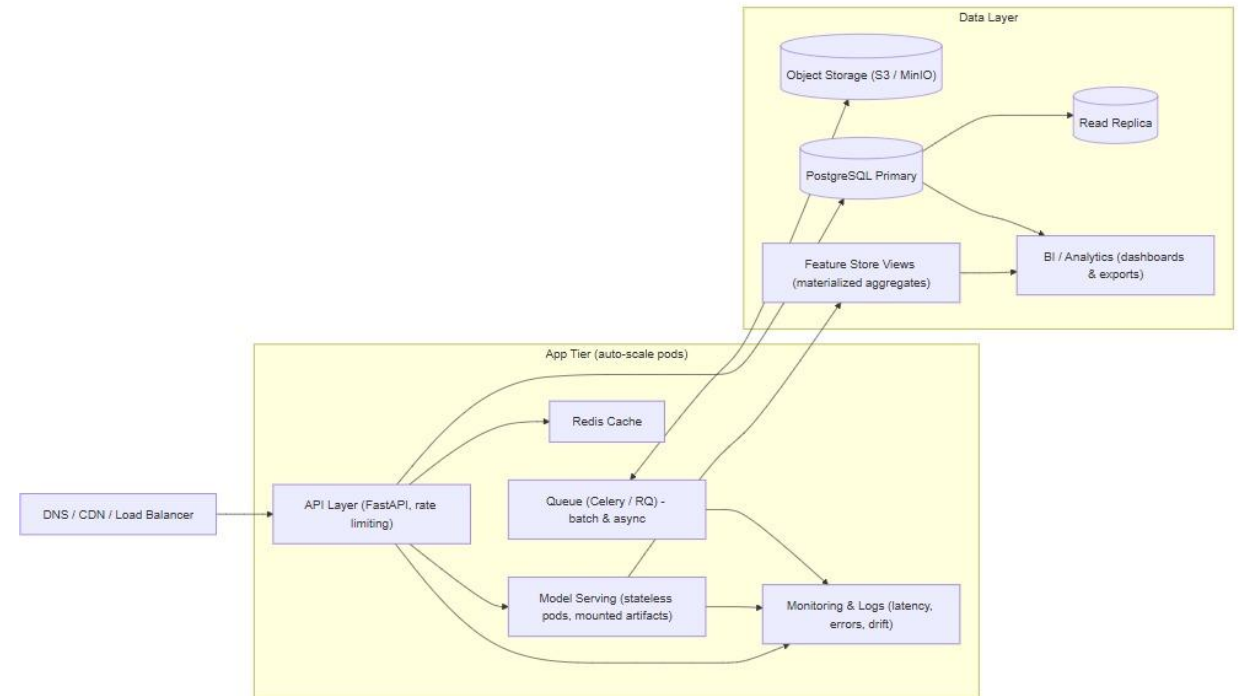
- Uses open-source datasets & APIs (no expensive sensors).
- Works on low-bandwidth (2G-friendly).
- Scalable across regions with minimal setup.

## Challenges & Risks:

- Local farm-level data may be limited.
- Low tech literacy among farmers.
- Weather unpredictability.

## Strategies to Overcome:

- Using regional averages + satellite data for cold start.
- Visual & voice-based UI for easy adoption.
- Partner with Krishi Kendras, cooperatives & NGOs for outreach.



# IMPACT AND BENEFITS



## Impact on Farmers:

- 10–15% increase in yield with optimized practices.
- 15–20% savings on fertilizer & irrigation costs.
- Lower pest losses → more stable income.

## Broader Benefits:

- **Economic:** Better income, reduced input costs.
- **Social:** Improves rural livelihood, reduces farmer stress.
- **Environmental:** Conserves water, reduces chemical overuse.
- **Government:** Supports Digital Agriculture Mission 2025.

## Research Papers:

- Crop yield prediction in agriculture: A comprehensive review of ML & DL approaches (2024) – [ScienceDirect](#)
- Integration of ML and remote sensing in crop yield prediction (2025) – [Agronomy Journals](#)
- Enhanced crop yield forecasting with deep learning & remote sensing (2024) – [Springer](#)
- Next-gen agriculture: AI + Explainable AI for precision farming (2024) – [Frontiers](#)

## Datasets & APIs:

- OpenWeatherMap API – [openweathermap.org](#)
- SoilGrids Database – [soilgrids.org](#)
- Copernicus Sentinel Data (NDVI/EVI) – [copernicus.eu](#)