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- **Problem Statement ID – SIH25044**
- **Problem Statement Title -** *AI-Powered Crop Yield Prediction and Optimization*
- **Theme - *Agriculture, FoodTech & Rural Development***
- **PS Category - *Software***
- **Team ID -**
- **Team Name - *D-Generation X***

D-Generation X

AI-powered Crop Yield Prediction & Optimization

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What is the Problem? :

86% of farmers in India are small & marginal.
There Decisions are based on **guesswork** or shopkeeper advice.
The **Lack of personalized, scientific guidance** → low yield, high costs, overuse of fertilizers.
Existing apps give generic advice, **not explainable or localized**.Farmers **need personalized, trustworthy, accessible yield prediction & advisory.**

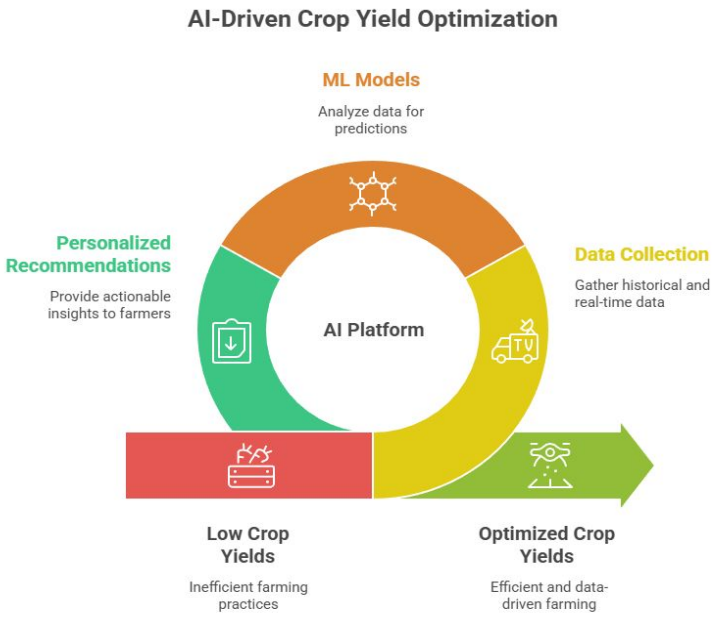
Innovation & Uniqueness:

Integration of **AI/ML + weather + soil health** in one solution

- **What-if simulation engine** (fertilizer/irrigation → yield impact)
- **Explainable AI** → SHAP-based insights for farmer trust
- Multilingual **voice-enabled advisory** for low-literacy farmers.

Proposed Solution:

- AI-driven platform for **crop yield prediction & optimization**
- Mobile + Web app interface for farmers, available in **regional languages**
- Combines **historical data, weather, soil health, and ML models**
- Provides **personalized, actionable recommendations**



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TECHNICAL APPROACH

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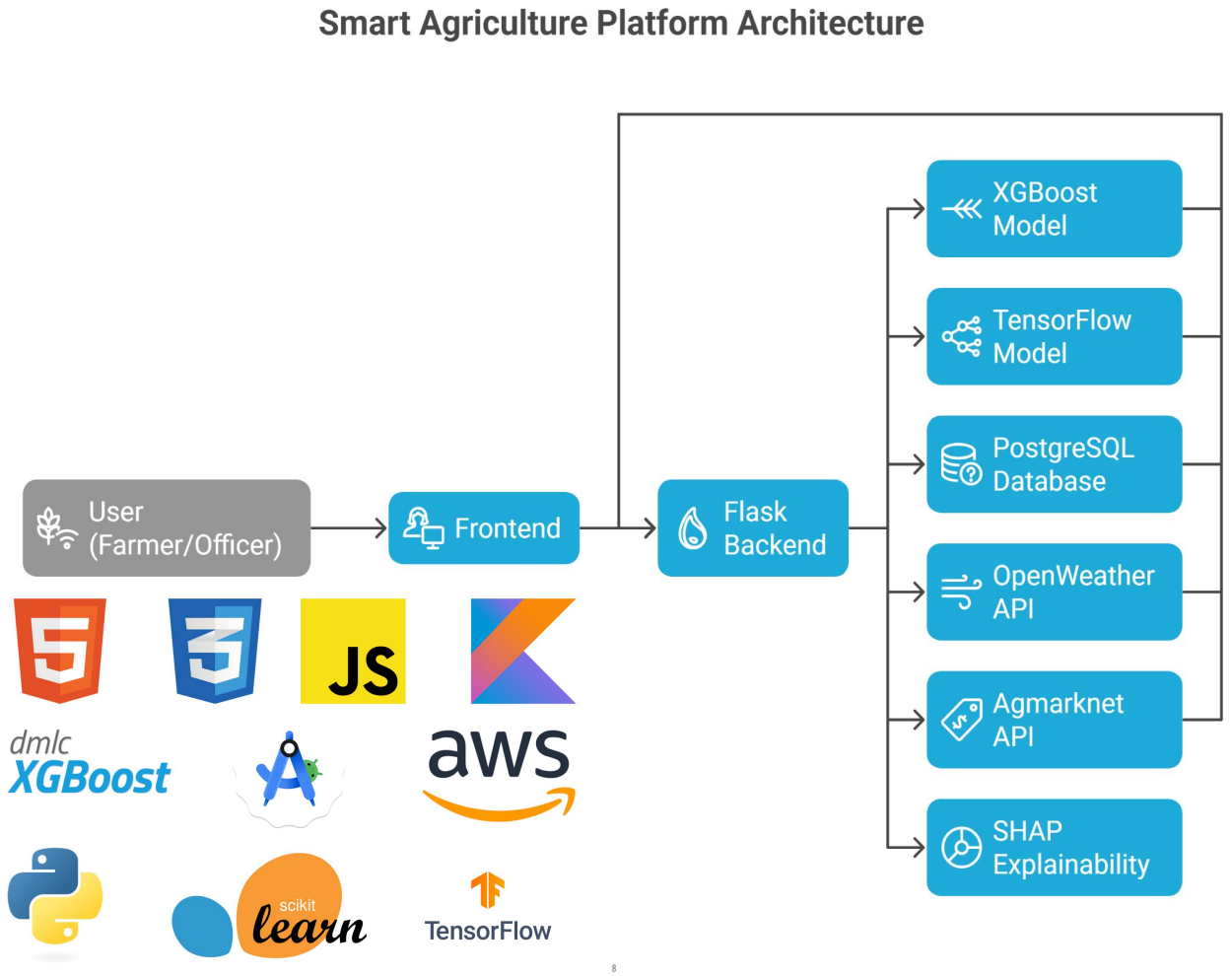
Technologies:-

- Python (ML: XGBoost, TensorFlow/tflite(LSTM))
- Flask backend
- HTML+CSS / Jetpack Compose+Kotlin frontend (multilingual UI + voice support)
- PostgreSQL (structured soil/crop data), OpenWeather API, Agmarknet API
- AWS / GCP → Model training & scalable deployment
- Optional future: IoT sensors for soil moisture → extend input data.

Methodology:-

- Collect & preprocess data (soil, weather, crop history, mandi prices)
- Train ML models(XGBoost+LSTM) for **yield prediction & optimization.** Target accuracy **~85%** based on benchmark studies.
- Build REST APIs for integration with mobile/web apps
- Provide real-time insights + explainability layer (**SHAP**) of each factor.
- Output :- Interactive **Dashboard for Farmers and Officers** with yield and forecast reports.



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FEASIBILITY AND VIABILITY

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Feasibility

Data Availability → Soil Health Card, IMD weather APIs, Sentinel NDVI, ICAR crop datasets ensure reliable input sources.

Tech Stack → Proven ML models (XGBoost for tabular + LSTM for time-series), SHAP for explainability, REST APIs for deployment.

Infrastructure → Works on low-end smartphones; supports offline + multilingual + voice.

Adoption Path → FPOs, KVKs, and NGOs act as digital intermediaries for farmers without smartphones.

Future Expansion (Optional IoT) → Integration with low-cost IoT sensors (soil moisture, temperature) can further enhance accuracy.

Viability

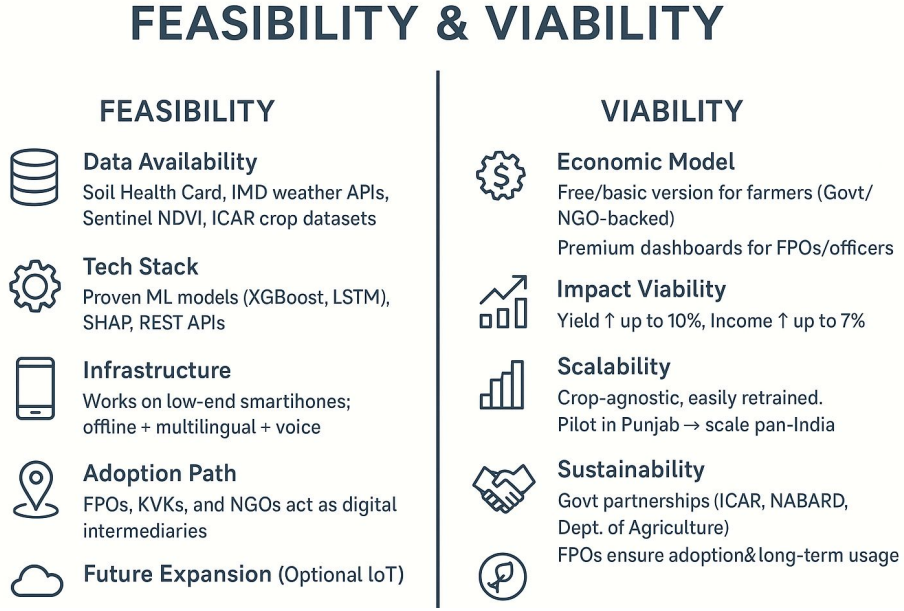
Basic version for farmers (supported by Govt/NGOs);**Multilingual.** Premium dashboards for FPOs/officers.

Yield ↑, Income ↑ .
Resource optimization → reduces fertilizer/water misuse.

Crop-agnostic, easily retrained for multiple regions & crops. Pilot in Orissa → scale pan-India.

Govt partnerships (ICAR, NABARD, Dept. of Agriculture).
FPOs ensure grassroots adoption & long-term usage.

Future Growth (Optional IoT) → Potential to expand into full **smart-farming ecosystem** (sensor-driven irrigation, fertigation).



***We have the data, models, and infrastructure ready. IoT can strengthen the system in later phases.**

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IMPACT AND BENEFITS

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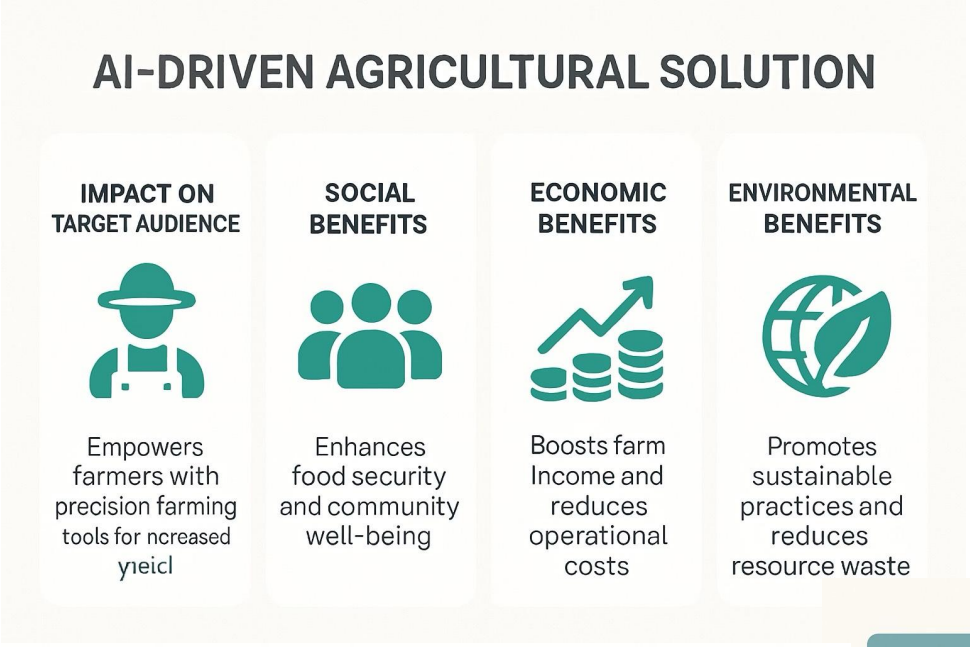
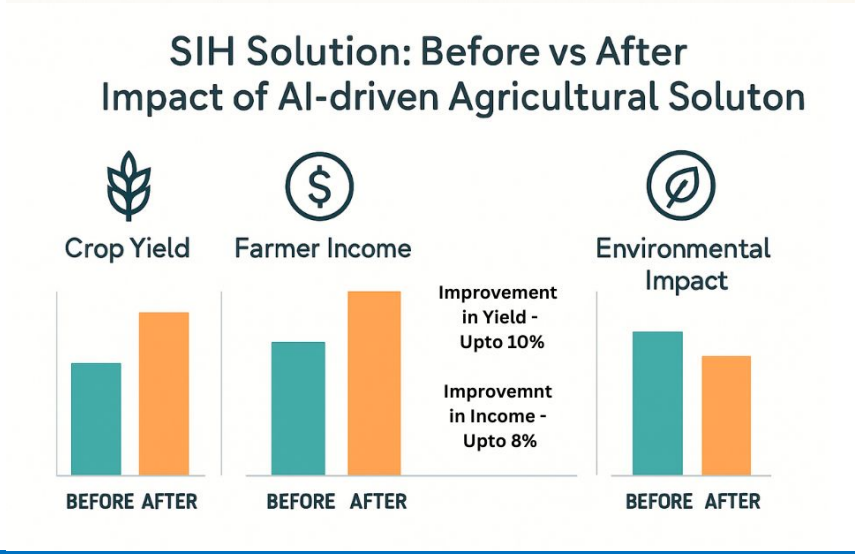
Potential Impact on Target Audience

- Farmers: Access to AI-driven advisory, improved yields, reduced losses from pests/diseases, better market decisions.
- Government & Policymakers: Data-driven insights for crop planning, food security, and subsidy optimization.
- Agricultural Supply Chain: Improved predictability in crop production and procurement, reducing wastage

*Pest impact indirectly reflected via NDVI & weather trends. Indirect early warnings of crop stress (via NDVI/weather trends)





Social

- Farmers get easy tech tools in local languages.
- Simple apps and voice support make tech accessible.

Economic

- Early warnings reduce crop damage from pests/diseases.
- Direct market links help farmers get fair prices.

Environmental

- Encourages eco-friendly, sustainable farming.
- Prepares farmers for weather and climate risks.

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RESEARCH AND REFERENCES

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Section 1: Data Sources & APIs

- Soil Health Card Scheme(Govt. of India)
- OpenWeather API / IMD
- ICAR Research – icar.org.in
- Sentinel/Google Earth for NDVI
- Agmarknet / eNAM
  - Department of Agriculture - Orissa Government

Section 2: Research Papers

- Bendre & Thool (2016) – Big data in precision agriculture
- Kamilaris & Prenafeta-Boldú (2018) – Deep learning in agriculture survey
- Khaki & Wang (2019) – Crop yield prediction with deep neural networks
- K. Patil et. al. (2021) - Machine learning in agriculture domain: A state-of-art survey

Section 3: Tools & Frameworks

- TensorFlow – tensorflow.org
- Scikit-learn – scikit-learn.org
- PostGIS – postgis.net

PostGIS Spatial PostgreSQL

भाकृअनुप ICAR

eNAM Uttam Fasal Uttam Enaam

NATIONAL AGRICULTURE MARKET