SMART INDIA HACKATHON 2025

TITLE PAGE

- **Problem Statement ID -** SIH25044
- **Problem Statement Title -** AI-Powered Crop Yield Prediction and Optimization
- **Theme -** Agriculture, FoodTech & Rural Development
- **PS Category -** Software
- **Team ID -** S4_03
- **Team Name -** TEAM_AGROSENSE

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- AI-powered Crop Yield Prediction using **Machine Learning (ML)**, **Deep Learning (DL)**, and Predictive Analytics trained on weather, soil health & historical agricultural data.
- Smart Farming Advisory System providing real-time, data-driven recommendations for precision irrigation, optimized fertilization & **AI-based pest management**.
- **Increased Productivity** – Enables farmers to achieve **10%+ yield improvement** while ensuring **resource optimization** & **cost reduction**.
- **Innovation** – **Cloud-integrated ML/DL models** & **weather APIs** for continuous learning and accuracy. Calculations based on sustainable values.
- **Uniqueness** – **Multilingual**, mobile-first interface ensuring last-mile accessibility for **small & marginal farmers**, **no monetization**, **user friendly** and **no expertise** needed. Recommendation on **various factors not just yield.**
- **Scalability** – Cross-platform (**Web + Mobile App**), **adaptable** to diverse crops & regional conditions, **community** is built(so **discussion forums**)
- **Future Scope & Implementation-**
- 🎙️Voice Input (**NLP + Speech Recognition**) – Conversational **AI in regional languages**.
- 📸Image Processing (Computer Vision) – Disease & pest detection using **CNN-based models.**
- 📊Market Intelligence (**Big Data Analytics**) – **Supply-demand** forecasting, profit prediction & pricing insights.
- 🏛️ GovTech Integration (**APIs**) – **Personalized government schemes**, subsidies & compliance guidelines via secure user authentication.

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TECHNICAL APPROACH

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Technologies Used-

- Frontend – HTML, CSS, JavaScript, Bootstrap
- Backend – Python & supported libraries, FastAPI
- Data- Kaggle, Huggingface, Supabase for data analytics
- Database – MongoDB / PostgreSQL / SQLite
- APIs – OpenStreetMap (GPS → State), ML/DL model API (Yield & Soil Prediction)

Methodology & Process:

- **Inputs Collected:** GPS, NPK values, crop type, fertilizer used, and area.
- **Process Flow**:
  1./get-state: **GPS** is converted to **state**.
  2./predict-yield: Estimates yield and extra fertilizer needed.
  3./soil-health: Computes the **Soil Health Index (SHI)** and **NPK** requirements.
  4.**Final Response:** A JSON is sent to the frontend for a **user-friendly display**.

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FEASIBILITY AND VIABILITY

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Feasibility Analysis

- Time series, Proven **AI/ML models (KNN, RandomForest, XGBoost,Regression**, **CNNs**, **RNNs**), publicly available **weather & soil Data.**
- **Multilingual interface** for farmer accessibility.
- **Low-cost, scalable solution** using **open-source datasets & cloud computing.**
- Available **offline app,** using **Internet to improvise** predictions and recommendations further.
- **Whatsapp** for **seamless communication & simplicity.**

Challenges & Risks

- **Incomplete / inconsistent agricultural data** (data quality issue)
- Rural connectivity gaps affecting **real-time analytics**
- **Climate variability** impacting prediction accuracy
- **Farmer adoption barriers** – trust & digital literacy issues

Strategies

- Integrate **satellite imagery + crowdsourced farm data** for **Big Data-driven insights**
- **Discussion forums** integrating **LangChain and LLMs** help farmers solve problems.
- **LLMs, Agentic AI & chatbot** based **advisory** in **regional languages.**
- Real time **report summaries, government schemes** and **guideline updates** via **Whatsapp.**

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IMPACT AND BENEFITS

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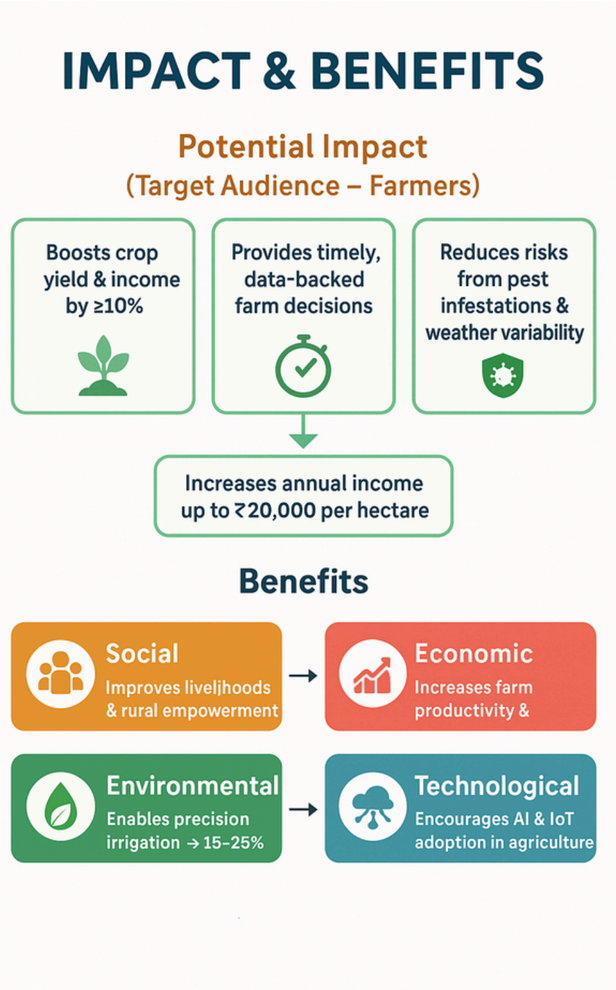
Potential Impact (Target Audience – Farmers)

- Boosts **crop yield & income by ≥10%** through **AI-driven predictive analytics**.
- Provides **timely**, **data-backed farm decisions** (irrigation, fertilization, pest control).
- Reduces risks from **pest infestations** & **weather variability** using **real-time monitoring**
- **Increases annual income up to ₹20,000 per hectare**, empowering small-scale farmers.

Benefits of the Solution

- Social Impact
  - Improves **livelihoods** & **rural empowerment**.
  - Enhances **food security** & reduces dependence on guesswork.
- Economic Impact
  - Increases **farm productivity** & **profitability.**
  - **Reduces input costs** via **optimized fertilizer & irrigation**.
- Environmental Impact
  - Enables **precision irrigation → 15–25% water savings**. **Soil nutrient optimization**
  - Promotes **sustainable agriculture** with **minimal resource wastage**.
- Technological Impact
  - Encourages **AI & IoT adoption** in agriculture.
  - Integrates **Machine Learning, Big Data Analytics, Cloud Computing, and Smart Farming tools.**



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RESEARCH AND REFERENCES

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REFERENCE LINKS

- https://farmonaut.com, monetization
- https://kisansuvidha.gov.in-limited interface, no recommendation
- https://www.jiokrishi.com-with IOT
- https://www.cropin.com-Complex interface
- https://www.kaggle.com
- https://huggingface.co
- https://supabase.com
- https://claude.ai/new

RESEARCH LINKS

- https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=10965701
- https://www.sciencedirect.com/science/article/pii/S240584402416867 3
- https://www.data.gov.in/resource/crop-water-and-irrigation-water-requirement-under-surface-and-drip-irrigation-methods
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- https://www.ijfmr.com/papers/2024/6/29913.pdf