SMART INDIA HACKATHON 2025

E-Soil Smart Card: A Digital Approach for Sustainable Soil Health and Precision Farming

- **Problem Statement ID –** 25168
- **Problem Statement Title-** Enhancing farmer productivity through innovative technology solutions
- **Theme-**Agriculture, FoodTech & Rural Development
- **PS Category-** Software
- **Team ID-** 90464
- **Team Name -** THE GREENCODERS

सत्यमेव जयते

कृषि एवं किसान कल्याण मंत्रालय
MINISTRY OF AGRICULTURE AND FARMERS WELFARE

E-SOIL SMART CARD SYSTEM

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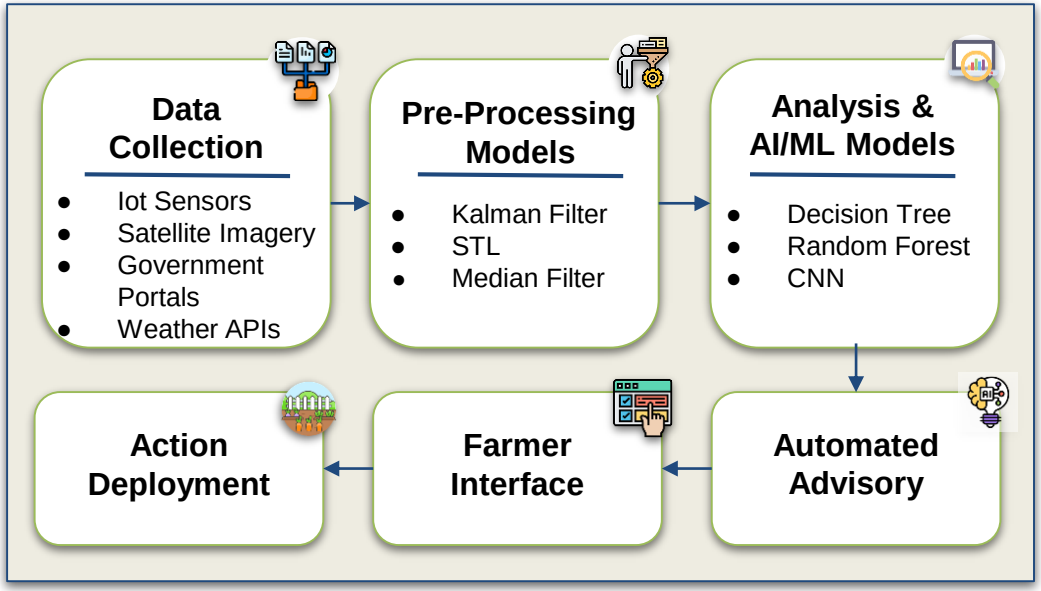
IDEA :- Our solution is an **E-Soil Smart Card system** that unifies soil health, weather, and market data into a single digital platform. By scanning/tapping a card, farmers receive **personalized AI-based recommendations** for sustainable and profitable farming.

PROPOSED SOLUTION :-

- **Market Intelligence + Advisory :-** Merge personalize crop advisory and latest market trends for **gaining more profits and yield**.
- **Smart Digital Twin with Pest & Disease Early Warning :-** A **Farm Digital Twin** uses soil, weather, and crop data to simulate sowing, irrigation, and fertilizer decisions & **AI-driven pest & disease detection**, it provides farmers with **personalized, preventive advisories** in easy local-language formats.

HOW IT ADDRESSES THE PROBLEMS :-

1] Combines soil, weather, and crop data to give accurate, **personalized recommendations.**
2] Provides early **pest and disease alerts** to reduce crop loss.
3] AI driven **Virtual Voice Assistance via voice bots** for advisories in local languages.



INNOVATIONS & UNIQUENESS :-

- **Digital Farm Twin** that simulates “what-if” scenarios for sowing, irrigation, and fertilizer use.
- **AI-powered pest & disease detection** integrated with weather triggers for preventive action.
- **Localized advisory delivery** via voice and simple visuals for low-literacy farmers.

TECHNICAL APPROACH

TECHNOLOGICAL ASPECTS

Frontend – React JS, Tailwind CSS, Chart JS, WebRTC/CamerAPI

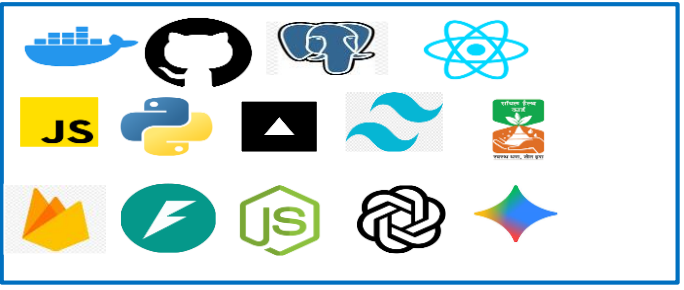
Backend – FAST API (Python), PostgreSQL with Supabase, Node JS, GraphQL

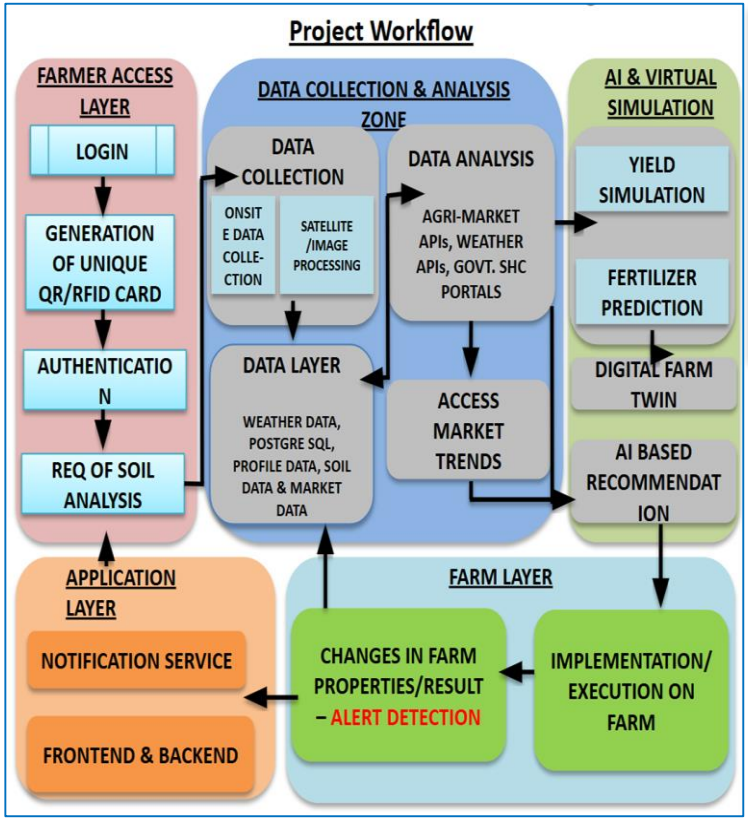
APIs/Datasets - Government SHC datasets, OpenWeatherMap API, AgmarkNet API, eNAM Portal, NASA Power API

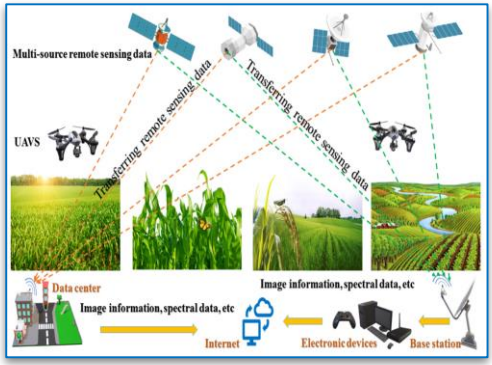
AI/ML Models – ChatGPT 5, Gemini 2.5 Pro, TensorFlow or PyTorch for custom AI models with concepts of RandomForest, Neural Networks, Regression Models, Artificial neural network, CNN for image classification, Decision Tree for Biofertilizers

Deployment – Docker, GitHub, Vercel, Render

Notifications - Firebase Cloud Messaging, Twilio







AI-Driven Remote Sensing for Smart Farming

Top 4 Technologies That Aid Agriculture.

Prototype Progress...

55%

Prototype Link:-

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FEASIBILITY AND VIABILITY

Feasibility and Viability:

1. **Technical Feasibility:** Govt. soil/NPK data + low-cost QR/RFID for reliable performance.
2. **Economic Feasibility:** Affordable cards (₹2–25) with strong government funding and incentives.
3. **Social Feasibility:** Rising digital literacy, QR/UPI familiarity, local language.
4. **Viability:** Strong farmer demand + ₹6,400 cr govt. backing for sustainable precision farming.

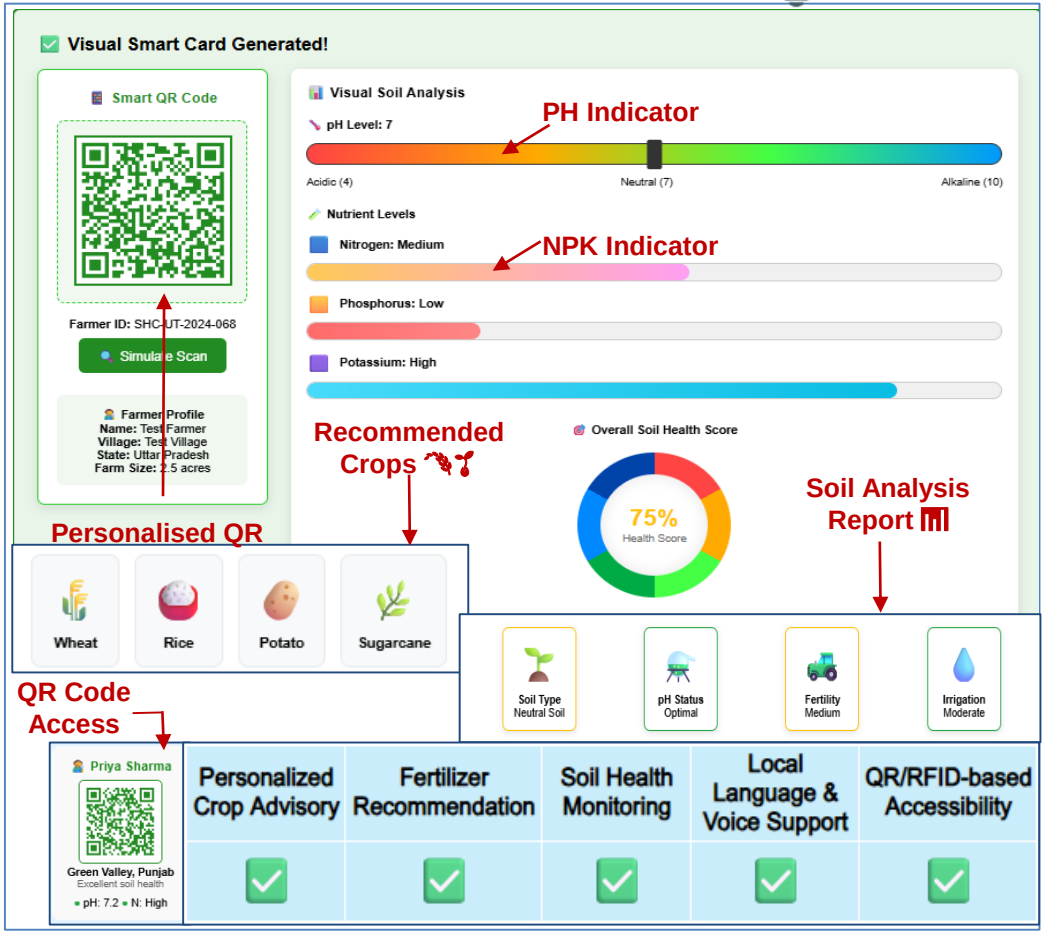
Potential Challenges and Risks:

- **Challenge 1: Privacy & Data Security →**
- **Strategy:** Strong encryption + compliance with regulations.

- **Challenge 2: Model Accuracy →**
- **Strategy:** Continuous updates, retraining with fresh/local data.

- **Challenge 3: Integration & Scalability →**
- **Strategy:** Modular design + API-based interoperability.

- **Challenge 4: Digital Literacy Barriers →**
- **Strategy:** Use QR/RFID, local language, and voice-based support



IMPACT AND BENEFITS

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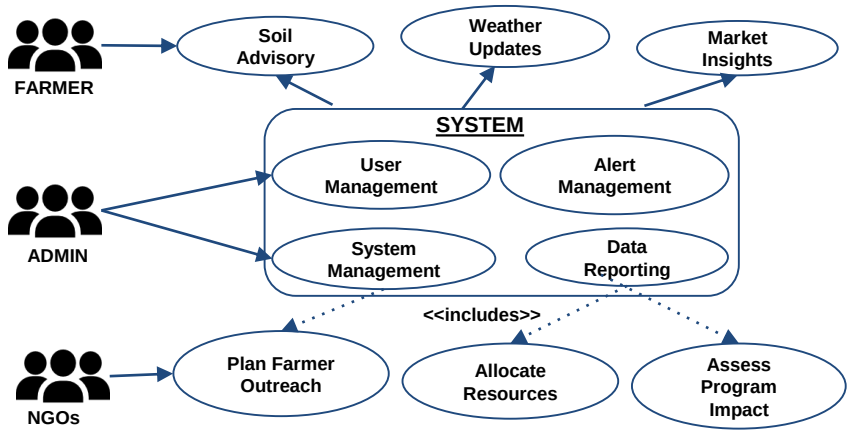
IMPACT ON TARGET AUDIENCE:

1. Farmer Empowerment - Provides personalised AI-driven crop, soil, market insights; enabling smarter decisions and higher profitability.
2. Policy & Planning - Creates a Unified digital soil and crop database, enabling Govt. to design smarter schemes & interventions.
3. Sustainable Agriculture - Encourages biofertilizers, biochars, & Eco-friendly practices hence protecting soil health and ensuring long term farming sustainability.

BENEFITS OF SOLUTION:

1. Social Benefits → Easy Access to soil data empower farmers for informed decisions and better food security.
2. Economical Benefits → Optimized fertilizer/crop use increases farmer income.
3. Environmental Benefits → Reduce chemical Fertilizer use, Promotes Biofertilizers, and Preserve long term soil and ecosystem Health.
4. Personalized Recommendations → Fertilizer, crop, invasive plant alerts tailored to each farm.
5. Data-Driven Farming → Historical soil trends for long-term planning and better yield.
6. Irrigation Scheduling → Optimizes water use for crops.
7. Pest & Disease Management → Early alerts for pests and diseases.
8. Sowing Times → Recommendations for optimal planting periods.
9. Satellite Imagery → Remote monitoring of soil and crop health.



USE CASES:

1. Personalized Soil Advisory- Smart card scan gives instant soil-based recommendations.
2. Market Decision Support- Mandi trends guide farmers on profitable selling time.
3.Weather & Irrigation Guidance- Weather APIs suggest irrigation schedules and protection steps.
4. Pest & Invasive Plant Alerts- AI warns about pests and invasive crop threats.
5. Government & NGO Monitoring- Soil database helps in schemes and subsidy planning.

RESEARCH AND REFERENCES

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Research Papers

- AGRI PREDICT: AI-based Crop Advisory System for Intelligent Agriculture
- Optimizing agricultural output to predict the best possible productivity and crop suitable on the very particular land using machine learning techniques.
- AgroBuddy: Empowering Indian Farmers Through Precision Farming Chatbot.

Government Agriculture & Soil Data Portals

- https://preprod-krishidss.da.gov.in/openapi
- https://soilhealth.dac.gov.in/home
- https://www.data.gov.in/
- https://upag.gov.in/

Market & Trading Information

- https://agmarknet.gov.in/agmarknet
- https://www.enam.gov.in/web/

Weather and Messages

- https://openweathermap.org/api
- https://www.twilio.com/docs/usage/api