



HACK KRMU 5.0

Problem Statement: Develop a mobile-first crop disease diagnosis system providing real-time, location-specific treatment advice in local dialects.

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Problem and Solution

Problem Statement

☁ Farmers lack predictive insights about rainfall, pest attacks, and crop yield — most decisions are reactive, not data-driven.

🌾 There's no unified platform combining analytics, AI advisory, and financial transparency — tools exist in silos.

💧 Resource management is inefficient — irrigation decisions are often made without real-time soil or weather awareness.

🌸 Small farmers face barriers in accessing digital payments, insurance, and government subsidies.

👨 Knowledge remains fragmented — farmers rely on outdated methods or informal networks instead of expert-guided recommendations.

Solution

ArrIgOTech integrates AI, ML, IoT, Web3 & Analytics into one ecosystem.





Core Modules:

- ❖ AI Prediction Engine – Rainfall, yield, AI pest/disease detection.
- ❖ Analytics Dashboard – Real-time soil, humidity & irrigation insights, 3-D Farm view (visualizes every plot of land in Real- time
- ❖ RAG Based Voice Enabled Chatbot – Contextual expert guidance.
- ❖ Web3 Wallet – Secure transactions & subsidy receipts.
- ❖ Crop Planner – Crop rotation & soil health optimization.
- ❖ Community Hub – Farmer–expert collab.
- ❖ IoT Smart Irrigation – Auto/manual modes via ESP8266 + sensors + LCD





Flow of Solution

Layer	Components	Features
Edge (IoT)	<ul style="list-style-type: none">• ESP32 sensors (soil, temp, humidity, pH)• Drone monitoring• Smart weighing systems	<ul style="list-style-type: none">• Tamper detection• Offline buffering• Real-time data collection
Cloud + AI	<ul style="list-style-type: none">• ML Models (rainfall, yield, pest, irrigation)• RAG Assistant• Govt APIs (weather, mandi, subsidy)	<ul style="list-style-type: none">• Explainable AI decisions• Knowledge retrieval• Sensor + drone + historical data fusion
Application	<ul style="list-style-type: none">• Next.js Dashboard + Node-Express Backend• PostgreSQL + MongoDB• Web3 Wallet	<ul style="list-style-type: none">•  Voice chatbot•  3D farm visualization•  Community sharing•  Blockchain logging
Automation	<ul style="list-style-type: none">• Smart irrigation system• Alert mechanisms• Farmer controls	<ul style="list-style-type: none">• Auto-execute with manual override• Tamper alerts• Transparent & auditable



Tech Stack and Approach

Technology Used



Frontend & Application

- React.js
- React Native
- Three.js
- Framer Motion

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- React.js
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AI, NLP & Intelligence

- TensorFlow
- PyTorch
- RAG Pipeline
- LangChain
- Whisper

AI, NLP & Intelligence

- TensorFlow
- RAG Pipeline
- LangChain
- Google Speech API
- LangCain
- Google Speech API
- Google Speech API



Backend & Data

- Node.js
- express.js
- Flask
- MongoDB



IoT, Blockchain & Deployment

- NodeMCU / Raspberry Pi
- Soil Moisture, Temperature & Weight Sensors
- Solidity, Ethereum Testnet
- JWT Authentication

IoT, Blockchain & Deployment

- NodeMCU / Raspberry Pi
- Solidity, Ethereum Testnet
- Vercel, Render, AWS IoT Core
- GitHub








Uniqueness & Innovation Factor

- Agentic AI–Driven Farm Management Autonomous AI agents analyse IoT, climate, and crop data to reason, decide, and act with explainable intelligence.
- 🌐 3D Digital Farm Intelligence Interactive 3D visualization of farm plots and sensors enables real-time, spatial understanding beyond traditional dashboards.
- Voice-First Multilingual Accessibility Speech-enabled AI assistant supports local languages, empowering even digitally illiterate farmers.
- 🔒 □ AI-Based Tampering Detection Detects manipulation in weighing and measuring instruments using sensor anomaly detection, ensuring fairness and trust.
- 🔗 Blockchain-Backed Transparency Immutable farm records and transactions provide tamper-proof traceability for farmers, buyers, and agencies.
- 🌐 Unified AI + IoT + Web3 Platform a scalable, end-to-end SaaS architecture combining intelligence, automation, and trust.



Feasibility and Market Use

Technical Feasibility	Market Use (India-Focused)	SaaS Buisness Model
✓ Tech Stack: IoT + AI + RAG → Highly feasible	B2B2G Model: <ul style="list-style-type: none">Govt, FPOs, agritech pay146M small farmers use	Tiers: <ul style="list-style-type: none">Free: Basic IoT + AIPremium (₹299): Yield, pest, plannerEnterprise: Multi-farm, Govt dash
✓ Cost: ₹1.5k–4k + ₹99–299/month	Use Cases: <ul style="list-style-type: none"> 40% water savings Tamper-proof mandis Subsidy validation Data- backed loans	Revenue: Subscriptions + API usage
✓ Adoption: Voice + 10 Indian languages	Scale: 146M farmers, 15M FPOs Impact: 23% crop loss prevention	Target: FPOs, Smart Villages, Co-ops
✓ Risk Control: Offline, blockchain, manual override	Edge: Offline-first, voice AI	ROI: ₹299/mo = 1 fertilizer bag 15-30% yield increase



Research and Reference

Datasets · Papers · APIs · Results



Datasets Used

- PlantVillage — 54,305 images → Disease Detection
- PAU Yield Data — 12K records → Yield Prediction
- IMD Weather — 15 years → Rainfall Forecasting
- SoilGrids — Global Soil DB → Fertilizer AI



Key Research Papers

- Hughes & Salathe (2015) — PlantVillage Dataset
- Kamilaris et al. (2018) — Deep Learning in Agriculture
- Lin et al. (2021) — Blockchain for Supply Chain
- NeurIPS 2023 — RAG vs Fine-Tuning
- Goap et al. (2018) — IoT Smart Irrigation



APIs & Tools

- OpenWeather API — Real-time forecasts
- OpenAI Whisper — Speech-to-text (Indian accents)
- Pinecone Vector DB — RAG retrieval
- Google Translate — Hindi ↔ English
- Polygon (Alchemy) — Blockchain



Model Performance

95.3%

Disease Detection
ResNet-50 CNN

$R^2=0.89$

Yield Prediction
Random Forest

85%

Rainfall Forecast
LSTM (1-day)

30%→5%

RAG Hallucination
RAG Chatbot