DYMRA TECH HACKATHON

Team: Somya Vats

PS: 3

Khet.AI – Technical & Functional Documentation

Problem Statement

AI-Powered Crop Disease Detection

SDG 2: Zero Hunger
SDG 15: Life on Land

The hackathon challenge aimed to create an AI solution that leverages drone imagery and deep learning to detect early signs of crop diseases and suggest treatments to minimize yield loss.

The Solution: Beyond the Brief

Khet.AI goes far beyond just disease detection. I envisioned a complete AI-powered farming assistant tailored for Indian farmers. This platform combines disease detection, crop recommendation, weather insights, government schemes awareness, and a conversational AI to guide farmers in their local language.

This holistic system empowers farmers with:

- Early diagnosis of plant diseases through image detection
- Intelligent crop selection based on soil & environmental conditions
- Real-time weather updates and analysis
- Awareness of government schemes to support agricultural growth
- A multilingual AI assistant to answer all agriculture-related queries

By integrating these components, we address not just crop disease but the broader farming ecosystem—delivering sustainability, productivity, and inclusivity.

Methodology

We followed a modular development approach to ensure robustness, scalability, and future enhancements.

Datasets Used

- **Plant Disease Detection:**
  PlantVillage Dataset – A curated dataset of diseased and healthy plant leaf images across multiple crop types.
- **Crop Recommendation Dataset:**
  A structured dataset with soil parameters (pH, nitrogen, potassium, phosphorous) and environmental data (temperature, humidity, rainfall), used to train a recommendation engine.

AI Models

- **CNN for Disease Detection:**
  A convolutional neural network trained on labeled plant disease images using TensorFlow and Keras.
- **Random Forest for Crop Recommendation:**
  Trained using scikit-learn with high accuracy on structured soil and weather data.
- **Gemini AI Assistant (via API):**
  Google's Gemini LLM used for prompt-based interaction in both English and Hindi for agricultural queries.
- **Weather Integration:**
  OpenWeatherMap API used to fetch real-time weather conditions like temperature, humidity, wind speed, and rainfall.

Functionalities

- **Image-Based Plant Disease Detection:**
  Users can upload images of diseased plants. The model predicts the type of disease or confirms healthy status.
- **Intelligent Crop Recommendation System:**
  Based on soil nutrients and weather parameters, the app suggests the most suitable crop to cultivate.

- **Weather Insights Dashboard:**
  A real-time weather module shows temperature, wind speed, humidity, and precipitation, assisting farmers in planning.
- **Government Scheme Awareness:**
  A curated list of government schemes related to agriculture, made available through a clean, accessible interface.
- **AI Agricultural Assistant (Khet AI):**
  A chatbot powered by Gemini responds to farmer queries about crop care, pest control, irrigation, and farming techniques in Hindi or English.

Tech Stack

- **Frontend:** HTML5, CSS3, JavaScript, Bootstrap
- **Backend:** Python, Flask
- **Machine Learning:** TensorFlow, Keras, scikit-learn
- **APIs:** Gemini (Generative AI), OpenWeatherMap
- **Version Control:** Git, GitHub)

Directory Structure

```
├── app.py                  # Main Flask application
├── templates/              # HTML templates
│   ├── base.html
│   ├── index.html
│   ├── disease-detection.html
│   ├── crop-recommendation.html
│   ├── government-schemes.html
│   ├── weather-insights.html
│   └── about.html
├── static/                 # Static files
│   ├── css/
│   └── js/
├── models/                 # Saved ML models
│   ├── plant_disease_cnn_model.h5
│   └── best_model_recommendation.sav
```

GitHub Repository

🔗 https://github.com/vatssomya/Khet.AI

Step-by-Step Flow

1. **Plant Disease Detection**
    - User uploads an image of a leaf.
    - Image is preprocessed and passed through a CNN model.
    - Model returns the disease prediction or 'healthy'.
2. **Crop Recommendation**
    - User inputs soil and climate data.
    - Random Forest model recommends the most viable crop based on training.
3. **Weather Insights**
    - Uses OpenWeatherMap API to fetch city-based real-time weather details.
4. **Gemini AI Assistant**
    - A prompt is generated based on the user's message and preferred language.
    - Gemini API generates the reply with practical farming tips, government help, and more.

Conclusion

Khet.AI is not just a plant disease detection tool, it is a full-stack agricultural companion. It understands the real challenges faced by Indian farmers and offers data-driven, AI-enhanced solutions.

Where the hackathon asked for disease detection, we provided:

- A multilayered support system
- Real-time decision-making tools
- Voice and language localization
- Empowerment through knowledge

Scalability & Future Scope

- **Drone Integration:** Automate disease detection across large fields.
- **Voice-Based Interaction:** Integrate voice assistants for illiterate or elderly farmers.
- **IoT Device Support:** Soil sensors, drones, and smart irrigation systems integration.
- **Multi-Crop Expansion:** Extend model support to include additional crop types and regional variations.
- **Mobile App Deployment:** Android-first app to make the system widely accessible in rural areas.
- **Marketplace Integration:** Connect farmers with sellers of fertilizers, seeds, and tools.

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About the Developer

I'm Somya Vats, a Computer Science undergrad passionate about building solutions at the intersection of AI and social impact.
I love blending creativity with technology and have a keen interest in research, hackathons, and empowering people through data.
Always curious, always building.