Rice Leaf Disease Detection & Expert Diagnosis using LangChain + Multi-Agent AI (CrewAI)

Overview:

This project is a smart crop health assistant tailored for rice farmers. It diagnoses rice leaf diseases from images and uses a team of AI agents to provide explanations, treatment recommendations, and risk assessments.

It also includes a fast rice disease chatbot using LangChain and Groq API for natural language Q&A in multiple languages.

Key Features:

- Detects rice diseases using a trained deep learning model (Keras)
- CrewAI for multi-agent expert diagnosis (via OpenAI API)
- Integrates a chatbot using LangChain + Groq API for instant disease Q&A
- Multilingual responses (English, Urdu, Hindi)
- Converts answers into voice using gTTS

Use Case:

- A farmer uploads a rice leaf image → gets disease prediction → AI agents explain the disease, suggest treatments, and analyze urgency → Response shown in text + audio
- Farmer types a disease question → Groq-powered chatbot responds instantly

Tech Stack:

Backend Intelligence

Component	Tech Used	Purpose
Disease Detection	Keras (model.h5)	Image classification for rice diseases
Multi-Agent AI	CrewAI + OpenAI API	Agents: Pathologist, Agronomist, Risk Advisor
Chatbot QA	LangChain + Groq API (llama3-70b)	Rice disease chatbot for natural language Q&A

Voice Generator	gTTS	Converts text to audio in selected language

Frontend & Deployment

- Gradio
- Hugging Face Spaces

Agent System (via CrewAI)

Using CrewAI, the following agents collaborate intelligently:

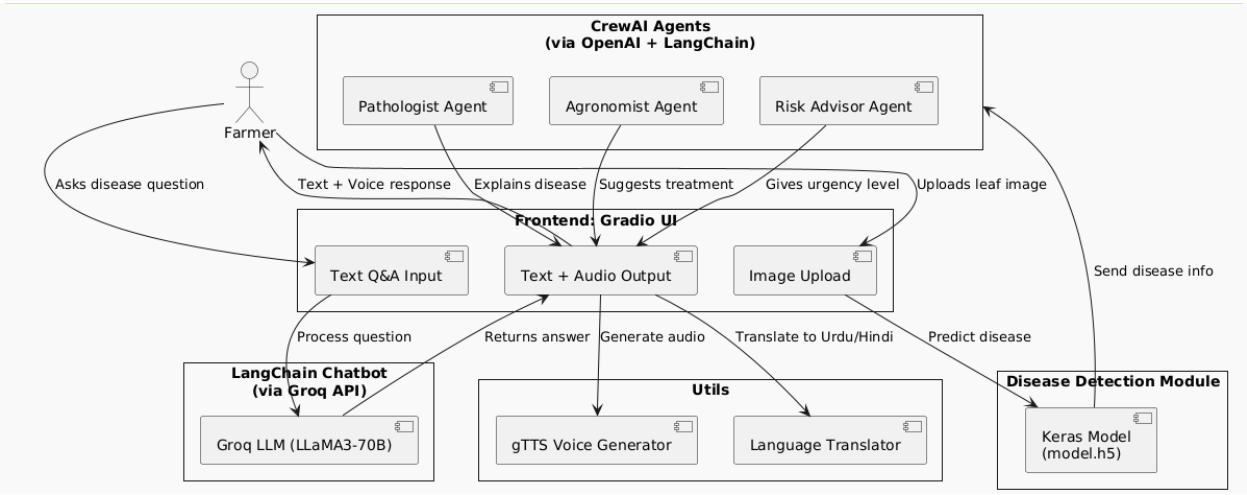
- *Pathologist Agent* – Explains the detected disease in scientific terms
- *Agronomist Agent* – Provides fertilizers and treatments
- *Risk Advisor Agent* – Suggests urgency or risk level to the crop

These agents interact via OpenAI API (only for CrewAI).

Rice Disease Chatbot (via Groq API)

- Built using LangChain and ChatGroq wrapper
- Model: llama3-70b-8192
- Takes any rice-related question and responds within seconds
- Fast, accurate, and cost-efficient (Groq inference)

Architecture Flow



File Structure

File Name	Role
app.py	Main UI and flow control using Gradio
rice_chatbot.py	LangChain-based Groq chatbot
crew_agents.py	Contains CrewAI agent logic (OpenAI API used here)
model.h5	Trained rice disease CNN model
requirements.txt	Dependencies

Languages Supported

- English
- Urdu
- Hindi

API Keys

Key	Purpose
OPENAI_API_KEY	Used only for CrewAI agents
GROQ_API_KEY	Used only for LangChain Chatbot

Set these in Hugging Face Secrets.

Deployment Instructions

1. Create a new Hugging Face Space
2. Choose Gradio + Python
3. Upload all required files
4. Add secrets:
    - OPENAI_API_KEY
    - GROQ_API_KEY
5. Click **Deploy**