AI-Based Farm Assistant for Disease Detection and Query Resolution

Nirbhay (220729), Charu_Saini(220729), Vishal_Yadav(220621)

BML Munjal University(Gurgaon-Haryana)

Abstract

In recent years, agriculture has increasingly adopted artificial intelligence (AI) technologies to improve crop yields and disease management. This project, "AI Farm Assistant," is an integrated system developed using machine learning models for plant disease detection and a conversational chatbot for assisting farmers. The model employs YOLOv5 for real-time disease detection and a lightweight chatbot for answering agricultural queries. The application is deployed using Streamlit, providing an easy-to-use interface for farmers. The aim is to offer fast, accessible, and regionally adaptable solutions to support farming communities.

Keywords

Agriculture, Deep Learning, YOLOv5, Plant Disease Detection, Chatbot, Streamlit, Smart Farming.

---

1. Introduction

Agriculture is a vital sector contributing to food security and economic growth. However, crop diseases and lack of timely expert advice remain major challenges for farmers. AI-based systems can provide efficient solutions for detecting diseases at early stages and providing on-demand agricultural assistance. This project introduces an AI Farm Assistant platform that combines a disease detection model
and a farmer query chatbot, thereby facilitating smarter, faster farming support.

---

2. Literature Survey / Background

Several research efforts have utilized convolutional neural networks (CNNs) for disease detection in plants. YOLO (You Only Look Once) models are widely recognized for their real-time object detection capabilities. Similarly, natural language processing (NLP) models like GPT have revolutionized chatbot development for domain-specific applications. Building on these advancements, this project leverages YOLOv5 and simple LLM-based chat interfaces to create a lightweight, accessible farm assistance tool.

---

3. System Design

The system is designed with two main components:

- **Disease Detection Module:** YOLOv5 model customized to detect common plant diseases.
- **Chatbot Module:** Language model to assist farmers by answering agriculture-related queries in English or regional languages.

The frontend is developed using Streamlit to allow easy interaction for farmers.

---

4. Methodology

4.1 Dataset / Model

- **Plant Disease Dataset:** Pre-collected dataset containing images of various plant diseases.
- **Model Used:** YOLOv5 fine-tuned on the dataset for high-accuracy detection.

4.2 Disease Detection

- Custom YOLOv5 model is trained and deployed.
- Model identifies the type of disease and suggests remedies.

4.3 Chatbot for Farmer Assistance

- A basic question-answering bot was integrated using static logic and optional OpenAI API for intelligent replies.
- Language preference selection allows users to receive responses in English or selected regional languages.

---

5. Implementation Details

- **Frontend:** Developed with Streamlit.
- **Backend:** Python scripts for disease detection and chatbot logic.
- **Model Deployment:** YOLOv5 loaded using torch.hub.
- **Language Support:** Multilingual capabilities using translation APIs (optional).
- **Hosting:** Local server with option for cloud deployment (e.g., AWS).

Libraries Used:

- torch
- torchvision
- streamlit
- opencv-python
- Pillow
- googletrans (optional)

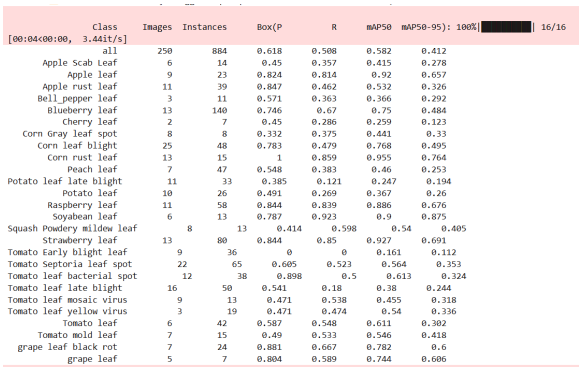
6.Appendix

Project Folder Contents:

- **disease_detector.py:** YOLOv5 based disease detection.
- **chatbot.py:** Multilingual chatbot using LLMs.
- **translation_helper.py:** Translation support module.
- **app.py:** Main integration script (likely Streamlit app).
- **models/:** Pretrained models (YOLOv5, LLM fine-tuned models).
- **requirements.txt:** List of Python libraries.
- **venv/:** Virtual environment.
- **yolov5/:** YOLOv5 source code.

7. Results and Screenshots

- **Plant Disease Detection:** Successfully detected diseases like blight, rust, and mildew from plant images.



Class	Images	Instances	Box(P	R	mAP50	mAP50-95): 100%| 16/16 [00:04<00:00, 3.44it/s]
all	250	884	0.618	0.508	0.582	0.412
Apple Scab Leaf	6	14	0.45	0.357	0.415	0.278
Apple leaf	9	23	0.824	0.814	0.92	0.657
Apple rust leaf	11	39	0.847	0.462	0.532	0.326
Bell_pepper leaf	3	11	0.571	0.363	0.366	0.292
Blueberry leaf	13	140	0.746	0.67	0.75	0.484
Cherry leaf	2	7	0.45	0.286	0.259	0.123
Corn Gray leaf spot	8	8	0.332	0.375	0.441	0.33
Corn leaf blight	25	48	0.783	0.479	0.768	0.495
Corn rust leaf	13	15	1	0.859	0.955	0.764
Peach leaf	7	47	0.548	0.383	0.46	0.253
Potato leaf late blight	11	33	0.385	0.121	0.247	0.194
Potato leaf	10	26	0.491	0.269	0.367	0.26
Raspberry leaf	11	58	0.844	0.839	0.886	0.676
Soyabean leaf	6	13	0.787	0.923	0.9	0.875
Squash Powdery mildew leaf	8	13	0.414	0.598	0.54	0.405
Strawberry leaf	13	80	0.844	0.85	0.927	0.691
Tomato Early blight leaf	9	36	0	0	0.161	0.112
Tomato Septoria leaf spot	22	65	0.605	0.523	0.564	0.353
Tomato leaf bacterial spot	12	38	0.898	0.5	0.613	0.324
Tomato leaf late blight	16	50	0.541	0.18	0.38	0.244
Tomato leaf mosaic virus	9	13	0.471	0.538	0.455	0.318
Tomato leaf yellow virus	3	19	0.471	0.474	0.54	0.336
Tomato leaf	6	42	0.587	0.548	0.611	0.302
Tomato mold leaf	7	15	0.49	0.533	0.546	0.418
grape leaf black rot	7	24	0.881	0.667	0.782	0.6
grape leaf	5	7	0.804	0.589	0.744	0.606

Fig.1- Model accuracy

- **Chatbot Assistance:** Provided basic farming advice and query resolution in selected languages.

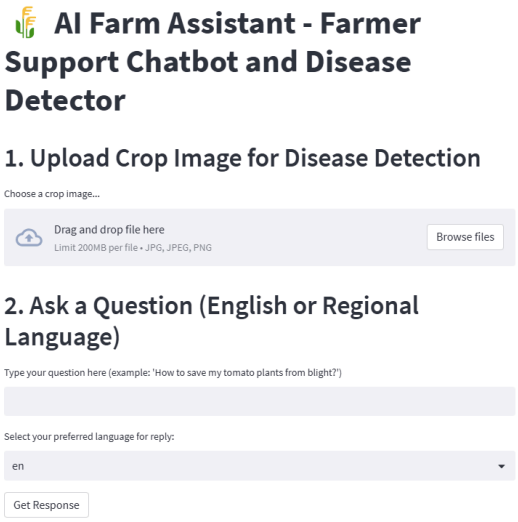


Fig.2 - First view of web page

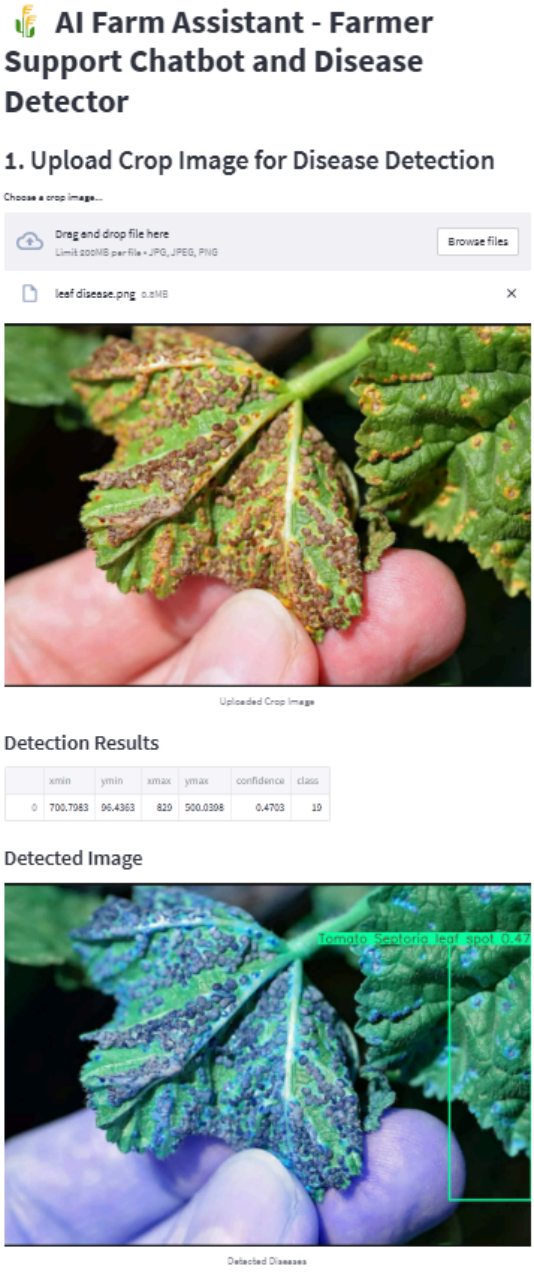


Fig.3 -Disease detection using image

Fig.4 -Response in Hindi

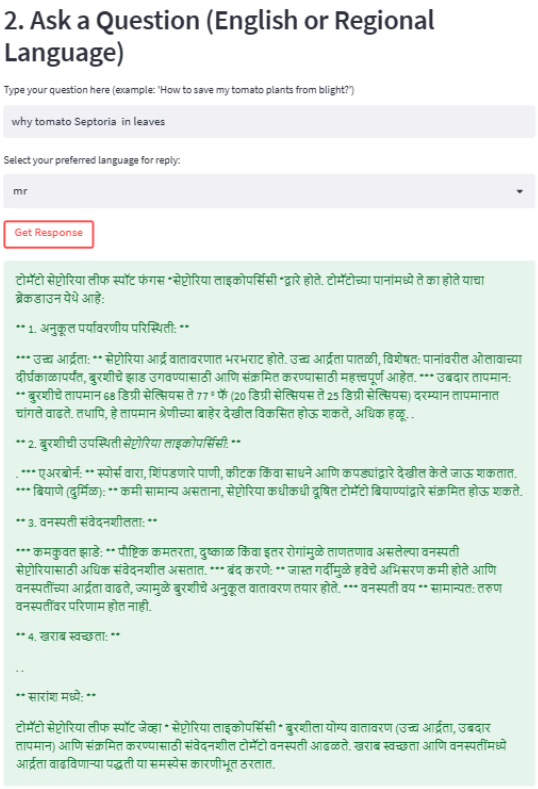


Fig.4 -Response in marathi

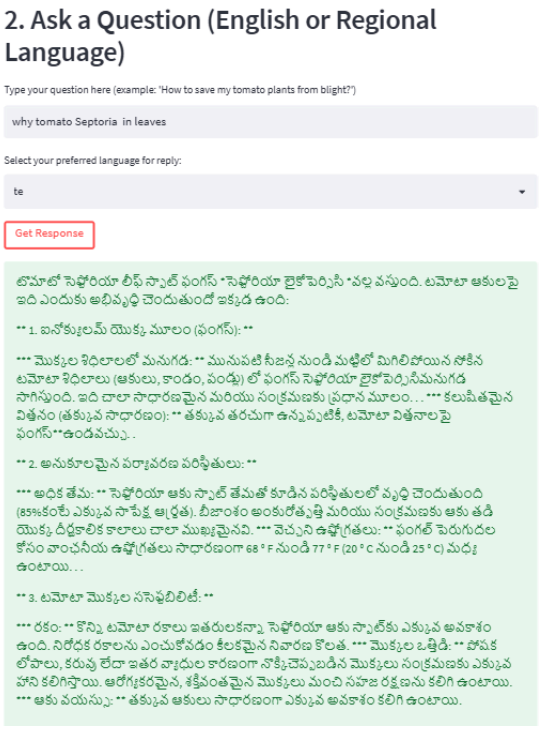


Fig.4 -Response in Tamil

8. Conclusion

The AI Farm Assistant serves as a lightweight, effective tool for farmers to detect plant diseases early and obtain agricultural advice. The project showcases the potential of combining computer vision and NLP techniques to support precision agriculture and empower rural communities.

8. Future Scope

- Integrate a more powerful language model (e.g., GPT-4) for smarter responses.
- Expand disease detection to cover more crop types and pests.
- Add voice assistant

- Add voice-based input and response for accessibility.
- Deploy the solution on mobile platforms.

References

1. M. Verma, A. P. Singh, J. Singh and S. Kumari, "Kissan Konnect: AI-Powered Plant Disease Control System Fusing Temporal Data Modeling with Deep Learning," *2024 First International Conference on Software, Systems and Information Technology (SSITCON)*, Tumkur, India, 2024, pp. 1-6, doi: 10.1109/SSITCON62437.2024.10796969.keywords: {Deep learning;Data analysis;Surveillance;Transfer learning;Crops;Real-time systems;Stakeholders;Forecasting;Viruses (medical);Remote sensing;remote sensing;agricultural sustainability;food security;plantvillage;kissan konnect;MySQL Admin;VGG19},
2. Sai, S., Kumar, S., Gaur, A., Goyal, S., Chamola, V. and Hussain, A., 2025. Unleashing the Power of Generative AI in Agriculture 4.0 for Smart and Sustainable Farming. Cognitive Computation, 17(1), pp.1-18.
3. Rane, Jayesh, Ömer Kaya, Suraj Kumar Mallick, and Nitin Liladhar Rane. Generative Artificial Intelligence in Agriculture, Education, and Business. Deep Science Publishing, 2024.
4. Samrose, Samira. "Leveraging Generative AI For Sustainable Farm Management Techniques Correspond To Optimization and Agricultural Efficiency Prediction." (2024).
5. Krupitzer, Christian. "Generative artificial intelligence in the agri-food value chain-overview, potential, and research challenges." Frontiers in Food Science and Technology 4 (2024): 1473357.
6. Koshiya, Neelam. "Sustainable Generative AI practices."
7. Raman, R. K., Kumar, A., Sarkar, S., Yadav, A. K., Mukherjee, A., Meena, R. S., ... & Kumar11, V. (2024). Reconnoitering Precision Agriculture and Resource Management: A Comprehensive Review from an Extension Standpoint on Artificial Intelligence and Machine Learning. Indian Research Journal of Extension Education(IRJEE), 108-123.
8. Raman, Rohan Kumar, Abhay Kumar, Sudip Sarkar, Anil Kumar Yadav, Anirban Mukherjee, Ram Swaroop Meena, Ujjwal Kumar et al. "Reconnoitering Precision Agriculture and Resource Management: A Comprehensive Review from an Extension Standpoint on Artificial Intelligence and Machine Learning." *Indian Research Journal of Extension Education(IRJEE)* (2024): 108-123.
9. Ali, S. H., Shahid, M. F., Tanveer, M. H., & Rauf, A. Integrating LLM for Cotton Soil Analysis in Smart Agriculture System.
10. Vizniuk, Artem, Grygorii Diachenko, Ivan Laktionov, Agnieszka Siwocha, Min Xiao, and Jacek Smoląg. "A Comprehensive Survey of Retrieval-Augmented Large Language Models for Decision Making in Agriculture: Unsolved Problems and Research Opportunities." *Journal of Artificial Intelligence and Soft Computing Research* 15, no. 2 (2025): 115-146.