# AI-DRIVEN TOBACCO PLANT DISEASE DETECTION AND MANAGEMENT SYSTEM USING DRONES AND DEEP LEARNING

***Project Reference No.:*** *48S_BE_4130*

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**Keywords:** AI, Crop Disease Detection, UAV, Machine Learning, Precision Agriculture

**Introduction:**

Agriculture remains a cornerstone of the Indian economy, yet plant diseases continue to pose a major threat to crop yield and food security. Traditional manual inspection methods are labour-intensive, time-consuming, and prone to human error. This project addresses the need for a scalable, real-time crop disease monitoring system using artificial intelligence and drone technology. The aim is to automate disease detection using the YOLOv11 deep learning algorithm integrated with drone-based imagery for timely intervention and management. Specifically, the focus is on tobacco plant health and apple orchards, leveraging YOLOv11 for high-speed, accurate disease prediction and integrating these with UAV systems for field deployment.

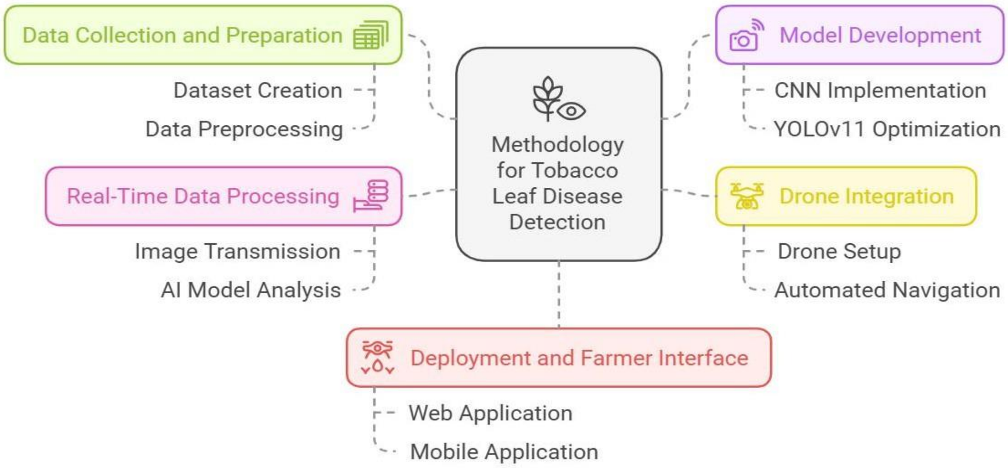
**Objectives:**

The primary goal of this project is to leverage AI and drone technology to enhance agricultural productivity by addressing tobacco plant diseases. The project objectives are:

1. Develop a robust AI model capable of accurately detecting diseases such as leaf spot, tobacco mosaic virus, and black shank in tobacco plants.
2. Utilize drone technology for real-time, scalable disease monitoring across large fields.
3. Design an end-to-end solution integrating AI, drones, and a farmer-friendly interface for actionable insights.
4. Enable early detection and timely treatment recommendations to reduce crop

losses.
5. Support sustainable farming practices and improve economic outcomes for farmers.

**Methodology:**




**Step 1: Data Collection and Preparation**

- Created our own dataset by collecting images of diseased and healthy tobacco leaves through field surveys and controlled experiments.

  Preprocessed the data using augmentation techniques such as flipping, rotation, and noise addition to improve model robustness.

**Step 2: Model Development**

- Used Convolutional Neural Networks (CNNs) for initial classification and disease detection.
- Upgraded to YOLOv11 for real-time detection, optimizing it for drone image input.

**Step 3: Drone Integration**

- Integrated drones equipped with high-resolution cameras for collecting aerial images.
- Configured drones using Pixhawk controllers and GPS modules for automated navigation and scanning.

**Step 4: Real-Time Data Processing**

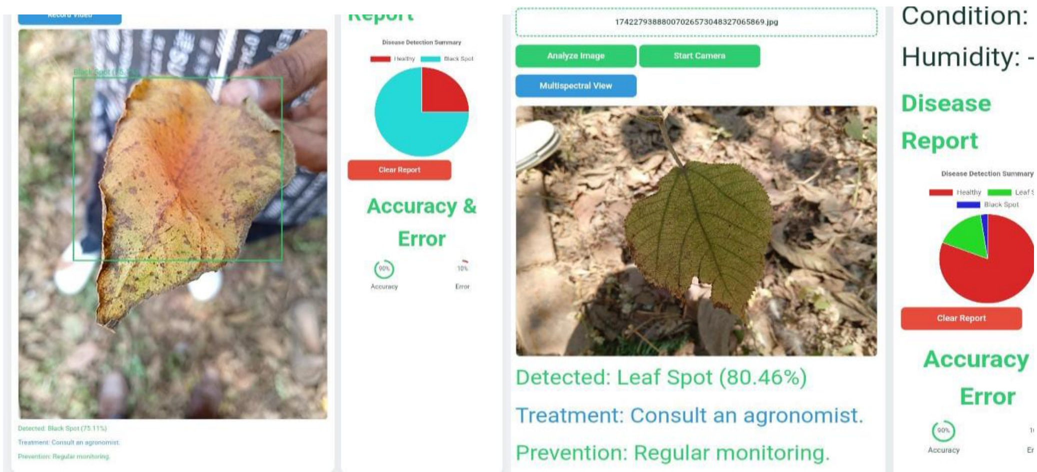
- Developed a pipeline for transmitting drone-captured images to the AI model for instant analysis.

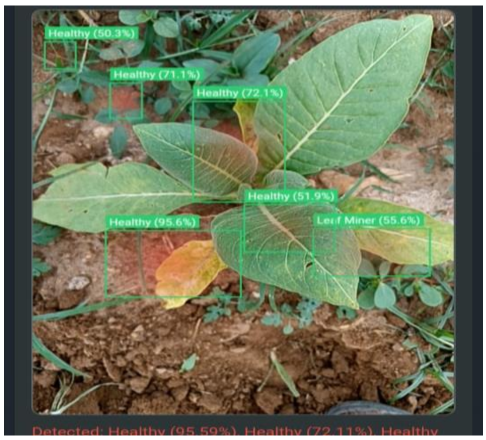
**Step 5: Deployment and Farmer Interface**

- Created a web and mobile application to visualize detection results and provide treatment recommendations.
- The interface also includes disease statistics, environmental factors, and crop management tips.

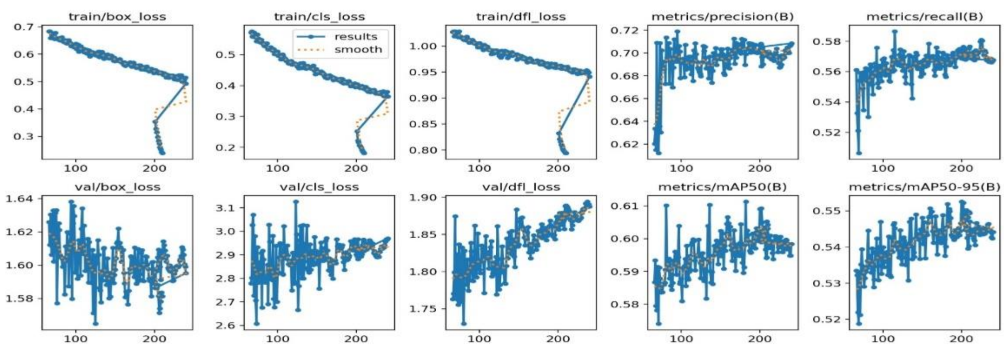
**Result and Conclusion:**

**<u>RESULT:</u>**




**<u>GRAPHS:</u>**



In conclusion,

The YOLOv11 model demonstrated excellent performance in detecting crop diseases with high accuracy and speed. Real-time detection was successfully tested using drone-mounted cameras over crop fields. The solution shows promise for improving agricultural productivity through early detection and reducing the need for manual inspections. This project successfully integrates advanced AI with drone systems, contributing toward precision agriculture.

**Project Outcome & Industry Relevance:**

The project delivers a practical, scalable, and tech-driven solution for precision agriculture. By utilizing YOLOv11 and UAVs, the system can benefit farmers, agribusinesses, and government agricultural programs. It has strong relevance in areas with limited access to agronomists, where timely detection can save crops from severe losses.

**Working Model vs. Simulation/Study:**

This project includes a working drone-based prototype integrated with the YOLOv11 model. The system was tested in real conditions to validate detection performance and drone flight capability.

**Project Outcomes and Learnings:**

- **Improved Early Detection:** AI-driven real-time disease identification for timely intervention.
- **Efficiency and Scalability:** Drone-based monitoring enables quick and efficient surveying of large farms.
- **Cost-Effective Solutions**: Reduces dependency on manual inspections and mitigates crop losses.
- **Farmer Empowerment:** Provides actionable insights and treatment recommendations, accessible via mobile and web apps.
- **Sustainability:** Promotes eco-friendly practices through early intervention and optimized resource use.

**Future Scope:**

The future scope of this project includes:

- Extension of the model to more crop types and pest categories.
- Integration with multispectral and hyperspectral sensors for enhanced accuracy.
- Addition of automated spraying features using drones.
- Collaboration with local farmer organizations and agri-tech companies for large-scale deployment.
- Real-time alert system with weather and soil data integration for more contextual decisions.