iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** VI **Month of publication:** June 2026

DOI: https://doi.org/10.22214/ijraset.2026.83899

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue VI June 2026- Available at www.ijraset.com

AgriAdvisor: AI-Enabled Decision Support System for Crop Planning, Disease Diagnosis and Pesticide Management

Bandi Rachana[1], Mr. G. Narasimham[2]
[1]MTech Student, Computer Science and Engineering, JNTU Hyderabad, Telangana
[2]Associate Professor of Computer Science and Engineering, JNTU Hyderabad, Telangana

Abstract: Agriculture plays a vital role in ensuring food security and economic stability worldwide. Farmers often face challenges in selecting suitable crops, identifying plant diseases, predicting crop yield, and obtaining accurate weather information. To address these issues, this paper presents AgriAdvisor, an AI-enabled smart farming system that integrates Crop Recommendation, Plant Disease Detection, Yield Prediction, and Weather Monitoring into a unified web-based platform. The proposed system utilizes machine learning and deep learning techniques, including XGBoost for crop recommendation, Convolutional Neural Networks (CNN) for disease detection, and Gradient Boosting Regression for yield prediction. A Streamlit-based interface allows farmers to access all services through a single dashboard. Experimental results demonstrate that the proposed system achieves high prediction accuracy and provides reliable decision support for modern precision agriculture.

Keywords: Smart Agriculture, Crop Recommendation, Disease Detection, Yield Prediction, Machine Learning, Deep Learning, XGBoost, CNN, Streamlit.

I. INTRODUCTION

Agriculture is one of the most important sectors contributing to economic growth and food security across the world. Farmers often face several challenges such as improper crop selection, plant diseases, unpredictable weather conditions, and inaccurate yield estimation, which significantly affect agricultural productivity. Traditional farming methods largely depend on manual observation and experience, making decision-making time-consuming and prone to errors. With the advancement of Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning (DL), intelligent agricultural systems can provide accurate recommendations and support farmers in making informed decisions.

To address these challenges, this paper proposes AgriAdvisor: An AI-Enabled Smart Farming System, a comprehensive web-based platform that integrates Crop Recommendation, Plant Disease Detection, Yield Prediction, and Weather Information services. The system utilizes machine learning and deep learning techniques to analyze agricultural data and generate useful insights for farmers.

By combining multiple agricultural services into a single platform, AgriAdvisor aims to simplify farm management and improve overall crop productivity.

The Crop Recommendation module uses soil nutrients and environmental parameters to suggest the most suitable crop for cultivation using the XGBoost classification algorithm. The Yield Prediction module estimates expected crop production through a Gradient Boosting Regressor model based on crop type, area, rainfall, fertilizer usage, and temperature. The Disease Detection module employs a Convolutional Neural Network (CNN) trained on the PlantVillage dataset to identify plant diseases from leaf images and provide appropriate pesticide recommendations. In addition, a weather module provides real-time weather information to support agricultural planning and decision-making.

The proposed system is implemented as a Streamlit-based web application, offering a simple and user-friendly interface for farmers and agricultural stakeholders. The integration of AI-powered crop recommendation, disease diagnosis, yield estimation, and weather monitoring enables farmers to make accurate and timely decisions. By reducing crop losses, improving resource utilization, and increasing agricultural productivity, AgriAdvisor contributes to the advancement of precision farming and sustainable agricultural practices.

II. LITERATURE REVIEW

The integration of Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning (DL) technologies in agriculture has gained significant attention in recent years due to their potential to improve crop productivity, disease management, and decision-making processes.

The increasing availability of agricultural datasets and advancements in computational techniques have enabled researchers to develop intelligent farming systems capable of assisting farmers in various agricultural activities. These systems aim to enhance productivity, reduce crop losses, and promote sustainable farming practices.

Research on crop recommendation systems has been extensively conducted using machine learning algorithms and soil parameter analysis. A study by Ramesh and Vydeki [1] proposed a crop recommendation system based on soil nutrients and climatic conditions, demonstrating that machine learning models can effectively assist farmers in selecting suitable crops. Similarly, Bhanose et al. [2] employed classification algorithms such as Decision Tree and Random Forest to recommend crops based on environmental factors. Their findings indicated that machine learning approaches significantly improve recommendation accuracy compared to traditional farming practices.

Plant disease detection has emerged as another important research area in smart agriculture. Mohanty et al. [3] utilized deep learning techniques on the PlantVillage dataset and achieved high classification accuracy for identifying crop diseases from leaf images. Their work demonstrated the effectiveness of Convolutional Neural Networks (CNNs) in automated disease diagnosis. Furthermore, Ferentinos [4] developed a deep learning-based plant disease identification system using CNN architectures and reported superior performance compared to conventional image-processing methods. These studies highlight the capability of deep learning models to detect diseases at an early stage, thereby reducing crop losses and improving agricultural productivity.

Yield prediction has also attracted considerable attention from researchers due to its importance in agricultural planning and resource management. Jeong et al. [5] investigated machine learning models for crop yield estimation using environmental and historical agricultural data. Their results showed that ensemble learning methods outperform traditional statistical approaches in yield forecasting. Similarly, Khaki and Wang [6] applied deep learning techniques for corn yield prediction and demonstrated the effectiveness of data-driven models in capturing complex relationships among agricultural variables. In addition, recent studies have explored the integration of weather forecasting with intelligent farming systems to support agricultural decision-making. Weather-based advisory systems help farmers plan irrigation, fertilization, and harvesting activities more effectively.

Despite significant progress in individual agricultural applications, most existing systems focus on a single functionality such as crop recommendation, disease detection, or yield prediction. Limited research has been conducted on integrating multiple AI-powered agricultural services into a unified platform. Therefore, there is a need for a comprehensive smart farming system that combines crop recommendation, disease diagnosis, yield estimation, pesticide suggestion, and weather information in a single user-friendly interface. To address this gap, the proposed AgriAdvisor: AI-Enabled Smart Farming System integrates XGBoost-based crop recommendation, Gradient Boosting-based yield prediction, CNN-based disease detection, pesticide recommendation, and real-time weather monitoring through a Streamlit web application, providing farmers with an intelligent decision-support system for precision agriculture.

III. METHODOLOGY

The proposed AgriAdvisor: AI-Enabled Smart Farming System integrates Machine Learning (ML), Deep Learning (DL), and real-time weather monitoring to assist farmers in making informed agricultural decisions. The system consists of multiple modules including Crop Recommendation, Disease Detection, Yield Prediction, Pesticide Recommendation, and Weather Forecasting. The methodology follows a structured pipeline comprising data acquisition, data preprocessing, model development, prediction generation, and model evaluation. These stages ensure that agricultural data is transformed into meaningful insights for improving crop productivity and farm management.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue VI June 2026- Available at www.ijraset.com

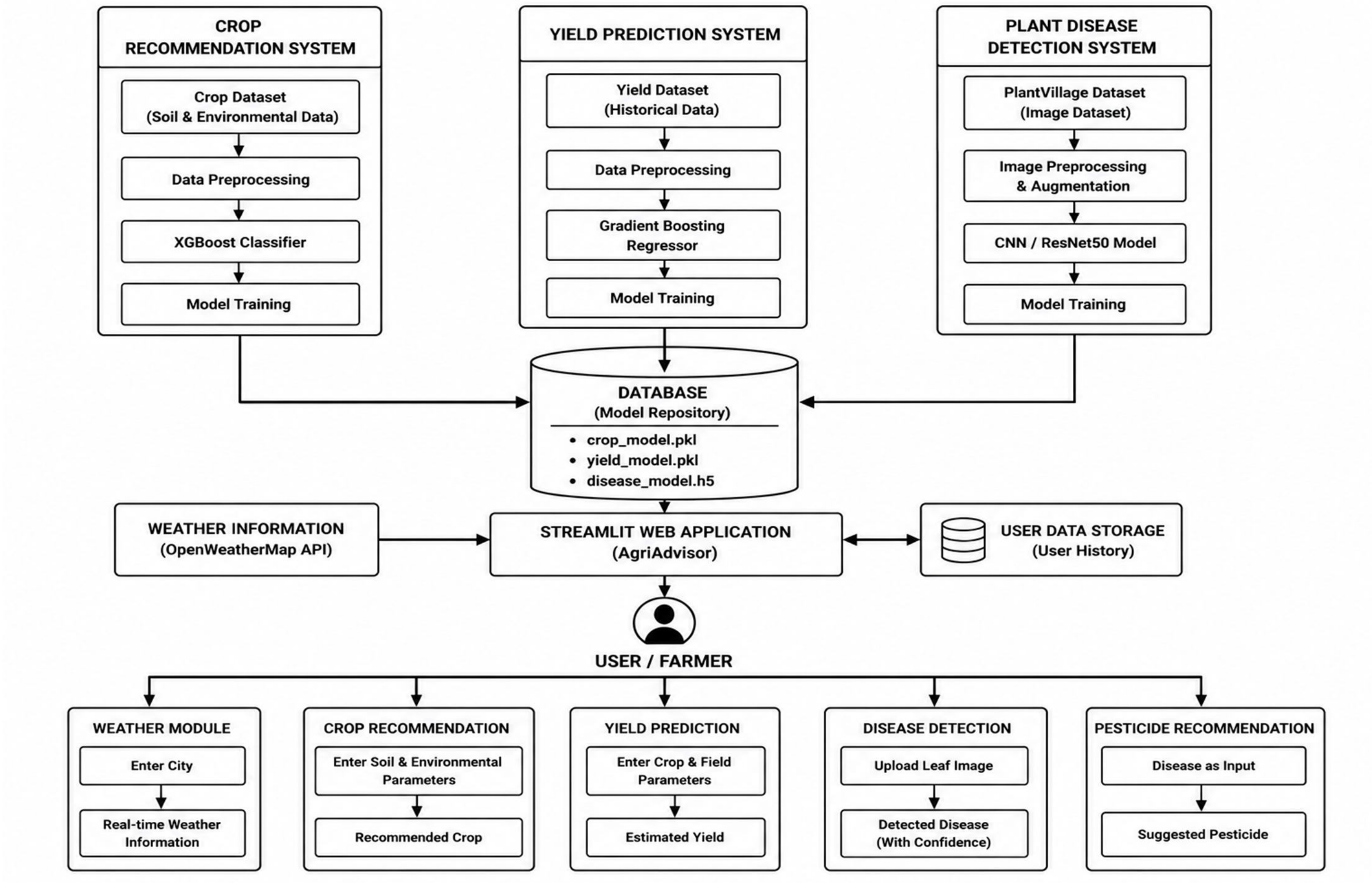


Fig .1.System Architecture

A. Data Acquisition

The first stage of the methodology involves collec g and testing the machine learning and deep learning models. Three different datasets were utilized in this project. The Crop Recommendation dataset contains soil nutrients and environmental parameters such as Nitrogen (N), Phosphorus (P), Potassium (K), temperature, humidity, pH, rainfall, and crop labels. The Yield Prediction dataset contains information related to crop type, cultivation area, rainfall, fertilizer usage, temperature, and yield values. For disease detection, the PlantVillage dataset was used, which contains thousands of labeled leaf images belonging to healthy and diseased plant categories..

TABLE I
SAMPLE DATASET FOR CROP RECOMMENDATION

1	N	P	K	temperature	humidity	ph	rainfall	label
2	90	42	43	20.8797437	82.00274423	6.502985292	202.9355362	rice
3	85	58	41	21.7704617	80.31964408	7.038096361	226.6555374	rice
4	60	55	44	23.0044592	82.3207629	7.840207144	263.9642476	rice

TABLE II
SAMPLE DATASET FOR YIELD PREDICTION

Crop	Area	Rainfall	Fertilizer	Temparature	Yield
Rice	10	1200	200	28	45
Wheat	8	600	180	22	30
Cotton	15	800	250	32	35

SAMPLE DATASET FOR PLANT DISEASE

B. Data Preprocessing

The raw agricultural datasets contain variations and inconsistencies that may affect model performance. Therefore, preprocessing is performed before training the models. Missing values and duplicate records are removed from the crop and yield datasets. Numerical attributes are normalized and formatted appropriately for machine learning algorithms. For disease detection, image preprocessing techniques such as image resizing, normalization, and augmentation are applied to improve model generalization and reduce overfitting. The crop labels are encoded into numerical values for model training and later decoded to display crop names as output predictions.

C. Model Development

After preprocessing, machine learning and deep learning models were developed for different agricultural tasks. The Crop Recommendation module uses the XGBoost Classifier to recommend suitable crops based on soil nutrients and environmental conditions. The Yield Prediction module employs the Gradient Boosting Regressor to estimate crop yield using parameters such as crop type, area, rainfall, fertilizer usage, and temperature. For both models, the datasets were divided into 80% training data and 20% testing data to ensure reliable performance evaluation. The Disease Detection module utilizes a ResNet50-based Convolutional Neural Network (CNN) trained on the PlantVillage dataset. Transfer learning was applied using pre-trained ImageNet weights to improve classification accuracy. Leaf images were preprocessed through resizing and normalization before training. The dataset was split into 80% training data and 20% testing data, enabling effective model learning and validation. The trained model identifies plant diseases from uploaded leaf images and provides appropriate pesticide recommendations.

D. Model Evaluation

The performance of the developed models is evaluated using standard classification and regression metrics. The Crop Recommendation and Disease Detection modules are assessed using Accuracy, Precision, Recall, and F1-Score. A Confusion Matrix is also generated to analyze classification performance. The Yield Prediction model is evaluated using Mean Squared Error (MSE), Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), and R^2 Score.

IV. IMPLEMENTATION

The proposed AgriAdvisor: AI-Enabled Smart Farming System was implemented using Python and various machine learning, deep learning, and web development libraries. The system integrates Crop Recommendation, Disease Detection, Yield Prediction, Pesticide Recommendation, and Weather Monitoring modules into a unified platform. The application was developed using the Streamlit framework, which provides an interactive and user-friendly interface for farmers to access agricultural services.

The Crop Recommendation module was implemented using the XGBoost Classifier and trained on a dataset containing soil nutrients and environmental parameters such as Nitrogen, Phosphorus, Potassium, temperature, humidity, pH, and rainfall. The Yield Prediction module was developed using the Gradient Boosting Regressor algorithm, utilizing crop type, area, rainfall, fertilizer usage, and temperature as input features. Both models were trained using an 80:20 train-test split and stored using the Joblib library for efficient deployment and prediction. For Disease Detection, a ResNet50-based Convolutional Neural Network (CNN) was implemented using TensorFlow and Keras. The PlantVillage dataset was used to train the model for identifying healthy and diseased plant leaves. Image preprocessing techniques including resizing, normalization, and augmentation were applied before training. The trained model was saved in H5 format and integrated into the web application to classify uploaded leaf images and provide corresponding pesticide recommendations.

The entire system was deployed as a Streamlit web application. Users can enter soil and environmental parameters to obtain crop recommendations, upload leaf images for disease detection, estimate crop yield, and view weather information based on location. The integration of machine learning, deep learning, and web technologies enables AgriAdvisor to provide real-time agricultural decision support through a single intelligent platform.

TABLE III
TECHNOLOGIES AND TOOLS USED IN AGRIADVISOR SYSTEM

Component	Technology Used
Programming Language	Python
Frontend/UI	Streamlit
Crop Recommendation	XGBoost Classifier
Yield Prediction	Gradient Boosting Regressor
Disease Detection	ResNet50 CNN
Deep Learning Framework	TensorFlow, Keras
Data Processing	NumPy, Pandas
Model Storage	Joblib, H5
Weather Service	OpenWeatherMap API
Dataset	Crop Recommendation, Yield Dataset, PlantVillage Dataset

Fig.2. AgriAdvisor Homepage

V. RESULTS & DISCUSSION

The proposed AgriAdvisor: AI-Enabled Smart Farming System was successfully implemented and tested using agricultural datasets for crop recommendation, disease detection, and yield prediction. The Crop Recommendation module, developed using the XGBoost Classifier, effectively recommended suitable crops based on soil nutrients and environmental parameters. The Yield Prediction module, implemented using the Gradient Boosting Regressor, generated reliable yield estimates based on crop type, cultivation area, rainfall, fertilizer usage, and temperature. Experimental results demonstrated that both models were able to provide accurate predictions and support agricultural decision-making..

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue VI June 2026- Available at www.ijraset.com

The Disease Detection module utilized a ResNet50-based Convolutional Neural Network (CNN) trained on the PlantVillage dataset. The model successfully identified healthy and diseased plant leaves and provided appropriate pesticide recommendations. The integration of real-time weather information further enhanced the usability of the system by helping farmers make informed farming decisions. Overall, the obtained results indicate that the proposed AgriAdvisor system can serve as an effective decision-support tool for precision agriculture by improving crop selection, disease management, and yield estimation while promoting sustainable farming practices.

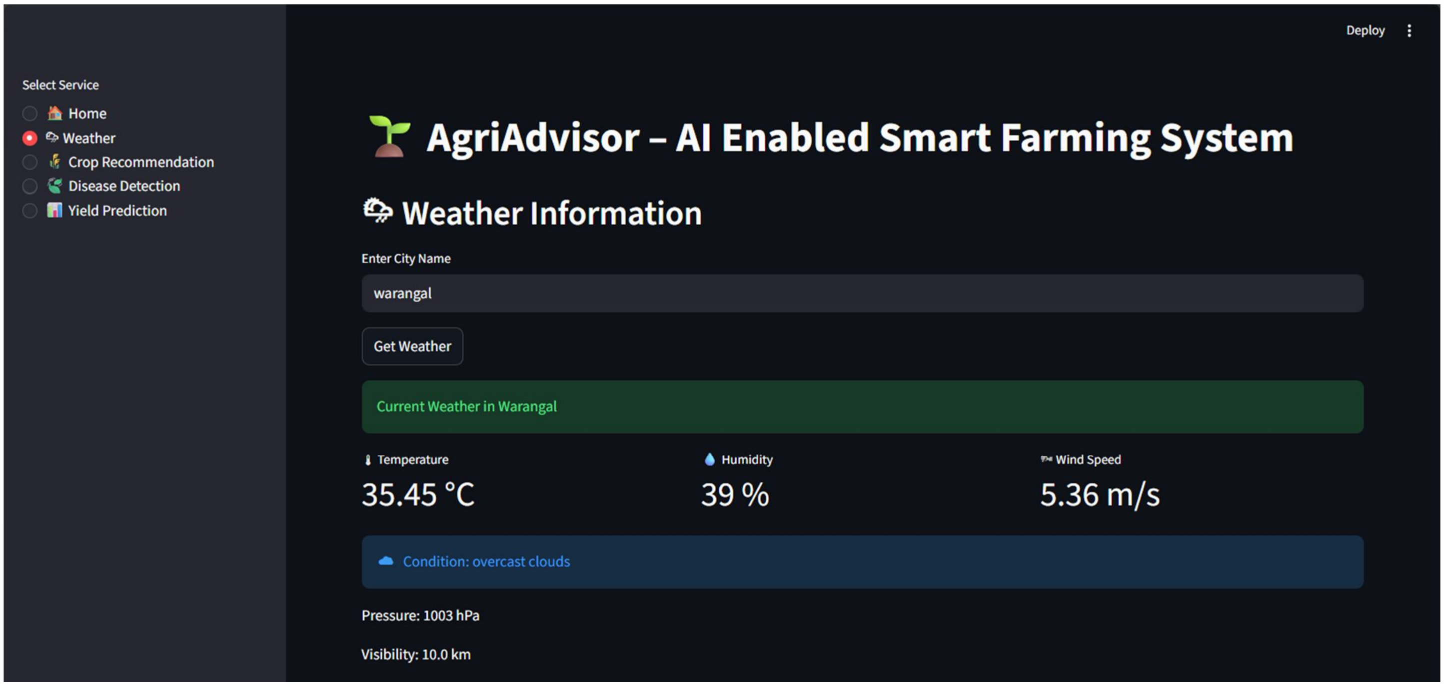


Fig. 3.Interface for Weather Forcast

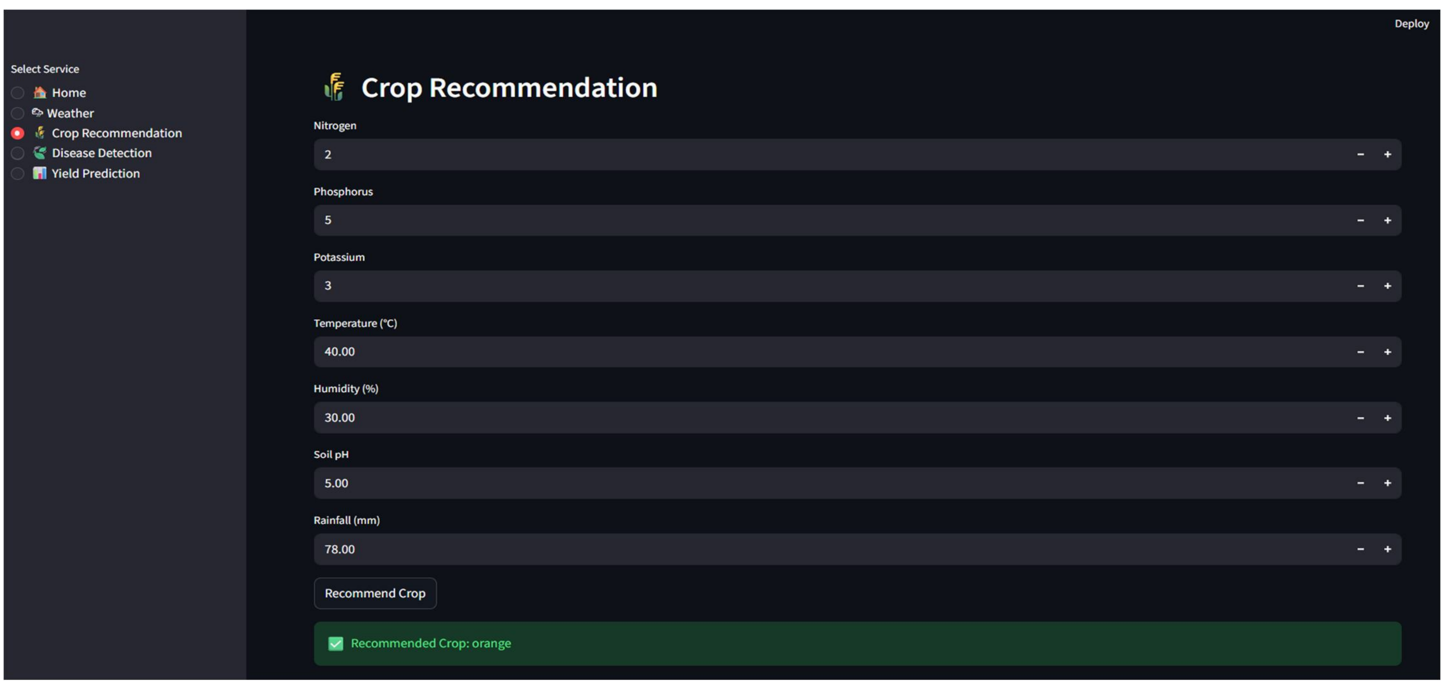


Fig .4.Interface for Crop Recommendation

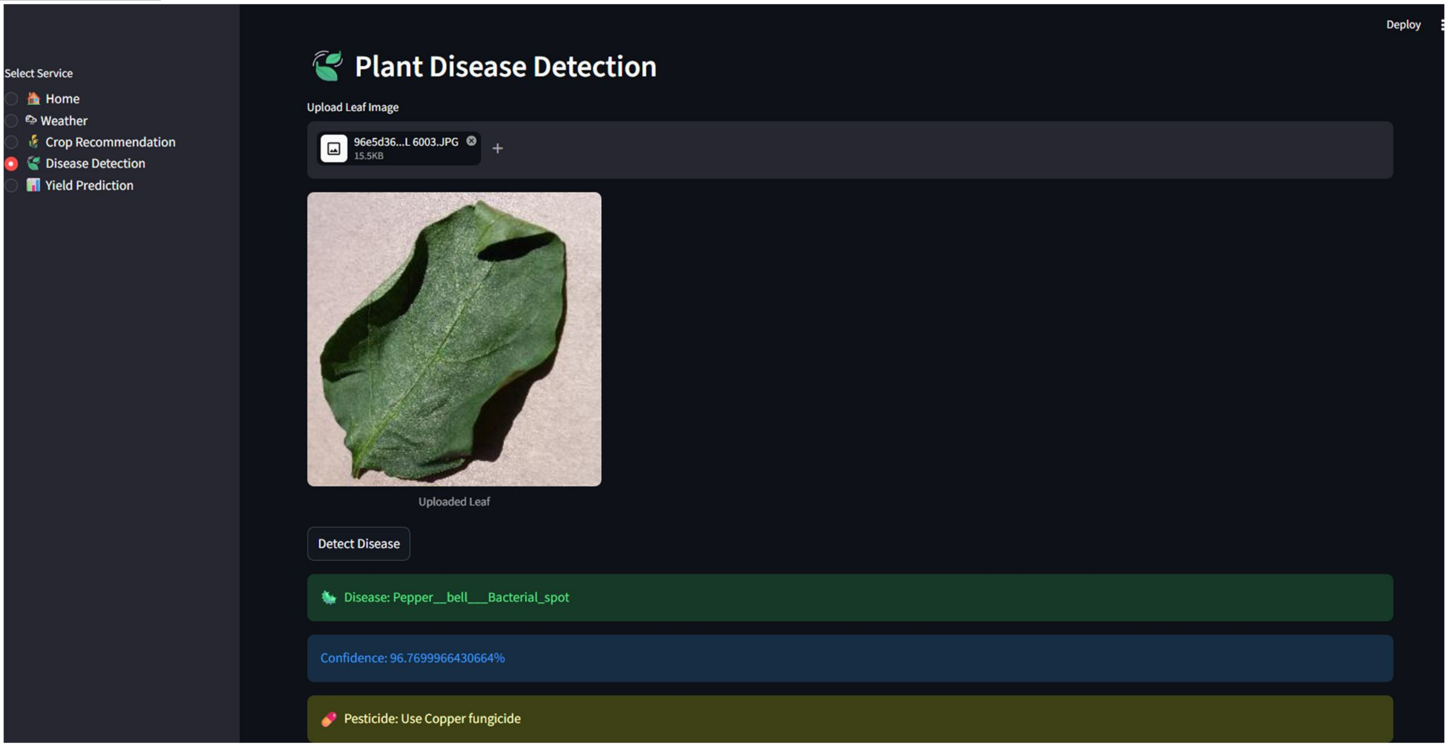


Fig. 5: Disease Detection Interface

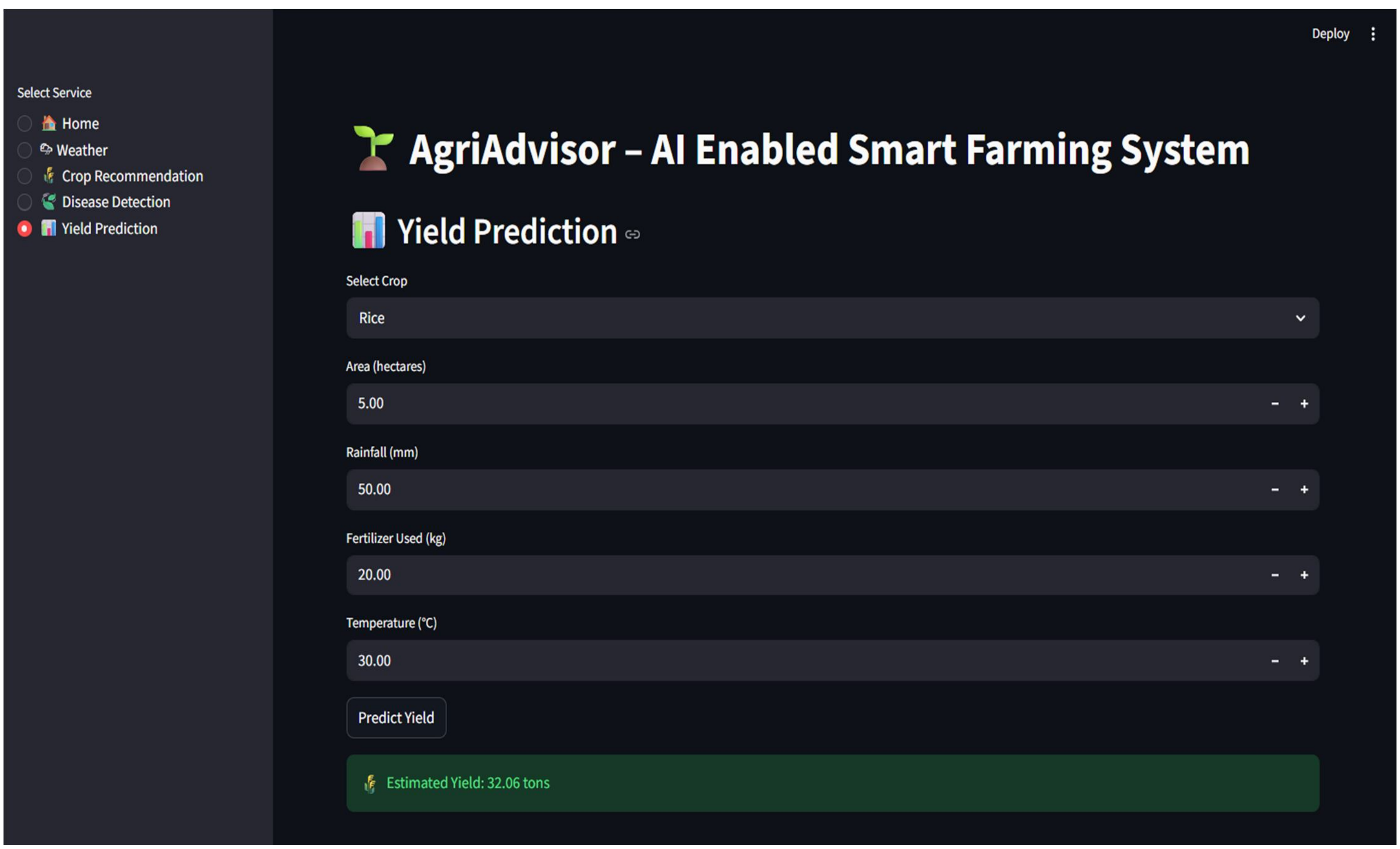


Fig. 6. Yield Prediction Interface

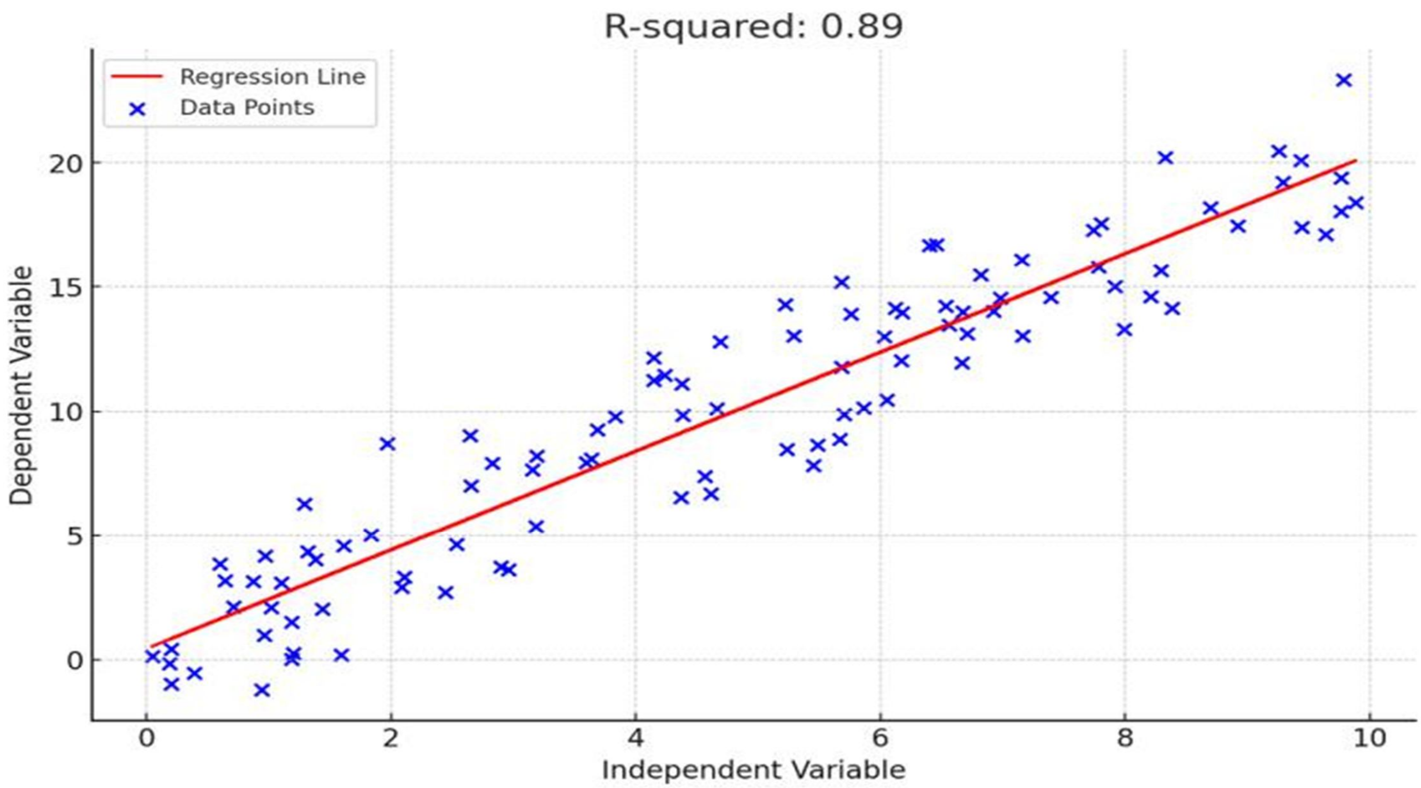
```
Accuracy:  0.9662345492915285
Classification Report:
              precision    recall  f1-score   support

           0       0.96      0.96      0.96      1482
           1       0.97      0.97      0.97      1835

    accuracy                           0.97      3317
   macro avg       0.97      0.97      0.97      3317
weighted avg       0.97      0.97      0.97      3317
```

Fig.7.Performance Matrics for XGBClassifier

Fig.8.Regression Model



Evaluation-R-Squared

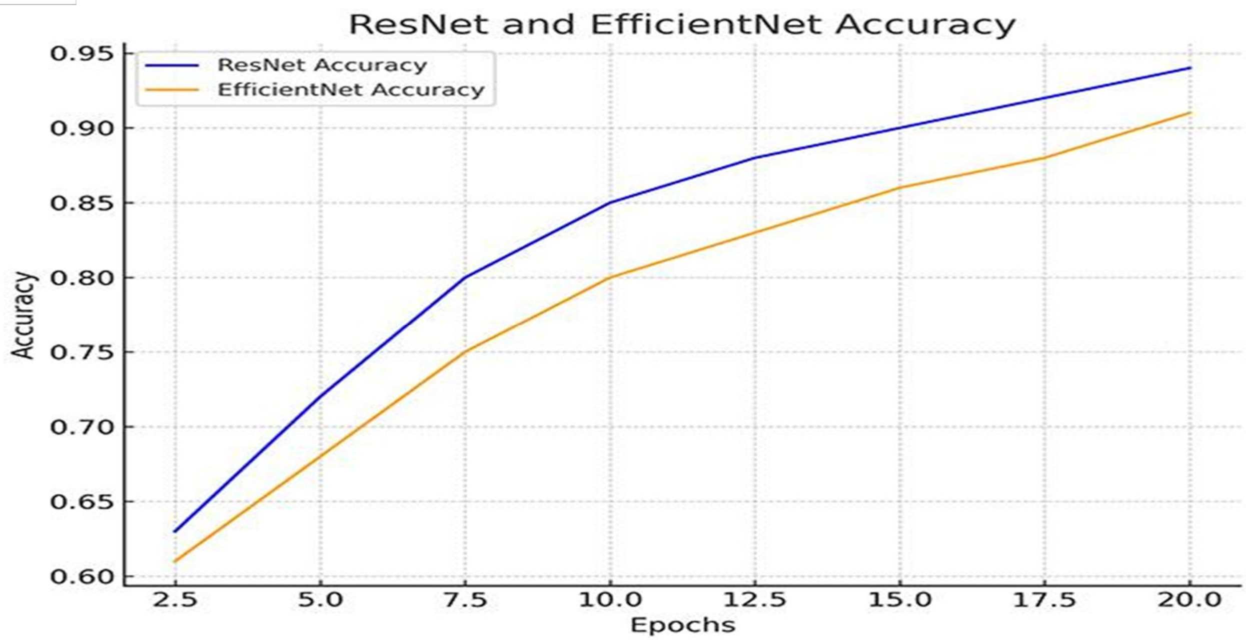


Fig.9.Model Comparison Graph

The accuracy comparison graph demonstrates that both ResNet50 and EfficientNet models improve steadily with increasing training epochs. However, ResNet50 consistently achieves higher accuracy than EfficientNet throughout the training process, indicating its superior capability in extracting discriminative features from plant leaf images. After 20 epochs, ResNet50 reaches an accuracy of approximately 94%, whereas EfficientNet achieves around 91%.

The results suggest that ResNet50 provides better classification performance and faster convergence for plant disease detection in the AgriAdvisor system. Therefore, ResNet50 was selected as the primary deep learning model for disease identification due to its higher prediction accuracy and reliability. The experimental findings confirm that the use of transfer learning with ResNet50 enhances disease diagnosis performance and contributes to more effective and accurate agricultural decision support.

VI. CONCLUSION

The proposed AgriAdvisor: AI-Enabled Smart Farming System successfully integrates Crop Recommendation, Disease Detection, Yield Prediction, Pesticide Recommendation, and Weather Monitoring into a unified agricultural decision-support platform. The system utilizes XGBoost for crop recommendation, Gradient Boosting Regressor for yield prediction, and a ResNet50-based Convolutional Neural Network (CNN) for plant disease detection. Experimental results demonstrated that the developed models provide accurate and reliable predictions, enabling farmers to make informed decisions regarding crop selection, disease management, and productivity enhancement. The integration of real-time weather information further improves the practicality and effectiveness of the system.By combining machine learning, deep learning, and web technologies within a user-friendly Streamlit application, AgriAdvisor contributes to precision agriculture and sustainable farming practices. In the future, the system can be enhanced by incorporating IoT-based sensor data,advanced weather forecasting, fertilizer recommendation modules, and multilingual support to provide more comprehensive and intelligent agricultural assistance.

VII. FUTURE WORK

The current AgriAdvisor system provides crop recommendation, disease detection, yield prediction, pesticide recommendation, and weather monitoring through an integrated web platform. In the future, the system can be enhanced by incorporating IoT-based sensors for real-time soil moisture, temperature, and nutrient monitoring. Advanced weather forecasting models can be integrated to provide location-specific agricultural advisories and irrigation recommendations. Additional modules such as fertilizer recommendation, market price prediction, and crop growth monitoring can further improve decision-making for farmers. The disease detection module can be extended to support a wider range of crops and diseases using larger datasets and more advanced deep learning architectures. Furthermore, deploying the system as a mobile application with multilingual support would increase accessibility and enable farmers from diverse regions to benefit from intelligent and data-driven agricultural assistance..

VIII. ACKNOWLEDGMENT

I express my sincere gratitude to my guide, Mr. G. Narasimham, Associate Professor, Department of Computer Science and Engineering, Jawaharlal Nehru Technological University Hyderabad, for his valuable guidance, continuous support, and constructive suggestions throughout the development of this research work.

I also extend my heartfelt thanks to the faculty members of the Department of Computer Science and Engineering for their support and motivation during the course of this study.

REFERENCES

[1] J.-J. Liu, H. Wu, and I. Riaz, "Advanced Technologies for Smart Fertilizer Management in Agriculture: A Review," IEEE Access, vol. ? (2025), doi: 10.1109/…/11105387. [Online]. Available: https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=11105387

[2] E. Aldhahri, A. A. Almazroi, M. H. Alkinani, N. Ayub, E. A. Alghamdi and N. F. Janbi, "Smart Farming: Enhancing Urban Agriculture Through Predictive Analytics and Resource Optimization," Available: https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=10843189

[3] I. Ahmed, G. Habib and P. K. Yadav, "An approach to identify and classify agricultural crop diseases using machine learning and deep learning techniques," Proc.Int. Conf. Emerging Smart Computing and Informatics (ESCI), Pune, India, 1-3 March 2023, pp. 1-6. [Online]. Available: https://www.researchgate.net/publication/370150161_An_Approach_to_Identify_and_Classify_Agricultural_Crop_Diseases_Using_Machine_Learning_and_Deep_Learning_Techniques.

[4] M. Mustofa, "Optimization of Pesticide Spray Using AI Techniques," IEEE Access, vol. ?, no. ?, pp. ?, 2024, doi :10.1109/…/11105387. [Online]. Available: https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=11105387

[5] R. Rani, J. Sahoo, S. Bellamkonda, S. Kumar and S. K. Pippal, "Role of Artificial Intelligence in Agriculture:An Analysis and Advancements With Focus on Plant Diseases, IEEE Access ,
Available: https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=

[6] J. O. Betancourt, "A Computational Framework for Precise Aerial Agricultural Spraying Optimization," Univ. / technical report / conference (2024). [Online]. Available: https://msol.berkeley.edu/wp-content/uploads/2024/04/205.pdf

[7] J. Xu, "Collaborative orchard pesticide spraying routing problem: optimization and algorithms," Journal of Cleaner Production, 2024. [Online]. Available (publisher link/abstract): https://www.sciencedirect.com/science/article/abs/pii/S0959652624018778

[8] M. K. Senapaty, A. Ray, and N. Padhy, "A Decision Support System for Crop Recommendation Using Machine Learning Classification Algorithms," Agriculture, vol. 14, no. 8, 2024. [Online]. Available: https://www.mdpi.com/2077-0472/14/8/1256

[9] J. Xu, "Collaborative orchard pesticide spraying routing problem: optimization and algorithms," Journal of Cleaner Production, 2024. [Online]. Available (publisher link/abstract).https://www.sciencedirect.com/science/article/abs/pii/S0959652624018778

[10] A. Soussi, et al., "Smart Sensors and Smart Data for Precision Agriculture," Sensors, vol. 24, no. 8, 2024. [Online]. Available: https://www.mdpi.com/1424-8220/24/8/2647