IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 2, March 2026
Impact Factor: 8.2

Crop Disease Detection Using AIML

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Abstract: *The agriculture sector faces several significant challenges, including plant diseases, fluctuating market prices, and a lack of proper guidance for selecting crops suitable for different seasons. These issues often lead to reduced productivity and financial instability for farmers. This research proposes an AI-based smart agriculture system that integrates* ***crop disease detection, crop price prediction****, and* ***seasonal crop recommendation*** *within a single platform. The crop disease detection module analyzes images of plant leaves using deep learning models to accurately identify diseases and provide possible treatment suggestions. The crop price prediction module utilizes historical agricultural market data to forecast potential future prices, enabling farmers.*

Keywords: *agriculture*

I. INTRODUCTION

Agriculture plays a crucial role in ensuring food security and supporting the economic growth of many countries, especially in developing nations like India. A large portion of the population depends on farming as their primary source of livelihood. However, farmers face several challenges during the cultivation and marketing of crops. Some of the most common problems include plant diseases, fluctuating market prices, and limited knowledge about which crops are suitable for different seasons. These challenges often lead to reduced crop yield, financial losses, and inefficient farming practices.

With the rapid advancement of Artificial Intelligence (AI) and Machine Learning (ML), it has become possible to develop intelligent systems that assist farmers in making better agricultural decisions. The proposed smart agriculture system integrates crop disease detection, crop price prediction, and seasonal crop recommendation into a single platform. By using deep learning models for disease detection and machine learning algorithms for price prediction and crop recommendation, the system aims to provide farmers with accurate information and guidance. This approach can improve agricultural productivity, reduce crop losses, and help farmers make informed decisions for sustainable farming.

II. LITERATURE REVIEW

Several studies have explored the use of artificial intelligence and machine learning in the field of agriculture to improve farming efficiency and productivity. Researchers have successfully applied deep learning models, particularly Convolutional Neural Networks (CNN), to detect plant diseases from leaf images with high accuracy by analyzing visual patterns and symptoms on crop leaves. In addition, many researchers have focused on crop price prediction using machine learning algorithms such as regression models and time series forecasting techniques to analyze historical market data and estimate future price trends. These predictive systems help farmers understand market fluctuations and decide the best time to sell their produce. Furthermore, crop recommendation systems have also been developed using machine learning methods that analyze environmental factors such as soil conditions, temperature, rainfall, and seasonal patterns to suggest suitable crops for cultivation. These studies highlight the potential of integrating multiple intelligent technologies into a single smart agriculture platform to support farmers in making informed decisions and improving overall agricultural productivity.

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DOI: 10.48175/IJARSCT-31522

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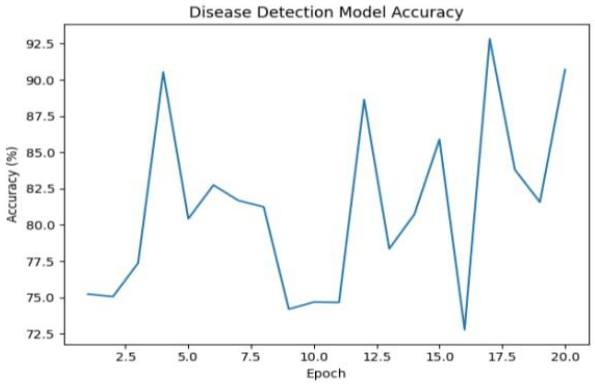
III. METHODOLOGY

The proposed smart agriculture system consists of three main modules: crop disease detection, crop price prediction, and seasonal crop recommendation. In the crop disease detection module, farmers upload images of plant leaves through a web interface. These images are processed and analyzed using a deep learning model, specifically a Convolutional Neural Network (CNN), which identifies the type of disease affecting the crop and provides possible treatment suggestions. Image preprocessing techniques such as resizing and normalization are applied before the images are passed to the trained model to improve detection accuracy.

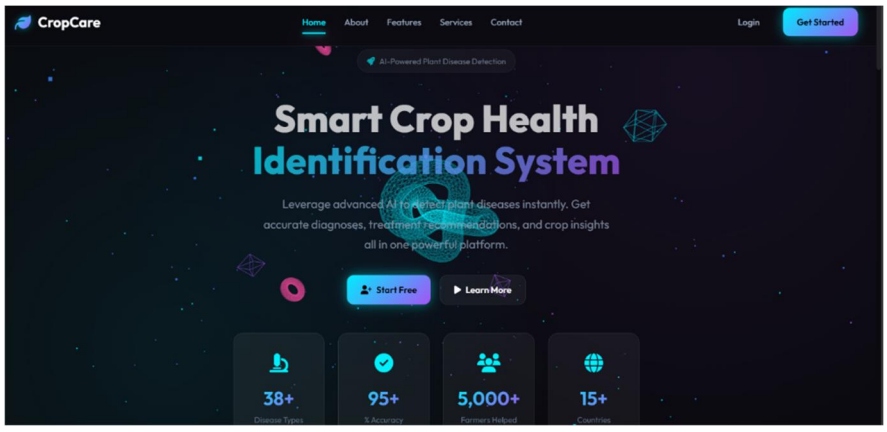
IV. IMPLEMENTATION

The proposed system is implemented using modern software technologies and machine learning tools. The backend of the system is developed using Python and Flask, which connect the machine learning models with the web application. The crop disease detection model is built using TensorFlow and deep learning techniques, while the crop price prediction module uses machine learning algorithms trained on historical agricultural market data. The user interface is designed using HTML, CSS, and JavaScript to provide a simple and interactive platform where farmers can upload leaf images, view price predictions, and receive crop recommendations.



V. RESULT & DISCUSSION

The experimental results show that the system is capable of detecting plant diseases from leaf images with good accuracy and providing useful treatment suggestions. The crop price prediction module successfully analyzes historical data and generates predictions that help farmers understand possible future market trends. In addition, the seasonal crop recommendation module suggests crops suitable for specific seasonal conditions. Overall, the system demonstrates that integrating artificial intelligence with agriculture can support farmers in making better decisions and improving productivity.



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VI. DATASET DESCRIPTION

The dataset used for crop disease detection consists of plant leaf images collected from publicly available agricultural datasets such as the PlantVillage dataset. It contains thousands of labeled images of healthy and diseased crop leaves, including crops such as tomato, potato, and corn. Each image in the dataset is categorized based on the type of disease affecting the plant, such as bacterial spot, leaf blight, or rust, along with healthy leaf samples. The images are used to train and test the deep learning model for accurate disease classification. Before training, the dataset is preprocessed by resizing the images, normalizing pixel values, and dividing the data into training and testing sets. This dataset helps the model learn the visual patterns of different plant diseases and improves the accuracy of crop disease prediction.

VII. APPLICATIONS

The AI-based crop disease detection system has several applications in modern agriculture. It can help farmers quickly identify plant diseases by analyzing images of crop leaves, allowing early treatment and reducing crop losses. The system can be integrated into mobile applications so farmers can easily detect diseases using their smartphones. It is also useful for agricultural researchers and scientists to study plant diseases and improve crop health management. In addition, agricultural extension services and government farming programs can use this technology to provide better guidance and support to farmers, promoting smart and sustainable farming practices.

VIII. CONCLUSIONS

This research presents an AI-based smart agriculture system that integrates crop disease detection, crop price prediction, and seasonal crop recommendation into a single platform. The system helps farmers identify plant diseases at an early stage using deep learning models, predict possible future crop prices using historical market data, and select suitable crops based on seasonal conditions. By combining these technologies, the system provides farmers with useful insights that can support better decision-making in farming practices. The proposed system demonstrates how artificial intelligence can improve agricultural productivity, reduce crop losses, and assist farmers in achieving more efficient and sustainable farming.

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