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AI-Driven Crop Disease Detection and Market Price Prediction System for Sustainable Farming

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Abstract - Agricultural productivity is highly affected by plant diseases, unpredictable market prices, and limited expert guidance for farmers. This project presents an AI-powered intelligent farming assistant that detects crop diseases from leaf images, predicts real-time market prices, and generates customized recommendations to improve crop health and maximize yield. The system uses machine learning and computer vision to identify diseases such as blight, wilt, and nutrient deficiencies with high accuracy. A price prediction model analyzes historical and current market trends to help farmers plan profitable sales. Additionally, the platform provides preventive measures, pesticide suggestions, irrigation schedules, and fertilizer recommendations based on crop conditions and weather data. Designed as a mobile-friendly application, this solution empowers farmers with early disease diagnosis, cost-effective decision-making, and continuous monitoring of crop growth. The proposed system improves farm productivity, reduces losses, and supports sustainable agricultural practices, making it a valuable tool for modern smart farming.

Key Words: AI-Driven Crop Disease Detection System, smart farming, crop disease detection, machine learning, computer vision, market price prediction, precision agriculture, agricultural analytics, cloud-based platform, React Native, Node.js, Python, MongoDB, image processing, real-time monitoring, crop health analysis, fertilizer recommendation, pesticide suggestion, irrigation management, weather-based advisory, sustainable farming, yield improvement, decision support

1.INTRODUCTION *(Size 11, Times New roman)*

AI-Driven Crop Disease Detection and Market Price Prediction System (ACDMP) is a cloud-enabled, intelligent smart farming platform designed to assist farmers in early disease diagnosis, market decision-making, and crop management through a unified mobile and web- based ecosystem. The mobile application, developed using React Native, allows farmers to capture and upload crop leaf images, monitor crop health, view predicted market prices, and receive real-time recommendations, while the admin dashboard built with Next.js provides centralized control over datasets, model performance, user management, and system configurations. The backend infrastructure is powered by Node.js and Python-based microservices integrated with MongoDB, ensuring secure data handling, real-time processing, and seamless communication between machine learning models and application services. By combining computer vision-based disease detection, machine learning-driven price prediction, weather-based advisory systems, and personalized recommendations for fertilizers, pesticides, and irrigation into a single scalable architecture, ACDMP transforms traditional farming practices into an intelligent, efficient, and data-driven agricultural ecosystem that improves crop productivity, reduces losses, and supports sustainable farming practices.

2. LITERATURE SURVEY

Several research works have contributed to the development of AI in agriculture. Deep learning techniques have been widely used for plant disease detection. Mohanty et al. demonstrated the effectiveness of convolutional neural networks (CNNs) in identifying plant diseases with high accuracy.

Ferentinos further evaluated multiple deep learning models and achieved reliable classification results across various crops. Machine learning techniques have also been applied for crop price prediction using regression and time-series analysis.

IoT and big data technologies have enhanced precision farming by enabling real-time monitoring and decision-making. These studies collectively support the development of an integrated system combining disease detection and market prediction.

3. SYSTEM ARCHITECTURE

The system follows a **client-server architecture** consisting of:

- **Frontend:** React Native mobile app & Next.js admin panel
- **Backend:** Node.js and Python microservices
- **Database:** MongoDB cloud storage

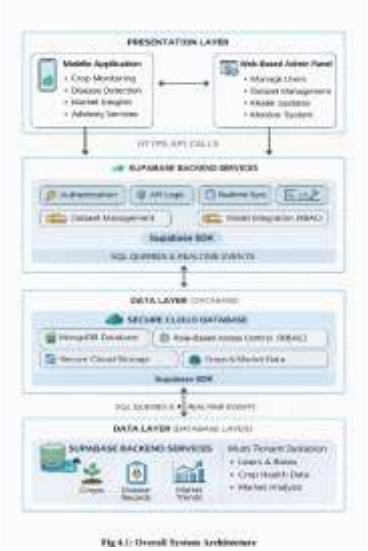

Fig – 1: Architecture Diagram

Working Flow

1. Farmer uploads crop image
2. Image processed using AI model
3. Disease identified with confidence score
4. Market price predicted using ML
5. Recommendations generated

This architecture ensures real-time processing, scalability, and secure data handling.

4. PROPOSED SYSTEM

The proposed system automates agricultural processes using AI and machine learning.

Features:

- Automatic crop disease detection
- Real-time market price prediction
- Personalized recommendations
- Cloud-based data storage
- Mobile-friendly interface

Advantages:

- Reduces manual effort
- Improves decision-making
- Increases crop yield
- Enhances profitability

The system transforms traditional farming into a data-driven smart farming ecosystem.

5. IMPLEMENTATION

The system is implemented using modern technologies:

Technologies Used:

- React Native (Mobile App)
- Next.js (Admin Panel)
- Node.js (Backend APIs)
- Python (Machine Learning Models)
- MongoDB (Database)

Modules:

- Disease Detection Module
- Market Prediction Module
- Advisory System
- Admin Dashboard

Workflow:

- Image upload → AI processing → Prediction → Recommendation

The system ensures real-time communication using secure APIs and cloud infrastructure.

6. RESULTS AND DISCUSSION

The system successfully detects crop diseases and predicts market prices in real time. Farmers can upload images and instantly receive results along with treatment suggestions.
From the *results section (Pages 37–40)*:

- Disease detection is fast and accurate
- Market prediction helps in better selling decisions
- Real-time alerts improve crop management

The system reduces dependency on manual methods and increases productivity.

7. CONCLUSIONS

The AI-Driven Crop Disease Detection and Market Price Prediction System provides an efficient solution for modern agriculture. It integrates AI, machine learning, and cloud computing to automate key farming activities.
The system improves crop health monitoring, enhances decision-making, and increases profitability. It also promotes sustainable farming practices.

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