Crop Yield Prediction Using AI and Precision Agriculture

Abstract

Agricultural productivity is influenced by multiple factors, including soil quality, weather conditions, and crop management techniques. Traditional crop yield prediction models rely on historical data, which often lacks real-time environmental adaptability. This project introduces an **AI-powered Precision Agriculture system** that leverages **Deep Learning, IoT-based smart farming, and Satellite Remote Sensing** to improve crop yield predictions.

The system utilizes **AI-powered drones and IoT soil sensors** to monitor soil conditions, water levels, and nutrient availability in real time. **Satellite imagery from NASA's MODIS and ESA's Sentinel-2** provides geospatial insights into land use patterns and climate conditions affecting crop growth. The AI model, built using **Transformer-based architectures (Time-Series BERT, Spatio-Temporal CNNs)**, predicts crop yield based on **historical trends, weather forecasts, and real-time sensor data**.

The project also integrates **Blockchain-based smart contracts** for transparent and fair trade between farmers and buyers. AI-powered **disease detection models (ResNet, YOLOv5 for plant disease recognition)** analyze plant health from drone-captured images, enabling early pest and disease intervention.

To enhance precision farming, an **AI-driven irrigation system** optimizes water usage based on real-time weather data and soil moisture levels. Future developments include **5G-connected agricultural robotics** for automated crop monitoring and **AI-powered climate-resilient farming strategies** to mitigate the effects of climate change.