Project Proposal: AI-Driven Smart Agriculture System for Crop Yield Prediction

Project Title:

SmartFarm AI: An Intelligent IoT-Based System for Crop Monitoring and Yield Prediction

Objective:

To develop a smart agriculture solution that uses Internet of Things (IoT) sensors and AI-based predictive modeling to monitor farm conditions and accurately predict crop yields. The system will enhance decision-making for farmers, leading to improved productivity, optimized resource use, and sustainable agricultural practices.

Background & Rationale:

Agriculture in many regions still relies on intuition and periodic manual checks, which can result in inefficient irrigation, nutrient application, and poor yield forecasting. With climate change and population growth, it's crucial to adopt data-driven techniques. Combining **IoT sensors** (for real-time data collection) with **AI models** (for predictive insights) enables precision farming and proactive crop management.

System Design:

1. Sensors & Hardware:

Soil Moisture Sensor: Monitors water levels in the soil.

Temperature & Humidity Sensors: Track environmental conditions.

Light Intensity Sensor (LDR): Measures sunlight exposure.

NDVI Camera or Module: Assesses plant health via vegetation index.

Raspberry Pi/Microcontroller: Collects sensor data and communicates to cloud/edge.

2. AI Model:

A hybrid pipeline using Random Forest (scikit-learn) and a DNN (TensorFlow) for yield prediction.

Input features: temperature, humidity, soil moisture, NDVI, sunlight, days since planting.

Model trained on synthetic/simulated dataset; adaptable to real farm datasets.

3. Data Flow:

*Sensor readings → Raspberry Pi → Cloud/Edge → AI Inference → Yield Output.

Deployment-ready TensorFlow Lite model for Raspberry Pi inference.

Deliverables:

i. Sensor-integrated Raspberry Pi system
ii. Trained AI model and TensorFlow Lite version
iii. Colab training pipeline and visual analytics dashboard
iv. Deployment script for local/edge AI predictions

Benefits:

i. Predict yield with high accuracy before harvest
ii. Enable data-driven irrigation/fertilization
iii. Support sustainable farming practices
iv. Reduce waste and resource overuse

Timeline:

Week 1: Sensor integration & data collection

Week 2: Model training & validation

Week 3: Edge deployment & testing

Week 4: Reporting & optimization

Estimated Budget:

Hardware (\$150), Software (Open Source), Development Time (\~1 month)