AI-Driven IoT Smart Agriculture System for Crop Yield Prediction

Proposal

Introduction

Agriculture faces growing pressure from climate variability, resource constraints, and the need for food security. This proposal presents a Smart Agriculture System that integrates Artificial Intelligence (AI) and the Internet of Things (IoT) to enable real-time environmental monitoring and accurate crop yield prediction. By leveraging IoT sensors and AI models, the system supports data-driven decision-making for optimized irrigation, fertilization, and harvesting, particularly in small-scale and precision farming contexts.

System Objectives

- Continuously monitor environmental and soil conditions using distributed IoT sensors.
- Use AI to predict crop yield based on dynamic and historical data.
- Provide real-time dashboards to guide farm interventions (e.g., watering, pest control).
- Reduce input waste and maximize productivity under changing climatic conditions.

Sensor Infrastructure

The system requires the following sensor modules:

Sensor Type	Purpose
Soil Moisture	Track water content and irrigation needs
Temperature	Monitor climate stress on crops
Humidity	Predict disease risk and growth conditions
pH Sensor	Ensure soil suitability and nutrient absorption
CO_2 Sensor	Monitor air quality affecting plant health
Light Sensor (LDR)	Assess sunlight exposure
Rain Gauge	Record precipitation
NDVI Camera	Detect vegetation health (via drones or fixed sensors)
GPS Module	Enable geospatial analysis of crop patterns

AI Model and Data Processing

A cloud-based **LSTM (Long Short-Term Memory)** model processes time-series sensor data to forecast crop yield per plot or hectare. The model is trained using:

- Historical yield data
- Weather records
- Real-time IoT sensor readings

Alternative Model:
Random Forest or XGBoost for classification or regression when only seasonal snapshots are available.

System Architecture & Data Flow

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[IoT Sensors]
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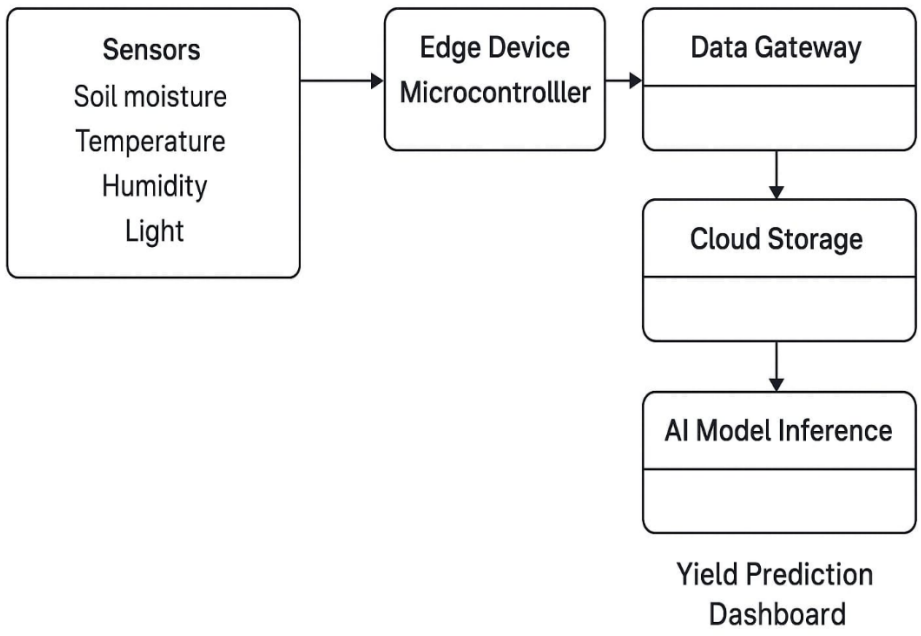
[Microcontroller / Edge Device (e.g., ESP32/Raspberry Pi)]
↓
[IoT Gateway / Wi-Fi / LoRa]
↓
[Cloud Storage + Preprocessing]
↓
[AI Model (LSTM)]
↓
[Prediction Dashboard / Farmer App]

Data is collected locally, preprocessed on the edge, and uploaded to a cloud environment where the AI model infers yield predictions. The output is visualized via a dashboard or SMS alerts to assist farmers in planning.

Benefits and Impact

- **Precision Agriculture**: Enables tailored resource use and minimizes waste.
- **Early Risk Detection**: Alerts farmers to low productivity zones and soil imbalance.
- **Climate Adaptability**: Adjusts predictions dynamically with changing weather inputs.
- **Accessibility**: Can be scaled down for smallholder farmers with solar-powered edge devices.



Data Flow Diagram (AI processing sensor data)