Power Learn Project

Software Development – February 2025 – Cohort VII

Specialisation: AI for Software Engineering

Assignment Title:

AI-Driven IoT Concept – Smart Agriculture System Proposal

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1️⃣ Objective

To design a smart farming system that helps farmers **predict crop yields** and **improve farm management** using real-time data collected by IoT sensors and analysed by AI.

The goal is to make farming more **efficient, sustainable, and profitable**.

2️⃣ Overview of the System

This system combines:

✅ **IoT Sensors** in the field to collect data automatically.
✅ **Edge Device** (e.g., Raspberry Pi) to process data locally.
✅ **AI Model** to predict crop yields based on sensor data.
✅ **Dashboard or Alerts** to help farmers make decisions.

3️⃣ Sensors Needed (Detailed List)

These sensors collect important environmental data:

- **Soil Moisture Sensor**
  - Measures how much water is in the soil.
  - Helps decide when to irrigate.
- **Temperature Sensor**
  - Records air temperature.
  - Affects crop growth and pest risk.
- **Humidity Sensor**
  - Measures moisture in the air.
  - Impacts disease risk.
- **Rain Gauge**
  - Measures how much rain has fallen.
  - Adjusts irrigation needs.
- **Light (Sunlight) Sensor**
  - Tracks sunlight intensity.
  - Influences photosynthesis and yield.
- **Soil pH Sensor**
  - Monitors soil acidity or alkalinity.
  - Helps manage soil health.
- **NDVI Camera (Optional but Powerful)**
  - Captures images of plant health.

- Calculates NDVI (Normalized Difference Vegetation Index) to spot stress early.

✅ *These sensors can be connected via wired or wireless connections to an edge device in the field.*

4️⃣ Proposed AI Model

Type of AI Model: Regression (predicts continuous numbers).

What It Does:

- Uses sensor data + historical farm data to predict **crop yield** (e.g., tons per hectare).

Inputs (Features):

- Soil moisture
- Temperature
- Humidity
- Rainfall
- Sunlight intensity
- Soil pH
- Historical yield records
- Optional: NDVI image data

Output:

- Predicted yield for current or upcoming season.

How It Works:

- The AI model learns patterns in data: e.g., "If soil moisture is low + high temperature → yield may drop."
- It then makes predictions for the farmer.

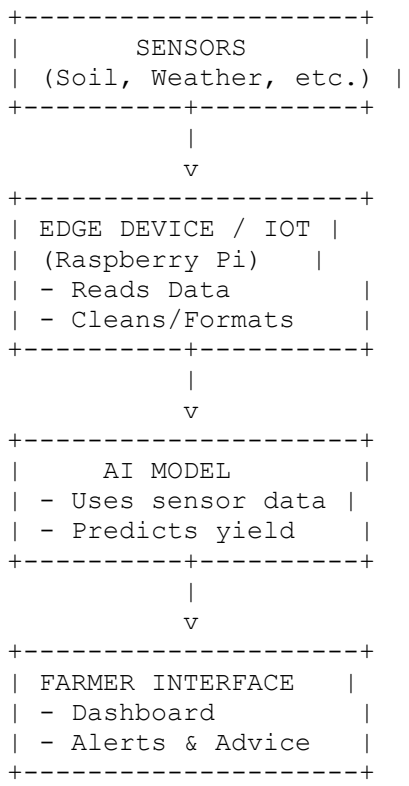
Tools to Build It:

- TensorFlow (for neural network regression)
- Scikit-learn (for simpler linear regression)

✅ The model can run on:

- **Edge devices** (Raspberry Pi with TensorFlow Lite)
- **Cloud services** for heavier processing

5️⃣ Data Flow Diagram



✅ **Short Explanation**:
1️⃣ Sensors collect data (moisture, temp, etc.).
2️⃣ Edge device gathers and prepares data.
3️⃣ AI model predicts expected yield.
4️⃣ Results go to farmer as dashboard graphs or SMS alerts.

6️⃣ How It Works (Step by Step)

✅ Step 1: Data Collection

- Sensors measure soil and weather conditions 24/7.
- Data sent to Raspberry Pi or similar device.

✅ **Step 2: Data Pre-processing**

- Edge device cleans the data: removes errors, averages readings if needed.

✅ **Step 3: AI Prediction**

- Edge device runs the AI model.
- Predicts yield based on current conditions + past patterns.

✅ **Step 4: User Interface**

- Results shown on a dashboard (web or mobile app).
- Alerts sent for:
  - Low soil moisture (recommend irrigation).
  - Expected yield drop (recommend fertilizer).

7️⃣ Example Use Case

- A farmer installs moisture, temperature, and pH sensors in their field.
- Every hour, the system collects data automatically.
- AI model predicts that yield will drop if no rain is expected.
- Farmer gets an alert to irrigate immediately.
- Result: higher yield, less wasted water.

8️⃣ Benefits for Farmers

✅ Real-time decision making.
✅ Saves water and fertilizer.
✅ Increases yield and profit.
✅ Reduces crop losses from drought or disease.
✅ Works in remote areas with no internet (using Edge AI).
✅ Supports sustainable farming.

9️⃣ Optional Deployment Details

✅ **Edge AI Option**:

- Model runs locally on Raspberry Pi.
- Works offline in rural fields.
- Low power use.

✅ **Cloud Option**:

- Data uploaded when there’s connectivity.
- Heavier models can run in cloud for even better predictions.
- Central dashboard for many farms.

1️⃣0️⃣ Conclusion

This smart agriculture system uses sensors and AI to help farmers make better decisions and improve yields.

By combining IoT for data collection and AI for prediction, it offers a modern, affordable, and sustainable way to grow food more efficiently.