Title and Overview:

Project Title: "Machine Learning-Powered Smart Agriculture System"

Team:

Name	Student ID
Attur Prudhvilok	11817543
Patan Khaja Mukhit Ali Khan	11773782

Project Overview:

This Project aims to develop an automated irrigation system which can maintain the necessary environmental conditions such as humidity, moisture content in soil and temperature based on the type and size of the crop using a machine learning model.

This model has a capability to predict and estimate the total expenditure, power consumption and the yield time of the crop based on the data we trained. This model is integrated with the IOT, through which the day-to-day updates about the crop are communicated with the user.

Significance of the project:

In present scenario, automation of the irrigation already exists, but with several limitations such as requiring repeated human observation, human timely errors and no machine learning models has been developed properly.

Integration of Machine Learning model in this field will make the irrigation almost completely autonomous. The trained model will have a control over all the hardware components like humidifier, Air conditioner, water sprinkler and even some kind of sensors, through which it understands the condition of the plant and adjust or maintain suitable environment required for the plant growth without any human intervention and involvement.

Moreover, the model predicts the power consumption and expenditure will be spent on the crop till it comes to yield and it forecasts the yield time and size by comparing the present state of the crop and trained data. This gives the user a hustle free cropping experience.

Goal and Future Development:

The goal is making the irrigation completely autonomous without any human intervention. To achieve this goal, training the model to control hardware and sensor components is not enough, the model should be trained to identify the disease or contamination occurring to the crops. So, as part of future development, we will be training the model to monitor the health of the plant and identifies the disease or contamination in case of occurrence and communicate those data with the user.

Objectives:

Based on the project complexity we have divided the project into several milestones below.

Phase1: Research & Planning

Define System Requirements and Select Sensors & Components- Listing all the components (Sensors, ML model, IOT integration, controller. Etc) currently fixed to Raspberry Pi 4 controller and python with simply for simulation work.

Research IoT platform and ML models- Finding required datasets for irrigation prediction and other communications

Phase 2: Hardware Setup & Sensor Integration

Connect & Test Sensors and write Sensor Data Scripts- Connect all the sensors and hardware components to the controller and perform control operation on them.

Basic IoT Communication- Send sensor data to a cloud platform

Phase 3: Machine Learning Model Development

Train AI Model for Irrigation Prediction- Based on soil moisture, temperature, weather data

Test & Validate ML Model- Ensure accuracy of prediction models

Phase 4: IoT Integration & Cloud Connectivity

Develop IoT Dashboard- Display real-time data (moisture, temperature, health status)

Mobile Notification System- Send alerts for irrigation time to time updates & disease detection

Remote Control Feature- Allow users to manually control irrigation via mobile app

Phase 5: Humidity & Temperature Simulation

Implement SimPy for Environmental Simulation- Simulate humidity & temperature variations

Integrate Simulation with ML Model- Allow ML model to consider simulated data

Validate Predictions with Simulated Data- Testing the model based on the provided data sets.

Phase 6: Testing & Optimization

Run Real-World Testing- Deploy on a small-scale test farm to test the real-world scenario

Fine-Tune ML Model & IoT System- Improve accuracy & efficiency by repeated validations

Optimize Power Consumption- Reduce Raspberry Pi & sensor energy usage if there is any possibility.

Phase 7: Documentation

Create a final project report for the project and demonstrate to everybody.

References:

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