AI-Optimized Smart Irrigation System for Precision Water Management in Crop Cultivation

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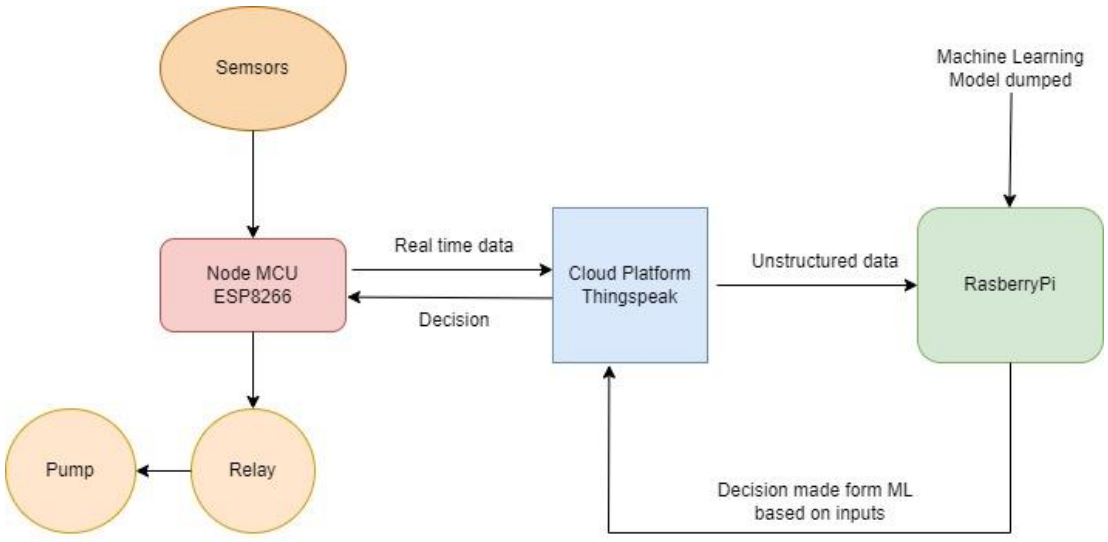
Objective

The main goal of this project is to propose an automated smart micro-irrigation system powered by AI with Humidity stabilizing. The resultant prototype consists of two modules Data collection module, Decision taking module. We also generate a open-source dataset on smart irrigation from the data collected.

Components required:

- DHT11 sensor
- Soil moisture sensor V2.0
- Connecting wires
- ESP8266
- Raspberry Pi
- Relay

Flow diagram:



Working:

The epicenter of the module is a Node MCU ESP8266 to which all the sensors and actuators are connected. The real time sensory data collected is to transmitted to the cloud platform Think Speak powered by MATLAB via Wi-Fi using the unique WRITE API key produced.

The varied data collected from the Data Collection module is stored under different fields in Thing Speak. In order to take data-driven decision on Irrigation the stored data is transferred to the Decision-making module using the unique READ API key produced.

The decision taking module is an embedded system preferably a Raspberry Pi, in which we dump the machine learning model. The data from the cloud storage is structured and provided as the input to the ML model which produces us the decision of whether or not to irrigate the crop. This decision is again back propagated to the Node MCU via thing speak in a separate channel. The module is attached with a pump and the relay is connected to the ESP8266.

Dependencies:

1. Stable Wi-Fi connectivity for seamless data transmission.

2. Appropriate sensor reading intervals for timely data acquisition.

3. Stable power supply to ensure uninterrupted system operation.

4. Robust data security measures for protecting sensitive agricultural data.

5. System compatibility to ensure seamless integration and synchronization.

Results:

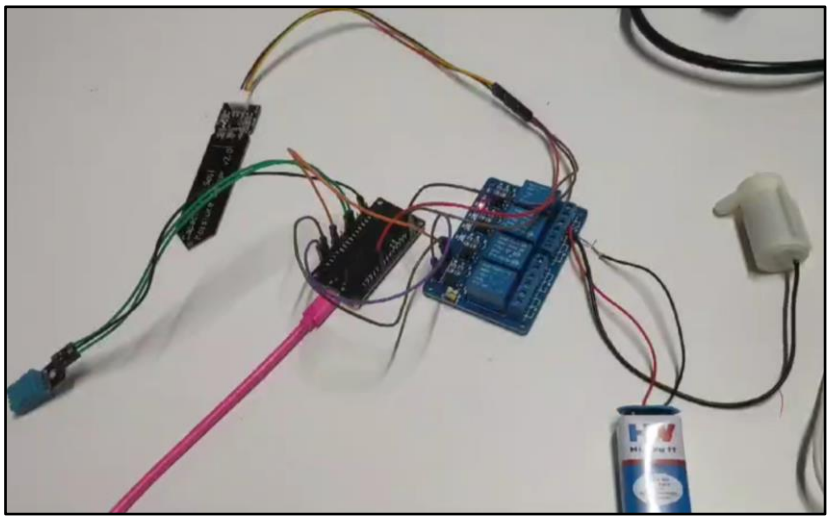


Fig 1.0 The setup of AI-Optimized Smart Irrigation System

Working video links:

https://drive.google.com/file/d/1OhqK9R4-JukciARla0iagq_NHo3Dkr7J/view?usp=sharing

https://drive.google.com/file/d/1RJ3r496yV0XWogxdo-mhHtqvpI67JATZ/view?usp=sharing

Conclusion:

In conclusion, effective data collecting, analysis, and decision-making for crop irrigation have been made possible by the Node MCU ESP8266 and Raspberry Pi's successful integration as the system's main components. Robust API keys enable the system to transmit data to ThingSpeak in real-time, showcasing a useful application of IoT and machine learning in the agricultural field. The system's ability to optimise water usage and improve crop output is highlighted by the smooth interaction between the Data Collection and Decision-making modules as well as the intelligent control of the irrigation process through the pump and relay.