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Automatic Irrigation System

Parsneel Kumar[1] , Kajal Kothari[1], Shiu Kumar[1], Ronesh Sharma[1]

1 School of Electrical & Electronics Engineering, Fiji National University, Suva, Fiji.

INTRODUCTION & AIM

The Fiji agricultural sector is challenged by irregular irrigation and water wastage, particularly in rural agriculture. To solve this problem, an Automatic Irrigation System was created based on IoT to enable the process of automatic watering according to the real time data of the soil and the environment.

The goal is to offer an easy, low-cost, and crop-specific irrigation system to enhance water efficiency and sustainable agriculture of crops that are commonly cultivated in Fiji including ginger, turmeric, eggplant, chili, and okra.

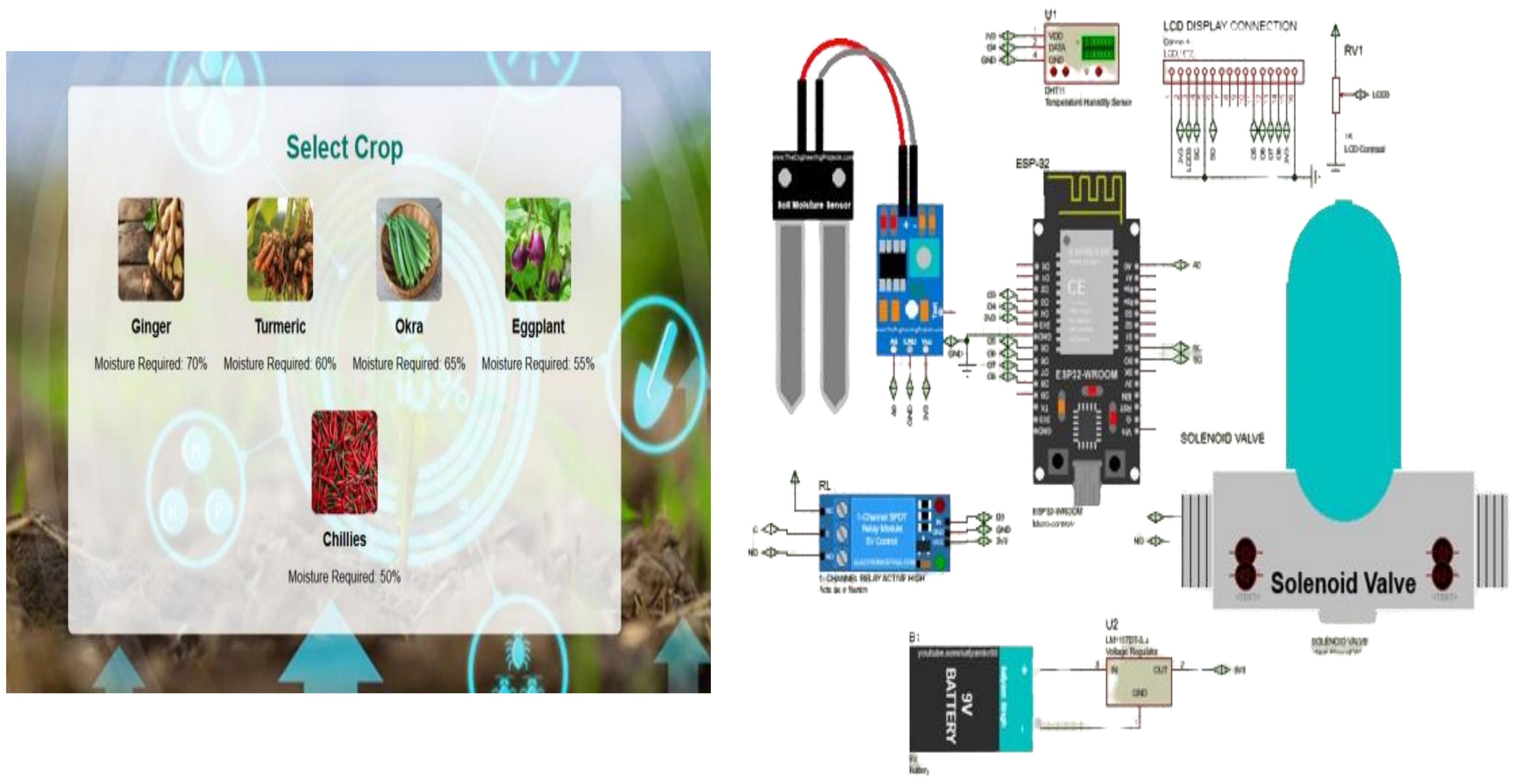

Figure 1: (Left) Crop selection dashboard (Right) Schematic diagram

METHOD

The system employs an ESP32 microcontroller that is linked with soil moisture, temperature, humidity and water-flow sensors. Water pumps are switched on/off depending on sensor values and appropriate solenoid valves controlled via relay control.

Two modes were implemented:

1. **Automatic Mode:**

Irrigation is triggered when the moisture drops below a crop specific threshold and is switched off at full saturation. The range of moisture calibration is 0 (dry) to 2557 (wet).

2. **Manual Mode:**

The farmers are notified with the help of Blynk app and can switch the pump ON/OFF using the web or mobile interface.

An automated crop selection menu loads preset thresholds of each crop using stored information.

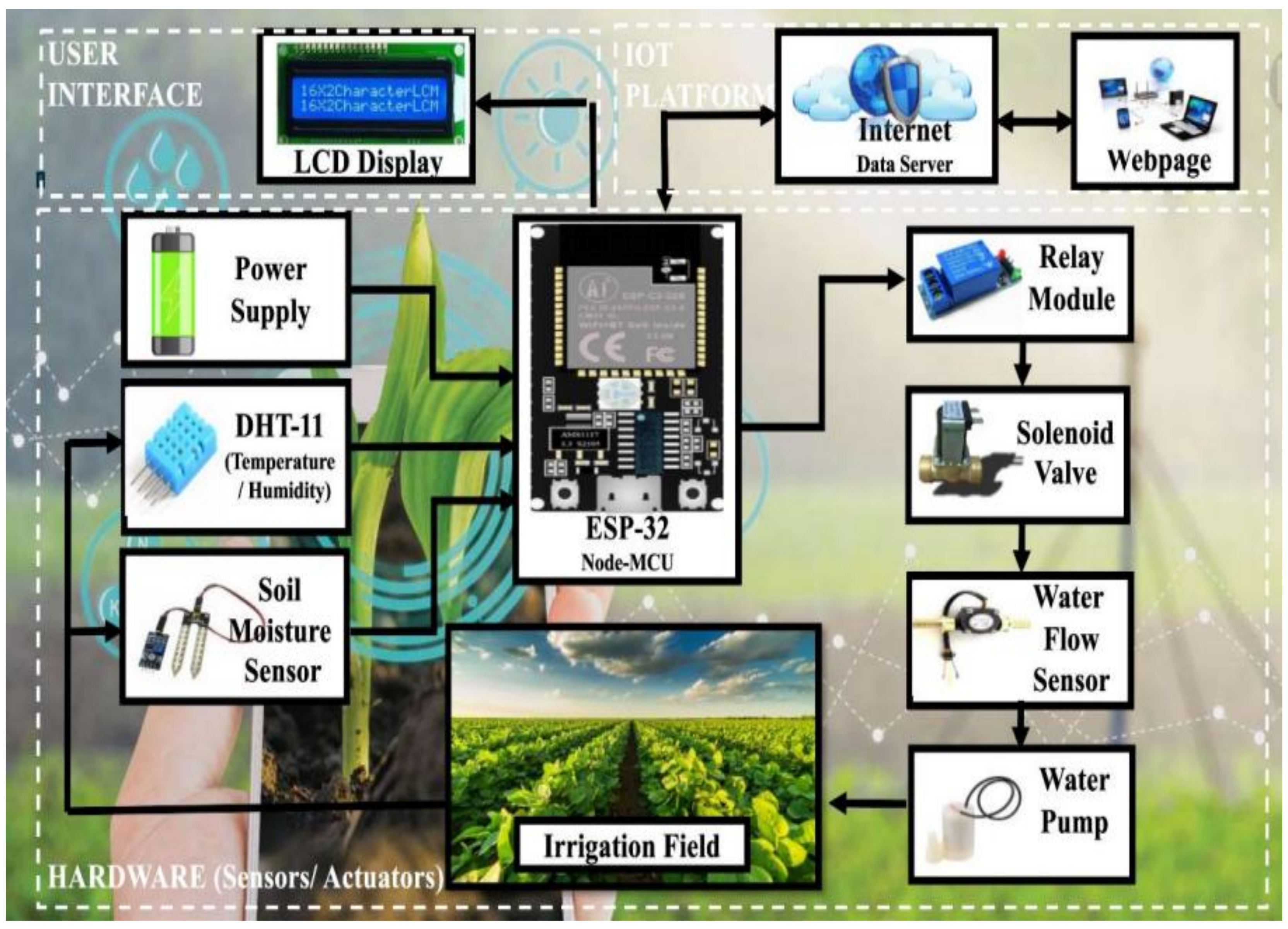

Figure 2: Block diagram of the Automatic Irrigation System with IoT.

RESULTS & DISCUSSION

Testing showed stable and efficient irrigation across all selected crops. The automatic mode maintained moisture within ±5% of target thresholds and prevented overwatering. The manual mode enabled reliable real-time control and alerts through Blynk.

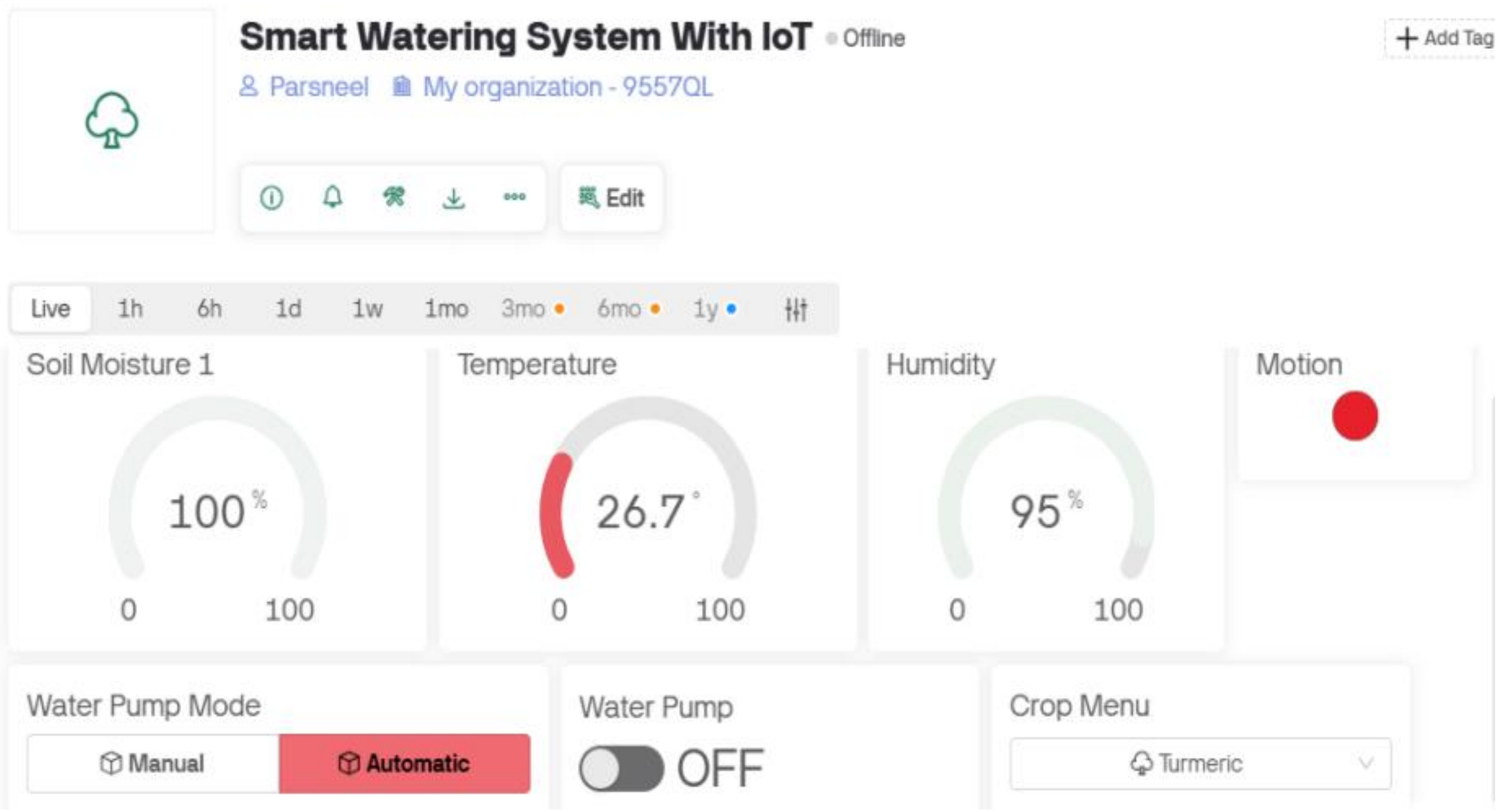

Figure 3: Web dashboard for Blynk integration

The system demonstrated:

- Accurate sensor readings after calibration
- Consistent pump control and reduced water usage
- Effective visualization of live data via the Blynk webpage
- Improved irrigation precision for specific crops in Fiji

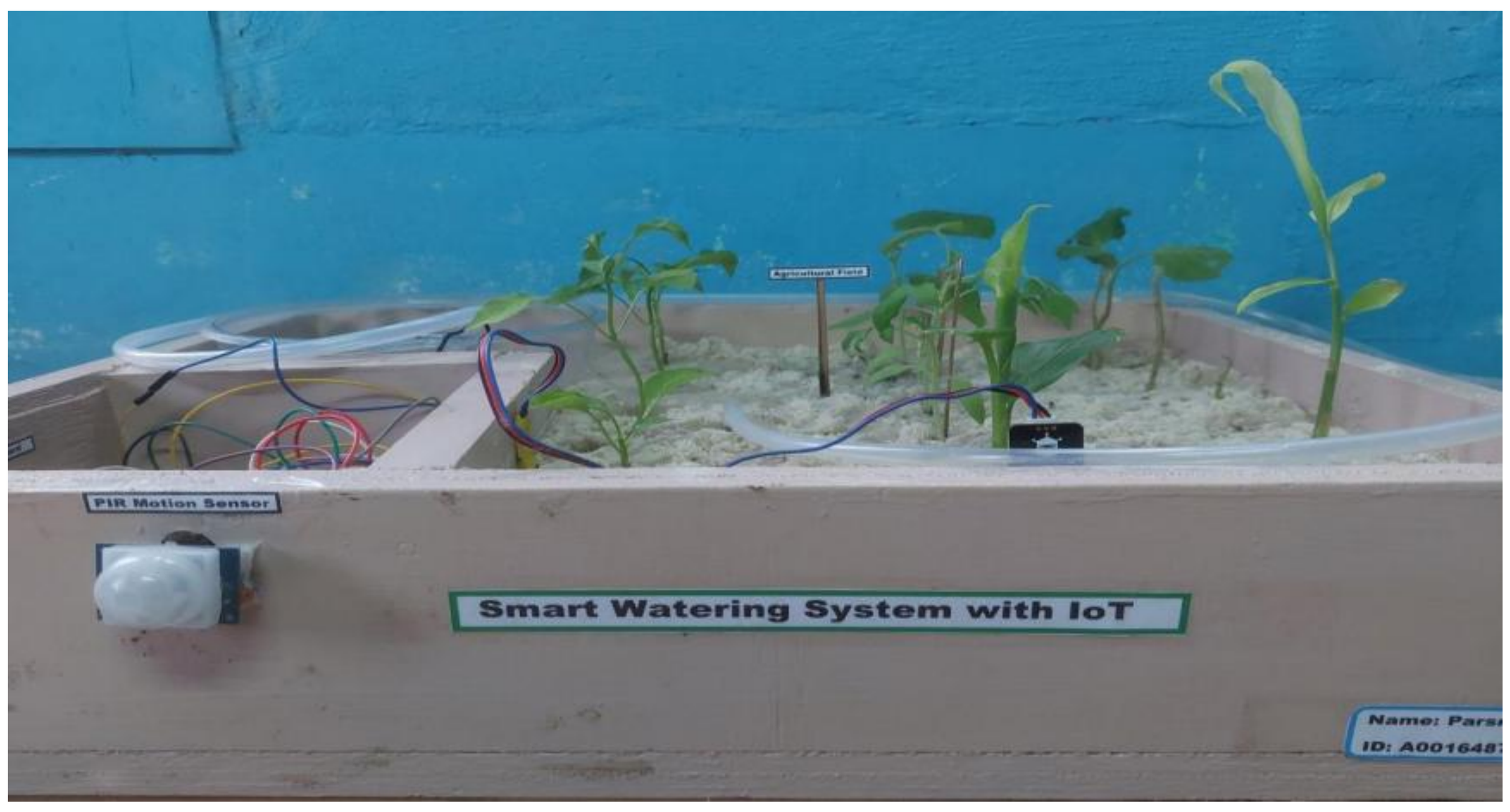

Figure 4: Hardware prototype of the Automatic Irrigation System

CONCLUSION

This project was effective in developing an Automatic Watering System based on IoT to optimize irrigation in agriculture, showing that water is efficiently used and crop yields are better. Using the soil moisture data, temperature, and humidity combined with remote control through the Blynk platform, the system delivers a more accurate irrigation system based on the specific crop requirements, which promotes sustainable agriculture. Among important lessons are the need to ensure proper sensor calibration, good connectivity and easy-to-use interfaces, which play a critical role in adoption, especially to small-scale farmers.

FUTURE WORK

Future enhancements may involve the use of data analytics and trend prediction to plan irrigation more efficiently, the ability to connect with other IoT systems like weather stations to collect more accurate environmental data, and a larger crop database to address regional variations. These upgrades will make the system more efficient, flexible and sustainable, thus becoming more useful to farmers and a standard towards sustainable agriculture.