SMART CROP MONITORING SYSTEM AND IOT

Sandeep V R[1], Sangeetha M R[2], Varsha D[3], Kavya P[4] , Usha R[5]

[1]*Asst.Professor, Electronics and communication Department, SJMIT, Karnataka, India*
[2]*UG Student, Electronics and communication Department, SJMIT, Karnataka, India*
[3]*UG Student, Electronics and communication Department, SJMIT, Karnataka, India*
[4]*UG Student, Electronics and communication Department, SJMIT, Karnataka, India*
[5]*UG Student, Electronics and communication Department, SJMIT, Karnataka, India*

ABSTRACT

This project presents a smart, cost-effective IoT-based crop monitoring and protection system designed to assist farmers with real-time agricultural management. It integrates Arduino Uno and ESP8266 microcontrollers to automate irrigation, lighting, crop protection, and intrusion detection. A soil moisture sensor activates a water pump when dryness is detected, ensuring timely irrigation. An LDR sensor controls lighting at night to attract pests away from crops. A rain sensor triggers a servo motor to deploy a protective canopy during rainfall. The PIR sensor detects intrusions from animals or humans, activating alerts via LEDs and buzzers. The DHT11 sensor monitors temperature and humidity to aid in crop health and storage. All sensor data is transmitted to the Blynk IoT app, allowing farmers to monitor and control the system remotely. The solution reduces manual labor, promotes efficient resource use, and enhances sustainable farming practices.

Keyword : - *IoT Sensors, Real Time Monitoring, Precision Agriculture, Smart Irrigation, Remote Sensing*

1. INTRODUCTION

Agriculture is vital for food security and economic growth, especially in developing regions. Traditional farming faces issues like unpredictable weather, water inefficiency, and pest threats. This project introduces a smart crop monitoring system using IoT technologies. It integrates sensors for rain, moisture, light, temperature, and motion detection. Automated actions include irrigation, lighting, canopy deployment, and intrusion alerts. Data is processed by Arduino and ESP8266 and displayed on the Blynk IoT app. Farmers can monitor real-time field conditions remotely using their smartphones. The system supports solar or battery power, suitable for rural areas. Its user-friendly design helps even semi-literate farmers manage their crops. Overall, it promotes efficient, sustainable, and modern agricultural practices.

1.1 Objective

- To automate irrigation using a soil moisture sensor and a 5V DC water pump.
- To conserve water by activating irrigation only when soil moisture is low.
- To detect low light levels at night using an LDR sensor.
- To automatically turn on field lighting to attract insects and improve visibility.
- To protect the crops from the unexpected rain using rain sensor.

1.2 Proposed System

The proposed system is a cost-effective, modular smart farming prototype tailored for small farmers. It integrates soil moisture sensors, LDRs, rain sensors, PIR sensors, DHT11 temperature/humidity sensors, ESP8266 Wi-Fi module, and Arduino Uno. The system performs automated tasks such as switching on irrigation pumps when the soil is dry, turning on field lights at night, deploying a crop canopy during rain, and alerting intrusions through LEDs and buzzers. Data collected by the sensors is processed and sent to the Blynk IoT app, allowing even semi-literate or illiterate farmers to monitor conditions using simple visual indicators and sound alerts. The system can be solar-powered or battery-operated and can be deployed in various farming zone.

2. REQUIREMENTS

2.1 Hardware Requirements

1. Arduino Uno - Microcontroller for sensor data processing and system control.
2. ESP8266 - Wi-Fi module for wireless communication and data transmission to the Blynk app or Arduino Cloud.
3. Rain Sensor - Detects rainfall to trigger the servo motor for crop shielding.
4. Servo Motor - Operates the crop protection cover in response to rain detection.
5. Soil Moisture Sensor - Monitors soil moisture levels to automate the water pump.
6. 12V Aquarium DC Motor - Controls the water pump for irrigation.
7. PIR Sensor - Detects animal movement and sends alerts to the farmer.
8. LDR Sensor - Controls automatic lighting based on ambient light levels.
9. Power Supply - Provides necessary voltage to Arduino, sensors, and motor.
10. Relay Module - Controls high-power devices like the water pump.
11. Blynk App or Arduino Cloud - For real-time monitoring and control.
12. Jumper Wires and Breadboard - For circuit connections and prototyping.
13. DHT11 Sensor - Measures temperature and humidity for environmental monitoring

2.2 Software Requirements

1. Arduino IDE - For coding, compiling, and uploading programs to the Arduino Uno.
2. Blynk App - For real-time monitoring and controlling sensors using a mobile device.
3. Arduino Cloud *(Optional)* - For cloud-based data storage and remote monitoring.
4. ESP8266 Library - To enable communication between ESP8266 and the Arduino.
5. Servo Motor Library - For controlling the servo motor for crop shielding.
6. DHT11 Library - For reading temperature and humidity data.
7. Blynk Library - For connecting sensors to the Blynk app via ESP8266.
8. C/C++ Programming Language - For writing the Arduino code

3. SYSTEM DESIGN

The system is designed around an IoT-based architecture to monitor and control various parameters crucial to modern farming. At its core, the system uses ESP8266 or ESP32S microcontroller as the processing and communication unit. Various sensors such as soil moisture sensor, temperature and humidity sensor (DHT11), PIR sensor for security, and a submersible DC pump are integrated with the microcontroller. These sensors continuously gather data from the field and transmit it to a cloud server via Wi-Fi. The Blynk app acts as the user interface, allowing farmers to monitor real-time data and control operations like irrigation or security alerts directly from their smartphones.

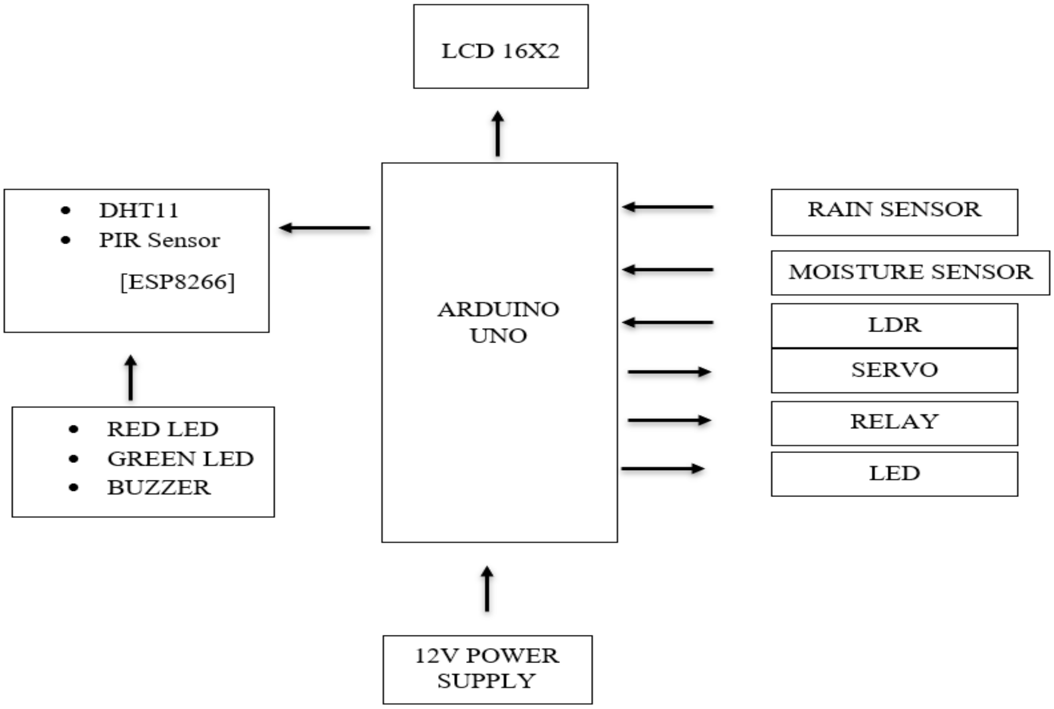

Fig – 1 Block Diagram

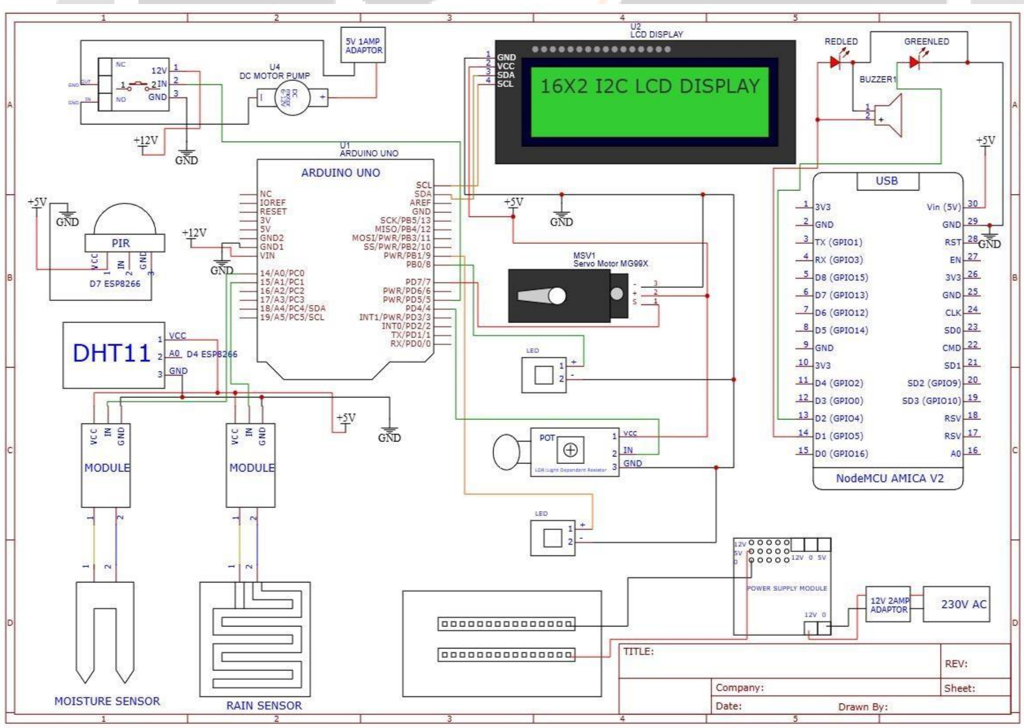

Fig -2 Schematic Diagram

3.1 Methodology

- Objective Definition
  Identify key goals: automate irrigation, crop protection, lighting, and intrusion detection.
- Component Selection
  Choose sensors (moisture, rain, LDR, PIR, DHT11), microcontrollers (Arduino Uno, ESP8266), and actuators (pump, LEDs, servo motor).
- Circuit Design
  Connect sensors and actuators to the microcontroller on a breadboard or PCB.
- Power Supply Setup
  Use a 5V DC supply, with optional solar panel or battery for remote use.
- Software Development
  Write code in Arduino IDE to process sensor data and control outputs.
- IoT Integration
  Connect ESP8266 to Wi-Fi and send data to the Blynk app for remote access.
- Automation Logic
  Implement logic to trigger devices based on sensor thresholds (e.g., moisture, light, motion).
- Testing and Calibration
  Test each component and calibrate sensors (e.g., set moisture thresholds, motion sensitivity).
- Field Deployment
  Install the system in a farm setting to monitor and control real conditions.
- Farmer Feedback and Iteration
  Gather user feedback to improve system functionality and usability.

3.2 Activity Diagram

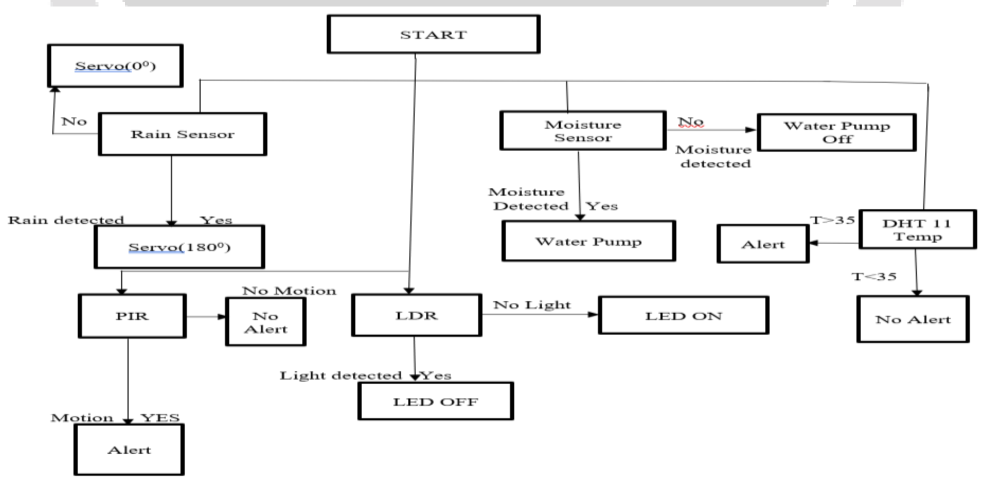

Fig – 3 Flowchart

4. RESULTS AND DISCUSSION

The implemented system successfully demonstrated real-time crop monitoring and automation using IoT. It efficiently managed irrigation based on soil moisture levels, activated lighting at night, and deployed a protective canopy during rainfall. Intrusion detection and environmental monitoring were accurately handled by PIR and DHT11 sensors, with alerts and data transmitted to the Blynk app. Field tests confirmed the system's reliability, low cost, and ease of use, even for semi-literate farmers. Overall, the system improved crop protection, resource efficiency, and reduced manual labor, making it a practical solution for sustainable agriculture.

5. CONCLUSION

The project demonstrates that integrating IoT in agriculture can significantly enhance farming efficiency, resource management, and crop protection. By automating irrigation, lighting, environmental monitoring, and intrusion alerts, the system reduces manual effort and supports sustainable practices. Its low cost, ease of use, and remote monitoring capabilities make it ideal for small and large-scale farmers, promoting the adoption of smart farming technologies.

6. REFERENCES

[1] Rohit Dange et al., Smart Agriculture Automation using ESP8266, Journal of Electronics and Applied Math, 2023.

[2] Ankur Patil et al., IoT Based Smart Agriculture Monitoring Using Arduino, IJIIRD, 2022.

[3] S. Ramesh et al., Smart Irrigation with Tracking System Using Node MCU ESP8266, IJSRCSE, 2018
.

[4] Rajesh Kumar et al., Smart Agriculture System Using Arduino and Cloud Computing, IJRPR, 2022.

[5] Vikas Sharma et al., Smart Farm Using Node MCU ESP8266, JETIR, 2019.