A
Lab report
On

IOT based Smart Agriculture Monitoring System

ADVANCE INTERNET OF THINGS LAB
(KOT-651)

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I. Introduction

The world is witnessing a rapid evolution in technology, and its impact on various sectors is undeniable. Agriculture, being the backbone of our civilization, is not immune to this transformation. With the advent of the Internet of Things (IoT), a new era of smart agriculture monitoring systems has emerged, promising to revolutionize traditional farming practices. These systems leverage the power of connectivity, data analytics, and automation to provide farmers with real-time insights and control over their crops and environmental conditions. In the past, farmers had to do on manual observations and intuition to manage their fields, which often led to suboptimal decision-making and resource wastage. However, with IoT-based smart agriculture monitoring systems, a paradigm shift has occurred. By deploying a network of sensors throughout the fields, farmers can now collect data on crucial parameters such as soil moisture, temperature, humidity, and plant health with unprecedented precision and frequency. This vast amount of data, combined with advanced analytics and cloud computing, enables farmers to gain valuable insights into their crops' conditions. They facilitate resource optimization, minimize water and energy consumption, improve crop yields, and enhance overall farm efficiency.

Firstly, this infrastructure will enable seamless data collection and transmission from the agricultural fields to a centralized cloud-based platform. Secondly, the project focuses on developing advanced analytics and decision support systems that can process the collected data and provide actionable insights to farmers. This empowers them to take timely and informed actions for efficient crop management and yield optimization. It provide real-time monitoring and control capabilities, it reduces reliance on manual labor and guesswork, leading to improved resource management, reduced costs, and increasedyields. Additionally, it enables precision agriculture, where inputs such as water,fertilizers, and pesticides are applied precisely and in response to the actual needs of thecrops. This not only enhances productivity but also minimizes environmental impact byreducing unnecessary resource usage. By integrating sensors, connectivity, and data analytics, the project enables farmers to make informed decisions, optimize resourceusage, and enhance productivity. The project holds great significance in addressing the challenges faced by the agriculture sector and has the potential to pave the way for sustainable and efficient farming practices.

II. Tools or Technology Used

1. Hardware Requirements

- ESP 8266 Microcontroller
- Soil Moisture sensor
- Rain sensor
- DHT 11(Humidity and Temperature)
- LCD display
- LDR
- Buzzer
- Pressure sensor

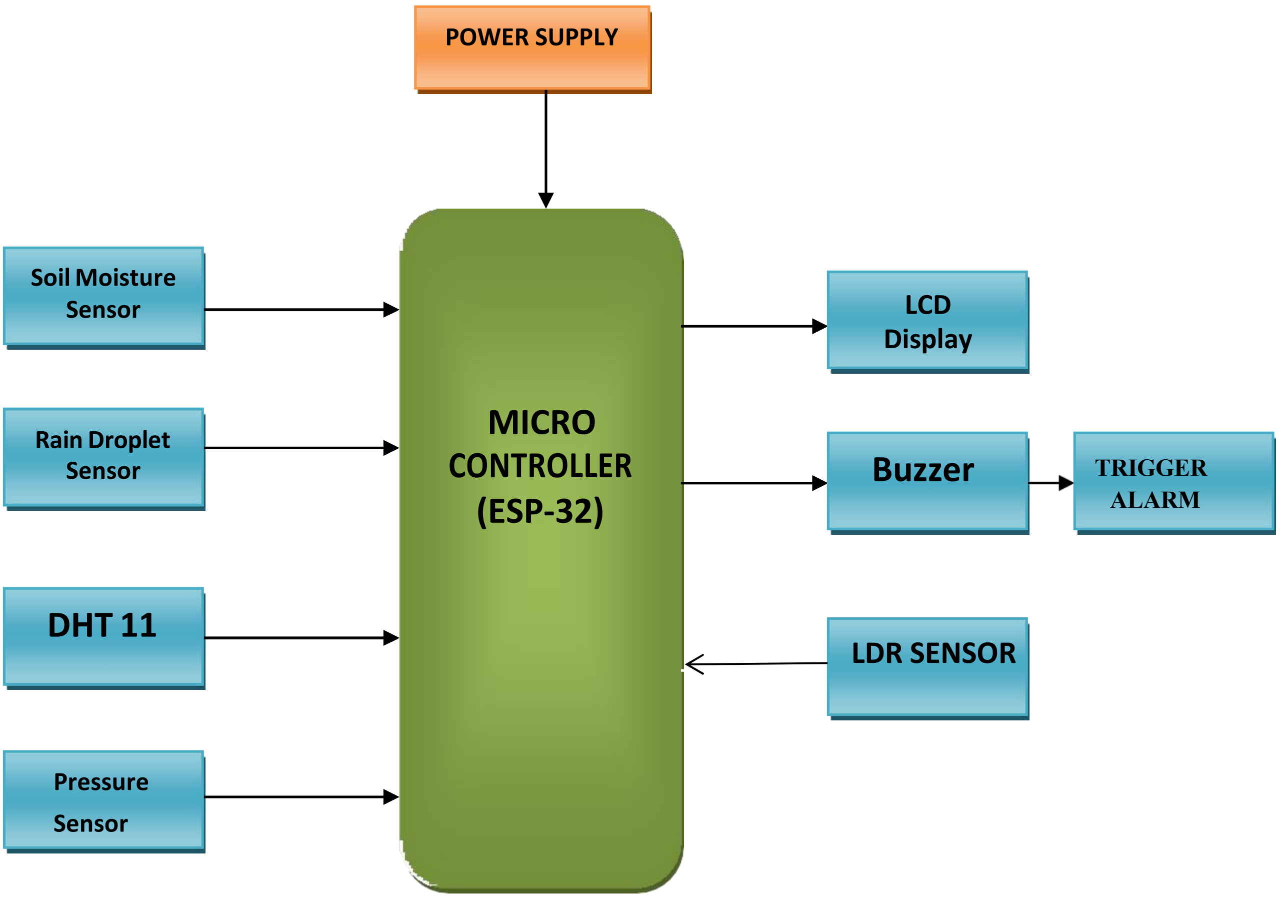

Fig 1.1 Block Diagram

i. ESP 8266 Microcontroller

The ESP8266 is a popular and affordable microcontroller module that provides Wi-Fi connectivity for various electronic projects. It was developed by Espressif Systems, a company based in China. The ESP8266 module consists of a powerful 32-bit microcontroller unit (MCU) with built-in Wi-Fi functionality, making it an ideal choice for Internet of Things (IoT) applications. The ESP8266 comes with built-in Wi-Fi support, allowing devices to connect to the internet and communicate with other devices over a local network or the internet. It supports 802.11 b/g/n Wi-Fi standards.

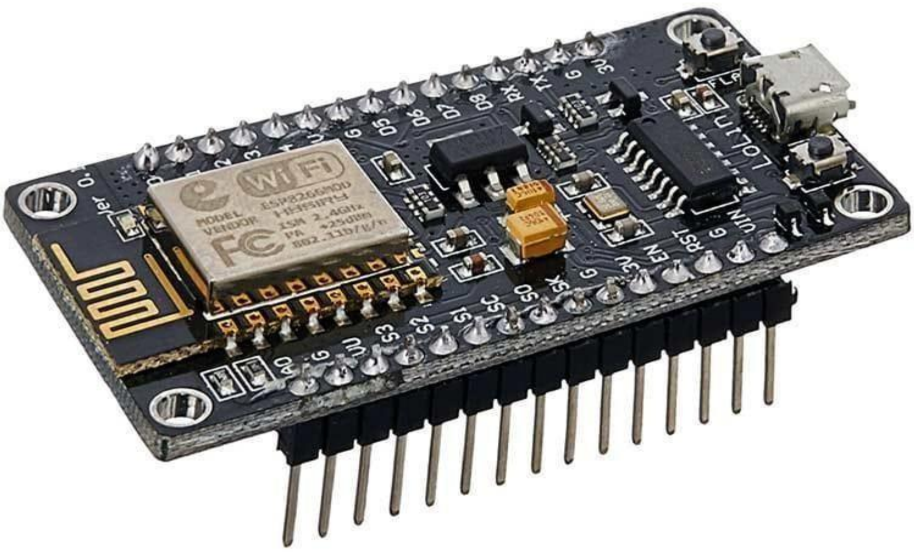

FIGURE 1.2 ESP - 8266

ii. Pressure Sensor

A pressure sensor is a device that measures the pressure of a gas or liquidand converts it into an electrical signal. It is commonly used in various industrial, automotive, medical, and consumer applications. Pressure sensors are crucial in monitoring and controlling pressure levels in systems and processes. Pressure sensors work based on various principles, such as piezoresistive, capacitive, piezoelectric, and optical. The most common type is the piezoresistive pressure sensor, which uses the change in resistance of a sensing element (typically a silicon diaphragm) under applied pressure to measure the pressure.

Fig 1.3 Pressure Sensor

iii. Soil Moisture Sensor

A soil moisture sensor is a device used to measure the moisture content or water level in the soil. It plays a crucial role in agriculture, gardening, and environmental monitoring. The sensor typically consists of two electrodes that are inserted into the soil. When the soil is moist, it conducts electricity, allowing the sensor to detect the presence of water. The moisture sensor provides valuable information about the soil's moisture level, helping farmers and gardeners make informed decisions regarding irrigation and watering schedules. It enables efficient water management, prevents over-watering or under-watering of plants, and promotes optimal growth and health. Soil moisture sensors are often integrated into smart agriculture systems and IoT-based monitoring solutions to enable remote monitoring and automation. They are a valuable tool for maintaining healthy plants, conserving water, and improving agricultural productivity.

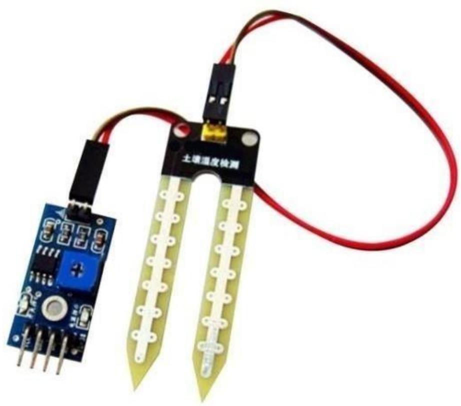

Fig 1.4 Soil Moisture sensor

iv. Rain droplet sensor

A raindrop sensor, also known as a rain sensor or rain detector, is a device used to detect the presence of rain or raindrops. It is commonly used in various applications, including weather monitoring systems, automated irrigation systems, and smart home automation. The sensor typically consists of a set of conductive electrodes that detect changes in electrical conductivity when raindrops come into contact with them. The presence of rain or raindrops interrupts the current flow between the electrodes, triggering a signal indicating rainfall. Raindrop sensors provide real-time data on rainfall, allowing for timely actions such as activating rainwater harvesting systems, closing windows, or adjusting irrigation schedules. They are simple to use and can be integrated into electronic circuits or IoT platforms to enable automated responses based on weather conditions. Raindrop sensors contribute to water conservation efforts and help in designing weather-aware systems for efficient resource management.

Fig 1.5 Rain droplet sensor

v. DHT 11

The DHT11 is a widely used digital temperature and humidity sensor in the field of electronics and IoT applications. It is a low-cost sensor that provides reliable measurements of ambient temperature and relative humidity. The DHT11 sensor consists of a capacitive humidity sensing component and a thermistor for temperature measurement. It communicates with the host microcontroller using a simple single-wire digital interface. The sensor offers a moderate level of accuracy and is suitable for applications that require basic temperature and humidity monitoring. The DHT11 sensor is easy to integrate into projects due to its compact size, low power consumption, and straightforward interface. It finds applications in weather stations, home automation systems, HVAC control, and other projects where temperature and humidity measurements are essential.

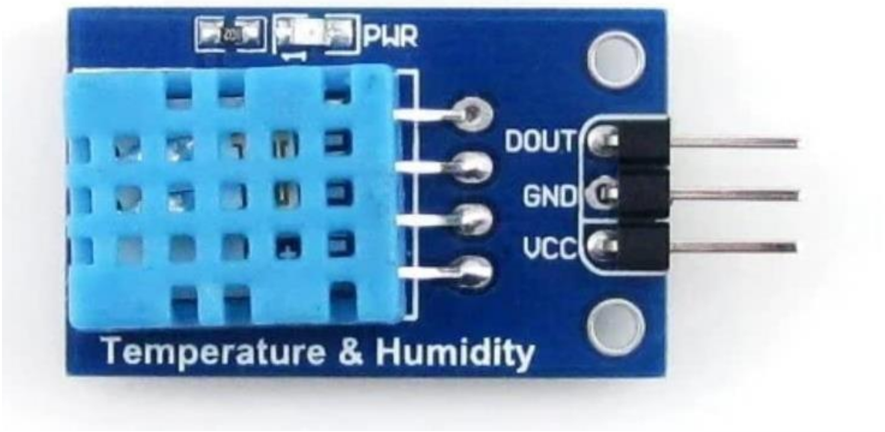

Fig 1.6 DHT 11

vi. LDR sensor

LDR sensor, also known as a Light Dependent Resistor or a photoresistor, is an electronic component that exhibits a change in resistance based on the intensity of light falling on it. It is a type of resistor whose resistance decreases with increasing incident light intensity and vice versa. LDR sensors are commonly used in various applications to detect or measure light levels. They are composed of a semiconductor material that has high resistance in the dark and low resistance in the light. The resistance change occurs due to the variation in the number of charge carriers (electrons or holes) in the semiconductor material, which is influenced by the incident light**.** LDR sensors can be used to automatically control street lights based on ambient light levels. When it gets dark, the resistance of the LDR decreases, triggering the street lights to turn on. In daylight, the resistance increases, and the lights turn off.

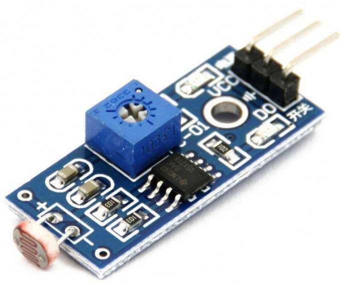

Fig 1.7 LDR sensor

vii. LCD display

An LCD (Liquid Crystal Display) is a flat-panel display technology that uses liquid crystals to produce images. It is commonly used in various electronic devices, including televisions,computer monitors, smartphones, and more. LCDs have become incredibly popular due totheir low power consumption, thin profile, and high-quality visuals.

The basic principle behind an LCD display involves manipulating the properties of liquid crystals to control the amount of light passing through them. Liquid crystals are a unique state of matter that exhibits both solid and liquid characteristics. They can be aligned in a way that allows or blocks the passage of light, depending on the electrical charge applied to them.

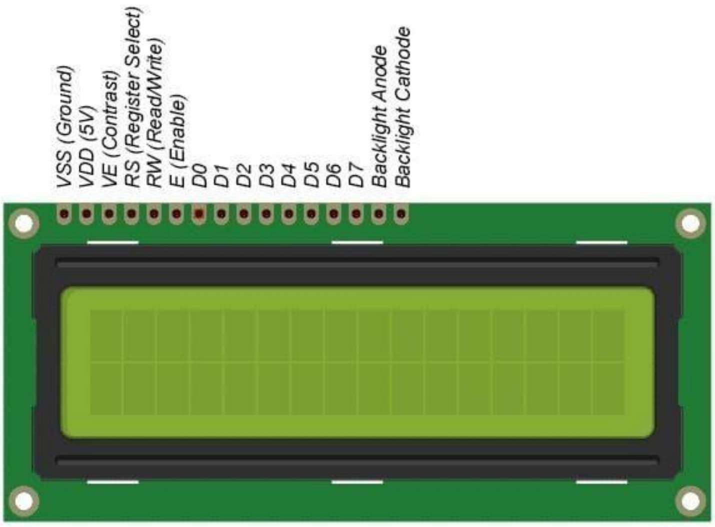

Fig 1.8 LCD Display

ix. Buzzer

A buzzer is an electronic component that produces a buzzing or beeping sound when activated. It consists of a piezoelectric element or an electromagnetic coil that generates sound waves when an electric current passes through it. Buzzer units are commonly used to

provide audible alerts, notifications, or alarms in various electronic devices and systems.

They are compact, lightweight, and easy to integrate into circuits. Buzzer sounds can vary in

widely employed in applications such as alarm clocks, timers, security systems, doorbells,

pitch and intensity, depending on the design and specifications of the buzzer. Buzzer units are

warnings in electronic devices and serve as an important component in many sound-based sytem.

Fig1.9 Buzzer

2. Software Used

- **Arduino IDE**

The Arduino IDE (Integrated Development Environment) is a software platform used for programming and developing applications for Arduino microcontrollers. It provides a user-friendly interface that simplifies the process of writing, compiling, and uploading code to Arduino boards. The Arduino IDE supports a simplified version of the C++ programming language, making it accessible to beginners and experienced developers alike. It offers a range of built-in libraries and functions that facilitate the interaction with various sensors, actuators, and other components. The IDE also includes a serial monitor for debugging and monitoring data transmission between the Arduino board and the computer. With its intuitive interface and extensive community support, the Arduino IDE has become the go-to choice for programming Arduino-based projects, enabling users to bring their ideas to life and create interactive electronic systems.

- **Tinkercad**

Tinkercad is a browser-based computer-aided design (CAD) platform that allows users to create, design, and simulate 3D models and circuits. It offers an intuitive and user-friendly interface, making it accessible to beginners and students interested in learning CAD and 3D modeling. With Tinkercad, users can create 3D designs using a wide range of pre-built shapes and objects, or they can design their own custom shapes using basic geometric primitives. Additionally, Tinkercad provides a circuit design feature where users can simulate and prototype electronic circuits by connecting virtual components. Tinkercad is widely used in educational settings, as it provides a hands-on approach to learning about 3D design and electronics. It allows users to visualize their ideas, experiment with different designs, and share their creations with others. Tinkercad serves as a valuable tool for enthusiasts, hobbyists, and students interested in exploring the world of CAD and electronics.

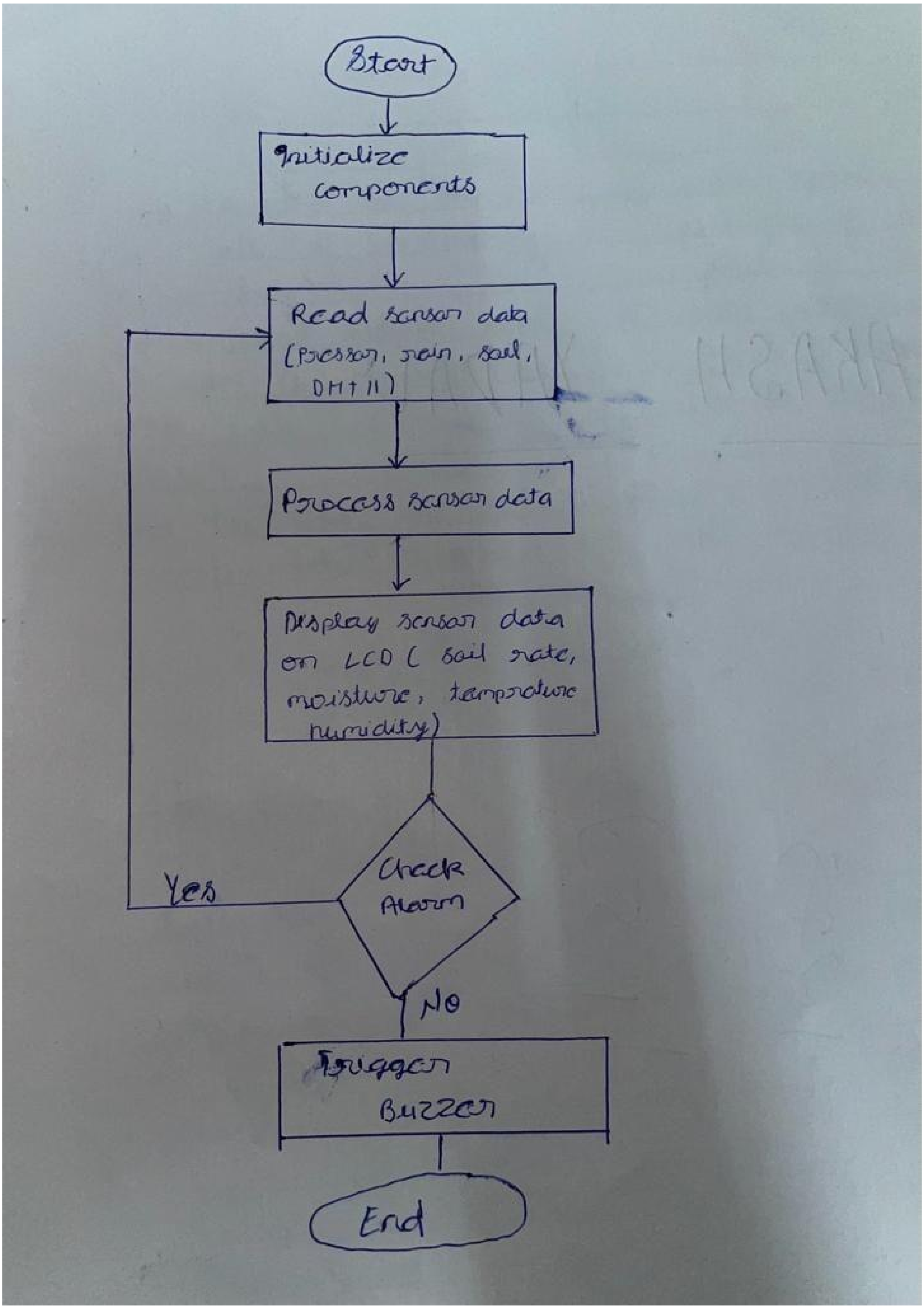

Fig 1.10 Flow Chart

III. Methodology

1. **Requirement Analysis:** Identify the specific requirements and objectives of the smart agriculture monitoring system. This includes understanding the needs of farmers, the types of crops to be monitored, the environmental parameters to be measured, and the desired outcomes such as optimized resource usage, improved crop yields, and sustainable farming practices.
2. **Sensor Selection and Deployment:** Choose appropriate sensors to measure essential parameters such as soil moisture, temperature, humidity, and light intensity. Consider factors such as accuracy, reliability, power consumption, and communication protocols. Deploy the sensors strategically across the agricultural fields to ensure adequate coverage and representative data collection.
3. **System Testing and Validation:** The implemented system is thoroughly tested to ensure that it functions correctly and meets the specified requirements. This includes testing sensor accuracy, data transmission and reception, control functionality, and overall system reliability.
4. **Visualization and User Interface:** Design intuitive and user-friendly interfaces that allow farmers to access and interpret the monitored data effectively. Develop visualizations, dashboards, and alerts that provide real-time information on crop conditions, resource usage, and recommended actions. Ensure the user interface is accessible via multiple devices such as smartphones, or oled display.
5. **Monitoring and Control:** Enable real-time monitoring and control capabilities for farmers to remotely manage their agricultural operations. This can involve integrating actuators and automation systems that can adjust irrigation systems, nutrient delivery systems, or greenhouse ventilation based on the monitored data and recommended actions.

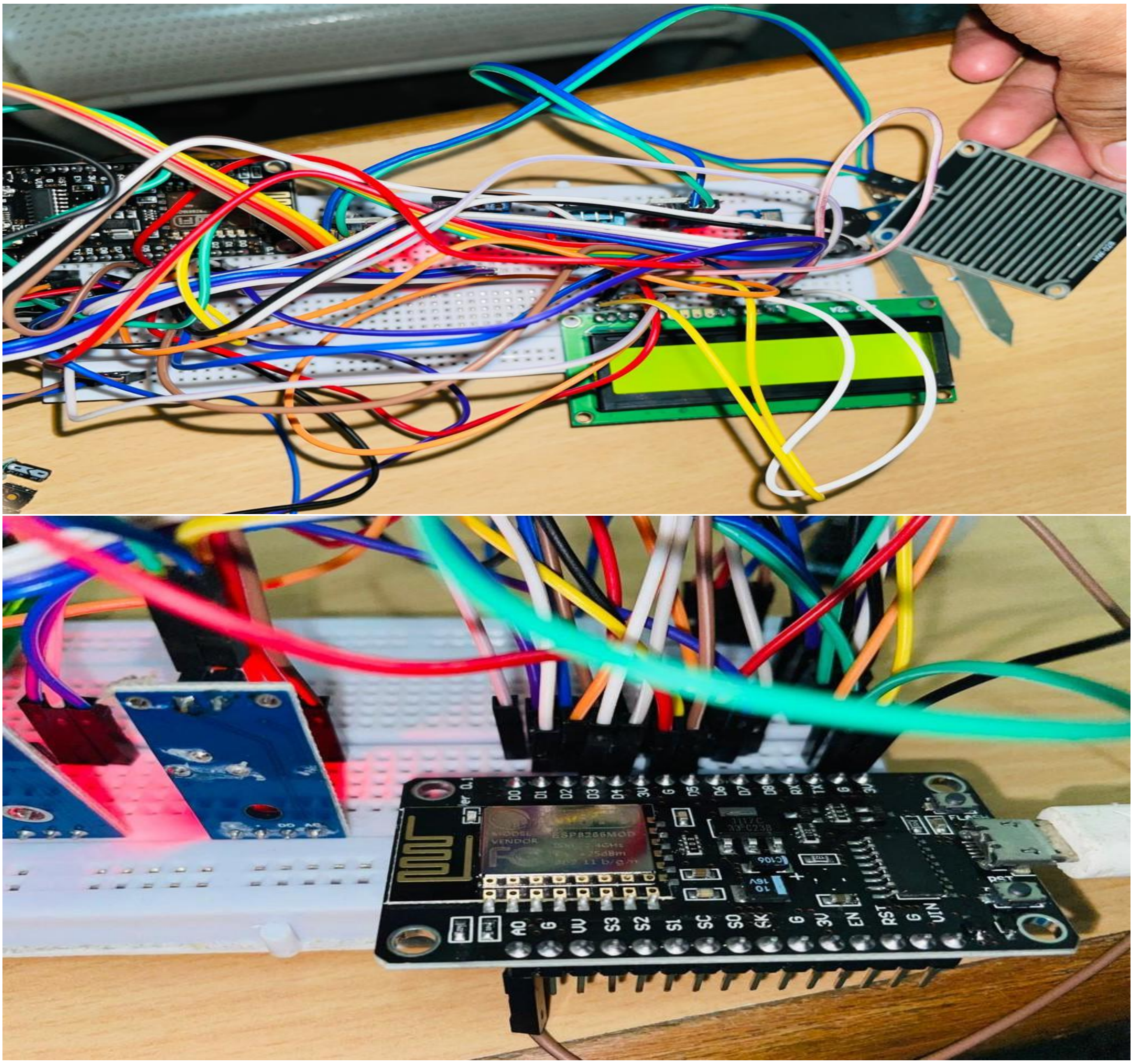

Fig 1.1 circuit diagram

IV. Result and Conclusion

The implementation and deployment of an IoT-based smart agriculture monitoring system have shown promising results in enhancing agricultural practices. Through the integration of sensors, connectivity, and data analytics, the system effectively collects real-time data on crucial parameters such as soil moisture, temperature, and humidity. The collected data is then processed and analyzed, providing farmers with actionable insights for optimizing resource usage, improving crop yields, and promoting sustainable farming practices. The system has demonstrated its ability to facilitate precision agriculture by enabling farmers to make data-driven decisions and take proactive measures to address issues such as irrigation and fertilization. Furthermore, the system's user-friendly interfaces and remote accessibility have empowered farmers to monitor their fields and manage their crops conveniently.

Fig 1.12 Result

V. References

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3. https://www.tinkercad.com

4. "Internet of Things (IoT) Based Smart Agriculture: A Comprehensive Review" by N. Anbumani et al.

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A. Raut et al. - This research article presents a comprehensive IoT-based smart farming system for crop management, covering aspects such as soil moisture monitoring, temperature sensing, and irrigation control.