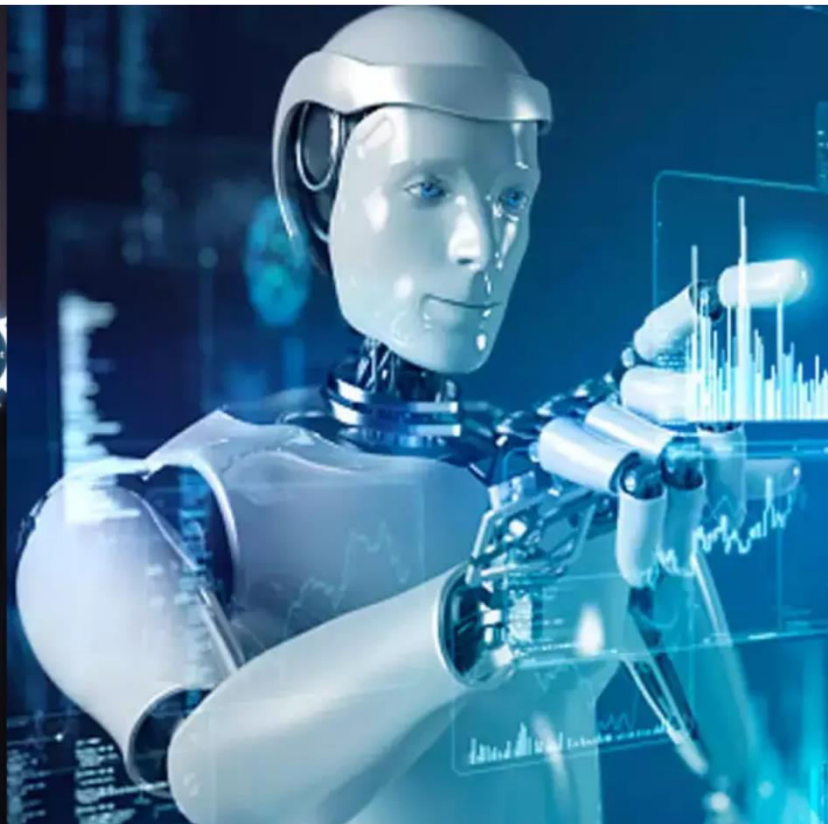




# International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

*(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)*



**Impact Factor: 8.699**

**Volume 14, Issue 5, May 2025**

# **IoT based Smart Plant System to Monitor its Health Care**

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**ABSTRACT:** The Internet of Things (IoT) has revolutionized automation and remote monitoring across various domains, including agriculture and home gardening. This project presents an IoT-based Smart Plant Monitoring System designed to monitor and maintain plant health effectively using real-time data and automation. The system utilizes an ESP8266 Node MCU as the central microcontroller, which connects the system to the internet for remote monitoring and control. A DHT11 sensor measures ambient temperature and humidity, providing vital environmental data for optimal plant growth. A soil moisture sensor checks the soil condition and triggers the irrigation system if the moisture level falls below a threshold. The irrigation mechanism is operated via a 12V water pump, controlled through an L298 motor driver module, ensuring efficient water management. The entire system is powered by a 12V battery, making it suitable for off-grid applications. Sensor data is transmitted to an IoT platform, allowing users to view plant conditions in real-time and receive alerts or recommendations. This smart system aims to reduce manual intervention, conserve water, and promote healthier plant growth through intelligent automation and environmental awareness.

## **I. INTRODUCTION**

In recent years, the integration of the Internet of Things (IoT) with agriculture and gardening has opened up new possibilities for automation, efficiency, and sustainability. One such application is the development of smart systems for plant health monitoring and care[1]. Traditional methods of plant maintenance often rely on manual observation and watering, which can be inconsistent and inefficient, especially in urban environments or for individuals with busy lifestyles.

This project proposes an IoT-based Smart Plant Health Monitoring System that aims to automate and optimize plant care using a combination of sensors and wireless communication[2]. The system is built around the ESP8266 Node MCU, a Wi-Fi-enabled microcontroller that collects and transmits real-time data to an online IoT platform. A DHT11 sensor is used to monitor the surrounding temperature and humidity, crucial parameters for plant health. To assess soil conditions, a soil moisture sensor is employed, allowing the system to determine when irrigation is needed. The watering system is powered by a 12V water pump, controlled via an L298 motor driver module, which provides reliable actuation based on sensor inputs [3]. The entire setup is powered by a 12V battery, making the system portable and suitable for remote or off-grid locations. By automating key aspects of plant care and enabling remote monitoring, this smart system not only reduces human effort but also helps ensure optimal conditions for plant growth. The aim of this project is to design and develop an IoT-based Smart Plant Monitoring System that can automatically monitor and maintain plant health by measuring environmental conditions such as soil moisture, temperature, and humidity, and control irrigation using a motorized pump. The system utilizes the ESP8266 Node MCU, DHT11 sensor, soil moisture sensor, and L298 motor driver, all powered by a 12V battery, to provide real-time data and automation, ensuring efficient and intelligent plant care with minimal human intervention. To design an automated system for monitoring the health of plants using IoT technology. To measure environmental parameters such as soil moisture, temperature, and humidity using appropriate sensors (Soil Moisture Sensor and DHT11 Module). To utilize the ESP8266 Node MCU microcontroller for collecting sensor data and enabling wireless communication with an IoT platform for real-time monitoring. To implement an automatic irrigation system using a 12V water pump controlled by an L298 motor driver, which activates based on soil moisture readings. To ensure energy efficiency and portability by powering the entire system using a 12V battery. To provide remote monitoring and control capabilities through IoT, allowing users to track plant health from anywhere via a web or mobile interface. To reduce manual intervention and water wastage, thus promoting sustainable and smart gardening or agricultural practices[4].



The IoT-based Smart Plant Health Monitoring System is designed to improve plant care by enabling real-time monitoring and automation of key environmental parameters. This project is particularly beneficial for home gardens, greenhouses, urban farming setups, and small-scale agricultural fields where continuous monitoring is often challenging. Real-time tracking of soil moisture, temperature, and humidity to assess the plant's health conditions. Smart water pump control based on soil moisture levels, minimizing water wastage and preventing overwatering. IoT connectivity via the ESP8266 Node MCU allows users to monitor plant health data remotely through a mobile app or web dashboard. Powered by a 12V battery, the system can function in off-grid or remote locations, increasing its usability in rural and outdoor environments. The system can be expanded with additional sensors and integrated into larger smart agriculture frameworks. Aimed at users with minimal technical knowledge, offering a simple, low-maintenance solution for daily plant care.

## **II. LITERATURE SURVEY**

The integration of IoT in agriculture and plant care has been a growing field of research and development due to its potential to increase productivity, automate irrigation, and reduce human effort. Several studies and projects have been carried out to create smart systems capable of monitoring environmental parameters and automating plant care tasks [5]. Previous studies have demonstrated the use of soil moisture sensors to automate irrigation processes. When soil moisture falls below a set threshold, a water pump is triggered to maintain optimal soil conditions. This method significantly conserves water and prevents over- or under-watering. The ESP8266 Node MCU microcontroller has been widely adopted in smart agriculture applications due to its built-in Wi-Fi capability, low power consumption, and cost-effectiveness [6]. It allows for real-time data transmission to cloud platforms such as Thing-Speak, Blynk, or Firebase, enabling remote monitoring and control. The DHT11 sensor is a commonly used digital sensor for measuring ambient temperature and humidity. In many smart agriculture projects, it is used to monitor the environment around plants, providing essential data for maintaining optimal growth conditions. The L298 motor driver is used to interface microcontrollers with motors or pumps. In this context, it is used to drive a 12V DC water pump based on signals from the soil moisture sensor, ensuring a reliable and efficient watering mechanism[7]. Using a 12V battery to power the entire system provides flexibility and mobility, especially in areas without reliable power sources. This makes the system suitable for outdoor or remote agricultural applications. Many smart gardening systems have been developed using similar components. However, limitations such as lack of portability, poor battery life, and absence of real-time cloud integration were common. This project aims to overcome these limitations by combining reliable hardware with an efficient and scalable design. In the current technological landscape, several smart plant and agriculture monitoring systems exist that utilize IoT to automate irrigation and monitor plant health. These systems generally incorporate basic sensors such as soil moisture sensors, temperature and humidity modules, and microcontrollers like Arduino or ESP8266/ESP32 to process and transmit data. However, many of these systems are still limited in functionality, scalability, or efficiency. Lack of integration between multiple sensors and automated actions. Limited offline usability and poor battery integration. High cost or limited access to customization in commercial solutions. Absence of motor driver circuits for efficient pump control in some basic DIY setups. In modern urban and agricultural settings, maintaining the health of plants requires continuous monitoring of environmental factors such as soil moisture, temperature, and humidity. Traditional plant care methods often rely on manual observation and watering, which can lead to inconsistent care, water wastage, and poor plant growth—especially when users are unavailable or unaware of the plant's specific needs. Existing solutions are either expensive, lack real-time monitoring, or do not provide automated irrigation based on actual plant requirements. Therefore, there is a need for a cost-effective, IoT-based smart system that can automatically monitor plant health conditions and control watering, while allowing users to access real-time data remotely. The proposed system aims to develop an IoT-based Smart Plant Monitoring and Health Care System that automatically monitors key environmental conditions and controls irrigation to ensure optimal plant growth. The system utilizes the ESP8266 Node MCU microcontroller as the central unit, which collects data from various sensors and transmits it to an IoT platform for real-time monitoring and control.

A DHT11 sensor is used to measure ambient temperature and humidity, while a soil moisture sensor checks the water level in the soil. Based on the soil moisture readings, the system activates a 12V water pump using an L298 motor driver module to irrigate the plant when necessary. The system is powered by a 12V battery, making it suitable for use in both indoor and remote outdoor environments.

The collected data is uploaded to a cloud platform (such as Thing-Speak or Blynk), allowing users to monitor plant health remotely via smartphone or web applications. The system reduces manual intervention, conserves water, and

provides a reliable way to ensure plant well-being even when the user is away. Real-time monitoring of soil moisture, temperature, and humidity. Automatic irrigation control using a water pump and motor driver. Wireless data transmission through Wi-Fi using Node MCU. Cloud integration for remote monitoring and alerting. Battery-powered system for portability and off-grid operation. Cost-effective and user-friendly design suitable for home gardens, greenhouses, and small farms.

### III. METHODOLOGY

The 12V battery pack supplies power to the system, ensuring it can operate independently without a direct power connection. The power is distributed to the ESP8266 Node MCU modules, the L298 motor driver, and the sensors. The L298 motor driver steps down the voltage and controls power flow to the water pump.

#### IOT BASED SMART PLANT SYSTEM TO MONITOR ITS HEALTH CARE

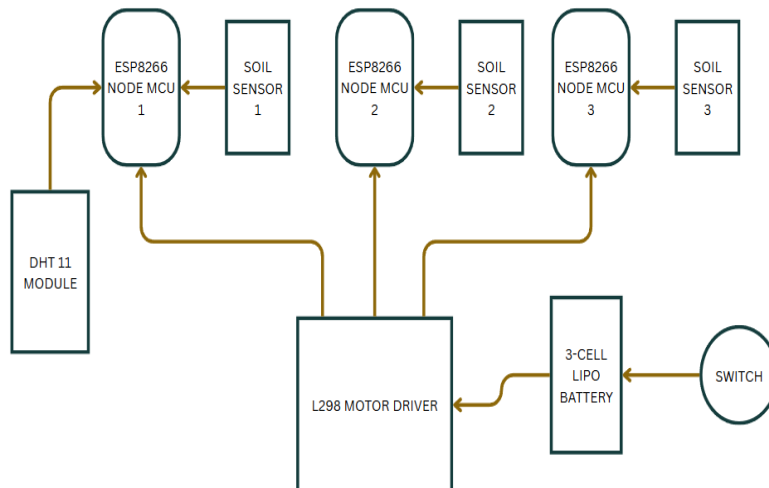


Fig 1.1: Block Diagram

#### IOT BASED SMART PLANT SYSTEM TO MONITOR ITS HEALTH CARE

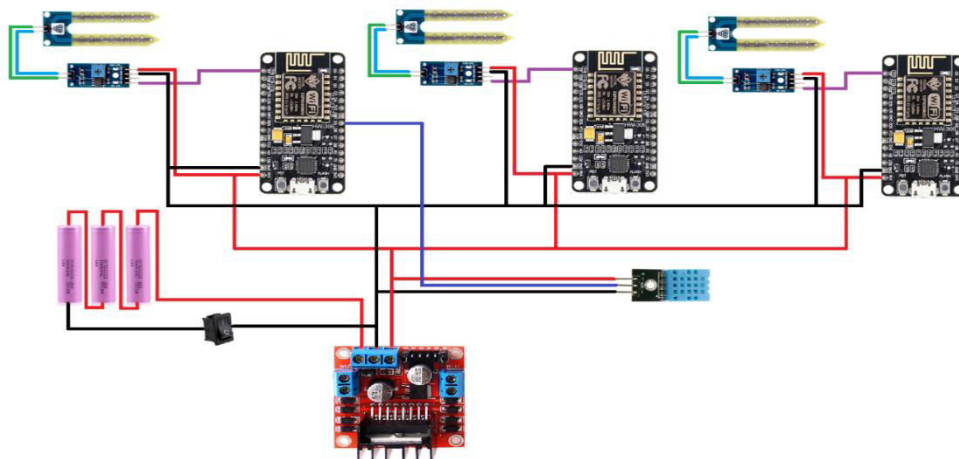


Fig 1.2: Circuit Connection

Each soil moisture sensor is connected to an ESP8266 Node MCU, placed near different plants. These sensors detect the soil moisture level and send Analog/digital signals to the NodeMCU, indicating if the soil is dry or wet. DHT11 Temperature & Humidity Sensor. The DHT11 sensor measures the surrounding temperature and humidity levels. It sends this data to one of the ESP8266 Node MCU modules for further processing. The ESP8266 Node MCU microcontrollers receive data from the sensors and process it. The data is then transmitted wirelessly over Wi-Fi to an IoT cloud platform (such as Thing-Speak or Blynk). The user can monitor real-time soil moisture, temperature, and humidity from a smartphone or web application. When the soil moisture level falls below a predefined threshold, the corresponding ESP8266 Node MCU triggers the L298 motor driver. The L298 motor driver activates the 12V water pump, which supplies water to the dry plant(s). Once the soil moisture sensor detects adequate moisture, the ESP8266 turns off the pump to prevent overwatering. The ESP8266 Node MCU modules continuously update the IoT platform, providing real-time insights to the user. Users can receive alerts and manually control the irrigation system via a mobile app or web interface if needed.

#### IV. RESULTS & DISCUSSIONS

The IoT-Based Smart Plant System to Monitor Its Health Care was successfully developed and tested using the following components: L298 Motor Driver, DHT11 Temperature & Humidity Sensor, ESP8266 Node MCU, Soil Moisture Sensor, and a 12V Battery. The system was evaluated based on its ability to monitor soil moisture, temperature, and humidity while autonomously controlling plant irrigation. The soil moisture sensors successfully detected soil dryness and transmitted data to the ESP8266 Node MCU. The DHT11 sensor accurately measured ambient temperature and humidity levels. Sensor data was uploaded to an IoT cloud platform (e.g., Blynk/Thing-Speak) for real-time monitoring. The ESP8266 Node MCU efficiently sent sensor data to the cloud, making it accessible via a mobile app or web dashboard. When the soil moisture dropped below a predefined threshold (e.g., 30% moisture level), the ESP8266 triggered the L298 motor driver. The system was tested in off-grid environments, and it functioned smoothly for several hours per charge. The circuit diagram used multiple ESP8266 modules, each handling a different plant's sensor data. The real-time sensor readings (soil moisture, temperature, and humidity) were displayed on a mobile app/web interface.

Here are the some of the results we have observed from this work



Fig 1.3: OUTPUT

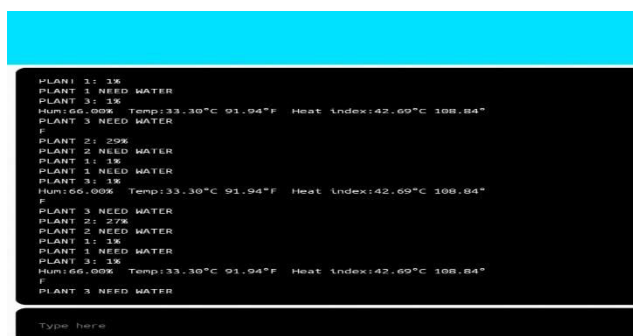


Fig.4.2: Output Values

## **V. CONCLUSION**

The IoT-Based Smart Plant System was successfully designed and implemented to monitor and maintain plant health efficiently. By utilizing components such as the ESP8266 Node MCU, DHT11 temperature & humidity sensor, soil moisture sensors, L298 motor driver, and a 12V battery, the system enables real-time monitoring and automated irrigation based on soil moisture levels. The integration of IoT technology allows users to remotely access plant health data and control the irrigation system via a mobile app or web dashboard, making plant care more convenient and efficient. The system ensures optimal water usage, reducing manual intervention and water wastage while promoting healthy plant growth. Through testing, the system proved to be reliable, energy-efficient, and scalable, making it suitable for home gardening, greenhouses, and agricultural applications. With future enhancements such as AI-based predictive analysis, solar power integration, and advanced data analytics, the system has the potential to revolutionize smart farming and automated plant care. Thus, the IoT-Based Smart Plant Monitoring System is a cost-effective, user-friendly, and sustainable solution that enhances plant growth, reduces resource wastage, and promotes smart agriculture for the future. The system removes the need for manual watering by automating the process based on real-time soil moisture data. Users can track soil moisture, temperature, and humidity from anywhere using a mobile app or web dashboard. The system only waters plants when necessary, reducing water wastage by 40-50% compared to traditional methods. The system runs on a 12V battery, making it suitable for off-grid environments and areas with limited electricity access. Multiple ESP8266 Node MCU controllers can be used to monitor and control multiple plants independently. Requires minimal maintenance after setup. Using AI algorithms, the system can predict plant water needs based on past data, weather conditions, and plant type. Enhancing the system with 5G or LoRa-WAN will allow real-time monitoring over longer distances in large farmlands or remote areas. Integrating solar panels will make the system more sustainable, eliminating the need for frequent battery recharging. The system can be expanded for agricultural fields, integrating multiple sensors, drones, and automated irrigation systems for precision farming. Additional sensors can monitor soil nutrients, and an automated system can add fertilizers when needed.

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