BUILDING AN IOT-BASED SMART IRRIGATION SYSTEM MODEL WITH NODEMCU,SOIL MOISTURE SENSOR,WATER PUMP, MOTOR CONTROLLER AND MOBILE APP CONTROL.

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INTRODUCTION

In the pursuit of resource-efficient and sustainable agriculture, this project focuses on designing an IoT-based smart irrigation system model. This innovative endeavor merges cutting-edge technology with irrigation practices, integrating components such as NODEMCU, A soil moisture Sensor, a water pump, and a mobile control app.

By marrying IoT capabilities

with irrigation, it aims to Revolutionize water management and optimize crop growth for a more sustainable future.

OBJECTIVES

- **Water Conservation:** Develop a smart irrigation system that optimizes water usage by delivering water precisely when and where it's needed, reducing water wastage.
- **Enhanced Crop Health:** Create an irrigation system that maintains optimal soil moisture levels, promoting healthy plant growth and improving overall crop yield.
- **Automation and Efficiency:** Design an automated system that intelligently monitors soil moisture and triggers the water pump only when necessary, minimizing manual intervention.
- **IoT Integration:** Integrate the NODEMCU microcontroller with the soil moisture sensor and water pump to enable real-time data collection, processing, and irrigation control.
- **Remote Monitoring :** Implement a mobile control app (such as arduino iot remote app)that allows users to remotely monitor soil moisture levels and adjust irrigation settings from their smartphones.
- **User-Friendly Interface:** Create a user-friendly and intuitive mobile app interface that provides easy access to information , making it accessible to users with varying technical backgrounds.
- **Data Visualization:** Develop a system that visualizes soil moisture data trends over time, helping users make informed decisions about irrigation scheduling.

GOALS

- **Efficient Water Usage:** Reduce water consumption by a certain percentage compared to traditional irrigation methods by precisely regulating water delivery.
- **Decreased Water Costs:** Achieve cost savings for users by optimizing water usage, resulting in lower water bills.
- **Improved Crop Yield:** Demonstrate a measurable improvement in crop yield and health by maintaining ideal soil moisture conditions.
- **Automation Reliability:** Ensure that the system's automation accurately responds to soil moisture data, minimizing false triggers and ensuring reliable irrigation.
- **Real-Time Monitoring:** Enable users to monitor soil moisture levels and irrigation status in real time, enhancing their control over the irrigation process.
- **Mobile App Functionality:** Provide a functional mobile control app that is intuitive, responsive, and capable of delivering timely notifications to users.
- **Scalability and Adaptability:** Design a system architecture that can be easily scaled to accommodate larger agricultural areas or adapted for different plant types and soil conditions.
- **Educational Value:** Create a project that not only serves practical purposes but also serves as an educational tool, demonstrating the potential of IoT in agriculture.

MAIN COMPONENTS USED

1. NODEMCU (ESP8266): The NODEMCU serves as the brain of our smart irrigation system. This versatile microcontroller, powered by the ESP8266 chip, connects to the internet via Wi-Fi and facilitates seamless communication between all system components. It acts as the central hub, collecting real-time data, making intelligent decisions, and controlling the water pump based on sensor readings.

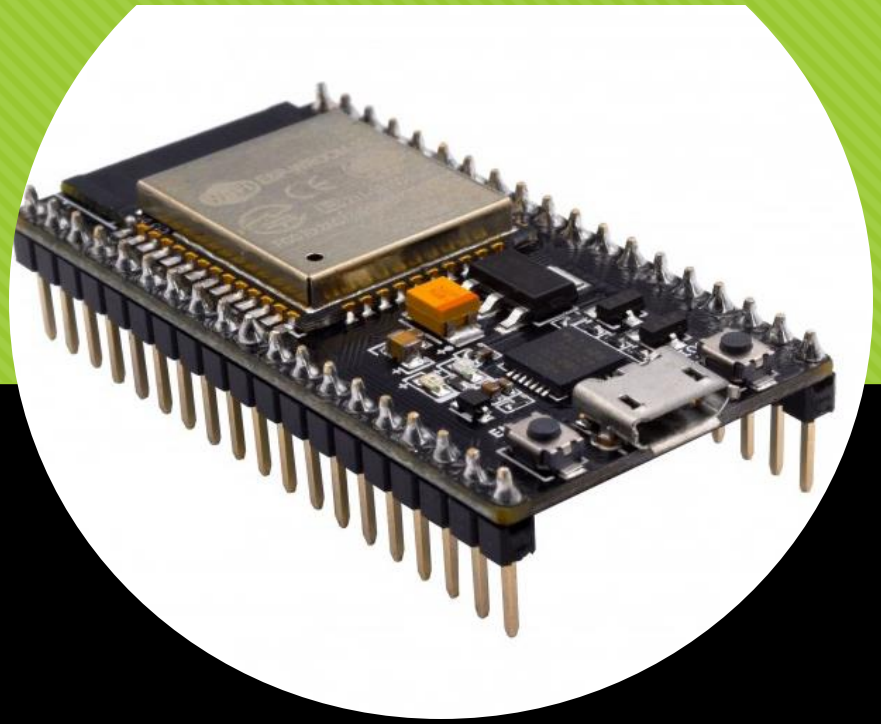


FIG.1 NODEMCU

2. Soil Moisture Sensor: At the heart of our system's intelligence lies the soil moisture sensor. This sensor monitors the moisture content of the soil, providing essential data to determine when and how much to irrigate. By accurately gauging soil conditions, it ensures that irrigation is precisely tailored to the plant's needs, promoting optimal growth and conserving water resources.

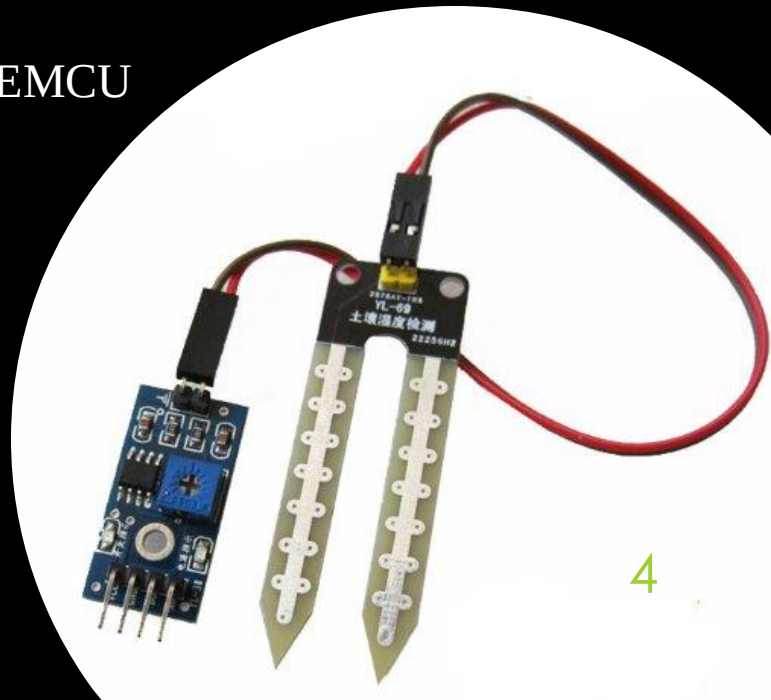
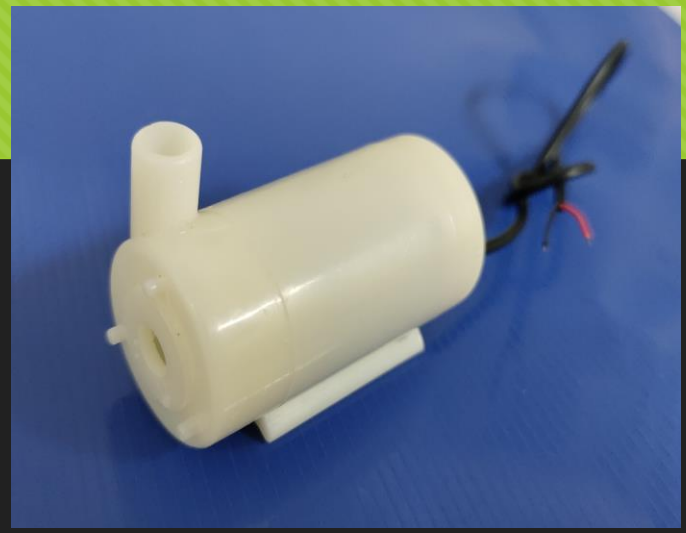


FIG.2 SOIL MOISTURE SENSOR

3. Water Pump: The water pump acts as the system's hands, delivering water to the plants with precision Controlled by the delivering water to the plants with precision Controlled by the NODEMCU, the pump activates based on the data received from the soil moisture sensor. It ensures that water is supplied only when the soil moisture Falls below a predetermined threshold, preventing over-irrigation and water wastage.

FIG.3 SUBMERSIBLE WATER PUMP



4. Arduino Iot remote App Integration: Enhancing user interaction and control, this mobile app is the gateway to our smart irrigation system. It provides a user-friendly interface that allows users to remotely monitor soil moisture levels, and adjust irrigation settings.

The app fosters convenience by enabling users to oversee their garden's irrigation process from their smartphones, ensuring efficient water management even when they're away.

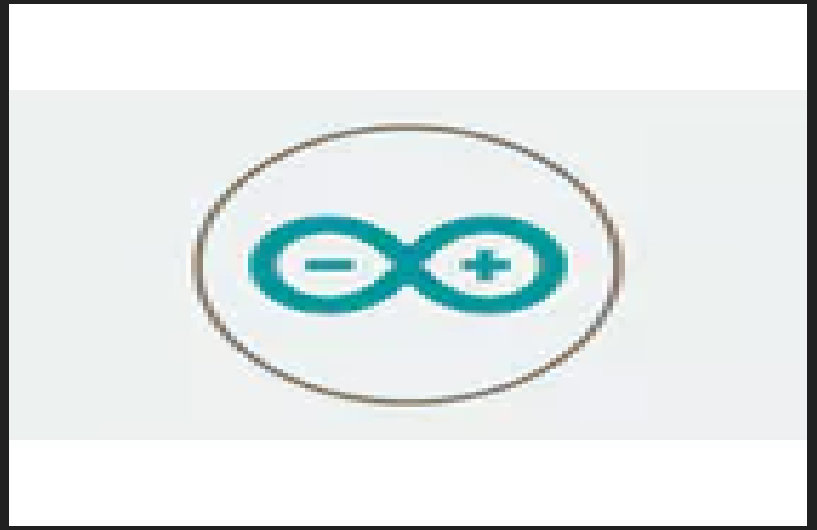


FIG.4 ARDUINO IOT REMOTE APP

4. Motor Controller: A motor controller is an electronic device or circuit that manages the operation, speed, direction, and sometimes other aspects of an electric motor. It typically receives control signals from a microcontroller, sensors, or human input and translates these signals into appropriate commands to regulate the motor's behavior, such as starting, stopping, accelerating, decelerating, and changing its rotation direction.

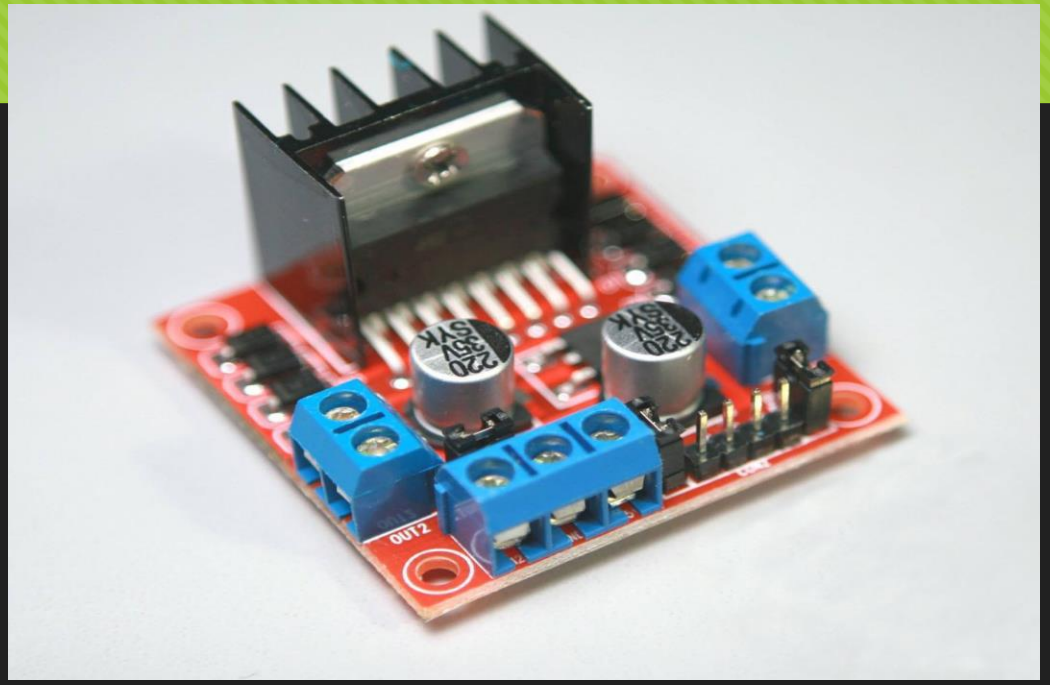


FIG. 5 MOTOR CONTROLLER

Motor controllers are commonly used in various applications, including robotics, automation, industrial machinery, and consumer electronics, to ensure precise and controlled motor performance.

5. System Integration: These components work in harmony to create a dynamic and responsive irrigation system. The NODEMCU processes data from the soil moisture sensor, analyzes it using pre-defined algorithms, and activates the water pump as needed. Meanwhile, the Mobile app(Arduino iot remote) connects seamlessly to the NODEMCU, offering user real-time insights into soil conditions and allowing them to fine-tune irrigation schedules with ease .In summary, our IoT-based smart irrigation system model utilizes the power of NODEMCU, a soil moisture sensor, a water pump, and the mobile app to reimagine irrigation practices. By seamlessly integrating these components, we aim to maximize water efficiency, enhance crop health, and empower users with a new level of control over their agricultural endeavors.

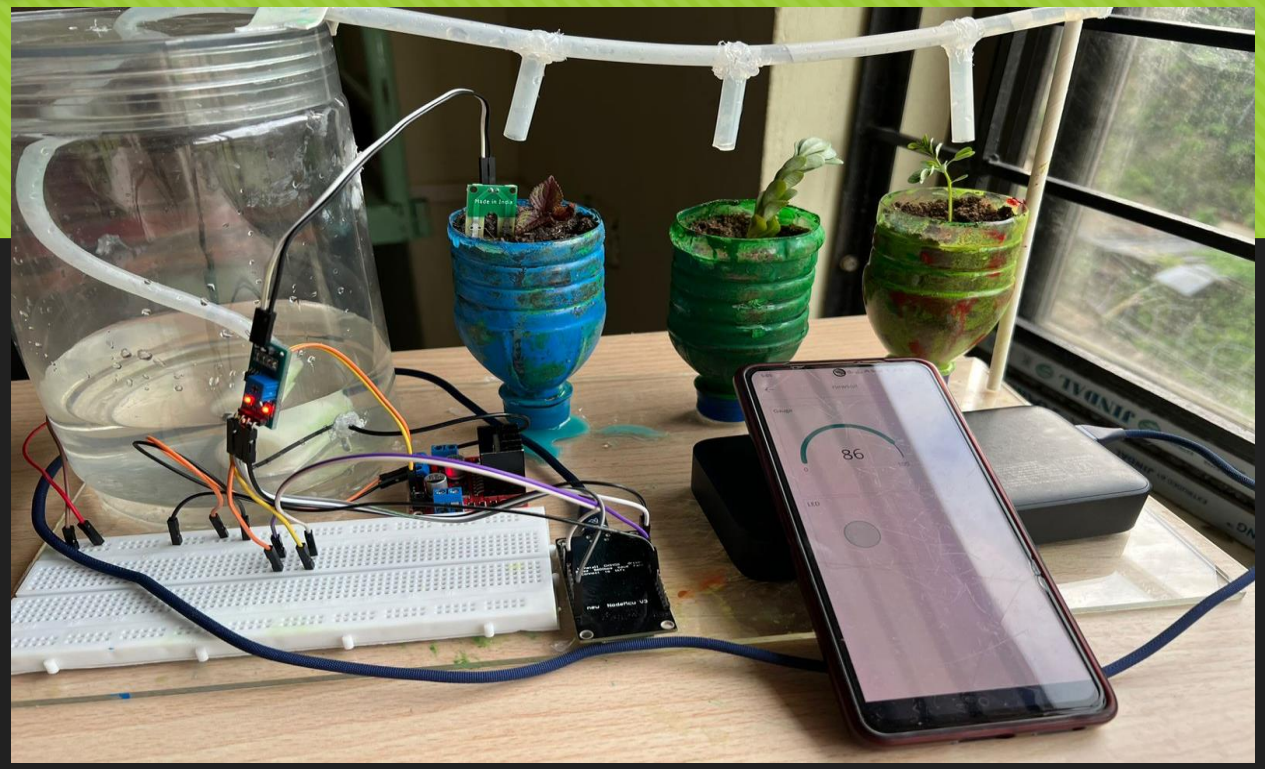


FIG.6 SYSTEM INTEGRATION

- **Soil Moisture Sensor:** Monitors soil moisture levels and sends data to the NODEMCU.
- **NODEMCU (ESP8266):** Receives soil moisture data, processes it, and makes irrigation decisions.
- **Water Pump:** Activated by NODEMCU when irrigation is needed, delivering water to plants.
- **Mobile App(Arduino iot remote):** Connects to NODEMCU via internet, allowing users to monitor, control, and schedule Irrigation remotely.
- **Interaction Flow:** Soil moisture data is collected by the sensor, sent to NODEMCU for analysis. NODEMCU triggers water pump if Needed. Mobile app communicate with NODEMCU, enabling users to view Data of moisture level in the irrigation cycles from their mobile devices.

WORKING PRINCIPLE

1. **Data Collection:** The soil moisture sensor measures soil moisture levels and sends data to the NODEMCU.
2. **Data Analysis:** The NODEMCU processes the soil moisture data and determines if irrigation is required.
3. **Decision-Making:** If soil moisture is below a threshold, the NODEMCU triggers the water pump.
4. **Water Pump Activation:** The water pump is activated to deliver water to the plants.
5. **Mobile Control App(Arduino Iot remote):** The NODEMCU communicates with the Arduino Iot remote app, allowing users to monitor and control the system remotely.
6. **User Control:** Users can observer the moisture level through the Arduino iot remote mobile app.
7. **Real-Time Updates:** The app displays real-time soil moisture data and system status.
8. **Optimized Irrigation:** The system continuously adjusts irrigation cycles based on real-time data, promoting efficient water usage and healthier plant growth.

MOBILE APP INTEGRATION (ARDUINO IOT REMOTE APP)

- **Real-Time Monitoring:** You can monitor soil moisture levels, motor status, and more in real time through the app.
- **Data Visualization:** The app presents sensor data in visual formats, aiding in understanding trends and optimizing efficiency.
- **Alerts and Notifications:** Receive notifications based on predefined conditions, such as low soil moisture or pump issues.
- **Automation and Scheduling:** Set up automation routines or schedules for efficient irrigation cycles.
- **User-Friendly Interface:** The app's intuitive interface makes interaction easy, even for non-technical users.
- **Remote Troubleshooting:** Diagnose and address system issues remotely, saving time and effort.
- **Data Analysis:** Historical data trends can inform adjustments for better system performance and water conservation.
- Incorporating the Arduino IoT Remote App enhances control, monitoring, and management of your smart irrigation system.

BENEFITS AND IMPACTS

- **Water Efficiency:** Precise irrigation minimizes water wastage, addressing water scarcity and reducing costs.
- **Improved Crop Health:** Optimal soil moisture levels lead to healthier plants, higher yields, and better quality produce.
- **Automated Control:** The system's automation reduces manual effort and ensures timely irrigation decisions.
- **Cost Savings:** Reduced water usage and energy-efficient practices result in lower bills and operational costs.
- **Remote Management:** The mobile app(Arduino iot remote app) Empowers users to monitor irrigation from anywhere, promoting convenience.
- **Data-Driven Insights:** Real-time data and trends enable informed decisions for effective irrigation strategies.
- **Environmental Conservation:** Efficient water usage minimizes environmental impact and soil erosion.
- **IoT Demonstration:** The project showcases the potential of IoT technology in sustainable agriculture.
- **Sustainable Practices:** Adoption of smart irrigation aligns with eco-friendly farming practices.

CONCLUSION

In the convergence of technology and agriculture, our IoT-based smart irrigation system shines as a beacon of innovation. The synergy between NODEMCU, soil moisture sensor, water pump, and the Arduino Iot remote mobile app has birthed a paradigm shift that promises efficient water usage and enhanced crop health.

Through real-time data analysis, I've transcended traditional irrigation methods. The system's ability to discern precise soil moisture levels and trigger irrigation only when necessary underscores our commitment to water conservation. The incorporation of the Arduino Iot remote app adds an extra layer of convenience and enabling remote supervision.

The far-reaching impact of this system echoes the urgency of our times. It addresses water scarcity concerns by minimizing wastage, resulting in substantial cost savings for farmers. Moreover, optimized irrigation directly translates into healthier crops and increased yields, vital for food security in a growing global population.

As I close this chapter, I don't just celebrate a technological achievement; i celebrate a commitment to sustainable agriculture. My IoT-based smart irrigation system doesn't just water plants; it nurtures a vision of a greener, more efficient future where technology and nature flourish side by side.

REFERENCES

1. Author: OpenAI II Model : GPT-3.5 II Date : august 4th,2023 II Title : A) Objectives and Goals of smart irrigation system

   B)Benefits and impacts of smart irrigation system

2.Web images:- fig.4 Electronic Spices L298 Motor Driver Circuit Board https://amzn.eu/d/hlznQ36

PROJECT COST TABLE

MATERIAL	QUANTITY	COST
1.NODEMCU	1	RS 280
2.MOTOR DRIVER	1	RS 250
3.WATER PUMP	1	RS 200
4.JUMPER WIRES	10	RS 30
5.ADAPTER(5v OUTPUT)	1	RS 100
6.DATA CABLE	1	RS 200
7. BREADBOARD	1	Rs 199
8. SOIL MOISTURE SENSOR	1	RS 200
TOTAL		RS 1429

THANKYOU