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Indoor Gardening Irrigation System

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***Abstract* - In daily operations related to agriculture or gardening watering is the most important practice and the most labor intensive task. It doesn't matter what the weather is, whether it's too hot and dry or too cloudy and wet. Also, you want to be able to control the amount of water that reaches your plants. Modern watering systems can be used effectively to water plants when they need it. But this manual watering process requires two important aspects to consider: when and how much to water. To replace manual activities and simplify the work of gardeners, we have created the Indoor Gardening Irrigation System. With the indoor gardening irrigation system or agricultural fields, you will help all plants reach their full potential and save water. For the implementation of the Indoor Gardening Irrigation System, we have used a combination pipes. In this paper we have used Esp 8266 Node Mcu as microcontroller. It is programmed to detect the plant's moisture level at all times, if the moisture content is less than the specified range it will be predetermined according to the specific plant's water needs then the desired amount of water is supplied until it reaches the range. Generally, trees should be watered at least twice a day, morning and evening. We also use the DHT11 sensor to measure temperature and humidity values. The system is designed in such a way that it reports its current data through a mobile application like the Telegram platform, it is also displayed using the LCD.**

Keywords: Indoor Gardening, Irrigation System, Agriculture, Gardening watering, Watering process.

I. INTRODUCTION

This “Indoor Gardening Irrigation System" focuses on the issues mentioned today to meet all technical and economic aspects. This project presents soil moisture monitoring using a controller with a WiFi module to monitor soil moisture, temperature and humidity.

The project works fully automatically measuring the moisture reduction of existing plants to operate the irrigation system, restoring water as needed while minimizing excess water use. “Indoor Gardening Irrigation System" also uses a more efficient and simple solution based on technology "Internet of Things (IOT)".

The built model is used to detect soil moisture, temperature & humidity, data uploaded via the Internet analyzed. In the existing water irrigation monitoring system, only the soil moisture sensor is used, not the temperature & humidity sensor. It also requires labor to operate the system, knowing when and how much to water are two important aspects of the watering process. Therefore, developing a soil moisture monitoring system is very important to monitor plants in the future.

II. PROBLEM STATEMENT

Irrigation is an important thing in a gardening system. The water we provide, which is the main element, will ensure that the plants survive in certain conditions. As we all know, most gardeners use manual methods for their traditional irrigation but this system is inefficient and because, the water is irrigated directly in the soil, grow- plants experience high stress from variations in soil moisture, therefore plant appearance is poor.

Plants will either die if the water supply is not sufficient for the plants or vice versa. In their daily activities many people often forget to water their plants and thus it becomes challenging for them to keep their plants healthy and alive. Also it is a challenge for gardeners to maintain their plants and manage the watering of plants during water shortages.

To maintain the situation and overcome the problem, “Indoor Gardening Irrigation System” is used. This will not require manpower and time if using an automatic watering method instead of manual. Less Irrigation previously did not include any kind of data about temperature & soil moisture to the plant. Sensors such as temperature sensors and soil moisture detectors are used to control temperature, soil moisture and watering in the gardens.

This system also has the capacity to monitor the condition of the garden remotely from a Smartphone by using an IoT module. Information will be sent using wifi and data will be displayed using in telegram and LCD. So users will know the state of their garden anywhere.

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III. PROJECT OBJECTIVES

- Monitor soil moisture and environmental conditions using a Soil Moisture Sensor and a DHT11 sensor.
- Control a DC pump motor to automate plant watering based on sensor readings.
- Send sensor updates and pump status to the user via the Telegram app for remote monitoring.
- Provide real-time data display through an LCD screen.

IV. PROJECT SCOPE

This project operates automatically when it is turned on. To carry out its operation, this project uses Esp 8266 Nod MCU as a control unit that controls and works to give water to the plants, by using soil moisture sensor, when the soil moisture is not sufficient according to the specifications that have been set, then the water from the DC pump will open to flow water to the plants. Next DHT 11 sensors will work to detect temperature & humidity, if the weather temperature exceeds 35.20°C, and then water will be given. In addition, each measured data will be displayed on the LCD and in telegram.

V. PROJECT RESULTS

1. Automatic Watering Based on Plant Needs:

The system will detect soil moisture levels and activate the pump only when necessary, preventing overwatering or underwatering.

2. Optimized Water Usage:

Water will be used efficiently, reducing waste and conserving resources through intelligent sensor-based control.

3. Remote Monitoring via Telegram:

Users will receive real-time notifications of temperature, humidity, and soil moisture status through the Telegram app.

4. Healthy Plant Growth:

Consistent and timely watering will maintain optimal soil moisture conditions, promoting better plant health and growth.

5. Reduced Manual Effort:

The automated system will save time and labor by eliminating the need for manual watering.

6. Integration of Smart Sensors:

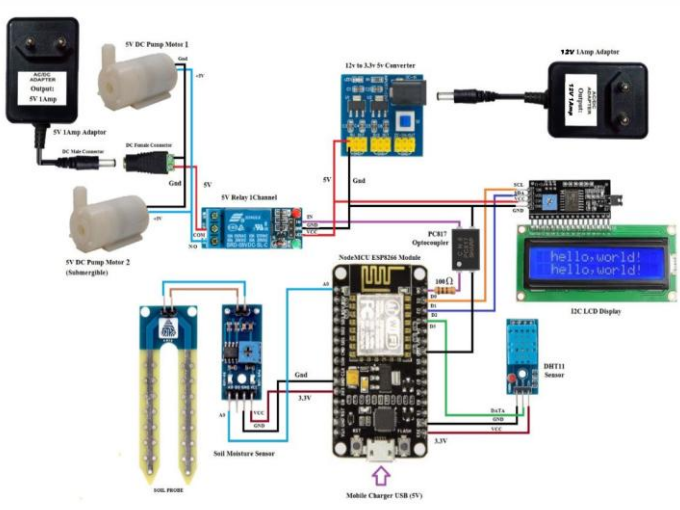
The use of DHT11 and soil moisture sensors will ensure accurate environmental monitoring.

7. Demonstration of Smart Agriculture Technology:

The project will serve as a model for applying IoT and automation in indoor gardening, supporting sustainability.

VI. ELECTRICAL/ELECTRONIC CIRCUIT CONNECTION

The Automated Watering Plant System uses the Arduino Uno, a basic microcontroller board without Wi-Fi capability, making it suitable for offline and standalone operations. In contrast, the Indoor Gardening Irrigation System is powered by the ESP8266 NodeMCU, which has built-in Wi-Fi, allowing it to connect to the internet and interact with cloud services for remote monitoring and control. Sensor-wise, the Automated Watering Plant System does not include a DHT22 sensor, which is typically used for temperature and humidity measurements. On the other hand, the Indoor Gardening Irrigation System utilizes a DHT11 sensor, a simpler and cost-effective alternative to the DHT22, to collect environmental data like temperature and humidity.



Regarding output display, the Automated Watering Plant System only relies on an LCD to show sensor values locally. In comparison, the Indoor Gardening Irrigation System displays information via both LCD and Telegram, leveraging the internet connectivity of the ESP8266 for remote monitoring capabilities.

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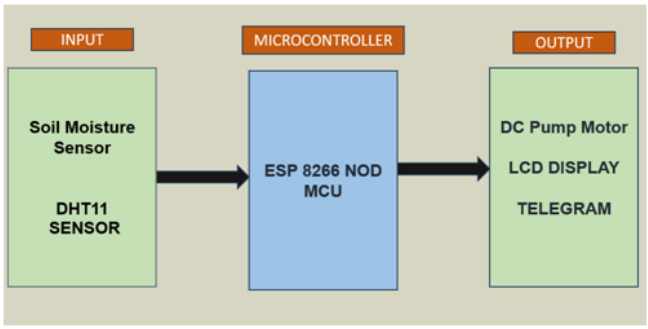
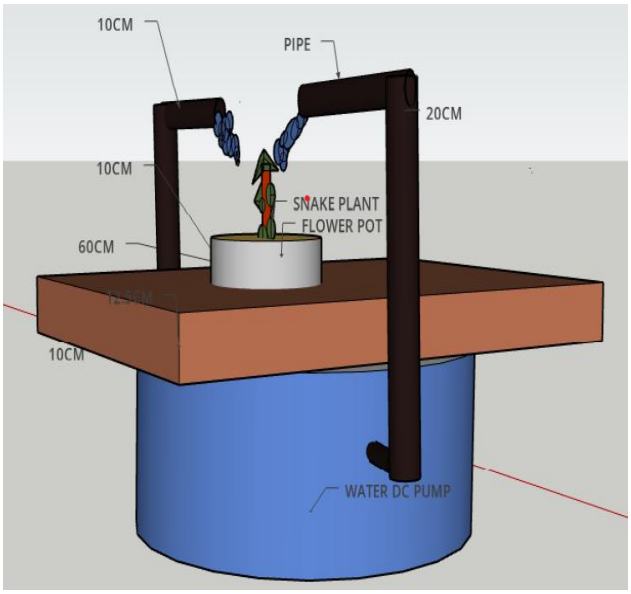
Block Diagram

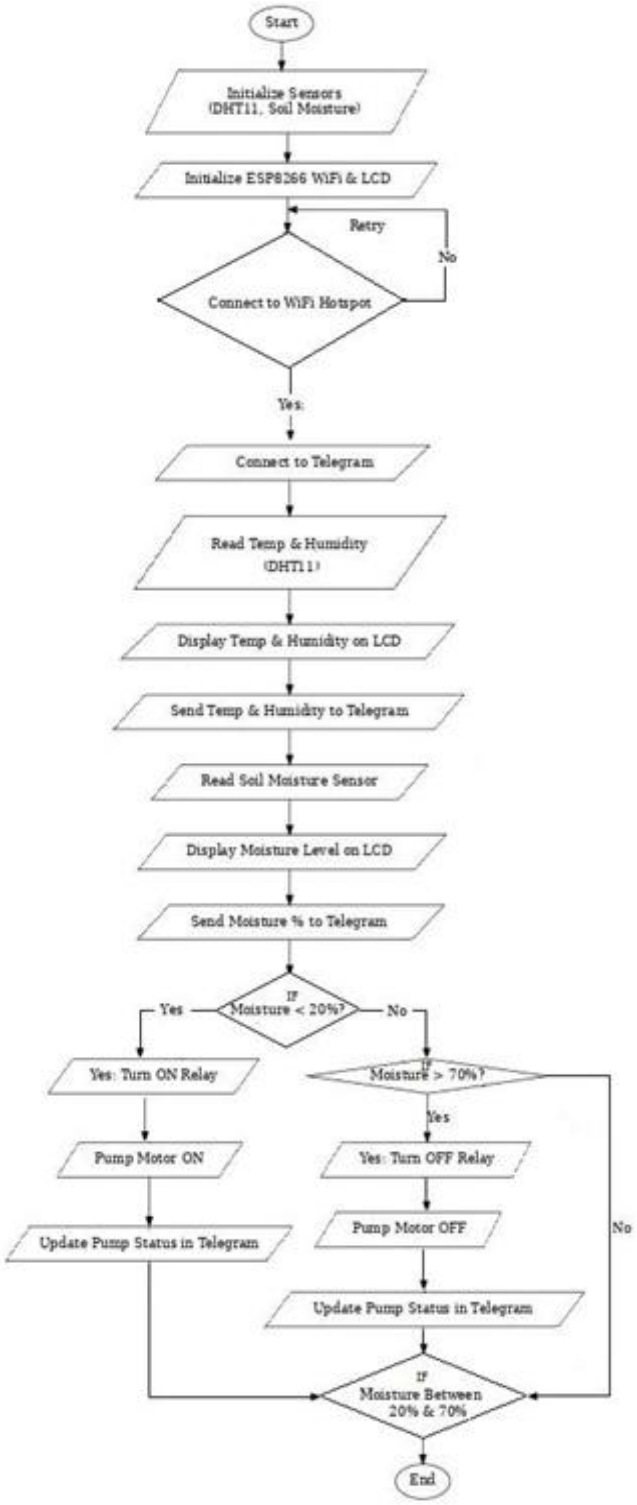


This diagram illustrates a basic automated irrigation system that utilizes sensors and a microcontroller. Input Section Soil Moisture Sensor (DHT11 Sensor): This sensor measures the moisture level in the soil. It helps in determining whether the soil is dry or adequately moist for plant growth. Microcontroller Section ESP 8266 NOD MCU: This is the microcontroller unit that processes the information received from the soil moisture sensor. It is capable of controlling other components based on the data it processes. Output Section DC Pump Motor: This component is activated to water the plants when the soil moisture levels are low.LCD Display: This display shows real-time data about soil moisture levels, providing visual feedback to the user. Telegram: This indicates that the system can communicate with a messaging platform (like Telegram) to send notifications or alerts regarding the soil moisture status. This automated system helps in efficient irrigation management, ensuring plants receive the right amount of water based on soil conditions.

3D Design of Proposed System



Flowchart



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VII. RESULTS

Prototype Hardware of Watering System

Prototype Hardware of Control Unit

- When the soil moisture is dry, the pump motor automatically turns ON.
- When the soil moisture reaches a sufficient level (e.g., 89%), the pump motor turns OFF.
- The system sends real-time updates to the Telegram app, showing
- Temperature, Humidity, Soil Moisture status

VIII. CONCLUSION

The "Indoor Gardening Irrigation System" is an innovative solution designed to automate plant watering using IoT technology. By integrating sensors, a microcontroller, and a mobile application, the system ensures optimal moisture levels for indoor plants while reducing water waste and manual effort. The project successfully demonstrates how automation can simplify plant care, making it more efficient and reliable.

One of the key achievements of this system is its ability to monitor soil moisture in real-time using a soil moisture sensor. When the moisture level drops below a set threshold, the system activates a DC water pump to irrigate the plants, stopping once the soil reaches the desired moisture level. This prevents both underwatering and overwatering, promoting healthier plant growth. Additionally, the inclusion of a DHT11 sensor allows the system to track temperature and humidity, providing users with a complete environmental overview.

The use of the ESP8266 NodeMCU microcontroller enables IoT connectivity, allowing the system to send real-time data and alerts to users via the Telegram app. This remote monitoring feature ensures that users can check plant conditions and system status from anywhere, enhancing convenience and responsiveness. The system also includes an LCD display for local feedback, making it accessible even without an internet connection.

From a practical standpoint, the project's modular design, featuring PVC pipes for water delivery and an enclosure for electronics, ensures durability and ease of maintenance. The system is scalable and can be adapted for larger setups or different plant types with minimal modifications. In conclusion, the "Indoor Gardening Irrigation System" effectively addresses common challenges in plant care by combining automation, IoT, and smart monitoring. It offers a reliable, water-efficient, and user-friendly solution for indoor gardening, making it a valuable tool for both hobbyists and small-scale agricultural applications. The project not only meets its objectives but also lays the groundwork for further advancements in smart irrigation technology.

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