IOT Intelligent Watering Sensor For Indoor Plant

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Summary
The number of people who own indoor plants is growing today, but as a result of their busy lifestyles—such as work or travel—as well as a lack of enthusiasm in caring for their plants, their plants wither. The use of an irrigation control system with a surveillance camera can assist such folks in taking care of their plants. Such a device can assist in remotely watering plants at predetermined times and checking on the health of the plants. The proprietors would be able to live comfortably without feeling bad thanks to this change. Internet access is required for this technology in order to monitor the plants and control the watering through apps. A sensor is installed in the soil to monitor soil humidity and send data to the microcontroller for irrigation, allowing the owner to schedule irrigation as they see fit and keep an eye on their plants all day. With the use of a remote irrigation control system, the plants will grow properly and be irrigated with the proper amount of water, and the owners will be so glad and delighted to watch their plants. Knowing the time and quantity of water are vital parts of the plant growth.
***Keywords**:*
Indoor plants, monitor, soil humidity, remote irrigation.

1. Introduction

During the past decades, hundreds of medical studies have been conducted on the relationship between human health and house plants, and the results of many of them found that they have multiple health benefits from the physical and psychological aspects, when caring for these house plants in a correct manner. [1] Automated irrigation systems are quickly gaining acceptance as necessities in the modern world [2]. People no longer have the time or resources to manually water their plants, whether they are in little gardens or vast farms, because they are too busy or have other commitments outside of work [2]. Automated, remote-controlled irrigation systems with the capacity to make wise decisions can lower costs and boost irrigation efficiency [3]. Remote and intelligent irrigation are made possible by the Internet of Things (IoT), which arranges agricultural objects to produce the required monitoring media [4]. As in other areas of our society, IoT systems are now crucial to precision agriculture [5][6]. the plants and Helps people with special need to watch their plants. However, there are some issues with plant acquisition, such as plant wilt due to forgetting to water the plant due to travel or work. But if we decide to take a long trip or move elsewhere, can we take care of watering our plants and monitor them from a distance without disturbing our neighbors? Without it you wither and perish? In our study, a smart watering system that uses the Internet of Things to monitor plants in the home garden was proposed.

2. Literature Review

In study [7], In a nation like India, where agriculture is the main source of income and the climate is isotropic, agricultural resources are still underutilized. Unplanned water use, which wastes a large amount of water, is another significant factor. The use of an Arduino board, a water pump, and a soil moisture sensor has been made. The Arduino IDE is used for programming. The soil's moisture content and temperature are detected by the humidity and temperature sensor. Water is provided to the plant by the motor/water pump. This clever irrigation system gives plants more time to get watered and creates the best circumstances for growth. According to studies, this automatic irrigation system uses 40–50% less water than a conventional system and is easy to use. It was created by fusing the features of all the employed hardware components. As a result, the autonomous plant watering system has been successfully constructed and tested. It has been verified that the mechanism operates automatically. For Internet of Things (IoT) smart irrigation systems, the researchers. In [8] Designing a watering system for the plant's health is the paper's main objective. On an Adafruit cloud website, an IOT platform, sensor data will be graphically represented. Thus, the technology irrigates the plants while conserving water and minimizing the need for ongoing human supervision. The project in [9] involves creating an automated mechanism to control water level. A system for automatically watering plants has been proposed According [10], to ensure that the plants receive water when the soil moisture is below a threshold value and sunlight is present. The system also has features that prevent overwatering by measuring the height of the water level, maintains a constant water supply so that the plants never

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become dry, and alerts the owner via a specific message when there is a leak in the water supply or a shortage of water in the main water source. According [11], the researchers proposed a straightforward automated method of plant irrigation control system with GSM notification in an effort to improve the manual method of water irrigation process to the automated one and promote opportunities for capacity building. In this design, the soil moisture sensor senses the percentage of water in the soil and updates the percentage if it goes below the threshold value for that particular crop/plant to the microcontroller unit for the start of the watering and updates to the owner via SMS. The Arduino is the main control of the system that coordinates the control to other system components. The Atmega328p and ESP-01 Wi-Fi module are used to construct an autonomous plant watering system, as shown According [12]. The document describes how the pump is turned on and how the relay circuit operates. The system devised According [13], operates on the tenet that the soil moisture level is measured using sensor technology, which controls the water pump via microcontroller to supply the plant with adequate water as needed. The researchers created an automatic plant watering system in the paper research [14]. The moisture sensors gauge the various plants' moisture content (or moisture level). The moisture sensor alerts the microcontroller if the moisture level is below the acceptable level, which causes the water pump to switch on and feed the appropriate plant with water. The mechanism automatically stops when the target moisture level is attained, and the water pump is shut off. Using an air or ground-based humidity sensor, an automated plants watering system for small gardens at homes is described in paper research [15]. A prototype for an autonomous plant watering system has been developed by the researchers in [16] taking into account everything from small gardens to vast agriculture fields. The Arduino UNO, soil moisture sensor, water level sensor, water pump, and GSM module are the project's primary components. According to [17], study results on the design of an IoT-based automatic plant sprinkler system with the aid of a solar-based electrical power supply were produced using the waterfall approach with methodical stages. With the use of an inverter, solar panels have successfully produced 220V AC electricity, which can be utilized to power the controllers for IoT devices. A copper plate sensor acting as an electrode is used in [18] to measure soil resistance, which is then transformed into analog voltage and subsequently into digital data so that the Arduino Uno microcontroller can process it. The system described in [19] offers information for both the soil's relative humidity and the temperature of the atmosphere. The researchers have described an autonomous system that aids in watering indoor potted plants that are organized along a predetermined pattern in their research paper [20]. The mobile robot is capable of three key tasks: detecting the need for watering in plants, finding them, and ultimately watering the plants on its own without the assistance of a person. According to [21], have created an IoT gadget that can water plants automatically whenever the moisture content in the pot falls below a predetermined level. The proposed system in [22] was constructed so that it continuously checks the soil moisture content. If there is enough water in the above water tank, the system responds appropriately when the soil moisture level is low by watering the soil with the exact amount needed, and when the required level of soil moisture is reached, it turns off the water supply. The research study [23] has put out the concept of a smart sprinkler system that combines automation and human involvement. The sprinkler system turns on automatically if the moisture content falls below a certain threshold. If rain is predicted in the coming days, watering the plants may need to wait a few days, according to weather data. This technology saves time and effort in maintaining houseplants and improves the self-confidence of homeowners in maintaining houseplants from any remote location they can monitor. The system will help people monitor the houseplant freely and know the condition of the plant. The systems reviewed above have increased our knowledge and awareness of the most important features and characteristics that must be taken into account in the irrigation system we have proposed, such as attractive design and variety of offerings. Like monitoring the plant all day long. The systems reviewed have many features, but they also come with limitations. Some of the most common limitations are: Many of these systems do not support the Arabic language, in contrast, the irrigation system provides all of these features.

3. Problem Statement

Some people like to own indoor plants and take care of them; however, they cannot look after their plants due to their busy lifestyles. Extreme thirst leads to cutting the root if the soil is clay cohesive. Excessive thirst also causes the plant to lose its ability to carry out the vital processes necessary for its continuation of its life. It gradually withers and dies when thirst arrives for a long time. Furthermore, some people have a problem with the irrigation process, as they water the plants excessively. The continuous heavy irrigation leads to suffocation of the roots and their inability to breathe, and thus their death. Also, constantly moist soil encourages the growth of soil fungi. Therefore, the ultimate goal of this project is to introduce Intelligent watering sensor for indoor plants by using IOT with the ability to monitor plants, it designs to control plant watering and watch plants remotely, for a remote plant irrigation and monitor system, the moisture level sensor is connected to the plant soil and when the sensor reading is lower than the pre-set value, you will be notified and you can see your plant through the camera. To irrigate the plant from a distance. We can also specify the time period for irrigation by scheduling irrigation, example (4 times a week).

Main Objectives:

This research project's major goal is to:

- Create an automated irrigation system.
- Offer a range of irrigation control choices.
- Offer a camera for monitoring the plant.
- Make it easier for the owner to water plants.
- Establishing a WIFI connection between the sensor and the camera application.
- Ensure the plant's longevity and health.
- Maintain a clean environment.
- Soothe the plant owner, watch the plants flourish, and let them live their lives free of obligations to the plants.
- Assists those with special needs in keeping an eye on their plants.

4. System Development

4.1 System Design:

The system design model will help us to decide the hardware, software, and understands the functional requirements for the system by implementing them in the model. Figure (1) shows the system design model , (1) show us that the plants is dry and need water , (2,3) A notification will be sent to your mobile to alert you that the plant is dry and needs watering , (4) open the Blynk app , pic(5) The main interface of the program will appear showing you the percentage of soil moisture and irrigation methods (watering now , Automatic , schedule) , (5.1) shows you when you choose the watering now option and the soil moisture will increase , (5.2) when you choose the Automatic option the plant will be irrigated until the soil moisture increase then stop , (5.2.1) the schedule option include (days , start , stop) Determine the day and time to start and stop watering that is good for you , (6) a happy plant , (7,8) you will receive a thank you notification from your plant told you that you are the best owner.

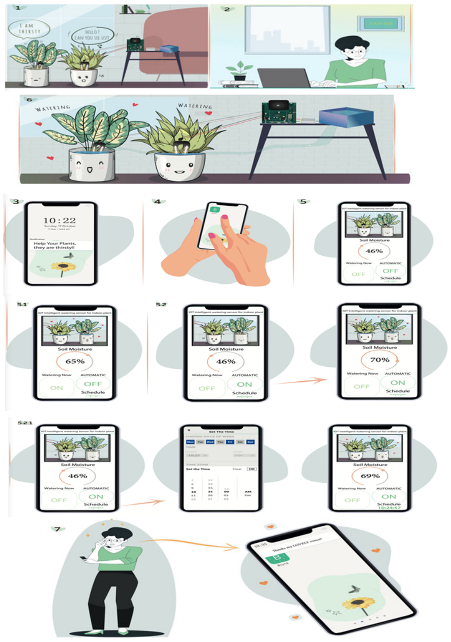

Figure 1: System Design

4.2 User Interface:

As shown in figure (1) shows the initial design for the application. This Application allows you to monitor the plant and send you a notification about your plant soil condition as shown in figure (1). This frame is about the options you can choose as (Watering Now, Automatic) as figure (2), Figure (2) Shows the schedule part if you chose Auto schedule, you can choose the period time for which you want to irrigate automatically without needing your intervention the time (from - to) and the days.

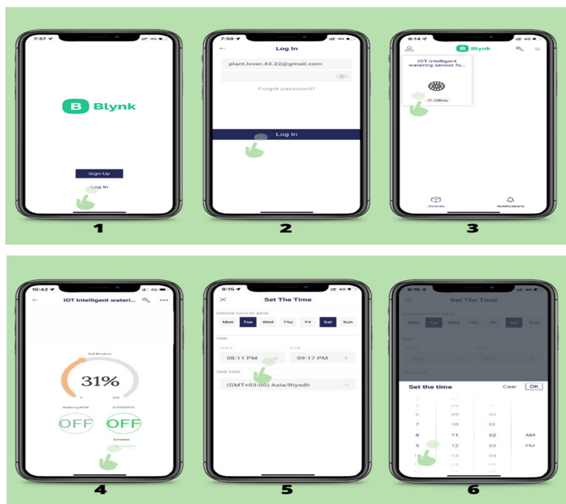

Figure 2: Application Frames

4.3 Simulation:

Proteus has been employed. Proteus Virtual System Modelling is a technology used in programs for simulating electronic systems that incorporates a number of software technologies. In order to simplify a later stage of simulation of electronic systems based on microcontrollers, it combines SPICE systems for simulating circuits and electronic elements (illustrating them in the form of animated gifs for ease of handling and accuracy) with microprocessor models. As a precursor to practical applications of its circuit diagrams, it was the first tool to build testing and simulation procedures for these systems. The Arduino receives the reading from the sensor and uses that value as the foundation for operating the pump. A motor equivalent to the pump was linked to the Arduino pin on the ground, and the sensor was connected to the analog input on the Arduino. Two LEDs were installed, the first representing that the soil does not require watering and the other indicating that the soil is dry and needs watering. I selected a value for the sensor's variable resistance in order to determine whether or not the soil is damp, as illustrated in figure (3). [24] A new and connected to a custom Pin for Serial Monitor with Arduino. Tables, Figures and Equations

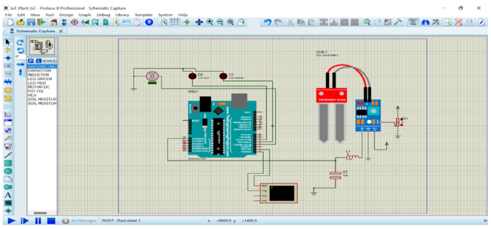

Figure 3: simulation

4.3.1 When the soil dry:

The LED displaying the soil's dryness illuminates if the sensor reading is less than 500, indicating that the soil is dry, and the pump activates to water the soil as shown in figure (4).

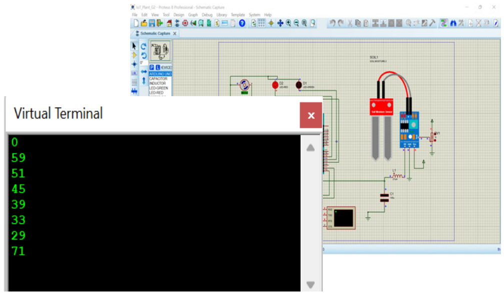

Figure4: when the soil dry

4.3.2 When the soil wet:

Every 100 delays, the sensor reading operation will be repeated. As shown in Figure (5), the engine is shut down once the sensor reading of the soil is activated once more to determine whether the humidity level has increased.

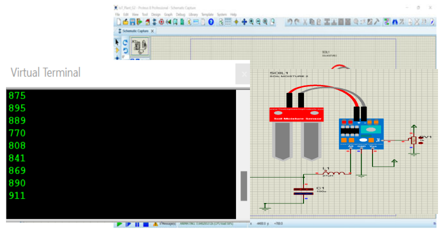

Figure 5: when the soil wet

4.3.3 Practical application:

The data from the soil moisture sensor was read by the ESP8266 microcontroller, which was then transferred via the internet and recorded by Ask Sensor. Ask Sensor will record the soil moisture value in real time as long as the irrigation system is connected to the internet.

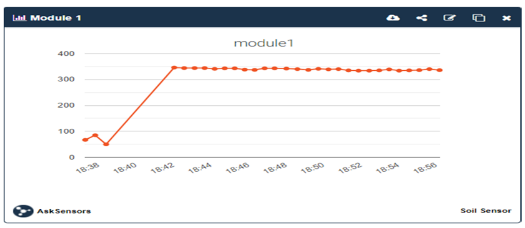

Figure6: The graphical representation on the Ask Sensor

The graphical representation on the Ask Sensor based on real-time detection is shown in Figure (6). The intensity levels continuously detected by the soil moisture sensor were represented by the orange dots in the graph.
A simple formula may be used to compute the average value of soil moisture, as illustrated below.

$$S = \frac{F}{T} x\ 100\% \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (1)$$

The entire sum of the final value of soil moisture (F) divided by the number of tests (T) is then multiplied by 100 percent to get the average value of soil moisture (S). The formula (1) may be used to determine the average final value of soil moisture or the average of increment values of soil moisture [25].

5. Implementation and Results

According to figures [7][8], when the sensor level hits 1024, it indicates that the soil is dry (10). The moist percentage rises together with the amount of water until it reaches the final amount of water. In this instance, as indicated in figure, the wet percentage approaches 92%. (11). Knowing this, the equation above is used to calculate the moist percentage. [26].

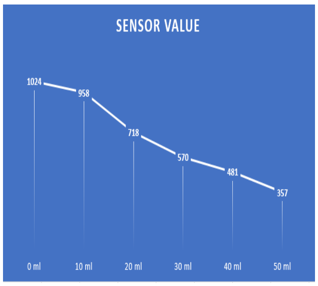

Figure 7: sensor level reaches the value of 1024

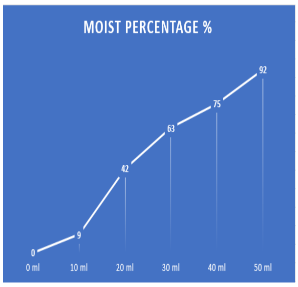

Figure8: The moist percentage reaches 92%

The results of the watering device are shown in the table [1] below, A soil moisture sensor, relay, ESP8366, irrigation hose, and solenoid valve make up this gadget. The test parameter depends on the detection outcomes from the soil moisture sensor. is set between 30% and 35%, which is the most popular range. If the sensor's detected level is between this range, it is a sign that the soil is in the dry level. Which means the plants are in need for water, therefore the relay state is ON and the solenoid valve is aroused and enables the watering pipe open in order to duct the water to the plants.

Table 1: Watering device's outcomes

Irrigation function test.	Soil moisture detection value	Esp8366	Relay	Solenoid Valve	Watering Pipe	Test Results
1	30 % - 35 %	On	On	open	Draining water	positive
2	Above 30%	On	Off	close	Not	positive

5.1 The soil moisture is tested by the Ask Sensor:

Ask Sensor conducts a test on the soil moisture in order to produce the findings of the observed and detected soil moisture. The five successive experiments used various 250 ml cups. After placing a certain amount of dirt in each cup, 150 ml of water was added to each one. The unique procedure that is being used tries to assess the soil's moisture level. [27] Additionally, the initial special treatment is expanded upon with the soil moisture value's top priority set to 0%. The following table displays the results.

Table 2:Result

Testing the soil moisture with initial soil	percentage of the soil moisture at the beginning		The percentage of soil moisture at the end	Increase in the moisture value (%)
1	0%		50%	50%
2	0%		66%	66%
3	0%		63%	63%
4	0%		65%	65%
5	0%		58%	58%

5.2 The Blynk interface when soil moisture in wet case:

After logging in into our Blynk, the soil's moisture was smaller than the average, which means the soil is wet as shown in figure (9).

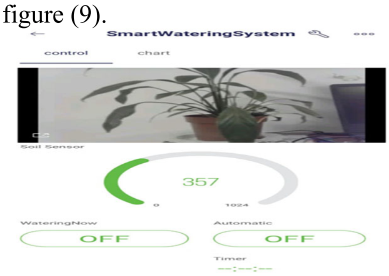

Figure 9: Blynk interface when soil moisture in wet case

In figure (10) and (11), we have a watering schedule. It indicates the times of providing the plant with the water it needs, including daily, weekly, and monthly variations. The green color on web chart indicates that the soil doesn't need water.

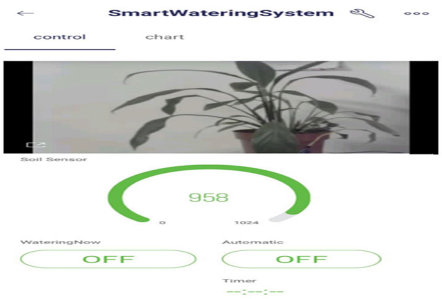

Figure 10: Blynk interface when soil moisture in dry case

5.3 The Blynk interface in a dry case with soil moisture:

The soil is dry since the value in figure (11) is higher than the norm. The first button in the diagram below irrigates the plant manually, the second one irrigates the plant automatically, and the final one schedules irrigation.

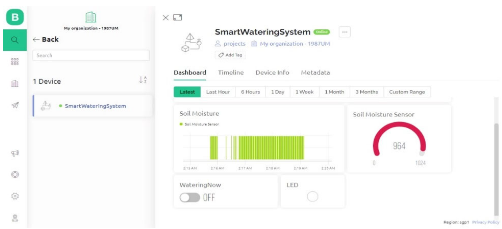

Figure 11: Chart on website (dry case)

The red color on web chart in figure (11) indicates that the soil needs to be watered.

6. Conclusions

In this paper, we proposed a remote automatic viewing system which is a suitable irrigation technique targeting plants in the home garden. The Blynk platform has been chosen for our system in this research report. The camera of this system is securely attached using Ngrok. It's useful to monitor the plant from a distance using Blynk and any website, provided we only use it for testing and not for anything permanent. Taking advantage of our technology, we have increased the happiness and confidence of plant owners and contributed to the preservation, monitoring and watering of home seedlings from a distance.

7. Future Works

As a research team we look forward to expanding the system to include:
• A website that combines the sensor and the camera together.
• The work of a system to monitor the growth and health status of the plant.
• Build a plant watering system inside the plant pot so that it contains this integrated system when purchasing the pot with instructions on how to use it.
A program that monitors the percentage of internal fertilization in plants for those who like home gardening in small gardens and those who like to eat healthy to grow and monitor their food in an organic way.

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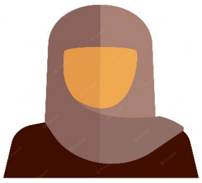

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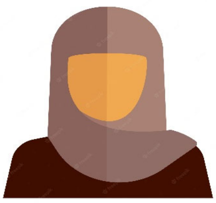

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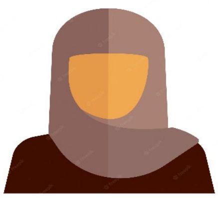

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