Smart Plant Irrigation with Blynk Server: Wireless Control

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***Abstract*—Smart homes have gained a good reputation among people because of their advantages regarding time management, convenience and costs. Through this study it is analysed how and when a household plant should be watered in an automated manner. A project was developed in this case, using Blynk server, which is a Internet of Things platform. Its purpose is to minimise human intervention on the watering part of the plant and to offer only precise amount of water at a needed time.**

***Index Terms*—Internet of Things (IoT), Irrigation, NodeMCU (ESP8266), Soil Moisture Sensor, Water Pump, Blynk Server, Service Set Identifier (SSID), User Interface (UI)**

I. Introduction

These days, many of use are in the search of making their lives easier by automating and minimizing the work that has to be done around them. The household activities are no exception, some of them taking valuable time from the people's lives. These monotone and easy task can be assigned to automated systems, like an Automated Plant Irrigation System using Blynk Server Application, which come in handy for people.

This project uses multiple hardware components, alongside the software needed to program them. The first and the most important one is the brain of the project, a esp8266 micro-controller with Wi-Fi integrated that receives instructions from Arduino IDE. To make the connections between the board, breadboard, moisture sensor, relay and water pump, the schematics can be followed. The soil moisture sensor measures the humidity at the plant's roots and sends the information to the board. Then it sends a signal to the water pump via the relay if the values exceeds a predefined limit, which is powered by a 9V battery [6].

Water is one of the most essential components of plant growth. The amount of water determines the plant's growth rate and life span. Too much or too little water will stifle its growth [1]. When soil moisture levels exceed a predefined limit, indicating the need for watering, the micro-controller activates the water pump via the relay. This process is powered by a 9V battery, providing autonomy to the system even in the absence of continuous power sources.

This project addresses a common concern among some people, which is maintaining indoor plants' health and vitality when they are not around. By automating the watering process based on real-time soil moisture data, the system ensures that plants receive the necessary hydration, reducing the risk of wilting or drying out.

Overwatering is a prevalent problem among home gardeners. Adding too much water to the soil might cause root rot. Water left on a plant's leaves can also lead to mould growth. When the soil at the base of your plants is excessively damp, the roots will have difficulties receiving the oxygen they require to survive. In contrast, too little water prevents plants from absorbing nutrients. Roots may become brittle and damaged, sometimes to the point of no return. To manage the right amount of water needed is done by understand your plant, climate, soil, and terrain. All of these factors influence the amount of water your plants require [5].

Significant attempts have recently been made to link IoT and cloud computing [3], [4], which shown that merging IoT with cloud computing can boost its benefits.

Furthermore, integrating the Blynk server into this automated plant care system allows homeowners to remotely monitor and control the watering process via a mobile or web application. This capability provides peace of mind, allowing homeowners to oversee their plants' well-being and adjust watering schedules as needed, regardless of their physical location.

In summary, the Automated Plant Irrigation System with Blynk Server Application offers a convenient and effective solution for managing household plants automatically.

II. Components Used

A. ESP8266 (NodeMCU V3)

The board used to control the system is NodeMCU 0.9, based on the ESP8266 micro-controller. It has Wi-Fi integrated that facilitates the data transmission through wireless so that a mobile application like Blynk could be used to visualize the state of the system. Among the pins we can find both analogue and digital ones along with multiple 3V and Ground pins [6].

B. Moisture Sensor

The moisture sensor is a capacitive type that works by calculating the dielectric constant of the soil. As the moisture inside the soil rises, the dielectric constant increases too, leading to a change in capacitance. It provides an analog output voltage which is proportional to the soil moisture level but it might need to be calibrated by taking readings from different moisture conditions.

C. Water Pump

For transporting the water from the reservoir to the plant, a DC motor water pump has been used. It can be supplied by a voltage between 6 and 12 V / 600 mA, having a debit between 1.2 and 1.6 liters/minute. Alongside, a 9V battery was attached in order to supply the pump with a decent amount of power.

D. Relay

To control the starting and stopping of the pump by providing, a single channel 5V DC relay module was used that cuts the power when not needed. If the sensor detects a low value of moisture in the soil, the pump turns on for a short period of time.

E. Connection Parts

When connections between devices were needed, a small scale breadboard and connecting wires of various types were used

III. Implementation and Results

As presented in the diagram from the figure below, the soil moisture sensor receives data regarding the water percentage which is then passed to the NodeMCU micro-controller. This sends the information through internet to the Blynk server, where the information can be displayed on computer and mobile device.

For communication, both mobile device and micro-controller should be connected to the same wireless network using the same credentials (SSID and password).

Although the system is automated and made to behave on its own inputs, the user can choose to manually start the water pump from the dedicated mobile Blynk application. This is made through a user interface like the one presented in Fig. 2 by pressing a button that toggles the state of the water pump from ON to OFF. Also, this UI provides the percentage of moisture that is present in real time in the soil through a dedicated gauge. Both button and gauge were added in the web dashboard.

The schema from Fig.3 represents the connection between the hardware components of the system, made with the help of cirkitstudio application [2]. As it can be seen, the sensor connects to the micro-controller via an analogue, voltage common collector (VCC) and ground pins. The relay connects its ground and power pins in the same manner as the sensor, but the signal is transmitted to the digital D3 port from the NodeMCU. The normally open (NO) port connects to the power wire of the pump, while the closed common (C) port is connected to the positive terminal of the battery. The negative terminal is then connected to the other wire of the water pump.

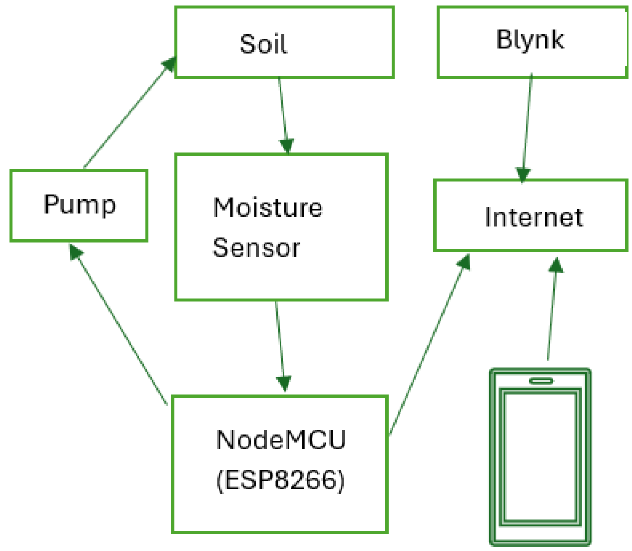

Fig. 1. Functionality Diagram.

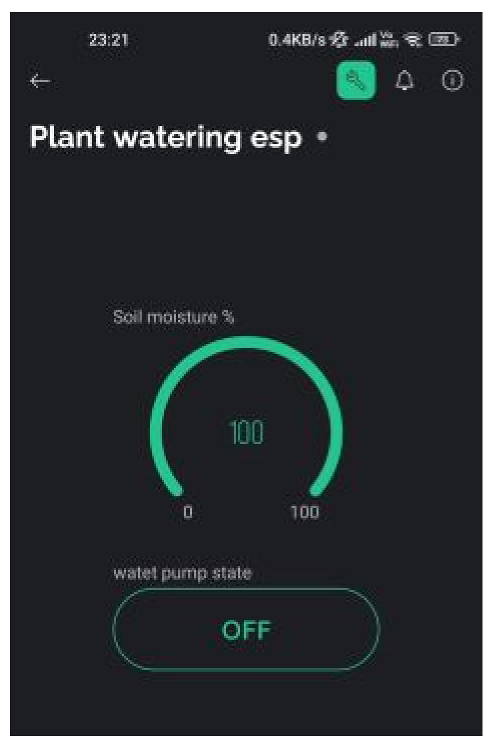

Fig. 2. Blynk mobile user interface.

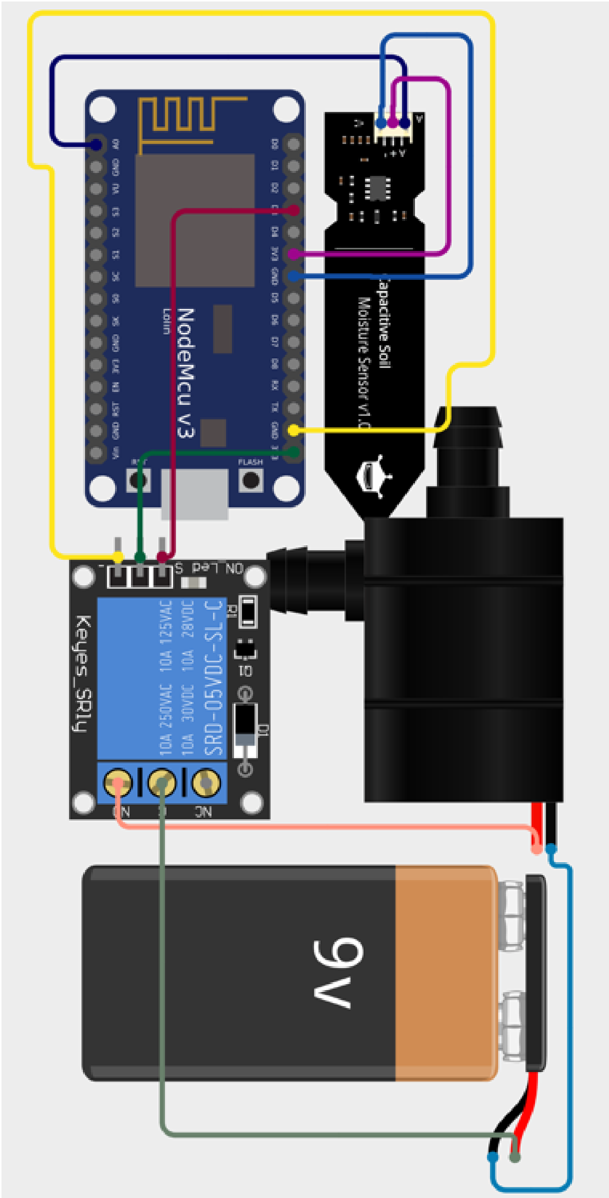

Fig. 3. Connections schema.

IV. Conclusions

In summary, this study presents an Automated Plant Irrigation System utilizing the Blynk server, streamlining household plant management. By integrating components like the NodeMCU, moisture sensor, water pump, and relay, alongside the Blynk platform, it minimizes human intervention while ensuring precise watering based on real-time soil moisture data. This addresses the need for automated solutions to simplify household tasks, particularly in plant care during absences. IoT technology enables remote monitoring and control via mobile or web applications, empowering homeowners to oversee plant health from anywhere. Carefully selected components and cohesive integration ensure efficient operation. Overall, the system offers a convenient, effective solution for automated plant care, enhancing convenience and promoting plant health within a smart home context.

Acknowledgment

The use of AI for generating content on this article was intended to be as small as possible. This was used in the first part of the document, more exactly in the "Introduction" section, for putting together information in two of the paragraphs and also in the "Conclusions" section.

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