

Automatic Plant Watering System

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Abstract— This paper illustrates the implementation of an automatic plant watering system using the Atmega328p and ESP-01 Wi-Fi module. The paper includes the working of the relay circuit and the activation of the pump. The automatic plant watering system is designed to help people in the daily activities of watering plants or lawns which require utmost attention as an appropriate watering pattern is essential to ensure that the plants and the lawn stay green and healthy. Considering the current scenario it has become difficult for people to look after their plants with their hectic schedules as a result there is a strong need to automate this process in order to overcome this challenge. Automatic plant watering system has everything in store which is necessary to provide a garden with the watering action it demands.

Keywords— Plant, automatic, watering, Internet of Things.

1. Introduction

There are several people who have a small garden at home, out of interest or as a hobby, as an ornamental decoration or simply because they find it soothing. Watering plants is considered as one of the most essential cultural practice and the most labor-intensive task while considering efficient maintenance of plant life. However a busy schedule does not allow people to tend to their plants as much as they would like to [1].

Considering the present scenario where there is no one to address the household plants, watering them has become a neglected responsibility. We bring in the automatic plant watering system which reduces the efforts of watering the plants thereby saving your time on a busy day.

Watering the garden, potted plants, shrubs and trees at the right time with the right amount of water is an important aspect in maintaining the health of a plant [2]. Watering systems prove to ease the burden of providing water to plants as and when they require the same [3].

Once the kit is installed water distribution to the required destination is automated thereby removing the human intervention for further operations. The kit is enabled

with a Wi-Fi module which can be controlled through a mobile application running on an Android platform thus overcoming physical barriers. Watering action is under complete control of the user thus optimizing energy requirements.

Automatic Plant watering system offers the right conditions for every situation: sprinkling of lawns or watering flower beds precisely, hedges and pot plants in the balcony — it does all this automatically at your convenience.

The user can control the automatic plant watering module using the mechanical switch available on the module or through a mobile application made using Blynk. Hence the main target of our product would be working individuals, people who frequently travel and are not around to take care of their plants.

The key element behind developing the said system is that through this prototype we can change the perception of how people look at maintaining plants without being worried about leaving them unattended.

2. Objectives

The main objectives of our Automatic Plant Watering System are:

2A. Supplementing Plant life

Our product with its remote application ensures that the user's plants are regularly watered on a day-today basis. This will ensure that plant life is not compromised due to negligence.

2B. Timely Watering of Plants

With a busy schedule people forget to water their plants which can have an adverse effect on plant life [4]. Our product through our mobile application will give the users a daily reminder as to when they should water their plants.

2C. Remote Plant Watering

When people who have a garden at home need to leave town for a few days, they have to ask someone to regularly water their plants or they leave the plants without water for that period. With our automatic plant watering system's mobile application the user can remotely water his plants at the ease of pressing a button.

2D. Maintaining Soil Health

Reduction in runoff from over watering saturated soils which will improve plant life at the same time prove to be instrumental in maintaining soil health [2].

2E. Multi-purpose Usage

The automatic plant watering system along with its pump, module and mobile application does not have its usage limited to watering plants. The product can also be used for applications such as cleaning places which cannot be easily accessed.

3. System Overview

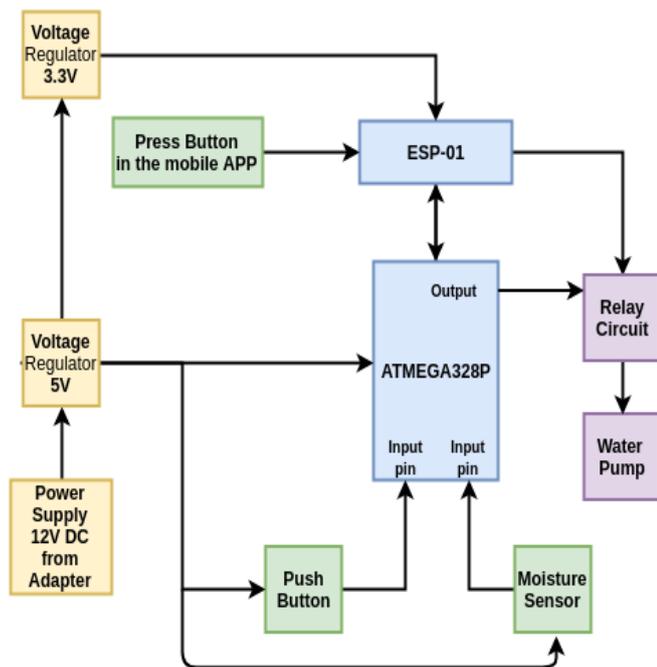


Fig.1 - Block Diagram of the proposed system

Fig.1 Illustrates the basic block diagram of the Automatic Plant Watering System. The main power supply of the module will be obtained from the 12V Adapter and DC Jack. The 12 Volt output from the DC jack is scaled down to 5 Volts with the help of the 7805 voltage regulator because the operating voltage of the Atmega328p is 5 Volts.

Similarly, the Esp8266-01 Wi-Fi module requires a supply of 3.3 Volts. This is obtained from the LM117 which is a 3.3 Volt voltage regulator whose input is from the 7805 regulator.

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The coil of the 12V relay is powered by the DC Jack. The relay circuit involves a transistor and at the base we have given the input through a resistor.

There are 3 ways to switch the relay:

- By the manual push button
- By the button on the mobile application
- When the soil sensor records value above threshold

The moment when the manual push button is pressed, the Atmega sends high output voltage to the relay circuitry and the pump starts drawing water.

Similarly, when the button on the mobile application is pressed, the pump is switched on as the ESP-01 makes its GPIO pin high.

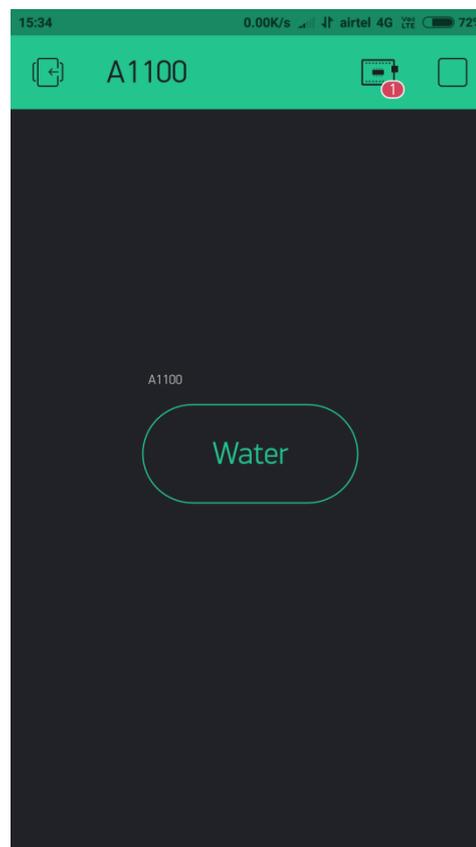


Fig. 2 - Layout of the mobile application (inactive mode)

Fig.2 illustrates the layout of the Blynk application for our automatic plant watering system.

Fig.3 illustrates how the Blynk mobile application appears when the module is activated and water is being pumped.

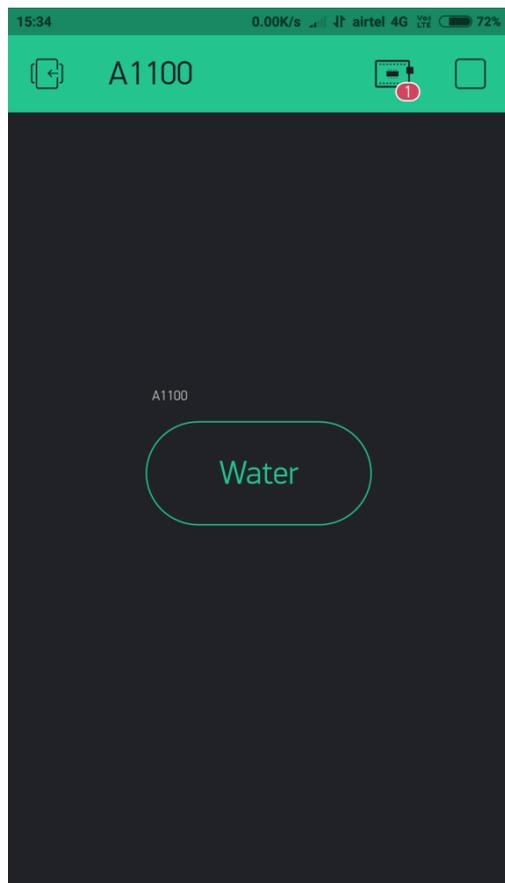


Fig. 3 - Layout of the mobile application (active mode)

4. Circuit Requirements

4A. Atmega328p

The Atmega328p is an 8-bit micro controller having 28 pins. The Atmega328p in this specific application is used to control the water pump through the relay circuit. There also exists serial communication between the Atmega328p and the Esp8266-01 Wi-Fi module.

4B. Esp8266-01

The Esp-01 Wi-Fi module is used in order to control the water pump via a mobile application. Blynk - which is an Internet of Things platform is equipped with a drag and drop mobile application builder for mobile applications. The Esp-01 module generates a high voltage on one of its GPIO0 pin (which is connected to the relay circuit) whenever the 'WATER' button on the mobile application is pressed.

4C. Soil Moisture Sensor

The purpose of the above sensor is to measure volumetric content of water within the soil and provide the moisture content of the soil it is in contact with as its output [5]. The sensor consists of two probes for the purpose of allowing the passage of current in the soil to calculate the resistance

offered by the soil in order to provide the moisture content of the soil as the output.

4D. Relay Circuit

The relay circuit is used to drive the water pump at 12V. A 12V relay is used for the same purpose. The 12V relay is driven with the help of a transistor BC547. When the relay is switched off, the coil of the relay produces high voltage spikes which may cause damage to other components in the remaining circuit. In order to protect the components from damage a diode is used across the relay coil.

5. Software Requirements

5A. EAGLE

EAGLE is a computer application for electronics circuit design. The EAGLE software is used to make the schematic and the PCB layout of the circuit. Routing of the PCB layout was also done with the help of this software.

5B. Arduino IDE

The Arduino IDE is an environment to program the Arduino boards [3]. We have used the Arduino IDE to program the Atmega328p and the Esp8266-01 module.

5C. Blynk

Blynk is an Internet of Things platform which provides drag and drop features for making mobile applications. This platform is used to make the mobile application. The application requires the **ssid** (the network name), password of the network and the authorization token issued by the Blynk platform.

6. Interfacing of Atmega328p and Esp8266-01

Esp8266-01 offers Wi-Fi connectivity to any microcontroller with the help of its TCP/IP Stack. For efficient use of the module, establishing communication between the Atmega328p and the Esp-01 is essential. The first step involves connecting the Esp-01 Wi-Fi module to the internet with the help of AT commands. This is done by establishing serial communication between Atmega328p and the Esp-01 by connecting the Rx (Receiver) pin of the Esp-01 to the Tx (Transmitter) pin of Atmega and similarly, connecting the Tx (Transmitter) pin of the Esp-01 to the Rx (Receiver) pin of Atmega. AT Commands can be broadly categorized into four types namely Test Command, Query Command, Set Command and Execute Command.

7. Working of Soil Sensor

The sensor consists of 4 pins. The Vcc, GND, a analog pin and a digital pin. It works on in the voltage range of 3-5V. We used the analog channel of the sensor for retrieving the moisture content of the soil. The sensor gives its output between 0 and 1023.

When the sensor is kept in dry soil it returns 1023 because the resistance provided by the soil is very high. When the sensor was immersed in water it returned 0 because of zero resistance. The sensor values were converted to percent moisture content. The system continuously checks for the sensor values and convert them to percent moisture content. When the moisture content in the potted plant falls below a predefined value the Atmega328p activates the relay circuit turning on the motor.

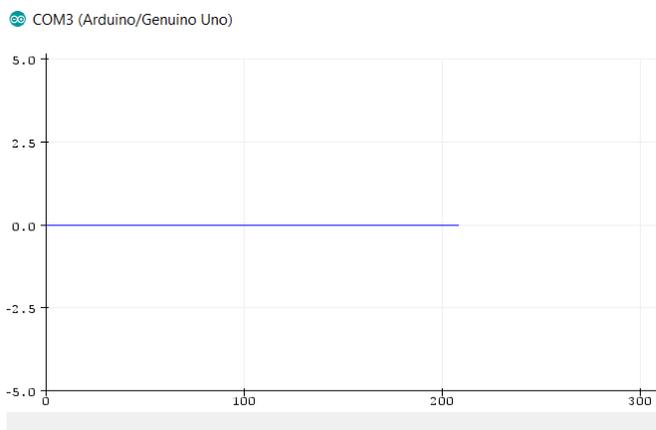


Fig. 4 - Sensor values in dry soil

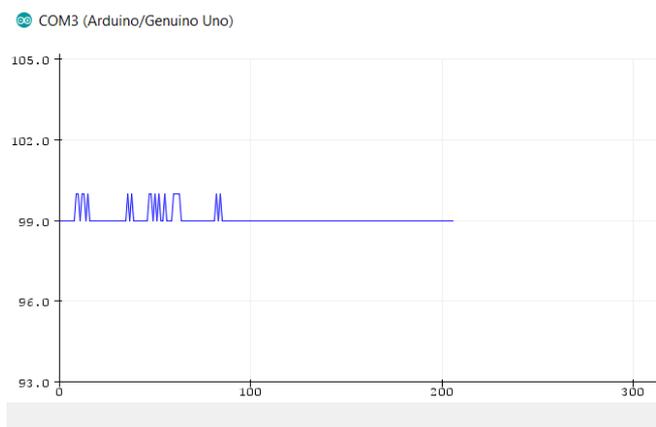


Fig. 5 - Sensor values when in contact with water

Fig. 4 shows the sensor values in dry soil. Fig. 5 shows the sensor values when the sensor is immersed in water.

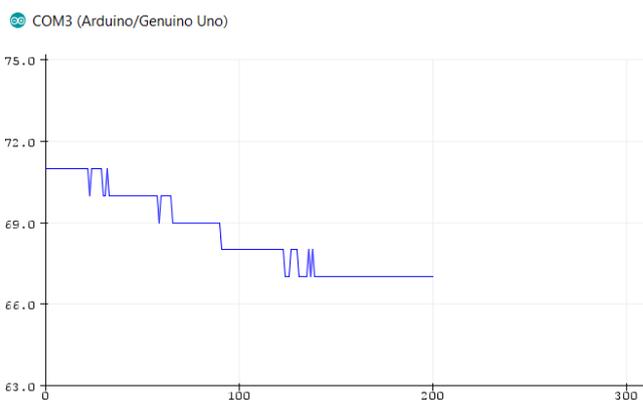


Fig. 6 - Sensor values when in contact with wet soil

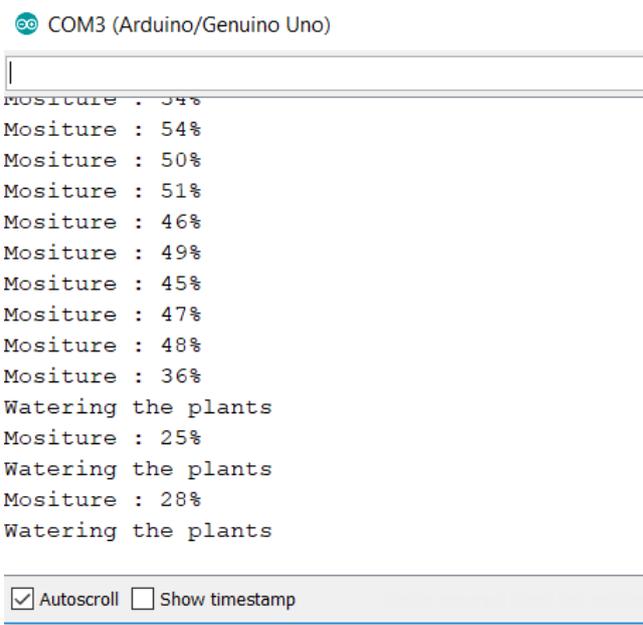


Fig. 5 -Messaging when low moisture content

Fig. 6 shows the sensor values when the sensor is immersed in wet soil.

Fig. 7 shows the sensor values and message to water the plants when moisture content falls below 40% through the Arduino COM port.

8. Applications

The said automatic plant watering system finds its application to ease the human efforts in maintaining domestic household gardens. At a commercial level of application, greenhouses would find it extremely useful as maintaining a regulated supply of water level is instrumental in supplementing plant life. The application of the said system can also be extended to botanical gardens and zoological parks wherein prime focus is to facilitate the interests of horticulture and botanical research. Ornamental garden spaces in commercial buildings or public parks can also implement the said system to embrace its benefits. The applicability of the module can be scaled up for usage at cricket stadiums, football grounds and golf courses for facilitating optimum maintenance schedules

where generally a timer based sprinkler system is used for carrying out the watering action at a set predefined interval of time [6].

9. Conclusions

Most of the scheduling models available for use require a significant number of inputs and unless they are monitored efficiently the system proves to be unreliable. Adding to it further the high end research models which have been developed to suffice the same purpose are either too costly or too sophisticated for full filling the purpose of efficient water delivery schedule. Many aspects of the the stated system can be customized according to the specific application and soft tuned as per the requirements. Considering the current importance and attention given to non-renewable sources of energy the present system could be driven by solar energy thereby making it a more energy efficient system.

10. Future Enhancement

Future scope of improvements may be open to interfacing various types of sensors to monitor plant life and provide appropriate feedback. In order to facilitate the growth of plants provisions can be incorporated to deliver fertilizers in a similar manner with the discharge control completely customized.

Acknowledgement

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