IoT Based Automatic Soil Moisturizer

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***Abstract*: Owing to shortage in accessing clean water for domestic purposes, including irrigation, water is now becoming very valuable for a day. The need for the hour is a mechanism for creating water conversation in order to maximize the use of water. Automation in agricultural systems is also a requirement for maximizing the use of water, reducing the loss of water and applying modern technology to agricultural systems. The soil moisture sensor is a novel system that senses the moisture content of the soil and allows water to be irrigated as per the moisture content of the soil by an acceptable mechanism. This promotes the flow of water to the plants or the stopping of water by using an automatic irrigation system. The system consists of an Arduino module, a micro-controller that activates the water pump and delivers water via the Revolving Platform Sprinkler to plants. For this purpose of pumping water, a motor pump is used. Low power consumption is used by this method. This requires a 2.5 V to 6 V power supply. The soil moisture sensor is inserted into the soil containing the probe to test soil moisture.**

Key words: GSM, pH value, IoT, Soil Moisture

1. INTRODUCTION

The most essential global practice and the most labor-intensive job are the daily operations related to watering the plants. It is very important to monitor the amount of water that enters the plants, regardless of the weather, whether it is too hot and cold or too dry and wet. Therefore, it would be efficient to use an automated plant watering system principle that waters plants when they need it, [1].

The idea of "when and how much to water" concept play a significant role in this project. A notion of plant watering method is adopted to decrease manual operations for the person to watering plant. The system used to continuously track the level of soil moisture and to determine whether or not watering is required and how much water is needed in the soil of the plant. This project can be grouped into subsystems such as; power supply, relays, solenoid valve, Arduino, Soil moisture sensor, [2].

Basically, the device is built and configured in such a way that the soil moisture sensor detects the moisture level of plants at a specific instance of time, if the moisture level of the sensor is lower than the prescribed threshold value that is predefined according to the need for water of the particular plant, then the desired amount of water is supplied until the predefined threshold value is reached. The system records its current state and sends an alert message to the tank about watering plants and adding water. By using Arduino UNO, all of this notification can be achieved, [3].

2. PROBLEM FORMULATION

More productive and positive use of existing water supplies has become critical in recent years, along with global warming. New technologies and ideas for the efficient use of water resources, especially in agriculture, have been developed for many years. Growers uniformly irrigate their own fields, [4].

However, the demand for water, fertilizer and agricultural chemicals for each tree or crop varies according to the age of the plant and the chemical content of the soil. To protect fresh water supplies, it is necessary to determine the demand for water for crops and trees. In this research, a solar-powered, low-cost, remote controlled, real-time irrigation monitoring system prototype was developed to regulate drip irrigation, [5].

Software for the control of irrigation valves and the monitoring of soil water content has been developed. Irrigation control methods (automatic or manual) may be chosen by users. Only the soil's water content was tracked. Nevertheless, it is also possible to expand the designed system by using sensors which measure other characteristics of water or air.

In addition to providing the effective use of fresh water supplies, remote controlled site-specific irrigation scheme avoids moisture stress of trees and salination. This irrigation method also reduces the labour needed for flood irrigation.

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Irrigation is the artificial transfer of water to the land or soil. It is used to encourage the cultivation of agricultural crops, the regeneration of landscapes and the re-vegetation in dry areas of degraded soils and in periods of inadequate rainfall. When a zone comes on, the water flows through the lateral lines and eventually ends up in the heads of the irrigation emitter (drip) or sprinkler. Many sprinklers on the bottom of them have pipe thread inlets that allow them to be connected to a fitting and the pipe. The sprinklers are generally mounted with the top of the head flush with the deck.

3. EXISTING METHOD

Here in this paper, an experimental scale is available in rural areas where an enormous role is performed by the irrigation system using the arm controller and wireless communication. The purpose of this deployment was to demonstrate that an automated irrigation system can be used to optimize/reduce water usage, [6], [7].

It can also be a photovoltaic irrigation device consisting of a solar powered sensor that is the soil humidity sensor and a temperature sensor that is a distributed network positioned under the soil where plant roots are reached, [8], [9] & [10]. The device has a water level sensor to show the existence of

the tank's water level. By programming the verge values of the soil moisture water level that was automated into a microcontroller, a software application was advanced.

4. PROPOSED METHOD

Figure 1 describes the concept of Automatic Soil Moisturizer.

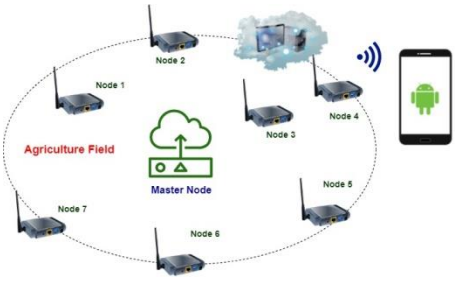


Figure 2 Block diagram of Sensor Node

Figure 2 shows the block diagram of Sensor Node. It consists of Arduino UNO, Soil Moisturizer sensor, Humidity Sensor DHT11, Zigbee module, Rechargeable battery, LCD unit, Relay Module.

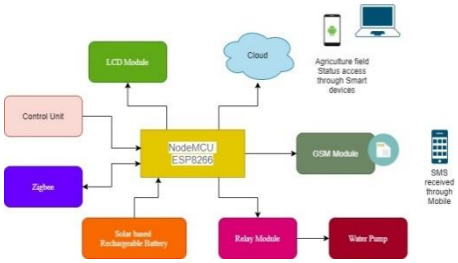


Figure 3 Block diagram of IoT based Master

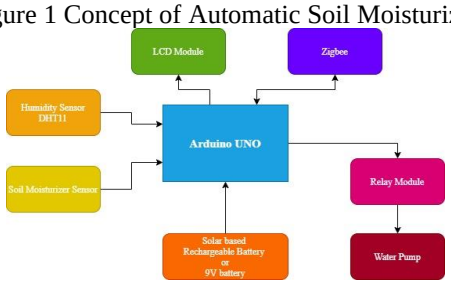
NodeFigure 3 shows the block diagram of IoT based Master Node. It consists of NodeMCU ESP8266, Master Control unit, Zigbee module, GSM Module, Rechargeable battery, LCD unit, Relay Module.

Working

The soil moisture sensor utilizes capacitance to measure the dielectric permittivity of the surrounding medium. In the soil, dielectric permittivity is a function of the water material. A voltage proportional to the dielectric permittivity and, consequently, to the soil water material is produced by the sensor. The soil moisture sensor consists of two probes which are used to measure the volumetric content of water.

The two probes allow the current to move through the soil and then it obtains the resistance value to calculate the moisture value. As there is more water, the soil will conduct more energy, meaning that there will be less resistance. Also, the volume of moisture will be greater. Dry soil absorbs electricity poorly, but when there is less water, there would be more resistance to the soil. Therefore, the moisture level will be lower.

Figure 1 Concept of Automatic Soil Moisturizer



5. Hardware Components NodeMCU ESP8266

Figure 4 NodeMCU ESP8266

NodeMCU is the open source firmware for which board designs are available for open source prototyping. The "NodeMCU" name blends "node" with "MCU" (micro-controller unit). Strictly speaking, the word 'NodeMCU' refers to the firmware rather than the development kits associated with it.

Arduino UNO

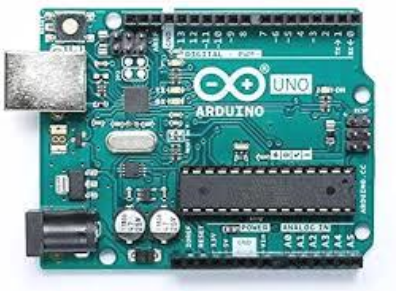


Figure 5 Arduino UNO

The best board to get started with electronics and coding is the Arduino UNO. If the first experience of tinkering with the platform, the UNO is the most stable board that will start playing with. In the entire Arduino family, the UNO is the most commonly used and recorded panel.

The Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 input/output digital pins, 6 analog inputs, a ceramic 16 MHz resonator, a USB connection, a power jack, a reset button and an ICSP header. It includes everything you need to help the microcontroller; just connect it to a device with a USB cable or power it to get started with an AC-to-DC adapter or battery.

Relay

A relay is an electrically powered switch. It consists of a set of input terminals for single or multiple control signals and a set of functioning touch terminals. The switch may have any number of contacts in certain contact forms, such as making contacts, breaking contacts, or combinations thereof.

Relays are used where an independent low-power signal is needed for a circuit to be controlled, or where one signal must be controlled by multiple circuits. In the long-distance telegraph networks, relays were first used as signal repeaters: they reset the signal coming in from one circuit by transmitting it to another circuit. In telephone exchanges and early computers, relays were used to perform logical operations.

Soil Moisture Sensor

Soil humidity sensors measure the volumetric content of water in the soil. Soil moisture sensors indirectly determine the volumetric water content by using certain other soil properties, such as electrical resistance, dielectric constant or neutron interaction, as a proxy for moisture content, since direct gravimetric measurement of free soil moisture requires the sample to be collected, dried and weighed.

The relationship between the measured property and soil moisture is necessary to calibrate and it can vary depending on environmental factors, such as soil type, temperature or electrical conductivity. Reflected microwave radiation is affected by the soil's moisture and is used for remote sensing in hydrology and agriculture.

Portable probe instruments can be used by farmers or gardeners. Soil moisture sensors typically refer to volumetric water content estimation sensors. Another class of sensors measures a different moisture property called water potential in soils; these sensors are generally referred to as soil water potential sensors which include gypsum tensiometers and blocks.

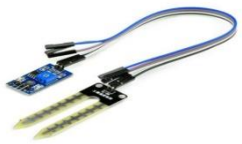


Figure 6 Soil Moisture Sensor

DC motor

The DC motor pumps the water out of the tank and this will lead to the plants being supplied with water. If the plant is properly watered, then the DC motor can stop pumping water. To track the water level of the tank, an ultrasonic sensor is used. A water tank will be installed in order to supply the plants with water.

9 VOLTS BATTERY

The 9-volts battery is a standard battery size that was created for the early transistor radios. With rounded edges and a polarized snap connector at the tip, it has a rectangular prism shape. This form is used commonly in walkie-talkies, clocks and smoke detectors.

The 9-volt battery format is commonly available in primary carbon-zinc and alkaline chemistry, in primary lithium iron disulfide, and in rechargeable form in nickel-cadmium, nickel-metal hydride and lithium-ion. The mercury-oxide batteries in this format, once popular, have not been produced in many years due to their mercury content.

NEDA 1604 and IEC 6F22 (for zinc-carbon) or MN1604 6LR611 are included in the designations for this format (for alkaline). The size is generally referred to as PP3, irrespective of chemistry, a classification originally reserved solely for carbon-zinc, or, in some countries, E or E-block.

Most 9-volt alkaline batteries are built from a wrapper of six individual 1.5 V LR61 cells. These cells are slightly smaller than LR8D425 and can be used for certain devices in their place, even though they are 3.5 mm shorter. In order to avoid drying, carbon-zinc types are manufactured with six flat cells in a stack enclosed in a moisture-resistant wrapper.

The key lithium forms are generated in a three-cell sequence. In 2007, in the United States, 9-volt batteries contributed for 4% of alkaline primary battery sales, and in 2008, 2% of primary battery sales and 2% of secondary battery sales were in Switzerland.

6. CONCLUSION

The Automatic Irrigation System based on soil moisture using Arduino has therefore been developed and tested successfully. It was designed with integrated functionality by integrating all the hardware components used. The existence of each module has been reasoned out and carefully positioned, thereby leading to the best work of the unit. Therefore, the Arduino Based Automatic Plant Watering System has been experimentally designed and tested. The automatic operation of the device has been tested. The humidity sensors measure the humidity level of the different plants (water content).

The moisture sensor sends the signal to the Arduino board, which uses the Rotating Platform/Sprinkler to cause the Water Pump to turn ON and supply the water to the respective plant, if the moisture level goes below the necessary and limited level.

When the target moisture level is reached, the system stops on its own, and the water pump is shut off. Thus, the entire system's design has been extensively checked and it is said to function successfully.

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