



IoT- based automatic plant watering system

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Abstract

A certain amount of water is required for a plant to grow. People forget to water their plants while they are on vacation or forget to water them on a regular basis, resulting in plant damage. Watering plants is one of the most important practises and, in general, a labour-intensive task. Automatic watering systems relieve you of the obligation of watering your plants as necessary. Knowing when and how much to water the plants are the two most important aspects of the watering procedure. In this study, a system is developed that detects the plant's soil moisture content and turns on the motor to irrigate it when necessary. By watering itself, this technique makes the plant more self-sufficient.

Keywords: automatic, plant, IOT, water

Introduction

There is a scarcity of water on the planet. To address this issue, a system that uses water wisely and judiciously is required [3]. There are a variety of plants that are sensitive to water and require a certain amount of it for proper growth, health, and overall development. If the plant's water supply is insufficient, there's a good probability it won't be able to survive any longer and will die or grow insufficiently. It's unlikely that everyone is aware of pertinent facts on plant growth in relation to their water requirements. There is a scarcity of water on the planet. To address this issue, a system that uses water wisely and judiciously is required. There are a variety of plants that are sensitive to water and require a certain amount of it for proper growth, health, and overall development. If the plant's water supply is insufficient, there's a good probability it won't be able to survive any longer and will die or grow insufficiently. It's unlikely that everyone is aware of pertinent facts on plant growth in relation to their water requirements.

Rather than replacing dead grass and plants, we should strive to conserve them and provide them with the best resources available to ensure their survival. Watering is the most important social behaviour in daily activities associated with farming or planting. It is necessary to be able to vary the amount of water that reaches the plants regardless of the climate, whether it is excessively hot and dry or excessively overcast and damp. Watering frameworks that are already available might be successfully employed to water plants as needed.

Regardless, this manual watering technique necessitates the measurement of two critical factors: when to water and how much to water. We created a planned plant watering framework with the purpose of replacing manual exercises and making the work of plant specialists easier. Most plants can attain their maximum potential and save water by

adding an autonomous plant watering framework to a garden or horticulture area. We may create a framework that is ideal for each plant in our yard by combining sprinklers, dribble producers, or a combination of both. It's programmed to detect plant wetness levels at specified times, if the dampness content isn't as high as expected.

When a restriction is set based on a plant's water requirements, the desired amount of water is delivered until it reaches edge 5]. However, with an autonomous plant watering system, the volume and method of water delivery to the plant is considerably more exact and environmentally friendly. To control a watering system, an automatic watering system senses the soil moisture levels. A plant should be irrigated twice a day on average, first in the morning and again in the evening. Many individuals enjoy plants, the benefits they provide, and the feelings that come with caring for them. Nonetheless, many people find it difficult to preserve their health and stay alive. To meet this test, we created a model that allows a plant to become more self-sufficient by hydrating itself. The proposed prototype aims to address difficulties such as regular attention and time management. Apart from that, it aids in water conservation by watering the plant according to its needs on a regular basis. With technological advancements, there will always be a way to make labour easier and reduce hazards. Many problems can be solved with embedded systems and microcontrollers.

Literature Review

Watering the plant is the most important activity in gardening on a day-to-day basis. Regardless of the weather, everyone wants to be able to control the amount of water that gets to the plant. The "Automated Plant Watering System" checks the moisture content of plants twice a day, and if it is below the intended value (which is already set for

each plant), a precise amount of water is delivered until it reaches the desired value ^[3]. An Atmega328p is used to run an automated plant watering system in order to create a model of an agrarian water system. Two sensors are used in this paper: a temperature and soil moisture sensor near the plant's foundation, and a unit that operates the sensors and sends data to the web ^[1].soil. It aids in the creation of green yields, scene maintenance, and the re-vegetation of maddens soils in dry domains and during periods of low rainfall. When a zone is activated, the water flows through parallel lines and eventually reaches the water framework maker (stream) or sprinkler heads.

Pipe string deltas are found on the bottom of several sprinklers, allowing a fitting and pipe to be connected to them ^[7]. A tonne of water can be passed through healthy plants, causing the nursery air to become more wet. A high relative mugginess (more than 80-85 percent) should be avoided since it can increase the occurrence of infection and reduce plant transpiration. Build-up on plant surfaces and the nursery structure can be avoided with adequate venting or progressive warming and venting ^[4]. The use of cooling frameworks during the hotter summer months causes the nursery air to become wet.

Mugginess control inside the nursery can be a challenge during periods of warm and humid open-air circumstances. Nurseries in arid, desert climates benefit greatly from evaporative cooling systems because a large amount of water can be evaporated into the approaching air, causing significant temperature reductions ^[4]. Because relative mugginess alone does not reveal anything about air's outright water retention capacity, a different evaluation is eventually applied to depict the dirt's ultimate dampness situation. The vapour weight deficiency is a measure of the difference between the amount of moisture in the air at any given minute and the amount of moisture it can hold at that temperature when immersed.

"A planned and created plant water system framework has been planned and developed. Higher qualities augment transpiration (although, too high can induce withering), while lower esteems repress transpiration and can cause build-up on leaf and nursery surfaces. The framework's small-scale model performed admirably.

These foundation components are simple to find and use, and they perform admirably. This industry becomes more concentrated and practicable by improving the effectiveness of water systems in rural areas. Similarly, in dry areas with insufficient precipitation, a legitimate water system is not possible. As a result, by applying this water system architecture and analysing the moisture content of the soil, we will be able to meet the field's water requirements. Water and time are the most important considerations for ranchers who want to save time and effort. They must withstand the current conditions until the land is entirely hydrated.

This hinders their ability to conduct a variety of exercises. This concept isn't just for farmers; it can also be used to hydrate plants. Agriculturists are inundating their harvests at the normal interval of time in our current period. They will waste more water as a result of the processes they use, which will cause water logging. We created a structure that will completely eliminate the fear of difficult labour ^[4].

Project Design and Implementation

The following hardware is used in the proposed system:

1. Uno Arduino Board

2. Soil Moisture Sensor
3. Water pump
4. Relay Module No.

Arduino Uno Board

Arduino is an open-source project development platform. It consists of a software, known as an Integrated Development Environment (IDE), that is used to develop code, as well as a circuit board to which the code is transferred from the computer ^[13]. The Arduino Uno board's pins (Figure 1) are used to connect wires in order to build a circuit. The Arduino Uno board may be used to monitor the environment by collecting data from numerous sensors and controlling actuators like as lights, engines, and servos. The Uno board is the first in a series of USB Arduino sheets and the Arduino form's reference exhibit ^[11].

Soil Moisture Sensor:

When controlling the volumetric moisture level of the soil, the soil moisture sensor .Capacitance is used by the Soil Moisture Sensor to determine the moisture content of the soil (done by determining the dielectric permittivity of the soil, which is one of the properties of the water content).Simply place this sensor inside the soil whose moisture content is to be determined to determine the soil moisture content, and the soil moisture content water is reported in percentage ^[2]. A FC 28 soil wetness sensor is used in this project.

Soil dampness sensors are used to determine the amount of water in the soil. The soil dampness sensor is the electrical blockage of the dirt, which was used in the mechanical approach. A plant's health is influenced by a variety of factors, one of the most important of which is the ready availability of moisture in the soil ^[6]. The gypsum square is used to measure soil moisture. We used dampness sensors that can be placed in dirt in this project, with the purpose of quantifying the wetness material of the dirt.

Water Pump

A water pump is used to supply water to a work site. It can be turned on and off as needed by emitting signals. Pumping ^[5] is the act of delivering water in a misleading manner. Pumping water is a simple and practical method, far more so than exposing it with one's hands or picking it up in a hand-held basin. Whether the water is transferred to a specific location, withdrawn from a new water source, refined, or used for horticulture reasons such as water system, washing or cleaning, manure treatment, or purging water from an unwanted territory, these tactics are legitimate ^[8]. The pump is powered by a 12 V dc engine. The pump will turn on and kill as a result of the read estimation of the Arduino board with the set reference esteem activating the engine driver circuit ^[5].

Relay Module

Relays are simply switches that may open and close circuits both electrically and electromechanically. They control one electrical circuit by opening and closing connections in a different circuit. While a relay connection is Normally Open (NO), when the relay module is not activated, there is an open circuit. When a relay connection is Normally Closed (NC), a closed connection occurs even when the relay is not activated. Giving electrical current to the connections will change the state of the relay in both circumstances. A relay

module's purpose is to control the water pump, which is connected to the Arduino Uno board [4]. When the soil moisture sensor detects moisture in the soil, the Arduino Uno board activates the relay, which transfers electricity to the water pump whenever it is required. A single channel relay module is used in this project. A relay is a switch that is operated by electricity. Many transfers for automatically replacing solenoid components are available, but they can also be used for a variety of other activities. Transfers are widely used as part of early PCs to perform useful activities on phones [12].

A. Block Diagram

The block diagram is a graphical representation of the automatic watering system that depicts the basic components that make up the system as well as their relationships [3]. In addition, the code instructs the relay to switch on/off the water pump to water the plants as necessary [2].

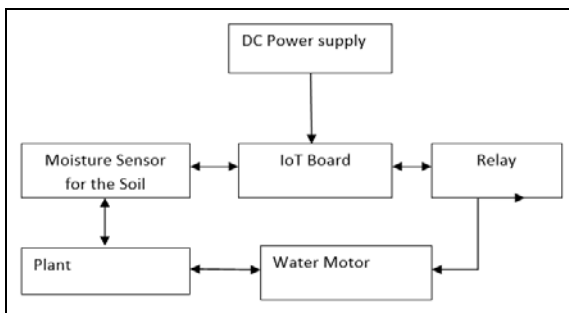


Fig 5: Automatic Watering System Components

The moisture sensor is attached to the Arduino Uno board and is located in the soil. The water pump is submerged in water to water the plants, and the relay module is connected to the Arduino Uno board and the water pump [4]. In addition, the code instructs the relay module to switch on/off the water pump in order to water the plants [12].

Flow Chart

The project is designed to water a plant automatically based on the moisture content of the soil. The project employs an Arduino Uno board that is configured to accept the soil moisture content as an input from a sensor embedded in the soil, as well as a water pump that distributes water to the plant based on that moisture content [7]. A "flowchart" is a visual representation of a logic sequence, a labour or manufacturing process, an organisational chart, or another organised structure. "A flowchart is a graphic representation of data flow through an information processing system."

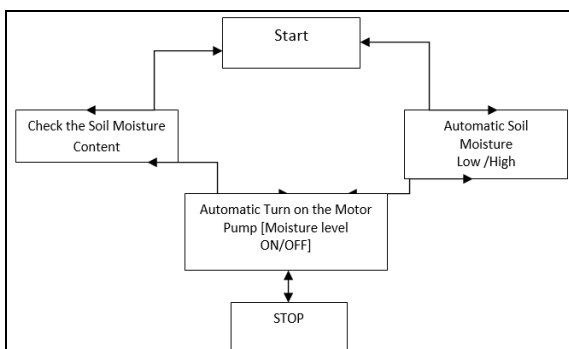


Fig 6

The relay module is linked to the Arduino Uno board as well as the water pump, which is submerged in the water to water the plants [4]. The flow chart depicts the project's workflow. The moisture content of the soil is sensed by a moisture sensor embedded in the soil, and the data is transferred to the Arduino Uno board and examined [7]. The Arduino Uno board delivers the information to the relay, which turns on the water pump if the moisture content is low. The water motor continues to supply water to the plant until the desired moisture content is reached, at which point it is turned off. If there is enough moisture, nothing happens, and the water pump remains turned off [7, 3].

Result

The proposed method's experimentation and validation were carried out by taking into account the amount of moisture in the soil and then giving the necessary moisture content to the plant. Which demonstrates that the plant is being watered based on the moisture sensed by the moisture sensor. The motor turns off on its own once the plant has received the proper amount of water.

The Arduino Uno board is then attached to the soil moisture sensor. The Arduino Uno board is attached to a relay, which instructs it to turn on and off the water pump in order to irrigate the plants. The soil moisture sensor is embedded in the soil to determine the moisture level of that particular plant's soil. The soil moisture sensor's output is revealed to be below the required amount of soil moisture content. Show the sensed soil moisture level when the soil is wet, which indicates that the soil is sufficiently damp.

Conclusion

A full framework for automatic watering of a plant is described in this research, which can be very useful because everyone constantly feeds the plant with a specified volume of water, preventing over-watering [12]. Another benefit to society from this method is the resource management that we would be performing, from conserving water to switching off the power at the appropriate time to ensure optimal consumption. The Arduino Uno board is coupled to a soil moisture sensor and a relay in this arrangement. The sensor will be placed in the soil, and it will check the moisture level of the soil and transmit the information to the Arduino Uno board, which will then send the information to the relay module, which will switch on/off the motor as needed to water the plant. This prototype aids in the regulation of a plant's dampness substance. Water pumping engine turned on or off by hand-off naturally as determined by soil dampness. There is very little water waste along these lines. The system also allows for delivery to the plant when it is needed, according on the type of plant, soil moisture, and monitored temperature.

People's efforts, as well as their occasional irresponsibility, may need to be limited by the venture. Several components of the framework can be changed, and programming can be used to calibrate the plant's requirements. As a result, the product is adaptable and supportive of innovation. We can tell whether the dirt is wet or dry with this sensor. In the case that it is dry, the engine will pump as a result. During the execution, a number of conclusions were considered in light of the viable outcomes obtained from the actualized frameworks, with the following being the most important: When compared to other approaches for creating frameworks, the framework created is practical.

Reference

1. Ankita Patil, Mayur Beldar, Akshay Naik, Sachin Deshpande, "Smart Farming Using Arduino and Data Mining", IEEE, 2016.
2. Archana P, Priya R, "Design and Implementation of Automatic Plant Watering System", International Journal of Advanced Engineering and Global Technology, 2016, 04:1.
3. Bishnu Deo Kumar, Prachi Srivastava, Reetika Agrawal, Vanya Tiwari, "Microcontroller Based Automatic Plant Irrigation System", International Research Journal of Engineering and Technology (IRJET), 2017.
4. Devika CM, Karthika Bose, Vijayalekshmy S, "Automatic Plant Irrigation System using Arduino", IEEE International Conference on Circuits and Systems, 2017.
5. Drashti Divani, Pallavi Patil, Prof. Sunil K. Punjabi, "Automated Plant Watering System", International Conference on Computation of Power, Energy Information and Communication (ICCPEIC), 2016.
6. Karan Kansara, Vishal Zaveri, Shreyans Shah, Sandip Delwadka, Kaushal Jani, "Sensor based Automated Irrigation System with IOT: A Technical Review", International Journal of Computer Science and Information Technologies, 2015, 6(6).
7. Pavankumar Naik, Arun Kumbi, Vishwanath Hiregoudar, Chaitra NK, Pavitra HK, Sushma BS et al. "Arduino Based Automatic Irrigation System Using IoT", International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 2017.
8. Devika S V, Khamuruddeen Sk, Khamurunnisa Sk, Jayanth Thota, Khalesha Shaik, "Arduino Based Automatic Plant Watering System", International Journal of Advanced Research in Computer Science and Software Engineering, 2014.
9. Santhosh Hebbar, Golla Vara Prasad, "Automatic Water Supply System for Plants by using Wireless Sensor Network", International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud), 2017.
10. Shaikh Gauhar Zareen, Khan Sanna Zarrin, Ansari Rabsha Ali, Prof SD Pingle. "Intelligent Automatic Plant Irrigation System", IJSRE, 2016, 4(11).
11. www.edgefx.in/arduino-uno-board-tutorial-and-itsapplications/ 12. Shradha, Madhurima and Saru Dhir, "IoT For Healthcare: Challenges and Future Prospects", Presented in 5th International Conference on "Computing for Sustainable Global Development" (INDIA Com 2018) on 14th – 16th March, 2018. Proceedings will be published in IEEE Xplore.
12. Saurabh Mishra, Madhurima Hooda, Saru Dhir, Alisha Sharma, "iCop: A System For Mitigation of Felonious Encroachment Using GCM Push Notification", Advances in Intelligent Systems and Computing, vol 731. Springer, ISBN:978-981-10-8848-3, 2018.