AUTOMATIC DRIP IRRIGATION SYSTEM FOR TERRACE GARDEN USING IOT

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***Abstract*— The need for particular innovations which enhances agricultural yields has led to the incorporation of several technologies into greenhouse facilities. A sensor network that is wireless featuring a variety of devices is used to observe the growth of crops and regulate the system for irrigation in greenhouses. The system used for irrigation used in greenhouses is the subject of this paper. In this article, the emphasis is on keeping an eye on gardening conditions, such as soil humidity and temperature, and acting quickly when necessary. Raspberry Pi, along with a number of other sensors and a real-time alert structure, make up the framework. If the necessary requirements are satisfied, the choice is made immediately. Plant mortality will be decreased as a result, and yields from agriculture will rise.**

***Keywords*— Drip irrigation, Solenoid valve, Server page, MAC buffer, automotive engine controller application, Porting process**

I. INTRODUCTION

Agriculture industries have not yet grasped the fact technological advances may be used to preserve our heritage as well as update it. Our dynamic culture is centred on agriculture, which should undoubtedly prosper in our country. Instead of irrigating a lawn, drip systems for irrigation are frequently put in places where blooms or bushes are developing (i.e., as separate components having gaps among them). In comparison to spray irrigation, drip irrigation systems enable users to concentrate on the roots of plants further accurately, which improve crop well-being and the utilisation of water. When it's needed, irrigation can be done autonomously. A variety of sensors are included in the automated irrigation system in order to keep track of its surroundings and provide results to an Arduino board. The designed smartphone application has a module for wireless networking that allows producers to get the data they need[1].

In the area of connectivity, the internet of things (IOT) has gained a lot of traction and is expanding quickly. The management and observation of the drip irrigation operation utilising IOT is outlined in this work. A collection of information is part of the computerised system and is used for assessing the water demands of crops. The database's integrity is modifiable in accordance with the type of soil in the location where we will be deploying this system and has predetermined moisture content levels. The moisture content of various kinds of soil will vary, and moisture content will alter depending on the weather conditions[2].

The ability to manage a garden's health using the Internet of Things (IoT) was one of the project's core goals. Our planter is equipped with sensors which continuously check on the health of the plants due to the adaptability of the equipment on hand and software. We created an app for smartphones that allows one to view the data and, when needed, perform the appropriate steps[3].

Our planter is the ideal way to add vegetation to a balcony or lawn because it is adaptable, inexpensive, and simple to construct. It has been demonstrated that the intelligent plant uses less water and makes administration as well as tracking easier. Even modest rooftop planting can employ this approach. The system is thoughtfully implemented in a manner which renders it possible for everyone to use and that allows anyone to navigate the stages and processes with ease[4].

- The proposed system is developed with an integrated embedded system, To add an excrement in his developing area, then, he will turn on the manure button on web server then the fertilizer will normally mixed in with water and it will be directly given to the plants.
- When the soil moisture level is low, the owner can use the server page to turn on the pump motor even if he is not in the garden.
- If the owner does not respond for a predetermined amount of time, the pump motor will automatically turn on, and the user will be notified of the status.
- The soil's moisture will cover a portion of the garden. Water stream will be initiated assuming that the dampness level falls underneath the edge.
- The solenoid valve will be used to control the water flow.11 Flow sensor IDs are also used to check if the pipe line is leaking.
- This intelligent irrigation system, as a result, greatly reduces the need for human intervention. It uses less water and saves time.

The remainder of the essay is structured as a thorough literature review in the second portion. In the third section, the choice of system tools and issue identifications are covered. In the fourth chapter, the system architecture and specific system design stages are covered. Potential improvement is discussed as the end of the paper.

II. BACKGROUND STUDY

S.Ayyasamy et al. 2020 Smart farming uses the Internet of Things most often for watering. IoT is employed in this case for controlling waterway flow on fields. With the help of the soil moisture sensor that exists, agricultural land's soil hydration is kept under observation. The Cloud Service Brokerage instructs this relay to turn on the sucking engine when a specific level of moisture has been achieved. This partially automated water handling device can operate independently or be managed by employing a smartphone app. The climate at that particular place may be examined using the DHT sensor values, and it can be projected for the course of ten days using estimation software.

A. Math et al. 2018 On the campus of the National Institute of Technology in Karnataka, the project's goal is to water the crops utilizing a smart drip irrigation technique. A central controller for the whole thing is a platform based on open source, which is utilized to do this. The characteristics of the elements influencing the well-being of plants are constantly transmitted by a variety of sensors. Water is delivered to the crops at certain periods of time by operating a solenoid valve according to data collected from the RTC unit. The website allows for oversight and control of the complete watering system. The ability to personally or remotely manage plant watering is provided on this website. A raspberry pi camera that provides continuous transmission to the webpage keeps an eye on the condition of the crops. Through wireless connectivity, a water circulation sensor provides data regarding water movement to the controller. The controller examines this data in order to identify pipe leaks. In order to control the amount of water supplied, it is also done so that climate prediction may be done, making it more dependable and effective.

I. Mohanraj et al.2017 In comparison to the conventional approaches, the suggested method uses WSN to streamline watering and fertigation, resulting in greater crop production. WSN actual time tracking of climate and soil conditions is used for calculating the timing of irrigation. Evapotranspiration (ET) systems are combined into watering units that employ the Penman-Monteith FAO-56 method to figure out crop requirements for water in order to meet the pressing demand of addressing restrictions. The benefits of ICT involvement in the field of farming will be addressed in the study. By effectively using water assets and lowering worker costs, the technique gets beyond the drawbacks of conventional farming methods. Since only the necessary fertilizer products are introduced through the drip structure, the suggested approach significantly contributes to water saving and also helps to prevent soil deterioration. The findings regarding surface drip watering and beneath the surface drip irrigation, which are used in fields of maize and sugarcane, accordingly, are also included in the article.

D. I. Ahmed et al. 2017 The feasibility of drip systems, the best water-efficient farming technique, and the usage of solar cells to power the system for drip irrigation are all demonstrated in this study. Drip irrigation can be used to water an acre (4000 square metres) surface with a medium-size 40W screen, according to estimates. Additionally, for best results, this paper describes a novel method of observing the sun. This report concludes by emphasizing additional applications for solar energy produced outside of irrigation seasons and how they affect rural Bangladesh's ability to enhance its standard of existence.

M. Leh et al. 2019 Crop cultivation and landscaping are the main topics of the study. If this technology is used on a large scale, its restrictions could be quite costly. Each plant required a sensor setup because it is necessary to understand the soil's state. For any plant, a water pump needs to be installed for the purpose to deliver the water. For this task, it is necessary to connect the hardware with the blynk software app on a mobile device that can use a dht 11 sensor and a water content sensor to determine the wellness of the plant. The tests that were conducted constitute the foundation for the conclusions in this paper. The use of smart irrigation and conventional irrigation were the subjects of the initial two tests. The results after 7 days revealed that smart irrigation defeated conventional irrigation. The following three studies involved the visibility of natural light, water pH levels, and gusts of wind. Based on the goals that each of the three goals had previously been met, this paper's result.

A. Premkumar et al. 2018 Because of the population growth that is occurring rapidly, we must manage our scarce assets wisely. The need for water rises along with the growing demand for agricultural products. This idea served as the inspiration for our project, and regulating the system for watering is the paper's main goal. The suggested approach makes use of an Arduino for managing water flow and humidity detecting, and a Node Microcontroller Unit (MCU) for informing farmers via mobile devices regarding the current state of the irrigation system that was created. The suggested "Automatic Irrigation System" was designed using automation and the Internet of Things (IOT).

III. SYSTEM DESIGN

The majority of lawns in homes are not protected by building rooftops, making them vulnerable to environmental fluctuations like excessive precipitation or days of extreme heat. The development of the plants in the backyard may be impacted by these various outside variables. To make sure the plants are developing properly, the property owner should periodically check on this small garden. The ability to keep an eye on their plants, meanwhile, may be challenging for gardeners who are gone for an extended period of time. Any irrigation system that can water crops from various locations should be tracked and managed by just one device.

Many systems for irrigation are available now that function with a computerised system. The system is not able to be implemented in a small home gardening because of the high cost of the necessary supplies. A sophisticated and expensive computer is required by the watering system that numerous experts have created in order to track development of plants.

III.METHODOLOGY

The humidity and moisture sensors for the soil in the irrigation system for the greenhouse are used to gauge the field's humidity and water content. To determine the amount of water present in the reservoir, a sensor to measure the water level is fitted in the reservoir. Pipes carry water around the garden, and a solenoid valve regulates the water's direction. Microcontroller is used to track and handle all of these systems. A text-based notice will be sent to the owner for alert when the level in the water container drops below the minimum level.

When the web server's fertiliser button is activated, fertiliser will immediately be combined with water and provided to the crops whenever the proprietor chooses to add fertiliser to his agricultural activity.

In order to activate the pump motor when the ground water content is insufficient when the owner is far from the garden, he must use the server page. After a predetermined amount of time passes without a response from the owner, the pump motor will turn itself on and inform the user of its state. A particular part of the garden will be covered by the water content of the soil that has been put there. The movement of water will start if the humidity level falls under the critical threshold. The path of the flow of water will be managed by the solenoid valve. Additionally, flow sensors are employed to find any leaks in the pipe system. As a result, adopting this intelligent watering technology significantly decreases the need for human involvement. Both time and water use are reduced. It uses a microcontroller to retrieve and analyse information collected by the sensor. At last, it provides sensors authorization via a server page.

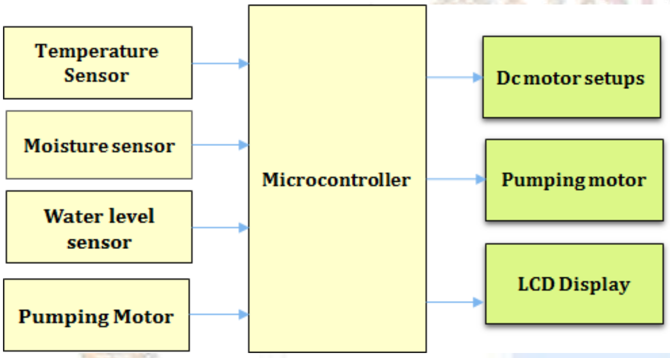


Fig. 1. System architecture of Proposed Automatic Drip Irrigation system

Fig 1. Shows the system architecture of proposed DRIP irrigation system. The system initiated with data collection.
This system measures the field's temperature and moisture using a sensor for soil moisture. A water level sensor is installed in a water tank to measure the water level. The water courses through the nursery utilizing pipes and the stream bearing is controlled utilizing solenoid valve. The water flow sensor is used to determine whether the pipe line is leaking. A microcontroller is used to monitor and control each of these systems.
A text message will be sent to the owner to let them know if the water level in the water tank drops below a certain level or if the soil moisture level drops below a certain level.
The owner can use the server page to turn on the motor of the water pump when he is not in the garden. Pump motor automatically turns on and informs user of status if owner does not respond for a certain amount of time.
To add a manure in his cultivating land, then, at that point, he will turn on the compost button on web server then the compost will naturally blended in with water and it will be straightforwardly provided to the plants.
If the owner isn't in the garden, he can use the server page to turn on the pump motor when the soil moisture level is low. The pump motor will automatically turn on if the owner does not respond for a predetermined amount of time, and the user will be informed of the status. A portion of the garden will be covered by the moisture in the soil. Water flow will be activated if the moisture level falls below the threshold. The solenoid valve will be utilized to direct the flow of water.
11 In addition, flow sensor IDs are used to determine whether the pipe line is leaking. Consequently, this intelligent irrigation system greatly reduces human intervention. It saves time and uses less water.

A. ESP8266

Microcontrollers can link to 2.4 GHz Wi-Fi employing IEEE 802.11 BAN due to the ESP8266 chip. It can either be used as an independent MCU by executing an RTOS-based SDK, or it can be utilised with ESP-AT software to give wireless internet access to outside hosting MCUs.

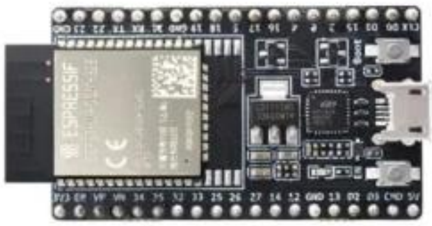


Fig 2. ESP8266 Wireless connectivity

B. Water pumping motor

The liquids are circulated by a pump motor, a type of DC motor. Direct current electricity is transformed into mechanical energy by a DC motor. The basic idea behind a DC or direct current motor is that when a conductor carrying current is put in a magnetic field, it encounters a torque and possesses an impulse for movement. Motoring activity is the term for this. Pumps use an operation to move the fluid (usually reciprocating or rotational), which requires energy to accomplish.

Fig 3. Water pumping motor

Fig 3. Shows the water pumping motor utilized for irrigation purpose. The water level is detected by the water level sensor, further the demand on water is analysed and supplied through switching the water pumping sensor.

Water flow sensor

The sensor consists of setup with a copper body, a water rotating rotary setup with Hall Effect sensor. The flow of water is identified by the sensor by analysing the speed of the rotor.

Fig 4. Water flow detector

Fig 4. Shows the water flow detector programatically controlled and evaluated through microcontroller.

Water depth sensor

Fig 5. Water depth sensor

Water depth sensor detect the depth of the water through pressure associated within the sensor layers. The difference within the plates provides the depth of the water components engaged to the sensor. Fig 5. Shows the water depth sensor. The sensor contains VCC+5 V DC with respect to ground connected to the microcontroller digital pin that assumes the logical value '0' or '1' depends on the water depth.

Fig 6. Soil moisture sensor

Fig 6. Shows the soil moisture sensor used to detect the soil moisture level. The sensor contains VCC+5 V DC with respect to ground connected to the microcontroller digital pin that assumes the logical value '0' or '1' depends on the soil moisture level. The sensors are easily configured using the low power microcontroller.

IV. RESULTS AND DISCUSSIONS

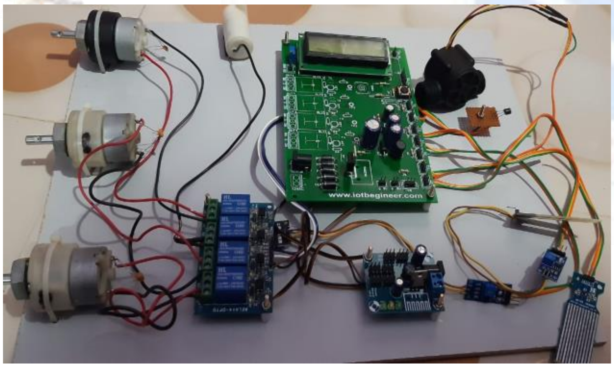
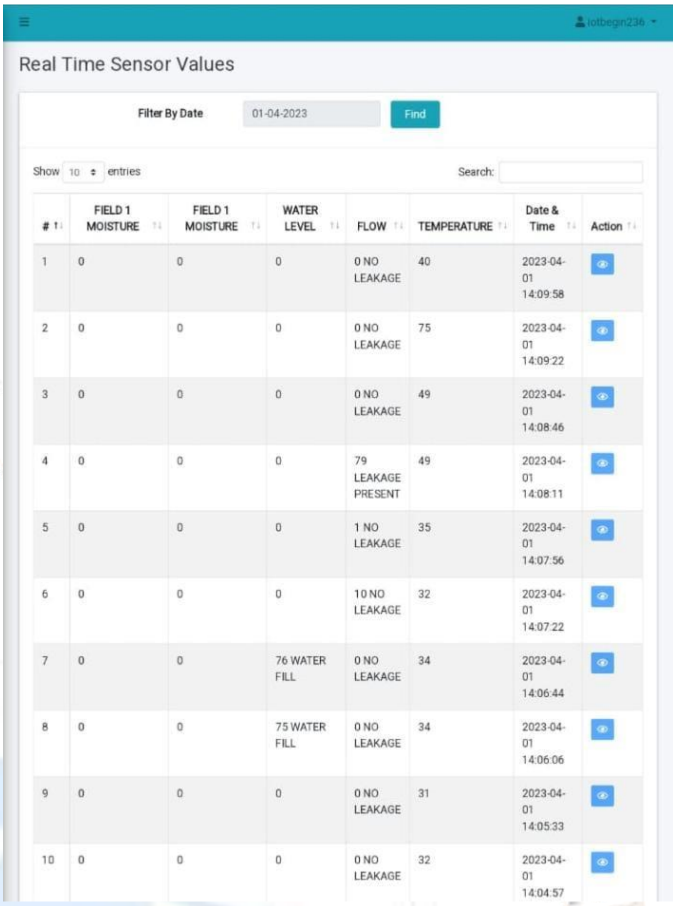


Fig. 7. Integrated hardware

Fig 7. Shows the integrated hardware utilized for Drip irrigation system in terrace garden. The systematic approach demonstrated with test samples of plants and tested with different soil conditions. The reliability of microcontroller and sensors associated with it plays an optimum role in analyzing the automated irrigation system.



#	FIELD 1 MOISTURE	FIELD 1 MOISTURE	WATER LEVEL	FLOW	TEMPERATURE	Date & Time	Action
1	0	0	0	0 NO LEAKAGE	40	2023-04-01 14:09:58	
2	0	0	0	0 NO LEAKAGE	75	2023-04-01 14:09:22	
3	0	0	0	0 NO LEAKAGE	49	2023-04-01 14:08:46	
4	0	0	0	79 LEAKAGE PRESENT	49	2023-04-01 14:08:11	
5	0	0	0	1 NO LEAKAGE	35	2023-04-01 14:07:56	
6	0	0	0	10 NO LEAKAGE	32	2023-04-01 14:07:22	
7	0	0	76 WATER FILL	0 NO LEAKAGE	34	2023-04-01 14:06:44	
8	0	0	75 WATER FILL	0 NO LEAKAGE	34	2023-04-01 14:06:06	
9	0	0	0	0 NO LEAKAGE	31	2023-04-01 14:05:33	
10	0	0	0	0 NO LEAKAGE	32	2023-04-01 14:04:57	

Fig 8. IoT Cloud update

Fig 8. Shows the IoT cloud update displaying the parameters such as moisture, water level, temperature, water flow status etc. the IoT cloud is configured with unique user ID and password which is helpful to activate the cloud access.

V. CONCLUSION

Smart irrigation systems are developed in many applications. A small drip irrigation model for terrace garden is developed here. The proposed system utilized embedded systems enabled irrigation system. It is possible and affordable to construct a smart drip irrigation system utilizing IoT. The mechanism is fully autonomous and activates the motor depending on the amount of wetness in the soil. The webpage has a manually operated valve control option to ensure users may operate the system more effectively. The user can monitor and administer the system from a mobile device, and the technology decreases user involvement while allowing for a drop in overall water consumption.

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