International Journal of Engineering and Creative Science, Vol. 5, No. 1, 2022 www.ijecs.net

Intelligent Drip Irrigator Using Dual Moisture Sensor & Wireless Control

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Abstract – Agriculture is the biggest livelihood source in India. With an increasing population, there is a great requirement to increase the production of agricultural products. For enhancing the level of agriculture, there should be a critical need to have proper planning to avoid the wastage of water. This technology should be developed without putting extra pressure on farmers. In this research paper, a novel Bluetooth-enabled smart drip irrigation system is proposed which reduces the usage of excess water and electricity in an inefficient manner. In this proposed methodology, dual moisture sensors are involved in the implementation of an intelligent drip irrigation system. These sensors enable users to determine the moisture in farm soil at two different levels, i.e., at the top layer of the soil and the bottom of the roots as well. This Intelligent Drip Irrigation using dual moisture sensors and wireless control proved to be an alternative for traditional drip irrigation systems and the proposed topology provides maximum output from minimal water and fertilizers. The proposed work is validated with the help of an experimental prototype.

Keywords- Drip Irrigator, Android, Agriculture, Intelligent, Moisture, Bluetooth.

I- INTRODUCTION

Agriculture is indubitably the biggest livelihood source in India. With a growing population, there are requirements for increasing the production rate of agricultural products. For a better rate of production, the requirement for water for agricultural activities will always increase. At present, according to the sources, the agriculture sector embraces 83% of the total water utilization in India. Currently, the water is not being utilized in a planned way, thus it is just water being wasted. This illustrates that there is a critical need to develop systems that stop the wastage of water without putting pressure on the farmers. Drip irrigation is the most efficient irrigation technique. It delivers water and nutrients specifically at roots, in the right quantity, so each plant gets exactly the amount of water it needs to grow optimally. Due to drip irrigation, farmers can increase their yields while saving water as well as fertilizers, energy, and even crop protection products.

Primitive drip irrigation has been used for a long time now. Fan Shengzhi Shu, the Chinese literature from 1st century BCE, describes the use of buried clay pots filled with water, as a means of irrigation. In 1860 Germany, research on modern drip irrigation started when researchers began experimenting with subsurface Irrigation using clay pipes is used to create combination irrigation and drainage systems. Various innovations were adopted in the drip system which conserves water by minimizing wasteful surface runoff and losses due to evaporation. Modern drip irrigation has undoubtedly been the world's most valued innovation in agriculture since its invention in the 1930s of the impact sprinklers, as it offered the first practical alternative to surface irrigation. Analysis of important factors like topography, soil, water, crop, and agro-climatic conditions are needed to determine the most suitable drip irrigation system and components to be used in a specific installation.

Over the last few decades, the soil moisture sensing field has advanced immensely, with two distinct reasons; the first one is the improvement of computer technology along with powerful, handy integrated circuits developments and the second one is the significant advances in the application of electromagnetic methods for the measurement of soil water availability.

The main objective of this paper is to design and develop a novel Bluetooth-enabled smart drip irrigation system to reduce the usage of excess water and electricity inefficiently. To stop unused water and reduce the labour cost, a monitoring system is designed which will be controlled through mobile. The major contributions of this paper are focused on the following points:

• Development of an automated solar-driven drip irrigation system to monitor the soil moisture conditions, Humidity, and Temperature.

• Use an Android-based application for controlling and monitoring the Irrigation through your mobile.

• To communicate and store the data in the cloud for analytics and research.

II- PROPOSED METHODOLOGY

The proposed methodology involves the implementation of an intelligent drip irrigation system through dual moisture sensors. Sensors enable users to determine the moisture in farm soil at two different levels, i.e., at the top layer of the soil and the bottom of the roots as well. According to the moisture level in the soil, the microcontroller gives a signal to the relay to start the pump which will provide irrigation to the crops through a drip system or simply water the plants according to the need of the consumer. The system will be solar-powered and hence energy conservant.

Along with these, the temperature/ humidity sensor is also employed in the system to generate researchoriented data for the user.

Furthermore, the data is generated in the form of customized input of moisture level which enables the user to set different moisture level criteria per different crops or plants.

The value of the different parameters can be sent by using an app to the microcontroller. This makes the system automated as well as manually controlled according to the user's needs.

Sr. No.	Component	Rating	Quantity
1	Bluetooth Module	5V	1
2	Solar Panel	40W, 12V	1
3	Battery	3.7V*3	3
4	Water Pump	6V	1
5	Relay	10A, 30V	1
6	Soil Moisture Sensor	0-1023 ADC	2
7	Temperature Sensor	20-60 degrees	1

Table 1- List of Components

The electricity is generated by the solar panel set up in the field and then is used to charge the battery. The battery is being used to provide backup. This further activates the Dual-soil Moisture Sensor. These are places at two different levels in the soil. The sensors get activated and sense the soil moisture level. This moisture level is displayed on the console screen.

The Bluetooth when switched on connects to our system and sends the data containing all the different parameters of soil moisture to the mobile device. The mobile divide also acts as a console screen in our system. The screenshots of output are being put into the further section.

After receiving the data, based on the information received, if the level of Moisture is found to be below

Impact Factor-4.013 International Journal of Engineering and Creative Science, Vol. 5, No. 1, 2022 www.ijecs.net

the predefined value as set in the algorithm, the pump will start automatically till attaining the value of moisture required.

If the Moisture level is found to be adequate or higher than the predefined amount, then the pump will not start. The consumer also has an added feature, which can be accessed from their mobile phone. They can even start the pump irrespective of moisture level in the field according to their needs, just by providing instruction to do so. This is done wirelessly through the Bluetooth signal. Another added advantage of the system is the temperature sensor. This sensor does not directly influence the drip irrigation system but is used for research purposes. The continuous value of the temperature and take the related decisions or perform a long time of research. This solves the issues like wrong cropping patterns and wrong crop selection, etc.



Fig.1- Block Diagram of System

The system not only makes irrigation easy for consumers but also makes it eco-friendly, sustainable, and durable in the long course. Along with a high level of precision, the accountability of the system is commendable. The research-oriented enhancement further makes the system a boon for every user suffering shortage of water to irrigate the land for farming or gardening purposes.

III- DESIGN

The experimental prototype thus prepared has the ability to irrigate 1 square meter. of the area with a proportional rating to larger systems that can be used in a practical farm or gardens.

The experimental prototype incorporated 3 Zinc-Carbon



Fig.2- Flow Chart of Proposed system

batteries with an output of 9 V. The two soil moisture sensors were placed in an area of 1 square meter such that approximate moisture of the whole area is obtained. The result we obtained had a near-perfect value as there was a negligible variation of moisture level over the area. The system is tested over plants and the results have been obtained. The efficiency was observed to increase drastically and water usage was much lesser than the prevalent drip irrigation system.



Fig.3-Pictorial Representation of Experimental Prototype

Fig.3 shows the pictorial representation of an experimental prototype of an original system. The assembly is expected to be mounted near the main pump switch of the farm/ garden and is not at all bulky. Also, it can be easily deployed just by upgrading the traditional drip irrigation apparatus (if already present).

Condition	Output	
When Moisture is sensed to be <u>less</u>	Analog Value1: <50% Analog Value2: <60% Now soil type is 2 Temperature: <live temp.=""> Soil Type 2 Start Watering</live>	
When moisture is sensed to be adequate or more	Analog Value1: >50% Analog Value2: >60% Now Soil type is 2 Temperature: <live temp.=""> Soil Type 1</live>	

The output thus obtained by the system is displayed on the console screen in the two different cases that have been mentioned above. The condition mentioned here talks about the condition of the soil that the moisture sensor had fed the microprocessor with. The outputs presented above can be seen on the Bluetooth connected device, in the same way, every second.

IV- CONCLUSION

Drip irrigation has been implemented in the current study may be common but the dual moisture sensors which are implemented in this system make it unique. There are moisture sensors at two different levels in the soil which increases the accuracy of the system. The unit is synchronized with the pump, which dispenses water as per the need of the user only. Hence by the study of soil conditions, delta, duty, and wilting point of the crops the knowledge of the minimum and maximum moisture content required by the crops are known and the board is configured. This reduces water usage and increases the yield. The system aims to reduce the physical as well as monetary efforts of the farmers. A large part of India is water-deficient and the water table in the country is depleting year over year. Thus, Intelligent Drip Irrigation Using Dual Moisture Sensors and Wireless Control is the alternative to further improve the traditional drip irrigation system and get the maximum output from minimal water and fertilizers.

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