SMART IRRIGATION SYSTEM FOR SOIL MOISTURE USING IOT

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ABSTRACT

Agriculture remains the biggest contributor to India's GDP. However, it ought to be stated that given the technology used in this location, the improvement is not that amazing. Generation is making terrific strides these days and is having a big impact on diverse sectors along with agriculture, healthcare, and more. Agricultural development is essential as India's major source of income relies upon agriculture. Even these days, most irrigation structures are manually operated. There are traditional strategies which include drip irrigation and sprinkler irrigation. This technology ought to be combined with IoT to apply water effectively, via receiving numerous measurements from sensors together with soil moisture, water level sensors, and water fine. IoT helps record access and critical selection-making approaches. The goal of this paper on the whole specializes in decreasing water waste and minimizing guide exertions in irrigated fields. It saves farmers time, money, and attempt.

Key Words: IoT, Sensors, Irrigation method, Water quality, Arduino board.

I. INTRODUCTION

The Indian economy's quality is its horticulture. Nevertheless, agricultural water usage each year exceeds precipitation. Enhancing agricultural efficiency is crucial in meeting the ever-increasing worldwide need for food due to population expansion. One can prolong the farm's output by foreseeing and taking into account the environmental conditions. Information gathered in the field, such as soil moisture, surrounding temperature, stickiness, etc., is used to determine the trim quality. Modern technology and innovations can be applied to increase agricultural productivity. The development of the Internet of Things can help gather a vast amount of data on the environment and cultures.

"The IoT incorporates numerous unused savvy concepts to be utilized within the near future, such as savvy domestic, savvy city, shrewd transport, and savvy horticulture" [1]. This methodology can be utilized to apply correct wholes of fertilizer, water, pesticides, etc. to form strides in proficiency and quality. Sensors are a promising contraption for sharp development. Real-time characteristic parameters such as soil clamminess levels, temperature, and supply water levels continuously impact a crop's life cycle. By forming an organizer of sensors, incredible watching of water control in cultivation can be fulfilled.

This article presents a water framework watching and control system. The system was laid out to screen normal conditions such as temperature, soil moistness, talk about mugginess, and water levels in farmland for water framework organization. Real-time condition data is sent to a cloud server for capacity, choice-making, and organization of future exercises.

II. RELATED WORK

Much investigation has been done to advance the efficiency of agricultural production.

In their 2016 publication, Archana and Priya presented a research paper that focused on the relationship between mugginess and soil moisture. The study involved placing sensors within the plant's root zone, and these sensors were connected to micro-controllers that regulated the water supply to the field based on recorded data. However, this system does not provide any information to the farmer regarding the current condition of the field [1].

Agricultural System (AgriSys) [2] uses temperature, pH, moistness, and blur sensorsoutput for sensor data input. The system monitors sensor info on the LCD and PC.

VR Balaji and M. Sudha (2016) proposed an artifact deriving the system of electricity from sunlight, thanks to

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photovoltaic cells. This framework is free of power. A soil dampness sensor was utilized and is based on the spared values of the PIC microcontroller utilized ON/OFF of the engine pump. Climate figure isn't included in this framework [3].

Sanjukumar (2013)[4] has successfully developed and implemented an "Improved Strategy for Determining Soil Moisture Content Based on the automated motor pump for agricultural land" with the use of a flow sensor. The system includes automated closed-loop irrigation, temperature and water flow control. Users can easily adjust moisture levels and regularly monitor the current values of all parameters on the LCD display. In the future, the system will also incorporate other important soil parameters such as soil pH and soil electrical conductivity.

In [5], the utilization of Zig Bee technology in a remote sensor network enables the monitoring and control of air humidity, soil humidity, and temperature. This system incorporates various components such as soil sensors, humidity sensors, temperature sensors, water pumps, fans, switches, and buzzers.

In [6], a remote sensor network is established using ZigBee technology to transmit soil moisture levels and temperature values. The collected data is then transmitted to a network server through GPRS over the cellular network. Monitoring and analysis of the data can be performed through a web-based graphical application.

“Automated Wireless Irrigation System” proposed by Chetana (2012)[7].Astructure that advises the client of its status. Two modes of operation offer the client plausibility of the programmed and manual handles. The framework moreover gives a log record of completed occasions.

The paper [8] explains the placement of a remote sensor that describes the level of soil stickiness, temperature and relative stickiness values. The life of the layout hub is extended by a sleep-wake system. The framework described in this article implements hub clustering. A graphical user interface (GUI) made in MATLAB for data processing.

In [9] addresses the problem of physical sensor nodes malfunctioning by informing the system regarding that particular node. Alternative methods to predict the values of humidity,tempature and humidity of the soil.

In[10],paper discussed how the IoT has been associated with the automation of all aspects of agriculture and farming methods. The challenges and benefits for the implementation of sensory based irrigation systems are discussed. It will assist researchers and farmers to better understand irrigation techniques and provide an adequate approach would be sufficient to carry out irrigation related activities.

In paper [11] discussed how recurrent neural networks used in smart irrigation solution for precision farming. Monitoring the irrigation scheduler's efficiency allows it to concentrate on agricultural necessities like irrigation water quantity and time conservation.

In paper[12] focuses on an IOT based smart irrigation system which is cost effective and can be used by a middle class farmer in farm field. It will compare the water savings in different soils like sand, clay and sandy clay. In comparison the found the reduction of water from this system as of traditional process.

In [13] this study seeks to develop an automated solar-powered irrigation system. This will provide a cost-effective solution to the traditional irrigation method.This project is aimed at designing a system that harnesses solar energy for smart irrigation and allows for more efficient way to conserve water on the farmland.

In[14] discuss how an IoT enabled ML-trained recommendation system is proposed for efficient water usage with the nominal intervention of farmers.To make the system robust and adaptive, an inbuilt feedback mechanism is added to this recommendation system.

This paper[15] demonstrates the efficient use of Internet of Things for the traditional agriculture. It shows the use of Arduino and ESP8266 based monitored and controlled smart irrigation systems, which is also cost-effective and simple.

In the context of a wireless sensor node, every system described above is identical. Communication technology and storage of data collected from knots are the main differences. In general, systems use several servers to collect data. The server will need more storage space when the number of nodes grows, and that's going to increase its costs.

III. PROBLEM STATEMENT

Farming is the business of most Indians and one of their fundamental sources of jobs. In order to preserve a positive state of soil dampness and to anticipate a lack of dampness within the plant due to the right utilization of water assets, water is connected frequently and regularly every day. The trickle water system is sparing water because it is where the root zone of the plant gets its dampness. In case the correct sum is utilized, a little quantity of water will be misplace damidpro found infiltration. The ubiquity of trickle water system is due to its capacity to extend trim yields and decrease water utilization necessities and work.

For overhead or surface irrigation, Drip irrigation takes about half of the required water. The reduction in energy costs is due to the lower operating pressure and flow rate. Water management can be improved. A more precise amount of water can be used for plants. If the leaves remain dry, diseases and insect damages are reduced. Operating costs are usually reduced. Since the rows between the plants are dry, compounding can continue during watering.

A. Conventional irrigation methods

Conventional water system strategies such as overhead sprinklers, and overflowed frameworks for the most part damp the lower clears out and the stem of the plants. The complete soil surface is immersed with water and frequently remains damp, even long after watering has wrapped up. This condition contributes to leaf form disease against drip or trickle water system, may be a sort of cutting-edge water system strategy that gradually applies small sums of water on a portion of the root zone of the plants.

Existing system limitations:

- ❖ The farmer has to physically manage drip irrigation.
- ❖ Water and time are wasted.

B. Smart Irrigation System

Smart irrigation systems offer numerous advantages over traditional irrigation systems. They have the capability to adjust water levels by taking into account factors like soil moisture and weather conditions. This adjustment is made possible through the utilization of wireless humidity sensors that communicate with the smart sprinkler's monitoring system. These sensors supply essential data to the system, indicating the necessity of watering the landscape. Furthermore, intelligent irrigation management collects local weather information, helping to determine the optimal timing for watering the land.

Smart irrigation systems utilize Internet of Things technology to automatically control watering based on soil moisture and weather conditions, such as rainfall. The BOLT cloud platform presents sensor data in a visual format. These systems offer significant advantages. The advanced irrigation system enables efficient management of landscaping and water requirements, even making autonomous decisions when you are not present.

Valves are employed to activate and deactivate the irrigation system. By utilizing controllers and solenoids, these valves can be conveniently managed. The implementation of automated irrigation in farms or nurseries enables farmers to efficiently utilize the appropriate quantity of water at the precise moment, without concerning themselves with the manual operation of the valves.

Benefits of Smart Irrigation are

- ❖ Water conservation
- ❖ Cost saving
- ❖ Remote monitoring for crops
- ❖ Reduce the storage and transportation infrastructure for water
- ❖ Safeguard water sources for the benefit of future generations

IV. PROPOSED SYSTEM

These days, agriculture is much more challenging due to the shortage of water resources. Farmers needed intelligent irrigation systems to assist them to deal with these challenges. In this system, the Arduino micro-controller's input ports are connected to a number of sensors, including pressure, pH, soil humidity, DHT11, and PIR (intruder detection system). The values that the sensors recorded are displayed on the LCD. The pump is attached to the driver circuit, which helps to alter the voltage, and is automatically engaged by the relay circuit if the value exceeds the program's thresholds. The farmer will receive updates on the field's condition from the GSM module, which will also update the website. Farmers have access to the data in this system at any time by means of a field's state.

Two design phases were undertaken; hardware and software.

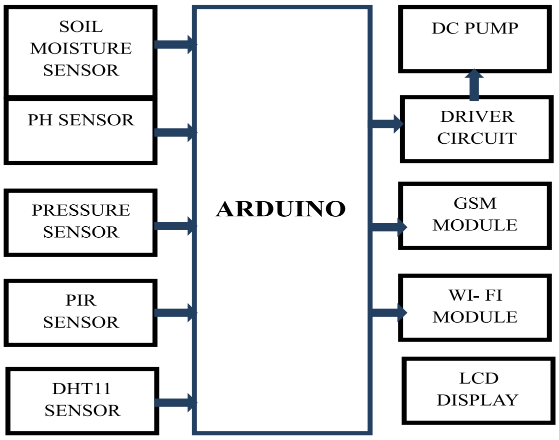

Figure 1: Block Diagram

A circuit schematic for an automatic plant-watering system is shown in Figure 1. An Arduino UNO circuit board, an LCD screen, a motor, a 12V water pump, a motor driver integrated circuit and a soil moisture sensor are all needed to operate the water pump in this circuit. By connecting it, the Arduino board can be charged using a wall wart, adaptor, or solar panel that runs on 7 or 12 volts.

1. **Arduino UNO:** Here, a microcontroller called an Arduino UNO is being utilized. A microcontroller board, the UNO is based on the ATMEGA 328P. The 32 KB flash memory of the ATMEGA 328P is used to store code. The board includes an ICSP circuit, six analog inputs, USB, a 16 MHz crystal, 14 digital input and output pins, and a reset button. The Arduino program can be used to program the UNO.
2. **Soil Moisture sensor:** The soil moisture module is composed of two components: probes and an amplifier circuit. A potentiometer is used to set the threshold. Since it gives the installations precise information on humidity, the analogue output of the system is helpful.
3. **PH Sensor :** A measure of acidity or alkalinity is called PH. the proportionate amount of hydrogen H + hydroxyl OH ions arepresent in the aqueous solution. Any pH over 7 is basic, while anything under 7 should be sour. A change in the solution's temperature may also have an impact on its pH.
4. **DHT11:** Temperature and humidity are measured by sensors, and differential pressure traces are detected by pressure sensors that locate differential pressure transmitters. The PCB will convert this signal to Differential Signal Pressure so that it can be used for weather forecasts.
5. **PIR sensor:** This sensor uses changes in infrared radiation to detect movement. At a temporal angle of ±15 degrees, it can move up to 10 meters. The PIR is identical to that outside. It illuminates using a motion detector and responds to motions of heated objects.

V. RESULT

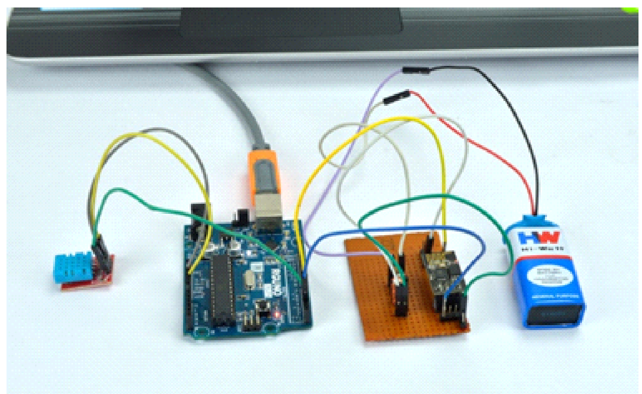

Figure 2 : Hardware configuration

Data display on the network:

SENSORS	**SENSOR VALUE RANGE**
Soil Moisture	-10c to +85 c
Pressure	±102 mmH2O
DHT11	Temp -55c to +150 c
Humidity	40%
pH Sensor	6.5 to 7.5

VI. CONCLUSION

We have successfully developed and tested a SMART IRRIGATION SYSTEM for SOIL MOISTURE using IOT in this manner. It has been developed using all of the hardware components' built-in features. At work, the system was tested automatically. Plant moisture content is measured by humidity sensors; each plant has a unique water content. If the humidity falls below the required and restricted level, the humidity sensor sends a signal to the Arduino board, which initiates the water pump and supplies water to the relevant plant. As soon as the desired humidity is reached, the system shuts down automatically and the water pump is disconnected. Consequently, a comprehensive testing of the system's functionality has been conducted.

Therefore, the entire system's functionality has been thoroughly tested and has been found to be successful.

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