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"IOT BASED GARDEN WATERING AND WATER CONSUMPTION ANALYSIS"

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Abstract: This project introduces an IoT-based garden watering system with integrated water consumption analysis, aimed at addressing the pressing need for sustainable water management in gardening. By combining advanced sensor technology, microcontrollers, and a user-friendly interface, the system offers an automated solution for monitoring and regulating the watering process based on real-time soil moisture data. The implementation of water flow sensors enables precise tracking of water consumption, facilitating data-driven insights into optimal watering practices.

Through the development of a user-friendly web application, the system empowers users to remotely control and customize watering schedules, promoting efficient water usage and fostering eco-friendly gardening practices. The project underscores the significance of leveraging IoT capabilities to create a smart, data-driven solution for water conservation in gardening, highlighting its potential to contribute to sustainable environmental practices and the effective management of precious water resources.

Index Terms – Internet of Things, GSM Modem

I. INTRODUCTION

In the contemporary landscape of environmental awareness and sustainable practices, the efficient management of water resources has emerged as a critical concern, particularly in the context of gardening and agriculture. With the increasing need to optimize water usage and promote eco-friendly gardening practices, the development of advanced technologies has become imperative. In response to these challenges, this project introduces an innovative IoT-based garden watering system that not only automates the watering process but also integrates water consumption analysis for efficient resource utilization.

Gardening, as a recreational activity and a vital component of sustainable living, heavily relies on appropriate water supply to ensure the healthy growth of plants. However, conventional gardening practices often lack a systematic approach to water management, leading to excessive water consumption and potential environmental repercussions. In this context, the project aims to address these challenges by leveraging the capabilities of the Internet of Things (IoT) to create a smart and automated system that monitors and controls the watering process based on real-time data.

By integrating various sensors, including soil moisture sensors and water flow sensors, the system can accurately assess the moisture levels in the soil and regulate the water flow accordingly. This real-time monitoring mechanism ensures that water is dispensed only when necessary, thereby preventing water wastage and promoting sustainable water conservation practices. Additionally, the incorporation of a user-friendly interface allows users to remotely control the watering schedule and adjust the water flow as needed, enhancing the system's adaptability and user engagement.

Furthermore, the project emphasizes the significance of data analysis and visualization in understanding water consumption patterns and optimizing watering schedules. Overall, the project represents a significant step towards the integration of smart technologies in gardening, contributing to sustainable water management practices and environmental conservation efforts.

1.2 PROBLEM STATEMENT

Conventional gardening practices often lead to inefficient water management, resulting in excessive water consumption and potential environmental implications. Inefficient watering techniques, lack of real-time monitoring, and imprecise control over water flow contribute to water wastage and suboptimal use of resources. Moreover, the absence of a comprehensive system for tracking water consumption in gardening limits the ability to make data-driven decisions for sustainable water management.

The project aims to address these challenges by developing an IoT-based garden watering system that not only automates the watering process but also integrates water consumption analysis. By providing a solution that optimizes water usage through real-time monitoring, data analysis, and user-controlled customization, the project endeavors to promote efficient water management practices and foster sustainable gardening techniques.

1.3 OBJECTIVES

- Develop a robust IoT-based system that integrates sensors and microcontrollers to monitor soil moisture levels and regulate water flow in real time.
- Implement water consumption analysis algorithms to track and analyze the amount of water used for gardening purposes.
- Create a user-friendly interface for remote monitoring and control, allowing users to adjust watering schedules and levels based on the specific needs of their garden.
- Promote eco-friendly gardening practices by optimizing water usage and minimizing water wastage through data-driven insights and recommendations.
- Contribute to sustainable water management efforts by demonstrating the effectiveness of IoT technologies in conserving water resources in the context of gardening and agriculture.
- Provide a platform for users to understand and visualize water consumption patterns, encouraging informed decision-making regarding water usage and conservation.
- Ensure the security and privacy of user data by implementing robust encryption protocols and security measures to protect sensitive information and system integrity.

II. LITERATURE SURVEY

In day to day works associated with gardening, watering the plant is the most significant task. Irrespective of the weather, everyone wants to be skilled to manage the quantity of water that reaches the plant.

“Automated Plant Watering System” determines moisture level of plants twice a day, if the moisture content is below the desired value (value is already defined as per a plant) then the specific quantity of water is supplied till it reaches the desired value [3]. An automated plant watering framework is controlled utilizing Atmega328p to build up a model of agrarian water system framework. In this paper, two sensors: temperature and soil moisture sensor set close to the foundation of the plant and a unit controls the sensors and exchanges data to web [1].

Water framework is the fake use of water to the land or soil. It helps the creating of green yields, upkeep of scenes, and re vegetation of maddens soils in dry domains and in the midst of times of lacking rainfall. Exactly when a zone proceeds, the water courses through the parallel lines and in the long run breezes up at the water framework maker (stream) or sprinkler heads. Various sprinklers have pipe string deltas on the base of them which empowers a fitting and the pipe to be joined to them [7].

Healthy plants can come to pass a ton of water, bringing about an expansion in the moistness of the nursery air. A high relative mugginess (over 80-85%) ought to be maintained a strategic distance from because it can expand the occurrence of infection and lessen plant transpiration. Adequate venting or progressive warming and venting can avert buildup on plants surfaces and the nursery structure [4]. The utilization of cooling frameworks amid the hotter summer months builds the nursery air dampness. Amid periods with warm and moist open-air conditions, mugginess control inside the nursery can be a test. Nurseries situated in dry, dessert conditions advantage incredibly from evaporative cooling frameworks since a lot of water can be vanished

into the approaching air, bringing about critical temperature drops [4]. Since the relative mugginess alone does not disclose to us anything about the outright water holding limit of air, an alternate estimation is at some point used to portray the supreme dampness status of the dirt. The vapor weight deficiency is a measure of the contrast between the measure of dampness the air contains at a given minute and the measure of dampness [2] it can hold at that temperature when the air would be immersed. Weight deficiency estimation can disclose to us how simple it is for plants to come to pass: higher qualities fortify transpiration (however too high can cause withering), and lower esteems repress transpiration and can prompt buildup on leaf and nursery surfaces. "Programmed plant water system framework has been planned and developed. The small-scale model of the framework worked by appropriately. These framework parts are effortlessly accessible, and they work very dependable.

By enhancing the water system effectiveness in rural segment, this industry turns out to be more focused and feasible. Likewise, in dry regions, where there is no adequate precipitation, legitimate water system isn't conceivable. Henceforth by utilizing this water system framework by checking the dampness substance of soil are can meet the water prerequisites important for the field. To spare exertion of ranchers, the critical contemplations are water and time. In current condition, they must hold up until the point that field is completely watered. This limits them to do different exercises. This thought isn't intended for agriculturists yet additionally to water the plants. In our present period, the agriculturists are inundating their harvests at customary interim of time. The procedures they utilize will expend more water by making water logging and results in water wastage. This framework that we composed will totally wipe out the worry of difficult work [4]

III. RESEARCH METHODOLOGY

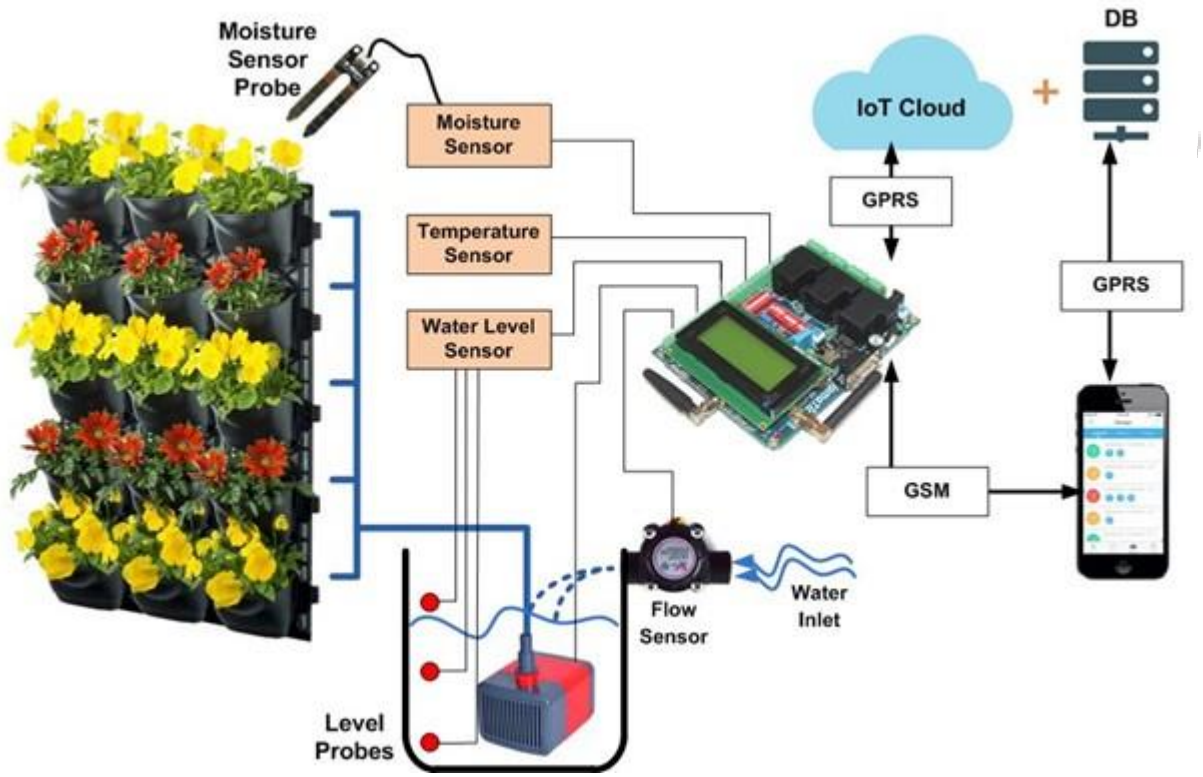

Fig. 3.1 IoT based Garden Watering & Water Consumption Analysis

The diagram shows the system architecture of proposed system. As per shown this is how garden look alike or how it get managed. It is difficult to water garden, so it needs proper pipeline for watering purpose which can be seen as blue line in diagram. Now whenever system start water intake using water pump it will be measured through this flow sensor this will help water consumption. Next there is a Moisture sensor which measures the amount of water in soil and generate alert about low water or even it can ask system to start water pump. Next there will be a temperature sensor which let the system monitor temperature and humidity of environment. All this automation will be controlled through this central Arduino based microcontroller board. Other part of the system is to control pump action remotely hence system will be having GSM modem to let user connect through mobile phone send pump start command via miss call and user will get confirmation through SMS about pump status ON or OFF. Finally using IoT technology system will upload all statistics like temperature, humidity, water level to cloud server via GPRS connection and using web

application user can generate analysis report or the graphical charts of the data. This is how the system will work.

IV. SYSTEM REQUIREMENT

4.1 Hardware Requirements:

1. Water Pump: A device used to pump water from a water source to the garden, ensuring consistent and controlled water flow to the plants.
2. Flow Sensor: A sensor that measures the flow rate of water, enabling the system to track the amount of water used for watering the garden.
3. Soil Moisture Sensor: A sensor that measures the moisture content in the soil, providing real-time data on soil conditions and indicating the need for watering.
4. GSM Modem: A communication device that enables the system to send and receive data via the Global System for Mobile Communications (GSM) network, facilitating remote monitoring and control.
5. Water Level Detector: A sensor that detects the water level in a tank or reservoir, ensuring that the system has access to a continuous water supply for the watering process.
6. Temperature and Humidity Sensors: Sensors used to monitor the temperature and humidity levels in the garden environment, providing essential data for optimizing watering schedules and plant growth conditions.
7. Arduino Microcontroller Board: A microcontroller board that serves as the central processing unit for the system, facilitating the integration and control of various hardware components.

4.2 Software Requirements:

1. HTML, CSS, JS: Web development languages used for creating the user interface and designing the front-end components of the application, enabling users to interact with the system.
2. ASP.Net: A web application framework used for developing the back-end components of the application, handling data processing, and facilitating communication between the user interface and the database.
3. MS SQL Server DB: A relational database management system used for storing and managing the data collected by the system, ensuring efficient data retrieval and storage for further analysis.
4. Arduino Programming Software: An integrated development environment (IDE) used for programming the Arduino microcontroller board, enabling the implementation of firmware and control algorithms for the hardware components.

V. APPLICATION

5.1 Applications

1. **Residential Gardening:** The IoT-based garden watering system can be utilized in residential gardens, allowing homeowners to efficiently manage their garden watering schedules and promote the healthy growth of plants.
2. **Commercial Agriculture**: The system can be scaled up for use in commercial agriculture, enabling farmers to optimize water usage, reduce water wastage, and enhance crop yield through precise monitoring and control.
3. **Public Parks and Landscapes:** Municipalities and organizations responsible for maintaining public parks and landscapes can implement this system to ensure effective water management and promote sustainable maintenance practices.
4. **Greenhouses and Nurseries**: The system can be adapted for use in greenhouses and nurseries to regulate moisture levels and automate watering processes, ensuring optimal conditions for the growth of various plant species.

VI. ADVANTAGES

6.1 Advantages

- **Water Conservation:** The system facilitates the efficient use of water by regulating the watering process based on real-time data, thereby minimizing water wastage and promoting sustainable water management practices.
- **Automated Control:** With the integration of IoT technology, the system automates the monitoring and control of the watering process, reducing the need for manual intervention and enhancing operational efficiency.
- **Data-Driven Insights**: The water consumption analysis provides valuable insights into watering patterns and helps users make informed decisions about water usage, fostering environmentally conscious gardening practices.
- **Remote Accessibility:** The inclusion of a user-friendly interface enables remote monitoring and control, allowing users to adjust watering schedules and levels from anywhere, enhancing convenience and accessibility.
- **Optimized Plant Growth:** By ensuring appropriate moisture levels and efficient watering, the system promotes optimal plant growth, leading to healthier and more vibrant gardens, crops, and landscapes.
- **Sustainable Gardening:** The system encourages the adoption of sustainable gardening techniques, promoting environmental conservation and responsible water usage for both residential and commercial gardening applications.

VII. CONCLUSION

The smart irrigation system implemented is cost effective for optimizing water resources for agricultural production. The proposed system can be used to switch on/off the water sprinkler depending on the soil moisture levels thereby making the process simpler to use. Through this project it can be concluded that there can be considerable development in irrigation with those of IOT and automation. Thus this system is a solution to the problems faced in the existing process of irrigation.

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