

A Study on Automatic Irrigation System and its Benefits

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ABSTRACT: *Automatic irrigation involves using a gadget to control irrigation systems to change the flow of water from a creek even when there is no irrigation. Given that the Indian population is over 1.2 billion and growing rapidly, significant food shortages could arise in 30 to 40 years, necessitating greater agricultural productivity. Farmers are currently grappling with both water scarcity and lack of rain. Traditional field watering processes require human work. Automation in irrigation equipment minimizes the need for human involvement. These sensors provide an interrupt signal to the microcontroller when it observes changes in the temperature and humidity of the environment. The main objective of this paper is to investigate more about automatic irrigation systems along with key benefits. With the help of this clever irrigation system for future potential, plants can be watered for longer periods, while still achieving the best possible conditions for growth. It saves time and provides automatic watering by incorporating temporary delays depending on environmental factors.*

KEYWORDS: *Automatic Irrigation System, Agriculture, Microcontroller, Moisture, Sensor.*

1. INTRODUCTION

In India, agriculture is the primary source of income for 70% of farmers and the general public. The majority of irrigation systems in India are manually controlled. These antiquated methods are being replaced by automated or semi-automatic ones. Sprinkler systems, terraced irrigation, drip irrigation, or ditch irrigation are a few of the most popular methods. The rising need for greater agricultural production, poor performance, as well as a decrease in the quantity of water available for agriculture defines the worldwide irrigation scenario. These issues may be effectively remedied if individuals employ an automated watering system [1].

1.1. Irrigated System:

An irrigation system is a technique for giving water to crops. When there is a lack of rain or subsurface water, it is essential in field agriculture to supply water to plants. For crops to flourish, it is essential to provide them with enough water. As a consequence, this technique is used to adequately hydrate both soil and crops.

1.2. Auto Irrigated System:

The automatic irrigation system is crucial in the agriculture sector. Agriculture relies heavily on maintaining the topsoil moisture or water content. Lack of or too much water can stunt plant development, costing farmers money. This problem is intended to be solved by the provided solution. This tool monitors the soil's moisture content and makes sure it stays within acceptable ranges. The quantity of moisture present may be assessed with a moisture sensor. Following the amount of moisture sensed, the water pump either turns on or off [2].

1.3. The Need for Automatic Irrigation:

- a) Its installation and configuration are quick and easy. Saving energy and resources to ensure their efficient and proportionate usage.

- b) Farmers would be able to apply the exact amount of water there at right time by automating irrigation for agriculture or nurseries.
- c) Lower runoff by avoiding irrigation during the wrong moment of the day, which will boost crop productivity and prevent overwatering saturated soils.
- d) In an automation system, valves control the motor's on and off states. Using controllers, it is simple to automate the turning on and off of motors, doing away and the need for human intervention.
- e) It is a customized irrigation system that helps manage soil moisture in crop production in greenhouses.
- f) It eliminates human error while altering the available soil moisture level, saving time.

1.4. Smart Irrigation Technique:

Customers can benefit from a variety of applications that are covered by this technology. It is crucial to choose the right technology for the situation to realize potential water savings. The irrigation timer can be adjusted for days when watering is allowed because some areas of Oklahoma have irrigation restrictions. Two kinds of irrigation controls exist [3].

- a) Climate-based controllers, also known as evapotranspiration (ET) controllers, adjust irrigation schedules in response to local meteorological data. The phrase "evapotranspiration" refers to both plant-part transpiration and soil surface evaporation. These climate-based controls ensure that the landscape receives precisely the proper quantity of water by gathering local weather data and changing irrigation run-time accordingly.
- b) Historic ET controllers utilize a water consumption curve that is pre-programmed and is based on prior water use in certain places. The curve can take both temperature and solar radiation into account.
- c) Based on locally collected meteorological data, on-site weather measurement controllers compute continuous ET readings or water.

1.4.1. Soil Moisture Sensor Controllers:

Soil moisture sensors are among the smart irrigation controls. Soil moisture sensor controllers use a soil moisture sensor placed underground in the root zone of lawns to estimate water demands rather than meteorological information. The soil moisture sensor estimates the volumetric water content of the soil. The fraction of total soil volume that's also made up of water is referred to as volumetric water content. When the volumetric water content exceeds a user-defined threshold, the controller may be programmed to open the valves and start the irrigation. The allowed threshold level varies according to soil type and plant species, although it normally ranges between 10% and 40%.

1.4.2. Smart Irrigation Technology Add-on Sensors:

Many homes currently have a scheduled irrigation controller, making the transition to a smart controller challenging. To boost efficiency, rain, soil moisture, air, or frost sensor can be added to an automatic watering system. Some manufacturers create devices that can monitor multiple environmental parameters with a single device. Several sensors are compatible with existing systems, are easy to install, and produce results equivalent to smart irrigation controllers. Add-on sensors are often less expensive than smart irrigation controllers if a suitable irrigation timer is already installed on-site [4] [5].

1.4.3. Soil Moisture Sensors:

Soil moisture sensors may be connected to an existing irrigation system controller before a scheduled watering event, the sensor checks the soil moisture content in this root zone and skips cycles if the moisture level is over a certain level. There are many different kinds of soil moisture sensors available, but before buying one, the customer should make sure that it is compatible with their system. If the temperature drops below 32 degrees Fahrenheit, a soil freeze sensor on some soil moisture monitors will halt the watering cycle. There are both standard and wireless soil moisture sensors available. The cost of a soil moisture sensor can vary from \$99 to \$165. [6].

Using Android or GSM, an irrigation controller can optimize water and power use. Valves regulate the on and off states of the motor in an automated irrigation system. The use of controllers makes it simple to automate these valves. Farmers may provide the exact quantity of water at the right time without depending on personnel to switch valves on and off by automating irrigation for farms or nurseries. Additionally, farmers that use automation technology may lessen runoff from saturated soils, prevent irrigating at the wrong time of day, as well as increase crop output by making sure that there is enough water or nutrients available when it is needed. Controllers make it simple to automate such valves. It only makes it possible for the user to maintain and remotely check the moisture level at any time. The developed microcontroller-based irrigation system can run continuously for an endless period, even under exceptional circumstances, when operated from a remote location. The crops' productivity may increase by 25 to 30 percent if they receive adequate water at the proper time [7], [8].

Jia Uddin et al. studied the system was powered by solar panels and had a bidirectional communication link built on a cellular-Internet interaction that allowed information inspection and irrigation control to be configured via a web page. When compared to conventional agricultural irrigation approaches, the automated process resulted in water estimates suggesting up to 90.00% throughout its 136-day test period in a sage crop field [9]. Kriti Taneja et al. studied an automatic system using sensors or Arduino has been developed to efficiently use water for irrigation. A water level sensor is positioned in a water container out of which pumping water to the crops for irrigation, and moisture in the soil sensor is put into the soil of the plants. A soil moisture sensor's threshold values and a water level sensor used to keep track of the tank's water level were combined to construct an algorithm for controlling the quantity of water in the soil. Increasing plant growth while reducing expenses is a challenge today, which inspires the innovative idea of using an automated irrigation system, which will help with better management of both water and human resources. The tank's level is detected by the water level sensor, guaranteeing that there is adequate water in the tank to supply the crops [10].

2. DISCUSSION

Growing worries regarding the sustainability of irrigated agriculture have arisen in several parts of the country as a result of increased water demand. Understanding crop's water demand is therefore a crucial practical element for increasing irrigation water usage effectiveness. Traditional irrigation techniques water a segment of a field more than is necessary while neglecting to irrigate other areas of the field. Artificially supplying water to soils as well as land is known as irrigation. It is used in arid areas and during dry seasons to help with landscape maintenance, the development of crops, and the vegetation of degraded soils. In irrigation systems, valves are used to turn irrigation on and off. This article's main objective is to provide readers with additional information about automation irrigation systems as well as how they might potentially save farmers money, time, or energy. These valves can easily be automated through the use of controllers or solenoids. Additionally, farmers that use automation

technology may lessen runoff from saturated soils, avoid irrigating at the wrong time of day, as well as increase crop output by making sure that there is enough water and nutrients available when they are needed. Future possibilities this ingenious irrigation system makes it possible to water plants for longer periods while still providing the ideal conditions for development. It allows the introduction of a scheduling delay depending on environmental parameters and expedites automated watering.

2.1. Automated Irrigation Advantages:

These are the advantages of automated irrigation:

- a) Decreased labor
- b) timely irrigation-controlling greater flow rates to irrigate plants only when necessary
- c) precise water cut off as opposed to manual inspection
- d) Costs for the trucks used to monitor irrigation were lowered due to the decreased discharge of water and fertilizers.

3. CONCLUSION

The recommendation for this evaluation is made to support aggressive farming water management. The device's microcontroller asserts that reducing power usage, will increase the system's lifespan. It is advised to use it in public gardens for proper irrigation as well as in cricket or golf stadiums. The market for automated irrigation systems is quite promising. They can regulate available soil moisture levels more quickly and without making human errors, maximizing their net earnings depending on factors like product growth, sales, or quality. All drip irrigation system operations are effectively monitored and managed by the sensors-based automation system. The sensors-based automated irrigation system is a practical tool for precise soil moisture control in highly specialized greenhouse vegetable production. It also serves as a simple and accurate irrigation method. Additionally, it reduces human error in controlling the amount of soil moisture accessible, which increases net profits. The main goal of this paper is to provide readers with additional information about automated irrigation systems, including the many types of smart irrigation systems and how they might potentially save farmers time, money, or energy. Future Possibilities Plants may be watered for extended periods while still receiving the best possible circumstances for growth thanks to this intelligent irrigation system. It saves time and enables automatic watering with the inclusion of a temporal delay based on environmental factors.

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