SMART IRRIGATION SYSTEM

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Abstract : Water scarcity is currently one of the biggest issues facing the globe, and agriculture is an intense activity that uses a lot of water. Therefore, a system that makes prudent use of water is needed. About 70% of people in India are employed in agriculture, making it an agricultural nation. With the use of technology, it can be enhanced. An autonomous watering system can help with irrigation management. It suggests irrigating the agricultural lands automatically. At the moment, automation plays a significant role in human existence. This paper addresses and reviews intelligent irrigation ways. In addition to being comfortable, it also saves time, energy, and improves efficiency.

1. INTRODUCTION

Water scarcity is currently one of the biggest issues facing the globe, and agriculture is an intense activity that uses a lot of water. Therefore, a system that makes prudent use of water is needed. About 70% of people in India are employed in agriculture, making it an agricultural nation. With the use of technology, it can be enhanced. An autonomous watering system can help with irrigation management. It suggests irrigating the agricultural lands automatically. At the moment, automation plays a significant role in human existence. This paper addresses and reviews intelligent irrigation ways. In addition to being comfortable, it also saves time, energy, and improves efficiency.

1.1 Smart irrigation technology:
The method of reducing water consumption during irrigation by science and technology is known as smart irrigation. It has various controllers, soil sensors, and weather sensors. The controller decides when to open or close the water valve based on data from the sensor, which also tracks the real ground humidity and the current weather. Scientific judgment on whether, when, and how much water is needed. Technologies like the Internet of Things, mobile Internet, and remote sensing monitoring are all integrated into the smart irrigation system. Wirelessly operate valve switches from a distance. Save irrigation water by giving plants the appropriate amount of water based on soil type and weather. The primary technologies used in the smart irrigation system are computer, sensor, and automated control technologies in addition to garden watering techniques like drip and sprinkler irrigation.

1.1.1 New controllers:
Irrigation controllers can be separated into two main categories: Climate based controllers and soil moisture-based controllers.
1.1.1.1 Climate based controllers:
ET controllers or climate-based controllers adjust irrigation schedules based on local weather conditions. They collect meteorological data and modify irrigation schedules to ensure the landscape receives the right amount of water.
1.1.1.2 Soil moisture-based controllers:
Soil moisture controllers use a buried sensor to detect soil moisture levels and initiate watering. The sensor estimates volumetric water content, the percentage of soil volume that is water. Users can set a specific level at which irrigation begins.

1.1.2 Add on Sensors:
It might not be feasible to upgrade to a smart irrigation controller if the land currently has a scheduled irrigation controller. Instead, adding a soil moisture, rain, wind, or freeze sensor can improve the effectiveness of automatic irrigation systems. Some manufacturers offer instruments that can measure multiple environmental factors using a single device. Installing several sensors is easy, and they can work with current systems while producing comparable outcomes to smart irrigation controllers.

1.1.2.1 Soil moisture sensor:
The soil moisture sensor measures soil dryness. It's inserted at the same depth as the plant root for accurate readings. Soil sensors are used with controllers for irrigation in different locations. The platform sets alarm values for each region, which triggers the controller to open or close the water valve. When the soil moisture exceeds the alarm value, the controller shuts off the water valve, and when the soil moisture falls below the alarm value, the controller opens the water valve. Different soil types require different soil moisture sensors. Consumers need to ensure system compatibility when purchasing sensors.
1.1.2.2 Evaporation sensors and leaf wetness sensors:
Evaporation sensors are devices related to weather monitoring. Its value reflects the evaporation of the soil surface. By obtaining this climate-related data, irrigation time can be modified. Irrigation water usage can be greatly decreased with an evaporation sensor. Because the leaf wetness sensor mimics the properties of a leaf, it can precisely reflect changes in leaf moisture. We can assess whether the plants are deficient in water and whether the soil needs to be watered by keeping an eye on the leaf moisture content. In contrast, the evaporation sensor gauges the amount of water that evaporates from the soil's surface. The evaporation of plant leaves is reflected in the leaf wetness sensor.
1.1.2.3 Rain and snow sensors:
If it starts to rain while you are watering your grass, you make sure to stop right away. Watering in the rain wastes water and money, and causes unnecessary runoff. Smart irrigation also has such a function. The rain and snow sensor is the basis for realizing this function. The rain and snow sensor has metal wires on its surface that conduct electricity when it comes into contact with precipitation. The management platform receives an electrical signal, processes it, and then alerts the controller to promptly close the water valve.
1.1.2.4 Wind speed sensors:
Watering your lawn during windy conditions can lead to uneven distribution of water and reduce the amount of water that is absorbed by the soil. Therefore, it is important to install wind speed sensors that can interrupt the irrigation cycle if the wind speed exceeds a certain threshold. By taking into account the current weather conditions in your region, you can properly schedule the irrigation cycle and duration, which can help to save a significant amount of water resources over time.

2. WORKING:

This real-time system uses a soil moisture sensor to detect moisture levels in the soil. The microcontroller is programmed to power the system and regulate the water supply based on the limit set for the crop and soil type. When moisture levels are low, the pump irrigates the crops, and when they are high, the water supply is turned off. The solenoid valve regulates water flow, and the main motor is programmed to shut off once all fields reach the required water level.

3. COMPONENTS

The main components used are:
3.1 Sensors:
A sensor is a device that detects and gathers information about physical events in its environment. This information is then transmitted to other electrical components, such as a computer processor, in the form of a digital signal that can be measured, read, and analyzed further. Smart irrigation systems employ a variety of sensors, such as soil moisture sensors, wind speed sensors, and leaf wetness sensors, to monitor environmental conditions and make automated decisions about the delivery of water to plants.

3.2 Controller:
An internet-connected gadget called a smart controller, sometimes referred to as a weather-based irrigation controller, modifies the frequency and duration of your irrigation system's operation in accordance with the amount of water required by your landscape.After processing the data, the microcontroller regulates the output.

3.3 Solenoid Valve:
An electrically operated valve that controls water flow is called an irrigation solenoid valve. A voltage applied across the coil causes the valve to open, allowing liquid to pass through.

3.4 LCD Display:
It is employed to show the most recent data.In addition to generating alert messages, it shows the observed sensor values.
3.5 Pump and Motors:
Submersible pumps are fully immersed in the liquid they pump and have a hermetically sealed motor. They prevent cavitation. The motor converts electrical energy into mechanical energy using the magnetic field and the current-carrying conducto

4. ADVANTAGES AND LIMITATION OF SMART IRRIGATION SYSTEM. COMPONENTS

4.1 Advantages of smart irrigation system.:

- Saves water
- Saves money
- The system can also be operated at night, thus minimizes the water loss due to evaporation.
- Reduce human work load
- Reduces the growth of unwanted weeds.

4.2Limitations of smart irrigation system.

- It is more costly compared to conventional technique.
- There are chances of deterioration of the plastic components in hot and arid climate.
- Routine checking is needed for proper working.

5. FUTURE SCOPE

A number of recently developed technologies have the potential to increase these systems' efficacy and efficiency.
1. AI is used in smart irrigation to forecast water requirements by analyzing weather data.
2. Drones are already being used in agriculture to track crop development and identify crop damage. In the future, they may also be utilized to track soil moisture content and provide real-time data to intelligent irrigation systems.
3. The Internet of Things (IoT) is a network of interconnected devices/sensors that can communicate with each other and the internet

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