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Comparative Analysis of Sprinkler Irrigation System with Drip Irrigation System through IOT Module

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ABSTRACT: In recent years, the fact that water is becoming gradually scarce in many regions and required well planned irrigation system and it will be more beneficiary for farmers. The main objective of this paper is to compare performance analysis of sprinkler irrigation system with IoT module and along with drip irrigation system. Here compared the percentage of yield value of different crops for sprinkler irrigation system with IoT module with drip irrigation system. The results show that using this method wastage of water can be prevented and reduce the manual work of human in irrigation. The sensor is used to take the readings of soil like soil moisture and soil temperature. This system will be more useful in areas where there is scarcity of water and will be worth efficient with satisfying its requirements and to utilize the lowest amount of water.

KEYWORDS: sprinkler irrigation; drip irrigation; IoT; soil sensor; node MCU

1. INTRODUCTION

Irrigation is the artificial application of water to the soil or agriculture field. It is the replacement or Supplementation of rain water with another source of water. It is used in dry areas and during periods of adequate of rainfall. In Drip irrigation water is applied near the plant root through the on or below the soil surface. At the low rate vary from 20litres per hour. The soil moisture is kept at an optimum level with frequent irrigation. Drip irrigation is the most efficient and can be practiced for a large variety of crops. Especially in vegetables, flowers, orchard and plantation crops. Sprinkler irrigation, in this method water is sprayed into the air and allowed to fall on the ground surface. Somewhat resembling rainfall. The spray is developed by flow of water under pressure, through small orifices are nozzles. Sprinkler irrigation system suitable method for irrigation on unevenlands and on shallow soils. We will develop such a system that will help a farmer to understand his field status in his home, or residing in any part of the world. It proposes automatic irrigation system for the agricultural lands. Currently, the automation is one of the important role in the human life. It not only provides comfort but also reduces energy efficiently and time saving. Now the industries use automation and control machine which is high in cost and not suitable to use in a farm field. Here is a designed smart irrigation technology in low cost which is usable by farmers. An automated irrigation system is developed to optimize water usage for agricultural crops. This project has been developed to reduce water requirement and increase the productivity. This system is best suited for places where water is scarce and has to be used in limited quantity. Internet of things (IoT) is a technology where in a mobile device is used to monitor the function of device. The Internet of things is concerned with interconnecting, communicating objects that

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are installed at different locations that are possibly distant from each other. This is a type of network technology which sends the information from different sensors and makes anything to join the Internet to exchange information.

II.MATERIAL AND METHODS

The literature reviews of technical papers and reports revealed the following important observations:

[1] P. Claude, Sprinkler Irrigation. 1970. [Online]. Available: https://eprints.nwisrl.ars.usda.gov/1134/1/205.pdf

In these studies about the sprinkler irrigation system, parts of the system and their working. Need of maintenance to keep sprinkling system operating at peak efficiency and advantages of sprinkler irrigation system compared to other irrigation methods.

[2] Kiran R. Bidua and Chhaya N. Patel," Internet of Things and Cloud Computing for Agriculture in India", International Journal of Innovation and Emerging Research in Engineering, Volume 2, Issue 12, pp.

In these studied about, With the Internet of Things, single farmer will be able to deliver the crops directly to the consumers not only in a small region or shops but in a wider area. This will change the whole supply chain which is in the hand of large companies and brokers. A more direct, chain between producers and consumers can be established to provide benefit to farmers. Cloud Computing would enable corporate sector to provide all the necessary services at affordable cost to farmers in rural areas. IOT will transform the way rural India live, play, and work. It can be an exciting area for innovation.

[3]Santosh Kumar and Uday Kumar R. Y, "Development of WSN Systems for Precision Agriculture". IEEE Sponsored 2nd International Conferences on Innovation in Information Embedded and Communication Systems, 2015.

In this studied about, in modern precision agriculture, a Wireless Sensor Network (WSN) provides a simple cost-effective solution to monitor and control.The basic parameters to be monitored are temperature and humidity (moisture content in the soil).

METHODOLOGY

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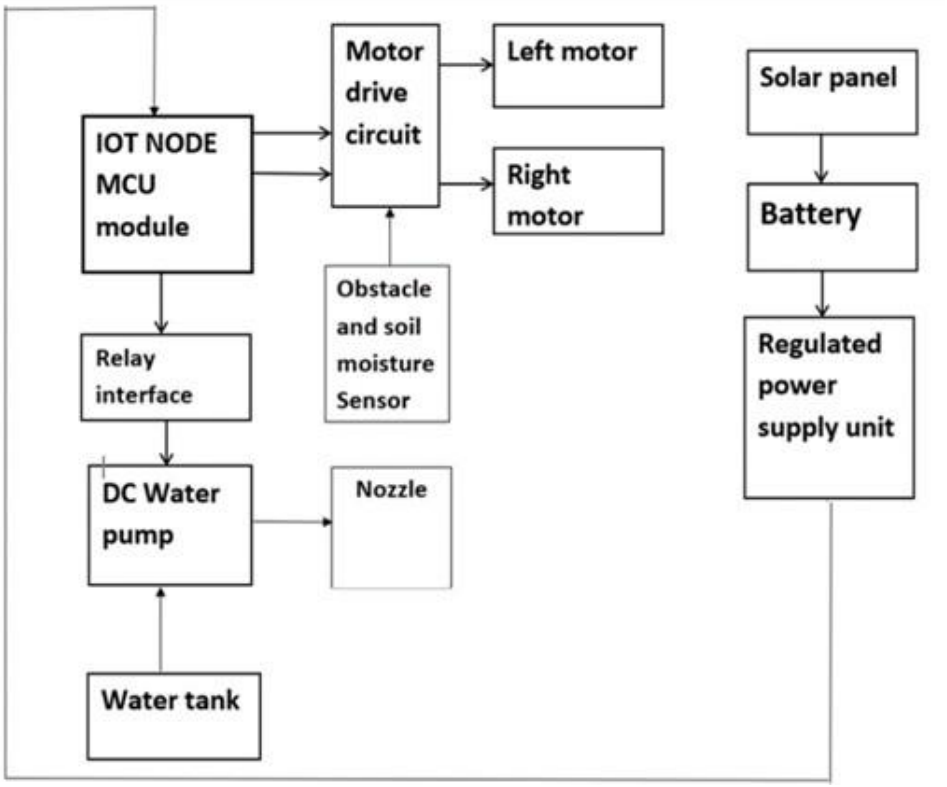

Figure 1. Working of the system

MCU (WI FI MODULE):

Figure 2. Node MCU

These modules come in different form factors and pin outs. Usually these modules have no boot stapping resistors on board, insufficient decoupling capacitors, no voltage regulator, no reset circuit, and no USB-serial adapter. These makes using them somewhat tricky, compared to development boards which add these features. Provide sufficient power to the module. For stable use of the ESP8266 a power supply with 3.3V and >= 250mA is required. Using the power available from USB to Serial adapter is not recommended, these adapters typically do not supply enough

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current to run ESP8266 reliably in every situation. An external supply or regulator along with filtering capacitors is preferred.

Soil moisture sensor:

Figure 3. Soil moisture sensor

Soil moisture sensors measure the volumetric water content in soil. When the soil is dry, the sensor output analog value will decrease. Using this sensor make an automatic watering device, when you are not at home or over a long period of time watering, it can sense whether your plant is thirsty. Prevent the plants to wilt that this is caused by lack of water. With the Arduino controller to make your plants more comfortable, the garden is more intelligent.

Water pumping:

Figure 4. Coil pump

A coil pump is a low lift pump which is composed of a tube, shaped as a coil and mounted on a rotating axle powered by an engine. Due to the rotation, water is then picked up by the tube and pumped upwards in the hose. The coil pump, as many low lift pumps, is commonly used for irrigation purposes and for drainage of lands.

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III. SIMULATION&RESULTS

A. PERFORMANCE

Table 1. Comparison of sprinkler irrigation and drip irrigation system

	Sprinkler irrigation	Drip Irrigation
Suitable crops	Sprinkler irrigation is suited for most row, field and tree crops and water can be sprayed over or under the crop canopy. However, large sprinklers are not recommended for irrigation of delicate crops as lettuce.	Drip irrigation is most suitable for row crops (vegetables, soft fruit), tree and vine crops where one or more emitters can be provided for each plant. Only high value crops are used because of the high capital costs of installing a drip system.
Suitable slopes	Sprinkler irrigation is adaptable to any farmable slope, whether uniform or undulating. The lateral pipes supplying water to the sprinklers should always be laid out along the land contour whenever possible. This will minimize the pressure changes at the sprinklers and provide a uniform irrigation	Drip irrigation is adaptable to any farmable slope. Normally the crop would be planted along contour lines and the water supply pipes (laterals) would be laid along the contour also. This is done to minimize changes in emitter discharge as a result of land elevation changes.
Suitable soils	Sprinklers are best suited to sandy soils with high infiltration rates although they are adaptable to most soils. The average application rate from the sprinklers (in mm/hour) is always chosen to be less than the basic infiltration Rate of the soil that surface Ponding and Runoff can be avoided. Sprinklers are not suitable for soils which easily form a crust. If sprinkler irrigation is the only method available, then light fine sprays should be used. The larger sprinklers producing larger water droplets are to be avoided.	Drip irrigation is suitable for most soils. On clay soils water should be applied slowly to avoid surface water ponding and runoff. On sandy soils higher emitter discharge rates will be needed to ensure adequate lateral wetting of the soil.
Suitable irrigation water	A good clean supply of water, free of suspended sediments, is required to avoid problems of sprinkler nozzle blockage and spoiling the crop by coating it with sediment.	Drip irrigation is particularly suitable for water of poor quality (saline water). Dripping water to individual plants also means that the method can be very efficient in water use. For this reason it is most suitable when water is scarce
System layout	Pump unit Mainline and sometimes submainlines Laterals Sprinklers	Pump unit Control head Main and submain lines Laterals Emitters or drippe

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B. Wetting Patterns:

Sprinkler Irrigation

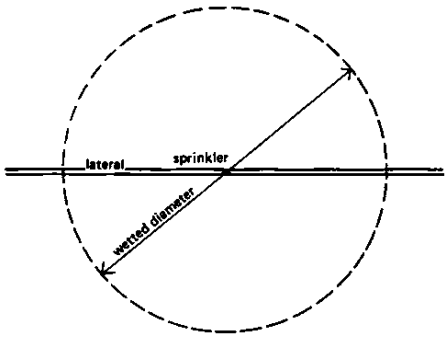

Figure 5. Wetting pattern for a single sprinkler (TOP VIEW)

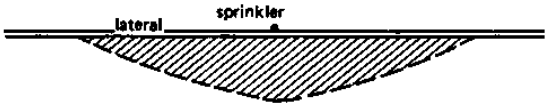

Figure 6. Wetting pattern for a single sprinkler (SIDE VIEW)

Drip irrigation:

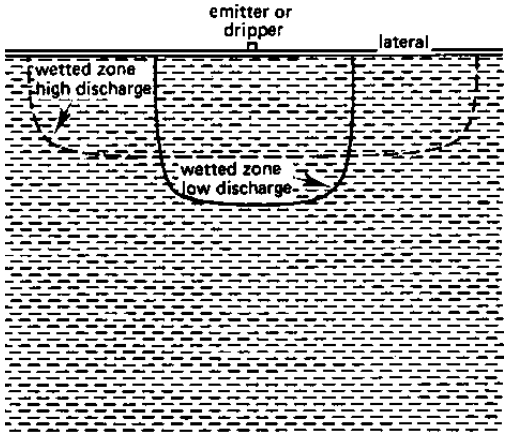

Figure 7. Wetting patterns for sand and clay soils with high and low discharge rates

C. Percentage improvement in yield for crops irrigated using sprinklers relatives to the same crops with drip irrigation:

TABLE 2. YIELD FOR DIFFERENT TYPES OF IRRIGATION

Crops	Sprinkler Irrigation	Drip Irrigation
Cotton	50	38
Chilly	28	24
Bean	27.2	15.8

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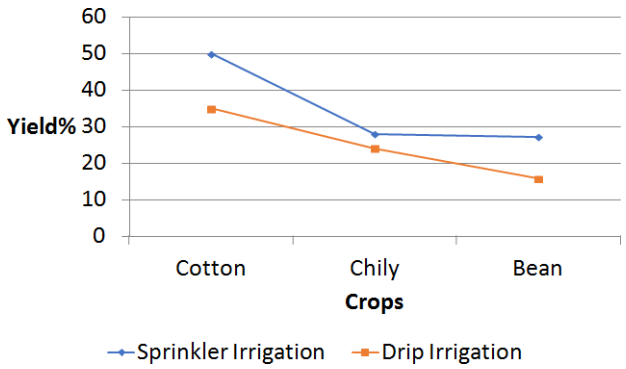

Chart 1. Yield percentage of different crops in irrigation system

Here we have compared the improvement in the yield of crops for sprinkler irrigation with respect to drip irrigation. The efficiency of yield improvement for crops in sprinkler irrigation is higher than the drip irrigation

D. Technical Specifications of moisture sensor:

Supply voltage: 3.3V or 5V

Operating current: less than 20mA

Output voltage :0-2.3V [2.3V is completely immersed in water voltage value], 5V power supply, the greater the humidity, the greater the output voltage.

Sensor Type: Analog Output

IV.DISCUSSIONS

The literature survey gives the idea of different irrigation systems and the need of maintenance to keep sprinkling system operating at peak efficiency. Techniques to control the water wastage and programs to target on monitoring of water supply and sanitation. High productivity along with secured farming is described by many researchers. Wireless sensor networks are used for modern precision agriculture..

V. CONCLUSION

An IOT based Smart Sprinkling prototype has been designed to efficiently to reduce the wastage of water used when compared to drip irrigation. The use of IOT as a platform for our design offers high flexibility without user direct interaction and mobile phone is used to control the sprinkling device. It reduces certain tedious work in field and encourages many people to take up agriculture as an occupation. The disadvantages of time based watering system have been overcome by need based watering system, which saves water.

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