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Article

Soil Moisture Sensor for Precision Agriculture

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A B S T R A C T

Irrigation and farming has been the core of our economy. Soil moisture has great significance as it is important for plants growth. Here, The significant contribution in the changing the way in which irrigation has been employed and executed over the years. This work presents an implementation of a customized system which monitors the moisture level of the soil and waters the plants as per the requirements Water plays a vital role in irrigation. Efficient irrigation watering not only saves water, but provides better plant yields, reduces dependency on fertilizers and recovers crop quality. As there is an increase of demand for food, measuring soil moisture will get more and more significant. There are variety of methods used to measure soil moisture content, but the best one is utilizing the soil moisture sensor devices. For efficacious irrigation, it is necessary to check soil moisture content continuously in the irrigation fields. The soil moisture probes selection is one of the most significant criteria in calculating soil moisture. The soil moisture sensors usage is high nowadays as it gives real time readings.

Keywords: Drip irrigation, Image Processing, Evapotranspiration, Capacitive Sensors, Moisture Sensors, Relay

Introduction

Agriculture is depending on the rain which is not enough sources of water for whole irrigation for the agricultural crops. The irrigation system helps to supply water to fields according to the moisture of soil. Rain play a vital role in irrigation; water supply is obligatory because of most of the fields are depends on the rain. In conventional system the farmer must work properly and with a full care of water supply for watering the crops, which depends on crops types. Insufficient watering ruins the plants. To provides proper and needed amount of water for diverse region and avert the water overflow at the sloppy areas and considering the situation of farmer, the water irrigation system will be most useful for proper irrigation. The proper water supply system is the major examine in cropping system. An irrigation process is useful to reduce water use for agricultural crops which is a much-required process. The need of water irrigation system is to prevail over irrigation and under irrigation. Over irrigation occurs because of bad distribution of water and chemical which fed to water pollution. To overcome these problems and to minimize the manpower by smart irrigation system has been used. To Overcome these limitation new techniques are been implementing in the irrigation system, through which small amounts of water is supplied to the every parts of root of a plant. The plant soil moisture stress is cure by providing proper amount of water resources frequently by which the moisture condition of the soil will retain better growth.

Smart irrigation system, contrary to a outmoded irrigation technique, controls supplied water rendering to the needs of the fields and crops. The feedback mechanism of a smart irrigation system is a moisture sensor. Evapo-transpiration (ET), thermal imaging, capacitive methods, and neutron scattering method and gypsum blocks are some of the skills that enable moisture sensing. Capacitive sensors, however instantaneous, are costly and need to be calibrated often with varying temperature and soil type. Moisture technique based on neutron probe is very accurate, but they are very

costly. The full concept of the water irrigation system is like traditional techniques of sprinkler or surface irrigation requires half of water sources. Even more specific amounts of water can be supplied for plants. The main objective of this paper is to save water and reduce or minimize labor work in the agriculture lands. Continuously Monitoring the rank of sensors provide signal for captivating essential action to applying the process and get the output of soil moisture sensor & provide water rendering to the essential or obligatory of crop.

Literature Survey

Archana and Priya (2016) planned a paper in which the humidity and soil moisture sensors are placed in the root zone of the plant. Based on the sensed values the microcontroller is used to mechanism the supply of water to the field. This system doesn't familiar the farmer about the field status.[1] SonaliD. Gainwar and Dinesh V. Rojatkar (2015) proposed a paper in which soil parameters such as pH, humidity, moisture and temperature are measured for getting high yield from soil. This system is fully automated which turns the motor pump ON/OFF as per the level of moisture in the soil. The current field status is not intimated to the farmer.[2] V. R. Balaji and M. Sudha (2016) planned a paper in which the system originates power from sunlight nonetheless photovoltaic cells .This system doesn't be contingent on electricity. The soil moisture sensor has been used and based on the sensed values PIC microcontroller is used to ON/OFF the motor pump. Weather forecasting is not included in this system.[3] G.Parameswaran and K.Sivaprasath (2016) planned a smart drip irrigation system using IOT in which humidity, temperature and pH sensors are used. Irrigation status is updated to the server or local host using personal computer. The farmer can't access about the field condition without internet.[4] S.Reshma and B.A.Sarath (2016) proposed an IOT based automatic irrigation system using wireless sensor networks in which various sensors are used to measure the soil parameters. This system provides a web interface to the user to monitor and control the system remotely. Weather monitoring is not done in this system.[5] Joaquin Gutierrez (2013) proposed a gateway unit which handles sensor information, triggers actuators, and transmits data to web application.[6]

Some Irrigation Method

Irrigation obligation be contingent on kind of crop, season, weather factors, soil kind and kind of irrigation system used. Against the backdrop of the rapid decline in irrigation water potential and low water use efficiency in the conventional methods of irrigation, precision irrigation methods has recently been introduced in Indian agriculture. Besides saving a substantial amount of water, it also helps to increase the productivity of the crops. Oven dry method, gypsum block method and Sand bath Method are one of the common methods to determine moisture content in soil.

Over Dry Method

It is a very common technique to amount moisture in soil. In this method,

- You take a soil sample of say 200 grams
- You dry the sample in an oven at a temperature of 105 to 110 centigrade for a day
- You weigh the sample and determine the moisture loss by subtracting the result with the moist weight

Moisture content is judged by the percentage of oven dry weight of the soil. For example - if a 212-gram moist soil weighs 197 after drying, you calculate it by dividing 197 into 15 that gives 7.6%. Don't forget to subtract the weight of the container from both the moist and dry weight determinations. It is the most accurate method to determine soil moisture. Moisture content value obtained is highly dependent on the type of oven used, conditions within oven and the time and temperature of drying.

Figure 1.Oven dry method

Gypsum Block Method

The electrical Properties of resistance can also be utilized to amount moisture in soil. When the moisture content changes, the electrical belongings of the soil also alteration. Porous blocks of the gypsum covering electrical elements are mixed in the soil. Gypsum blocks are made of the resources such as fiber glass and nylon. AS the soil moisture changes, the moisture content of the blocks also changes. To use gypsum blocks, dig a hole to the deepest from which you want moisture data. At each desired interval-bury a gypsum and being its leads to the surface. Bury a number of blocks at diverse depths in one location.

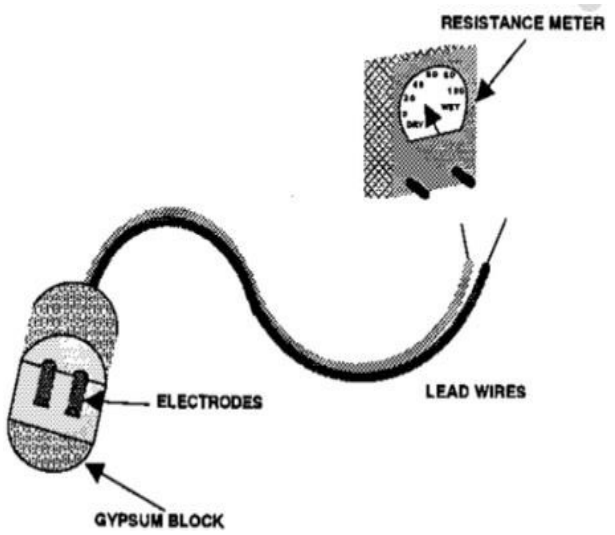

Figure 2.Gypsum method

Sand Bath Method is a field technique of decisive rough value of the water content. The container with the soil is located on a sand bath heated over a Kerosene stove. The soil become dry within ½ to 1 hour. It should not be used for organic soil or soil containing higher percentage of gypsum.

Figure 3.Sand bath method

Proposed System

The main objective is to reduce the load on the farmers by using "soil moisture sensors". Farmers doesn't have to visit the farm at equal interval of time to monitor the water content of the soil instead he can detect the moisture level by once using moisture sensor and get the readings and accordingly proceed with the irrigation process. Soil moisture sensor is used to measure the volumetric water content of the soil. We can use it for agricultural settings such as soil science, environment science, biology and botany

Soil moisture sensor procedures the capacitance of the soil, the moisture content of the soil changes the capacitance. It is calculating the dielectric permittivity of the soil and detects the moisture in the soil. The reading on the sensor denotes the volumetric water content of the soil and it reads from 0%-45% (common unit). Why? : Because soil is made by minerals, organic and also spaces. So when we add moisture to the soil, we're filling up those pores. How to use/place the sensor: the sensor should be placed horizontally in the soil. To get a better reading, compact the soil around the sensor. Once the reading is taken gently remove the sensor out of the soil finally after the sensor is placed in the soil it detects the moisture and sends the reading to a device, which can be easily read by the famers. Hence it is beneficial to use soil moisture sensors as it can save work load and time of farmers/users.

Figure 4.Sensor for determining soil moisture

Figure 5.Soil moisture Sensor

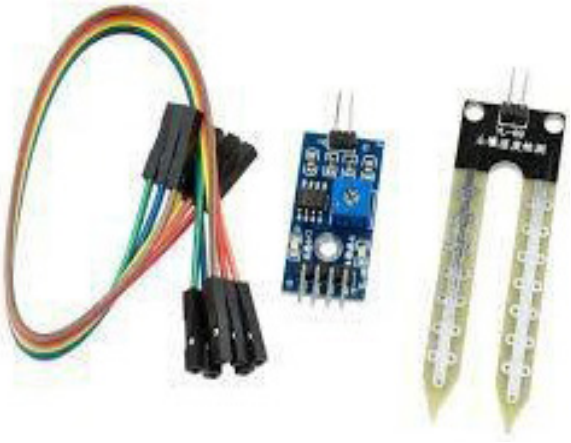

Figure 6.Hardware Implementation

Hardware Implementation

Soil moisture sensor ranges 0 to 45% volumetric water content in soil (capable of 0 to 100% VWC with alternate calibration). It has accuracy 4% typical. Typical Resolution of soil moisture sensor is 0.1%. Power of sensor is 3 mA @ 5VDC. Operating temperature of sensor is within –40°C to +60°C.Dimension of soil moisture sensor is 8.9 cm × 1.8 cm × 0.7 cm (active sensor length 5 cm).

Conclusion

By using soil moisture sensor, we can reduce the workload of farmers and save time. The moisture sensor detects the moisture in the soil in few minutes and give the reading and accordingly by which farmers can proceed with their irrigation.

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