SMART FARM SYSTEM

R.PADMAVATHI[1], V.PAVITHRA[2], V.SWETHA[3]

UG Scholars Department Of Computer Science Engineering

Vivekanandha College Of Engineering For Women, Tiruchengode, Tamil Nadu, India.

Dr.C.SURESH GNANA DHAS M.E.,Ph.D.,[4]

HEAD OF THE DEPARTMENT

Department of Computer Science Engineering

Vivekanandha College of Engineering For Women

I. ABSTRACT

Growing vegetables requires the soils which are rich in nutrients, easy to dig and also easy to handle when it is ready to be planted. Thus, there are a few different types of soils are being compared to determine the best soil that can be recommended for growing plants. Moisture content in soil also one of the major parts of plant growth. Measuring the soil water content by using manual method shows inaccurate results and not really precise. The previous method is not compatible with the result needed from the measuring the water content of soil. The old method of monitoring the crops every single time will waste of time and energy. This report is focused on analysis of the different moisture sensor material with the water content on the three types of soil. The analysis not only focusing on the sensor but also the soils. The measurement was taken during the experiment which involves different type of soil moisture sensor measurements with the three types of soils that fixed to 200gram each. The measurement data were compared for each type of sensor and each type of soil. The result shows the he smallest particle of soil retains the most amounts of water but the well-suited soil for variety of plants required the high nutrition, moderate to hold the water and drain well. Besides, the above method is suitable for measure the water content in soil using Humidity Sensor the and PH soil moisture sensor but not compatible using gypsum block sensor.

II. INTRODUCTION

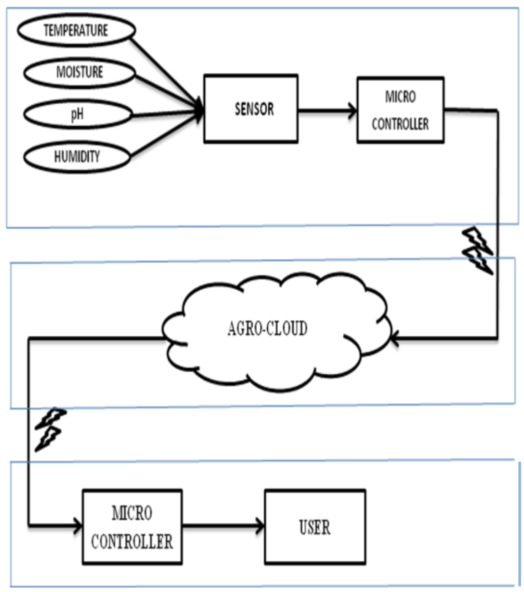
The systematic irrigation management will increase and improve crop quality, conserve water and also can save energy. By using the soil moisture sensor is the alternative ways to help make improved water management decision. Besides that, a good soil with the good characteristic also be the main part in contributes to plant growth. Soil can be classified into four main types includes sandy, silt, clay and the other one is loam soils. Each of the soils has different characteristics and benefits for the crops planted. Soils also have a different size of particles and clay soil resulted has the smallest particles (below 0.002mm) comparable to sand (2.00-0.20mm) and silt soils (0.02-0.002mm). Since the sand soil particles are large, therefore the water and nutrient quickly drain away from the soil compare to clay soil that are compact and hold the water and prevent water to easily drain. Silt soil has a similarity with the clay soil, but retains a moderate amount of water. Soil is basically a layer of unconsolidated material found at the Earth's surface that has been influenced by the soil forming factors. The gaps between the soil particles are known as pore spaces or voids, which consist of variable amount of air and water. The amount of void space within a soil depends on the distribution of particle sizes, and is quantified by soil porosity. Besides solid particles, the soil also contains air, the amount of which may vary depending on the soil type. "Soil saturation" state is reached when the volume of air in the soil is higher and the density of soil is lower. It is then theoretically possible to replace the whole amount of air with water. Soil does not have the ability to hold all the water as, due to the force of gravity of the Earth; therefore there will always be the tendency of the water to drain away under normal condition. Immediately after a rain or irrigation water application, when all the gravity water has drained down to the water table, a certain amount of water is retained on the surfaces of soil grains by molecular attraction and by loose chemical bonds. This water cannot be easily drained under the action of gravity and is referred to as field capacity (in per cent by volume). The determination of field capacity is extremely useful because it is one of the factors that allow calculating the amount of water available for plant use. Field capacity corresponds to soil tensions of about 0.3 bars (0.08 bar for sands and up to 0.5 bar for clay soils). Light soils cannot bind the water so tightly and the field capacity is here far below the state of soil saturation. In reverse to the water binding capacities of the soil, the plants, via their roots, suck the water they need for evaporation out of the soil. The suction potential of the plants, however, is limited and does not suffice to draw all the water out of the soil. The state until which the plants can draw water out of the soil is referred to as the wilting point (in per cent by volume) or it can be expressed as the soil moisture content at which plant can no longer extract sufficient water for its growth, hence begins to wilt. Therefore, the plant can use water only in the span between wilting point and field capacity. Available soil moisture is therefore the difference in water content of the soil between field capacity and permanent wilting point (Garg, 1999). This is the soil water that is available for plants to use. The water left in the soil after the permanent wilting point is reached, cannot be removed, and it's known as unavailable moisture. Therefore 19 the soil moisture is described as the level of saturation in the upper soil layer relative to the soil field capacity and is regulated by the precipitation and potential evaporation and is highly variable in space and time. The water below the water table is known as ground water and above the water table as soil moisture. Soil moisture can be expressed either in gravimetric which is the mass of water/mass of solid material or in volumetric which is defined as the volume of soil/total porosity. The moisture content in the surface layers of the soil is an important parameter for many applications in hydrology, agriculture and meteorology.

Soil moisture is one of the few directly observable hydrological variables that play an important role in the water and energy budgets necessary for climate studies. In agriculture point of view, soil moisture information is essential for many applications like irrigation scheduling, plant stress and improving crop yield. Soil moisture also determines the partitioning of net radiation into latent and sensible heat components in the field of meteorology. Therefore, accurate and reliable soil moisture estimates are essential in several applications as to examine the effect of climate change on land surface hydrological variables such as soil moisture, infiltration fluxes, runoff and surface temperature caused by changes in heat fluxes; to characterize changes in the simulated and observed planetary boundary layer depths due to variations in the surface temperature, soil moisture and heat fluxes; to quantify the amount and variability of regional water resources in water limited regions of the world on seasonal and annual time scale; and to examine the impact of assimilation of the derived land surfaces variables on predictive capabilities of mesoscale and global circulation models. There are various approaches for determining the soil moisture, which will be discussed in this section.

III. LITERATURE SURVEY

Soil moisture sensors measure plant-available water as a function of soil volumetric water content as it relates to matric potential, the behavior of which is illustrated in Figure 1. A completely dry soil sample contains void spaces between the soil particles, a soil property known as porosity. As water infiltrates into soil, these voids are filled. Some water drains through the voids due to the effects of gravity, but a portion remains held in the voids by forces exerted by the soil particles. Examples of soil at the extremes, sand and clay, are shown in Figure 1. Sandy soils have a low matric potential and relatively high hydraulic conductivity. That is, water enters them relatively freely and travels quickly along a gradient. Clay soils have high matric potential and low hydraulic conductivity. Water does not enter these soils easily, and it travels slowly through the soil profile. The finer particles in the clay soils tend to hold the water more tightly than in sandy soils. The strength of this bond is expressed as matric potential. It is useful to define soil moisture with respect to an operational range. The high end of this range the field capacity of soil is typically defined as the moisture content two to three days after a rainfall or irrigation event has ended, where excess water has drained away. At the low end, the permanent wilting point of a soil is the value at the lower moisture threshold beyond which a plant can no longer withdraw moisture from the soil. By convention, the wilting point is defined as the soil water content measured at approximately 15 bars (502 feet of water) of matric potential. Sandy soils have both a lower wilting point and higher field capacity but dry out quicker. Thus, sandy soils hold less water than clay soils. However, the water within the pores of a sandy soil is more available to the plants than water in a clay soil. Therefore, “relative” boundaries can be set using these observed parameters by setting the upper threshold of soil moisture measurements at field capacity and the lower threshold at the value when wilting is observed.

IV. SYSTEM ARCHITECTURE



A. SOIL MOISTURE SENSOR

The Soil Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium. In soil, dielectric permittivity is a function of the water content. The sensor creates a voltage proportional to the dielectric permittivity, and therefore the water content of the soil.

B. PH SENSOR:

pH is the numeric representation of gram-equivalent per liter of hydrogen ion concentration in any solution. It varies between 0 to14. It is the logarithmic measurement of moles of hydrogen ions per liter of solution. The solutions having pH value between 0 to 7 are acidic solutions with large concentration of hydrogen ions whereas solutions having pH value between 8 to 14 are basic solutions with small hydrogen concentration. The solutions having pH value of 7 are neutral solutions. Measuring the pH gives the measure of alkalinity or acidity of a solution. pH sensors combine high accuracy and performance with ease of use.

C. HUMIDITY SENSOR

A humidity sensor (or hygrometer) senses, measures and reports both moisture and air temperature. Humidity sensors work by detecting changes that alter electrical currents or temperature in the air.

D. TEMPERATURE SENSOR

When the voltage increases then the temperature also rises. We can see this operation by using a diode. An example for a temperature sensor is LM35. The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius temperature.

E. PIC microcontroller

PIC stands for Peripheral Interface Controller. Peripherals like PORTS, Timers, Interrupts, ADC, RTC etc are interfaced with the Microcontroller to do a specific Applications.

F. TRANSFORMER

The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op-amp. The advantages of using precision rectifier are it will give peak voltage output as DC; rest of the circuits will give only RMS output.

G. RECTIFIER

A rectifier is an electrical device that converts alternating current to direct current or at least to current with only positive value, a process known as rectification. Rectifiers are used as components of power supplies and as detectors of radio signals.

H. BRIDGE RECTIFIER

When four diodes are connected as shown in the power supply circuit diagram, is called Bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners.

V. CONCLUSION

This project show the analysis of different materials and type of soil moisture sensor compared to the different type of soil. The same and simple technologies used for all the sensors in obtained the results and finding was observed in order to achieve the objective of the project. By using build in moisture sensors can provide the best reading compared to the commercialized moisture sensor. The material of sensor react with the oxygen in the moisture condition cause the corrosion will affect measurement reading. Thus ph sensor, humidity sensor prevent from corrosion. By using this method to measure the water content in soil moisture using PH sensor compatible . The smallest particle of soil which retains most of water was not the best selection of the right of soil planet. The soil with high nutrient and ability to retain the water from becoming waterlogged and also drain well being the best soil . Therefore real Implementation, the combination of three soil with different ratio of each soil will be the best soil for plants growth.

VI. REFERENCES

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