

Soil Parameters Monitoring With Automatic Irrigation System

Sonali D. Gainwar, Dinesh V. Rojatkar*

Abstract— The continuously increasing population in India demands for the rapid improvement in food production technology. Indian economy is mainly based on agriculture. While farming, some important soil parameters such as ph,moisture,humidity and temperature are measured for getting high yield from soil. The method which is used for measurement of these parameters is completely based on chemical process on soil sample. The process is generally carried out in near Agriculture Office. Soil Parameter Monitoring with Automatic Irrigation System include the measurement of these parameters on the field so that the farmer doesnt need to go somewhere else. This sytem also consist of a fully automated irrigation system which will turn on and off a water pump as per the level of moisture in soil..

Index Terms—Soil parameters, automatic irrigation.

I. INTRODUCTION

Irrigation in agriculture is one of the main task. It is very much important to water the crops as per their need. Very less watering or too much watering can damage the crops. In present irrigation system, a farmer cannot check the moisture level of soil. Hence sometimes it may happen that the watering is more than the need of the crop and sometimes water doesn't reach upto the roots of the plants. This will waste the water and efforts. If water doesn't reach upto the plants roots then it will directly affect the plant growth and profit. Traditional irrigation system requires manpower. Hence, it become neces- sary to do something so that the irrigation will become more convenient. Automatic irrigation system is a project which is developed to automate the traditional irrigation system. It is a simple system, using Arduino to automate the irrigation and watering of crops.This system does the control of soil moisture. In case of dry soil it will activate the irrigation system pumping water for watring plants. The system uses a LCD display to notify all actions that are taking place and a real time clock.This system uses a water level sensor and a moisture sensor to detect the moisture level. A pump is also connected which will get on when moisture level falls down and will automatically turn off when moisture level will become sufficient. A LCD will display the digits indicating operation. All these tasks are controlled by an

Arduino board. Different sensors are used to detect the different parameters of the soil like moisture, temperature, humidity, and pH of soil content of the soil. Depending upon the sensors output the AVR Microcontroller will take the necessary action. The moisture sensor output will help to determine whether to irrigate the land or not depending upon the moisture content. Along with moisture sensor the temperature sensor output can also be taken into consideration while irrigating the land. If the moisture content of soil is very low and the temperature is very high then there is need of irrigation for plants, but the time for which irrigation will be provided is different for different temperature range. Because if the temperature is very high then the evaporation rate is also very high and hence we have to provide water for more time in order to attain the proper moisture level in the soil. Hence for different temperature range and moisture content level in the soil the land will be irrigated for different time interval. Soil pH is also detected and measured. pH of the soil is also important factor which will affect the plant growth. Acidic or basic nature of the soil will affect the nutrient availability in the soil. Soil nutrients i.e. macronutrients or micronutrients are helpful for plant growth and there availability depends on the pH of the soil. Hence there is need to measure soil pH. Depending upon the measured pH of the soil, suggestions can be given to the farmer to add various chemicals in order to achieve the desired pH of the soil for good plant growth.

If Automatic Irrigation System is used in farm then at first it will completely reduce or eliminate the need of manpower for irrigation. It avoid the wastage of water due to overwatering to the crop. Also it is the most convenient way to water the crop as per their need. Also due to use of other sensors used in the system, the farmer can measure ph, humidity and temperature of the soil without taking soil sample into the lab.

The description and importance of four parameters which this system can measure are given below-

A. ph value

The ph measurement of soil is important task in agriculture. We know that a ph below 7 is termed as acidic nature, a ph at 7 is neutral while a ph above 7 is alkaline. The effect of pH on a soil is to remove from the soil or to make available certain ions. Soils with high acidity tend to have toxic amounts of aluminum and manganese. Plants which need calcium need moderate alkalinity, but most minerals are more soluble in acid soils. Soil organisms are hindered by high acidity, and most agricultural crops do best with mineral soils of pH 6.5 and organic soils of pH 5.5.

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Sonali D. Gainwar, Electronics and Telecommunications Department, Government College Of Engineering, Chandrapur, India.

Dinesh V. Rojatkar, Electronics and Telecommunications Department, Government College Of Engineering, Chandrapur, India..

B. Humidity

Humidity is nothing but the level of water droplets or level of water vapour in the air. Most of the crop diseases occur mainly in humid climate. Also humidity is an important factor for some crop that grows best in humid climate. Hence, humidity measurement has been added in the system

C. Temperature

Soil temperature is the measure of how hot or cold the soil is. More technically, it's the detection of the internal energy of the soil, or its heat. Soil scientists consider temperature a very important soil physical property and it controls many chemical and biological processes within the soil. When a farmer plants, he waits for the temperature to rise above a certain value (i.e., he waits until the soil has enough internal energy) so that his seeds will germinate. For every 10 degree rise in soil temperature, we expect biological activities, like soil respiration, to double. If the temperature gets too high, it kills things that live in the soil, like plant roots and other organisms. Likewise, chemical reactions that aren't mediated by soil organisms tend to go faster as the temperature increases. Hence, it becomes very important to measure soil temperature in agriculture.

D. Moisture

Moisture content is the amount of water in the soil. The irrigation is completely dependent on the moisture content or moisture level in the soil. It is very important to maintain a particular level of moisture in the soil for proper growth of the plants. Very low or very high moisture in soil can damage the crop.

II. METHODOLOGIES

Automation of the irrigation system is gaining importance as there is a need to use water resources efficiently and also to increase the field productivity. The system is used to turn the valves ON or OFF automatically as per the water requirement of the plants. The system is used for sensing, monitoring, and for controlling purposes. The system block diagram is shown in Fig.1.

It consists of four sensors, a microcontroller, a LCD display, relays, and a water pump or motor. The working of the project is divided into two parts. First is parameter measurement and second is irrigation system. The pH, moisture, and temperature sensors are inserted in the soil while the humidity sensor is kept above the ground level. All the sensors will record the value and give it to the microcontroller. The microcontroller then displays this value on a LCD screen. The values will be displayed on the screen one by one at an interval of 10 seconds.

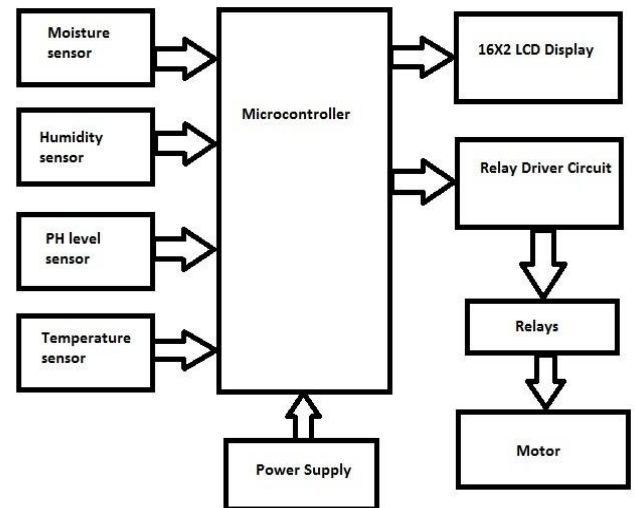


Fig 1 Block diagram of the system

Second part of the circuit is automatic irrigation system. A moisture sensor is inserted in the soil. This sensor will record the moisture level in the soil and send this value to the microcontroller. The microcontroller then compares this value with a certain predefined value. This predefined value can be set by us as per the crop because different crops need different amounts of water. If the moisture level in the soil drops to a particular value, the water pump will get on and the process of irrigation will begin.

During this time, the moisture sensor will continually send the moisture value in soil to the microcontroller. After some time when the moisture level in the soil reaches a particular level, the water pump will automatically get switched off. In this way, the circuit performs the task of irrigation.

The description of various components which have been used in the circuit is given below-

A. Temperature sensor

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to centigrade temperature sensors calibrated in Kelvin, as the user temperature.

B. pH probes

The sensor which has been used for the measurement of pH is pH100. At the heart of the Stevens-Greenspan pH Sensor is a gel-filled electrochemical sensor which is very selective and sensitive to hydrogen ions. Coupled earth loop currents, a frequent source of errors with high impedance pH probes, are eliminated through the use of optically isolated signal conditioning electronics. Built-in temperature compensation removes temperature-related errors.

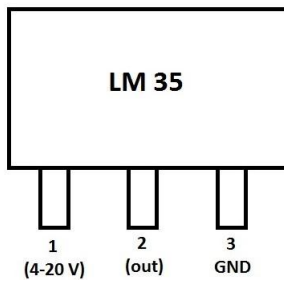


Fig 2 Temperature sensor

C. humidity sensor

This humidity sensor consists of 2 copper conductors that are located at small distance from each other. The relay switches as soon as the moisture makes a connection that is more or less electrically conductive between the 2 electrodes.

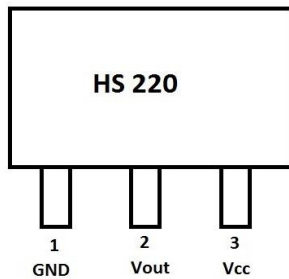


Fig. 3. Humidity sensor

D. Moisture sensor

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neurons, as a proxy for the moisture content. The sensor used here is VH400.

E. Microcontroller

The microcontroller used in the circuit is atmega 328. It is a 28 pin microcontroller from atmel which belongs to mega avr family. Its clock frequency is 16 MHz.

F. LCD Display

A 16X2 LCD module has been used as a display that means it can display 16 character per line and their are 2 lines. LCDs are preferred over LEDs and seven segment displays because they are economical and easily programmable.

G. Relays

Relays are electromechanical device which are actuated by an electric current. To function relays properly, a relay driver circuit should be used in the circuit.

CONCLUSION

The main objective of this paper is to design a fully automated irrigation system. The system provides a real time feedback control system which monitors and controls all the activities of drip irrigation system efficiently. The system valves are turn ON or OFF automatically depending upon the moisture content. The system also provides the efficient information regarding the soil pH and soil nutrients. Thus the system monitor, and control. Using this system, one can save manpower, water to improve production and ultimately increase profit.

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BIOGRAPHIES



Sonali D. Gainwar, Government College of engineering, Chandrapur.



Dinesh V. Rojatkar, Government College of Engineering, Chandrapur. He has published papers and participated in International Conference.1.(2002),”Application of Wavelet Transforms in One and Two Dimensional Image Processing” at National Conference, SSGM College of Engineering, Shegaon, Maharashtra. 2.Recognition of Some Handwritten English Characters Drawn by Mouse Dragging Using Correlation Approach, International Conference at Mumbai(in process).