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Microcontroller Based Soil Parameter Monitoring For Automatic Irrigation System

P. M. Mali
Department of Electronic Science
H.P.T. Arts & R.Y.K. Science College, Nashik-05
prakashmali14@gmail.com

***Abstract*—** Agriculture field plays vital role in Indian economy. Major part of country is dependent on agriculture for their income.The food requirement of all countries are fulfilled by farmers. But now a days farmers are facing number of problems such as drought situation, seasonal plant diseases, lack of knowledge of pesticides etc. Because of this reasons farmers are not able to get enough product from agriculture field. Presently big problem faced by farmers is lack of water for agriculture. On the other hand the availability of water in different regions of the country is different. To solve this water problem we need to study the soil condition along with water availability.The soil parameters like moisture, temperature, pH etc helps in understanding the soil condition. This project works helps by monitoring soil parameters for automatic irrigation system to provide adequate amount of water to the crops.

Keywords- *Soil parameters, Microcontroller, automatic irrigation system.*

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I. Introduction

Recent irrigation system is beneficial which supplies adequate amount of water to the crops from the available resource. In traditional system,farmer supplies water to the plant without knowing the actual requirement of the soil. Sometime more or less watering damages the crop and affects the growth.To avoid water wastage and increase in food production,irrigation in the agriculture is necessary. Automation is done using microcontroller. This system controls soil moisture and temperature.Both the values are important. Second thing is that farmer provides some chemical or pesticides to the crops in order to increase its growth without knowing the availability of nutrients in the soil. Hence, it is necessary to measure the pH of the soil. From the pH value farmer came to know the essentiality of nutrients.By providing desired macronutrients to the plant pH value is maintained.The output of all the sensors are used by the microcontroller to take necessary action.The LCD display shows the values of the parameters before and after action of the controller.In case of dry soil it will activate the irrigation system by pumping water for desired plants. A pump is gets ON when moisture level falls down and will automatically turn off when moisture level will become sufficient. All these tasks are controlled by the microcontroller.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.

II. Soil Parameters

A. Moisture

Water content present in soil is known as Moisture. Each type of crops are needing different level of moisture.Sensor detects moisture and gives its value to controller for further action. The controller is getting continuously the value of moisture level. Depending on the value of moisture, it turns on & off the motor valve 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. Not all the water, held in soil, is available to plants. Much of water remains in the soil as a thin film. Soil water dissolves salts and makes up the soil solution, which is important as medium for supply of nutrients to growing plants.

B. pH

The pH is nothing but concentration of hydrogen ions present in water. For the growth of the crops, pH of soil must be constant to a particular value. The soil's acidity level also affects the dispersal of other important nutrients in the soil, and an imbalance can block a plant's ability to absorb them. Soil chemistry plays an important role in the availability of nutrients to the plant. Acidity or alkalinity (basicity) of the soil solution determines availability of nutrients. A lack of knowledge in this area may cause plant producers to incorrectly assess plant problems and spend unnecessary time and money trying to resolve them. Some of the symptoms of incorrect acidity or alkalinity in the soil may appear to be problems associated with diseases and other pests. Proper monitoring of irrigation water and soil allows growers to understand what is going on below the surface of the soil so that symptoms can be handled properly.

C. Temperature

Soil temperature is simply the measurement of the warmth in the soil.Soil temperature is very important soil physical property and it controls many chemical and biological processes within the soil. Soil temperature affects climate, plant growth, the timing of budburst or leaf fall, the decomposition rate of organic material.When a farmer plants,

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he waits for the temperature to rise above a certain value so that his seeds will germinate.If the temperature gets too high, it kills things that live in the soil, like plant roots and other organisms.

III. WORKING OF THE SYSTEM

The automation in the irrigation system is becoming essential as there is need to use water resources efficiently and also to increase the field productivity. The system is used to turn the Motor ON or OFF automatically as per the water requirement of the plants.This action is actually done with help of AC motor.The system block diagram is shown in Fig 1. It consist of three sensors, microcontroller, LCD display, relays and a water pump or motor.The pH, moisture and temperature sensors are inserted in the soil.All the sensors which are placed in the soil gives particular value of parameter and these measured values from the different sensors are given to

microcontroller through analog to digital Converter. Microcontroller analyses the input and compares with stored values and then performs operations on these values and take necessary actions.Then it display this value on a LCD screen.The values will be displayed on the screen one by one at some interval.

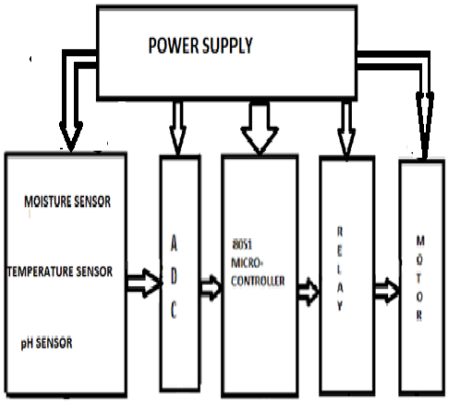


Fig: 1. Block diagram of the system

Second part of the work is automatic irrigation system. A moisture sensor inserted in the soil measure the moisture level in the soil and send this value to the microcontroller.Microcontroller then compare this value with a certain predefined value.This predefined value can be set by us as per the crop because different crops need different amount 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 moisture level in the soil reach to a particular level, the water pump will automatically get switched off. In this way, the circuit perform the task of irrigation.

IV. Sensors & Components

A. Temperature sensor

LM35 is very accurate and very good sensor to show the temperature in celcius.LM35 is a linear temperature sensor.The LM35 series are precision integrated-circuit temperature device with an output voltage linearly proportional to centigrade temperature sensors.It has sensitivity of 10mV/^{o}c. Its operating voltage ranges from 4v to 20v.We can measure temperature more accurately than a using a thermistor.The sensor circuitry is sealed and not subject to oxidation.Basically it is a IC sensor with low impedance.The LM35 generates a higher output voltage than thermocouples and may not require the output voltage be amplified.

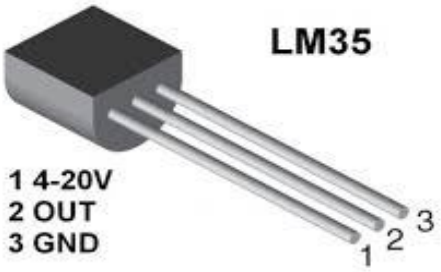
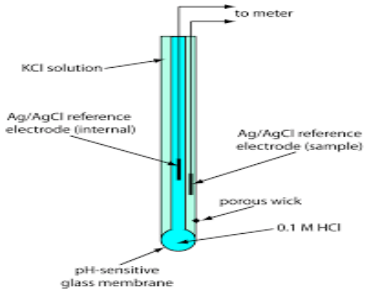


Fig 2.Temperature sensor

B. pH sensor

The sensor which has been used for the measurement of pH is ph100.Soil pH is measured from soil solution using pH electrode.pH electrode has output in mill-volts depending upon the pH value. pH electrode basically measures the hydrogen ion [H^{+}] activity. Measurement of pH with pH electrode is based on the principle that potential is developed when two solutions of different pH comes in contact through a thin glass membrane.



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C. *Moisture Sensor*

Soil moisture sensors measure the water content in soil. A soil moisture sensor is simply made by taking two metal electrodes separated by 4cm.The sensor uses capacitance or resistance principle.In capacitive sensor dielectric constant between two electrodes changes according to the water content within the soil.Basically this sensor is inserted into soil that measure the volumetric water content in soil.The moisture sensors were designed using probes made from corrosion-resistant material which can be stuck into soil sample. In resistive soil sensor, voltage levels corresponding to the wet and dry states of the soil sample were computed by measuring the resistance between the moisture detector electrodes.

D. Microcontroller

The microcontroller is the heart of the system. It accept the digital inputs from the ADC and take correct action corrective action The 8051 is a 8-bit microcontroller with 40 pins. It has 4 Kbytes of ROM and 128 bytes of RAM. Its clock frequency range is 4MHz to 40 MHz.

E. A/D Converter:

The microcontroller needs only digital data for processing. Hence analog to digital converter is required to convert analog data from the different sensors into digital.The converter used is ADC 0808 which is 8-bit converter and its conversion time is about 100µSec.

E. LCD Display

To monitor the soil parameters before and after the action of a microcontroller, LCD display is required. It displays the actual values of all the sensors

F. Relays

A relay is an electromechanical switch used to make the motor ON and OFF. To increase the current capacity, a relay driver is used.

G. Motor

To supply the water to the crops, Motor is made ON and OFF depending upon the soil condition.

V. *CONCLUSION*

The automation in the agriculture save the water along with time of the farmer.The sensors are useful to maintain exact requirement of the soil.It avoids unnecessary use of the some chemicals, powders,etc.Thus the system maintains various parameters to the required value.

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