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Design and Implementation of Soil Moisture Detector using Arduino

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Abstract - India is known as land of farmers. It gives more importance to farming as agriculture contributes a lot in the economic growth of the country. Weather is very important for growing crops and should be monitored for proper growth and good quality of crops. The farmers have to adopt the modern technology to have better yield and quality crops. In order to help the farmers we decided to make this automatic water supply using microcontroller. The main aim of this project was to provide water to the plants or gardening automatically using microcontroller (Arduino Uno). We can automatically watering the plants when we are going on vacation or don't we have to bother my neighbors, Sometimes the Neighbors do too much of watering and the plants end up dying anyway. There are timer based devices available in India which waters the soil on set interval. They do not sense the soil moisture and the ambient temperature to know if the soil actually needs watering or not. Assimilation is that the artificial application of water to the land or soil it is used to assist in the growing of agricultural crops, maintenance of landscapes, and revegetation of disturbed soils in dry areas and during periods of inadequate rainfall

Key Words: (soil moisture sensor, adurino uno, LCD, pumping motor,)…

1.INTRODUCTION

On the hardware side, there are a number of products currently on the market that can perform some of the requirements of this project. The Automatic Sprinkle System is the best example. The Automatic Sprinkle System is a Connect microcontroller with a built-in Bluetooth module. It is able to perform many of projects functions, such as communicating with wired and wireless sensors, transmitting information to an Android device via Bluetooth, and storing data to an SD card. However, the main problem with this solution, along with many others like it, is that the microcontroller must be programmed to perform this operation. This makes the microcontroller an impossible solution for users who don't know how to program, and an impractical solution for those that can program, but don't want to. A better product would already have the code pre-compiled, the input ports clearly labeled, and require little to no setup from the user.

1.1 SOIL MOISTURE MEASUREMENT

Moisture content of the soil is a major factor determining plant growth1, especially in irrigated systems. Currently there are many and varied methods for determining soil water content on a volume basis or a tension as described by Gardener. The basic objective of irrigation scheduling is to minimise water stress of the plant, that of over irrigation, and under irrigation. The manager aims to manipulate the biological process of cell elongation and cell reproduction for improved plant yield3 and maximum use of available effluent

1.2 Types of Soil Moisture Measurement

1.2.1.The Neutron Probe (NP): The technique is based on the measurement of fast moving neutrons that are slowed in the soil by an elastic collision with existing Hydrogen particles in the soil. Hydrogen (H+) is present in the soil as a constituent of

1. Soil organic matter
2. Soil clay minerals
3. Moisture content

1.2.2. Tensiometers: Portable and stationary tensiometers measure the soil moisture content as a tension or pressure ranging from 0 to -100 kPa). Tensiometers fundamentally act in a similar fashion to a plant root measuring the force that plants have to exert to obtain moisture from the soil. As the soil dries the water is lost from the tensiometer via a ceramic cup. The loss of water creates a vacuum in the tensiometer and is reported as a pressure reading, the drier the soil the higher the pressure reading.Tensiometers may be placed permanently in the soil giving an analogue or digital output.

1.2.3. Oven drying method: The soil sample is dried in hot air oven at 105^0 C until constant weight is obtained and dry weight of the sample is recorded. Moisture content (on weight basis) = Wet weight-Dry weight X 100/ Dry weight

2. Why soil moisture sensor

All the above methods are take some time to give the moisture content of the soil ,in order to measure the soil moisture quickly the soil moisture sensor is used

2.1. Soil moisture sensor

2.1.1 Introduction

The soil moisture sensor is one kind of sensor used to gauge the volumetric content of water within the soil. As the straight gravimetric dimension of soil moisture needs eliminating, drying, as well as sample weighting. These sensors measure the volumetric water content not directly with the help of some other rules of soil like dielectric constant, electrical resistance, otherwise interaction with neutrons, and replacement of the moisture content.

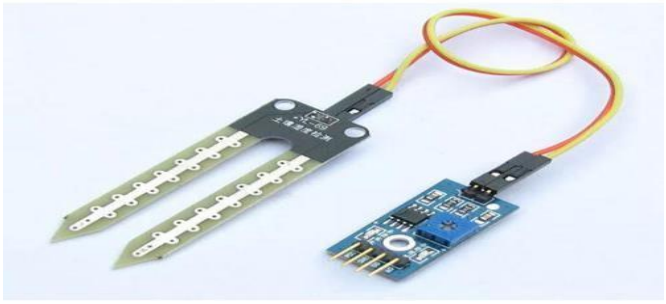


figure 2.1 soil moisture sensor

2.1.2. PIN definition

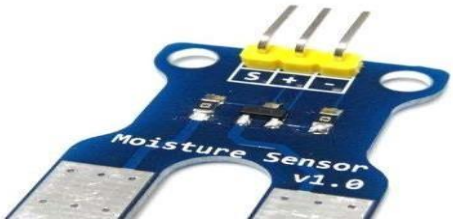


Figure 2.2 PIN definition

1. The symbol “s ”in this soil moisture sensor denotes signal. That is the current passing through the probe to the adurino uno

2. The symbol “+” in this soil moisture sensor denotes positive supply to the interface. The current less than 0.8mA is passed through the probe.

3. The Symbol “-” in this soil moisture sensor denotes negative supply to the interface. That is the symbol is connected to the ground

2.1.3. Working Principle of 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. The sensor averages the water content over the entire length of the sensor. There is a 2 cm zone of influence with respect to the flat surface of the sensor, but it has little or no sensitivity at the extreme edges.

The working of the Soil Moisture Sensor is very simple. It works on the principle of voltage comparison. The following circuit will be helpful in understanding the working of a typical soil moisture sensor.

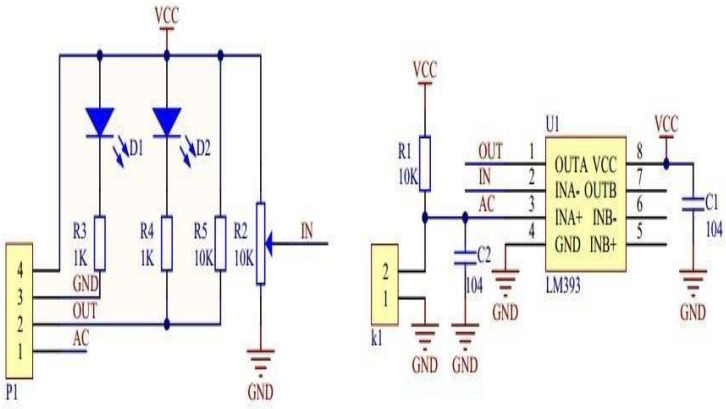


Figure 2.3working principle of soil moisture sensor

2.1.4. Specification

- Working Voltage:5V
- Working Current<20mA

3. Fast Diagram

The complete system design with its logical components is more easily presented by utilizing the FAST diagram. The FAST diagram is able to take what could possibly be a complicated project and break it down to an easy to follow format. Having a recognizable format such as this enables the designer to best focus their efforts on what is needed in the final product. The FAST diagram developed by the team is shown below. There are two functional components in this project. They are the moisture sensors module and the motor driver for motor pump. Thus the Arduino Board is programmed using the Arduino IDE software. The function of the moisture sensor is to sense the temperature content present in the soil, and also it measure moisture level in the soil. The motor driver interrupts the signal to, water pump supplies water to the plants. This project uses microcontroller Arduino Uno board to controls the motor and monitor soil moisture

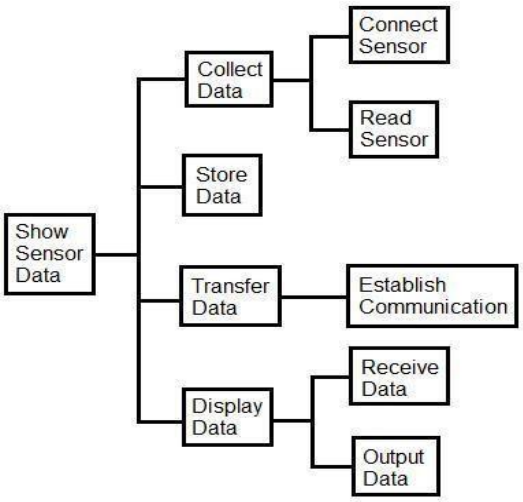


Figure 3.1 Fast diagram

3.1 Project Objective:

The Sensor Interface can be broken own into three main components: The LCD, the microcontroller, and the sensors which it communicates with. The LCD and microcontroller are essentially the support behind the sensors to collect, store, transfer and display data. Designing more advanced sensors was beyond the scope of this project, so the LCD and microcontroller became the areas of focus. The Sensor Interface was designed to accept a wide variety of sensors, analog, digital, wired and IC. Any of the sensors can also be connected to another Bluetooth module to allow a wide variety of wireless sensors to communicate with the central Sensor Interface microcontroller. Monitor the moisture content of the soil using a soil moisture sensor and the water level of the tank using a float switch. Turn the motor ON when the soil moisture falls below a certain reference value and if there is enough water in the tank. Display the status of the soil and the tank using a 16×2 LCD. Let's begin to build our project – Soil Moisture Based Automatic Irrigation System.

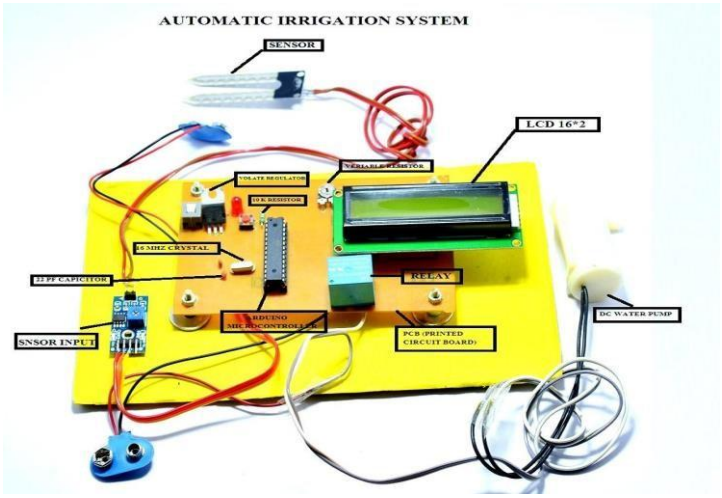


Figure 3.2 Automatic irrigation setup

4. Test result of this project:

This project has three various testing that included with low, medium and high water content in the soil. The soil moisture detector detects the soil moisture content if the soil moisture content is very low then the motor is automatically on and water supplies to the soil. If the soil has a sufficient amount then the motor turn off automatically. That are shown in below diagram as different conditions and different water levels and there outputs.

Step1:

When the water content of the soil is very low then, the result will appear like this. (i.e the plant needs some water), so the motor is on and water is supplied to the plant until it reaches the minimum water level needed

After giving some water to the plant.

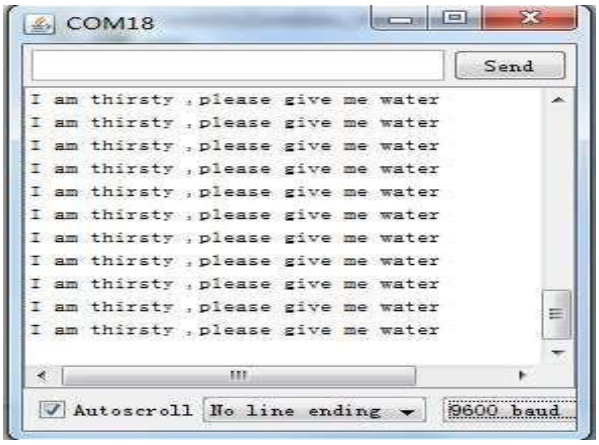
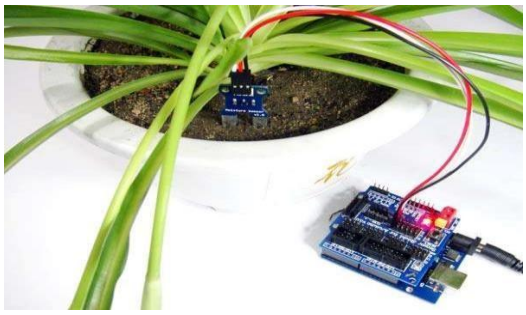


Figure 4.1 Result 1

Step2: After giving some water to the plant .The result will be like this (i.e the plant need not more water).So, the motor is automatically off and stops the watering to the plant



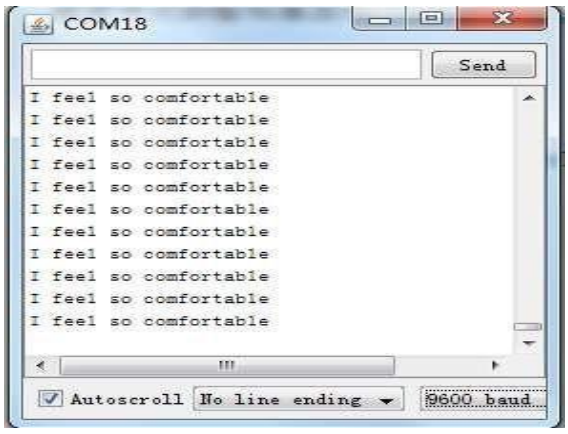
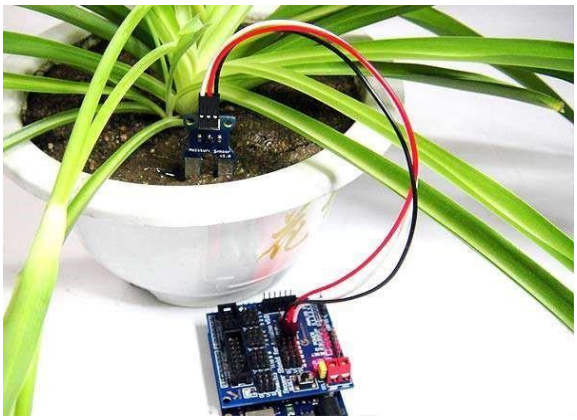


Figure 4.2 Result 2

Step 3: When we give to much amount of water than the result will be like this (i.e the plant reaches the minimum amount of water it needs), further watering the plant may hurts the plant.so the motor off automatically



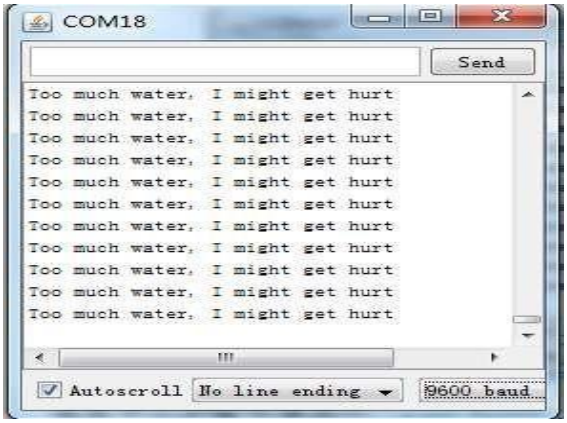


Figure 4.3 Result 3

5. Benefits:

1. Irrigation and watering play a substantial role in determining the quality and yields of farming. More appropriate is the process of watering of the fields, more favorable are the end results..

2. Time saving.

3. No need Extra work Hard.

4. Save Water, Accordingly our Requirement of water, depends upon water level quantity soil and crops.

5. Money Saving (Electricity bile + Water).

5.1. Conclusion

Thus the "Automated Irrigation system based on soil moisture using Arduino" has been designed and tested successfully. It has been developed by integrated features of all the hardware components used. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Thus, the Arduino Based Automatic Plant Watering System has been designed and tested successfully. The system has been tested to function automatically. The moisture sensors measure the moisture level (water content) of the different plants. If the moisture level is goes to be below the desired and limited level, the moisture sensor sends the signal to

the Arduino board which triggers the Water Pump to turn ON and supply the water to respective plant using the Rotating Platform/Sprinkler. When the desired moisture level is reached, the system halts on its own and the water Pump is turned OFF. Thus, the functionality of the entire system has been tested thoroughly and it is said to function successfully.

6. References

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