Soil Moisture Sensor

Introduction

A soil moisture sensor is used to measure the moisture content of the soil which is immensely useful in the fields of agriculture, weather forecasting and in constructions etc.

Here we used the capacitance-based method to build up the sensing element. Therefore, we used AC bridge concept to measure the capacitance of the soil mixture which we used to measure the moisture content.

Using the AC bridge concept, we get the voltage difference when the moisture level is varying in the soil mixture. Then, we used a voltage level indicator for displaying that voltage level.

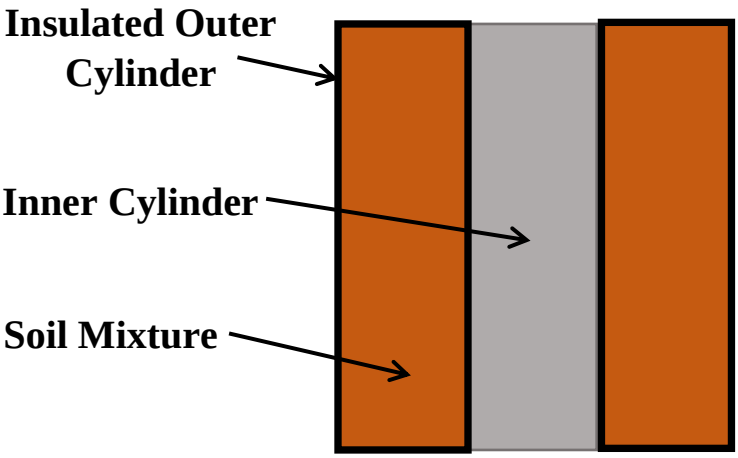
This way we are able to measure the moisture content of a mixture of soil.

Methodology

This soil moisture sensor is proposed to be constructed using the concepts of a capacitance bridge. A co-axial cylindrical Aluminum capacitor is used as the variable capacitor, through which the level of moisture in the soil will be sensed. The dielectric material for the coaxial capacitor will be soil with moisture for this case. Hence, the change of moisture content in the cylinder can be used as a measurement of the capacitance of the coaxial cylindrical capacitor. But here we consider the voltage difference which is used to get the balanced condition to indicate the mixture content of the soil sample.

The construction of the variable capacitor should be done with enough precautions to avoid the oxidizing/electrolyzing the Aluminum cylinders. Therefore, the cylinders are insulated using cello tape.

It is of great importance to keep the two cylinders coaxial, maintaining equal distance among the two plates of the capacitor. The two cylinders must not touch each other. A longitudinal cross section of the sensor capacitor is shown below.



A usual capacitor bridge is used to build the sensing element of this sensor. One of the arms in the bridge is consists a capacitor in parallel with a resistor. The opposite arm consists of a variable capacitor while the other two arms consist of resistors.

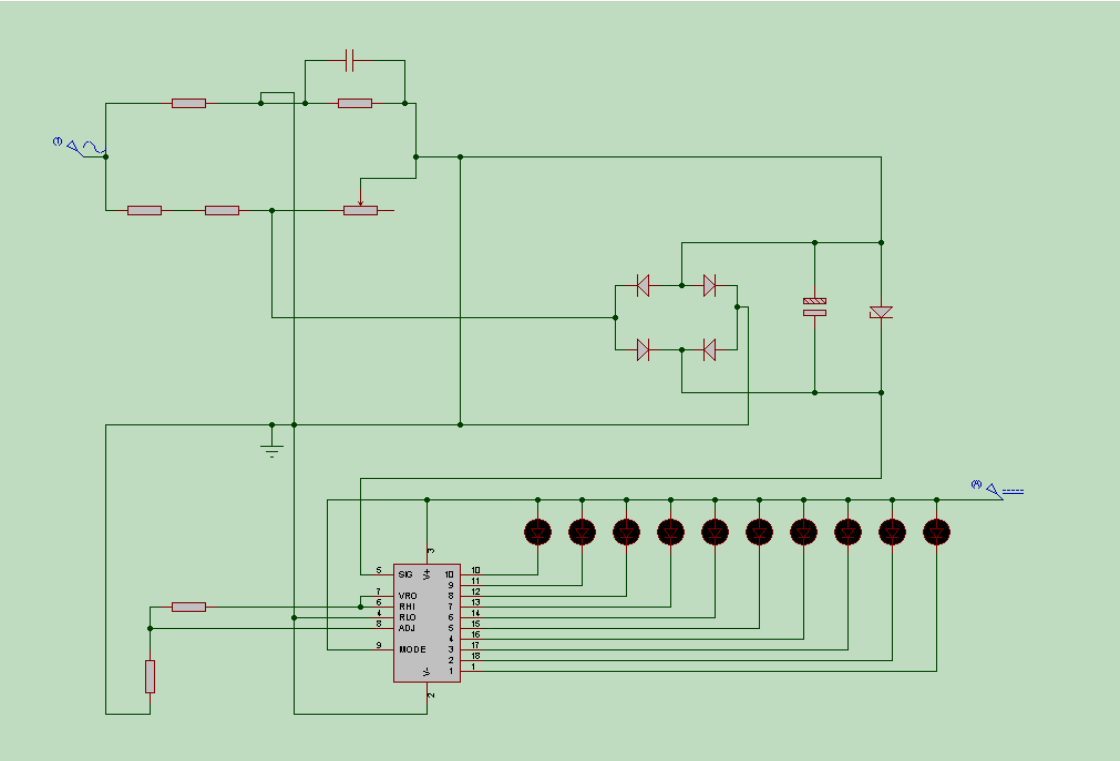
The bridge is balanced using a known capacitor and the resistor and got a reference point for other readings.

Both the input and the output to this bridge is an AC voltage. Therefore, in order to retrieve a DC signal, a rectifier bridge is used in between the voltage indicator and the capacitance bridge to rectify the AC voltage signal.

The voltage indicator would indicate the moisture level by lighting up the LED bulbs. In this sensor, the LED indicator indicates the moisture level using a set of LED bulbs, where the number of LED s lit is proportional to the level of moisture that is to be measured.

Here, when the moisture content is low, more number of LEDs are lighting and when the moisture content is high, less LEDs are lighting. That way we are able to get an idea about the moisture content of the soil sample we tested.

The Circuit Diagram Of Moisture Sensor Circuit



This sensor can be further improved by using a seven segment display or even a digital display. IC s can also be used as intermediate components to make the process more convenient. So, we hope to implement this to display the moisture content on a digital screen and we are planning to use this sensor for a smart irrigation system for agricultural unit.

Calibration for Different Soil Samples