Moisture Levels Detecting System By Using Hygrometer Soil Moisture Sensor

Khaing Khaing Soe[1], Sandar Oo[2], Eia Di Say[3], Swe Swe Hlaing[4]

Abstract

The moisture levels detecting system of a mechanism is established to find the moisture content in the soil with the help of soil moisture sensor and depending upon the condition of the sensor the water is controlled. This system is very busy world because people usually forget to water their plants which leads to bad growth and health of their plants. This system designed and constructed with HL-69 hygrometer soil moisture sensor, moisture sensor module, piezo buzzer, light emitting diode and Arduino Uno board. Microcontroller is the main controller of this system. The program of this project is written in C-language and up load to the microcontroller of Arduino Uno board through the Arduino IDE software. The program controls the operations of the whole circuit. This system can be widely used area range because it can be provided for the cultivator and the cultivated lend.

Keywords: Arduino UNO, C language, IDE software, HL-69 hygrometer soil moisture sensor

Introduction

People all over the world need water sparingly because water is the scarce use of water where it is needed and not when it is not needed. It is very important to use water proper soil moisture is measured by allowing plant to grow and water. Moisture is a huge problem for agriculturalists and farmers. Unreasonable moisture can cause adverse effects on the soil. This system is built with Arduino Uno microcontroller board, HL-69 hygrometer soil moisture sensor, moisture sensor module, piezo buzzer, LED and other electronic components. Arduino Uno microcontroller is main control device in this system and the operation of the whole system are controlled by the program. The control program used C programming language.

An HL-69 moisture sensor consists of two parts, the actual prong sensor and the controller. The two pins on the sensor need to connect to the two separate pins by the controller. The other side of the controller has four pins, three of which connect to the Arduino microcontroller. The four pins are, from left to right, Ao (Analog Output), Do (Digital Output), GND, and Vcc. The values can be read from the controller through the IDE when its connected to computer. Connect the sensors two pins to the positive and negative pins on controller using the provided connecting wires, lower reading indicate that more moisture is being detected and higher reading indicate dryness. The sensor sense water condition of soil for plant and then this data sent the microcontroller. If the dater sending is above nine hundred, its plant is seriously thirsty. If its plants go too thirsty, LED will light and the piezo buzzer will sound.

People are so busy that they forget water needed for plants to grow, the system can be solved this problem. Monitoring plant health is very important for their fast growth. In this system busy world, people usually forget water for their plants which leads to bad growth and health of their plants. Figure 1 shows block diagram of the system.

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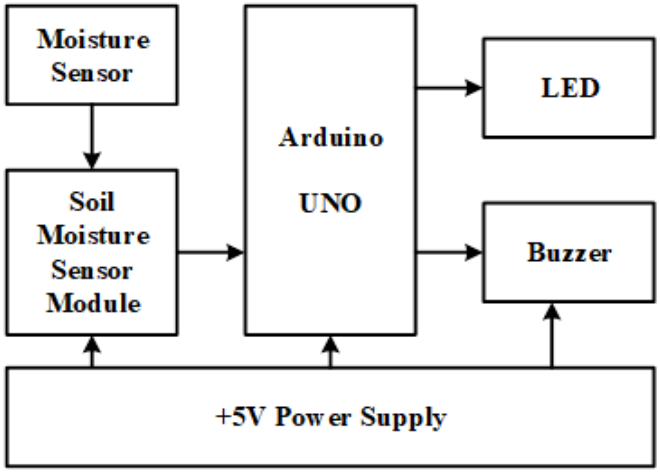


Figure 1. Block diagram of the system

Resources of Devices Used

Arduino UNO Board

Arduino is used to control interactive exhibits and conferences and trade shows in both the industry and in digital media sectors. It is used as management-consulting tools to help teams coordinate problem solving and improve collaboration. The Arduino board can only control and respond to electricity, so specific components are attached to Arduino board to interact with the real world. "UNO" means one in Italian. The Arduino UNO has a second microcontroller on board to handle all Universal Serial Bus (USB) communication. Arduino UNO is a microcontroller board based on the ATMEGA 328P. It has 14 digital input/output pin (of which 6 can be used as PWM output), 6 analog input, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; which is connected to a computer with a USB cable and powered by AC-to-DC adapter or battery. Arduino board can operate on an external supply of 6V to 20V. If the supply is less than 7V the board will be unstable and the supply with more than 12V is used the voltage regulator will overheat and damage the board. The recommended range is 7V to 12V. Figure 2 shows the general purpose of Arduino Uno board.

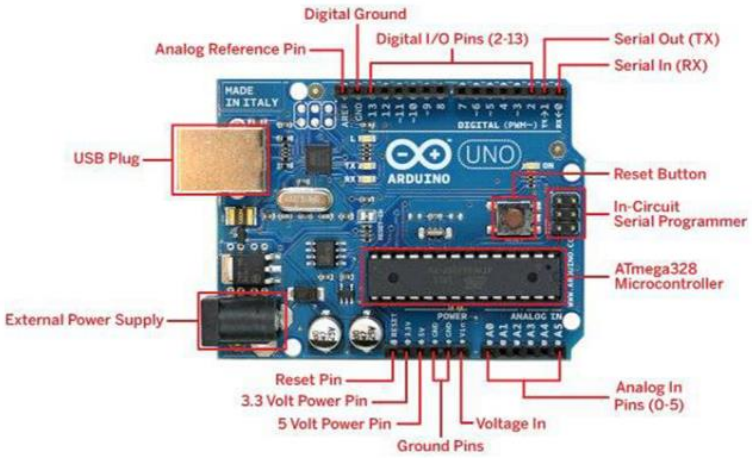


Figure 2. Arduino UNO board

Soil Moisture Sensor

The soil moisture sensor or the hygrometer is mostly used to detect the humidity of the soil. It is perfect to build an automatic watering system. Guide for soil moisture sensor HL-69 with Arduino. The soil moisture sensor or the hygrometer is usually used to detect the humidity of the soil. So, it is perfect to build an automatic watering system or to monitor the soil moisture of your plants. The sensor is set up by two pieces the electronic board (at the right) and the probe with two pads, that detects the water content (at the left). The sensor has a built in potentiometer for sensitivity adjustment of the digital output (DO), a power LED and a digital output LED.

Application that typically need soil moisture sensors are watershed characterization, irrigation scheduling greenhouse management, fertilization management plant ecology water balance studies, microbial ecology, plant disease forecasting soil respiration hydrology and soil health monitoring. Insert a trowel into the soil, then tilt the trowel to check the moisture of garden plants. User can also insert a wooden dowel into the soil to determine the depth of soil moisture. If the dowel comes out clean, the soil is dry. The moisture sensor is a sensor for measuring moisture of sand consisting of a central probe surrounded by four other probes. The probes and sensor housing are made of stainless steel AISI 321. Soil Moisture Sensors aid good irrigation management. Good irrigation management gives better crops, uses fewer inputs and increases profitability soil moisture sensors help irrigators to understand what is happening in the root zone of a crop.

The benefits of optimizing irrigation scheduling with soil moisture sensors include increasing crop yields, saving water protecting local water resources from run off, saving on energy costs, saving on fertilizer costs and increasing farmer profitability. Soil moisture is a measure of soil health, the water content present in a certain area of the ground. The voltage present in a certain area of the ground. The voltage that the sensor outputs changes accordingly to the water content in the soil. When the soil is wet, the output voltage decreases and dry: the output voltage increases.

The output can be a digital signal(D0) LOW or HIGH, depending on the water content. If the soil humidity exceeds a certain predefined threshold value, the modules outputs LOW, otherwise it outputs HIGH. The threshold value for the digital signal can be adjusted using the potentiometer. A resistive soil moisture sensor works by using the relationship between electrical resistance and water content to gauge the moisture levels of the soil. When the water content in the soil is LOW, it has poorer electrical conductivity. Hence, a higher resistance reading is obtained, which indicates LOW soil moisture.

When electric current passes through theses electrodes, they form an electromagnetic field in the soil. The probe measures the permittivity of a soil medium by measuring the charge time of a capacitor made with that medium and thus the soil waters content. The soil moisture content for different types of soil at which irrigation should occur:

Moisture Sensor Module

Moisture sensor module consists of four pins i.e. VCC, GND, DO, AO. Digital output pin is connected to the output pin of LM393 comparator IC while the analog pin is connected to Moisture sensor. The internal circuit diagram of the moisture sensor module is given below. Using a moisture sensor module with a microcontroller is very easy. Connect the analog/digital output pin of the module to the analog/digital pin of microcontroller. Connect V_{CC} and GND pins to 5V and GND pins of microcontroller. Insert the probe inside the soil. When there is more water presented in the soil, it will conduct more electricity that means resistor will low and the moisture level will high. V_{CC} is the power supply pin of the moisture sensor that can be

connected to 3.3V or 5V of the supply. But do not that the analog output will vary depending upon the provided supply voltage. GND is the ground pin of the board and it should be connected to the ground pin of the Arduino. DOUT is the digital output pin of the board, output low indicates soil moisture is appropriate, and high indicated soil moisture is low. AOUT is the analog output pin of the board that will give us an analog signal in between V_{CC} and ground. Figure 2.4 shows photograph of Soil Moisture Sensor HL-69 and Sensor Module. Figure 3 Circuit diagram of Moisture Sensor Module. Figure 4 Pin diagram of Soil Moisture Sensor HL-69 and Moisture Sensor Module.

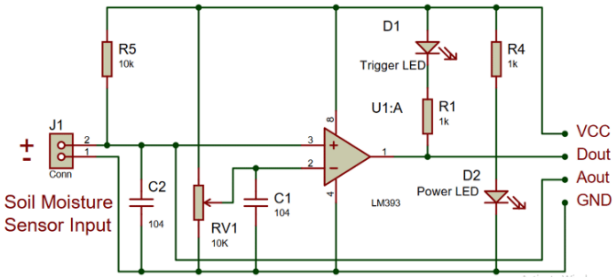


Figure 3. Circuit diagram of moisture sensor module

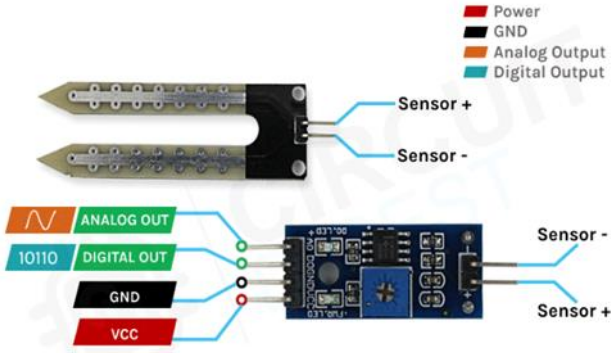


Figure 4. Pin diagram of Soil Moisture Sensor HL-69 and Moisture Sensor Module

Construction and Operation of System

Circuit Construction

The system has two parts, namely, hardware and software. The hardware construction consists of an embedded system that is based on 8-bit microcontroller (ATMega 328), a soil moisture sensor with sensor module, buzzer, light emitting diode (LED) and 5 V adaptor. In this work, HL-69 hygrometer moisture sensor was connected to power pin of soil moisture sensor module. The soil moisture sensor module was connected to analog pin A_0 of Arduino microcontroller. The digital pin number 13 of Arduino microcontroller was connected to light emitting diode (LED) and the buzzer was connected to digital pin number 11 of Arduino microcontroller. And also, soil moisture sensor module is powered by using 5 V adaptor.

Figure 5 shows the circuit diagram of "Moisture Levels Detecting System". Arduino microcontroller is main control device in this system and the operation of the whole system are controlled by the program. The control program used C programming language. This program is embedded into the Arduino. The circuit operation flowchart is shown in Figure 6.

Circuit Operation

The whole process in this system is controlled by Arduino microcontroller. Arduino microcontroller controlling output is via the help of soil moisture sensor and sensor module. When the power is on, the sensor sense a water conduction of soil and then this data sent a microcontroller. If the dater reading is above 900, it's plant is seriously thirsty. If it's plants goes too thirsty, LED will high and the piezo buzzer will sound. If it's data is under the nine percentage, LED and piezo buzzer stops. If it data is above the nine percentage, LED and buzzer are off. The flowchart of the whole operation system is shown in Figure 7 (a) to (c) shows the photograph of test circuit.

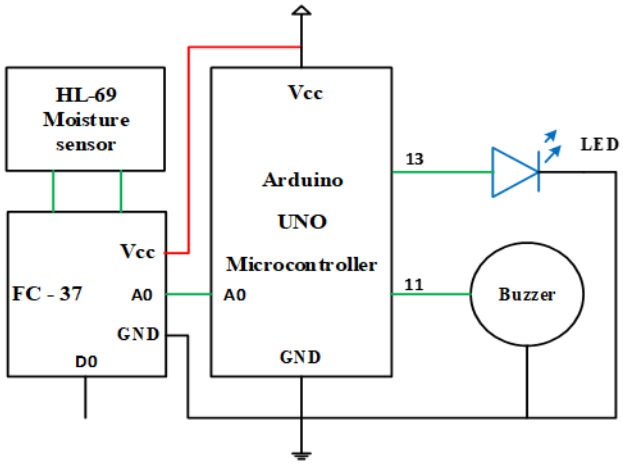


Figure 5. Complete circuit diagram

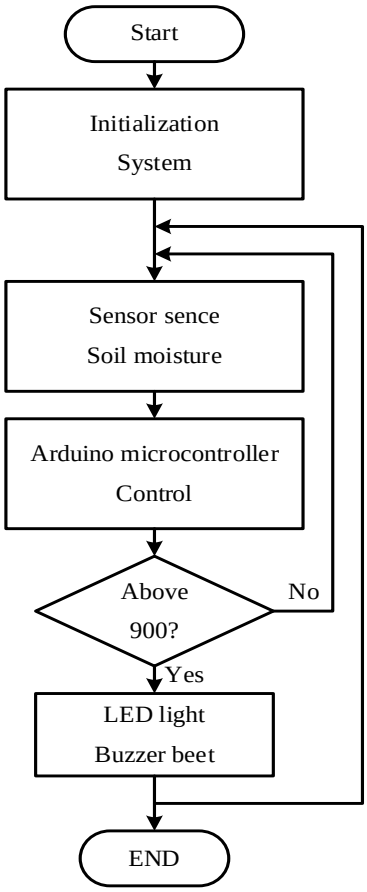
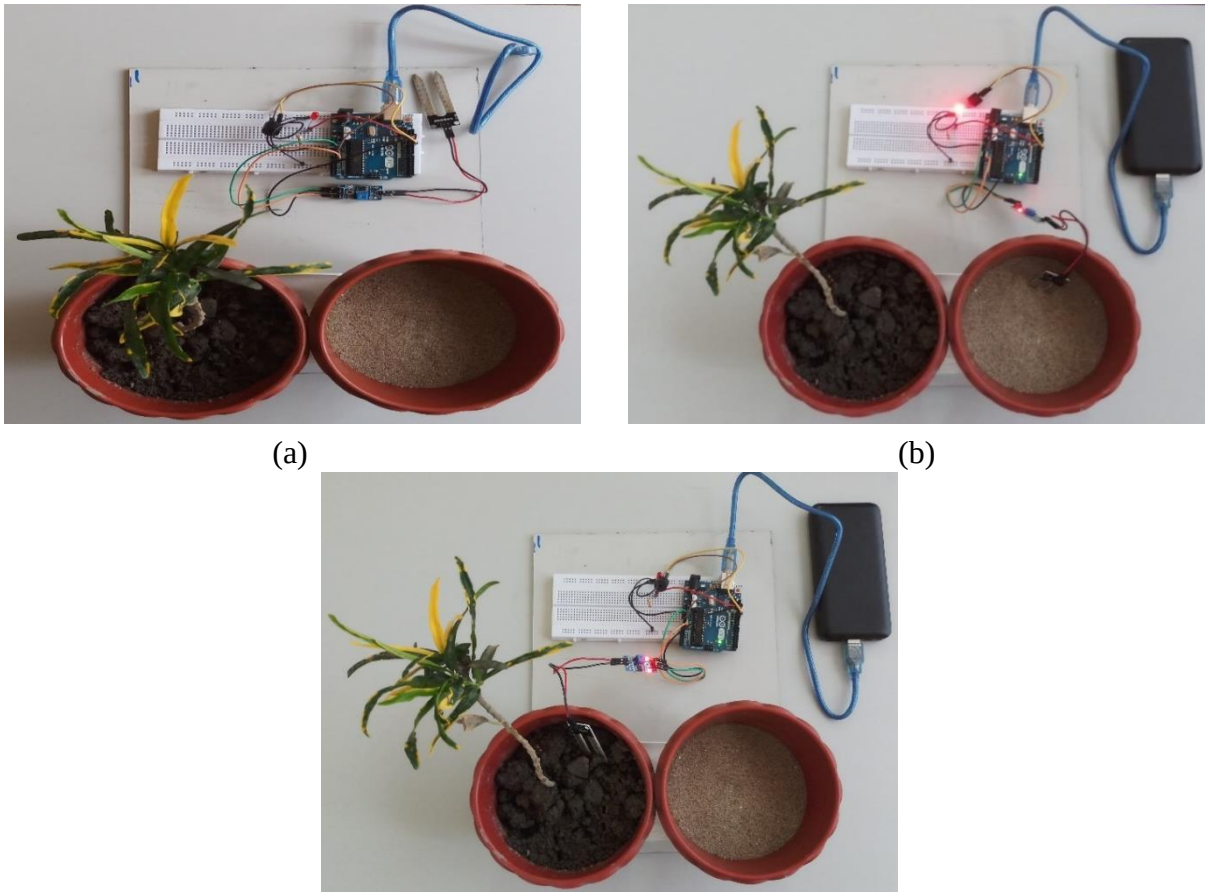


Figure 6. Circuit operation flowchart



(a) (b)

(c)

Figure 7. Photograph of test circuit

Discussion and Conclusion

Place the moisture sensor prong in the soil of plant user want to monitor. As the soil dries out, the Arduino reads the value from the sensor and sends it to the IDE. When the value from the sensor rises above calibrated values, the LED will light and buzzer will sound. The plant is seriously thirsty. When the value from the sensor sent under calibrated values, the LED and buzzer stop working. The plants are enough water. Figure 8 shows the sensor rises above calibrated values. The sensor sent under calibrated values is shown in Figure 9.

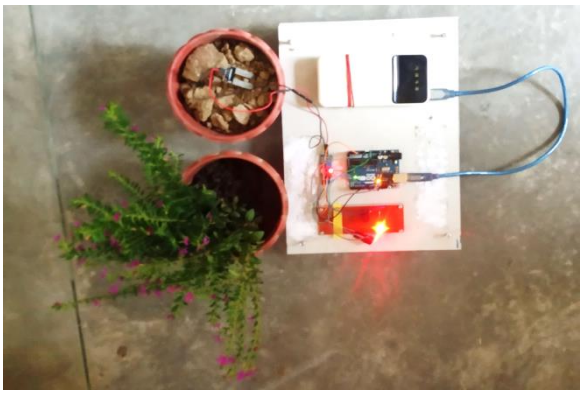


Figure 8. Sensor rises above calibrated values

Figure 9. Sensor sent under calibrated values

Conclusion

This project is a new type of analog sensor that detects moisture levels. When people are very busy, they forget that water is needed for plants. At this time the circuit will set up a light and sound alarm system to tell the plant needs watering. Therefore, this system is very busy world, people usually forget to water their plants which leads to bad growth and health of their plants.

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