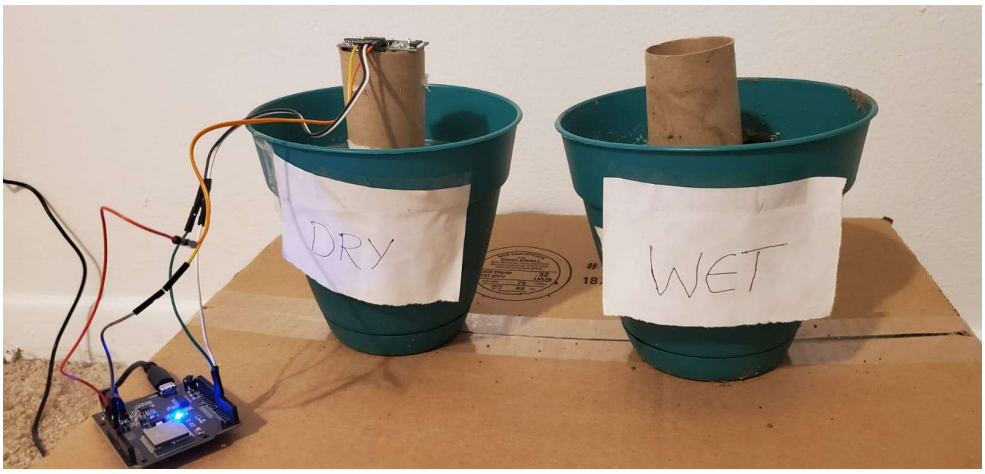
Computer Sci Electrical Engr 5590 0003

IoT

Project Title

Soil Moisture Detection using Ultrasonic sensor



Team Members (Team-2)

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- Sri Sai Nikhil Kantipudi
- Sreevalli Tata

Introduction

Many systems were available in market for detecting or measuring soil moisture in the farming sector. Mostly, all systems use the traditional system which is the combination of microcontroller and normal soil moisture sensor. Those sensors might become ineffective after some period. Hence, we want to find the alternative solutions or different process using different sensors. We came across one of the research paper which detects the soil moisture using ultrasonic sensor. This project is to detect the soil moisture using ultrasonic sensor.

Motivation

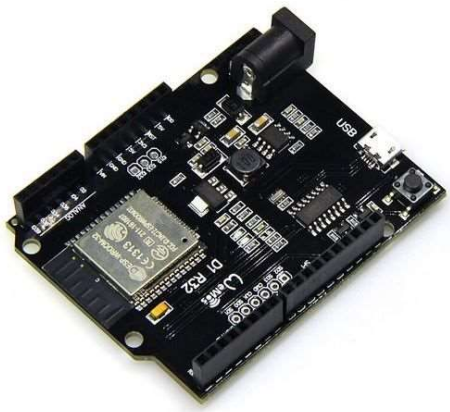
Farmers typically overwater their crops by 20-50%. The pressure on the diminishing water resources can also be alleviated and, as a result, more land can be put under irrigation. Efficient irrigation practices provide a consistent moisture supply to crops, we can overcome water deficiencies. Higher yields and low water costs make this behavior rational. Precision irrigation systems exist and can substantially reduce agricultural water use; the current bottleneck for these systems is soil moisture data. The soil moisture sensors that exist are either too costly, obstructive, or too inaccurate to use in conjunction with precision irrigation. Advantages: Moisture Accuracy, Cost per sensor, low environmental impact, battery free, insensitive to salinity, and can be measured at different depths in the same locations.

Goals & Objectives

The main goal of this project is to measure the moisture/water level in the soil using ultrasonic sensor. Also, we want to compare both the systems traditional and ultrasonic to show how both are performing in different types of soil at the different intervals of time. Thus, we can learn how effective both systems can be in the current usage.

Hardware & Software

- Microcontroller - Wemos D1 R32 (Aurdino UNO kind)



- Communication – ESP32
- Cloud – Blynk

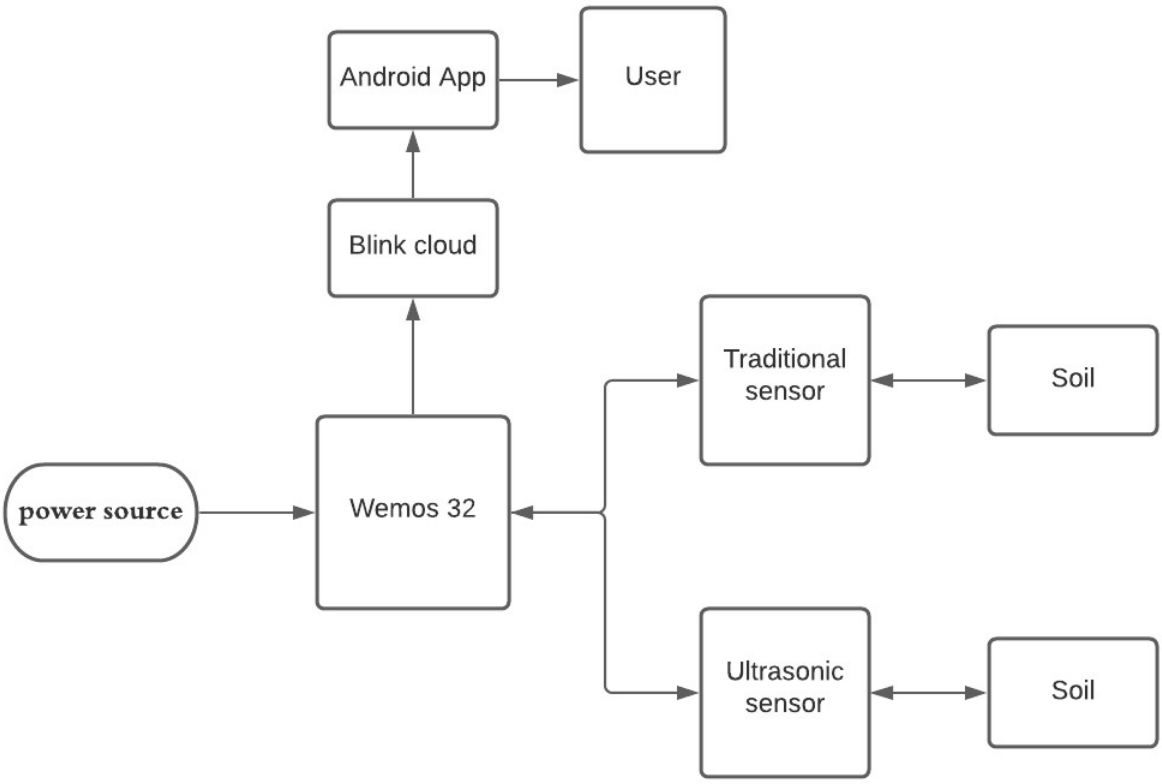
- IDE – Aurdino IDE
- Hollow tubes (Bath tissues roll)

- Soil moisture sensor

- Ultrasonic senor

- plastic pots with soil

Design



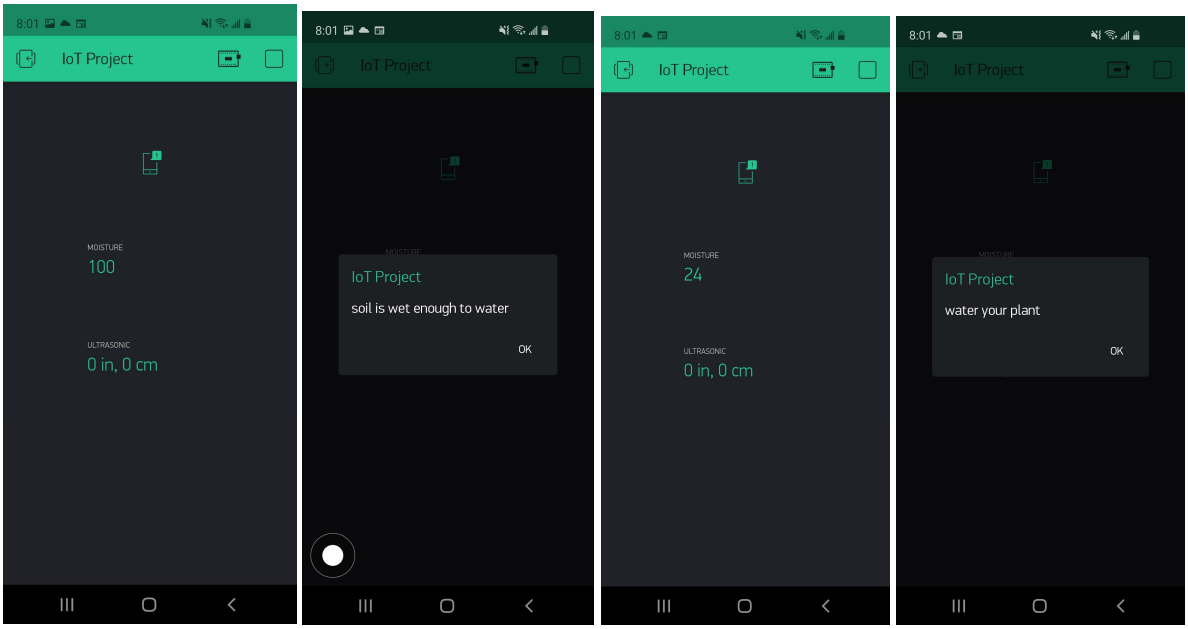
Implementation

- ### Traditional System

In traditional system, we used soil moisture sensor with wemos d1 r32 which has inbuilt esp32. And the we connected the wemos to the blynk cloud which later used for android app .

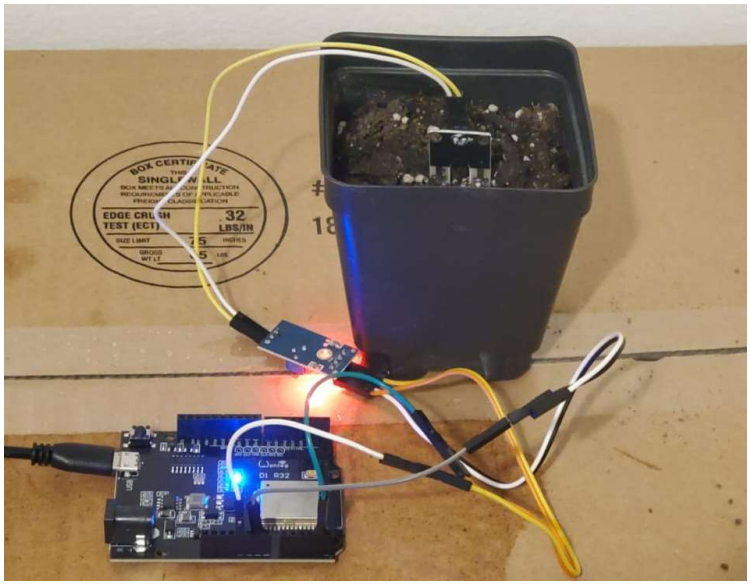
1. Initially we connected to soil moisture sensor to the wemos with proper pin connection using analog pin 36.
2. Then, we connected the wemos to the power source here we connected to the laptop.
3. Using Aurdino IDE, we dumped the required code to board by connecting to the bynk cloud using secret token for authentication. In the code, we are reading the data from the analog pin and sending the same value in time interval to the blynk cloud.

4. We created an android app using Blynk app and created an module to get the data from wemos and the app also contains the notification system.



5. Now, we placed the soil moisture sensor in the one dry pot. We noted the readings and then again poured some water and again noted the readings. In the same way, we noted the readings for different soils in different time intervals.

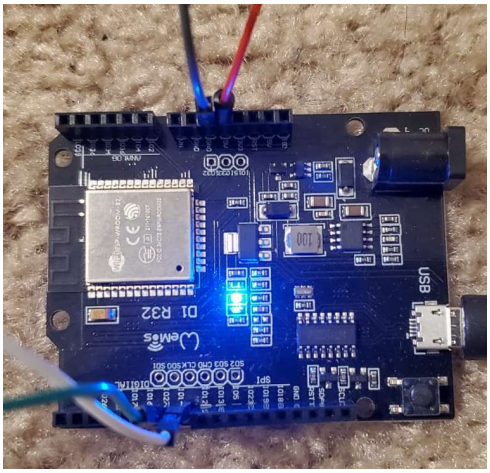
6. Thus we successfully implemented the traditional system.



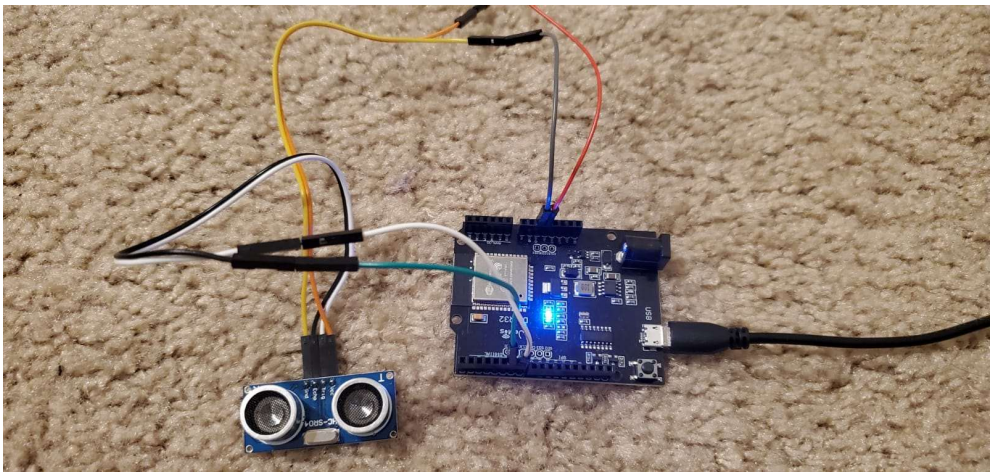
- ## Ultrasonic System

Same like traditional sensor, In ultrasonic system, we used ultrasonic sensor with wemos d1 r32 which has inbuilt esp32. And the we connected the wemos to the blynk cloud which later used for android app .

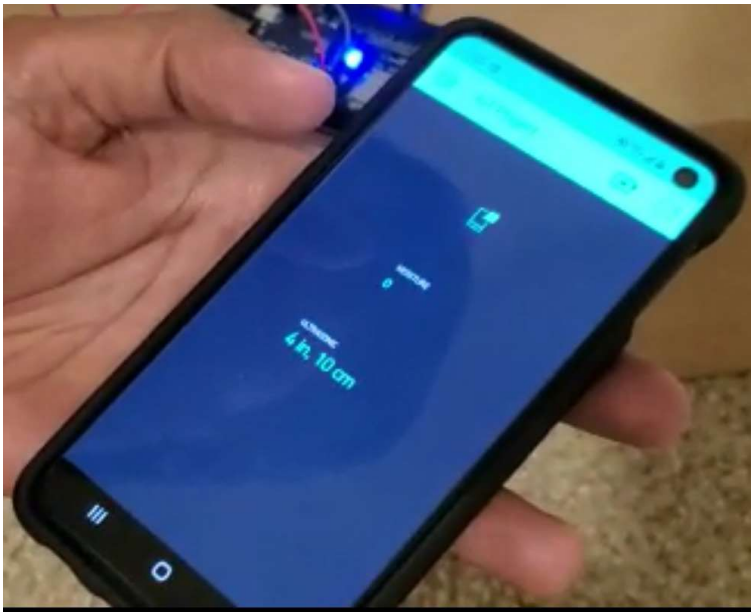
7. Initially we connected to ultrasonic sensor to the wemos with proper pin connection using digital pins.



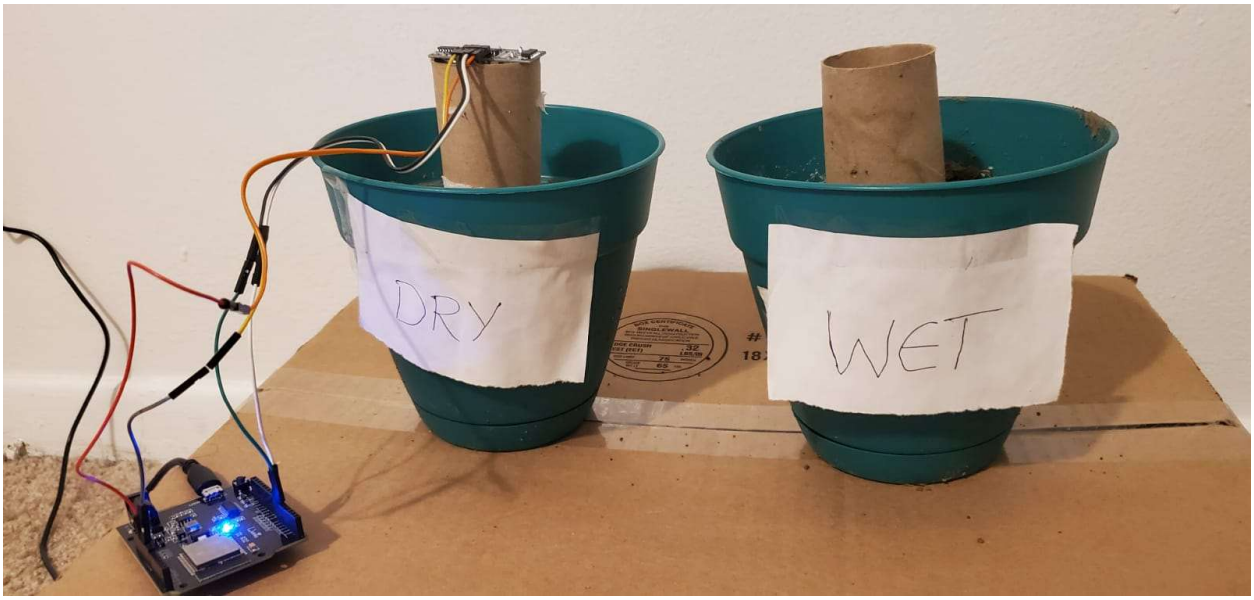
8. Then, we connected the wemos to the power source here we connected to the laptop.



9. Using Aurdino IDE, we dumped the required code to board by connecting to the bynk cloud using secrent token for authentication. In the code, we are reading the data from the analog pin and sending the same value in time interval to the blynk cloud.
10. We created an android app using Blynk app and created an module to get the data from wemos.



11. Now, we placed the ultrasonic sensor in the one dry pot. We noted the readings and then again placed in wet pot and again noted the readings. In the same way, we noted the readings for different soils in different time intervals.
12. Thus we successfully implemented the ultrasonic system.



Source Code:

https://github.com/jaisekhar/Soil-Moisture-Detection-using-ultrasonic/blob/main/SourceCode

Results

Ultrasonic

Soil type-1

distance	time
3.5	12:00
3.8	1:00
4	2:00
4.3	3:00

Soil Type -2

distance	time
2	12:00
2.7	1:00
3	2:00
4.8	3:00

traditional sensor

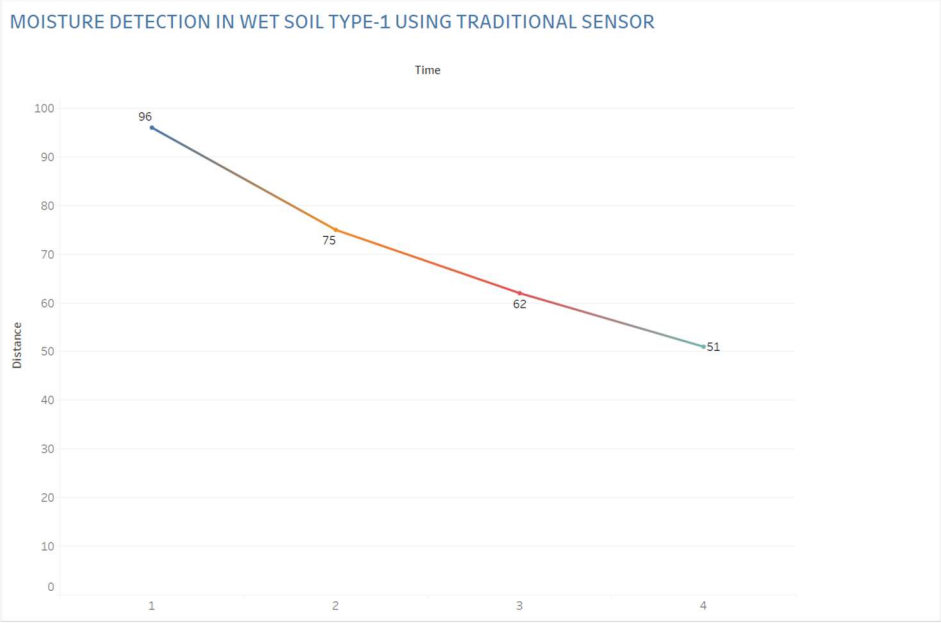
Soil Type-1

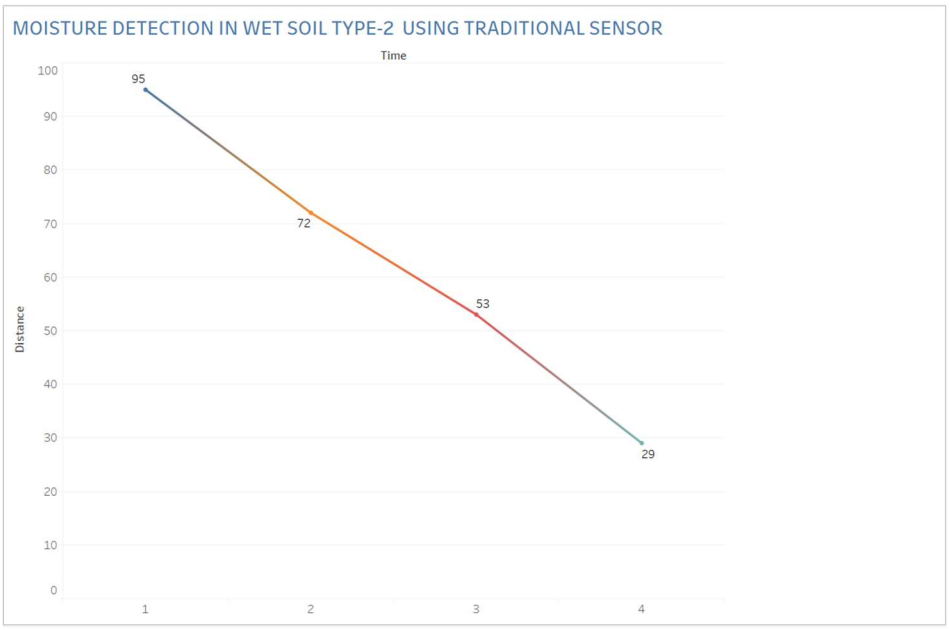
distance	time
96	12:00
75	1:00
62	2:00
51	3:00

Soil Type-2

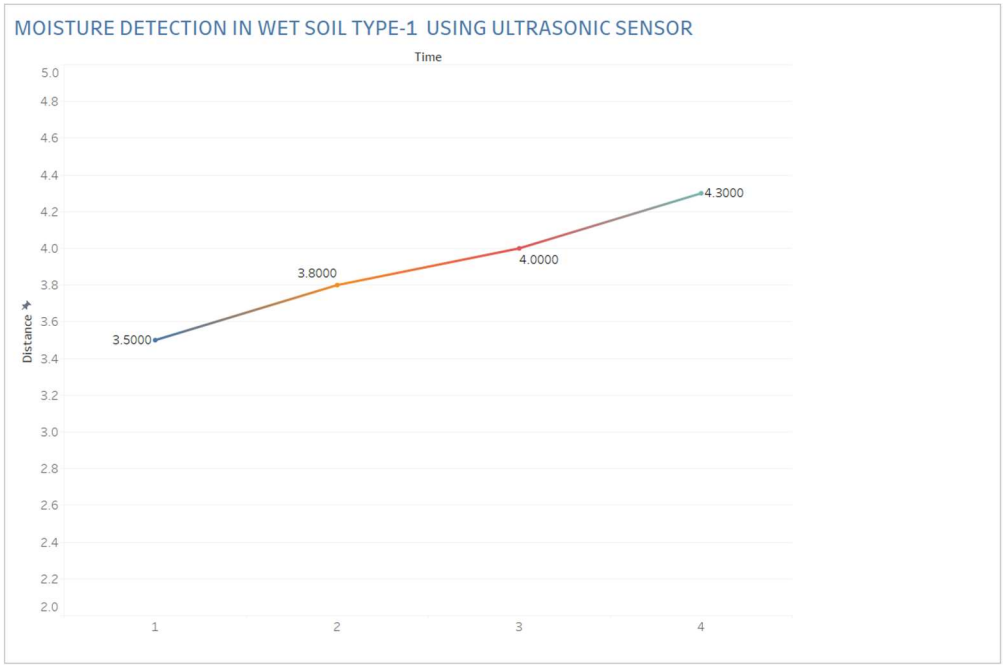
distance	time
95	12:00
72	1:00
53	2:00
29	3:00

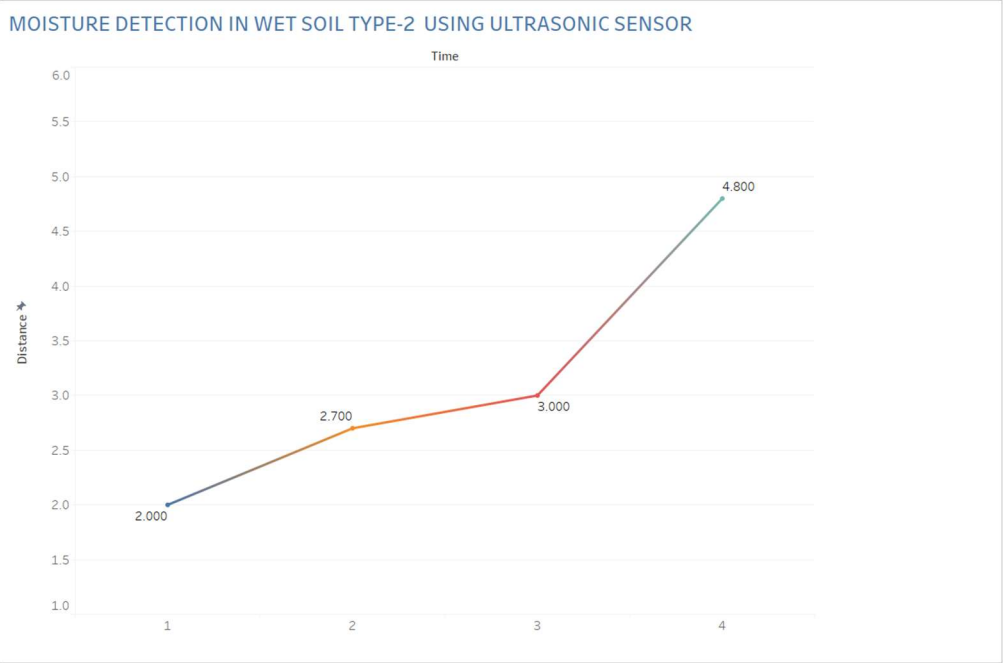
In the below results, the readings are from traditional system where the readings are decreasing and graph also decreasing related to the time gradually. Two graphs for two different soils.





In the below results, the readings are from ultrasonic system where the readings are increasing and graph also increasing related to the time gradually. Two graphs for two different soils.





Conclusion

By this project we came to know that ultrasonic sensor can also be used to detect the soil moisture/water level in soil/field. We successfully identified the difference between traditional systems and ultrasonic system. Even though we are able to measure the soil moisture using ultrasonic, we felt traditional system is more accurate than the ultrasonic system.

Reference

[Improved measurement of soil moisture using an ultrasonic waveguide to predict rainfall-induced slope failure - IOPscience]