IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 5, June 2023

D-Crop Soil Moisture Monitoring and Controlling System for Crop Production

Thierry Nduwimana[1] and Mr Mtende Mkandawire[2]
Student, Department of Computer Science[1]
Project Supervisor, Department of Computer Science[2]
DMI-St. John the Baptist University, DMI-SJBU, Lilongwe, Malawi[1]
DMI- St. John the Baptist University, Computer Science Lilongwe, Malawi[2]

Abstract*: D-crop Soil Moisture Monitoring and Controlling System for crop production, is a system that based on assisting famers to monitor the moisture (Temperature & Humidity) and uptake of water by the crops for the better growth and development of crops. The system will help to monitor the uptake of water by the crops throughout all seasons to make sure the crops do not run out of water for more crop production. With its capability, the system is able to find out whether or not the crops are running out of water in the soil. When the crops run out of water, the system will detect through soil moisture sensor and sends the notification to the software showing the percentage of water level that is currently in the soil. Etc. The software to control the system is developed in C# language specifically with xamarin cross platform for both desktop and mobile app. The system also engages the firebase and ThingSpeak API for real time Display of data. The system will help both small scale farmers and for those willing to invest much in Farming. Irrigate the correct amount of water at right time which can lead more crop yields, less diseases and serving water as well.*

Keywords: xamarin, Moisture Sensors, C#, Analogue port, IDE (integrated development Environment), soil moisture Content (SMC), statistics analysis, Soil moisture Sensors system

I. INTRODUCTION

We are living in the world where every life depends on Agriculture. This sector has been the most contributing factor to the growth of the human and country development. It has been one of the primary occupations of man since our fore parents that is during early civilization. Many aspects have been ignoring this sector yet it has sustained them alive till to date. Furthermore, the most difficult activity in agriculture is to irrigate the crops. Of course, there are different types of approaches which may have improved on this agricultural field and also may have made it easier for the work of a farmer to carry out irrigation without using more energy. With the coming of more and more improved technologies, it is possible to manage and control your filed hence saving time and energy for your other activities. The famers have been irrigating and controlling their lands from time to time using manual control. However, with this type of improved D-Crop Monitoring and controlling system for crop production, it helps a small-scale farmer to carry out their irrigation monitoring using mobile phone. Being able to collect real time data from the soil through soil moisture sensor in order to know more on when and what time the farmer has to irrigate the crops. The famer will also be able to know what kind of crops that can be grown at that particular environment having such temperature and humidity. In this Project, the most significant advantage is that the system works with real time online database which is able to compare data and notify the famer about the record of his or her farm. The system uses main components like Arduino UNO connecting all components, ESP8266Wi-Fi to communicate with the mobile, soil moisture sensor inserted in the land (farm) to collect water level and temperature and Humidity readings from the soil. The system uses C # language developed in visual studio 2019.

1.1 OBJECTIVES

There are many objectives of this research study of D-Crop Monitoring and controlling system for crop production which are stated as follows;

- Checking and determining the need of irrigation of the land scape by checking the water level of the soil and the temperature around.
- Helps a famer to know which type of crops can fit in that environment depending on the weather changing.
- Collecting the info about the current soil moisture status and the temperature of the soil through sensors. This help a farmer to be informed and make a proper decision on the farm.
- Increasing crop production throughout the year through efficient supply of abundant water and timing.
- Collecting and keeping soil moisture and temperature info in order to manage the irrigation time table. This helps to know when and what time the crops may need supply of water.

II. RELATED WORKS

[1]. Smart Agriculture monitoring and Control System Using IOT, Pros of the system is that the system analyses soil parameters Data collected used to learn using the machine learning However, The system has no software interface for interaction.

[2]. Development of a pilot Smart Irrigation System for the Peruvian Highlands by Sentiago Guevara. The pros are that they pro reliable measurement of soil moisture, temperature and conductivity. The system is of Low cost. However, in the system there is lack of system synchronization between water supply from irrigation district and prototype operating hours. No mobile system control. Wastage of more energy in Operating the electro valve and depressurizing the system.

Irrigation in Precision in Agriculture the Recent Trends on Sensors and IOT Systems, The system works all the time throughout the year. However, they concentrate most on the hardware functionality. The System is very complex to use especially for the famers. It has Learning curve

IOT Based Smart Irrigation Monitoring and Controlling System, They system aims to help in high crop production. However, they concentrate most on the hardware part. Due to the lack of software monitoring, it is hard to maintain some of the parts when they breakdown.

Development of Smart Drip Irrigation System Using IOT. There is a full monitoring and control since it is a system based. They concentrated most on developing the hardware part of the system. Evaluation of a low-cost soil water content sensor for wireless network applications. On the other side, the system is very expensive to maintain. It may not be easy on large farms. The electronic needs protection from weather influence. Security issue (if the device is connected online, there is a possibility of getting hacked)

Smart Irrigation System Based on Soil Moisture Using IOT, when we are considering the technology that is deployed in the field to help in this agriculture sector, we find that the development is not tremendous. There is a need of combining the techniques with the IOT in order to come up with a very supportive system which the agricultural sectors can depend on. In this paper, wireless sensor network is integrated with in ZigBee to transmit soil moisture level and temperature values. Furthermore, the data is transmitted to the specific web server by using General Packet Radio Service through cellular or local network. This monitoring could be achieved by or via internet using graphical application.

III. METHODOLOGY

This is a classical software development methodology, it is also defined as linear sequential approach. It resemble waterfall

- Requirements: all things that are needed are in your project are defined in the requirement stage. It involves Idea creation.
- Designing: when the requirements are clearly understood, then the design stage begins. In this case different tools are used for the project
- Implementation: this is where the coding begins both coding for IOT devices to work in Arduino IDE and coding for the software part
- Execution of the system: This involves the building of the hardware part of the system and the software application part.
- Maintenance: this is where errors from both hardware part and software part are corrected.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 5, June 2023

Figure 1: Waterfall Model

V. ALGORITHM

Furthermore, Base64 : Which works on binary- to- text encoding schemes that represents data, also works with encryption and decryption. It makes sure that data is safe and protected from anyone who does not have access.

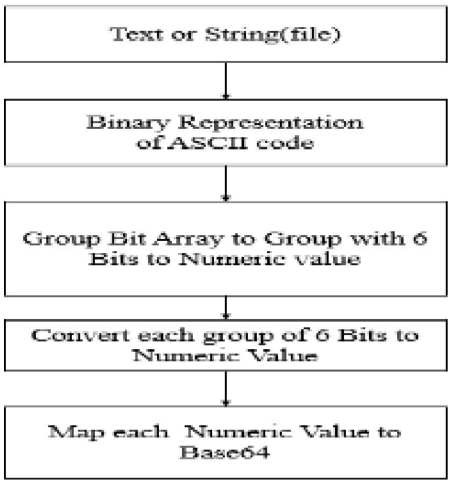

Figure 2: Base64 algorithm

The main components of this architecture include Mobile, Nodemcu ESP 8266, Arduino UNO and the Sensors. These work hand in hand to communicate in order for the user to get the real time information on the soil moisture, temperature and its water level. Above all power supply must be powered on always and every time to avoid the shutting down of the system

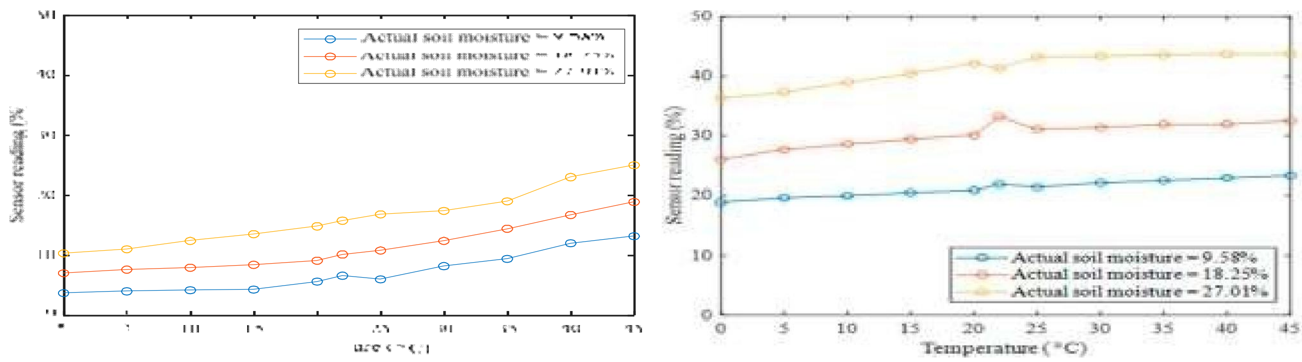

Table 1: soil moisture against Temperature

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 5, June 2023

This graph shows variations and comparison among the moisture readings against temperature. The analysis displayed, investigates the calibration of soil moisture sensors, regarding the impact of temperature. Below is a diagram shows modules connected to each other:-

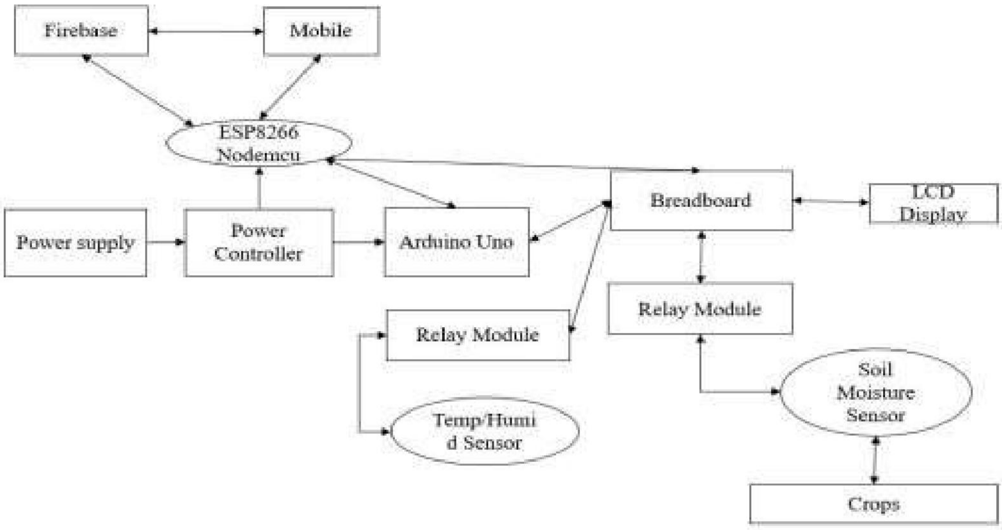

Figure 3: System architecture diagram

This flow diagram explains and describe how information flows through a whole process of the system. It indicates data inputs, outputs, stores and the various sub processes the data moves through. In this system, data starts flowing by entering into the system through soil moisture sensor. It is then collected by the ESP8266 Nodemcu through breadboard. The data is then sent to desktop app via Arduino IDE. The Desktop displays real time database. The Data is displayed in a bar graph, and the sent to real time database. From the database, the data is sent to the mobile app where data is displayed and is able to be sorted out using date

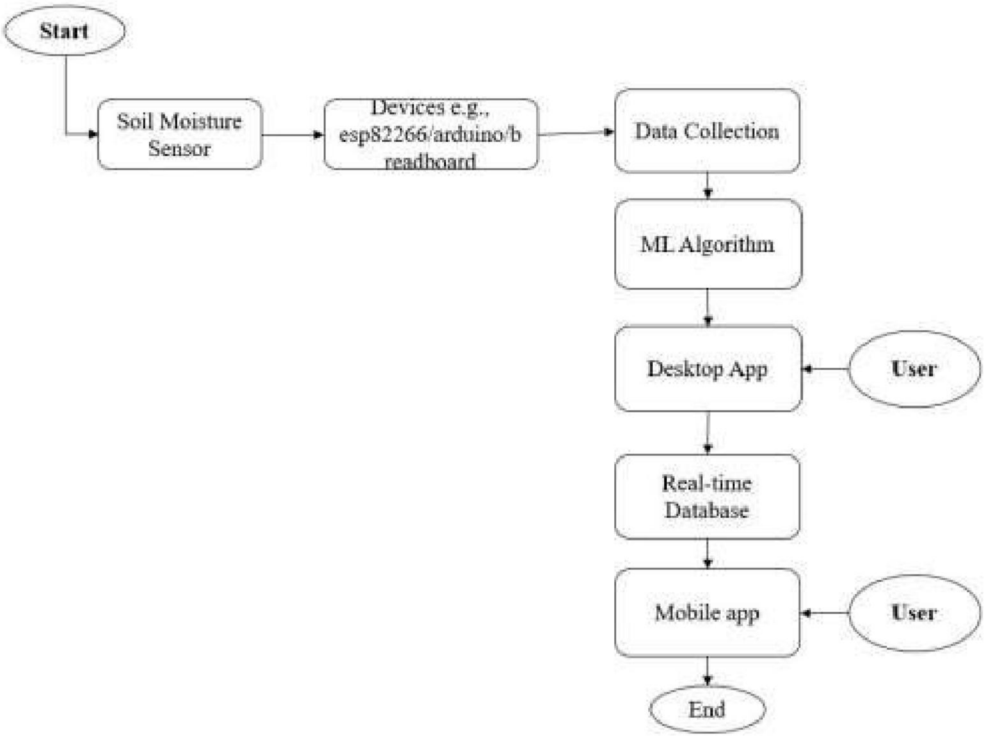

Figure 4: Moisture reading Flow diagram

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 5, June 2023

VI. EQUIPMENTS

The major Hardware and Software are as follows:

1. ESP8266 Nodemcu
2. Arduino Uno
3. DHT11(Temperature and Humidity)
4. Soil moisture Sensor
5. LCD Display
6. Power Cables and jumper wires

Below is the image of hardware components connected together. All components are connected to the solder less board for easy communication and sharing of power and data among the components.

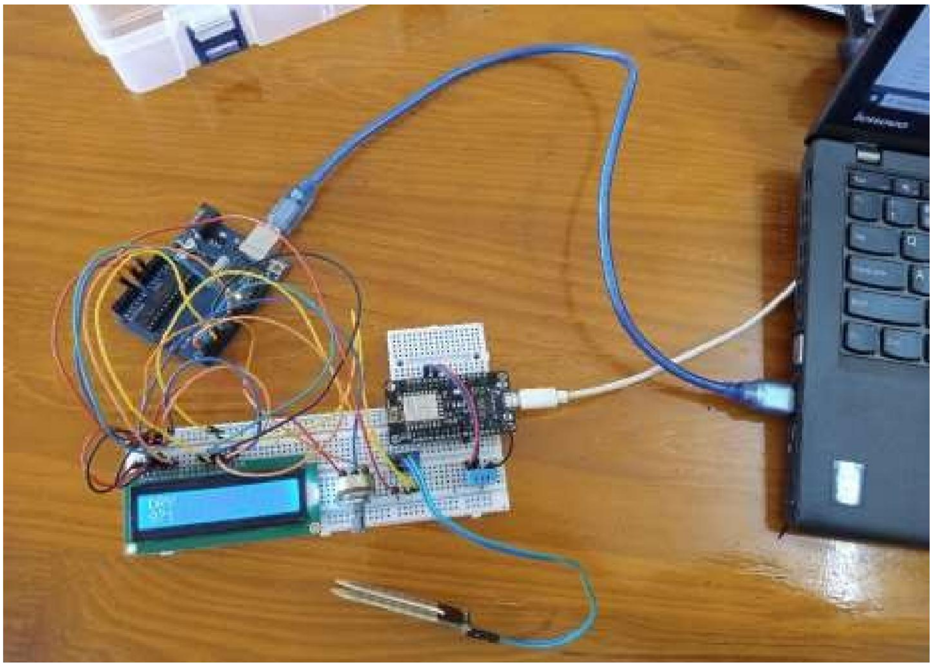

Figure 5: Hardware Components

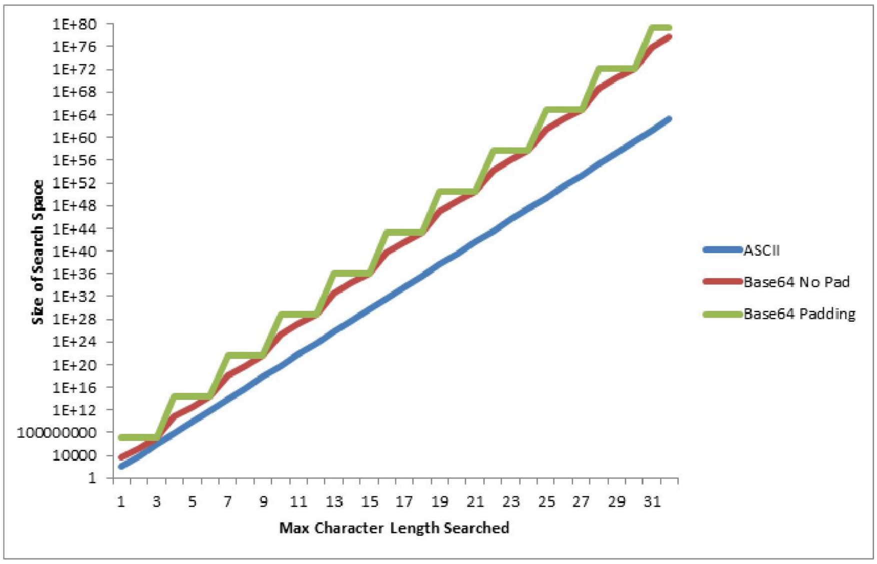

Table 2: Base64

Above is the graph of the application. this explains on the mobile side algorithm. Any data that leave the computer and go to the online real-time database. The data is encrypted when it arrives in the database. It is then decrypted in the mobile app. below is the software system implementation part with screenshots. .

Below software screen shorts shows functionality of different modules.

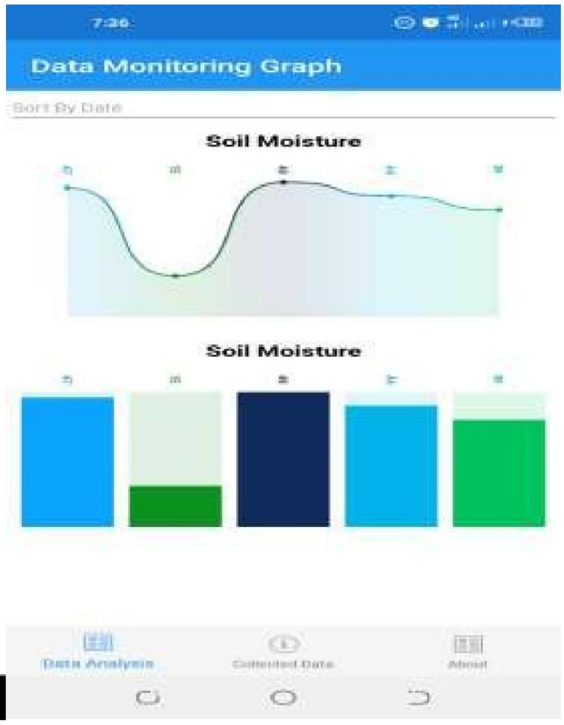

Figure 6: Login **Figure 7:** Data analysis

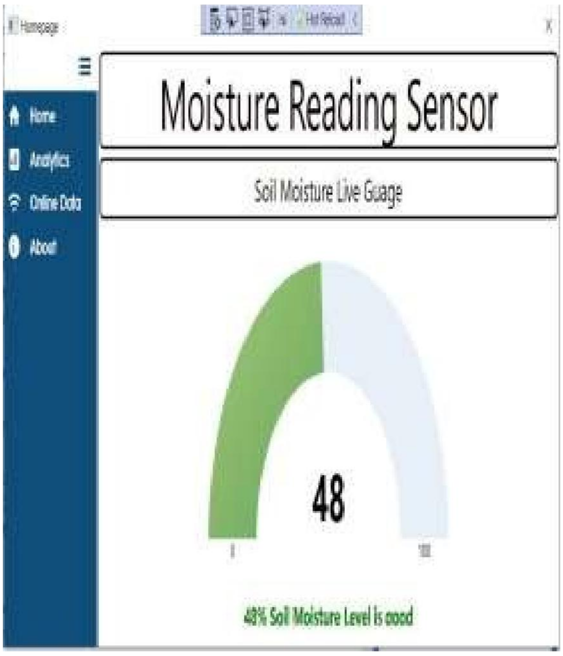

Figure 8: Moisture Live gauge **Figure 9:** Collected Data

VII. RESULT AND DISCUSION

After testing the system and having checked on the whole functionality of the system, the paper is proved to be ready using xamarin from c#. The system runs properly both desktop and mobile app in updated visual studio 2019 and above. Table 1 show that the Base 64 algorithm is the best choice for dealing with encoding and decoding of data. It makes sure that one is able to see and decrypt the data that has been sent to the database. This will help to avoid hackers from cracking the system.

VIII. FUTURE IMPROVEMENT

Adding water pump to the system. This system will help farmer to turn on and off the pump for irrigation. Furthermore, I would like to increase Mobile app features for more interaction. For instance, showing favourable conditions (degrees) for some crops to grow. Lastly, adding various functions depending on the increase demand from users (farmers).

IX. CONCLUSION

The project has been successfully developed and completed by meeting the requirements of its aims and objects. The project serves to reduce some of the challenges that famers and small scale famers meet in their daily life. The lack of rain fall throughout the year made people to thing other ways of irrigating crops by monitoring controlling the growth of the crops. On the other hand, the growth of technologies has enabled people to invest in agriculture and also use different ways to know whether crops are getting enough water or not, and also to be able to know the water level in the soil. With this D-Crop Soil Moisture monitoring and controlling project, a user will be able to get data and be informed on the progress of the crops regardless of the distance. That is, a famer may have a lot of deadline on the table that needs to be handled by the end of the day, and end up forgetting to irrigate the crops, however, with this application, the famer is able to know whether the plants needs water or not hence he may reschedule his task and get time for irrigating the crops.

Furthermore, a person may need to take journey and return after a period of time. If the person has the D-Crop mobile app connected to the system it would be very possible to keep receiving data at anywhere anytime, As long as the mobile is connected to the internet. Monitoring and controlling soil moisture sensor is very important as it saves time to attend other daily tasks. Likewise, crops always receives enough supply of water throughout 24/7. On the other hand, reflecting on this project, soil moisture is affected by many factors, and its parameter depend on various indicators namely, vegetation, vegetation, and topography. The factors affecting soil Moisture may include, texture, Density, salinity, structure, organic matter content, depth, and temperature

REFERENCES

[1]. Cardenas-Lailhacar, B., & Dukes, M. D. (2010). Precision of soil moisture sensor irrigation controllers under field conditions. Agric. Water Mgmt., 97(5), 666-672. http://dx.doi.org/10.1016/j.agwat.2009.12.009.

[2]. Cardenas-Lailhacar, B., & Dukes, M. D. (2012). Soil moisture sensor landscape irrigation controllers: A review of multi-study results and future implications. Trans. ASABE, 55(2), 581-590. http://dx.doi.org/10.13031/2013.41392.

[3]. Cardenas-Lailhacar, B. M. (2010). Sensor-based automation of irrigation on Bermudagrass, during dry weather conditions. J. Irrig. Drain. Eng., 136(3), 184-193. http://dx.doi.org/10.1061/(ASCE)IR.1943-4774.0000153.

[4]. Dukes, M. D., Shedd, M., & Cardenas-Lailhacar, B. (2009, April 2). Smart Irrigation Controllers: How Do Soil Moisture Sensor (SMS) Irrigation Controllers Work? EDIS, 2009(2). https://doi.org/10.32473/edis-ae437-2009

[5]. Dukes, M. D., & Scholberg, J. M. (2005). Soil moisture controlled subsurface drip irrigation on sandy soils. Applied Engineering in Agriculture, 21, 89-101.

[6]. Geoffrey, G., Dieu, M. J. D., Pierre, N. J., & Aimable, T. (2015). Design of Automatic Irrigation System for Small Farmers in Rwanda. Agricultural Sciences, 06(03), 291–294. https://doi.org/10.4236/as.2015.63029

[7]. Haley, M. B., & Dukes, M. D. (2012). Validation of landscape irrigation reduction with soil moisture sensor irrigation controllers. J. Irrig. Drain. Eng., 138(2), 135-144. http://dx.doi.org/10.1061/(ASCE)IR.1943-4774.0000391.

[8]. Prasetya, F., Saifuddin, D. T., & Ansir, N. Y. (2020, April 25). https://www.ijser.org/research- paper-publishing-april-2020.aspx. International Journal of Scientific & Engineering Research, 11(04), 1801–1806. https://doi.org/10.14299/ijser.2020.04.06

[9]. Underwood, E. (2019, September 10). Soil Moisture Drives Great Plains Cloud Formation. Eos, 100. https://doi.org/10.1029/2019eo132567

[10]. S. Millán, J. Casadesús, C. Campillo, M.J. Moñino, M.H. Prieto, Using soil moisture Sensors for automated irrigation scheduling in a plum crop, Water 11 (2019) 2061, doi: 10.3390/w11102061

[11]. Turgay Yıldırım, Z., Yılmaz, T., & Yıldırım, S. (2021, August 31). https://dergipark.org.tr/tr/download/article-file/1845500. Cukurova Anestezi Ve Cerrahi Bilimler Dergisi, 4(2), 102–112. https://doi.org/10.36516/jocass.2021.78

[12]. Chen, Zhangzhong, Zheng, Yu, Wang, Wang, & Huang. (2019, October 10). Data-Driven Calibration of Soil Moisture Sensor Considering Impacts of Temperature: A Case Study on FDR Sensors. Sensors, 19(20), 4381. https://doi.org/10.3390/s19204381