VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JNANA SANGAMA, BELAGAVI – 590 018

MINI PROJECT WORK (BEC586) REPORT

ON

TERRA HYDROSENSE[DETERMINATION OF SOIL MOISTURE

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF V SEMESTER

BACHELOR OF ENGINEERING
IN
ELECTRONICS AND COMMUNICATION

SUBMITTED BY

SHANKARAGOUDA	1AK22EC049
TEJASWINI P	1AK22EC057
AISHWARY	1AK23EC400
BASAVARAJ B	1AK22EC007

UNDER THE GUIDANCE OF
MRS PADMAVATHI N
Associate Professor, Dept. of ECE

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

AKSHAYA INSTITUTE OF TECHNOLOGY

LINGAPURA, TUMAKURU – KORATAGERE ROAD, TUMAKURU-572106, KARNATAKA

December 2024

AKSHAYA INSTITUTE OF TECHNOLOGY

LINGAPURA, TUMKURU, KORATAGERE ROAD, TUMAKURU 572106, KARNATAKA

AKSHAYA INSTITUTE OF TECHNOLOGY

LINGAPURA, TUMKURU, KORATAGERE ROAD, TUMAKURU 572106, KARNATAKA

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

CERTIFICATE

This is to certify that the Project entitled "**TERRA HYDRO SENSE**"has been carried out by **SHANKARAGOUDA P[1AK22EC049]TEJASWINI P1AK22EC057] AISHWARY[1AK23EC400] BASAVARAJ B[1AK22EC007]** are bonafide student of **AIT College of Engineering, Tumakuru** in partial fulfillment for the award of **Bachelor of Engineering** in **Electronics & Communication Engineering** of the **Visvesvaraya Technological University, Belagavi** during the year **2024-2025**. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report deposited in the departmental library.

Project Guide	Head of the department	Principal
MRS PADMAVATHI N	**Dr. NAGENDRA KUMAR M**	**Dr. K. V. SREENIVAS RAO**
Associate Professor	**Professor and HOD**	**Principal, AIT**

Examiner viva

Name of the Examiner	Signature with Date
1.	

DECLARATION

The Students **Shankaragouda patil[1AK22EC049] Tejaswini P[1AK22EC057] Basavaraj B[1AK22EC007] AISHWARY [1AK23EC400]** hereby declare that the mini project work (BEC586), entitled **TERRA HYDROSENSE[Determination of soil moisture]** has been independently carried out under the guidance of **MRS PADMAVATHI N,** Department of Electronics and Communication Engineering, Akshaya Institute of Technology, Tumakuru in partial fulfilment of the requirements for a 5th Semester Mini Project, in Electronics and Communication Engineering, Visvesvaraya Technology University, Belagavi.

SHANKARAGOUDA	**[1AK22EC049]**
TEJASWINI P	**[1AK22EC057]**
BASAVARAJ B	**[1AK22EC007]**
AISHWARY	**[1AK23EC400]**

PLACE: TUMAKURU

ACKNOWLEDGEMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without mention names of the people who made it possible, whose constant guidance and encouragement crowned our effort with success.

We are thank full to our honourable Chairman **Dr. SHIVAKUMAR K S, Akshaya Education Trust®** for providing us with the better facilities and his encouragement also helped us in completion of Project.

We earnestly thank **Dr. K. V. SREENIVAS RAO, Principal, AIT, Tumakuru,** for facilitating academic excellence in the college and providing us with the congenial environment to work in that helped us in completing this Mini Project.

We earnestly thank **Dr. YATHISHA L, Dean, AIT, Tumakuru,** for giving a valuable support and providing us a project laboratory in completing this Mini Project.

We wish to extend my profound thanks to **Dr. NAGENDRA KUMAR M, Head of the Department, Electronics & Communication Engineering, AIT, Tumakuru**, for giving us the consent to carry out this Mini Project.

We would like to express my sincere thanks to the our Project Guide **MRS PADMAVATHI N, Associate Professor, Department of Electronics & Communication Engineering, AIT, Tumakuru,** for her able guidance and valuable advice at every stage of our project, which helped us in the successful completion of the Mini Project.

We would like to express our sincere thanks to all the faculty of ECE department and also to our parents and friends for their support.

SHANKARAGOUDA P (1AK22EC049)
TEJASWINI P (1AK22EC057)
BASAVARAJ B (1AK22EC007)
AISHWARY (1AK23EC400)

CONTENTS

ABSTRACT

This report explores the use of sensors to determine soil moisture content. Soil moisture sensors are increasingly popular in agricultural and environmental monitoring due to their ability to provide real-time, in-situ data. This report examines various types of soil moisture sensors, including Time-Domain Reflectometry (TDR), FrequencyDomain Reflectometry (FDR), and capacitive sensors, comparing their principles, advantages, and limitations. Soil moisture analysis is a vital tool for understanding soil water dynamics, optimizing irrigation, and promoting sustainable water management. This study reviews the principles, methods, and applications of soil moisture analysis, highlighting its importance in agriculture, hydrology, and environmental monitoring. Various sensor-based techniques, including Time-Domain Reflectometry (TDR), capacitance, and resistance sensors, are examined for their accuracy, resolution, and sensitivity. The study also discusses challenges associated with soil moisture measurement, such as sensor calibration, soil heterogeneity, and interference from external factors. Advanced technologies, including wireless sensor networks, IoT integration, and machine learning algorithms, are explored for their potential to enhance soil moisture analysis. The results underscore the significance of soil moisture analysis in optimizing water resources, improving crop yields, and mitigating the impacts of climate change.

CHAPTER 1:- INTRODUCTION

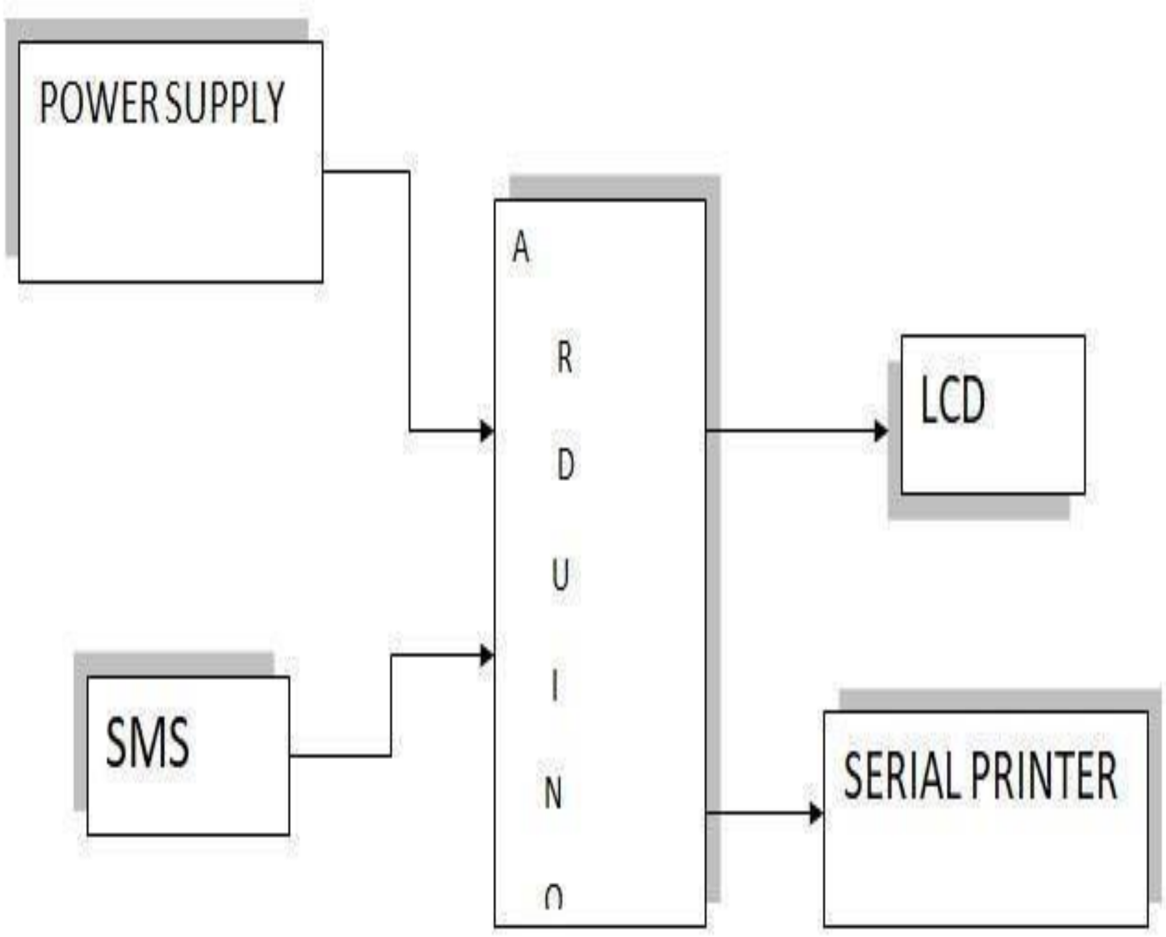
Soil moisture is a critical factor in agriculture, hydrology, and environmental science, impacting plant health, water conservation, and soil structure. Traditional methods of determining soil moisture content, such as the gravimetric method, are accurate but time-consuming and labor-intensive. Soil moisture sensors, however, offer a convenient, non-destructive means to continuously monitor soil moisture levels. This report investigates sensor-based soil moisture determination, providing insights into sensor selection, calibration, and data interpretation**.** Soil moisture analysis is a critical component of understanding soil water dynamics, optimizing irrigation, and promoting sustainable water management. Soil moisture refers to the amount of water held in the soil's pores and porespace, which affects plant growth, groundwater recharge, and surface water runoff.

CHAPTER 2:- LITERATURE SURVEY

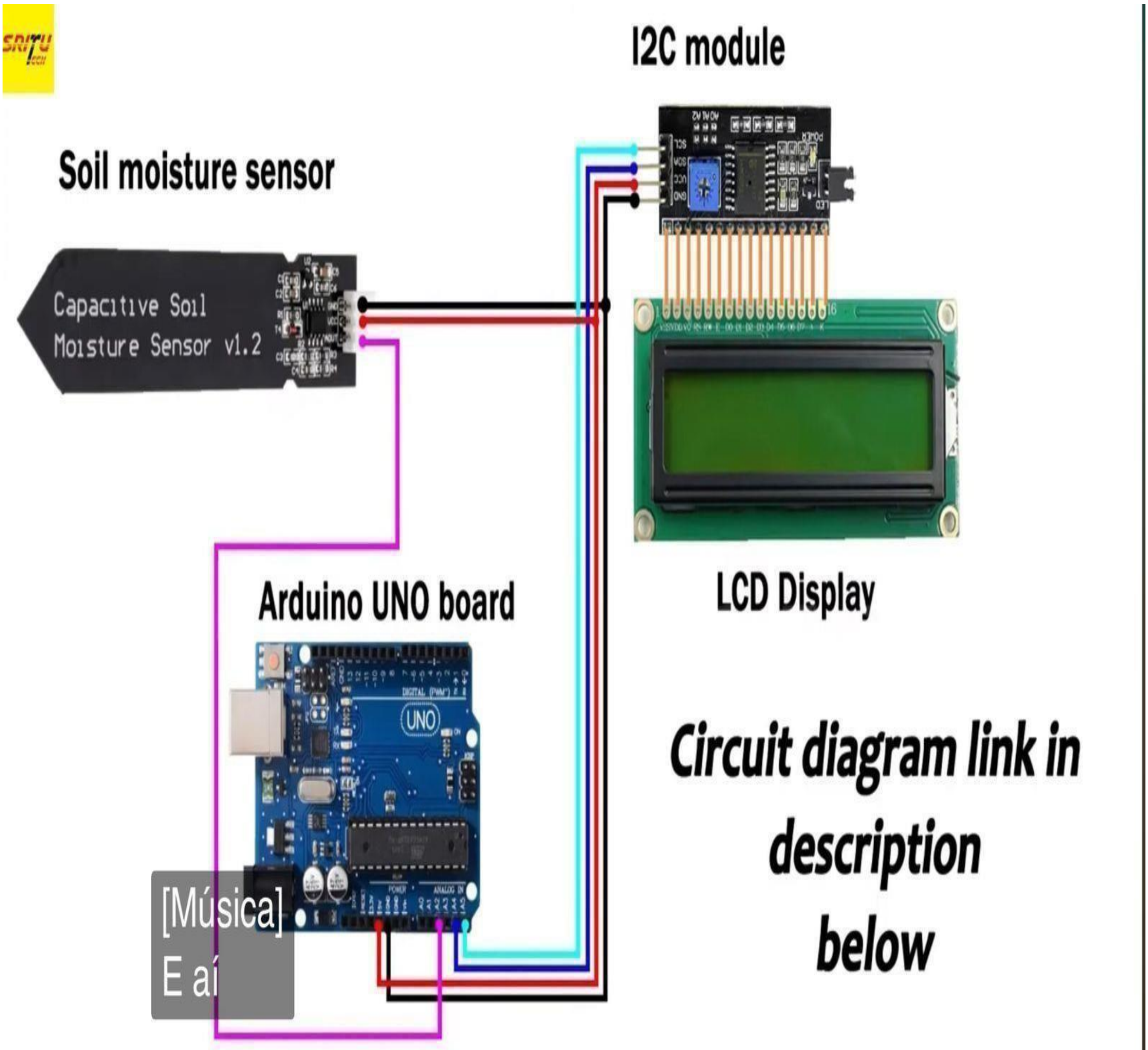
In this project we used these scientist concepts.[1]. The study likely aimed to evaluate a low-cost sensor's effectiveness in monitoring soil moisture, with a specific emphasis on its application in wireless sensor networks (WSNs). These networks allow for the remote monitoring of soil conditions, which is crucial for precision agriculture, irrigation systems, and environmental monitoring. The authors probably tested the accuracy, reliability, and practicality of the sensor in various soil types and environmental conditions. This would include comparing the performance of the sensor against more expensive, industry-standard devices to establish its suitability for real-world applications. [2]. The study may deal with the methods of measuring soil moisture, perhaps discussing various sensors (e.g., time domain reflectometry (TDR), capacitance probes, or neutron probes) used for agricultural or environmental monitoring. The authors may have explored the ways soil moisture interacts with soil properties, such as texture, organic matter content, and pore structure. .[3] The paper likely begins with an overview of different types of soil moisture sensors (e.g., capacitance sensors, time domain reflectometry (TDR), neutron probes, etc.), discussing their applications in agriculture and the challenges of measuring soil moisture accurately. The authors likely discuss how proper calibration can lead to improved soil moisture management, which is critical for irrigation systems, water conservation, and optimizing crop yield. .[4] This study evaluates several methods for measuring soil water content, which is a critical parameter for irrigation management, agricultural practices, and environmental monitoring. Specifically, the paper compares frequency domain**,** dielectric permittivity**,** and time-domain reflectometry (TDR) methods, which are common techniques for monitoring soil moisture content in the field. The paper likely presents findings regarding the accuracy and precision of the different techniques. TDR is often considered the gold standard for soil moisture measurement because of its high accuracy, but it can be expensive and more complex to operate.

.[5] his paper is focused on evaluating the performance and accuracy of soil moisture sensors used for determining soil profile water content. It addresses key factors that influence the reliability of these sensors in the field, including sensor accuracy, axial response (the spatial resolution of the sensor), calibration techniques, temperature dependence, and overall precision. Soil moisture is an important indicator of soil health and water dynamics in ecosystems. The results may also be relevant for researchers monitoring soil water content in natural or semi-natural environments. Agricultural Practices. By providing a comprehensive evaluation of sensor performance, the study may contribute to improving agricultural practices, ensuring that farmers can rely on sensors for accurate and cost-effective moisture monitoring.

CHAPTER 3:- BLOCK DIAGRAM



CHAPTER 4:- CIRCUIT DIAGRAM



CIRCUIT DIAGRAM

CHAPTER 5:- METHODOLOGY

1.Sensor Selection:

Select a sensor type based on project requirements, budget, and soil characteristics.

2.Installation:

Proper sensor placement is critical for accurate data. Sensors should be placed at the root zone depth for agricultural purposes or at various depths for environmental monitoring.

3.Calibration:

To ensure accuracy, sensors must be calibrated to the specific soil type. This can be done by comparing sensor readings with known moisture levels obtained through gravimetric analysis. 4.Data Collection and Analysis:

Data from soil moisture sensors is typically logged in real-time. The data can be analyzed to observe trends in soil moisture, assess irrigation needs, and support environmental monitoring.

CHAPTER 6:- REQUIREMENT

Arduino Board (e.g., Arduino Uno): Acts as the control unit for receiving, processing, and outputting data from the soil moisture sensor.

Soil Moisture Sensor: Measures the volumetric water content in the soil. It consists of two prongs that probe the soil and provide an analog signal based on the soil's moisture level.

Display (optional): An LCD or LED display to show the moisture level data.

Power Source: Battery or USB power for the Arduino.

IV

CHAPTER 7:- RESULT TABLE

WATER ADDED [ML]	PERCENTAGE OF DRYNESS	WATER ADDED [ML]	PERCENTAGE OF DRYNESS	WATER ADDED [ML]	PERCENTAGE OF DDRYNES	WATER ADDDED [ML]	PERCENT AGE OF DRYNESS
0	99%	0	99%	0	99%	0	99%
4	91%	4	91%	4	82%	4	53%
8	51%	8	51%	8	76%	8	50%
10	49%	10	49%	10	73%	10	47%
14	46%	14	46%	14	66%	14	43%
18	43%	18	43%	18	60%	18	37%
22	43%	22	43%	22	59%	22	35%
24	41%	24	41%	24	58%	24	33%
30	40%	30	40%	30	54%	30	31%
34	34%	34	34%	34	50%	34	30%
38	29%	38	29%	38	45%	38	28%

CHAPTER 8:- RESULTS AND DISCUSSION

The results from sensor data demonstrate the effectiveness of TDR and FDR sensors in providing precise, real-time soil moisture readings across various soil types. Capacitive sensors, while less accurate, are useful for general moisture monitoring where high precision is not critical. The sensor data correlates well with traditional methods, showing that sensor-based measurements can effectively replace labor-intensive methods for continuous monitoring applications.

CHAPTER 9:- CONCLUSION

Soil moisture sensors provide a rapid and reliable means of determining soil moisture levels, essential for efficient water management, irrigation planning, and environmental studies. TDR and FDR sensors are recommended for applications where high accuracy is essential, while capacitive sensors are suitable for costsensitive projects requiring basic moisture data. Calibration and correct installation are crucial for ensuring sensor accuracy.

CHAPTER 10:- APPLICATIONS

Determining soil moisture is crucial for various applications across different fields. Here are some key applications. Agriculture Irrigation Management Helps farmers optimize water use and improve crop yields. Crop Monitoring Assists in determining the right time for planting and harvesting. Environmental Science Erosion Control Understanding moisture levels can help in managing soil erosion. Land Use Planning Informs decisions about suitable land uses based on moisture availability. Hydrology Water Cycle Studies Aids in understanding precipitation and evaporation patterns. Flood Prediction Helps in assessing potential flooding risks by analyzing soil saturation. Soil Science

Soil Health Assessment Indicates soil conditions and fertility, guiding amendments and management practices. Construction and Engineering Foundation Stability Determines soil stability for construction projects, influencing design and safety. Climate Research Climate Modeling Contributes to models predicting climate change effects on land and ecosystems. Remote Sensing Satellite Imagery Utilized in monitoring large areas for agricultural and environmental assessments.

CHAPTER 11:- REFERENCE

1. Bogena, H. R., Huisman, J. A., Oberdörster, C., & Vereecken, H. (2007). Evaluation of a low-cost soil water content sensor for wireless network applications. Journal of Hydrology, 344(1-2), 32-42.

2.Robinson, D. A., Campbell, C. S., Hopmans, J. W., Hornbuckle, B. K., Jones, S. B., Knight, R., & Young, M. H. (2008). Soil moisture measurement for ecological and hydrological watershed-scale observatories: A review. Vadose Zone Journal, 7(1), 358-389.

3.Fares, A., & Polyakov, V. (2006). Advances in Crop and Soil Sciences: Calibration of Soil Moisture Sensors. Agricultural Water Management, 84(1), 189-201.

4.Kizito, F., Campbell, C. S., Campbell, G. S., Cobos, D. R., Teare, B. L., Carter, B., & Hopmans, J. W. (2008). Frequency, dielectric permittivity, and time-domain reflectometry methods for monitoring soil-water content: A field evaluation. Soil Science Society of America Journal, 72(3), 681-690.

5.Evett, S. R., Tolk, J. A., & Howell, T. A. (2006). Soil Profile Water Content Determination: Sensor Accuracy, Axial Response, Calibration, Temperature Dependence, and Precision. Vadose Zone Journal, 5(3), 894-907.