POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

COMPARISON OF ACCURACY SOIL MOISTURE TEST USING STANDARD METHOS TEST WITH IR4.0 TECHNOLOGY

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This report is submitted to the Department of Civil Engineering as fulfilling part of the conditions of the award Diploma of civil engineering

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AKUAN KEASLIAN DAN HAK MILIK

COMPARISON OF ACCURACY SOIL MOISTURE TEST USING STANDARD METHOD TEST WITH IR4.0 TECHNOLOGY

1. Kami, **NISSANTI A/P SIVA KUMAR (NO KP: 010208-01-0814)** dan **ANUSHA SUBRAMANIAM (N0 KP:)**adalah pelajar **Diploma Kejuruteraan Awam, Politeknik Sultan Salahuddin Abdul Aziz Shah**, yang beralamat di **Persiaran Usahawan, 40150 Shah Alam, Selangor.**

2. Saya mengakui bahawa comparison of accuracy soil moisture test using standard method test with IR4.0 technology dan harta intelek yang ada di dalamnya adalah hasil karya/ reka cipta asli saya tanpa mengambil atau meniru mana-mana harta intelek daripada pihak-pihak lain.

3. Saya bersetuju melepaskan pemilikan harta intelek comparison of accuracy soil moisture test using standard method test with IR4.0 technology kepada Politeknik Sultan Salahuddin Abdul Aziz Shah bagi memenuhi keperluan untuk penanugerahan **Diploma Kejuruteraan Awam** kepada saya.

Diperbuat dan dengan sebenar-benarnya diakui
oleh yang tersebut;

NISSANTI A/P SIVA KUMAR ……..…….
(No. Kad Pengenalan:010208-01-0814) NISSANTI A/P SIVA KUMAR

ANUSHA A/P SUBRAMANIAM ……..…….
(No. Kad Pengenalan:010208-01-0814) ANUSHA A/P SUBRAMANIAM

Di hadapan saya, NORLIZA BT MD JAHID (730820-09-5313) ……..……..…….
sebagai Penyelia Projek pada tarikh: ……..……. NORLIZA BT MD JAHID

APPRECIATION

Thank God we were able to complete the final project with excellence within the stipulated period of 12 months without facing any problems that are difficult to resolve as a condition for the awarding of the Diploma in Civil Engineering session Dec 2021. We express our appreciation to all parties involved directly or indirectly especially our supervisor Pn Norliza bt MD Jahid who has given us a lot of guidance, advice, encouragement and constructive criticism so that we managed to complete this final project report. Not forgetting also to the friends and family members who helped a lot in terms of views and finances in completing this final project assignment.

With this we are thankful to god then this final project is ready. We hope that this report can be used as an example and guide to the relevant parties in the future.

ABSTRAK

Air bawah tanah sering menjadi punca pertikaian antara pemilik dan kontraktor dalam projek pembinaan. Isu air tanah yang biasa semasa pembinaan ialah kebocoran air, ruang bawah tanah basah dan pertumbuhan acuan. Air bawah tanah juga menjejaskan fungsi dan reka bentuk kemudahan, dan kos pembinaannya. Sensor kelembapan tanah mengukur kandungan air dalam tanah. Mengukur kelembapan tanah adalah penting untuk aplikasi pembinaan untuk membantu jurutera menguruskan sistem pengairan mereka dengan lebih cekap. Ciptaan baharu ini akan membantu jurutera atau pelajar dalam kursus kejuruteraan awam untuk mengenal pasti kelembapan tanah. Sensor kelembapan tanah mengukur atau menganggarkan jumlah air di dalam tanah. Ia boleh menjadi pegun atau mudah alih seperti probe pegang tangan. Sensor Kelembapan Tanah boleh memantau kandungan air tanah menggunakan rintangan atau perubahan kemuatan. Kajian literatur ini akan mengkaji penggunaan penderia dan bahan yang sesuai untuk menghasilkan penderia kelembapan tanah. Penderia lembapan tanah kapasitif mengesan kelembapan dengan memantau perubahan dalam kapasiti. Kapasitan ialah ukuran jumlah cas elektrik yang boleh ditahan merentasi potensi elektrik. Proses pemadatan yang digunakan untuk menilai kandungan air optimum di mana tanah boleh dipadatkan untuk mendapatkan ketumpatan tertinggi (berat unit kering). Jadual 2.1 menunjukkan pangkalan data dan penyelidikan terdahulu mengenai sensor kelembapan tanah sebagai cara manual dan juga menggunakan beberapa alat IR juga. Penderia adalah mudah dalam reka bentuk, kos terhad, kepekaan tinggi, kawasan penderiaan yang besar dan masa tindak balas yang baik. Bahan yang dipertingkatkan, proses pembuatan mems, titik kuantum graphene (gqds) sebagai grafena sifar dimensi (0d). Penderia lembapan tanah kapasitif medan pinggiran menggunakan teknologi papan litar bercetak.

ABSTRACT

Groundwater is a frequent cause of disputes between owners and contractors in construction projects. Common ground water issues during construction is water leaks, wet basements, and mold growth. Groundwater also affects the function and design of the facility, and the cost of its construction. Soil moisture sensors measure the water content in soil. Measuring soil moisture is important for construction applications to help engineers manage their irrigation systems more efficiently. This new invention will help out the engineers or students in civil engineering course to identify the moisture of the soil. Soil moisture sensors measure or estimate the amount of water in the soil. They can be stationary or portables such as handheld probes. Soil Moisture Sensor may monitor soil water content using resistance or capacitance changes. This literature review will examine the use of appropriate sensors and materials to produce soil moisture sensors. A capacitive soil moisture sensor detects moisture by monitoring changes in capacitance.Capacitance is a measure of the amount of electrical charge that can be held across an electrical potential. A compacting process used to evaluate the optimal water content at which a soil may be compacted to get the highest density (dry unit weight). Table 2.1 shows database and previous research regarding soil moisture sensor as manual way and also using some IR gadgets too. The sensor is simple in design, limited cost, high sensitivity, large sensing area and good response time. Improved materials, mems manufacturing process, graphene quantum dots (gqds) as zero-dimensional (0d) graphene. A fringing field capacitive soil moisture sensor using the printed circuit board technology.

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IOT	Internet Of Thing
IR4.0	Industrial Revolution

LIST OF ABBREVIATIONS

CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

Construction Industry is one of the important and wanted in all over country. The geotechnical engineering Soil and environmental monitoring is an integral part of Civil Engineering structural solutions for long-term stability and safety. Long term soil moisture monitoring provides indication of soil saturation, water leaking under structures, and weakness associated with excess moisture. Soil sensors may be installed through or under asphalt or concrete structures and buried in place. The sensor data cables connect to a data logger, which provides periodic readings that are recorded in the data logger memory. This information is key to safety, soil and structure stability, or for providing compliancy and regulatory agency documentation, and may provide warning levels that the moisture is too high, or subject to shearing movements as well as other issues. The installation of soil sensors at varying depths indicates water movement and the changes in water balance. Buildings and some structures require moist soil to maintain the foundation's stability. Both soil-monitoring needs are solved with the soil sensors and loggers. The loggers provide set points that will trigger irrigation or alarms when soil is too dry, and have alarms available when the soil is too wet. From this, research this project will easily detect the soil moisture easily and will help out the engineers at the construction areas. By using Iot products and gadgets and Iot programming systems too. This method won't be thread to the users or effect the environment.

At Malaysia, soil moisture sensors have helped many engineers around the globe to enhance their construction soil moisture content. The devices have significant economic. Through the use of soil moisture sensors, engineers are able to know the exact soil moisture on their construction site. Modern commercial landscapes and residential lawns have been installed with soil moisture sensors that are compatible with irrigation controllers.

A probe is inserted into the soil for a few minutes, and a meter subsequently indicates the moisture content. Soil moisture sensors influence the engineer's techniques to be used for optimal performance. Torsiometers, Electrical resistance blocks, Time Domain Reflectometry (TDR Sensors), Frequency Domain Reflectometry (Capacitance Sensors), Neutron moderation 2 used in instantaneous measurement of the soil moisture content, salinity and temperature. Helps to track down the health of the soil. These are essential factors which every engineers, which are going to increase the quality of the soil, should focus on. Different kind of soil measurements and sensor are available with affordable price which every conscious engineers should use to check moisture contents.

Soil moisture sensors are ideal for research and experiments relating to relevant disciplines such as soil science, Geotechnics, environmental science and agriculture science and construction (civil engineering). The devices are also used as supplementary sensors for measurements relating to soil respiration and solute transport studies.

1.2 RESEARCH OF BACKGROUND

Types of soil tests for building construction works depend on properties of soil. Design of the foundation is based on soil test report of construction site. Soil moisture tests for construction of buildings or any structure is the first step in construction planning to understand the suitability of soil for proposed construction work.

Soil which is responsible for allowing the stresses coming from the structure should be well tested to give excellent performance. If soil shouldn't have tested correctly, then the whole building or structure is damaged or collapsed or leaned. So, soil inspection or testing is the first step to proceed any construction. Test for moisture content is an atterberg limits tests. Moisture content or water content in soil is an important parameter for building construction. Atterberg limits tests to measure the critical water content of a fine grained soil, atterberg provided three limits which exhibits the properties of fine grained soil at different conditions.

This study was conducted because soil moisture sensor is a humidity sensor that can detect moisture under the ground. These sensors are advanced, but ideal for monitoring residential area, and water levels construction areas. This sensor consists of two probes to pass current through the ground, then read the resistance to get the moisture level value. More water making the soil easier to transmit electricity which is small resistance, while if the soil is dry it's very difficult to transmit electricity which make large resistance. This sensor is very helpful for alerting the moisture level to buildings areas of monitoring soil moisture.

1.3 PROBLEM STATEMENT

One of the problems is experienced by engineers in particular is the difficulty of monitoring soil moisture underground at construction areas or residential areas. Moisture measurement were measured alternately in a soil tester to generate data. Soil Moisture tests takes a quite long period to do and generate data. It almost takes 12 until 24 hours to identify the soils moisture content. Mostly soil moisture sensors are invented for to test gardening and plants soil accurately.

A site should have adequate soil volume to support the growth and development of the buildings selected. Avoid selecting a site where layers of rocks are near the soil surface, because there is little soil to absorb the water. Below ground soil layers that are impervious to or restrict water infiltration can cause problems. Hardpan that occurs within 30 inches of the surface should be penetrated.

Whenever construction must take place below the water table or soil is used to retain water, groundwater affects the project by impacting the function and design of the facility, and the cost of its construction. Groundwater is a frequent cause of disputes between owners and contractors in construction projects. Common ground water issues during construction is Construction delays, Unstable subgrade , Unstable excavation and **c**ommon ground water problems after construction is water leaks, wet basements, and mold growth ,Cracked and uneven floors, Cracked and uneven walls, unstable slopes and retaining walls, delayed movements of foundations.

1.4 OBJECTIVES OF THE PROJECT

The objectives of this project is: -

i. To validate the accuracy of standard method test in laboratory.

ii. To validate the accuracy of IR4.0 in site construction field

iii. To compare accuracy measurement of standard method test anfd IR4.0 technology.

1.5 SCOPE OF THE PROJECT

This study or project is focuses on the civil engineering field. This project is mainly focused for geotechnics subject. This study or project is to determine the moisture of the soil at construction or residential areas accurately. This project will be tested at Geotechnics Lab to test the dry and wet soil easily. This research will be done about one month to complete the project and to be tested at the Lab. For this project ESP32, soil moisture sensor, project board and connector wires will be used.

1.6 IMPORTANCE OF THE PROJECT

This project will contribute towards the construction sector. This research involves the soil moisture towards the construction sector. Therefore, this research will help to determine the soil moisture accurately and easily. This new invention will help out the engineers or students in civil engineering course to identify the moisture of the soil. Therefore, through this research we able to test and measure completely the hypothesis and concepts.

1.7 DEFINITION OF TERMS

Soil moisture sensors measure the water content in soil. Measuring soil moisture is important for construction applications to help engineers manage their irrigation systems more efficiently. Knowing the exact soil moisture conditions on their site, able to generally investigate the water content. They are also able to identify the moisture level easily using this gadget at construction sites.