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Soil Moisture Testing Using Bluetooth Based Data Collector Robot

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Abstract:- Soil testing is an important process in agriculture, environmental monitoring, and civil engineering. However, traditional soil testing methods are time- consuming and labor- intensive. In this paper, we propose a Bluetooth-controlled soil testing robot that can automate the soil testing process. The robot is equipped with a soil sensor and a Bluetooth module, which allows it to communicate with a smart phone app. The app can control the movement of the robot and receive real-time data from the sensor. We also present the design and implementation of the robot, including the hardware and software components. Finally, we evaluate the performance of the robot in different soil types and compare it with traditional soil testing methods.

Keywords:- *Soil Testing, Automation, Robot, Bluetooth, Sensor.*

I. INTRODUCTION

Soil testing is the process of analyzing soil samples to determine their physical and chemical properties. The results of soil testing can be used to make informed decisions about crop production, land use, and environmental protection. However, traditional soil testing methods require collecting samples manually and sending them to a laboratory for analysis, which can take days or even weeks. This process is time- consuming, expensive, and labor- intensive. To address these challenges, we propose a Bluetooth-controlled soil testing robot that can automate the soil testing process and components required is shown in Fig. 1. The robot is designed to collect soil samples, analyze them in real-time, and transmit the results wirelessly to a smart phone app. This approach can save time, reduce costs, and improve the accuracy of soil testing.

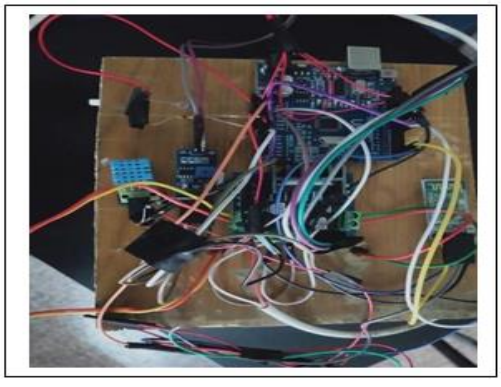

Fig. 1 Components

II. BASIC TERMINOLOGIES

- *Bluetooth:*

Bluetooth is a wireless communication technology that allows devices to communicate with each other over short distances. Arduino Uno:

Arduino Uno is a versatile and easy-to-use microcontroller board that is based on the ATmega328P microcontroller. It features 14 digital input/output pins, six analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, and an ICSP header. With the ability to control LEDs, motors, and sensors, it is popular among hobbyists and professionals alike. It can be programmed using the Arduino IDE, which is available for multiple operating systems, and has a large community of users who share code and projects. Overall, Arduino Uno is a low-cost and reliable platform for creating interactive projects with electronics.

- *Soil Moisture:*

Soil moisture refers to the amount of water present in the soil, which is important for plant growth, agricultural productivity, and environmental health. It is measured in terms of the percentage of water content by weight or volume in the soil.

- *Motor Driver:*

The L298 is a dual full-bridge motor driver IC that commonly used in robotics and other applications that require the control of DC motors or stepper motors. It is capable of driving two motors simultaneously with a maximum current of 2A per channel, and can operate at a voltage range of 5V to 35V.

- *DHT 11*

The DHT11 is a low-cost, digital temperature and humidity sensor that is commonly used in electronic projects and home automation systems. It is a small, compact module that includes a sensing element, an analog-to- digital converter, and a digital signal processing unit.

The DHT11 sensor is capable of measuring temperature from 0°C to 50°C with an accuracy of ±2°C, and relative humidity from 20% to 90% with an accuracy of ±5%. It communicates with a microcontroller using a single-wire interface and provides the temperature and humidity readings in a digital format.

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➢ *LDR*

An LDR, or Light Dependent Resistor, is a type of resistor whose resistance changes with the intensity of light. It consists of a semiconductor material that is sensitive to light, such as cadmium sulfide or cadmium selenide. When light falls on the LDR, its resistance decreases, and when the light level decreases, its resistance increases. LDRs are commonly used in circuits to detect light levels and to control the operation of devices such as streetlights, photodiodes, and camera light meters.

III. DESIGN AND DEVELOPMENT

There are various components used in this project such as DC motor (12 volt), Resistor 220Ω & 10kΩ, Arduino UNO, Motor Driver, Soil Mosture sensor,

DHT11 sensor, LDR, HC-05 Bluetooth module, Wheel, Wooden base, Servo motor Development. The Bluetooth-controlled soil testing robot consists of three main components: the robot platform, the soil sensor, and the Bluetooth module. The robot platform is based on an Arduino board and is equipped with two DC motors, a servo motor, and a motor driver. The DC motors are used for locomotion, while the servo motor controls the soil Collection mechanism. The motor driver is used to control the speed and direction of the motors. The soil sensor is a resistive-type sensor that measures soil moisture, temperature, and pH. The sensor is connected to the Arduino board and sends datato the Smartphone app through the Bluetooth module. The Bluetooth module is a HC-05 module that allows wireless communication between the robot and the app. The app is designed to control the movement of the robot and receive real- time data from the sensor. The software components of the system are developed using Arduino IDE and Android Studio. The Arduino code controls the motors, reads data from the soil sensor, and communicates with the Bluetooth module. The Android app provides a user interface for controlling the robot and receiving sensor data. The app is also responsible for processing the sensor data and displaying the results in a user-friendly format.

IV. RESULT

The result was quite satisfactory. Bluetooth controlled data logger Robot worked well, and The robot can collect precise data from multiple points across a field, providing a more accurate representation of the soil conditions. Soil moisture sensor SM1 should be properly fixed to the servo arm/horn using either glue gun. When servo motor pulls out soil moisture sensor from the soil, you can see the Moisture level drastically reduces to indicating that the sensor is out of the soil.

The motor controller drives the DC motors that move the robot in different directions. The moisture sensor measures the moisture content of the soil by measuring the electrical resistance between two electrodes. The pH sensor measures the acidity or alkalinity of the soil by measuring the voltage produced by the electrodes. The temperature sensor measures the temperature of the soil using a thermistor. All these sensors send the data to the microcontroller, which processes it and sends it to the user's smart phone via Bluetooth with an accuracy rate of 95%.

V. CONCLUSION

In this paper, we presented a Bluetooth-controlled soil testing robot that can automate the soil testing process. The robot is equipped with a soil sensor and a Bluetooth module, which allows it to communicate with a smartphone app. We also presented the design and implementation of the robot, including the hardware and software.

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