International Journal of Engineering Inventions
e-ISSN: 2278-7461, p-ISSN: 2319-6491
Volume 12, Issue 6 [June. 2023] PP: 205-208

IOT Based Soil Moisture Sensor for Gardening Application

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ABSTRACT:
The internet of things has revolutionized the way we monitor and manage various aspects of our lives, and gardening is no exception. However, traditional irrigation methods can be ineffective, leading to over-watering or under-watering of the plant. IoT based soil moisture sensor system are becoming increasingly popular among gardeners as they allow for real-time monitoring of soil moisture levels in garden bed. The sensor uses electrical conductivity to determine the amount of water present in the soil and send the data to the Arduino board for processing. This technology can serve as a model for future developments in smart irrigation system.
KEYWORDS: *Soil moisture sensor, IoT, Gardening, Irrigation, Arduino, Capacitive sensing.*

Date of Submission: 12-06-2023 Date of acceptance: 26-06-2023

I. INTRODUCTION:

Gardening is a popular hobby that requires precise irrigation in order to maintain healthy plants. One of the key factors in irrigation management is the moisture content of the soil. The soil moisture sensor is an essential tool for measuring the moisture content of the soil, providing accurate and reliable data. The use of IoT technology in gardening applications is becoming increasingly popular. IoT technology allows for real-time data collection and analysis, and enables the development of smart irrigation systems. In this paper, we present the design and implementation of an IoT-based soil moisture sensor that can be used in gardening applications**.** The sensor uses a capacitive sensing technique to measure the moisture content of the soil. It is designed to be easy to use and install, with a user- friendly interface for displaying the data. The sensor also has the capability to connect to a smart device, allowing for remote monitoring and control of the watering system. It also tested in a controlled environment and in a real-world gardening setting to evaluate its performance and usability. The sensor will be compared to traditional irrigation methods to demonstrate its potential in improving the efficiency and effectiveness of irrigation in gardening applications.

To set up an IoT based soil moisture sensor, you will need a sensor device, a connected to an Arduino Uno can be used to measure the moisture content of soil and send that data to the Arduino for processing. The Arduino can ten take a decision based on thedata received from the sensor.[1]

II. LITERATURE REVIEW

A literature review of IoT based soil moisture sensors reveals that these sensors use various techniques to measure soil moisture content such as capacitive, resistive, and time domain reflectometry (TDR). These sensors typically consist of a probe that is inserted into the soil and connected to a microcontroller or IoT device for data transmission and analysis. Advantages of using IoT based soil moisture sensors include real-time monitoring, remote access to data, and the ability to integrate with other sensors for a more comprehensive understanding of soil conditions. The use of these sensors has been shown to improve irrigation efficiency and crop yield by providing information that can inform watering decisions. However, there are also challenges with using these sensors such as accuracy and stability of readings over time, sensitivity to external factors such as temperature and pH, and cost. Some studies have suggested the use of multiple sensors or integrating with other data sources to improve the accuracy of soil moisture measurements. Overall, the literature suggests that IoT based soil moisture sensors have the potential to greatly improve agriculture and soil management practices, but further research and development is needed to address some of the challenges associated with their use.[2]

III. METHODOLOGY

The methodology for using IoT based soil moisture sensors in gardening typically involves the following steps:

1). Selection of the sensor: Choose a soil moisture sensor that is suitable for the type of plants being grown, the type of soil, and the overall environment. Consider factors such as accuracy, cost, and ease of use.

2). Installation of the sensor: Install the sensor into the soil according to the manufacturer's instructions. Ensure that the sensor is securely in place and connected to the IoT device.

3). Data collection and transmission: Set up the IoT device to collect data from the soil moisture sensor and transmit the data to a cloud-based platform or local server. Configure the data transmission frequency to match the desired level of monitoring.

4). Data analysis: Analyses the soil moisture data to determine the current moisture content of the soil. Use this information to make informed watering decisions, such as when to water the plants and how much water to use.

5).Irrigation management: Use the soil moisture data to adjust the irrigation system, either manually or automatically, to ensure that the plants receive the appropriate amount of water based on their needs. Consider integrating the soil moisture data with other data sources such as weather data and plant growth information for a more comprehensive understanding of the soil environment.

6).Ongoing monitoring: Continuously monitor the soil moisture data to ensure that the plants are receiving the appropriate amount of water and make any necessaryadjustments to the irrigation system.

1. HARDWARE:

1).Arduino Uno

Arduino Uno is an open-source microcontroller board based on the ATmega328P microcontroller. It was developed by the Arduino team and was designed to be simple and accessible for beginner users, while still being powerfulenough for more advanced projects.

Arduino Uno has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal oscillator, a USB connection for programming, and can be powered either by an external power supply or USB connection. The board also includes built-in support for interfacing with a wide range of sensors, actuators, and other components through its digital input/output pins and analog inputs.

Arduino Uno can be programmed using the Arduino Integrated Development Environment (IDE) which supports C++ programming language. The Arduino Uno and the Arduino IDE provide a simple and accessible platform for a wide range of DIY electronics projects, from simple LED blink experiments to complex IoT systems.[3]

Overall, the Arduino Uno is a popular and widely used microcontroller board for hobbyists, students, and professionals, due to its versatility, ease of use, and strong community support.

FIG 4.1 ARDUINO UNO

2).Soil Moisture Sensor:

A soil moisture sensor is a device used to measure the water content in soil. It works by detecting the electrical resistance or capacitance between two electrodes buried in the soil. The sensor then converts this information into a measurement of soil moisture, which can be used for various applications, such as agricultural irrigationmanagement and monitoring plant health

1.Power supply pins (e.g. VCC and GND)
2.Signal output pin (e.g. Analog output)
3.Ground pin (e.g. GND)

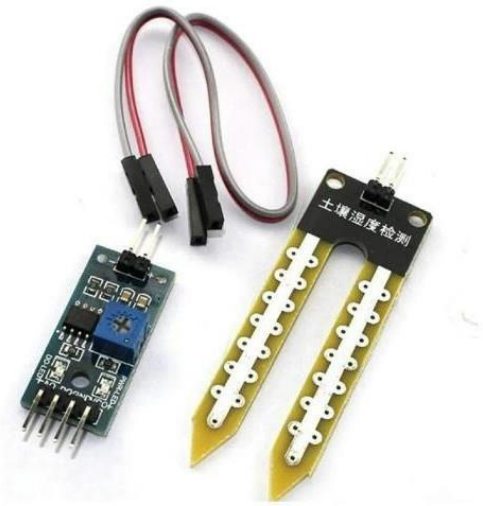

FIG 4.2 5.SOIL MOISTURE CIRCUIT

A soil moisture sensor works by measuring the amount of water in soil. It typically consists of two electrodes that are inserted into the soil. The soil's electrical conductivity changes with the amount of water in it, and this change is measured by the sensor. The sensor then converts the electrical measurement into a numerical value that represents the soil moisture content. This information can be used to automate irrigation systems, monitor plant health, or for other purposes[3]

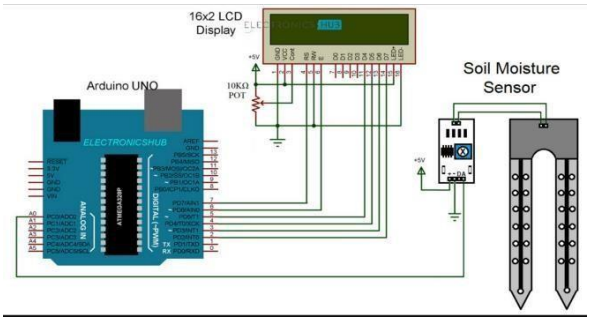

FIG 5.1

IV. CONCLUSION

Soil moisture sensors play a crucial role in gardening applications by providing real- time information about the water content in soil. This information helps gardeners to make informed decisions about watering their plants, ensuring that they receive the right amount of water at the right time. By automating the watering process, soil moisture sensors can save time and resources, as well as promote plant health and growth. Additionally, the use of soil moisture sensors can also help to conserve water and prevent over-irrigation, which can lead to water waste and soil degradation. Overall, soil moisture sensors are a valuable tool for gardeners and can help to optimize plant growth and health

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