AUTOMATIC PRECISION IRRIGATION SYSTEM WITH REMOTE OPERATION

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1. Introduction

Most years, some places in the state receive sufficient rainfall for good plant growth. But in many of those years, other areas of the state experience reduced yields and/or reduced quality on non-irrigated crops due to water stress from insufficient soil moisture.

For irrigation planning purposes, the average precipitation during the growing season is not a good yardstick to determine irrigation needs. The timing and amounts of rainfall during the season, the soil's ability to hold water and the crop's water requirements are all factors that influence the need for irrigation. Any location in the state can have what might be considered "wet or dry" weeks, months and even years.

Under irrigation, soil and water compatibility is critical. If they are not compatible, the applied irrigation water could have an adverse effect on the chemical and physical properties of the soil. Determining the suitability of land for irrigation requires a thorough evaluation of the soil properties, the topography of the land in the field, and the quality of water to be used for irrigation. A basic understanding of soil/water/plant interactions will help farmers efficiently manage their crops, soil irrigation systems and water supplies.

So, the solution we developed for proper soil health is wirelessly monitoring various soil parameters in real-time using multiple sensors such as moisture sensor, DHT11(Temperature and Humidity sensor) and module as ESP32.

2. Applications

One of the most significant advantages of an intelligent monitoring system is its ability to save water. Generally speaking, traditional watering methods can waste as much as 50% of the water used due to inefficiencies in irrigation, evaporation, and overwatering. Smart monitoring systems use sensors for real-time or historical data to inform watering routines and modify watering schedules to improve efficiency. They are also helpful in improving efficiency in using fertilisers since they can be used to check the ammonia content of the soil.

We can measure chemicals level in soil, and with this information, we can use pesticides and fertilisers so that overuse of harmful chemicals can be avoided and soil will not lose fertility.

CREDITS: https://blog.dhigroup.com

3. Specifications of the solution developed

3.1 Software specifications

- We have used Arduino IOT cloud for making the UI to get real-time data from our sensors by uploading it using WIFI.
- We have used Arduino IDE 2.0 for editing the code and uploading and reading the data in the serial monitor.
- We have used "LiquidCrystal.h" Library: This library allows to send and receive data to the LCD Display.
- We have used DHT.h Library: This library provides functions to get the data from the DHT11 sensor.

3.2 Hardware Specifications

• ESP32

Description: ESP32 is a series of low-cost, low-power systems micro controllers with integrated Wi-Fi and dual-mode Bluetooth. that can be integrated into various electronic projects.

• LCD display

Description: The "LiquidCrystal" library allows you to control LCD displays. They are usually the 16-pin interface.

Model LCD 16x2

. • DHT11

Description This sensor provides temperature and humidity data.

Model DHT11.

• Breadboard

Description A breadboard is used for building temporary circuits. It is useful to designers because it allows easily removing and replacing components. It is helpful to build a circuit to demonstrate its action.

- Resistors

  Description A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit.

  Model Resistors 10kΩ.

- Moisture Sensor

  Description It senses the soil's moisture level and determines whether the soil has been overwatered or underwatered.

  Model number ESC034

- Connecting Wires

  Description Used to connect components in the circuit.

3.3 Circuit Design

We have designed all the circuits in wokwi software. The image for connections is as follows,

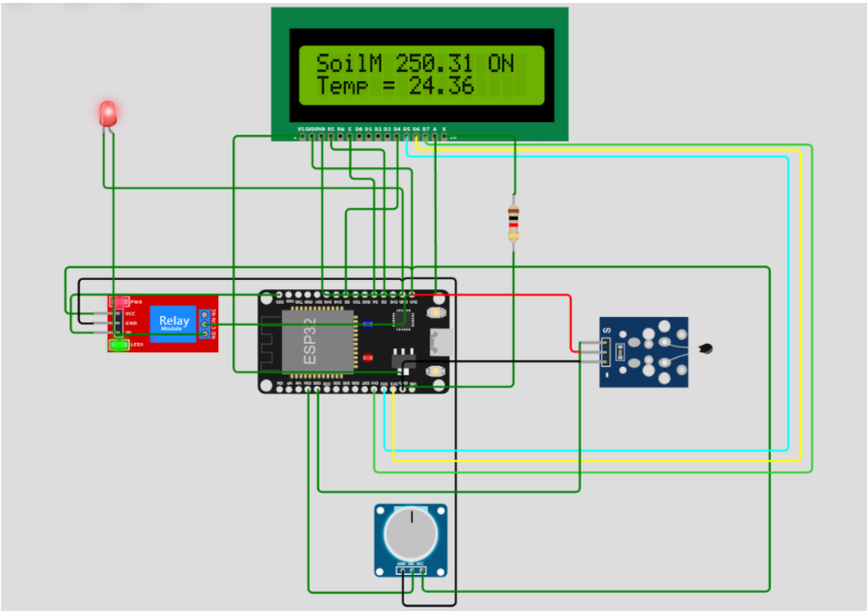

Figure:1 Circuit Design

3.4 Data Flow Diagram

- DHT11 –> ESP32 –> LCD Display
  Description: The values of temperature and humidity from the DHT11 sensor are received by Arduino and then displayed by sending it to an LCD display.
- Moisture Sensor –> ESP32 –> LCD Display
  Description: The values of moisture from the moisture sensor are received by Arduino and then displayed by sending it to the LCD display.
- DHT11 –> ESP32 –> Cloud application (Arduino IOT cloud)
  Description: The temperature and humidity values from the DHT11 sensor are sent using WIFI to the cloud wirelessly through the internet.
- Moisture sensor –> ESP32 –> Cloud application (Arduino IOT cloud)
  Description: The moisture values from the moisture sensor are received WIFI module and then sent to the cloud wirelessly through the internet.

4. Testing Details

The health of soil can be tested for various soil types having different parameters such as moisture, temperature and humidity. These parameters can be observed in real-time, drastically increasing crop yield in agriculture. These parameters can be accessed wirelessly in any device with a minimalistic and easy-to-use User Interface**.**

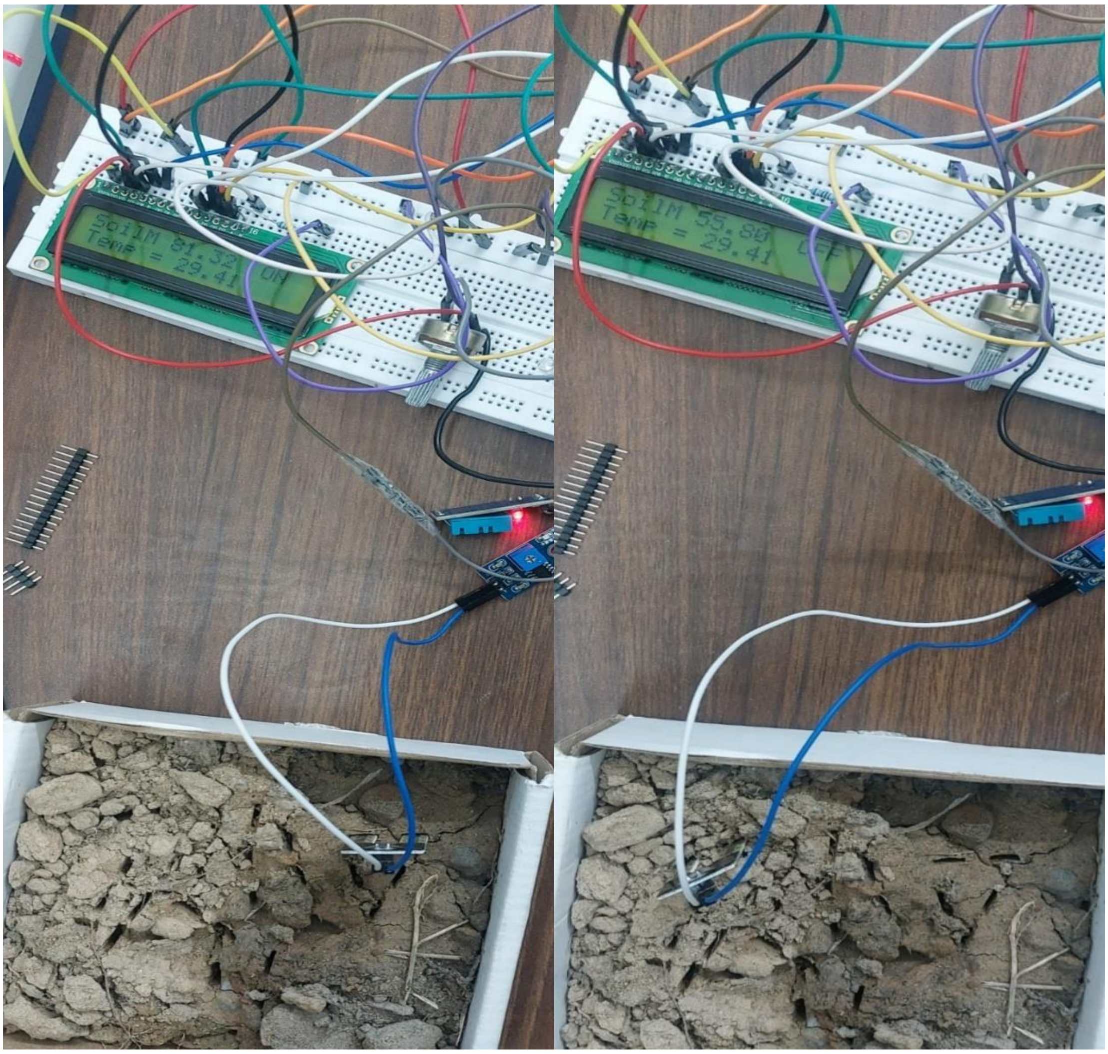

Figure 2 Real-time working.

As we can see, while testing in two different situations (high and low moisture content soil), we know the moisture level, temperature and humidity on the LCD display.

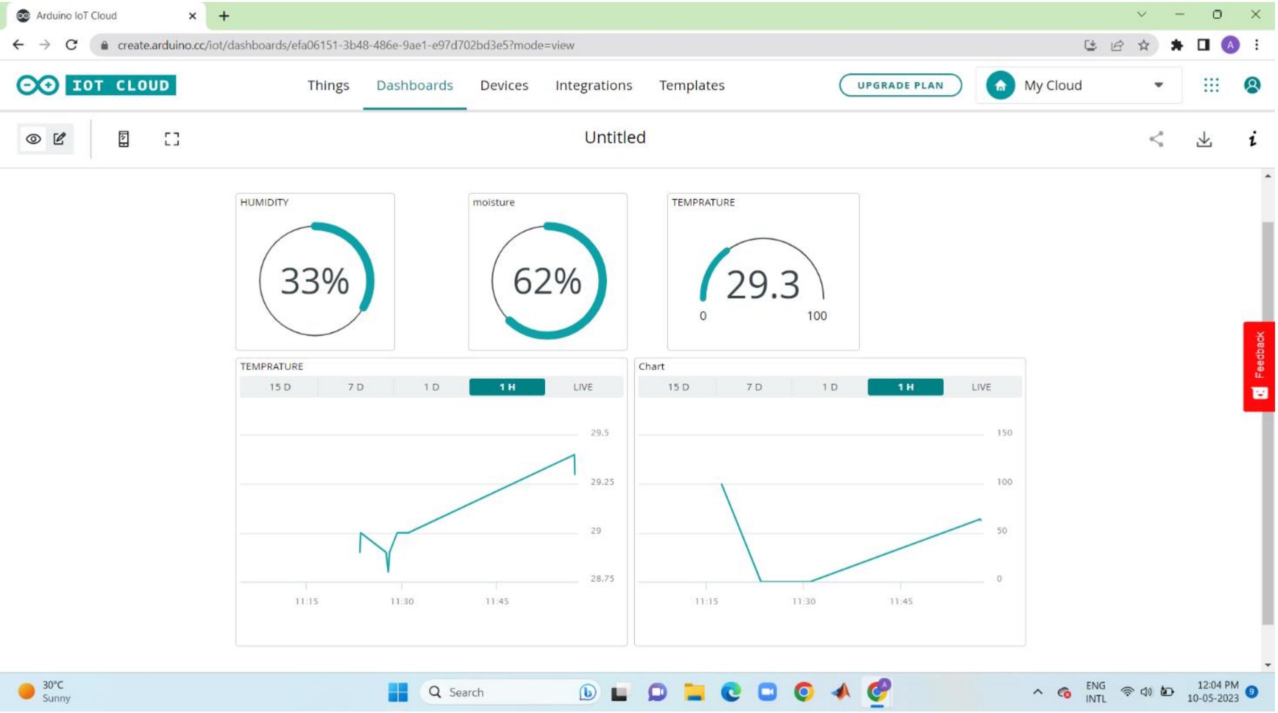

Figure:3 Laptop interface

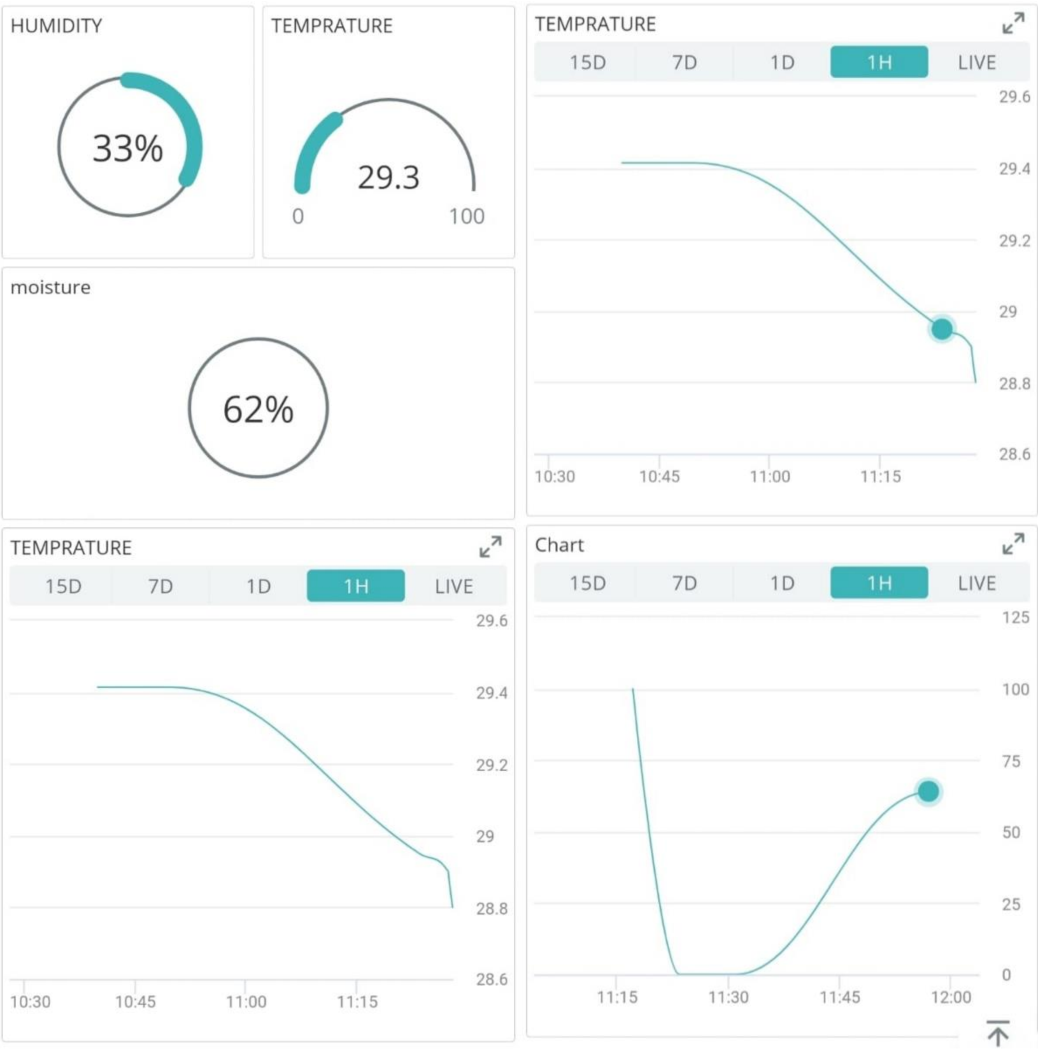

Figure:4 Mobile App interface

5. Conclusions and Future Improvements

The health of the soil is essential for efficient growth and yield of crops. It can positively affect the agriculture sector if the soil monitoring system is developed on a large scale. It is also economically efficient and affordable.

Future improvements:

- We can include an ammonia sensor to check the amount of ammonia in the soil and use fertilisers only when ammonia is deficient in the soil. This will reduce the unnecessary content of fertilisers and improve their efficiency.
- We can also include pesticide and chemical sensors to check and reduce the chemical content so that the crops have lower harmful chemical content.
- We can use a water pump for irrigating the crops wirelessly; It can also be done automatically by setting a range of moisture values so that the moisture remains in that range of values automatically.