SMART PRECISION IRRIGATION SYSTEM

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MOTIVATION

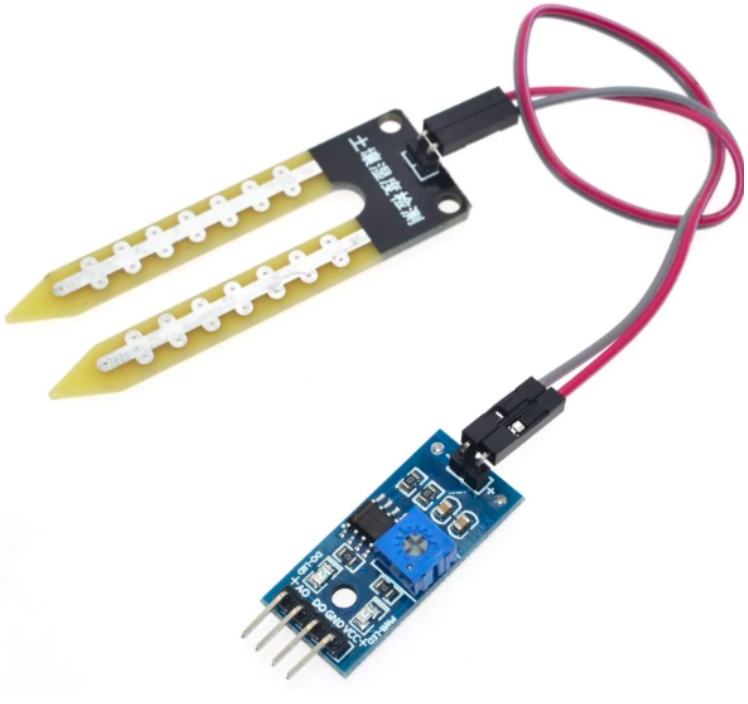
Smart irrigation systems that use real-time data to optimise watering schedules are critical to conserving water resources and ensuring optimal plant growth. By measuring temperature, humidity, and moisture levels, this project can accurately determine the water needs of plants and irrigate them accordingly. This will not only increase efficiency and save water but also lead to healthier and more robust plant growth, ultimately improving crop yields and contributing to sustainable agriculture.

COMPONENTS USED

- Soil moisture sensor
- Humidity & temperature sensor (DHT-40)
- Bluetooth module (HC-05)
- Arduino UNO
- Breadboard
- Water pump
- Buzzer
- Jumper wires

SOIL MOISTURE SENSOR

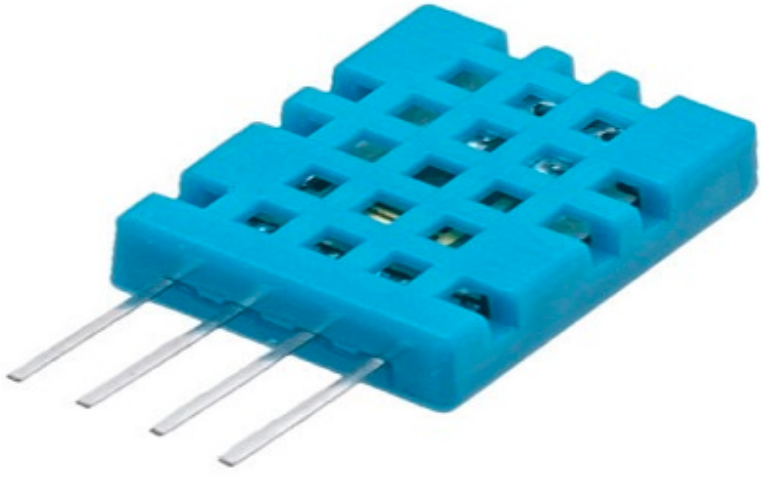
This **soil moisture sensor module** is used to detect the moisture of the soil. It measures the volumetric content of water inside the soil and gives us the moisture level as output. The module has both digital and analog outputs and a potentiometer to adjust the threshold level.



Pin Name	Description
VCC	The Vcc pin powers the module, typically with +5V
GND	Power Supply Ground
DO	Digital Out Pin for Digital Output.
AO	Analog Out Pin for Analog Output

TEMPERATURE & HUMIDITY SENSOR

DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc... to measure humidity and temperature instantaneously.

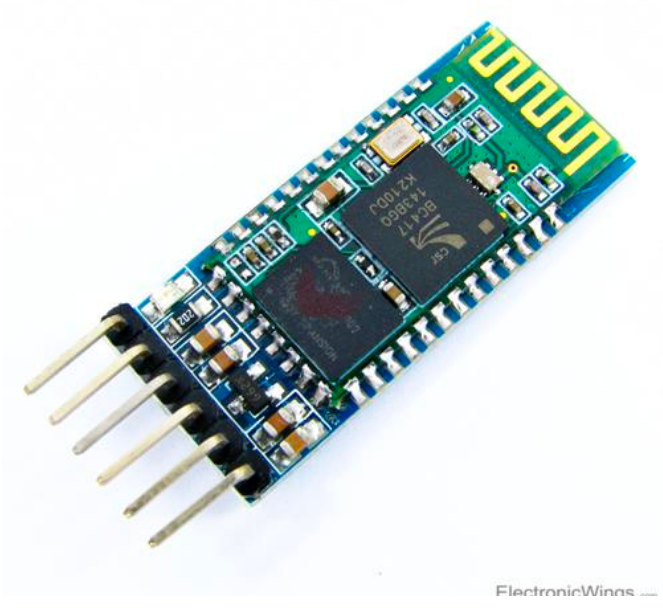


1	Vcc	Power supply 3.5V to 5.5V
2	Data	Outputs both Temperature and Humidity through serial Data

3	NC	No Connection and hence not used
4	Ground	Connected to the ground of the circuit

BLUETOOTH MODULE (HC - 05)

Designed to replace cable connections HC-05 uses serial communication to communicate with the electronics. Usually, it is used to connect small devices like mobile phones using a short-range wireless connection to exchange files. It uses the 2.45GHz frequency band. The transfer rate of the data can vary up to 1Mbps and is in range of 10 meters.

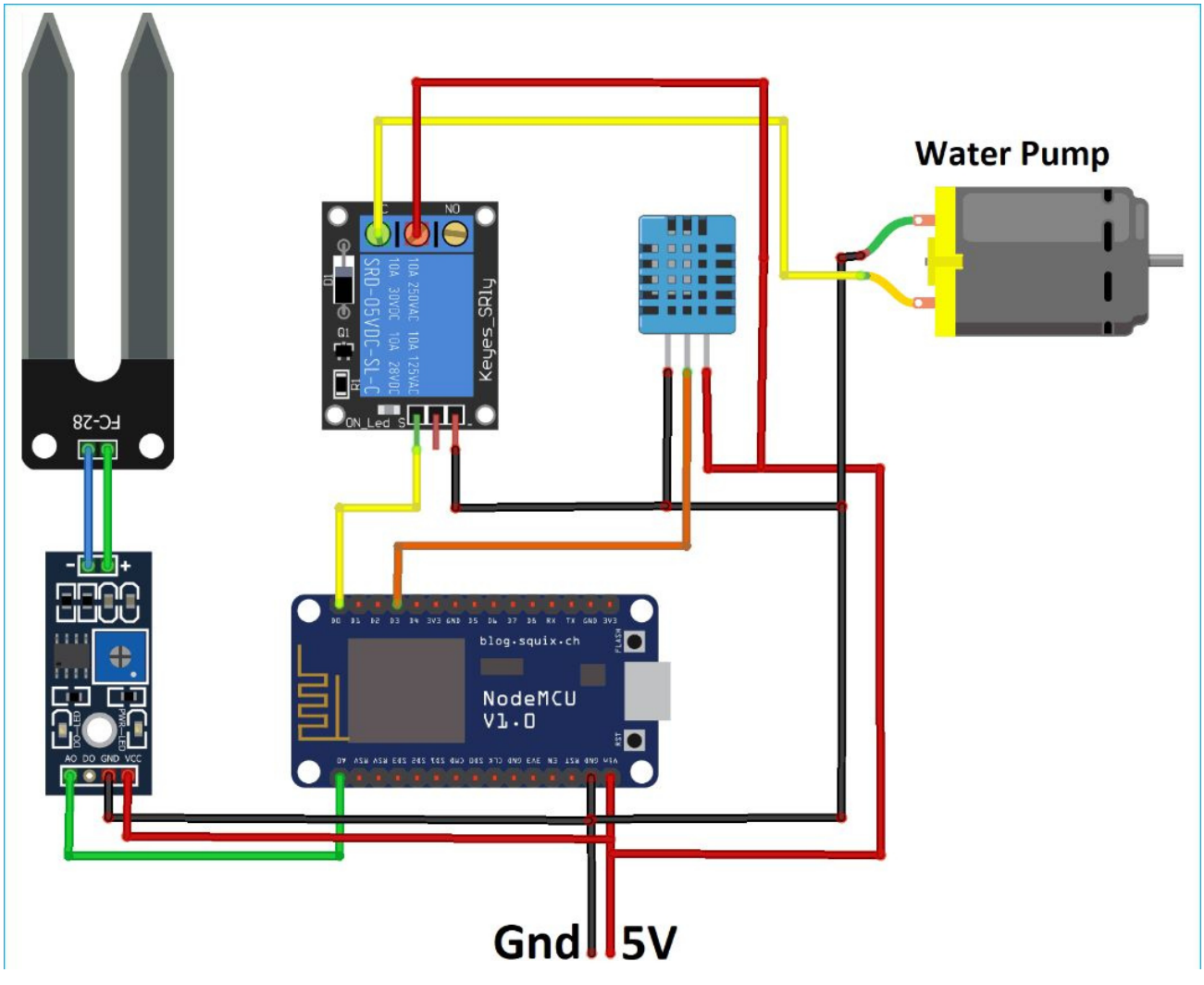


Pin Number	Pin Name	Description
1	Enable / Key	This pin is used to toggle between Data Mode (set low) and AT command mode (set high). By default it is in Data mode
2	Vcc	Powers the module. Connect to +5V Supply

		voltage
3	Ground	Ground pin of module, connect to system ground.
4	TX – Transmitter	Transmits Serial Data. Everything received via Bluetooth will be given out by this pin as serial data.
5	RX – Receiver	Receive Serial Data. Every serial data given to this pin will be broadcasted via Bluetooth
6	State	The state pin is connected to on board LED, it can be used as a feedback to check if Bluetooth is working properly.
7	LED	Indicates the status of Module • Blink once in 2 sec: Module has entered Command Mode • Repeated Blinking: Waiting for connection in Data Mode • Blink twice in 1 sec: Connection successful in Data Mode

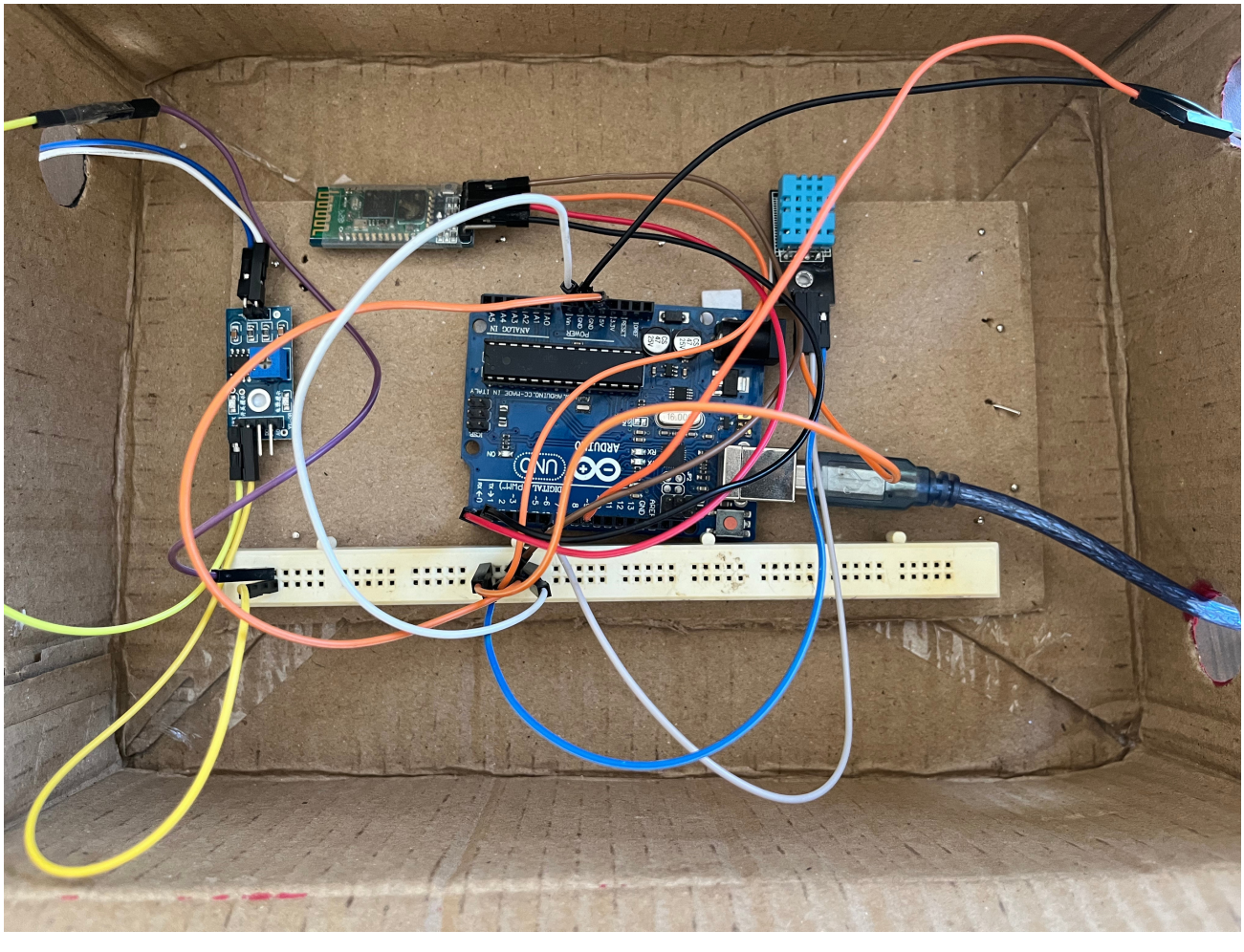
8	Button	Used to control the Key/Enable pin to toggle between Data and command Mode

CIRCUIT DIAGRAM



FUNCTIONS

- Records the humidity, temperature and moisture using DHT-11 sensor and soil moisture sensor.
- Depending on the humidity, temperature and soil moisture levels read, the pump is switched on/off to provide the plant with optimum water as per its need.
- The sensor values are also transmitted via Bluetooth to a custom app, and can be read through the app



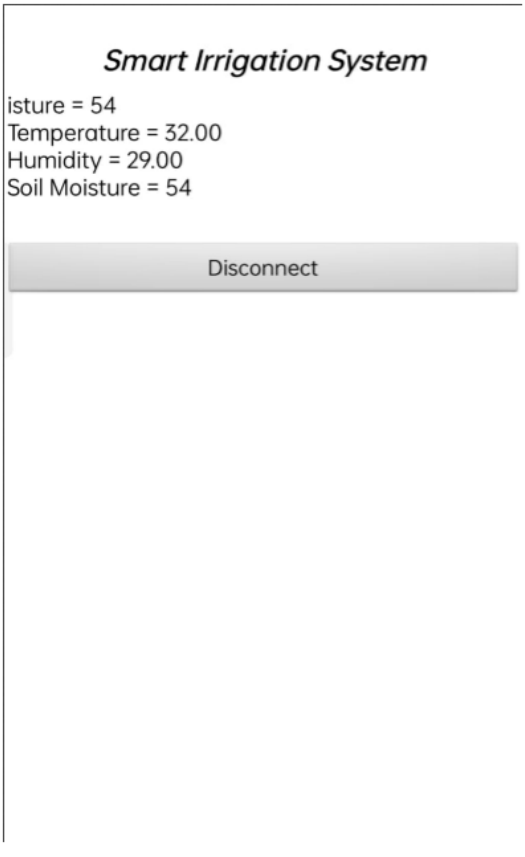
CODE

```
#include <dht.h>

dht DHT;

#define DHT11_PIN 7
#define sensor_pin A1
#define limit  50

void setup(){
  Serial.begin(9600);
  pinMode(8, INPUT); // soil moisture

  pinMode(9, OUTPUT); //motor
}
  void loop(){

    int moisture_;
    int sensor_analog;

     sensor_analog = analogRead(sensor_pin);
     moisture_ = ( 100 - ( (sensor_analog/1023.00) * 100 ) );


      int chk = DHT.read11(DHT11_PIN);


      if(moisture_ < limit){
        digitalWrite(9, HIGH);
      }

      else{
        digitalWrite(9,LOW);
      }


        Serial.print("Temperature = ");
        Serial.println(DHT.temperature);
        Serial.print("Humidity = ");
        Serial.println(DHT.humidity);
        Serial.print("Soil Moisture = ");
        Serial.println(moisture_);


    delay(100);

  }
```

Brief Code Explanation:

- The DHT module is imported to make its functionalities available to the code.
- Next, the pins are defined along with their types (input/output)
- The soil moisture is read and if it is greater than 50%, the pump will be switched off.

- The temperature, moisture and humidity values are then sent to the app which is connected to the Arduino via Bluetooth and printed on the app screen.



In the future, the project can be expanded to include

- Various other sensors like rain sensor
- Allowing the app to start and stop the water pump as well
- Integrating a database of multiple plants, soil types and regions to provide plant specific optimal irrigation.

In conclusion, the smart remote irrigation system (controlled by an app) which measures temperature, humidity, and moisture is a promising solution for efficient and optimal plant growth. By incorporating real-time data collection and automated watering based on plant needs, this system reduces water waste, saves time and effort, and ensures healthy plants. The app provides users with easy-to-understand visualisations and alerts, enabling them to monitor and adjust their irrigation schedule remotely. Overall, the implementation of a smart

irrigation system is an excellent example of how technology can support sustainable and environmentally friendly practices in agriculture.