IOT BASED SMART AGRICULTURE MONITORING SYSTEM

A project report

Submitted by

Ragavi R(710020106020)

Rashmiya J(710020106022)

Kowsalya S(710020106016)

Nivaashini S(710020106019)

In partial fulfilment of the requirements for the course

Powering IoT using Arduino and Raspberry Pi

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DEPARTMENT OF ECE

Anna University Regional Campus,Coimbatore

Coimbatore – 641046

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BONAFIDE CERTIFICATE

This is to certify that the project report entitiled "**Iot based smart agriculture monitoring system** "submitted by "**Ragavi R(710020106020),Rashmiya J (710020106022),Nivaashini S (710020106019),Kowsalya S(710020106016)**" in partial fulfilment of the requirements for the course in PoweringIOT using Arduino / Raspberry Pi conducted by SkillsDa under Naan Mudhalvan Scheme is Bonafide Record of the work carried out under my guidance and supervisioned at Anna University Regional Campus,Coimbatore.

Name of the Guide

Guide

HOD

Department of ECE

Evaluated on:

INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

In this project, we are going to build a **Smart Farming System using IoT**. The objective of this project is to offer assistance to farmers in getting Live Data (Temperature, Humidity, Soil Moisture, Soil Temperature) for efficient environment monitoring which will enable them to increase their overall yield and quality of products. This smart agriculture using IoT system powered by NodeMCU consists of a DHT11 sensor, Moisture sensor, DS18B20 Sensor Probe, LDR, Water Pump, and 12V led strip. When the IoT-based agriculture monitoring system starts, it checks the Soil moisture, temperature, humidity, and soil temperature. It then sends this data to the IoT cloud for live monitoring. If the soil moisture goes below a certain level, it automatically starts the water pump. We previously build Automatic Plant Irrigation System which sends alerts on mobile but doesn't monitor other parameters. Apart from this, Rain alarm and soil moisture detector circuit can also be helpful in building Smart Agriculture Monitoring System.

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Ragavi R

Rashmiya J

Kowsalya S

Nivaashini S

TABLE OF CONTENTS

CHAPTER 1

COMPONENT

Components Required for Smart Agriculture System

Hardware

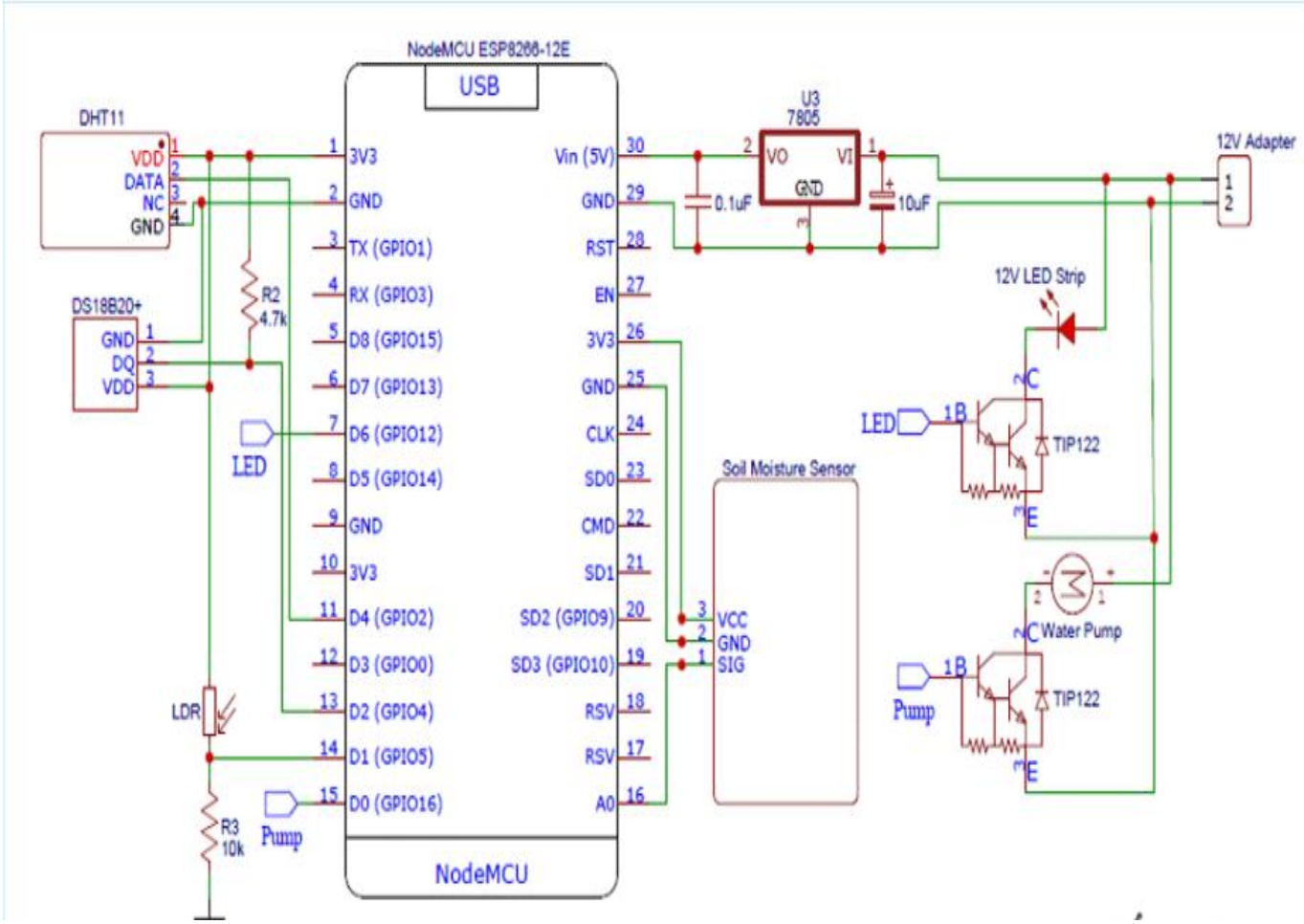
- NodeMCU ESP8266
- Soil Moisture Sensor
- DHT11 Sensor
- DS18B20 Waterproof Temperature Sensor Probe
- LDR
- Submersible Mini Water Pump
- 12V LED Strip
- 7805 Voltage Regulator
- 2×TIP122 Transistor
- Resistor (4.7K, 10K)
- Capacitor (0.1µF, 10 µF)

Online Services

- Adafruit IO

CHAPTER-2

CIRCUIT DIAGRAM



Here we have used 4 sensors i.e. DHT11, DS18B20 sensor probe, LDR and Soil Moisture Sensor, one 12V LED Strip, 12V water pump, 7805 voltage regulator, and two TP122 transistors to control Led strip and water pump. 7805 is used to get the regulated 5V from the 12V adapter, DHT11 sensor is used to get the temperature and humidity readings. The DS18B20 sensor probe is used to get the soil temperature and a soil moisture sensor is used to read the Soil moisture so that the water pump can be turned on/off automatically.

CHAPTER-3

ADAFRUIT IO SETUP

Adafruit IO is an open data platform that allows you to aggregate, visualize, and analyze live data on the cloud. Using Adafruit IO, you can upload, display, and monitor your data over the internet, and make your project IoT-enabled. You can control motors, read sensor data, and make cool IoT applications over the internet using Adafruit IO.

STEPS:

- use Adafruit IO, first, you have to create an account on Adafruit IO. To do this, go to Adafruit IO website and click on 'Get started for Free' on the top right of the screen.

- After finishing the account creation process, log in to your account and click on 'View AIO Key' on the top right corner to get your account username and AIO key.

- To create a feed, click on 'Feed.' Then click on 'Actions,' you will see some options, from them, click on 'Create a New Feed.'

- After this, a new window will open where you need to input the Name and Description of your feed. Writing description is optional

- Click on ‘Create,’; after this, you will be redirected to your newly created feed.For this project, we created a total of eight feeds for Water pump, LED Strip, moisture data, Temperature, Humidity, Weather data, and Soil Temperature.

- After creating feeds, now we will create an Adafruit IO dashboard to show all of these feeds on a single page. To create a dashboard, click on the Dashboard option and then click on the ‘Action,’ and after this, click on ‘Create a New Dashboard.’

- As our dashboard is created, now we will add our Blocks to dashboard. To add a Block, click on the ‘Gear’ in the top right corner and then click on ‘Create New Block’.

- First, we will add two toggle buttons blocks to turn ON/OFF LED Strip and Water Pump manually, then four sliders to display Temperature, Humidity, Soil Temperature, and Moisture Value and in last, two Graph blocks to display last 30 day Moisture and Soil Temperature Data. To add a button on the dashboard, click on the Toggle block.

CHAPTER-4

Getting the OpenWeatherMap API

As mentioned earlier, we are also going to display weather forecast on Adafruit IO dashboard and for that, we will use OpenWeatherMap API to request the day's weather forecast for chosen location. OpenWeatherMap provides highly recognizable weather products that make working with the weather data a way easier. This data can be accessed via fast, reliable APIs that follow industry standards and compatible with different kinds of enterprise systems. OpenWeatherMap offers both paid and free plans and here in this project, we are going to use its free plan to get the weather forecast data.

Now to obtain the API key, it's necessary to sign up on their platform, so first create an account and once your account is created, you'll be redirected to dashboard as shown below. From there click on your Name and then click on 'My API Keys' and you will be presented with a unique API key to pull information from the site.

CHAPTER-5

Programming NodeMCU for Smart Agriculture System

1) After installing the libraries to Arduino IDE, start the code by including the required libraries files.

```
#include <ESP8266WiFi.h>
#include <DallasTemperature.h>
#include <OneWire.h>
#include "DHT.h"
#include "Adafruit_MQTT.h"
#include "Adafruit_MQTT_Client.h"
#include <ArduinoJson.h>
```

2) Then enter the Wi-Fi and Adafruit IO credentials that you copied from the Adafruit IO server. These will include the MQTT server, Port No, User Name, and AIO Key.

```
const char *ssid =  "Wi-Fi Name";
const char *pass =  "Wi-Fi password";
#define MQTT_SERV "io.adafruit.com"
#define MQTT_PORT 1883
#define MQTT_NAME "Adafruit IO Username"
#define MQTT_PASS "AIO Key"
```

3) Then set up the Adafruit IO feeds for storing the sensor data and controlling LED and water pump. In my case, I have defined four feeds to store different sensor data namely: Soil Temperature, Temperature, Humidity and Moisture, one feed for displaying Weather data and two feeds to control LED Strip & Water Pump.

```
Adafruit_MQTT_Client mqtt(&client, MQTT_SERV, MQTT_PORT, MQTT_NAME, MQTT_PASS);

Adafruit_MQTT_Publish Moisture = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/Moisture");

Adafruit_MQTT_Publish Temperature = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/Temperature");

Adafruit_MQTT_Publish Humidity = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/Humidity");

Adafruit_MQTT_Publish SoilTemp = Adafruit_MQTT_Publish(&mqtt,MQTT_NAME "/f/SoilTemp");

Adafruit_MQTT_Subscribe LED = Adafruit_MQTT_Subscribe(&mqtt, MQTT_NAME "/f/LED");

 Adafruit_MQTT_Subscribe Pump = Adafruit_MQTT_Subscribe(&mqtt, MQTT_NAME "/f/Pump");
```

4) Now inside the ***setup()*** function, initialize the Serial Monitor at a baud rate of 9600 for debugging purposes. Also Initialize the DHT sensor, and DS18B20 sensor with the ***begin()*** function.

```
void setup()
{
  Serial.begin(9600);
  delay(10);
  dht.begin();
  sensors.begin();
……..
}
```

5) Now comes the ***void loop()***. This is where all the tasks are performed. So, in this loop, first we will get the weather forecast data from OpenWeatherMap API, then we will read the sensors data and in last step, we will publish all this data on Adafruit IO dashboard.

6) Reading the Weather Forecast:

To read the weather forecast data from OpenWeatherMap API, we will use the code snippets that we generated using ArduinoJson Assistant. Here in void loop, we will only call the API after a particular time interval so that we don't exceed our daily limit.

```
if (millis() - lastConnectionTime > postInterval) {
    // note the time that the connection was made:
    lastConnectionTime = millis();
    makehttpRequest();
  }
```

7) Reading the Sensor Data:

Now after getting the weather data, next we will read all the sensor data. Here we are using the DHT11, DS18B20, LDR and Soil Moisture Sensor. LDR and soil moisture sensor data will be used to automate LED strip and water pump. So first we will read the LDR status and if the LDR reading is less than 200, then LED will be turned on automatically. Similarly, if the soil moisture percentage is less than 35, then water pump will be turned on.

```
int ldrStatus = analogRead(ldrPin);
```

```
    if (ldrStatus <= 200) {
       digitalWrite(ledPin, HIGH);
    }
    else {
      digitalWrite(ledPin, LOW);     }
  moisturePercentage = ( 100.00 - ( (analogRead(moisturePin) / 1023.00)
* 100.00 ) );
if (moisturePercentage < 35) {
  digitalWrite(motorPin, HIGH);
}
temperature = dht.readTemperature();
 humidity = dht.readHumidity();
sensors.requestTemperatures();
```

8) Publishing the Data on Adafruit IO:

Now as we have collected all the data, it's time to publish this data on Adafruit IO dashboard, so that we can monitor it from anywhere. Here we will publish the different sensor data to their respective feeds.

```
 if (currentTime - previousTime >= Interval) {
    if (! Moisture.publish(moisturePercentage))
    if (! Temperature.publish(temperature))
    if (! Humidity.publish(humidity))
    if (! SoilTemp.publish(soiltemp))
    if (! WeatherData.publish(icon))
}
```

```
soiltemp = sensors.getTempCByIndex(0);
```

CHAPTER-6

RESULT

To test this project, we have sprouted some seeds in a plastic tray as shown in the below image:

We mounted the hardware box beside the tray, connected a water pump to a water bottle, and connected the power supply. With this done, it starts monitoring the different parameters like soil moisture, soil temperature, etc. All these reading will be published on Adafruit IO dashboard.

REFERENCES

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