ECE3026 – IoT System Architecture

J – Component Final Report

"Iot Weather Station With Multiple Sensors"

Using Node mcu and Thingspeak

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CERTIFICATE

This is to certify that **Arun Kumar Verma (16bis0096), Ishan Yash (16bis0102), Malhar Trivedi (16bis0171), Dhruvit Sakariya (16bis0174), Rohan Singh (16bis0175)** have completed the project, '**Iot Weather Station With Multiple Sensors**', under the supervision of **Prof. Sasikumar P** in the Fall Semester of 2018-2019 for the course "IoT System Architecture".

SIGNATURE

ABSTRACT

The primary goals of this project to measure the temperature and humidity inside the room and then display this information on a server, including present time and date.
Weather monitoring is a necessity in every city. With natural weather conditions like rainfall, extreme heat, etc. day and night, we require a smart weather monitoring system to constantly track the weather changes and record them. In this report, we have proposed and designed a simple technique to monitor the weather in a smart city. Since, we refer to a smart city, the city will be entirely connected using Internet of Things. With the help of Google Maps, for instance, we may transmit the weather data of a particular location to the meteorological board, who will take necessary actions based on the weather of that particular location. This project is accomplished using low cost components like Node MCU, which acts as the controller, a few passive elements, rain sensor, light sensor, and an ESP8266 Wi-Fi module for networking.

INTRODUCTION

A weather station can be described as an instrument or device, which provides us with the information of the weather in our neighbouring environment. For example it can provide us with details about the surrounding temperature, barometric pressure, humidity, etc. Hence, this project basically senses the temperature, pressure, humidity, light intensity, rain value. There are various types of sensors present in the prototype, using which all the aforementioned parameters can be measured. It can be used to monitor the temperature or humidity of a particular room/place. With the help of temperature and humidity we can calculate other data parameters, such as the dew point. In addition to the above mentioned functionalities, we can monitor the light intensity of the place as well. We have also enabled to monitor the atmospheric pressure of the room. We can also monitor the rain value. The brain of the prototype is the ESP8266 based Wi-fi module Node MCU (12E). Four sensors are connected to the Node MCU namely temperature and humidity sensor (DHT11), pressure sensor (BMP180), raindrop module, and light dependent resistor (LDR).

COMPONENTS REQUIRED

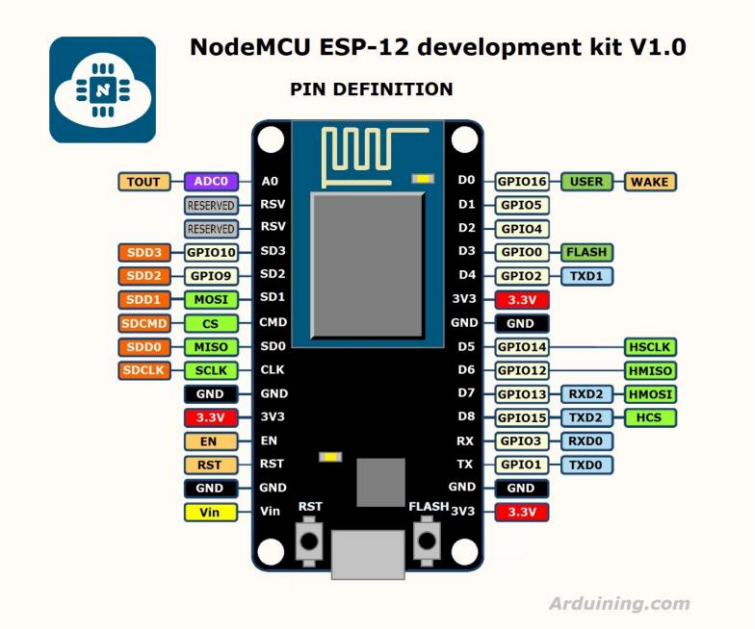
- ESP8266 enabled Node MCU board, programmed with Arduino IDE;
- DHT11/22 sensor;
- BMP180 sensor;
- Rain sensor;
- Light sensor;
- Flashing indication led

TECHNICAL SPECIFICATIONS

➢ Hardware

a. NodeMCU

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs



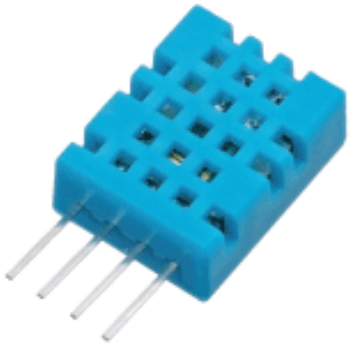
b. Sensors

DHT11 : The DHT11 is a commonly used Temperature and humidity sensor. The sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is also factory calibrated and hence easy to interface with other microcontrollers.

The sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90% with an accuracy of ±1°C and ±1%.

DHT11 Specifications:

- Operating Voltage: 3.5V to 5.5V
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data
- Temperature Range: 0°C to 50°C
- Humidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit
- Accuracy: ±1°C and ±1%

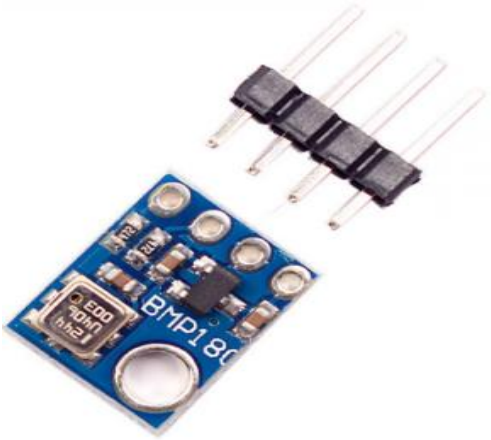


DHT11

LDR : It is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor can be applied in light-sensitive detector circuits, and light-activated and dark-activated switching circuits.

Rain Sensor: Rain sensor is a switching device activated by rainfall. Modern day rain sensors are based on the principle of total internal reflection where the change in intensity of light that returns to the sensor is used to determine the amount of rainfall.

BMP180 : BMP 180 atmospheric pressure sensor is a such type of sensor which is mainly used for measuring atmospheric pressure or biometric pressure.It is a high precision low cost sensor.



- **Cloud**

  ThingSpeak is an open source Internet of Things (IoT) application and API to store and retrieve data from things using the HTTP protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates".

  ThingSpeak was originally launched by ioBridge in 2010 as a service in support of IoT applications.

WORKING

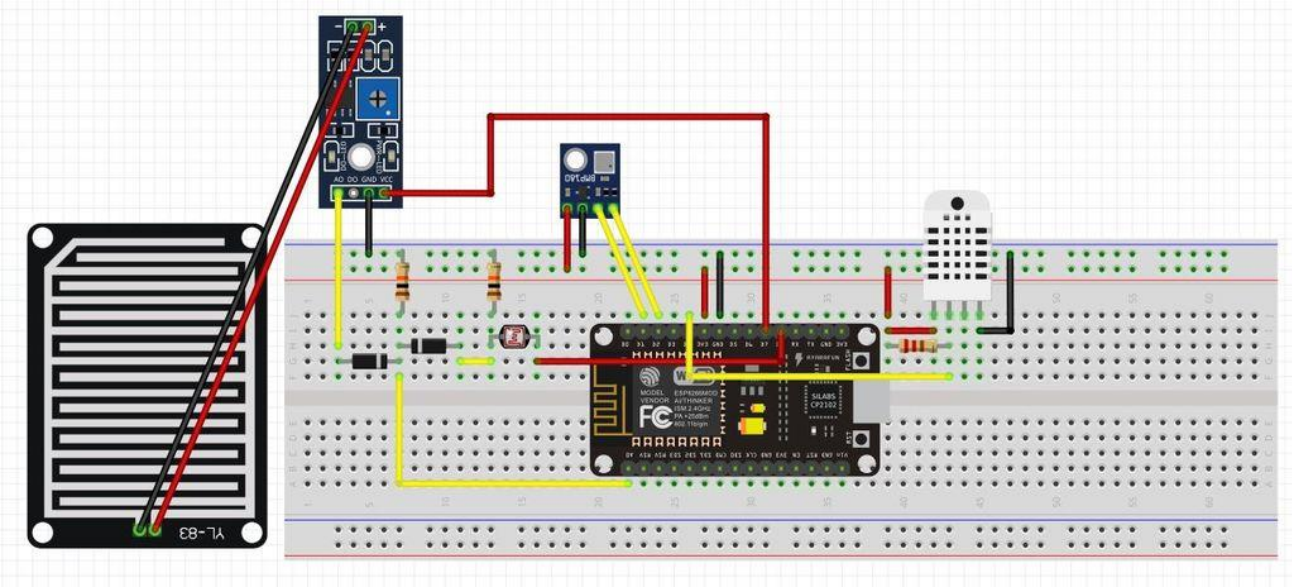
The Node MCU board has only 1 analog pin, but in this project two analog output devices, viz, LDR and Raindrop Module, are multiplexed to the A0 using two diodes. The multiplexing circuit is shown in the Fig.7 below. Here the V_{cc} Fig. 7. Multiplexing circuit. of Raindrop sensor is connected to the D7 of the Node MCU and the input of LDR is connected to the D8 of Node MCU. When D7 is High, D8 is Low making LDR off and raindrop module on. Hence the output of raindrop sensor reaches the A0 of Node MCU through the diode. Similarly, when D8 is High and D7 is Low, LDR is on and raindrop module is off making a path for the LDR output to reach to the A0 of the Node MCU through the second diode. The 10k resistance is used to reduce the voltage drop across raindrop module and LDR. Hence, we are accommodating 2 analog devices in the Node MCU having just one analog pin.

We have identified a suitable implementation model that consists of different sensor devices and other modules. In this implementation model we used Node MCU embedded on board with Wi-Fi module is as embedded device for sensing and storing the data in cloud.

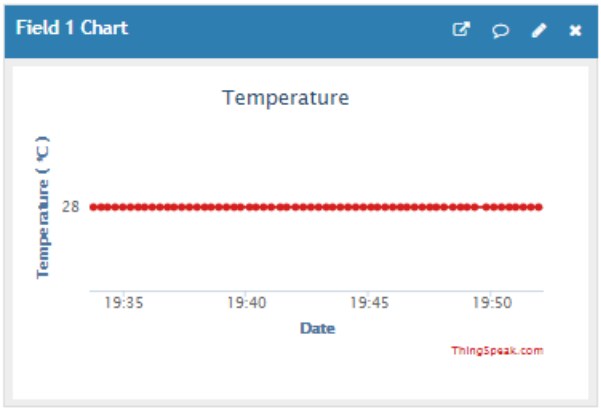
- # Connecting to thinkspeak

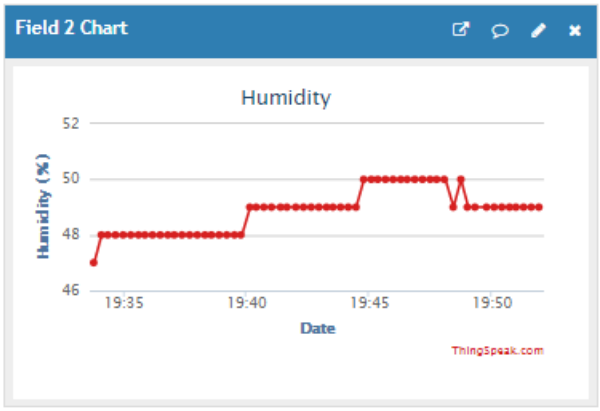
  - ✓ As we are going to push our data to Thingspeak we have to make an account. Thingspeak is a cloud service. It is great and easy to use, Thingspeak provides several options for interaction with your data such as Thingtweet, Thinghttp etc.
  - ✓ Simply we have to go to thingspeak.com and make an account. Fill in ‘Temperature' in field 1, ‘Humidity' in field 2, ‘Dew point' in field 3, ‘Pressure' in field 4, ‘Temperature' in field 5, ‘Light intensity' in field 6, ‘Rain measurment' in field 7 and ‘Altitude' in field 8.
  - ✓ From Thingspeak account a key has to be mention in the arduino sketch under the tap 'API key'. This key is necessary to connect the arduino to the Thingspeak channel.

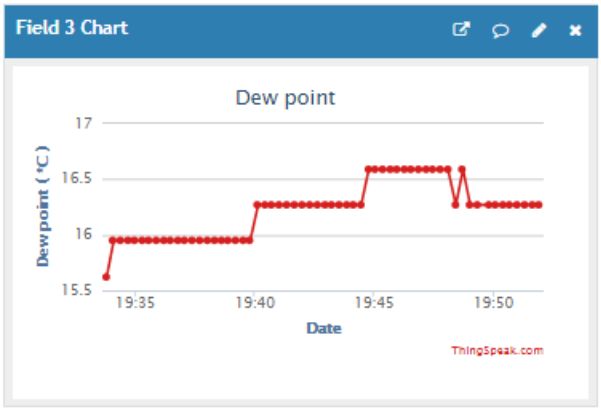
CIRCUIT DIAGRAM

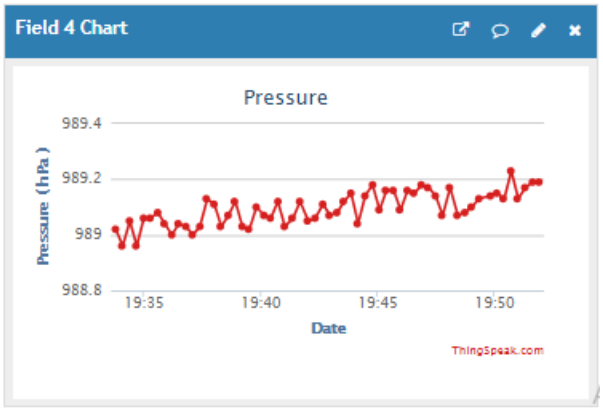


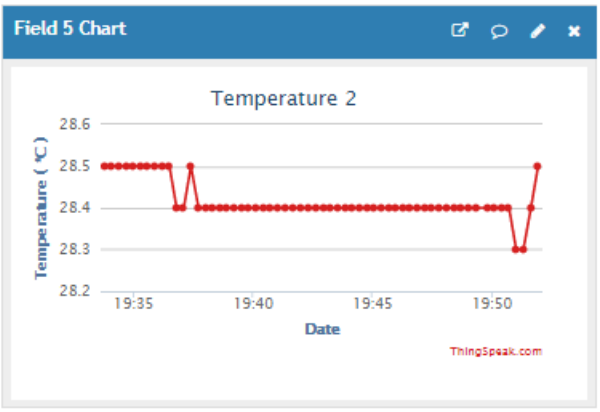
RESULT

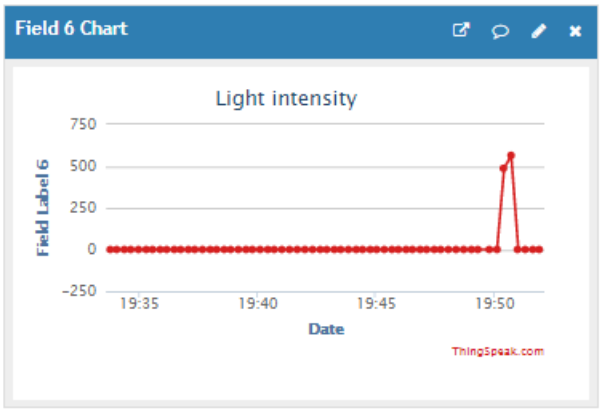

Field 1 Chart
Temperature
Temperature (℃)
28
19:35
19:40
19:45
19:50
Date
ThingSpeak.com

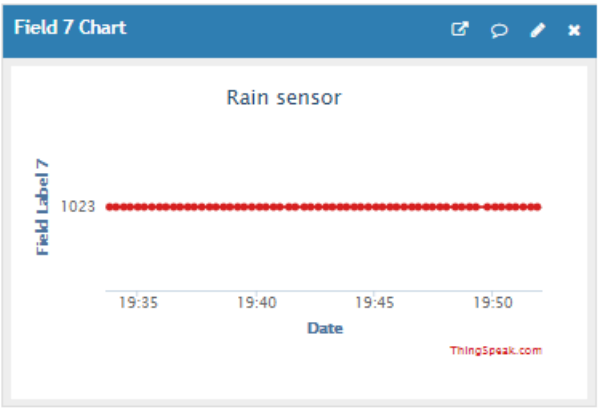

Field 2 Chart
Humidity
Humidity (%)
52
50
48
46
19:35
19:40
19:45
19:50
Date
ThingSpeak.com

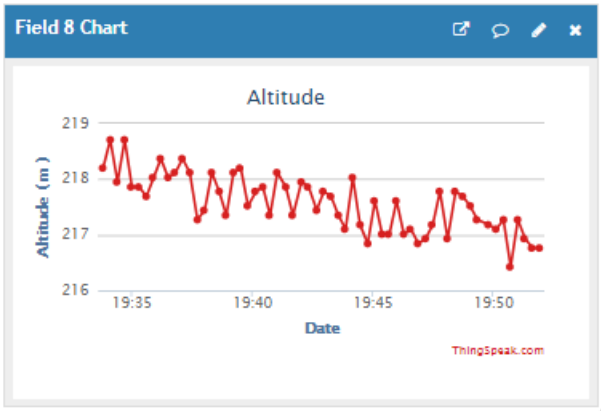

Field 3 Chart
Dew point
Dewpoint (℃)
17
16.5
16
15.5
19:35
19:40
19:45
19:50
Date
ThingSpeak.com


Field 4 Chart
Pressure
Pressure (hPa)
989.4
989.2
989
988.8
19:35
19:40
19:45
19:50
Date
ThingSpeak.com


Field 5 Chart
Temperature 2
Temperature (℃)
28.6
28.5
28.4
28.3
28.2
19:35
19:40
19:45
19:50
Date
ThingSpeak.com


Field 6 Chart
Light intensity
Field Label 6
750
500
250
0
-250
19:35
19:40
19:45
19:50
Date
ThingSpeak.com


Field 7 Chart
Rain sensor
Field Label 7
1023
19:35
19:40
19:45
19:50
Date
ThingSpeak.com


Field 8 Chart
Altitude
Altitude (m)
219
218
217
216
19:35
19:40
19:45
19:50
Date
ThingSpeak.com

FUTURE SCOPE

The proposed IoT based weather station can be modified to incorporate many more features. We can add an OLED display to display the surrounding parameters into it. We can also add a GPS module in the design so that the location of the surrounding will also be mailed or messaged to the user along with the surrounding parameters like, temperature, humidity, pressure, light intensity etc. It can also be modified such that whenever a message or email is sent from a particular phone number or email id to the server, all the environmental parameters of the device along with its location will be delivered to that phone or email id. This device can also be used to monitor a particular room or place whose environmental parameters are required to be monitored continuously.

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