

IOE-4 Smart Weather Monitoring System

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1. Abstract

With the advent of high-speed Internet, more and more humans around the globe are interconnected. Internet of Things (IoT) takes this a step further and connects not only humans but electronic devices which can speak amongst themselves. With falling costs of Wifi-enabled devices, this trend will only gather more momentum. The main concept behind the Internet of Things(IoT) is to connect various electronic devices through a network and then retrieve the data from these devices (sensors)which can be distributed in any fashion, upload them to any cloud service where one can analyze and process the gathered information. In the cloud service, one can utilize this data to alert people by various means such as using a buzzer or sending them an email or sending an SMS, etc.A weather station can be described as an instrument or device, which provides us with information of the weather in our neighboring environment. For example, it can provide us with details about the surrounding temperature, barometric pressure, humidity, etc. Hence, this device basically senses the temperature, pressure, and humidity. 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. The brain of the prototype is the ESP8266-based Wi-fi module. Various sensors are connected to the Arduino namely the temperature and humidity sensor(DHT11), and pressure sensor(BMP180). The values are then shown to the user

2. Introduction/Theory

A weather monitoring system deals with detecting and gathering various weather parameters which can be analyzed or used for weather forecasting. The aim of this system is achieved by technologies such as the Internet of Things(IoT) and the Cloud. The idea of the internet of things is to connect a device to the internet and to other required connected devices. Weather Monitoring is an essential practical implementation of the concept of the Internet of Things, it involves sensing and recording various weather parameters and using them for alerts, sending notifications, adjusting appliances accordingly, and also for long-term analysis. Also, we will try to identify and display trends in parameters using a graphical representation. The devices used for this purpose are used to collect, organize and display information..The data captured is transmitted to the cloud so that the data could be further displayed. Besides this, the system consists of components such as the Arduino UNO board which is a microcontroller board consisting of 14 digital pins, a USB connection and everything used to support the microcontroller; DHT11 is Temperature and humidity sensor which is used for detecting these mentioned parameters; WIFI module is used to convert the data collected from the sensors and then send it to the webserver

3. Problem Statement

The main aim of the project is to develop a smart weather monitoring system. The system will then predict the weather conditions accordingly. The parameters which would be monitored by the system will include temperature, pressure, and humidity of the surroundings.

4. Implementation

The Weather stations normally consist of a few sensors to measure environmental parameters and a monitoring or logging system to analyze these parameters. In this project we have built a wireless IoT-based weather station that can measure critical environmental parameters like Temperature, Humidity, and Pressure. Also since our weather stations, IoT enabled, we can send these parameters to a ThingSpeak channel (IoT cloud)where we can store, analyze, and access the data remotely.

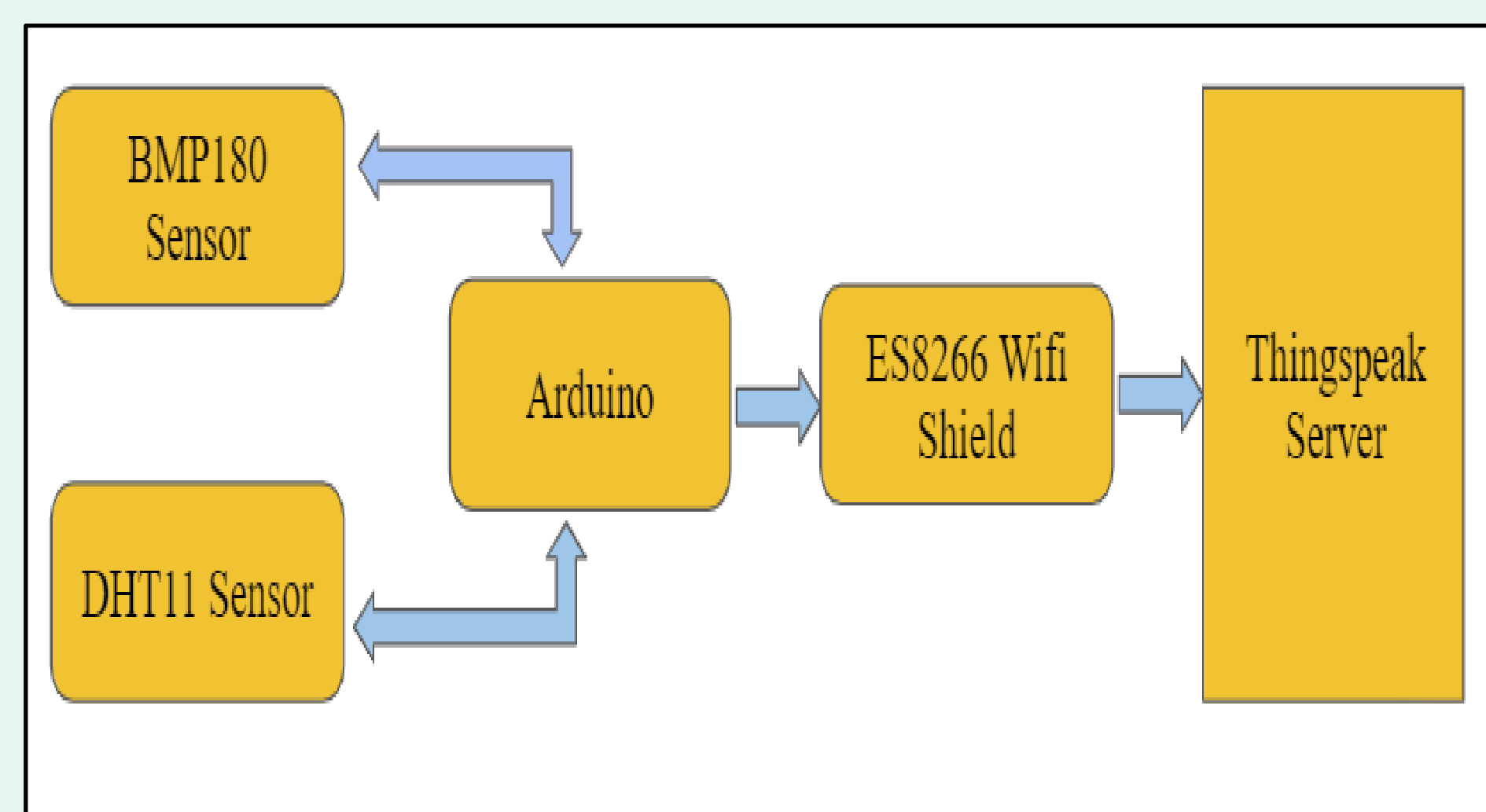


Fig 4.1 Flowchart

We will be using the Arduino board along with the DHT11 sensor, BMP180 sensor, and an ESP8266 wifi module. The DHT11 sensor senses the temperature and humidity, while the BMP180 sensor calculates the pressure, and ESP8266 is used for internet connectivity. In our previous project, we already learned to use the DHT11sensor to monitor temperature and humidity with Arduino, here in this project, we are adding another sensor (BMP180) to make a complete weather station using Arduino. Sending these data to ThingSpeak enables live monitoring from anywhere in the world and we can also view the logged data which will be stored on their website and even graph it over time to analyze it.

5. Circuit Diagram

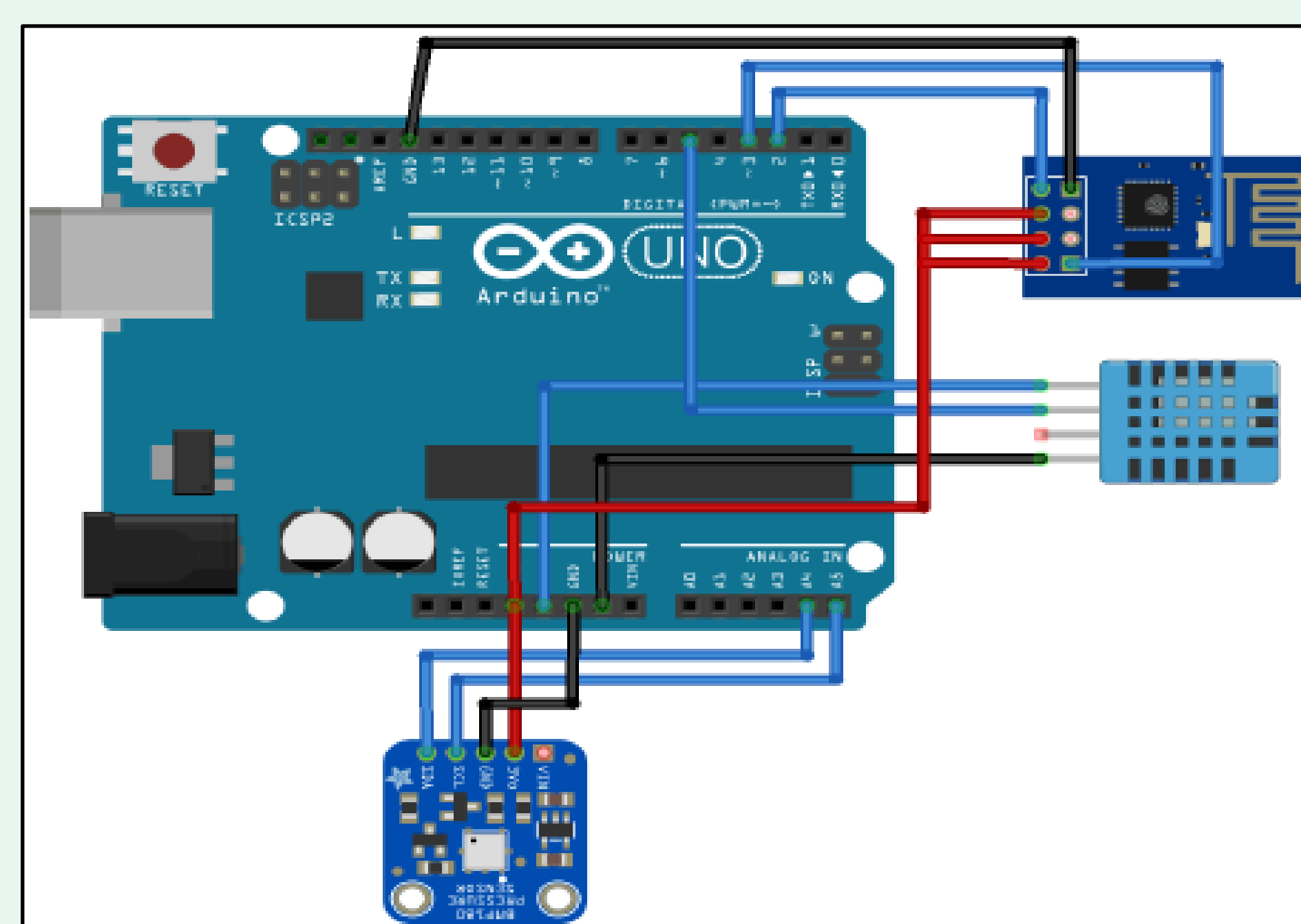


Fig 5.1 Circuit Diagram

The DHT11 sensor is powered by the 5V pin of the Arduino and its data pin is connected to pin 5 for one-wire communication. The BMP180 sensor is powered by the 3.3V pin of Arduino and its data pins SCL (Serial Clock) and SDA (Serial Data)are connected to the A4 and A5 pins of Arduino for I2C communication. The ESP8266 module is also powered by the 3.3V pin of the Arduino and its Tx and Rx pins are connected to Digital pins 2 and 3 of Arduino for serial communication. You can use the below table as a reference for making your connections.

6. Results

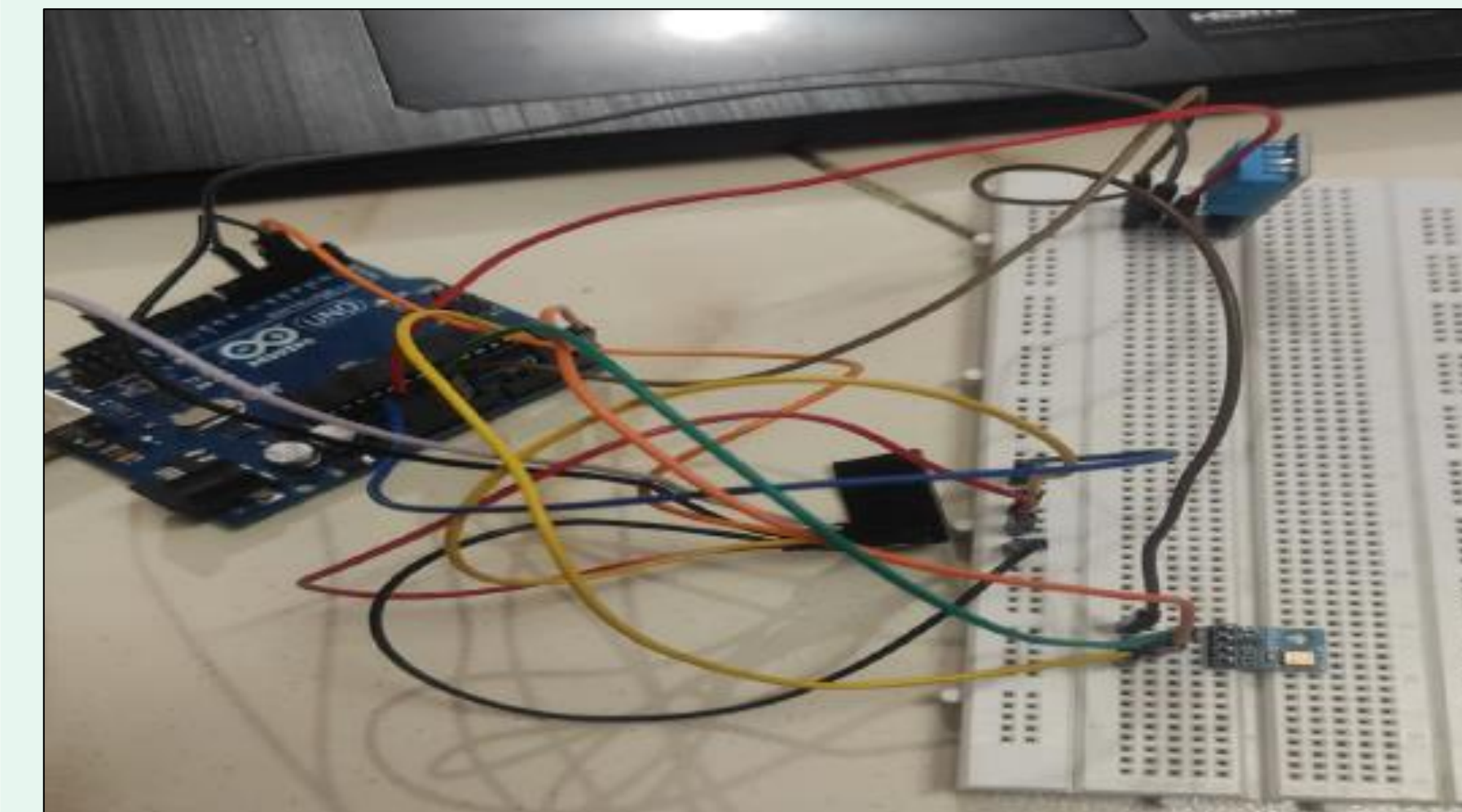


Fig 6.1 Actual Model

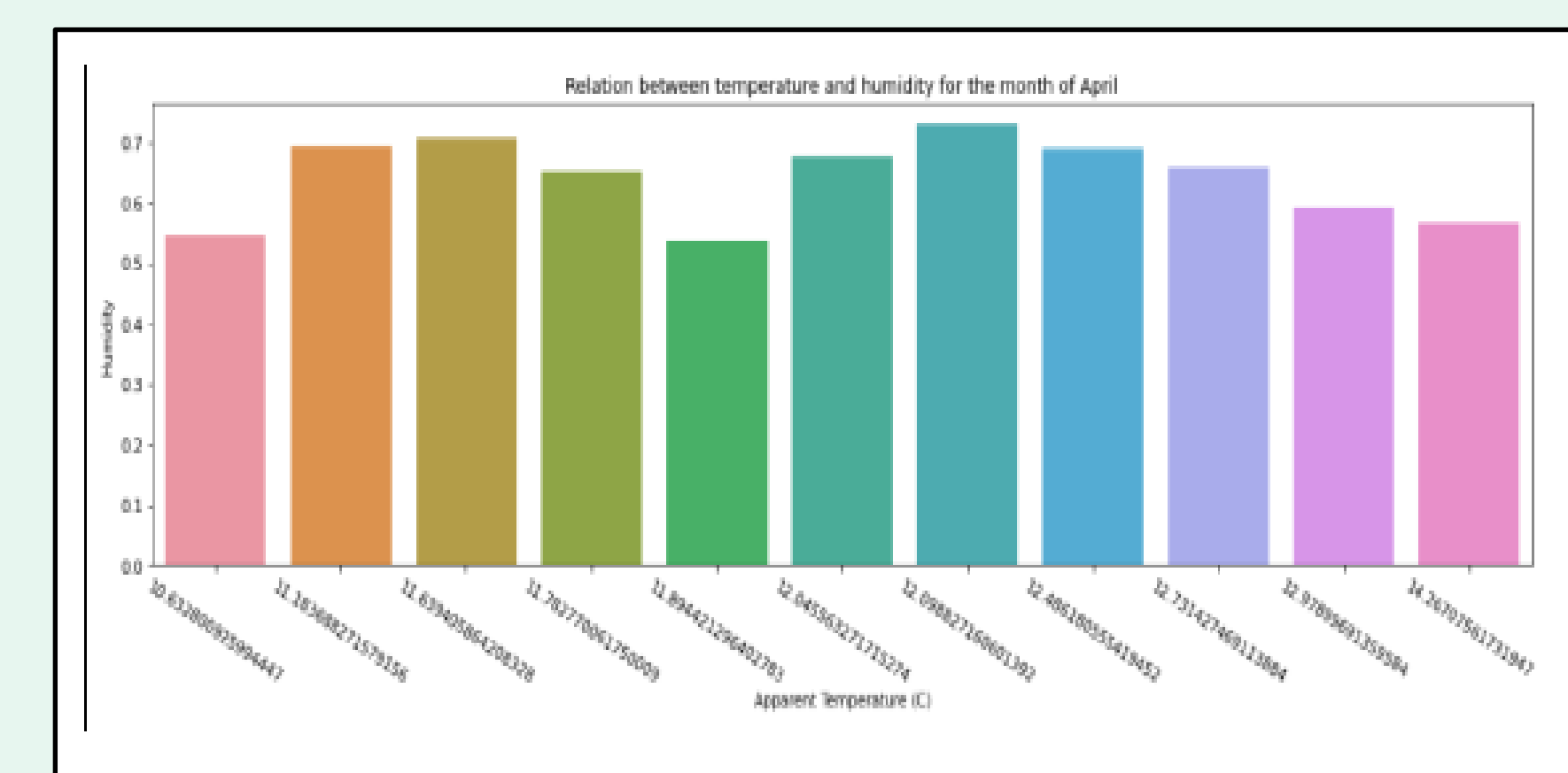


Fig 6.2 Temperature ranges

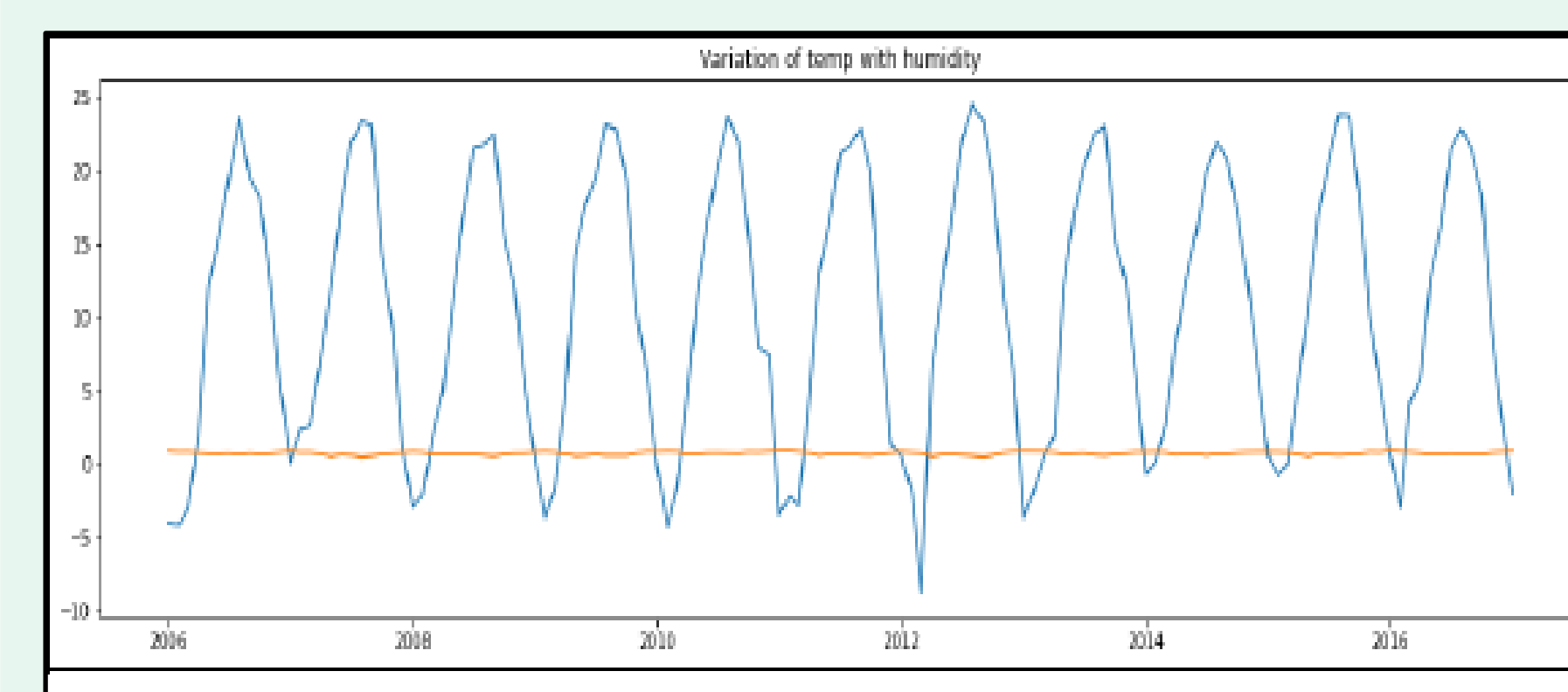


Fig 6.3 Temp vs Humidity

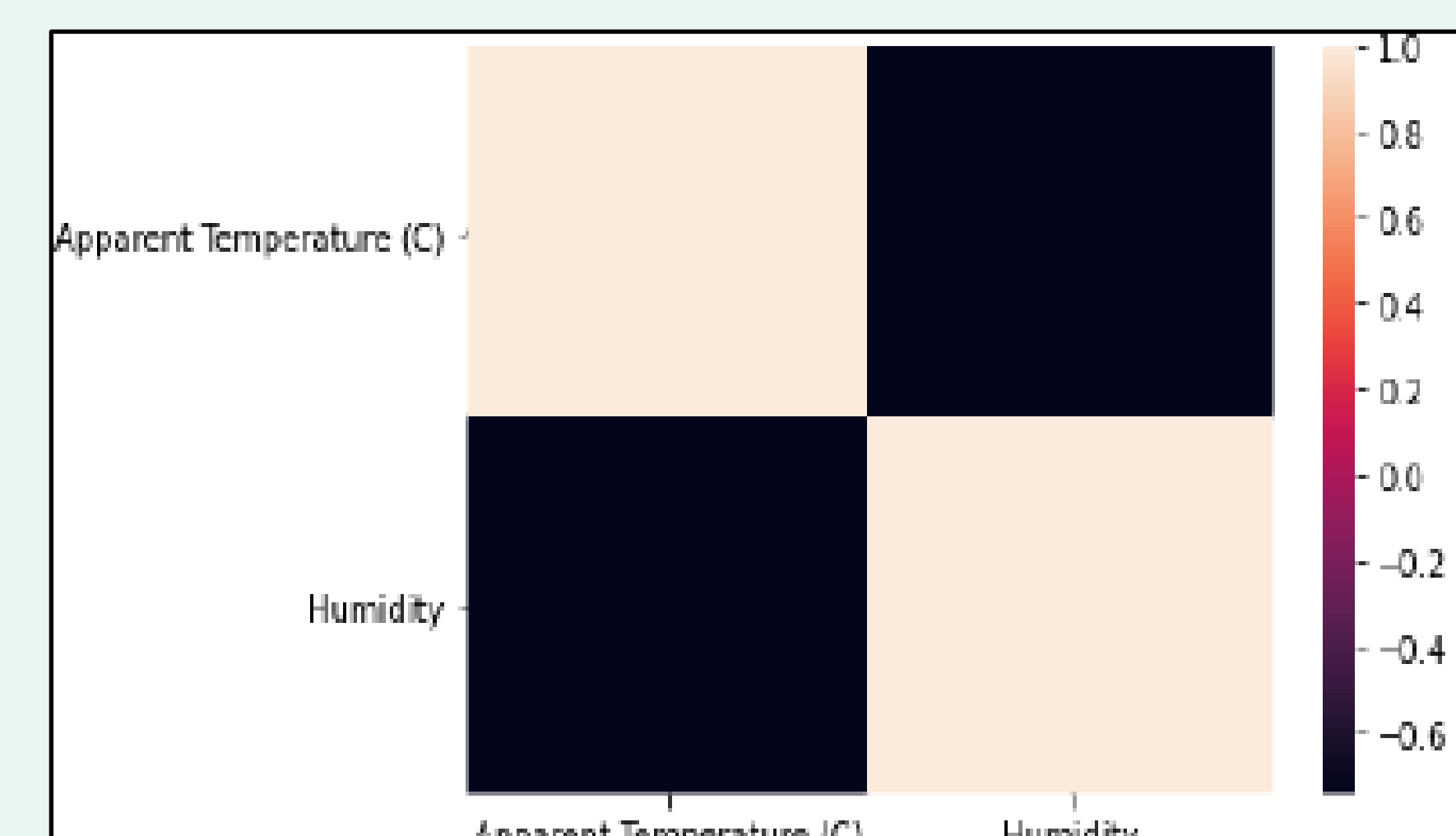


Fig 6.4 Correlation Matrix

7. Conclusion

In this project, a smart weather monitoring system is developed. The model is developed sing different sensors.The model shows the live data values and also a similar dataset is taken which is used for predicting .Also, the parameters can be further used to analyze the weather conditions and predict the climate conditions. The model is trained and the weather is predicted using machine learning. Also, the analysis of the live data is seen on the dashboard of thingspeak. The main aim of the model is to provide the values which can be further used for prediction, classification, or many other things and can help solve issues like global warming, unnatural rains, and so on.

References

- [1] A. Lage and J. C. Correa, "Weather station with the cellular communication network," in 2015 XVI Workshop on Information Processing and Control (RPIC),Oct 2015, pp. 1–5.
- [2] T. Thaker, "Esp8266 based implementation of wireless sensor network with Linux based web-server," March 2016