IoT and Arduino Based Weather Station

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Abstract : *A weather station is a device which gives an information about the weather in neighbouring environment. The weather station provide the information about temperature, humidity, atmospheric pressure, wind flow, etc. This device can sense the various parameters using the sensors. There are various sensors present such as humidity and temperature sensor, raindrop sensor, pressure sensor. The main part of this device is the ESP8266 based Wi-Fi module NodeMCU. Three sensors are connected to the NodeMCU namely humidity and temperature sensor (DHT11),pressure sensor(BMP180),raindrop module.*

Index Terms—IoT, ESP8266, Humidity and Temperature sensor, Pressure sensor, Raindrop sensor.

1. INTRODUCTION

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 [1]. With falling costs of Wi-Fi enabled devices is 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 analyse and process the gathered information.

Humidity, Temperature and Pressure are three basic parameters to build any Weather Station and to measure environmental conditions. We have already covered humidity and temperature measurement using arduino and displayed using mobile app.

Typical weather stations have the following instruments:

- Thermometer for measuring air temperature
- Barometer for measuring atmospheric pressure
- Hygrometer for measuring humidity
- Anemometer for measuring wind speed
- Wind Vane Sensor for measuring wind direction

Earlier people staying in home and busy in their household chores or people busy in their offices workload had no idea about the environmental parameters outside their home or office. They have no idea if the temperature outside is quite high or quite low or normal or if it is raining outside or not or what is the value of the humidity in the outside environment.

This project as well measures environmental parameters such as temperature, humidity, pressure, light intensity etc and publish the current weather condition on MQTT Dash Protocol.

2. OBJECTIVE

The objective of this project is to develop an electronic device that can sense the temperature/ humidity, pressure, raindrops and send the data to the MQTT Dash server to publish it on individual cell phones. And

a DHT sensor (Digital Humidity Temperature sensor) that can detect the temperature differences should be integrated to the system.

3. LITERATURE SURVEY

Sourabh Halder,G Sivakumar(1) Embedded System interfaced with an integrated temperature and humidity sensor to Acquire, Process, Archive and Publish data from weather sensors. The embedded system of the weather monitoring station uses an AVR microcontroller Atmega2560 to access the data from the integrated temperature and humidity sensor and process them into engineering data. The microcontroller is integrated on Arduino development board which is an open source electronics & software platform. The Arduino development board is connected to an Ethernet Shield which allows the communication through LAN and hence can publish the data on a webpage through internet. The Arduino is also interfaced with a TTL-232 convertor board which allows the communication of the system to a PC available at short distance through serial communication over RS232. The Arduino board is also interfaced with an USB host Shield 2.0 so that it can access the internet and directly publish the data on the internet through wireless communication. The collected data is uploaded on internet cloud and accessed through an android phone application on which the data can be monitored easily.

Dev Gaurav, Dishant Mittal, Bhavya Vaidya, Jimmy Mathew(2) The proposed a system, which can predict whether a particular place is suitable for establishing the solar power plant and/or wind power plant. We designed and implemented a low cost and reliable instrumentation system for remote wireless measurements of weather, with the help of various sensors. Our model is easily deployable by keeping it on top of a building, or being light in weight, it can be floated with a balloon. The device is made as a standalone data acquisition unit, from which data is sent via GSM based communication to the ground station. A number of power saving mechanisms are implemented to give maximum battery life for the sensor module.

Asif Imtiaz, Sufi Galib Omar, Tanvir Asif Ali (3) the aim of the project is to design such a weather station at a cheaper price that can take the real data of temperature, humidity, pressure and wind speed from the weather. After taking the input, it processes the output and sends it to the database. Then the data will be visualized.

4. BLOCK DIAGRAM

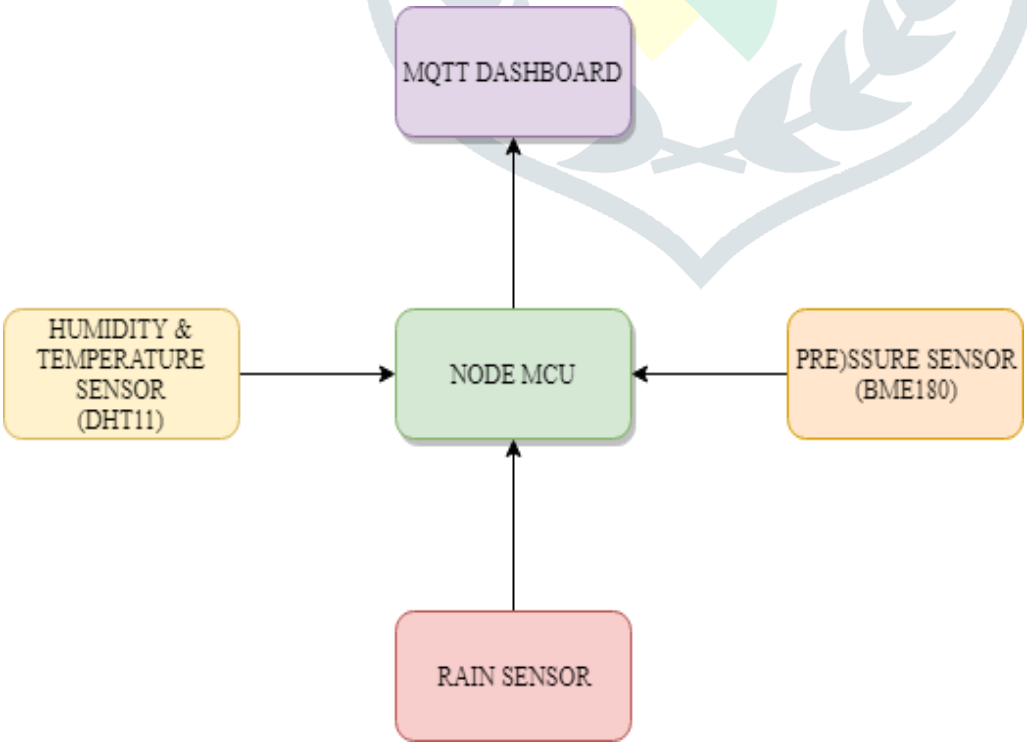


Figure 1: Block diagram of IoT and Arduino Based Weather Station .

5. WORKING OF DIFFERENT SECTIONS

A. Nodemcu

It is the heart of the device. It provides the platform for IOT. It's a Wi-Fi module having esp8266 firmware within. All the other sensors are connected to this micro-controller. They send the measured values to it and it uploads all the values to the cloud where the values are analyzed. The developer of this board is ESP8266 Open source Community. It has an operating system called XTOS. The CPU is ESP8266 (LX106). It has an in-built memory of 128 Kbytes and a storage capacity of 4 MBytes.

B. DHT-11 (Temperature Sensor)

It senses the temperature of the surrounding. It's a 4-pin device. We should connect a 10k resistor between pin 1 and pin 2.Pin 1 is connected to the 3.3V. Pin 4 is connected to GND. Pin 2 is the output pin which gives input to the nodeMCU pin D4. Pin 3 is left empty.

C. BMP 180(Pressure Sensor)

It senses the barometric pressure from the surrounding. BMP180 is an I2C standard device. It's a 4-pin device, viz, SDA, SCL, VIN, GND. VIN and GND are connected to 3.3V and GND respectively. SDA is connected to D2 pin of nodeMCU and SCL is connected to D3 pin of nodeMCU.

D. Raindrop Module

It is used for the detection of rain. It can also be used for measuring the intensity of the rain. It has both digital output as well as analog output. This module measures the moisture through analog output pin and when the threshold of moisture exceeds too much it provides a digital output. The more water or the lower resistance means lower output voltage. Whereas, the less water means higher resistance, i.e., high output voltage on the analog pin. For example a completely dry board will cause the module to output five volts. The analog output of the module is connected to the A0 pin of the nodemcu.

6. ADVANTAGES

- Design of hardware is easy.
- Portable hardware so easy to keep anywhere.
- Installation of software is easy.
- Low cost.

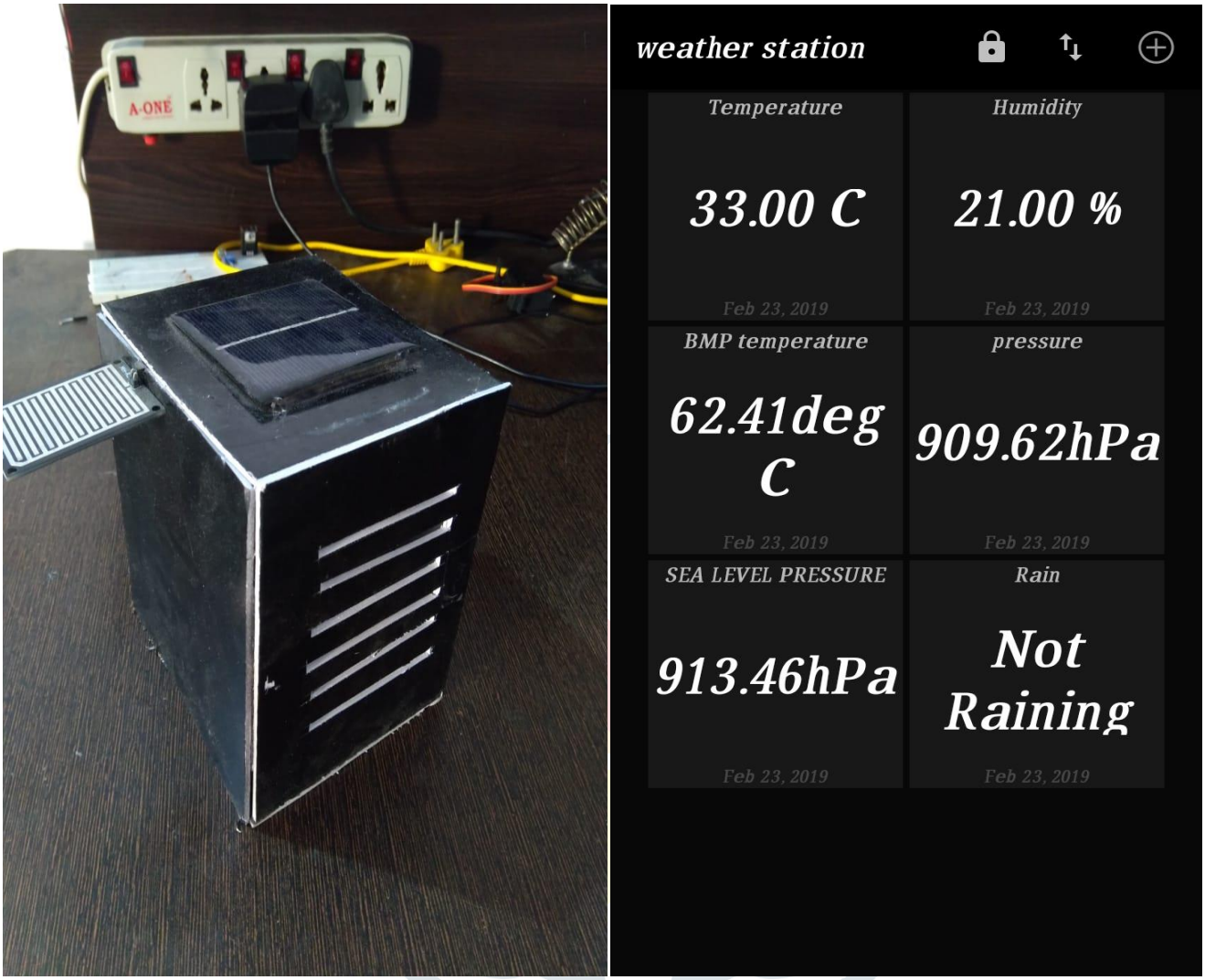
7. APPLICATION

- Weather situation can be monitored using remote.
- Need smart phones with MQTT Dash protocol to know the weather parameters.
- Used at small companies and industries.

8. RESULT

After the sensor measurements are uploaded to the server test.mosquitto.org,

MQTT Dash application, the values are analysed there and then we can see the real time value of weather parameters.



9. FUTURE SCOPE

The proposed IoT based weather station can be modified to incorporate many more features. We can add an LED 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.

10.CONCLUSION

Thus we have efficiently used the IoT concept and learned how the weather station can be implemented using it. Interfacing between the components was done with a view for future uses and applications.

11.REFERENCES

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