Review on Weather Monitoring System using Internet of Things (IOT)

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ABSTRACT

A IoT based weather station are often described as an instrument or device, it provides us with the information of the weather in our environment. It can provide us with details about the temperature, barometric pressure, humidity, etc. so, the weather station device senses the temperature, pressure, humidity, light intensity, rain value. There are various varieties of sensors present within the prototype, using which all the aforementioned parameters are often measured. For this they used ESP8266 based Wi-fi module NodeMCU (12E) which is the brain of the prototype. Temperature and humidity sensor (DHT11), pressure sensor (BMP180), raindrop module, and light dependent resistor (LDR) are four sensors connected to NodeMCU. It sends the alert via SMS, an Email and a Tweet post to the owner of the appliance to take necessary measures whenever these values exceed a chosen threshold limit.

Keyword: *Internet of Things (IoT) Embedded Computing System, NodeMCU, ESP8266, Sensors.*

1. INTRODUCTION

With the appearance of high-speed Internet, more and more humans around the world 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]. Fall over costs of Wi-Fi enabled devices this trend will only gather more momentum. The main idea 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 scattered in any fashion, upload them to any cloud service where one can analyze and process the gathered information. One can also utilize these data to alert people by various means such as using a buzzer or sending them an e-mail or sending them an SMS etc. via cloud service.

As mentioned before, IoT enables not only Human-Human interaction, but also Human-Device interaction also as Device-Device interaction. This particular development within the shape of latest outlet of interactions will impact essentially every industry like transportation and logistics, energy, healthcare etc. for example, within the case of energy, IoT is being applied to make Smart Grids which may detect and respond changes in local and broader level changes in energy consumption, which goes to be an integral a part of any nations energy policy.

Looking beyond the aforementioned energy example, there are many areas of interests where IoT can make a meaningful impact like, Smart Homes, which involve IoT to heighten the degree of automation; Wearable technologies such as smartwatches and fitness bands; One of the biggest areas of potential in IoT is connected healthcare. Many global electronics behemoths have already invested deeply within the Internet of Things infrastructure. With players like Intel, Rockwell Automation, Siemens, Cisco and General Electric the market is on the cusp of an explosion, with analysts predicting there'll be 26 billion connected devices, quite 4 per human on the earth, and therefore the industry is projected to bring $19 Trillion, in costs savings and profits with firms like Samsung and Google leading the pack.

With this new technological platform however, comes its own set of challenges and obstacles, like what to do with the big amounts of knowledge which is collected This project as well measures environmental parameters like temperature, humidity, pressure, light intensity etc. and In cloud service upload these values, IBM Bluemix.[2] In the cloud the data are analyzed and if the retrieved data are above or below a certain threshold limit, depending on the value, an email, an SMS and a twitter post is published at the exact moment[3].
Earlier people staying in home and busy in their household chores or people busy in their office's workload had no idea about the environmental parameters outside their home or office. They have no idea if the temperature outside is sort of high or quite low or normal or if it is raining outside or not or what is the worth of the humidity in the outside environment. This device can are available quite handy in these situations. It will notify us whenever the temperature is just too low or too high through an e-mail, an SMS and a twitter post. It will also automatically notify whenever there is a downpour within the surrounding and remind us to hold an umbrella or a raincoat [4]. It will also greet us with morning and good evening messages because it also has an LDR which measures the light intensity of the encompassing environment [5]. The core of the project is that the ESP8266 based NodeMCU which is a low-cost Wi-Fi module and all other sensors are connected to this device. The C code is written in Arduino IDE and uploaded to the ESP8266 through a serial bus. Once the code is uploaded then the board is connected to a Wi-Fi and the device starts working. The code has to be uploaded only once.

2. IMPLEMENTATION SETUP

2.1 Components Required: Hardware

i. ESP8266 based Wi-Fi module NodeMCU [6]
ii. 2) Temperature and Humidity Sensor (DHT11) [7]
iii. Barometric Pressure Sensor (BMP180) [8]
iv. LDR [9]
v. Raindrop Module [10]
vi. Mobile phone to receive email and SMS

2.2 Components Required: Software

i. Arduino IDE [11]
ii. Accessible Wi-Fi
iii. IBM Bluemix [12]

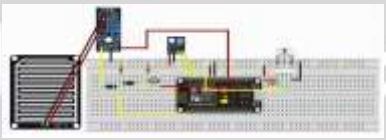

Figure 1. The complete setup of the device

3. METHODOLOGY

3.1 NodeMCU

It is the heart of the device. It provides the platform for IOT. It is 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.

Figure 2. NodeMCU.

3.2 DHT-11 (Temperature Sensor)

It senses the temperature of the surrounding. It is 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.

Figure 3. DHT11.

3.3 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.

Figure 4. BMP180.

3.4 Light Dependent Resistor (LDR):

An LDR is a variable resistor controlled by light. increasing light intensity falling on it decreases the resistance of the LDR. It has an analog output which is an input to the A0 pin of the NodeMCU.

Figure 5. LDR.

3.5 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, 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.

Figure 6. Raindrop Module

3.6 Working of the analog pin(A0)

The NodeMCU 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 Vcc of Raindrop sensor is connected to the D7 of the NodeMCU and the input of LDR is connected to the D8 of NodeMCU. When D7 is High, D8 is Low making LDR off and raindrop module on. Hence the output of raindrop sensor reaches the A0 of NodeMCU 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 NodeMCU 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 NodeMCU having just one analog pin.

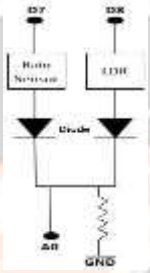

Figure 7. Multiplexing circuit

4. RESULT

After the sensor measurements are uploaded to the cloud, IBM Bluemix, the values are analyzed there then an email, an SMS and a tweeter post is published whenever the threshold limit exceeds. Some of the sample results are as following:

Fig. 8. Email received

Fig. 9. Message received.

Fig. 10. Tweeter post published

5. FUTURE SCOPE

The proposed IoT based weather station are often modified to include more features. We can add an OLED display to display the encompassing parameters into it. We can also add a GPS module within the design in order that location of the surrounding will be mailed or messaged to the user alongside 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 it to the server, all the environmental parameters of the device alongside its location will be delivered to that phone or email id. This device also can be used to monitor a specific room or place whose environmental parameters are required to be monitored continuously.

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