IoT Based Efficient Atmosphere Monitoring System

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***Abstract*— The system proposed in this paper is a solution for monitoring the atmosphere conditions at a particular place and make the information accessible from anywhere via Internet. The technology behind this is Internet of Things (IoT), which is an advanced and efficient solution for connecting things to the internet and to connect the entire world of things in a network. These things might include electronic devices, sensors and automotive electronic equipment. The system deals with monitoring and controlling the weather conditions like temperature, humidity, light intensity and CO level with sensors and sends the information to the user and then plot the sensor data as graphical statistics. The data updated from the implemented system is accessible via internet from anywhere.**

Index Terms - Internet of Things (IoT) Embedded Computing System; Arduino UNO; Arduino Software, Smart Environment.

I. INTRODUCTION

With high speed Internet, more and more people around the globe are interconnected. Internet of Things (IoT) however takes this a step further, and connects not only people but electronic devices which can speak amongst themselves [1]. With falling costs of Wi-Fi enabled devices this trend will only gather more momentum. The main idea behind the Internet of Things (IoT) was to connect various electronic devices through a network and then collect data from these devices (sensors) which can be further processed in any fashion, upload them to any cloud platform 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 e-mail or sending them an SMS etc.

As discussed above, IoT enables not only Human-Human interaction, but also Human-Device interaction as well as Device-Device interaction. This particular development in the shape of new avenues of interactions will impact essentially every industry such as transportation and logistics, energy, healthcare etc. For example, in the case of Power, IoT is being applied to create Smart Grids which can detect and respond to changes in local and broader level changes in energy consumption, which is going to be an integral part of any nations power policy.

Apart from the aforementioned power example, there are many areas of interests where IoT can contribute significantly such as, Smart Homes, which involve IoT to increase the degree of automation; Wearable gadgets such as smartwatches and fitness bands; another area of potential in IoT is connected healthcare.

Many global electronics giants have already invested deeply in the Internet of Things infrastructure. With big guns like Intel, Rockwell Automation, Siemens, Cisco and General Electric the market is on the brink of an explosion, with analysts predicting there will be around 26 Billion connected devices, more than 4 per human being on the planet, and the industry is projected to bring in $19 Trillion (approx.), in overall 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, such as what to do with the enormous amounts of data which is collected.

This project as well measures environmental parameters such as temperature, humidity, pressure, light intensity etc. and uploads these values to a cloud service, IBM Bluemix.[2] In the cloud the data are analyzed and if the retrieved datas are above or below a certain threshold limit, depending on the value, an e-mail, an SMS and a twitter post is published at the exact moment[3].

People living in home and busy in their household chores or people busy in their offices workload had little or no idea about the surrounding parameters outside their home or office. They have no idea if the temperature outside is high or quite low or normal or if it's raining outside or not or what is the value of the humidity in the outside environment. This proposed framework can come in quite useful in these situations. It will notify us whenever the temperature is too low or too high through an alert like e-mail, an SMS and a twitter post etc. It will also automatically notify whenever there is a downpour in the surrounding and remind us to carry an umbrella or a raincoat [4]. It will also greet us with good morning and good evening messages as it also has an LDR which measures the light intensity of the surrounding environment[5]. The core of the project is the ESP8266 based Nodemcu which is a low cost wifi module and all the 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 Wifi and the device starts working. The code has to be uploaded only once.

II. IMPLEMENTATION SETUP

A. Components required: Hardware

1) ESP8266 based wifi module Nodemcu[6]
2) Temperature and Humidity Sensor(DHT11)[7]
3) Barometric Pressure Sensor(BMP180)[8]
4) LDR[9]
5) Raindrop Module[10]
6) Mobile phone to recieve email and SMS

B. Components required: Software

1) Arduino IDE[11]
2) Accessible Wifi
3) IBM Bluemix[12]

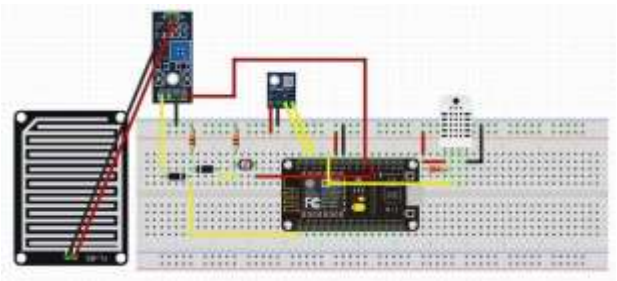

Fig 1. The complete setup of the device.

III. METHODOLOGY

A. Nodemcu

It provides the platform for IOT. Its a wifi module having esp8266 firmware within. All the other sensors are connected to this micro-controler. The sensors send the detected values to it and it uploads all the values to the cloud where the values are analyzed. The developer of this board is ESP8266 Opensource 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.

Fig. 2. Nodemcu.

B. DHT-11 (Temperature Sensor)

It senses the temperature of the surrounding. Its 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.

Fig. 3. DHT11.

1) BMP 180(Pressure Sensor): It senses the barometric pressure from the surrounding. BMP180 is an I2C standard device. Its 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.

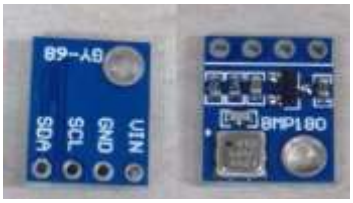

Fig. 4. BMP180.

C. Light Dependent Resistor(LDR)

An LDR is a variable resistor controlled by light. The 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.

Fig. 5. LDR.

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. Where as, 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.

Fig. 6. Raindrop Module.

I. *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

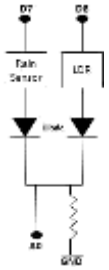

Fig. 7. Multiplexing circuit.

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 accomodating 2 analog devices in the nodemcu having just one analog pin.

IV. RESULTS

After the sensor measurements are uploaded to the cloud, IBM Bluemix, the values are analyzed there and 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.

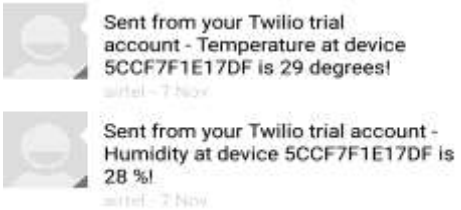

Fig. 9. Message received.

Fig. 10. Tweeter post published.

V. 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 modifeid 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.

VI. REFERENCES

[1] M. H. Asghar, A. Negi, and N. Mohammadzadeh, "Principle application and vision in internet of things (iot)," in *International Conference on Computing, Communication Automation*, May 2015, pp. 427–431.

[2] A. Gheith, R. Rajamony, P. Bohrer, K. Agarwal, M. Kistler, B. L. W. Eagle, C. A. Hambridge, J. B. Carter, and T. Kaplinger, "Ibm bluemix mobile cloud services," *IBM Journal of Research and Development*, vol. 60, no. 2-3, pp. 7:1–7:12, March 2016.

[3] S. Gangopadhyay and M. K. Mondal, "A wireless framework for environmental monitoring and instant response alert," in *2016 Interna- tional Conference on Microelectronics, Computing and Communications (MicroCom)*, Jan 2016, pp. 1–6.

[4] H. Saini, A. Thakur, S. Ahuja, N. Sabharwal, and N. Kumar, "Ar- duino based automatic wireless weather station with remote graphical application and alerts," in *2016 3rd International Conference on Signal Processing and Integrated Networks (SPIN)*, Feb 2016, pp. 605–609.

[5] A. Lage and J. C. Correa, "Weather station with cellular communication network," in *2015 XVI Workshop on Information Processing and Control (RPIC)*, Oct 2015, pp. 1–5.

[6] T. Thaker, "Esp8266 based implementation of wireless sensor network with linux based web-server," March 2016.

[7] Y. Zhou, Q. Zhou, Q. Kong, and W. Cai, "Wireless temperature amp; humidity monitor and control system," in *2012 2nd International Conference on Consumer Electronics, Communications and Networks (CECNet)*, April 2012, pp. 2246–2250.

[8] R. H. Budi Setiyono, Sumardi, "Measurement system of temperature, humidity and air pressure over 433 mhz radio frequency: An application on quadrotor," October 2015.

[9] G. M. Salim, H. Ismail, N. Debnath, and A. Nadya, "Optimal light power consumption using ldr sensor," in *2015 IEEE International Symposium on Robotics and Intelligent Sensors (IRIS)*, Oct 2015, pp. 144–148.

[10] A. V. Bosisio and M. P. Cadeddu, "Rain detection from ground-based radiometric measurements: Validation against rain sensor observations," in *2015 IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*, July 2015, pp. 2323–2326.

[11] "Arduino." [Online]. Available: http://www.arduino.cc/download/

[12] I. Corporation, "Ibm bluemix." [Online]. Available: https://www.ibm.com/cloud-computing/bluemix/