REAL TIME THERMAL AND PRESSURE ANALYSIS SYSTEM FOR DATACENTER USING AN IOT BASED NODE MCU AND AWS IOT ANALYTICS

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Abstract : This paper presents monitoring the temperature and humidity of a server room using wireless sensor network to ensure the performance. This system is an advanced solution for monitoring temperature in server room that uses IoT to make its real time data easily accessible over a very wide range. This system are designed to monitor temperature and humidity and the generating data which can be saved at cloud from where this information can be accessed through applications and further actions can be taken. In this paper the implementation and results of monitoring system which employs sensors for temperature and humidity of the surrounding area. The sensed data is uploaded to cloud and presents the results to the end users. The system contains Node MCU, DHT11 sensor, ESP8266 Wi-Fi module, which transfers its data to AWS IoT analytics where it is analyzed and stored. This system is useful for every home, school or workplace, so taking measurements, and local data is generated, stored and can compare with this to previous data.

IndexTerms **- Internet of Things (IoT), development boards, embedded systems, DHT sensor, Node MCU, ESP8266, Arduino IDE, Node-Red, AWS IoT Analytics.**

1. INTRODUCTION

Internet of Things (IoT) is expected to revolutionize our world by enabling us to monitor and control vital phenomena in our environment through the use of devices capable of sensing, processing and wirelessly transmitting data to remote storage like cloud which stores, analyses and presents this data in useful form. From the cloud, this information can be accessed through various front end user interfaces such as web or mobile applications, depending upon suitability and requirements. Internet lies at the heart of this transformation playing its role in efficient, reliable and swift communication of data from devices to the cloud and from the cloud to the end users. In this new paradigm, the concept of the typical end system or host in the Internet is modified and hosts comprise of devices or things hence the name Internet of Things. The “things” are capable of sensing and transmitting data such as temperature, pressure, humidity, noise, pollution, object detection, patient vitals etc.

Datacentre temperature monitoring is an important IoT application which involves monitoring the surrounding environment and reporting this data for effective short term measures such as remotely controlling the heating or cooling devices and long term data analyses and measures. This paper presents the implementation details and results of an environmental monitoring system. The system comprises of a central Node MCU board which interfaces at the input with temperature and humidity monitoring sensor DHT11 and at the output with ESP8266 Wi-Fi module which transmits the sensed data through Internet to a AWS IoT analytics. AWS IoT analytics are carried out on data and trigger is generated. This is a low cost system which gives insight into the design and implementation of a complete IoT application involving all aspects from sensing and wireless transmission to cloud storage and data retrieval from cloud. It involves comprehensive study and deployment of Node MCU development board, its interfacing with input and output modules such as sensors and Wi-Fi module. The results of the project show the real-time monitoring of temperature and humidity levels from any location in the world and its statistical analysis. This system can be extended to enable remote controlling of appliances based on sensed data.

AWS IoT Analytics will allow storing large amounts of device data, process messages.it automates the steps required to analyse data from IoT devices. IoT Analytics filters transform and enrich data before storing it in a time-series for analysis. You can make the service to gather solely the info that you would like from your devices, apply mathematical transforms to a method the info, and enrich the info with device-specific information like device kind and placement before storing it. Then, you'll analyse your information by running queries victimization the intrinsic SQL question engine or perform more complex analytics and machine learning inference. AWS IoT Analytics includes pre-built models for common IoT use cases, therefore, you'll answer queries like that devices area unit on the brink of failure or that customers area unit in danger of abandoning their wearable devices.

2. LITERATURE SURVEY

Among all the environmental parameters, temperature is very essential and critical parameter. There are many areas that needs real time temperature to be monitored. The areas like mines, labs, food and medical industries, etc. needs to be maintained at constant temperature. Hence, the proposed system will help to constantly monitor the temperature of any place.

3. METHODOLOGY

3.1 RELATED WORK

IoT applications involve some kind of sensors and transducers normally attached to a microcontroller along with wired or wireless transmission to either a local database or a remote cloud which transforms raw data into useful information which can be effectively utilized. The proposed embedded device is for monitoring Temperature, Humidity in the datacentre to make the interactive with the objects through wireless communication. The proposed model is shown in figure Figure 3.1 which is more adaptable and distributive in nature to monitor the environmental parameters. The proposed architecture is discussed in a 4- tier model with the functions of each individual modules developed for monitoring datacentre thermal condition. The proposed model consists of 4-tiers. The tier 1 is the environment, sensor devices in tier 2, sensor data acquisition and decision making in tier 3 and intelligent environment in tier 4.

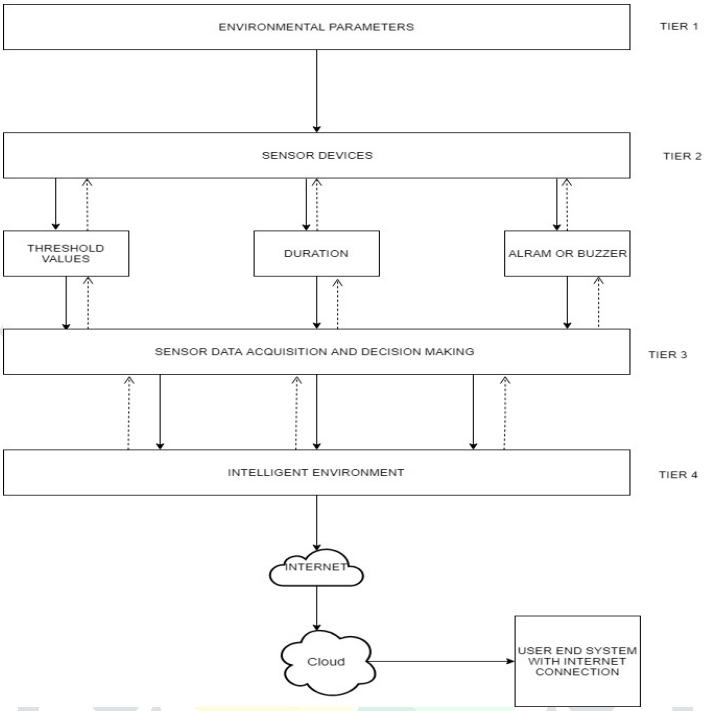

Figure 3.1: 4 tier architecture

The proposed architecture is shown in figure 3.1. Here, the tier 1 provides information about the parameters which is to be monitored for temperature and humidity control. Tier 2 deals with the sensor devices with suitable characteristics, features and each of these sensor devices are operated and controlled based on their sensitivity as well as the range of sensing. In between tier 2 and tier 3 necessary sensing and controlling actions will be taken depending upon the conditions, like fixing the threshold value, periodicity of alarm or buzzer or LED. In the tier 4 deals with the intelligent environment. Which means it will identify the variations in the sensor data and identify the threshold value depending on the identified level of datacentre. In this tier temperature, humidity, are sensed and the data are sent wirelessly using Node mcu to Aws IoT analytics for analysing the parameters

4 SYSTEM ARCHITECTURE

The implemented system consists of a node MCU as a processing unit for the entire system and all the sensor are connected to it. The devices is operated by the microcontroller to retrieve information from them and it processes the analysis with the sensor data and updates through Wi-Fi module connected to it.

The below diagram describes the work flow of data.

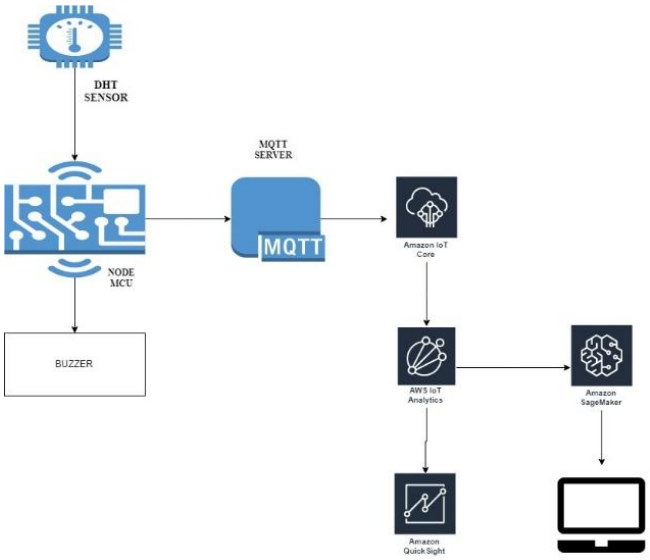

Figure 4.1 : System Architecture

4.1 HARDWARE COMPONENTS

ESP8266 (NODE MCU): the Node MCU Dev Board is based on widely explored esp8266 System on Chip from Express if. It has combined features of WIFI access point and the microcontroller and uses simple LUA based programming language. ESP8266 Node MCU offers Arduino-like hardware IO, Event driven API for network applications, 10 GPIOs D0-D10, PWM functionality, IIC and SPI communication, 1-Wire and ADC A0 etc. all in one board, Wi-Fi networking (can be uses as access point and/or station, host a web server) and connect to internet to fetch or upload data.

DHT11 SENSOR: DHT11 is a Humidity and Temperature Sensor, which generates the calibrated digital output. DHT11 will be an interface with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 may be a low price wetness and temperature sensing element that provides high accuracy and future stability.

5 ANALYSIS

The real time system consists two sections - one senses the humidity and temperature by using sensor DHT11. The second section reads the DHT sensor module's output and extracts temperature in Celsius and then using MQTT server it send the data to the AWS IoT Analytics for data analysis. First Node MCU send a signal to DHT sensor and then DHT response signal containing temperature and humidity data. Node MCU collect and extract the data. This data is then sent with the specific time period. Before sending data to Node MCU needs some initialize command with a time delay. And the whole process time is about 1min. The whole hardware setup is integrated with MQTT from Node-Red. The data is then sent to the AWS IoT core via hypertext transfer protocol. Once the DHT sensor send the data to MQTT it then transfers the data to the AWS IoT Analytics via IoT Core. The IoT Analytics triggers when the MQTT transfers the data to the AWS IoT core and then If the threshold value reaches above the maximum then notification is sent to the subscribers E-mail and mobile. IoT Analytics automates the steps that are required to analyze data from IoT devices. This service collects only the data from the devices. The data from the devices are then can be used for analysis using Jupyter notebook from Amazon Sagemaker and Amazon Quicksight

6 SCREENSHOTS.

6.1 NODE MCU ESP-8266 and DHT 11 sensor

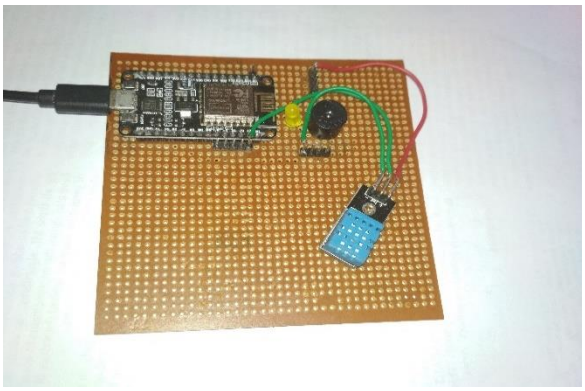

Figure 6.1: Node MCU ESP8266 it's a controller that transfers data through wifi

6.2 OUTPUT IN ARDUINO IDE SERIAL MONITOR

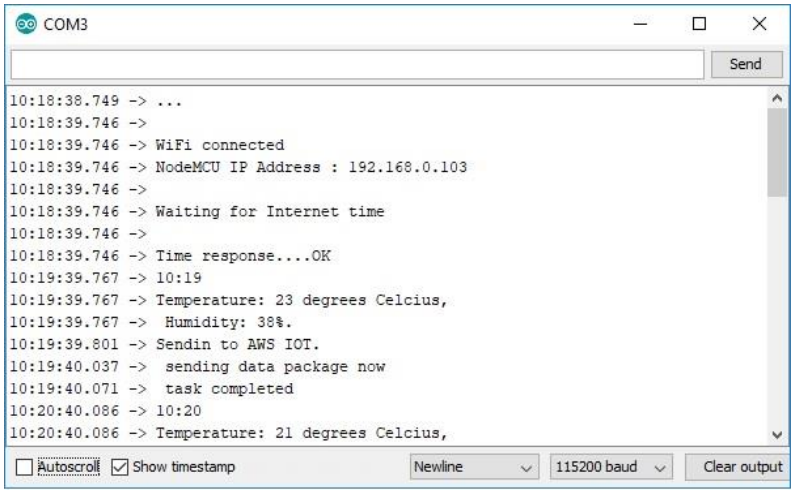

Fig 6.2: The data transferring from Node MCU to MQTT broker.

6.3 NODE-RED CONNECTION

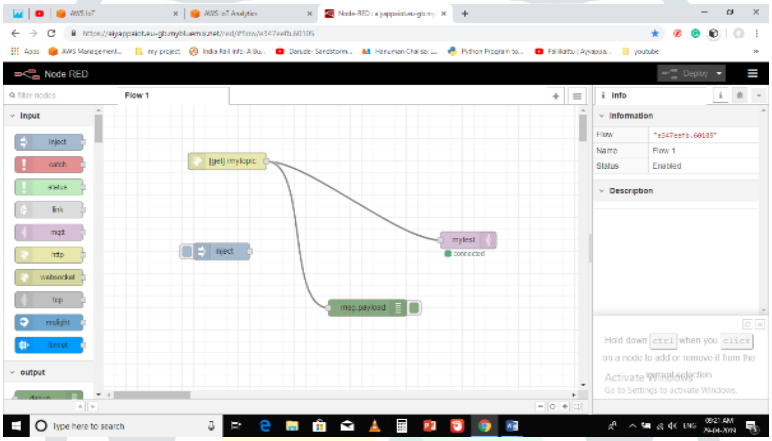

Figure 6.3: Node Red Connection

6.4 RECEIVING DATA IN AWS IOT

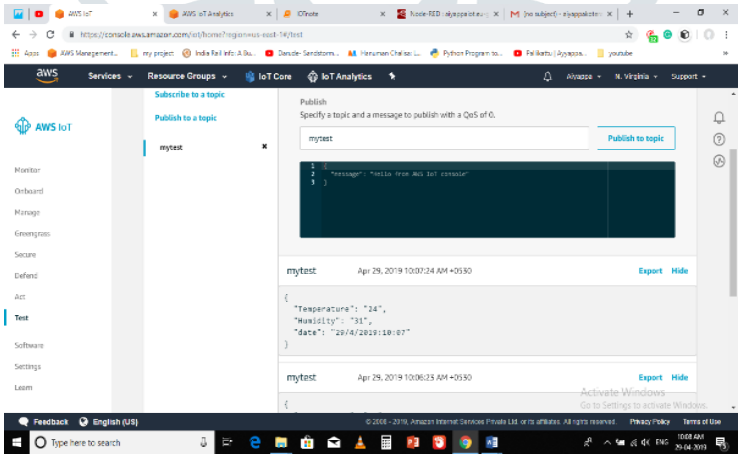

Figure 6.4 : Datas in the AWS Iot Core

6.5 DATA STOTING IN AWS IOT ANALYTICS

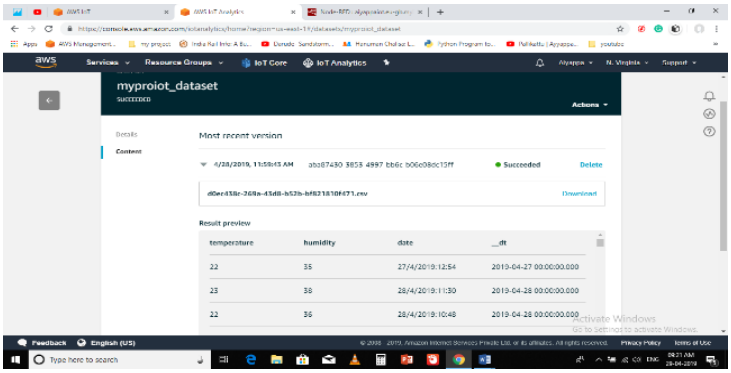

Figure 6.4 : Data in the AWS Analytics

6.6 SMS ALERT

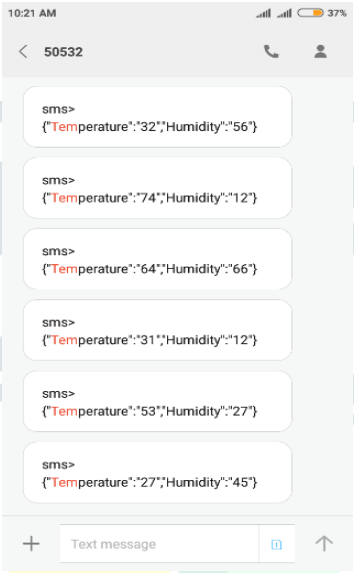

Figure 6.6 : SMS Alert

6.7 ANALYSIS IN AWS QUICKSIGHT

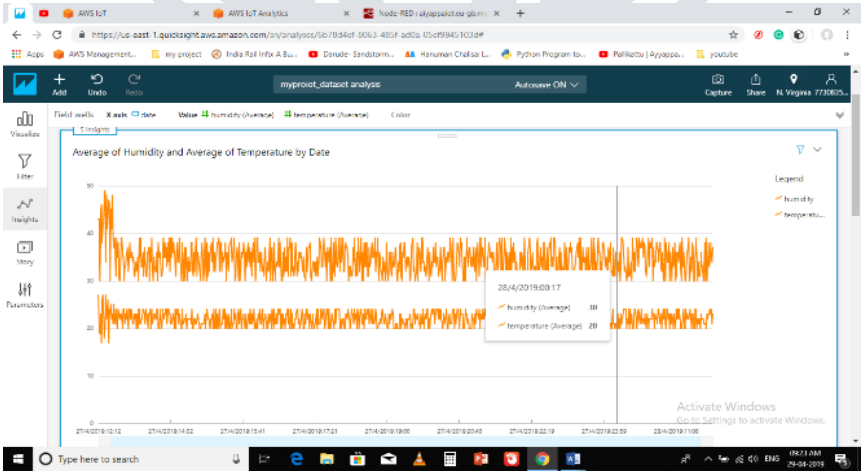

Figure 6.7:analysis in aws quicksight

7 RESULT

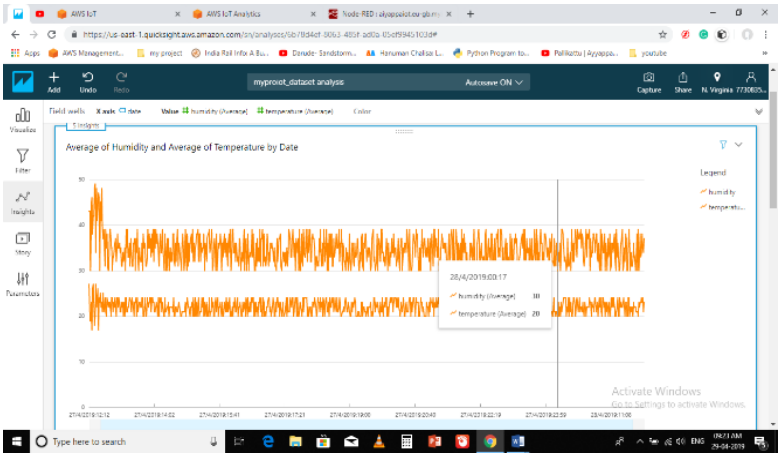

Figure 7.1: Final result aws quick sight

8 CONCLUSION AND FUTURE SCOPE

The proposed IoT based datacenter temperature and humidity analysis can be modified to incorporate many more features. We can add an OLED display to display the surrounding parameters into it. We can also design so that the location of the surrounding will also be mail or message to the user along with the surrounding parameters like temperature, humidity, pressure, light intensity etc. It can also be modified

9 REFERENCES

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