Mongodb on Cloud for Weather Data (Temperature and Humidity) in Sittway

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Abstract

The environmental conditions play the major effects on human beings and the weather parameters are very important roles in our daily life. Many research efforts have paid to solve the environmental problems. So the collecting of data about different parameters of the weather is necessary for planning in home and environment, and the database of weather parameters become more important for living things. In this work, two weather parameters: temperature and relative humidity in Sittway township, Rakhine state have been measured by Raspberry Pi 4 with DHT22 sensor for solving the environmental problems. The collected data from the system have been stored and transmitted to the cloud by MONGODB with Java Script programming language and then the comparison of the data collected from the sensor and the Mongo database on cloud has been made for the accuracy of the project.

Keyword - *DHT 22, IoT, Momgodb*

I. INTRODUCTION

Weather condition plays an important role in our daily life as weather and climate are the most ubiquitous factors for home and environment planning. Moreover, the tremendous development of Internet nowadays made possible to monitor weather conditions and collect the respective data in-situ. All the objects, sensors and devices can be linked through Internet to share and analyze the data collected at various locations.

Most Internet applications focus on providing information for human beings. IoT is Internet of Things, known as M2M between smart devices that collect data, relay information to the others, process the information collaboratively, and take action automatically. IoT can be much more extensive in predicting and knowing the weather conditions in particular place by connecting the weather station to the Internet. IoT is a system consists of things attached with sensors, connected to the internet via wire or wireless network. In this paper, the attempt to support the solving the environmental problems and the real time weather conditions have been made to get the smart

system for human beings and, living things or non-living things[1][6].

DHT22 is a digital sensor with built-in analog-to-digital converter. It consists of both temperature sensor with negative temperature coefficient and humidity sensor. So, it has been used to detect the temperature and relative humidity of the desired environment. Raspberry Pi 4 reads the output from DHT22 first. And then the data collected are continuously stored in SD card of the Pi-board. By using MONGODB, these data are transmitted to the cloud to make the sharing data with the others, and the predicting the weather condition of specific area[2][8].

II. RELATED WORK

S. Adnan et.al proposed "Low Cost Embedded Weather Station with Intelligent System" using reflective optical sensor, 1-turn continuous potentiometer, low-power linear active thermistor. All sensors being used were basic type sensors, so the cost of the system was reduced. And "Design of Weather Monitoring System using Arduino Based Database Implementation" to measure and store temperature, humidity and wind speed was made by N. M. Sarmad and F. H. Forat. And then N. Ahmad et.al proposed "Design and Construction of Digital Anemometer". A three-cup anemometer was designed to reduce the measurement errors in this work and microcontroller was used to make it digitalized.

III. BACKGROUND THEORY

Weather forecasting normally tells people the weather conditions for a certain place and a certain period of time. However, the forecasting sometimes cannot predict precisely, especially in a particular case. For example, strong wind during winter would make the actual feel temperature much lower than what it is. To support the

solving these problems, the weather forecasting station has been built and tested. Control system, embedded system and wireless communication are essential parts in weather station[9][11].

A. Control System

Measuring, comparing, computing and correcting are four functions in control system. The measuring is completed by detector, transducer and transmitter. Comparing and computing are within the controller and the correcting is with final control element.

B. Embedded System

Embedded system consists of hardware, software and other parts to perform specific function. Personal computer has general purpose and is able to do many different things. The embedded system is the system within a larger system. Modern cars and trucks contain many embedded systems. One embedded system controls anti-lock brakes, another monitors and controls vehicle's emission and a third displays information on the dashboard.

C. Wireless Communication

The transfer of information between two or more points is called wireless communication by electromagnetic waves. Wireless sensor networks are responsible for sensing noise, interference and activity in data collection networks. This allows us to detect relevant quantities in monitor and collect data, and to perform decision-making functions.

Wireless data communications are used to spin a distance beyond the capabilities of typical cabling in point-to-point or point-to-multipoint communication, to provide a backup communication link in case of normal network failure, to link portable or temporary workstations, to overcome situations where normal cabling is difficult or financially impractical, or to remotely connect mobile users or networks[5][10].

IV. EXPERIMENTAL DETAIL

The proposed system consists of (i) temperature sensor, (ii) humidity sensor, (iii) data input from hardware sensors and (iv) data output to storage SD card and to the cloud for sharing with the others.

Figure 1. DHT22

Figure 2. Raspberry pi 4

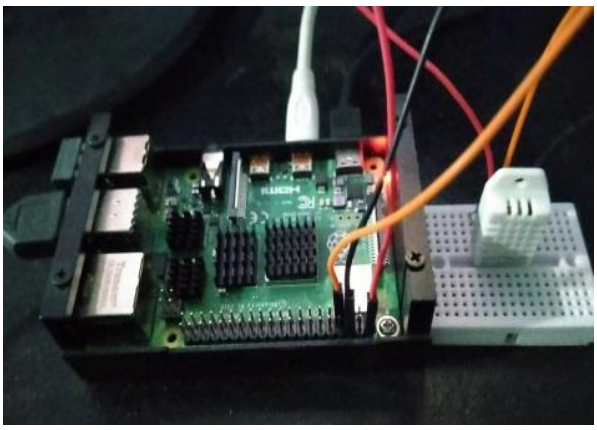

Figure 3. Proposed system

In this proposed weather data collected system, DHT22 has been used for temperature and humidity of the environment. It is a digital sensor with an inbuilt analog-to-digital converter (ADC) and the data can be transmitted through wire up to 20 m away from Raspberry pi. It consists of a humidity sensing component, a NTC (negative temperature coefficient) temperature sensor and an IC on the back side of the sensor. It is necessary to put on 10 kΩ resistor between pin-1 and pin-2 of DHT22.

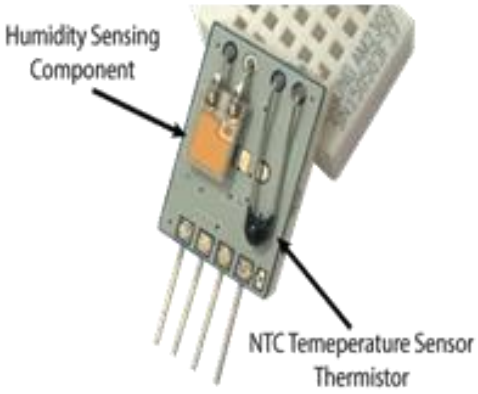

Figure 4 Internal configuration of DHT22

The weather data such as temperature and humidity in Sittway, have been collected by using DHT22 with the aid of Raspberry Pi 4 by Java Script. The first part creates the database ("test") and the collection ("dht") which apply the connection to the cloud. For the data sorting on CLOUD, the first creates the variable "insert" for temperature and humidity. When the term "data inserted" appears, the data value can be inserted, and it is necessary to create ID on cloud. The duration time between one-data and another is 10 s[3][7].

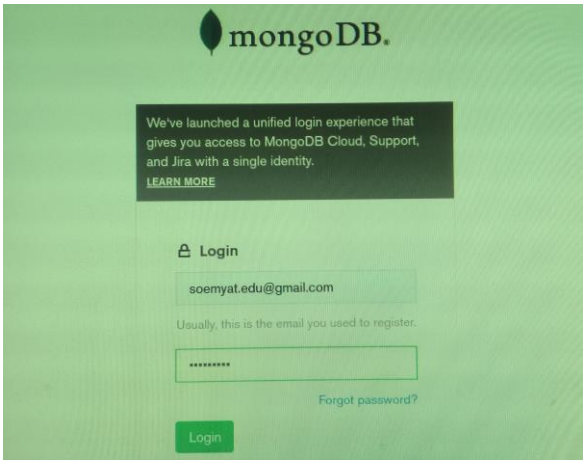

Figure 5 Email address of MongoDB to Cloud

MongoDB is a cross-platform, document oriented database that provides, high performance, high availability, and easy scalability. It works on concept of collection and document. MongoDB is also a NoSQL type database. NoSQL is not a relational database. It provides more flexibility, since all records are not restricted by the same column names and types defined across the entire table. Fig. 5 shows email address of MongoDB "soemyat.edu@gmail.com" and its password "005350soe".

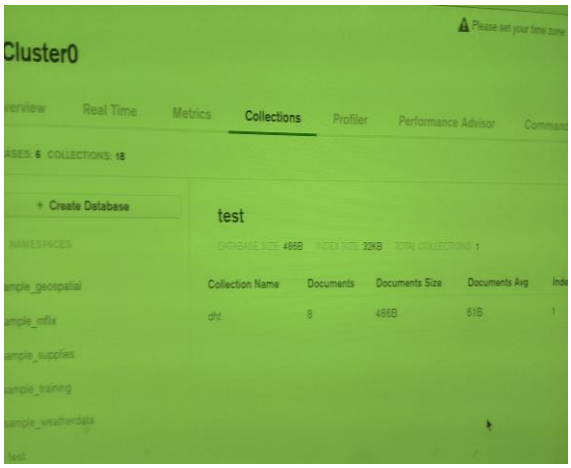

Figure 6. Create "test" database on cloud

Database is a physical container for collections. Each database gets its own set of files on the file system. A single MongoDB server typically has multiple database. To store the weather data, "test" database must be created on cloud.

Collection is a group of MongoDB documents. It is the equivalent of an RDBMS table. A collection exists within a single database. In this work, "dht" collection has been made under "test" database.

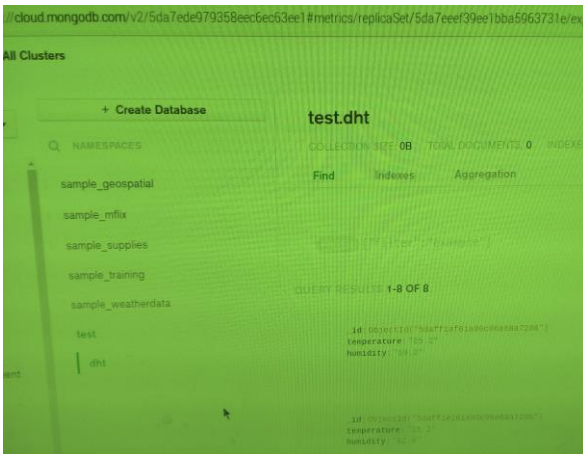

Figure 7. "dht" collection of "test" database

In the proposed work, "dht" collection of "test database" has been created for temperature and humidity data in Sittway. MongoDB can be used for "BIG DATA" in its collection of respective database. It is a document database in which one collection holds different documents. Number of fields, content and size of the document can differ from one document to another, and then data is stored in the form of JSON style documents.

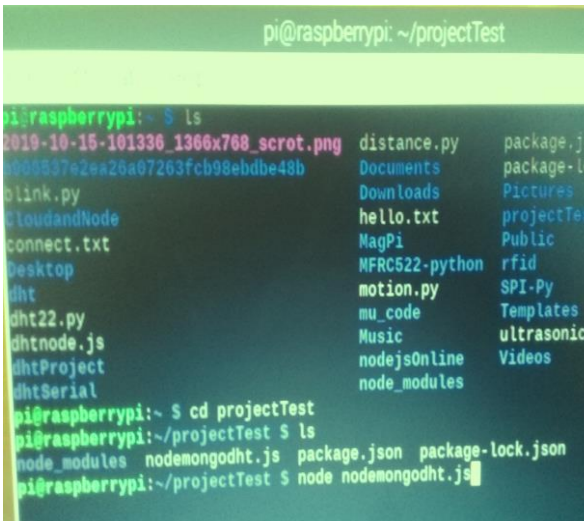

Figure 8. nodemongodht.js

For the running program of node.js, it is necessary to make the command “node nodemongodht.js”. In this work, there are three programs such as “nodemongodht.js, “package.json” and “package-lock.json” in “projectTest” directory.

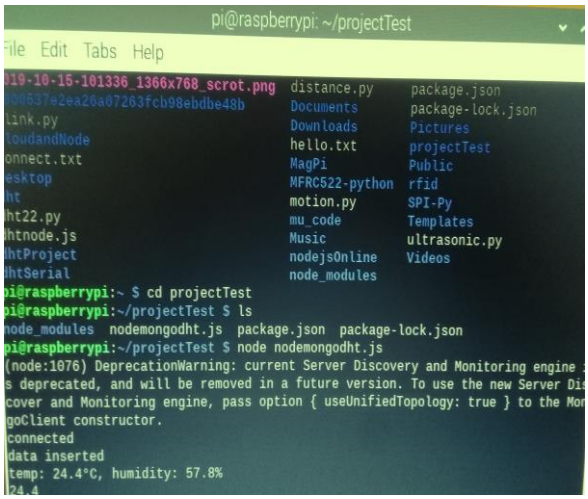

Figure 9. Output data of the system

As shown in Fig. 9, the first data output of temperature is 24.4ºC and its humidity is 57.8%. The second data will be produced within 10 s after the first output. The temperature and the humidity data of the desired environment for specific duration time are continuously collected by the proposed system.

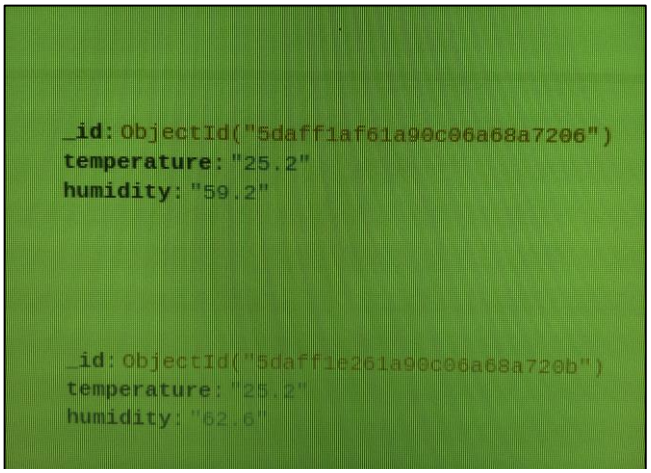

Figure 10. Temperatures & Humidities on Cloud

It is now seen that each document is printed in JSON style. The temperature and humidity data in Sittway, Rakhine state, transmitted into the cloud are shown in Fig. 10.

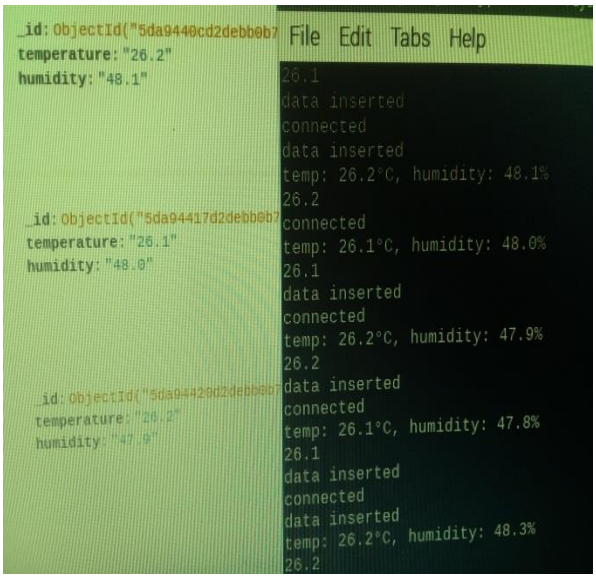

Figure 11. Comparison of sensor outputs and data on Cloud

Fig. 11 shows the comparison of DHT22 sensor outputs and data on cloud for the accuracy of the project.

Sensor Data

data inserted
connected
temp: 26.2 °C, humidity: 48.1% **(*)**

data inserted
connected
temp: 26.1 °C, humidity: 48.0%

data inserted
connected
temp: 26.2 °C, humidity: 47.9%

data inserted
connected
temp: 26.1 °C, humidity: 47.8%

data inserted
connected
temp: 26.2 °C, humidity: 48.3%

data inserted
connected
temp: 26.2 °C, humidity: 48.1%

data inserted
connected
temp: 26.1 °C, humidity: 48.3%

data inserted
connected
temp: 26.2 °C, humidity: 48.0%

Cloud Data

_id:ObjectId("5daff1af61a90c06a68a7206")
temperature: "26.1"
humidity: "48.0"

_id:ObjectId("5daff1af61a90c06a68a720b")
temperature: "26.1"
humidity: "48.3"

_id:ObjectId("5daff1af61a90c06a68a720c")
temperature: "26.2"
humidity: "48.0"

_id:ObjectId("5daff1af61a90c06a68a7205")
temperature: null
humidity: null (*)

_id:ObjectId("5daff1af61a90c06a68a720a")
temperature: "26.2"
humidity: "48.1"

_id:ObjectId("5daff1af61a90c06a68a7207")
temperature: "26.2"
humidity: "47.9"

_id:ObjectId("5daff1af61a90c06a68a7208")
temperature: "26.1"
humidity: "47.8"

_id:ObjectId("5daff1af61a90c06a68a7209)
temperature: "26.2"
humidity: "48.3"

As shown in the data list on Mongo-cloud, the identification numbers (Object Id) are not in ascending list. So, it is necessary to get the careful data sorting for the comparison between the sensor output data and the data on the cloud. In the above description, every row has a unique objectId. The output clearly shows that all of the documents are printed in JSON style. JSON is a format called JavaScript Object Notation and is just a way to store information in an organized, easy-to-read manner. The comparison of sensor-data and cloud-data is shown in Fig. 12 and Fig. 13. According to the data comparison, the first data bit cannot reach onto the cloud (*), and the data sorting on the cloud must be taken carefully at the beginning.

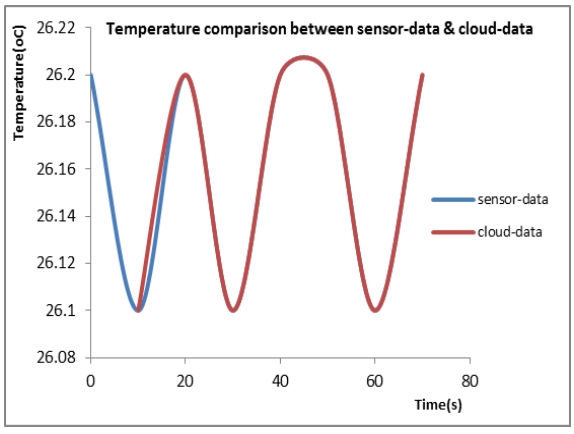

Figure 12. Temperature comparison between sensor-data and cloud-data

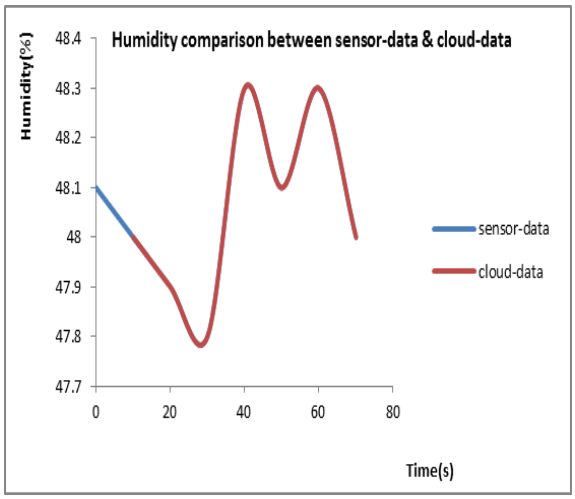

Figure 13. Humidity comparison between sensor-data and cloud-data

"test" database with "dht" collection on cloud for temperature and humidity of Sittway, Rakhine state is shown in Table (1) and Fig 12. When the temperature is less than 26°C and the humidity is greater than 80%, there will be expected to rain in 30 minutes. So the weather condition of Sittway in this period is fine[4][12].

TABLE I. TEMPERATURE AND HUMIDITY IN SITTWAY

Temperature & Humidity in Sittway			
Date	Time	Temperature(° C)	Humidity(%)
25-10-2019	13:36:00	26.2	48.1
25-10-2019	13:36:10	26.1	48
25-10-2019	13:36:20	26.2	47.9
25-10-2019	13:36:30	26.1	47.8
25-10-2019	13:36:40	26.2	48.3
25-10-2019	13:36:50	26.2	48.1
25-10-2019	13:37:00	26.1	48.3
25-10-2019	13:37:10	26.2	48

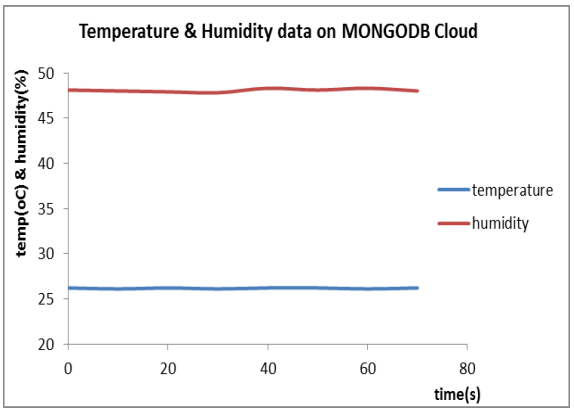

Figure 14. Temperature and humidity on cloud

V. CONTRIBUTION

The proposed system has been designed to create the low cost weather station to get the information of real time weather condition and easy to install to achieve the weather data of a specific area. And then the data can be used to share to the others by using MONGODB with node.js.

VI. CONCLUSION

Weather prediction is a very important factor, which forecasts the climate in a region based upon the values of weather parameters. So the calculated results from this system can be used in forecasting the weather of that locality for a period of time. This research makes the understanding concepts of humidity sensor and temperature sensor of DHT22 according to the construction of them, and then how to create the MONGO database on cloud of the weather parameters of the specific area. The data from sensor are transmitted to sever where they can be viewed globally which will be easily accessible to everyone. All the weather parameters were successfully displayed via MONGO database which are accessible by both administrator and users. Because there is no concept of relationship in MongoDB, a document database, in which one collection holds different documents and it can deal with big data. The comparison between sensor data and cloud data has been made for the determination of the accuracy of mongo-node.js on private-cloud. The system can make to solve the environmental problems due to the weather condition for living-things and non-living things.

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