



ONTOLOGY REPRESENTATION AND VISUALIZATION OF SENSOR COLLECTED DATA USING ONESAIT CLOUD PLATFORM

¹GajendraSinh N. Mori, ²Dr. Priya R. Swaminarayan

¹Assistant Professor, ²Dean - Faculty of IT & CS

¹TMES Institute of Computer Studies, Mandvi, Surat, India, ²Parul University, Vadodara, India

Abstract: Today, IoT applications offer new opportunities for all the domains like home automation, medical diagnosis, agriculture, transportation, etc. where we can see widespread use of many different IoT devices to measure and manage real-time data and then get some insights from it, This insights will help us to make better business decisions. IoT is projected to cover a market share of over \$11.1 trillion by 2025, according to McKinsey Global Institute research. There are great options to find out more about this prediction by diving into the IoT domain. In this paper, we represent and visualize sensor collected data using ontology on a cloud platform. The concept is low-cost, efficient, and suitable for any household automation application. Here, we use DHT11 sensor and NodeMCU ESP8266 module for getting real time data of temperature and humidity on the Thingspeak cloud platform and then represent and visualize using ontology concept on Onesait cloud platform.

Keywords - ThingSpeak Cloud; Onesait Cloud; ESP8266 NodeMCU; DHT11 Sensor; IoT;

I. INTRODUCTION

The Internet of Things is now the leading domain for most industries that provide humans with an easy and flexible lifestyle. The IoT can be used for a variety of applications in Home Automation by controlling electrical lights, air conditioning, locks, and other home appliances for enhanced safety and security. It also can be used in other industries like medical, agriculture, transportation, and so on where we can manage our devices and get real-time data that helps us make business decisions and gain insight. There are many smart devices in today's world like smart phones, smart TVs, smart fridges, smart washing machines and many other devices that are used in daily life. These devices are also very useful for communicating and interacting with each other [1]. In this paper, we use DHT11 sensor and NodeMCU ESP8266 module for getting real time data of temperature and humidity on the Thingspeak cloud platform and then represent and visualize using ontology concept on Onesait cloud platform.

II. RELATED WORKS

IoT (Internet of Things) enables the connection of heterogeneous devices and software over a network, and it is the latest trending technology today [3]. In 2003, after the network had been improved, K. Y. Lee and J. W. Choi proposed that a Smart Home was a connected, communicating, and monitored unit [4]. Using this system, many different types of devices can be interoperable with several networks, protocols, technologies, Bluetooth, WiFi, ZigBee, 6LowPAN and IEEE 802.15.4 standard also [5]. Instead of strictly tracking the device, we can use microcontroller sensors to forecast possibilities based on data. As considering the economy, the proposed system uses a single sensor called the DHT sensor for reading temperature and humidity information and also for creating the authentication framework of the climate database. [6]. In contrast to the Arduino core which was built using the ESP8266 Wi-Fi website accessible on GitHub, the ESP8266 module is an innovation that contributes to robust and complete systems. The module is a platform that combines ESP8266 and NodeMCU to provide machine learning capabilities [7]. All home appliances can be accessed quickly and easily with the home automation system. A voice-controlled home automation system can be useful for the physically challenged and elderly since they have difficulty reaching the switchboard to turn on or off the appliances [5]. An Android smart phone with a microcontroller, the Google assistant, and Wi-Fi (ESP8266) connectivity for accessing and controlling both devices and appliances using the Google assistant and NodeMCU microcontroller [8]. Sensor data is sent directly from the ESP8266 controller via WiFi to the thingspeak cloud platform through the gateway. Depending on the sensor, things can get a signal along with a value. Once processed, the controller can send the system a cooling or heating signal. [9]. In 2013, S. V. A. Syed Anwaarullah proposed that use RESTful web services for communication between the home automation system and the home appliances to create an inexpensive, but powerful, home automation system that monitors using an Android device [10].

III. SYSTEM ARCHITECTURE & WORKING PRINCIPLES

As a first step, we will discuss briefly the system architecture of the proposed system as shown in below Figure 1.

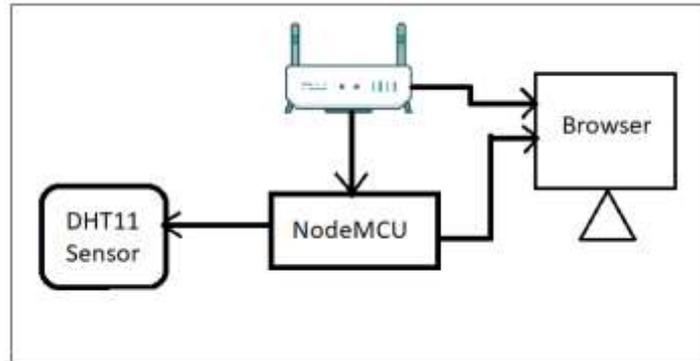


Figure 1: System Architecture

Basically, the Above System Architecture requires a NodeMCU ESP8266 Wi-Fi Module, a DHT11 Sensor and a Thingspeak cloud platform that has Wi-Fi connectivity. Follow the below steps to learn how the System works.

- 1) Connect DHT11 Sensor with NodeMCU Module using Jumper Wire.
- 2) Connect NodeMCU Module with PC using USB to OTG cable.
- 3) Finally, The NodeMCU and PC are powered by the electric port, the DHT11 sensor sends temperature and humidity data to the NodeMCU, and at last, the NodeMCU sends the data to the Thingspeak cloud web server.

IV. HARDWARE DESCRIPTIONS

4.1 NodeMCU ESP8266 Wi-Fi Module

An Arduino Company product, the NodeMCU ESP8266 is an open-source Arduino-compatible microcontroller with inbuilt Wi-Fi capabilities. With this module, we can easily communicate via the GPIOs by connecting to the Internet and transmitting data over the Internet using a Wi-Fi chipset[11]. The machine learning environment is based on this module. In below Figure 2, this module supports bands within the 802.11n and 802.11b categories, which makes it suitable for use as both an access point (AP) and Wi-Fi system at the same time. [7].

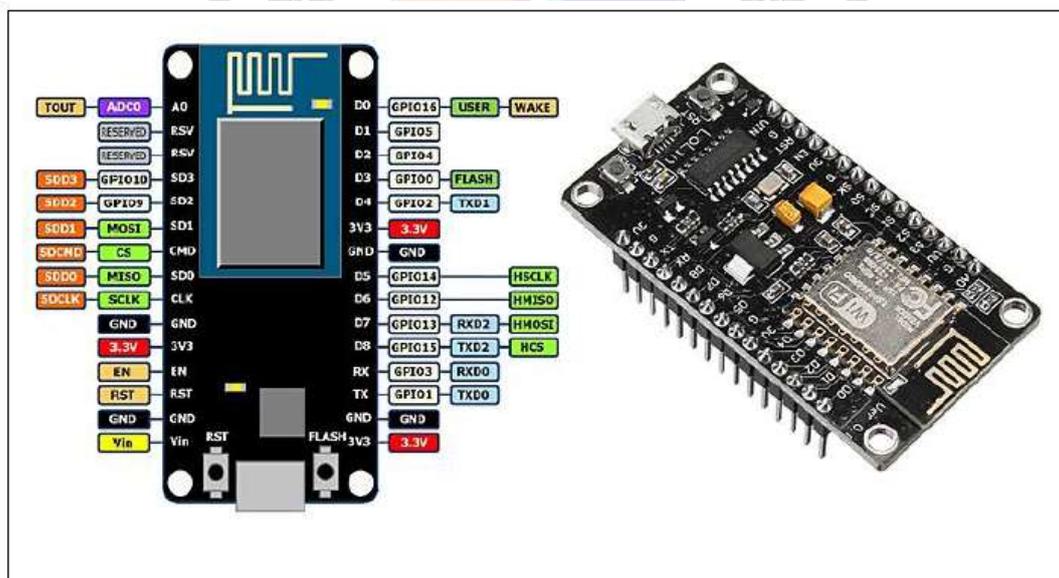


Figure 2: NodeMCU ESP8266 Wi-Fi Module

4.2 DHT11 Temperature & Humidity Sensor

Temperature and humidity can be measured easily using the DHT11 sensor. It captures the value of temperature (T) and humidity (H) using optical signal. It measures temperature and humidity values as serial data using the Negative Temperature Coefficient (NTC) concept. It can measure temperature from 0 °C to 50 °C and humidity from range 20 % to 90 %. It provides easy installation, reliable quality, quick response, anti-interference in terms of measurement, and a low price [12] that we can see in below Figure 3.

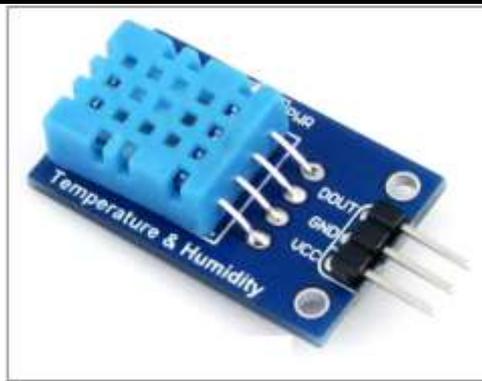


Figure 3: DHT11 Sensor

V. SOFTWARE DESCRIPTIONS

5.1 Arduino IDE.

Arduino IDE is a software that is used to program the Node MCU ESP8266. While operating, the DHT11 sensor transmits temperature and humidity to the IDE, and it displays the data on the IDE's serial monitor. By utilizing the IP address of the NodeMCU ESP8266 it becomes possible to control it remotely from anywhere in the world once it is connected to the internet.

5.2 About Thingspeak Cloud Platform

The ThingSpeak platform allows you to build IoT applications exclusively with its various services. It provides real-time data collection, visualization in form of charts, and the ability to create plug-in and apps to collaborate with web services, social networks, and other APIs are offered also

5.3 About Onesait Cloud Platform

Onesait Platform Community Edition is a free, open-source Digital Platform that anyone can download and use to build a complete solution over it; It provides multi dimension view of engine, intelligence and things and also helpful for people, systems and things with lots of features that mentioned in below Figure 4

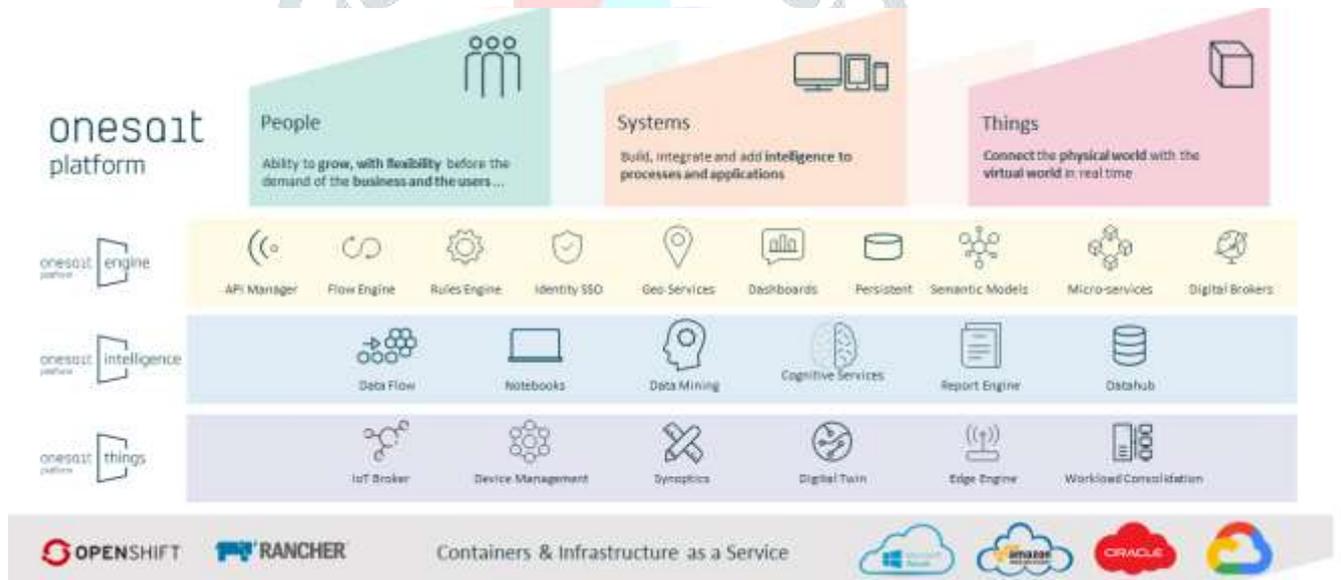


Figure 4: Onesait Cloud Platform Features

VI. METHODOLOGY & IMPLEMENTATION

To measure temperature and humidity for home automation environments, we must connect the required hardware, such as DHT11 Sensors, to the NodeMCU ESP8266 Wi-Fi Module, as shown in below Table 1.

Table 1: Circuit Mapping

Jumper Wire	DHT11 Pin	NodeMCU Pin
Red	VCC	3V3
Blue	Data	D1 (GPIO5)
Green	GND	GND

Here, connect both with power supply. As shown below Figure 5, enable Wi-Fi connectivity for both NodeMCUs and PCs respectively.

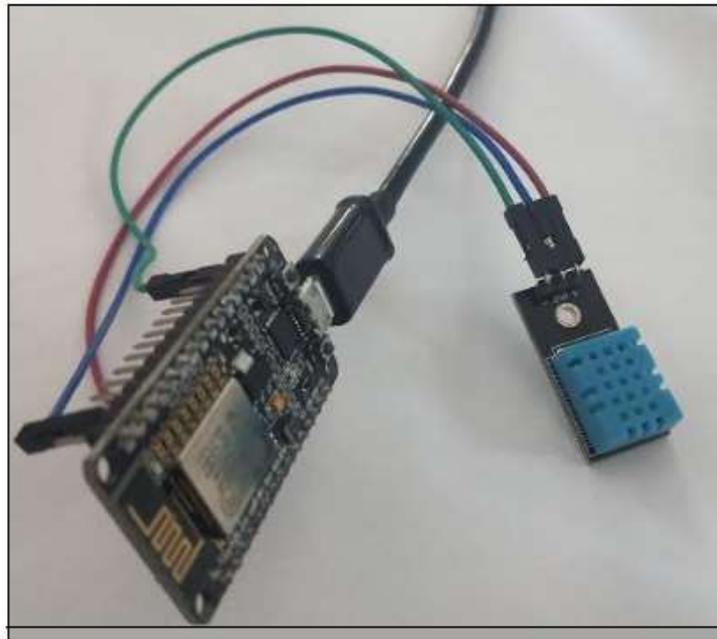


Figure 5: Schematic of Connection

It requires us to write the code for it in Arduino IDE after designing the circuit, we will have to include some libraries like ESP8266WiFi, ESPAsyncTCP, ESPAsyncWebServer and Adafruit_Sensor, after that, we need to set the Wi-Fi credentials, select the port number and write HTML code with CSS for displaying temperature and humidity values on serial monitor as well as send data to Thingspeak cloud platform. Therefore we need to create channel first, then add gadgets like below Figure 6.

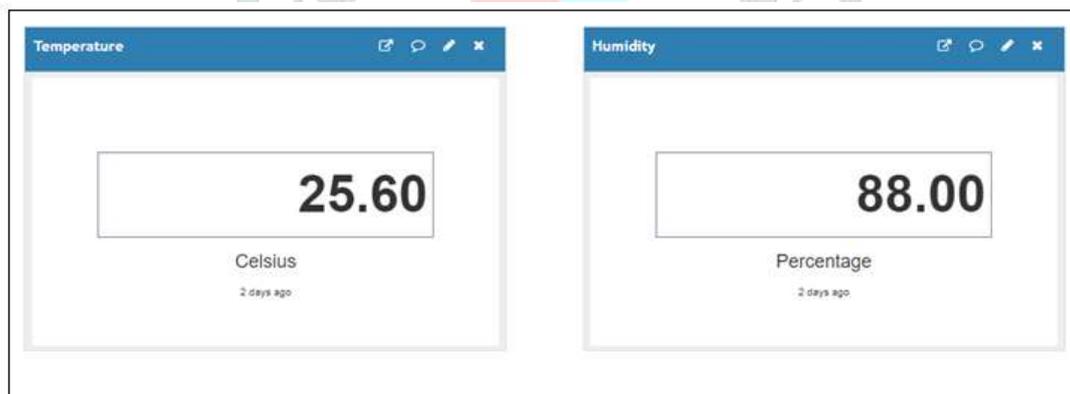


Figure 6: Widget to display Temperature & Humidity data

After displaying data on Thingspeak cloud we need to download data into CSV file format to represent data on Onesait cloud platform. for creation of ontology, we will use CSV file, we choose creation from file option on Onesait cloud, then upload file and create JSON schema, give name of ontology, description and select MONGO DB as a database, give authorization to it also apply query on it[13] see below Figure 7.

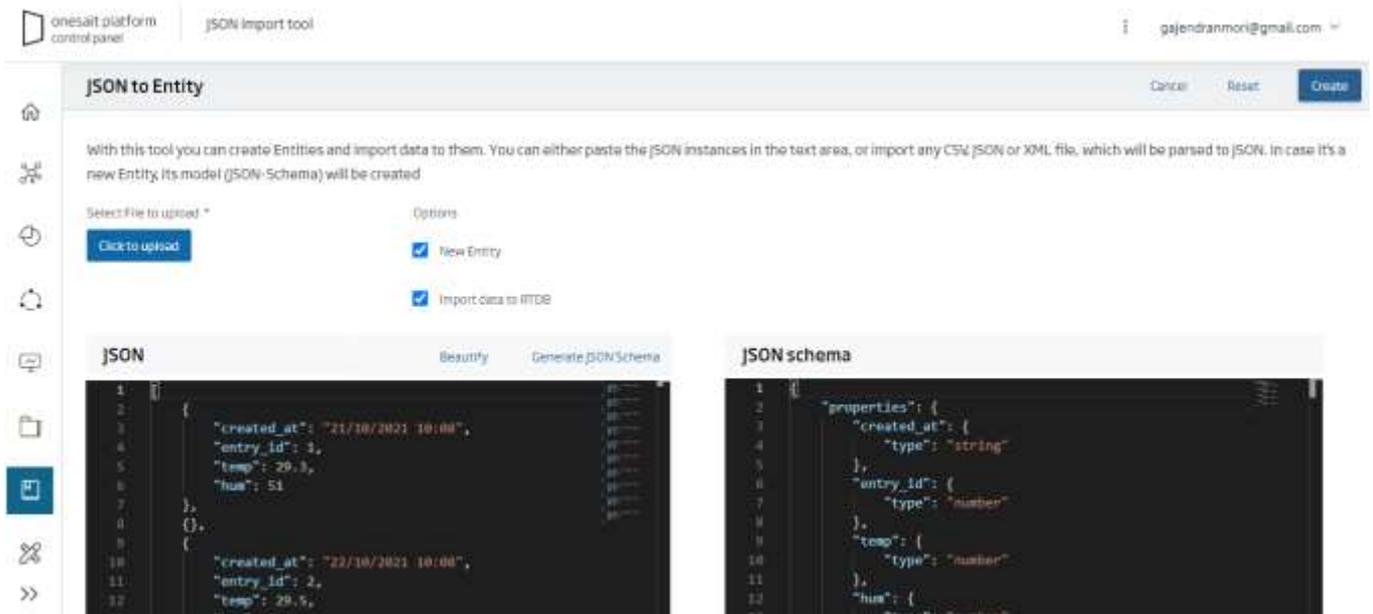


Figure 7: Ontology Creation

For displaying data we use gadgets in Dashboard options, use dashboard as per your demand and display like below Figure 8.



Figure 8: Display Data using Gadgets

CONCLUSION

Here, we conclude that DHT11 sensor is cheap and reliable to measure temperature and humidity, easy to install, and NodeMCU ESP8266 Wi-Fi Module comes with inbuilt Wi-Fi so there's no need to take extra steps for Wi-Fi connectivity. Using this system we can get latest data of temperature and humidity with auto refresh from anywhere. Overall, this work will help to the needy peoples who wish to access real time data of home on the cloud platform. For future enhancement we can connect other different sensors like, smoke, radiation, leak gas and many more for home automation also we can develop prediction model based on sensor collected data.

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REFERENCES

- [1] Waheb a. jabbar 1,2, (senior member, ieee), Tee kok kian1 , Roshahliza m. ramli1 , (member, ieee), Siti nabila zubir1 , Nurthaqifah s. m. zamrizaman1 , Mohammed balfaqih 3,4, (member, ieee), Vladimir shepelev3 , and Soltan alharbi, Design and Fabrication of Smart Home With Internet of Things Enabled Automation System.
- [2] R. piyarel and S.R. Leel, "Smart Home-control and Monitoring System Using Smart Phone", Independent Computer Consultant Association 2013, ASTL vol.24,pp 83-86,2013.
- [3] Saurabh Singh, Harjeet Matharu and Dr. Sangeeta Mishra, "Internet Of Things (Iot) Based Home Automation System", November, 2017, DOI: 10.5281/zenodo.1049436.
- [4] K. Y. Lee, and J. W. Choi, "Remote-Controlled Home Automation System via Bluetooth Home Network" vol. 3, 2003, pp. 28242829.
- [5] Sabharwal, N., Kumar, R., Thakur, A., & Sharma, J. (2014). A Low-Cost Zigbee Based automatic Wireless Weather Station With Gui And Web Hosting Facility. International Journal of Electrical and Electronics Engineering.
- [6] Krishnamurthi, K., Thapa, S., Kothari, L., & Prakash, A. (2015). Arduino based weather monitoring system. International Journal of Engineering Research and General Science, 3(2), 452-458.
- [7] Sarmad Nozad Mahmood, Sameer Alani, Forat Falih Hasan, Mohammed Sulaiman Mustafa, ESP8266 Node MCU Based Weather Monitoring System.
- [8] Loga Priya1, Mrs. S. Saranya2, Voice-Activated Home Automation using NodeMCU K.
- [9] Khin Kyawt Kyawt Khaing, Temperature and Humidity Monitoring and Control System with Thing Speak.
- [10] Amar Pawar1 , Rahul Sharan 2 , Rahul Patil3 , Sandip Chavan 4. "Home Automation using Bluetooth and IOT".
- [11] X. Bajrami, I. Murturi, An efficient approach to monitoring environmental conditions using a wireless sensor network and NodeMCU.
- [12] Mouser Electronics Homepage, <https://www.mouser.com/ds/2/758/DHT11> last accessed 2019/05/20.
- [13] <https://dzone.com/articles/iot-for-around-the-house-connecting-a-sensor-with>

