BS Project Mid-Sem Report

Monitoring Humidity and Temperature using Bluetooth and WIFI module via Android device.

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***Abstract*-** The weather has always been a universal concern, and the contemporary changes in the climate is becoming an issue, in particular, has made us realize the importance of having precise, robust and trustworthy sensors that are capable of predicting change of weather conditions over a specific period of time. Nowadays, the requirement for portable weather surveillance instruments which can be trusted on for real-time alerting and reporting on the changing environmental conditions becomes increasingly necessary. To meet these requirements, we have designed an efficient, compact and cost effective weather system that gives us valuable information about temperature and humidity using highly reliable sensor DHT11 sensor and HC-05 Bluetooth module. The DHT11 sensor serves the purpose of high accuracy in terms of measuring temperature and humidity whereas the HC-05 Bluetooth module enables high data rate, better range and portability.

Keywords — DHT11 sensor, HC-05 Bluetooth module, MIT app inventor, Arduino Uno, weather system, temperature, humidity.

I. INTRODUCTION

Monitoring is considered to be an essential aspect of environmental changing conditions. Monitoring of temperature and humidity is employed to assess and mapping of biodiversity over vast regions, in alerting of any changes to the climate conditions. Measurement and maintaining constant temperature are also important in industrial processes[1]. Temperature transducers which are used in electrical measurements are numerous due to a wide range of temperatures being measured, and because of the measurement accuracy in a specific area. Humidity is the amount of water vapor that is contained in a sample of air[2-4]. It is a very important feature of the air both in terms of weather as well as in terms of bioclimatic. In this project, we use an IOT based system to monitor the temperature and humidity and send that data to an android device. Today in the modern-day scenario we want reliable transmission of data and the reliable transmission of data can be provided with the help of wifi and Bluetooth module[5],[9],[27]. Nowadays wireless Communication becomes a spectrum by which we can send innumerable data streams from one channel to the other channel. The system involves the transmitter part and the receiver part which are used for transmitting and the reception of data[7],[9]. We collect the data using the temperature and humidity sensor DHT11 and send it to the android device using a Bluetooth module. The sensor used to measure humidity is the DHT11 sensor. The DHT11 is a basic,

low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use but requires careful timing to grab data[13]. The Bluetooth module used here is HC05 which is a four-pin Bluetooth module that is used for the interfacing purpose with that of the Arduino board. This board is chosen because of its high demand and availability in the market. The Bluetooth which we are using here takes care of a short range of distance. i.e within this short range, the data can be transmitted from the Arduino to android[14],[9],27]. Arduino serves as the platform of hardware configuration and whereas the main media for transferring the data can be served with the Bluetooth module and apart from this, the coding for manipulation is done in the Arduino software environment which is a simple IDE environment used for uploading the sketches. Nowadays android phone has a quite efficient demand in the market due to its's high superior manifestation in the market compared to the earlier operating systems which were expired now due to the modern-day motivation and the innovation in the technology department[1-3]. With the help of the pairing between Arduino and the Bluetooth module, we are going to send the data whereas this android part acts as a receiver one, and the Arduino acts as a transmitter. Here in the case of transmission and the reception of data the default band rate is considered which is in the range of 9600[6].

II. MATERIALS REQUIRED

Arduino Uno Board:

Arduino Uno board is heart of the project and is responsible for all the major operations in the project. Due to its robustness and open source nature, it is interfaced with the DHT11 sensor and the Bluetooth module easily[1]. The Arduino Uno board has a microcontroller based on ATmega328P.This board provides the services of serial communication for displaying the received data on the PC and provides an Integrated Development Environment for easy programming[3].

Fig-1 Arduino Uno Board

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Breadboard:

The Breadboard is used as a connecting of the hardware samples with it with the help of connecting wires and the different interface mechanisms. In this project, the breadboard is used to connect the peripherals of the Arduino and the Bluetooth module.

Connecting wires:

The connecting wires are used to interface between the Arduino and alongside that of the Bluetooth module. The Arduino board is fixed on the breadboard and the receiver module of the Arduino is connected with that of the Bluetooth module to provide high ended reliable and efficient mode of communication[2]. The connecting ends of the Arduino board are connected with that of the Bluetooth module and the connecting parts are explained as below:-

- TX OF Arduino is connected with RX of Bluetooth module
- RX of Arduino is connected with that of the TX of the Bluetooth module
- Vcc is connected to a 5V power supply
- Gnd of Arduino board is connected with the Gnd pin of the Bluetooth module[7].

The above mentioned are the different connections that are used to interface between the Arduino board and the Bluetooth module.

LCD display:

In 16x2 LCD there are 16 pins overall if there is a backlight, if there is no backlight there will be 14 pins. One can power or leave the backlight pins. Now in the 14 pins, there are 8 data pins (7-14 or D0-D7), 2 power supply pins (1&2 or VSS&VDD or GND&+5v), 3rd pin for contrast control (VEE-controls how thick the characters should be shown), and 3 control pins (RS&RW&E)[5],[6].

PIN1 or VSS to ground

PIN2 or VDD or VCC to +5v power

PIN3 or VEE to ground (gives maximum contrast best for a beginner)

PIN4 or RS (Register Selection) to PIN0 of ARDUINO UNO

PIN5 or RW (Read/Write) to ground (puts LCD in read mode eases the communication for user)

PIN6 or E (Enable) to PIN1 of ARDUINO UNO

PIN11 or D4 to PIN8 of ARDUINO UNO

PIN12 or D5 to PIN9 of ARDUINO UNO

PIN13 or D6 to PIN10 of ARDUINO UNO

PIN14 or D7 to PIN11 of ARDUINO UNO[23].

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Digital Humidity Temperature Sensor(DHT11):

DHT11 is a digital temperature and humidity sensor which provides a calibrated digital signal output of the temperature and humidity. Due to its exclusive digital modules and the temperature and humidity sensing technology, it makes sure that the output obtained is of high reliability and stability. The sensor consists of a resistive sense of wet components and an NTC temperature measurement devices , and connected with a high-performance 8-bit microcontroller[1-4] . DHT11 sensor ensures fast response, low consumption of power, low cost. In addition to this, it also has the ability to avoid interference and can transmit data to a long distance. The communication and synchronisation between microcontroller unit and the DHT11 sensor takes place using a single wire two way connection and requires single bus data format for the same[6-7]. The information packet transmitted by the sensor is of 40 bits. The sensor operates in 2 different modes-low power consumption mode and running mode[5]. The start signal signifies the transformation from low power mode to running mode. As the start signal is completed, the sensor sends a response signal containing the information regarding the relative temperature and humidity[26]. For the Bluetooth based weather station, the sensor used is a 3 pin module consisting of Vcc , Data and Ground (GND)[11],[20].The Data pin is connected to the A0 pin of the Arduino board whereas the Vcc is connected to the 5V pin of Arduino. The sensor transmits the information of temperature and humidity to the Arduino board which is later displayed on the serial monitor using serial communication[14].

Specification title	DHT 11
Temperature scale	$0 - 50°C, \mp 2°C$
Humidity scale	$20\% - 80\%, \mp 5\%$
Reading rate	One reading/second
Sensor size	$15mm \times 12mm \times 5.5\ mm$
Applied voltage	$3 - 5$ volt
Maximum current while reading data	2.5 mA

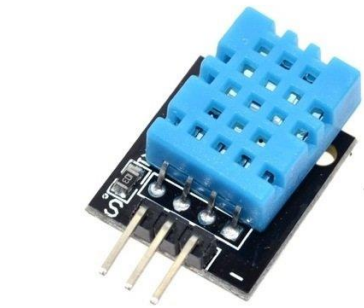

Fig-2 Digital Humidity Temperature sensor

HC-05 Bluetooth Module

HC-05 Bluetooth Module HC-05 as shown in Fig. 3 is a Bluetooth module which operates on the principle of Serial Port Protocol (SPP). This module is specifically designed for wireless serial communication[2]. This module is equipped with Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It makes use of CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature)[9-12]. The Bluetooth module is used for its low cost, low consumption of power and high range that enables the user to access the weather station from a considerable distance. The Bluetooth module has a sensitivity of -80dBm.It makes use of UART interface whose baud rate can be programmed. Typically the baud rate used is 36800 and the data packet usually involves 8 bit of data, 1 stop and no parity bits[15]. These Bluetooth modules have two modes: master and slaver device. Those device with even number (HC-04) can be configured as master or slaver when it is out of factory and can't be changed to the other mode. However, for the device with odd number like HC-05, the user can configure the mode as master or slave using AT commands. The Bluetooth module used in the project is HC-05 which operates in the slave mode[9],[15],[18]. HC-05 is a 6 pin IC where the TX and RX pin is connected to the RX and TX pin of the Arduino board respectively. The potential divider circuit used is to reduce the Arduino 5V potential to 3.3V for proper transmission and reception between the Arduino and the Bluetooth Module[7]. We have to make sure that the baud rate of the Bluetooth module is synchronised with that of the Arduino so that there is no loss of data and proper communication is achieved.

Fig-3 HC-05 Bluetooth Module

Android Interface

The android interface is used in this project to showcase the data obtained in the form of temperature and humidity. It is a Bluetooth communication application. It enables the connection of Android devices with any Bluetooth device which is associated with Serial Port Profile[6]. This allows easy exchange of data between the two systems. In this project, the data in the form of temperature and ambient humidity is displayed on the android mobile phone[9]. The main advantage of using this application is to provide a user friendly interface which avoids any ambiguities for the user as shown in Fig 6[15]. The interface has different colours for configuring the device and the incoming data. The data which is to be sent or displayed is highlighted according to the range.

III CIRCUIT DIAGRAM

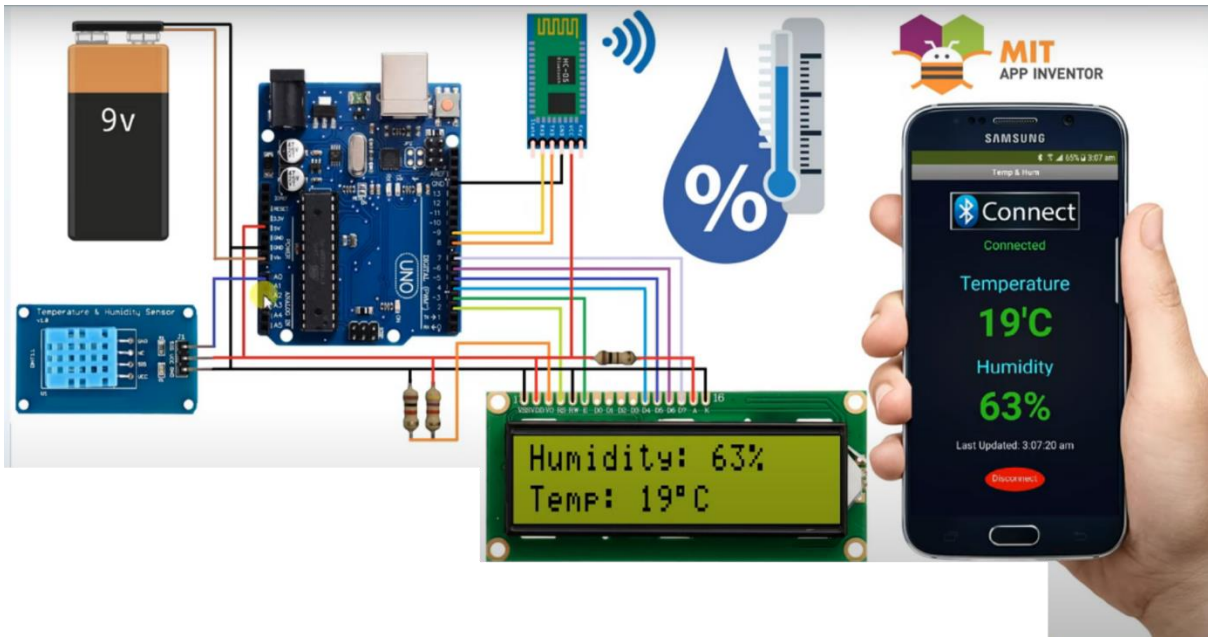

Fig-4 Circuit Diagram.

Hardware Representation:

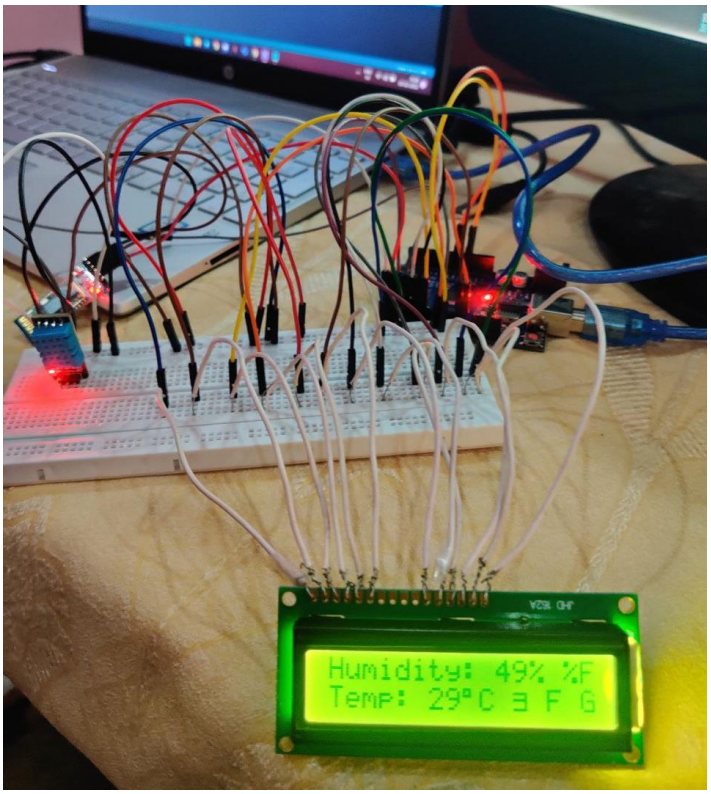

Fig-5 Experiment Setup.

IV. METHODOLOGY

System Model:

Fig-6 system model

Internet of Things is an auspicious scientific development to optimize life based on intelligent sensors and smart equipment that work together through the internet network, all the equipment we use in our daily lives can be controlled and monitored using IOT[30]. The majority of processes are achieved with the help of sensors in the IOT. The sensors are deployed wherever, and these sensors convert raw physical data into digital signals and transmit them to the control center[18]. In this way, we can Monitor

changes in the environment remotely from any part of the world via the internet. The architecture of this system will be based on the context of operations and processes in real-time scenarios[14], [20], [30]. Security in the IOT is currently undergoing an excellent development with a lot of security research using IOT, some algorithms that can be applied on IOT like Tripple Transposition Key, Base64, Blowfish and many others and most dominant use were symmetric cryptography algorithm[32]. Humidity and temperature detection prototype is designed using several components such as DHT 11 sensor, Arduino UNO R3, 1x16 LCD, I2C LCD,HC-05, MIT APP[24]. The primary element to detect the sensor using DHT 11 which can identify good enough humidity conditions and room temperature, this sensor has a thermistor type NTC (Negative Temperature Coefficient) to measure the temperature and an 8-bit microcontroller that process both sensors and send the results to the pin output in a single-wire bi-directional format[22]and android app via bluetooth HC-05, figure 19,20 is the detailed method on the designed humidity and temperature detection prototype.

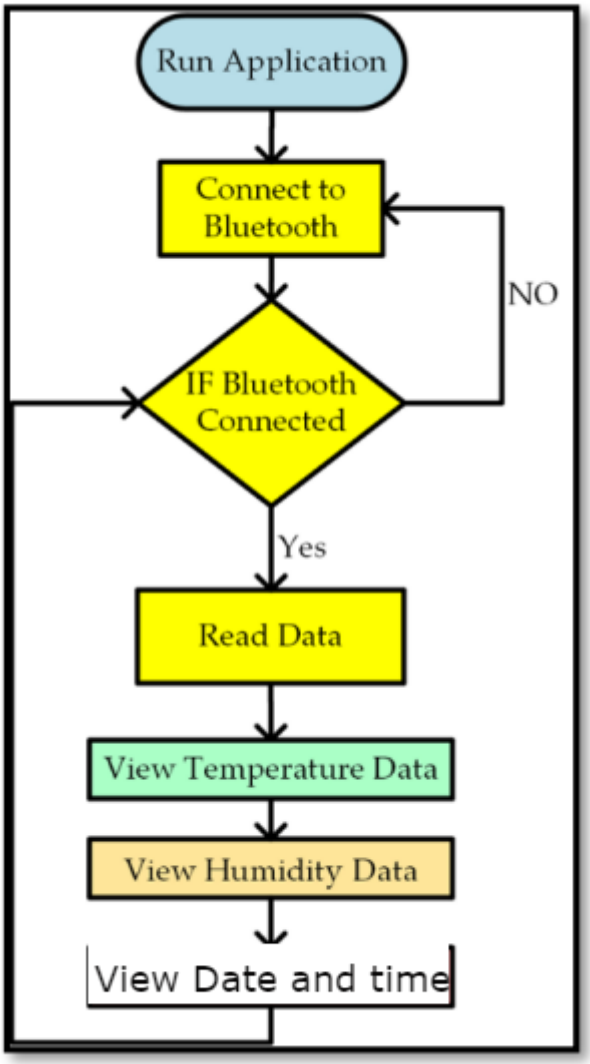

Fig-7 Software Architecture

How to connect Arduino to android:

Step-1 Step-2 Step-3

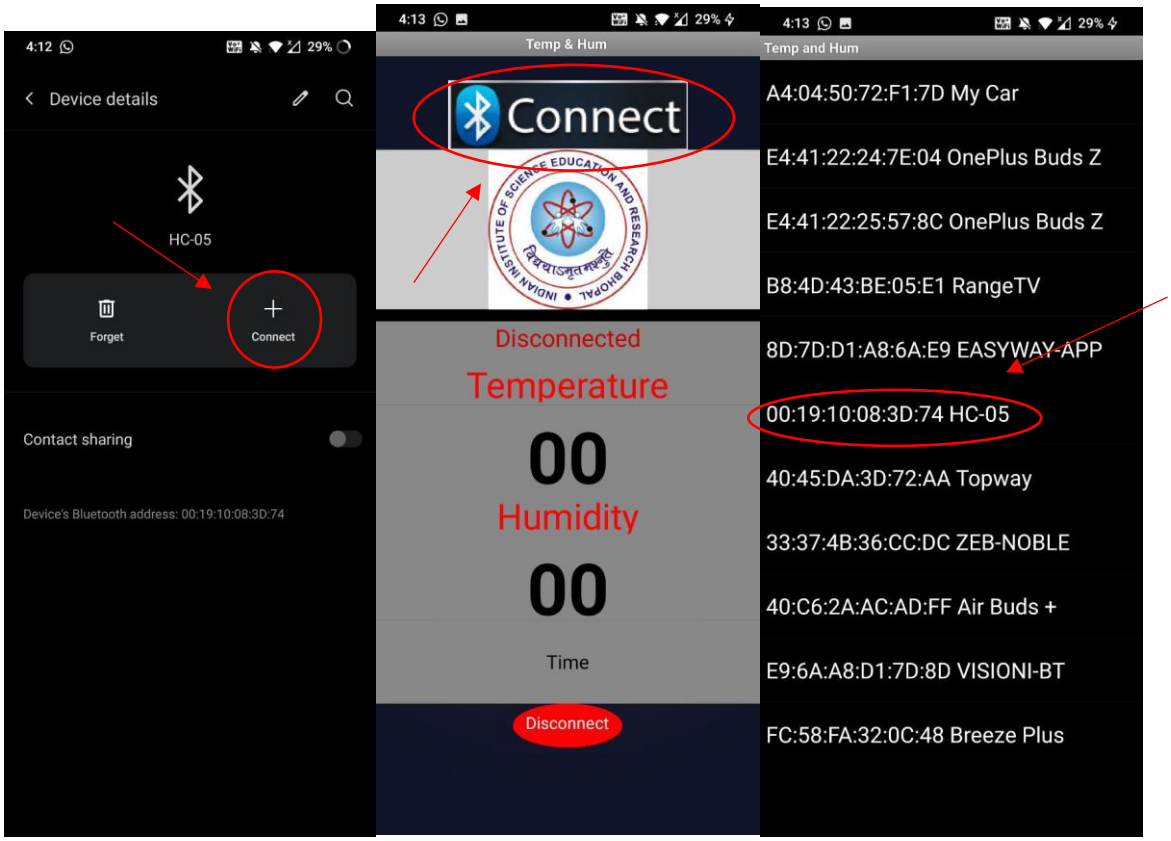

Fig-6 Bluetooth connection in Android app.

V. RESULTS AND DISCUSSION:

The Bluetooth based weather station was tested at IISER Bhopal. The sensor grabbed the information about the humidity and temperature in the lab which was displayed on the serial monitor screen of Arduino as seen in Fig. 7. The data is also displayed on the android mobile using MIT application through HC-05 Bluetooth module as seen in Fig. 8

Temperature is 29C

Humidity is 49%

Serial Monitor output

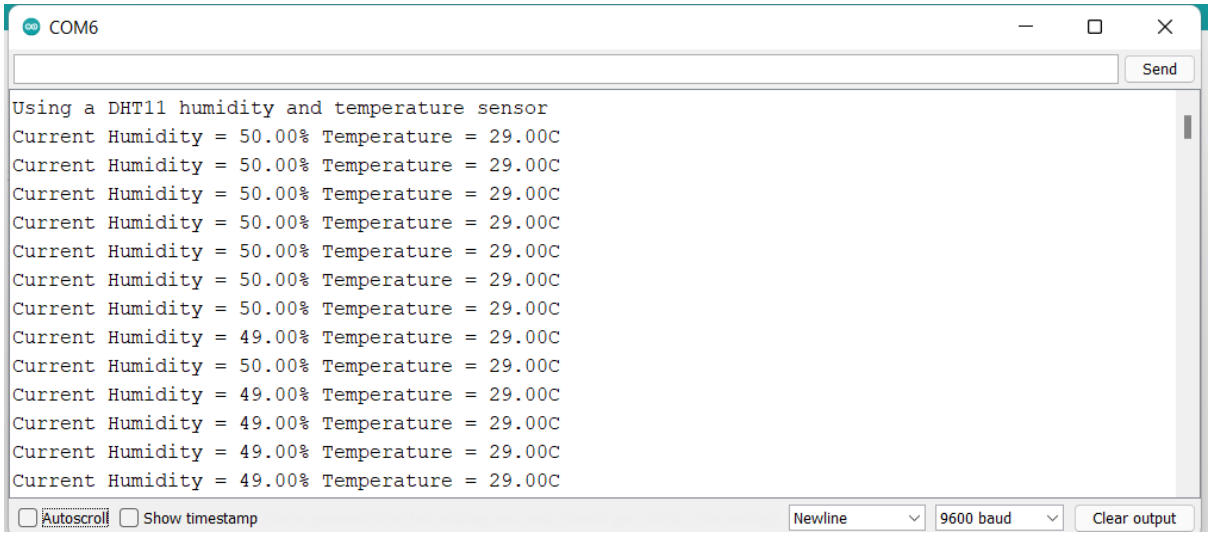

Fig-7 Serial Output

Android Output:

Fig-8 Android app output

DHT11 uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital and HC 05 works in serial communication. The android app is designed to receive serial data from the Arduino Bluetooth module. The Arduino Bluetooth module at the other end sends the

data and receives it through the TX pin of the Bluetooth module (Connected to the RX pin of the Arduino). The code uploaded to the Arduino checks the received data and compares it.

Github link for app and code: https://github.com/bhargavpetla/Temp-and-hum

VI. CONCLUSION:

Bluetooth based weather station serves as a reliable and efficient system for accurate measurement of the environmental parameters like temperature and humidity. It not only allows user to reduce the human power, but it also allows user to see precise changes in it. This project can be further extended towards measuring the light intensity using an LDR (Light Dependent Resistor). Furthermore, we can also use IOT (Internet Of Things) in the same project and display the results on a server, thereby making a mini data acquisition system.

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