10. Experiment : Data analysis and Visualization

Access the data pushed from sensor to cloud and apply any data analytics or visualization services.

Aim : To design and Develop a cloud based Environment using Thing Speak cloud and push the Sensor Data (temperature and Humidity Data)Cloud platform and apply any data analytics or visualization services.

Apparatus Required :

1. ESP32 – wifi Module

2. DTH 22 – Sensor

3. Wokwi – Online Simulator

4. Thing speak – online Free cloud

Description:

ESP -32

The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all WiFi networking functions from another application processor. This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area.

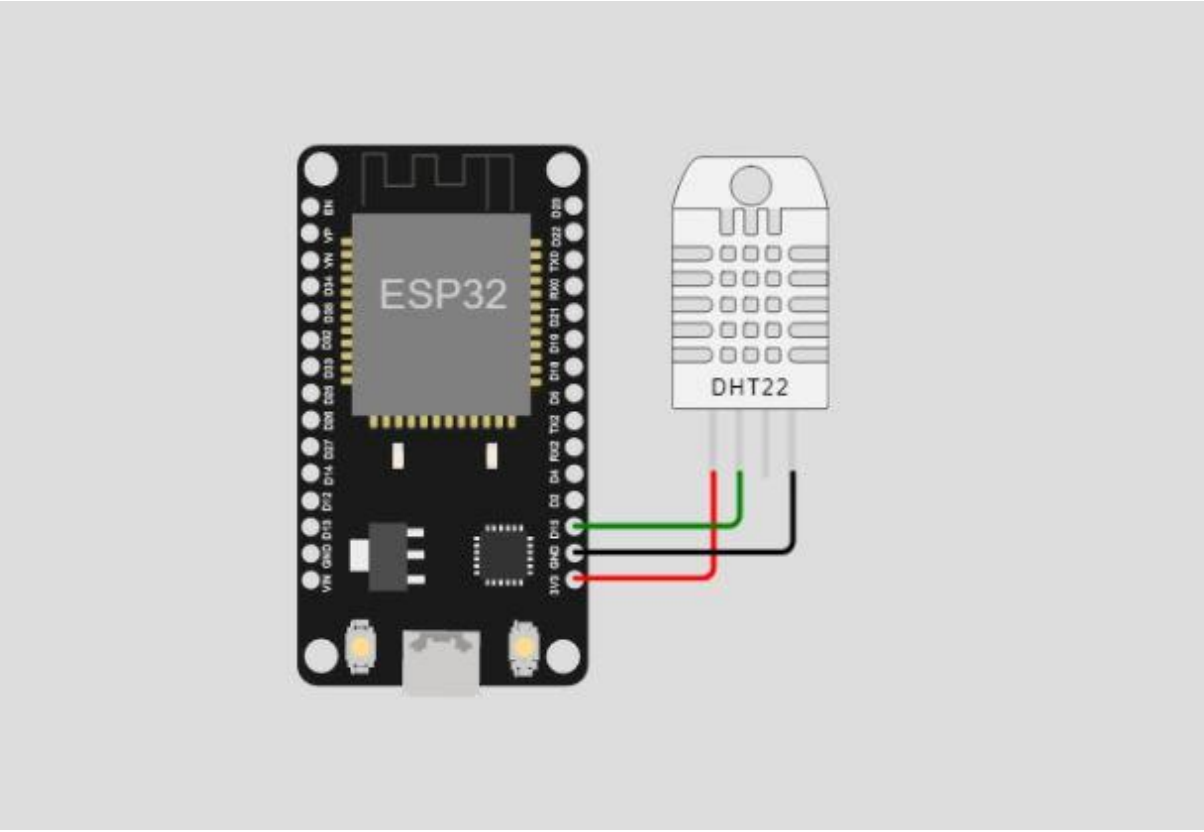
Temperature Sensor – DTH22

A temperature sensor is an electronic device that measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes. There are many different types of temperature sensors. Some temperature sensors require direct contact with the physical object that is being monitored (contact temperature sensors), while others indirectly measure the temperature of an object (non-contact temperature sensors). Non-contact temperature sensors are usually infrared (IR) sensors. They remotely detect the IR energy emitted by an object and send a signal to a calibrated electronic circuit that determines the object's temperature.

There are two main types of thermistors: Negative Temperature Coefficient (NTC) and Positive Temperature Coefficient (PTC). Thermistors are more precise than thermocouples (capable of measuring within 0.05-1.5 degrees Celsius), and they are made of ceramics or polymers. Resistance Temperature Detectors (RTD) are essentially the metal counterpart of thermistors, and they are the most precise and expensive type of temperature sensors.

Temperature sensors are used in automobiles, medical devices, computers, cooking appliances, and other types of machinery.

Circuit connection :



Code :

```
#include <WiFi.h>
#include "DHTesp.h"
#include "ThingSpeak.h"
#include <Adafruit_Sensor.h>
const int DHT_PIN=15;
const char* ssid="Wokwi-GUEST";
const char* pass="";
WiFiClient client;
unsigned long myChannelNumber=2;
const char* myWriteAPIKey = "W3UPRN3V399KMWLD";
const char* server = "api.thingspeak.com";
unsigned long lastTime=0;
unsigned long timerDelay=30000;
int temperatureC;
int humidity;
DHTesp dhtSensor;
void setup()
{
Serial.begin(115200);
dhtSensor.setup(DHT_PIN, DHTesp::DHT22);
dhtSensor.getPin();
delay(10);
WiFi.begin(ssid, pass);
while(WiFi.status() != WL_CONNECTED)
{
```

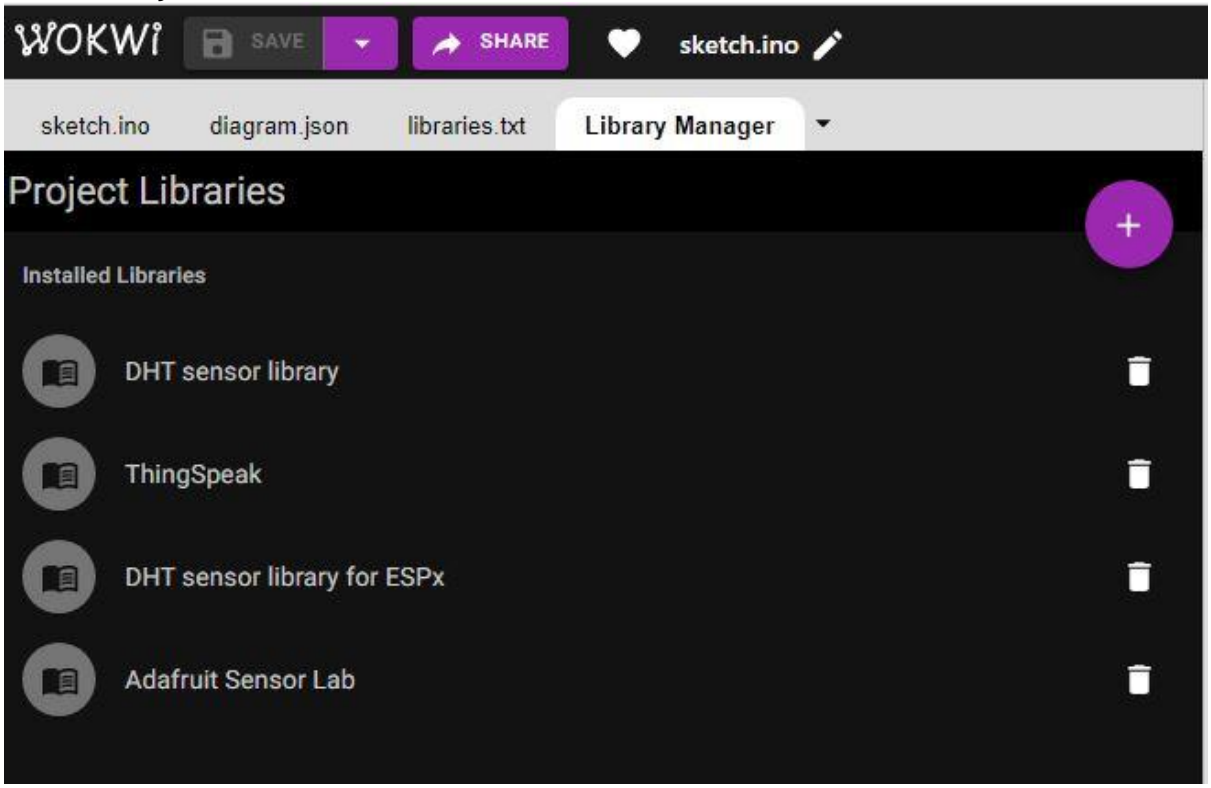
```
delay(100);
Serial.println(".");
}
Serial.println("Wifi Connected");
Serial.println(WiFi.localIP());
WiFi.mode(WIFI_STA);
ThingSpeak.begin(client);
}
void loop()
{
temperatureC = dhtSensor.getTemperature();
Serial.print("Temperature :");
Serial.println(temperatureC);
humidity=dhtSensor.getHumidity();
Serial.print("Humidity (%);");
Serial.println(humidity);
ThingSpeak.setField(1, temperatureC);
ThingSpeak.setField(2, humidity);
int x = ThingSpeak.writeFields(myChannelNumber, myWriteAPIKey);

if (x == 200)
{
  Serial.println("Channel Update Successfull");
}
else
{
Serial.println("Problem"+ String(x));
}
}
```

Execution Steps

1. Connect the ESP 32 and Temperature Sensor.
2. Write the code
3. Add the Following Library File in Library Manager
    a. DHT sensor library
    b. ThingSpeak
    c. DHT sensor library for ESPx
    d. Adafruit Sensor Lab

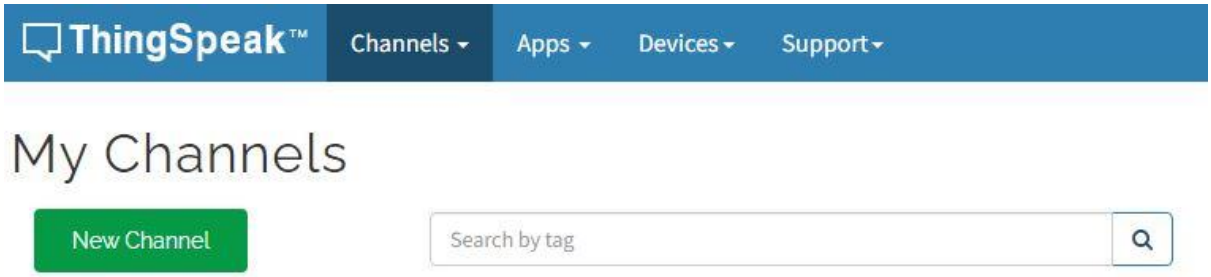
4. Open the cloud platform : www.thingspeak.com
5. Sign with Google login
6. Click Add Channel and Create a new Channel for your application
7. Generate the API Key and Add the Key to code
8. Finally Run the Wokwi Simulation and Change the temperature and Humidity Slider
9. Now Same Date will be stored and update in the thingspeak cloud platform
10. And sensor data will be update in frequency of time interval in cloud.

Add library in Wokwi



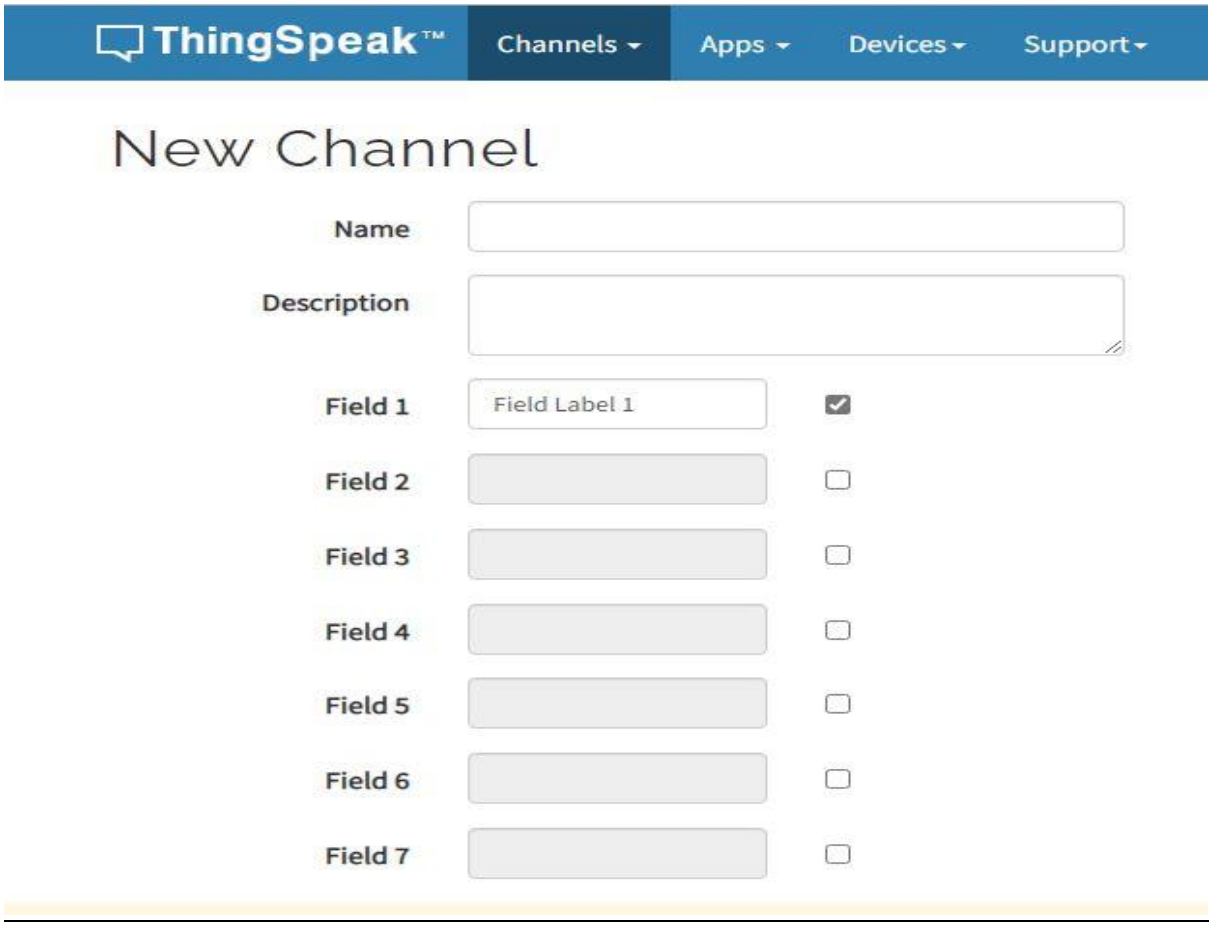
Open WWW.Thingspeak.com

Sign in with Google Account

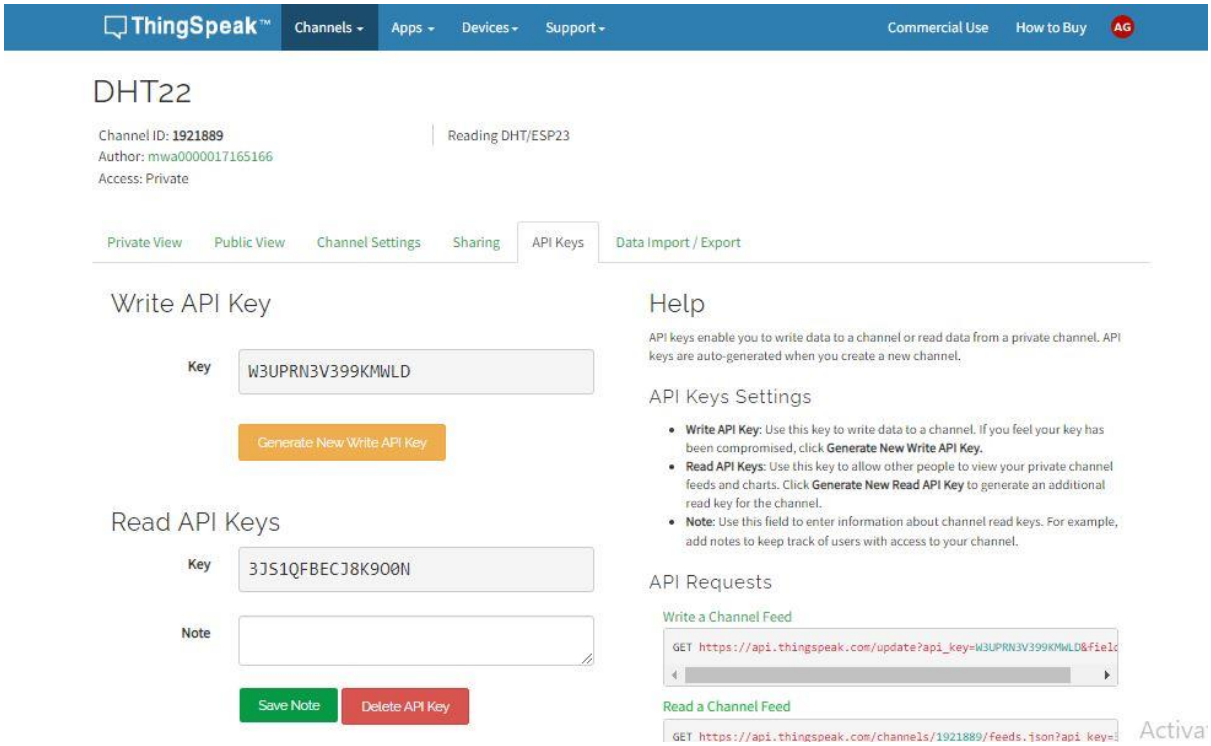


Create New Channel

1. Give the name of the channel , Description of channel
2. Select the field required (Example : Temperature and Humidity)
3. Next Click Save Channel ., Now Channel created



4. Save the created channel and go to API keys . (**__**COPY**__ :the API Key to used further)

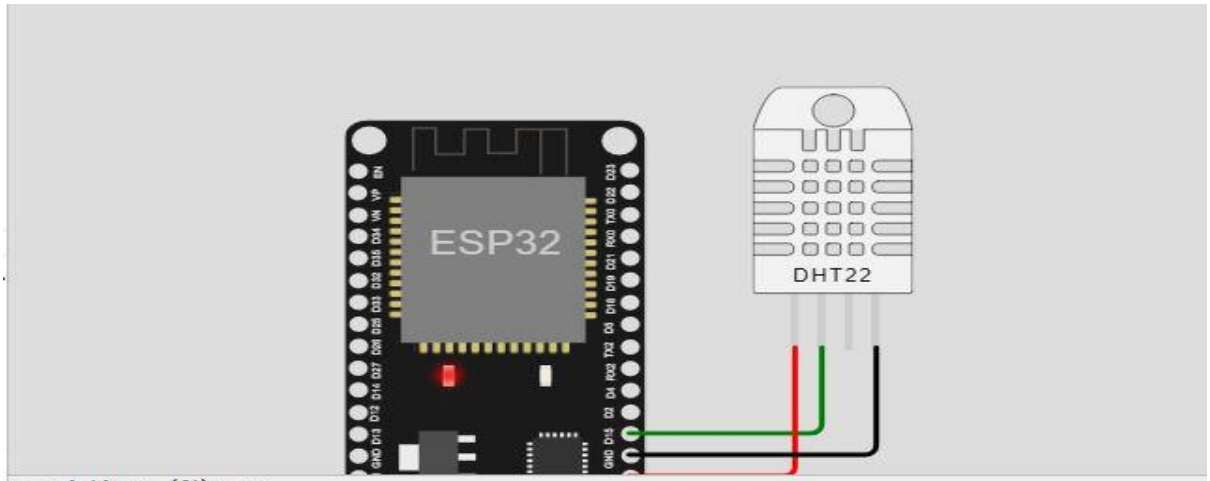


Paste the API Key in Code

```
const char* myWriteAPIKey = "W3UPRN3V399KMWLD";
const char* server = "api.thingspeak.com";
```

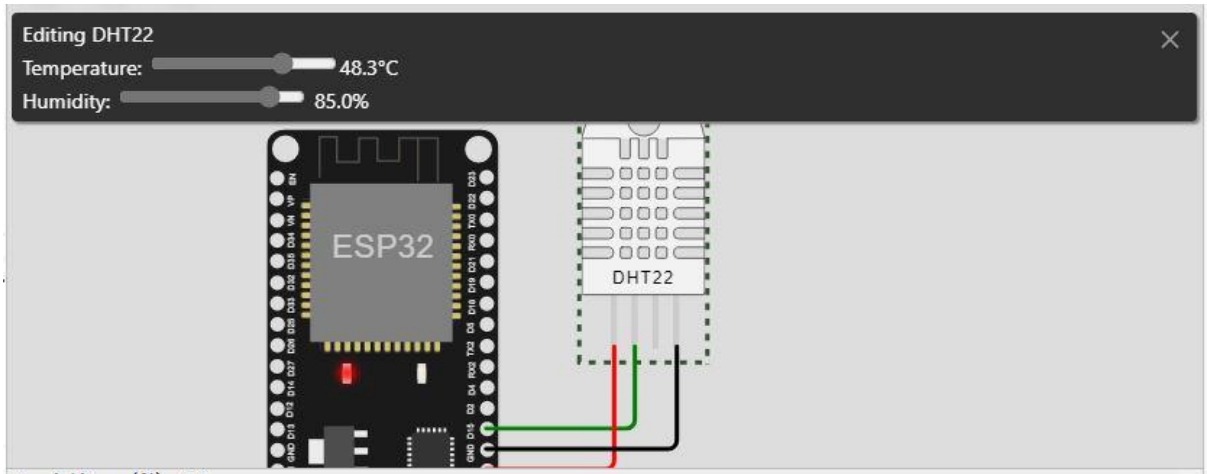
This will eastablish the Link between the Wokwi portal and ThingSpeak cloud platform with respect to the channel which we already created in name (Example : DHT22)

OUTPUT: (Sensor data updated in Channel in Thing speak cloud - which we created – DTH22)




```
Humidity (%);68
Channel Update Successfull
Temperature :33
Humidity (%);68
Problem-401
Temperature :33
Humidity (%);68
```

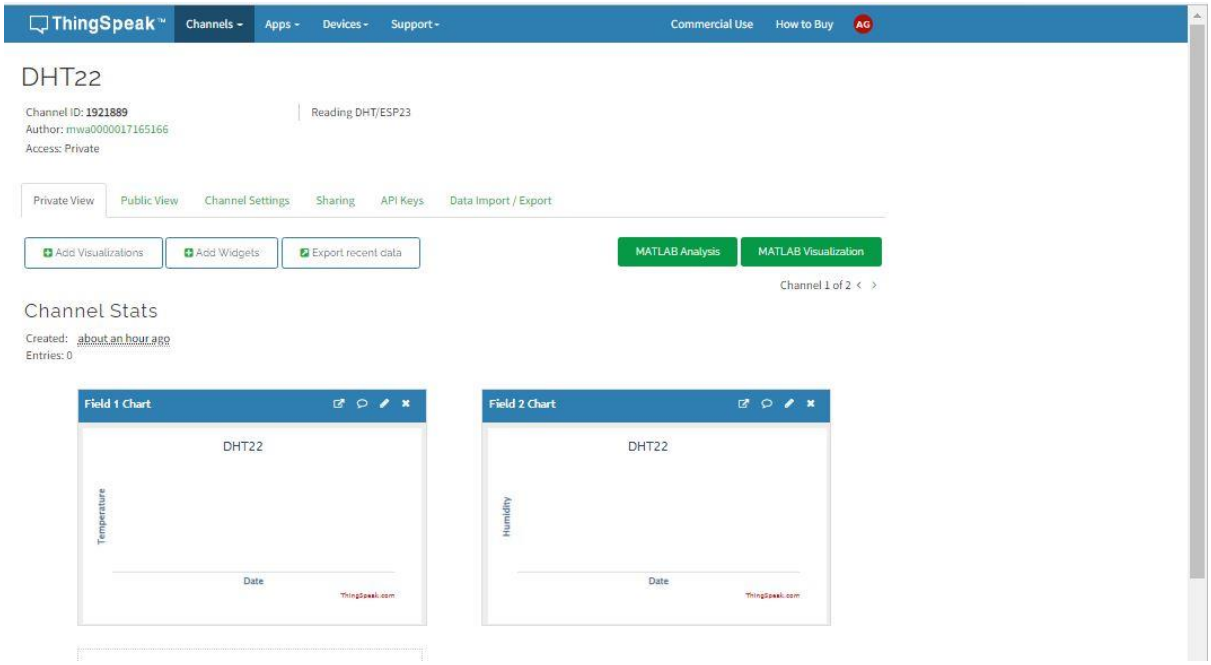
Activat
Go to Se



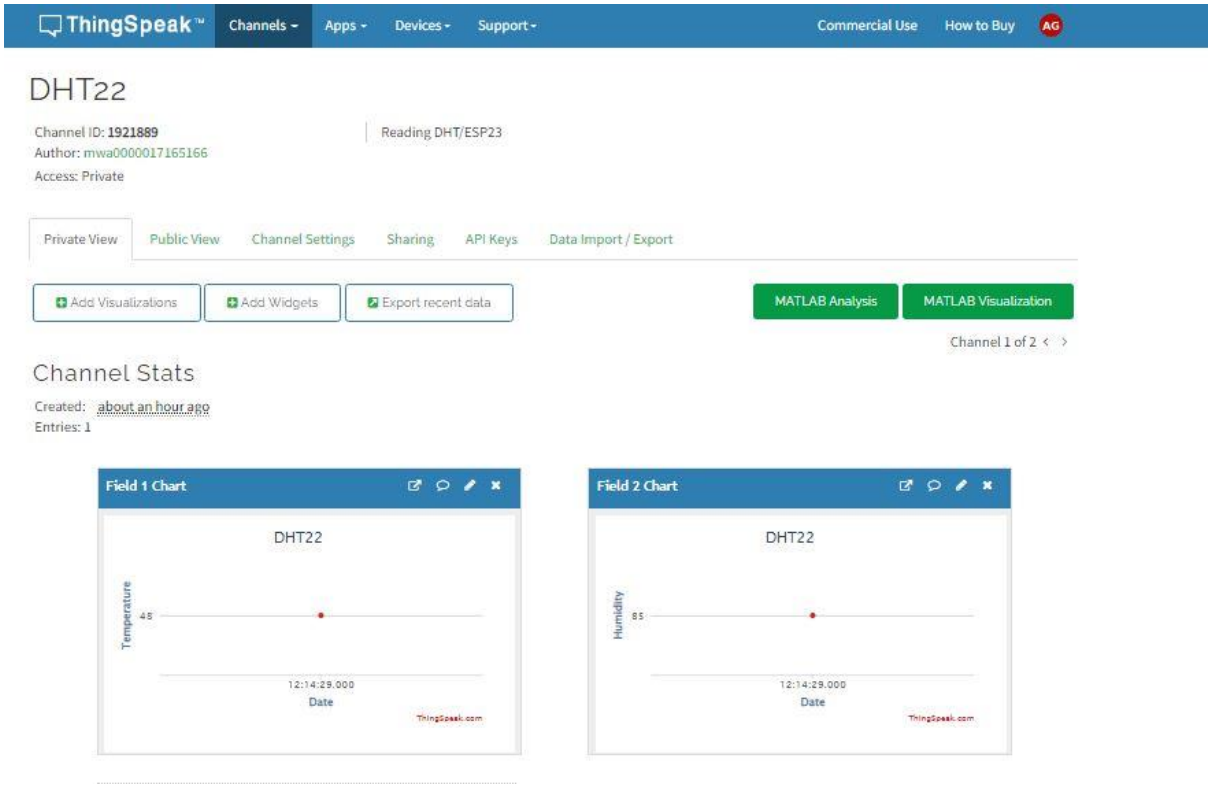

```
Humidity (%);68
Problem-401
Temperature :48
Humidity (%);68
Problem-401
Temperature :48
Humidity (%);85
```

Activate Windows
Go to Settings to activate Windows.

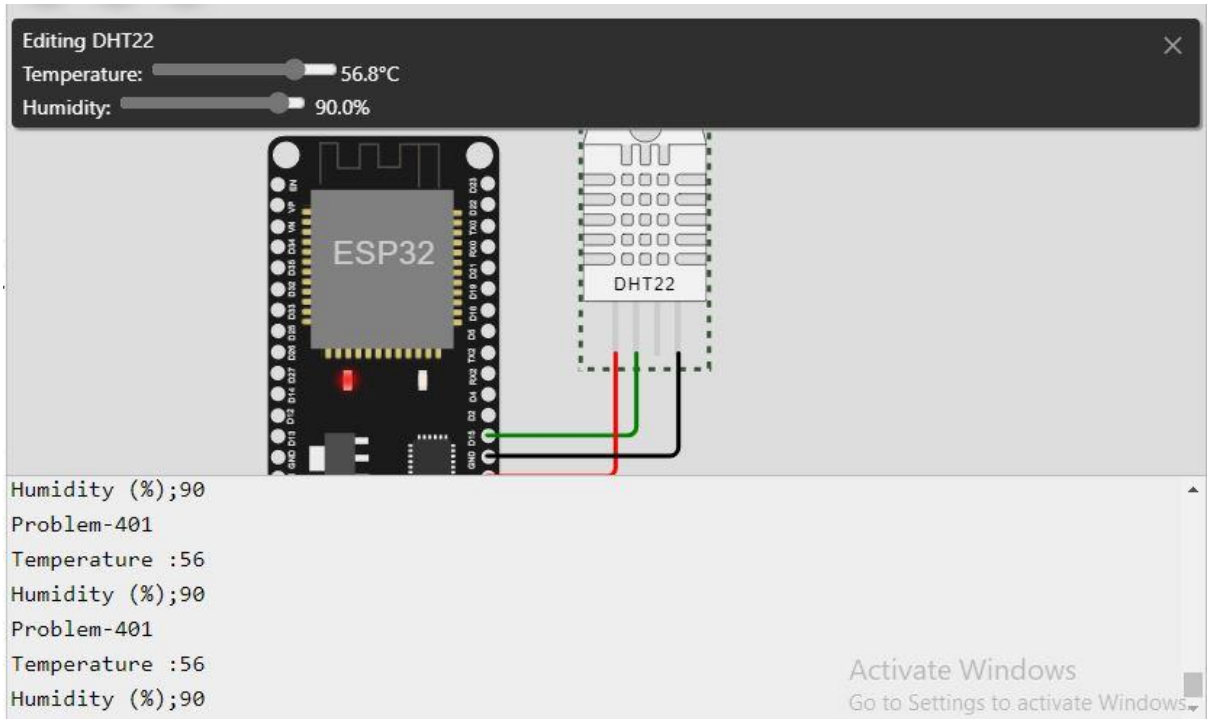
Data Analysis and Visualization – Click Private View in channel – Gives detail analysis of Field Which we selected (Temperature & Humidity)



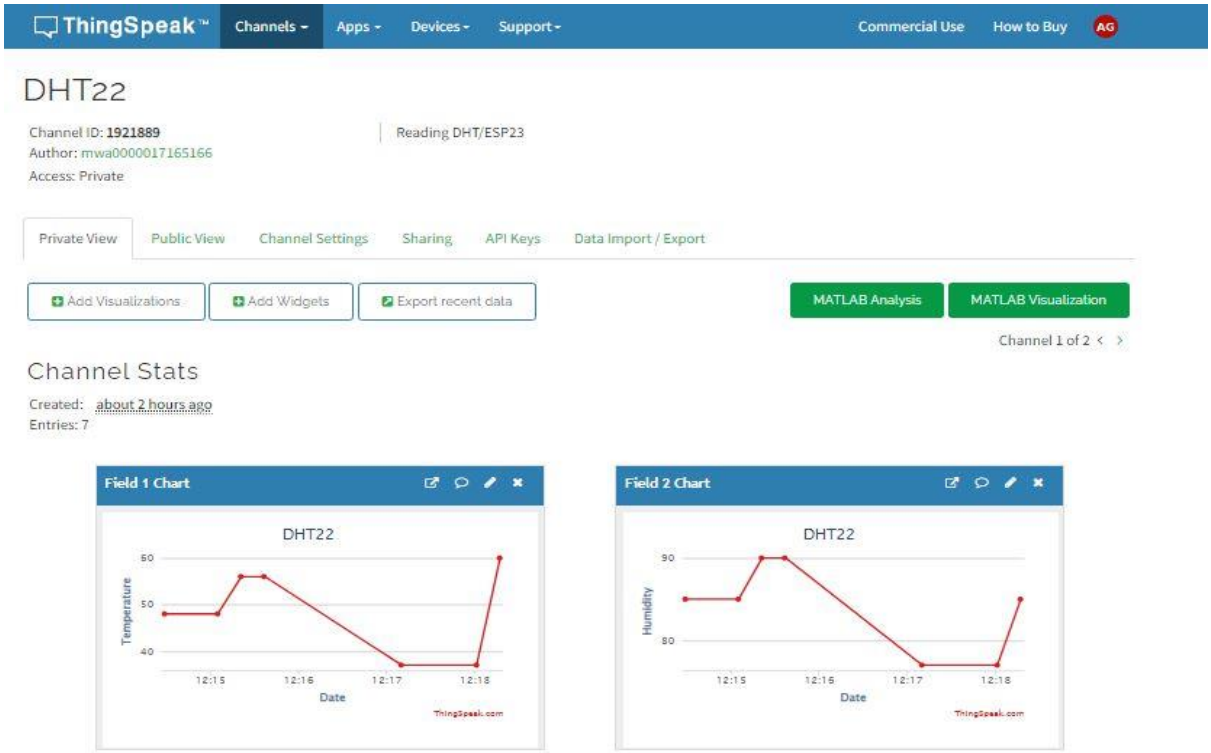
Depending upon the signal from Sensor the it will analysis and plot the graph



Depending upon the signal from Sensor the it will analysis and plot the graph (update in channel)



Depending upon the signal from Sensor the it will analysis and plot the graph



Result : We successfully designed and Developed a cloud based Environment using Thing Speak cloud platform and push the Sensor Data (temperature and Humidity Data) .Cloud platform