Temperature, Humidity and CO2 monitor using thingspeak mqtt

Part 1 - SHT40 and CO2 sensor data to thingspeak

Codes:

Node to BLE kit - https://github.com/Goyalrahul1516/Grasp/tree/main/node_sht_co2

BLE kit to thingspeak mqtt - https://github.com/Goyalrahul1516/Grasp/tree/main/central_node

Modules

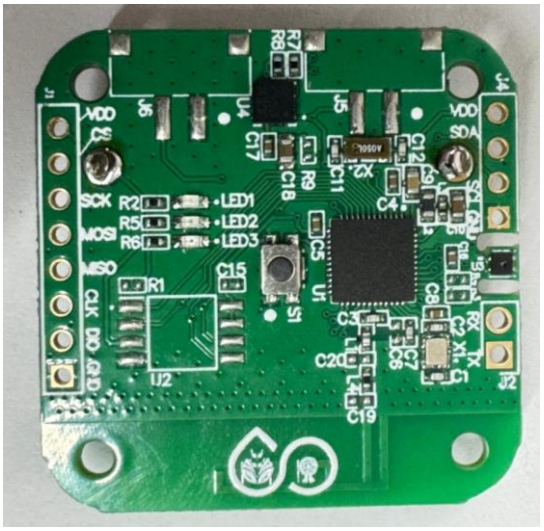


Fig: BLE Node nRF52dk_nRF52832 (SHT40 Embedded)

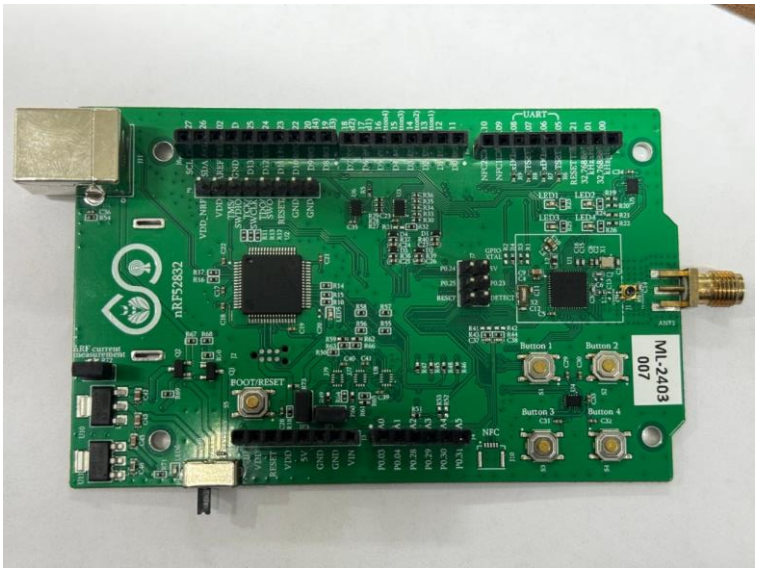


Fig: BLE Kit nRF52dk_nRF52832

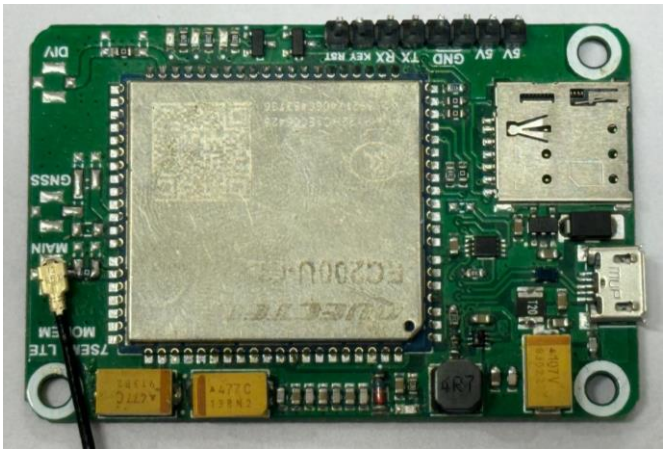


Fig: GSM Module QUECTEL EC200U-CN

Connections

1. **SHT40 and co2 to node**

Node	**SHT40(inbuilt)**
No Connections	
Node	**CO2**
Rx	Tx
Tx	Rx
-----	Gnd (external 5v supply Gnd)
-----	+5v (external supply +5v)

2. **BLE kit to gsm module**

Kit	**GSM**
P0.08	Tx
P0.06	Rx
Gnd	Gnd
----	Vdd (External power supply)

Process

A. For BLE Node
   a. nothing to change in main.c (though you can change the advertising interval of your node)
   b. All configurations are done in prj.conf file
   c. Flash the code
B. For BLE Kit
   a. In main.c change the credentials and channel ID to your thingspeak channel and mqtt device

b. All configurations are done in prj.conf file
c. Flash the code

Thingspeak mqtt publish setup in Central node Observer.c

Fill credentials in observer.c

"AT+QMTCFG=\"recv/mode\",0,0,1\r\n",

"AT+QMTOPEN=0,\"mqtt3.thingspeak.com\",1883\r\n",

"AT+QMTCONN=0,\"<ClientID>\",\"<Username>\",\"<password>\"\r\n"

```
241    // Array of test strings
242    const uint8_t *test_strings[] = {
243        "AT+QMTCFG=\"recv/mode\",0,0,1\r\n",
244        "AT+QMTOPEN=0,\"mqtt3.thingspeak.com\",1883\r\n",
245        "AT+QMTCONN=0,\"KxsxCgMeBiYMJxMgIgk1BDg\",\"KxsxCgMeBiYMJxMgIgk1BDg\",\"j5UcciTBw1jlqc5vVv3k8q50\"\r\n"
246    };
247
```

Fig: Change credentials in observer.c of Central node

Fill channel id in payload

For Single field

AT+QMTPUBEX=0,0,0,0,\"channels/<channelID>/publish/fields/<field_no>\",2\r\ %d \r\n

Eg: “AT+QMTPUBEX=0,0,0,0,\"channels/2345234/publish/fields/field1\",2\r\ %d \r\n”, value

For multi fields

AT+QMTPUBEX=0,0,0,0,\"channels/<channelID>/publish\",<payload_length>\r\nfield1=%d&field2=%d& status=MQTTPUBLISH\r\n

Eg:
AT+QMTPUBEX=0,0,0,0,\"channels/2342344/publish\",68\r\nfield5=%d&field1=%d&field2=%d&field3=%d&field4=%d&status=MQTTPUBLISH\r\n

Here <payload_length> is length of string “field1=%d&field2=%d& status=MQTTPUBLISH” and 68 is the length of “field5=%d&field1=%d&field2=%d&field3=%d&field4=%d&status=MQTTPUBLISH”

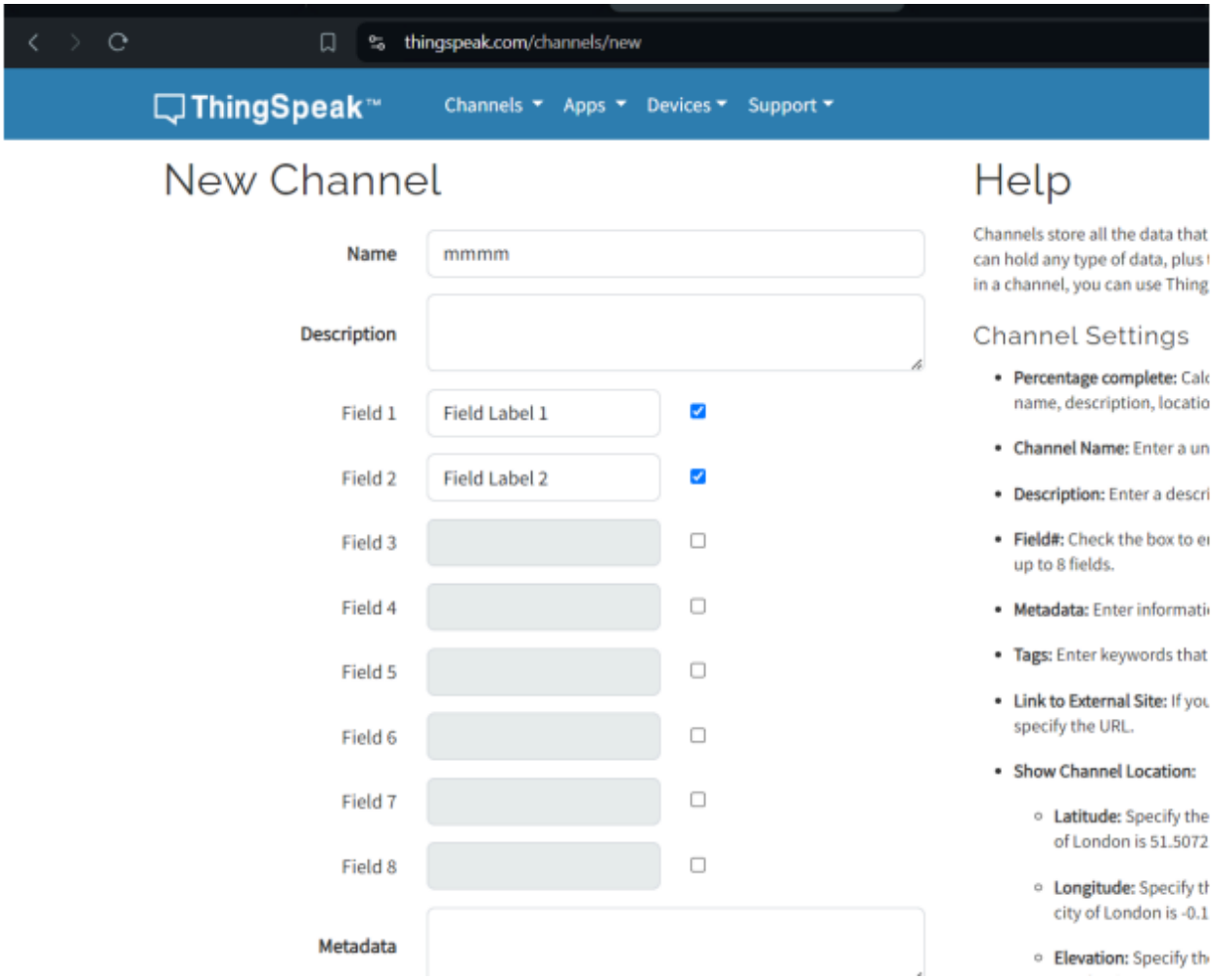
```
char formatted_string[128];
snprintf(formatted_string, sizeof(formatted_string),
        "AT+QMTPUBEX=0,0,0,0,\"channels/2588719/publish\",68\r\nfield5=%d&field1=%d&field2=%d&field3=%d&field4=%d&status=MQTTPUBLISH\r\n",
        write_array[0], write_array[1], write_array[2], write_array[3], write_array[4]
);
```

Fig: Change channel ID in observer.c of central node

Thingspeak setup

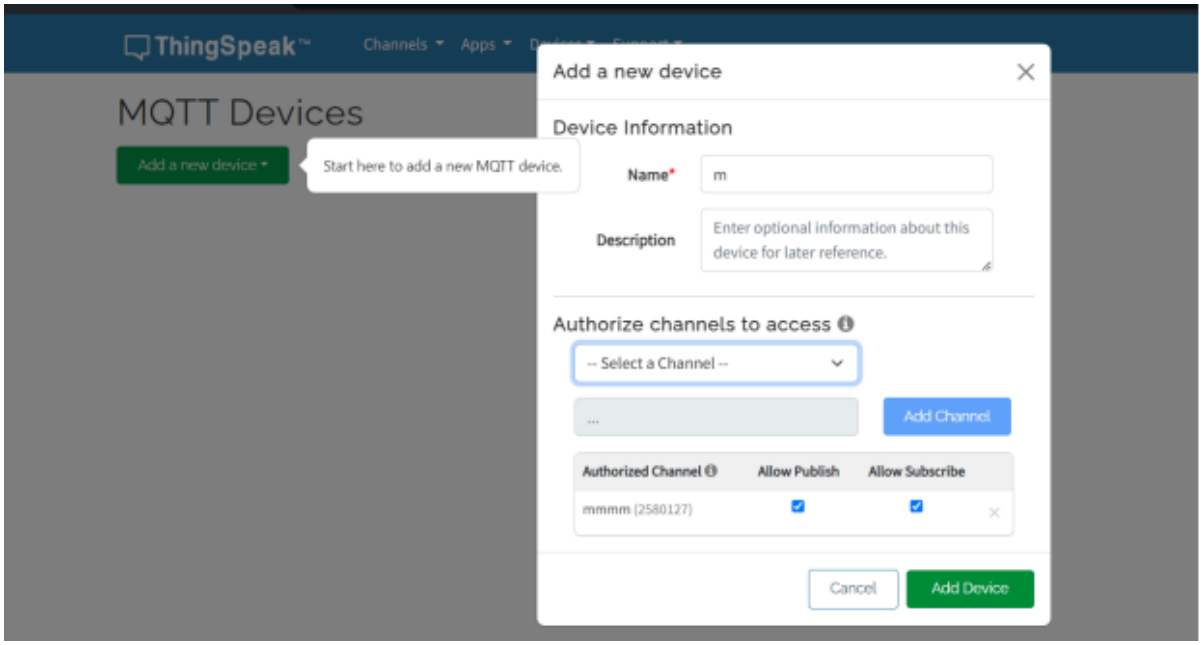
1. SIGNUP to thingspeak using university account if available

2. Create a new channel



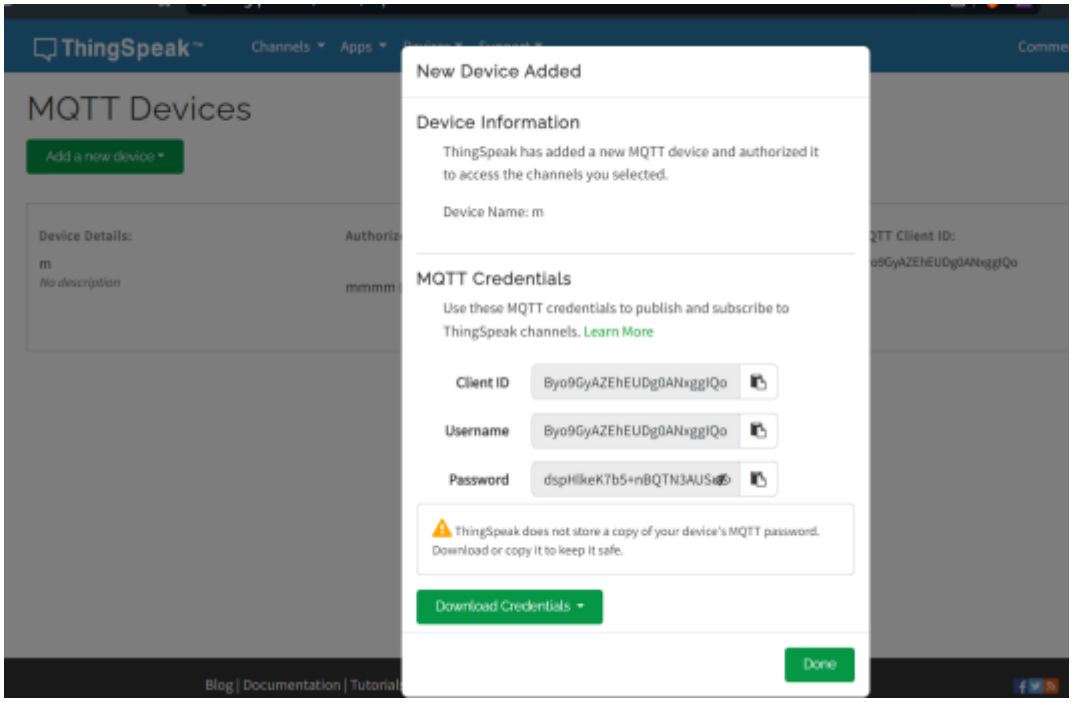
3. Go to devices > MQTT > Create a new device > add this channel to that device

4. Give Publish and subscribe permissions

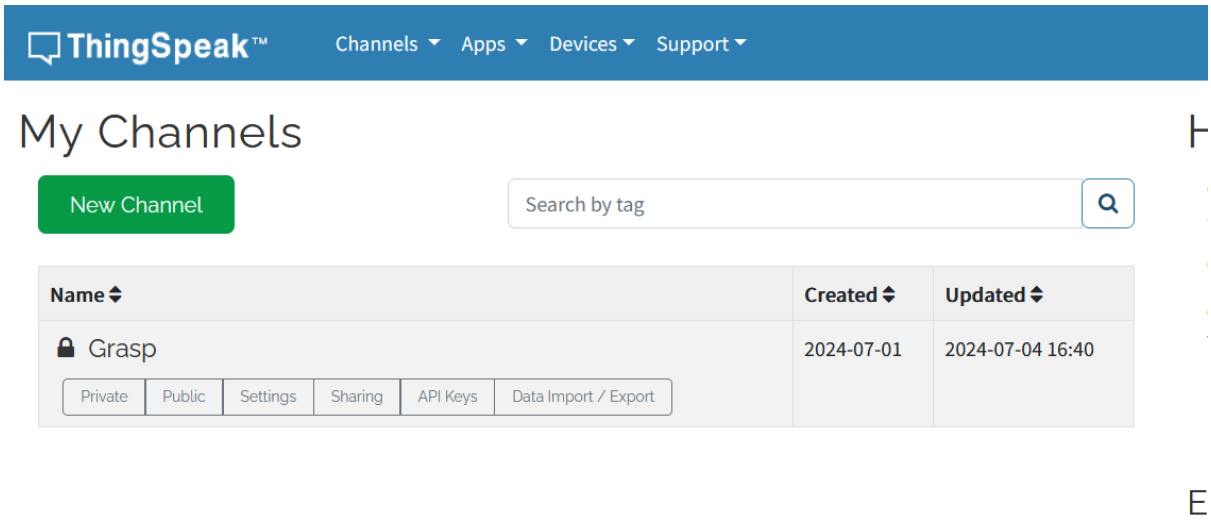


5. After Adding the device , you will get the following credentials , download them.

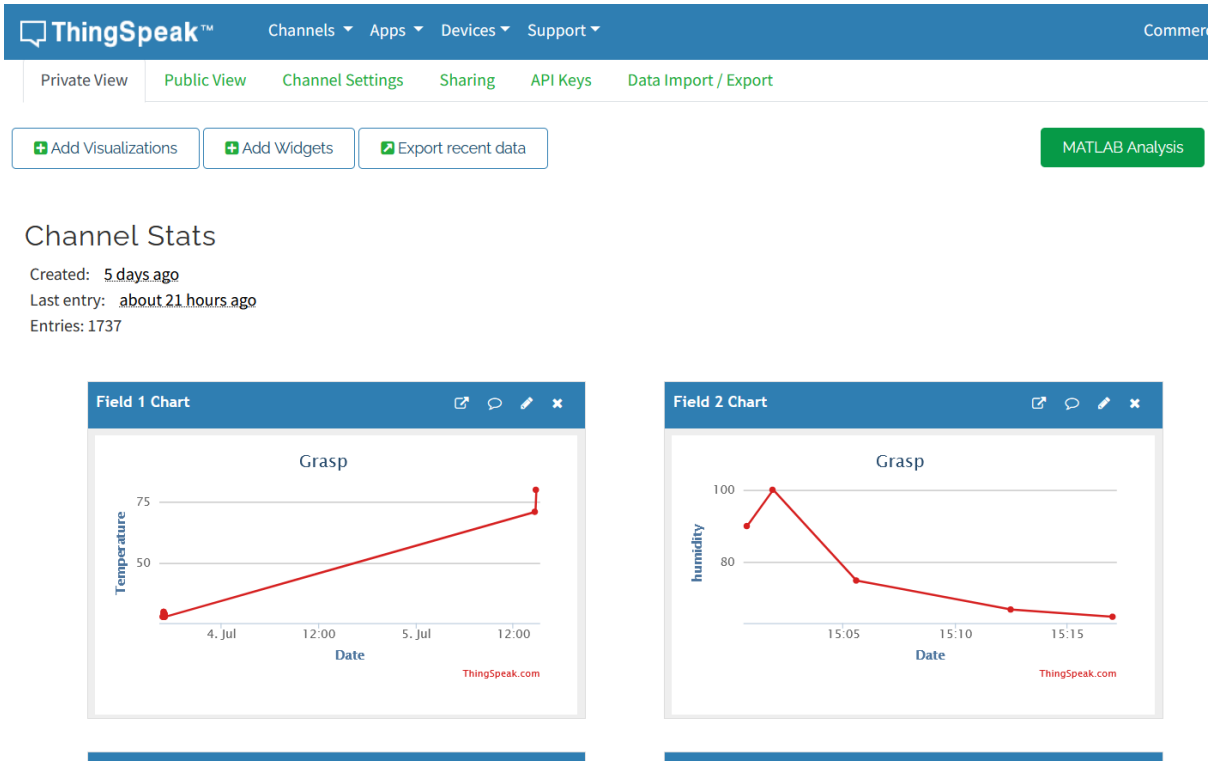
6. These will be used in the AT commands mentioned and similarly in the code



This is how your channel would look like



7. Click on the private button

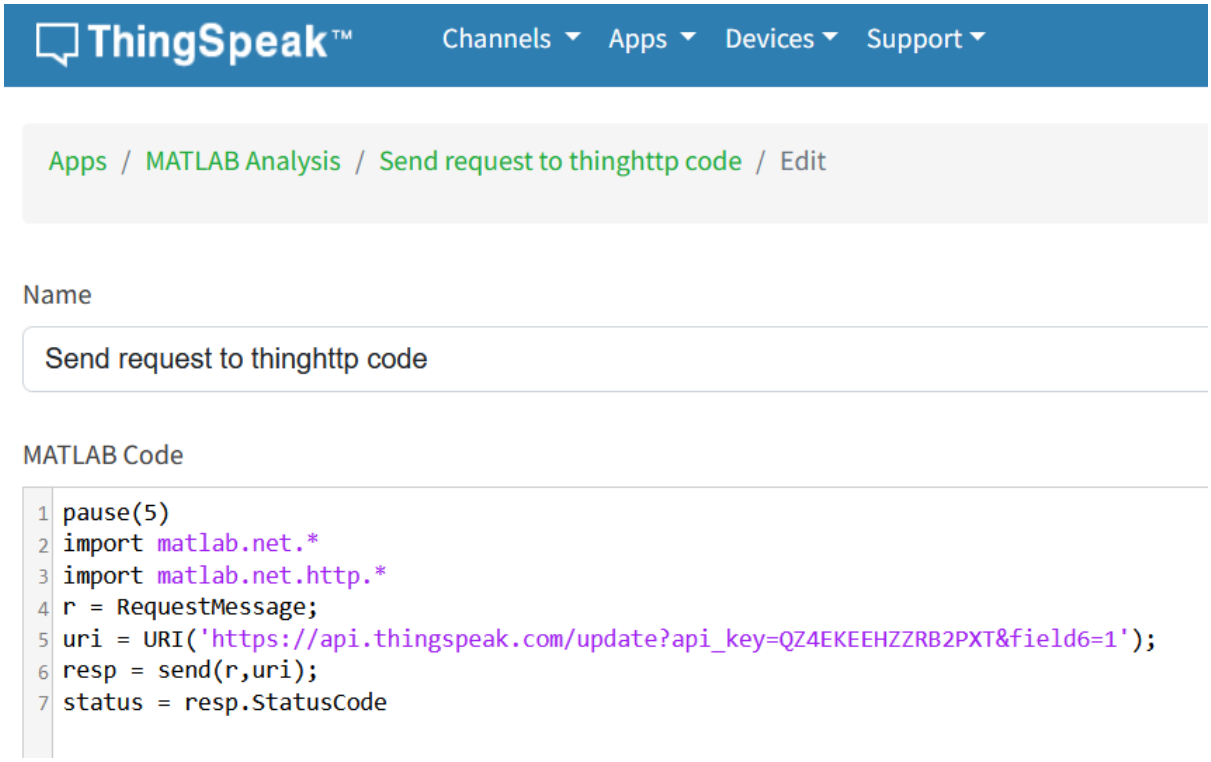


This channel ID will also be used while publishing to MQTT You can add widgets to your dashboard too

Part 2 – Published data analysis

1. **Create a MATLAB analysis script to send back alert/message or any other reaction to the incoming data in fields of channel and save it**

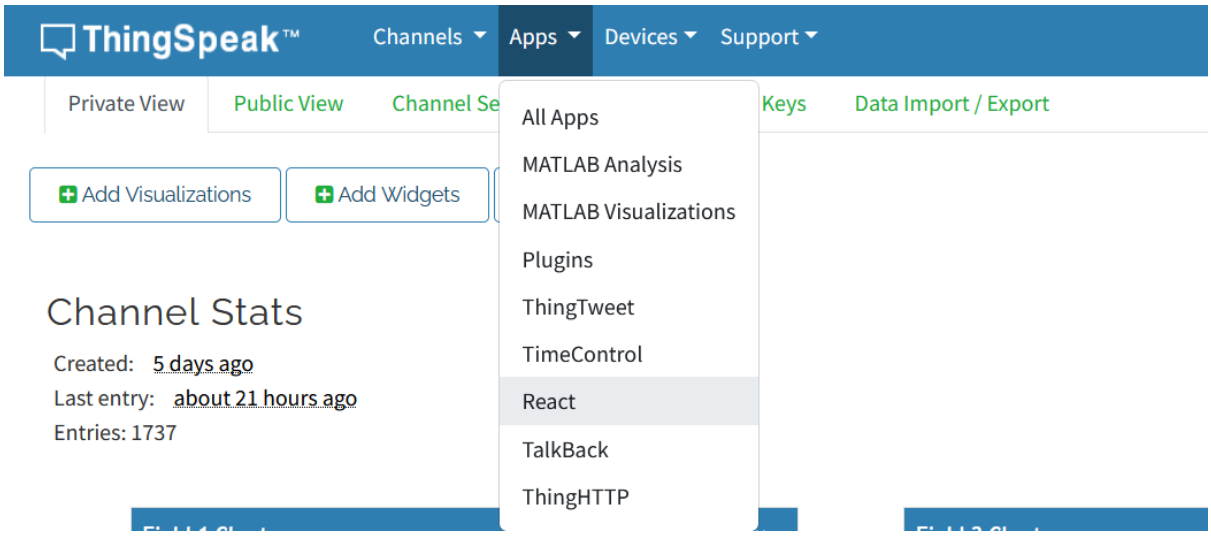
My analysis code



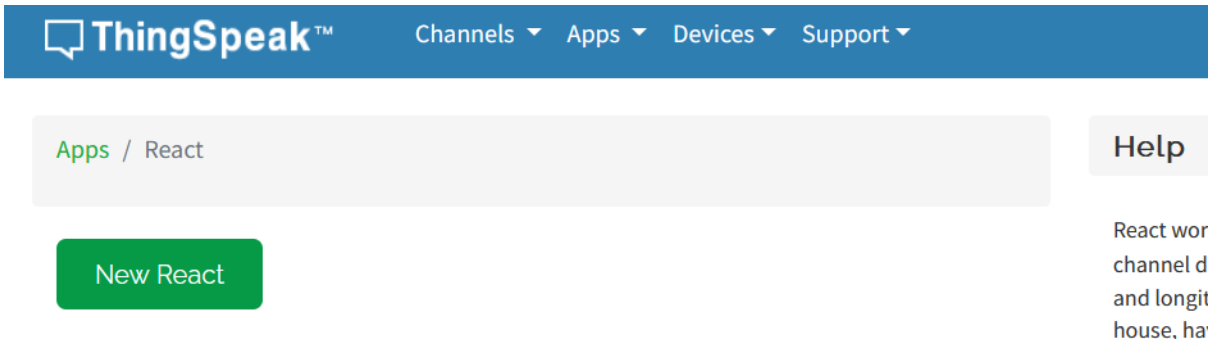
***Note:** You need to learn about read and write Api keys of Thingspeak channels and how they work, in this code the api_key used is a write one which writes data to field number 6 channel*

See this to know more : https://in.mathworks.com/help/thingspeak/matlab-analysis-app.html

2. **Create an event identifier to check incoming data at regular intervals using React app**
   a. Open apps section and choose react

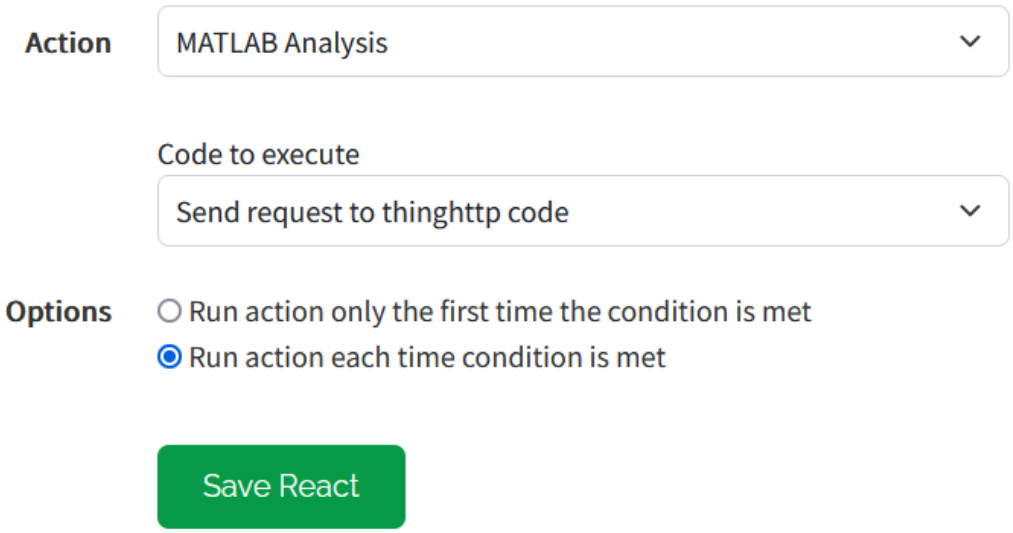


b. Create new react



c. Enter all necessary details for the react app to activate and call the analysis code, then save the app

see this https://in.mathworks.com/help/thingspeak/react-app.html

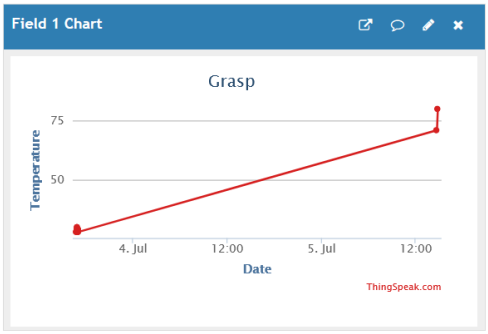


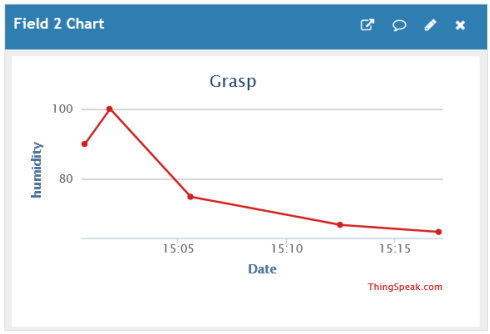
To see data you can

1. **use the visualizations**

Channel Stats

Created: 5 days ago
Last entry: about 21 hours ago
Entries: 1737





2. **Use python script to fetch data and save in csv file**

Code : https://github.com/Goyalrahul1516/Grasp/blob/main/mqtt.py

mqtt.py | thingspeak_data.csv

D:\data_fetch\mqtt.py | data

```
Timestamp,Field1,Field2,Field3,Field4,Field5,Field6,Field7,Field8
2024-07-03 10:51:10 UTC,1668,28,78,4,0,26,
2024-07-03 10:50:55 UTC,1667,29,77,4,0,26,
2024-07-03 10:50:44 UTC,1666,29,76,4,0,26,
2024-07-03 10:50:39 UTC,1665,29,75,4,0,26,
2024-07-03 10:50:34 UTC,1664,30,76,5,0,26,
2024-07-03 10:50:29 UTC,1663,31,79,5,0,26,
2024-07-03 10:49:23 UTC,1662,28,79,4,0,26,
2024-07-03 10:49:18 UTC,1661,28,80,4,0,26,
2024-07-03 10:48:46 UTC,1660,28,79,4,0,26,
2024-07-03 10:48:36 UTC,1659,28,80,4,0,26,
2024-07-03 10:48:31 UTC,1658,28,80,4,86,26,
2024-07-03 10:48:26 UTC,1657,28,80,5,66,26,
2024-07-03 10:48:20 UTC,1656,28,80,5,44,26,
2024-07-03 10:48:15 UTC,1655,28,80,5,0,26,
2024-07-03 10:48:10 UTC,1654,28,80,4,96,26,
2024-07-03 10:48:05 UTC,1653,28,80,4,91,26,
2024-07-03 10:48:00 UTC,1652,28,80,4,90,26,
2024-07-03 10:47:54 UTC,1651,28,80,4,93,26,
2024-07-03 10:47:49 UTC,1650,28,80,4,96,26,
2024-07-03 10:47:44 UTC,1649,28,80,4,95,26,
2024-07-03 10:47:39 UTC,1648,28,80,4,99,26,
2024-07-03 10:47:34 UTC,1647,28,79,4,95,26,
```

3. **Use MATLAB**

Code : https://github.com/Goyalrahul1516/Grasp/blob/main/data_fetch.m

```
Command Window
    03-Jul-2024 16:16:57         28          79           4          90          26         NaN
    03-Jul-2024 16:17:02         28          79           4          89          26         NaN

              :                   :           :           :           :           :           :

    05-Jul-2024 15:05:51        NaN         NaN         NaN         NaN         NaN           1
    05-Jul-2024 15:12:30        NaN          67         NaN         NaN         NaN         NaN
    05-Jul-2024 15:12:46        NaN         NaN         NaN         NaN         NaN           1
    05-Jul-2024 15:17:03        NaN          65         NaN         NaN         NaN         NaN
    05-Jul-2024 15:17:29        NaN         NaN         NaN         NaN         NaN           1

    Display all 100 rows.


timeStamp1 =

  struct with fields:

           ChannelID: 2588719
                Name: 'Grasp'
         Description: 'Temperature, humidity and CO2 data collection'
            Latitude: 30.9692
           Longitude: 76.4732
            Altitude: []
             Created: 01-Jul-2024 09:31:11
             Updated: 04-Jul-2024 16:40:26
        LastEntryID: 1737
    FieldDescriptions: {'Temperature'  'humidity'  'co2'  'co2 decimal'  'Node ID'  'response from analysis'}
             FieldIDs: [1 2 3 4 5 6]
                  URL: 'https://api.thingspeak.com/channels/2588719/feed.json?'

fx >>
```