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IOT- Assignment 3

STEPS:

To develop the cloud-based IoT system, I used the ThingSpeak platform with Python to simulate virtual environmental stations. Here's a breakdown of the steps:

ThingSpeak Channel Setup

- A ThingSpeak channel contained three data fields for Temperature, Humidity and CO2 measurements.
- The system required both the Channel ID and Write API key for MQTT data push functionality.

Virtual Sensor Creation

- Developed a Python script to simulate random sensor data (Temperature: -50 to 50°C, Humidity: 0–100%, CO2: 300–2000 ppm).
- Configured the MQTT client to publish data every 15 seconds to the correct ThingSpeak topic:channels/{channel_id}/publish
- Ensured correct payload formatting (field1=value&field2=value&field3=value) as expected by ThingSpeak.

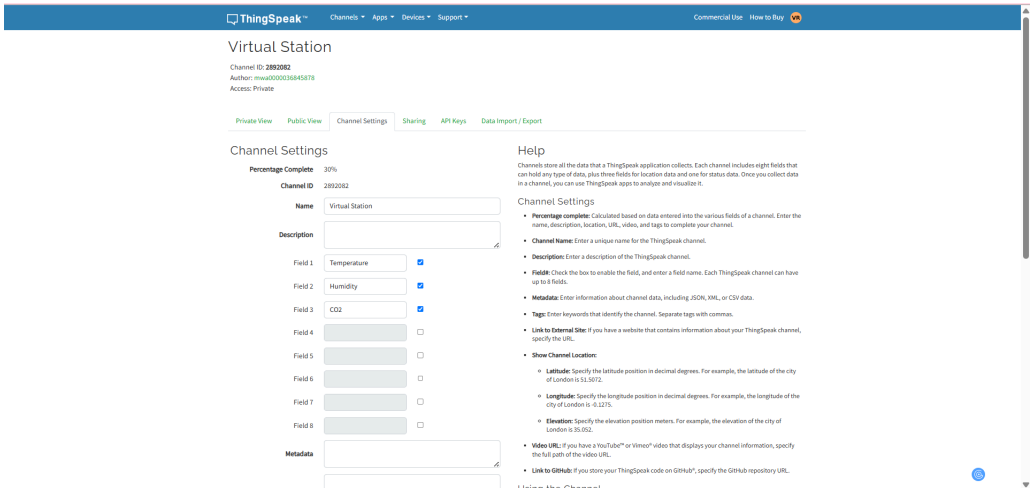
Data Collection and Visualization

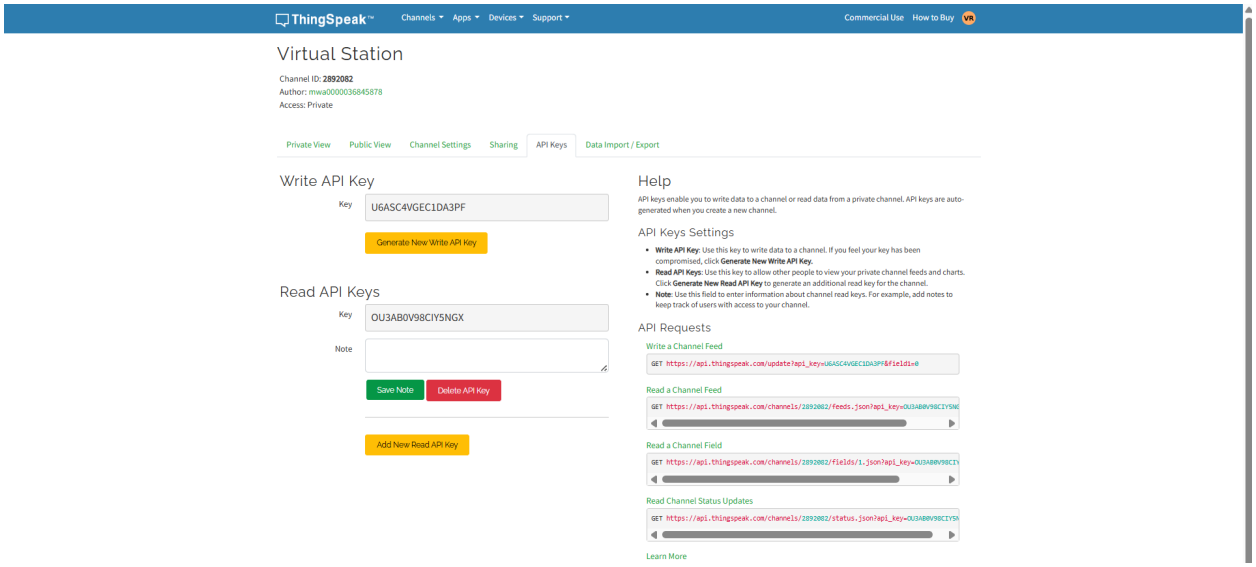
- Sent multiple data points using the API.
- Retrieved sensor values via ThingSpeak's REST API.
- Verified successful data transmission on the ThingSpeak dashboard, where field charts auto-update in real time.
- Implemented a separate visualization script using matplotlib to display time-series plots.

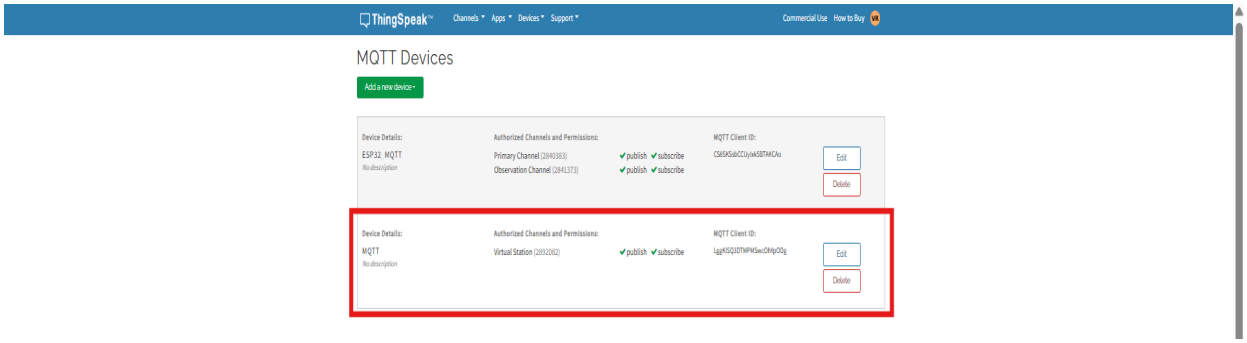
Output & GitHub Submission

- Captured screenshots showing:
  MQTT device configuration
  Live data updates on ThingSpeak
  Field graphs
  Terminal output of published payloads
- Plotted visualizations using matplotlib
- Uploaded code and notebook to GitHub with a structured README.

Screenshots







IOT3.ipynb

File Edit View Insert Runtime Tools Help

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Commands + Code + Text

```
!pip install paho-mqtt
```

```
Collecting paho-mqtt
  Downloading paho_mqtt-2.1.0-py3-none-any.whl.metadata (23 kB)
Downloading paho_mqtt-2.1.0-py3-none-any.whl (67 kB)
   ---------------------------------------- 67.2/67.2 kB 3.0 MB/s eta 0:00:00
Installing collected packages: paho-mqtt
Successfully installed paho-mqtt-2.1.0
```

```
import random
import time
import paho.mqtt.client as mqtt

# MQTT Configuration
channel_id = "2892082"
mqtt_host = "mqtt3.thingspeak.com"
mqtt_port = 1883
mqtt_user = "IggKISQ3DTMPMSwcOhYpODg"
mqtt_password = "FtEId/T+76s9sCBkXCVkf2y9"
client_id = "IggKISQ3DTMPMSwcOhYpODg"
topic = f"channels/{channel_id}/publish"

# ✅ Correct usage of client_id
client = mqtt.Client(client_id=client_id)
client.username_pw_set(mqtt_user, password=mqtt_password)
client.connect(mqtt_host, mqtt_port, 60)

def generate_data():
    temp = round(random.uniform(-50, 50), 2)
    hum = round(random.uniform(0, 100), 2)
    co2 = round(random.uniform(300, 2000), 2)
    return temp, hum, co2

while True:
    temp, hum, co2 = generate_data()
    payload = f"field1={temp}&field2={hum}&field3={co2}"
    client.publish(topic, payload)
    print("Published:", payload)
    time.sleep(15)  # publish every 15 seconds
```

```
<ipython-input-3-5d30aa075456>:15: DeprecationWarning: Callback API version 1 is deprecated, update to latest version
  client = mqtt.Client(client_id=client_id)
Published: field1=-34.81&field2=76.25&field3=1500.85
Published: field1=26.88&field2=62.45&field3=1198.45
Published: field1=19.68&field2=86.13&field3=1551.61
Published: field1=21.63&field2=49.76&field3=1500.7
Published: field1=23.61&field2=10.62&field3=841.6
```

Executing (4m 20s) <cell line: 0>

ThingSpeak™ Channels Apps Devices Support Commercial Use How to Buy

Private View | Public View | Channel Settings | Sharing | API Keys | Data Import / Export

Add Visualizations | Add Widgets | Export recent data | MATLAB Analysis | MATLAB Visualization

Channel 3 of 3

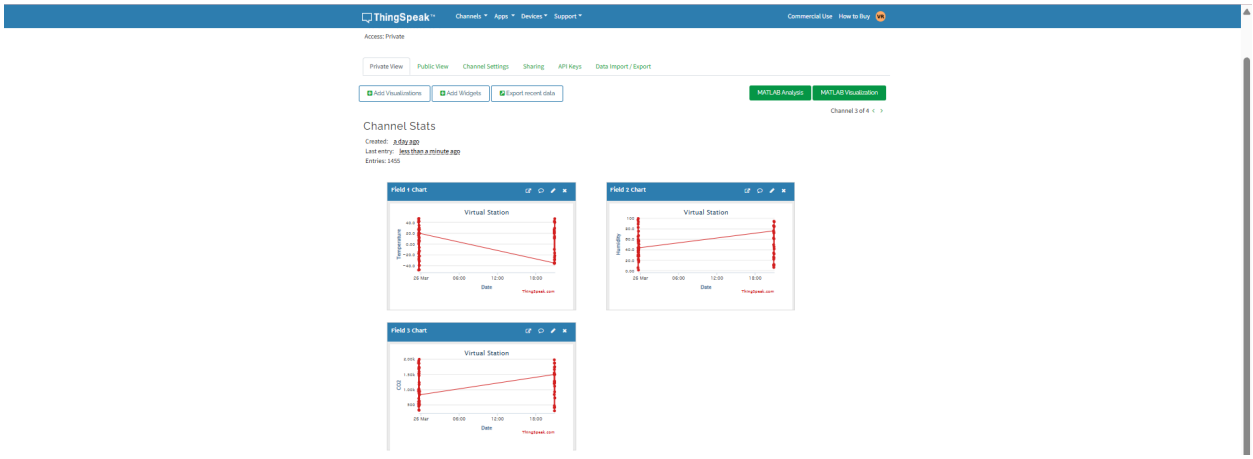
Channel Stats

Created: 14 minutes ago
Last entry: less than a minute ago
Entries: 20

Field 1 Chart

Field 2 Chart

Field 3 Chart



Reflection:

This assignment helped me understand how IoT systems interact with cloud platforms using real-world protocols like MQTT. I found it fascinating to see how a virtual sensor system could stream live data into a web-based dashboard with real-time visualization.

Initially, I encountered an issue with the paho-mqtt client due to a version mismatch, but resolving it helped me better understand Python's evolving libraries. Another challenge was formatting MQTT payloads correctly for ThingSpeak, which I overcame by carefully checking the documentation and payload structure.

Overall, I feel more confident working with IoT data, APIs, and cloud platforms now, and I enjoyed the process of solving real-world problems during this project.

Github:

https://github.com/Vansh3117/IOT_Cloud_Assign3