WOKWI Code:

import network

import time

import urandom

from umqtt.simple import MQTTClient

# ThingSpeak MQTT broker details

mqtt\_client\_id = "Fzw8Ay0wMjkaIgUWMBkhCzk"

mqtt\_user = "Fzw8Ay0wMjkaIgUWMBkhCzk"

mqtt\_password = "YUPZi9BJVykwp+Gsz2xbuDv1"

mqtt\_server = "mqtt3.thingspeak.com"

mqtt\_port = 1883

mqtt\_topic\_temperature = "channels/2488582/publish/fields/field1"

mqtt\_topic\_humidity = "channels/2488582/publish/fields/field2"

mqtt\_topic\_co2 = "channels/2488582/publish/fields/field3"

# Wi-Fi details

WIFI\_SSID = "Wokwi-GUEST"

WIFI\_PASSWORD = ""

# Historical data storage

historical\_data = []

# Function to generate random sensor values

def generate\_sensor\_data():

    temperature = urandom.uniform(-50, 50)

    humidity = urandom.uniform(0, 100)

    # Ensure CO2 value is within the acceptable range (300 to 2000 ppm)

    co2 = urandom.uniform(300, 2000)

    return temperature, humidity, co2

# Function to publish data to ThingSpeak

def publish\_to\_thingspeak(temperature, humidity, co2):

    client = MQTTClient(mqtt\_client\_id, mqtt\_server, user=mqtt\_user, password=mqtt\_password)

    client.connect()

    client.publish(mqtt\_topic\_temperature, str(temperature))

    client.publish(mqtt\_topic\_humidity, str(humidity))

    client.publish(mqtt\_topic\_co2, str(co2))

    client.disconnect()

# Connect to Wi-Fi

sta\_if = network.WLAN(network.STA\_IF)

sta\_if.active(True)

sta\_if.connect(WIFI\_SSID, WIFI\_PASSWORD)

# Wait for Wi-Fi connection

while not sta\_if.isconnected():

    pass

print("Connected to Wi-Fi")

# Main loop to generate and publish sensor data

while True:

    temperature, humidity, co2 = generate\_sensor\_data()

    historical\_data.append((temperature, humidity, co2))  # Store historical data

    if len(historical\_data) > 720:  # Approximately 5 hours with data every 5 seconds

        historical\_data.pop(0)  # Remove oldest data point if exceeds 5 hours

    publish\_to\_thingspeak(temperature, humidity, co2)

    print("Published: Temperature={:.2f}C, Humidity={:.2f}%, CO2={:.2f}ppm".format(temperature, humidity, co2))

    time.sleep(5)  # Adjust the delay as needed (Reduced to 5 seconds for faster data entry)

WOKWI Screenshots:

A computer screen shot of a computer

Description automatically generated

Thingspeak Screenshots:

A screenshot of a computer

Description automatically generated

MATLAB Code:

% Set your ThingSpeak channel ID and read API key

channelID = 2488582;

readAPIKey = 'MPNAS1NNOPSD721K';

% Get the current time and time five hours ago

currentTime = datetime('now', 'TimeZone', 'UTC');

fiveHoursAgo = currentTime - hours(5);

% Set up the ThingSpeak URL for fetching data

url = sprintf('https://api.thingspeak.com/channels/%d/feeds.json?api\_key=%s&start=%s&end=%s', ...

channelID, readAPIKey, datestr(fiveHoursAgo, 'yyyy-mm-ddTHH:MM:SSZ'), ...

datestr(currentTime, 'yyyy-mm-ddTHH:MM:SSZ'));

% Fetch data from ThingSpeak

data = webread(url);

% Extract sensor data

if ~isempty(data.feeds)

sensorData = [data.feeds.field1]; % Assuming the sensor data is in Field 1

timestamps = datetime({data.feeds.created\_at}, 'InputFormat', 'yyyy-MM-dd''T''HH:mm:ss''Z''', 'TimeZone', 'UTC');

% Display sensor data

disp('Sensor Data:');

disp(sensorData);

disp('Timestamps:');

disp(timestamps);

else

disp('No data found in the specified time range.');

end

A screenshot of a computer

Description automatically generated

MATLAB output:

Sensor Data:

27.5504241.174359.112859-34.40225-26.78329-12.933247.541168-10.8920829.54958-23.66084-41.6596537.85606-2.159023-19.96767-27.66344-10.47438-21.32213-9.1738225.218029-20.98063-40.8530513.953888.23007812.7586742.41808-7.04966823.69806-37.92054-25.1162525.832390.09102821-17.1399523.8016538.72827-3.24143220.3617723.32346-47.482434.03074-36.33099-10.287522.18366-5.2284365.322635

Timestamps:

Columns 1 through 8

27-Mar-2024 21:48:32 27-Mar-2024 21:49:48 27-Mar-2024 21:49:54 27-Mar-2024 21:50:00 27-Mar-2024 21:50:06 27-Mar-2024 21:50:12 27-Mar-2024 21:50:18 27-Mar-2024 21:50:24

Columns 9 through 16

27-Mar-2024 21:50:30 27-Mar-2024 21:50:38 27-Mar-2024 21:50:45 27-Mar-2024 21:50:51 27-Mar-2024 21:50:58 27-Mar-2024 21:51:04 27-Mar-2024 21:51:10 27-Mar-2024 21:51:16

Columns 17 through 24

27-Mar-2024 21:51:22 27-Mar-2024 21:51:29 27-Mar-2024 21:51:38 27-Mar-2024 21:53:19 27-Mar-2024 21:53:25 27-Mar-2024 21:54:46 27-Mar-2024 21:54:52 27-Mar-2024 21:55:27

Columns 25 through 32

27-Mar-2024 21:55:33 27-Mar-2024 21:55:39 27-Mar-2024 21:55:45 27-Mar-2024 21:55:51 27-Mar-2024 21:55:58 27-Mar-2024 21:56:04 27-Mar-2024 21:56:10 27-Mar-2024 21:56:16

Columns 33 through 40

27-Mar-2024 21:56:23 27-Mar-2024 21:56:29 27-Mar-2024 21:56:35 27-Mar-2024 21:56:41 27-Mar-2024 21:56:47 27-Mar-2024 21:56:53 27-Mar-2024 21:56:59 27-Mar-2024 21:57:06

Columns 41 through 48

27-Mar-2024 21:57:12 27-Mar-2024 21:57:18 27-Mar-2024 21:57:27 27-Mar-2024 21:57:32 27-Mar-2024 21:57:54 27-Mar-2024 21:58:00 27-Mar-2024 21:59:30 27-Mar-2024 21:59:46

Columns 49 through 56

27-Mar-2024 22:00:52 27-Mar-2024 22:00:59 27-Mar-2024 22:01:04 27-Mar-2024 22:02:00 27-Mar-2024 22:02:06 27-Mar-2024 22:02:19 27-Mar-2024 22:02:24 27-Mar-2024 22:03:06

Columns 57 through 64

27-Mar-2024 22:03:13 27-Mar-2024 22:03:19 27-Mar-2024 22:03:25 27-Mar-2024 22:03:31 27-Mar-2024 22:03:37 27-Mar-2024 22:03:43 27-Mar-2024 22:03:49 27-Mar-2024 22:03:55

Columns 65 through 72

27-Mar-2024 22:04:02 27-Mar-2024 22:04:07 27-Mar-2024 22:04:13 27-Mar-2024 22:04:19 27-Mar-2024 22:04:26 27-Mar-2024 22:04:32 27-Mar-2024 22:04:38 27-Mar-2024 22:04:44

Columns 73 through 80

27-Mar-2024 22:04:50 27-Mar-2024 22:04:57 27-Mar-2024 22:05:03 27-Mar-2024 22:05:09 27-Mar-2024 22:05:15 27-Mar-2024 22:05:22 27-Mar-2024 22:05:28 27-Mar-2024 22:05:34

Columns 81 through 88

27-Mar-2024 22:05:40 27-Mar-2024 22:05:46 27-Mar-2024 22:05:53 27-Mar-2024 22:05:59 27-Mar-2024 22:06:07 27-Mar-2024 22:06:13 27-Mar-2024 22:06:19 27-Mar-2024 22:06:25

Columns 89 through 96

27-Mar-2024 22:06:31 27-Mar-2024 22:06:37 27-Mar-2024 22:06:43 27-Mar-2024 22:06:49 27-Mar-2024 22:06:55 27-Mar-2024 22:07:01 27-Mar-2024 22:07:07 27-Mar-2024 22:07:13

Columns 97 through 104

27-Mar-2024 22:22:45 27-Mar-2024 22:22:51 27-Mar-2024 22:22:57 27-Mar-2024 22:23:03 27-Mar-2024 22:23:09 27-Mar-2024 22:23:15 27-Mar-2024 22:23:21 27-Mar-2024 22:58:07

Columns 105 through 106

27-Mar-2024 22:58:13 27-Mar-2024 22:58:21