Experiment No 05

AIM

To design and implement a cloud-based temperature and humidity monitoring system using a Raspberry Pi Pico W, DHT22 sensor, and ThingSpeak IoT platform.

THEORY

The Internet of Things (IoT) enables physical devices to collect and share data over the internet. Environmental monitoring (temperature and humidity) is one of the most common IoT applications.

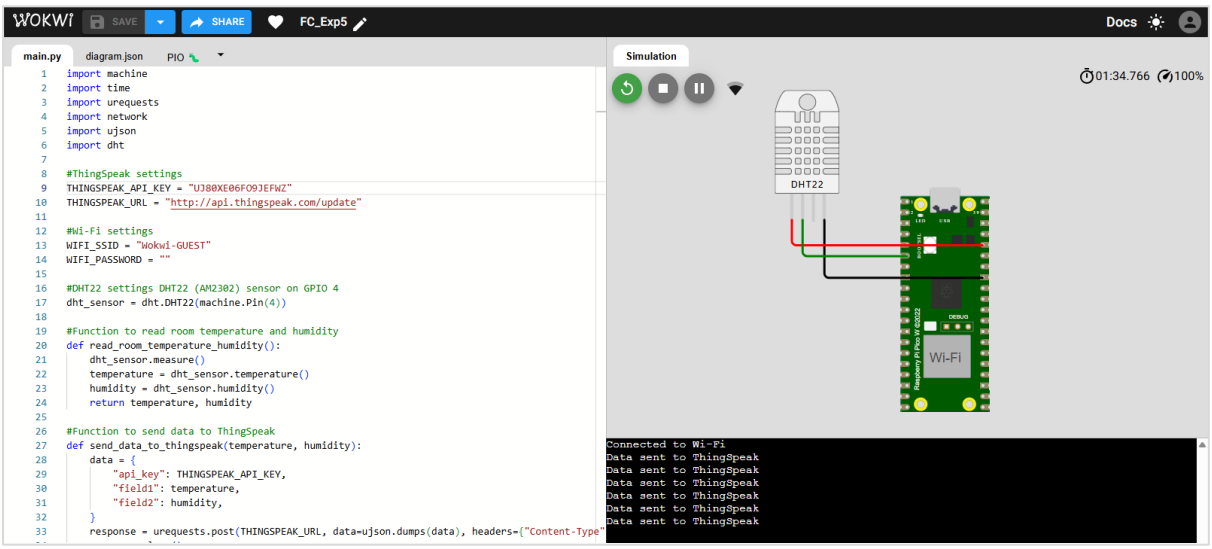
In this practical, a DHT22 (AM2302) sensor is used to measure room temperature and humidity. The Raspberry Pi Pico W processes this data and connects to Wi-Fi. Using HTTP POST requests, the data is sent to the ThingSpeak cloud platform.

ThingSpeak allows real-time data visualization, storage, and analysis through charts, which can be accessed anywhere via the internet. This demonstrates how IoT integrates sensors, microcontrollers, networking, and cloud platforms for smart applications.

PROCEDURE

1. Hardware Setup

- Connect the DHT22 sensor to the Raspberry Pi Pico W:
  - VCC → 3.3V
  - Data → GPIO 4
  - GND → GND



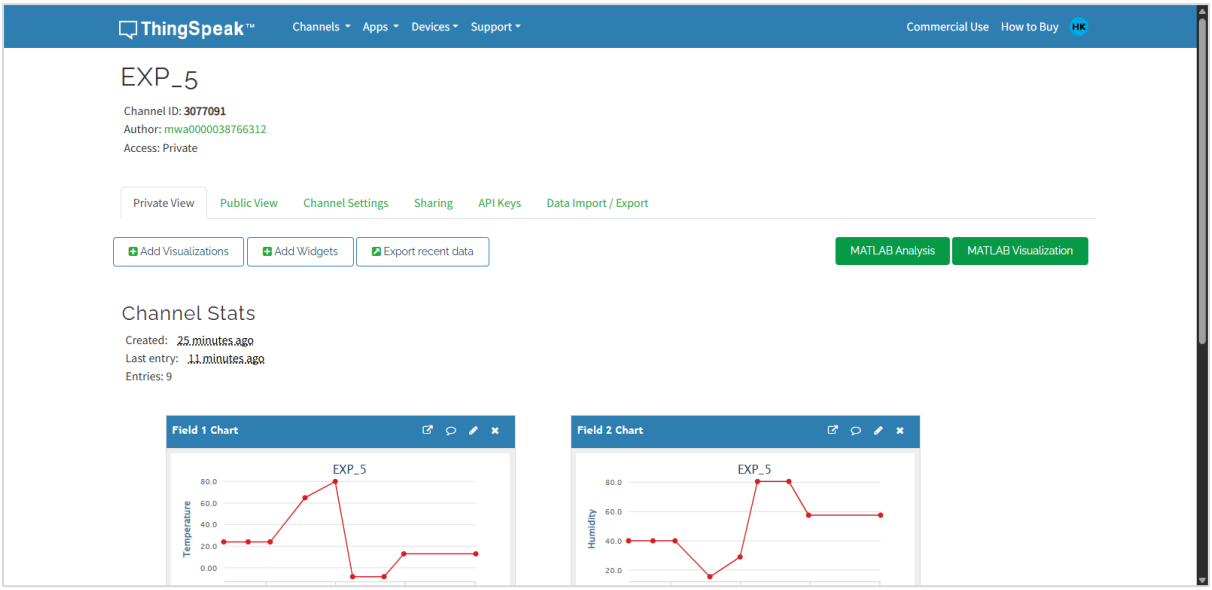
2. **Software Setup**
   - Install MicroPython firmware on Raspberry Pi Pico W.
   - Use **Thonny IDE** to write and upload Python code.
   - Install required MicroPython libraries (urequests, ujson, dht).
3. **ThingSpeak Setup**
   - Create a ThingSpeak account at https://thingspeak.com.
   - Create a new channel with two fields: **Temperature** and **Humidity**.
   - Copy the **Write API Key** for use in the code.
4. **Programming the Pico W**
   - Configure Wi-Fi credentials and ThingSpeak API key in the code.
   - Read data from the DHT22 sensor.
   - Send data to ThingSpeak every few seconds.
5. **Execution**
   - Upload the program to the Pico W.
   - Monitor serial output to confirm Wi-Fi connection and data transmission.
   - View live graphs on ThingSpeak dashboard.

STEPS

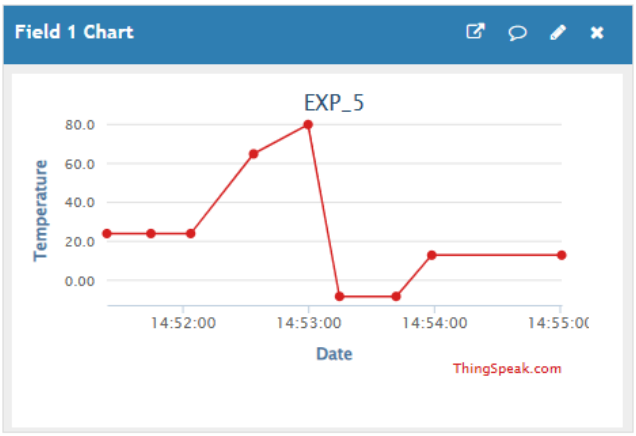
1. Connect hardware components properly.
2. Power on the Raspberry Pi Pico W.
3. Open Thonny IDE and run the MicroPython code.
4. Wait until "Connected to Wi-Fi" message appears.
5. Observe serial output: Temperature and Humidity readings being sent.
6. Open ThingSpeak channel and confirm live data graphs.

OUTPUT

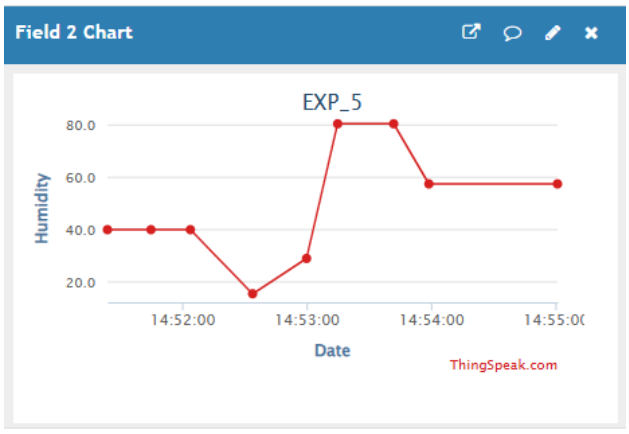
- Serial Monitor:



- ThingSpeak Dashboard:
  - **Field 1 (Temperature)**: Real-time line graph.



  - **Field 2 (Humidity)**: Real-time line graph.



CONCLUSION

The experiment successfully demonstrates how an IoT-based system can monitor environmental parameters (temperature and humidity) and upload them to a cloud platform in real time. The use of Raspberry Pi Pico W and DHT22 sensor with ThingSpeak provides a low-cost, efficient solution for cloud-based environmental monitoring, which can be extended to applications like smart homes, agriculture, and weather stations.