

Project Summary

In this project we implemented a networked system consisting of 1 temperature sensor, 1 humidity sensor, 1 gateway and 1 server. The sensors connected to the gateway and sent information to the gateway. The gateway connected to the server and after monitoring the activity of the sensors, it sent the information to the server. On the server, the information received was printed on the console and displayed on 2 HTTP servers. We decided to use Python and the socket library for this project.

Our Solution Approach

We started with research about:

- Socket library in Python,
- TCP and UDP sensors,
- How to create a gateway and a server,
- What are the properties of the gateway and server?
- How can we send received data from server to http's?

After gathering some information, we decided to build a temperature sensor and a humidity sensor. The reason was that they were easier to implement than a gateway and a server. Once we were sure that the sensors were working correctly, we started to think 'how do we design a gateway'. After some research, we started to design our gateway step by step. First, we connected the temperature sensor to the gateway and when it was working correctly, we connected the humidity sensor to the gateway. Then we started researching and designing a server. When we connect the server to the gateway, we add some properties to the gateway and the server. The properties were the "TEMP OFF" signal when the temperature sensor does not send new messages after 3 seconds, "HUMIDITY OFF" signal when the humidity sensor does not send "ALIVE" message after 7 seconds, and HTTP to show the temperature and humidity sensors in a web page.

Encountered Problems and Solutions

We handle the "TEMP OFF" signal in a simple way. But when we tried the same method with the humidity sensor, it didn't work. The possible reason was that the humidity sensor sends 2 different messages to the gateway. When we check the elapsed time using the last message, the other message updates it and we can't get the time right. So we searched and found a new solution which was the `settimeout(7)` method. This method cancels the humidity sensor and at the end of the "HUMIDITY OFF" message sent to the gateway. Also, we firstly handle the HTTP server with `http` module in Python, but that was forbidden, so we tried to figure how can we handle that and found the solution by researching some resources.

Unresolved Issues

We couldn't achieve the bonus part. We tried some methods but if we can't store the last value on the sensor, our methods can't send the value to the gateway.

Usage Explanation

In our project solution, there are 4 different python files which are "temp.py, humidity.py, gateway.py, server.py".

The usage is as given:

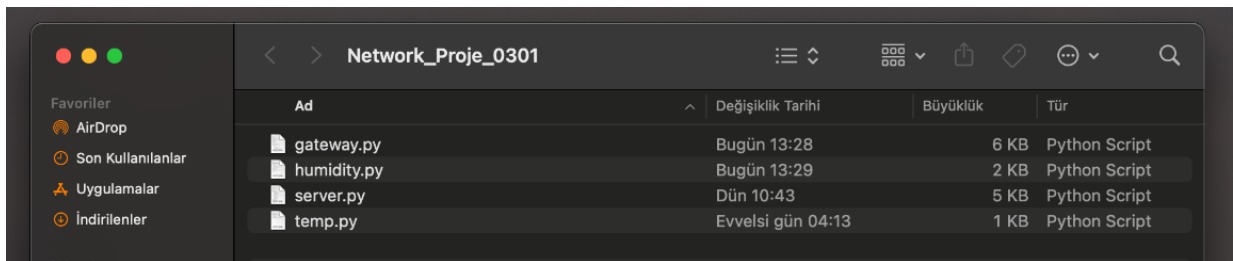
- Run the server.py
- Run the gateway.py
- Run the humidity.py
- Run the temp.py

When all the files are running go and see results on "<http://localhost:8080/humidity>" for humidity values and "<http://localhost:8080/temperature>" for the temperature values. Also, the values printed to the console. In the project file, there will be log files created for each python file. You can check it too.

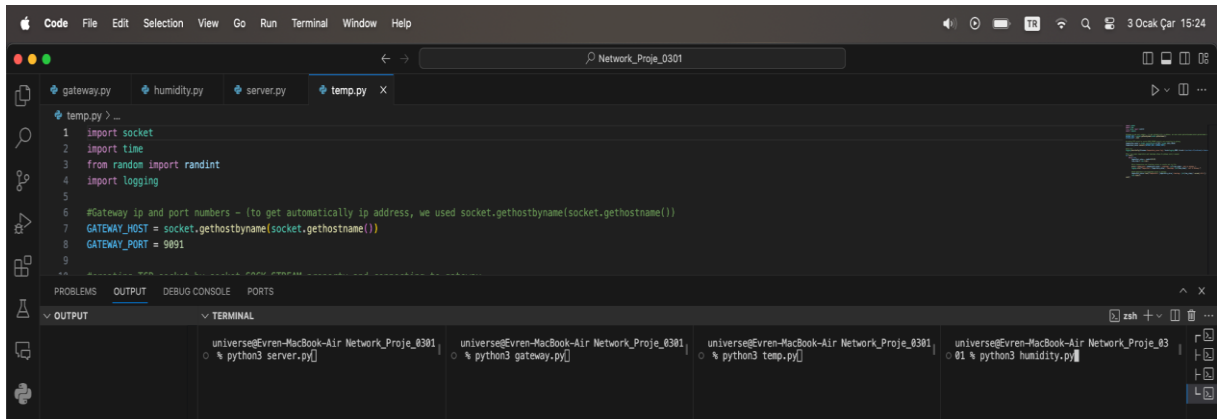
Details of Protocol (Between Server-Gateway)

On the server we receive the messages from the gateway. If the received message starts with "temperature" or "TEMP", it is stored in a global array named temperature_data, and if the received message starts with "humidity" or "HUM", it is stored in a global array named humidity_data, it is stored in a global array called humidity_data. After storing these received messages in arrays, we sent them to the HTTP according to "GET temperature" or "GET humidity" responses.

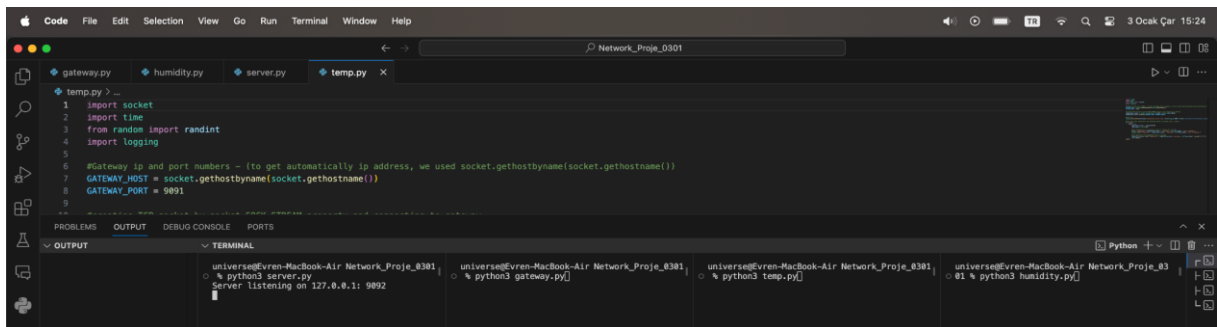
Screenshots



1- Initial Folder



2- Console Commands



3- Run the Server

The screenshot shows the VS Code editor with the file `gateway.py` selected. The code defines a server that listens on `127.0.0.1:9892` and `127.0.0.1:9893`. It uses `socket.gethostname()` to get the IP address. The terminal output shows the server starting and accepting connections on both ports. The handshake is successful on both ports.

```
1 import socket
2 import time
3 from random import randint
4 import logging
5
6 #Gateway ip and port numbers - (to get automatically ip address, we used socket.gethostname(socket.gethostname()))
7 GATEWAY_HOST = socket.gethostname(socket.gethostname())
8 GATEWAY_PORT = 9891
9
```

Terminal Output:

```
universe@Eren-MacBook-Air Network_Proje_0301
% python3 gateway.py
Server listening on 127.0.0.1: 9892
Accepted connection from Gateway on: ('127.0.0.1', 50275)
Handshake successful
Listening Temperature sensor on 127.0.0.1 PORT: 9893
Listening Humidity Sensor on 127.0.0.1 PORT: 9898
```

4- Run the Gateway

The screenshot shows the VS Code editor with the file `gateway.py` selected. The code defines a server that listens on `127.0.0.1:9892` and `127.0.0.1:9893`. It uses `socket.gethostname()` to get the IP address. The terminal output shows the server starting and accepting connections on both ports. The handshake is successful on both ports. The server then receives data from the gateway and sends it to the humidity sensor.

```
1 import socket
2 import time
3 from random import randint
4 import logging
5
6 #Gateway ip and port numbers - (to get automatically ip address, we used socket.gethostname(socket.gethostname()))
7 GATEWAY_HOST = socket.gethostname(socket.gethostname())
8 GATEWAY_PORT = 9891
9
```

Terminal Output:

```
universe@Eren-MacBook-Air Network_Proje_0301
% python3 gateway.py
Server listening on 127.0.0.1: 9892
Accepted connection from Gateway on: ('127.0.0.1', 50275)
Handshake successful
Received data from Gateway: ALIVE - timestamp: 1784284789
Received data from Gateway: humidity: 85 - timestamp: 1784284789
Received data from Gateway: humidity: 85 - timestamp: 1784284789
Sent humidity sensor data to server: ALIVE - timestamp: 1784284789
Received data from humidity sensor: humidity: 85 - timestamp: 1784284789
Sent humidity sensor data to server: humidity: 85 - timestamp: 1784284789
```

5- Run the Humidity Sensor

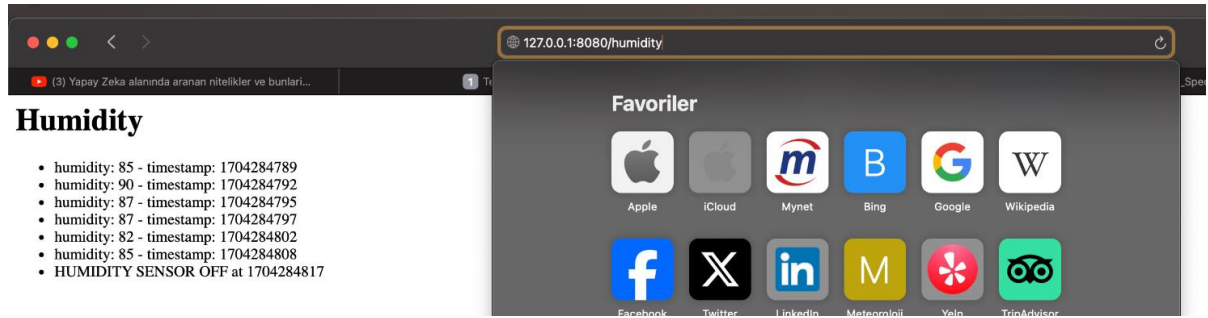
The screenshot shows the VS Code editor with the file `humidity.py` selected. The code defines a sensor that sends data to the gateway. The terminal output shows the sensor starting and sending data to the gateway. The data is received by the gateway and sent to the humidity sensor.

```
1 import socket
2 import time
3 from random import randint
4 import logging
5
6 #Gateway ip and port numbers - (to get automatically ip address, we used socket.gethostname(socket.gethostname()))
7 GATEWAY_HOST = socket.gethostname(socket.gethostname())
8 GATEWAY_PORT = 9891
9
```

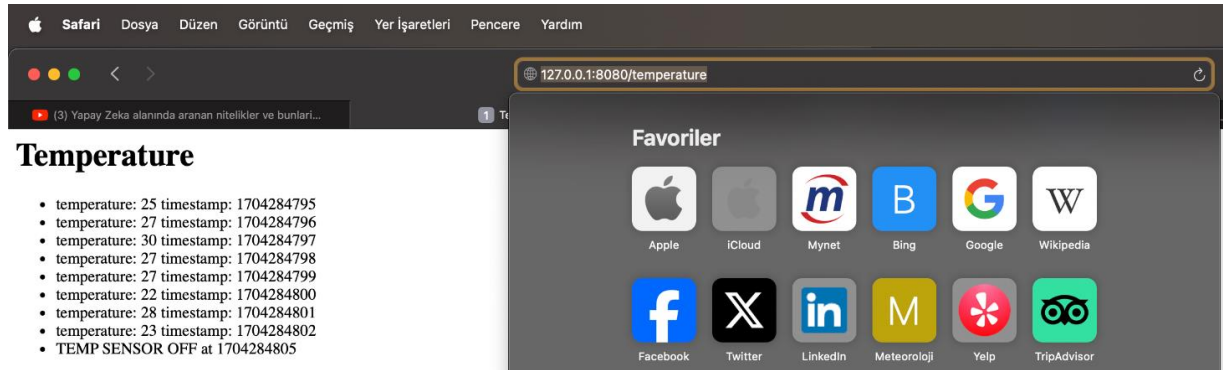
Terminal Output:

```
universe@Eren-MacBook-Air Network_Proje_0301
% python3 humidity.py
Humidity: 85 - timestamp: 1784284789
ALIVE message sent to Gateway at 1784284789
Humidity value -85- exceed 80. Sent to Gateway.
Humidity: 50 - timestamp: 1784284791
Humidity: 41 - timestamp: 1784284791
ALIVE message sent to Gateway at 1784284792
Humidity value -90- exceed 80. Sent to Gateway.
Humidity: 50 - timestamp: 1784284793
Humidity: 53 - timestamp: 1784284794
ALIVE message sent to Gateway at 1784284795
Humidity: 87 - timestamp: 1784284795
Humidity value -87- exceed 80. Sent to Gateway.
Humidity: 79 - timestamp: 1784284796
Humidity: 87 - timestamp: 1784284797
Humidity value -87- exceed 80. Sent to Gateway.
% python3 temp.py
Temperature: 25 - timestamp: 1784284795
ALIVE message sent to Gateway at 1784284795
Temperature: 27 - timestamp: 1784284796
Temperature: 27 - timestamp: 1784284796
Sent temperature sensor data to server: temperature: 25 timestamp: 1784284795
Received data from temperature sensor: temperature: 25 timestamp: 1784284795
Sent temperature sensor data to server: temperature: 27 timestamp: 1784284796
Received data from humidity sensor: humidity: 87 - timestamp: 1784284797
Sent humidity sensor data to server: humidity: 87 - timestamp: 1784284797
```

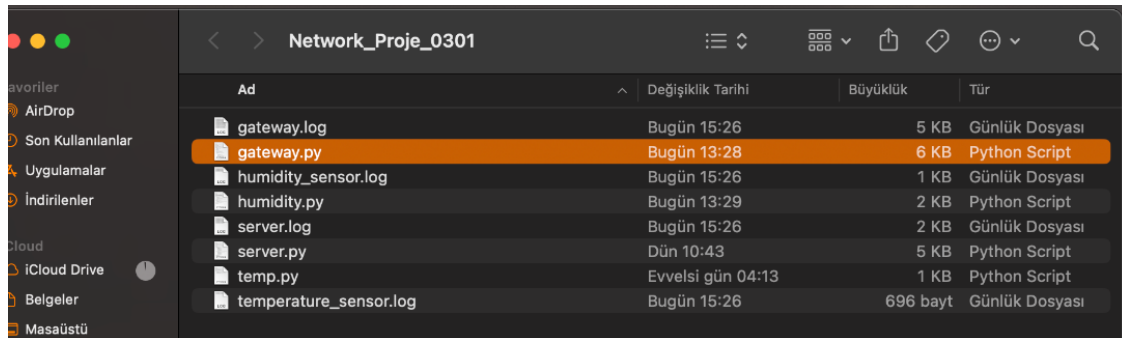
6- Run the Temperature Sensor



9- See the Results from localhost:8080/humidity



10- See the Results from localhost:8080/temperature



11- Log Files Created


```
gateway.log
Göster Şimdi Sil Yeniden Yükle Paylaş
2024-01-03 15:26:27,391:INFO:Handshake successful.
2024-01-03 15:26:27,391:INFO:Listening Temperature sensor on 127.0.0.1 PORT: 9091
2024-01-03 15:26:27,391:INFO:Listening Humidity Sensor on 127.0.0.1 PORT: 9090
2024-01-03 15:26:29,009:INFO:Connected with humidity sensor on ('127.0.0.1', 8070)
2024-01-03 15:26:29,009:INFO:Received data from humidity sensor: ALIVE - timestamp:1704284789
2024-01-03 15:26:29,009:INFO:Sent humidity sensor data to server: ALIVE - timestamp:1704284789
2024-01-03 15:26:29,009:INFO:Received data from humidity sensor: humidity: 85 - timestamp: 1704284789
2024-01-03 15:26:29,009:INFO:Sent humidity sensor data to server: humidity: 85 - timestamp: 1704284789
2024-01-03 15:26:32,014:INFO:Received data from humidity sensor: ALIVE - timestamp:1704284792
2024-01-03 15:26:32,015:INFO:Sent humidity sensor data to server: ALIVE - timestamp:1704284792
2024-01-03 15:26:32,024:INFO:Received data from humidity sensor: humidity: 90 - timestamp: 1704284792
2024-01-03 15:26:32,024:INFO:Sent humidity sensor data to server: humidity: 90 - timestamp: 1704284792
2024-01-03 15:26:35,015:INFO:Received data from humidity sensor: ALIVE - timestamp:1704284795
2024-01-03 15:26:35,015:INFO:Sent humidity sensor data to server: ALIVE - timestamp:1704284795
2024-01-03 15:26:35,039:INFO:Received data from humidity sensor: humidity: 87 - timestamp: 1704284795
2024-01-03 15:26:35,039:INFO:Sent humidity sensor data to server: humidity: 87 - timestamp: 1704284795
2024-01-03 15:26:35,619:INFO:Connected with temperature sensor on('127.0.0.1', 50277)
2024-01-03 15:26:35,619:INFO:Received data from temperature sensor: temperature: 25 timestamp: 1704284795
2024-01-03 15:26:35,619:INFO:Sent temperature sensor data to server: temperature: 25 timestamp: 1704284795
2024-01-03 15:26:36,624:INFO:Received data from temperature sensor: temperature: 27 timestamp: 1704284796
2024-01-03 15:26:36,625:INFO:Sent temperature sensor data to server: temperature: 27 timestamp: 1704284796
2024-01-03 15:26:37,046:INFO:Received data from humidity sensor: humidity: 87 - timestamp: 1704284797
2024-01-03 15:26:37,046:INFO:Sent humidity sensor data to server: humidity: 87 - timestamp: 1704284797
2024-01-03 15:26:37,630:INFO:Received data from temperature sensor: temperature: 30 timestamp: 1704284797
2024-01-03 15:26:37,631:INFO:Sent temperature sensor data to server: temperature: 30 timestamp: 1704284797
2024-01-03 15:26:38,021:INFO:Received data from humidity sensor: ALIVE - timestamp:1704284798
2024-01-03 15:26:38,021:INFO:Sent humidity sensor data to server: ALIVE - timestamp:1704284798
2024-01-03 15:26:38,636:INFO:Received data from temperature sensor: temperature: 27 timestamp: 1704284798
2024-01-03 15:26:38,637:INFO:Sent temperature sensor data to server: temperature: 27 timestamp: 1704284798
2024-01-03 15:26:39,639:INFO:Received data from temperature sensor: temperature: 27 timestamp: 1704284799
2024-01-03 15:26:39,640:INFO:Sent temperature sensor data to server: temperature: 27 timestamp: 1704284799
2024-01-03 15:26:40,646:INFO:Received data from temperature sensor: temperature: 22 timestamp: 1704284800
2024-01-03 15:26:40,646:INFO:Sent temperature sensor data to server: temperature: 22 timestamp: 1704284800
2024-01-03 15:26:41,024:INFO:Received data from humidity sensor: ALIVE - timestamp:1704284801
2024-01-03 15:26:41,024:INFO:Sent humidity sensor data to server: ALIVE - timestamp:1704284801
2024-01-03 15:26:41,651:INFO:Received data from temperature sensor: temperature: 28 timestamp: 1704284801
2024-01-03 15:26:41,651:INFO:Sent temperature sensor data to server: temperature: 28 timestamp: 1704284801
2024-01-03 15:26:42,063:INFO:Received data from humidity sensor: humidity: 82 - timestamp: 1704284802
2024-01-03 15:26:42,063:INFO:Sent humidity sensor data to server: humidity: 82 - timestamp: 1704284802
2024-01-03 15:26:42,652:INFO:Received data from temperature sensor: temperature: 23 timestamp: 1704284802
2024-01-03 15:26:42,652:INFO:Sent temperature sensor data to server: temperature: 23 timestamp: 1704284802
2024-01-03 15:26:44,027:INFO:Received data from humidity sensor: ALIVE - timestamp:1704284804
2024-01-03 15:26:44,027:INFO:Sent humidity sensor data to server: ALIVE - timestamp:1704284804
2024-01-03 15:26:45,000:INFO:Temperature sensor lost connection at 1704284805. TEMP SENSOR OFF message sent to server.
2024-01-03 15:26:47,032:INFO:Received data from humidity sensor: ALIVE - timestamp:1704284807
2024-01-03 15:26:47,032:INFO:Sent humidity sensor data to server: ALIVE - timestamp:1704284807
2024-01-03 15:26:48,091:INFO:Received data from humidity sensor: humidity: 85 - timestamp: 1704284808
2024-01-03 15:26:48,091:INFO:Sent humidity sensor data to server: humidity: 85 - timestamp: 1704284808
2024-01-03 15:26:50,038:INFO:Received data from humidity sensor: ALIVE - timestamp:1704284810
2024-01-03 15:26:50,038:INFO:Sent humidity sensor data to server: ALIVE - timestamp:1704284810
2024-01-03 15:26:57,040:INFO:Humidity sensor lost connection at 1704284817. HUMIDITY SENSOR OFF message sent to server.
```

12- Log file of Gateway

```
humidity_sensor.log
Göster Şimdi Sil Yeniden Yükle Paylaş
2024-01-03 15:25:47,767:INFO:Humidity value -83- exceed 80. Sent to Gateway.
2024-01-03 15:25:47,768:INFO:ALIVE message sent to Gateway. at 1704284747
2024-01-03 15:25:50,768:INFO:ALIVE message sent to Gateway. at 1704284750
2024-01-03 15:26:29,008:INFO:ALIVE message sent to Gateway. at 1704284789
2024-01-03 15:26:29,008:INFO:Humidity value -85- exceed 80. Sent to Gateway.
2024-01-03 15:26:32,014:INFO:ALIVE message sent to Gateway. at 1704284792
2024-01-03 15:26:32,023:INFO:Humidity value -90- exceed 80. Sent to Gateway.
2024-01-03 15:26:35,015:INFO:ALIVE message sent to Gateway. at 1704284795
2024-01-03 15:26:35,038:INFO:Humidity value -87- exceed 80. Sent to Gateway.
2024-01-03 15:26:37,045:INFO:Humidity value -87- exceed 80. Sent to Gateway.
2024-01-03 15:26:38,020:INFO:ALIVE message sent to Gateway. at 1704284798
2024-01-03 15:26:41,023:INFO:ALIVE message sent to Gateway. at 1704284801
2024-01-03 15:26:42,062:INFO:Humidity value -82- exceed 80. Sent to Gateway.
2024-01-03 15:26:44,026:INFO:ALIVE message sent to Gateway. at 1704284804
2024-01-03 15:26:47,032:INFO:ALIVE message sent to Gateway. at 1704284807
2024-01-03 15:26:48,091:INFO:Humidity value -85- exceed 80. Sent to Gateway.
2024-01-03 15:26:50,037:INFO:ALIVE message sent to Gateway. at 1704284810
```

13- Log file of Humidity Sensor

```
server.log
Göster Şimdi Sil Yeniden Yükle Paylaş

2024-01-03 15:26:26,019:INFO:Server listening on 127.0.0.1: 9092
2024-01-03 15:26:27,391:INFO:Accepted connection from Gateway on: ('127.0.0.1', 50275)
2024-01-03 15:26:27,391:INFO:Handshake successful
2024-01-03 15:26:29,009:INFO:Received data from Gateway: ALIVE - timestamp:1704284789
2024-01-03 15:26:29,009:INFO:Received data from Gateway: humidity: 85 - timestamp: 1704284789
2024-01-03 15:26:32,015:INFO:Received data from Gateway: ALIVE - timestamp:1704284792
2024-01-03 15:26:32,024:INFO:Received data from Gateway: humidity: 90 - timestamp: 1704284792
2024-01-03 15:26:35,015:INFO:Received data from Gateway: ALIVE - timestamp:1704284795
2024-01-03 15:26:35,039:INFO:Received data from Gateway: humidity: 87 - timestamp: 1704284795
2024-01-03 15:26:35,619:INFO:Received data from Gateway: temperature: 25 timestamp: 1704284795
2024-01-03 15:26:36,625:INFO:Received data from Gateway: temperature: 27 timestamp: 1704284796
2024-01-03 15:26:37,046:INFO:Received data from Gateway: humidity: 87 - timestamp: 1704284797
2024-01-03 15:26:37,631:INFO:Received data from Gateway: temperature: 30 timestamp: 1704284797
2024-01-03 15:26:38,021:INFO:Received data from Gateway: ALIVE - timestamp:1704284798
2024-01-03 15:26:38,637:INFO:Received data from Gateway: temperature: 27 timestamp: 1704284798
2024-01-03 15:26:39,640:INFO:Received data from Gateway: temperature: 27 timestamp: 1704284799
2024-01-03 15:26:40,646:INFO:Received data from Gateway: temperature: 22 timestamp: 1704284800
2024-01-03 15:26:41,024:INFO:Received data from Gateway: ALIVE - timestamp:1704284801
2024-01-03 15:26:41,651:INFO:Received data from Gateway: temperature: 28 timestamp: 1704284801
2024-01-03 15:26:42,063:INFO:Received data from Gateway: humidity: 82 - timestamp: 1704284802
2024-01-03 15:26:42,652:INFO:Received data from Gateway: temperature: 23 timestamp: 1704284802
2024-01-03 15:26:44,027:INFO:Received data from Gateway: ALIVE - timestamp:1704284804
2024-01-03 15:26:45,000:INFO:Received data from Gateway: TEMP SENSOR OFF at 1704284805
2024-01-03 15:26:47,033:INFO:Received data from Gateway: ALIVE - timestamp:1704284807
2024-01-03 15:26:48,092:INFO:Received data from Gateway: humidity: 85 - timestamp: 1704284808
2024-01-03 15:26:50,038:INFO:Received data from Gateway: ALIVE - timestamp:1704284810
2024-01-03 15:26:57,041:INFO:Received data from Gateway: HUMIDITY SENSOR OFF at 1704284817
```

14- Log file of Server

```
temperature_sensor.log
Göster Şimdi Sil Yeniden Yükle Paylaş

2024-01-03 15:26:35,619:INFO:temperature: 25 - timestamp: 1704284795 sent to Gateway.
2024-01-03 15:26:36,624:INFO:temperature: 27 - timestamp: 1704284796 sent to Gateway.
2024-01-03 15:26:37,630:INFO:temperature: 30 - timestamp: 1704284797 sent to Gateway.
2024-01-03 15:26:38,635:INFO:temperature: 27 - timestamp: 1704284798 sent to Gateway.
2024-01-03 15:26:39,639:INFO:temperature: 27 - timestamp: 1704284799 sent to Gateway.
2024-01-03 15:26:40,645:INFO:temperature: 22 - timestamp: 1704284800 sent to Gateway.
2024-01-03 15:26:41,650:INFO:temperature: 28 - timestamp: 1704284801 sent to Gateway.
2024-01-03 15:26:42,651:INFO:temperature: 23 - timestamp: 1704284802 sent to Gateway.
```

15- Log File of Temperature Sensor