Programming for Iot - Lab 4

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1 Introduction

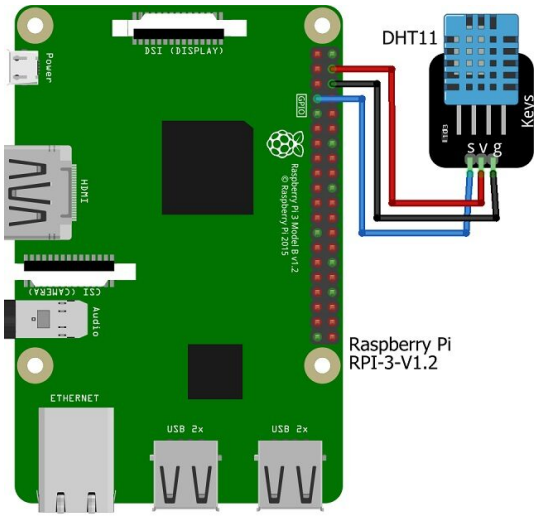
1.1 Data format

In this lab we will try to develop different kind of sensor simulator that use REST and MQTT.
Remember to lways use SenML as data format:

```
{
        "bn": "http://example.org/sensor1/",
        "e": [
                {
                    "n": "temperature",
                    "u": "Cel",
                    "t": 1234,
                    "v":22.5
                }
            ]
    }
```

1.2 Hardware connection

To check that the sensor works fine you should connect the DHT 11 sensor as shown in the picture below



Then you should run the test file located in the "Documents" folder of the Raspberry in order to check that the sensor is working.

2 Exercices

2.1 Exercise 1

Using the Raspberry Pi develop a REST service for the temperature sensor. This sensor should provide a GET method to manage 3 different uri:

- "/temperature" should return the measured temperature as a json in SenML format
- "/humidity" should return the measured humidity in the as a json in SenML format
- "/allSensor" should return the data from all the sensor as a json in SenML format

Develop the script on your PC and check they work correctly on it before deploying it on the Raspberry.

2.2 Exercise 2

Using the Raspberry Pi develop an MQTT publisher and and MQTT subscriber This publisher should publish every 5 seconds a message in SenML format with the following information:

- "/temperature" should provide the measured temperature as a json in SenML format
- "/humidity" should provide the measured humidity in the as a json in SenML format
- "/allSensor" should provide the data from all the sensor as a json in SenML format

The subscriber should be able to receive all the message from all the topics and print it on screen in an user friendly way that indicates also the topic that provide that message.

Example: If the message below is received

```
{
    "bn": "matteo/sensor1/temperature",
    "e": [
            {
                "n": "temperature",
                "u": "Cel",
```

```
                "t": 1234,
                "v":22.5
            }
        ]
    }
```

The publisher should print

> matteo/sensor1 measured a temperature of 22.5 Cel at the time 1234

Develop the script on your PC and check they work correctly on it before deploying it on the Raspberry.

When you're ready try to run the publisher on the raspberry and the subscriber on your laptop to check if you developed a real IoT device.

2.3 Exercise 3

In most of the cases we want to perform some kind of processing on the data we receive to have more significant information to show to the user or to take actions. In order to do this we need to develop script that are able to receive data and process it according to our needs.

Therefore try to develop 2 post processing script as follow:

- The first one should ask the temperature to the sensor developed in the first exercise every x seconds (choose x as you prefer, 3 should be a feasible value). Every 10 data aquisition it should calculate the average temperature and printing it on screen.
- The second script should be an MQTT subscriber that will recieve the humidity measurements from the sensor developed in the second exercise. Every 10 measurements it should publish a message with the average humidity at a topic of your choice.

For the second script you can test that everything works using a subscriber with a wildcard that prints all the message received.

2.4 Exercise 4

In some cases, for testing reason it could be useful to have virtual sensors that can emulate as much as possible the behaviour of a real one.

Develop an MQTT publisher to emulate an heartrate sensor that publish random values in the range [55,180] every 5 seconds for 2 minutes.

Develop also an MQTT subscriber that receives these values, prints these on screen and save these on a json file called *hrLog.json*. To generate the values, you can use one of the functions of the library numpy listed at this link, try with different functions to evaluate which is the one that has the most realistic result. You can find a visualization of some of this generator here (you can even make your test there before writing your code)

2.5 Exercise 5

Develop an MQTT publisher to emulate a sensor of your choice that publish random values in the 3 possible ranges. For example for an heartrate sensor we could define 3 ranges as [resting,sport,danger]. Then create a simple terminal client for this MQTT publisher to select the range to be used to send the data. Develop also an MQTT subscriber to receive those data and in case of data in a warning range provide some kind of feedback to the user.