

Environmental Station Monitoring System

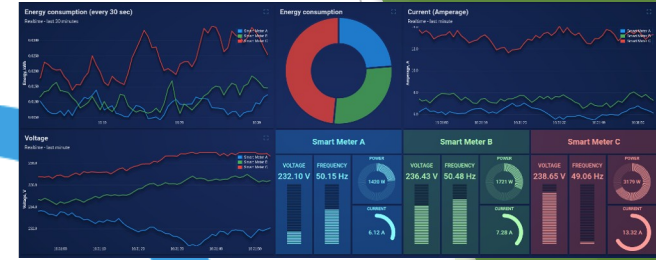
Made with ThingsBoard and RIOT OS

Main idea

- We want to monitor 2 environmental stations, each with 5 sensors:
 - Temperature (- 50 ... 50 °C)
 - Humidity (0 ... 100 %)
 - Wind Direction (0 ... 360 Degrees)
 - Wind Intensity (0 ... 100 m/s)
 - Rain Height (0 ... 50 mm/h)
- We send the data via MQTT-SN to a broker, which will then forward the messages to ThingsBoard through an MQTT channel.
- We visualize the data making it visible to anyone who'd like to.

Architecture

ThingsBoard Dashboard



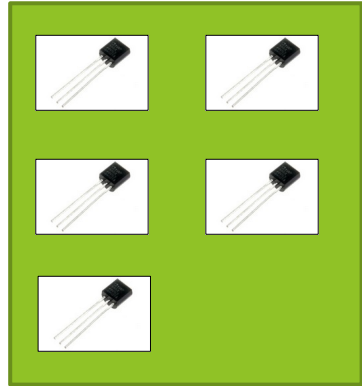
ThingsBoard IoT Platform



Mosquitto broker

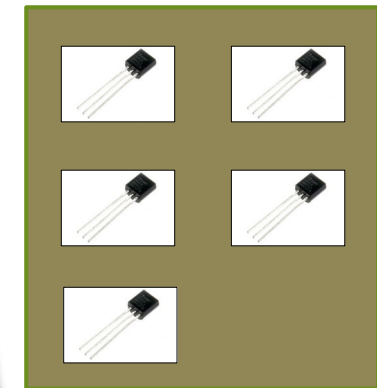


MQTT-SN Messages



Python Bridge

MQTT Channel



Environmental Station 2

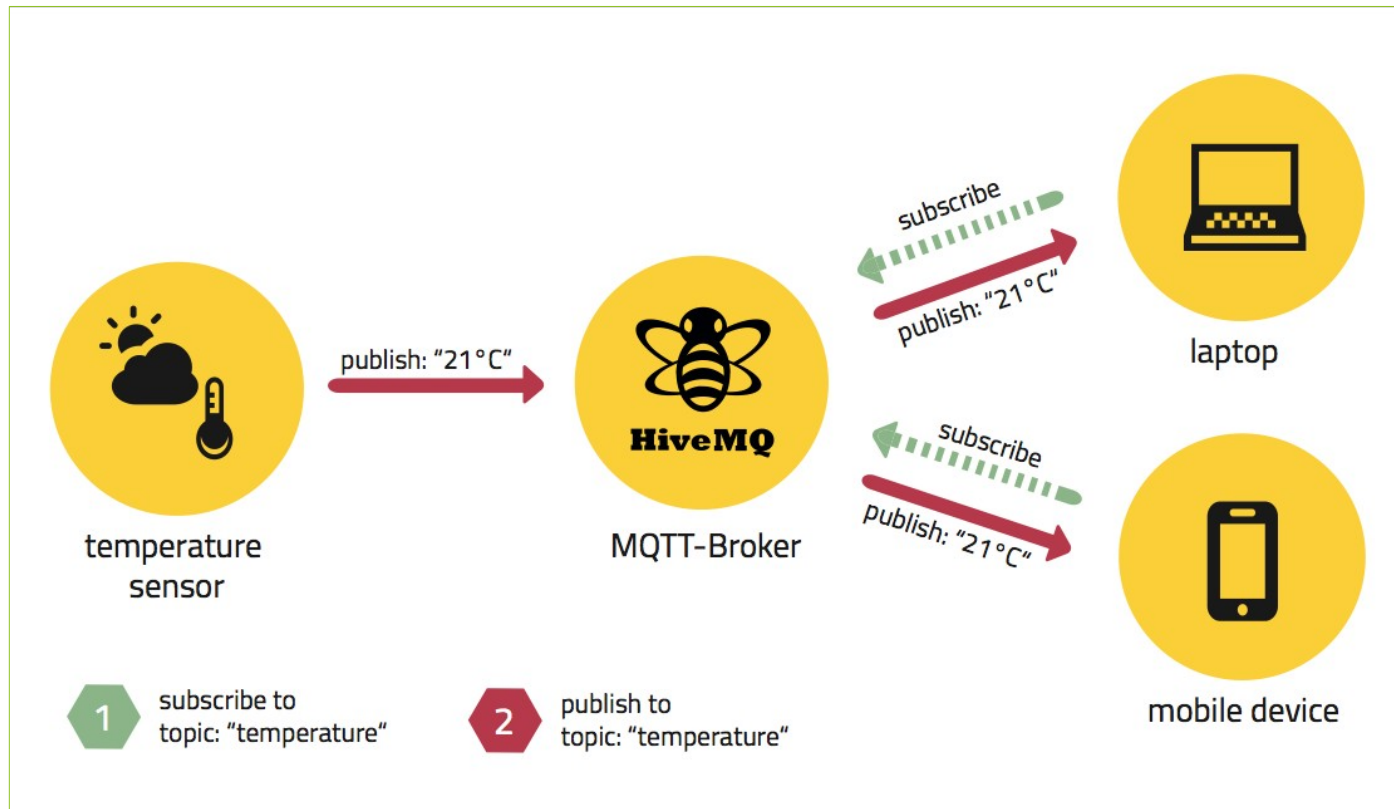
Environmental Station 1

Implementation

- The sensors and environmental stations are simulated by a simple program done RIOT OS
- The data is sent with MQTT-SN messages to the Mosquitto broker, which forwards them to a bridge made with Python. The bridge indeed is subscribed to the topics that represent telemetries, and sends them to ThingsBoard through MQTT messages.
- ThingsBoard IoT platform collects data through the MQTT channel (MQTT broker integrated in the platform) and shows it on its dashboard, which is public so that anyone could check it out.

Technology: MQTT Protocol

- MQTT is a machine-to-machine connectivity protocol, designed to be lightweight and work well even in situations where little resources are provided. Because of this, it's ideal for sensor communication.
- It's based on the publish subscriber paradigm



Technology: MQTT-SN

- MQTT-SN stands for MQTT for Sensor Network, and it was designed specifically for this environment. Unlike MQTT, it doesn't rely on TCP, as it would be too much for devices with low power and little memory and computing capabilities.
 - Main differences in respect to MQTT:
 - CONNECT message is split in 3 smaller messages, so that also the will message is sent to broker. The will message specifies what to send in case the device is no longer connected to the network.
 - to identify the topic an ID of 2 bytes is used, instead of a string.
- There are other differences but are not so relevant to us.

Technology: RIOT OS

- RIOT OS is an open source operating system designed for the Internet of Things. Supports most low power devices and microcontroller architectures (32-bit, 16-bit and 8-bit).
- It's programmable in C and C++, uses wide spread tools such as gcc and valgrind, and it's compliant with POSIX.
- It supports most IoT standards and it's resource friendly. When a program it's executed usually there are two threads running: the main thread that executes the task, and the idle thread which runs when the main thread stops. The idle thread puts the device in a “sleep mode” to save energy and resources.



Technology: Mosquitto RSMB

- Mosquitto Really Small Message Broker is a server implementation of MQTT and MQTT-SN protocols.
- It was first released under IBM, and now it's open source as an Eclipse project.



Technology: ThingsBoard



- ThingsBoard is an open-source IoT platform to collect, process, visualize data and manage devices.
- Enables connectivity through standard IoT protocols like CoAP, HTTP, MQTT and supports cloud deployment.
- The pillars of this platform are scalability, fault-tolerance and performance.

References

- RIOT OS: <http://riot-os.org/>
- MQTT/MQTT-SN: <https://mqtt.org/>
- Mosquitto RSMB: <https://github.com/eclipse/mosquitto.rsmb>
- ThingsBoard: <https://thingsboard.io>

Thank you for you attention!