WROCŁAW UNIVERSITY OF TECHNOLOGY

EMBEDDED ROBOTICS

INTERMEDIATE PROJECT

Home automation with IoT concept

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January 27, 2017

Abstract

This article presents description of Internet of Things network for home automation. Two nodes of that network have been developed and are going to be described precisely in here. Those nodes are of two kind of types. The first one is only about hardware. For this purpose the ESP8266 module has been used. The second one is about web application with database developed in Python Django framework. The whole network works in specific for IoT net protocol – MQTT with online server as a broker.

1 Introduction

1.1 Network

For the purpose of Internet of Things network, the proper communication protocol should be used. It has to be light, robust and not requiring much resources to work. One of example might be a MQTT protocol which uses publish-subscribe pattern which is another nice feature of that. Using MQTT protocol, the IoT network can look like below.
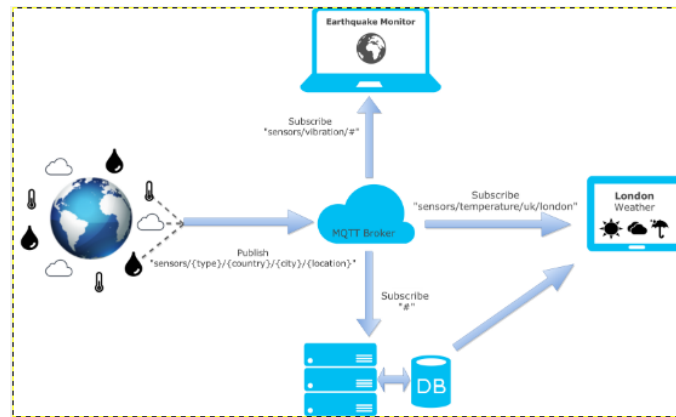

Figure 1: IoT network design with MQTT communication protocol.

In the upper figure one element is both very important and may be unknown – it is a MQTT broker and its job is to work as server which allows other clients to connect to itself and publish/-subscribe messages. In other words it means every node in network has an access to network via MQTT broker and every single message which is pushed into network has to go through MQTT broker.

As a confirmation of high usability of this kind of protocol can be real life applications like Facebook messanger or Twitter.

1.2 Node description

Hardware

On the market there are many available small electronic devices which can work in Internet of Things technology. Unfortunately many of them are not small enough or don't serve built-in wireless communication which is required in here. So in fact there are only few devices which might be taken into consideration: ESP8266 and Intel Curie modules. Apparently only one of mentioned has a small price feature and it is ESP8266 device which was used in case of that project and can be seen at below figure.

Figure 2: ESP8266 module

Technical features of ESP8266:

- IEEE 802.11 b/g/n Wi-Fi

- SPI

- I2C

- I2S

- OneWire

- UART

- ADC

- GPIO

Web application

A web application is a node with fully functionality relatively to the network. It also works in MQTT protocol. It also can exchange messages via network. As a difference to hardware module it can store whole history of messages. That is possible because of designed database. The web application was developed in Python Django framework.

2   Implementation

Hardware

From many available the NodeMCU software development kit with Lua script support has been chosen to accomplish this project.

 This node provides two different types of service

- temperature measurement,

- light switch.

 For temperature measurement service, the sensor DS18b20 has been chosen. The module makes a measurement every three seconds and sends the result to the network.

 For light switch purpose, the push button has been designed with event based control. It simply sends a message of its output state only if the interrupt has been detected.

Web application

This node builds an user interface. It allows users to have an access to the network by internet browser. It gives the following functionality:

- read actual temperature

- check actual light state

- change actual light state

- store history of all data

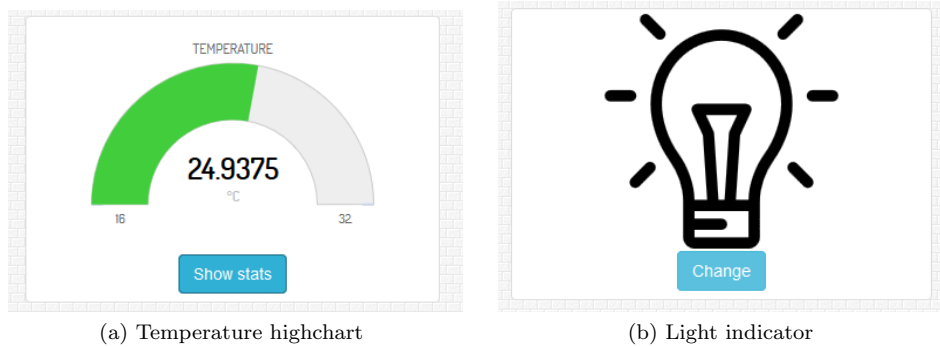The appearance of described website is presented on the picture below.

(a) Temperature highchart   (b) Light indicator

Figure 3: Web application appearance

Network

The MQTT broker is settled as online server – cloudmqtt. This one is an exception of many other clouds, because it supports totally free version. Of course it has some limitations in usage but in non-production application it can be used successfully.

3   Conclusions

Whole network works perfectly fine. Communication is robust. The network has its own built-in mechanism to deal with problem with queue.

4   Resources

- http://www.hivemq.com/blog/how-to-get-started-with-mqtt

- https://eclipse.org/paho/clients/js/