

Internet of things
Project: Smart Thermostat 2019
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Approach:

Design and implement a prototype of a smart thermostat using Contiki (2.7) operative system and simulating it in Cooja. The system is composed by a set of sensors, ideally placed in each room of a house, which manage and monitor the temperature. For controlling purposes, the thermostat communicates using CoAP with a local webpage based on the Node-RED dashboard. The smart thermostat is composed by 4, plus a border router. This topology reproduces the one of the RPL border router example seen at lesson.

The thermostat is meant to:

- turn on/off the air conditioning, the heating and the ventilation unit;
- capture, store and visualize the temperature of each room;
- send an alert when the average temperature is above/below a certain threshold

Contiki/cooja: We create own source code on Contiki OS. In the code define boot setup of temperature, the status of each mode of a thermostat, notification if the value exceeds the threshold. Put back the notification (Boolean value about heater/cooler/ventilation). In folders you could find thermostat.c document (it shows thermostat configurations)

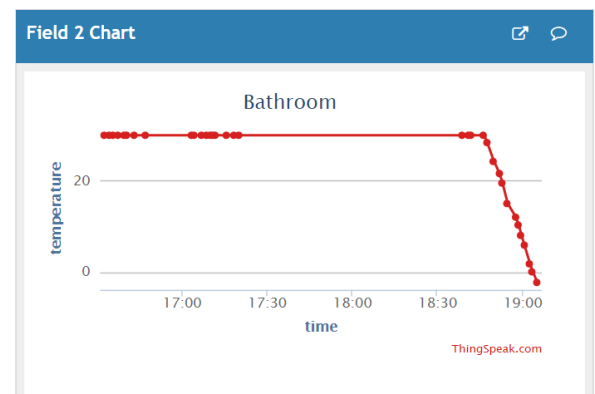
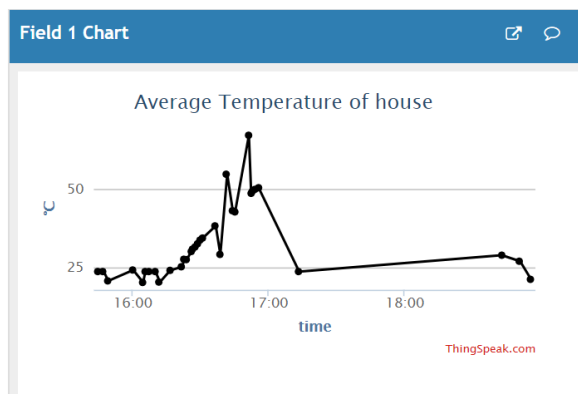
And rpl-border-router.c collect data from motes and interact with each mote, after send it to client-side. 4 motes define as 4 rooms (living room,bathroom,kitchen,bedroom).

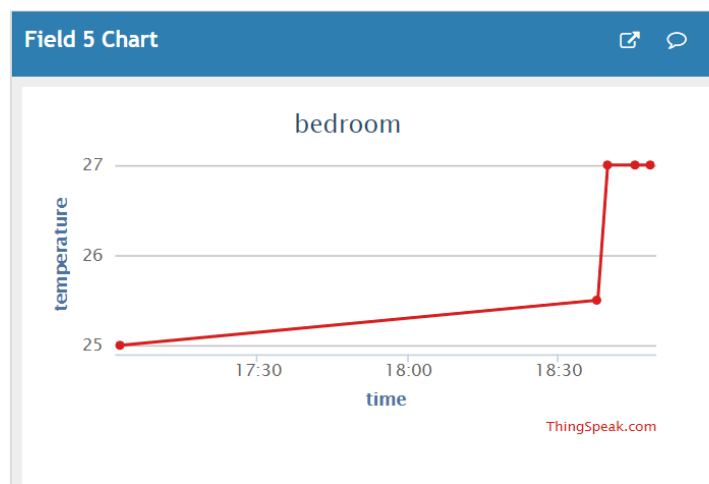
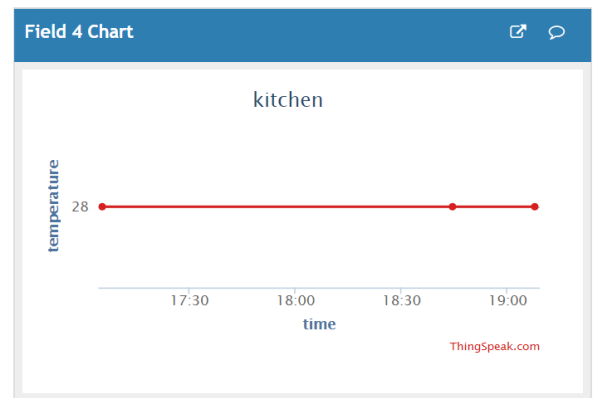
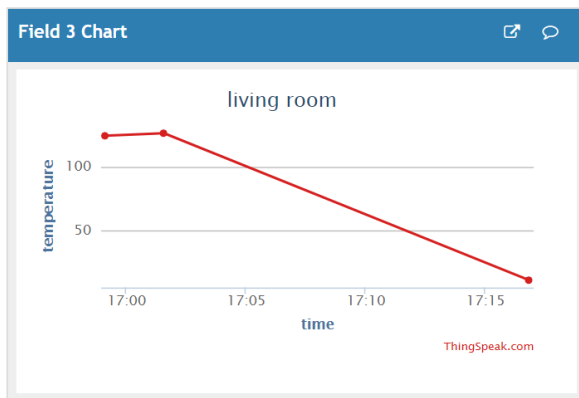
We simulate each mote (sky mote) as a thermostat.

Node-Red:It is Client-side system. Here made flow to show value of each thermostat and control thermostat, via Get COAP request we take the status, temperature of each room, and via MQTT send temperature of each to Thingspeak server. On dashboard there are switchers to Turn on/off Cooler, Heater, Ventilation; charts of temperature of rooms, average temperature of house.

When temperature exceeds the threshold, notification pops up. When we try to switch on cooler/and heater notification pops up it doesn't let us to do that. Also, there is notification to send the mail when temperature exceeds the threshold.

ThingSpeak: Server gets the temperature of each room. And send back to Node-Red via MQTT Project based on Contiki-2.7 OS.





Setup

In order to run the project, copy the project to Contiki folder (also if it necessary change the path in Makefile.h). Open new simulation. Add SkyMote1: rpl-border-router.c . And enable "serial socket(server)" our port is 60001. On terminal go to "cd rpl-border-router" folder and write down "Make connect-router-cooja" to enable router.

Run the Node-red. Copy everything in inside Thermostat.txt file. Go to Flows->Import and paste all there.

Below I attached the link, there you could find the video where I run and simulated my project.

Link of simulation https://youtu.be/FfRo_Z4t7Fo

Issues during the project:

- I have no idea why thingspeak server doesn't see my data which is published from MQTT. Also found documentation in <https://www.mathworks.com/help/thingspeak/mqtt-api.html> but cant implement it on my PC. Thus, I use CoAP http request to publish my data to Thingspeak server. Also, in sample-thingspeak.txt I put code which doesn't work (just as additional information).
- Because my PC is not powerful sometime VM breaks down and have failed logs. Also, representation the data from simulation is too slow