TB IoT
Testing and Learning Hub

NOVIA
UNIVERSITY OF APPLIED SCIENCES

Vaasan yliopisto
UNIVERSITY OF VAASA

VAMK
VAASAN AMMATTIKORKEAKOULU
UNIVERSITY OF APPLIED SCIENCES

Technobothnia IoT Teaching and Learning Hub

Novia Cases

1.10.2020, Hans Lindén

European Union
European Regional
Development Fund

Leverage from
the EU
2014–2020

POHJANMAAN LIITTO
ÖSTERBOTTENS FÖRBUND • REGIONAL COUNCIL OF OSTROBOTHNIA

Technobothnia IoT Teaching and Learning Hub

NOVIA
UNIVERSITY OF APPLIED SCIENCES

- 5 IoT cases
- Some comercial IoT devices
- Basic IoT testing equipment
- IoT course

Hans Lindén

Laboratory engineer in Technobothnia, Novia UAS

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050 595 4366

1. Temperature profile Risöfladan

MCU: Pycom LoPy4 (~35€)

Radio: LoraWAN (Digita)

Energy source: 3 pcs AA batteries

Sensors:

- air temperature
- 12 sensorers in the ground

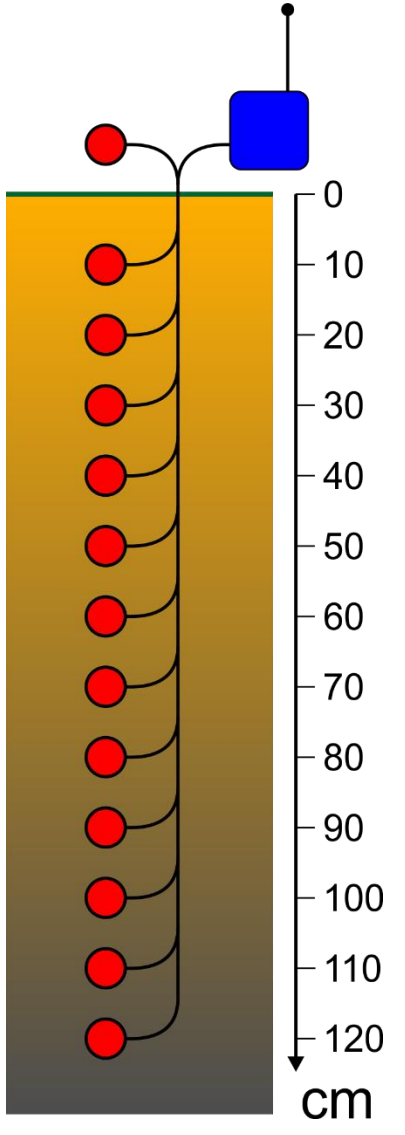
Data storage: Local DB (iotdb.novia.fi)

Datapresentation:

Iot.novia.fi/data/fladan.html

Status:

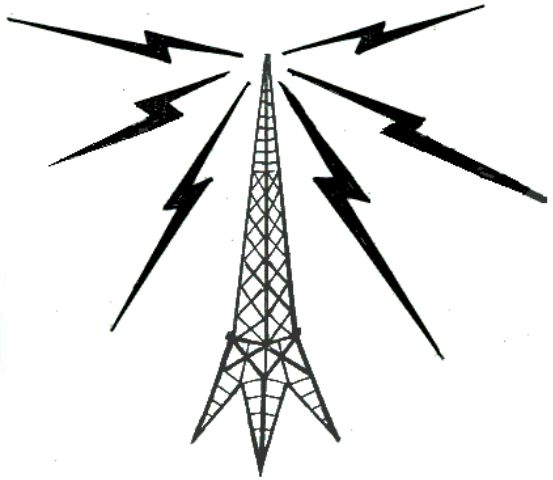
Data since Januari 2020



1. Temperature profile Risöfladan

DIGITA

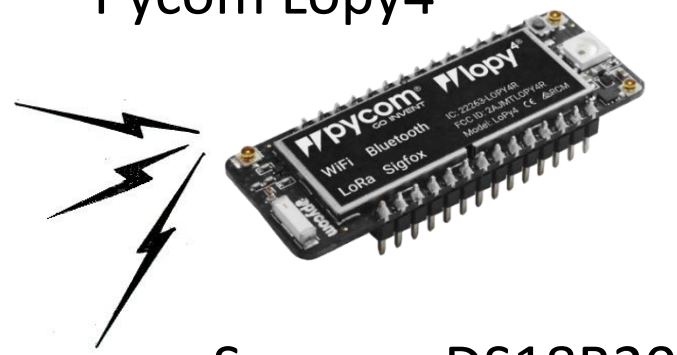
ThingPark by actility Making Things Smart



LoRaWAN

MicroPython

Pycom Lopy4



Sensors: DS18B20

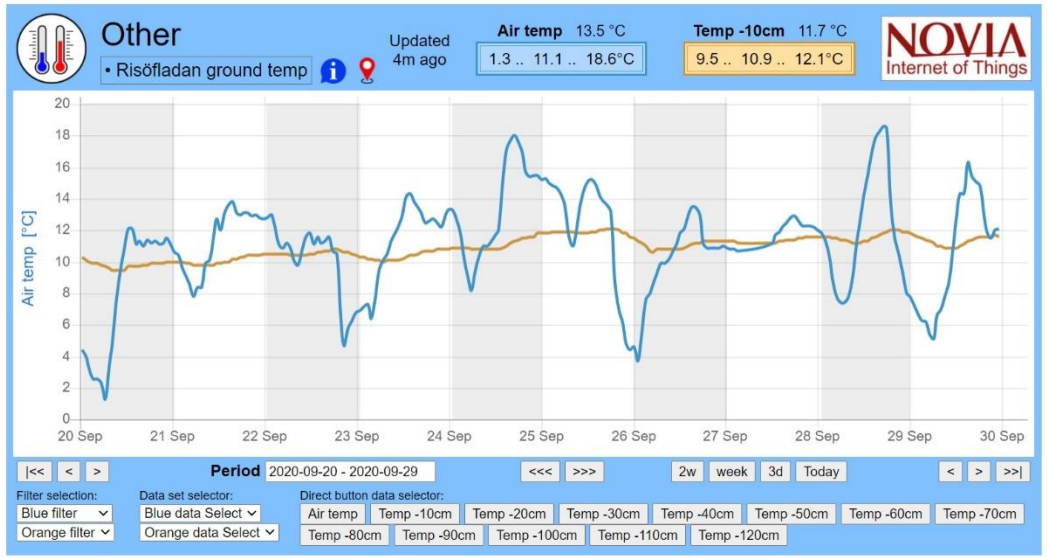
Rest API

node.js

lotdb.novia.fi

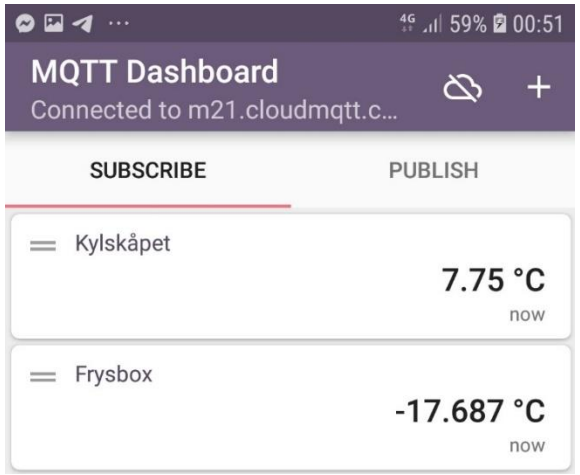
http

chart.js



iot.novia.fi/data/fladan.html

2. Monitoring fridges and freezers in TB



Sub

MQTT broker
iot.novia.fi

Pub

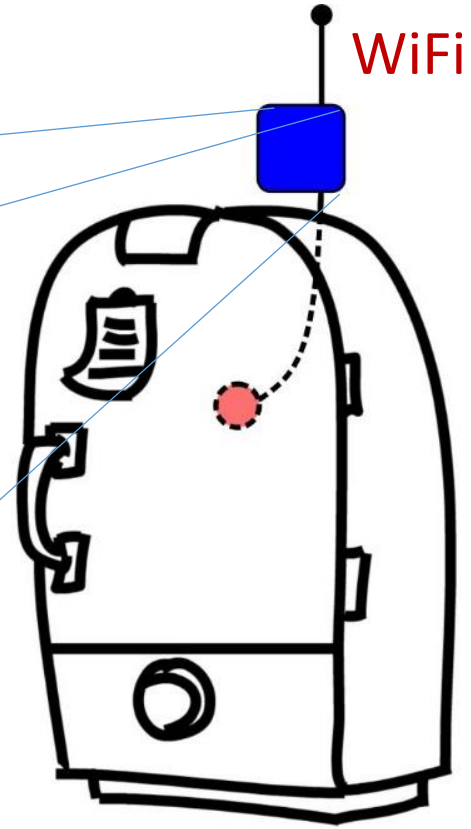
Sub

Iotdb.novia.fi

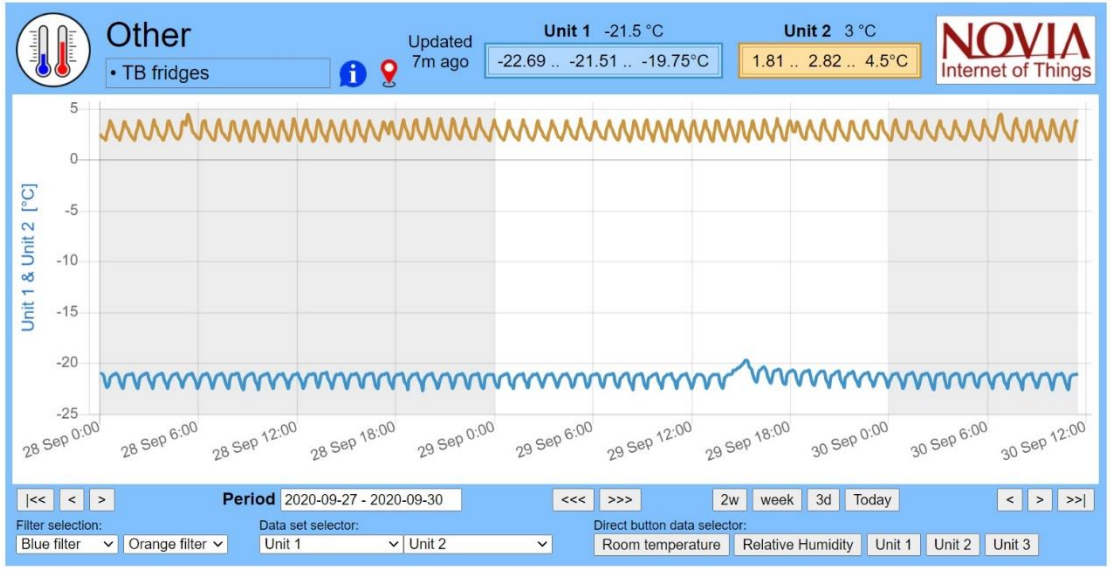
Platforms:

ESP8266, ESP32,

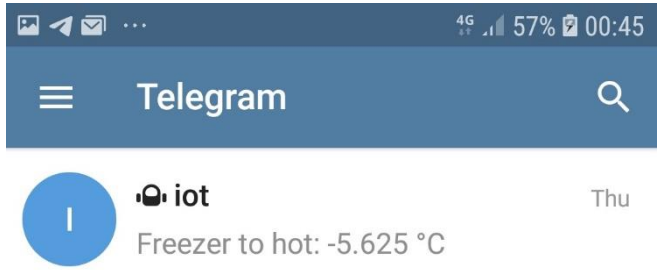
Raspberry Pi



iot.novia.fi/data/fridgeTB_01.html



Telegram
Alarm



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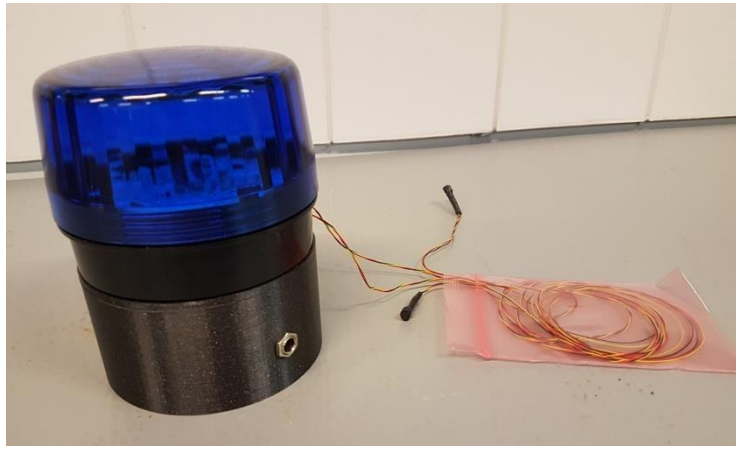
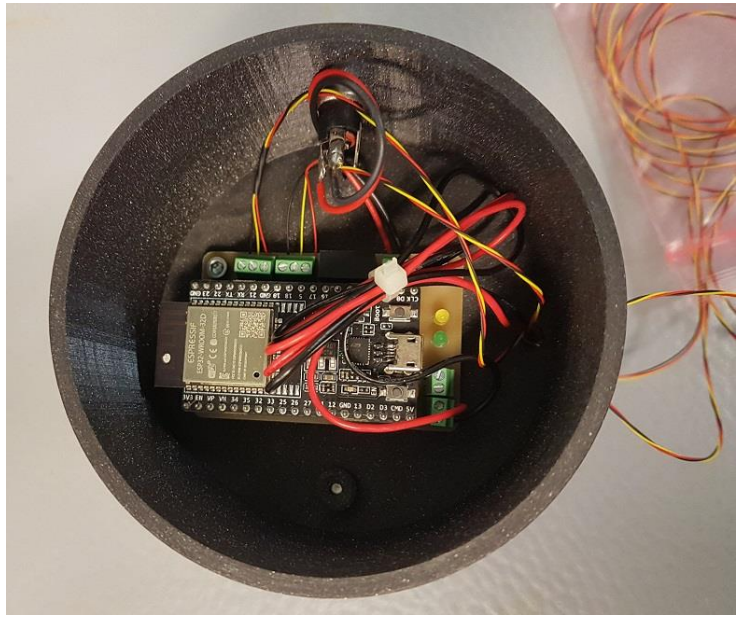




MCU: ESP32 (~10€)

Radio: Wifi

Energy: Grid (230VAC)

Sensors:

- Sensorers inside devices
- Optionally room temperature

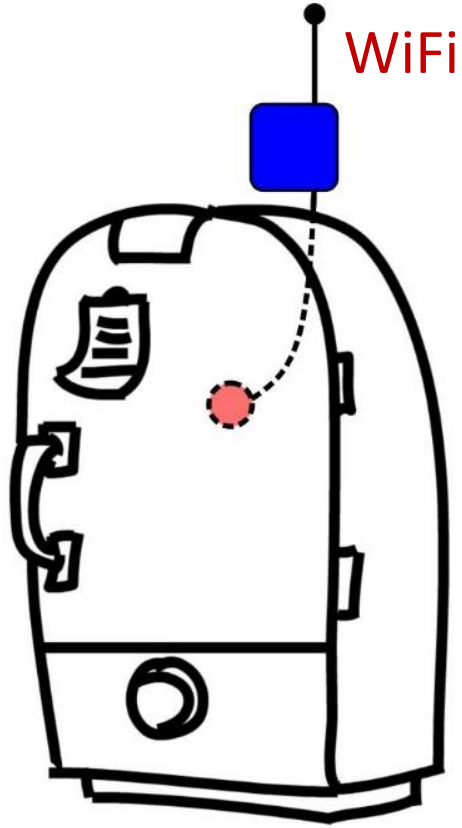
Data storage: Local DB (iotdb.novia.fi)

Data presentation:

- MQTT (iot.novia.fi)
- Telegram, alarm
- Web: iot.novia.fi/data/fridgeTB_01.html

Status:

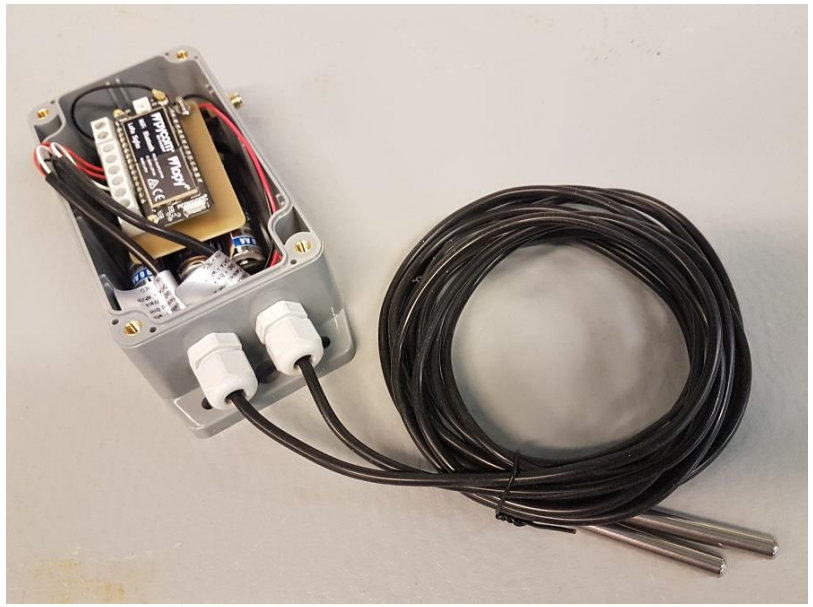
Monitoring 1 fridge and 2 freezers



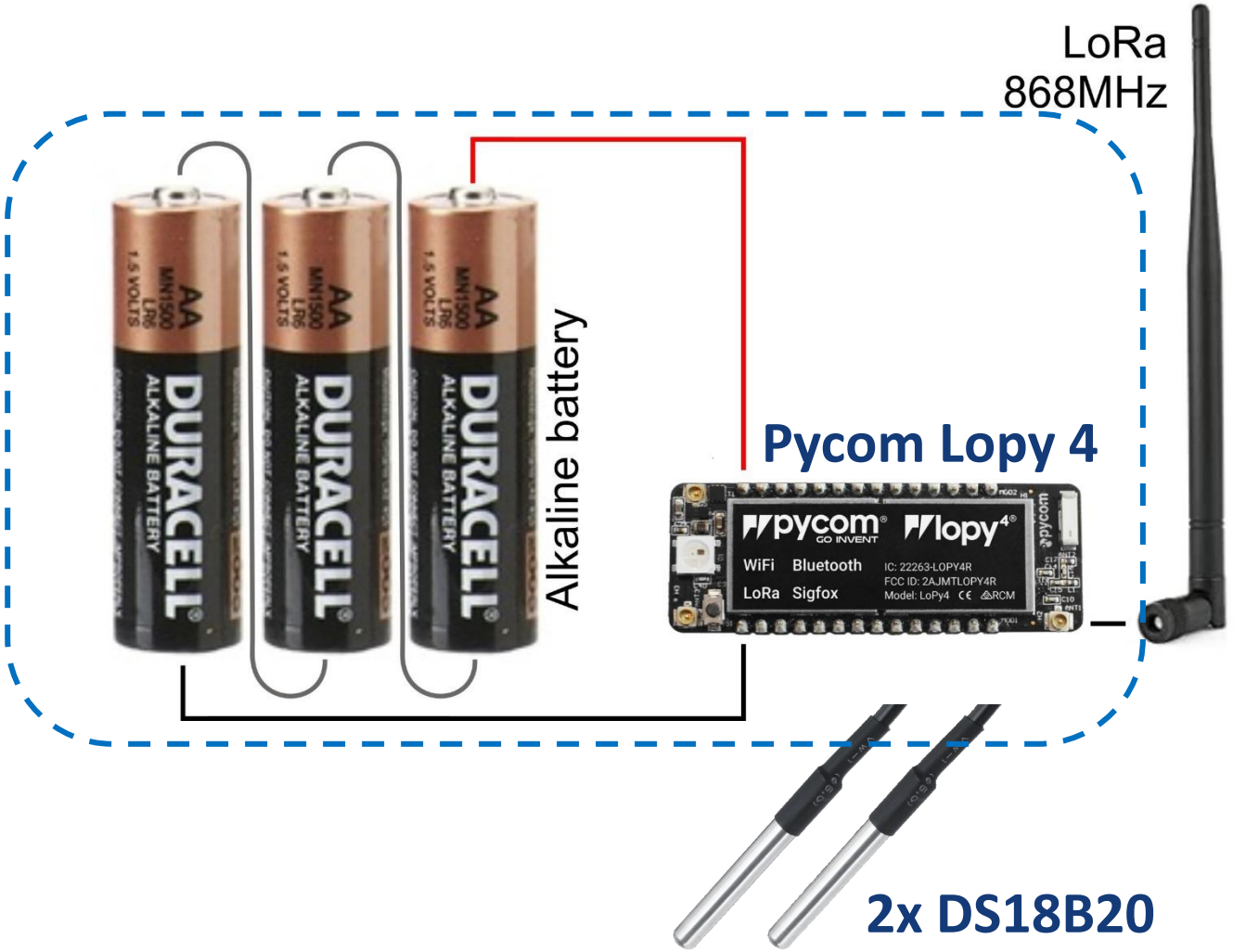
3. Beach Water Temperature

3. Beach Water Temperature

Measuring units in use now



Complete unit



3. Beach Water Temperature

MCU: Pycom Lopy4 (~35€)

Radio: LoraWAN (Digita)

Energy: 3 pcs AA batteries

Sensors:

2 water temperature

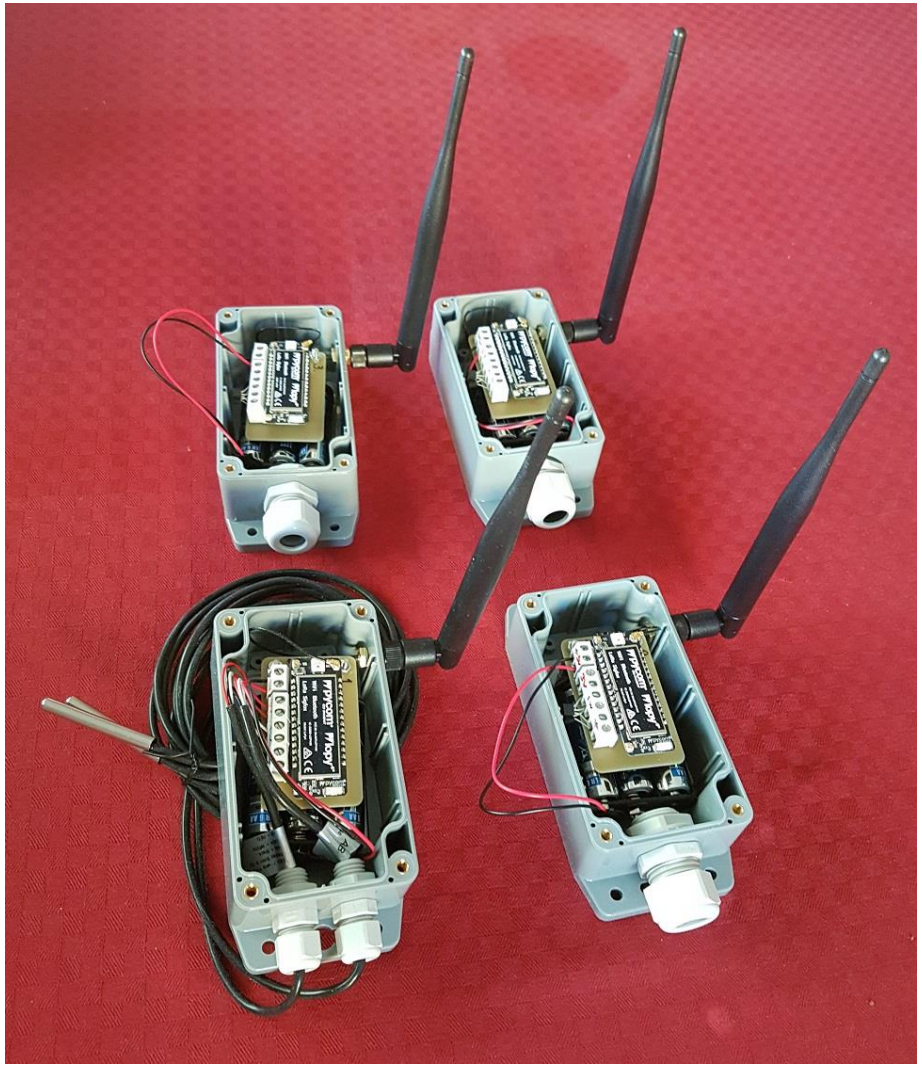
Data Storage: Local DB (iotdb.novi.fi), Azure cloud

Data Presentation:

- Azure cloud
- MQTT: iot.novia.fi
- Web: iot.novia.fi

Status:

Data since may 2020, 3 active now

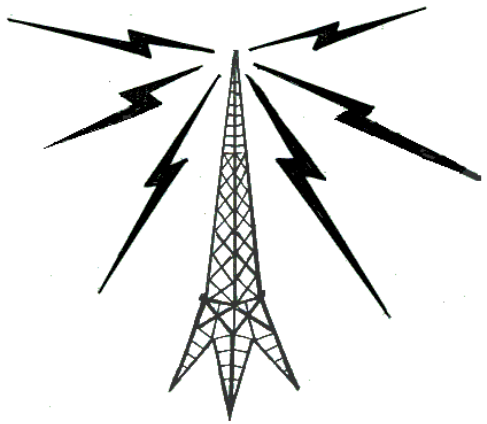


Pycom Lopy 4

3. Beach Water Temperature

DIGITA

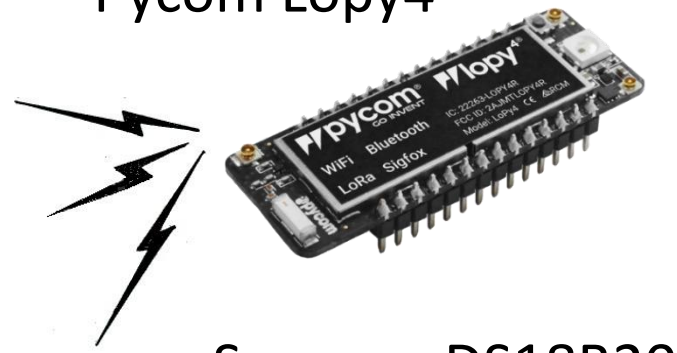
ThingPark by actility



LoRaWAN

MicroPython

Pycom Lopy4



Sensors: DS18B20

Rest API

node.js

Iotdb.novia.fi

http

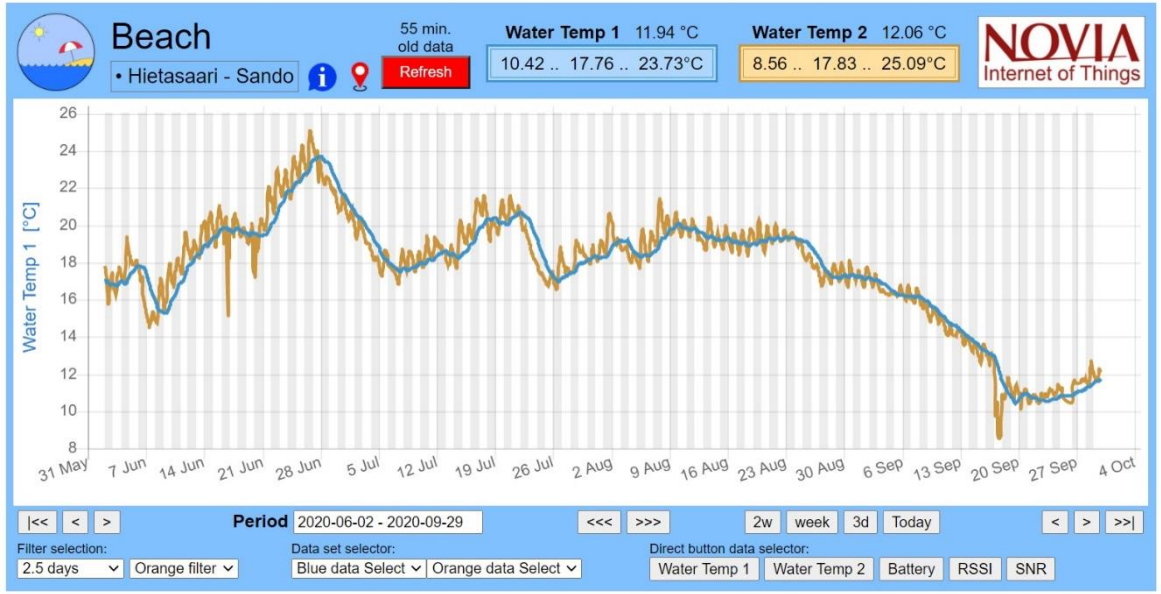
Pub

Microsoft Azure

Sub

MQTT broker
iot.novia.fi

chart.js

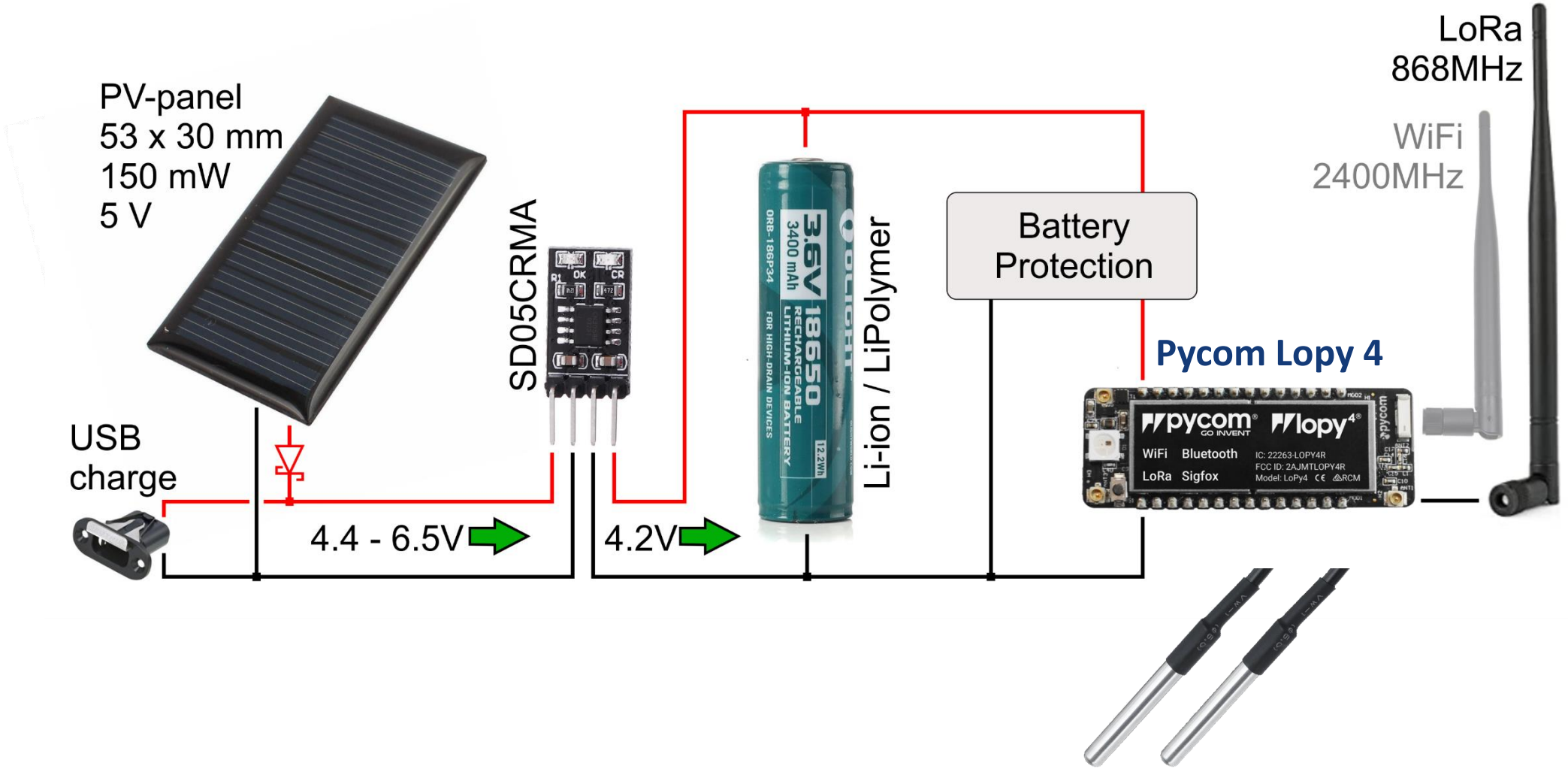


iot.novia.fi/data/sando.html

3. Beach Water Temperature v.2.0

Under development

All parts deliverde. Not put together. Update for next summer…



4. Temperature and humidity monitoring

Long time monitoring of relative humidity and temperature in buildings.

- Technobothnia have several Modules
- The customer can enter wifi network and password.
- Loggs data to Novia DB
- Anonymous real time data at: iot.novia.fi

Example: iot.novia.fi/data/TempRH_01.html

4. Temperature and humidity monitoring

MCU: ESP32 (~10€)

Radio: Wifi

Energy: grid

Sensors:

Temperature and RH

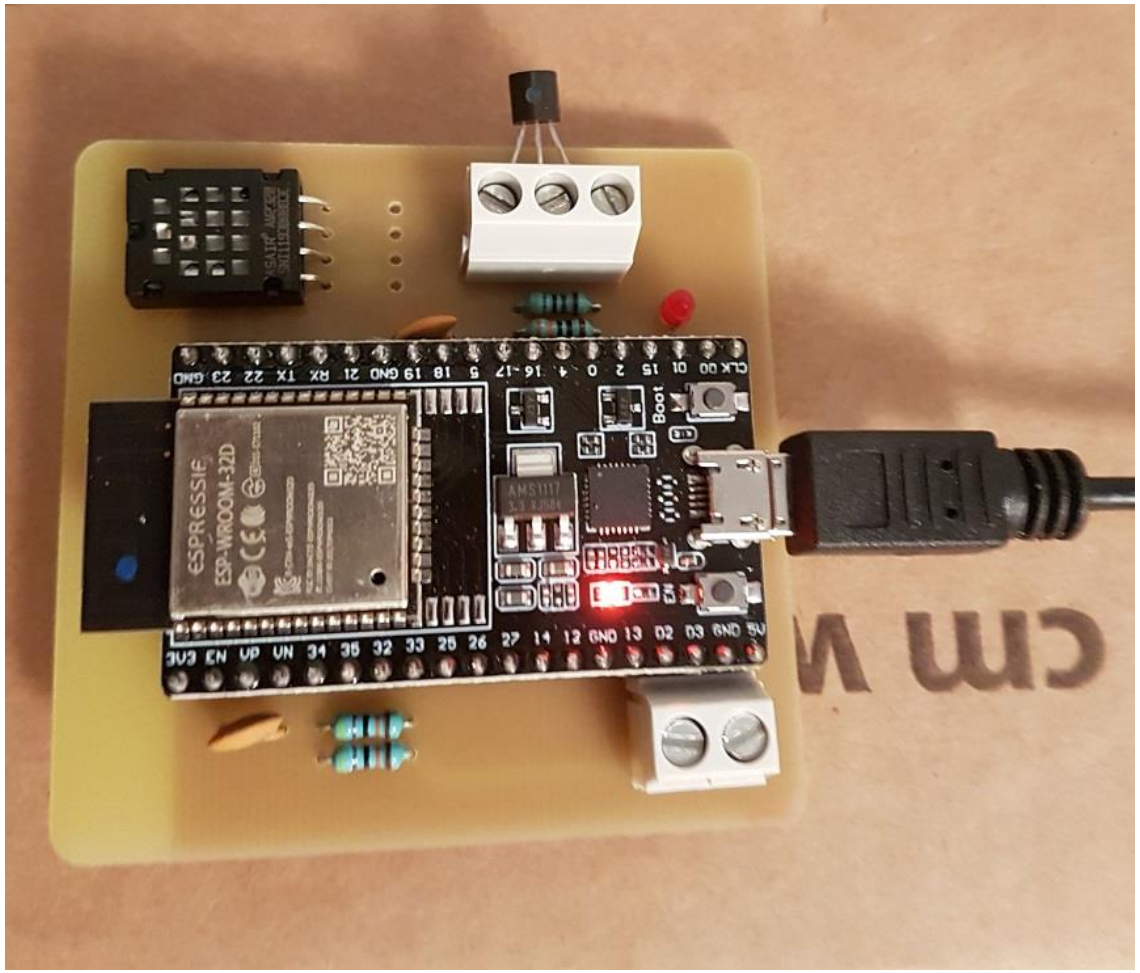
Data Storage: Local DB (iotdb.novi.fi)

Data Presentation:

- MQTT: iot.novia.fi
- Web: iot.novia.fi

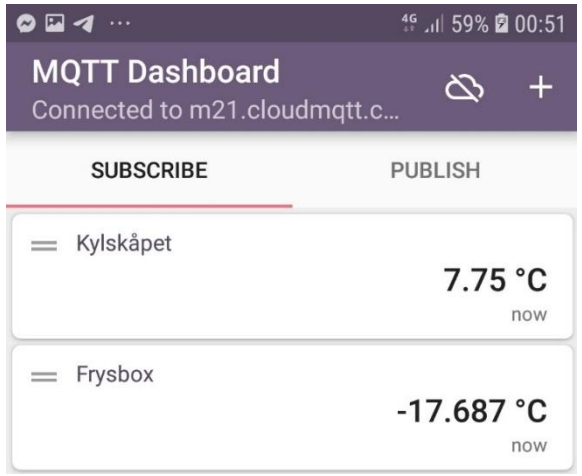
Status:

September 2020, 2 active now



ESP32 DeviKitC

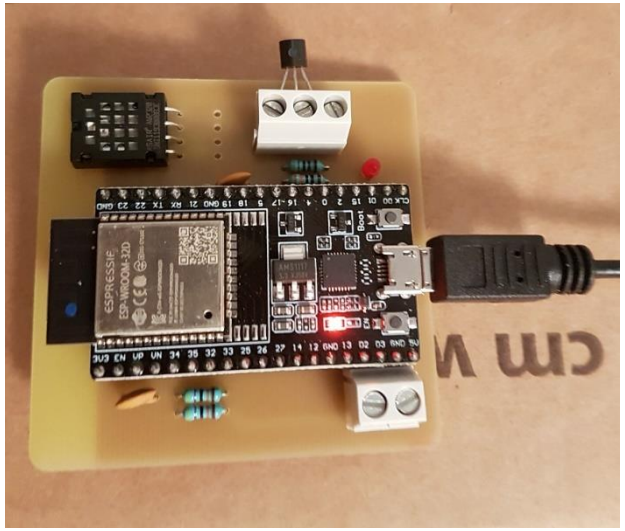
4. Temperature and humidity monitoring



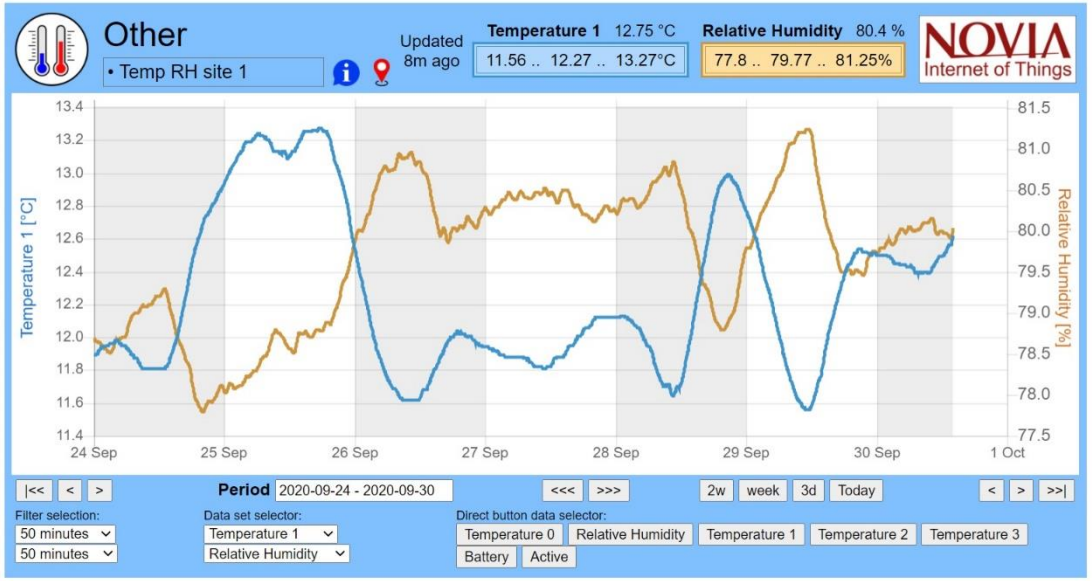
Sub

MQTT broker
iot.novia.fi

Pub



Sub



Iotdb.novia.fi

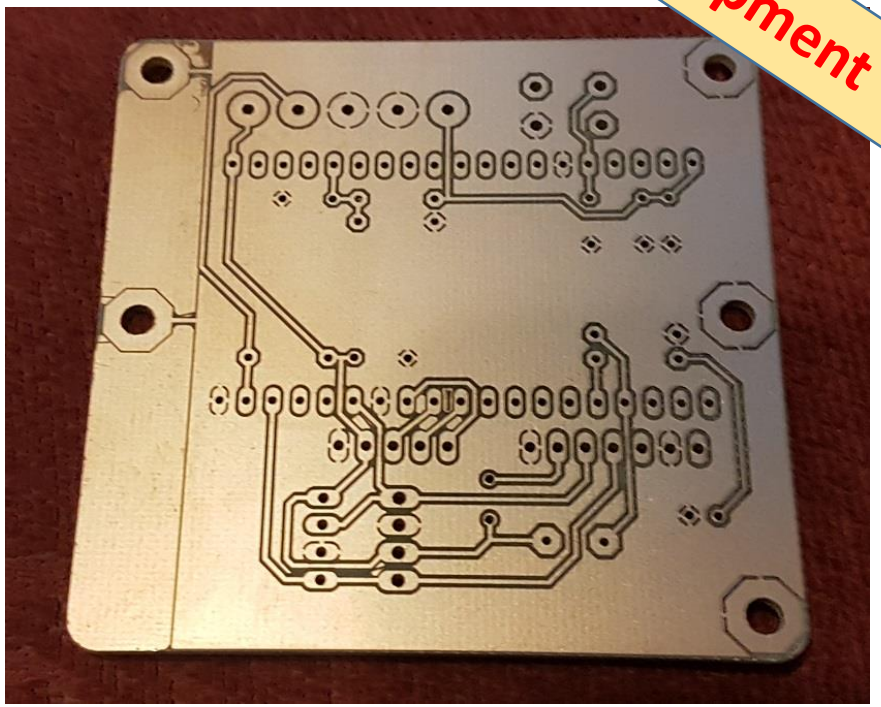
iot.novia.fi/data/TempRH_01.html

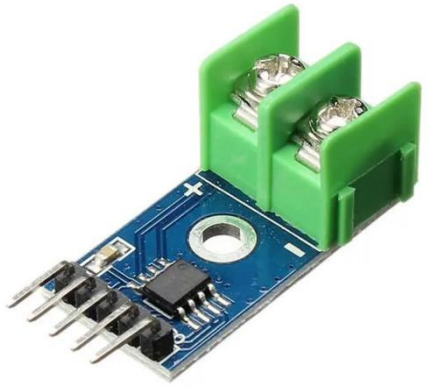
4. Temperature and humidity monitoring

Under development

Version 2.0, Under development, PCB made but not soldered together.

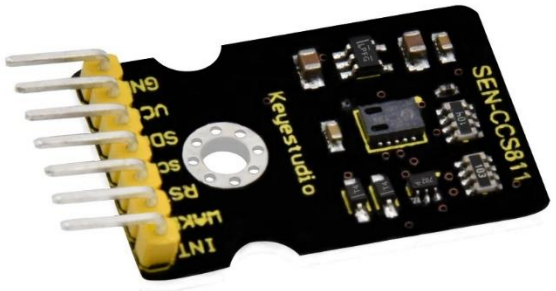
- Temp and RH as v1.0
- USB chargable Lithium or grid connected
- Thermocouple (ex. shimney temperature)
- Light sensor
- Volatile organic compounds (TVOCs)
- Equivalent carbon dioxide (eCO2)
- Metal oxide (MOX)





MAX6675 I2C

Thermocouple



Keystudio CCS811 I2C

TVOCs, eCO2, MOX

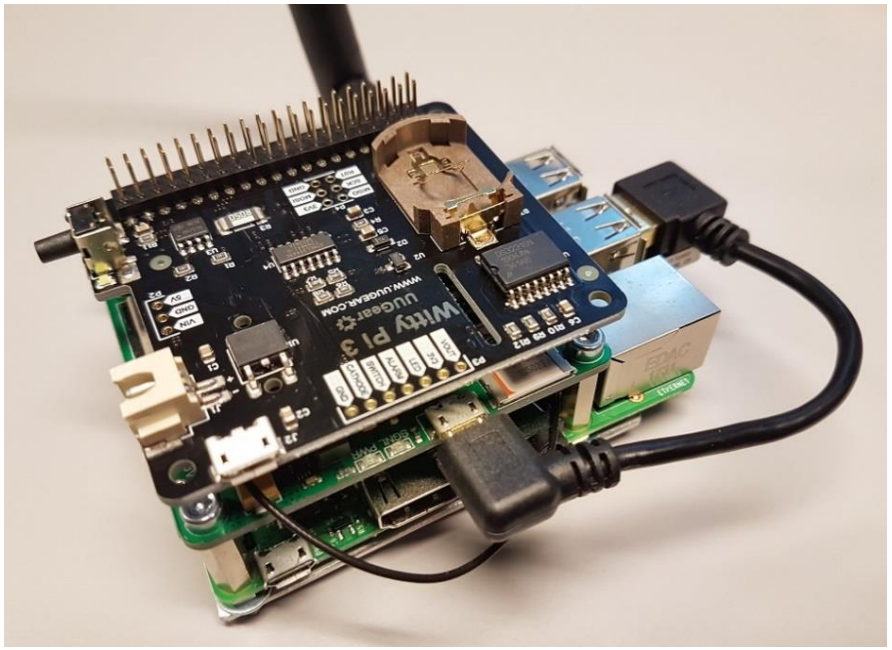
5. Remote IoT cloud

Example at Risöfladan

- Novia research project
- 18 Ha field divided into 12 areas
- Many sensors at diferent locations
- Remote

5. Remote IoT cloud

Central unit



Raspberry Pi, Sixfab 4G GSM
Witty Pi3 power management

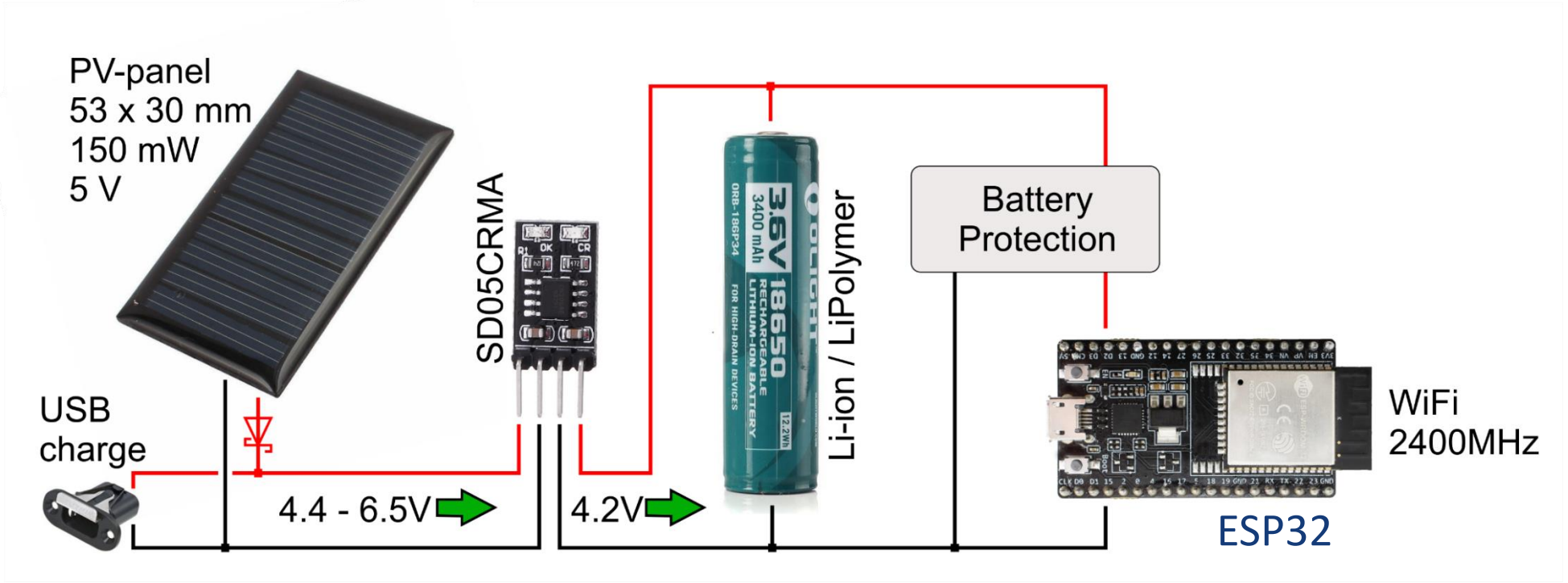
- Raspberry Pi
- Sixfab 4G GSM card, Internet and OpenVPN
- Local Wifi hotspot
- MQTT broker for sensor I/O
- Energy management with Witty Pi3
- AGM ~100Ah battery (7 days active storage)
- About 100W solar panel

November - January reduced on time

5. Remote IoT cloud

Under development

Measuring node



5. Remote IoT cloud

Under development

Measuring node, sensor examples

DS18B20
Temperature
1-wire digital

Watermark
Ground humidity
Analog/PWM

BME280
Temperature & RH
I2C

RG-15
Rainfall
Digital

Solinst 3001 Junior with SDI-12 RS232 reader cabe

Ground water level

6. Tested comercial sensors

Dragino LoraWAN tracker, 38€ (4 pcs)

- GPS position and Accelerometer
- Alarm button
- USB charged Li-battery

AutoPi Tracker,

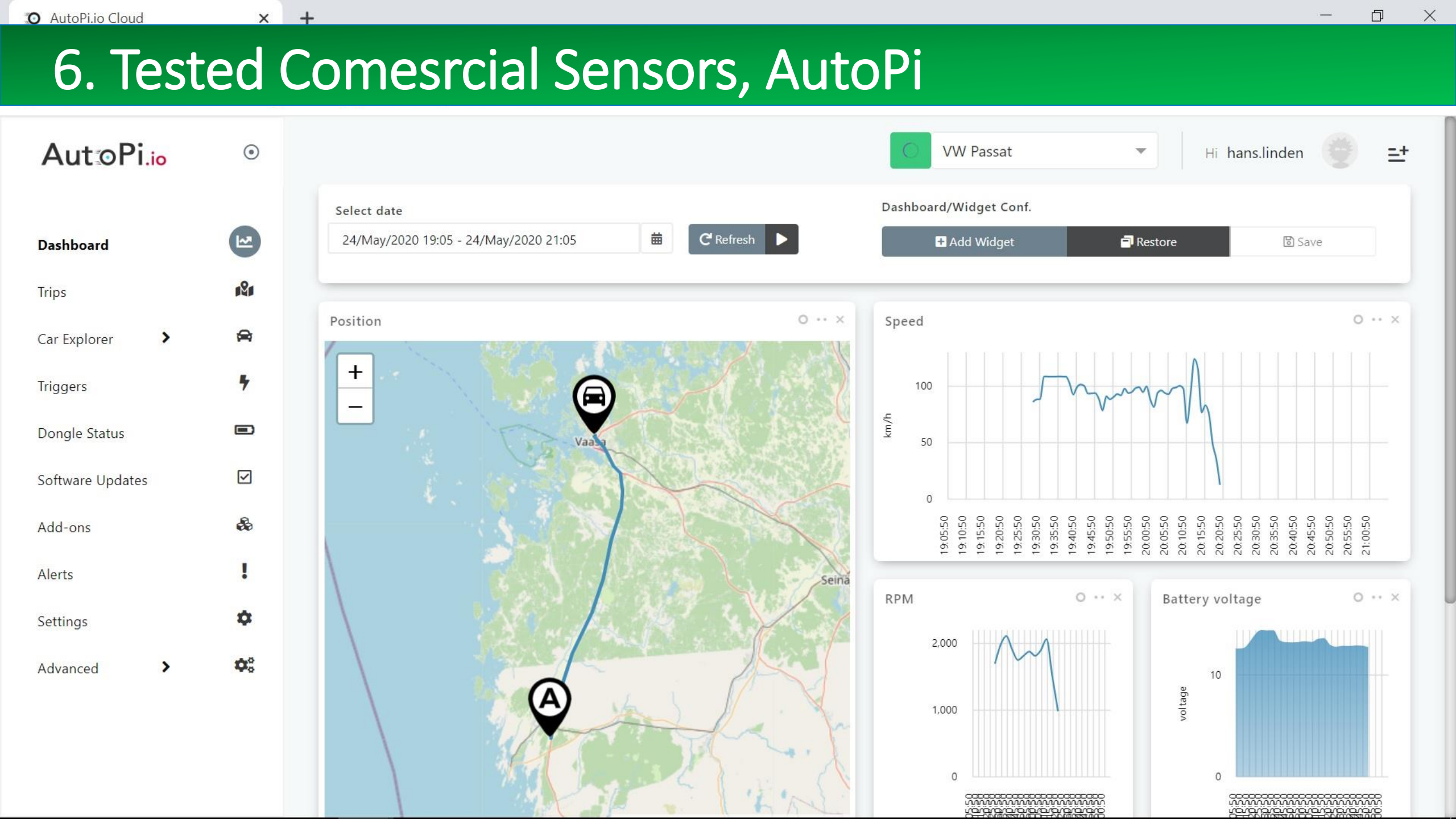
220 €

(2 pcs)

OBD2-port

SIM-card

6. Tested Comesrcial Sensors, AutoPi



6. Tested comercial sensors

Dragino LHT65

- Temperatura and Relative humidity
- LoraWan
- USB Chargable, Li-battery

Cost: 30 €/pcs (4 pcs)

6. Tested comercial sensors

Ellenex PLD2-L

- Submersible temperature and level transmitter
- LoraWan

Cost: 270 €/pcs (1 pcs)

Ellenex PLD2-L

7. IoT test equipment, power and energy

Watt Meter

Simple DC power and energy.

AVHzY

Power and energy for USB.

7. IoT test equipment, power and energy

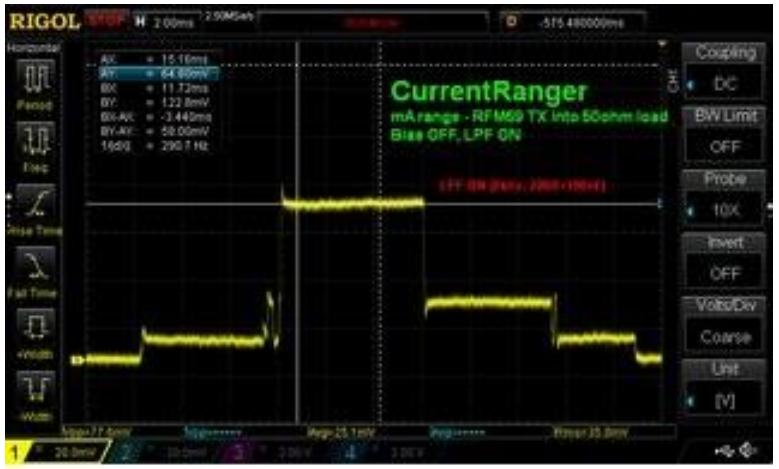
Welectron LowPowerLab

Current to voltage converter.

Ranges: mA → mV, µA → mV, nA → mV

Cut-off frequency: 300 kHz

PicoScope 2205A



Current consumtion during execution

7. IoT test equipment, temperature dependency

Small simple RF-transparent temperature adjustable fridge/freezer. To test battery lifetime dependency of temperature.

IndelB TB15

- 15 liter compressor freezer
- Adjustable temperature +10…-18°C

8. Basics in IoT course

Nov-Dec 2020

Week 1, Raspbery Pi intro **6h**

IoT intro, Raspberry installation
Programming Node-Red and dashboard
Digital I/O
1-wire temperature sensor (DS18B20)

Week 2, Raspbery Pi, BLE **6h**

BLE sensors, ex. RuuviTag
Email, twitter, Telegram or Whatsapp

Week 3, Raspbery Pi / ESP32, MQTT **6h**

Wifi sensors, MQTT
Smart Bulbs, sockets, switches and sensors

8. Basics in IoT course

Nov-Dec 2020

Week 4, LoraWan **6h**

Pycom Lopy 4 / Arduino MKR WAN 1310

Digita / The Things Network

Week 5, Home automation **6h**

Google/Amazon smart speakers

or Samsung Smart Thing

or Raspberry Pi Home automation

Smart* (light bulbs, sockets, switches, sensors, …)

Week 6, Miscellaneous **6h**

Cloud services, trackers, special sensors, temperature dependancy of betteries, 4G NB IoT, extra time on previous tasks.

Optional part 2 of the course, University of Vaasa