Environment warner

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Outline

- Main Idea
- Introduction of final product
- Main logic in nutshell
- Android app & low power bluetooth
- Server side & our website
- Power measurement
- Live demo

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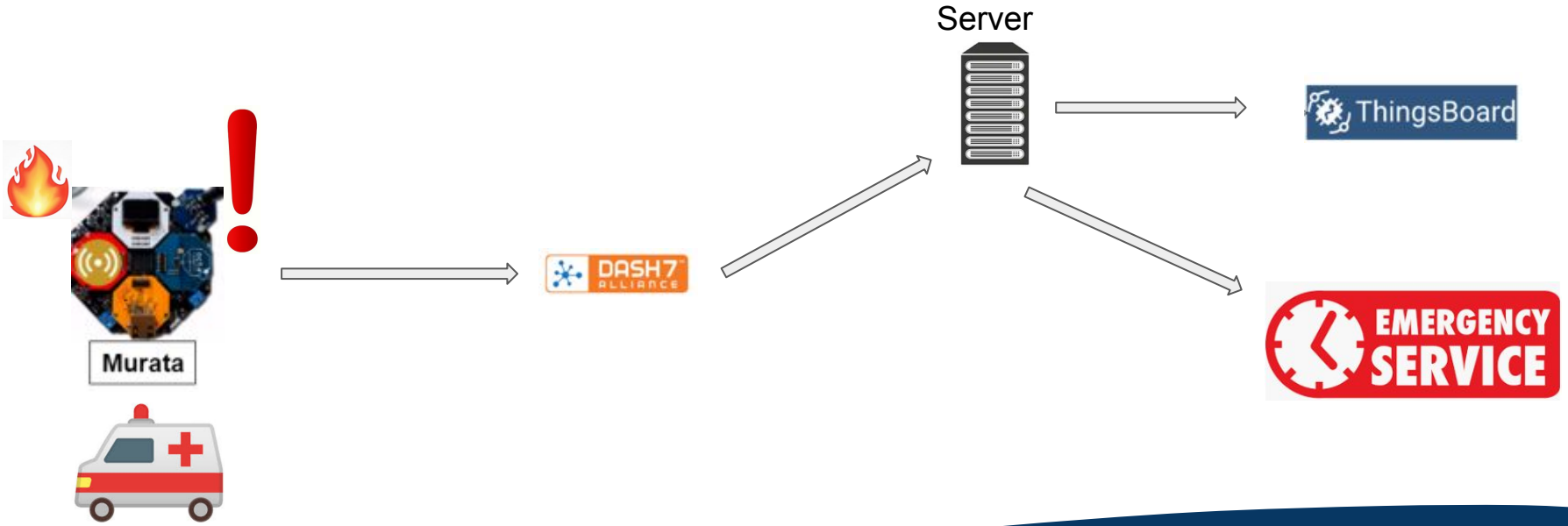
Main idea



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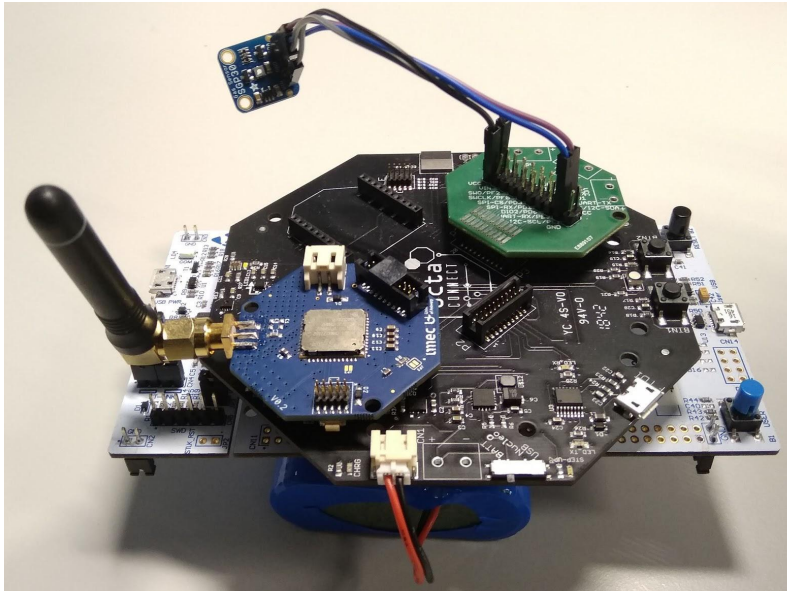
Final product



- Nucleo L496ZG
- ISP1507 BLE
- Octa platform
- Murata module
- HTS221 Temperature & Humidity sensor
- SPG30 gas sensor module
- Battery

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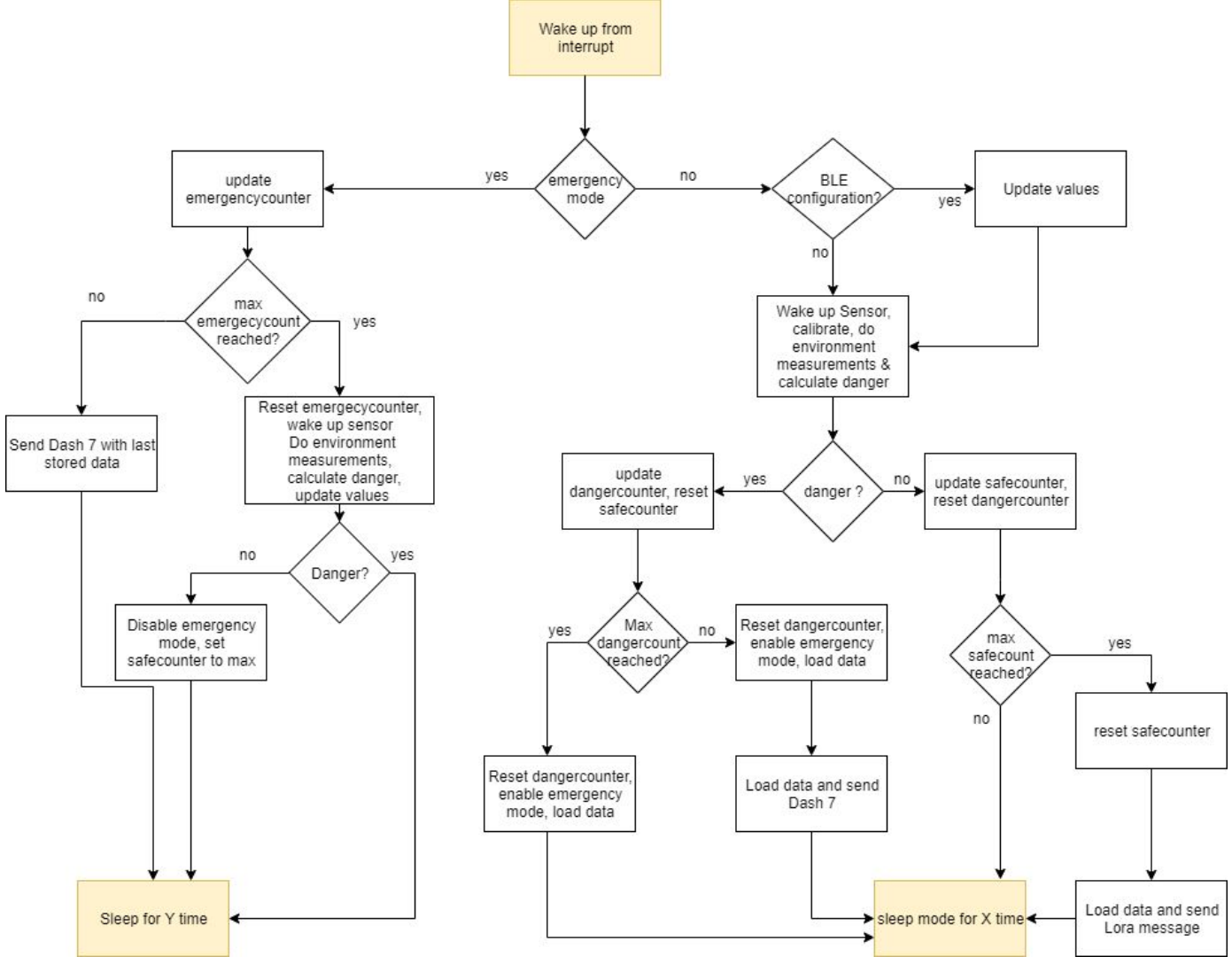
Device logic in nutshell

- Wake up using RTC from deep sleep
- Do measurements
- Calculate danger
- Based on outcome, determine what to do


Wake up from interrupt
emergency mode
yes
update emergencycounter
no
BLE configuration?
yes
Update values
no
Wake up Sensor, calibrate, do environment measurements & calculate danger
max emergecycount reached?
no
yes
Send Dash 7 with last stored data
Reset emergecycounter, wake up sensor Do environment measurements, calculate danger, update values
danger ?
yes
update dangercounter, reset safecounter
no
update safecounter, reset dangercounter
Danger?
no
yes
Disable emergency mode, set safecounter to max
Max dangercount reached?
yes
no
Reset dangercounter, enable emergency mode, load data
max safecount reached?
yes
reset safecounter
no
Reset dangercounter, enable emergency mode, load data
Load data and send Dash 7
Sleep for Y time
sleep mode for X time
Load data and send Lora message

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Low power bluetooth

- ISP1507 BLE
- ble_app_uart (example)
  - change name of device
  - and then understand how it works

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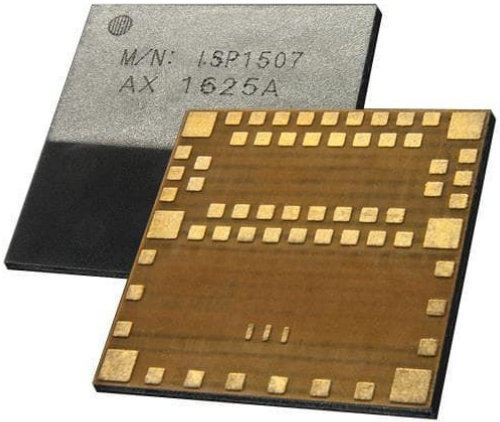
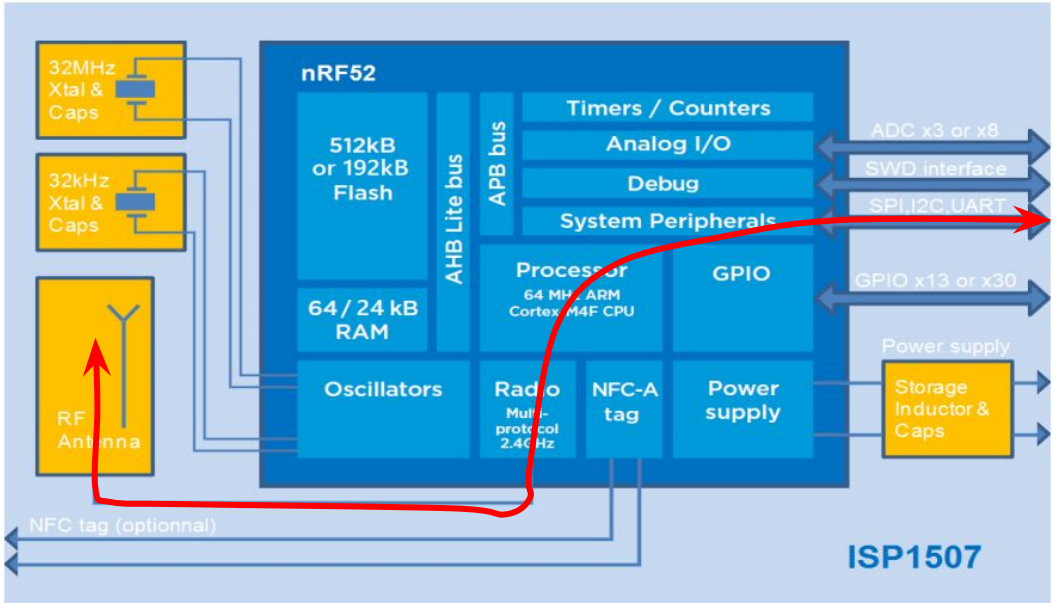
ISP1507 BLE





https://www.insightsip.com/fichiers_insightsip/pdf/ble/ISP1507/isp_ble_DS1507.pdf

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BLE UART use

- change application variables
  - normal timer
  - emergency timer
  - All data thresholds

```
uint16_t NormalSleepTime = 0x000A;
uint16_t EmergencySleepTime = 0x000A;

volatile uint16_t TemperatureTreshold[2];
volatile uint16_t HumidityTreshold[2];
volatile uint16_t CO2Treshold[2];
volatile uint16_t TVOCTreshold[2];
```

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Android App

- based on example
- change main functionality
- added necessary features
- transition to BLE mode in device

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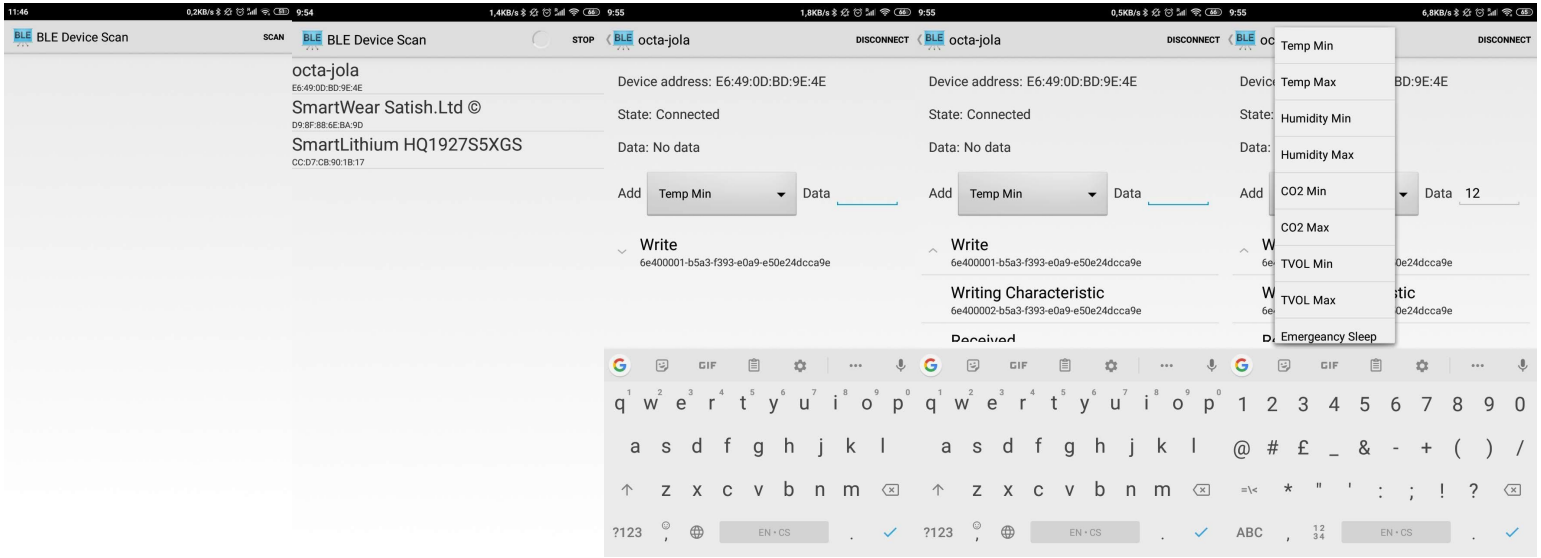
Android App



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Server side

- Main service - python script:
  - connecting to DASH7 and LoRa brokers
  - subscribing DASH7 and LoRa messages
  - reading information about temperature, humidity, CO2 and TVOC level, emergency, danger, strength of signals from gateways (last only for DASH7 messages)

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Server side

- Main service - python script:
  - saving informations in database
  - counting localisation with fingerprinting
  - publish informations to Things Board
  - sending mail if it is emergency mode

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Server side

- database (json file) for measurements
  - information about:
    - which device, number of sent message
    - measured data
    - if it is danger/emergency
    - number of gateway and signal strength (DASH7)

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Server side

- fingerprinting:
  - script for collecting data
  - training data: databases for all measurements and locations
  - script for making fingerprinting
  - used library: sklearn.neighbors

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Website

- devices configuration (octa-jan, ocna-jola, octa-ruben)
  - attributes
  - latest telemetry - last saved values of measurements
- dashboard:
  - map of classrooms with latest position of devices
  - displayed data

is_danger
1

is_emerg
1

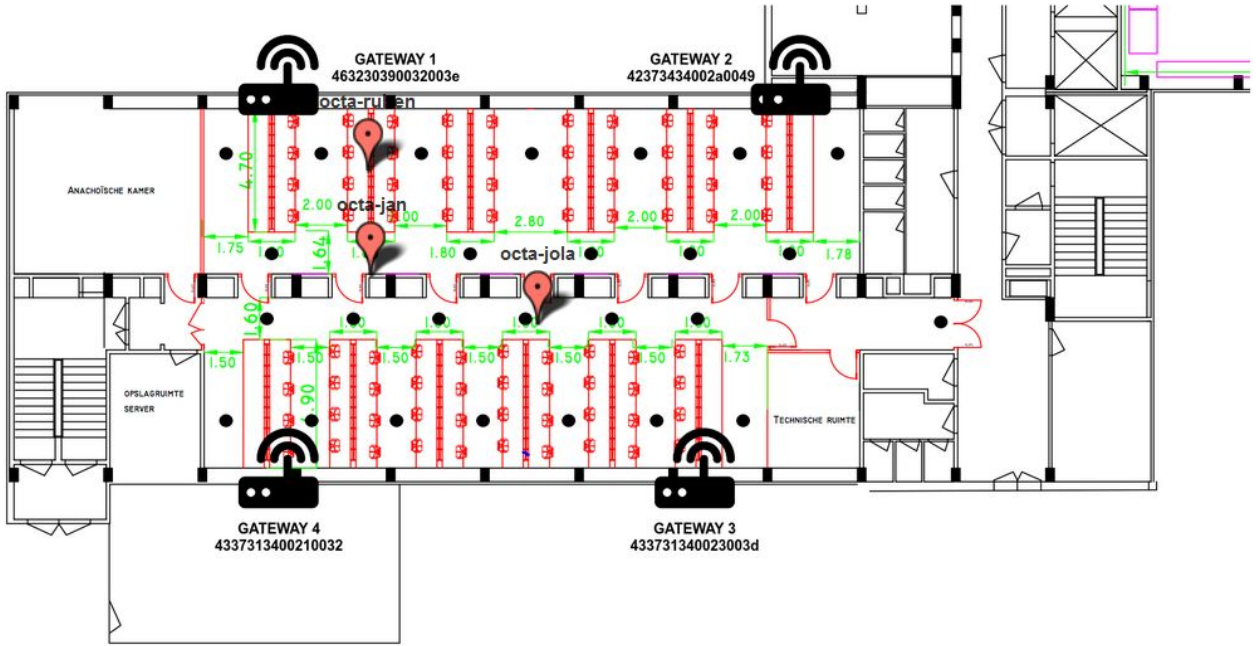
humidity
31 %

CO2
757 ppm

TVOC
147 ppb

temperature
25 °C

Map of classrooms



Text

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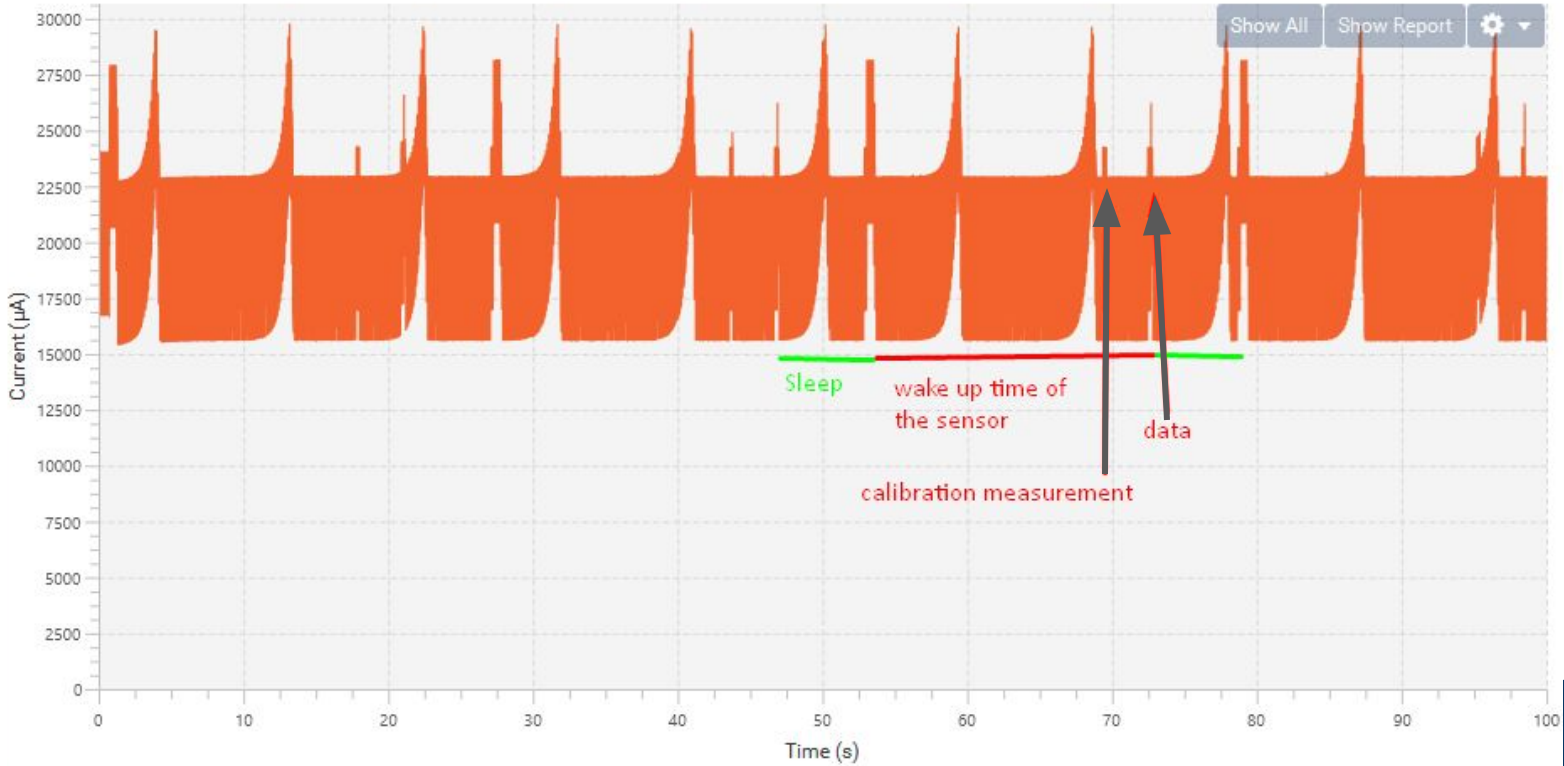
Power measurements



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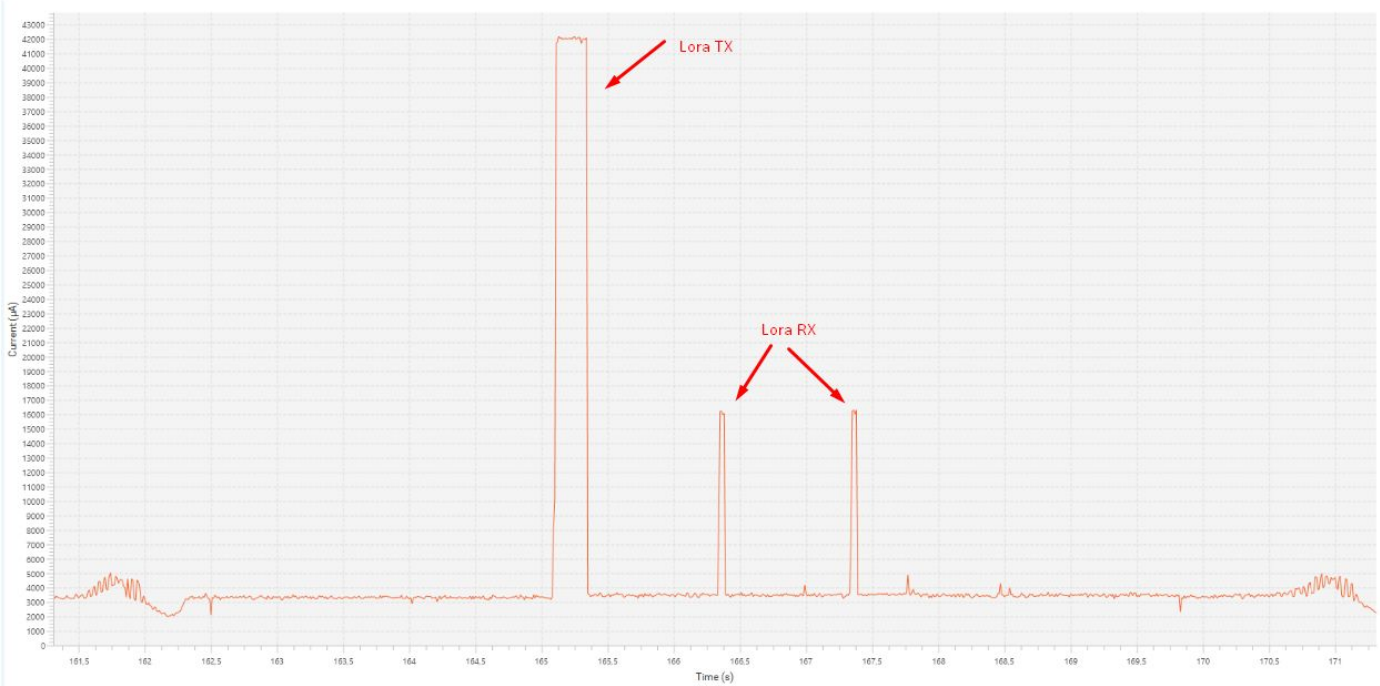
Power measurements



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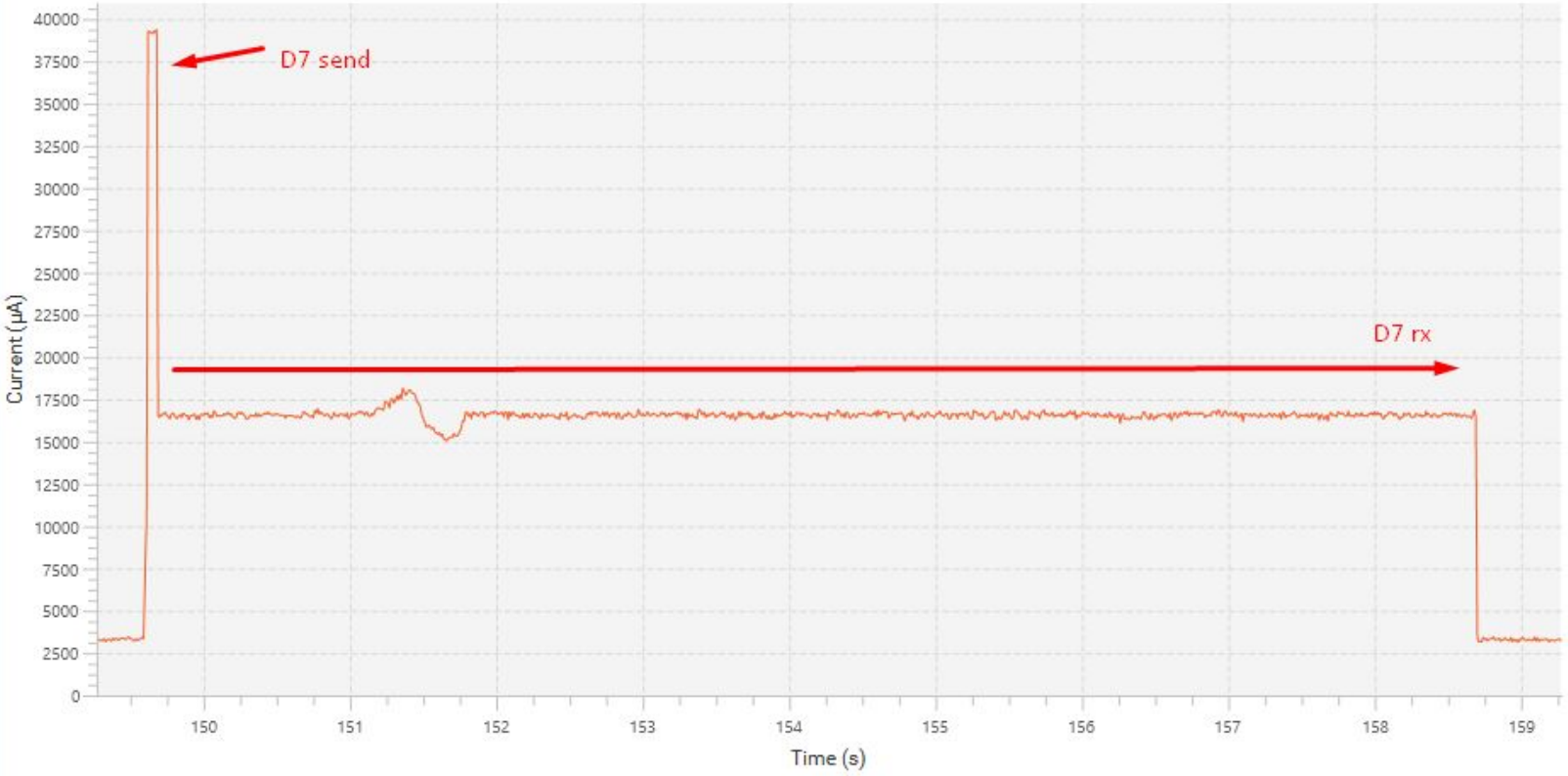
Power measurements



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Power measurements

- assuming normal wake up every 20 min, emergency wake up every 5 min with sleep consumption 22 mAh

1 hour normal:		**1 hour emergency**	
sleep time (s):	3544	sleep time (s):	3355
sleep consumtion (mA):	21,66	speel consumtion (mA):	20,50
active time (s):	56	active time (s):	245
active consumption (mA):	0,96	active consumption (mA):	3,44
total consumption (mA):	22,62	total consumption (mA):	23,94
battery life in days	12,16	**Battery life in days:**	11,49
1 hour danger		**Always sleep mode:**	
sleep time (s):	3530	sleep time (s):	3600
sleep consumtion (mA):	21,57	**sleep consumtion:**	22
active time (s):	70		
active consumption (mA):	1,13	**battery life in days:**	12,5
total consumption (mA):	22,70		
Battery life in days:	12,11		

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Power measurements

- assuming normal wake up every 20 min, emergency wake up every 5 min with sleep consumption 10 mAh

1 hour normal:		**1 hour emergency**	
sleep time (s):	3544	sleep time (s):	3355
sleep consumtion (mA):	9,84	speel consumtion (mA):	9,32
active time (s):	56	active time (s):	245
active consumption (mA):	0,96	active consumption (mA):	3,44
total consumption (mA):	10,80	total consumption (mA):	12,76
battery life in days	25,45	**Battery life in days:**	21,55
1 hour danger		**Always sleep mode:**	
sleep time (s):	3530	sleep time (s):	3600
sleep consumtion (mA):	9,81	**sleep consumtion:**	10
active time (s):	70		
active consumption (mA):	1,13	**battery life in days:**	27,5
total consumption (mA):	10,94		
Battery life in days:	25,15		

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Future improvements

- Send less data
- Better sensor
- Optimize low power

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Time for live demo… 

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Thank you for your attention!

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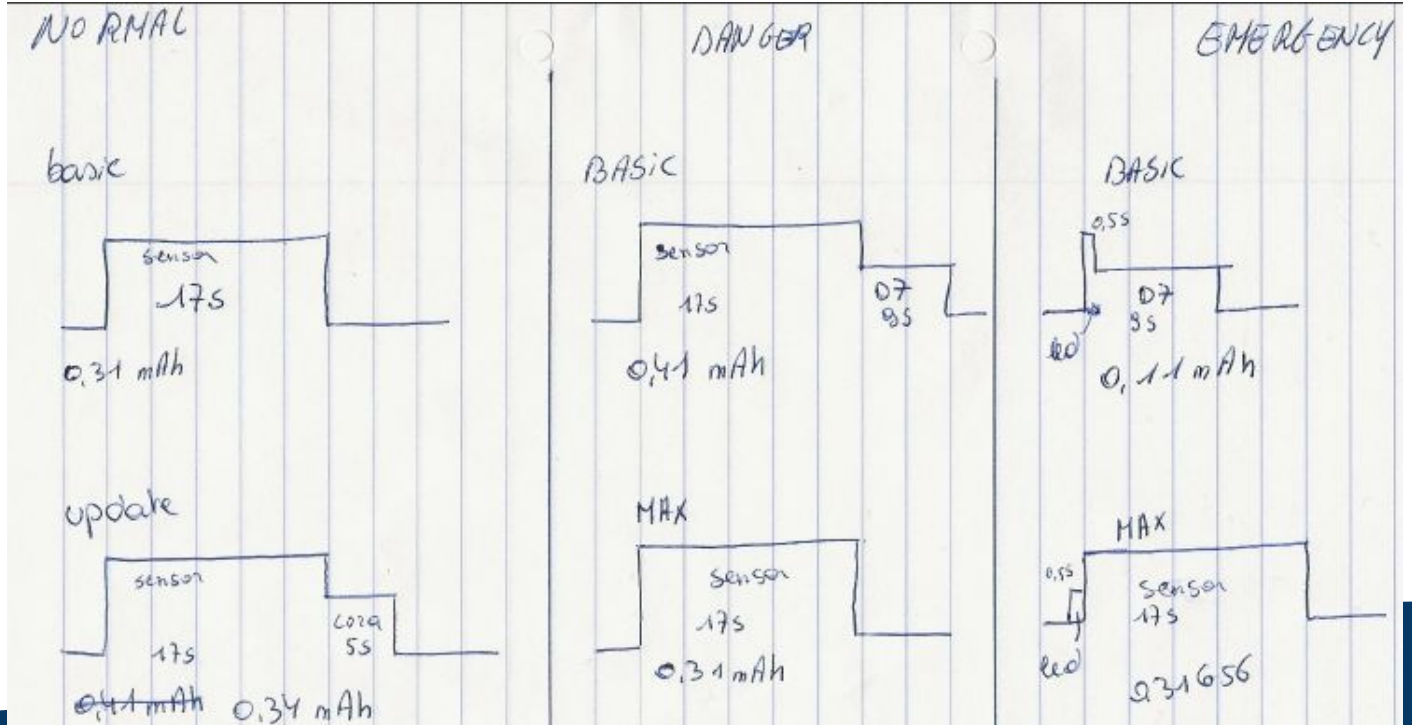
Power measurement calculations



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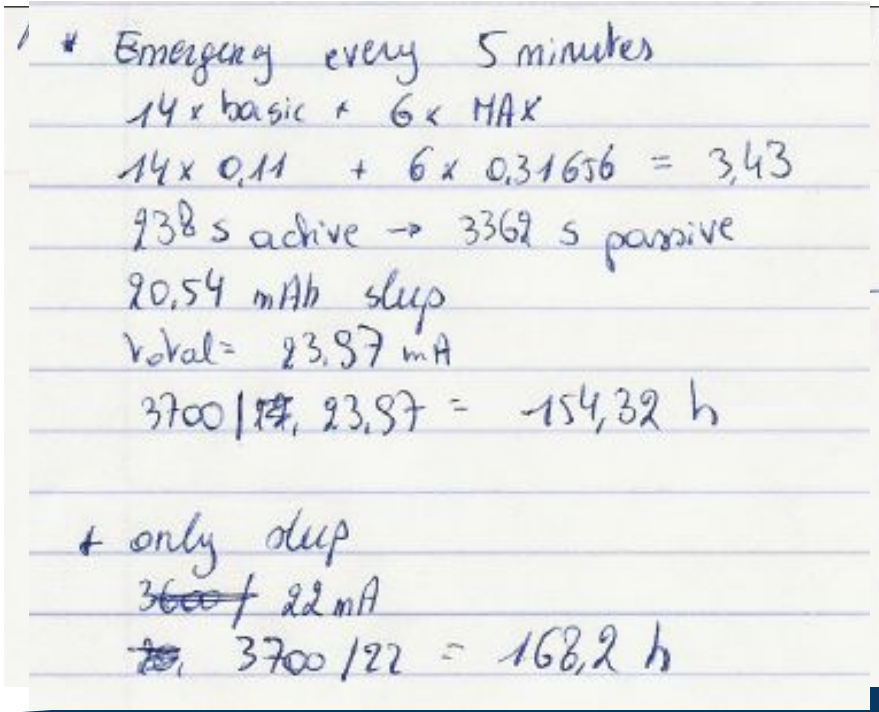
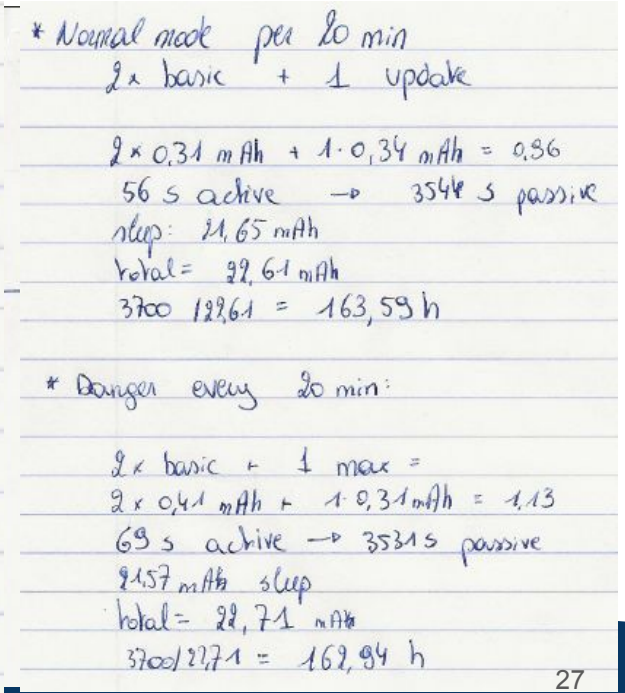
Power measurement calculations



* Emergency every 5 minutes
14 x basic + 6 x MAX
14 x 0,11 + 6 x 0,31656 = 3,43
238 s active → 3362 s passive
20,54 mAh slup
Total = 23,97 mA
3700 / 23,97 = 154,32 h

+ only slup
3600 / 22 mA
3700 / 22 = 168,2 h



* Normal mode per 20 min
2 x basic + 1 update

2 x 0,31 mAh + 1 · 0,34 mAh = 0,96
56 s active → 3544 s passive
slup: 21,65 mAh
Total = 22,61 mAh
3700 / 22,61 = 163,59 h

* Danger every 20 min:

2 x basic + 1 max =
2 x 0,41 mAh + 1 · 0,31 mAh = 1,13
69 s active → 3531 s passive
21,57 mAh slup
Total = 22,71 mAh
3700 / 22,71 = 162,94 h

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