SmartHouse

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Requirements of application

- Low power - IoT device
- Wireless communication:
  - Default: DASH7
  - Backup: LoRaWAN
- Localization
  - Indoor (DASH7)
  - Outdoor (LoRaWAN)
- Device configuration
  - Bluetooth
- Dashboard
  - Live visualization

Overview of application

- Tracking inside house
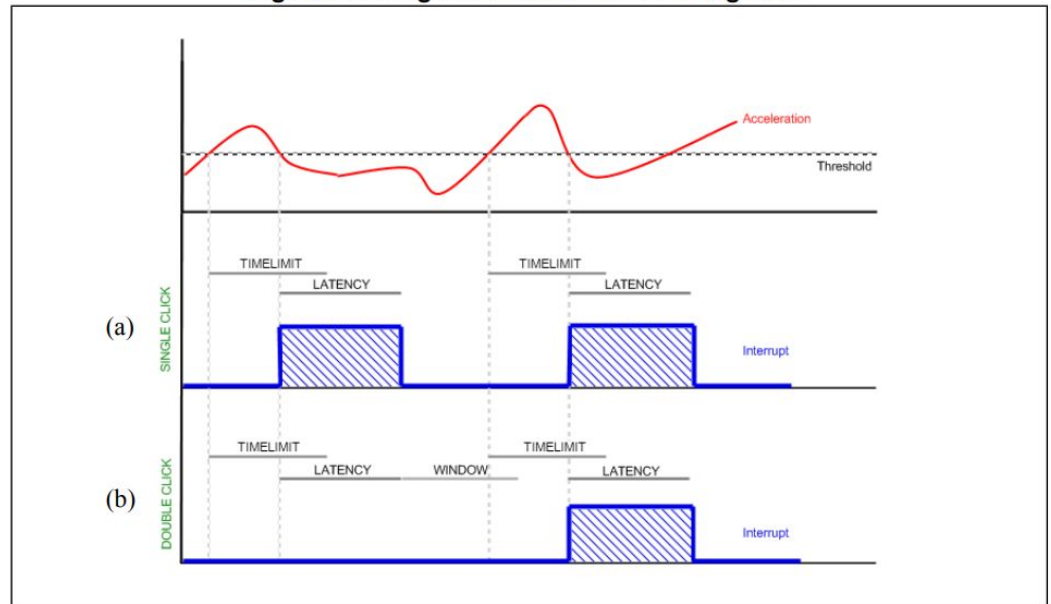- Setting temperature outside house
- Maximizing energy efficiency

Embedded Software

- Stop mode 1 (watchdog)
- Accelerometer (double click)
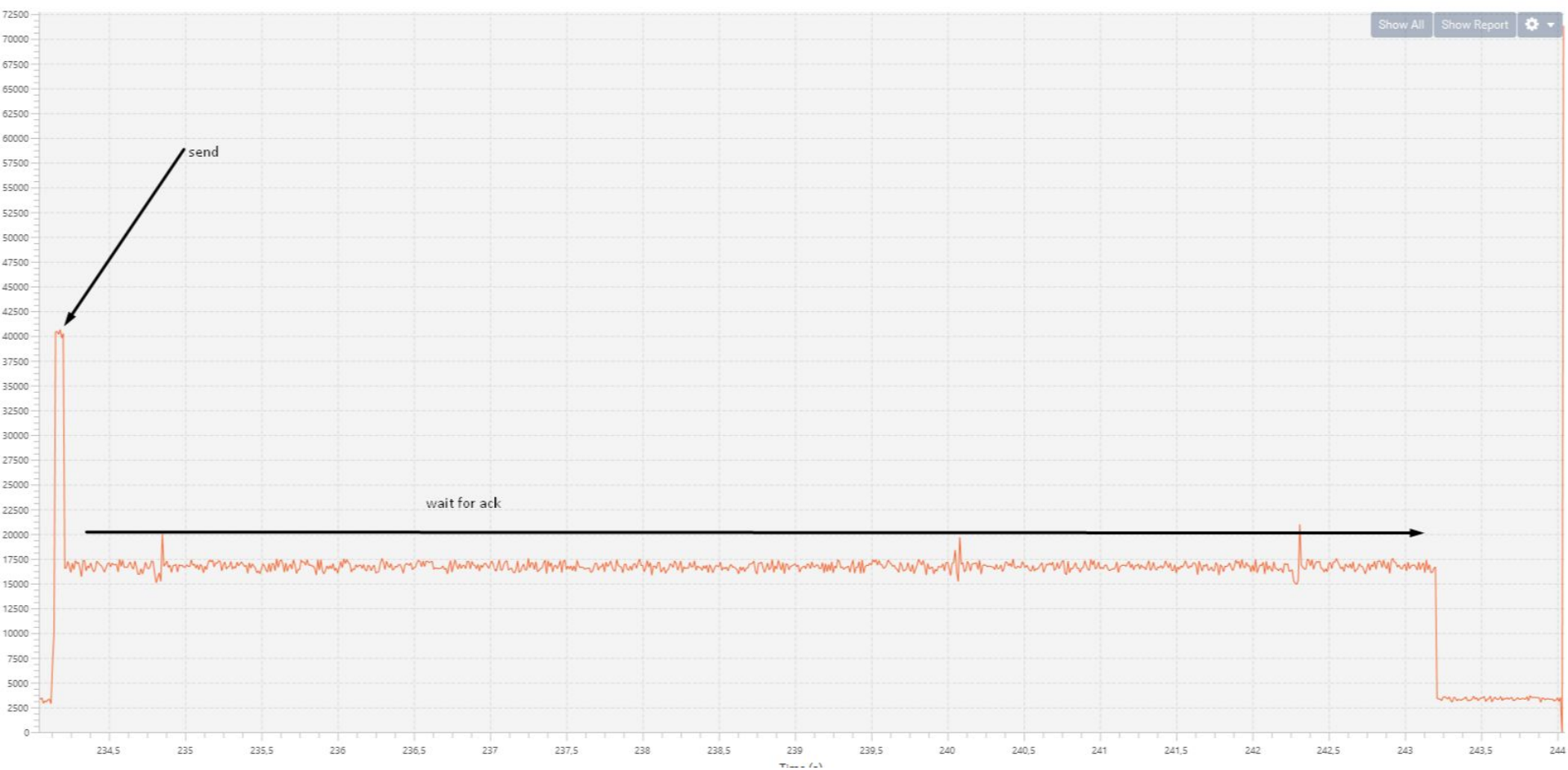- Dash7 / LoRaWAN
- Interrupts (priorities)
- BLE

Embedded Software

- Stop mode 1 (watchdog)
- Accelerometer (double click)
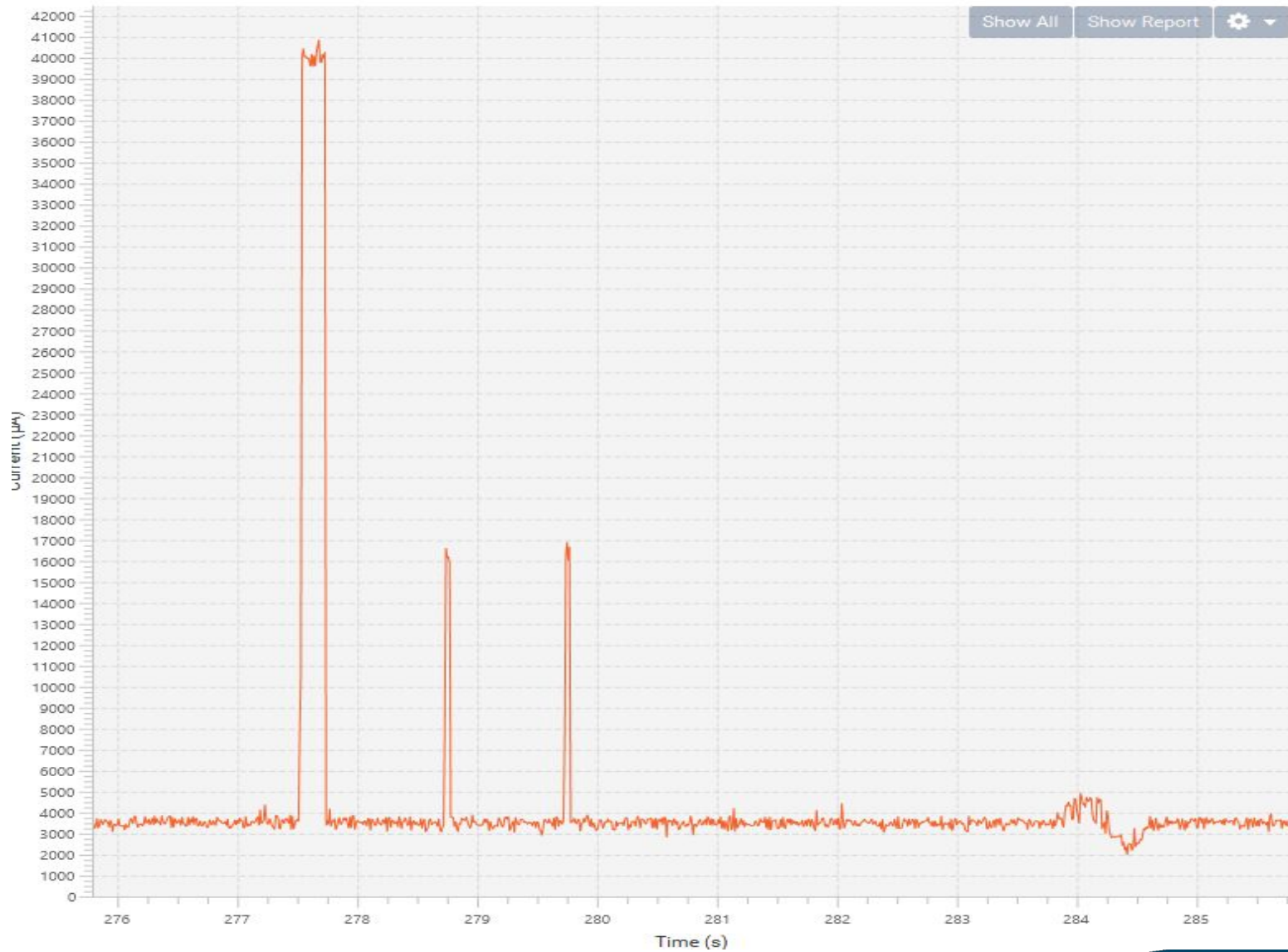- Dash7 / LoRaWAN
- Interrupts (priorities)
- BLE

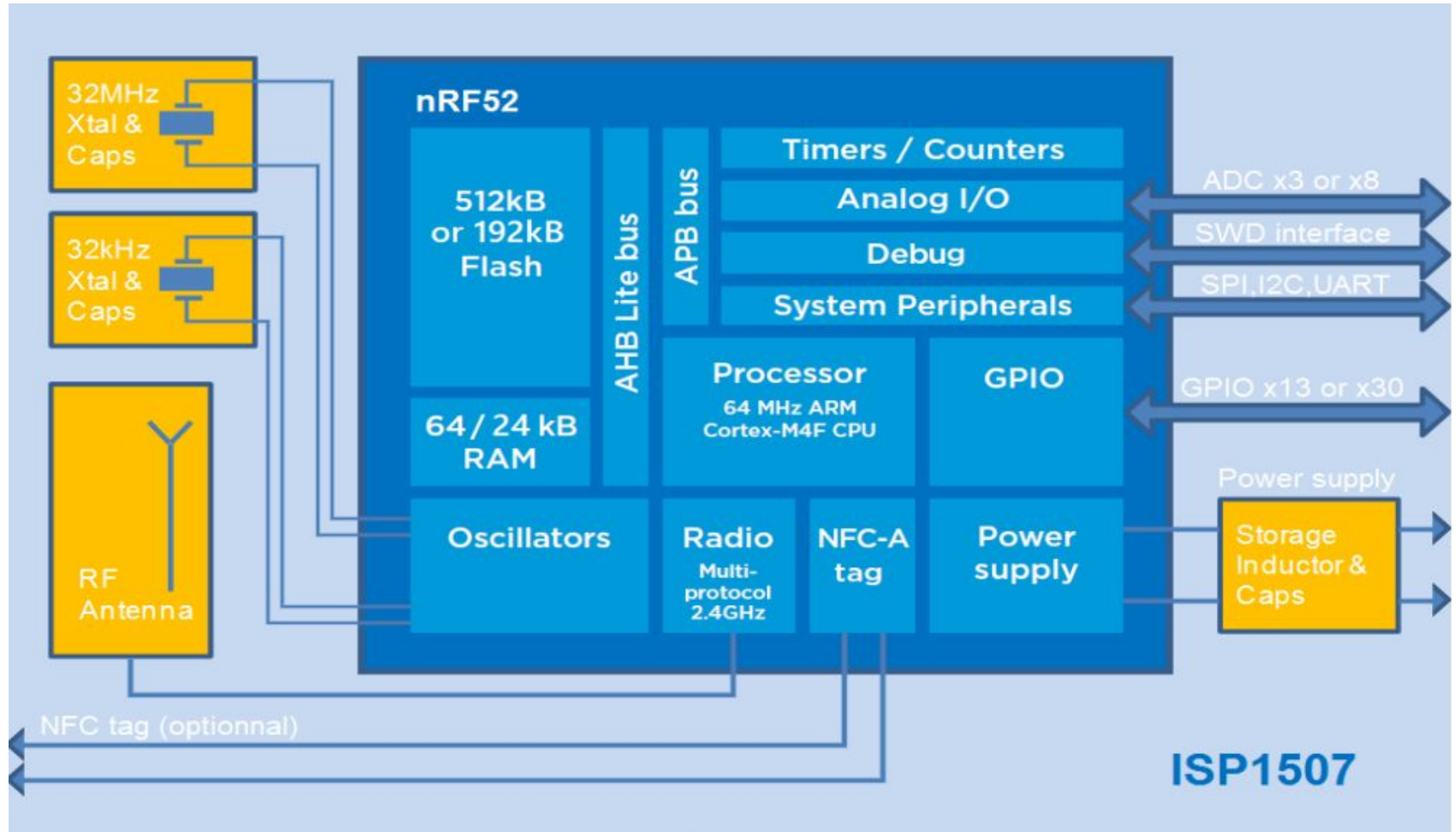Figure 18. Single and double-click recognition
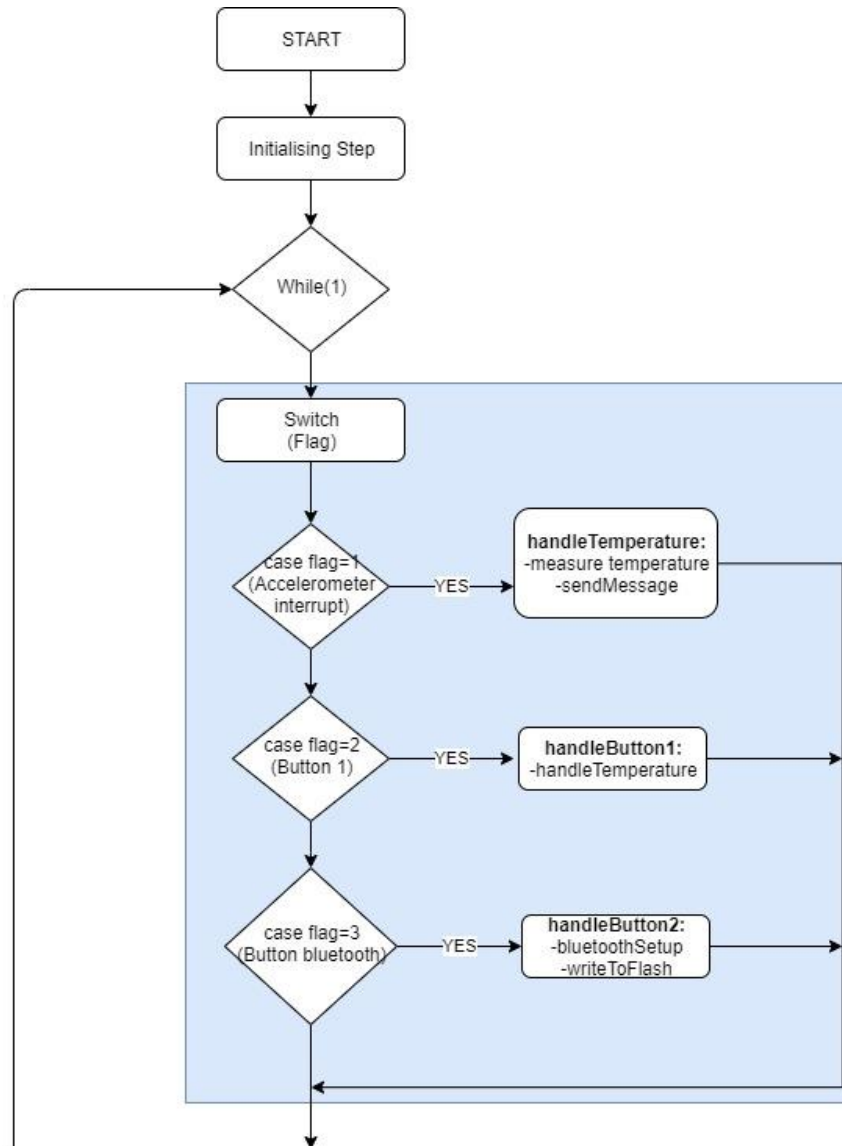
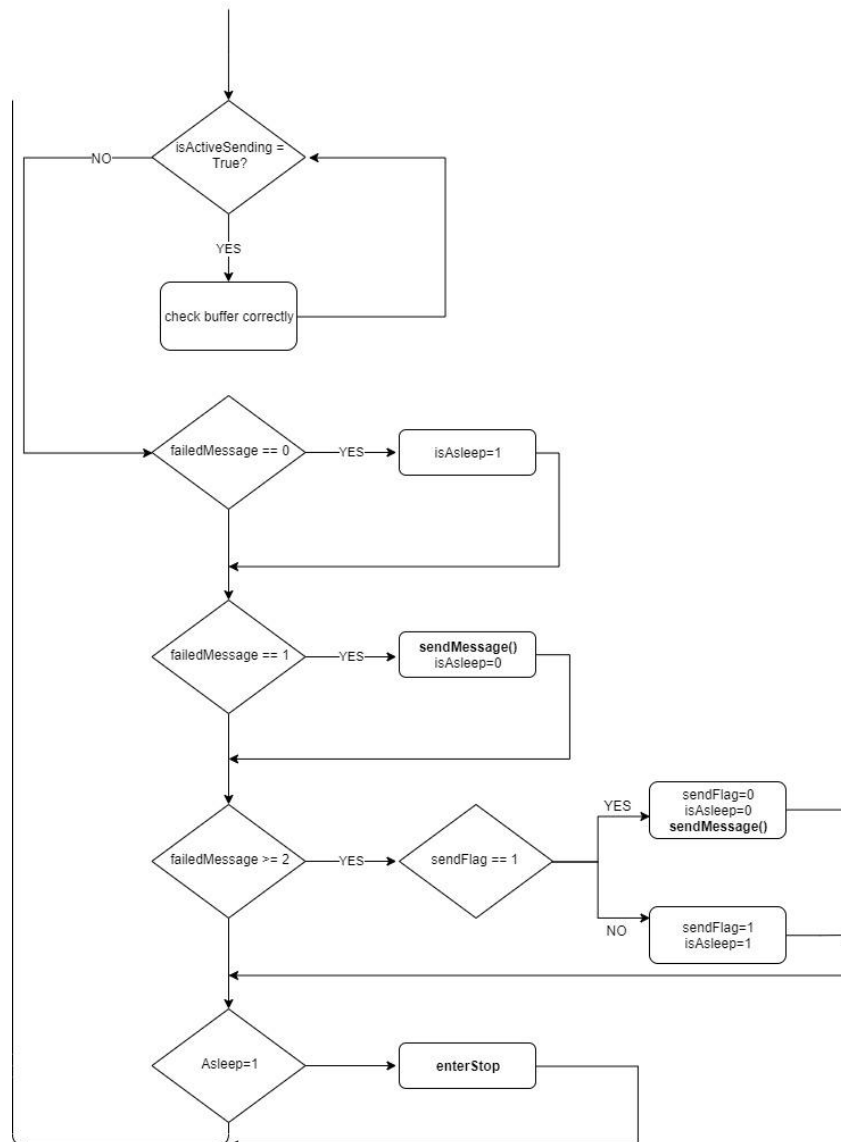# Embedded Software: Dash7
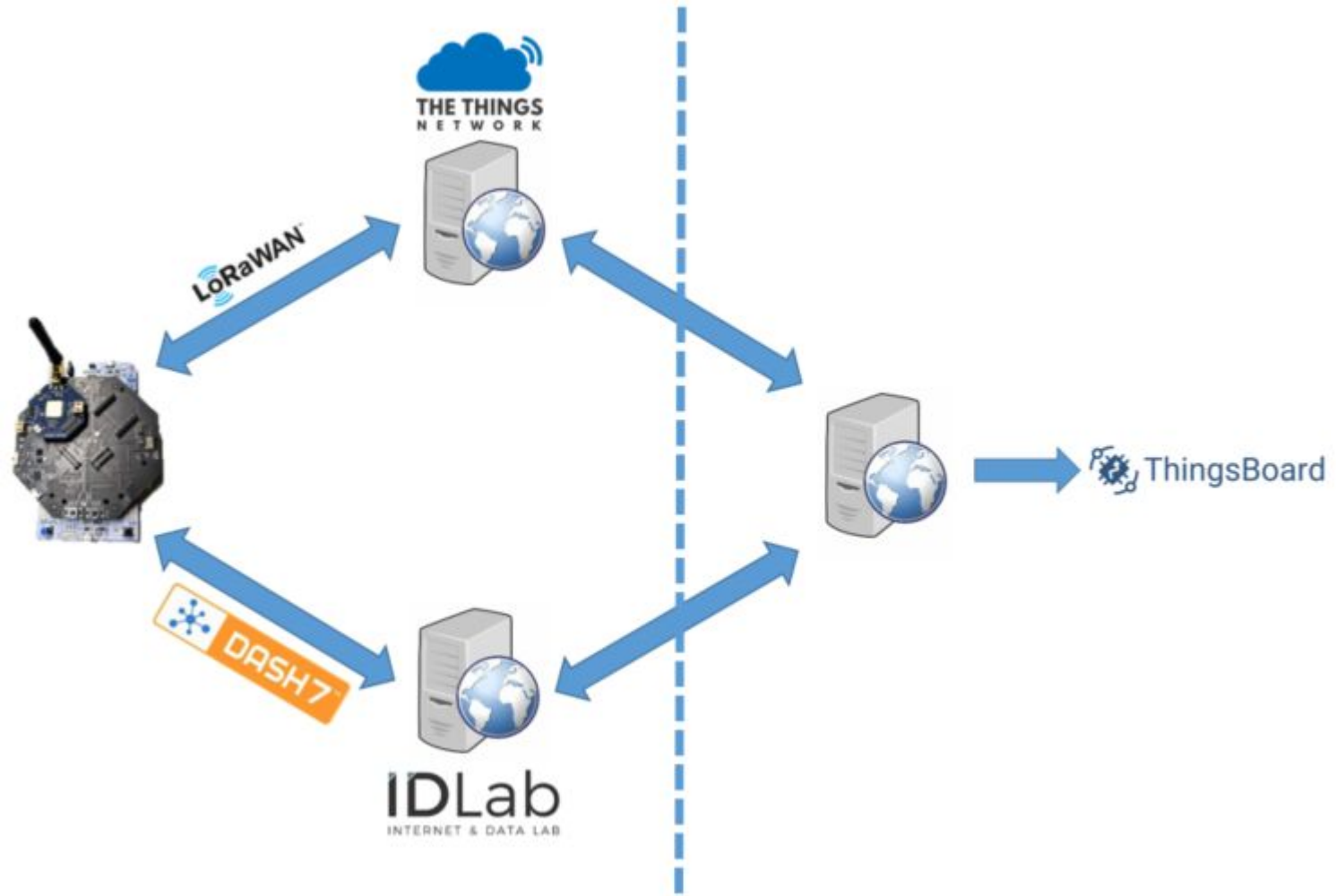
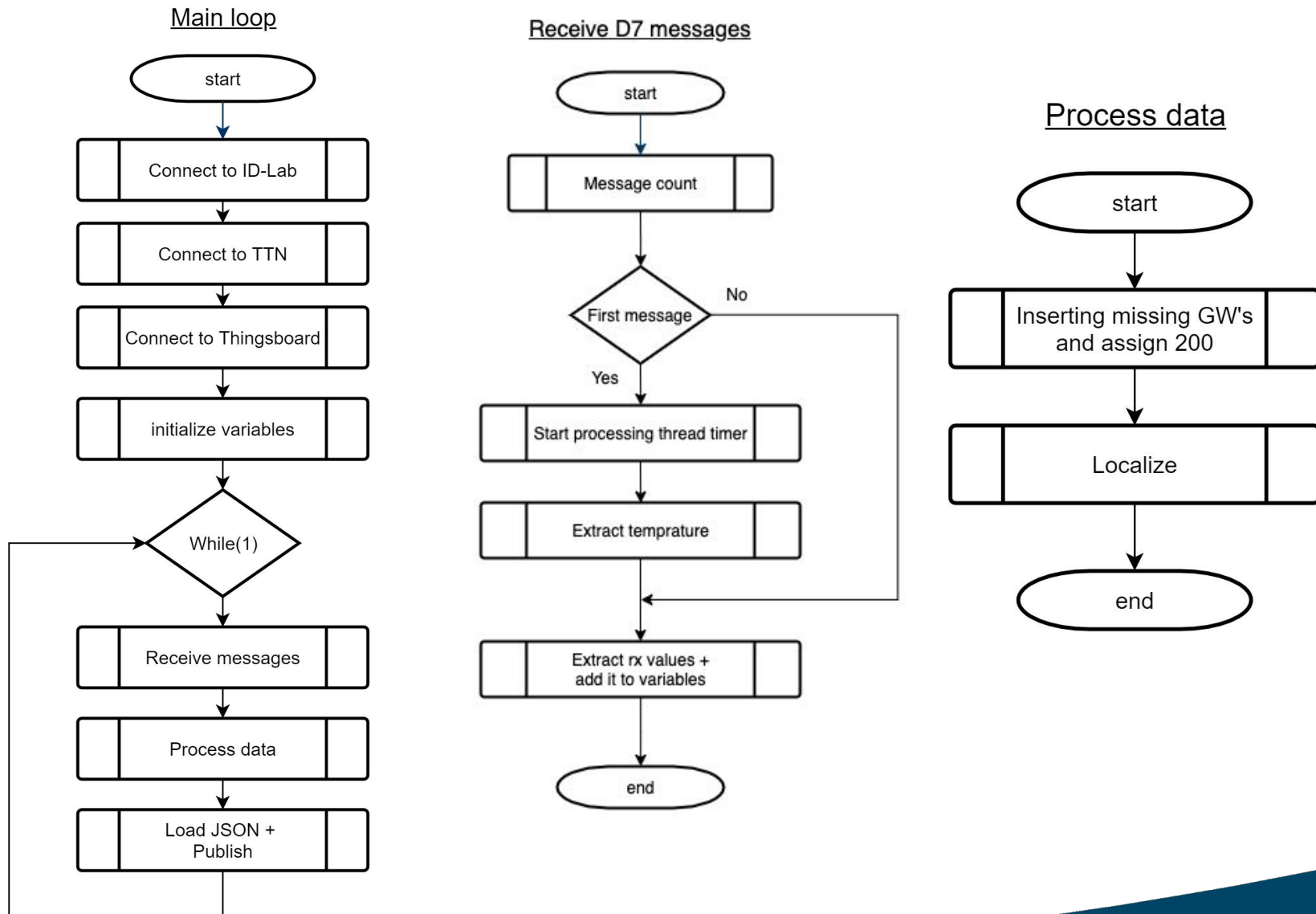# Embedded Software: LoRaWAN

Embedded Software: BLE

Embedded software

Embedded software

Overview

Back-end software

Main loop

start

Connect to ID-Lab

Connect to TTN

Connect to Thingsboard

initialize variables

While(1)

Receive messages

Process data

Load JSON + Publish

Receive D7 messages

start

Message count

First message — No

Yes

Start processing thread timer

Extract temprature

Extract rx values + add it to variables

end

Process data

start

Inserting missing GW's and assign 200

Localize

end

Back-end software

Receive Lora messages

start → Extract data → Add data to JSON format → Write to file → Publish → end

Load JSON + Publish

start → Transform coordinates → Add data to JSON format → Write to file → Publish → end
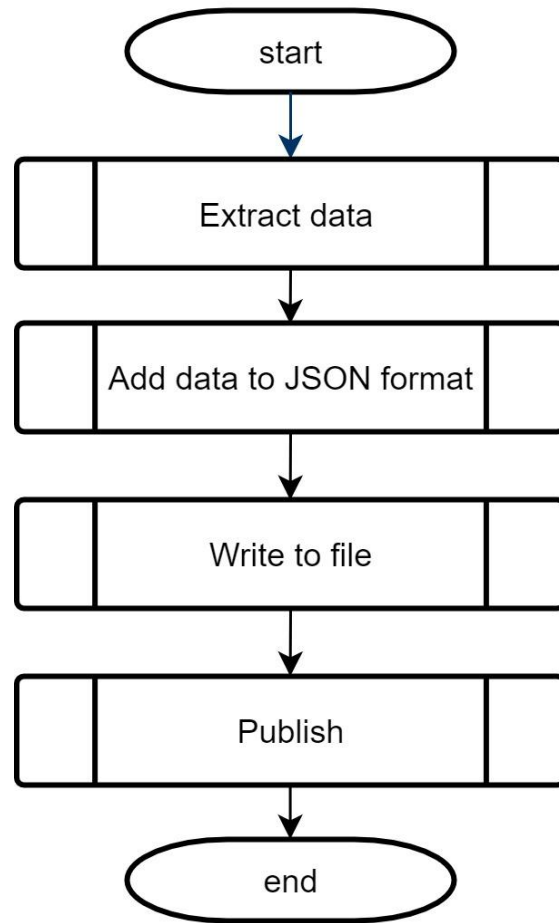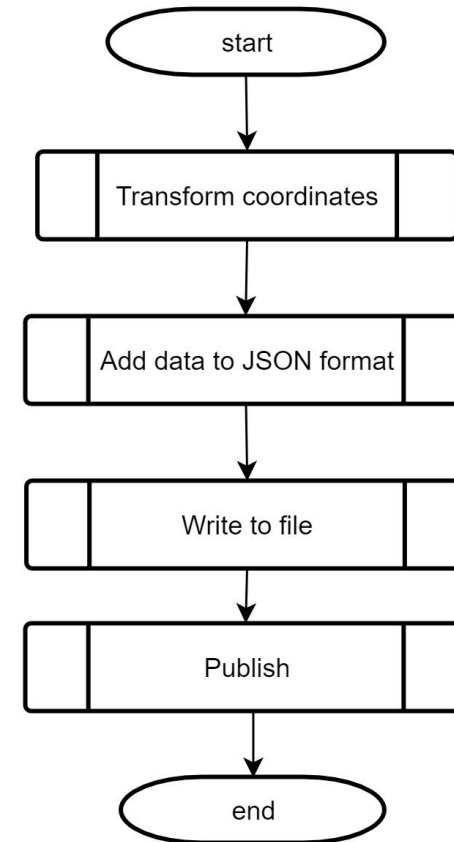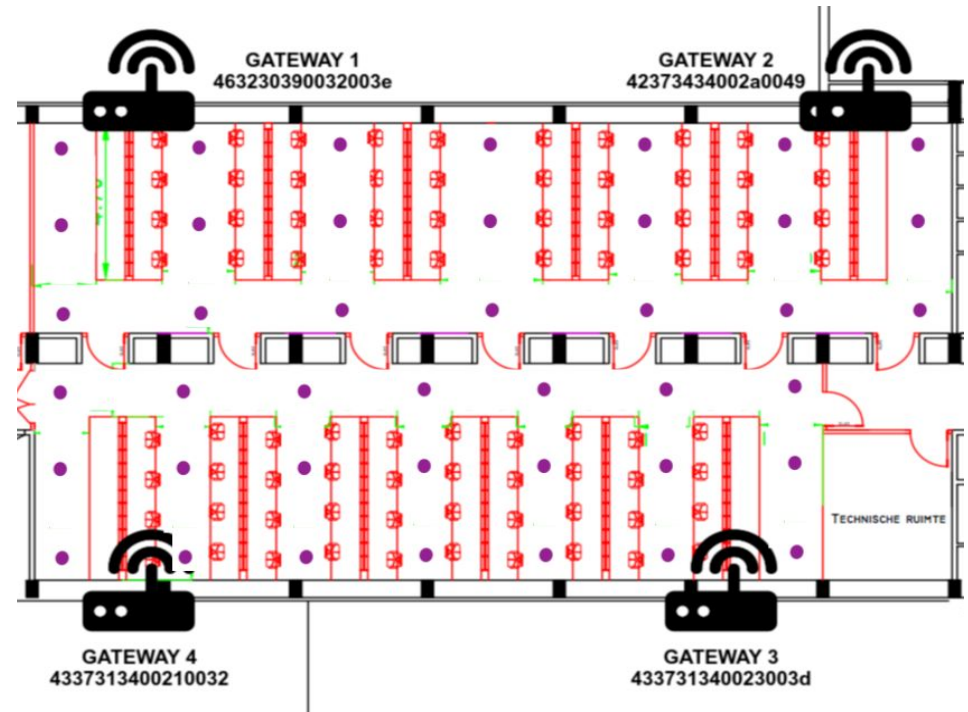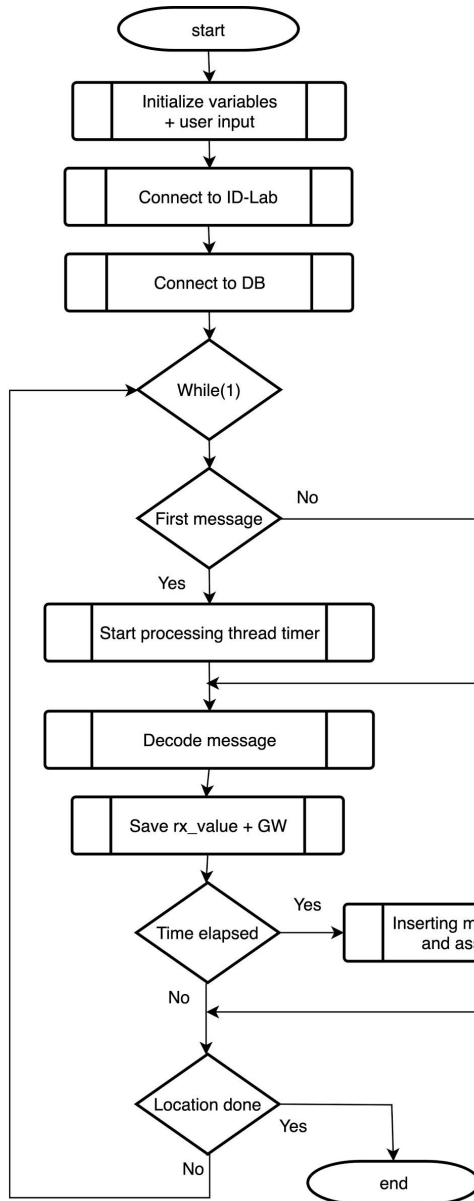
Localisation overview

- Fingerprinting
  - Two main steps
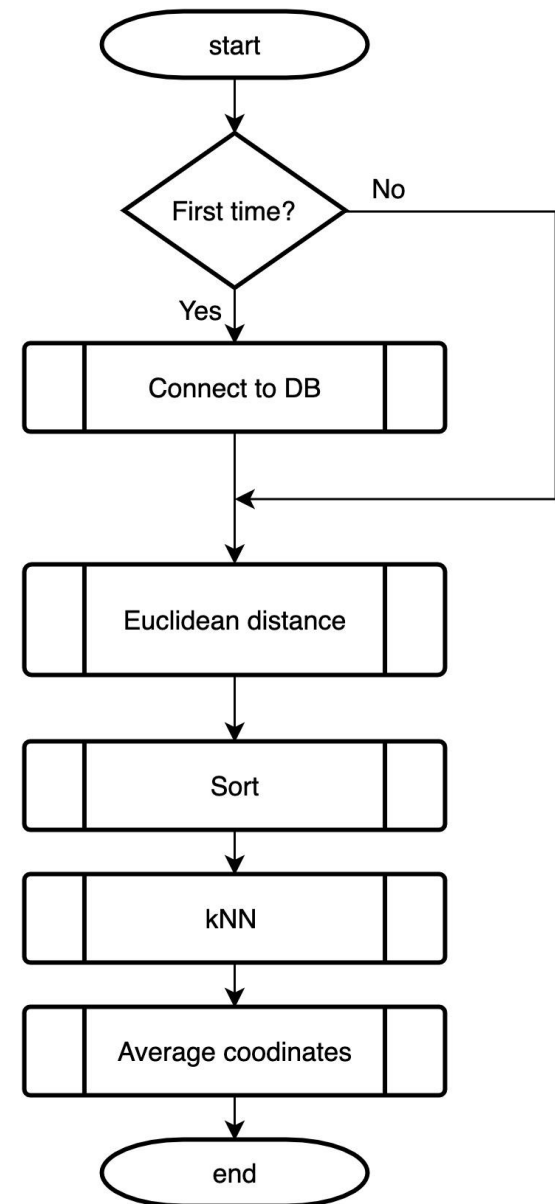   - Training step → Database builder
    - Operational step → Localisation

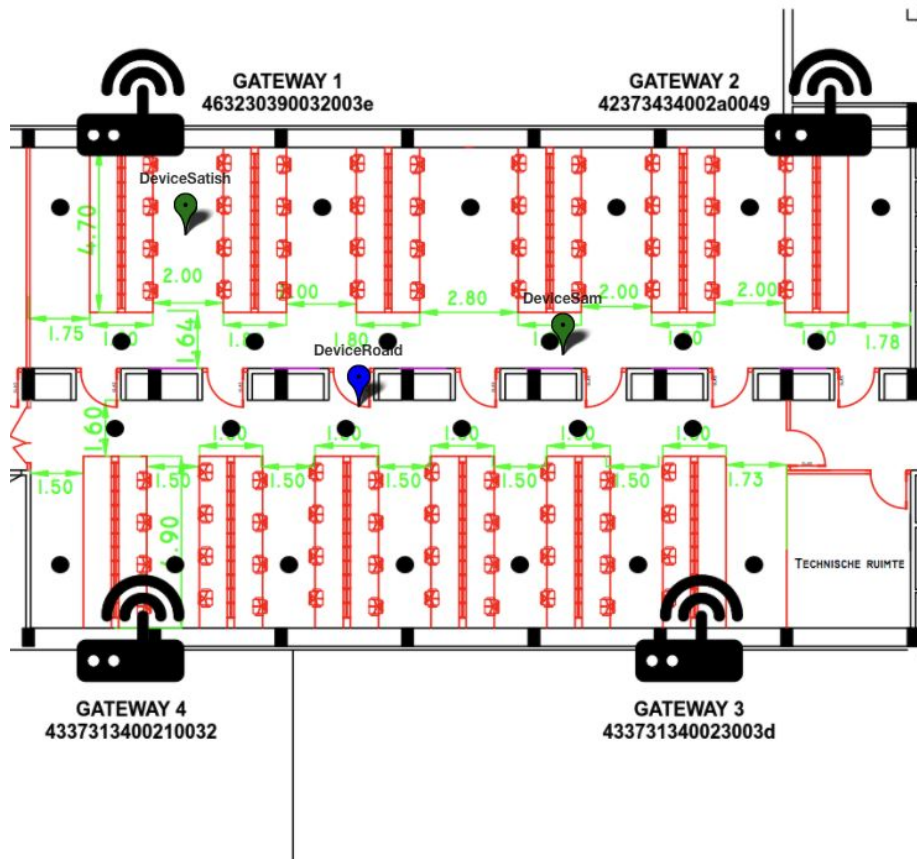# Localisation - Database builder

Localisation

- Euclidean distance
- kNN

Energy Profiling

Device Mode	energy consumption[mA]
Stop Mode (+murata basic-consumptionLeds)	14,625
Sending-dash(+active consumption)	62
rx-dash	41,5
Sending-lora(SF7)	62
rx-lora (2x slots)	38,5
Temperature-measurement	29,625
Write to flash	45,125
Bluetooth setup	27,125
Murata_basic	3,125
Active_Consumption	22

Use of 15 interrupts, 3 setups and 10 LoRaWAN messages a day with a battery of 6600 mAh, we have 449 working hours.

Future work

- Limiting LoRaWAN messages
- Turning off unused modules and peripherals
- Controlling lights inside of house
- Reduce clock frequency
- More failsafes, dummy proof
- ...

Demo

Questions?

Division of labour

Satish Singh	Embedded code
	Power measurements
Sam Peetermans	Localisation
	Backend scripts
Stevie Maes	Setup and maintaining backend
	Backend scripts
	Thingsboard
Roald de Brouwer	Thingsboard
	GUI