



mtec

IOT PROJECT PRESENTATION

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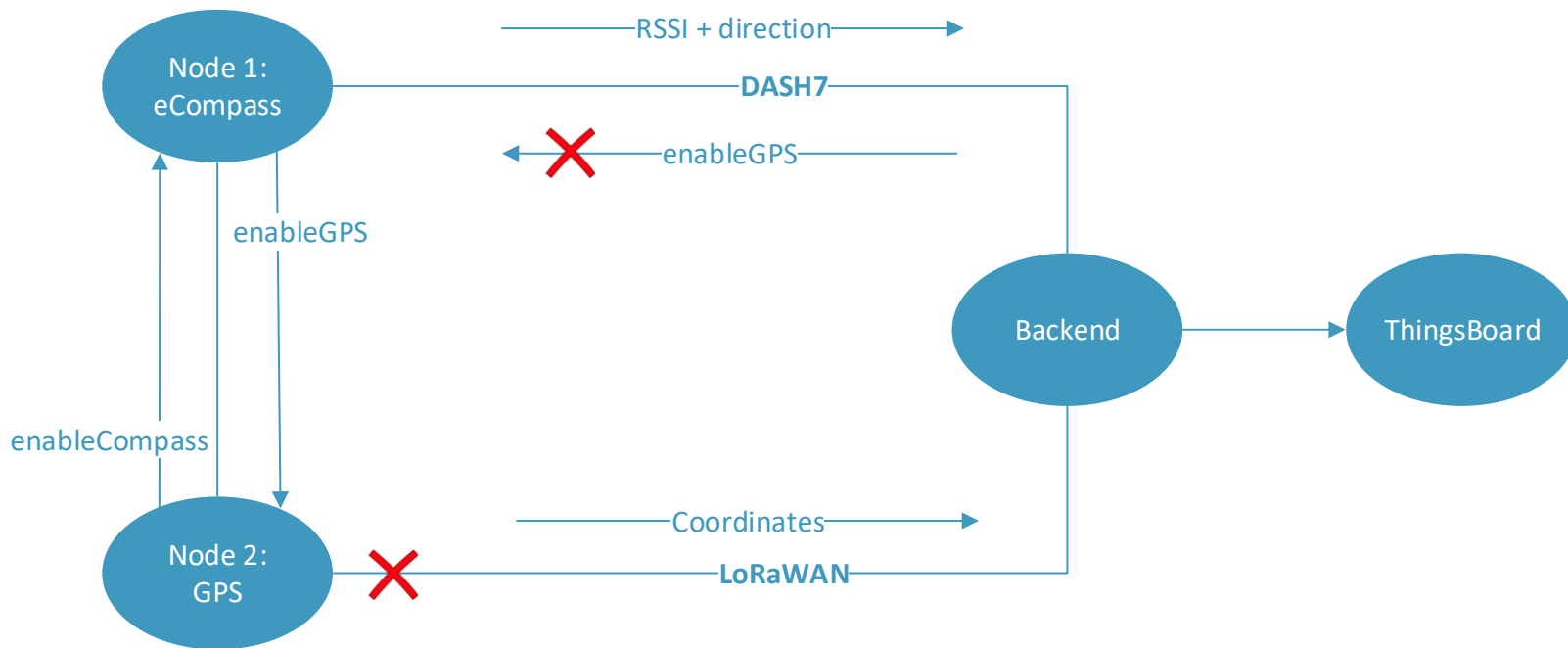
MONITORING RUNAWAY BEHAVIOR

- Overview
- Schedule
- Future work
- Power measurements
- Result: demo



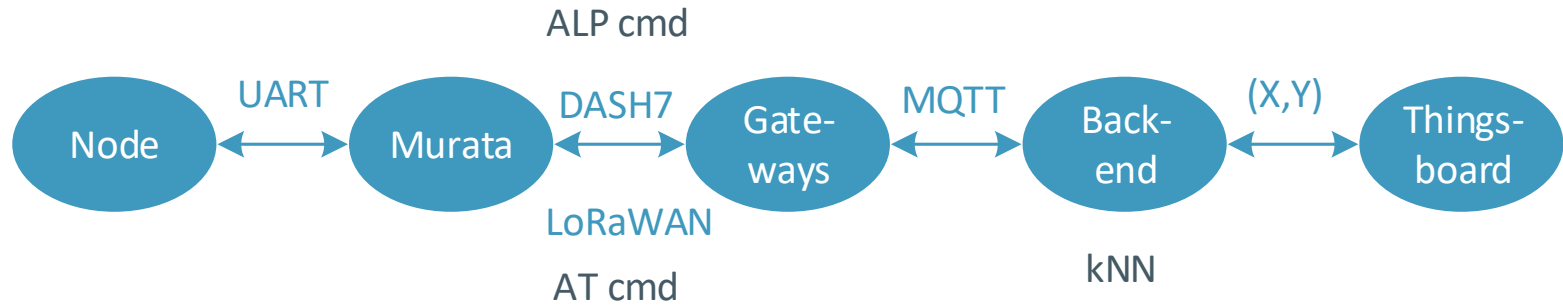
OVERVIEW

DATA FLOW



OVERVIEW

COMMUNICATION



SCHEDULE

I. GPS module (Jonas)

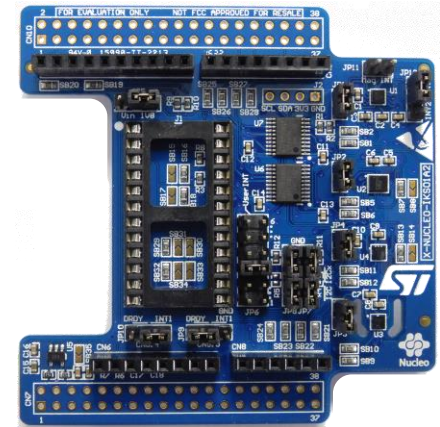
- Soldering
- Configuration (GPGGA, each 60s)
- Converting coordinates
- Enable if out of safe zone (input eCompass)
- Disable if in safe zone (re-enable eCompass)
- Low Power Sleep mode → GPS off
- TB: longitude, latitude, HDOP
- STM32 HAL & Mbed



SCHEDULE

2. eCompass (Jonas & Liam)

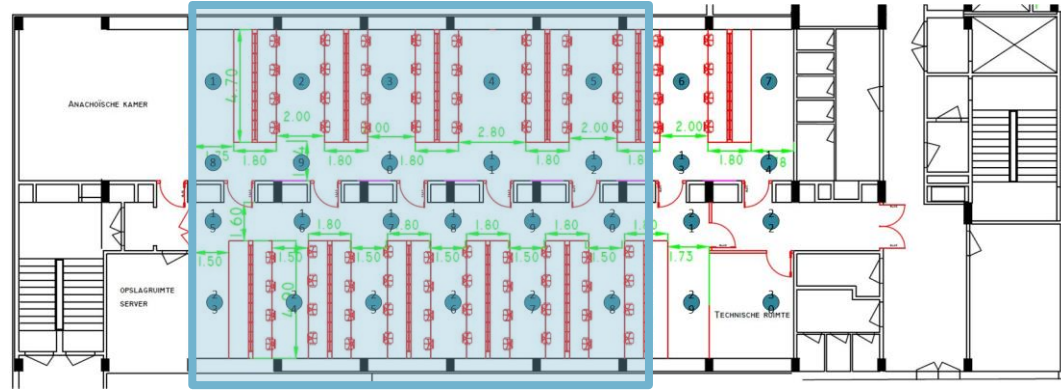
- Accelerometer (used as gyroscope): $x/y/z \rightarrow$ angles
- Magnetometer: $x/y/z \rightarrow$ angles
- Sensor fusion: accelerometer + magnetometer \rightarrow Tilt-compensated compass
- Calibration: hard iron (first 30s)
- Mbed
- TB: direction
- Configuration:
 - Magnetometer: single mode, low power mode, interrupt
 - Accelerometer: low power mode, DRDY interrupt
 - Ticker: timer of 1s activating sensors



SCHEDULE

3. Fingerprinting (Liam & Thomas)

- DASH7 fingerprinting database
 - 30 training points
 - 6 measurements per point
 - 4 different gateways
- Weighted kNN
 - $k = 6$ optimal
 - Weight function: Distance \rightarrow RSSI and direction (sensor fusion)
- TB: X,Y



SCHEDULE

4. LoRaWAN (Lennert)

- I- Cube Irwan extension
 - AT – SLAVE
 - Hardcoded LoRaWan Keys
 - SetDevEUI function
- AT Commands Through UART
- Problem with UART



SCHEDULE

5. DASH7 (Liam & Thomas)

- Uplink
 - Node sends ALP cmd: Return file data action, QoS = 0, multicast, AC = 0x01, file id = 40
 - Data: direction (0-7 = N, NE, E ...)
 - Gateways send RSSI to MQTT broker
- Downlink
 - Sending ALP command works, receiving the command does not work
 - GPS enable: via button
- Disable node if GPS enabled



SCHEDULE

6. Backend & TB (Liam & Thomas)

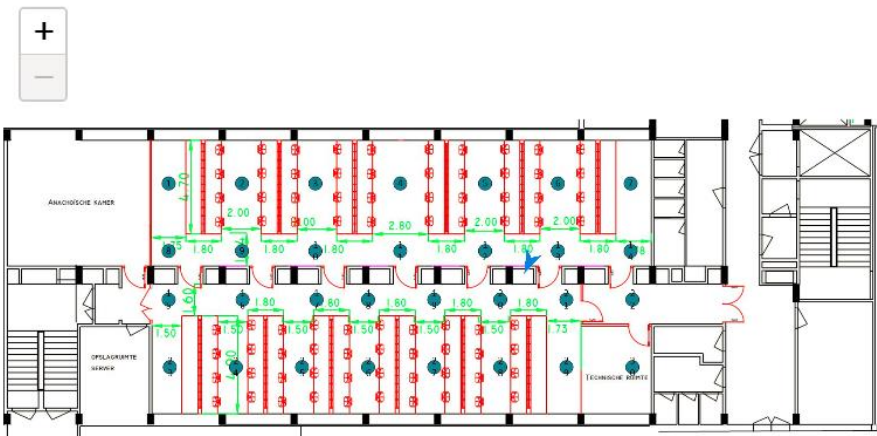
Backend

- Backend.py runs on Ubuntu
- Fingerprinting-algorithm
- Processing data of MQTT broker
- Pub-sub: /tb and /loriot
- Out of safezone → alarm

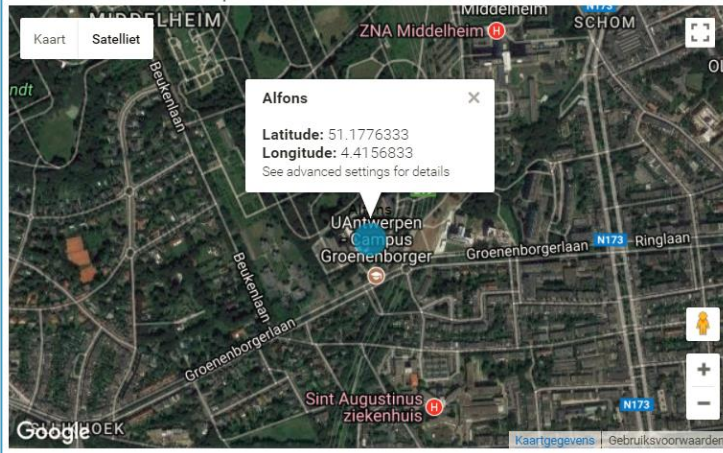
ThingsBoard

- JSON: X,Y, direction, latitude, longitude, HDOP
- Widgets: JavaScript

Indoor localization map



Outdoor localization map



FUTURE WORK

- Not realized
 - DASH7 downlink receive
 - LoRaWAN UART send
- Extensions
 - Barometer → sensor fusion + fall detection
 - Alarm button
 - NFC configuratie en proximity
 - Notification system (e.g. Dinner is ready!)
 - PIR sensor motion detection



POWER MEASUREMENTS

LPM01A

- LPM01A-board + STM32 cube monitor power
 - eCompass:
 - Calibration: 32 mA (30s)
 - Sleep between interrupts: 25 mA
 - DASH7 uplink: 29 mA
 - Press button to enable GPS and disable board: 32 mA
 - GPS
 - Nucleo low power sleep with GPS off: 2.4 mA
 - LoRaWAN message: 41 mA peak

STM32 Power Shield
Accurate power measurement

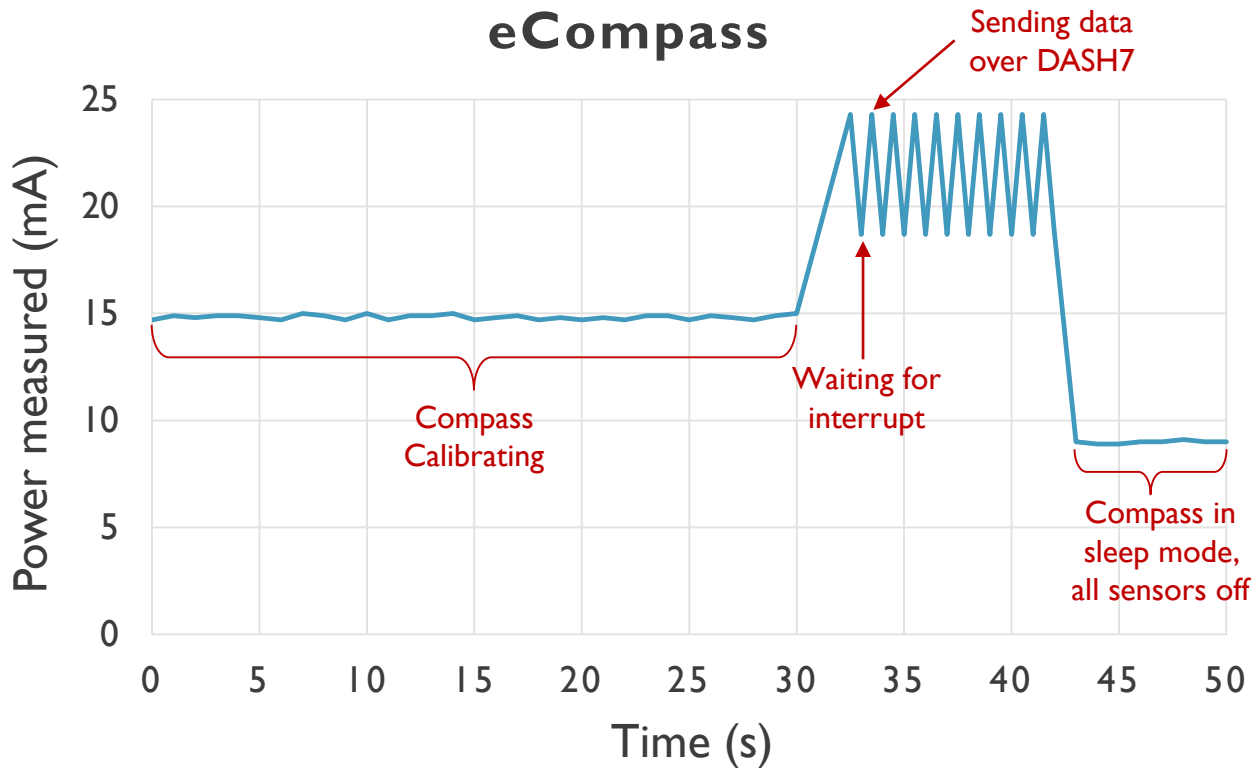


STM32
CubeMonitor-Power



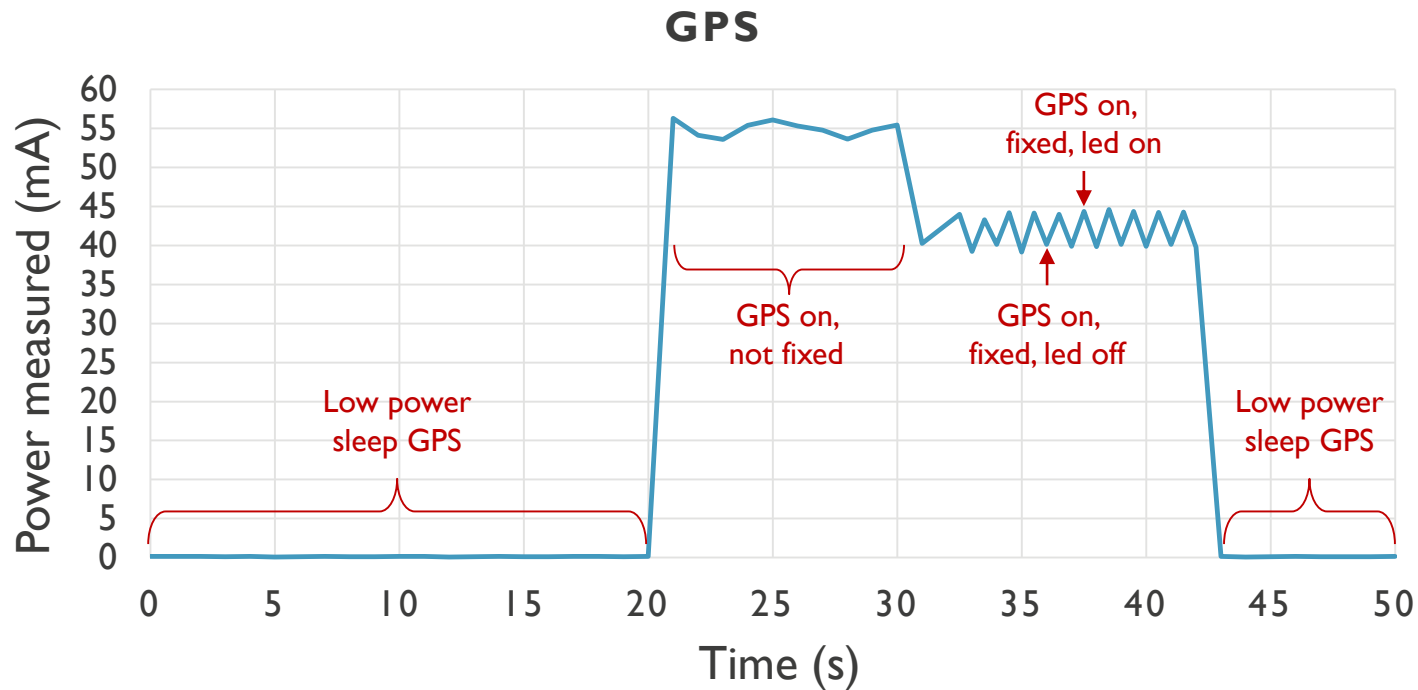
POWER MEASUREMENTS

MULTIMETER



POWER MEASUREMENTS

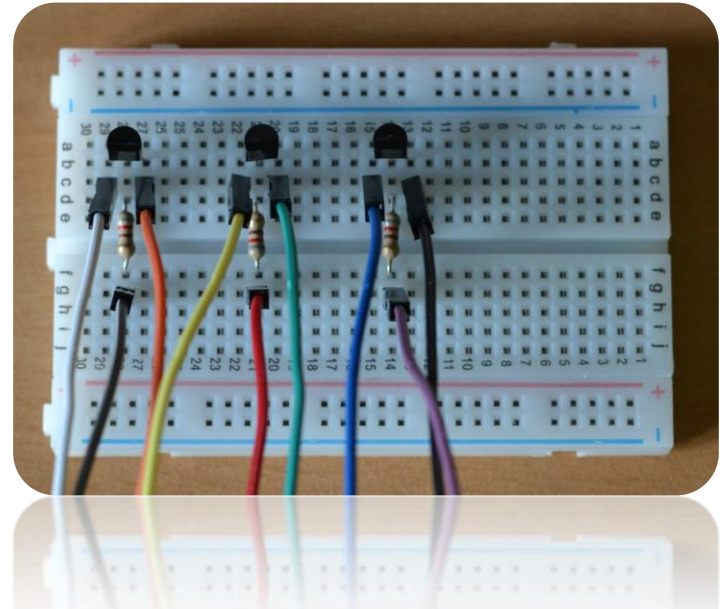
MULTIMETER



POWER MEASUREMENTS

LOW POWER ACTIONS

- Solder bridge SB18 of B-L072Z-LRWANI opened → LED 7 off
- Transistors used for
 - GPS
 - Discovery board: B-L072Z-LRWANI (DASH7)
 - Discovery board: B-L072Z-LRWANI (LoRaWAN)





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embracing a better life



RESULT: DEMO