



# mtec

## IOT PROJECT PRESENTATION

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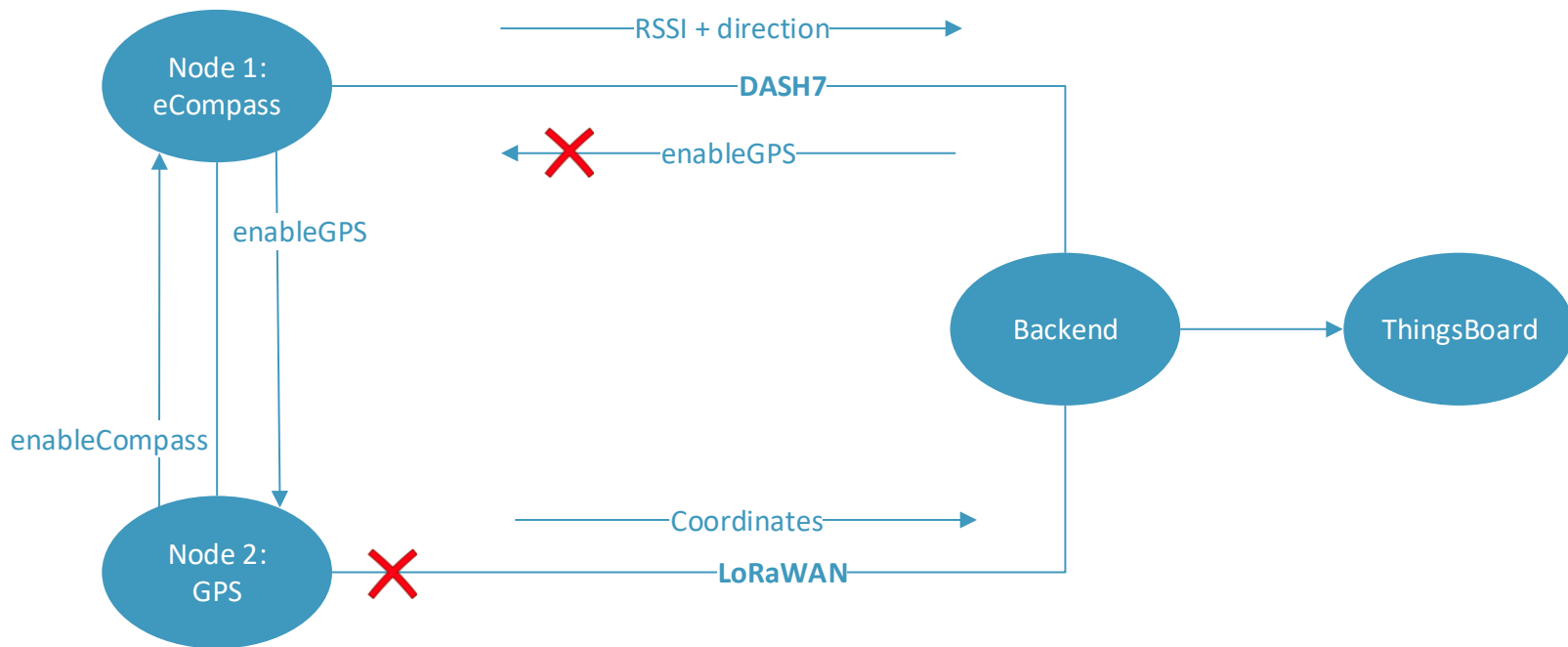
## MONITORING RUNAWAY BEHAVIOR

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



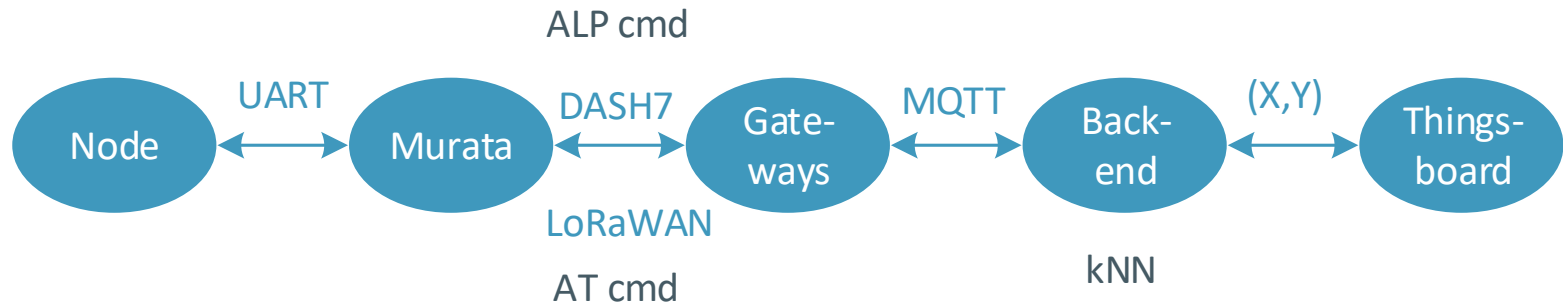
# OVERVIEW

## DATA FLOW



# OVERVIEW

## COMMUNICATION



# SCHEDULE

## I. GPS module (Jonas)

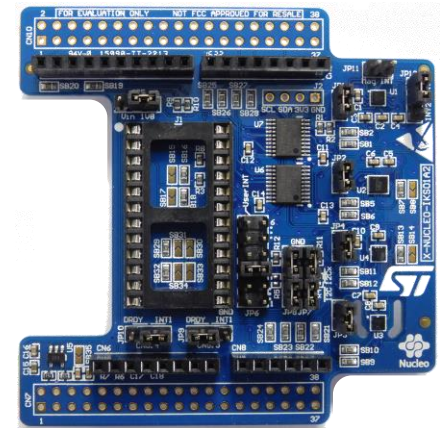
- Soldering
- Configuration (GPGGA, each 60s)
- Converting coordinates
- Enable if out of safe zone (input eCompass)
- Disable if in safe zone (re-enable eCompass)
- Low Power Sleep mode → GPS off
- TB: longitude, latitude, HDOP
- STM32 HAL & Mbed



# SCHEDULE

## 2. eCompass (Jonas & Liam)

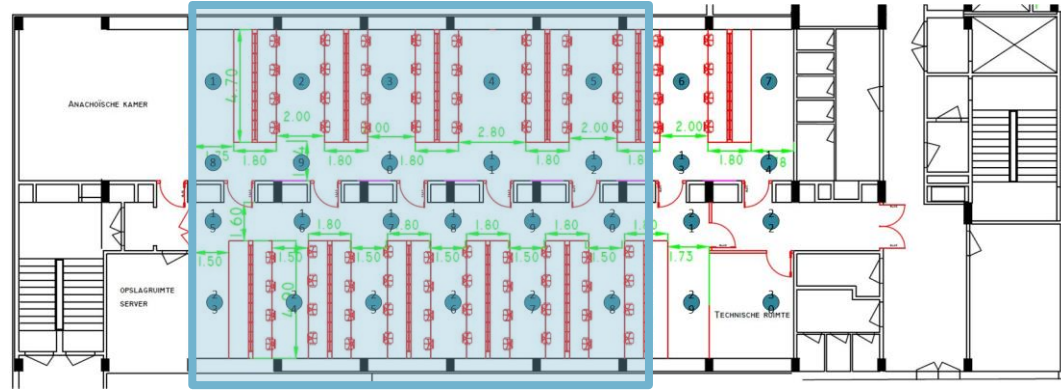
- Accelerometer (used as gyroscope):  $x/y/z \rightarrow$  angles
- Magnetometer:  $x/y/z \rightarrow$  angles
- Sensor fusion: accelerometer + magnetometer  $\rightarrow$  Tilt-compensated compass
- Calibration: hard iron + soft iron (first 30s)
- Mbed
- TB: direction
- Configuration:
  - Magnetometer: 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
  - ALP cmd: Return file data action, QoS = 0, multicast, AC = 0x01, file id = 40
  - Data: direction
  - 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)

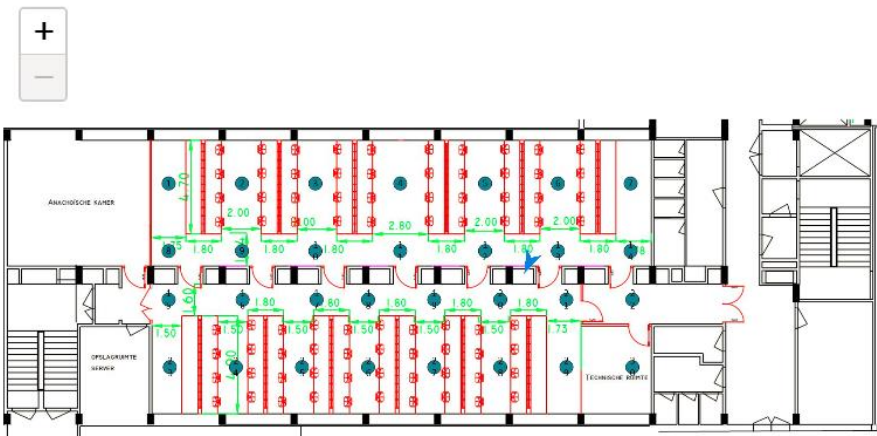
### Backend

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

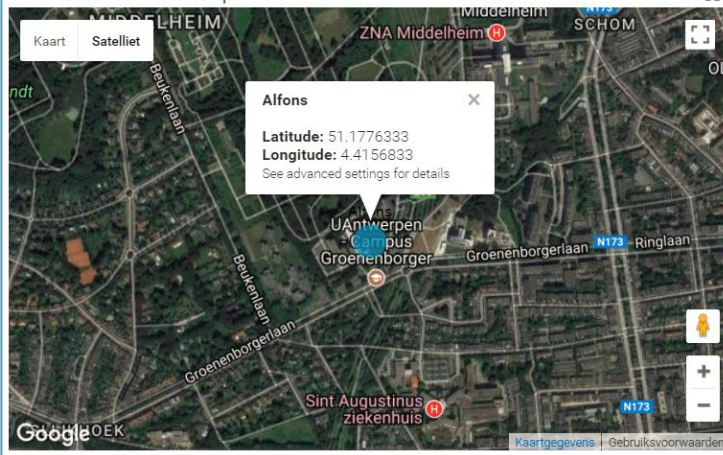
### ThingsBoard

- 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

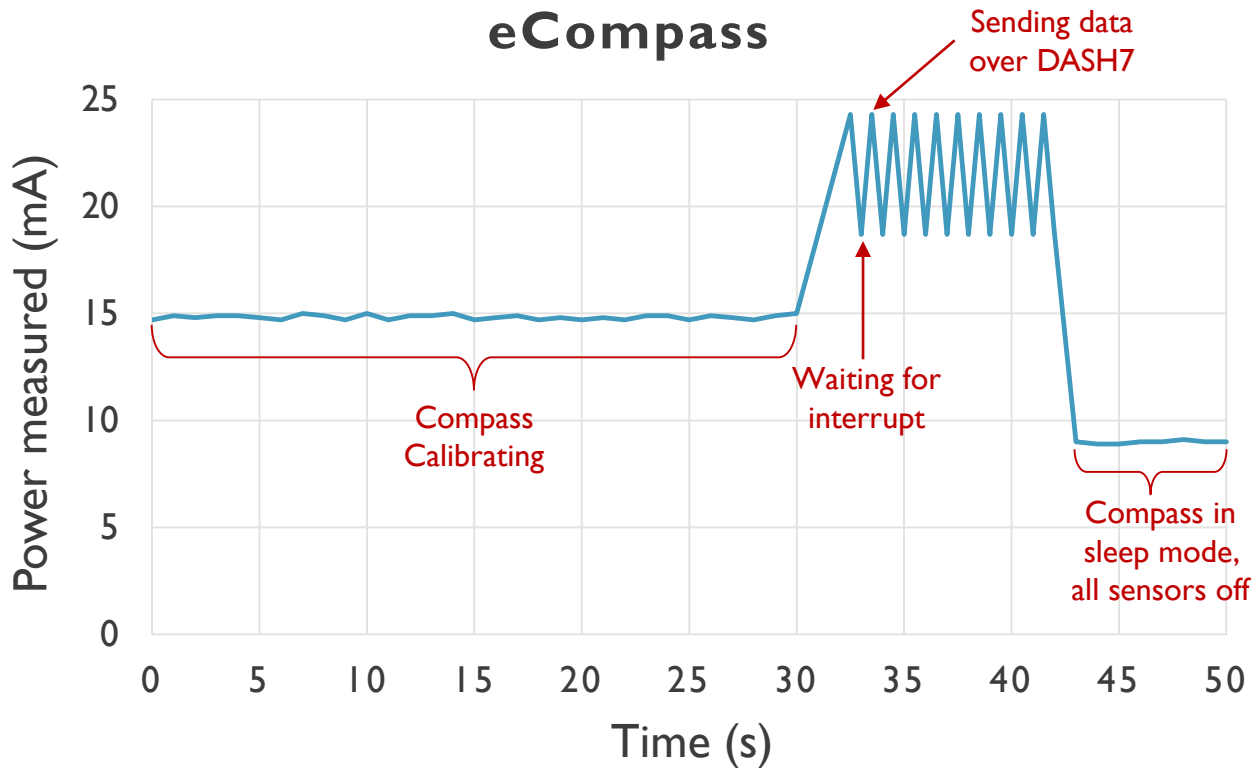


STM32  
CubeMonitor-Power



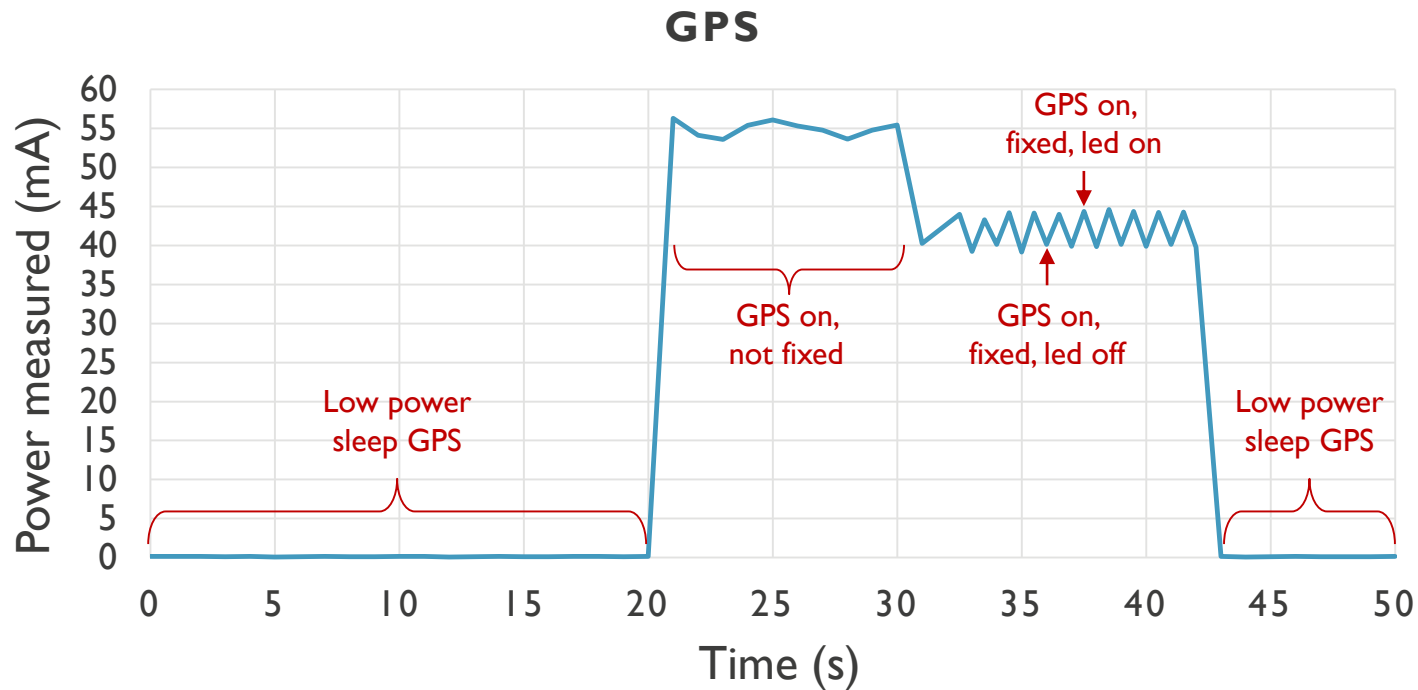
# POWER MEASUREMENTS

## MULTIMETER



# POWER MEASUREMENTS

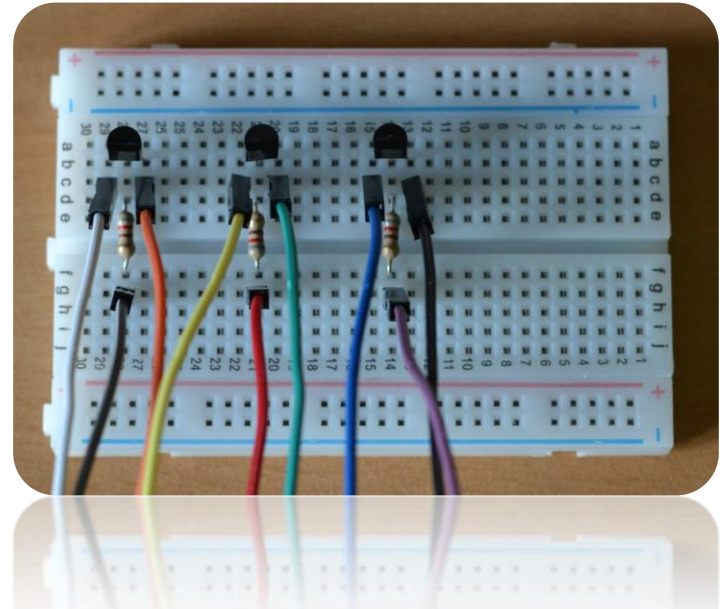
## MULTIMETER



# 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