IOT PROJECT PRESENTATION

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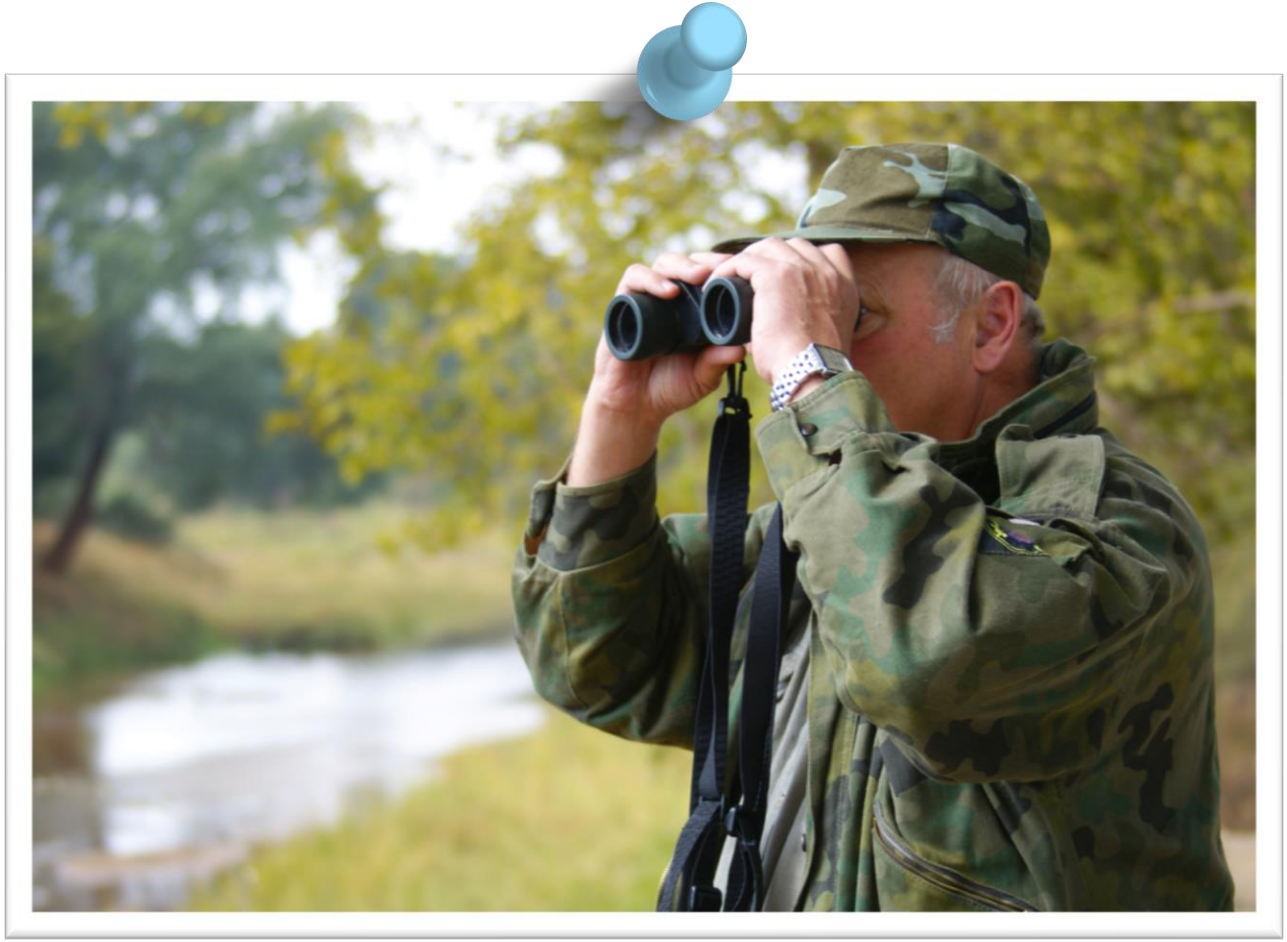

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CONTENTS

MONITORING RUNAWAY BEHAVIOR

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

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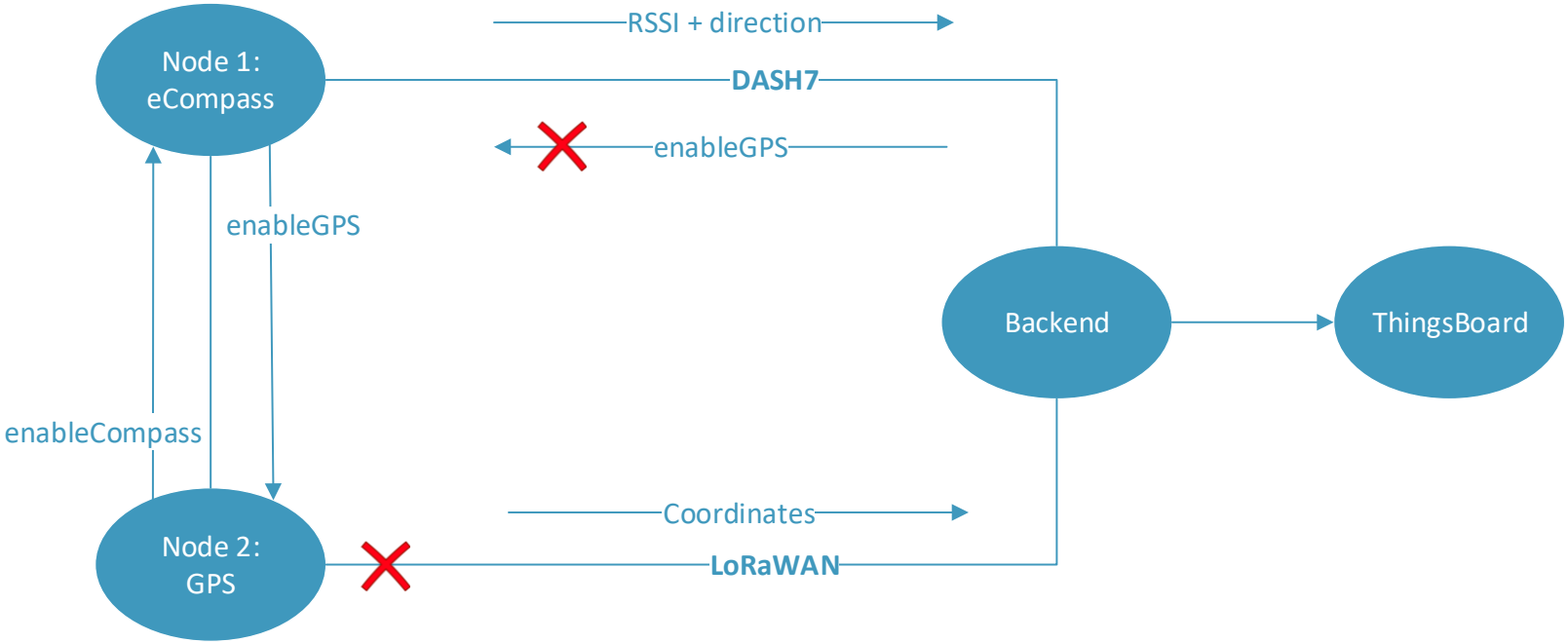
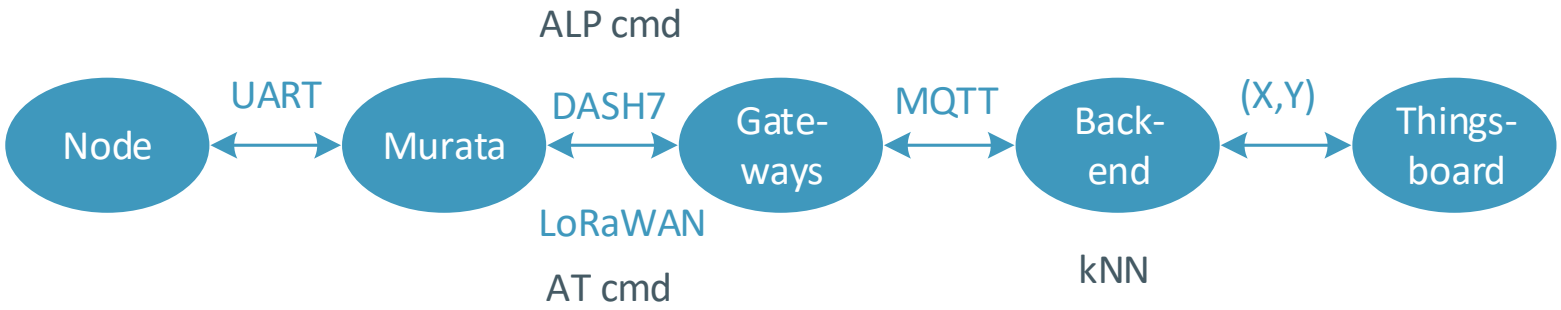
OVERVIEW
DATA FLOW



OVERVIEW
COMMUNICATION

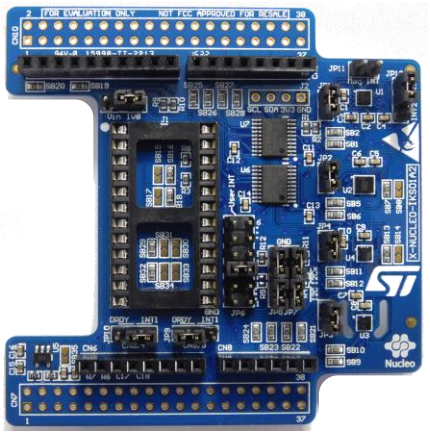


PLANNING

1. 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

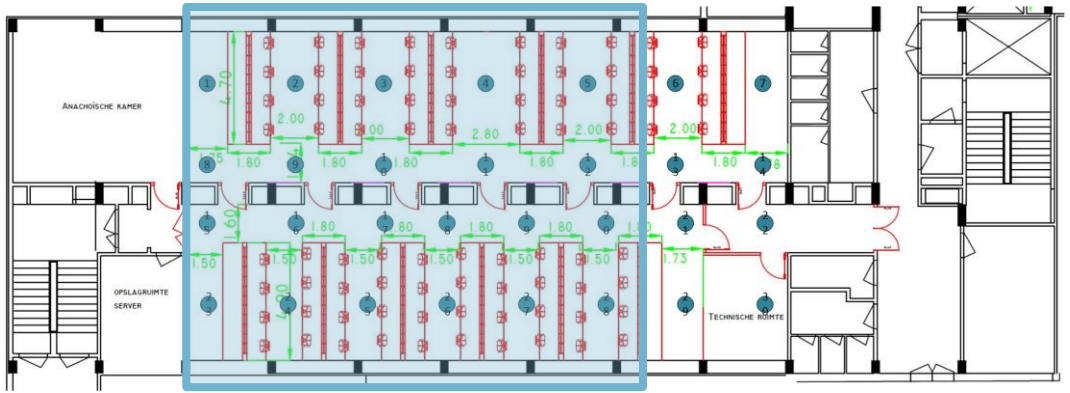
PLANNING

2. eCompass (Jonas & Liam)
   - Accelerometer (used as gyroscoop): x/y/z → angles
   - Magnetometer: x/y/z → angles
   - Sensor fusion: accelerometer + magnetometer → 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



PLANNING

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 → RSSI and direction (sensor fusion)
   - TB: X,Y

PLANNING

4. LoRaWAN (Lennert)
   - I- Cube lrwan extension
     - AT – SLAVE
     - Hardcoded LoRaWan Keys
     - SetDevEUI function
   - AT Commands Through UART
   - Problem with UART

PLANNING

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

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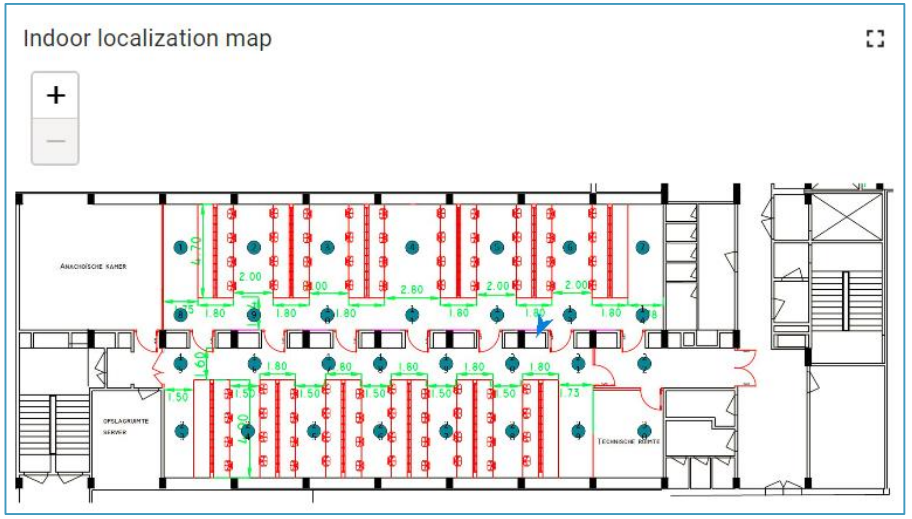
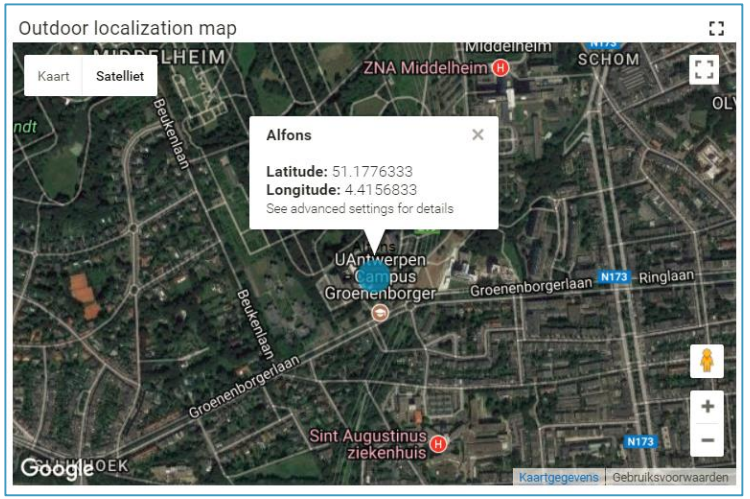
PLANNING

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





FUTURE WORK

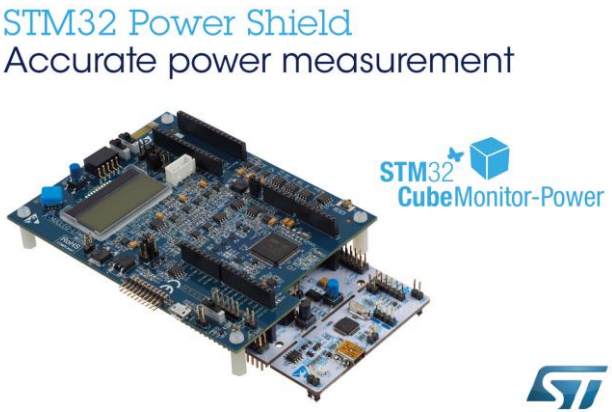
- Not realized
  - DASH7 downlink receive
  - LoRaWAN UART send

- 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

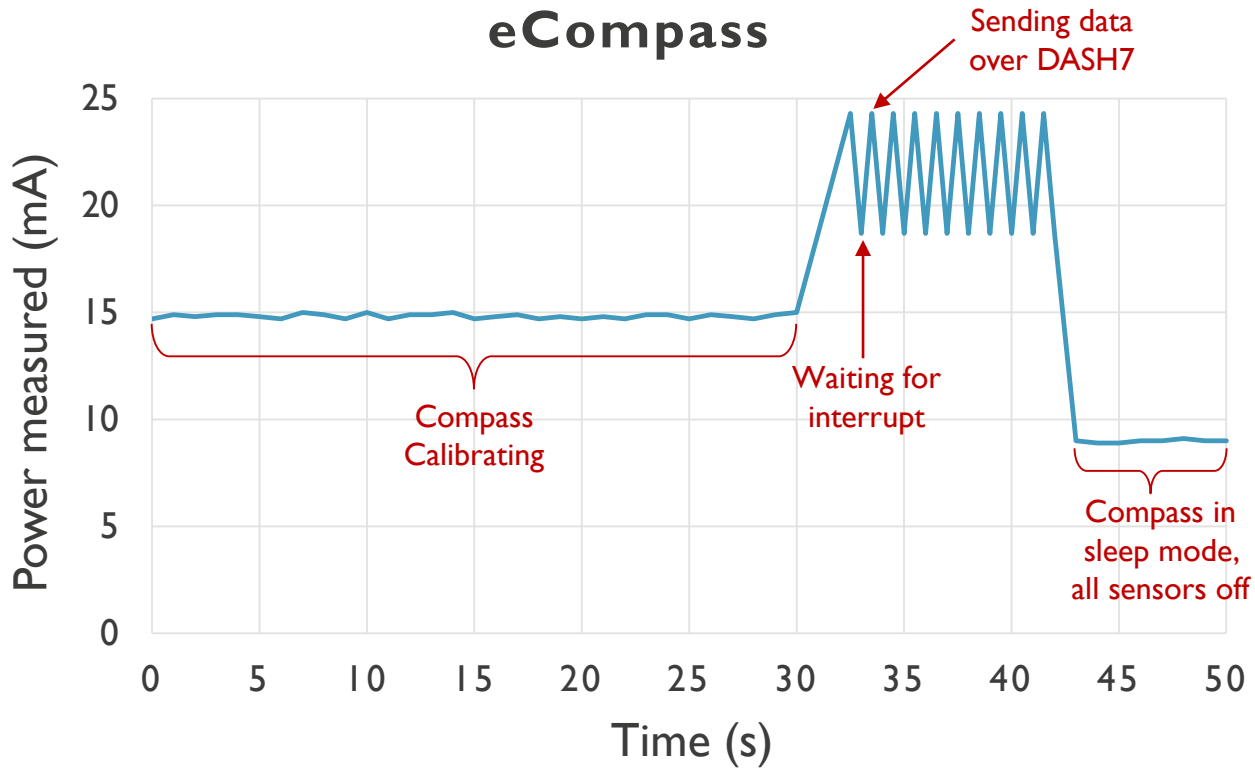
LPM01A

- 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



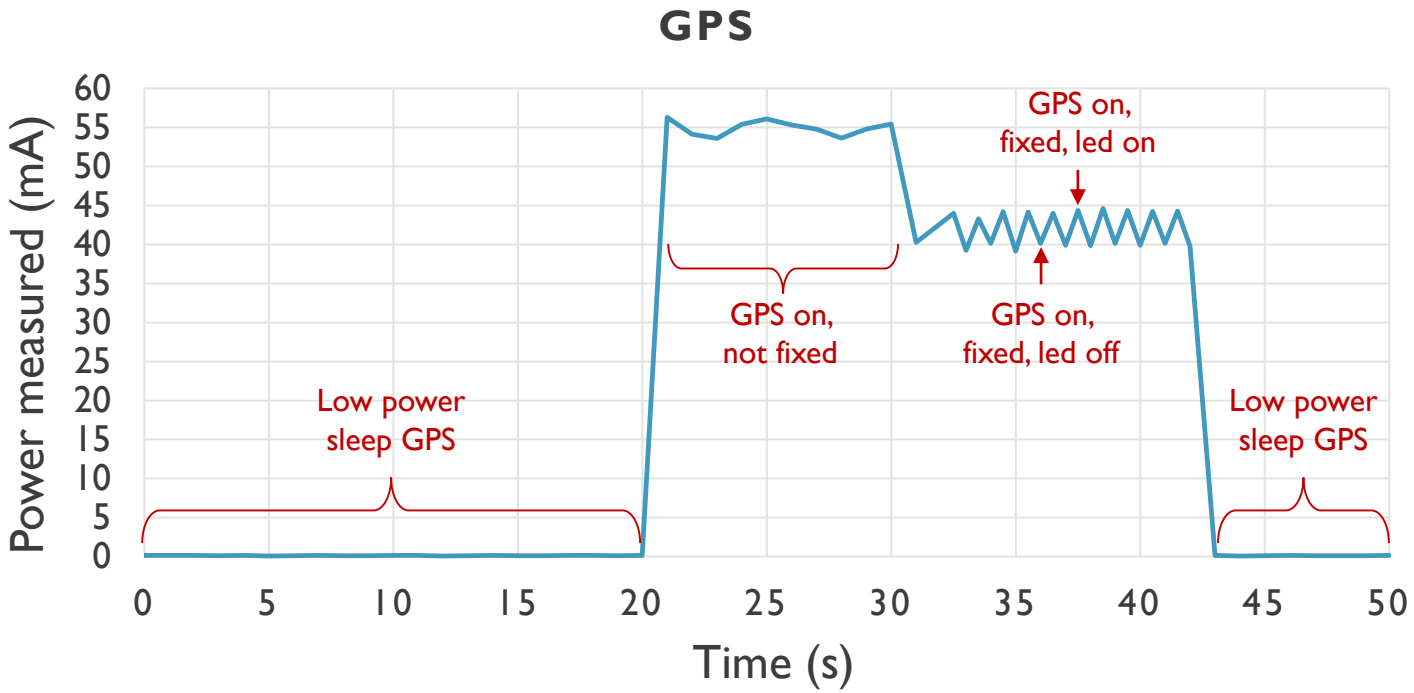
POWER MEASUREMENTS

MULTIMETER



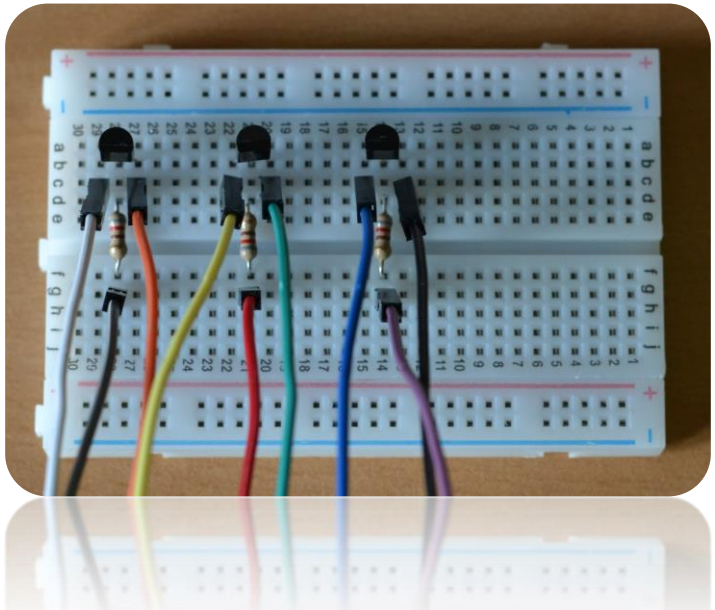
POWER MEASUREMENTS

MULTIMETER



POWER MEASUREMENTS
LOW POWER ACTIONS

- Solder bridge SB18 of B-L072Z-LRWAN1 opened → LED 7 off
- Transistors used for
  - GPS
  - Discovery board: B-L072Z-LRWAN1 (DASH7)
  - Discovery board: B-L072Z-LRWAN1 (LoRaWAN)



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RESULT: DEMO