

Project teammet4

II - Ambient Intelligence

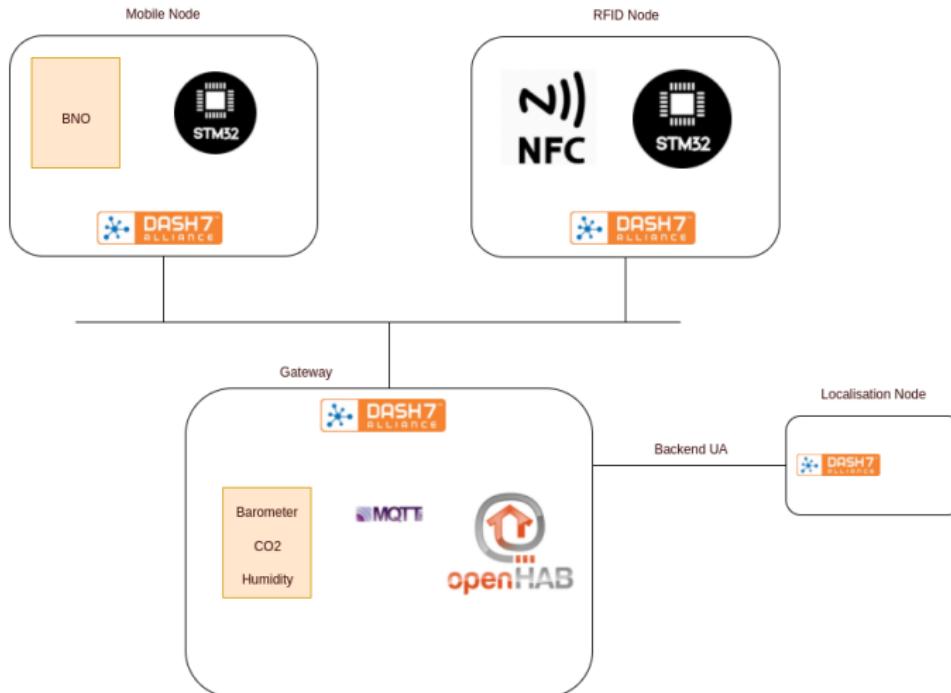
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Frederik Smolders
University of Antwerp
June 14, 2017

Universiteit Antwerpen



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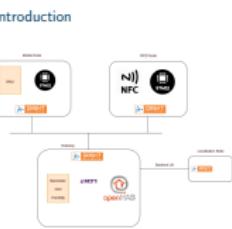
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Toelichten hoe het systeem is opgebouwd, zeggen dat mobiele node en RFID Node uitgelegd wordt door kwinten, de localisatie door frederic en gateway openhab door seb en bernd.



NFC Node - Eagle



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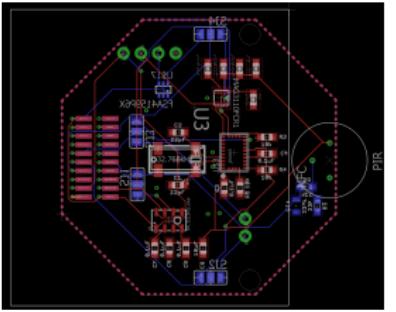
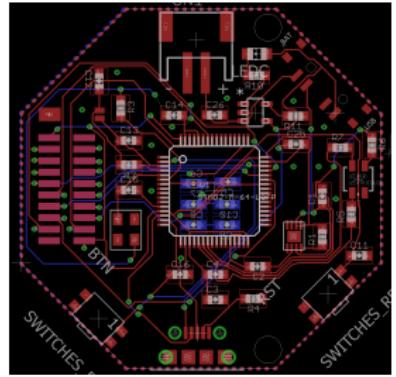
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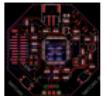


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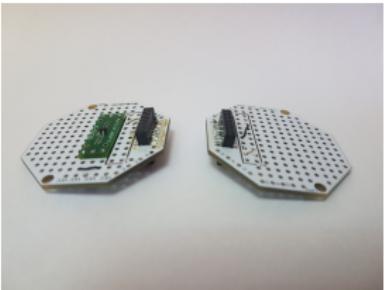
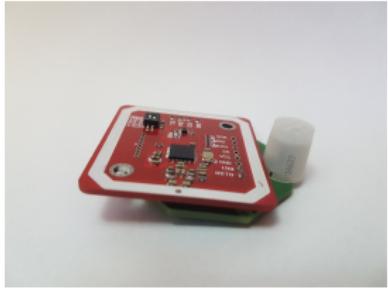
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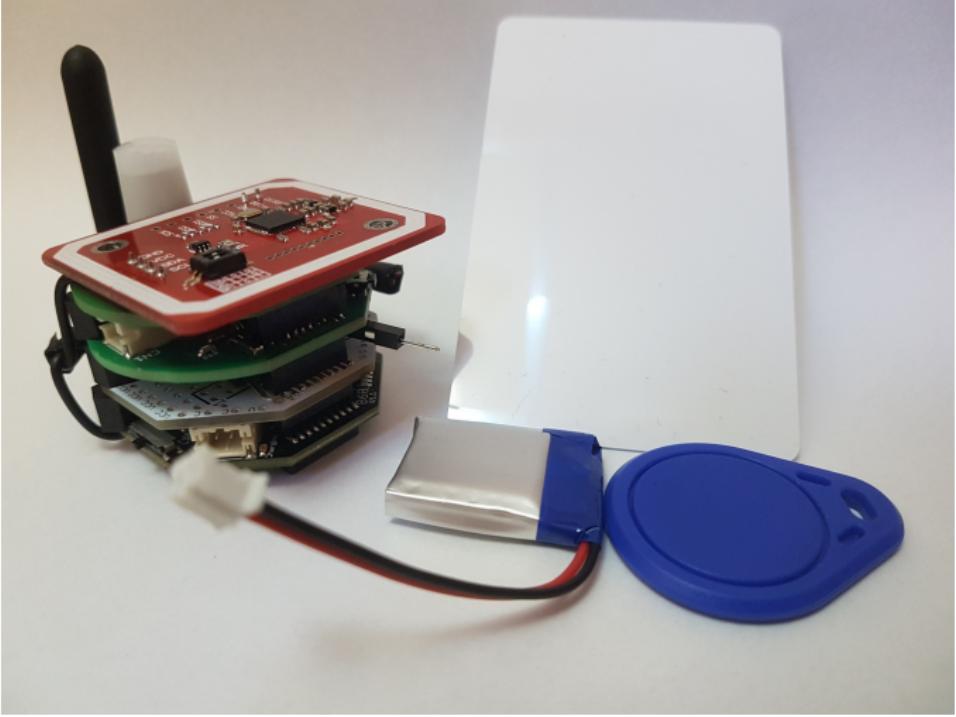
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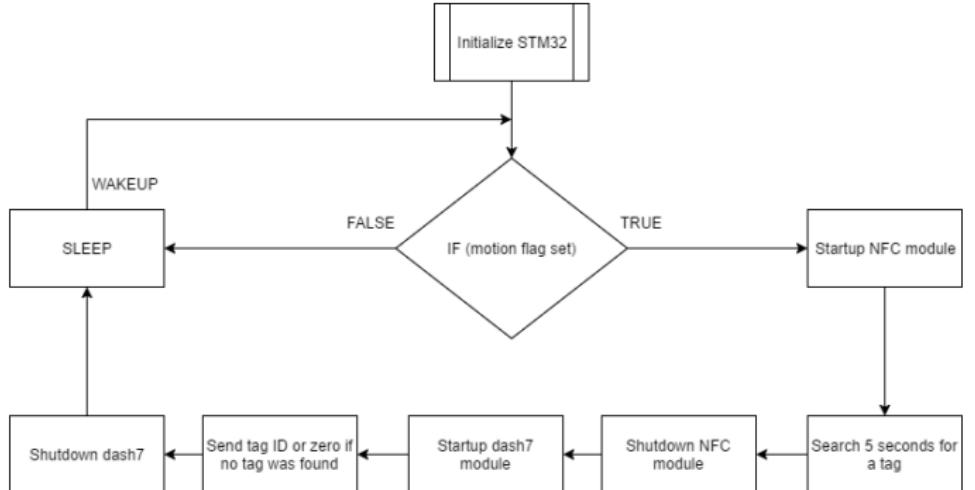
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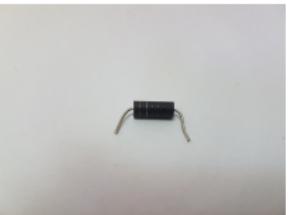
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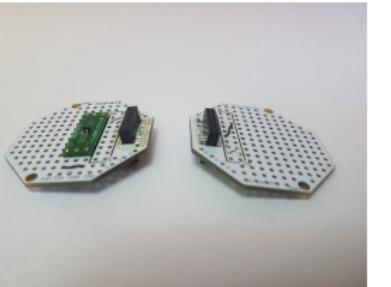
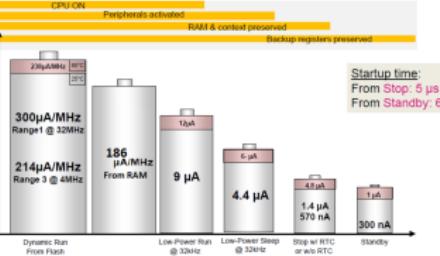
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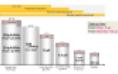


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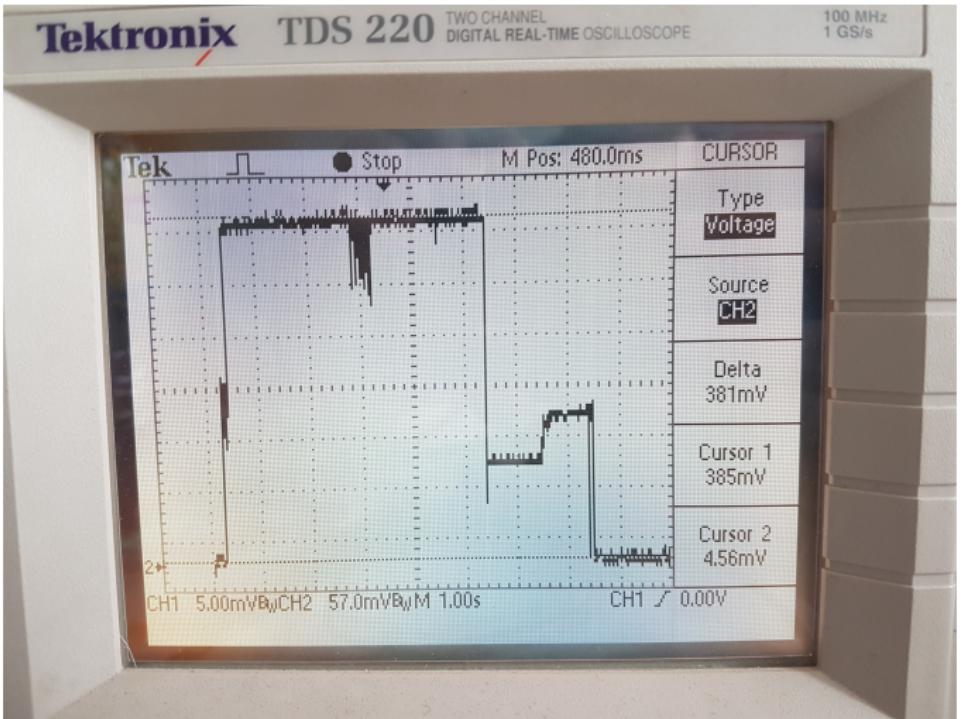
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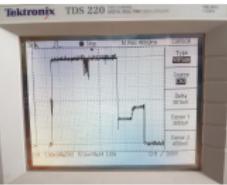
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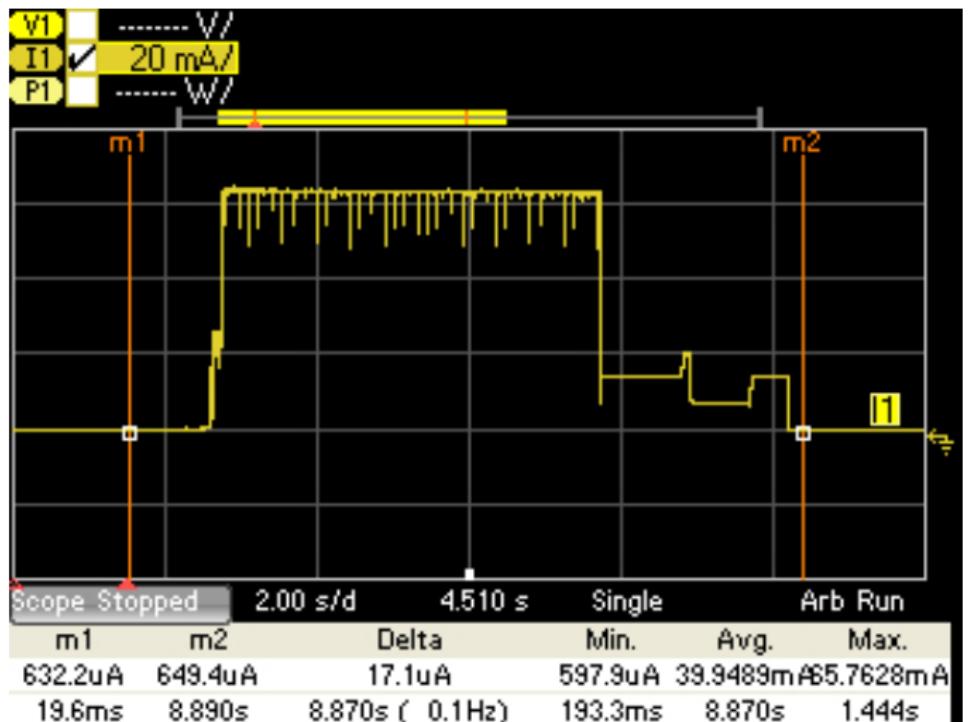
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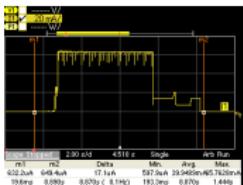
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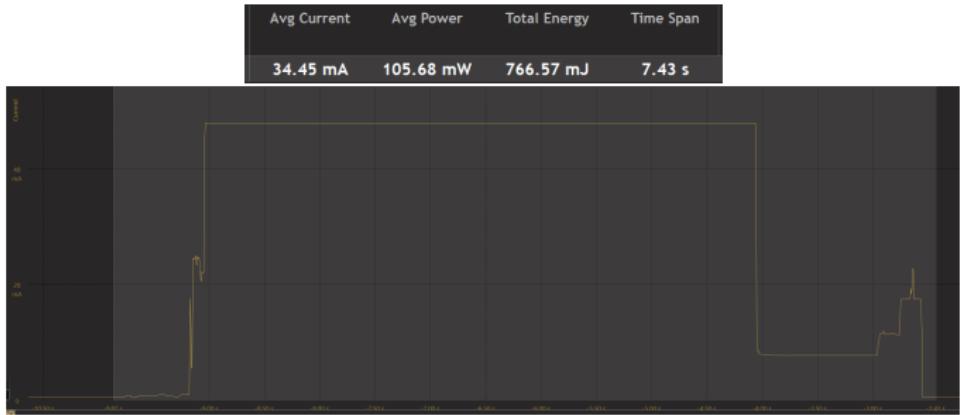
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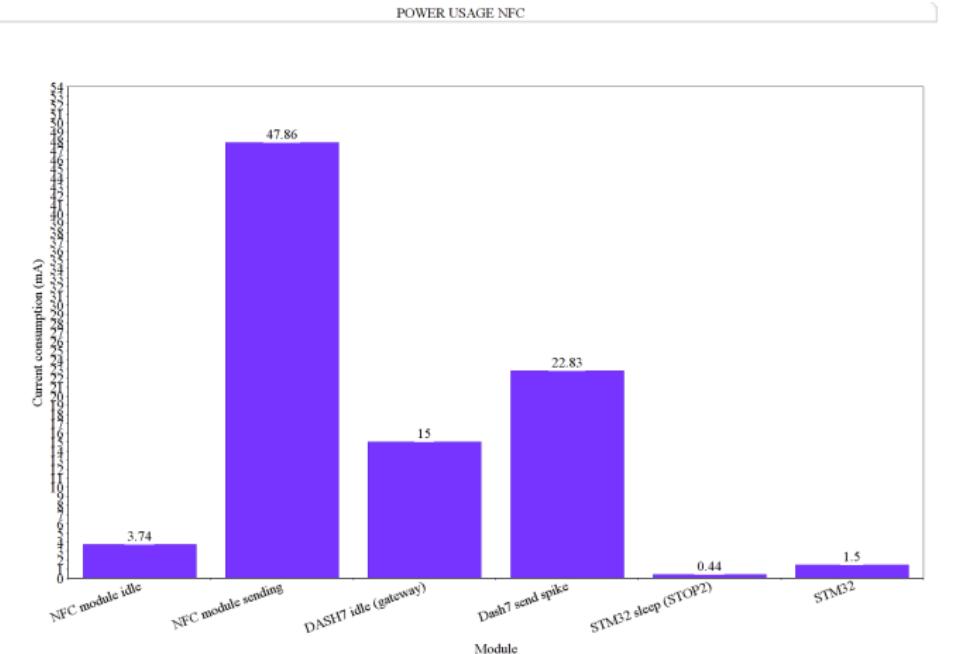
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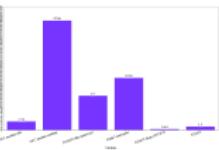
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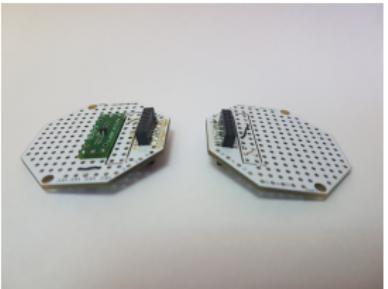
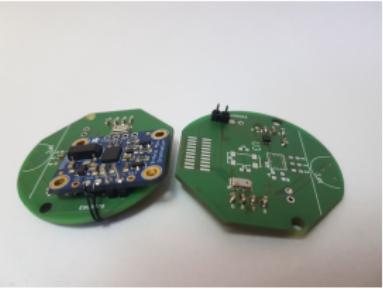
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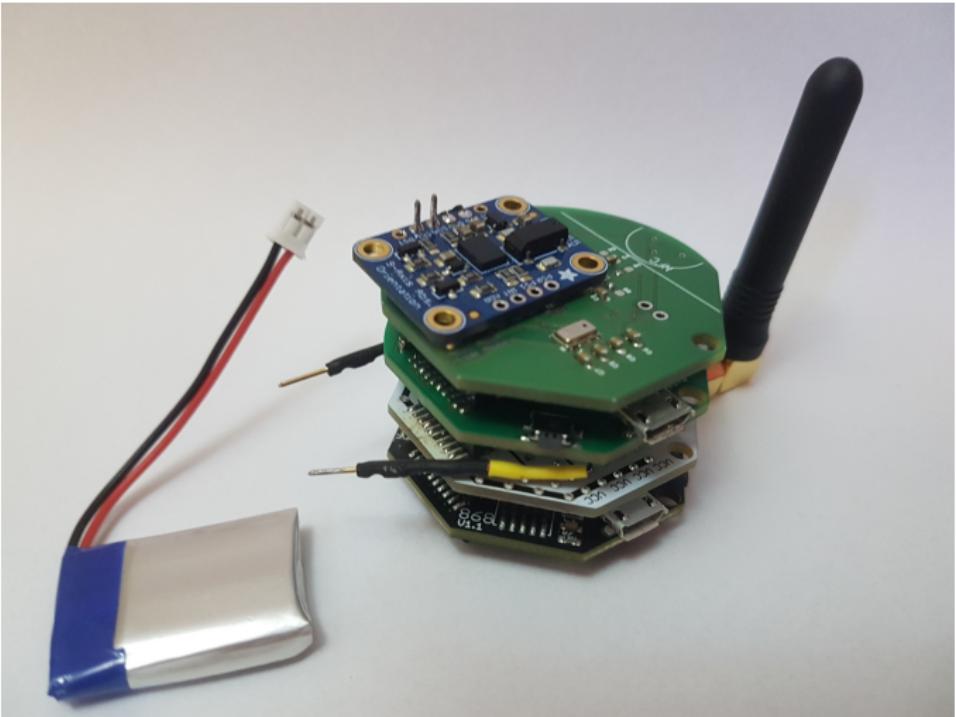
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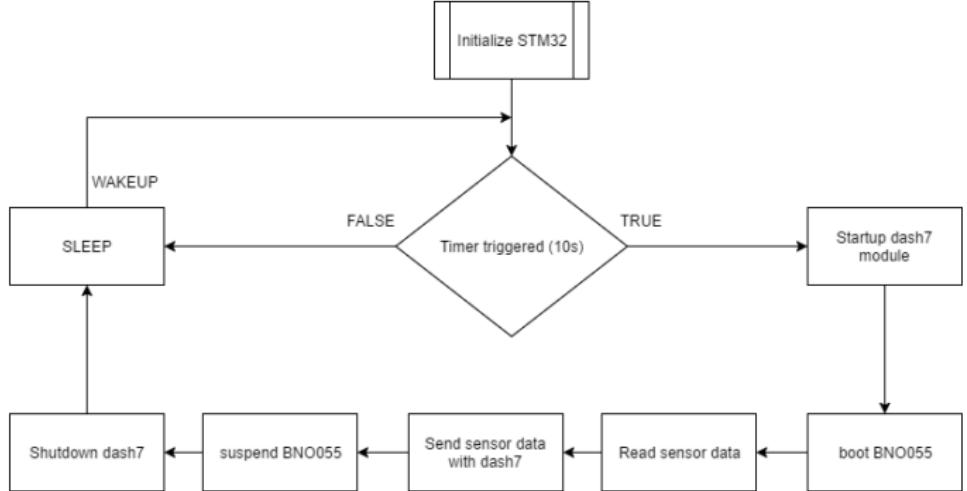
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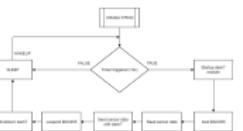


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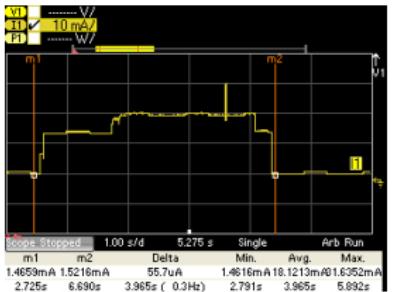
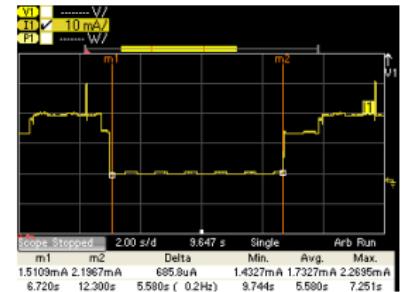
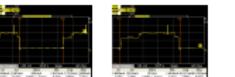
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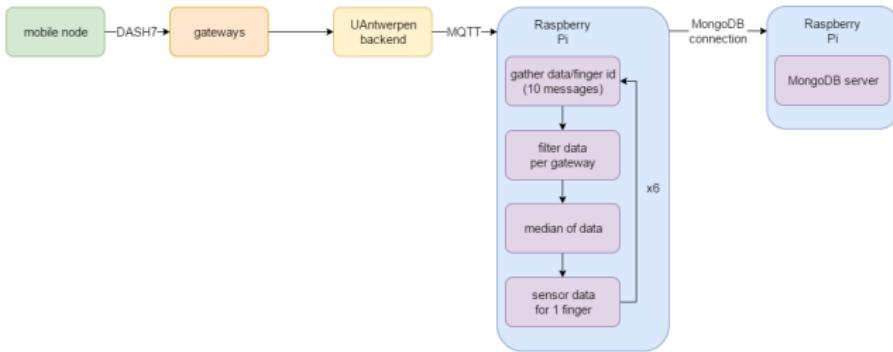
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► Fingerprinting Dash7



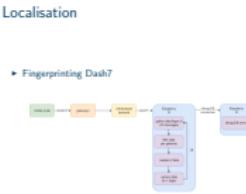
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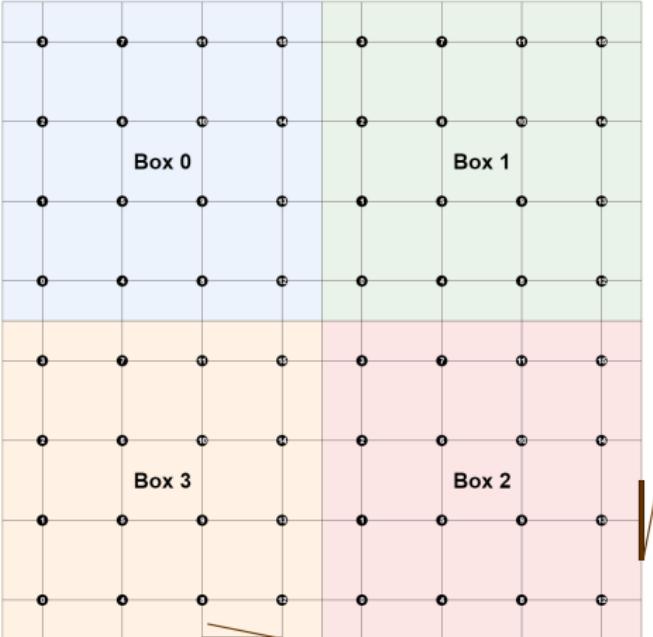
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- Mobiele node stuurt constant (ongeveer om de 0,5 seconden) berichten die de gateways, verspreid over deze verdieping, ontvangen.
- Informatie van het transmissiesignaal, zoals de link-budget en het tijdstip worden dan door een server van de UA gepublished via MQTT.
- Op de RaspberryPi loopt dan een script die deze data van MQTT uitleest. Het script haalt 10 berichten via MQTT binnen per finger id (plaats)
- Vervolgens wordt deze data gefilterd per gateway. Per elke gateway wordt dan van de ontvangen data de mediaan genomen.
- Dit wordt per finger id 6 keer herhaald zodat er per locatie 6 queries in de database worden opgeslagen.

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► Fingerprinting Dash7



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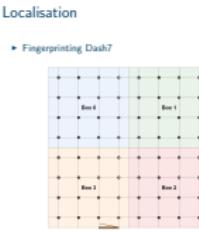
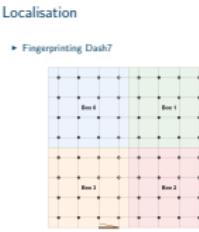
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- Dit is een afbeelding om te tonen hoe de data met DASH7 werd gemapt (het gaat hier over V315).
- De ruimte is in 4 blokken opgedeeld.
- Elk blok is opgedeeld in 16 fingers, even ver van elkaar verspreid. Voor elke finger werden er 6 querries in de database opgeslagen zoals eerder vermeld.

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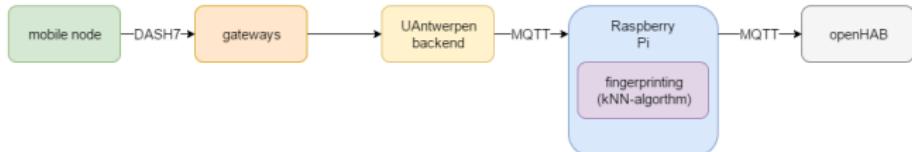
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► Dash7

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• Dash7



- De mobiele node stuurt constant DASH7 berichten.
- De gateways sturen transmissie gegevens door naar een server van de UA die deze data published via MQTT.
- De RaspberryPi leest deze data uit en past hierop het kNN-algoritme toe voor fingerprinting.
- De uitkomst (locatie) wordt dan door de RaspberryPi gepublished via MQTT zodat dit kan uitgelezen worden op openHAB

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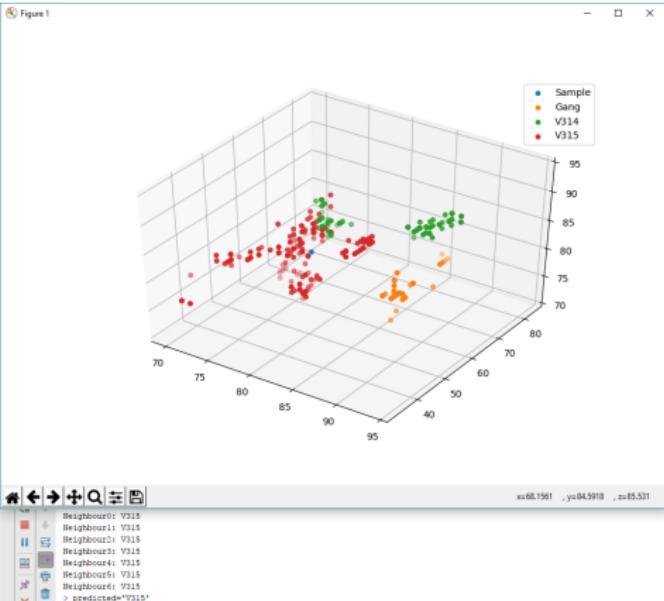
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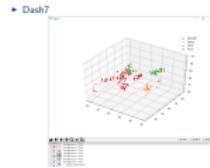
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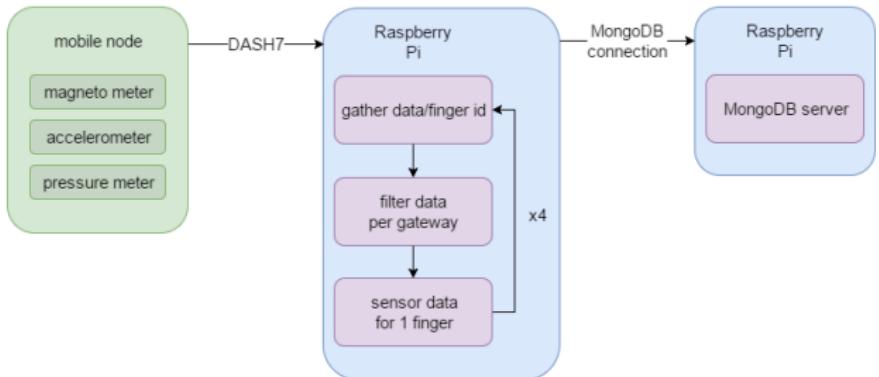
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► Fingerprinting Magnetometer



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- Mobiele node stuurt constant berichten via DASH7 met data in van de magneto meter, accelerometer en barometer.
- Op de RaspberryPi loopt een script die deze data via DASH7 ontvangt.
- Per finger id (plaats) worden er 4 querries in de database gezet.

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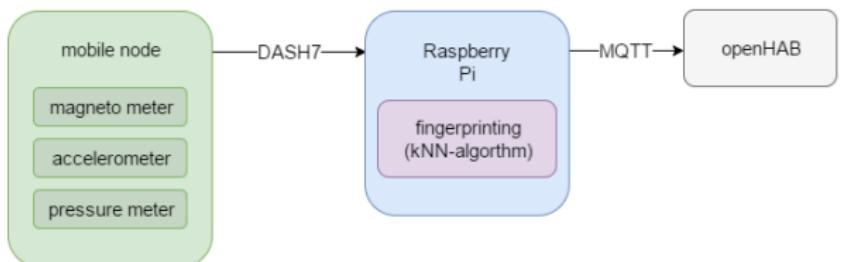
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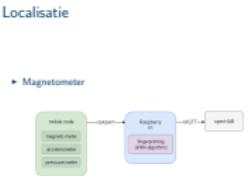
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► Magnetometer

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- Mobiele node stuurt constant berichten via DASH7 met data in van de magneto meter, accelerometer en barometer.
- Op de RaspberryPi loopt een script die deze data via DASH7 ontvangt.
- Op deze data wordt het kNN-algoritme toegepast voor fingerprinting.
- De uitkomst (locatie) wordt dan door de RaspberryPi gepubliceerd via MQTT zodat dit kan uitgelezen worden op openHAB.

kNN-Algorithm

- ▶ Dash7
 - ▶ $k = 7$
- ▶ Magnetometer
 - ▶ $k = 5$
- ▶ Distance metric
 - ▶ Euclidean distance
 - ▶ Manhattan distance



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- Voor DASH7 lokalisatie wordt $k=7$ gebruikt
- Voor Magnetometer lokalisatie wordt $k=5$ gebruikt
- Als distance metric wordt Manhattan distance gebruikt omdat deze nauwkeuriger is dan Euclidean distance voor meerdere gateways.

- ▶ Dash7
 - $k = 7$
- ▶ Magnetometer
 - $k = 5$
- ▶ Distance metric
 - Euclidean distance
 - Manhattan distance

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► Sensors

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▪ Sensors



- CO2 (CCS811): Maakt gebruik van de BCM2835-library, ook gebruikt voor de eerste taken rond de STM-bordjes
- Andere sensoren maken gebruik van de standaard I2C-library in Linux.
 1. MPL3115, adres is 0x60: Bit 1-3 geven druk en 4-5 temperatuur
 2. SI7021, adres is 0x40:
 - ▶ commando 0xF3, leest temperatuur uit
 - ▶ commando 0xF5, leest vochtigheid uit
 3. MAG3310, magnetometer ook op sensorbord maar niet geïmplementeerd in project.

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► Sensors



► Sensorvalues published on MQTT topics

- We hebben functies geschreven om alle data apart te lezen van de sensoren. Deze functies worden aangeroepen door een MAIN-functie. De gelezen waarden worden gefilterd (foute lezingen) en op verschillende MQTT Topics gezet
 1. rpi/temperature, rpi/humidity, rpi/pressure, rpi/airquality

► Sensorvalues published on MQTT topics

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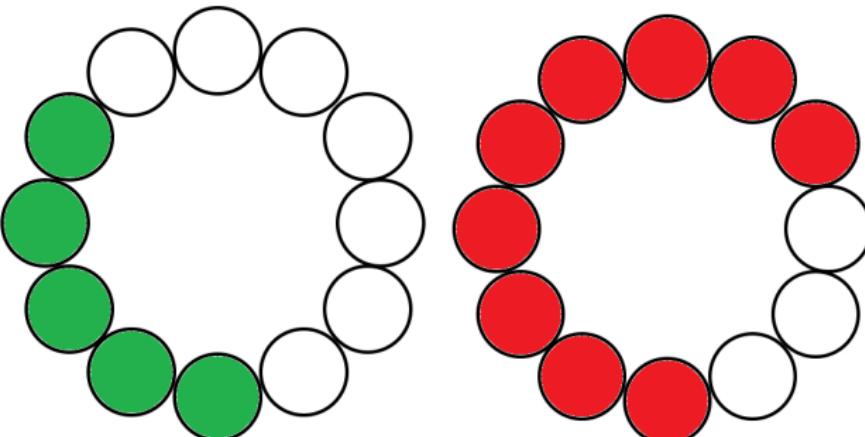
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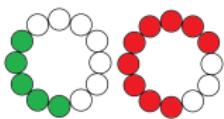


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Gateway
└── LED Visualisatie
 └── Gateway

Gateway

- LED Visualisation:
 1. Profiles
 2. CO₂ en Temperature Levels



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► Camera

► Scripts

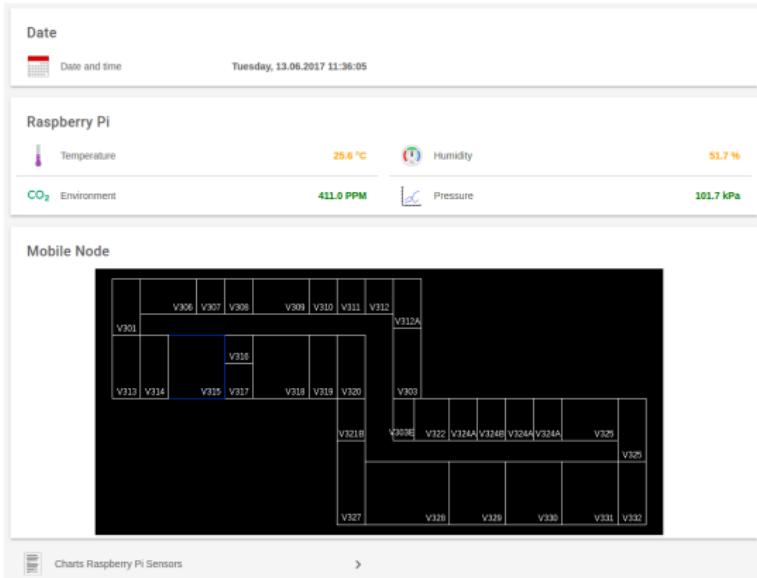
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- Camera script neemt foto en plaats dit in openhab folder
- Extra script om RFID inlog/presence te loggen, aangeroepen bij aankomst van dash7 bericht
- Crontab
 1. start camera bij startup
 2. start sensorlezing RPI bij startup
 3. elke 30sec sensorlezing
 4. gegevens van crontab worden ook weggeschreven in log
 5. Dash7 localisatie starten
 6. Dash7 module om gegevens van mobile node te krijgen

openHAB

► Basic UI



► HabPanel



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Basic UI



- Gestart met Basic UI omdat het makkelijker is om items uit te lezen.
- Overgeschakeld naar HabPanel voor presentatie
- Custom widgets aangemaakt in html gebruik makend van bootstrap
- Cusom widgets voor RPI, Mobile node sensoren
- Custom widget voor Live Weer updates
- Basic widgets voor afbeeldingen en tekstbestanden

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Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

Sensors

LED Visualisatie

Extra's

openHAB

Future Work

- ▶ Alexa is installed, this can be combined with OpenHAB
- ▶ Magnetometer localisation
- ▶ Combine localisation node with mobile node

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