

Project teammet4

II - Ambient Intelligence

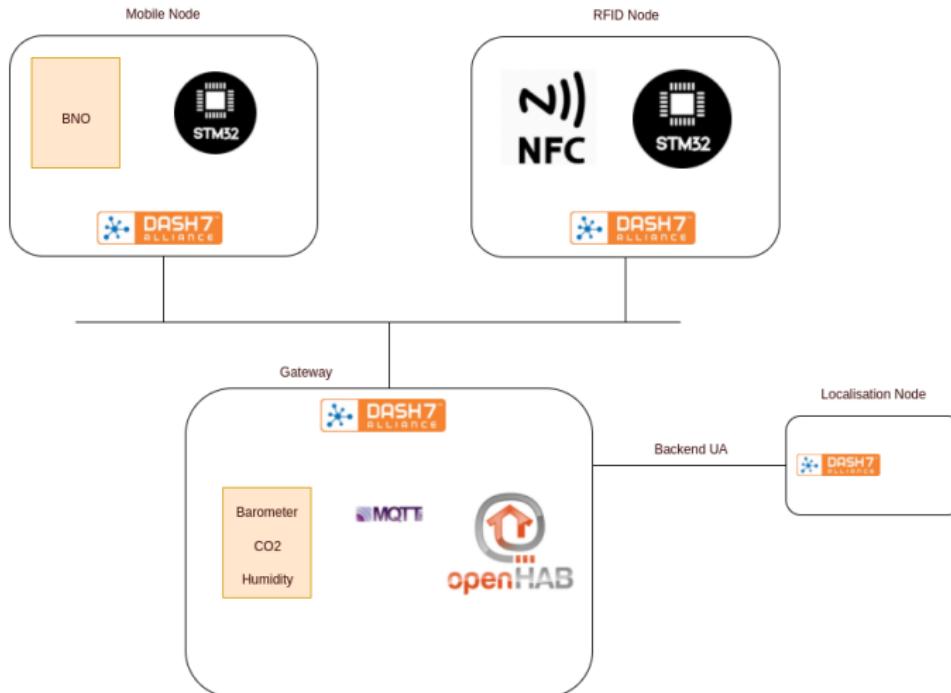
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Frederik Smolders
University of Antwerp
June 14, 2017

Universiteit Antwerpen



2017-06-14

Introduction



Introduction

2017-06-14

Introduction

Introduction

External Nodes

NFC Node
Mobile Node

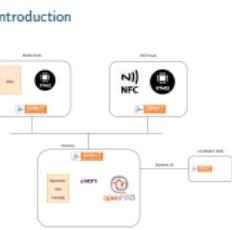
Localisation
Fingerprinting D7
Dash7
Fingerprinting MAG
Magnetometer
kNN-Algorithm

Gateway
Sensors
LED Visualisatie
Extra's

openHAB

Future Work

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



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

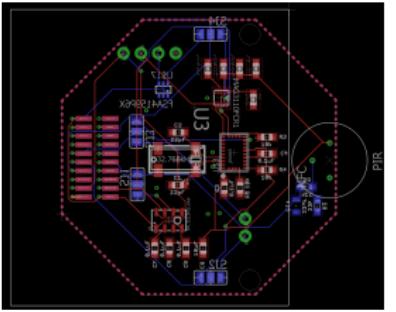
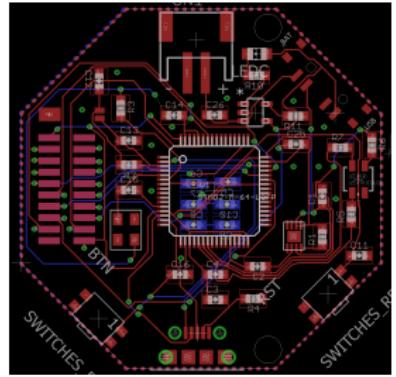
Sensors

LED Visualisatie

Extra's

openHAB

Future Work

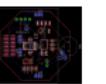
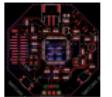


2017-06-14

External Nodes

NFC Node

NFC Node - Eagle



NFC Node - Hardware



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

Sensors

LED Visualisatie

Extra's

openHAB

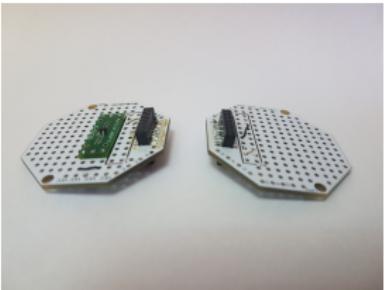
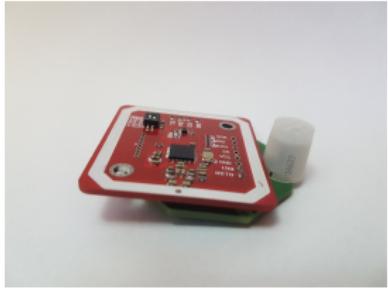
Future Work

2017-06-14

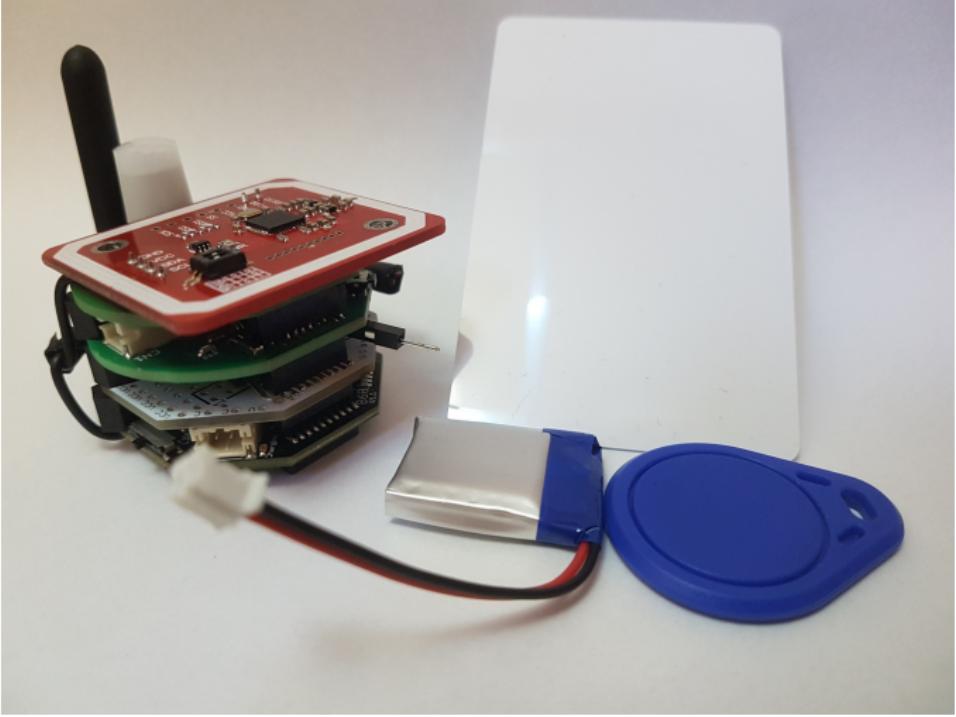
External Nodes

NFC Node

NFC Node - Hardware



NFC Node - Combinatie



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

Sensors

LED Visualisatie

Extra's

openHAB

Future Work

2017-06-14

External Nodes

NFC Node

NFC Node - Combinatie

NFC Node - Combinatie



NFC Node - Software



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

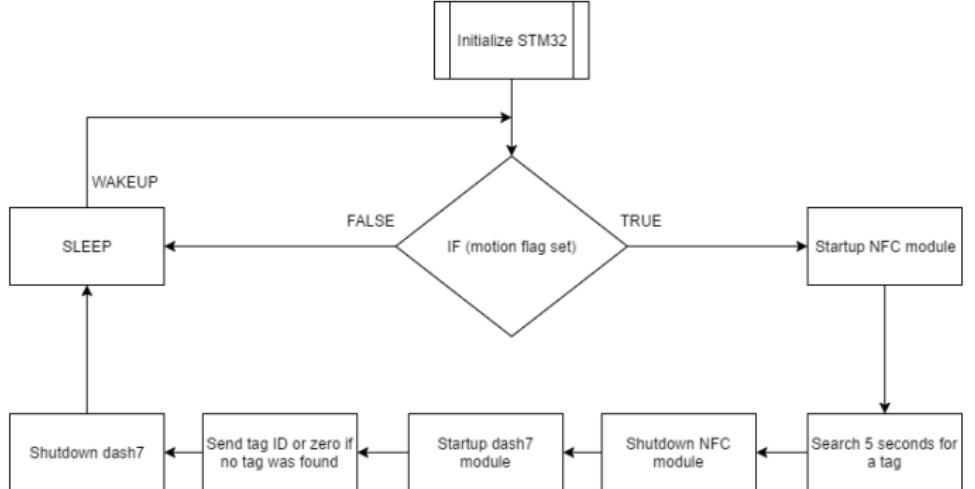
Sensors

LED Visualisatie

Extra's

openHAB

Future Work



2017-06-14

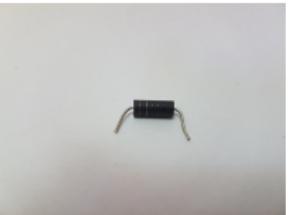
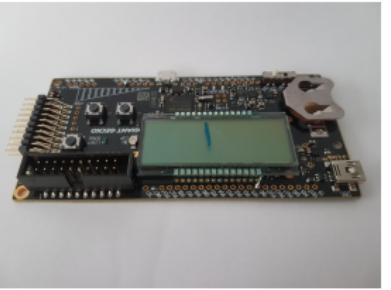
External Nodes

NFC Node

NFC Node - Software



NFC Node - Power Management



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

Sensors

LED Visualisatie

Extra's

openHAB

Future Work

2017-06-14

External Nodes

 └ NFC Node

 └ NFC Node - Power Management



NFC Node - Power Management



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

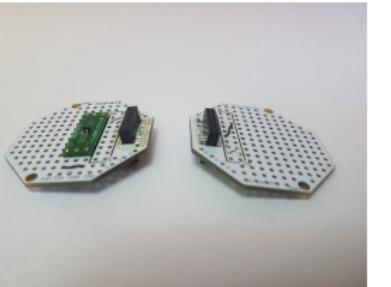
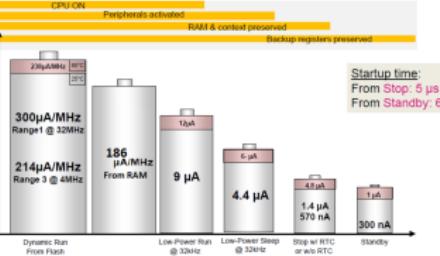
Sensors

LED Visualisatie

Extra's

openHAB

Future Work



2017-06-14

External Nodes

NFC Node

NFC Node - Power Management



NFC Node - Power Management



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

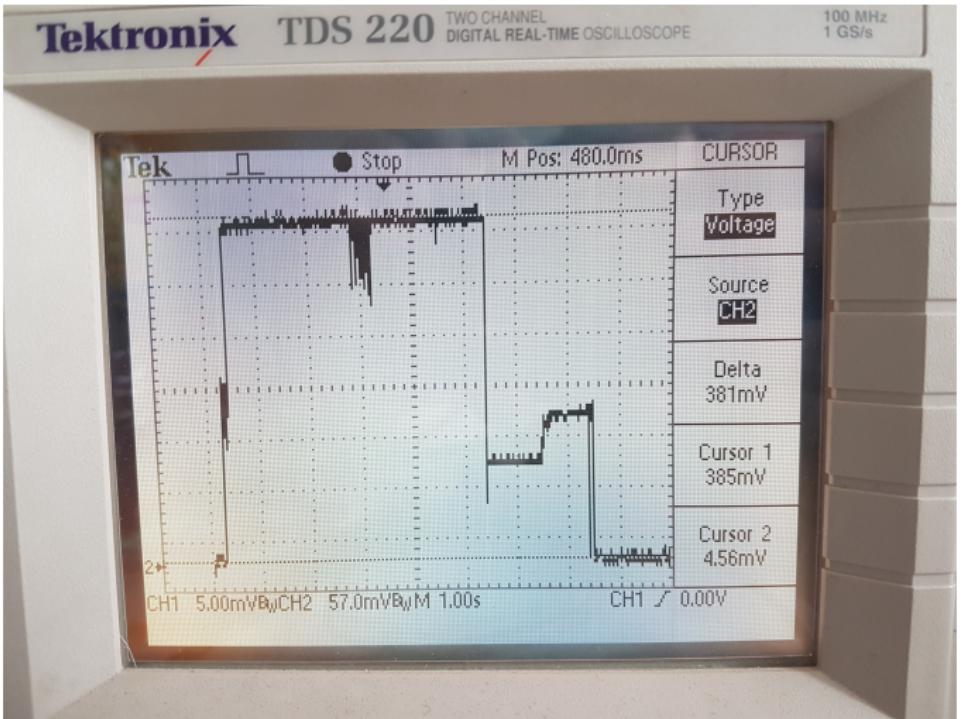
Sensors

LED Visualisatie

Extra's

openHAB

Future Work



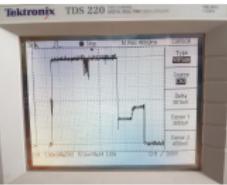
2017-06-14

External Nodes

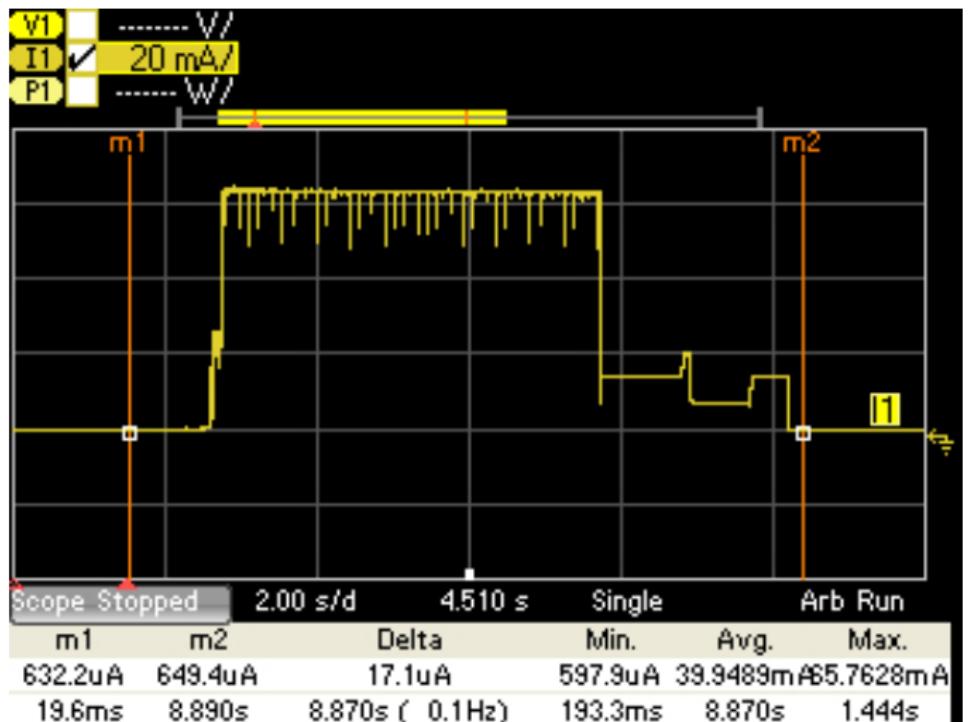
NFC Node

NFC Node - Power Management

NFC Node - Power Management



NFC Node - Power Management



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

Sensors

LED Visualisatie

Extra's

openHAB

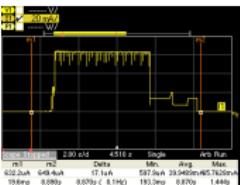
Future Work

2017-06-14

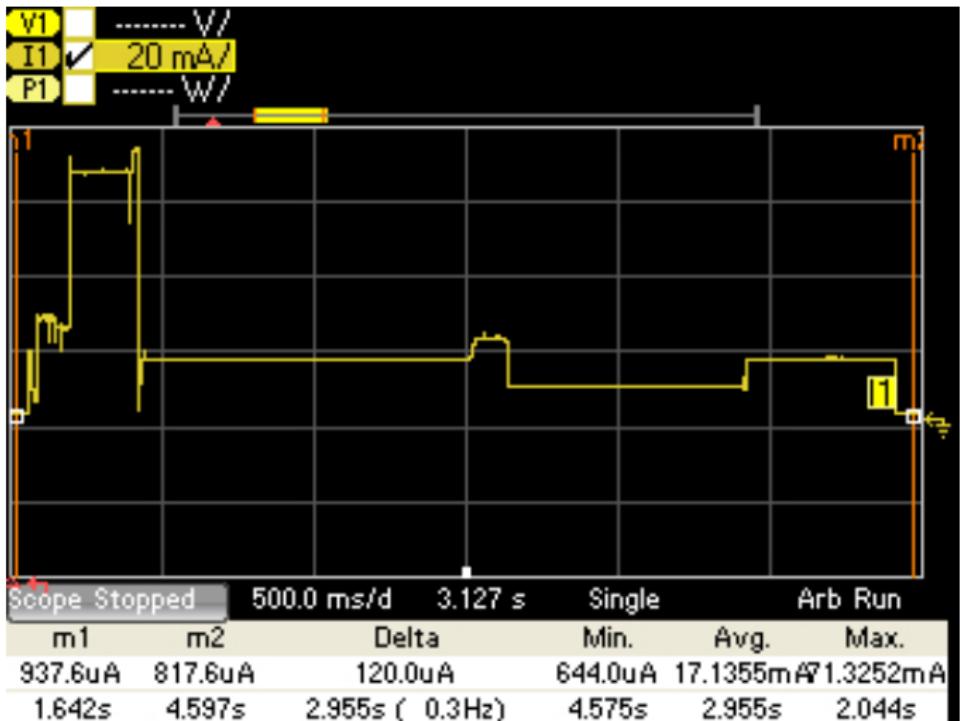
External Nodes

NFC Node

NFC Node - Power Management



NFC Node - Power Management



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

Sensors

LED Visualisatie

Extra's

openHAB

Future Work

2017-06-14

- └ External Nodes
- └ NFC Node
- └ NFC Node - Power Management



NFC Node - Power Management



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

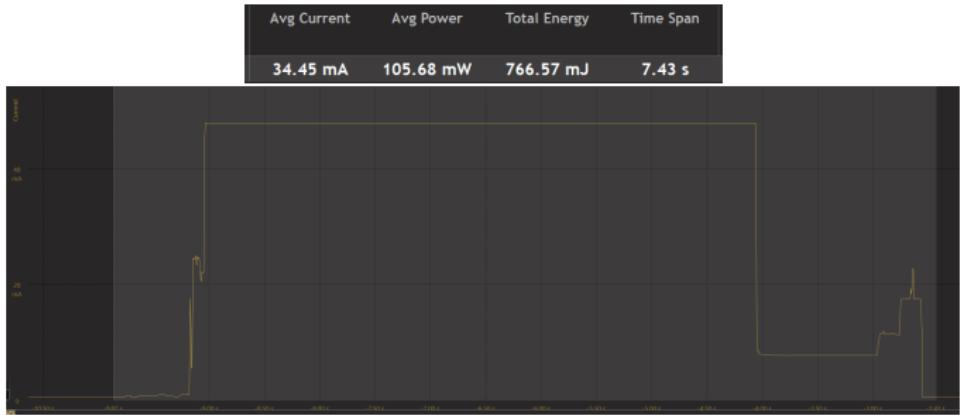
Sensors

LED Visualisatie

Extra's

openHAB

Future Work



2017-06-14

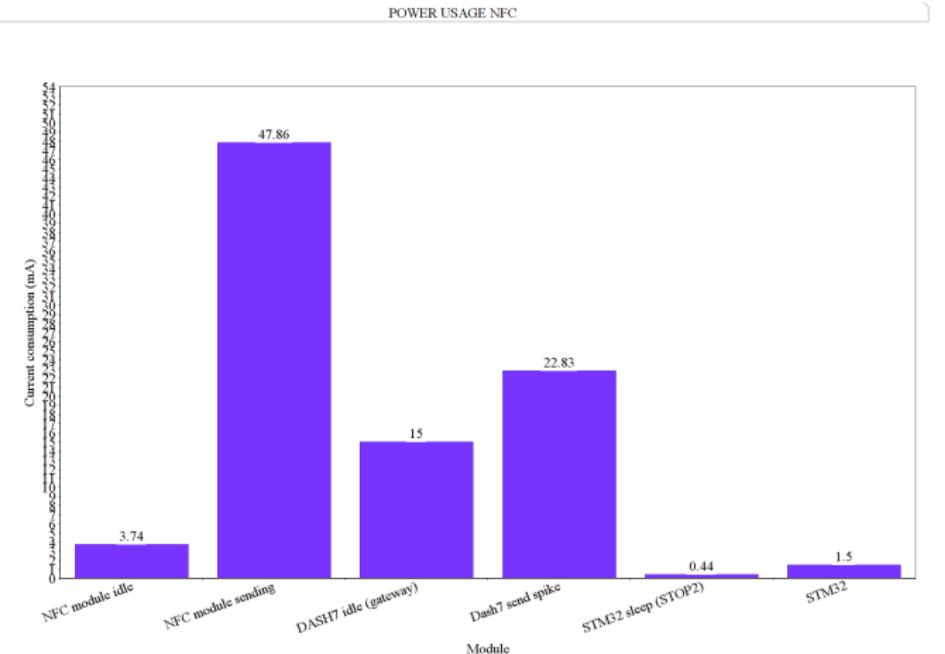
External Nodes

NFC Node

NFC Node - Power Management



NFC Node - Power Management



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

Sensors

LED Visualisatie

Extra's

openHAB

Future Work

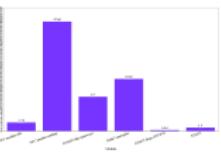
2017-06-14

External Nodes

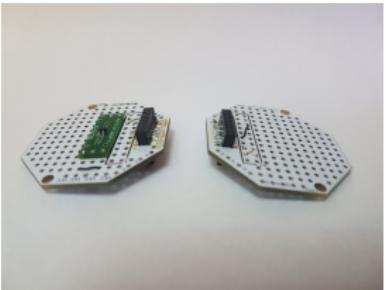
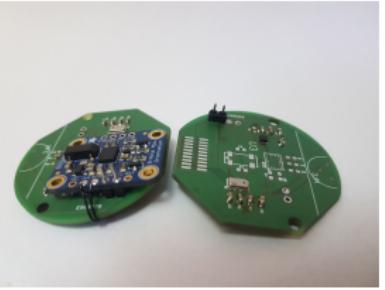
NFC Node

NFC Node - Power Management

NFC Node - Power Management



Mobile Node - Hardware



Introduction

External Nodes
NFC Node
Mobile Node

Localisation

Fingerprinting D7
Dash7
Fingerprinting MAG
Magnetometer
kNN-Algorithm

Gateway

Sensors
LED Visualisatie
Extra's

openHAB

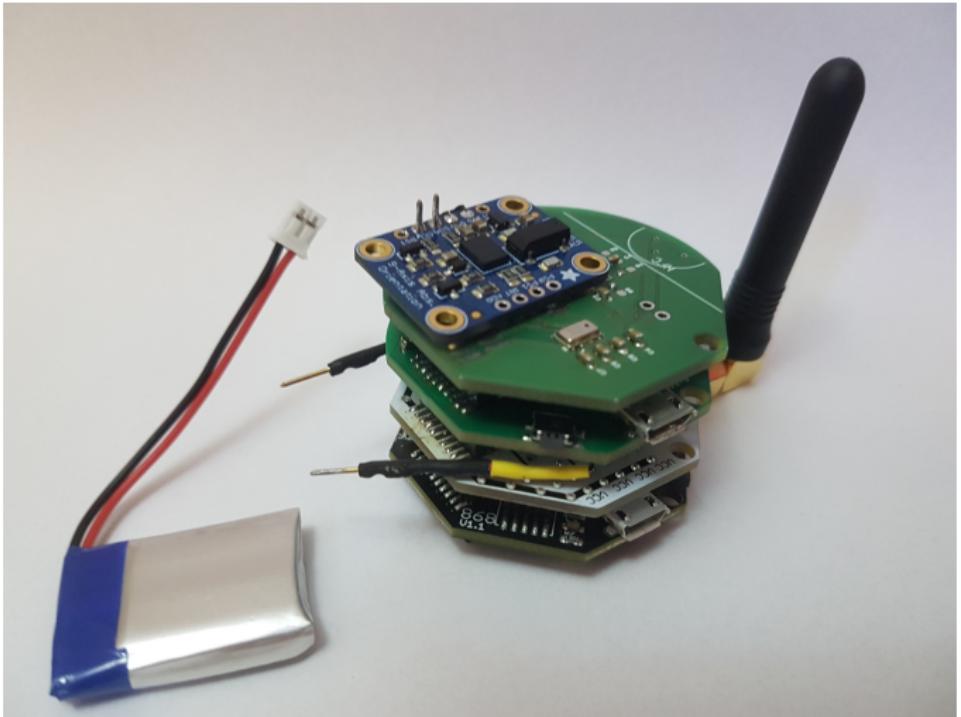
Future Work

2017-06-14

External Nodes
└ Mobile Node
 └ Mobile Node - Hardware



Mobile Node - Combination



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

Sensors

LED Visualisatie

Extra's

openHAB

Future Work

2017-06-14

External Nodes

Mobile Node

Mobile Node - Combination



Mobile Node - Software



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

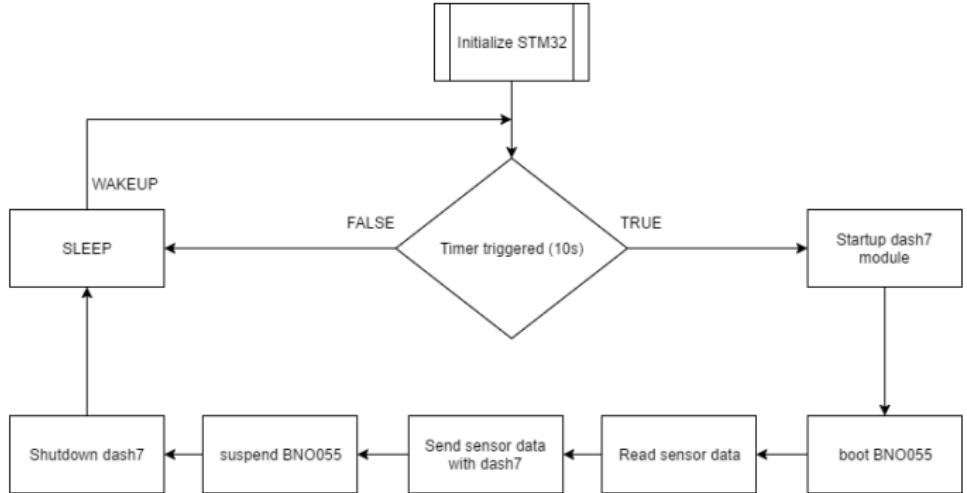
Sensors

LED Visualisatie

Extra's

openHAB

Future Work

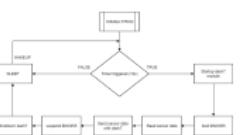


2017-06-14

External Nodes

Mobile Node

Mobile Node - Software



Mobile Node - Power Management



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

Sensors

LED Visualisatie

Extra's

openHAB

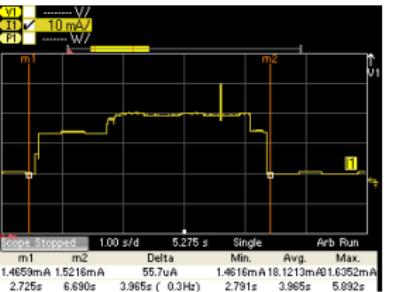
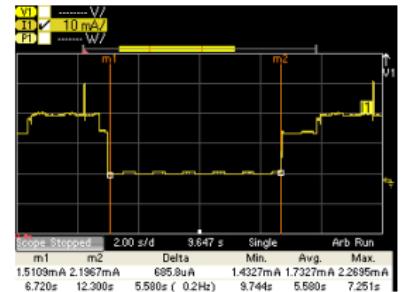
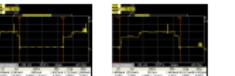
Future Work

2017-06-14

External Nodes

Mobile Node

Mobile Node - Power Management



Localisation



Introduction

External Nodes

NFC Node
Mobile Node

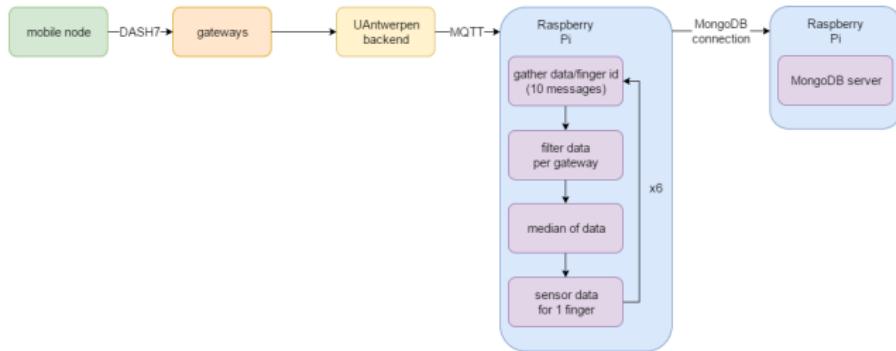
Localisation

Fingerprinting D7
Dash7
Fingerprinting MAG
Magnetometer
kNN-Algorithm

Gateway
Sensors
LED Visualisatie
Extra's

openHAB

Future Work



2017-06-14

Localisation
└ Fingerprinting D7
 └ Localisation

Localisation

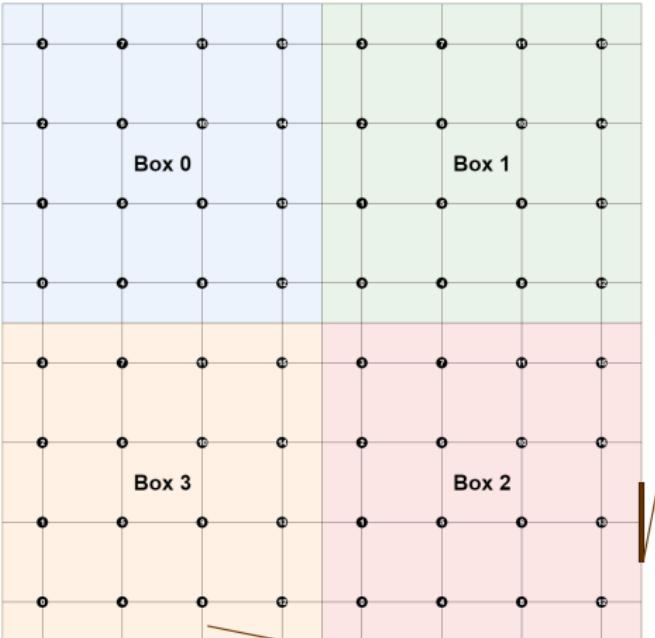
└ Fingerprinting Dash7



- 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.

Localisation

► Fingerprinting Dash7



Introduction

External Nodes

NFC Node
Mobile Node

Localisation

Fingerprinting D7
Dash7
Fingerprinting MAG
Magnetometer
kNN-Algorithm

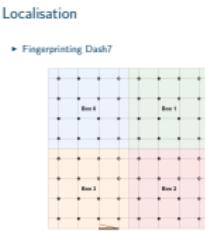
Gateway
Sensors
LED Visualisatie
Extra's

openHAB

Future Work

2017-06-14

Localisation
└ Fingerprinting D7
 └ Localisation



Localisation



Introduction

External Nodes

NFC Node
Mobile Node

Localisation

Fingerprinting D7

Dash7

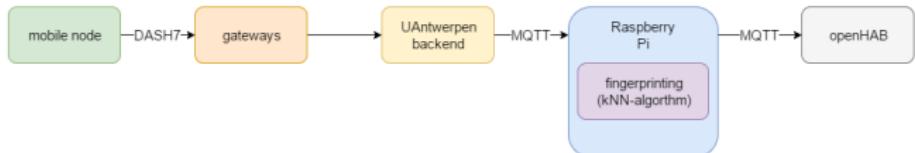
Fingerprinting MAG
Magnetometer
kNN-Algorithm

Gateway

Sensors
LED Visualisatie
Extra's

openHAB

Future Work



► Dash7

2017-06-14

Localisation
└── Dash7
 └── Localisation

Localisation

• 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

Localisation



Introduction

External Nodes

NFC Node
Mobile Node

Localisation

Fingerprinting D7

Dash7

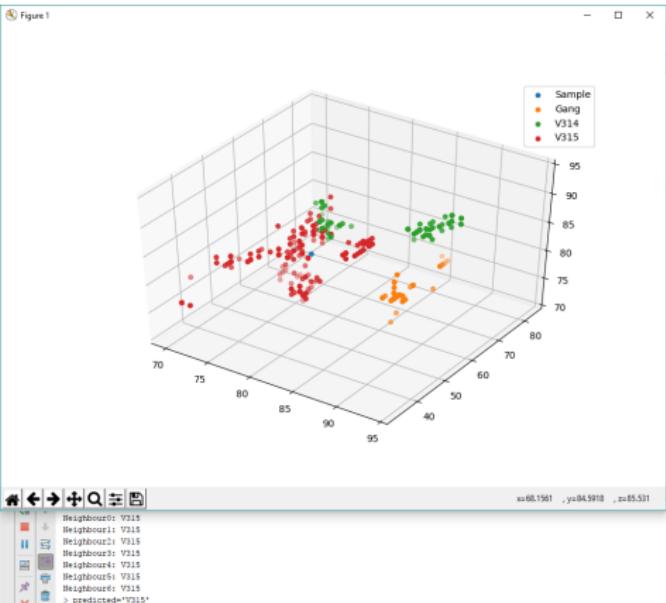
Fingerprinting MAG
Magnetometer
kNN-Algorithm

Gateway

Sensors
LED Visualisatie
Extra's

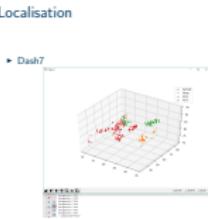
openHAB

Future Work



► Dash7

2017-06-14
└ Localisation
 └ Dash7
 └ Localisation



- Dit is een grafiek die de data-link waarden weergeeft op een grafiek.
- Deze afbeelding zou normaal 6-dimentionaal moeten zijn omdat er 6 gateways zijn maar omdat dit niet visueel mogelijk was hebben we gekozen om het 3-dimentionaal weer te geven met de 3 belangrijkste gateways.

Localisatie



Introduction

External Nodes

NFC Node
Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG
Magnetometer
kNN-Algorithm

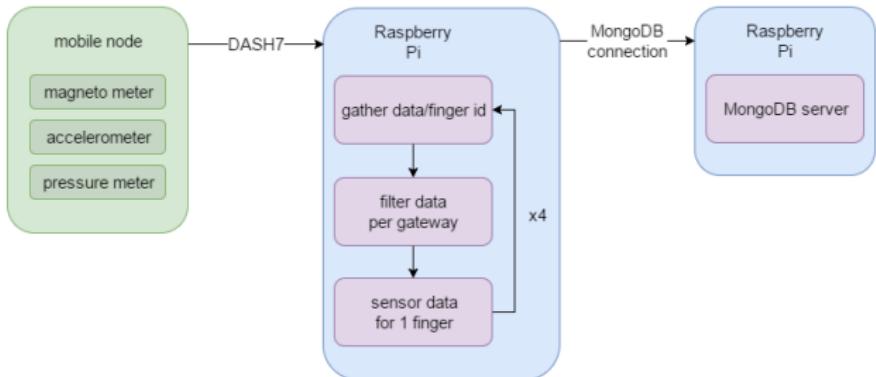
Gateway

Sensors
LED Visualisatie
Extra's

openHAB

Future Work

► Fingerprinting Magnetometer



2017-06-14

Localisation
└ Fingerprinting MAG
 └ Localisatie

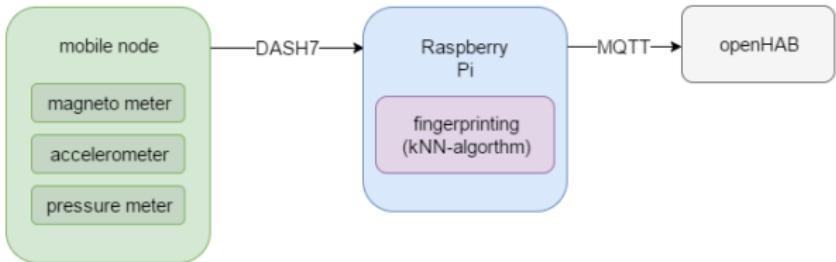
Localisatie



- 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.

Localisatie

► Magnetometer



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algoritme

Gateway

Sensors

LED Visualisatie

Extra's

openHAB

Future Work

2017-06-14

Localisation
└ Magnetometer
 └ Localisatie

Localisatie

► Magnetometer



- 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



Introduction

External Nodes

NFC Node
Mobile Node

Localisation

Fingerprinting D7
Dash7
Fingerprinting MAG
Magnetometer
kNN-Algorithm

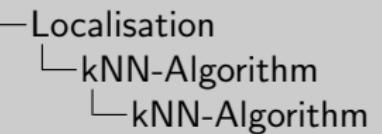
Gateway

Sensors
LED Visualisatie
Extra's

openHAB

Future Work

2017-06-14



- 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

Gateway



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

Sensors

LED Visualisatie

Extra's

openHAB

Future Work



► Sensors

2017-06-14

└ Gateway
 └ Sensors
 └ Gateway

Gateway

▪ 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.

Gateway



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

Sensors

LED Visualisatie

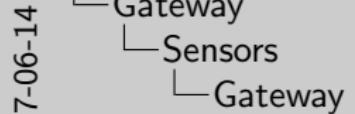
Extra's

openHAB

Future Work



► Sensors



Gateway

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

Gateway



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

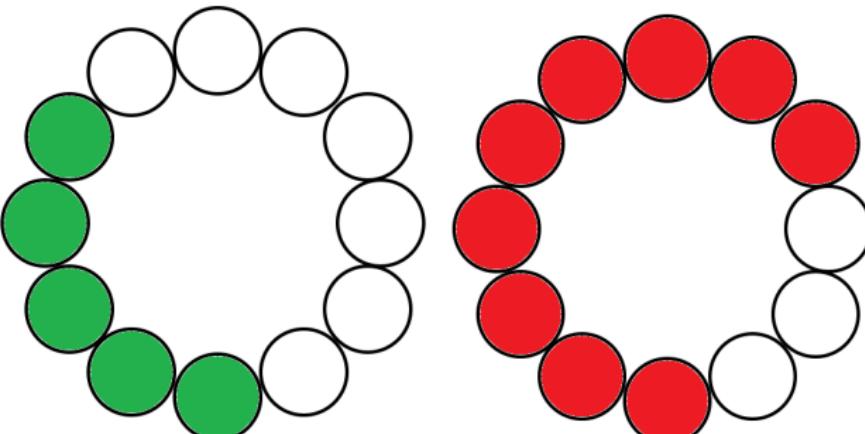
Sensors

LED Visualisatie

Extra's

openHAB

Future Work

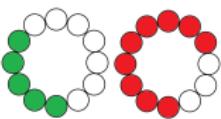


2017-06-14

Gateway
└── LED Visualisatie
 └── Gateway

Gateway

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



Gateway

► Camera



► Scripts



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

Sensors

LED Visualisatie

Extra's

openHAB

Future Work

2017-06-14

└ Gateway
 └ Extra's
 └ Gateway

Gateway

• Camera

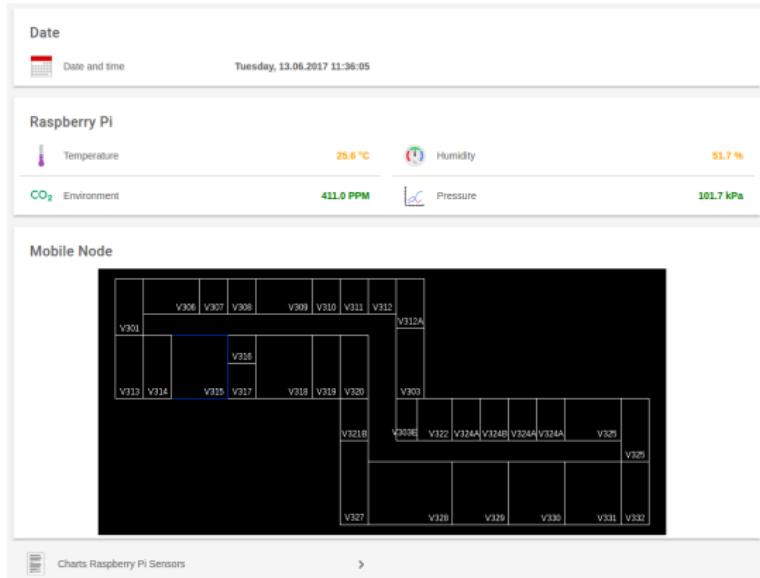


• Scripts

- 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



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

Fingerprinting D7

Dash7

Fingerprinting MAG

Magnetometer

kNN-Algorithm

Gateway

Sensors

LED Visualisatie

Extra's

openHAB

Future Work

2017-06-14

└ openHAB

└ openHAB

openHAB

► Basic UI



► HabPanel

- 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

Future Work



Introduction

External Nodes

NFC Node

Mobile Node

Localisation

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

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