

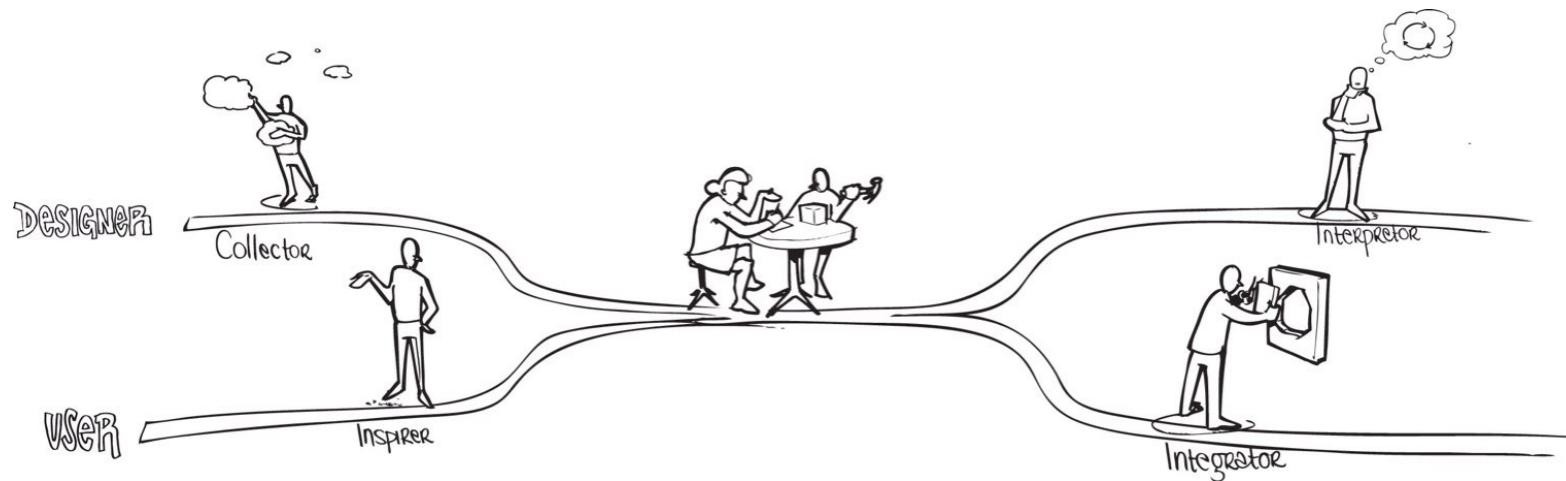


waag society

institute for art, science and technology



Making Sense



Emma Pareschi

Hardware Developer

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Waag Society

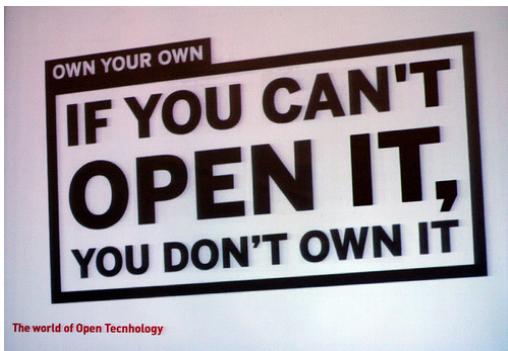
- Institute for Art, Science & Technology
- Since 1994, 63 Staff, based in Amsterdam
- Problems in the urban metabolism with social impact.
- Exploring emergent technologies & opening them up





Technology

- For self expression and communication
- Linking people, groups, communities
- Sharing thoughts, blueprints, algorithms
- Reflecting & understanding





Making Sense



The screenshot shows the homepage of the Making Sense website. At the top left is the logo. To its right is the title "Making Sense". A navigation bar with links "About", "Campaigns", "Toolkit", "Contact", and "Blog" is positioned above a large central section. This section has a dark background with the word "ABOUT" in white capital letters at the top. Below it is a large, bold, white text block that reads "A NEW APPROACH TO CITIZEN SCIENCE". Underneath this, in smaller white text, is the subtitle "Co-creating technology for change with concerned communities". The overall design is minimalist and modern.

OUR MISSION

Making Sense is a two years project that has been run since 2015. We aim to explore how open source software, open source hardware, digital maker practices and open design can be effectively used by local communities to fabricate their own sensing tools, make sense of their environments and address pressing environmental problems in air, water, soil and sound pollution.

The consortium consists of Waag Society (Lead partner – Netherlands), University of Dundee (UK), Peer Educators Network and Science for Change (Kosovo), Institute for Advanced Architecture of Catalonia – IAAC (Spain), and the EU Joint Research Centre (Belgium).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 688620.



Time Line



Making Sense

PILOT 1
UrbanAirQ
March 2016
October 2016

PILOT 2
Smart Kids Lab
September 2016
February 2017

PILOT 3
Gemma Sense
January 2017
June 2017



Making Sense Pilot 1: UrbanAirQ



We organised a special pilot in 2016 to measure air quality around the Valkenburgerstraat and Weesperstraat, under the name Urban AirQ. Citizens can actively participate in the measuring process.



Partners in Urban AirQ : KNMI, University of Wageningen, GGD Amsterdam, ECN and the LongFonds. Waag Society earlier conducted a pilot with the Smart Citizen Kit in Amsterdam to measure air quality. Urban AirQ is partly financed by the Amsterdam Institute for Advanced Metropolitan Solutions (AMS) The project is also part of the European financed program Making Sense.

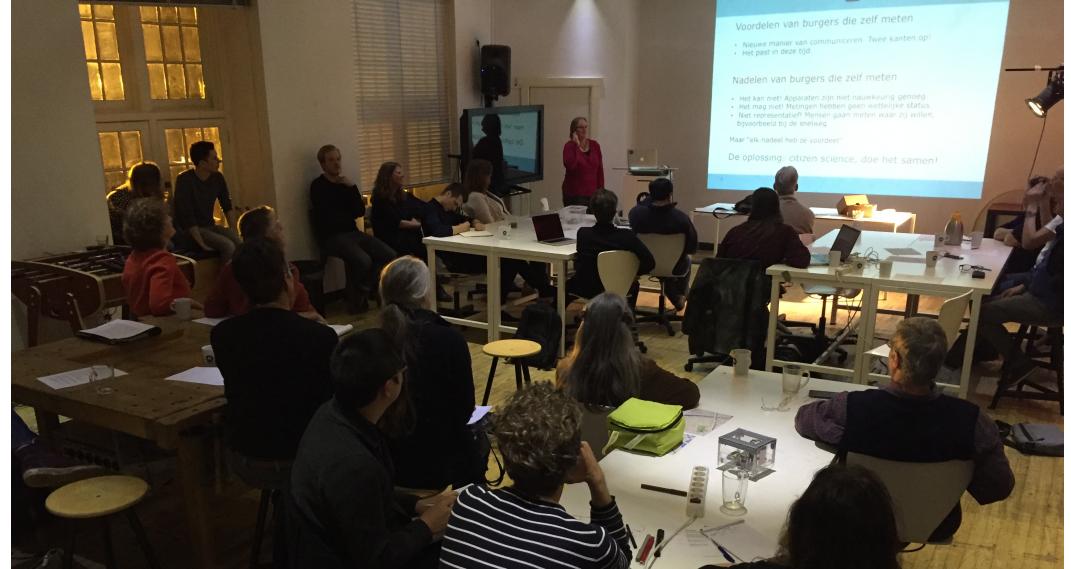
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Making Sense Pilot 1: UrbanAirQ



Discussions with
citizens and experts.
What to measure and why.

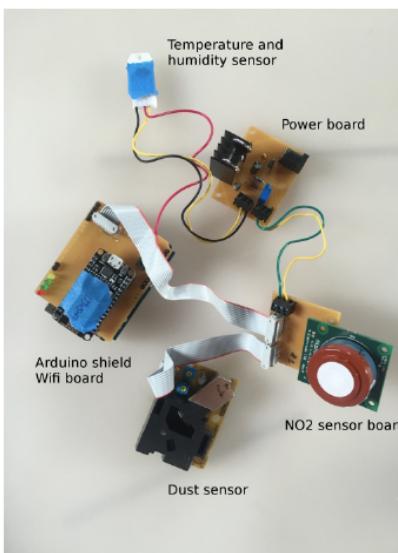


Bora Kit, Low Cost Sensors:

- NO₂
- Dust

Spec:

- Arduino based
- Wall plugged
- WiFi



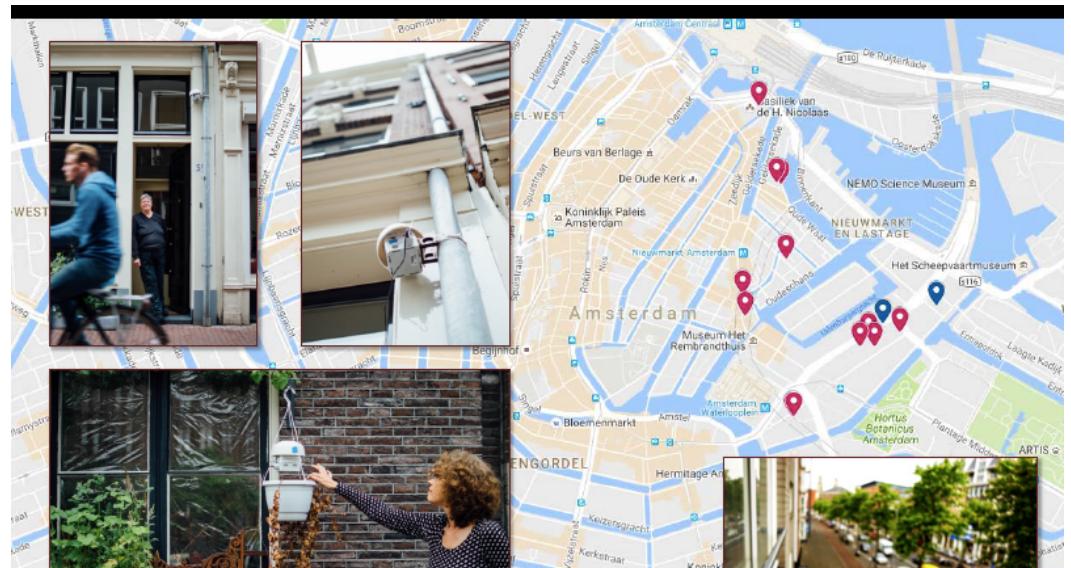


Making Sense Pilot 1: UrbanAirQ



Measurement Process:

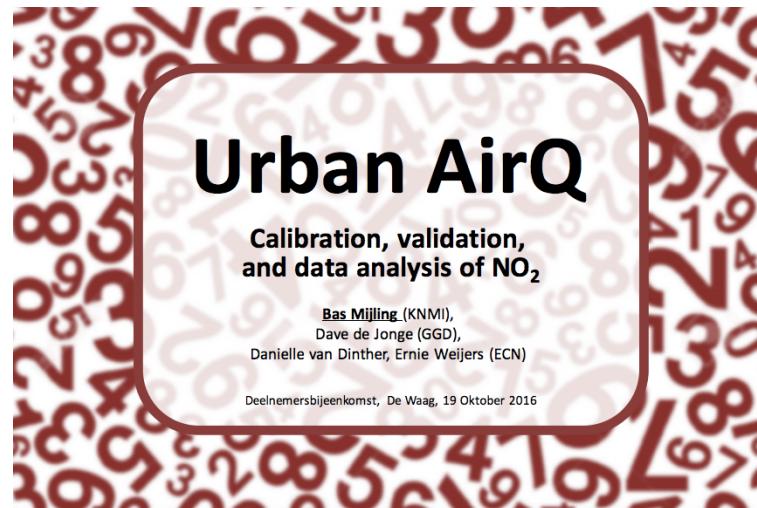
- Calibration: one week of calibration in Vondelpark.
- Two months of measurements at citizens houses.
- Calibration: 10 days of calibration in Vondelpark





Making Sense, Pilot 1

UrbanAirQ

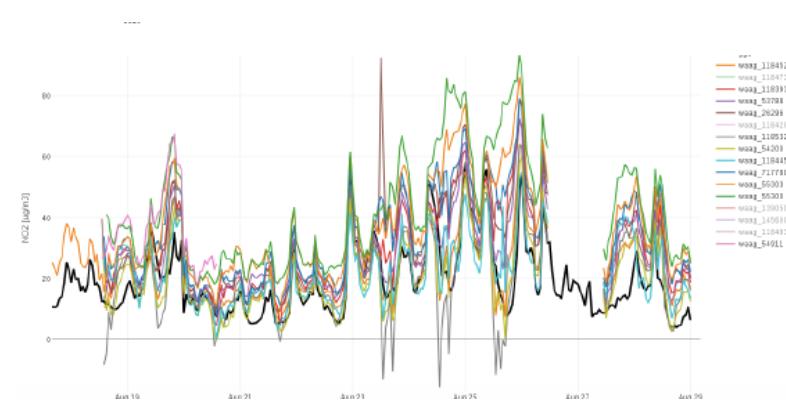


Vragen van deelnemers

- Effect van sluiting IJtunnel
- Straatkant versus achtertuin
- Hoofdstraat versus zijstraat
- Hoe hoger hoe schoner?
- Nachttaxi's naar de Wallen

Long-term averages of Waag sensors

- Many data gaps
- Make selection of sensors with simultaneous measurements
- 13 June – 16 August 2016: 48% of time



Cal/Val Conclusion

- To make electrochemical NO₂ sensor measurements useful, calibration and re-calibration of individual sensors is essential.
- Hourly measurement error of Waag NO₂ is estimated 7 µg/m³
- For future hardware, inclusion of O₃ sensor is recommended.



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Making Sense, Pilot 2 Smart Kids Lab



Low Tech Sensors



Medium Tech Sensors



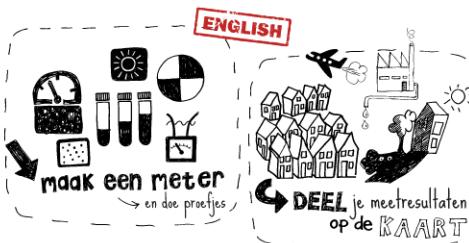


Making Sense, Pilot 2 Smart Kids Lab



The screenshot shows the homepage of smartkidslab.nl. At the top, there's a navigation bar with links like 'MAAK EEN METER!', 'METINGEN DELEN EN BEKIJKEN', and 'OVER ONS'. Below the navigation, a main heading reads 'Met het Smart Kids Lab kun je water, geluid, lucht, aarde en licht onderzoeken met zelfgemaakte meetinstrumenten.' There are also sections for 'maak een meter' and 'DEEL je meetresultaten op de KAART'.

Met het Smart Kids Lab kun je water, geluid, lucht, aarde en licht onderzoeken met zelfgemaakte meetinstrumenten.



Fijnstofmeter

Houdt FIJNSTOF vast in de LUCHT? Fijnstofhaaltjes zijn vaak klein, dat je ze NIET ziet! Maar wel met een stofmaskerje te ruiken... heelstof!



Waarom is zwemWATER geen drinkwater? Zitten er veel of weinig microben in de

SMART KIDS LAB meters maken → proefjes doen

MAAK EEN METER!

METINGEN DELEN EN BEKIJKEN

OVER ONS

Deel je
meetresultaat

Heb je een proefje gedaan met een
zelfgemaakte meter? Hier zet je je
resultaten op de GROTE
DATAKAART.



Geluidsmeter

Hoe hard blaat een GEULID? Het is hard
als een BRANDWEERWAGEN! Hoe je
beter je GEULID kan horen dan? Maak
het met een simpele APP!

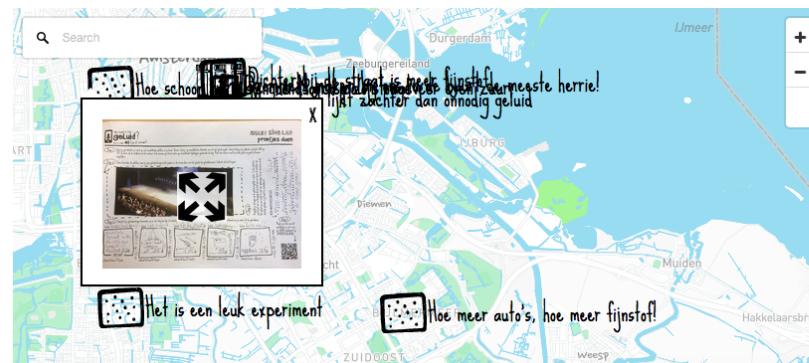
GEULIDOMETER



Microbenmeter

MICROBEN: de grond zit er wel met! Dat
is maar goed ook op de GROND kan
niet groeien! De kast is wel voor, maar
wel in een POTTE groeien en maken. Want
ze produceren STROOP!

MICROBENMETER



KLIK op de plek waar je de
metingen hebt gedaan en upload!

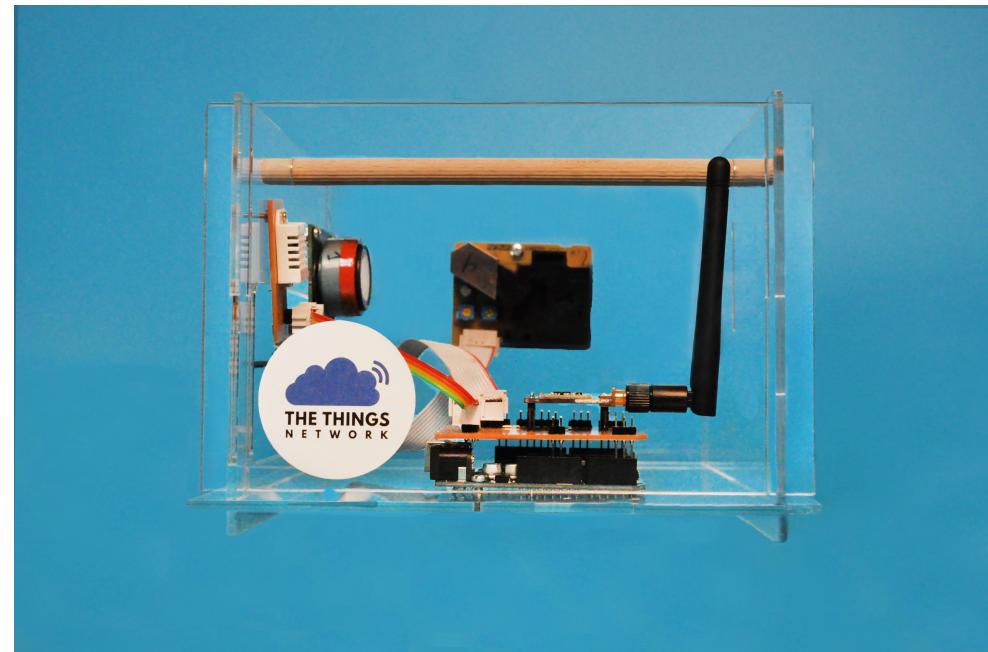


Making Sense, Pilot 2

Bora Lora Kit



Bora Kit



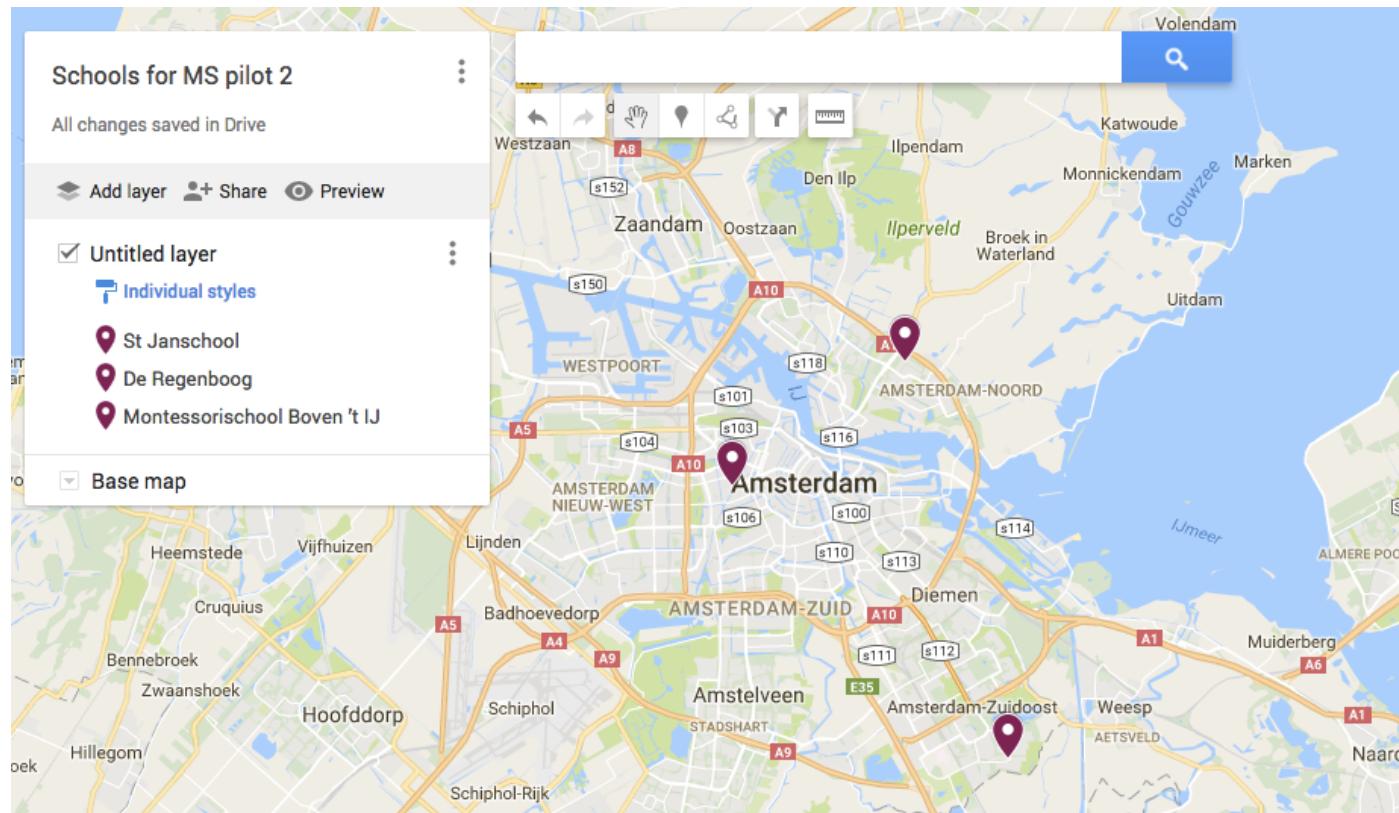
Bora Lora Kit





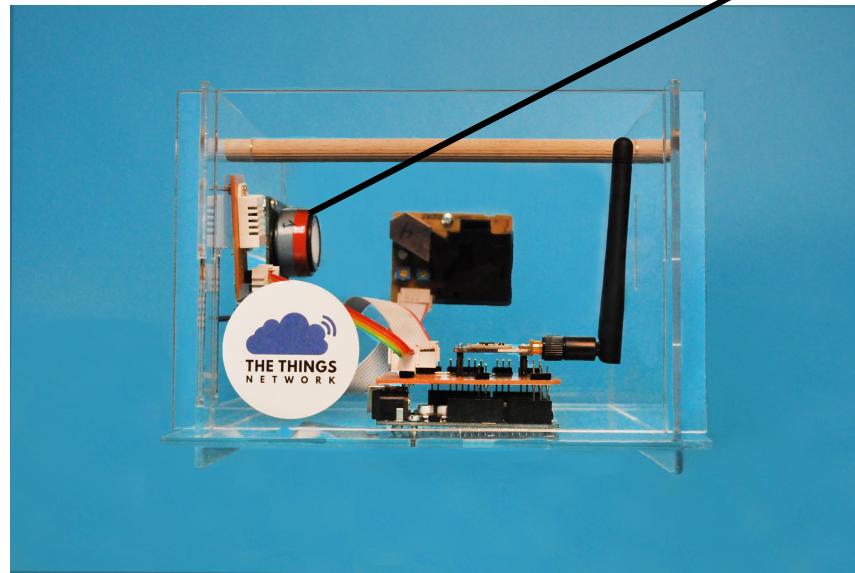
Making Sense, Pilot 2

Bora Lora Kit

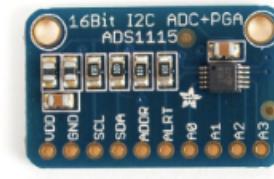




Making Sense, Pilot 2 Bora Lora Kit



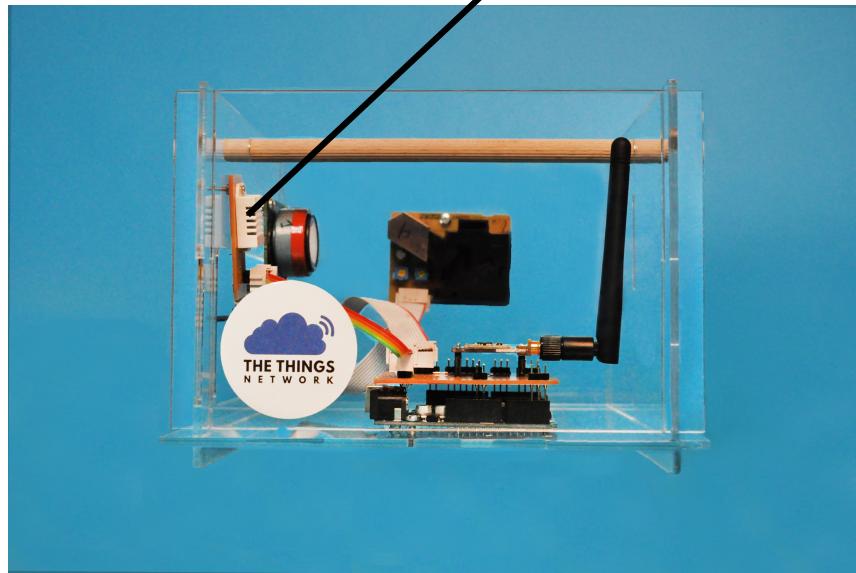
NO2 Sensor: NO2B43F Alphasense
Support Board: ISB Alphasense
ADC: ADS1115 breakout board Adafruit





Making Sense, Pilot 2

Bora Lora Kit

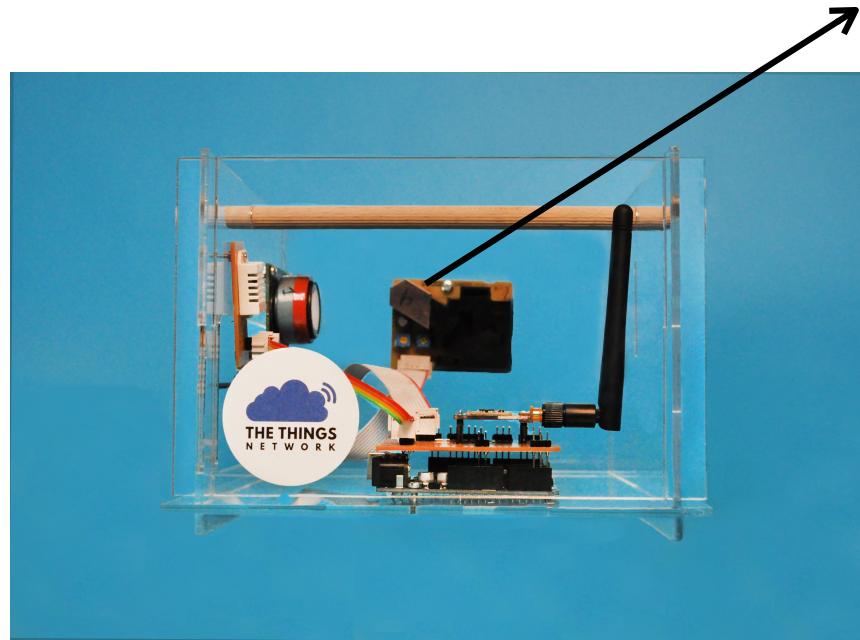


Temperature and Humidity: DHT22





Making Sense, Pilot 2 Bora Lora Kit



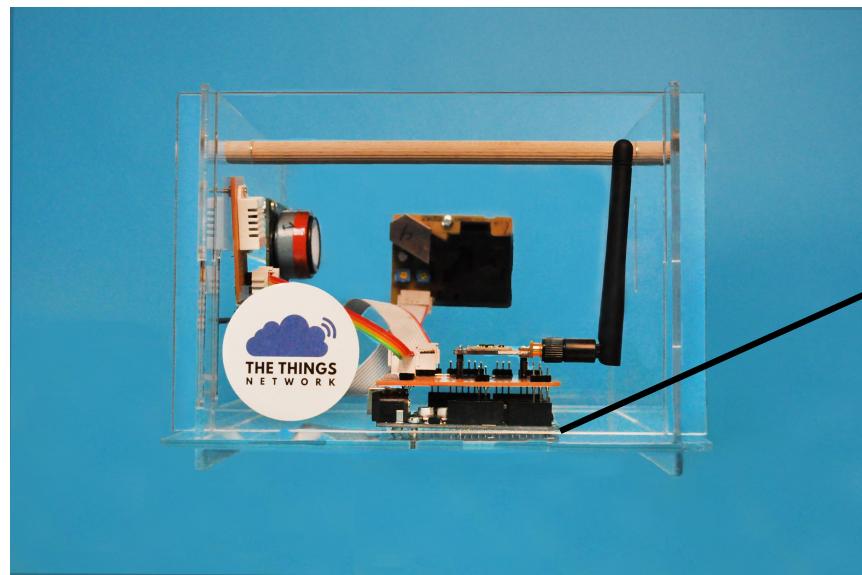
Dust Sensor: PPD42NS Shinyei





Making Sense, Pilot 2

Bora Lora Kit

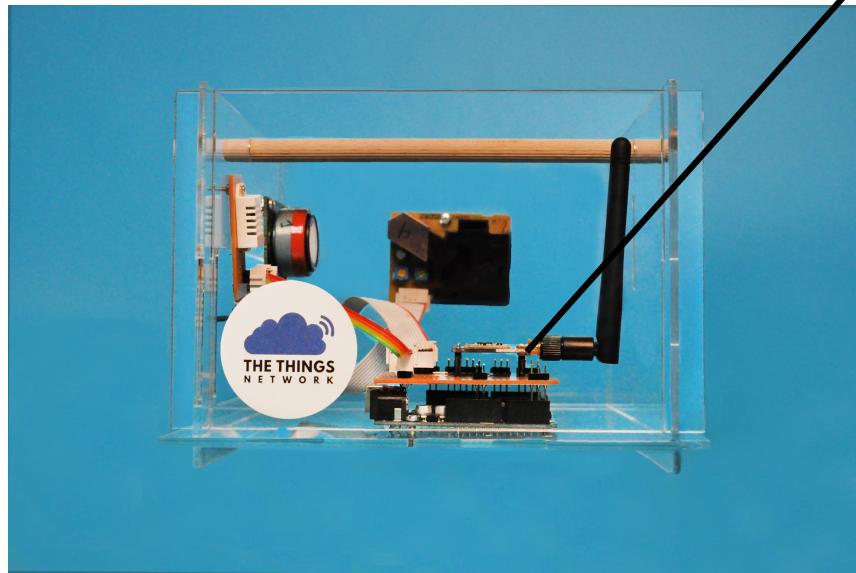


Arduino Uno





Making Sense, Pilot 2 Bora Lora Kit



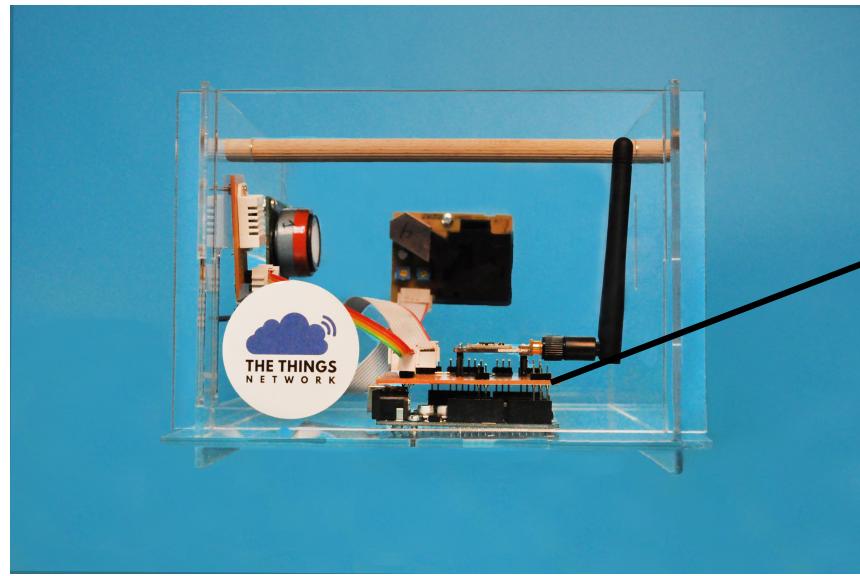
RFM95W LoRa Radio
Adafruit breakout board
SMA Tilt Swivel 1/2 Wave Whip antenna



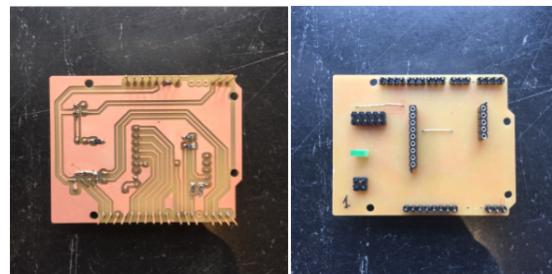


Making Sense, Pilot 2

Bora Lora Kit



Interface Board





Making Sense, Pilot 2

Bora Lora Kit



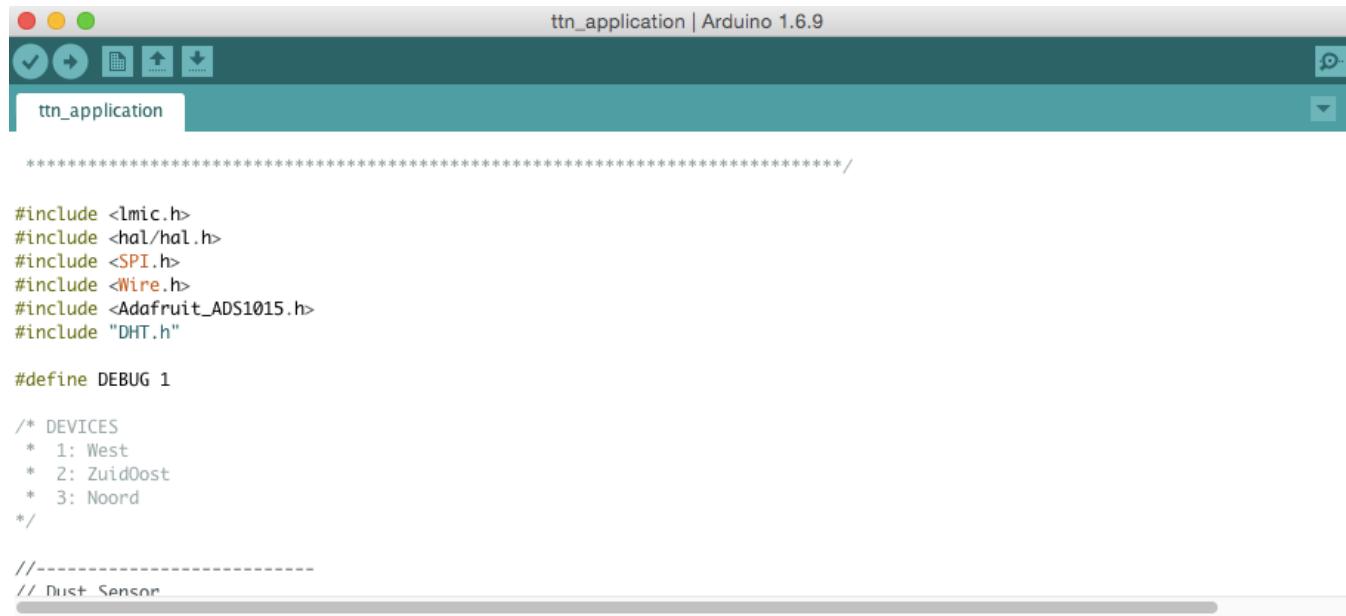
Programming Environment: Arduino IDE

LORAWAN protocol: IBM LMIC library (ttn-abp example)

Dust Sensor: based on Dustunio project from PublicLab

NO2 Sensor: uses the Adafruit library Adafruit_ADS1015.h

DHT22: uses the library DHT.h



The screenshot shows the Arduino IDE interface with the title bar "ttn_application | Arduino 1.6.9". The code editor contains the following C++ code:

```
ttt_ttn_application | Arduino 1.6.9

ttn_application

*****  

#include <lmic.h>
#include <hal/hal.h>
#include <SPI.h>
#include <Wire.h>
#include <Adafruit_ADS1015.h>
#include "DHT.h"

#define DEBUG 1

/* DEVICES
 * 1: West
 * 2: ZuidOost
 * 3: Noord
 */
//-----
//_Dust_Sensor
```



Making Sense, Pilot 2

Bora Lora Kit



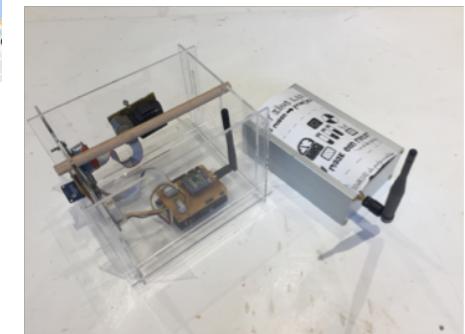
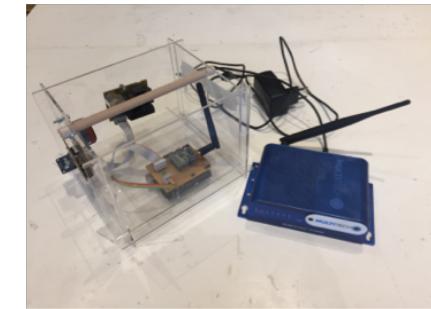
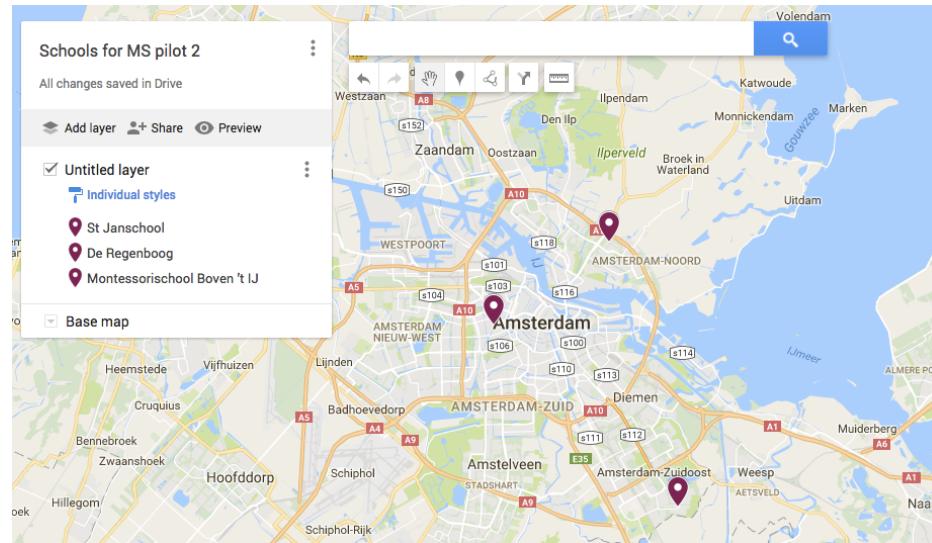
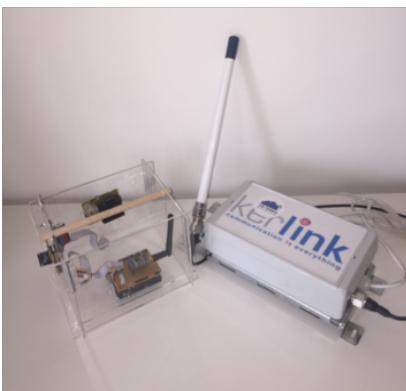
Payload

"hum": 23,	→ percent
"op1": 1195,) → mV
"op2": 1224,	
"pm10": 0,) → parts per cubic feet
"pm25": 291,	
"temp": 25	→ celsius



Making Sense, Pilot 2

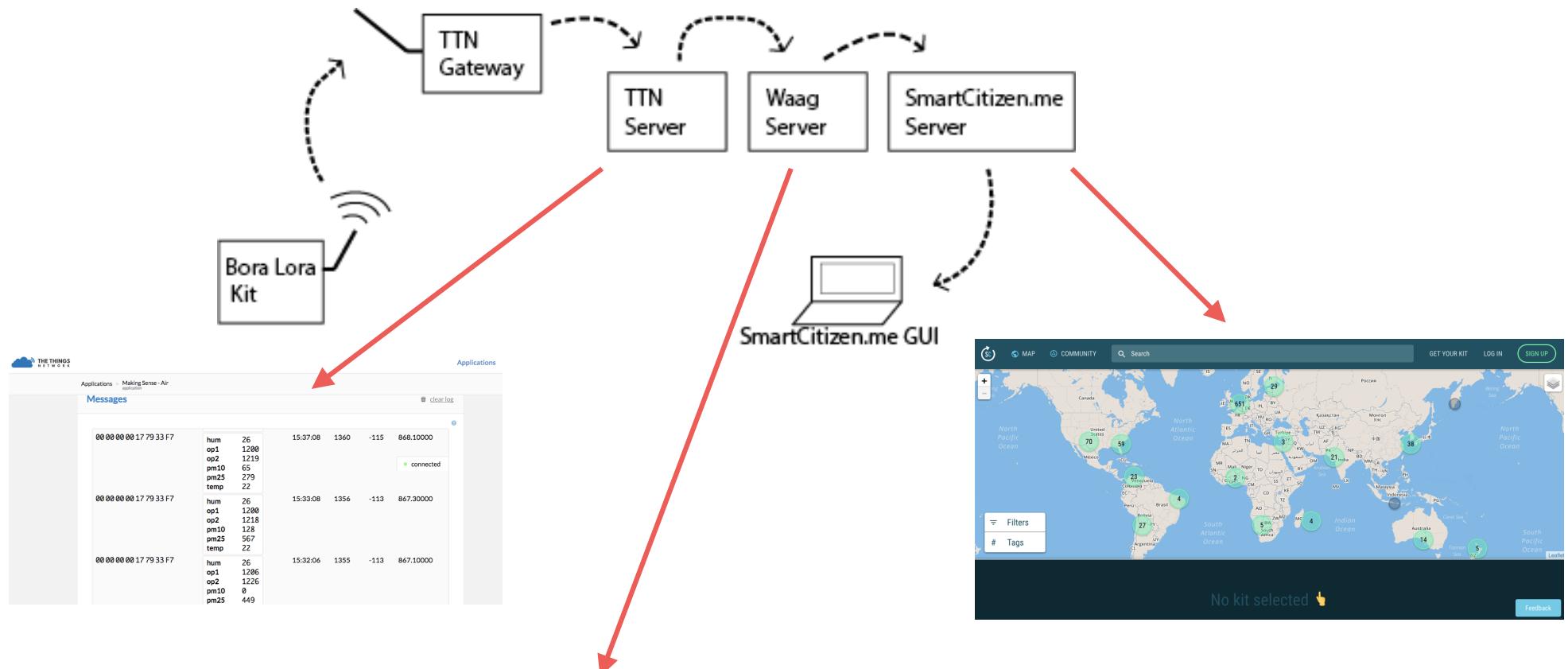
Bora Lora Kit





Making Sense, Pilot 2

Bora Lora Kit



Ubuntu 15.10, 4 CPUs quadcores, 32Gb RAM
MQTT broker: mosquitto
Back-end: Ruby, Postgres



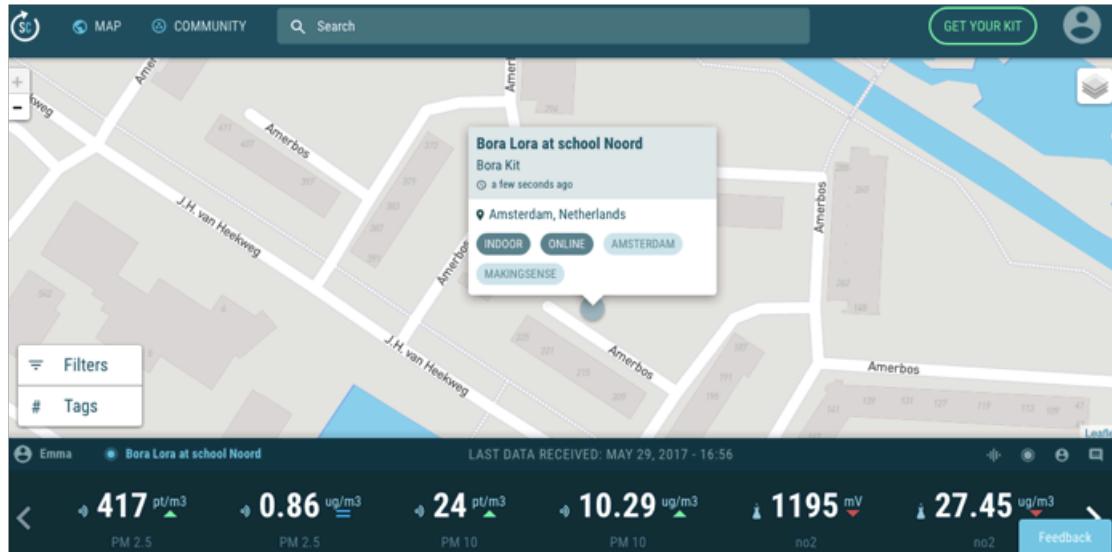
Making Sense, Pilot 2

Bora Lora Kit



Advantages of Smart Citizen platform:

- geo-location on the map
- real time data on the low bar
- plot overtime with two data comparison
- download the data, .csv format



Data

- humidity (%)
- temperature (C)
- NO₂ (ug/m³)
- PM2.5 (ug/m³)
- PM10 (ug/m³)





Making Sense, Pilot 2

Bora Lora Kit



Maintenance

Blackout in Amsterdam in January 2017

Migration to the new TTN Dashboard

Kids and Parents

Too difficult for kids but interesting for parents.

The dust measurements were used by the parents to understand the moments of the classes.

My conclusion

- friendly configuration of the devices on the dashboard
- fast and open support from TTN experts
- no need to access private local networks
- connection process smooth
- stable network.



Making Sense, Pilot 2

Bora Lora Kit



Everyone can have a look to the measurements following the links:

Noord -> <https://smartcitizen.me/kits/3767>

West -> <https://smartcitizen.me/kits/3764>

ZuidOost -> <https://smartcitizen.me/kits/3766>

Everyone can read more about the sensor kit:

https://github.com/waagsociety/air_quality_sensor_kit



Time Line



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PILOT 1
UrbanAirQ
March 2016
October 2016

PILOT 2
Smart Kids Lab
September 2016
February 2017

PILOT 3
Gamma Sense
January 2017

...



Making Sense, Pilot 3

Gamma Sense



What is gamma-radiation?

A form of man-made radiation that has so much energy it penetrates everything that is not behind >8 cm lead.

Why is it dangerous?

In high doses it can kill you within hours or damage your DNA so health-problems can occur (much) later.

If things go wrong..

.... we will need information – and fast.

Where, when, how much, course of action?

—> By preparing an emergency-infrastructure



Making Sense, Pilot 3

Gamma Sense



If you block all normal light with black tape, the white dots that remain are caused* by gamma radiation.
If you count them, you have produced a CPM, analogue to a classical Geiger–counter.



Making Sense, Pilot 3

Gamma Sense



DEMO: <https://gammasense.org/>

The screenshot shows a web browser window with the URL <https://gammasense.org/#instructions>. The page has a dark background with a world map. A central modal window contains the following text:

Gammastraling meten
Meet Gammastraling met de camera van je computer of telefoon.
Momenteel wordt alleen Google Chrome op een computer ondersteund om een meting te doen.

Plak je camera af
Dek de camera aan de voorkant van je apparaat volledig af met zwarte tape dat licht blokkeert.

Doe een meting
Het duurt één minuut om een nulmeting te doen, dit wordt gebruikt om de verdere meting correct te interpreteren. Na een meting te hebben voltooid is deze (binnenkort) terug te vinden in het menu rechtsboven.

A green "Got it" button is at the bottom of the modal.



References



Making Sense

<http://making-sense.eu/>

<https://www.waag.org/nl/project/making-sense>

<http://waag.org/en/blog/making-sense-making-sensor>

<https://github.com/waagsociety/making-sensor>

Thanks for your attention,
questions?