

senseBox



New Developments and Insights into
Volunteer User Interactions

Geospatial Sensor Web Conferences 04.09.2018

Mario Pesch, Jasper Buß

„ The **senseBox** is a do-it-yourself kit for stationary and mobile sensor stations – the **Citizen Science Toolkit**.“

senseBox:home

- Collect data
- Contribution to a sensor network
- Easy setup, no soldering



senseBox:edu

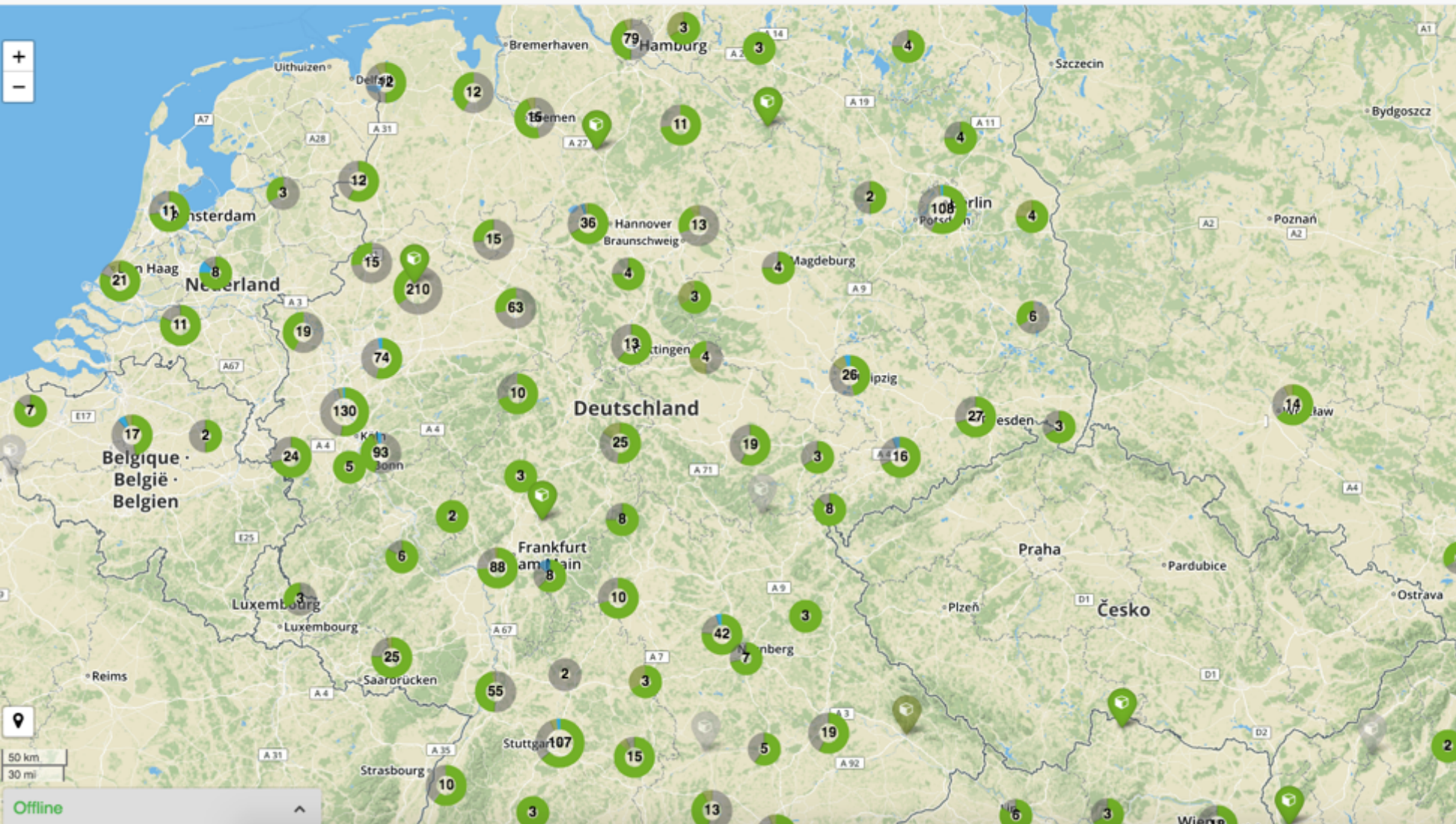
- schools and junior scientists
- Didactical concept
- learn programming



- Temperature
- Humidity
- Pressure
- UV-Light
- Illuminance
- Fine Particular Matter
(PM₁₀ / PM_{2.5})

Data?

Suche nach Boxen und Orten



senseBox_wifi_Yun

draußen

Aktualisieren in 41 Sek.

Hier stehen weitere Informationen zu dieser senseBox, der Besitzer dieser Station hat jedoch nichts hinterlegt.

UV-Intensität
130 $\mu\text{W}/\text{cm}^2$ vor 10 Minuten

Beleuchtungsstärke
7660 lx vor 10 Minuten

Luftdruck
1009.54 hPa vor ein paar Sekunden

rel. Luftfeuchte
99.99 % vor ein paar Sekunden

Temperatur
21.79 °C vor 10 Minuten

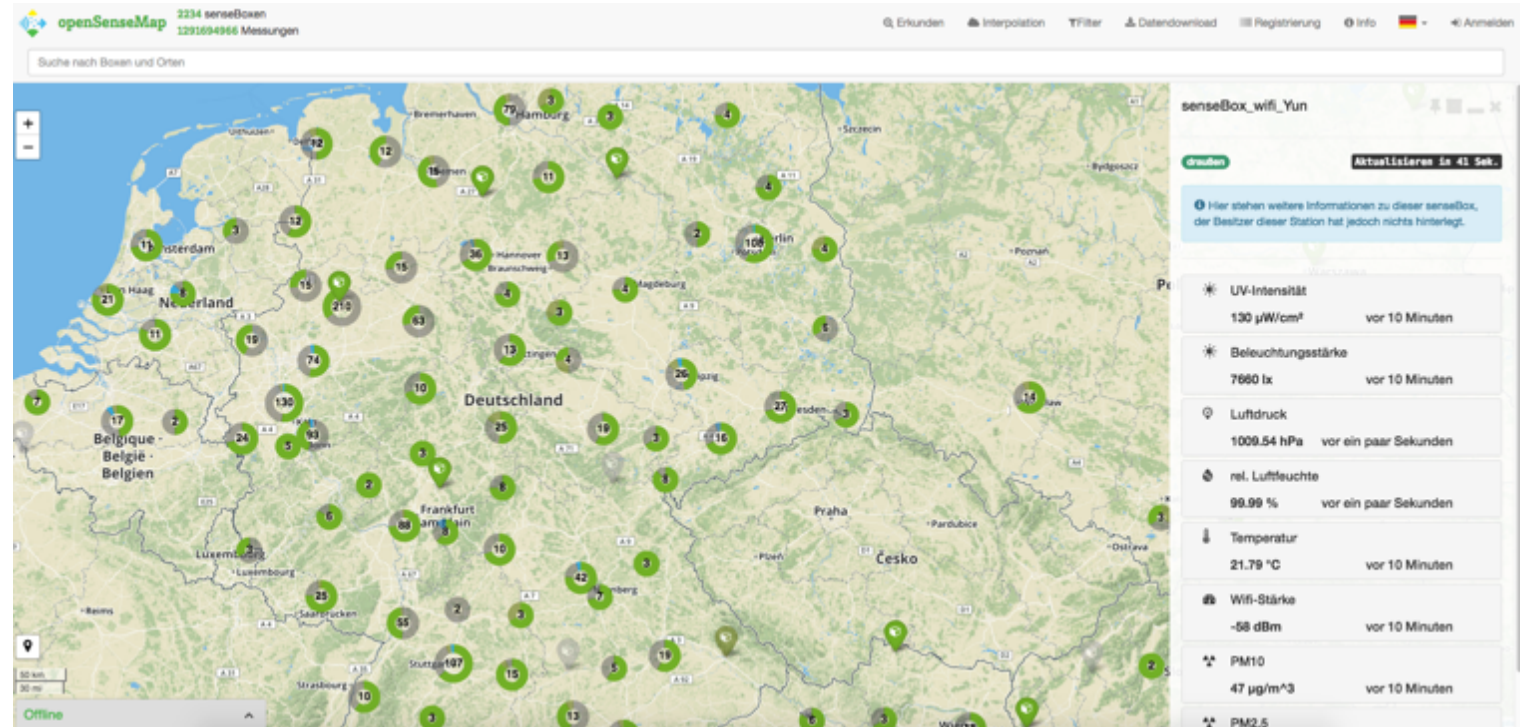
Wifi-Stärke
-58 dBm vor 10 Minuten

PM10
47 $\mu\text{g}/\text{m}^3$ vor 10 Minuten

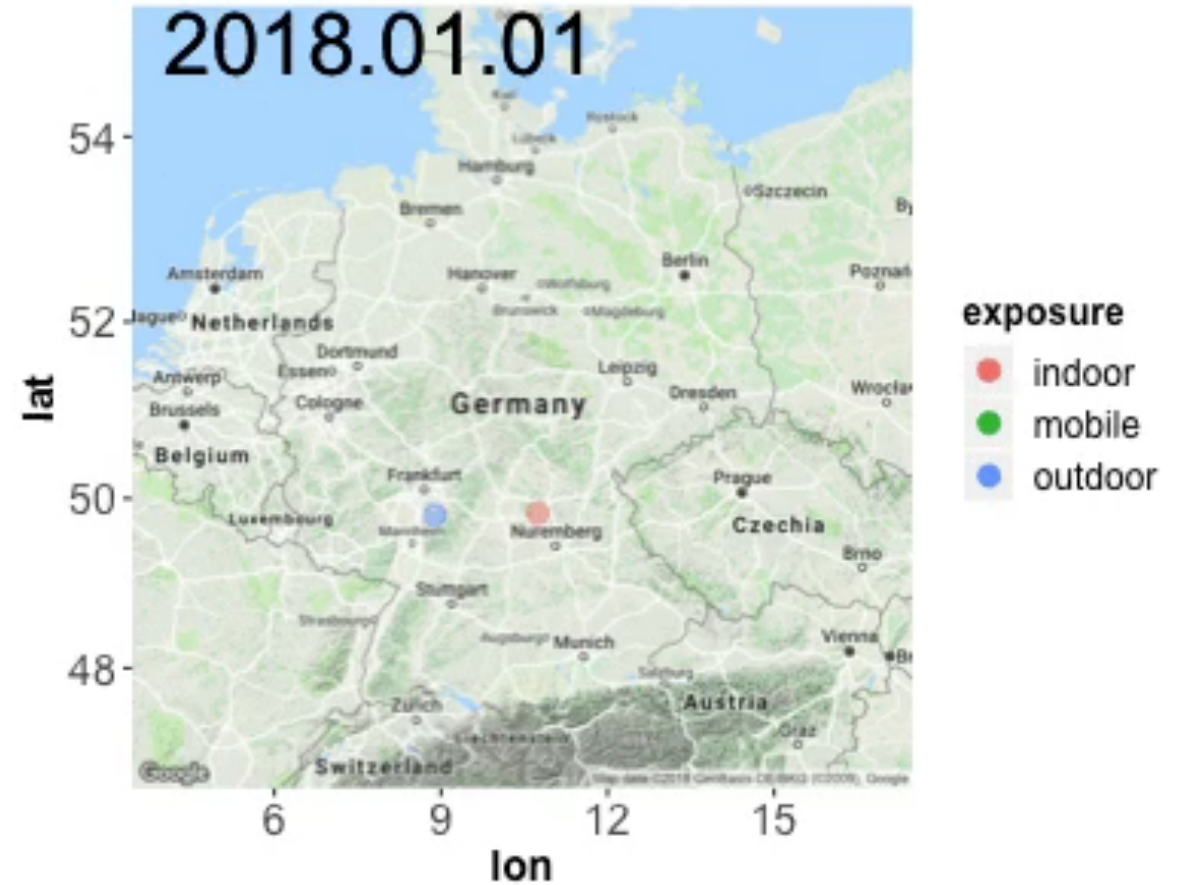
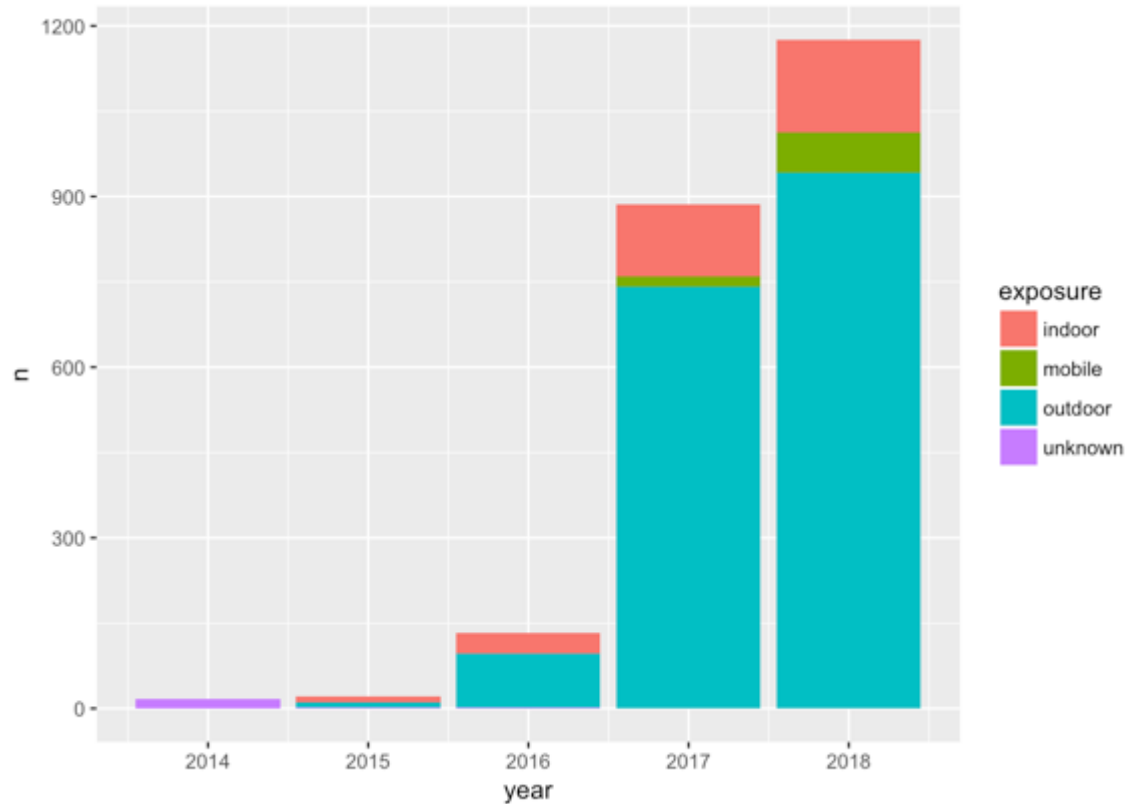
PM2.5

openSenseMap.org

- 2234 registered sensor stations
- 3000 measurements per minute
- REST API
- Frontend for easy registration, downloading and interpolation of the data (and more features)
- Device independent (open)
- acts in the field of „extreme Citizen Science“ (Haklay, 2013)



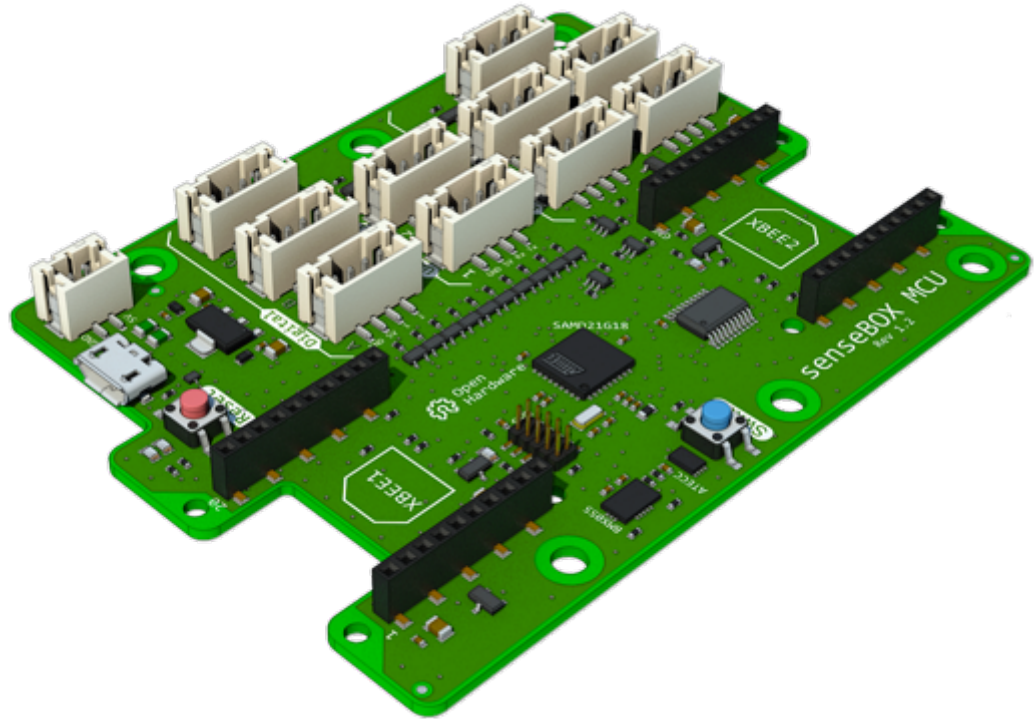
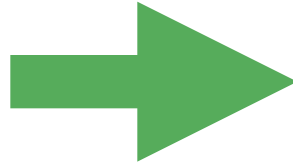
openSenseMap – 2018 Statistics



New senseBox Version! (Released 04/2018)

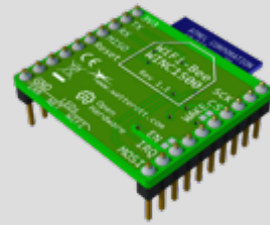
New Microcontroller

- More flash, faster cpu,
- Two XBEE Slots
- Two Hardware Serial Ports
- Crypto chip
- LiPo Connector
- Programming without Software Installation
- Build-in BMX055 (Absolute Orientation Sensor)

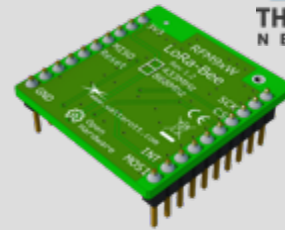




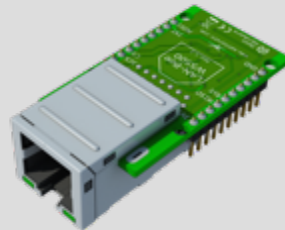
senseBox Microcontroller



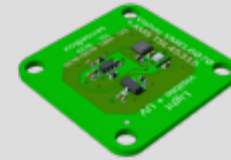
WiFi



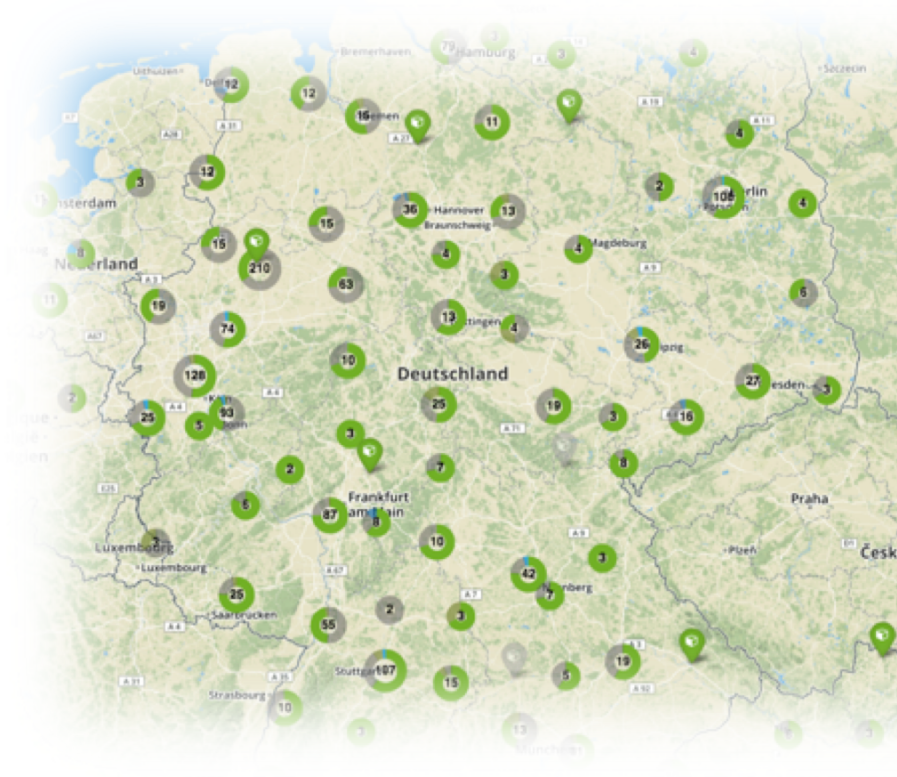
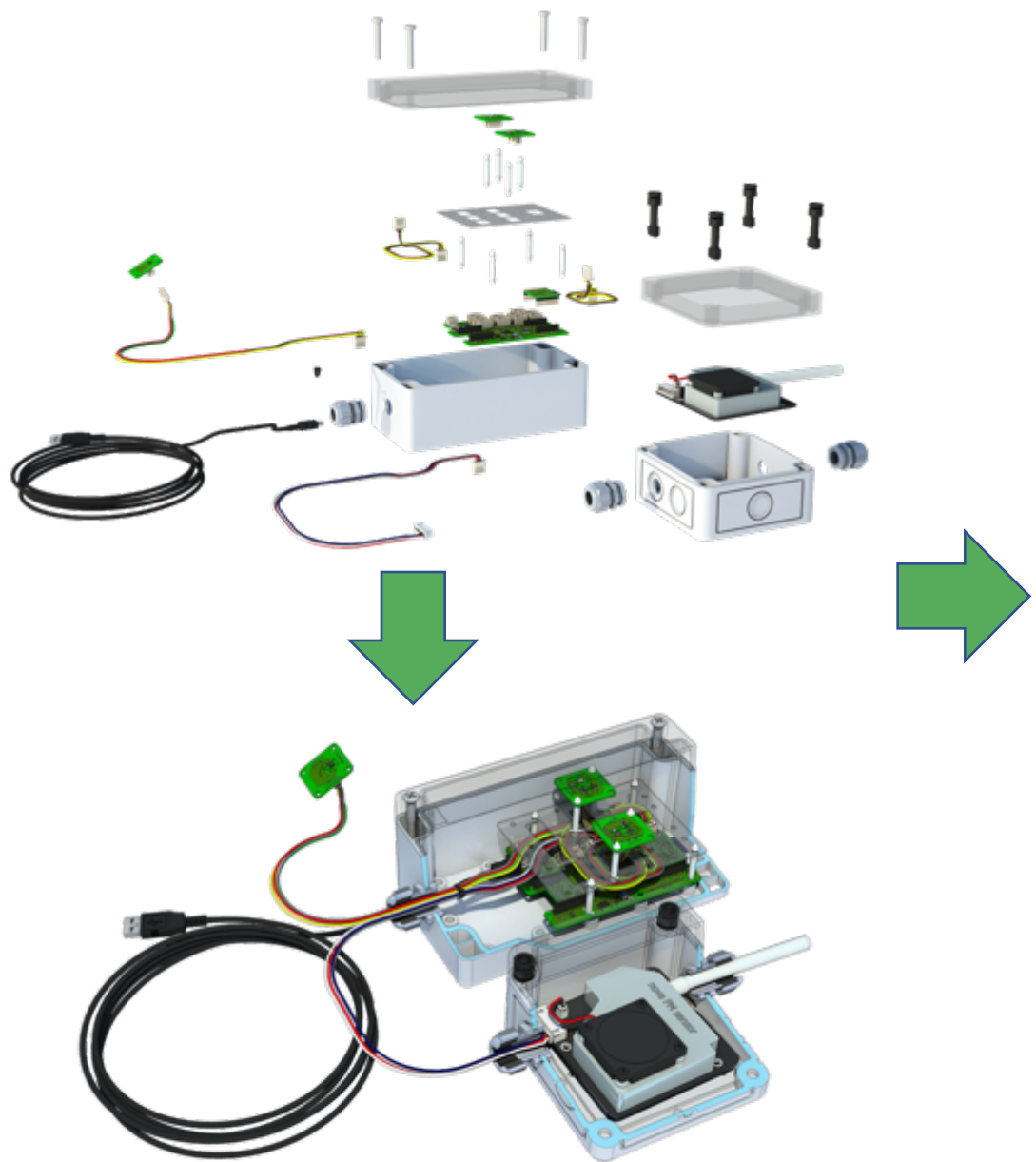
LoRa



Ethernet



Air-, Light- & Weather-Sensors



Stationen

Actual: Lissert, 10.10.2019

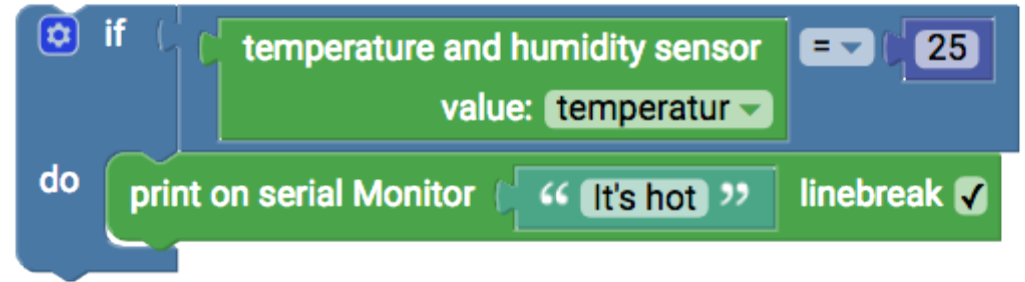
Hier stehen weitere Informationen zu dieser sensorBox, der Besitzer dieser Station hat jedoch nichts hinterlegt.

☀ UV-Intensität	0 $\mu\text{W}/\text{cm}^2$	vor 9 Minuten
☀ Beleuchtungsstärke	4 lx	vor 9 Minuten
🌀 Luftdruck	1015.03 hPa	vor 9 Minuten
💧 rel. Luftfeuchte	64.89 %	vor 9 Minuten
🌡 Temperatur	21.92 °C	vor 9 Minuten
📶 Wifi-Stärke	-60 dBm	vor 9 Minuten
☁ PM10	5 $\mu\text{g}/\text{m}^3$	vor 8 Minuten
☁ PM2.5	3 $\mu\text{g}/\text{m}^3$	vor 8 Minuten

New Features!

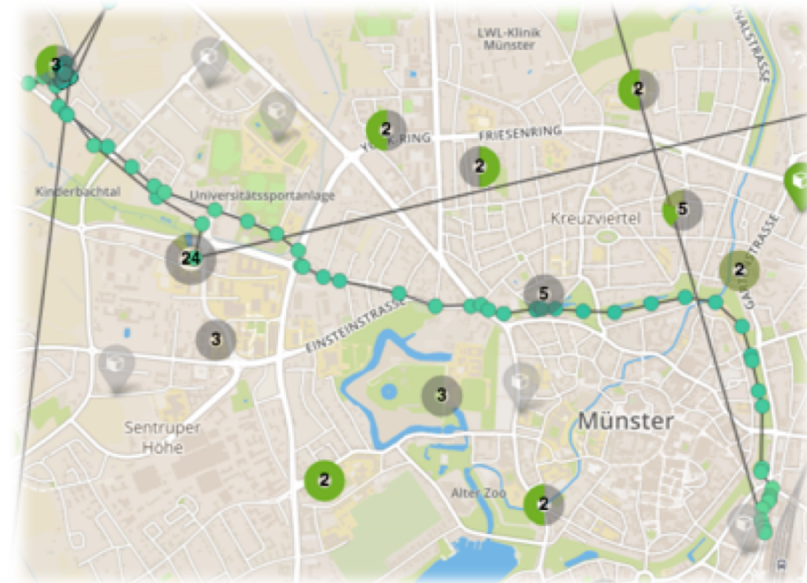
Blockly for senseBox:

- Visual programming interface
- Works online without any software installation
- Build and programm (mobile) sensor device in under 30 minutes

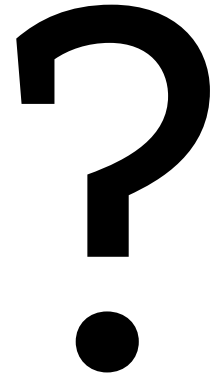


Mobile senseBoxes

- Implementation of a GPS Module
- Live connection (via LoRa or Wifi Hotspot) to the openSenseMap



"Create an Open-Source Sensor Data Platform and provide simple Hardware Solutions for the Users"



Method

2030 registered senseBoxes

Cleaning invalid email-adresses

1349 users in total recieved the online survey (286 responses):

Open Questions - Closed Questions - Likert-Scales

openSenseMap

The openSenseMap has reached the one billionth measurements in the last weeks and over 2000 sensor stations transmitting measurements to the platform now. We want to use this as an opportunity to conduct a user behavior survey. As the openSenseMap is open to different hardware setups and open for all kind of users we want to get some information from you to make it even better for your purpose.

The results will be evaluated in the context of a master thesis and you will find the results under senseBox.de.

The complete survey will take around 10 minutes and I would like to thank you in advance.

7. Please list your reasons for volunteering with this programme? Can you please rank these reasons?

☐ I don't want to share any information

ation

without

is.

Next

10. How much do the following statements apply?

I like learning new things and learning about unknown topics

I'm looking forward to learning more about the scientific work process

The DIY(Do-it-yourself) aspect was for me an important point to participate in the project

If there would be a finished product without own assembling and after the black-box principle I would nevertheless participate in the project

During the project I learned a lot about electronics

Even after setting up the measuring station, I continued to deal with hardware

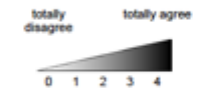
During the construction I had problems that I could solve myself

I would like more information about scientific backgrounds on the website

I like learning from others with more experience than me

I like sharing my experience, knowledge, or expertise with other volunteers

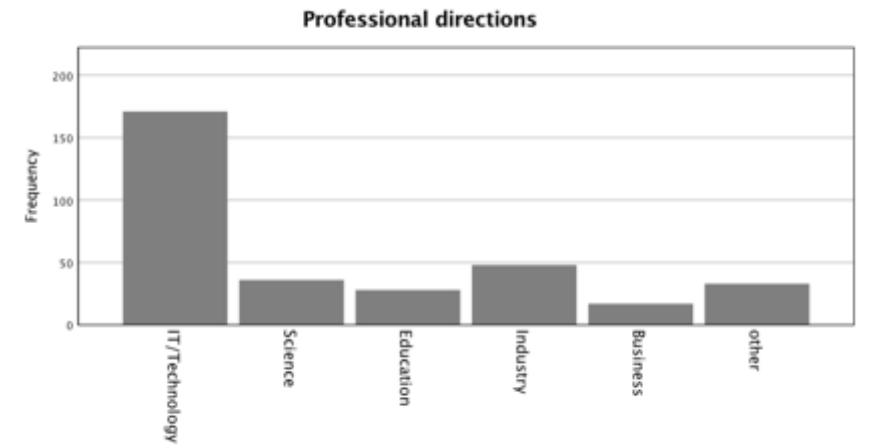
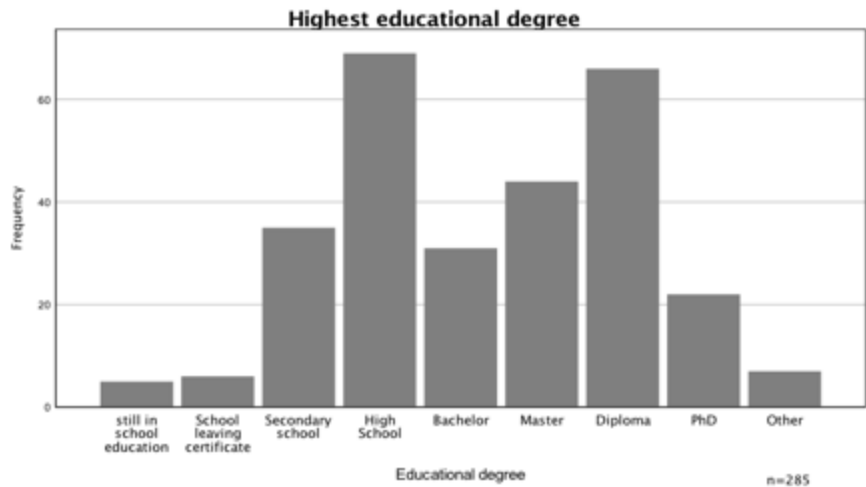
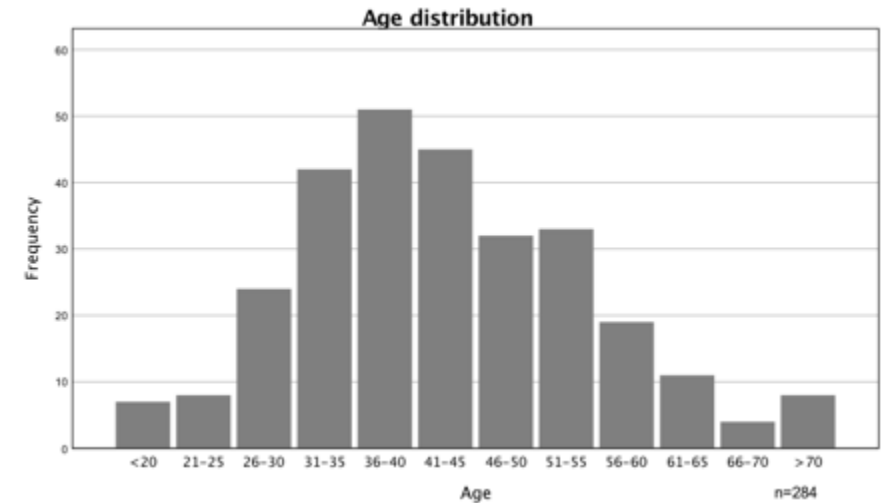
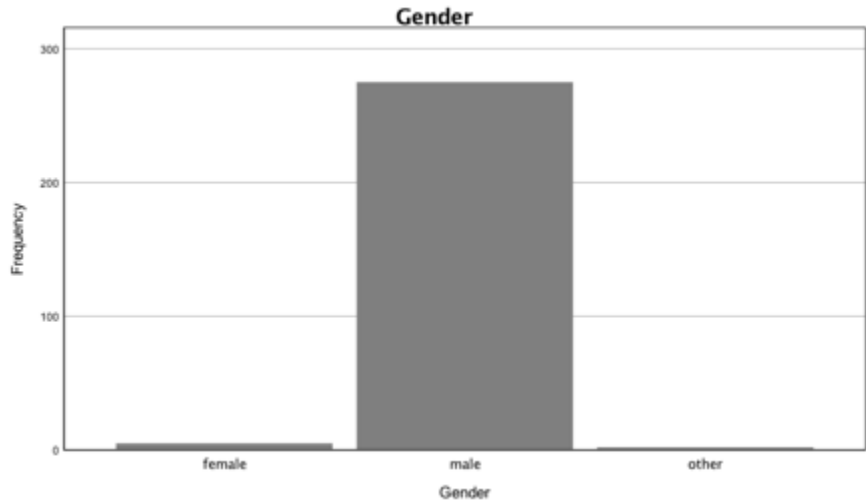
I want to interact with like-minded people

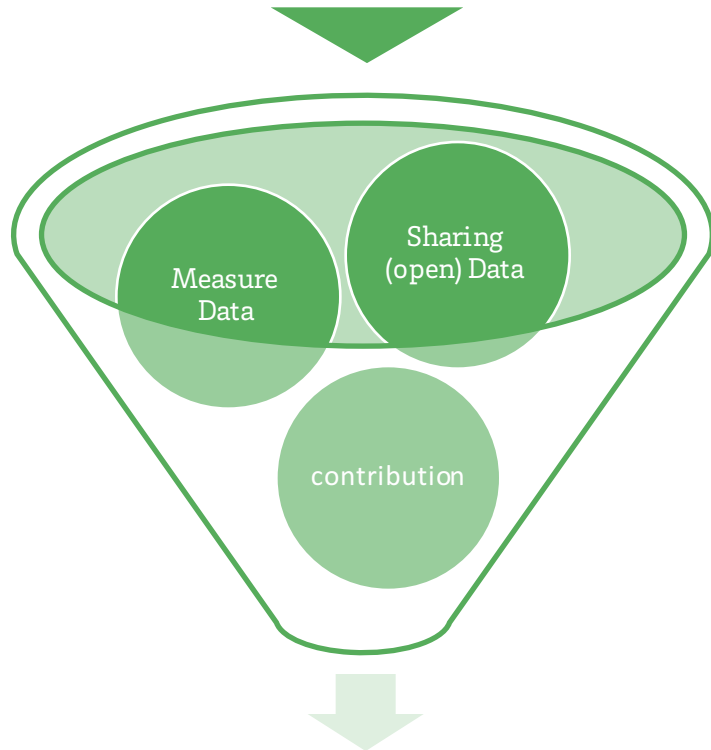
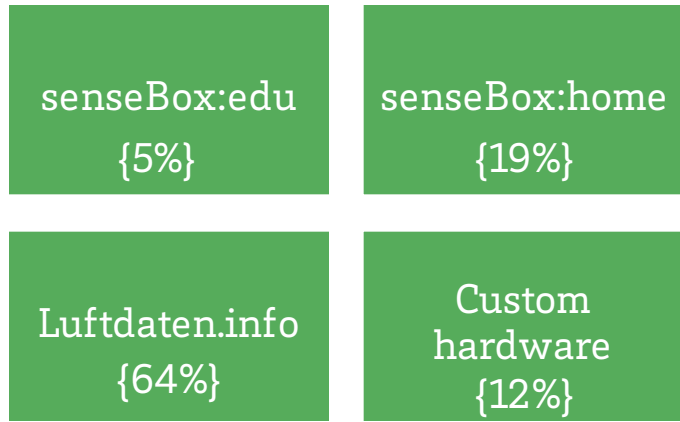


I can not judge

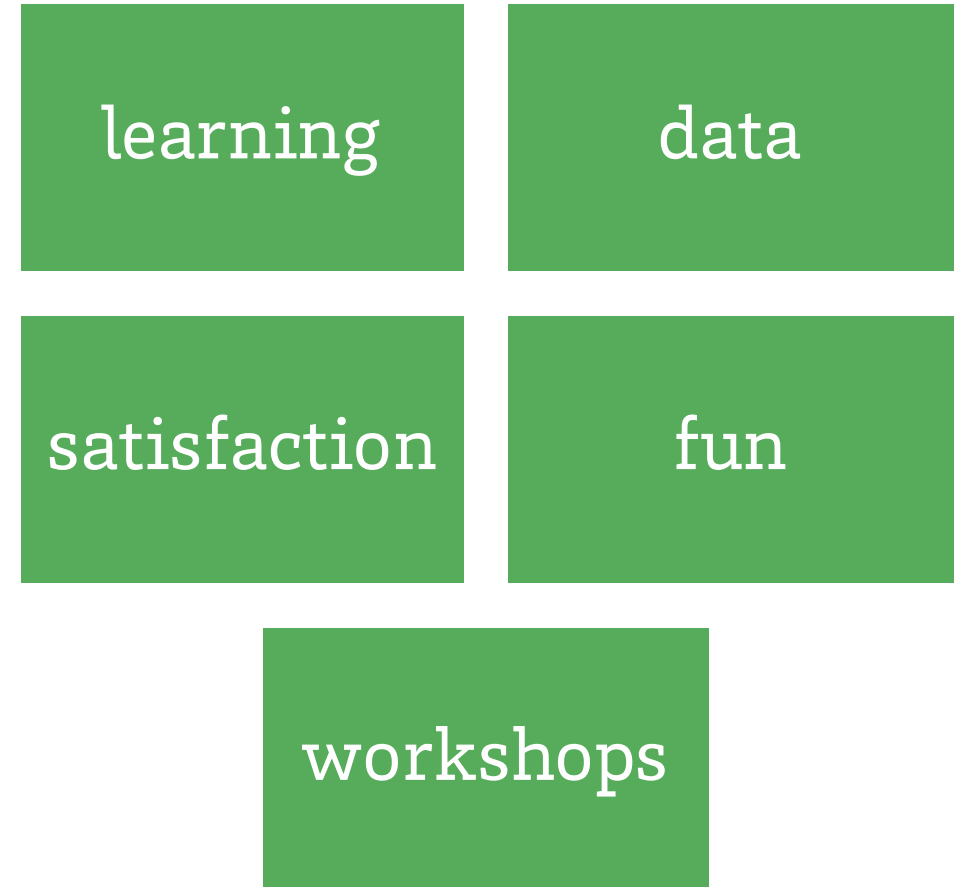
Next

Demographics



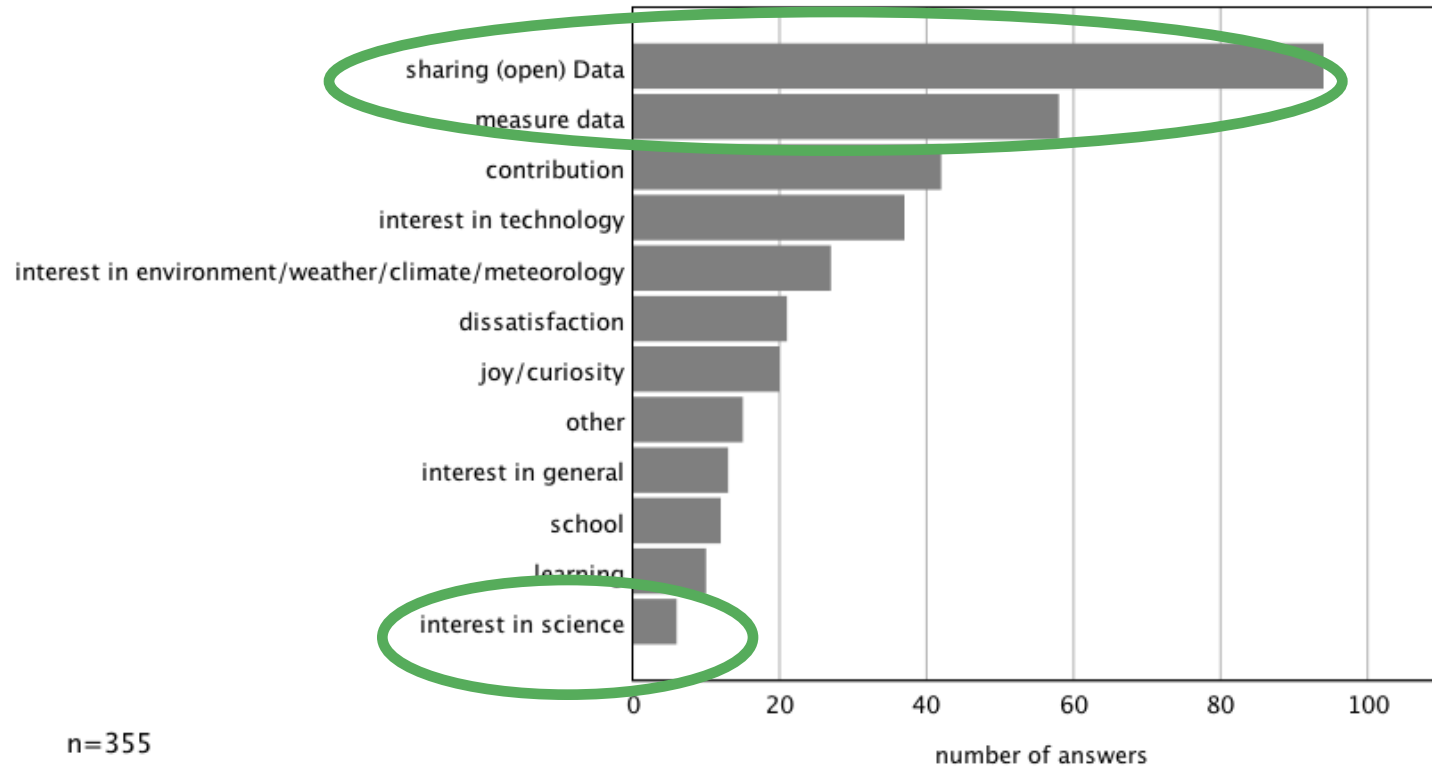


Motivations



Benefits

Motivations for taking part in the openSenseMap-project



12 motivations
in total!

A multi-spatial dashboard related to senseBox data

- senseBox data corresponding to its spatial affiliation
- visualizing graphics on interactive dashboard app
- Using R for programming & shiny as framework

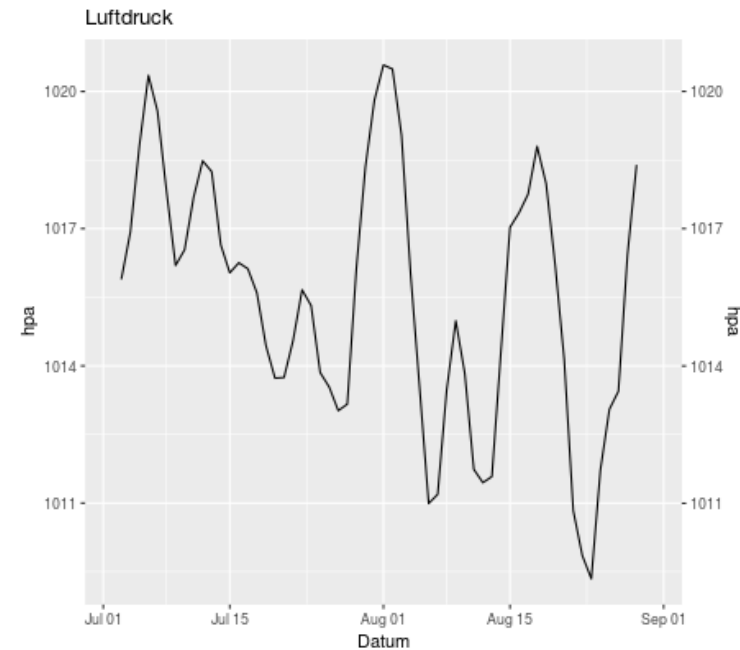


Processing data

- openSenseMap API query
- Turning it into structured format
- aggregating data

Plotting data

- plotting data with `ggplot()`
- plotted time series with moving average applied



DIE ERSTE SENSEBOX WURDE
2014-05-28 15:36:14 registriert

NEUESTE
2018-09-02 19:26:46

DIE AM LÄNGSTEN AKTIVE BOX LÄUFT SEIT
859 Tagen

Hilfe

Wähle eine Stadt

Münster



Wähle einen Zeitraum

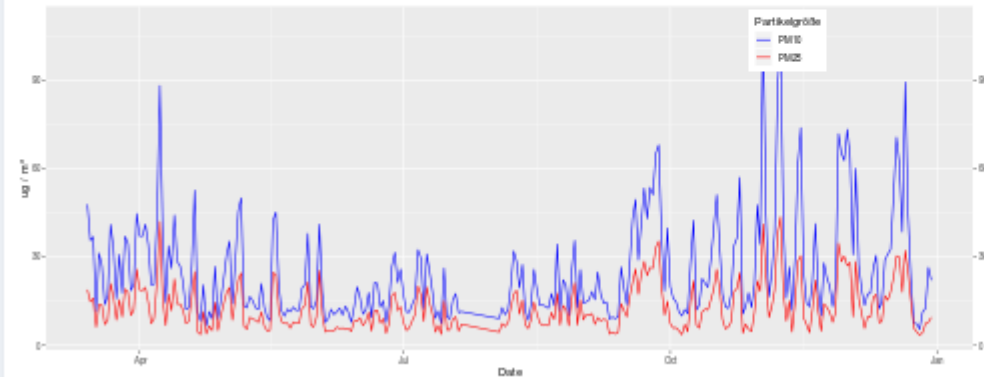
Letztes Jahr

AKTUELLE RELATIVE LUFTFEUCHTE
60.50 %

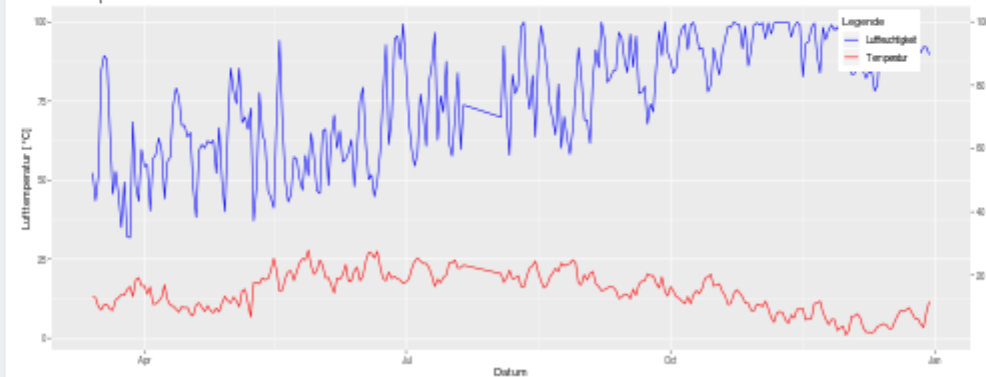
AKTUELLE TEMPERATUR
25.00 °C

AKTUELLE FEINSTAUBWERTE
PM10: 18.60 ug/m³ PM2.5: 14.07 ug/m³

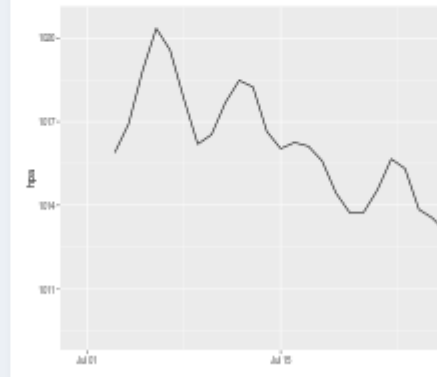
Feinstaub Konzentration



Lufttemperatur und Luftfeuchte



Luftdruck



Discussion & Outlook

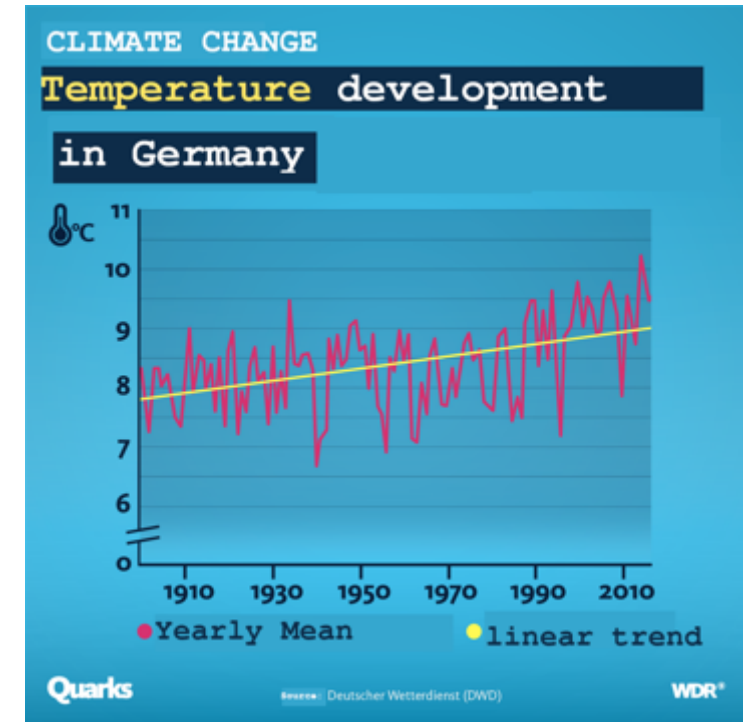
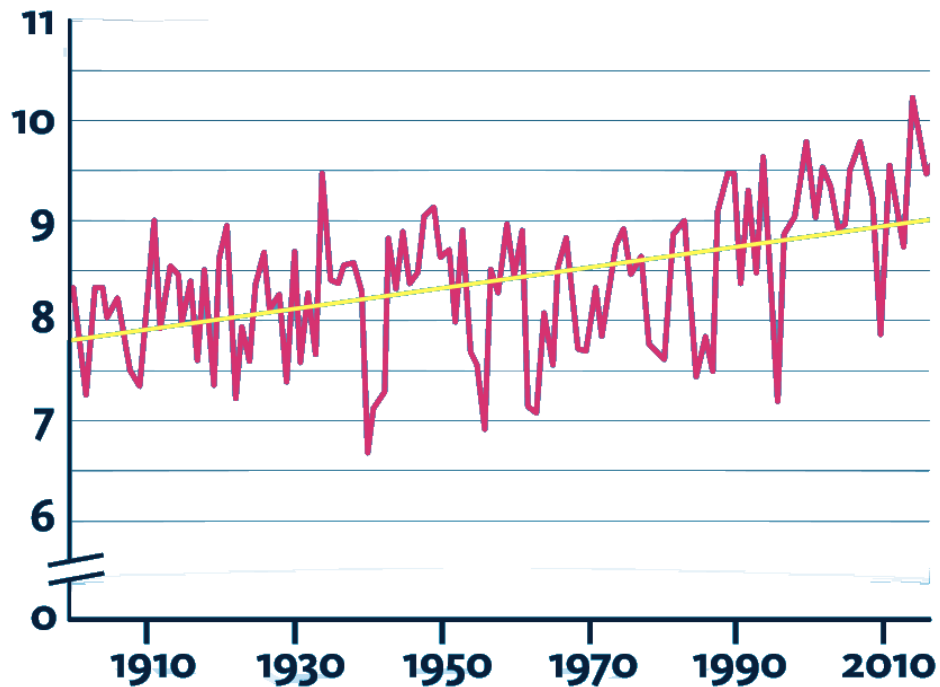
- R functioned as a powerful tool
- Packages facilitating work
- User can focus on functionality
- latencies due to huge amounts of data
- improving performance
- App generates intuitive use
- Dashboard good way to communicate information and science

Story-Dashboard

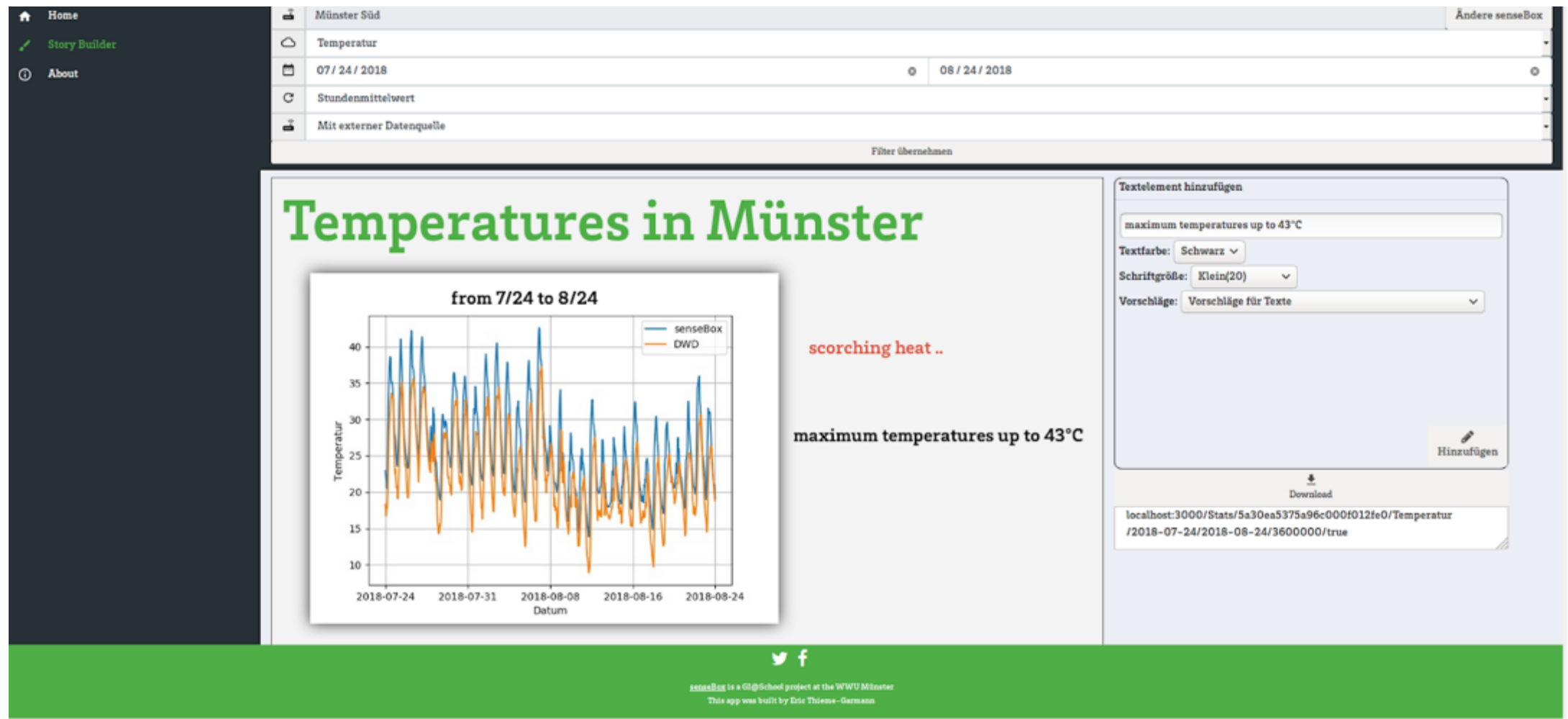
- Providing a tool for citizen scientists to interact with and explore senseBox data
- Additional data sources to compare the data with (e.g. DWD or Umweltbundesamt)

Story-Dashboard

Goal: Transforming data to wisdom by telling stories.



Source: 'Quarks und Co.' WDR 2018



- Application for senseBox users was developed
- Story can be downloaded and shared

Thank you for your attention

www.sensebox.de

www.opensensemap.org

@sensebox_de

FB/sensebox.de

github.com/sensebox

Mario Pesch

mario.pesch@uni-muenster.de

@mario_pesch

Jasper Buß

j_buss16@uni-muenster.de



ifgi

Institute for Geoinformatics
University of Münster

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