hackAIR

COLLECTIVE AWARENESS
FOR AIR QUALITY

D7.5: Pilot implementation report

WP7 – Pilot operation and evaluation

Document Information

Grant Agreement Number	688363	Acronym	hackAIR	
Full Title	Collective awareness platform for outdoor air pollution			
Start Date	1st January 2016	Duration	36 months	
Project URL	www.hackAIR.eu			
Deliverable	D 7.5 – Pilot implementation report			
Work Package	WP 7 – Pilot operation and evaluation			
Date of Delivery	Contractual	31 December 2018	Actual	27 December 2018
Nature	Report	Dissemination Level	Public	
Lead Beneficiary	NILU			
Responsible Author	Hai-Ying Liu & Sonja Grossberndt			
Contributions from	BUND, VUB, DRAXIS, CREVIS , Umbrellium Ltd			

Document History

Version	Issue Date	Stage	Description	Contributor
1.0	12.11.2018	Draft	First version, structure	NILU, BUND
2.0	26.11.2018	Draft	Second version, input for the pilot implementation in Norway	NILU
3.0	30.11.2018	Draft	Input for the Brussels pilot	CREVIS, VUB
4.0	07.12.2018	Draft	Input from the German pilot	BUND
5.0	13.12.2018	Draft	Input and comments from internal review	DRAXIS
6.0	21.12.2018	Draft	Input and comments from VUB, Umbrellium Ltd (Vertigo residency)	VUB, Umbrellium Ltd

Disclaimer

Copyright message

Table of Contents

1 Executive summary

This deliverable reports the hackAIR pilot implementation activities in Norway, Germany, Greece, Belgium, and England. It is a continuation of D7.4 – Intermediate pilot implementation and evaluation report (Liu et al., 2018) regarding the pilot activities.

As in D7.4, the first part provides a short summary of the pilot activities in the different countries. D7.4 describes the results of evaluating Key Performance Indicators (KPIs), the performance of SDS011 sensors under real-world conditions and participation and privacy aspects of the platform. The deliverable in hand is much shorter, focusing only on the actual pilot activities, concluding with a short list of "Lessons learned". Evaluation aspects are being dealt with in a separate deliverable (D7.7 – Pilot implementation and final evaluation report: pilot performance and impact of hackAIR (Veeckman et al., 2018)), due to their complex nature.

The targeted numbers for advanced users of hackAIR sensors in both Norway and Germany have been reached during phase IV, as well as the number of usable sky pictures provided by the users. However, it has been quite challenging to reach the target number for simple users in both countries. Thus, the consortium agreed at the final consortium meeting on a number of activities that should help to increase the number for simple users, including:

- The creation of a video in Norwegian to promote the public perception functionality of the hackAIR mobile app through social media;
- Asking NAAF (Norwegian Asthma and Allergy Association) for help to reach out to their members promoting hackAIR;
- A photo contest promoted by BUND.

Even though the target numbers for simple users could not be reached, the pilots have been very successful in terms of citizen engagement (i.e., workshops and events) and awareness raising as described at the end of this document.

2 Introduction

The implementation of the hackAIR activities took place in five phases (Liu et al., 2017):

Phase I – Pre-test (Nov 2016 – Aug 2017)
Phase II – Platform launch and test (Sep – Oct 2017)
Phase III – Full pilot (Nov 2017 – Mar 2018)
Phase IV – Full pilot expansion (Apr – Oct 2018)
Phase V – Evaluation and integration (Nov – Dec 2018)

This deliverable looks back on the **pilot activities implemented in phase IV starting in June 2018**. For the activities implemented in Phase I-IV May 2018, please see D7.4 – Intermediate pilot implementation and evaluation report (Liu et al., 2018). Although D7.4 included also a section on evaluation, this deliverable will only focus on the pilot activities in Norway, Germany, Belgium, Greece and England. The evaluation report that covers the full pilot implementation can be found in D7.7 – Pilot implementation and final evaluation report: pilot performance and impact of hackAIR (Veeckman et al., 2018).

3 Pilot implementation

3.1 Pilot implementation in Norway

From 1 June 2018, NILU held four hackAIR workshops in Bergen, Stavanger, Oslo and one at a local high school. Main aim of the workshops was a short introduction into AQ, the hackAIR project and as a practical part, the compilation of a hackAIR home V2 sensor.

All participants had to sign a consent form to join the workshop (in case of high schools, the parents had to sign this form) and completed an evaluation form after the workshop (see D7.7 (Veeckman et al., 2018)). They also had to sign a form where they confirmed that they borrowed the hackAIR sensor and agreed to return the sensors to NILU at the end of 2018.

3.1.1 Workshop in Bergen

NILU and Friskby Bergen held a hackAIR workshop at Marineholmen Makerspace on 14.06.2018 (Fig. 1). 20 people registered to attend the workshop, of whom 15 showed up including 2 school teachers who brought 12 junior high school students (12-13 years old) in addition. The participants had a very diverse background, such as medium school students and teachers, interested scientists and individuals, NGOs, people from the Bergen Green Party, etc.

The first part of the workshop was used for an introductory presentation about PM, PM measurements and hackAIR platform and tools. The remaining time was used to guide participants to flash the software on the sensor. During the workshop, two participants managed to connect the sensor to the WIFI-network and visualized their sensors on the hackAIR platform. They were very satisfied with the hackAIR platform. The students and teachers were not prepared to the programming, a bit confused and they would like to mechanically building the sensors, and expressed their interest in testing hackAIR low tech cardboard approach.

Figure 1 - Pictures from the Bergen workshop.

3.1.2 Workshop in Stavanger

NILU has been approached by an interested citizen from Stavanger who was interested in organising a hackAIR workshop there. This workshop has been carried out on 28.06.2018 (Fig. 2). Seven interested citizens attended the workshop, including two participants from the Bergen municipality. Two of the participants had already assembled a hackAIR sensor at home, but wanted to attend nevertheless. After an introductory presentation about AQ, AQ monitoring, results from the hackAIR sensor testing and information about the project, the participants had to flash the software on their sensors, which were already pre-assembled by NILU. Despite for the low participant number, it was a successful workshop and the participants were satisfied (see D7.7 (Veeckman et al., 2018)).

Figure 2 - Pictures from the Stavanger workshop.

3.1.3 Workshop in Oslo

The last sensor workshop in Oslo was held on 27.09.2018 (Fig. 3). Even though 15 people registered to attend, 19 people showed up. This was on the one hand a positive experience, as it showed interest in the topic in the population. However, even though we did not have enough sensors and food for all, it was a successful workshop. The first part consisted of an introductory presentation about AQ, AQ monitoring, micro sensors and the hackAIR project. In the remaining time, the participants had to flash the software on the pre-assembled sensors. It was an interested group, mostly with IT background, teachers (one of them from Trondheim – he managed to set up the sensor there and was very interested in letting his pupils build similar sensors at school), 2 engineers and several students, of whom one had already assembled a different PM micro sensor. In general, most people were satisfied with the workshop (see D7.7 (Veeckman et al., 2018)).

Figure 3 - Pictures from workshop III in Oslo.

3.1.4 High school workshop in Lillestrøm

NILU was invited by a high school teacher to hold a workshop at Skedsmo high school on air quality and its measurement technologies on 19.11.2018. 15 pupils and their teacher attended (Fig. 4). As required by the teacher, NILU gave first a 40 minutes presentation about AQ, exposure to PM and its health impacts, the hackAIR project, its tools, and the low cost PM sensors' performance assessment in Oslo. Then, together with the hackAIR home V2 sensor set-up manual and the help of the attending NILU staff, the pupils started to flash the software on the pre-assembled sensors. Due to the time limitation and the fact that the pupils did not manage to carry out all the steps to flash the sensors, a follow-up workshop will be held on 03.12.2018.

Figure 4 - Picture from workshop at Skedsmo high school.

3.1.5 Sensors distribution and deployment in Norway

Until now, NILU has distributed 115 hackAIR home V2 sensors to volunteers in Norway in total (Fig. 5-8), including workshop participants (69), employees from the Agency for Urban Environment of the Municipality of Oslo (20), junior high school pupils and their teacher (20), colleagues and family members (6). Currently, 29 sensors have been set up and are working and can be found on the hackAIR map (https://platform.hackair.eu). The sensor measurement results from these advanced users are being used for generating a real time air quality map in Oslo.

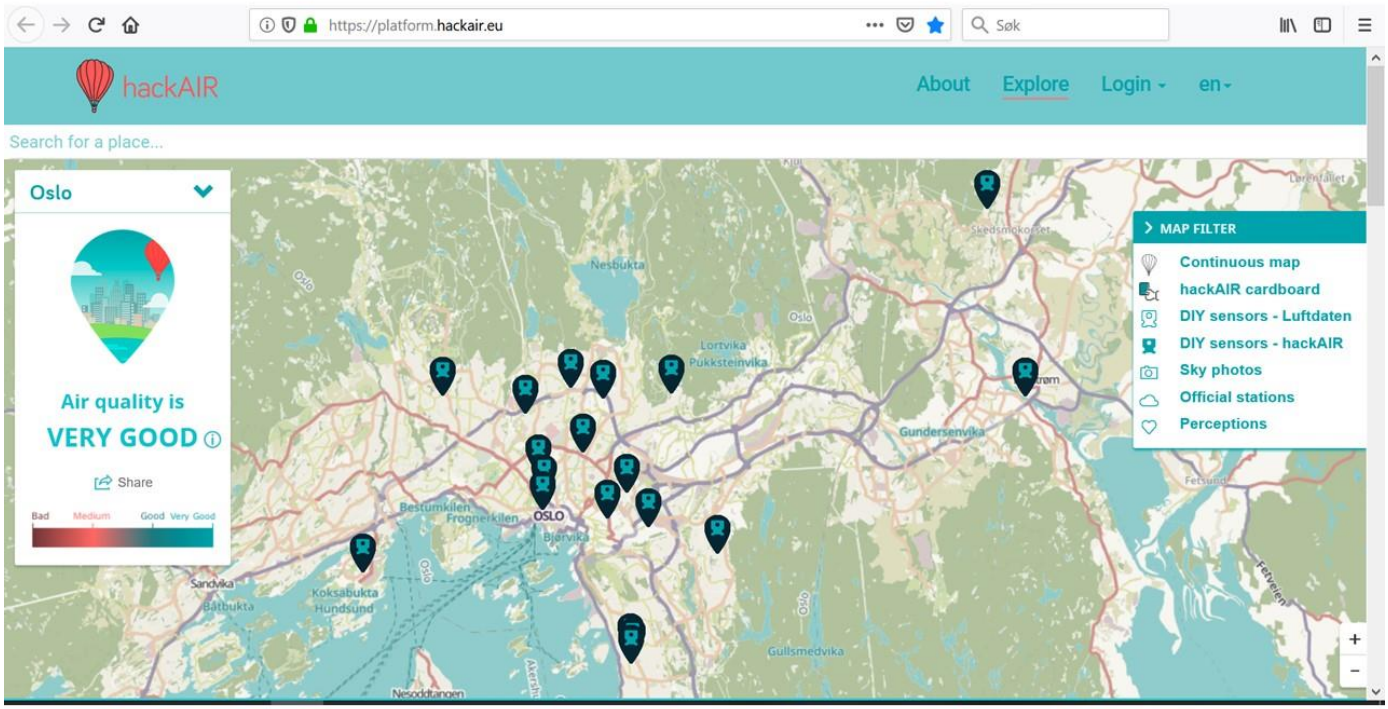

Figure 5 - Screenshot of up-and-running hackAIR sensors in Oslo – 22.11.2018.

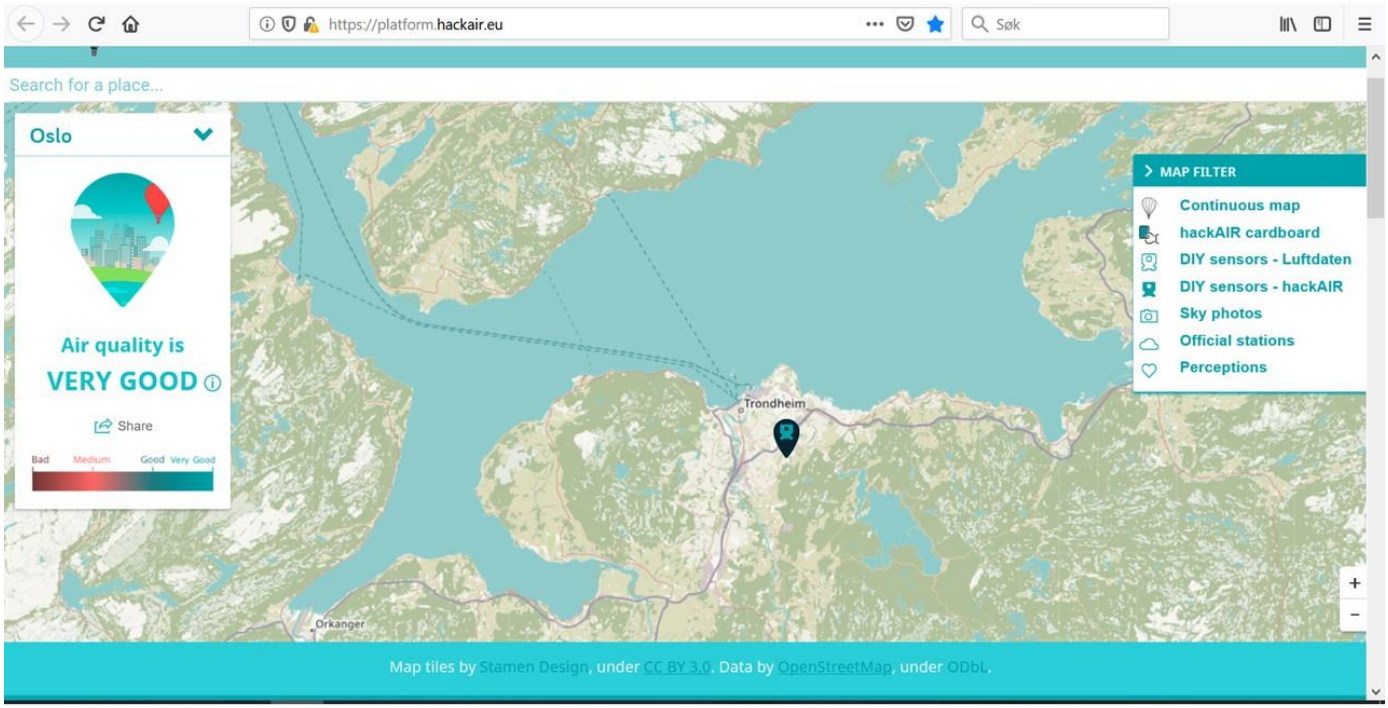

Figure 6 - Screenshot of up-and-running hackAIR sensors in Trondheim – 22.11.2018.

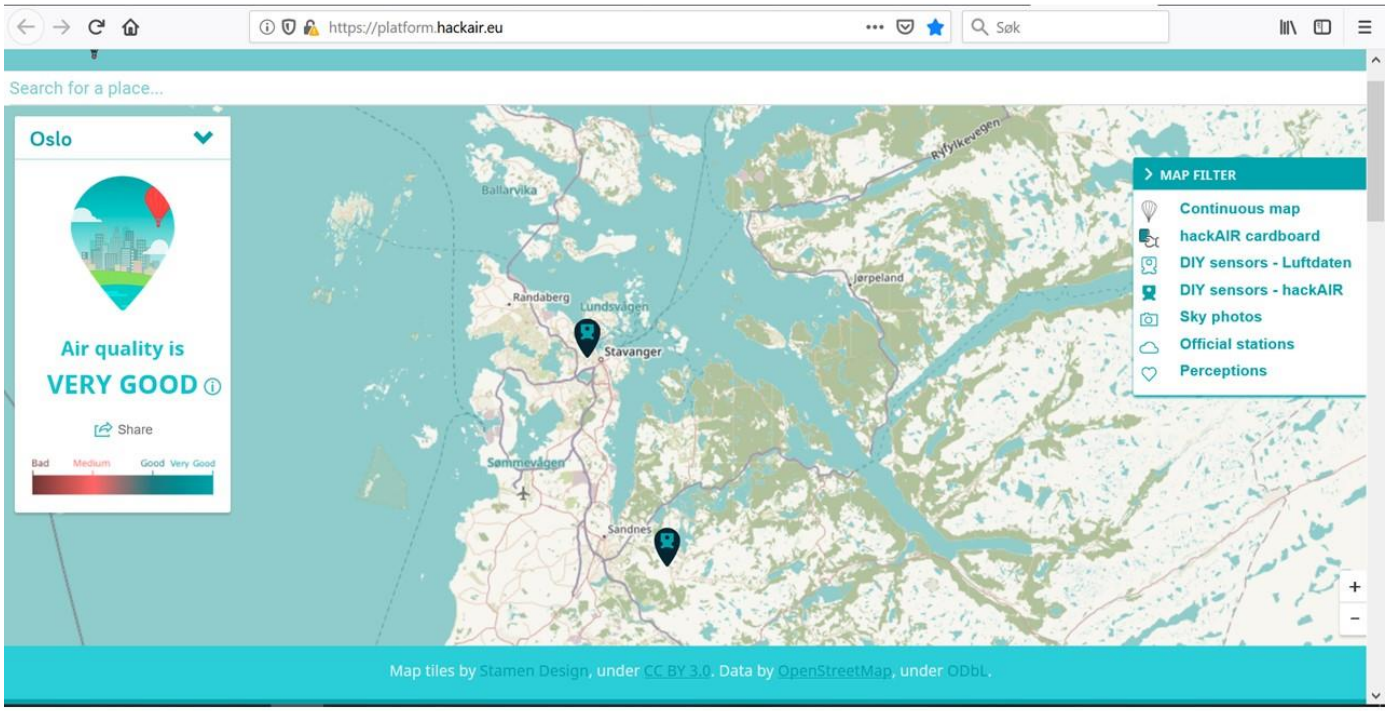

Figure 7 - Screenshot of up-and-running hackAIR sensors in Stavanger – 22.11.2018.

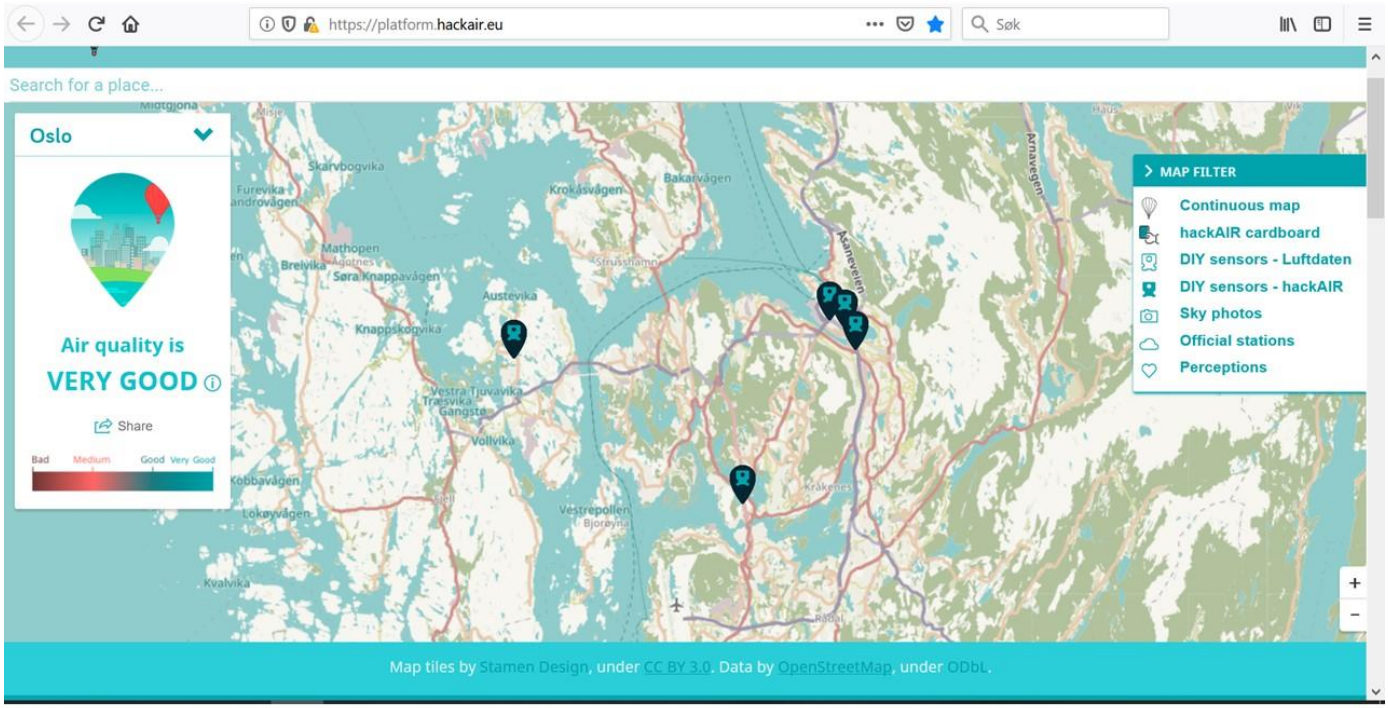

Figure 8 - Screenshot of up-and-running hackAIR sensors in Bergen – 22.11.2018.

3.1.6 Recruitment activities

In the middle of phase IV we realized that the number of simple hackAIR users both in Norway and Germany were quite low, putting the goal of reaching the target numbers described in the DoA in danger (i.e., 3.000 for Norway and 5.000 for Germany). Thus, NILU planned different activities to engage people to download the hackAIR app and contribute with pictures of the sky or own perception of air quality.

3.1.6.1 "Iskrem og boller" at NILU

On 19.06.2018, we bought some ice cream and buns ("boller") to engage colleagues at NILU (Fig. 9). Everyone who downloaded the app and contributed with a measurement (picture of the sky or perception) got either a bun or an ice cream cone for free. With this event, we could recruit 20 new users.

Figure 9 - Pictures from the "Iskrem og boller" event at NILU.

3.1.6.2 Facebook event "Vis luftkvaliteten der du er – Show the air quality right where you are"

We created an event on Facebook (Fig. 10) to recruit volunteers to download the hackAIR app and take pictures of the sky. The event lasted from 14-24.06.2018. We aimed at Norwegian speaking people that follow the hackAIR pages and made use of the Facebook ad-functionality, focusing on special target groups in Norway. We reached about 1.200 people with this ad, but the number of simple users in Norway increased only from 90 (20.05.2018) to 121 (21.06.2018).

Figure 10 – Facebook event "Vis luftkvaliteten der du er".

3.1.6.3 Facebook video "Hvordan er lufta der du er nå? – How is the air where you are now?"

NILU created also a video to recruit citizens to download the hackAIR app (Fig. 11). It was published 08.11.2018 on both hackAIR, NILU and the Norwegian Asthma and Allergy Association's Facebook pages. The video is also available on YouTube (https://www.youtube.com/watch?v=YEtXaL_OrJs&feature=youtu.be&fbclid=IwAR37pPmZ24KmX1-XuIlU_iXPXK7vcjAWAOa9-Cy-hDlqAcR6WqzCJtU_tLU). The video is in Norwegian and invites people to download the app and contribute with own perception of air quality right where people are. The Facebook video has been seen by almost 1.000 people.

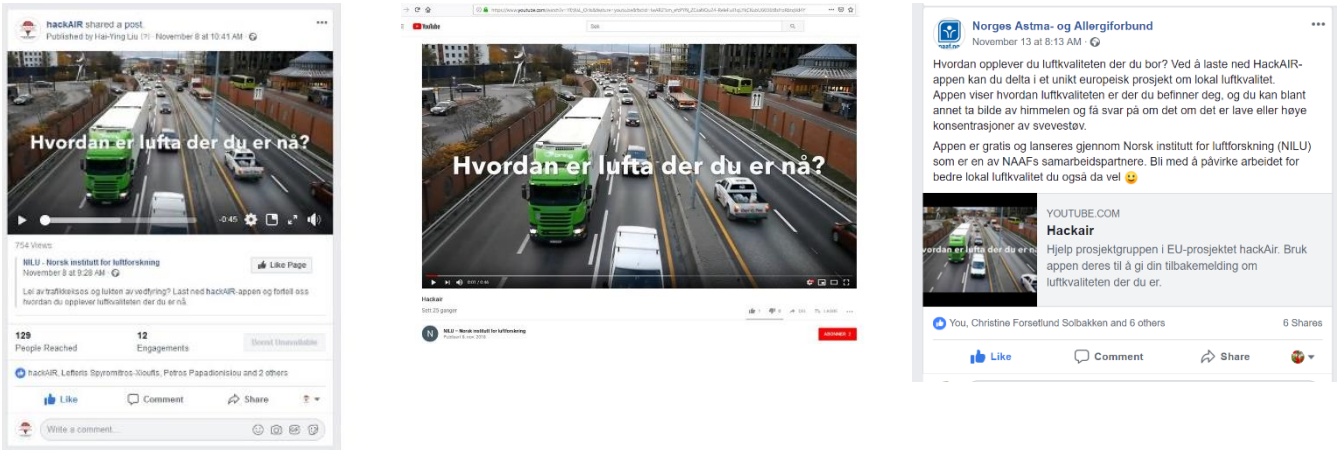

Figure 11 - Facebook and youtube video «Hvordan er luften der du er nå?».

3.1.7 Other pilot related activities

In September 2018, NILU has been contacted by a local politician from the municipality of Skedsmo (the municipality where NILU's main office is situated). He was asking NILU if they could suggest initiatives like hackAIR that could involve citizens into air quality monitoring in their local environments. This has also been approved by the municipality. Further meetings between NILU and the municipality are planned in December 2018.

Three pupils from a local high school had attended one of the hackAIR workshops in Oslo. They took measurements with the sensors they built and this has been part of their exam. Their teacher contacted NILU afterwards, asking for further cooperation and guidance from NILU in future micro sensor projects in their school. The first class has already

been assembling sensors that are similar to the ones from the hackAIR project. The pupils visited NILU and received a "mission" from NILU scientists about taking measurements with the sensors. They will present their results to NILU scientists in the beginning of 2019. Another teacher from a different high school in Oslo has also been in contact with NILU to carry out a similar exercise during a one-week "Science Camp" in December 2018.

The fact that the hackAIR sensors are very well suited for high school pupils with a focus on "Technology and Theory of Research" led to the participation of NILU in the H2020 ACTION project (PArticipatory sCience ToolkIt against pOllutioN). There, NILU will carry out a case study in high schools, where pupils will build a hackAIR-like sensor, code it and take measurements. So far, seven schools are participating. The results will be presented at a common conference where all participating pupils will present a poster about their research and results.

3.2 Pilot implementation in Germany

BUND carried out its pilot in several phases. Before the launch, BUND had already used its newsletters to spark interest in the new project (Fig. 12). With the official launch of the hackAIR platform in the beginning of February 2018 in Norway and Germany, BUND then started its distribution of the first batch of sensors to interested citizens. BUND initially sent out around 150 sensors in February and March and was 'sold out' within ~10 days. Consequently BUND ordered another set of hardware and followed up with another distribution of sensors in June, this time with ~140 sensors. On top of that BUND distributed sensors to interested participants of the workshops.

BUND chose to put a price on the sensor hardware. The hardware pieces as a set together with elaborate printed tutorials guiding the user to install and use the sensor were advertised for 17,50€ for non-BUND-members and 12,50€ for BUND members. This price was well below the purchase costs and contributed to financing the hardware costs within the project.

Figure 12 - Order-form on internal BUND website (there was a similar option on the official website for non-members).

In August 2018, BUND started to communicate the hackAIR app and to increase the uptake on its sky-picture function. The first months of the pilot were thus devoted mostly to users of hardware sensors and the organisation of workshops. This was partly due to the longer development time for the app, but BUND was also quite astonished by the efforts needed to secure proper support to those users of hardware sensors that had difficulties with their sensors. The most difficult barriers for users of sensors turned out to be the installation of the sensors software.

3.2.1 Workshops

From June 2018 until the end of year, BUND organised four workshops in Munich, Dresden and Leipzig. These workshops included theoretical background on air quality, project presentation, an assembly session for the individual sensors and a group discussion on the importance of sensor maintenance and data quality. All participants had to sign a consent form to join the workshop and completed an evaluation form after the workshop (see D7.7 (Veeckman et al., 2018)).

3.2.1.1 Workshop in Munich

On 14.06.2018, BUND organised a workshop in Munich, which was visited by 10 participants (Fig. 13). All participants reported that they were generally concerned about air quality and wanted to learn more about how to act on it and were interested to measure.

Figure 13 - Pictures from the workshop in Munich.

3.2.1.2 Workshop in Dresden

The workshop in Dresden took place on 20.06.2018 and 10 citizens participated (Fig. 14). Remarkable was the young and heterogeneous demographics of the workshop with a portion of the room filled with young tech savvy men, but also young mothers and interested teenagers. Most of the participants also deliberately came to secure themselves one of the hackAIR sensors.

Figure 14 - Pictures from the workshop in Dresden.

3.2.1.3 Workshop in Leipzig

Just before the summer break would make activities with citizens a bit harder, BUND visited Leipzig on 26.06.2018 to organise a workshop together with the local working group on climate and energy. They invited their local network and BUND had an interesting conversation about air quality and hackAIR with 12 participants.

3.2.1.4 Workshop II in Leipzig

The regional working group for climate and energy in Leipzig was so enthusiastic about citizen science measurements in air quality that they organised another hackAIR workshop on 23.10.2018. With this follow-up workshop they further supported their local activities around hackAIR.

3.2.2 Online Campaigning

Additionally to its sensor distribution and the local workshops, a big part of BUND activities used its social media outreach and its two newsletters, the activist newsletter with >4,800 addresses and its large newsletter with >180,000 addresses in order to promote hackAIR.

This was especially vital in our summer campaign since August that promoted the use of the hackAIR app. After the finalization of the app version that included some improvements BUND focused on its promotion. This was highlighted by several posts in the last months of the project (Fig. 15).

Figure 15 - Newsletter August 2018.

hackAIR photo contest

To improve the apps uptake before the winter months, BUND also organised a photo contest to further promote the app. The photo contest started on 31.10.2018 (Fig. 16) and continued for two weeks until the 14th of November. The three winners each received one hackAIR mobile sensor as a price.

Figure 16 - Announcement of hackAIR photo contest in both the BUND October Newsletter and on Facebook.

3.2.3 Other pilot related activities

Besides the sensor distribution, support and the activities to promote hackAIR in the pilot phase, there we also did other activities in the pilot phase. BUND also participated in the monthly pilot calls to follow up the pilot activities.

Furthermore, BUND was active in promoting hackAIR also towards the media, as part of its activities to support the pilot. The biggest outcome within the project was the documentation undertaken by the regional public TV station MDR on 03.08.2018: https://www.mdr.de/wissen/video-218124.html (Fig. 17)

Figure 17 - hackAIR report on German TV (MDR, 03.08.2018).

3.3 Extended activities in Athens

DRAXIS put effort to engage other citizen communities besides the ones in Germany and Norway to pilot test the hackAIR solution and contribute with air quality measurements. From DRAXIS' communication activities, one additional case study resulted in Athens. Specifically, some schools and communities of citizens who are interested in new technologies expressed their interest to be engaged in the hackAIR project and use the platform for their own purposes. In detail:

- The hackAIR consortium is in close collaboration with Kantas School in Athens. Kantas School gave to DRAXIS access to their 2 webcams that are placed in their schoolyard and depict sky, and these webcams were integrated in the hackAIR platform to provide estimations of the local air pollution levels. Furthermore, teachers of the high school built along with the students a Home v1 hackAIR sensor, placed it in the schoolyard and they are constantly checking their readings through the hackAIR platform. The parents of the children and the local community were formally informed about this activity, while the Kantas School with help from DRAXIS will organize an air pollution awareness event within the following year. On top of that, students of the Kantas School applied for funding under a Young Entrepreneurship Contest in Greece with an idea based on the hackAIR platform and its social benefits. Finally, the director of the school is considering to include the assembly of hackAIR sensing devices in their curriculum.
- DRAXIS also presented the hackAIR solution to representatives of the Greek-German school (Ellinogermaniki Agogi) in Athens who consider to include hackAIR activities in their programme. This is still under discussion.
- TEI and DRAXIS are in constant collaboration with the Athens Wireless Metropolitan Network that assembled and installed a hackAIR home v1 sensor in Athens. Their sensor is contributing with data to the hackAIR platform and they examine the possibility to connect other kind of air quality sensors with our system.
- Five hackAIR home v2 sensors were donated from DRAXIS to the LoRAthens community in Athens. The sensors were assembled and installed by volunteers, and they are sending data since February 2018. Volunteers from this community have also connected five additional sensors (three home v2 and two nodeMCU) with the hackAIR system and the current measurements can be reach through the platform.
- DRAXIS and TEI had also a meeting with the Hackerspace Athens community in autumn 2017. They were also interested to connect some already installed air quality sensors with the hackAIR platform but no progress have been performed yet.

Currently, 12 sensors have been installed in the greater Athens area sending data to the hackAIR system.

3.4 Extended activities in Brussels

The extended activities performed in Brussels (Belgium) set up a test case that focused on establishing collaborations with citizens' initiatives for testing the hackAIR platform, raising citizens' awareness on air pollution levels and mapping the local air quality in the city. Within this framework and in continuation with the activities that were already organised (see D7.4 – Intermediate pilot implementation and evaluation report (Liu et al., 2018)), the following activities were performed:

First, several workshops were organised:

- "Build your own air quality sensor": VUB, CREVIS and ON:SUBJECT supported the organisation of the "Build your own air quality sensor" event in Brussels on 13.06.2018. The event was co-organised by Open Knowledge Belgium, Influencair, Sandbox VRT, BRAL, Civic Lab Leuven, Luchtpijp, BeCentral, and hackAIR. 83 citizens participated in the event and built their own sensor expanding the already well-established network of air quality sensors in Brussels. Due to the high demand, additional similar workshops are currently being organised within Brussels but also in other municipalities of the Brussels region. Apart from the opportunity to synergise with other initiatives, raise awareness and disseminate hackAIR to a high number of participants, the event also permitted to reach out to a great number of participants for the behavioural change study performed by VUB. All participants of the workshop were informed about the study and 44 citizens decided to participate in the first phase of the study (more information on the study in D7.7 "Final evaluation report").
- Within the framework of the project "Luchtpijp" (https://www.luchtpijp.be/ - the hackAIR project is mentioned as project partner on their website), hackAIR has established a collaborative partnership with Beweging.net, an overarching network of different organisations in Belgium and the Christelijke Mutualiteit, the catholic medical service. Luchtpijp is an on-going initiative that aims at engaging citizens living in Brussels and its outskirts through various citizen science activities regarding air pollution through a series of workshops. On 13.09.2018 the VUB and CREVIS participated in the launch event "Build your own fine dust sensor" organised by Luchtpijp in Brussels at the AB, presenting the hackAIR project to the participants and supporting them in assembling their sensors (Fig. 19). In total, another 100 citizens attended the workshop. hackAIR also brought the "fun factor" to the workshop by offering participants the possibility to personalise and decorate the case of their sensor. The participants, especially the younger ones, welcomed this possibility. Press was also invited at this event, which led to several news articles with also the mentioning of hackAIR.


Figure 18 - Build your own fine dust sensor – launch event Luchtpijp (AB– September 2018).

- hackAIR also participated in another sensor workshop organised by Luchtpijp "Build your own fine dust sensor in Elsene" on the 29.11.2018 organised in Brussels with 10 citizens present. These small scale workshops rather have the objective to reach out to local members of Beweging.net, and engage a more diverse audience in terms of age and technical experience.
- hackAIR is also a partner in the growfunding campaign of Beweging.net: https://www.growfunding.be/en/bxl/luchtpijp - where several workshops of hackAIR (such as the cardboard sensor workshop and the photo safari from hackAIR) are promoted to the wider public.
- Pollution Explorers workshop: hackAIR, in collaboration with Umbrellium, organised a "Pollution Explorers" workshop in Brussels (Fig. 19). Pollution Explorer is an artist residency led by Ling Tan of Umbrellium, funded by Vertigo STARTS, supported by FutureEverything. It is a participatory project exploring air quality issues through people's subjective perception and wearable technology. The project team hosts workshops in local communities and schools. The first workshop took place on 20.09.2018 at the UNESCO school in Brussels (Koekelberg) with the participation of 9 students.

Figure 19 - Pollution Explorers Workshop (UNESCO school – September 2018).

- Last, one workshop was also organised at the Basisschool Prinses Juliana (primary school) on 7.11.2018 with a group of 25 pupils (7-8 years old) (Fig. 20). A general introduction was given by a researcher from the VUB who explained the causes and impacts of air pollution through videos and usage of post-its. Next, the pupils were invited to install (with the approval of their parents) the hackAIR application and to take a picture of the sky outdoors. Afterwards, each pupil formulated one action to take in the upcoming week to contribute to a cleaner air.

Figure 20 - Taking a picture of the sky with the hackAIR mobile app (Prinses Juliana primary school - November 2018).

Several activities are still ongoing, such as different bilateral and broader meetings with citizens initiatives working on air quality in Brussels/Belgium, which have been aiming at reaching wider dissemination and establishing collaborations. For example, the participation at "Researchers' meetings on Air Quality & Citizens Science". Following

previous meetings, CREVIS participated in the relevant meeting on the 15.11.2018. The focus of the discussion was the organization of the "Etats généraux de l'air de Bruxelles", a three days event to bring together different actors and perspectives concerned with air and raise the ambitions for healthier cities. The event is scheduled for 25-27.4.2019, consisting of different components: an international symposium, a hackathon, a citizens' day and a political debate. The VUB is planning to present some of the results of the behaviour change study of hackAIR at the international symposium. Due to the fact that the hackAIR project finishes in December 2018, it was discussed if the open data sets of the hackAIR platform can be provided for the organization of the hackathon. A follow up discussion is expected by the end of the year to discuss any further potential collaboration.

3.5 Pollution Explorers in Belgium and England

3.5.1 Key summary

Pollution Explorers is a participatory project in which people make sense of the quality of air in their environment through their innate subjective perception using wearable tools, air quality sensors and hackAIR platform. The aim is to explore our collective responsibility and capacity in tackling air quality issues and to collectively figure out ways to tackle air pollution. Through the engagement, participants make a statement on the air quality with their own physical actions of recording perceptual data using the wearable tools, help to fill in missing 'gaps' of air quality data in order to make sense of the quality of air in their neighbourhood and devise collective pledges that they can commit to helping tackle air quality issues for a period of time. Over the past 6 months, we have worked with a total of 90 participants (children, young adults, parents, activists and city officials) where they pollution explore in their neighbourhoods in London, Macclesfield and Brussels.

Pollution Explorers is a participatory project exploring air quality issues through people's subjective perception and wearable technology. Pollution Explorers is designed by Ling Tan as part of Umbrellium, based on technological elements from hackAIR, with the support of FutureEverything . The project is part of a 12 month Vertigo STARTS residency programme which organises collaborations between artists and tech projects.

We have carried out 6 Pollution Explorers workshops:

1) Poplar, London with local residents (aged 21 and above) in June 2018

2) Macclesfield, UK with local residents (mostly adults, 1 child aged 12 years old) in June 2018

3) Koekelberg, Brussels with high school students (aged 17-18 years old) from the UNESCO school in Oct 2018

4) Sablon, Brussels with city officials and EU commissions (aged 21 and above) in Dec 2018

5) Two workshops with students (aged 10-12 years old) from Marner Primary School in Tower Hamlets London in Dec 2018

Figure 21 - 6 workshops carried out with different communities in different cities over the last 6 months.

3.5.2 Key activities carried out in the workshops

In each workshop, participants are encouraged to make sense of air quality issues by collectively describing, discussing, and pollution exploring in their vicinity using technological tools. Depending on the length of each workshop, participants went through the various key activities:

1) An open discussion among participants regarding air quality in their neighbourhood

2) Pollution exploring in outdoor locations near the workshop space using wearable technology. Participants make sense of air quality using custom-made wearables designed to record their perception of air quality using body gestures.

3) Pollution exploring in outdoor locations near the workshop space using words. Participants make sense of air quality using words, each participant were told to write down 2 key words that describe the air quality at each location.

4) Debrief session where participants were shown data they have recorded during the walk and to collectively discuss and make their own correlation regarding the relationship between their perception and quality of air.

For the last two workshops in Tower Hamlets, we concentrated on air quality behaviour change since we had learned quite a lot from the previous workshops. We look at how we can harness collective behaviour change to tackle air quality issues through changes in participants' behaviour (coupling children to their parents) by encouraging them to commit to a specific action for an extended period of time. Their actions were tracked over a period of 21 days to analyse the correlation between their levels of commitment to air quality improvement.

Figure 22 - Key activities carried out in 6 workshops.

3.5.3 Key Findings

On the correlation between perception and air quality:

1) People's ability to assess the quality of air in each workshop compared to the digital sensors vary widely, the highest correlation in a workshop was 75%.

2) Humans are very good at perceiving extreme changes in their environments

3) While people may not always correctly perceive the air quality, they are good at telling if it's better or worse than a location they were at before.

4) Children are very sensitive to momentary changes in the air around them, such as a truck or car driving by, and adults tend to be more holistic about how they perceive the air around them.

5) People are good at perceiving changes in air quality from place to place

6) In the case of the Brussels walks, the AQ is really very good and even within the perception there is not much variability

7) There are differences from location to location and because the air quality base is good, some people feel a lot stronger about bad AQ because of that relativity

On behaviour change to tackle air quality:

Short-term behaviour change

In the first 4 workshops, at the end of each, we gave each participant a prepaid postcard to record and track an action they have identified to do to tackle air quality issue (e.g., walk to school/walk, reduce electricity consumption and take public transport etc.). Among participants who were part of the postcard experiment, 90% of participants aged 10-12 years old and 25% of participants aged 21 years committed to the action for 7 days consecutively.

Long-term behaviour change

In the last 2 workshops, each participant was given a custom designed badge that enables them to trace their actions over the period of 21 days. A larger poster designed to track participants' level of commitment to their pledges over the 21 days was placed at the school entrance. Each day participant can choose to stick 1 sticker found on their individual badge into the appropriate box in the poster if they have committed their action the day before.

1) At the end of each workshop, we gave each participant a prepaid postcard to record and track an action they have identified to do to tackle air quality issue (e.g walk to school/walk, reduce electricity consumption and take public transport, etc.).

2) With our workshop in Tower Hamlets, our analysis has shown that a high percentage of participants (63%) have committed to pledges which create short-term and visible outputs to AQ such as changing commute behaviour and encouraging a family member to stop smoking. Most participants chose these actions because they think that it will directly reduce the amount of gas exhaust and will help reduce the impact on health on people who have asthma.

3) Among the other participants (37%) who chose to commit to pledges that have long-term and less visible outputs to AQ such as planting or growing more plants and reducing electrical consumption, there was a higher level of commitment. The highest instance being 21/21 days and on average 12/21 days.

4) On average 54% of participants carried out their pledges with their parents at least once. Most participants who did not carry out the actions with their parents mentioned that their parents were busy with work.

5) Among the 46 participants, 57% of who have higher than average level of commitment to their pledges (higher than average of 7/21 days) were also the ones who have also shown higher sensitivity to AQ changes during the pollution explorers workshops.

4 Results

The following table (Table 1) provides an overview of the key pilot success indicators, their target values and the obtained numbers.

Table 1 – Key pilot success indicator and achieved number (per 14.12.2018)

Indicator	Obtained numbers	Target values based on the DoA
Simple users in Germany	1668	5000
Simple users in Norway	188	3000
Simple users (elsewhere or undefined location)	1021	-
Sensors in Germany	372	200
Sensors in Norway	128	100
Sensors elsewhere	307	-
Usable mobile sky photos everywhere	1271	800
Sky photos_No-login	4	-
Perceptions	1943	-

As it can be seen, most key pilot indicators reached the target numbers. However, the target value for simple users in both Norway and Germany could not be reached, despite multiple efforts from both NILU and BUND and the other consortium partners. The fact that the mobile app was not fully functional until phase IV, as it had to be updated to satisfy the user needs, might be an indicator for the low numbers of simple users. However, it is cumbersome to speculate about the reasons behind this, and since we do not know why people that heard about the project chose not to be engaged as simple users, we will not indulge in speculations.

Fact is however, that the pilots both in Norway and Germany, but also the extended pilots in Belgium and Greece where successful in terms of raising awareness and engaging people. Especially the sensor building activities were very popular amongst the citizens, especially amongst those that were interested in the technology. Another positive fact is that we were approached by a number of interested individuals and groups (e.g., municipality of Oslo and Skedsmo, interested individuals in Stavanger and Bergen, school teachers or TV stations). This indicates interest in the topic of air pollution in the society. And as described in section 3.1.7, many aspects of hackAIR have been taken up into further relevant project proposals and initiatives.

This deliverable only provides a report about the hackAIR activities in the different pilot countries. At this point we refer to D7.7 Pilot implementation and final evaluation report: pilot performance and impact of hackAIR, which provides results about the evaluation of the different hackAIR activities and a behavioural change analysis.

5 Lessons learned

We conclude this deliverable with a short section on lessons learned since we think this will be useful information for similar initiatives.

hackAIR is a novel approach, combining a range of different technologies for air quality monitoring and citizen engagement. A project with such a technical nature has to ensure that its technologies are working flawlessly, and in case it is aiming at technology amateurs which are easy to use, preferably as simple as plug-and-play. User friendliness and easiness of use are important. So, testing is crucial. To guarantee an easy uptake by the project participants, it is of advantage to include citizens from an early stage in the development of technologies and solutions.

Although social media have been proven to be a suitable tool nowadays to disseminate project information and reach interested citizens, personal contact is still indispensable. Especially when it comes to technology, it is important to provide help and guidance in person and also follow up with participants in a one-to-one communication to ensure the uptake of the technology and a continuation of the participants in the project activities.

Another important aspect for the participation and continuation in a citizen science project is meaningfulness for the participants. The technical solutions and project activities have to make sense for the participants and answer the questions “Why should I participate? What’s in it for me?”. Expectation management is a crucial point here.

And last but not least, one should think already from the planning phase about the end of the project. What will be the final result/product? How will this be implemented into already existing structures to guarantee for a continuous use and application by citizens and other stakeholders? This is an important question to assure the long-term participation of volunteers even after the project ends.

6 References

- Liu, H.-Y., et al. (2017). D7.1 – Pilot plan. Available at: http://www.hackair.eu/about-hackair/deliverables/ [Accessed 11th May. 2018].
- Liu, H-Y., et al., (2018). D7.4 – D7.4: Intermediate pilot implementation and evaluation report. Available at: http://www.hackair.eu/about-hackair/deliverables/ [Accessed 26th November. 2018].
- Veeckman, C., et al. (2018). D7.7 Pilot implementation and final evaluation report: pilot performance and impact of hackAIR. Available at: http://www.hackair.eu/about-hackair/deliverables/ [Accessed 11th May. 2018].