Redesigning the Smart Indoor Air Quality Monitor from the Privacy Perspective

DATA3710-1 22V Practical-IT project

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Preface

This project aims to analyze the privacy policy of a smart indoor air quality monitor, creating a video that highlights the most important issues, and redesign those policies to be more user friendly. The team that has been working on this project consists of two computer science students studying at Oslo Metropolitan University.

We want to thank our supervisors, Henry Mainsah and Nuno Marques, for all the guidance they have offered throughout the semester.

Oslo, 20.05.2022

Table of content

List of figures

1. Introduction

Smart homes seem to be the future and smart devices seem to be the new way of designing home appliances. But how many people read the privacy policy or the terms of use when installing a new smart device?

We are two students studying computer science at Oslo Metropolitan University (OsloMet), and our project is part of the Relink project from OsloMet, which is a research project that “aims to develop frameworks, tools, and scenarios that can address current and future risk and safety issues related to smart homes.” (Relink, n.d.). This work aims to bring an overview about the privacy policies of a device called smart indoor air quality monitor from the company Netatmo (called “the device”), by underlining the main issues in the privacy policy of this device. We will do this through creating an “unboxing” video, where there are highlighted the main issues of those policies, and suggesting a redesign of those policies for a better user experience, we aim to create a tool that can be included in the relink project.

2. Aims and Time Planning

The main aim of this project was to find a smart device, to analyze its privacy policies, create a video that highlights the main issues in this area, and redesign it from a privacy and ethical perspective. Since the war started in Ukraine (24th February 2022), we considered that the quality of the air is important for our health (Global citizen, 2022). Therefore, we decided to analyze a smart indoor air quality monitor, and since a member of our team owns one, we chose the one made by the company Netatmo.

2.1. Tasks

We divided our tasks into 2 phases:

Phase 1:

Getting an overview about the privacy issues in smart homes and analyzing the privacy issues of the chosen device by:

- Analyzing privacy and ethical issues in smart homes in the literature;
- Analyzing the privacy policy of the device, going through all the steps a user should do for installing it;

Phase 2:

- Creating an “unboxing” video about the privacy policy of the device, underlining some main issues;
- Redesign the device’s privacy policy from a new perspective, taking into consideration the user experience;

2.2. Time Planning

We made a time plan to get an overview of how our work progress should look, and important dates (Figure 1).

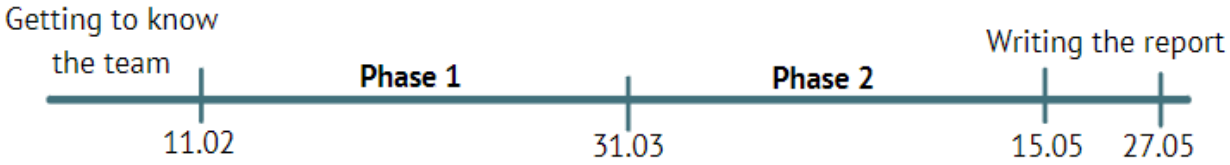

Figure 1 Timeline for our project, from the midterm presentation

3. Methods and Work Process

3.1. Phase 1

3.1.1. Description

We started our project by doing research and reading literature, first about smart devices and smart homes in general. After this, we looked at different smart devices to find one we wanted to analyze. After choosing our device, the smart indoor air quality monitor, we used the walkthrough method to analyze it and its privacy policy. We also had some questions we wanted to discuss with the company, Netatmo, and we tried contacting them. The last task we had planned for phase 1 was making a digital survey to get more insight about what others thought of the security of device.

3.1.2. Literature Review

In the literature review we read articles about smart homes and smart devices in general. We wanted to get an idea of what people knew about privacy and ethical issues, and what their thoughts were around the issues. We read many different articles and got help from our supervisors to find some of the resources.

In the article “User Perceptions of Smart Home IoT Privacy” (Zheng, S., Apthorpe, N., Chetty, M., & Feamster, N., 2018), we read that people tend to trade their privacy for advantages gained from smart devices and the more they gain, the more they are willing to trade. The users are willing to trade their personal data because it could be used to improve the product and therefore benefit themselves.

We also learned that consumers feel that their smart products are safe to use in general. Users trust the manufacturers to protect the user’s privacy, but they will not verify that their privacy

is protected. Many users will trust the smart devices of big companies with good reputation, even if the company did not have experience with smart devices (Zheng, S., Apthorpe, N., Chetty, M., & Feamster, N., 2018).

Users had privacy concerns about microphones that were always listening. Some were afraid smart devices could be listening when you are not aware (Chalhoub G., Kraemer M. J., Nthala N., Flechais I, 2021). Users were also less concerned about their privacy when using the smart device without audio or video (Zheng, S., Apthorpe, N., Chetty, M., & Feamster, N., 2018).

3.1.3. Walkthrough Method

When we had chosen our device, we wanted to look more into the device and its app ourselves. To do this, we used the walkthrough method (Light B., Burgess J., Duguay S., 2016) on ourselves. “The walkthrough method is a way of engaging directly with an app's interface to examine its technological mechanisms and embedded cultural references to understand how it guides users and shapes their experiences” (Light B., Burgess J., Duguay S., 2016).

We wanted to first download the app, and then go through the necessary steps to make an account and connect it to the device. This is also where we analyzed the privacy policy. Finally, we wanted to try to delete the account.

When the app is downloaded and opened, the screen for log in or sign up is presented (Figure 2). We saw that you had to have an account to use the app and the device, and it was not possible to use the device without making an account.

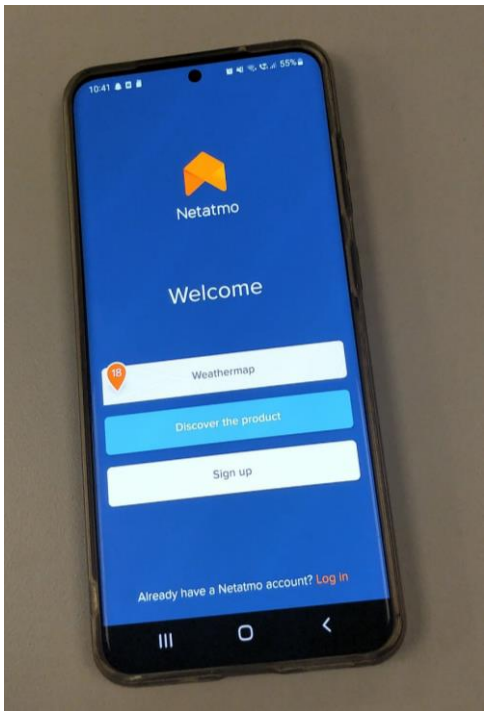

Figure 2 The first screen presented when the app is opened

When the user is going to make an account, it could be done in two different ways. Either they could join an existing family account, or they could make a new account. We tried both, once where one of our team members got an invitation on email from their family, and once where we made a new account with our school email.

After inserting our email address, we needed to create a strong password (Figure 3). It had to be at least 8 characters long, it must contain at least one upper key, one lowercase, one digit and one special character. Then we had to choose a country (Figure 3). It did not say if we should choose the country of our ethnicity or the country we are currently located in, but we chose the latter.

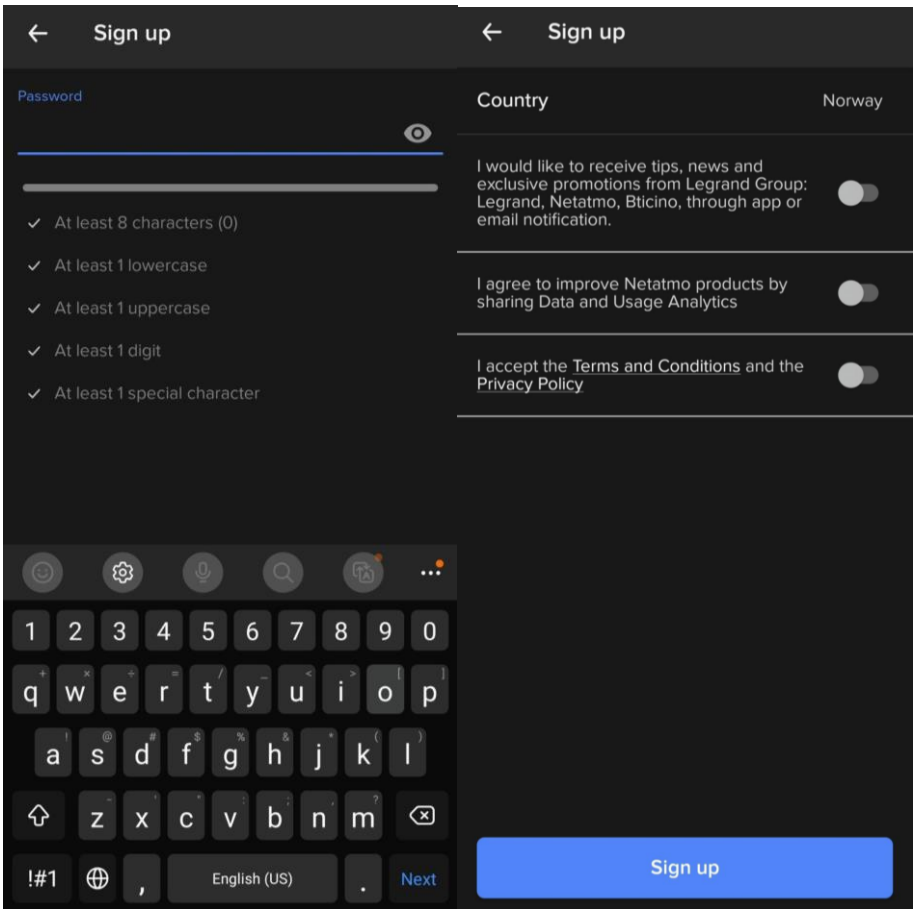

Figure 3 Screenshots from the app

Now we had come to the point where we needed to accept the terms of use and privacy policy, and before doing that, we analyzed it. To read and understand the privacy policy took us nearly a whole hour, which we thought was too much time.

The policy had its own link called “Access to data”, and this is where the information for personal data is. We found that we needed to go back and forth between the access to data and other parts of the privacy policy.

We also wanted to try to delete the account. To delete the account, you need to make a deletion request via email, or if the account is inactive in 3 years it will be deleted. The data that is sold to other companies can be kept by them for 10 years, but this is only measurement data from the device and not personal data. When we tried to delete our account, we found

out that we needed to fill out a form (Figure 4), where we needed to fill out information about our country, email, and full name. We thought it was weird that they asked for our full name, since we had not given it before, when we made the account.

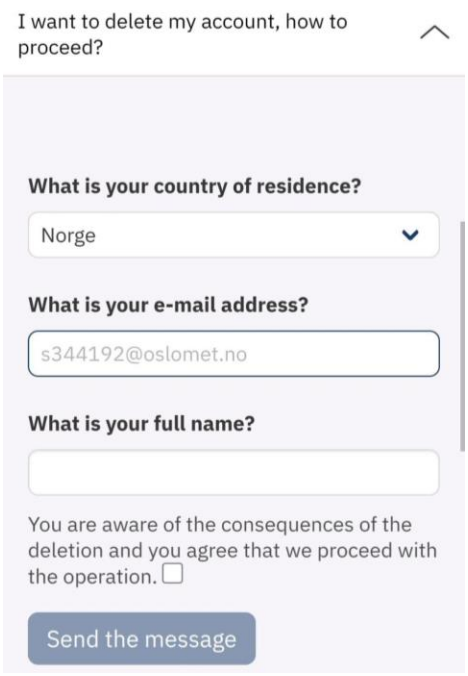

Figure 4 Screenshot from the form to delete the account

The device (Figure 5) has sensors that can monitor CO2 level, temperature, humidity, and noise level. We know that users can be skeptical of devices that have microphones (Chalhoub G., Kraemer M. J., Nthala N., Flechais I, 2021), and we wanted to know if this was something users of this devices needed to think about. On Netatmo's web page it is described that the sensor for sound is only a decibel meter, and cannot record sounds (Netatmo b, n.d.). Therefore, users don't need to worry about being recorded by this device.

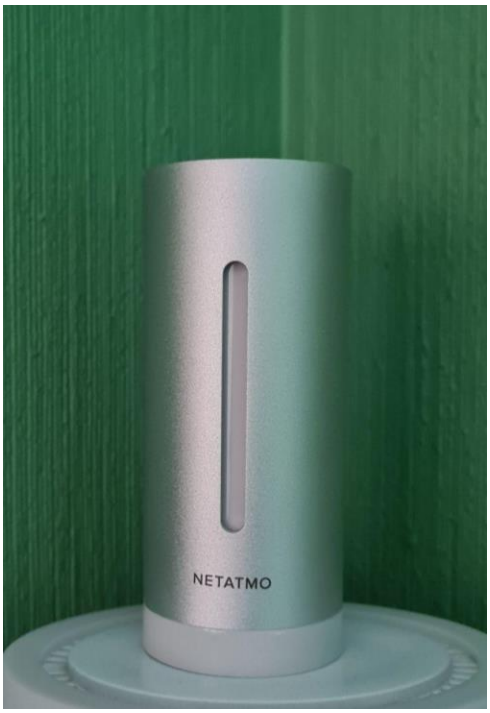

Figure 5 The smart indoor air quality monitor

3.1.4. Contacting Netatmo

Next, we wanted to know more about the product from the company Netatmo itself. We wanted to discuss the device and its privacy, to get their point of view. We noticed that it was difficult to find contact information, but we found a form that we could fill out and send as an email. Some of the matters we wanted to get their opinion on was the structure of the privacy policy, why it is so long and why they chose to have links for personal data. We also wanted to ask why the user needs to have an account to use the device, and if it could be possible to design it so it could be used without an account. Unfortunately, they replied: “Our teams spend a lot of time on privacy and security topics. Unfortunately, we don't publicly communicate about these subjects”. Therefore, all the information from Netatmo is from their website (Netatmo a, n.d.).

3.1.5. Survey

After we had gotten to know the product, we wanted to know more about what the users of the device thought about its privacy. We made a digital survey using Google Forms, since it was a familiar tool for us and was practical because we could get a link to send to our participant and they could fill it out themselves. The question from the survey can be found in Appendix 7.1 and the answers from the survey can be found in Appendix 7.2.

It was challenging to find users of the device, but we asked people we knew that use it to recommend other users. We got a total of 6 responses and were focusing on the qualitative side, not quantitative.

We asked them what they felt was safe about the product regarding privacy. Some said that the data that was collected was not important, and they felt it was safe to share this kind of information. When we asked them about what they did not think was safe they said that they did not know the intentions of the company for the use of their personal data, or how the company secures the data in general.

We also asked if they had read the privacy policy (Figure 6) and only ⅓ had read the whole. We can see that there is an issue since not everyone reads the policy, which we could understand since it took us such a long time to read.

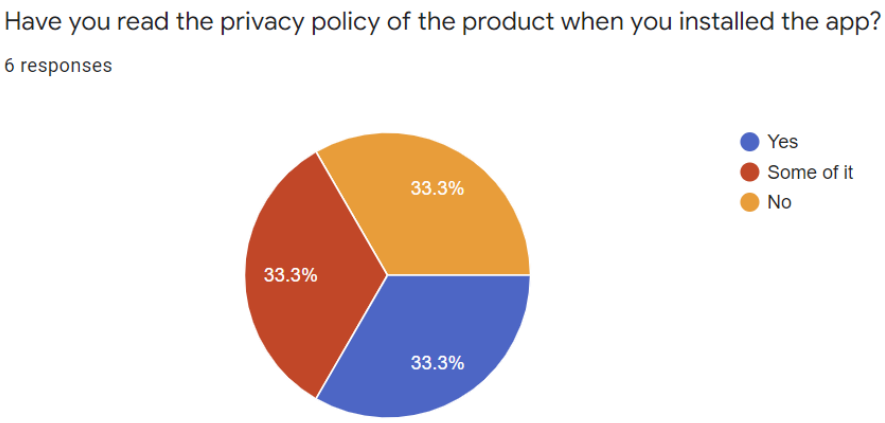

Figure 6 Screenshot from the results of the survey

Lastly, we asked if they would consider having other products from Netatmo, and even though some of them earlier had expressed some concerns, they all answered yes (Figure 7). As we learned from our research, we think this could be because users tend to trust the manufacturers of their smart devices to protect the user's privacy (Zheng, S., Apthorpe, N., Chetty, M., & Feamster, N., 2018).

Figure 7 Screenshot from the results of the survey

It was useful to get to know the opinions of other users, and to get a new point of view.

3.2. Phase 2

3.2.1. Description

Since we got an overview about the privacy issues in smart homes in general, and the ones of the device in phase 1. We planned to create a video that underlines the main issues of installing the device, regarding the data collected from the user. Because of the long time that it takes to read those policies, we decided to redesign it for it to be easier for the user to navigate through them and understand what data has been collected, by reducing the reading time drastically.

3.2.2. Creating the Privacy Policy "Unboxing" Video

After noting down the main issues that we considered while reading the privacy policies, we started structuring our video by highlighting the steps a user needs to take to use the device. We were going to make an "unboxing" video of the privacy policy. Oxford has a definition of unboxing; "The process of removing a new product from the material it is packed in and examining its features, filmed and put on the internet" (Oxford Learner's Dictionaries, n.d.). Our "product" would be the privacy policy, and we wanted to highlight some of the parts of the policy that we found important. It was important that the video was going to be short and only about 2 or 3 minutes, we thought that if it was any longer, people would not watch it.

We were using an Android running mobile phone (Samsung S20) and using an inbuilt feature to record the screen. We then recorded our voices separately in the app InShot, and put them together using the same app. All the editing was done in the app InShot on our phone.

We recorded the following steps:

Step 1: downloading the app

We were downloading the Netatmo app from the Play Store.

Step 2: installing the app

After downloading it, we installed it on our mobile phone. The app can be installed on mobile devices that run Android 5.0 or higher.

Step 3: creating an account

By creating an account there is needed to:

- Fill in an email address
- Create a password that needs to be at least 8 characters long, it must contain at least one uppercase, one lowercase, one digit and one special character
- There needs to be chosen the country where the user is located, a fact that we considered as being unnecessary since we are talking about an indoor device.
- Accepting the privacy policies and the terms of use, by checking a checkbox

Step4: confirming the account in the email received from Netatmo (Figure 8)

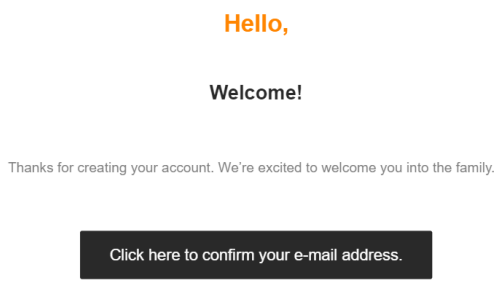

Figure 8 Screenshot of mail where we needed to confirm the email address

Now that the account is created, we wanted to delete it right away. We found out it was not possible to find the option in the app, before connecting the device to the app.

After connecting the device, we went through the steps to delete the account. The account will be automatically deleted if it is inactive for 3 years. Another way to delete the account is by email request by filling out a form with information about email, country, and full name. The

request should take a maximum of 30 days. We filled in the form on the 3rd of May 2022. The 6th of May 2022 we tried to login to the account, but it seemed to not exist. However, we didn't get any email regarding the deleting of the account.

3.2.3. Redesigning the Privacy Policy

We created a prototype of the design of the privacy policy, using the prototyping tool: Figma. We were designing it by creating icons for each main heading of the document, considering that having an icon instead of a text, would make the reading and understanding of the information more accessible (easy to read) for the user. At the same time, by clicking on the icon that is related to the information wanted to be read, we avoid overloading the screen with a lot of text.

We consider that a clean design, with less text, would decrease the length of the time needed to read and understand the privacy policy and the terms of use.

While we were prototyping, we looked at other privacy policies for inspiration. We were first looking at the privacy policy of Formula 1's website (Formula 1, n.d.). It was structured with headings and bullet points that made it easy to find the information if you were looking for something specific. It was also short and only took a few minutes to read, which we thought was important.

Another privacy policy we looked at was Google's (Figure 9) (Google, n.d.). This one was longer, but it was precise and structured. It also had videos and illustrations for some of the headings. The videos were all under a minute each, and the information was put in simple language. We were inspired by Google's illustrations, to use icons in our redesign. We also enjoyed the conveniences of the videos, and this is something we think more companies should consider.

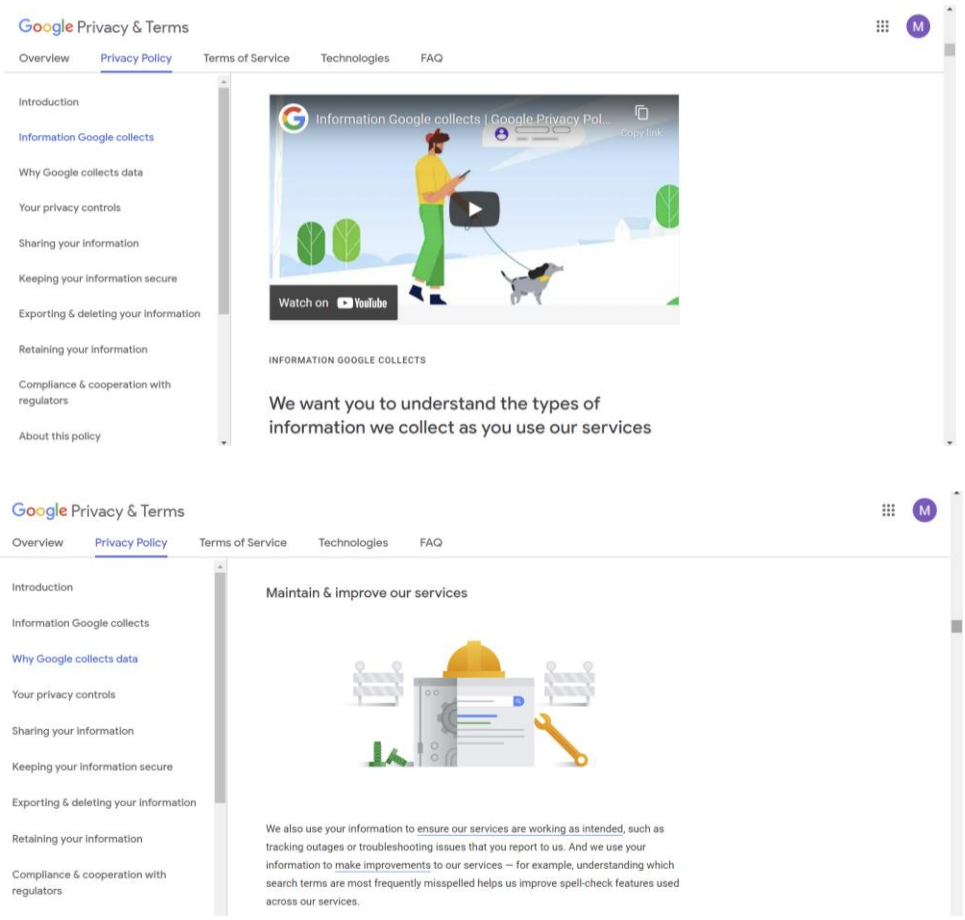

Figure 9 Screenshots from Google's privacy policy

4. Results and Recommendations

4.1. Results

The main results of this work process are:

- A video in which there are highlighted the main issues of the privacy policy of using the smart indoor air quality monitor manufactured by the company Netatmo. https://youtu.be/KABAu3NUIvo

Inspired by Google's privacy policy videos as a presentation tool, we created a video of the main issues of the privacy policy of our device. Instead of going through the whole one hour of reading of the policy, the video will remind them of the most important part, both visually and with audio explanation.

- A prototype of the design of the privacy policy of the device that should take much less time to read than the one existing now. https://www.figma.com/file/zIPbucVQBCweyoEQsIsgJS/Untitled?node-id=0%3A1

Based on our literature review, walkthrough method and our survey we realized that there are issues with many of today's privacy policies. With our prototype we have improved the issues regarding the time needed to read the privacy policy. We have improved the design of the privacy policy in our prototype by creating interactive icons according to each heading and reorganized the headings to a cleaner design to improve the user experience. With our new prototype and recommendations, we hope that more people will read the privacy policy.

Both the video and the prototype should be tools used in the Relink project from Oslo Metropolitan University.

4.2. Recommendations

Based on our findings from the literature review and walkthrough method, our recommendation to all manufacturers would be to redesign the privacy policies to a simple, clear, and suggestive model, so that users can easily go through all the information.

Doing this by:

- Creating suggestive icons that compliments the information and heading
- Creating short videos that explain the policy
- Clean design with less or shorter text and structured headings
- Interactive design where the user can choose the section they want to read

Our general recommendations for manufacturers regarding security of personal data of the users are:

- Implementing two step authentications after creating the account
- Asking for strong passwords
- Asking for Secured networks

5. Conclusion

The initial aims of this project have been achieved. However, we consider that there is still more work needed in this field since security of personal data is an issue, we all must deal more and more these days. Lots of smart devices require creating new accounts, giving some personal data and even though it might be stipulated how the data is being used, there are very few people that read this information.

We conclude that people care more about the features of the devices, than for their privacy.

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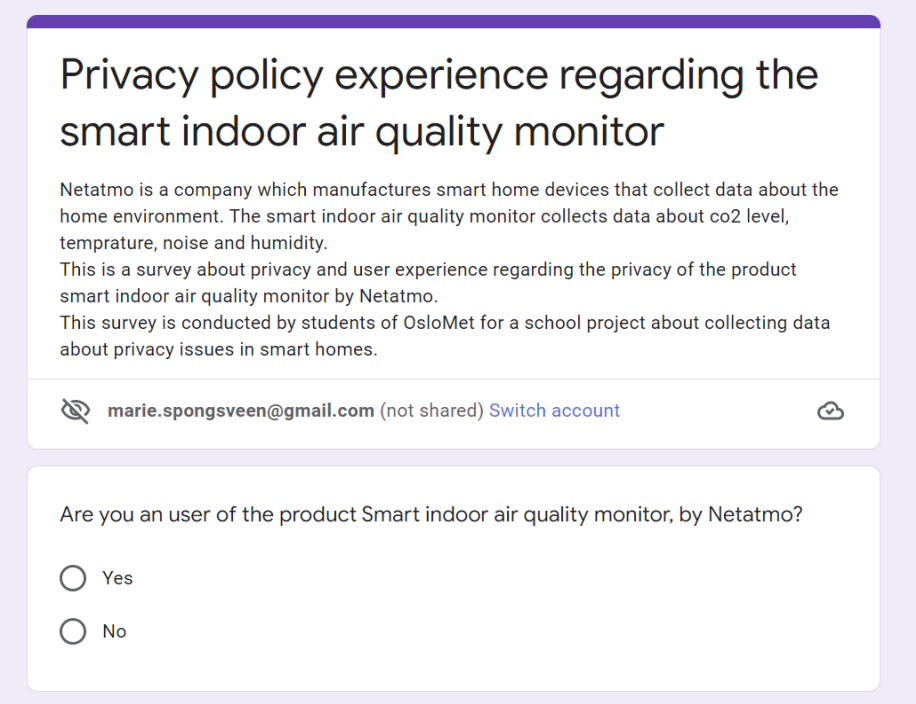
7. Appendix

7.1. Survey Questions



Privacy policy experience regarding the smart indoor air quality monitor

Netatmo is a company which manufactures smart home devices that collect data about the home environment. The smart indoor air quality monitor collects data about co2 level, temprature, noise and humidity.
This is a survey about privacy and user experience regarding the privacy of the product smart indoor air quality monitor by Netatmo.
This survey is conducted by students of OsloMet for a school project about collecting data about privacy issues in smart homes.

marie.spongsveen@gmail.com (not shared) Switch account

Are you an user of the product Smart indoor air quality monitor, by Netatmo?

- Yes
- No

How safe do you feel like the product is regarding your personal data?

	1	2	3	4	5	6	7	8	9	10	
not safe	○	○	○	○	○	○	○	○	○	○	very safe

What do you feel is safe about the product regarding you personal data?

Your answer

What do you not feel is safe about the product regarding you personal data?

Your answer

How much control do you feel you have over you personal data when using the product?

	1	2	3	4	5	6	7	8	9	10	
no control	○	○	○	○	○	○	○	○	○	○	a lot control

Do you remember what types of personal data were used when creating your profile?

- [ ] Yes
- [ ] No

If yes, what personal data were used?

Your answer

Have you read the privacy policy of the product when you installed the app?

- ◯ Yes
- ◯ Some of it
- ◯ No

Do you trust/not trust Netatmo with your personal data?

	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	Very much

If you take into consideration your personal experience regarding the privacy policy of Netatmo, would you consider having other products from this company?

- ◯ Yes
- ◯ No

7.2. Survey Answers

Are you an user of the product Smart indoor air quality monitor, by Netatmo?

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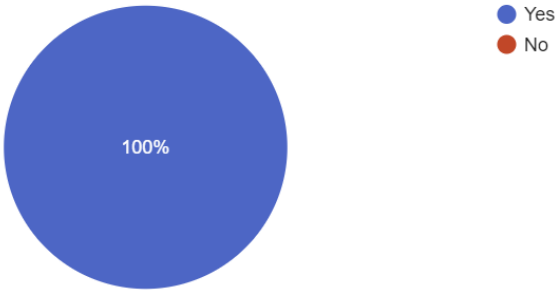
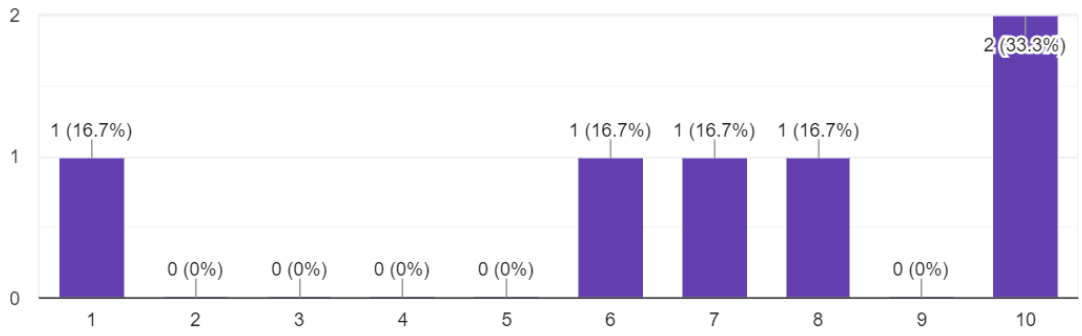
6 responses



How safe do you feel like the product is regarding your personal data?

Copy

6 responses



What do you feel is safe about the product regarding you personal data?

5 responses

I have made the decision to accept the user policy. I know data about my email, location of my house and temperature, noise and indoor air quality may be transmitted outside the EU, and that US government may use US law to gain access to these data. As a private citizen I have no objection that my email-address and the location of my house is transmitted outside the EU.
The data that is collected to as far as I am concerned public information (email and my address - as I own the part of our house the location is public available knowledge). The other data, temperature, air quality, noise-level is information I am comfortable sharing with the company.
As far as I understand the noise-senor does not use speech recognizing nor does it not transmit sound-clips to the service provider.

The personal data recorded are not that important

De er underlagt GDPR, er et franskt selskap og leverer tjenetser fra MS Azure i Nederland. De har de default innstillinger for personvern satt til et minimum av innsamling av data, og det er opp til bruker å skru de på.

It seems to be secured

What to feel about it, as user you have no insight in the backend and how they secure the data

What do you not feel is safe about the product regarding you personal data?

5 responses

There may a back-door to configure the software and thus change what the device actually do. This I do worry too much about. These may also be exploits that may be exploited, and thus try to gain access to other devices or accounts on our network, and possibly elevate privileges in other accounts I have. because of this we have all our IOT devices on a logically separate network segment.

It is difficult to know the intentions of the manufacturer for privacy/use of personal data

Hvis jeg ikke passer på så vil det logges mye informasjon om bruken av værstasjon - inkludert GPS info. Må være nøye med å sette innstillinger rett, men de har de fleste slike innstillinger default som av.

It is never secured

No independent evaluation of how the company secure the data

How much control do you feel you have over you personal data when using the product?

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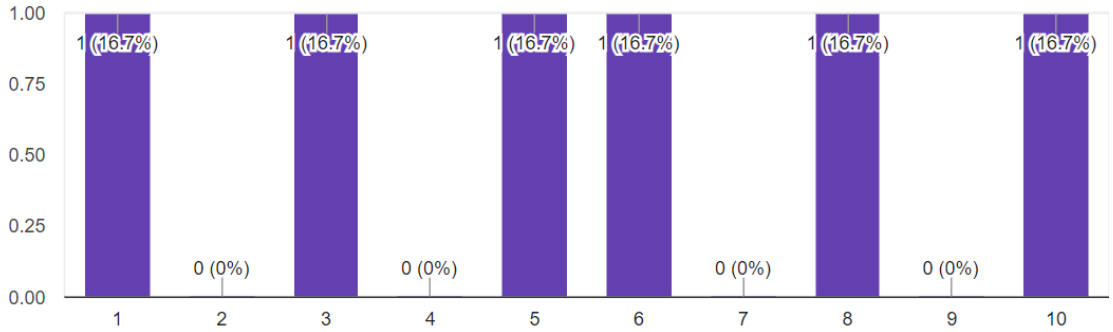
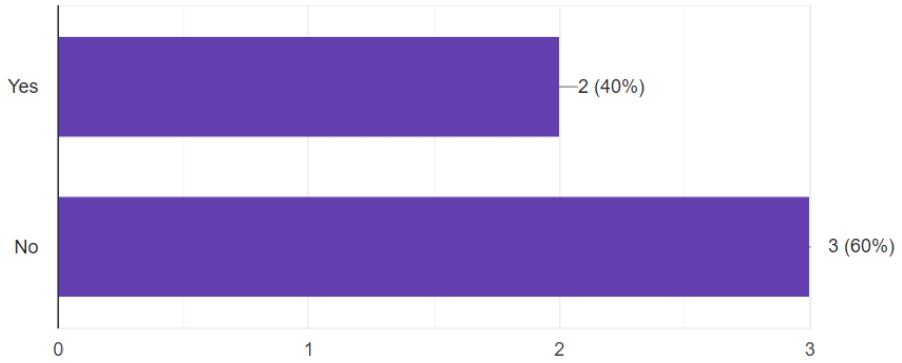
6 responses



Do you remember what types of personal data were used when creating your profile? Copy

5 responses



If yes, what personal data were used?

3 responses

Email, depending how you define personal data, I may alo have give ny home a name, the devides name og our rooms navme, eg, we have a devide in a room named with my sons name, eg <First name> room.

e-post adresse

email address and location

Have you read the privacy policy of the product when you installed the app?

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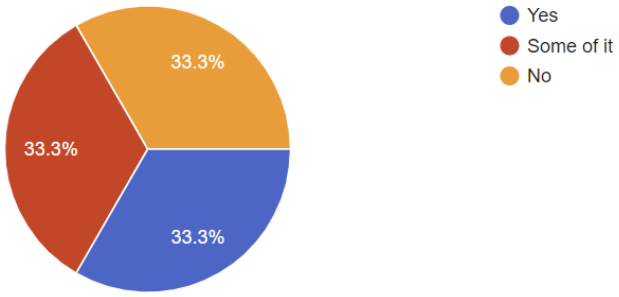
6 responses



Do you trust/not trust Netatmo with your personal data?

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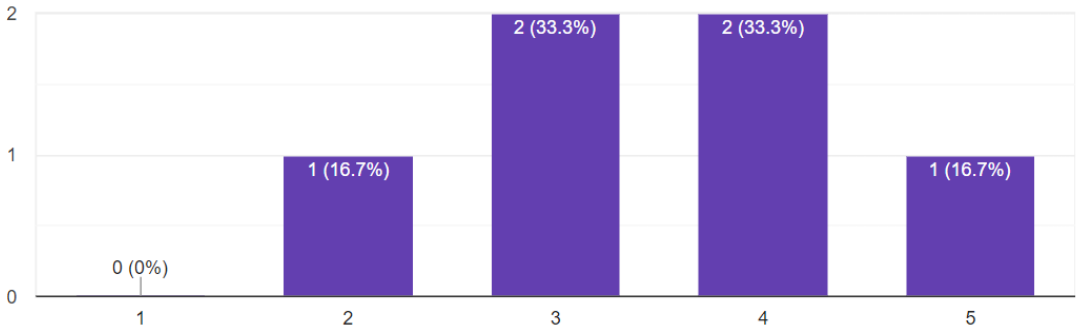
6 responses



If you take into consideration your personal experience regarding the privacy policy of Netatmo, would you consider having other products from this company?

Copy

6 responses