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MINUT

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In collaboration with Minut AB

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point. 3.

Abstract:

Internet of Things (IoT) devices play a huge role in our lives today, and this constant connectivity will continue to grow. As these products are becoming an increasingly more important part of our homes, it is interesting to explore the design of them. This thought of interest led to a collaboration with Minut AB and the development of their product called Point. In order for these products to function in a design harmony in ones home, a vision for future IoT devices was needed. A vision where the consumers should feel trust in the products and not overwhelmed by their appearance. This research will lay the foundations of the next generation Point alarm, and further develops its form, function and interaction experience.

This design process has brought a new generation of the Point home alarm system, where the product has been better adapted for the new target group: apartment residents in urban cities in Sweden.

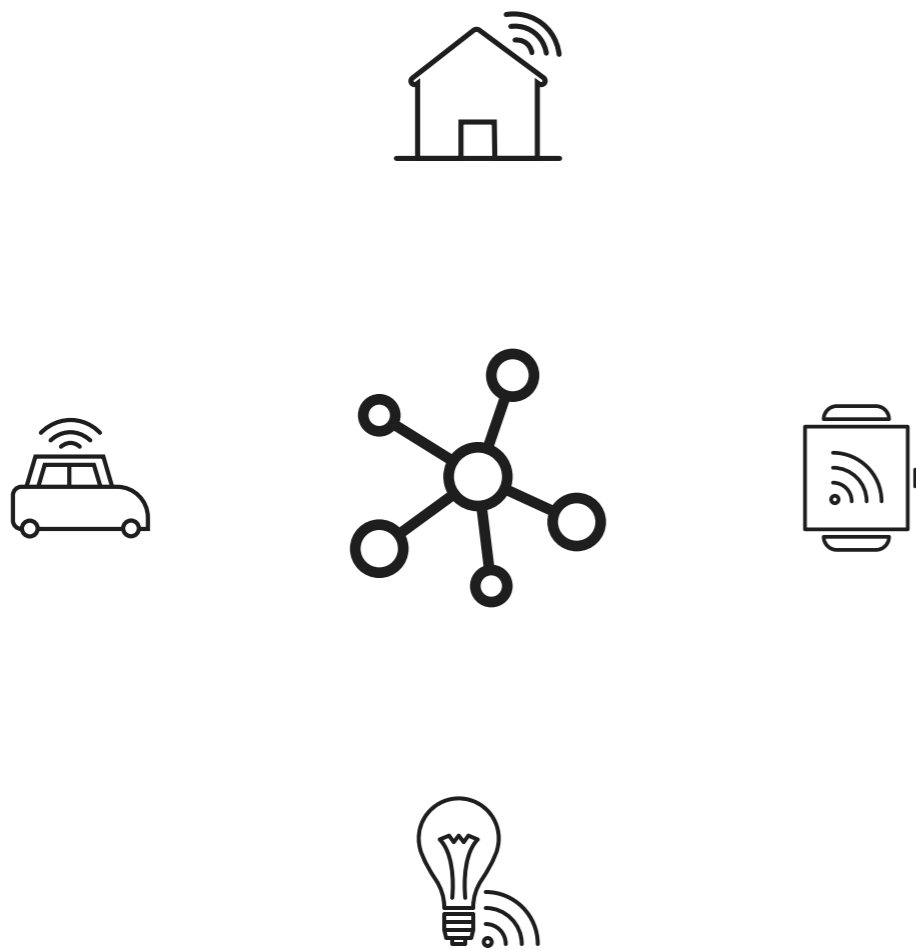
There are still details left to be solved before a launch. However a clear concept and vision of future IOT products has been developed to a level where it's easy for the company to continue the work.

Acknowledgment

I would like to give my gratitude to Minut and the people involved for the valuable information, collaboration, and helpful discussions. Further I wish to thank my supervisor Charlotte Sjödel and examiner Karl-Axel Andersson for ideas and great support along the way. Lastly, I give my thanks to Julia Larsson, my family and everyone else who has been a helping hand.

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01. Introduction



IoT and its home application usage

Internet of Things (IoT) is a description of devices and products with Internet connectivity, that enables them to exchange data through the network (Clark, 2016). During the past years it has been a debated topic, primarily since it is a constantly developing area of technology that is in a larger extent finding its way into people's lives and homes. It is a wide subject with many different applications like Smart Homes, transportation and personal health (Kubler et al., 2015). According to Statista the predicted amount of connected devices 2025 will be over 75 billion and already now there are more than twice the amount of connected devices than people on earth (Statista, 2017).

A growth in IoT devices is therefore to be expected for the years to come. Imagine a not so distant future world where we are surrounded by such devices. In order not to be overwhelmed by these products, it is of necessity to find a balance in the design. If we can benefit from the possibilities in a well thought-out design, where the form, functions and users are taken into consideration, we will most likely appreciate IoT products even more.

To explore the subject further, the research was carried out in collaboration with Minut AB.



Minut's business idea

Minut's product, named Point, is a home alarm system excluding cameras that through various sensors and algorithms recognizes sound, light and air in the home. Point monitors softer values such as mold, temperature and humidity compared to other home alarms. Minut's value is to respect customers' integrity and through good design develop affordable products that can reach out to many people.

Initial Brief

The aim of this Master thesis is to explore new areas of possibilities, solutions and design for the next generation of Point. Some potential areas could be remote sensors (eg. water leakage), elderly care or social housing. The moral aspects of a product gathering data should also be taken into consideration in the design process. The final goal of this project is to create new possibilities for the end users as well as for potential partners.

Project aims

From the beginning i wanted to work closely with the company to experience a freelancer role, the goal was to deliver something real that Minut easily could proceed with to production. In order to help Minut with their current challenges and opportunities, I wanted to create a concept and prototype that could be produced in two years time rather than in 10 or more years. The goal was not to research for future technologies or materials but rather to see what would be possible today. While also, keeping in mind a vision and goal for the future.

What's new?
Technical Specifications

In the next generation Point (2018) sensor stability and sensitivity has seen a substantial improvement. See below for the new features.



	Point (2018)	Point (2016)
Height:	46 mm (1.8")	40 mm (1.6")
Diameter:	85 mm (3.3")	86 mm (3.4")
Weight:	180 gram (6.3 oz)	240 gram (8.5 oz)
Coverage	Approx. 50 m ² (540 ft ²)	Approx. 50 m ² (540 ft ²)
Battery & Power	6-12 months (rechargeable, USB-C)	Up to 12 months
Features		
Sound	•	•
Temperature	•	•
Humidity	•	•
Alarm recognition	•	•
Speaker	•	•
Tamper	•	•
Window break	•	•
Siren	•	
Smoke	•	
Mould	•	
Pressure	•	
Motion	•	
Bluetooth (BLE)	•	
Ambient light	•	
Compatible with		
IFTTT	•	•
HOMEKIT	•	

The existing Point

There has already been two versions of Point, both launched and successfully funded Kickstarter campaigns. The Point is a non invasive smart home alarm with features that combine smart sound recognition and can detect temperature, humidity, alarm recognition, smoke and much more. Point let's you know if something is wrong when you are away from home without using invasive cameras or complex systems. Point does not only talk to you but to the whole family through their app. It is also easy to notify a friend or neighbor so it's easy to help each other in the community or housing cooperative.

Point constantly monitors your home and give you live information in the app. Therefore, Point is like an extra voice of your home so that you can always feel safe when you are away, or at home.

Further, Point automatically activates the alarm when the last person has left the home. It also disables the alarm when a family member enters the resident. Sensor data is processed through different algorithms and then shown in the app. It recognizes family members, and alerts if a stranger enters through any point of entry.

These features enable the owner to be mobile when entering and exiting their home, since Point manages the alarm for them. In this way, the consumer doesn't need to remember alarm codes which reduces errors.

Furthermore the existing Point has protocols in place to easily integrate in your smart home.

02. Research & Analysis

Existing customer

Minut's main marketing channel has been Kickstarter, therefore the current target group has mostly been early adopters and tech interested males. Although very successful Kickstarter campaigns the target group is quite small and niched. The current issue with using Kickstarter as their single source of reaching customers, is that it limits the potential target group. In order to find new customer grounds, research was needed around a new target group. One important goal at Minut was to make everybody safe, therefore Point needed to be available for everyone.



Company values

After an interview with the CEO it became clear that the main goal for Minut was to make everybody feel and be safe. Point is a step in this direction. However, the company does not want to be seen as a technical or safety company, but uses the safety market as a vector to get a foot in on the market. Their vision is that their products should be more as furnitures rather than technical products, and they want the products to cover health and safety aspects with their hardware. Further, furnitures have a softer impression and can blend in with the other interior to another degree, than what technical products do.

Being safe is a basic human need, but in today's society one might easily loose the sense of feeling safe.

"Safety is a basic human need. Throughout most of history we've relied on our communities, but in modern times we increasingly rely on technology to keep us safe. Most strikingly we've come to accept surveillance cameras into our homes. The need for safety is so strong that we allow almost everything we do at home to be recorded and stored on cloud servers for later viewing. We're uncomfortable giving our neighbors this kind of access to our private lives, so anonymous guards have come to replace our communities."

-Nils Mattisson



Market analysis of IoT products

The existing devices have a very generic form language, they are either techy and/or white and tries to be invisible in order to be generic and not draw attention. This could attract one type of user group, although a larger one could be addressed with a different design approach. It was also found that the prices of the majority of IoT products ranged from a few hundred SEK up to a few thousand. This could be everything from smart light bulbs to home automation hubs. There where many products focusing on health and also home monitoring but nothing bringing together functions quite as unique as Point. There was a strong trend towards home automation and voice control, although no voice control products contained home alarm functions. A lot of products come and go, many are Kickstarter based and do not make it after their first round of investment. This could be caused by the huge focus on technical aspects and functions, the products then become obsolete as soon as a slightly better one is created. The rapid technology development and the notion that the companies mainly focus on technology as a selling point is fueling an unhealthy linear product thinking and society. My goal was to find something in the design process to change this and bring more meaning to the product other than features purely based on functions. Not many IoT companies talk openly about personal data collection, and this made me realize that Minut was quite unique in their openness which could lead to gained trust not only in the company but also in their products.

Market analysis of alarms

I came to the conclusion that there were a few larger alarm companies in Sweden. All very similar and traditional, and nothing unique to offer. The alarm packages for apartments were the same as for villas but with less sensors. As one can see in the pictures to the right, the form language is quite generic and the products could all be from the same company. The large amount of sensors makes it highly confusing for the customer what is needed. Although these products cover most technical aspects of what is desired in a home alarm system, the installation is a very tedious process and a very permanent solution. It was realized that Minut had something unique on the market since it was a quite simple and a single unit product and that this should be preserved in the next generation as well.

Trygg Lägenhet

Ett professionellt uppkopplat inbrotts- och brandlarm med bildverifiering av inbrott och brand, kontaktlarm och röstenhet för snabbast rätt åtgärd. Fria uttryckningar med inre väktartjänst och utökad produktgaranti ingår i larmtjänsten.



Pris 3.990:-
(Ord. pris 4.990:-)

Larmtjänst från 299:-/mån.
Installation ingår i priset!

- ✓ Fria uttryckningar med äre väktartjänst
- ✓ Dubbel överföring till vår larmcentral
- ✓ Professionell installation
- ✓ Utökad produktgaranti



Larmpaketet innehåller:

Huvudenhet, 2 st Rököverskåp, Röstenhet med siren, Kameradetektor, Manöverpanel, Vibrationsdetektor, Larmbricka, Larmdyttar. Behöver du komplettera med flera produkter så är det fullt möjligt utifrån dina behov.

Startpaketet med rörelse- och rökdetektor

0 kr inkl. installation

Larmtjänst 399 kr/mån (utan bindningstid)
Rek. pris: 1990 kr och 434 kr/mån



Startpaketet ingår installation av:

1 centralenhet, 1 manöverpanel, 1 rörelsedetektor, 1 rökdetektor, 1 magnetkontakt, 1 larmbricka och ansträckande detaljer.



Rekommenderade av Villalagarna

Villalagarnas Riksförbund rekommenderar Sector Alarm som hemslämlieferantör.

Beskrivning av produkter

<p>Huvudenhet Huvudenheten är den centrala delen i larmsystemet. Den innehåller larmcentralen och är förbunden med alla andra enheter i systemet. Den har en batteribakåre och kan användas som ett självständigt larm om det behövs.</p>	<p>Röstenhet Röstenheten är en siren som ljuder när larmet går av. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Rököverskåp Rököverskåpet är en sensor som detekterar rök. Det är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Kameradetektor Kameradetektorn är en sensor som detekterar rörelser i ett rum. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>
<p>Manöverpanel Manöverpanelen är en enhet som används för att styra larmsystemet. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Vibrationsdetektor Vibrationsdetektorn är en sensor som detekterar vibrationer i ett rum. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Smart plug Smart plug är en enhet som används för att styra elektriska utrustningar. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Larmbricka Larmbrickan är en enhet som används för att styra larmsystemet. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>
<p>Vattendetektor Vattendetektorn är en sensor som detekterar vatten. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Trygghetspanel Trygghetspanelen är en enhet som används för att styra larmsystemet. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Smart kamera Smart kamera är en enhet som används för att styra larmsystemet. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Överskåpsdetektor Överskåpsdetektorn är en sensor som detekterar öppna dörrar. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>
<p>Smart larmdytt Smart larmdytt är en enhet som används för att styra larmsystemet. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Smart rörelsedetektor Smart rörelsedetektor är en sensor som detekterar rörelser i ett rum. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Möbeldetektor Möbeldetektorn är en sensor som detekterar rörelser i ett rum. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	

<p>Kameradetektor 1790kr En sensor som detekterar rörelser i ett rum. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Rörelsedetektor 1790kr En sensor som detekterar rörelser i ett rum. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Rökdetektor 1790kr En sensor som detekterar rök. Det är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>
<p>Vattendetektor 1790kr En sensor som detekterar vatten. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Glasrörelsedetektor 1490kr En sensor som detekterar rörelser i ett rum. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Magnetkontakt 890kr En sensor som detekterar öppna dörrar. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>
<p>Checkdetektor 1790kr En sensor som detekterar rörelser i ett rum. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Vibrationsdetektor 1790kr En sensor som detekterar vibrationer i ett rum. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Larmbricka 5-pack 1790kr En enhet som används för att styra larmsystemet. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>
<p>Smart larmdytt 890kr En enhet som används för att styra larmsystemet. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Smart rörelsedetektor 1790kr En sensor som detekterar rörelser i ett rum. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>	<p>Möbeldetektor 890kr En sensor som detekterar rörelser i ett rum. Den är förbunden med huvudenheten och kan användas som ett självständigt larm om det behövs.</p>

Elderly care
Apartments
Social housing

The new customer

In discussion with Minut there were three possible paths to choose for the following journey that would decide on the outcome of the project.

Elderly care would focus on a version that would preferably be permanently installed in senior living homes. Social housing would target low income rental apartments and be a cost reduced version with minimized features.

Apartments were the most promising since the other ones would mostly be focused on cost down/installation systems and not so much form and personalization. I also saw the apartment path to be the one that would gain Minut the most, to reach a bigger target group and mass adoption, and be closest in the time line. Since this also was the most general path it could of course cater for other paths as well. Rather than the early adopter or tech nerd the new target group would be the person that just wants the product to work out of the box and be able to trust the product to help when its needed.



Apartment

Urban city, Sweden

25-40 years

Target group

The decided target group was someone in the age between 25-40 years old, living alone or with others in an apartment in a urban city in Sweden. The age range between 25-40 years consist of the largest percentage of all apartment owners in Sweden (SCB). Second I narrowed it down to Sweden and urban city's since that's where I could conduct interviews in peoples homes. This was also the preferred geographic area of the company.

During the past years there has been a slight increase in apartment burglary. 8080 of all burglaries in 2016 were reported by apartment owners, (BRÅ, 2016). When crimes like these increase, the worry that someone would break into one's home augments as well. It was shown in the statistics from BRÅ that they worrying of all crime has gone from 19% in 2013 to 29% in 2017.

It is not that common to hear that people has an alarm system in their apartment, which was why I wanted to make further research into this area, to find if there existed tailored security alarm systems for apartments.

These where the two main reasons that made the apartment living people a target group worth investigating.

Interviews

To better understand potential users and people's general view on security it was necessary to talk directly to people to continue the project. I chose to use interviews as the research method to gain deeper knowledge of the new target group. The participants were chosen according to the criteria of the target group. Questions were formulated to get an understanding of people's view of security and the people's home situation. The goal was to get a deep understanding and gain qualitative answers, therefore the questions were quite broad and not leading so the participants would start a discussion rather than give a single line answer. Most of the interviews were conducted in people's homes and otherwise through phone calls.

9 Interviews

4 Stockholm
3 Malmö
2 Lund



Common and important denominators:

2/9 Thought about getting a home alarm for current or new apartment.

Most like multi functional devices, like the computer or mobile phone.

People is the reason another person feels either safe or unsafe. / Familiar situations or people are what makes people feel safe. / Most feel safe in other people's presence.

Of all accidents that can occur in an apartment, people are most worried about fires. They do not feel like a leaking dishwasher would be devastating (someone else would fix it).

There is a slight worry in that devices can cause accidents. / Some are afraid that alarm accidentally goes off (hence a reason not to have one).

Most believe that neighbors would help out if something bad happened.

Most believe that security is the same as feeling safe.

Most believe they live in a safe area and therefore the risk that something bad happens is low. / People are generally not worried that something bad would happen, but takes reasonable precautions.

Some feel unsafe when they do not have control over a situation.

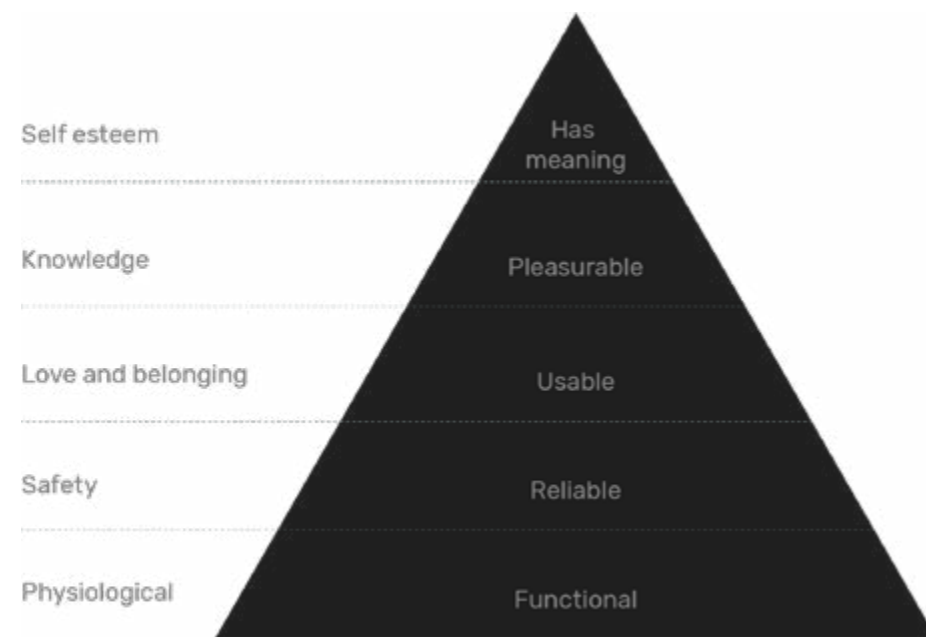
Most want super clear feedback if something happens, otherwise it creates extra uncertainty.

People interested in alarms owns the apartment they are living in.

They want an alarm to be very simple and user friendly.

Summary of the interviews

In summary, the result of the interviews were that people feel safe in other people's presence. Other common denominators were that they felt safe when they had control over the situation. Quite few of the participants understood the benefit of a home alarm since they cared more about the people in the home and not their belongings. They could see a benefit with having a home alarm system that would give them added value other than the basic functions, still being a very simple and user friendly product.



Human needs in products

Above is a slightly modified Maslow pyramid focused on products (Ruston, 2017). This could in many cases be used as a guide to validate the meaning for the user of the product. Since Minut already established a functional and reliable product, it was the higher needs that had to be address. The people that were interviewed were both interested in home decoration and interior design and express themselves through products and furniture in their home. They were all interested in if buying a smart home alarm, that it would give them something more than just being usable.

Self-expression

For some people, the interior of our homes are equally as important to what we wear every day. It is a way of self-expression and it is showing our personal lifestyle to ourselves, family, friends and guests. We purchase home decor to set our own touch and feeling in the environment we spend the most time. However, some technical products are a necessity and we buy them for their function rather than the design. How many proudly show their Wi-Fi router on display? Some technical products like expensive TVs or Hi-Fi systems have become a way to show our wealth. And other products like computers or smartphones have brands like Apple that have established an almost cult like following. So how do we select products that we add in to our homes? People tend to choose brands or products that they believe are appropriate for their self image (Cătălin, Andreea, 2014). In some technical products and especially for IoT products, I believe that this has been neglected and that the products are developed for their function and to an affordable cost.

The aim with this Master thesis is to explore new areas of possibilities, solutions and design for the next generation of Point. This targeted towards 25-40 years old living in apartments in urban cities, Sweden

Refined brief

After the target group was set, the brief was refined and included the target group to have a more defined goal. It became the words on the left.

It also became apparent that a brief was not enough to see this project through and solve the bigger problems, a general vision for future IoT products was needed.

A vision for the future of IoT

Today there are many discussions on privacy and data collection. Much less is focused on the physical products and the visual clutter and attention they require. Cities and digital media are overloaded with various advertisements. This has for some cities become the general standard, and we are almost wherever we go bombarded with visual impressions. If this continues, a virtual reality may become our reality to escape from the visual overload.

In the interviews it was shown that in our home we want to feel protected and relaxed, we want the interior to match our personality and not overwhelm us. In order to cater for the future target group a shift was needed from technology to user focus. The user should shape the technology and not the other way around. This is what could bring real value and distinguish it from other IoT products and gimmicks.

In order for IoT products to become mainstream in a balanced way they need to reach beyond the technology. The customers need to clearly understand the value of the products and they need to be seamlessly integrated into their everyday life (Ortiz, 2017).

Although impossible to predict the future, with a vision and a goal it is possible to be a part and shape the future. We need to adapt the users and society through design. We can not either only focus on the interaction between users and products but we need to consider the future of humanity and its society as well.



Ambient

/ˈambɪənt/

Adjective

Relating to the immediate surroundings of something.

Ambient products

In the same way ambient music can set the mood or create a feeling without barely being noticed. Technical products should not be invisible but rather become ambient, thus blend into an environment in harmony but not go unnoticed when needed.

A vision for these kind of ambient products, especially in the IoT sphere is needed in order to not overwhelm future users. How can a designer help with this? Through what means? These were some of my questions during the project and my answer became: through the design of the form and the user interaction.

In this case the products should relate to their users and to the user's preferred location of the product. Not being invisible, but noticed when needed and wanted, therefore being ambient in one's home.

03. Exploration



Brainstorm

With the vision in mind I started exploring functions and features of the product that could bring added value to the customer. The earlier conducted interviews had brought me a good understanding of the potential customer and what the needs could be. In previous versions of Point the company had an aim to include as many sensors and functions as possible to cover possible scenarios, although not as confusing as competitors it was clear that there was a gap in the usage between the old and new target group. Functions were not needed to be maximized but rather streamlined and easily understood.

From the interviews it was understood that people felt safe in other people's presence or when they had control over a situation, it made me think that Point could be that person or that Point could connect people in a new way. It was clear that Point needed to provide the user with clear notifications of the situation and with actions what to do. In order for the users to find value in the data rather than feeling confused about it.

Here it also became clear that satellite (remote) sensors were not preferable to the users since they want something super simple to use, therefore I believed everything needed to be contained within one unit even though it could limit some potential functionality.

In order to cater for these users we need to shift from technology to user focus. User should shape the technology and not the other way around. This is also what could bring real value and distinguish it from other IoT products and gimmicks.



Health aspect

Through the interviews it became clear that people care more about the other people in their home rather than the objects or the resident itself. Therefore, I wanted to slightly shift the focus to personal health and see what could be done there to add value to the product.

Personal health has become a social trend and people are becoming more aware of their health and wellbeing. The home is where we, especially children spend most time, which is why it is interesting to know if it is a good environment to be in. Sweden has the luxury of quite high air quality outdoors, what people might not know is that the indoor air quality can be quite different from the outdoor air quality. How would resident owners know if they need an air purifier indoors? The effects of bad air quality might appear several years later.

The health effects caused by air pollution may include difficulty in breathing, coughing, asthma and long time effects depending on particles. CO₂ levels can be 3x-8x times as high indoors. Drowsiness, headaches, breathing difficulty and nausea are a few of the symptoms, and one's cognitive performance can be reduced by up to 50%. The Point app should show some quality index or comparison to the average (other users or country data). Measuring and showing it in a simple way could be a grand added value. (Allen et al., 2016).

After further research, my suggestions were that Point should not only warn about the home's health (such as fires or water leakage), but also warn the people living in it. In addition to the existing sensors, a multi functional volatile organic compound (basically invisible but sometimes smellable gases) and a CO₂ sensor was to be added.



HUMIDITY

Avoid excessive humidity in your house



AIR QUALITY

Learn how to reduce indoor air pollution



NOISE

Monitor the sound level to achieve a good night's sleep



TEMPERATURE

Make sure the temperature is right for you, day and night



Home health research

My market analysis of IoT products that measure ones home environment showed that Point had similar technical specifications but showed the output data in a different way. The only sensor lacking in point was something to measure air quality (volatile organic compound and CO₂). This was easily implemented in the hardware but needed to be communicated better to the customer. Factors point to that air quality might be the next trend within personal health (Anzilotti, 2018). And although the air in Sweden is generally good, there is research shown that air pollution must decrease in towns and cities (SMHI, 2010).

Friendly

Warmth

Reflecting

Mood boards

I created mood boards to function as inspiration and means to communicate visual concepts to the interested parties. To gain the most from the mood boards I created three value words that reflected the company and the vision for the next generation of Point. Then I developed three mood boards to present to the company for evaluation and to explain what aesthetic vision would be best for the product vision.







Final mood board // Friendly, Warmth, Reflecting



Mood board conclusion

The Soft Tech mood board inspires and encourages an interaction with the product and has a visually very warm and friendly feel to it. The New Nordic mood board is something seldom seen in tech products. This is a style that has become ordinary in Nordic interior design lately, but not many companies have taken their products to this level yet. Finally, the refined Tech reference is a more refined version of purely functional products that are very technological and have a stylized and minimalistic impression. These parts are to stabilize and keep a clean and simple product.

After an introduction and discussions with Minut regarding the three mood boards, it was agreed that a combination of the Soft Tech and New Nordic mood board was preferred, the final mood board. To illustrate and visualize this feeling, I concentrated it to these words: friendly, warmth and reflecting. The three words I chose are values that should become apparent in the final product, in order to follow the new vision. The values are to create a product that is perceived as friendly and has a warm feel to it. This was important because I wanted to create a product that is perceived as a family member rather than as a plastic shell. It should be reflecting the status of your home and the people in it, but also thinking and analyzing and providing trustworthy data. In summary, I saw something unique with an IoT device in the New Nordic style, as well as to bring the product closer to a furniture look and be a part of the interior, rather than something you want to hide.

Constraints

The journey from the mood boards to the final concept was not a straight one but a bumpy road with a few blind alleys.

From the beginning the idea was to incorporate a smoke detector in the unit, this was a huge constraint due to regulations, placement and interaction of the product. And quite late in the form development this was revised and the constraint was removed since similar function could be constructed by combining the alarm recognition function through an existing fire alarm (which apartments in Sweden are required to have) and temperature sensor to provide an accurate function and alarm to the user.

Removing this constraint did minimal impact on the user experience but opened other types of placement and a huge cost saving in terms of r&d and certification costs for the company. This decision also rendered the outcome more in line with the general vision of the project. The smoke detector unit required a big internal volume and this could now instead be used for extra battery capacity. Time was put on metal mesh development and other certification requirements were researched, although the time did not feel wasted it was later not shown in the end result.

Point uses a PIR (passive infrared) sensor for motion detection. Therefore another big constraint was the front lens, since infrared light needed to pass this part it was very limited in material, color and texture. KUBE AG is a well renowned manufacturer of IR transparent lenses and raw material, and after some research it was shown that a white, slightly opaque, special plastic had to be used.



Placement

Placement was important not only for the function but also for the user interaction. After removing the smoke detector unit the new Point could be placed more freely. The main placements would be on the wall or on an existing surface like a table or bookshelf. And still be possible to mount in the ceiling if the user would like to. But best would be close to face height since that gives the most accurate CO₂ readings and the most convenient physical interaction.

Interaction

Due to the new types of placement of the product, different ways of interacting with the product had to be considered as well. Internal voice and gesture control among other concepts were evaluated but showed an increase in either price or complexity and for this concept they were disregarded. Although no longer would the interaction be only through the app but Point would be able to communicate coloured light and the user would respond by touching Point, using the existing app or connecting it to third party services.

The current app offers basic functions such as settings, alarm toggle, family/friends communication and data overview. From my research the users did not want more advanced app interaction, thus I decided not to focus on the digital interface but rather the physical user experience and product. The company was already in an internal process of giving the app a new interface and my help was more needed in developing the physical product and the interaction with it. The existing app would keep its functions and other interaction had to be designed in symbiose with the app.

Therefore the following functions were needed to function without app interaction: get visual feedback of Point's status, toggle the alarm, and send notifications to family members. These were the functions that needed to be implemented and upgraded in the physical product.

The visual feedback would be through three different light indications that would show when someone enters the home. One would be a simple welcome and show that everything is okay, the second that something could be wrong and the user should check the app, the last one would show danger and that immediate action is needed. When presented with the last scenario the family group would automatically be notified in their apps. By enabling settings, emergency services could also be directly notified after escalation.

In a normal scenario Point would automatically enable and disable the alarm by detecting the presence of your phone. Due to the reason that you can forget or lose your phone, the new Point will have a touch surface instead of having a physical button to toggle the alarm. This would allow a burglar to do the same, hence touching or moving the Point would always notify the family group.

By touching the front surface of Point after disabling the alarm one would also be able to send a notification to family members by touching the Point, for example children that come home from school to notify their parents. All the interaction could also be connected to voice control devices like Google Home, Alexa and Siri through protocols like IFTTT and Homekit. This would open possibilities for visually and physically impaired people or when a Point is placed in a hard to reach location.

04. Development

Ease of manufacturing and assembly

These are the parts that the previous Point consists of. As one can see there are a large number of separate parts for such a small unit, which partly drives up the manufacturing and assembly cost. In my development process I kept in mind to focus on a device which could easily be assembled and discarded, and hence consist of recyclable parts. A product consisting of fewer parts, will reduce energy consumption in the manufacturing process, which is why this has been taken into consideration. This would naturally also reduce the cost of the product.

The new design featured a single PCB (printed circuit board) that all electronic components could be attached to. Two standard 18650 battery cells with a capacity of 3000mah each (instead of a custom battery pack of 4000mah) were mounted directly with battery clips. This enables easier manufacturing as well as recycling of the product.

Due to the potential quantity of manufactured units, material choices were limited to standard injection molding plastics.





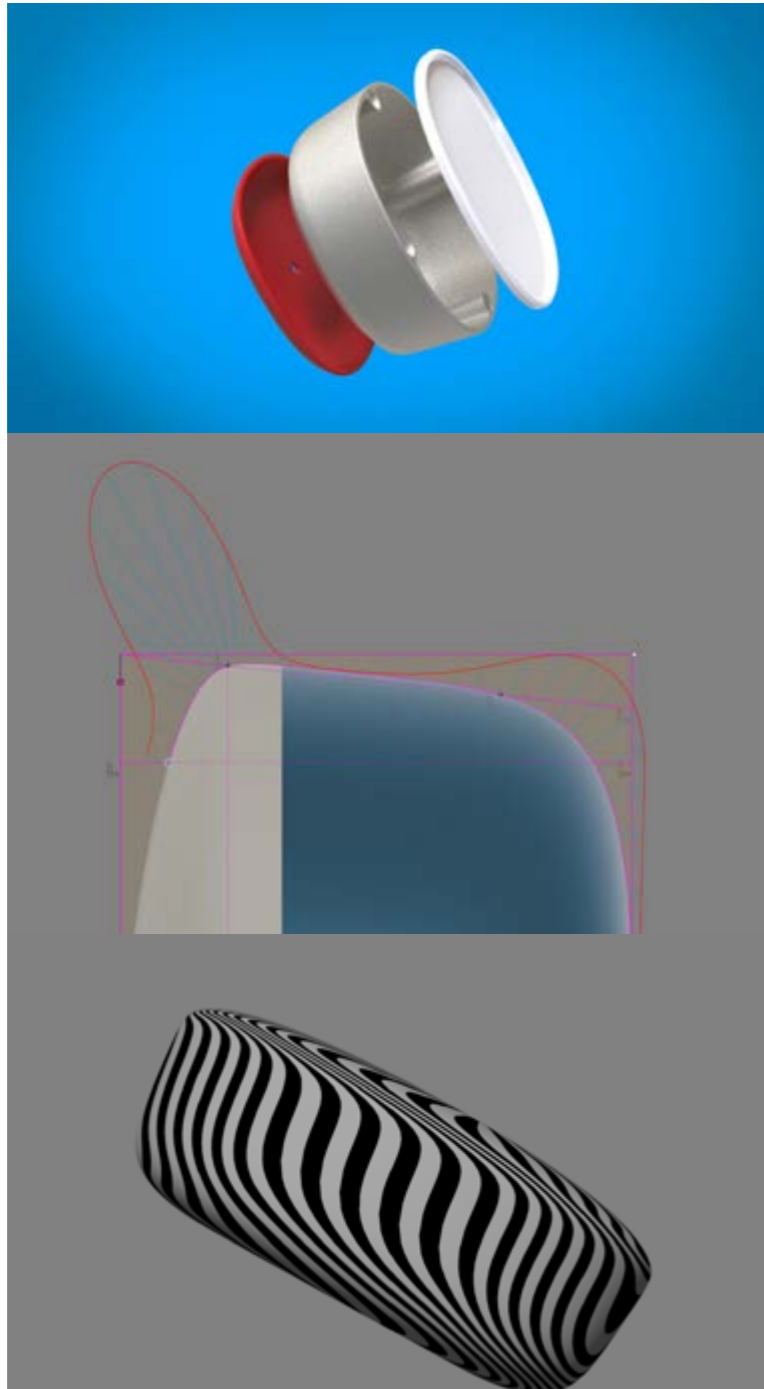
Form development

The form development was a constant balancing act between the physical aspect of fitting the internal components and the visual impact and the perceived size of the product. And later details like charging and mounting options. Manufacturing and assembly was considered through the process as well.



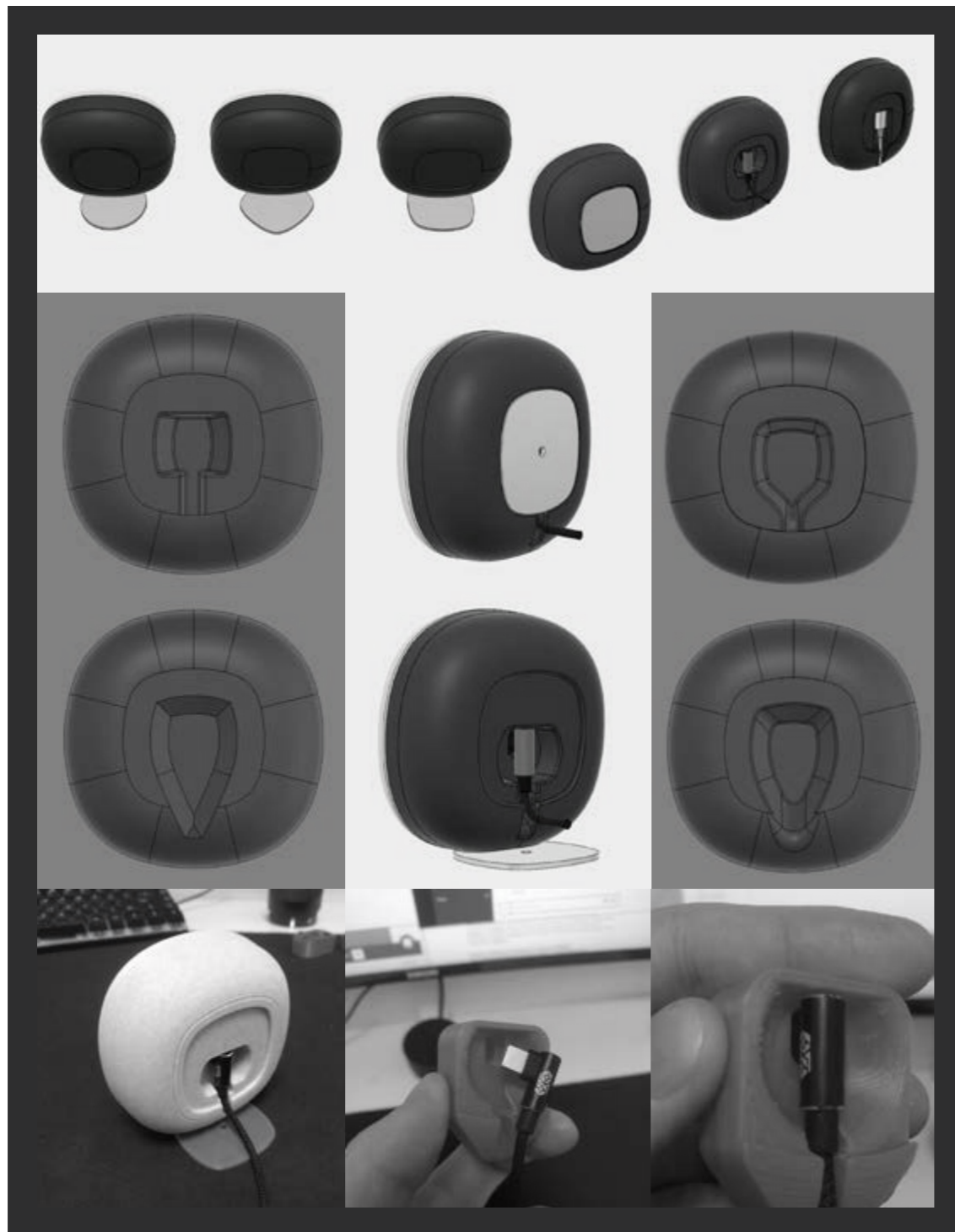
First mockups

The first mockups were based on similar volume as the previous Point since I knew there had to be room for similar components. Me and Minut liked the concept of a tetrahedron shaped version for it's possibility of an unique corner placement and ability to blend in. This was however not in line with the vision and the smoke alarm criteria, this would also offer the least internal volume and thus the squircle shape was favored. The squircle (black in the pictures to the left) was a optimized shape for internal volume, that was critical for battery capacity. And it still offered work to be done on the spline contour and other refinement areas. This was the shape I proceeded with to refine. Other shapes were disregarded due to placement difficulties and internal layout limitations.



Form Refinement

The shape was then refined in order to be curvature continuous and easy to manufacture with injection molding. The most important aspects here were draft angles, uniform thickness and avoidance of multi split line molds.



Charging port and mounting plate

Since it was desired for the USB cable being able to charge the Point whether it was mounted on the wall or standing on a surface, an angular contact was chosen since it acquired the least amount of space and also allowed for a simple injection mold. It also made it possible to internally use a single PCB. The problem with this solution was that it used a bit more internal volume due to the recess in the back of the model. The contact could not longer be removed by pulling the cable, but a recess had to be designed to use minimal internal volume, and still provide easy access to remove the cable. While still being able to provide cable connection in all positions. It was also desired for the mounting plate to be the same for wall or surface mounting and a magnetic metal plate with the same outline as the overall shape was designed.

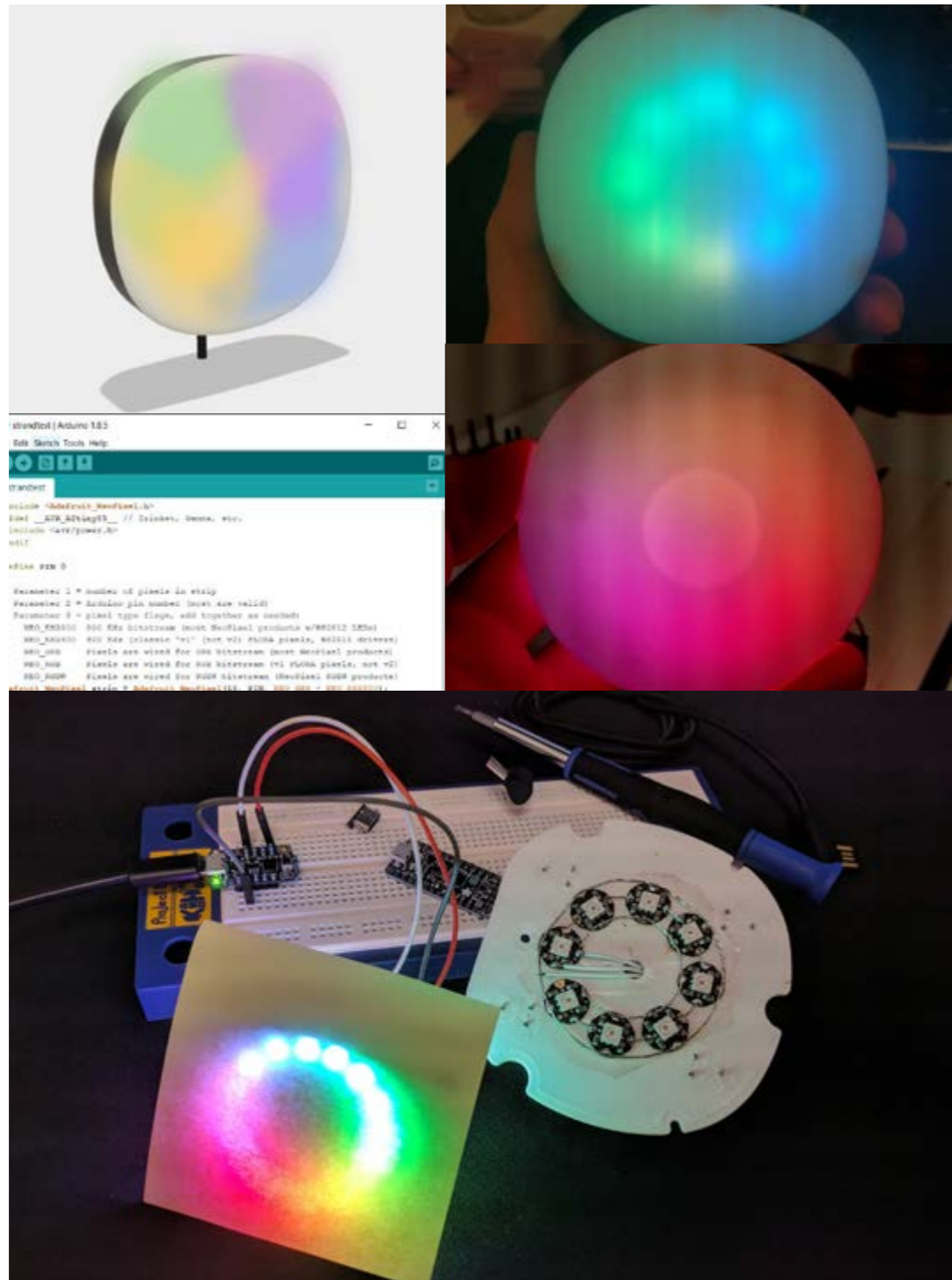


Colors and finishes

Since the front lens color, material and finish was already decided, the main body and mounting plate was the parts that needed refinement within this area. The mounting plate was made white with a matte coating for the reason that it could be attached to the wall and when the Point was removed for charging or other reasons the plate would match most common wall colors. This would later in production be a powder coated steel part, due to the low cost and high manufacturing capability.

The main body was more complex since the goal was to follow the set vision and differentiate from the white smoke detector plastics. Due to the lens being in a different and white plastic it would be quite difficult to color match the main body (that had to be another plastic material for structural ability). Thus other colors as shown in the picture were considered. Electroplating would be one option to make the product feel more exclusive, since this is a quite expensive option it was disregarded. Due to the soft and friendly form language any bright or pastel color were associated with childish or too playful products. Gray or half tinted colors felt dirty or misplaced in contrast to the front lens and thought environment. Therefore a matte dark grayish blue color was chosen for the prototype to the reason that it provided a feeling of being exclusive, calm and trustworthy. and it was a color that would be able to blend into most environments. This could and should easily be a bit more carefully user tested closer to production. Since it's very hard to predict plastic color in renders or by spray painting.

The mounting plate was decided to be white since it would match the majority of walls.



Electronics prototyping

The status communication through LEDs in the front surface was important. With custom arduino code a Trinket micro controller and WS2812 LEDs it was possible to make a prototype to evaluate light diffusion, animation and luminosity. This enabled control over all the above requirements. Distances, number of LEDs and diffusion all made big impact on the result. The goal was to have a visual communication to the user that would not feel like simple status LEDs but rather give a sense of life and a friendly impression to the observer.



Prototype making and future manufacturing

I chose to SLS print the shell of the prototype, this was easily accessible and provided a high quality finish after wet sanding and spray painting. Later in manufacturing the main body would be injection molded in ABS plastics for it's durability and since it's one of the most common available injection molding plastics it's available custom colors and finishes, The main body shape is optimized to only require one split line and has draft angles on all surfaces, The mounting plate needed to be magnetic and have a quite high tolerance, therefore it was cnc-milled from 2mm steel sheet, in mass production this would be, stamped or laser cut from the same material and then tumbled to deburr the edges and also powder coated in a matte white finish. The lens was only sanded and clear coated to keep its transparency for the led's. This would in proper manufacturing require precise injection molding in a IR transparent HDPE plastic and incorporate Fresnel lens elements for the motion detection. Magnets were embedded in the main body and lens part to easily open the prototype, they would not be used in a finished product.

05. Result



“Welcome home, everything is fine”



“Alarm, you might be in danger”



“Something is wrong, check the app”



Magnetic wall and table mount plate



USB-C cable for charging



18650 Li-Ion batteries

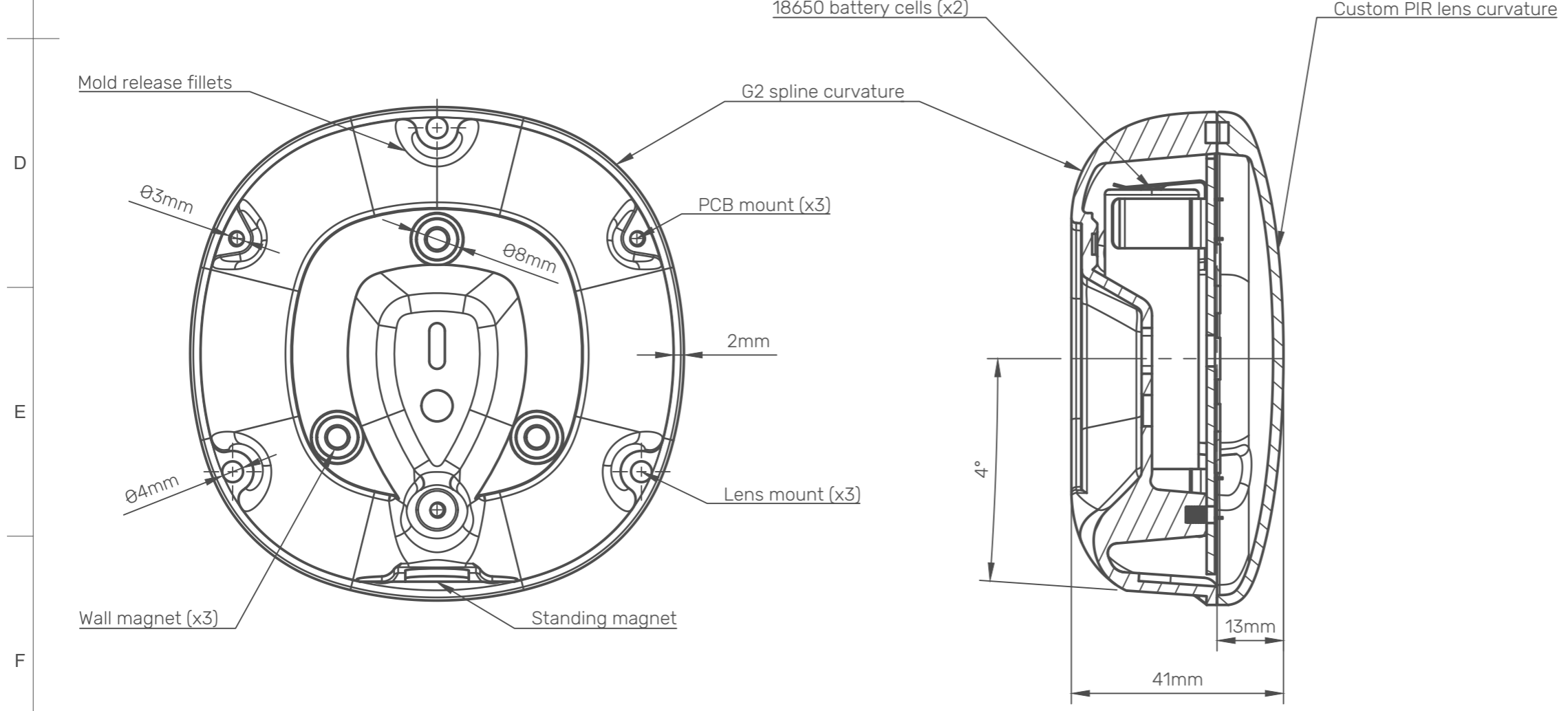
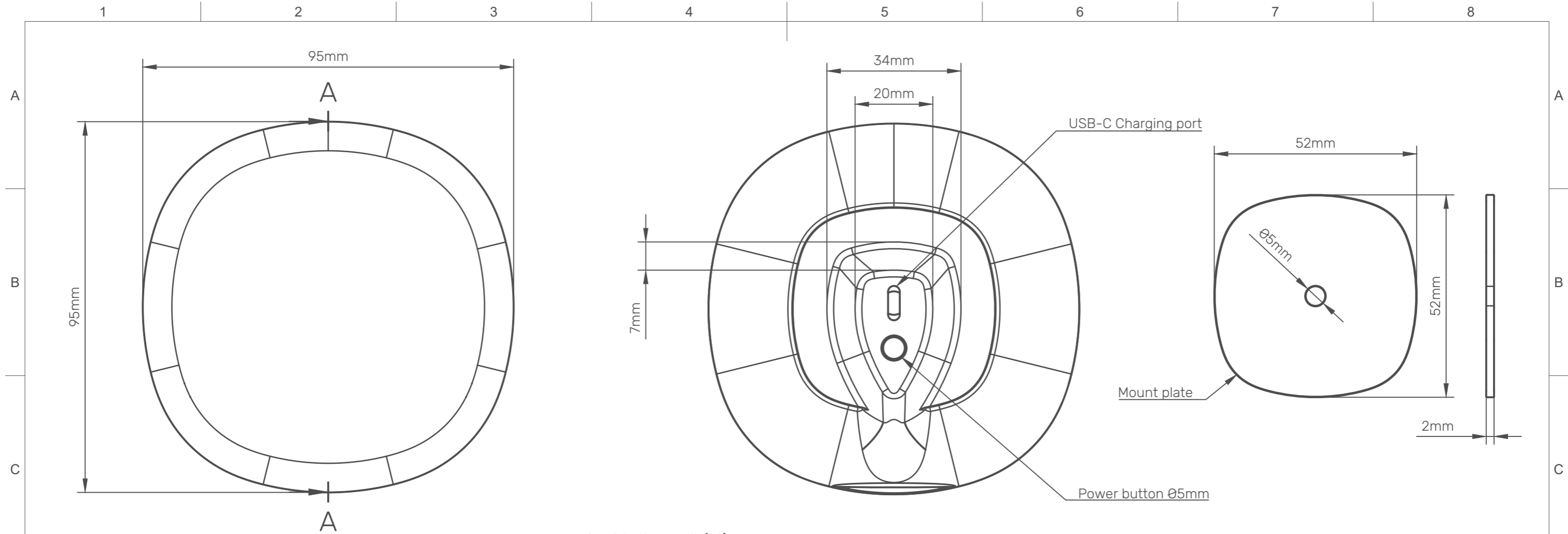


PCB (Circuit board)









Technical specifications:

Width: 95 mm

Height: 95 mm

Depth: 41 mm

Coverage: Approx. 50 m²

Battery: 6000mah, rechargeable

Features:

- Motion detection
- Sound (Alarm & window break)
- CO₂ & VOC (Volatile Organic Compounds)
- Temperature
- Humidity
- Tamper Detection
- Siren
- Speaker
- Bluetooth
- Ambient light
- IFTTT & Homekit compatible

06. Discussion

This process has covered the future of IoT devices from a design perspective. In order for consumers not to be overwhelmed by the visual aspects of home IoT products an ambient approach was taken for this project. The goal was to make a close to production ready home alarm product, I believe that was achieved to a satisfying level both for me and Minut. However, in retrospect, the following parts could have been taken into consideration.

Since the interview questions were broad and not necessarily specific around home alarms, I felt that a second round of interviews could have been beneficial to evaluate the user experience and functionality further.

Various technical details in the final product were left out intentionally, such as snap attachments for the lens and light guides for the LEDs. However they are standard details and easy to implement closer to production by the mechanical engineer at Minut.

Since color choices are a huge subject on its own, it was quite simplified in this project. My means of testing were limited to renders and spray painting and thus the colors of the final product could and should be more carefully selected with user testing. It should also be tested with samples or in production to get a more accurate representation.

Further, I did not develop any UI or UX aspects in the mobile application. Minut was already internally in progress with a new release of the app, therefore my intention was to leave the app out of this project scope. I still had some ideas and suggestions around the UI/UX. For instance, the interface should be developed to mirror the personal health aspect and show values instead of pure data and numbers. Not only for the added sensors but for the existing ones as well. One such example could be to give the consumer information about high, low and average levels of indoor CO₂ or humidity, and also to give the user recommended actions if needed.

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