CROWNSTONE:
THE FUTURE OF OUTLETS

TEAM A5

FINAL REPORT FOR UXAD
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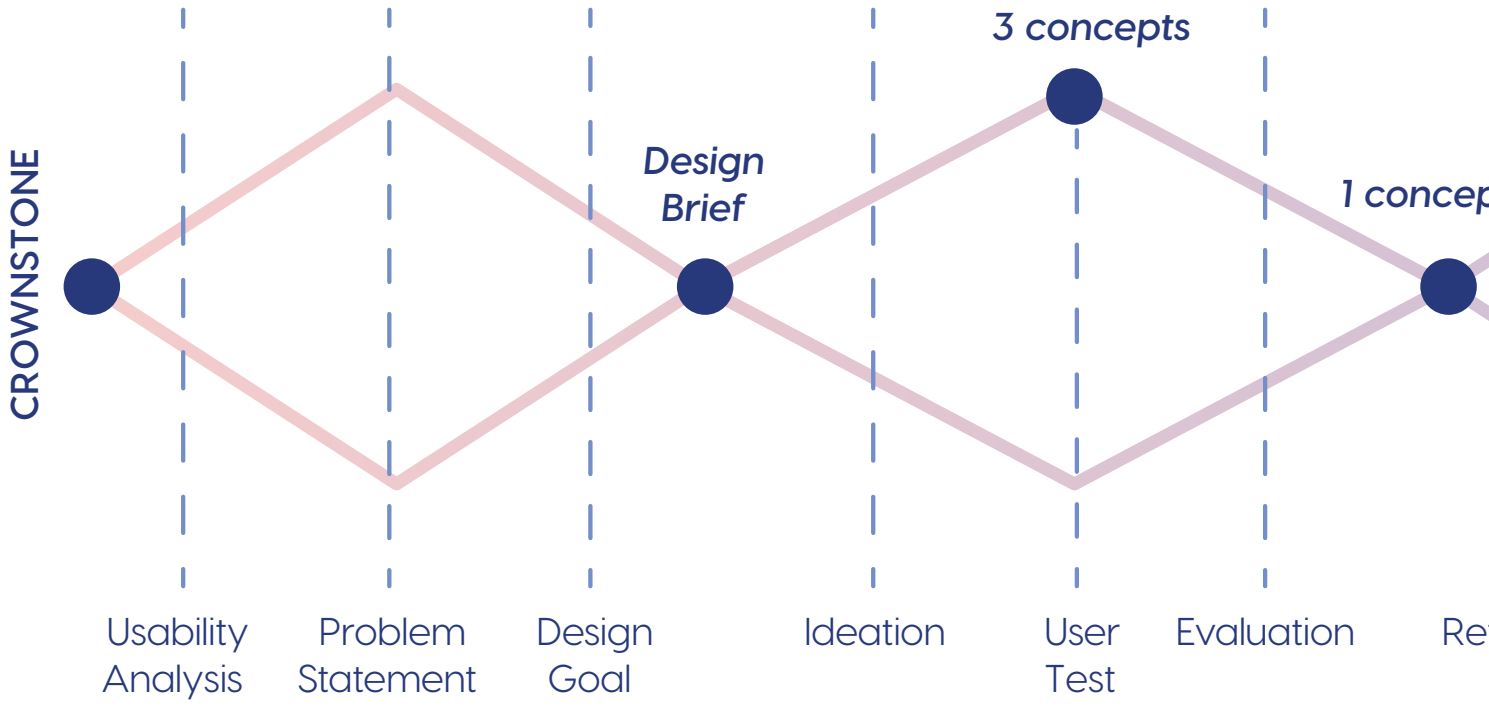

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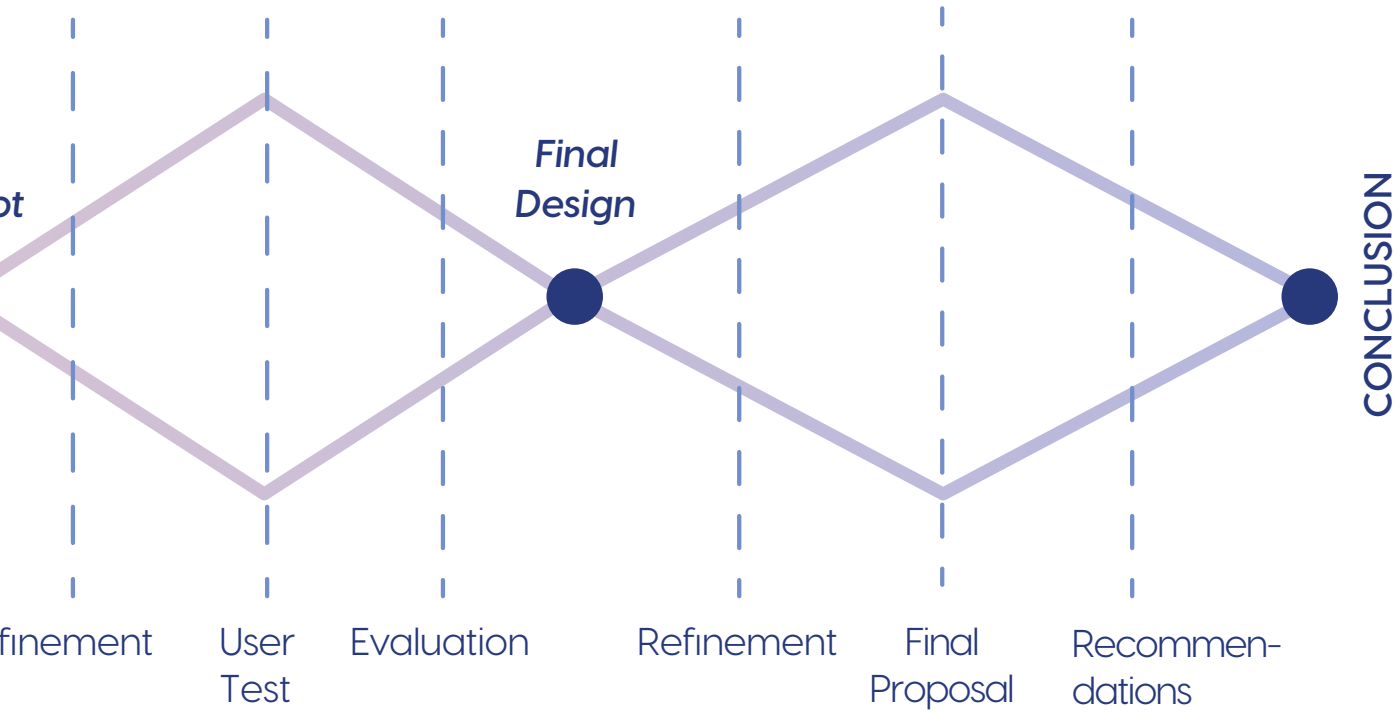


EXECUTIVE SUMMARY

Crownstone is a company that produces smart plugs to create an automated home experience. The plugs connect with Bluetooth to an app for smart devices (like a smartphone). With the app, users are able to control the outlets in their home. In order to improve the current product and create a richer and more personal experience, a design team of the Technical University of Delft has set out a redesign with the focus on the user.

The new concept for the Crownstone app and outlet was created based on a few essential properties of the current product that were defined as opportunities to improve in terms of usability. The focus was switched to emphasizing the comfort of the user and creating a more personal approach. The product can offer a range of complex technological possibilities, which makes it hard for the user to know and understand the jargon used. Firstly, the technical potential needs to be translated into features that are beneficial for the user. Secondly, hierarchy needs to be implemented in order to offer the user more guidance in usage. Besides the design of the app, the physical outlet needs improvement to give the user feedback about the connection with the smart device and to show the state it is in.

At the start of the iterative process, three redesign concepts were created. The concepts differed in the amount of guidance that they provided the user. This is described in more detail in Chapter 4. From a user test was concluded that different aspects of the redesign concepts were useful and this formed the base for a second redesign phase in which was converged to one single concept.

In the preliminary design proposal the functions and features of the system are introduced to the user when the app is opened for the first time. After landing in the home screen, the user can choose to watch a tutorial. Personal information can be added to improve the performance of the system. Besides watching their power consumption, the user can also set behaviors of the system. Behavior are settings or timers that initiate when devices will turn on or off.

This preliminary concept was assessed in a user test. Based on the results, a final redesign proposal was generated. Suggested improvements on the previous concept are to integrate an AI that will learn from the users habits and will set the system accordingly. Another advice is to improve the tutorial and create steps for the user to perform during it. All suggestions and recommendations, can be found in Chapter 6 and 7.

The final design is more user friendly and intuitive then the current product, accompanied by an upgraded outlet with more feedback. In the ideal situation the users don't need to carry their phones around in order for the system to work, because of the integrated AI. The system could be connected with multiple smart home products that also give input to provide a more comfortable way of living at home.

INTRODUCTION

This report describes the redesign project to improve the Crownstone product, produced by a company named likewise. The product is in the field of home automation and consists of a plug. With a smartphone, outlets and devices can be controlled, which provides ease and comfort. The product also helps with getting insights in power consumption.

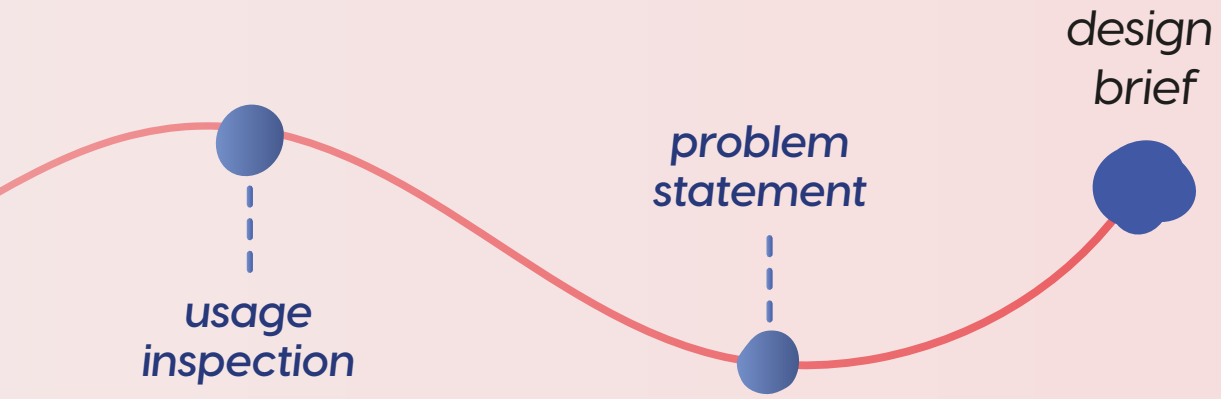
The current product is analysed and the findings are shown in a complete overview (see Chapters 1 & 2 of this report). There are some aspects of the usability that need to be improved in order for the user to experience the benefits and comfort of the Crownstone product. By this the product will become more mature and will be much more user-friendly. Crownstone can then start distinguishing itself from other competitors in the market.

In order to solve the usability problems, a team of five students was formed to work on the redesign of the product. The students are currently in the Design for Interaction Master program at the faculty of Industrial Design Engineering at TU Delft. The concepts developed by the team were evaluated in user tests and this was used as input to improve the redesign. The redesign was evaluated in mostly qualitative user testing. The process with all results and designs, will be discussed in this report.

READING GUIDE

This report will first explain the product and company in more depth. Furthermore an analysis of the current product will be executed, which will lead to an evaluation and a design challenge which is formulated in the design brief
Based on this design goal, the first three redesign concepts will be introduced. They will be evaluated through a user test and the results of this will form the input for another redesign concept. Again this design will be assessed with the help of a user test. All the information gathered until that point will be translated into a final design. The report ends with a reflection in which recommendation to the company for further development will be given.

STAGE 1
Anaylsis and Assessment


design
brief
problem
statement
usage
inspection

01.

CROWNSTONE:

COMPANY AND PRODUCT

This chapter introduces Crownstone, the company and the product in all its relevant aspects. Including how the product functions and information about the market in which the product exists. We will explain Crownstone's main features and core user interactions, our initial experience with the product, observations and interviews at the Crownstone company. Consequently, the understanding of the product itself will be presented with the context and its target group. Based on this, a Design Brief can be formulated, explaining what we want to improve, how this will be done and the user experience that is aimed for with the redesign.

1.1 CROWNSTONE

Company and Purpose

The purpose of Crownstone is making people's lives easier at home. It can take care of the user's lights and other devices in their home. Crownstone uses a Bluetooth based technology (see figure 1) with which the location of the user can be determined. Indoor positioning measures the distance between the user's mobile device and the Crownstone installed within the outlet.

Crownstone calls this indoor localization: the outlets can behave, turning on and off, based on the user location. The behavior of the outlets can also be based on a timer. In essence, this allows the user to save energy, time, and money. For example, it turns on the lights when someone enters the house and their hands are full of groceries. Crownstone can also switch off power-hungry devices automatically when they aren't used or are not near the user. In order to do so, a Crownstone monitors the power usage per outlet.

Figure 1. Smart devices can be connected to the outlet via Bluetooth.

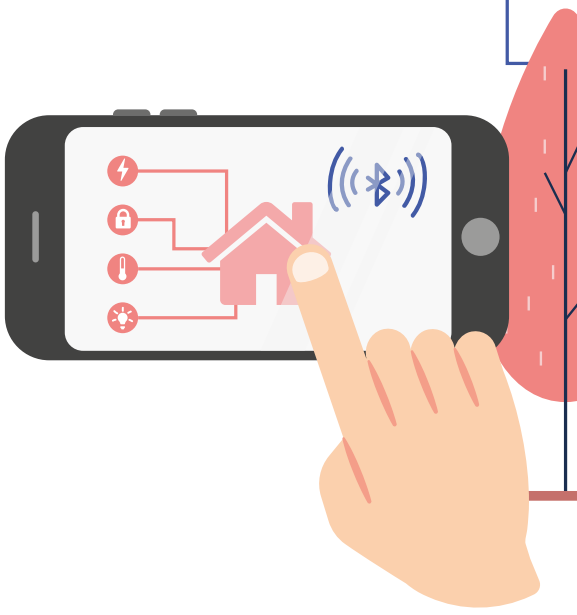
The Products

Crownstone currently offers two types of products, an external smart plug that inserts into an outlet, as well as a built-in version that exists behind the outlet. Outlets outfitted with the Crownstone system communicate with the Crownstone mobile app via a users Bluetooth enabled devices (e.g. smartphone, smartwatch). The user can then control and program these outlets in their home to behave automatically. The system is able to integrate with other smart home systems to allow for the optimal experience, including smart products such as the Toon Thermostat, Philips Hue and Amazon's Alexa.

Within the application, different outlets are visually listed and exist within an ecosystem called a 'Sphere', essentially the users collection of all their Crownstone plugs. The application gives the user a variety of control over their outlets, including switching it on and off through the app, detecting the presence of the user and reacting accordingly.

A standby killer
shuts down the outlets completely of the devices that are not being used, also when the user leaves the house.

A switch
it can turn on and off the devices in the user's house or office.



A dimmer
it can control the intensity of lights.

A presence detector
it can detect a user's presence based on bluetooth signals and determine distance.

A power monitor
it measures and tracks the power consumption of every device plugged into it.

1.2 CONTEXT OF USE

Currently, the Crownstone exists as a smart home product, but it's potential benefits could be seen in offices (see figure 2), or other business and possibly even public spaces. The systems most obviously benefits include saving money on the electric bill, and having another level of control over the outlets within a home.

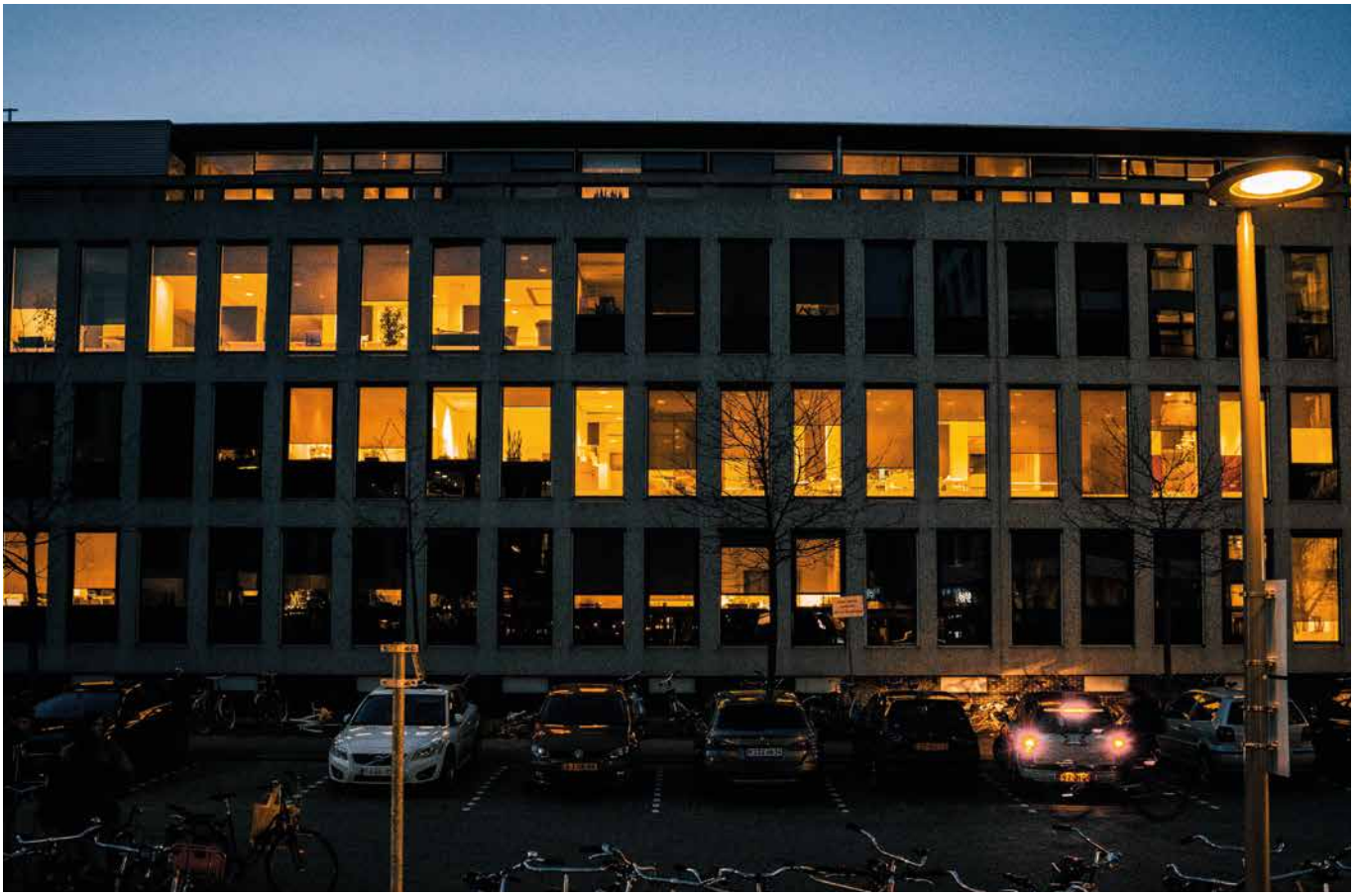
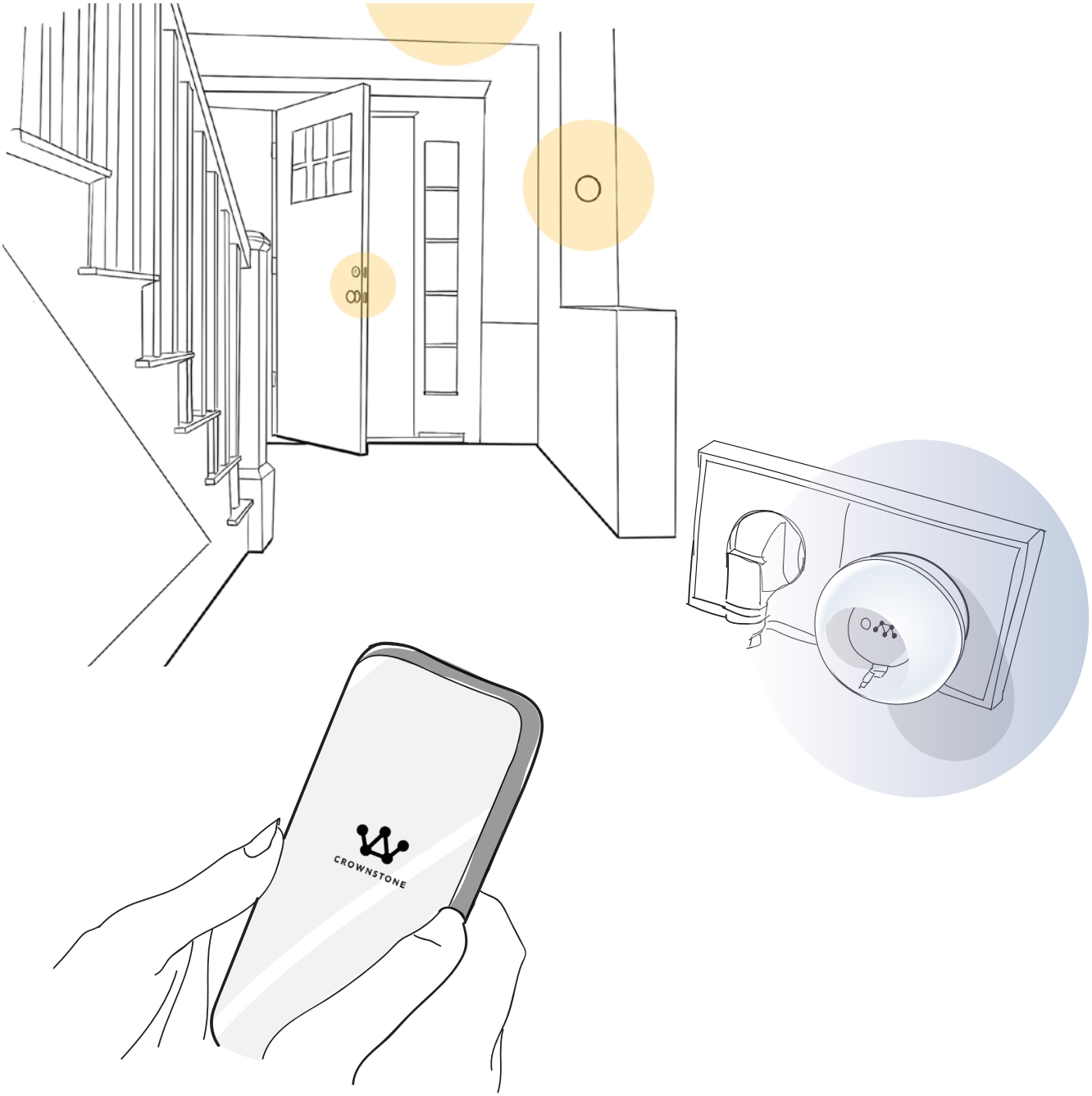


Figure 2. An empty office building with still many lights turned on.


CROWNSTONE

1.3 TARGET USER AND STAKEHOLDERS

Crownstone's current strategy is to sell fully integrated systems to new homeowners aged 30-50, ideally within homes having 20+ plugs. They are also working with real estate agents to sell newly renovated homes outfitted with a Crownstone system.

Stakeholders include other smart home systems Crownstone is able to integrate with, which currently include the company Toon, a smart home heating system. Future stakeholders might also include individuals or companies that would benefit from automated power saving, such as hotel or owner of a bed and breakfast, as well as wherever remote control might be necessary.

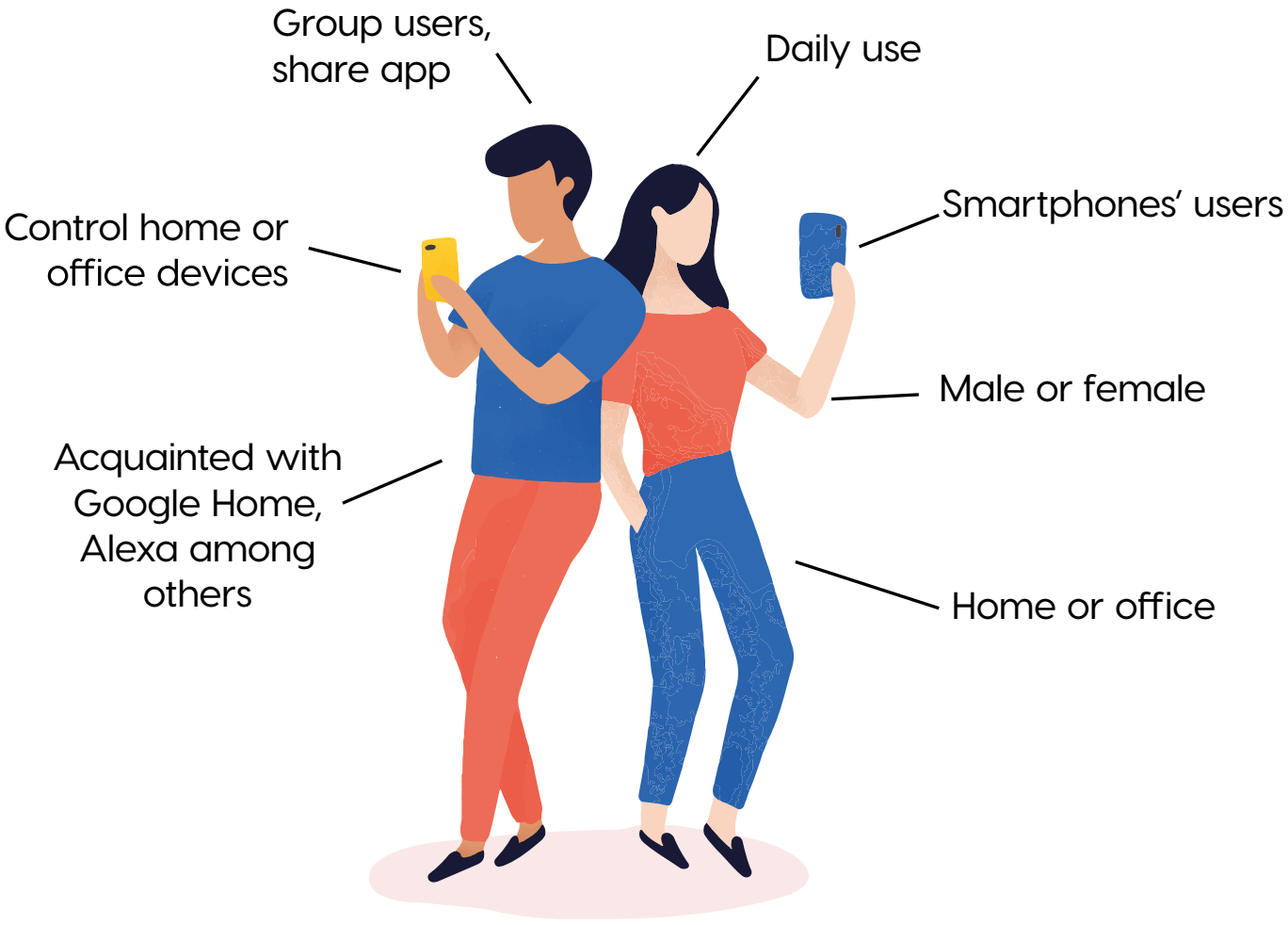


Figure 3. Stakeholders and their characteristics.

1.4 SCOPE OF THE EXISTING MARKET

The smart plug/outlet market is saturated with well known and trusted brands that offer cheaper products than the current Crownstone, and that are capable of integrating with multiple systems. For example Amazon's Smart Plug integrating with Amazon Alexa, 3rd party plugs capable of communicating with Google Home (hardware + application) and Apple's Home (application). Due to the extremely competitive nature of the market it is crucial for the brands to tackle a niche, and portray clear advantages over the existing products in the market.

AVERAGE SMART PLUG

Price between €20-30

Connect via bluetooth or Wifi, with an app.

Features controlling devices (turning on/off)

XIAOMI SMART PLUG

Price between €16,45

Connect via Zigbee, with an app.

Features controlling devices (turning on/off)

AVERAGE SMART MOTION SENSOR

Price between €20-40

Connect via bluetooth, Wifi or Zigbee

Features: detect motion, can turn on devices when people enter a room

Total costs €100-160
(for a minimal working system with 4 smart plug and 1 sensor)

XIAOMI SMART MOTION SENSOR

Price between €14,10

Connect via bluetooth Zigbee

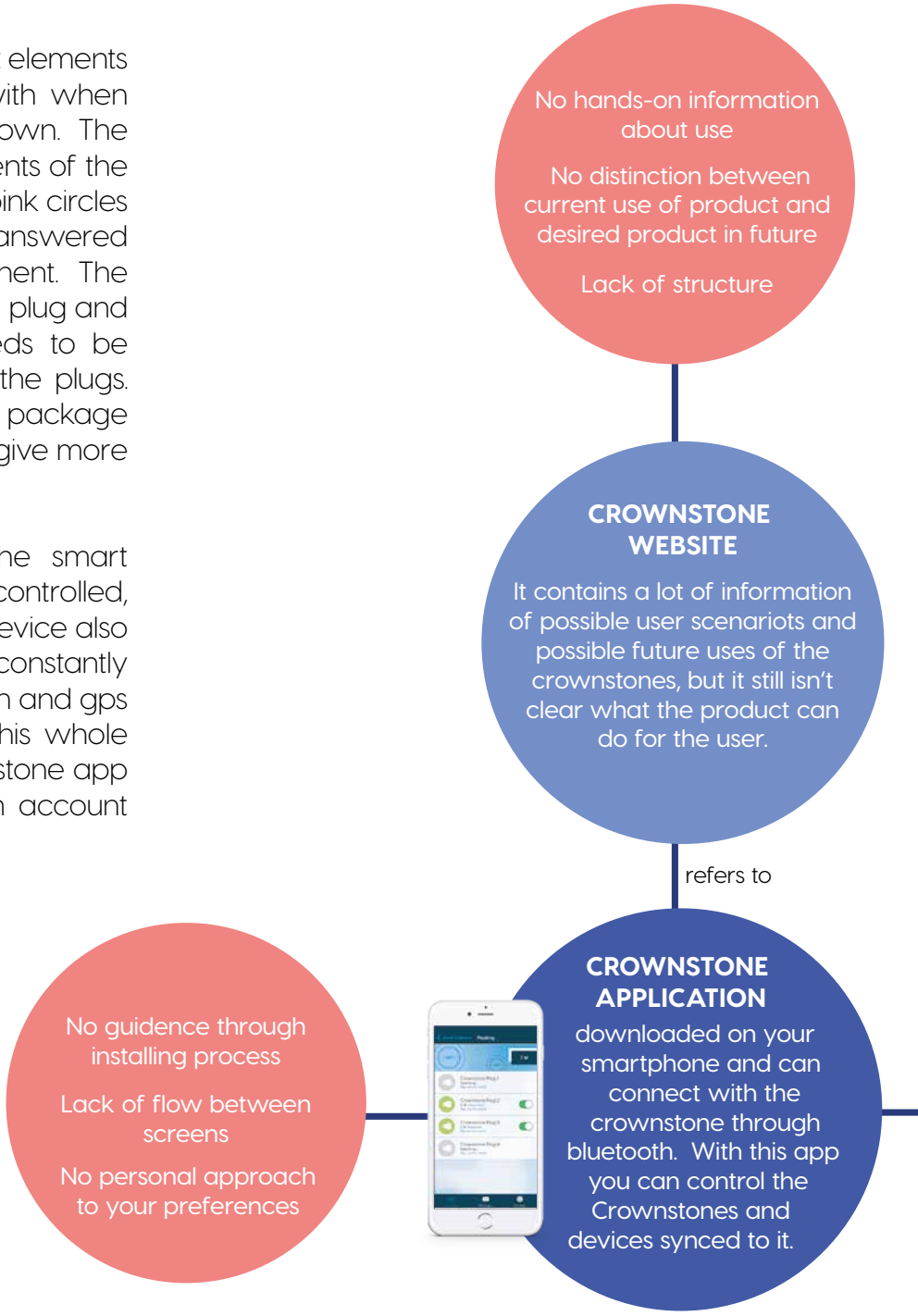
Features: detect motion, can turn on devices when people enter a room

Total costs €79,90
(for a minimal working system with 4 smart plug and 1 sensor)

1.5 PRODUCT BUILD UP

To give an overview of the different elements that a user comes into contact with when using this product, figure 4 is shown. The blue circles represent the components of the Crownstone product and the red/pink circles show the main issues and unanswered questions found for that component. The main elements are the Crownstone plug and the accompanying app that needs to be downloaded in order to operate the plugs. There are also elements like the package and the website, mainly serving to give more information about the product.

The physical Crownstone and the smart device from which the plugs are controlled, are connected via Bluetooth. The device also needs to track the users location constantly in order to function, for this Bluetooth and gps need to be switched on. Before this whole process can be started, the Crownstone app needs to be downloaded and an account must be created.



No hierarchy in features and functions

Too much information that isn't clear about the product

Doesn't contain a manual

BOX

The box shows a list of functions and features and function. There is no manual inside, so it's supposed to help you set up the product as well.

CROWNSTONE

Injection molded white plug with a blue line around it. Functions as an extension of your power outlet. It is operated through the Crown-stone app

Compatibility with smart devices unclear

Unclear what it can do for you up to what distances

Use for devices without a switch unclear

DEVICES

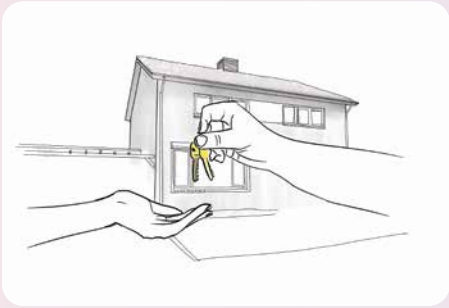
You can plug all kinds of devices in a crownstone to control their power usage automatically through settings in in the app. Smart devices like Philips hue and Toon can already be controlled through crownstone as well

Figure 4. Points of contact with the product.

1.6 STORYBOARD

The following storyboard represents potential use cases for a Crownstone system.

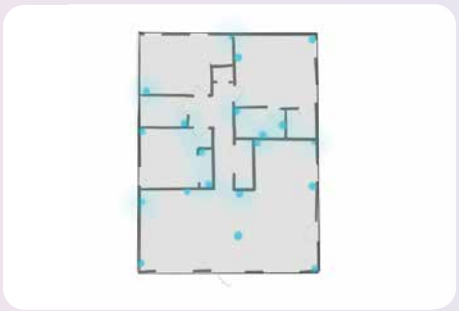
1. Joe and his new family are growing. He needs a house with more space!



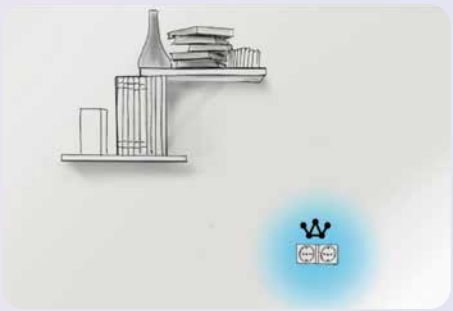
2. He meets a real estate agent who sells hima newly renovated home, with state-of-the-art appliances, including the Crownstone sytem.

5. He remembers he was told by his realtor to download the Crownstone app to gain control over the product.

6. The app takes a while to setup up, and is somewhat frustrating to use. The directions, configuration, and purpose overall is confusing.



3. All his outlets are outfitted with built-in Crownstones, to give him seamless control over his home .



4. He wants to charge his laptop in his new home, and sees the outlet, but does not know how to access the power system.

7. He now realizes he has to set up and configure the entire house's worth of plugs. He has trouble understanding which outlet is which.

8. He also needs to give control to his wife, and setting up the sphere is complicated.

1.7 CONCLUSION

After collecting the information about the context in which Crownstones are being used, the user experience was being explored in order to better understand the use of Crownstone. This was done through performing user tests and doing observations and interviews. The information about the product and company that is collected in this chapter will form the basis for the analysis in the next chapter, which aims at defining issues with the current usage of Crownstones and opportunities for improvements in the future.

02.

ASSESMENT OF USABILITY:

DETERMINING THE STRENGTHS AND WEAKNESSES

Since the main goal of this project is to improve the User Interface of a Crownstone, there's a need to understand how the product works, how the user interacts with it and how he/she experiences it. Moreover, in order to discover the weaknesses and strengths of the product in terms of usability, there were several activities that helped in finding these. Some of the activities carried out to analyse the product include describing the intended operation of the product, a detailed usage inspection, observations of user's first use of the product. These activities helped in identifying usability problems and the main pain points. It's important to mention that it wasn't possible to do interviews with current users.

2.1 INTENDED OPERATION

To start with, the flow through the screens was analysed. The following task flow diagram (figure 5) describes all the tasks that a user has to go through when using a Crownstone for the first time. This 'first time' use experience consists of 12 simple tasks that includes downloading the product's app, plugging in the physical product and completing a first sync.

The two tasks that are the most time-consuming and because of that cause a lot of frustration, are signing in and syncing. These steps are unclear and hard for the user to perform, since the flow is not intuitive and asks for a lot of active thinking of the user.

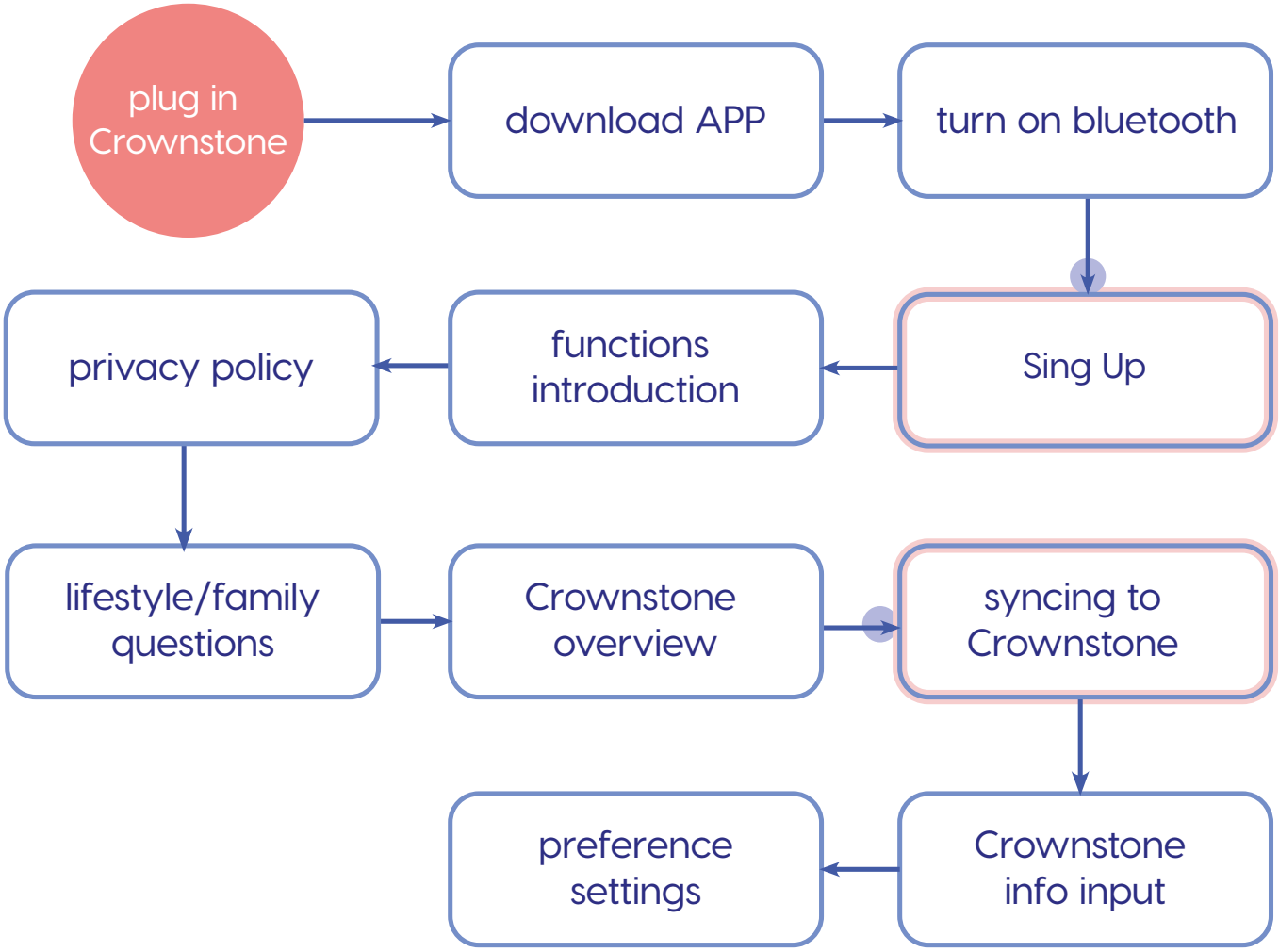


Figure 5. Process of using the application in a flowchart diagram

2.2. USAGE INSPECTION

In order to gain a better understanding of the product, a usage inspection was performed. Several users were asked to use a Crownstone for the first time, from unboxing it, installing the app to syncing and adding a device. This activity helped to understand if the product is fulfilling its purpose, how users feel while using the product and what steps are experienced positive or negative and why.

The following detailed usage inspection involved a controlled scenario in a kitchen setting at the IDE faculty at the TU Delft, where one of our team members went through the process of installing a Crownstone with the intention of using it to control a water kettle.

Unboxing

Inspecting packaging

Interpretting features

Unboxing

The packaging promises features including home safety, power monitor, smart home, comfort. When viewed together, there is no clear hierarchy of features offered. There is a lot of information everywhere and the slogan is 'your presence makes a difference' doesn't make sense. No manual or flyer is included about how this should be happening.

After unboxing and removing the products, the box lack space efficiency. This could be because they wanted the extra packaging for the fragility of the product

App installation

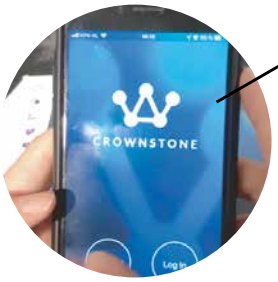
The user downloads the Crownstone app, but she has to manually search for it in the app store, without knowing the name of the app. After downloading, the user opens up the app and then selects the register account button. The on-boarding process is boring and doesn't help the user in understanding how the system can be optimally used for their living situation.

It makes for an underwhelming introduction, and the descriptions are vague and confusing and a bit all over the place, but in a lot of text. Indoor localization, the feature Crownstone is wishing to push the most, could use a better explanation and concise visuals.

The first impression of Crownstones AI appears boring and indescriptive. A static icon is displayed while it is promising very little in comparison to the features presented on the box. Crownstone wants the user to rely on their smart home system, yet they give the user nothing to be confident about, such as guidance, or a deeper explanation of how it might work best.

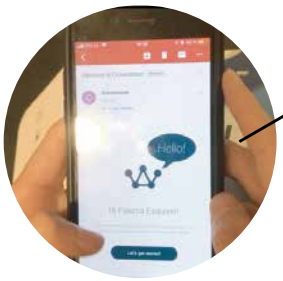
Sees instructions to download app

Finds the Crownstone app



Fills out basic user information

Selects Register button on landing



Re-enter login details

Redirected to email for confirmation

Syncing Crownstone

The user plugs in the Crownstone. We observed that if two of the external Crownstones were plugged in side by side, they would need significant space to fit. Two plugs will not fit next to each other on power strips or regular outlets.
When the Crownstone is plugged in, it becomes visible in the overview of the Crownstone page, but it is unclear whether the user should sync or not, as there are no instructions. After guessing to tap the Crownstone, the mobile device began pairing with the Crownstone. When the device is activated, it clicks. You cannot be sure which of the two you are syncing beforehand.

Plugs in Crownstone

Sees an unpaired Crownstone

After selecting Crownstone, pairing begins

Appliance Testing

The user plugs the water heater in the Crownstone. She then begins the confusing task of setting behaviors. It takes her several minutes to understand the options available. The options are limited to certain times, such as "2 minutes when you leave, 10 minutes when you leave" etc., offering unusual increments of time, and very little freedom to set her own schedule other than the preset options. The behavior is presented in a mathematical way.

When returning to the kettle, there is a severe second delay as the user enters into the range of the Crownstone. When the kettle activates, it stays powered until it boils. She unplugs the appliance and ends the testing.

Plugs appliance into Crownstone

Sets behavior for the appliance

Crownstone is activated and appliance turns on

Usage Inspection Conclusion

From this Usage Inspection exercise important pain points and insights were obtained which will help to improve the UX of the product in the next stages.

2.3 INPUT FROM COMPANY

The introduction meeting with Crownstone took place at their office in the city of Rotterdam. During this meeting important points about the product were discussed, moreover they shared the company vision and philosophy. Among the topics discussed, they pointed out the importance of communicating the emotional side of the product and giving the sense that the product is going to take care of the user. They also explained their technology and how the product operates by using Bluetooth signals to detect the user presence. They also shared the idea of designing an avatar to embody the AI within the app which will serve as a friendly character to interact with the user.

2.4 CONCLUSION

The Crownstone is a product with a complex technological basis, which has the potential to perform a set of interesting functions. Nevertheless, the product is lacking an effective/positive usability and a pleasant user experience, which is the result of its complexity. Based on the technical possibilities that are included in the product, there is an opportunity to grow in the market of smart home devices. In the next chapter a problem statement will be provided based on what was discovered in this chapter. It also gives information on the desired user experience the redesign should provide and the requirements in order to reach a user interface innovation.

03.

DESIGN BRIEF:

DELIVERABLES AND SCOPE OF PROJECT

In the previous chapter the usability and user experience were analysed in order to discover the strengths and weaknesses of the Crownstone. They were analysed from a designer's and user's perspective and were turned into a problem statement. This problem statement, together with the desired qualities and Crownstone's input, forms the input for the design brief, which is the starting point for the redesign. This design brief can be read in this chapter. It is used during the whole project to evaluate whether the redesign meets its goal. Writing the design brief also required defining the scope of this project, which is also discussed in this chapter.

3.1 PROBLEM STATEMENT

The usability issues that were found, based on using the product and our own experiences, are put in five categories: functions, hierarchy + aesthetic design, guidance and technology-driven and Crownstone Status. The most prominent issues are shown in the overview.

The Crownstone is a technology driven product and can perform a range of functions from simple to complex. Despite its complex technological foundation, the product has not reached its full potential yet. It is unclear what the purpose and the core functions of the product are, neither on the website, nor on the packaging or in the application. It also is unclear how to access certain functions and some important functions are buried deep within the app. For instance, to reset the state of the outlet the user should go really deep into the app while this is an important aspect. This is related to the fact that there is not enough hierarchy in the menus and and content. This makes it hard to navigate through the app and makes the presentation of information confusing. Also different styles of text and icons are mixed in different places in the screens, which contributes to this problem. There is a lot of information displayed, but as a user you don't wanna go through all this text to be able to use the product. We found that even when all the text is being read, the use still remains unclear for users and no intuitive flow is established. There is no strong welcoming that really guides the user through the first steps of the use and there is a lot of jargon used in the app, that is unclear for a first time user. This also gives the app a technological approach instead of a personal, which contradicts with the feeling that Crownstone wants to evoke: 'To let the home take care of you'.

Lastly, the status of the Crownstone cannot be known by the user, since there is no visual or auditory feedback between the app and the physical product. This is necessary to identify which outlet is which and to reset it.

Problem Categorization

These are the most important issues, but due to a limited time to spend on this project, choices had to be made on focussing on a specific part of using the app. We defined this in the scope of the project, from which the details will be described next.

FUNCTIONS

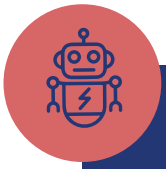
- No clear communaction of functions
- Unclear how to access functions
- Important info burried deep within app

HIERARCHY + AESTHETICS

- No clear hierarchy in content and menus
- No unified style in text, colors and icons
- Important info burried deep within app

GUIDANCE

- App contains too much text, while user is still lost
- No guidance with first time use
- No intuitive flow



TECHNOLOGY- DRIVEN

- Too much jargon used, which is unclear for a first time user
- No personal approach, benefits for user unclear

CROWNSTONE STATUS

- No visual or auditory feedback between app and plug
- Unclear which outlet is which when syncing
- The status of the outlet is unclear

3.2 SCOPE

After defining the problem statement, the main focus is put on two points: improving the initial system setup and give a more personal approach to the user interface. Firstly, we would like to redesign the system setup, which includes the procedure from installation to configuration and set up of a first device. Secondly, we are focussing on creating a more personal approach. In this way the product guides the users in a way where it becomes clear how it can help them. The technological terms in the app are hard to understand for users and contradict with the feeling Crownstone wants to evoke: that the users feel taken care of by their home. Therefore this problem needs to be tackled. The user interface design needs to be improved to provide the user with an easier experience through its installation and further use of the product. Since Crownstone mainly sees a future for the built-in Crownstone, we chose to only focus on this type of product rather than the plugs.

Problems to tackle are identified, but in order to improve, a definition needs to be given about what qualities the product should include instead of just showing what is not working or missing. The next paragraphs give information about the experience we intend to provide.

3.3. DESIGN GOAL

We are focussing on providing a smart home experience, where the product product offers comfort. This needs to be achieved by defining and explaining the features and functions clearer and make the user feel connected with their home. The installation process must be optimised in order to experience more ease when using the app. The flow through the app needs to be intuitive and people need to feel confident using it. In order to 'let the home take care of you', as is Crownstone's goal, the benefits of use should be emphasized. This goes both for app and plug.

We summarized this into one statement:

"We want to create a rich home experience and connect the users with their house to provide **ease and comfort**. In order to experience comfort and get the feeling that the Crownstones care for you, you need to feel **confident and in control** when using them"

3.4 DESIRED INTERACTION & PRODUCT REQUIREMENTS

The interaction with the product should feel fluent and the user should be guided through the steps of the usage. The process of installing and configuring the Crownstones should become more intuitive, easier and faster. The user should have control over the product and not the other way around.

This leads into the following requirements:

-The product and the application should be convenient, reliable & supportive.

-The onboarding process should be fluent and the user should be guided through.

-A user should get help understanding the features and functions due to clearer visual hierarchy.

-Users should be able to know what state the Crownstone is in, by getting feedback from it.

-The product should give a short but powerful guide instruction during the installation and configuration steps.

-The user should be able to find and configure all the settings in one place in the app.

-The product should support people's daily habits/patterns and not interfere with this.

-The user should feel confident in using the product by being able to navigate easily through the different menus.

-The user should be able to add another user to his/her system without wondering what the next step is.

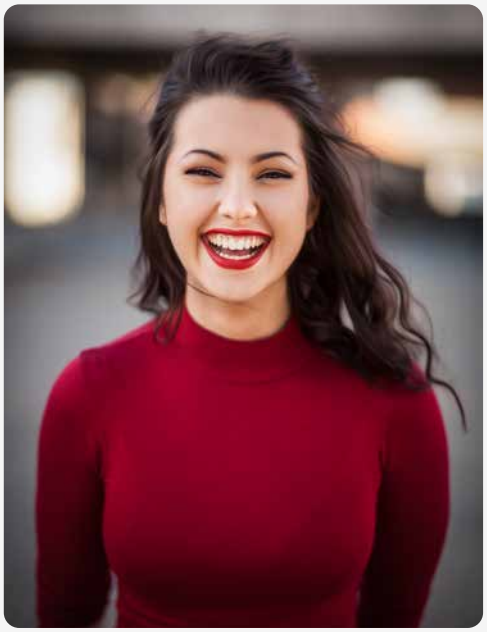
3.5 PERSONAS

For the purpose of picturing a more realistic scenario, we made use of 'user personas'. These represent the people kept in mind while designing. In this case, a young married couple is the most fittible user of the Crownstone, since the product is targeted at homeowners.

Home owner
Phil Burrell
42 years old
Engineer

Phil is a guy in his early forties with a steady job in a techy company, he is the owner of a two store house in the suburbs of Amsterdam. Phil, loves technology and gadgets; he owns many smart devices such as iWatch, Alexa, Philips Hue and Nest.

"One of the things I enjoy must about being home is that I can play with my gadgets and discover new funcionts and plug ins" - Phil



Co-user
Inés Gomez
38 years old
psychologist

Inés is Phil's wife, they've been married for 5 years and lived together for 8 years. Inés has some experience with smart devices but she ain't no expert, she feels more comfortable around books.

"I don't understand why Phil is so obsessed with using all this smart products in the house, I don't feel that we need any of these things." - Inés

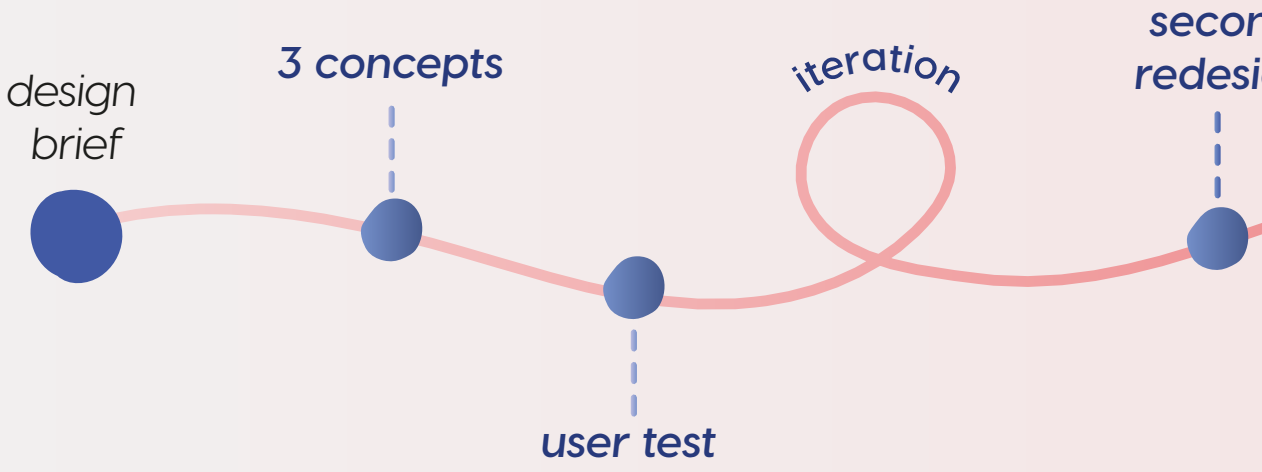
3.6 CONCLUSION

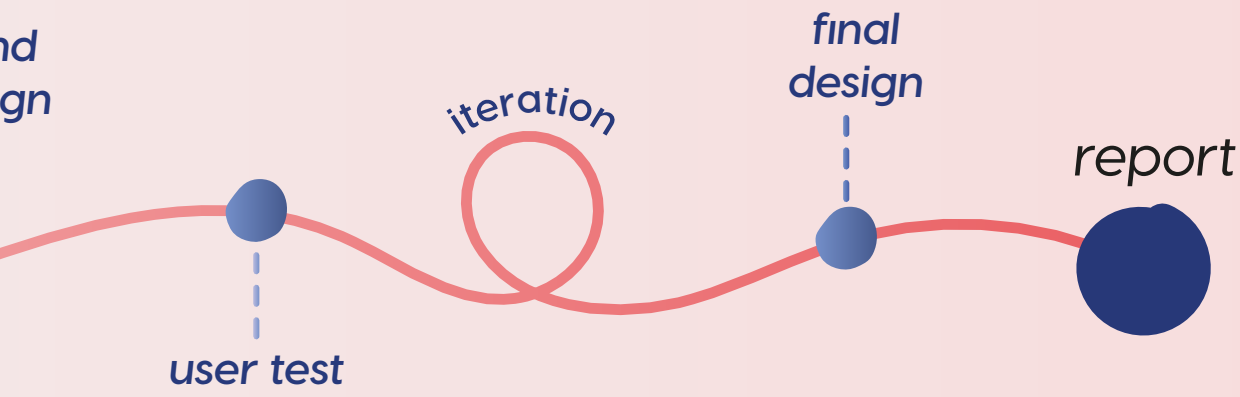
The Crownstone is a product with a complex technological basis, which has the potential to perform a set of interesting functions. Based on the technical possibilities that are included in the product, there is an opportunity to grow in the market of smart home devices.
To reach its full potential it is essential to reconsider the target group and purpose of the product. When a better understanding of this is acquired, the Crownstone can be improved on its usability and user experience. The goal of this project is to create a rich home experience and connect the users with their house to provide ease and comfort. In order to experience comfort and get the feeling that the Crownstones care for you, you need to feel confident and in control when using them. This goes for both physical plug and app.

This design brief serves as the fundament of the redesign. First steps towards an improved redesign concept can be read in the next chapter, together with our design process.

STAGE 2

The Process of Improvement
The Redesign of Crownstone

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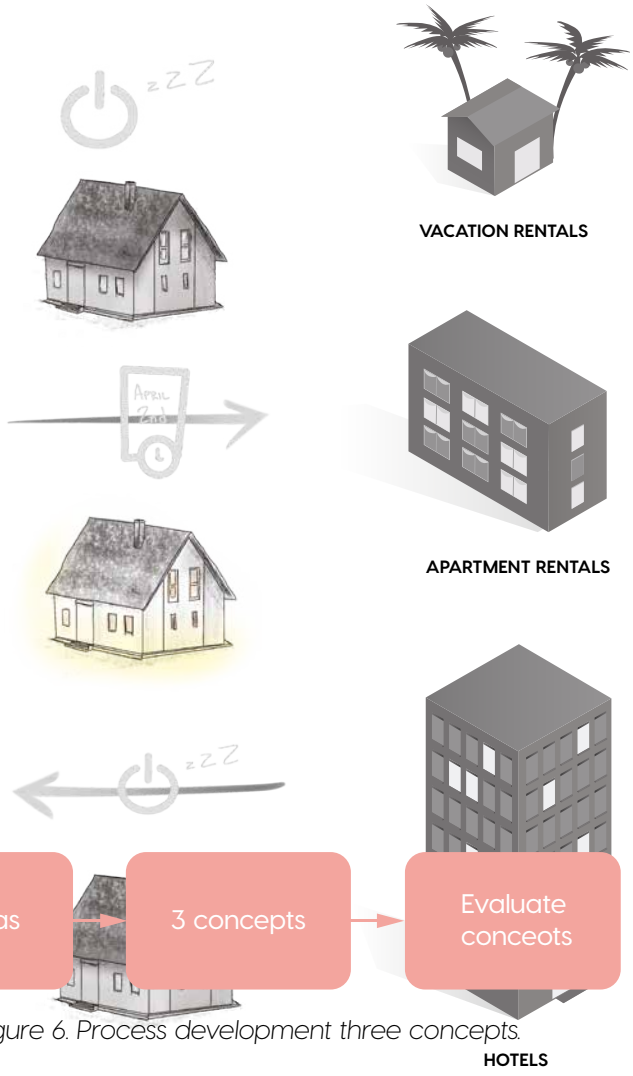
04.

CONCEPTUALIZATION:

THE FIRST THREE DIFFERENT CONCEPTS

The Design Brief defined in the previous chapter, is the foundation to start conceptualizing three new concepts to improve the Crownstone user interface with special attention to the pain points described in the problem statement. This chapter, provides a description of the initial ideation phase along with a detailed explanation of the first three defined concepts. Furthermore, the three concepts underwent a user test in order to gather insights and be able to narrow our design into one concept.

First Concept Ideas:



4.1 IDEATION PROCESS

Three different concepts were developed using the following method:

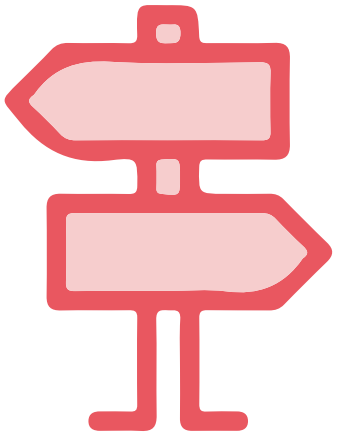
Figure 6. Process development three concepts.

Each concept guides the user through the installation process in different ways. These concepts all differ in several key aspects, including the order and way in which key information (about functionality, purpose, configurations etc.) is presented to the user. Another difference is the amount of steps that need to be taken in order to get the system to work. An explanation of the three concepts will be described.

4.2 THE CONCEPTS

Overview of our first 3 proposed concepts.

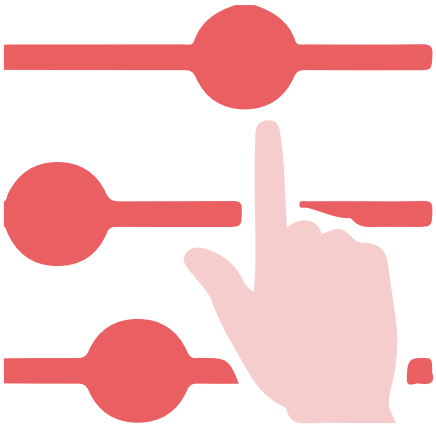
1



FUNCTION FIRST

Functions and features explained through the app, no led feedback from the outlet.

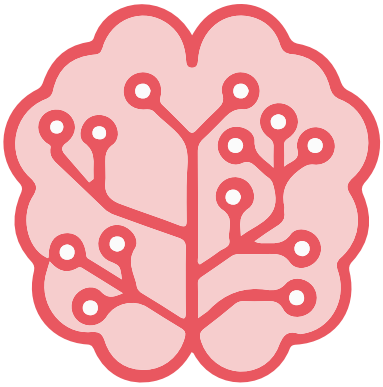
2



PLUG AND PLAY

The 'If This Then That' style, asking for the user feedback to optimize their experience.

3



HUMAN INTELLIGENCE

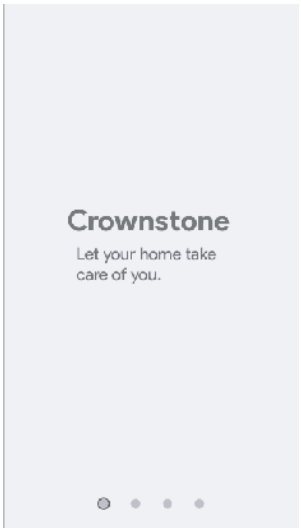
Helping the user with the initial set up and explaining the app.

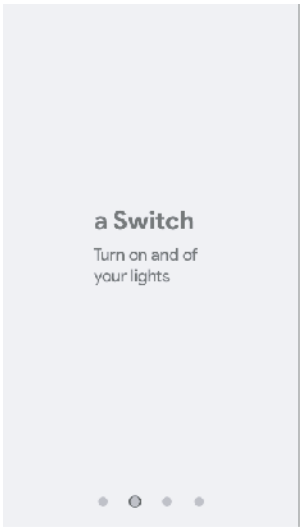
Function First

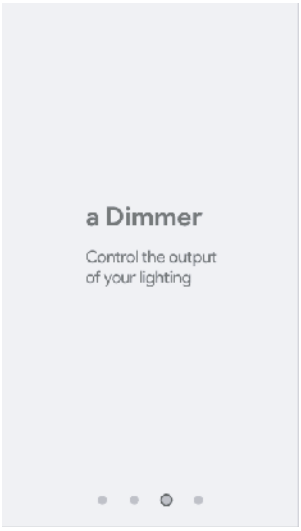
Concept 1

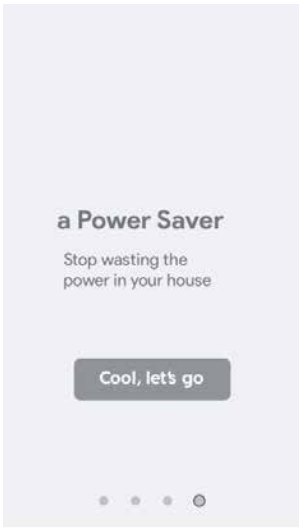
Logging in is the same for concept one and two, a username and password need to be generated.

The first concept contains little guidance. It shows the user the main functions once the first time with a swipe through tutorial. After this, there is no guidance anymore and the user has to explore himself how to configure.



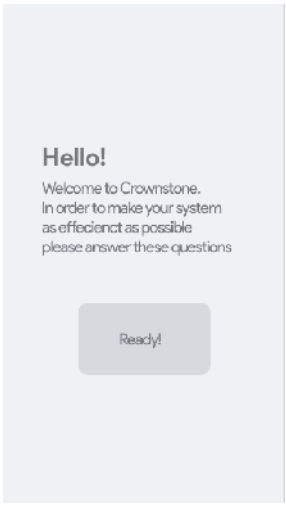


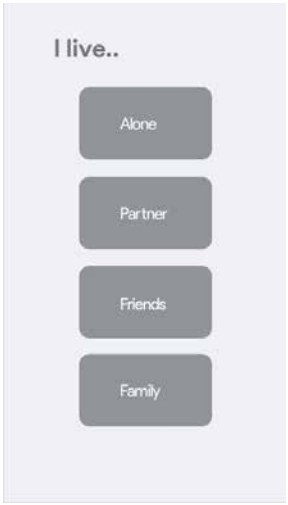


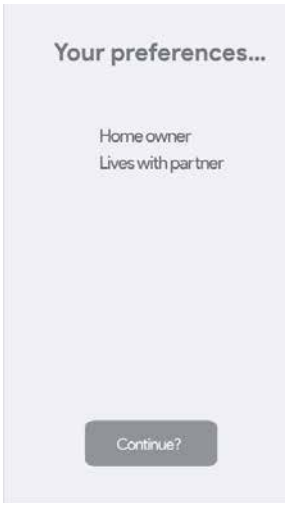


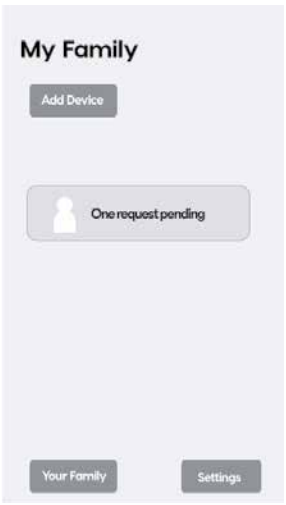
Plug and Play
Concept 2

It helps the user to understand the product by asking personal preferences in the beginning and uses that information to optimise the product. It will only show screens that are highly relevant for the user considering the preferences/information he/she gave. A personal story is created for every user to better engage with the Crownstone story.





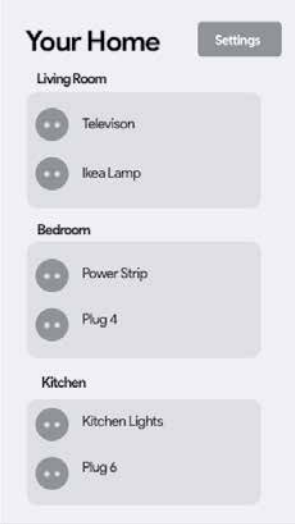


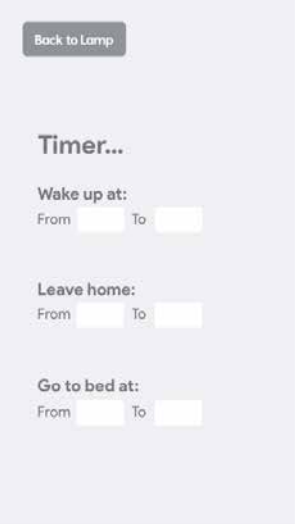


Human Intelligence

Concept 3

This concept eliminates part of the installation process. An installer that pre-installed the Crownstones in the outlets will come by and tell the user how the product works. He provides the user with pre-generated login credentials. The amount of outlets is already shown and categorized per room, but they still need to be synced. The psycial prototype of a wall was presented, where a LED gave feedback during the syncing to distinguish various outlets.

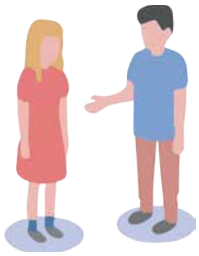




4.3 CONCEPT TEST ASSESSMENT

To test our three concepts and be able to gather data about the user experience and how assertive each concept was, a user test was conducted. The user test setup will be discussed below:

USER TEST SETUP



1 WELCOME

First we welcomed the participant. We thanked him or her for doing our user test. We also had some small talk to give a more personal feeling.

2 THE TEAM

We also introduced our whole team and explained the different roles of every one during the test. One person was the moderator, one played the installer and the others watched the test from the Control room.

3 CONSENT FORM

Before we could start the test, we had to inform the participants about the consent form. We gave them information about it, made sure all there questions were answered and then asked them to sign it.

4 INTRODUCTION

When the participant had signed the consent form, we could start the introduction. We informed them about what Crownstone is and what products they make.

5 STORYBOARD

To give them more feeling about the product, we showed them our storyboard. In this storyboard it is explained how the user would use the Crownstone smart plugs.

Research Goal

The research goal is to get an understanding of how people perceive the three different concepts, and learn which elements guide participants best through the installation. The aim is to compare the overall feeling that the participants have towards the concepts.

Research Questions

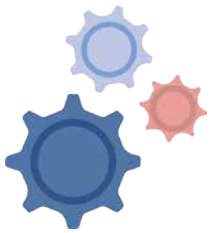
How do people use this concept?

How do people experience this concept?

What are the strengths and weaknesses and the causes for that?

6 START THE TEST

After the introduction we could start the 'real' test. We showed the participants the screens and asked them questions about it. We showed them three concepts, every time in a different order.



7 CONCEPT 1

Functions explained in a few opening screens, no LED light feedback from the outlet.

8 CONCEPT 2

Opening screens are in 'If This happens, Then That should happen' style, asking for user feedback to optimize the experience.

9 CONCEPT 3

An installer sets up the system and gives the user a walk through.

10 WRAP UP

After we showed all the concepts and talked about it, we asked the participants if they had any more questions or comments to add. After doing that we wrapped up the test and thanked them again.

Script

A script was prepared in order to make sure different moderators asked the exact same questions to every participant to get consistent data. The script can be found in Appendix G.

1. LOCATION

The usability test was operated in the Comfort Lab in the IDE Faculty. In another room, the Control room, the test can be followed with the help of a camera. In this way the influence of the observers can be minimized. Three team members observed in the Control room. One moderator was in the Comfort Lab, and one team member played the installer. Two cameras followed the conversation in the Comfort Lab. On the table were the physical prototype and paper prototypes.

2. TEAM MEMBER ROLES

During the test, one team member was the moderator, someone else played the installer and the rest observed.

Moderator

- Point of contact
- Preparing the different concepts
- Introduces the use evaluation
- Helps the participant if needed
- Asking the participant questions about the interaction with the concepts

Moderator

Installer

Set preferences through concept 3.
Has a conversation with the participant in concept 3

Installer

Prototypes

A fake wall (figure 7) was constructed out of foam core and decorated with wallpaper. The result was a realistic looking wall with two outlets in the middle. This was done to simulate the context wherein the real user will use the product. Behind the wall, an iPad was mounted, which was then controlled remotely to simulate an LED blinking.

Observer

Observing the participants behaviour during the interaction with the help of cameras
Noting down the striking occurrences

Observer

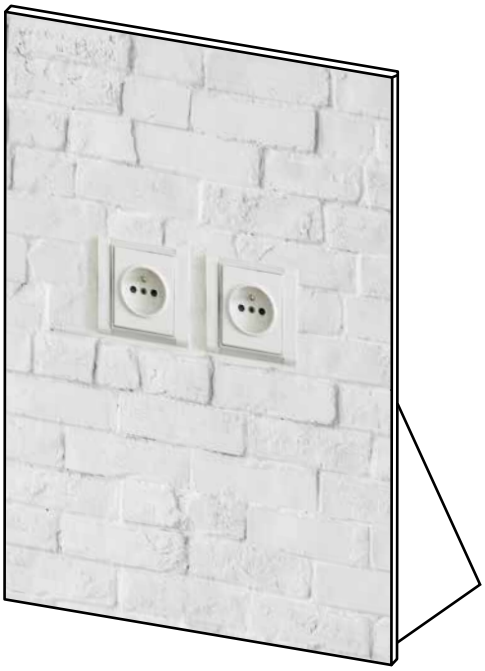


Figure 7. Prototype of the wall created for the user test.

USER TEST RESULTS

Five people were recruited in total for the user test (see figure 8). This number was adequate since it would allow the team to find the needed information (Faulkner, 2003).

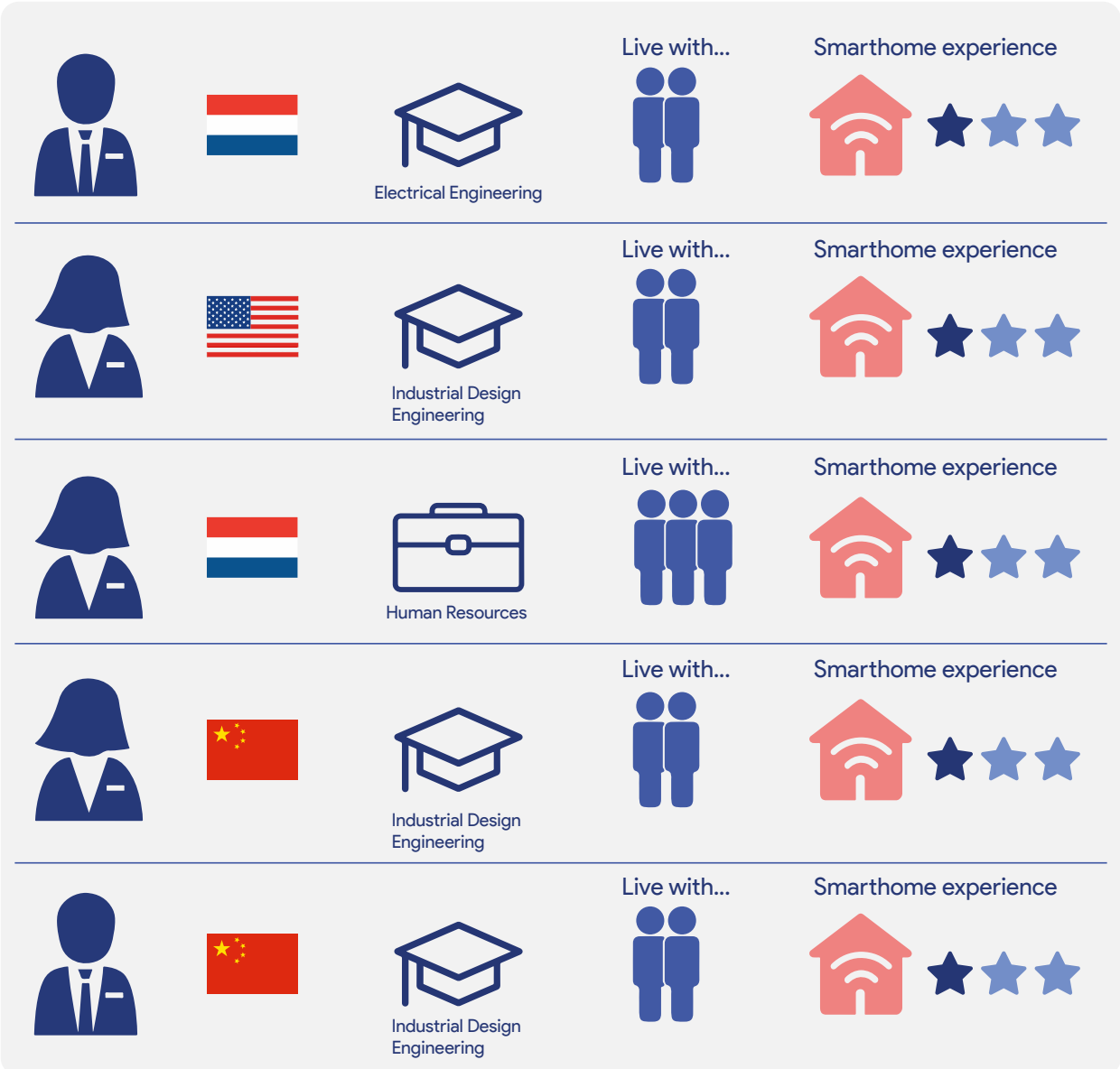
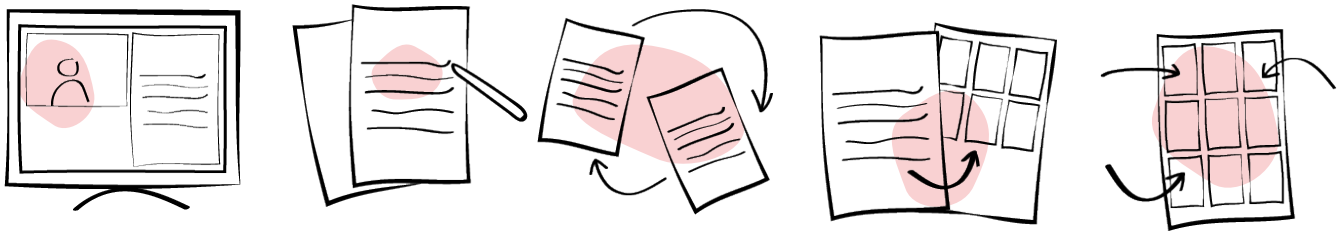


Figure 8. Overview of the recruited participants for the first user test.

ANALYSIS OF USER TEST

During the test, video and audio material was recorded (see figure 9). Later the relevant data could be extruded from it. The raw data is transformed into workable information, it was clustered into categories and rated (see figure 10).These four categories helped in assessing the three different concepts based on severity and frequency.



1 DIRECT ANALYSIS

During the test, we took notes in the control room. From this room we were able to view the test that was happing in the Comfort Lab. We mainly focussed on writting down observations and tried to not jump into conclusions to fast.

2 WATCHING BACK

After the test we watched back the videos. We all looked at one video and noted down everything that the participant mentioned. We have put all our insights into a table.

3 SWITCHING

When we had notes of every video, we switched. Everyone of use looked at another video and extended the notes that were made. We added things that were missing or that we interpreted differently. We switched a few times.

4 COMPARING

After we had made the extended notes, we looked back at the screens we made. We compared the comments of the participants with the screens and linked them to eachother.

5 VISUALIZING

To get a clear overview of all the information we collected, we noted down all the input next to the screens. This gave us insight in the differences between the three concepts.

Watching back the data

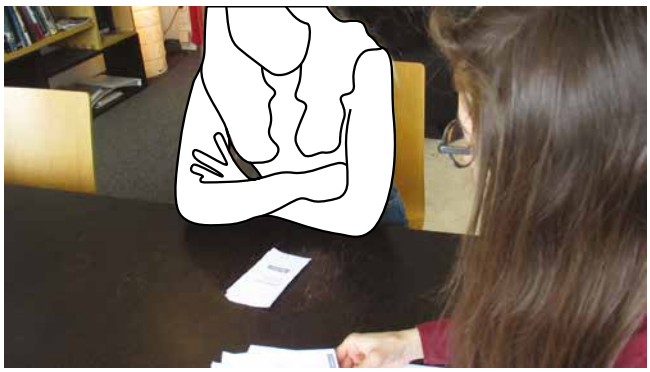


Figure 9. Screen shots from the recorded videos, in two different angles..

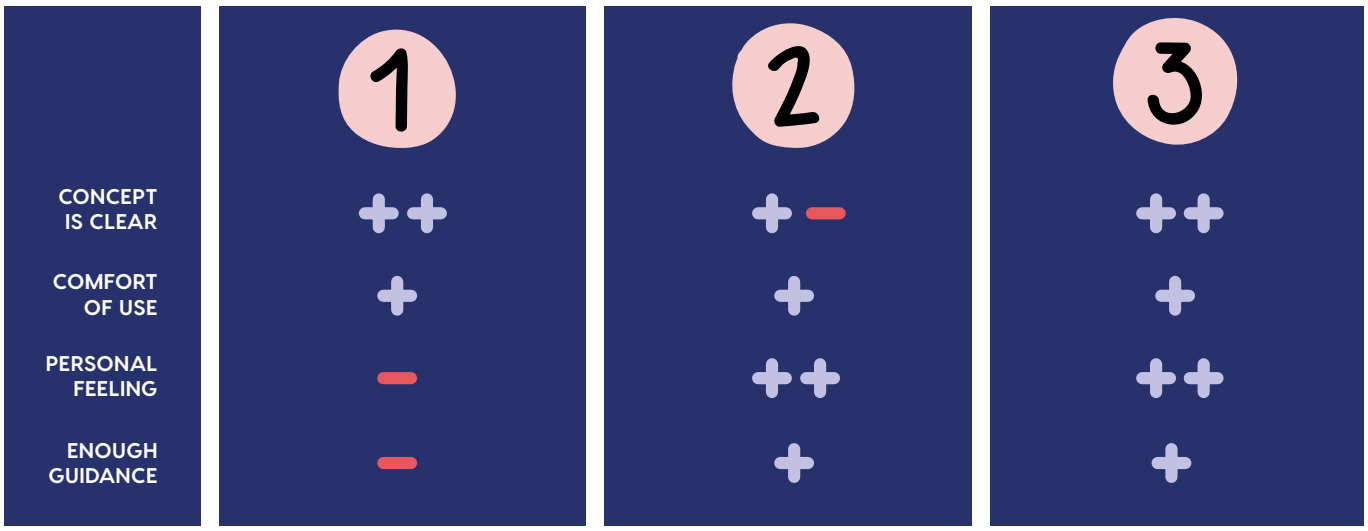


Figure 10. Three concepts rated on different categories.

4.4 EVALUATION OF 3 CONCEPTS

The conclusion from the user test, was that the second concept was the best one to continue with. In Appendix H the results are shown, an evaluation of the three concepts is shown in Appendix I, a selection is shown here.

START UP

+ Clear how to create an account or log in.

- More logical to have 'log in' first and then 'create an account' if the user doesn't have one already.

CONCEPT 1

+ The 'intuitive' approach worked well.
+ It was clear that the swipe through screens explain the functions.
+ Participants felt comfortable figuring the app out on their own.

- Icons and visuals are needed in 'welcoming introduction'.
- Purpose of showing functions not clear for everyone.

CONCEPT 2

+ Concept felt personal and useful.
+ Gets users engaged with the product.
+ Walk through experience is liked.
+ Evaluated most positive of the three concepts.

- Confusion regarding the purpose of the questions.
- Privacy concerns arose.
- Not all the selectable answers are clear or useful.

CONCEPT 3

+ The 'step-by-step' approach worked perfectly for inexperienced technology users.
+ The personal approach of this concept is preferred.

- Experienced technology users indicated that the assistance felt unnecessary.
- Feels like the home is taking over control.

GENERAL

+ Detailed home screen overview is useful.
+ Physical feedback from the outlet is appreciated.

- Not clear which outlet is installing.
- No instructions on proximity when installing.
- The word 'looking' when syncing is unclear.
- Where to add a name for the outlet is unclear.
- Home screen is unclear when there are no outlets. It states 'none' but something is showing

4.5 CONCLUSION

As a result from analysing the data, insights were gained about what works and what doesn't from each concept and what the preference is for most of the target group. Therefore, based on the results presented before, further development will be done on the second concept and some small features will be added from the other two concepts that were relevant to the users. This combined will lead into the second redesign of the Crownstone product.

It was confirmed during the user test that the personal approach is an important quality to incorporate in the beginning. This is done without invading the user's privacy and still let them have full control. Another important feature that we'll be taking from concept 3, is the light feedback from the outlet. It made a huge difference while going through the syncing of the products.

05.

DESIGN REFINEMENT:

DEVELOPMENT AND FURTHER IMPROVEMENT

The previous chapter elaborated on the three concepts with different levels of guidance, that were designed and evaluated. By picking certain aspects from each of the three concepts, a new redesign proposal was made.

This chapter shows and explains the new redesign and also shows how it was evaluated with the help of a user test. Based on the results of this test, a final design was created. The next chapter (Chapter 6) will elaborate on the final design of the application for the Crownstone system.

5.1 CONCEPT REFINEMENT

A selection of the screens of the redesign can be seen in the figure 11, all screens of the redesign are in Appendix J.

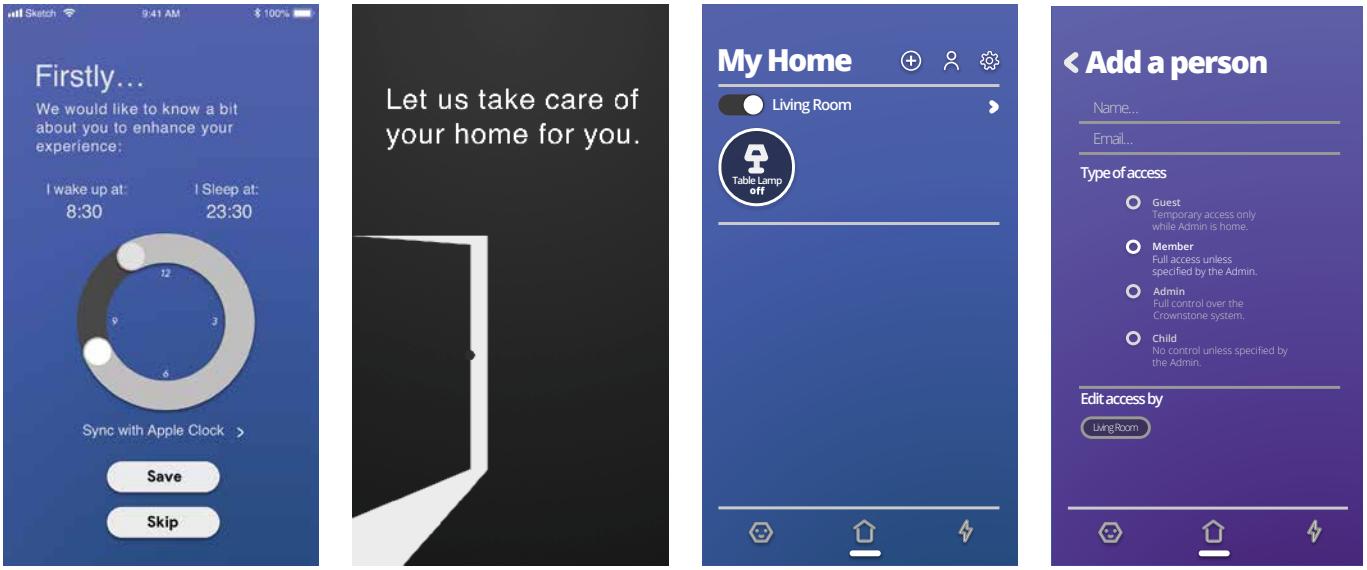


Figure 11. A selection of screens from the designed concept.

In this concept the features of the system are introduced to the user when the app is opened for the first time. After landing in the home screen, the user can choose to watch a tutorial which explains the functions. All functions can be accessed from the home screen. Personal information can be added to improve the performance of the system. Besides watching their power consumption, the user can also set behaviors of the system. Behavior are settings or timers that initiate when devices will turn on or off.

5.2 CONCEPT TEST ASSESSMENT

USER TEST SETUP

The setup of this second test was similar to the situation of the first test (Chapter 4). Only this time three cameras were used (figure 12).

Figure 12. Screen shots from the recorded videos, in three different angles.

The participant was explained the scenario of being a homeowner that recently bought a new house. A booklet was created to introduce the participant to the product (Appendix K). The steps in the booklet indicated what the user should to. This made the user test a mix of scenario and task based. The script of the test can be found in Appendix L. The process of the test is shown in figure 13.

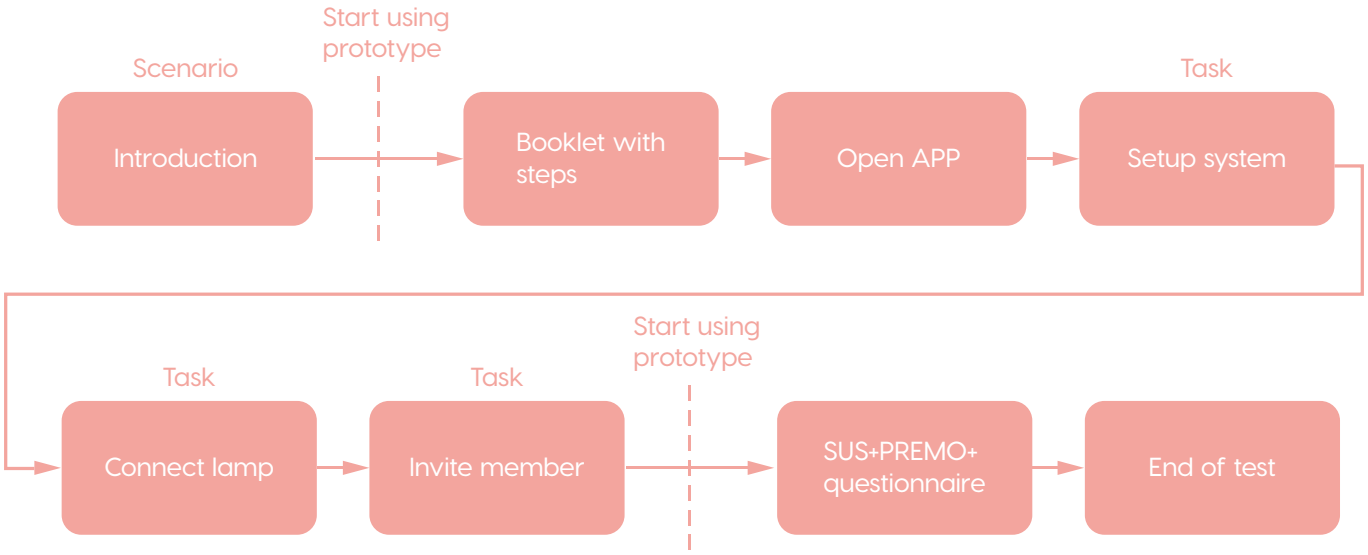


Figure 13. Process of the second user test.

The foam wall from the previous test (Chapter 4) was used again used. This time it was possible to plug a lamp into the outlet, this to make the scenario more realistic. See figure 14.

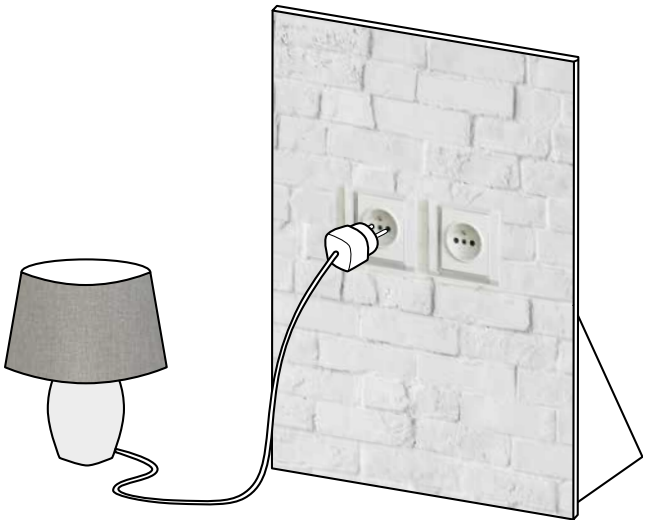


Figure 14. Prototype of the wall with a lamp plugged in.

USER TEST RESULTS

Afterwards using the prototype the participants (see figure 15) filled in a System Usability Scale (SUS) and the Product Emotion Measurement Tool (PrEmo). Both forms can be found in Appendix M.

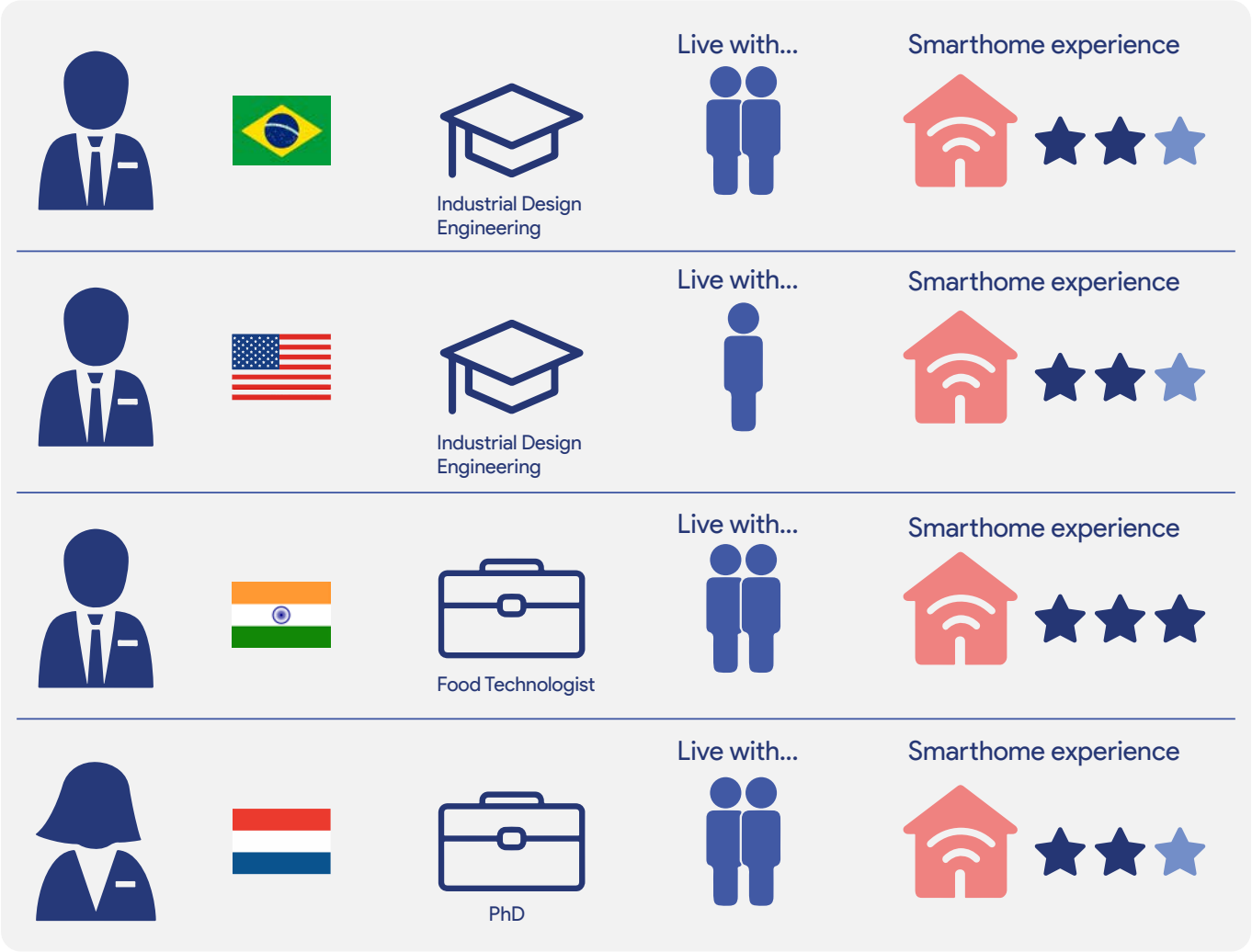


Figure 15. Overview of the recruited participants for the second user test.

SUS

Used to simply and quickly assess usability. Figure 16 shows the results of the System Usability Scale. One participant rated the experience different from the others. He was very critical about the purpose of the system, rather than focussing on the usability. After using the calculation that corresponds with using the SUS method, overal 3 participants rated the system as acceptable, except for the one outlier that gave it a score that would indicate as 'not acceptable'. The adjective scores accompanying the numbers would be different for all four participants: worst imaginable, good, ok and excellent.

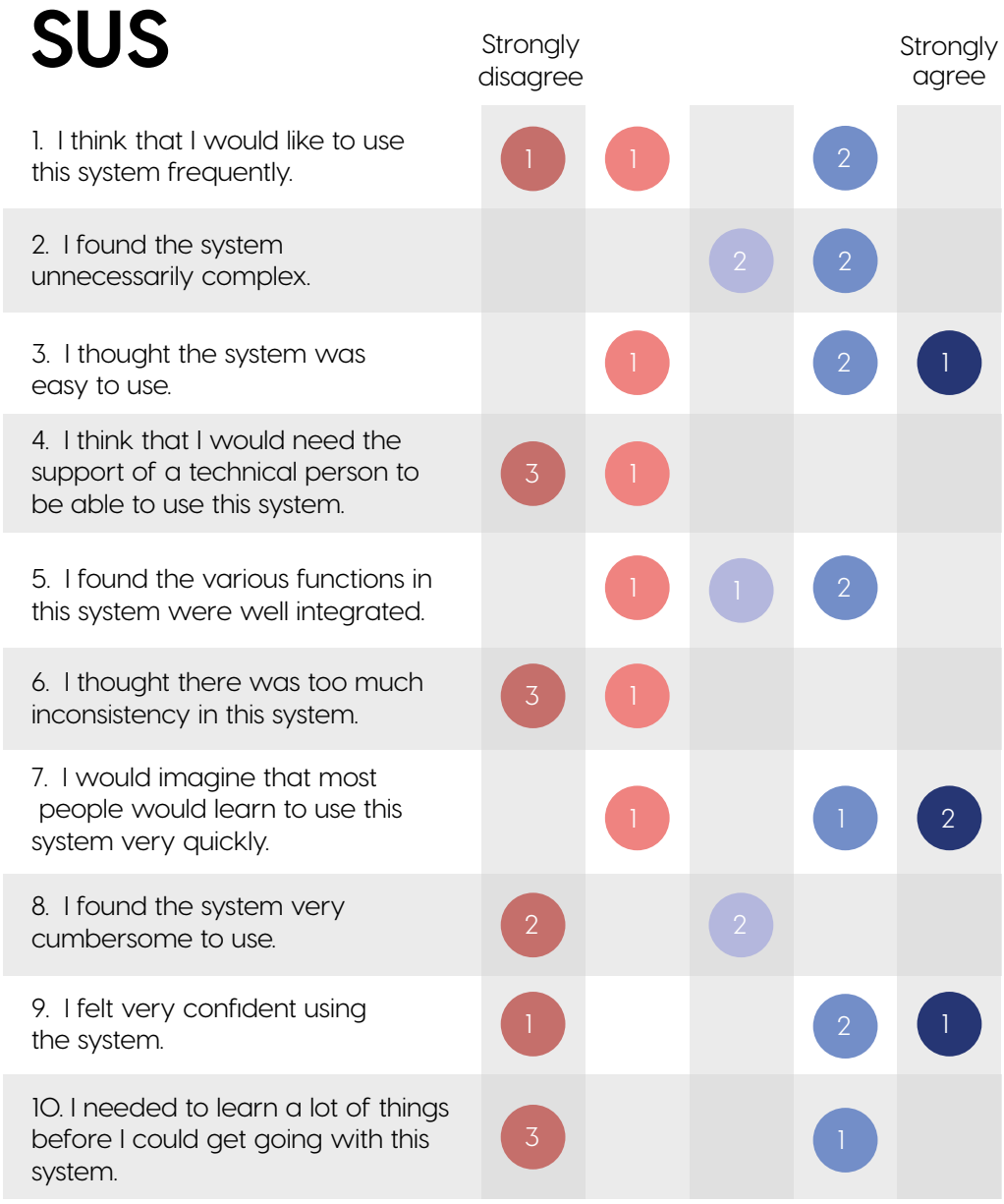


Figure 16. Results of the System Usability Scale.

PrEmo

Focuses more on the emotions of the user during the interaction.
Participants could rate the emotions on three levels; felt like emotion (whole circle filled), felt this a little (half a circle filled) or didn't feel like this at all (not chosen).
The graph (figure 17) shows that people experienced satisfaction and curiosity the most. This had to do with the fact that they were able to execute the tasks and reach the goals we assigned them in the scenario and booklet. Also they became curious about what this product could do if it is fully functional.

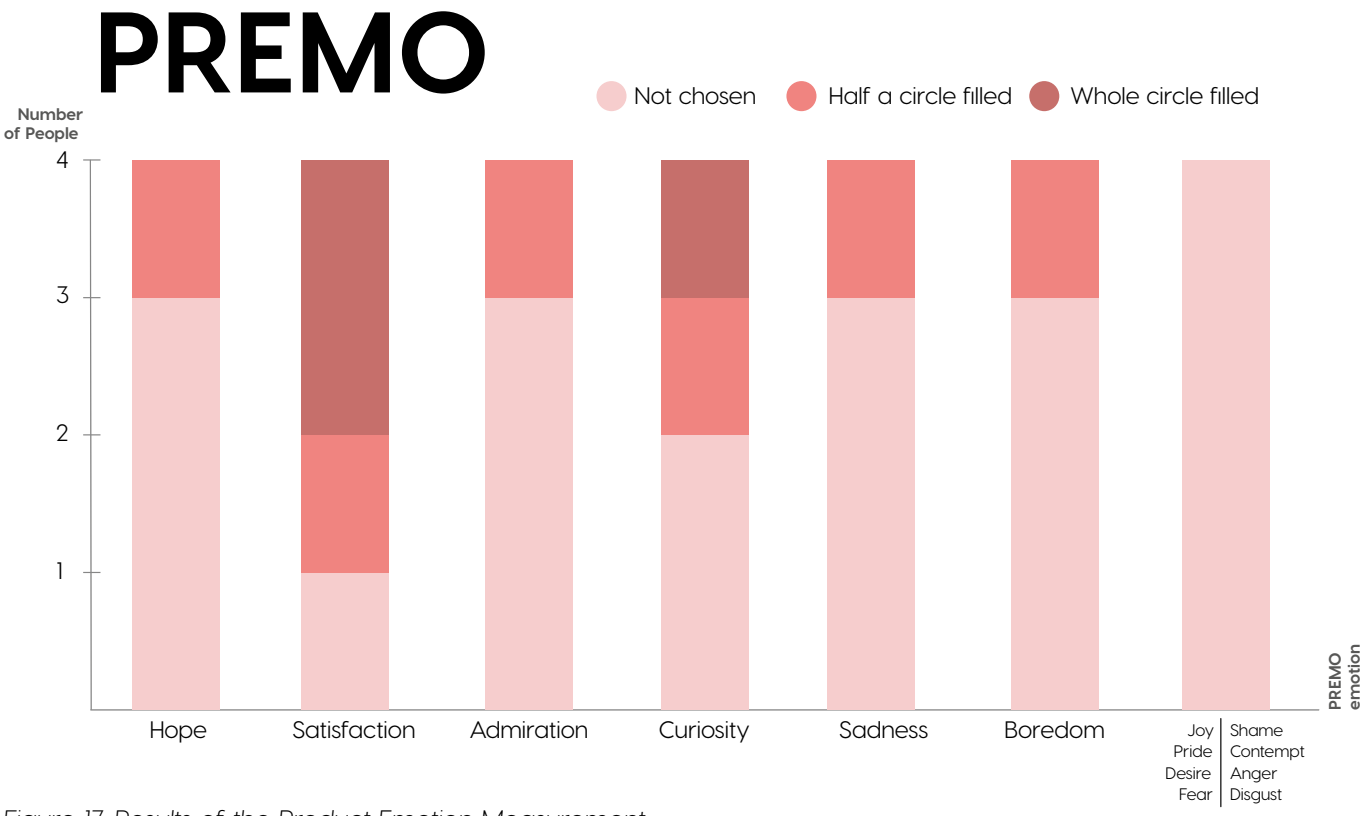


Figure 17. Results of the Product Emotion Measurement Tool.

An overview of the insights of the second redesign can be found in figure 18. The comments per screen can be found in Appendix N. After gathering all this detailed information about every aspect of the screens, they were ranked on priority (Nielsen, 1995) and put into seven different categories. Within each of this category the most important issue is put on top and gradually the problems become less prominent towards the bottom. Since this is not the same for every category, we used color coding to identify the severity of the problems.

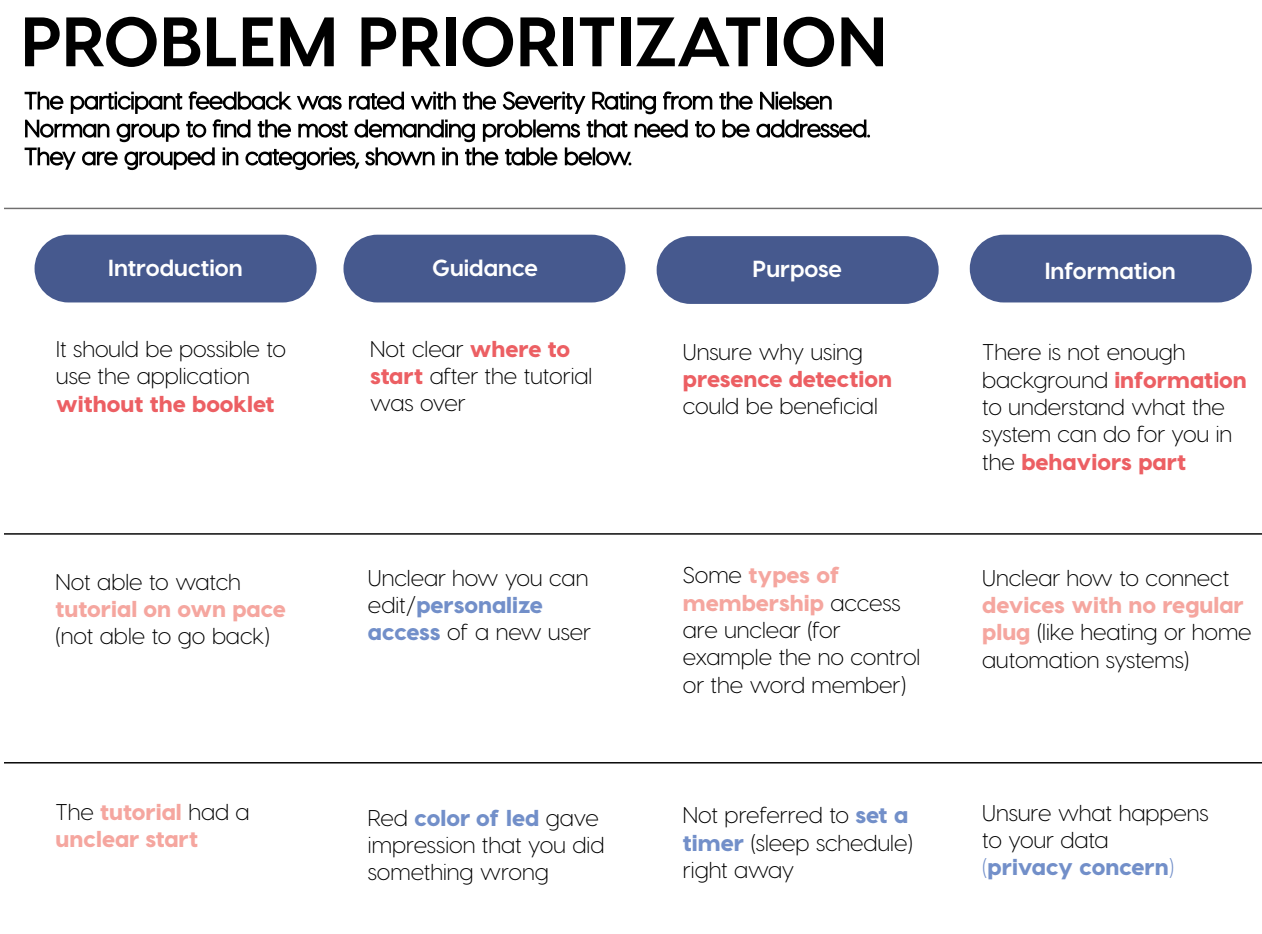


Figure 18. Presentation of the main problems with the current design.

Usability catastrophe = this needs to be fixed before the problem can be release
Major usability problem = important to fix, so should be given high priority
Minor usability problem = fixing this should be given low priority

Readability	Feedback	Interaction
Toggle difference between device/outlet and room unclear	The **toggles** gave not enough **feedback** whether they were on or off	**Buttons** need to be bigger/more space
Power consumption graphs need to give a clearer overview (graphs that make more sense for their purpose)	Unclear how you are able to **dim the lights**	Main **menu icons** were unclear
Intro animation wasn't fluent (interesting) and took too long	**Feedback** when saving/ changing/ sending something is unclear (not sure if the **action of the user** changed something)	**Add a member icon** was not clear

5.3 EVALUATION OF REDESIGN

This chapter elaborated on the second redesign. A user test was performed to estimate the maturity of the design considering the design brief.

The main takeaways from the user test, in terms of points to improve, are:

Improve the introduction. Both an animation to show the functions should be clear and also a tutorial to show where in the app functions can be found. This tutorial should be guiding the user step by step.

The behavior learning of the app should be explained better and be more transparent.

Icons and toggles need to be changed to become more communicative and send better feedback.

5.4 CONCLUSION

In the next chapter the final design will be shown, which is an improvement of the concept explained in this chapter. Due to the time span of this project it was only possible to create a new design but not to test again. The reflection and recommendations describe a possible future direction for the Crownstone product and can be found in Chapter 7.

06.

FINAL DESIGN PROPOSAL:

THREE DIFFERENT INTERACTION CONCEPTS

This chapter is about the final proposed redesign for the Crownstone's home system and is our best answer to the design brief. The participant feedback from both user tests is taken into account to create this design.

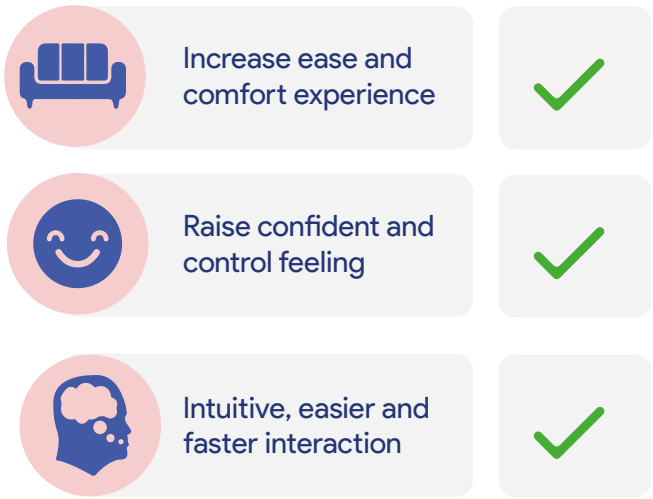
6.1 FINAL DESIGN

Our 3 main improvements on the Crownstone system are:

1. Overall UI Improvement
We established a clear hierarchy between the home screen and other menus. A menu bar which includes Behaviors, Home, and Power Habits is always shown at the bottom of the screen. We created our own style that uses thin line weights for iconography, minimal gradient transitions and clearly defined features.

2. Behaviors
A new feature we brought to Crownstone is the Behavior's function. This allows for the user to set outlets. It allows for combinations in automation to be set up easily and understood by the user.
Improving the AI in the system, which is learning from the user's habits, will have a positive influence on the experience. Automation and learning from patterns, will minimize the interaction users have with their smartphone, allowing them to maintain natural interactions.

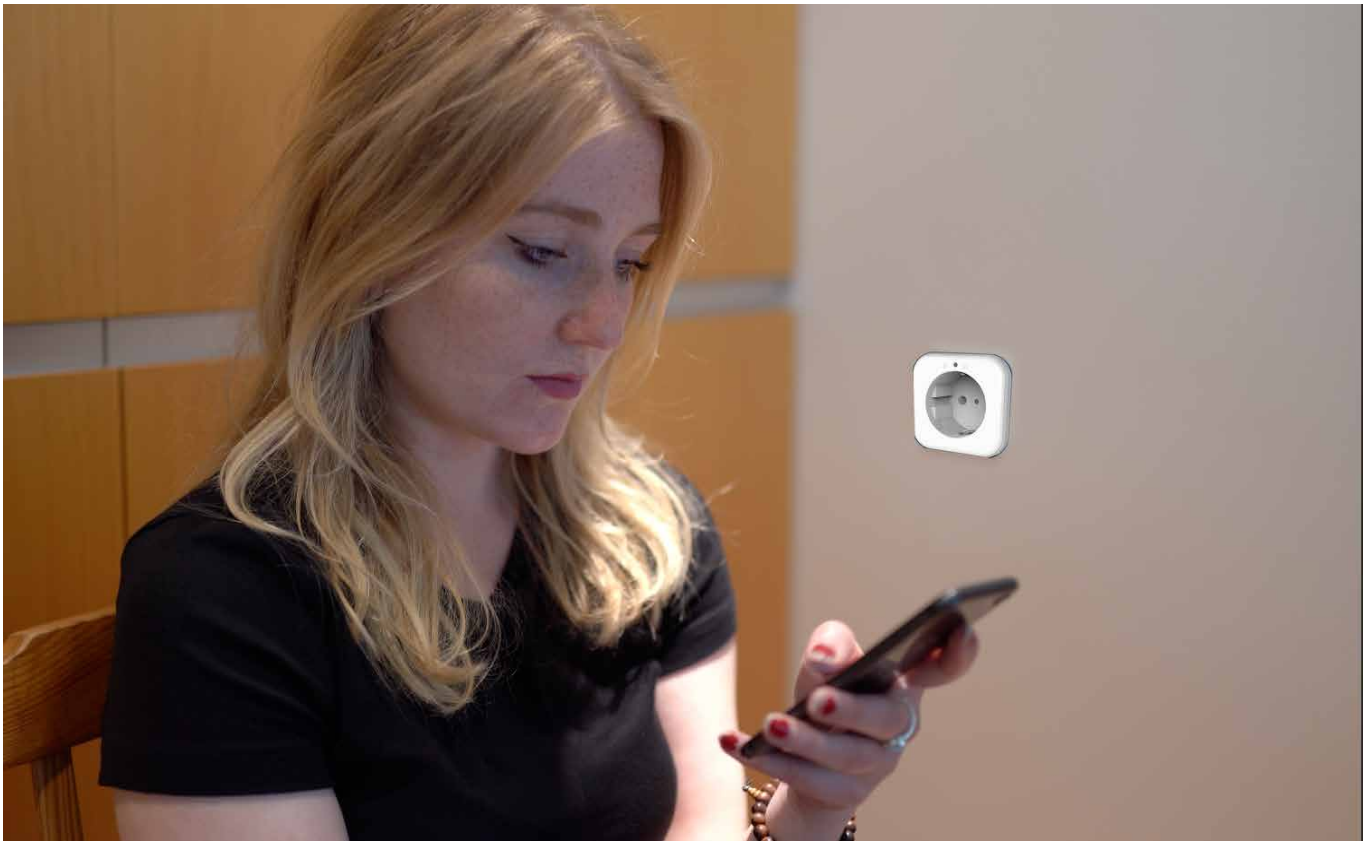
3. LED embedded in Outlet
Physical feedback from the outlet is essential, and is incorporated it within the outlet clearly visible at the top (see figure 19). The LED is integrated into the newly proposed logo.
Also a reset button is designed on the outlet, this makes it possible for the user to get the outlet out of the state when it is stuck without needing a smartphone with the app.



OTHER IMPROVEMENTS

The symbology used is clarifying and understandable. Furthermore the power monitoring function is clearly designed and able to give suggestions to save energy, according to the user's patterns.

An animation at the beginning of the app explains the functions. A small tutorial after it, helps users to learn to work with the system. In the settings, FAQ can be found to help the user even more.



CRÖWNSTONE

6.1 FINAL DESIGN

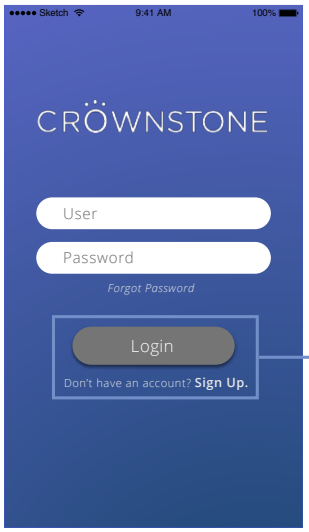
6.3 Final System Design

The screens below depict the main features of the application redesign explained. All the screens of the final design can be found in Appendix O.

Start up

Start Up Animation.
When the application is opened, an animation starts. This is to show the user that the app is laoding.

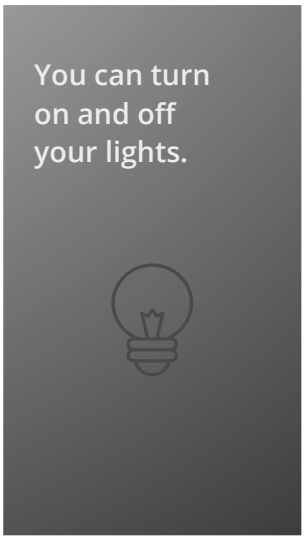
The logo of the app will be displayed with some moving features.



Option to Login in or Sign Up.
Possible to sign in if the user already has an account or it is an option to create one.

For logging in a button is created and Sign Up is visualised small, because the latter will only be performed once.

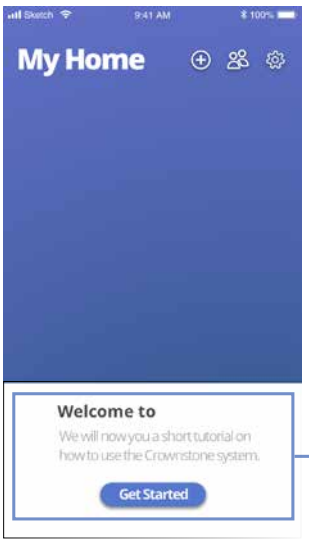
Introduction



Introduction of Features.
To give the user an understanding of what the system can do for them and how they can use it.

In different screens the different features and functions of the application are explained.

Tutorial



Introduction Tutorial.
To help the user when they use the system for the first time, a tutorial can be started after the introduction.

The user can choose to follow the tutorial. In the different screens the functions will be explained.

End of Introduction Tutorial.
To help the user, all the information of the tutorial can still be found.

At the end of the tutorial, the app makes clear that information can still be found under the 'i' icon.

Home Screen

Main Menus.
The three main menus are shown at the bottom to help the user navigate.

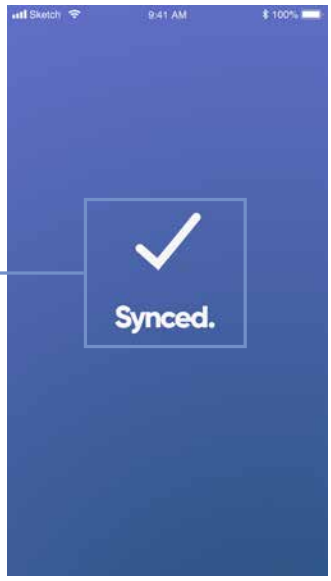
At the bottom of the screen the three different menus are shown. All are labeled with text to make it more clear for the user. The selected menu is indicated with a circle.

Overview Home Screen.
This image makes clear what the home screen will look if multiple outlets are synced. The difference between turning a device or room on/off becomes more clear. When the circle is white, it suggests that the device is on.

Adding an Outlet

Syncing an Outlet.
When the user is adding an outlet, it is clearly indicated when the app is synced and when this is completed.

Through visuals the state of the outlet is communicated to the user. The dots will turn around in a circle when it is searching for a phone to connect with. It is clearly indicted when the outlet is synced.



Switching on/off settings.
The toggle clearly indicated to the user if the setting is turned on or off.

There is a high contrast in color between the switched on and off mode of the toggle to indicate the state clearly.

Presence detection.
The presence detection setting is introduced to the user when an outlet is synced.

A clear description of the setting is given for the user to understand what it means.

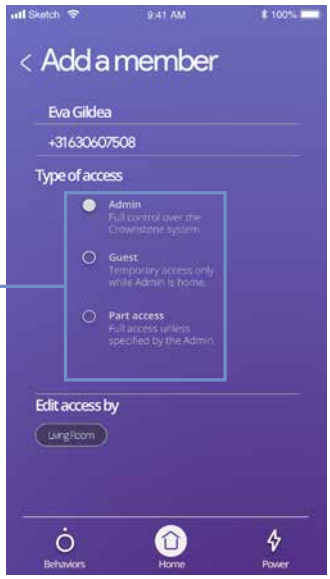
Adding a Member

Adding a member.
It is clearly indicated where the user can add a member. This is useful when the app is used for the first time.

When the user lands on the 'Members' screen, it is indicated with a pop up where to add a member.

Type of access.
The user is able to give different members different access, when needed.

When adding a member, the user can select three types of access. Intentionally this is kept not too extensive.



Power Habits

Power consumption.
To give the user an overview of their power consumption, graphs with this information are included in the app.

The graphs clearly state the power used and indicate the time span of this usage.

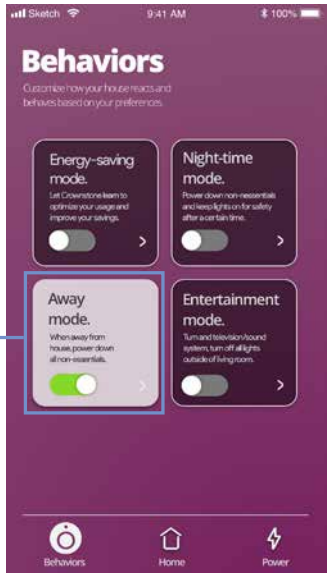
Energy saving.
To help the user safe energy, the power usage of different devices is shown.

For different devices the used energy is displayed. This helps the user to get insights and potentially safe energy.

Behaviors

Behaviors.
In the behaviors part of the app, users can set different modes that will direct the devices accordingly.

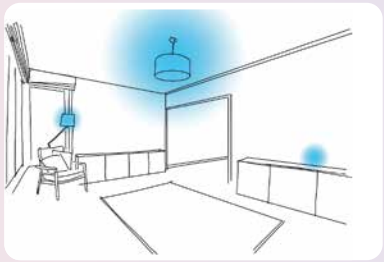
Because this part of the app can be complicated, a short explanation is given. If you click on it, additional information is provided about the mode. Toggles clearly indicate which settings are switched on/off.



STORYBOARD

IDEAL USE CASE

1. Mom returns home with her kids. The security lock integrated with Crownstone indetifys her and unlocks the door.



2. As she enters the home, her prescene (bluetooth signal) activates her lights in the living room)

3. Her kids immediately jump on the couch and attempt to watch T.V. but the home entertainment system is controlled by Crownstone, so the power stays off until the homework is done and Mom allows it.

4. Mom steps into the kitchen. Some of the appliances that do not always need to be running turn on in her prescence.

5. The kids have finished their homework, so she checks her Sphere and turns on the entertainment system.

6. When everyone goes to bed, Mom has configured the lights to shut off.

CONCLUSION

The A5 final design for Crownstone improves the current system both practically and aesthetically. Through a concrete design brief, concept iteration, and user testing, we were able to develop a system that is vastly improved from the current system. We think the redesign would be a realistic and effective way to improve the existing Crownstone in terms of usability and user experience. Still, the product itself and the context are complex, why alternative possibilities should be explored and more time and effort needs to be spent on improvement. Recommendations for these improvements can be found in the next chapter.

07.

CONCLUSIONS:

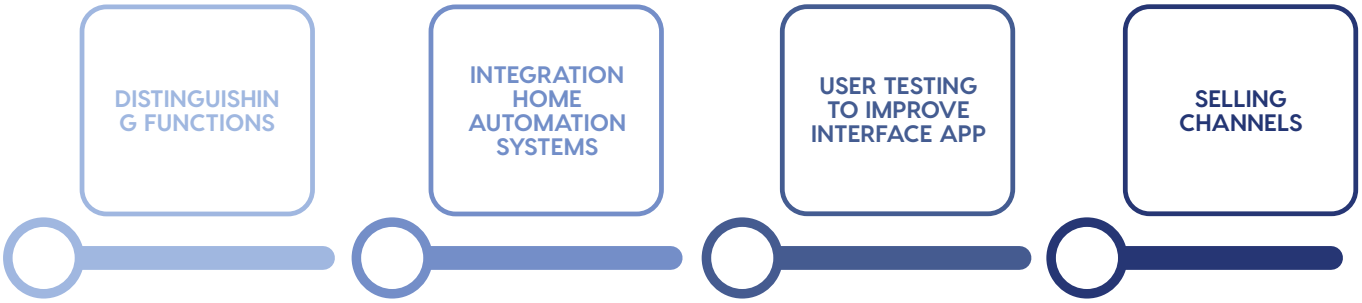
FURTHER DEVELOPMENT

In this last chapter we present the final conclusion and make recommendations to Crownstone about how they can keep improving their smart plug product. Besides this, some limitations from the project will also be discussed.

7.1 DISCUSSION

The two user tests performed, had some limitations. Both tests were done with a small amount of participants, so no extensive quantitative data was collected. Nevertheless, it was always the intention to perform more of a qualitative research instead of quantitative. Also in both tests, the prototype wasn't fully functional. If it was, the test might have given some more detailed insights.

Another limitation was that, during the process, it was not possible to come into contact with real users of the Crownstone product. They could have given a lot of insights about the use of the product and the interface of the application.



7.2 RECOMMENDATIONS

Due to the limited time of this project, not every problem could be tackled within the redesign. But since the two user tests gave rich insights, we translated them into recommendations for Crownstone for further improvement.
From both tests it became clear that users are not completely convinced about the benefits of using the product. The main features and functions are hard to distinguish, which doesn't benefit the value proposition. It is recommended to Crownstone, to spend time on deciding what makes them different from other smart plugs brands and communicate that to the potential users.
More effort can be invested in translating the technological possibilities into a consumer product. Visualising the (potential) technique in a hierarchy is needed for consumers to understand the product better.

Another recommendation is to hire a designer for the interface and user experience of the application and the product. Extensive user testing can help to evaluate the usability of the product and improve the design in an iterative process. Adding functionalities that concern saving energy and adding multiple behaviours are requested.
For the physical product, we recommend to develop an outlet that gives feedback, such as the socket with the LED light integrated suggested in Chapter 6.
From our perspective, the option to integrate with other smart home systems/automation products is needed to fully make use of the possibilities the product offers. Other applications and smart home products can be viewed for inspiration, examples are: Nest thermostat Sonos, Zero, Bose, Xiaomi etc.
Lastly we think it might be beneficial to find other selling channels instead of selling the Crownstones through the company's website. This way the product can draw more attention and can become more successful.

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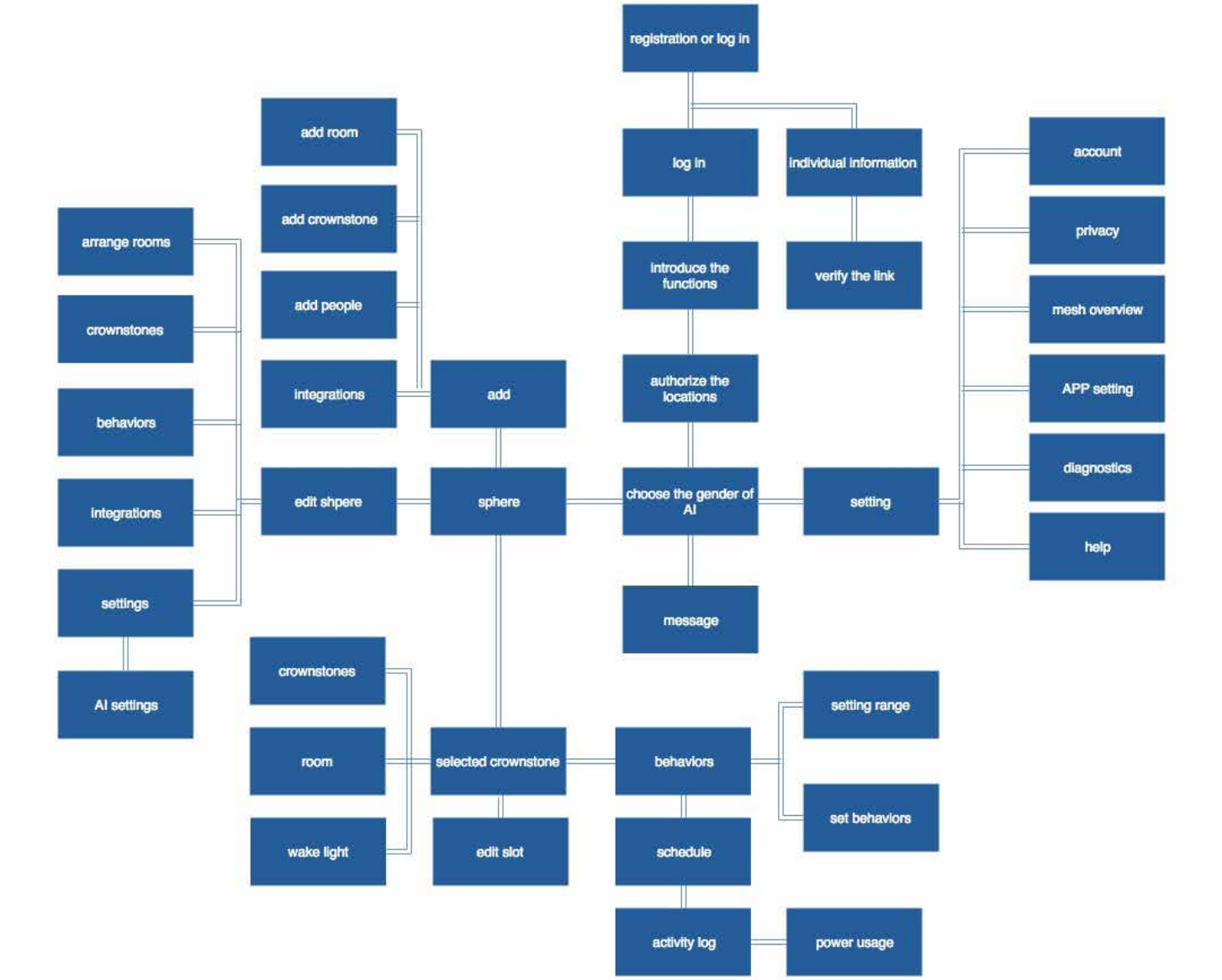
APPENDICES

APPENDIX A: Navigation Tree



APPENDIX B: Wireframe / Flowchart

APPENDIX C: Use Cases

Ease	Indoor localisation	Shut down your entire home with one app	Control your home from one app
Safety	Secure your home	Put child locks on preferred devices	Pretend that you are home
Connect	Connect Philips Hue	Connect with Toon and control the thermostat	Control the lights
Comfort	Wake up comfortably	Let your home take care of you	Come home in comfort and style

APPENDIX D: User Personas

Main user:

The Homeowner

The members of the household are the owners of the Crownstones. One of the family members is the main user of the app to which the Crownstones are connected. This user can invite the other members of his/her family to join the 'Sphere'.

Different User Types

Other user types can be divided into two groups. The ones who are in the house when...

...the household is **home**

...the household is **away**

mechanic | friends & family | neighbours | baby sitter | cleaner / help | thief

APPENDIX D: User Personas

Main target group: the Homeowner
Male / female 30-50

Experience: this user has some experience with smart devices. He had to learn to work with it when he was older, so has some difficulties sometimes.

Other products: this user has a smart phone which he uses every day. Besides that he knows how to work on a computer and can have some other smart devices in his home, like a Chromecast, a Sonos music installation or Philip Hue lights.

Use of the product: this user will try and make his house smart with the Crownstones. He wants to control his devices with his phone. That is why he is using the product every day.
This user is the main user, he will add his other family members to join him in the 'Sphere'.

Preferences: this user wants the application and the Crownstones to have some functionalities. For him it doesn't have to be super simple, but it must be easy to work with.

Secondary user: the Co-user
Child 0-16

Experience: this user has been growing up with technology so knows how to use it. Interacting with technology feels like her second nature.

Other products: this user has been playing with tablets and other smart devices since she was young. If she is old enough she will own a smart phone and possibly other smart devices. She also knows how to control her parents smart devices.

Use of the product: this user comes in to contact with the Crownstones because her parents bought them for their house. When she is still little she is not allowed to use the Crownstone or control it. This is for safety reasons. When she is old enough her parent will add her to the 'Sphere'.

Preferences: this user wants the app to look nice and wants it to work easily. But even if it doesn't she will find her way in working and playing with the app and the Crownstones.

Older user: the Elderly
Male / female 65+

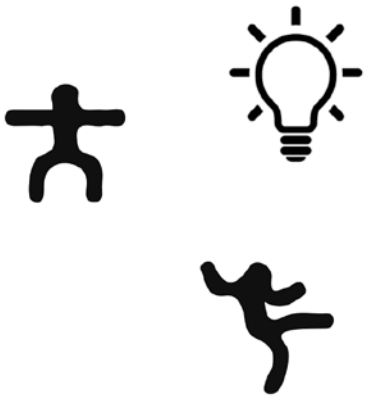
Experience: these users have little experience with technology and smart devices. They have just recently be introduced to it.

Other products: these users have a tablet and a laptop but aren't really experienced in using it. Sometimes they will take classes in improving their skills. They read about all the options the products have in newspaper or hear it on the news.

Use of the product: these users have heard about smart homes and how it can improve the safety. They are really interested in this last aspect and that is the reason why they bought it. When it was delivered to their home it was to hard for them to install. The product remained in the box.

Preferences: for these users the application and way of working with the Crownstones should be really easy. They would also like some help with installing it.

APPENDIX E: Ideation Process 3 Concepts



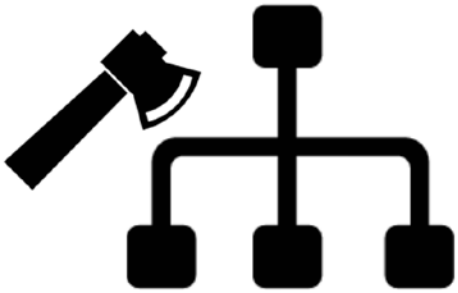
Add some certain physical interactions like body movements control to get a steady and special experience during the process.

At the downloading part, we can add a QR code on the package to guide users to download the Crownstone APP. It would be clearer.

At the registration, we can use other accounts like Facebook and Google for users to log in. It can accelerate the registration procedure.

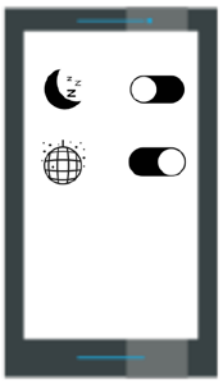
There is too much text in each page for users, which adds their load and ruins their experience. We can transform text to visual icons as well as unnecessory sentences.

Less is more and this APP contains too many functions. It will not only add their learning expense but also give more chance for them to make mistakes, which is a disaster. It would be better to focus on main functions and cut useless items like AI, indoors localization and so on.



Use micro-control-panel on the screen to escape troublesome of unlocking the screen

Do some individual model settings to control all the slots with only one tap, like sleeping model, reading-time model and party model.Do more automatic settings and make it easier for users to edit by themselves.



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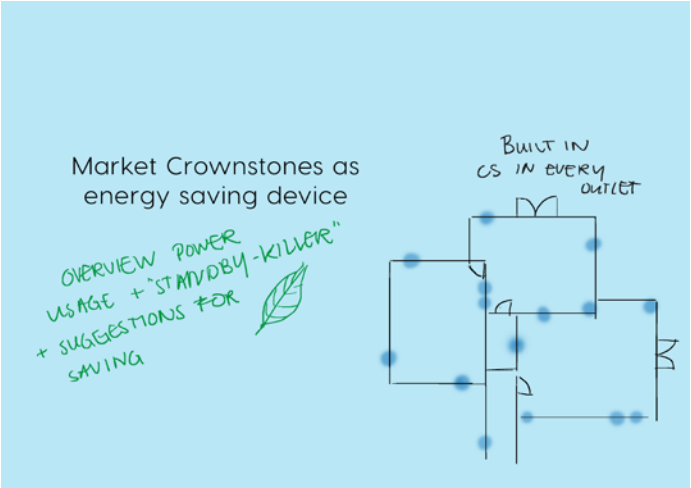
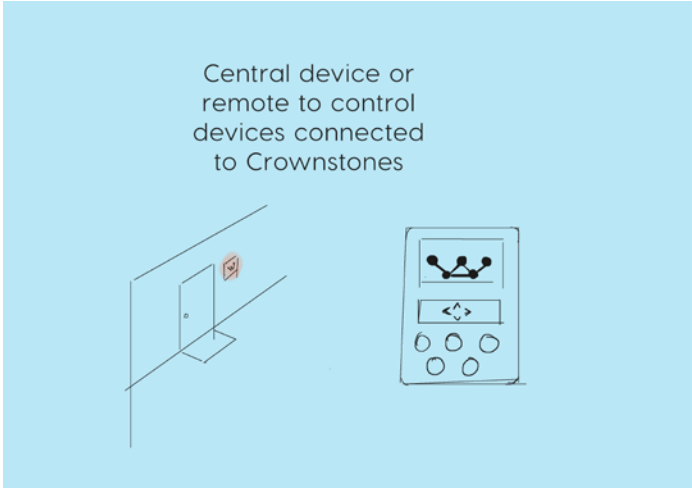
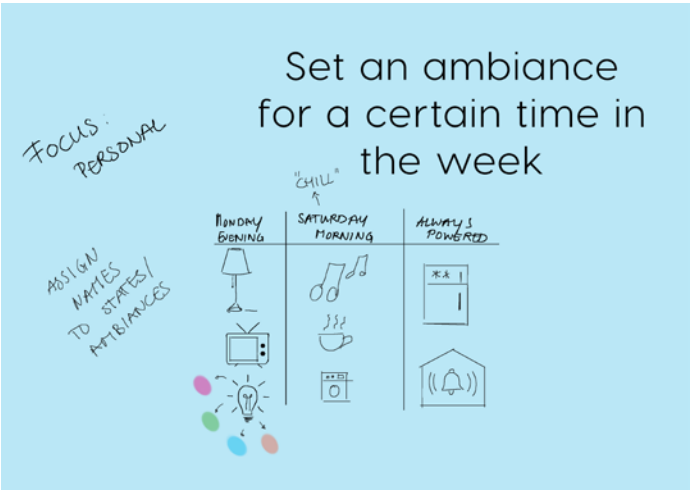
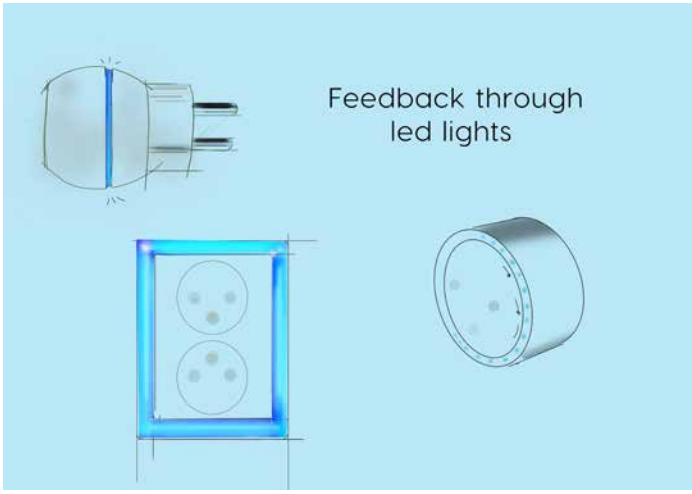


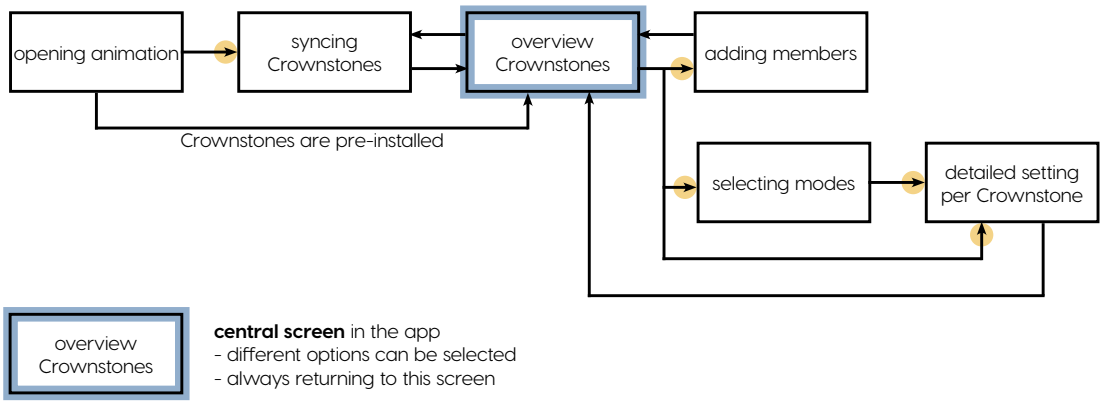


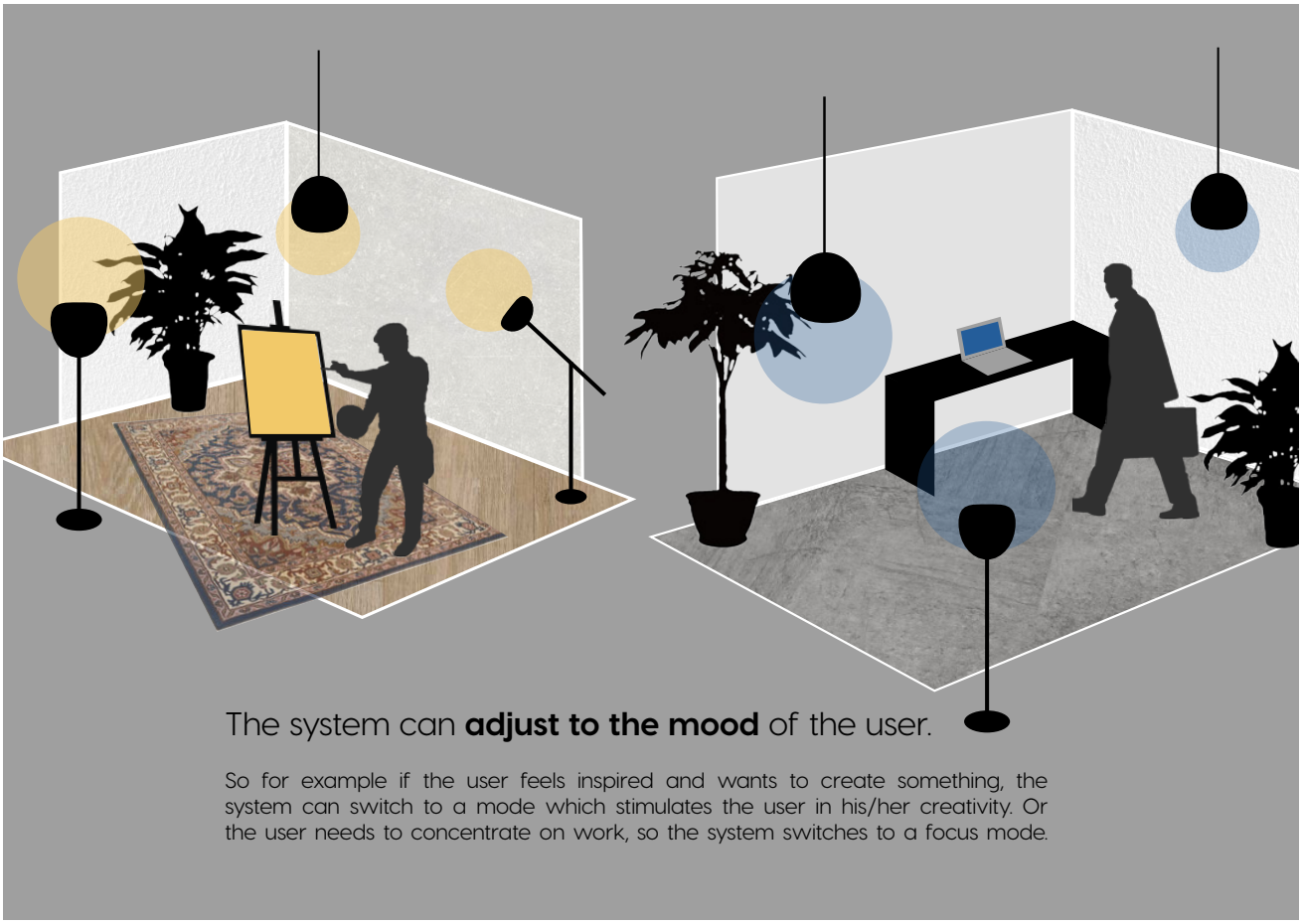




APPENDIX E: Ideation Process 3 Concepts

FLOWCHART

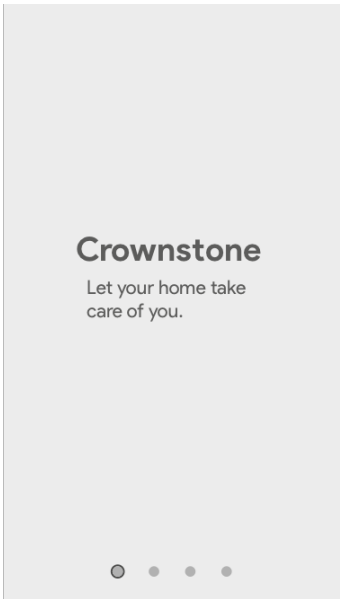


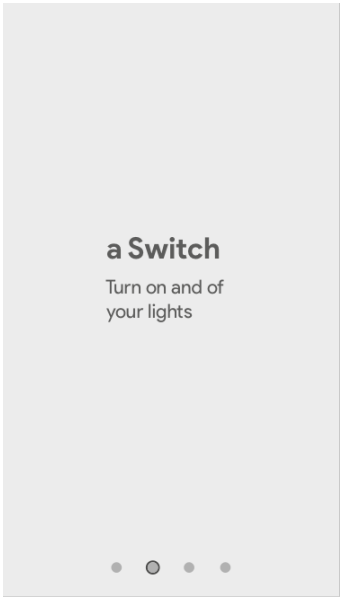


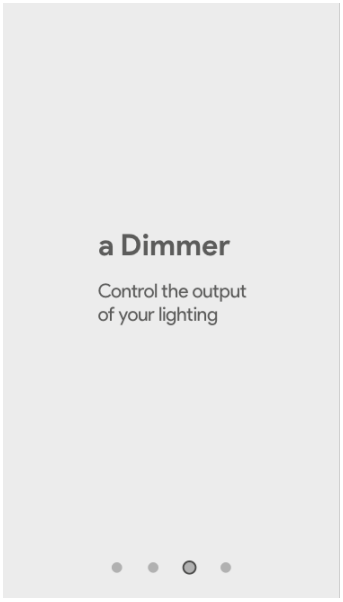
The system can **adjust to the mood** of the user.

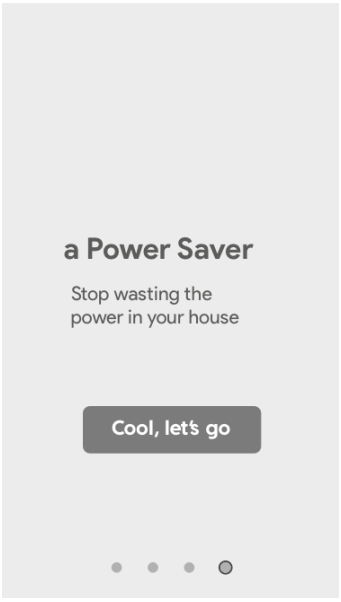
So for example if the user feels inspired and wants to create something, the system can switch to a mode which stimulates the user in his/her creativity. Or the user needs to concentrate on work, so the system switches to a focus mode.

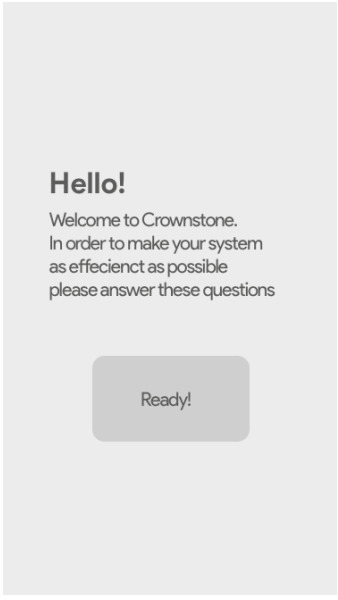
APPENDIX F: Screens of the 3 Concepts

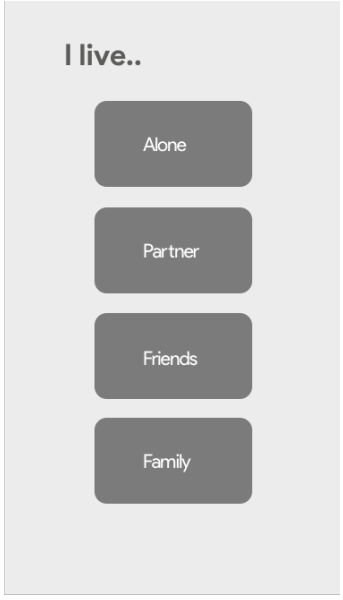












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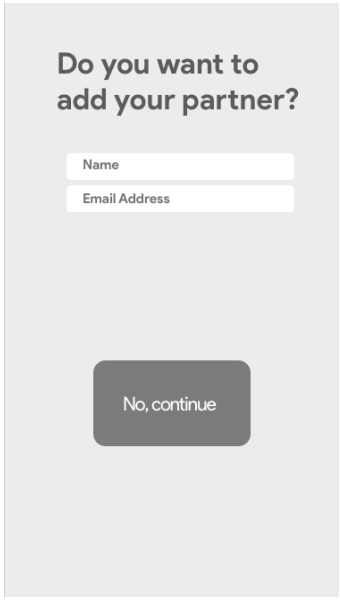
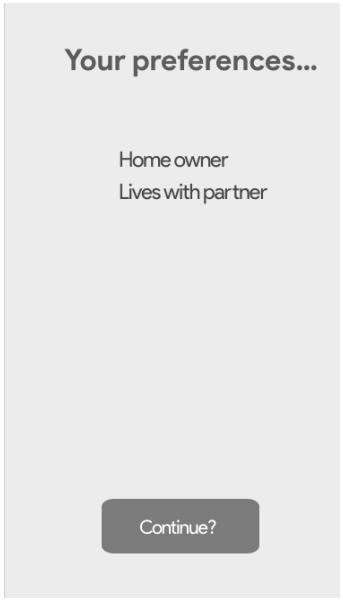
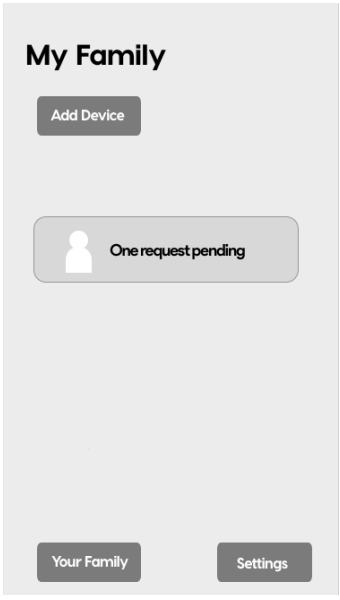
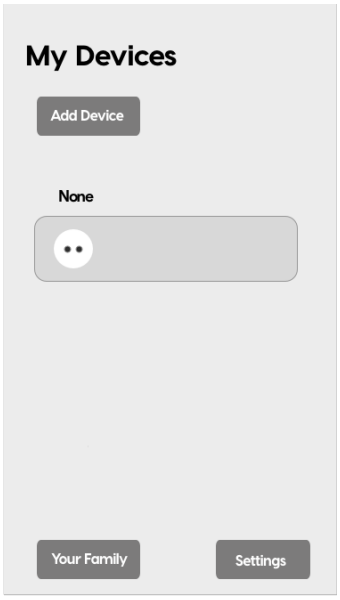
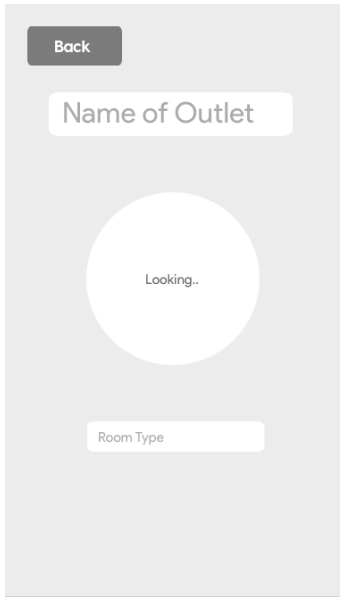
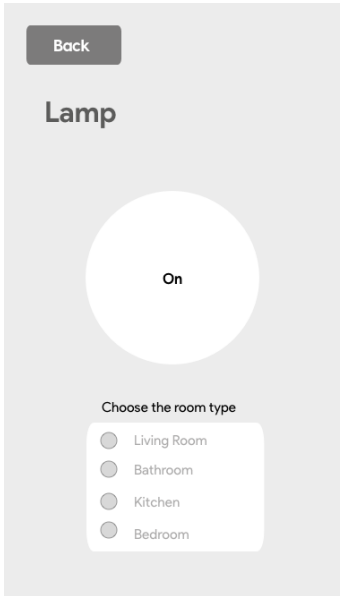


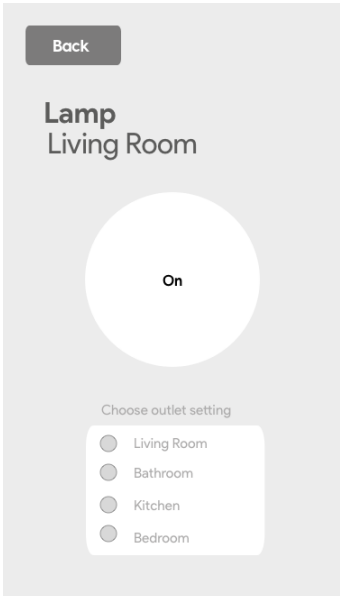




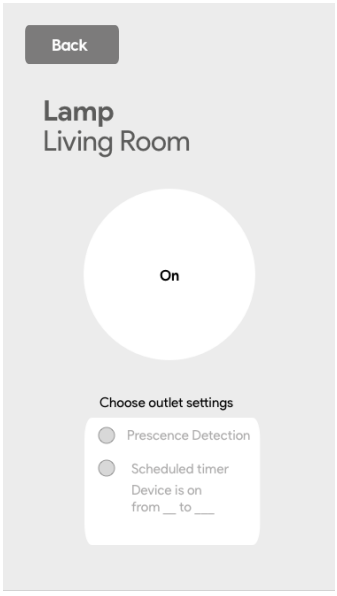


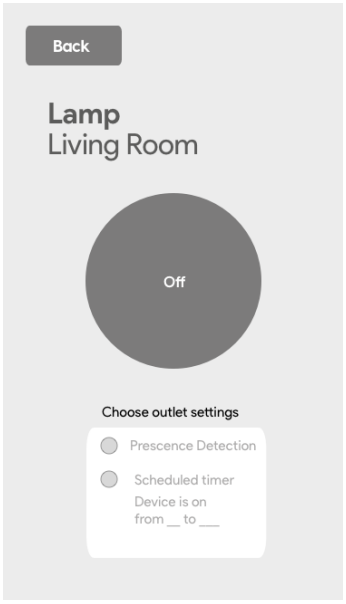


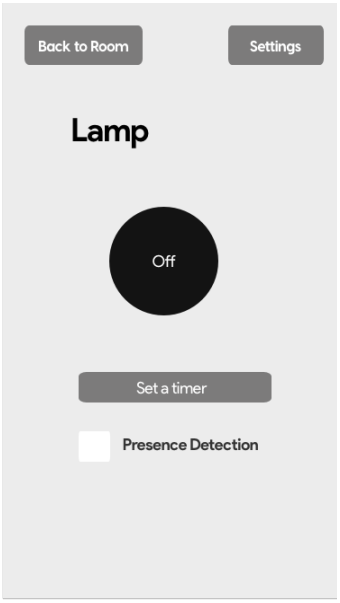


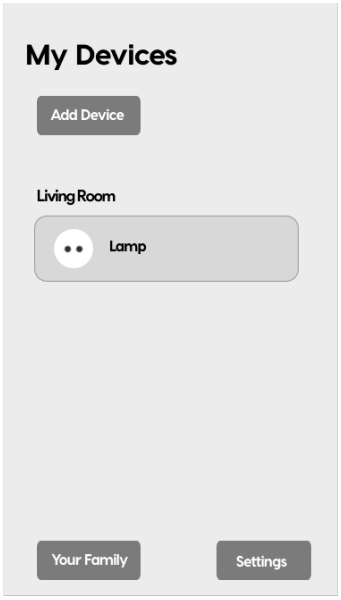


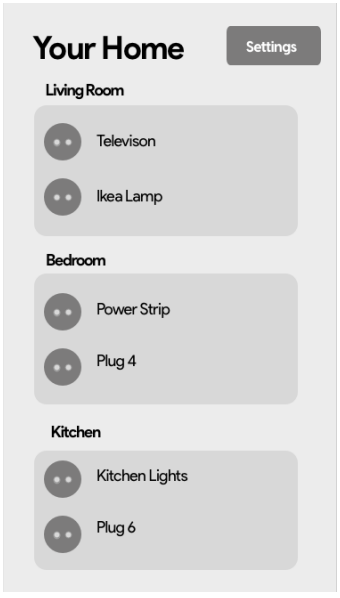
APPENDIX F: Screens of the 3 Concepts

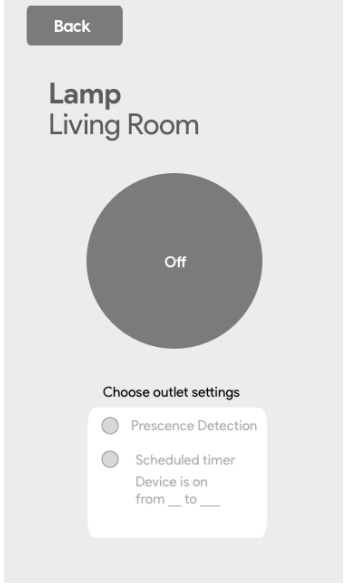


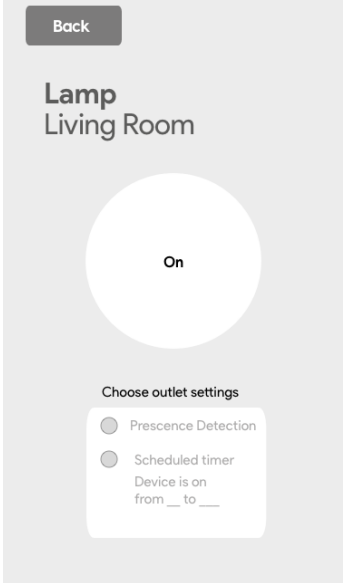


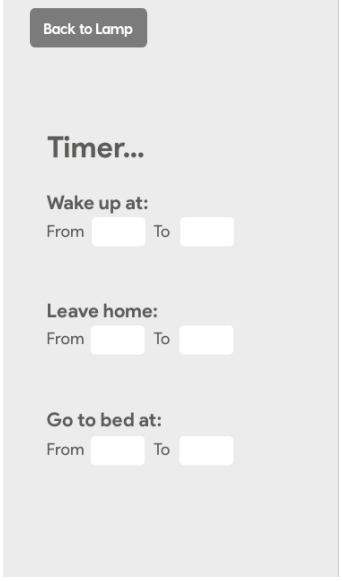












APPENDIX G: Script User Test 1

Script

Hi _____, nice to meet you.

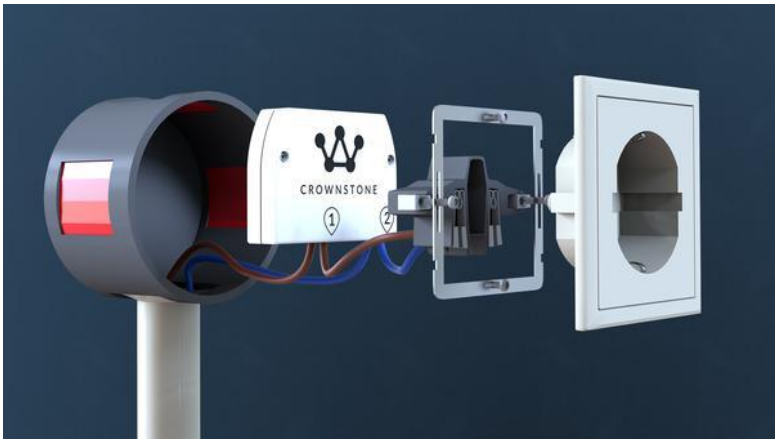
Thank them for participating in our test.
Have some **small talk** (ask how they are doing, if they are looking forward to do the test etc.)

I'm _____, and this is James who will be taking care of technical stuff. We're design master students at TU Delft, and are currently doing a project for a StartUp named Crownstone on one of their newer products, a smart plug that you can use to control your lights and the power of your devices at home..

SHOW THE CONSENT FORM - Give a pen and both copies to sign

We have put down on paper what we will do with the information gathered during the test. It says that we'd like to record this test on both audio and video, to be able to get as much data out of it as possible. We won't use the recordings for everything else but our research. We will not show the video to anyone besides our team of five students and our two coaches.
Please read this **consent form** and let us know if you have any questions. If you agree, please sign the form and we will start the test. *(Make sure that they understand it and feel free to ask any question they have about it.)*

Introduction
As I mentioned before, currently we are working on a project in which we will **improve the User Interface** of an existing product. This is the graphic visualisation of a product via which an user and a product interact with each other.
The product we are improving is the **Crownstone**, which is also the name of the company producing them. Crownstone is a smart plug/switch that can help homeowners to control the outlets in their house using a smart device or wearable (think of the app on a smartphone).
(*Show them a picture of the Crownstone products. Maybe also show them a picture of the app on a phone?)*



There is a **bluetooth connecter** inside the outlet that allows you to operate the outlet from your phone (*create an infographic about this and show them?*). In this way you can control the power

APPENDIX G: Script User Test 1

of your devices. We'd like you to pretend that this (*show them our 'wall'*) is a **wall in your own house** with two outlets that have a Crownstone installed in them (*show them again the image of the Crownstone that is integrated in the outlet*). The system detects your presence through the bluetooth signal your smartphone sends out.

We made a **storyboard** to show you an example how this system could work.

Is it clear what this product is to you? Any questions?

Explain the test

We'd like you to test 3 different concepts of our redesign. During the test please ask any question, and don't stop yourself from **thinking out loud** and describe how it feels. There is no right or wrong. By explaining everything you are trying and doing, you would really help us in our research. Also feel free to ask questions if something is unclear. All the concepts are related to the first use.

The test will consist of **three parts**, in every part we will show and let you try one concept. After each part we will ask you a few questions about your experience before we proceed to the next step. Before trying the first concept, we will ask you some **general questions**.
We'd like you to pretend that you are a homeowner that is living together with someone else (could be a partner, a roommate, children whatever) that just starts using the product. We have different concepts about the configuration phase that we'd like you to test. Imagine that in your house these Crownstones are already installed in the outlets, but not yet synced, so they're not ready to use yet.

Is everything that I explained clear? Do you have any questions?

Warm-up
To start, I'm going to ask you a few questions about yourself, in relation to sending mail and using technology. Let's get started:

1. How do you spend your time; do you work? Study?
    a. Full-time?
2. Can I ask you how old you are? If you are not comfortable with that you can also give an age range.
3. What kind of home do you live in?
4. What kind of phone do you have? Do you use apps on your phone? What apps do you use most often?
    a. How comfortable would you say you are with figuring out new things and applications on your phone?
5. Do you own a smart home system/product? If yes, of which elements does it consist?
6. How experienced are you with technology?

APPENDIX G: Script User Test 1

Test first concept

Questions first concept
So how did it go? (keep asking things like ‘anything else?’ and ‘why?’)
What kind of problems did you ran into?
What aspects did you like?
What aspects were clear?
What aspects were unclear?
What did you like/dislike?

Test second concept

Questions second concept
Same questions as with concept 1

Test third concept

Questions third concept
Same questions as with concept 1

Questionnaire (from 1 to 5)

1. *I think that I would like to use this system frequently.*
2. *I found the system unnecessarily complex.*
3. *I thought the system was easy to use.*
4. *I think that I would need the support of a technical person to be able to use this system.*
5. *I found the various functions in this system were well integrated.*
6. *I thought there was too much inconsistency in this system.*
7. *I would imagine that most people would learn to use this system very quickly.*
8. *I found the system very cumbersome to use.*
9. *I felt very confident using the system.*
10. *I needed to learn a lot of things before I could get going with this system.*

Enter the data in a spreadsheet to record data or make calculations such as:

11. *Success rates*
12. *Task time*
13. *Error rates*

Final questions
Put the three concepts next to each other (sort of overview image) and ask the participants what kind of differences they noticed.

1. What kind of difference between the concepts did you notice?

APPENDIX G: Script User Test 1

2. Which concept do you like best and why?
3. Which concept do you like the least and why?
4. What are aspects that you liked?
5. What are aspects that you didn't find convenient?
6. Would you consider using Crownstones in your own house? Why (not)?
7. How would you prefer to set up this system?
8. What do you think of the whole smart system experience?

STEPS IN KEYWORDS

Introduction
Thanking
Small talk
Improve UI - explain UI
Explain Crownstone
    Smart plug/switch
    Bluetooth
Show them 'the wall'
Storyboard

TEST

Think out loud
3 concepts
Consent form

General questions
3 parts of the test
Questions in between

APPENDIX H: Results User Test 1

Participant 1

Master student
Electrical Engineering
man, 24 years

Lives in house
with roommates/friends

Grew up with technology
Doesn't own a smarthome system

Participant 2

Bachelor student
Industrial Design Engineering
woman, 22 years

Lives in an apartment
with partner

Grew up with technology
Doesn't own a smarthome system

Participant 3

Working: communication department and photographer
woman, 47 years

Lives in house
with partner and child of 8

Has experience with technology
Does own a Sonos sound system

Participant 4

Master student
Industrial Design Engineering
woman, 25 years

Lives in house
with one roommate/friend

Grew up with technology
Doesn't own a smarthome system

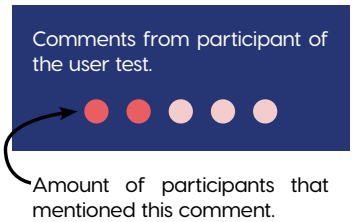
Participant 5

Master student
Electrical Engineering
man, 24 years

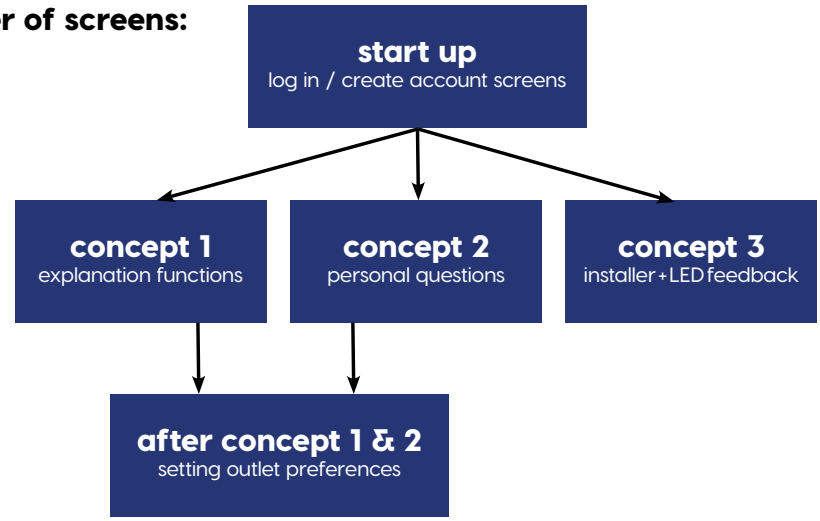
Lives in house
with roommates/friends

Grew up with technology
Doesn't own a smarthome system

Legend



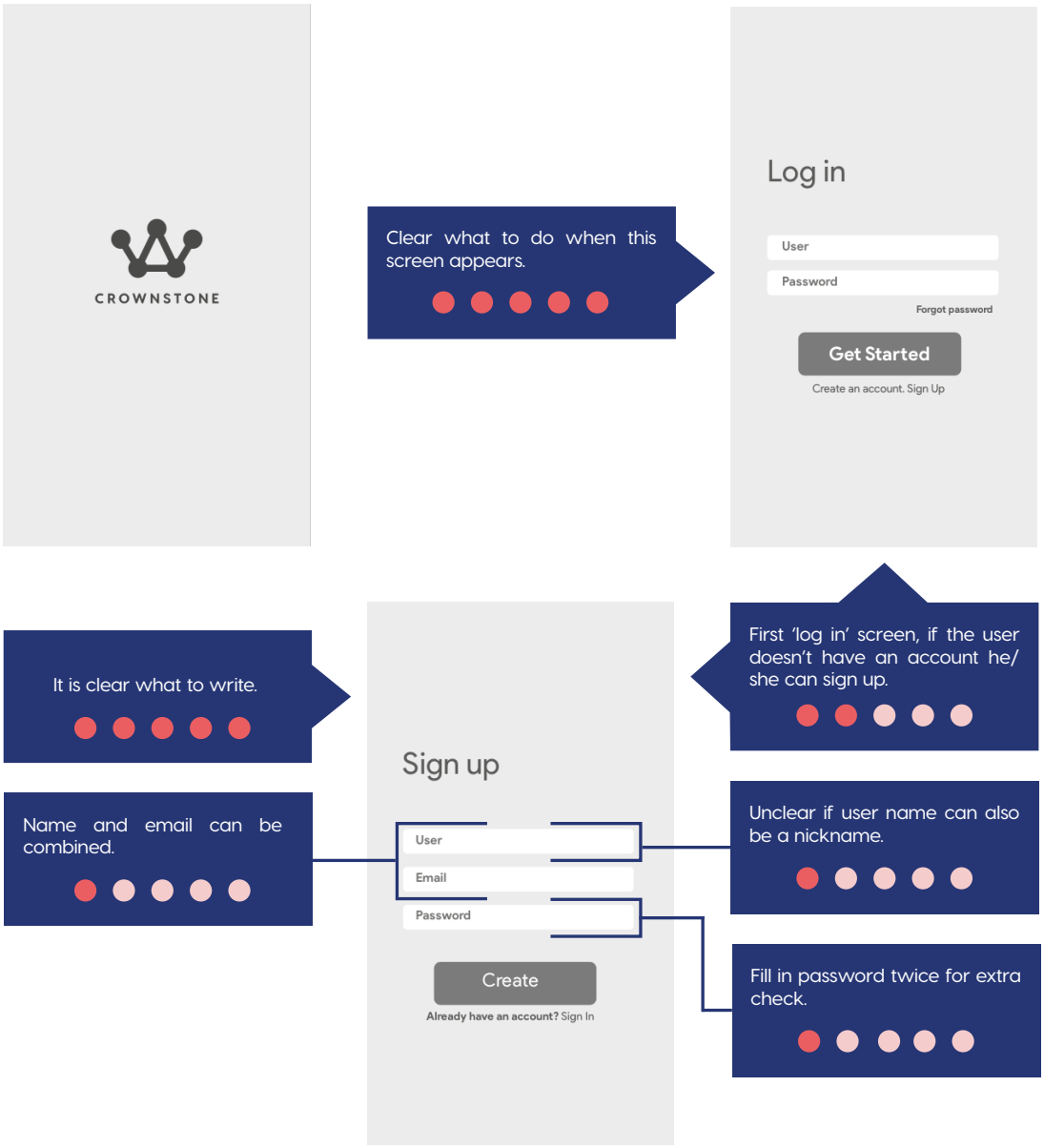
Order of screens:



APPENDIX H: Results User Test 1

Start up

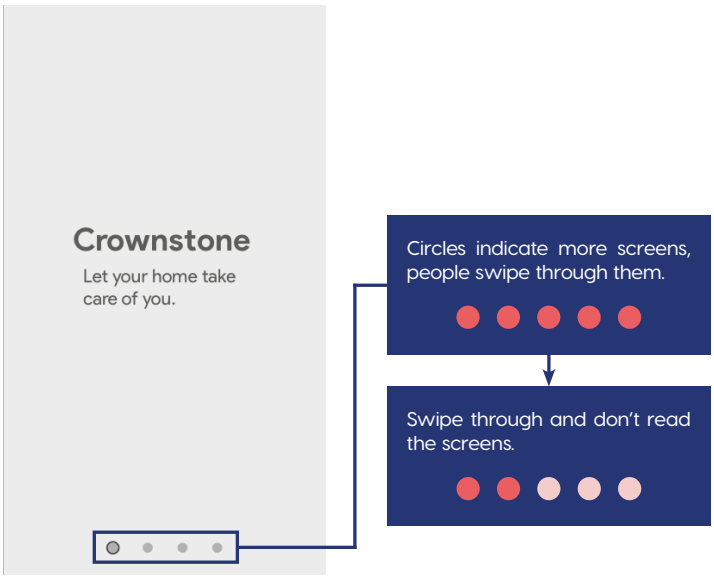
The start up screens are the same for all the three concepts.



APPENDIX H: Results User Test 1

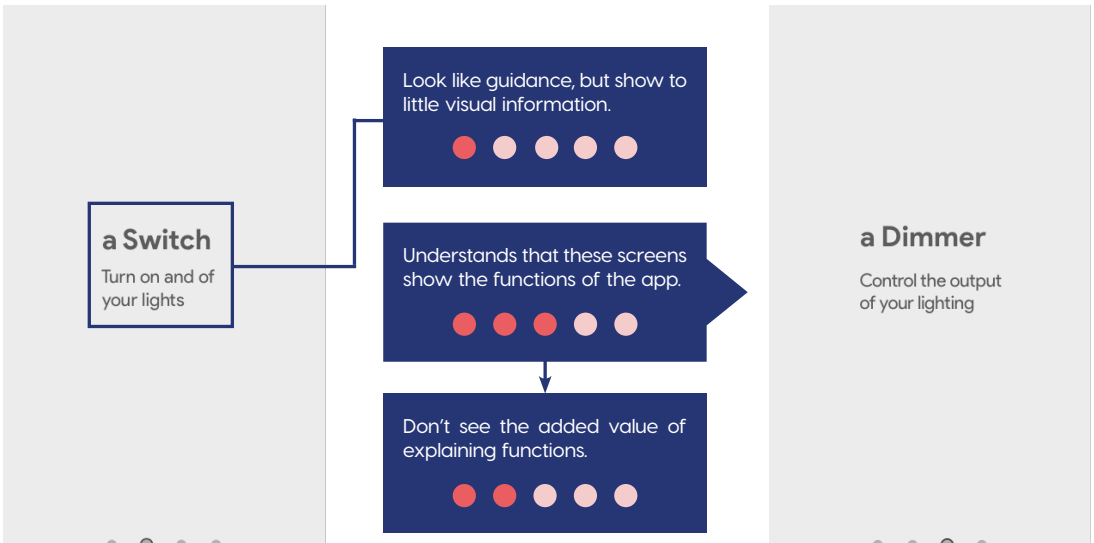
Concept 1

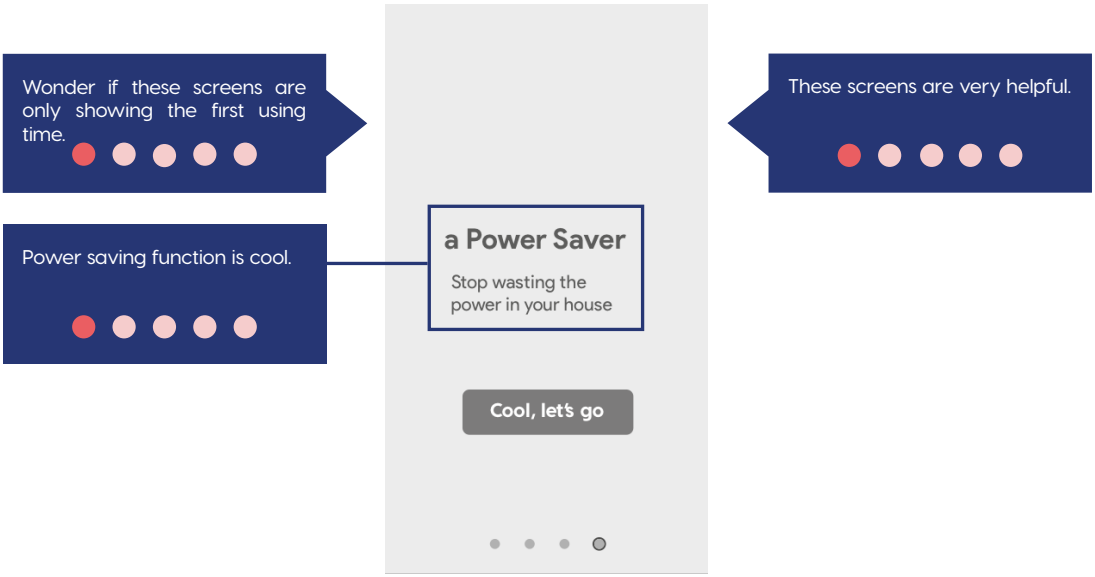
Functions explained in a few opening screens, no LED light feedback from the outlet.



Overall comments

Clear and consitent concept.





APPENDIX H: Results User Test 1

Concept 2

Opening screens are in 'If This happens, Then That should happen' style, asking for user feedback to optimize the experience.

Overall comments

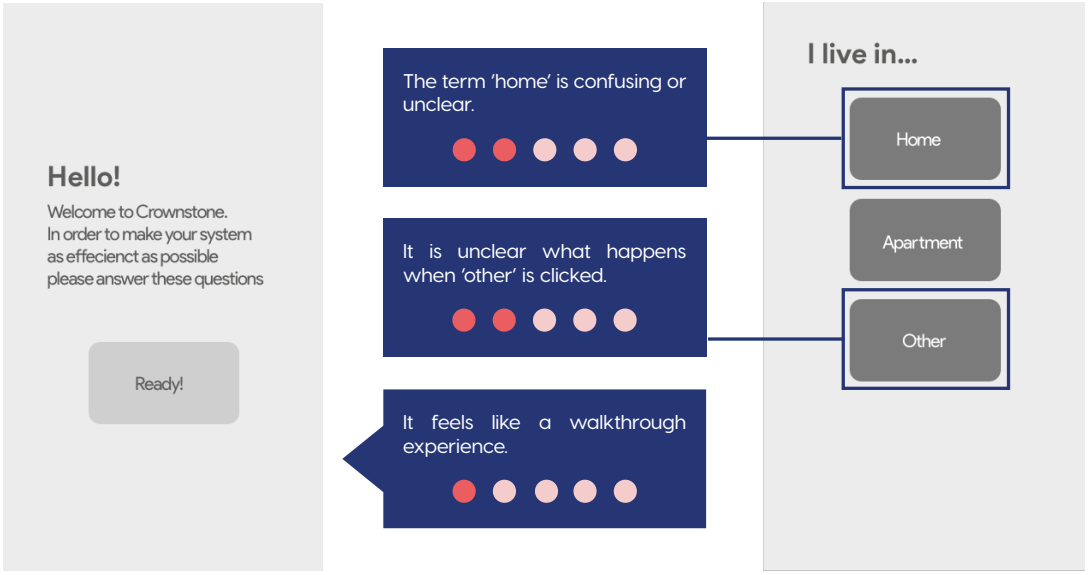
Concept is more personal.

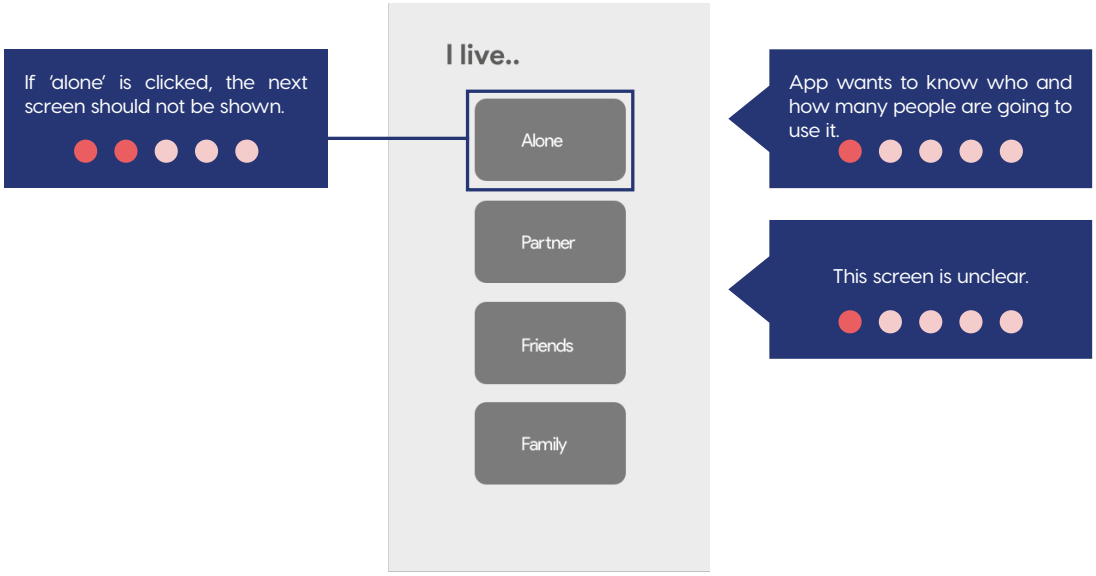
Could be more questions.

There are a lot of screens.

Asking preferences works. Should be able to change these preferences later.

Some questions are not necessary or unclear.

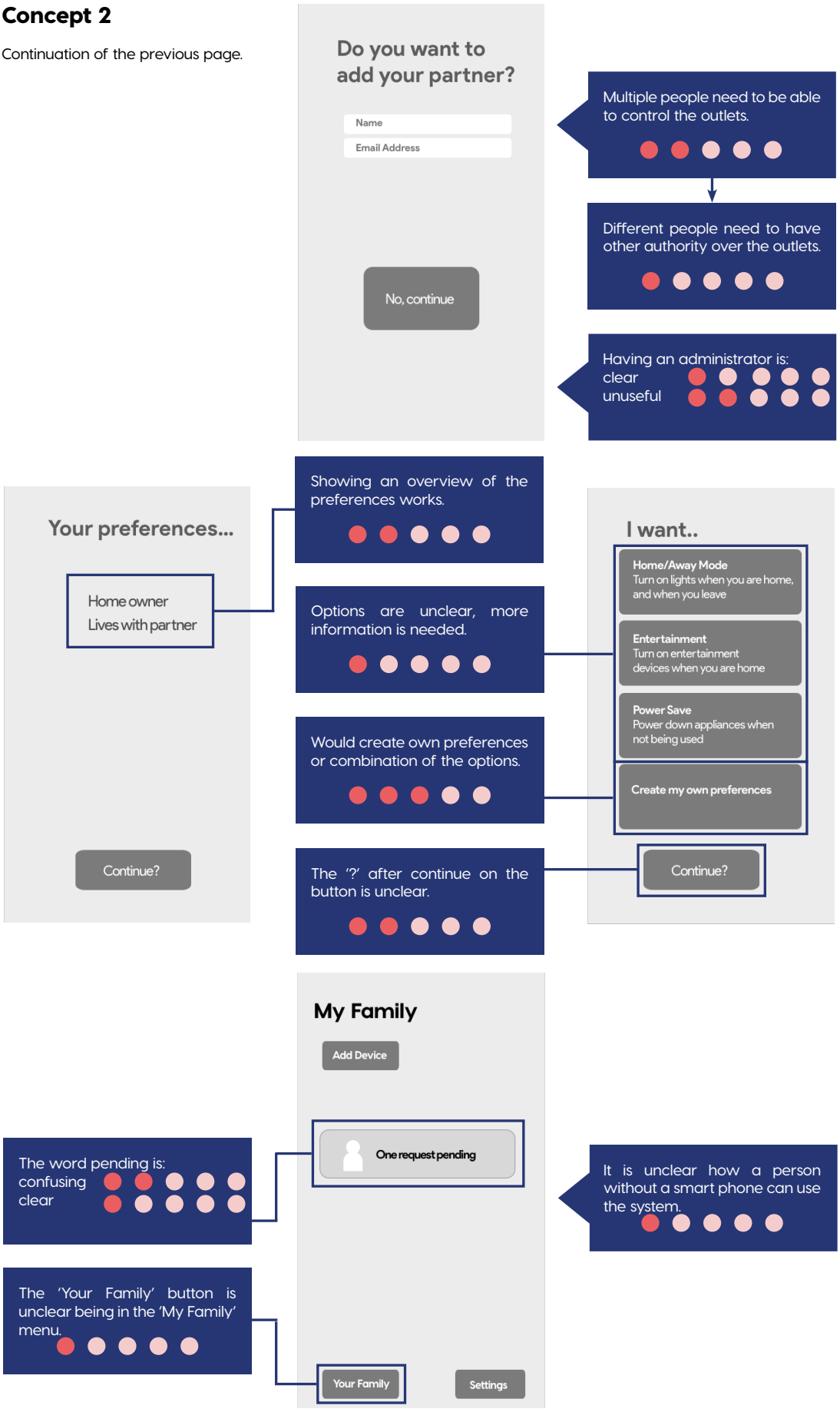




APPENDIX H: Results User Test 1

Concept 2

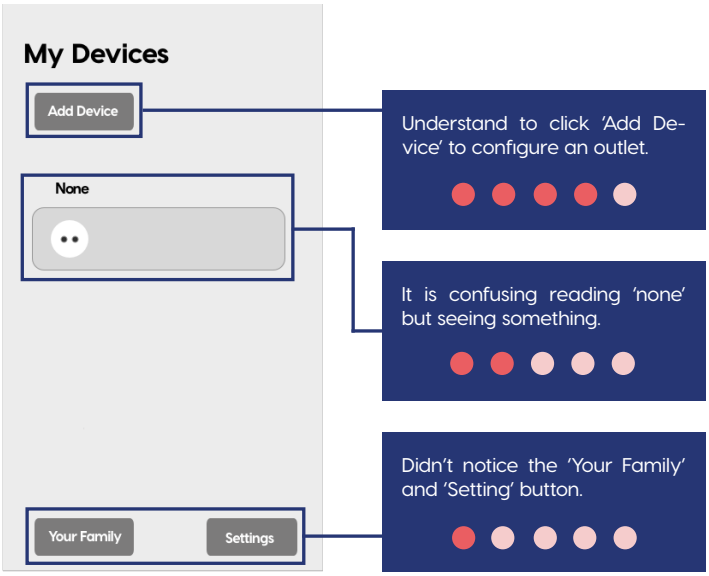
Continuation of the previous page.

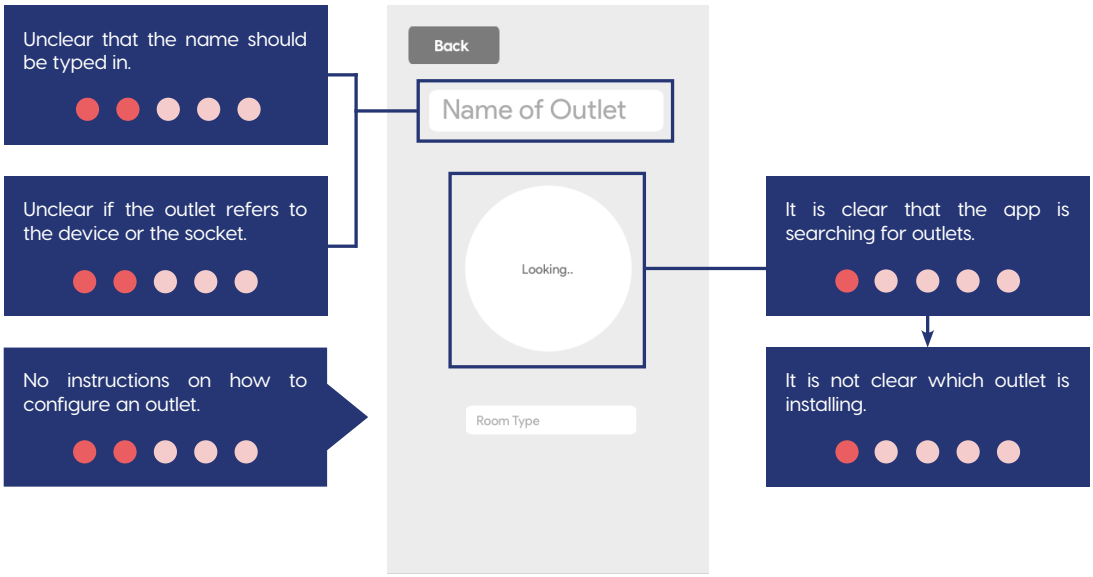


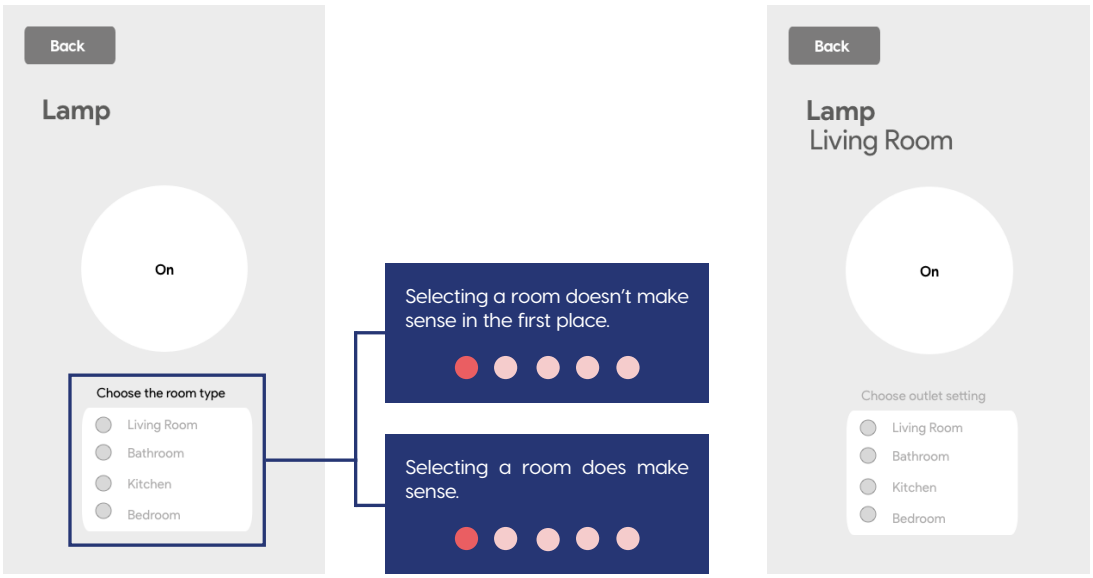
APPENDIX H: Results User Test 1

After concepts 1 & 2

Continuation of concept 1 and 2 after the opening screens.



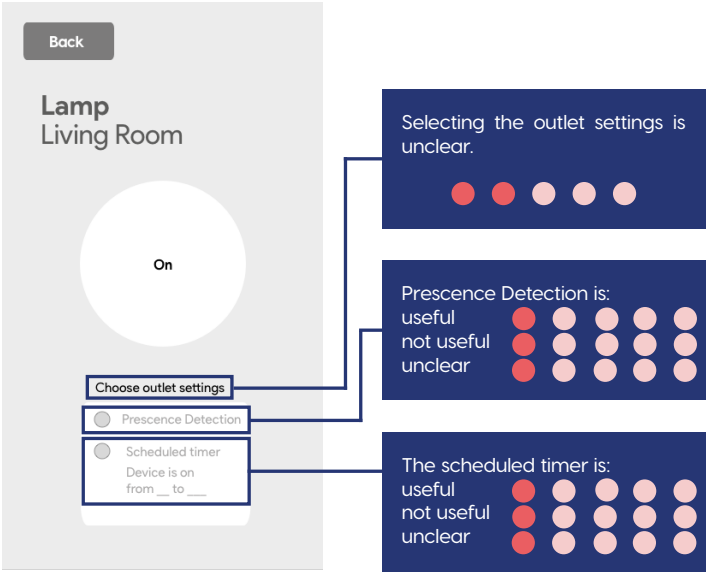


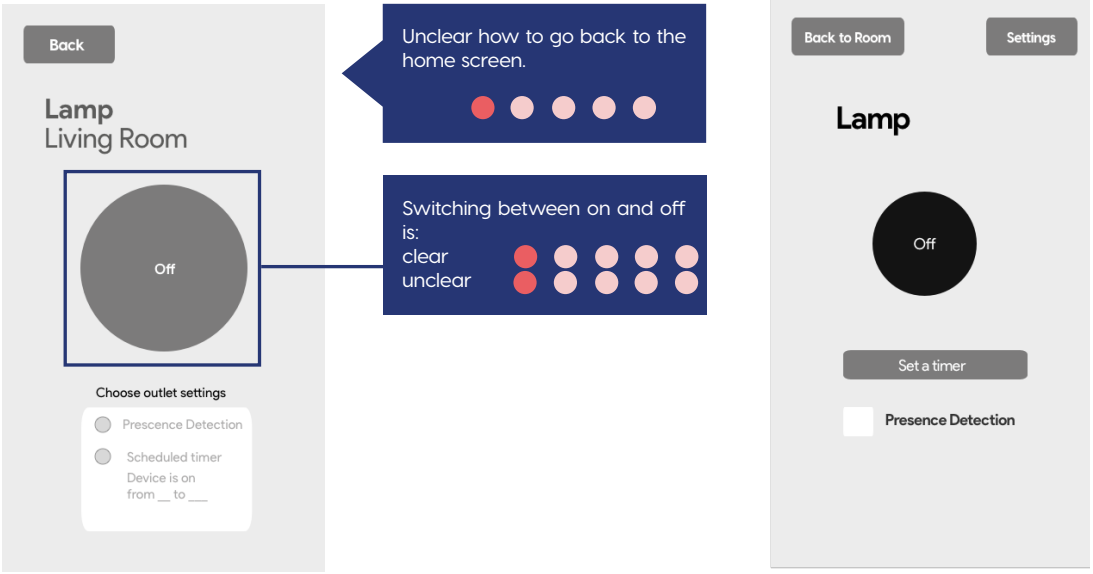


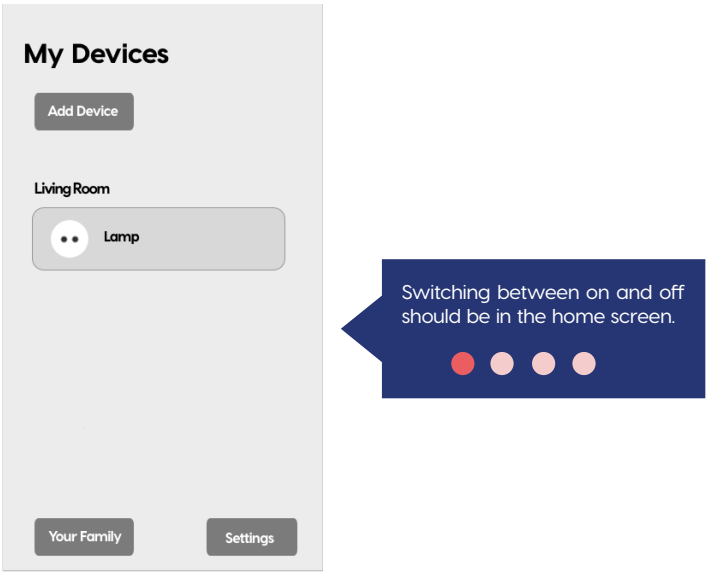
APPENDIX H: Results User Test 1

After concepts 1 & 2

Continuation of concept 1 and 2 after the opening screens.







APPENDIX H: Results User Test 1

Concept 3

An installer sets up the system and gives the user a walkthrough.

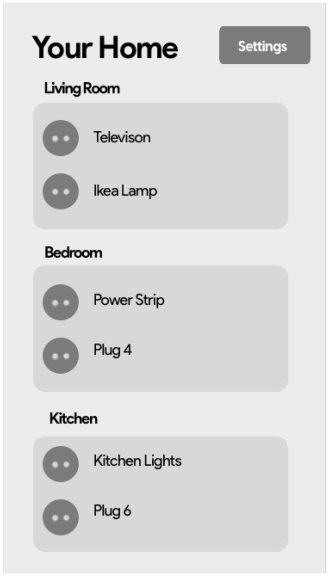
Overall comments

Visual feedback is useful.

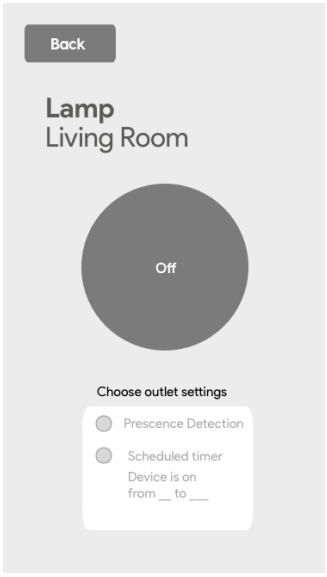
More personal.
Someone explaining is helpful.

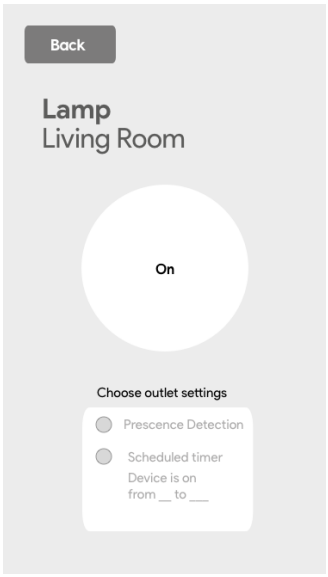
Pre installed system works.

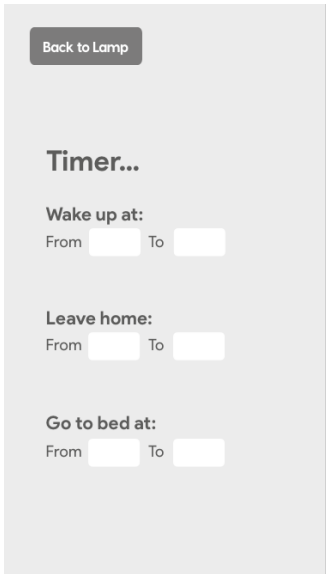
The overview is useful.



Would be nice to have a map of the house with the outlets.







APPENDIX H: Results User Test 1

	Concept 1	Concept 2	Concept 3
concept is clear	++	+-	++
comfort of use	+	+	+
personal feeling	-	++	++
enough guidance	-	+	+

Start up

+ Clear how to create an account or log in.

- More logical to have 'log in' first and then 'create an account' if the user doesn't have one already.

To improve:
Put the 'log in' before the 'create an account'.

Concept 1

+ It is clear that there will be more screens and the user can swipe through them because of the dots.

+ Clear that functions are explained in the swipe through screens.

- Not all participants convinced of the usefulness of showing the functions.

To improve:
Let the user experience more usefulness when showing the functions.

Concept 2

+ Asking the personal questions make sense and is clear.

- Not all the selectable options that are given as an answer to the personal questions, are clear or useful.

To improve:
Give more logical and useful options for the user to select.

After concept 1 & 2

+ Where to click for adding a device is clear.

- The 'home screen' is unclear when there are no outlets. Stating 'none', but showing something.

- The searching for the outlet is unclear. Where to add a name, what 'looking' means and why to select a room type.

To improve:
Make it more intuitive and logical for the user.

Concept 3

+ The personal experience of this concept is preferred by the participants.

+ The feedback of the LED in the outlet is very useful.

To improve:
Not really something to improve, but it should be considered if sending an installer to every users home is feasible.

APPENDIX I: Evaluation of 3 Concepts

In this appendix a more extensive evaluation of the three redesign concepts is described. The conclusion from the first user test, was that the second concept was the best one to continue with. The feedback on the different concepts will be shown below.

Concept 1

The 'intuitive' approach worked well with the participants, they felt comfortable in figuring out things on their own. One of the pain points found in this concept, was that icons and visuals were needed in the 'welcoming introduction'. This because the functions were only presented in a sentence thus they didn't catch the users' attention. Furthermore, users encountered some trouble when trying to sync the product to the app. Among their concerns were: how to know which switch you're installing, there were no instructions about getting closer to the product in order to install it, and what does 'looking' (referring to the crownstone that is searching for a Bluetooth connection) means.

Concept 2

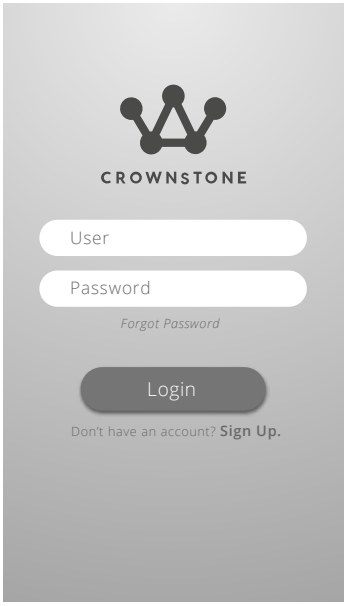
The 'If This, Then That' approach got more positive feedback than the other two concepts, users found it personal and useful. The comments were in general positive although there was some confusion regarding the purpose of the questions as well as privacy concerns. What users liked the most from this concept was that it walks the user through the experience and gets them engaged with the product.

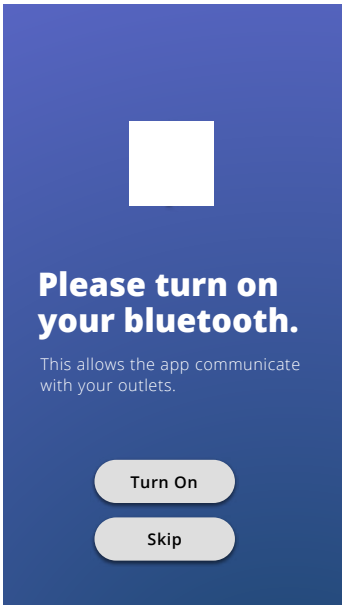
Concept 3

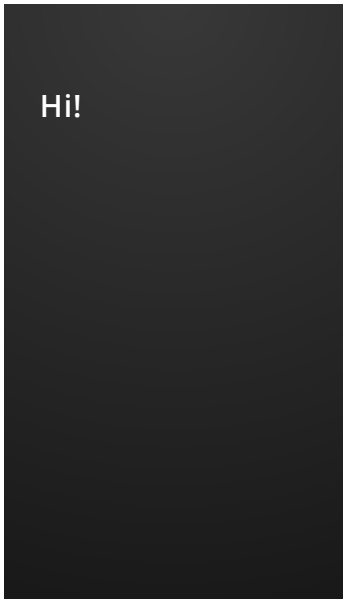
The 'step-by-step' approach worked perfectly for some users that didn't have much experience with technology, but for those who are familiar with technology in general, the assistance felt unnecessary.

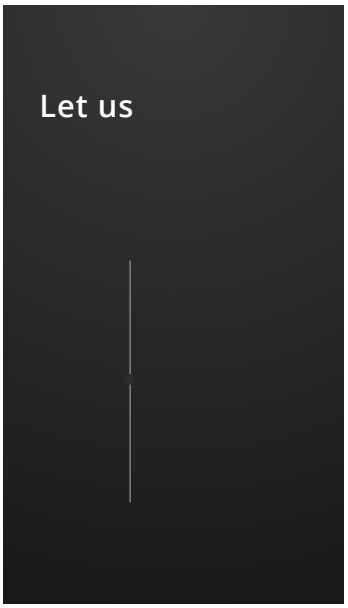
One of the dislikes towards this concept among some users, was having someone in their home taking over control. On the other hand, something that was appreciated by everyone was the use of a LED light as feedback from the product when it was being synced. Lastly, the detailed home screen overview from this concept was very useful in comparison to the others.

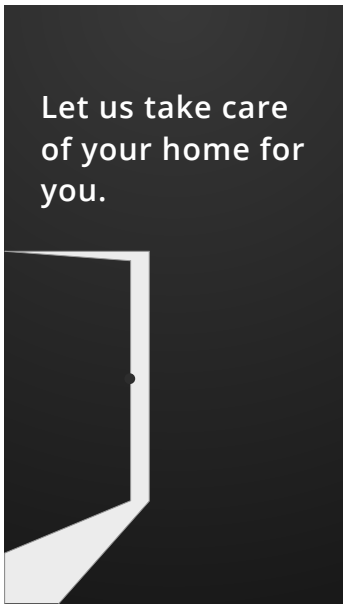
APPENDIX J: Screens Redesign Concept



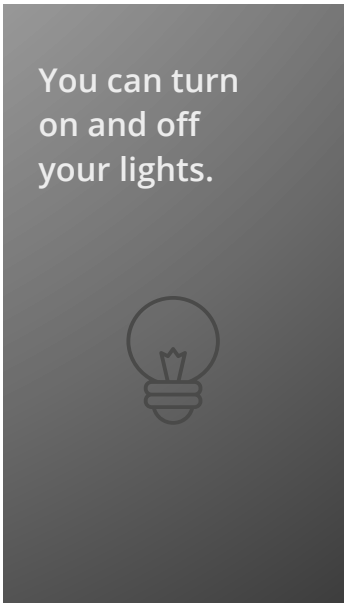


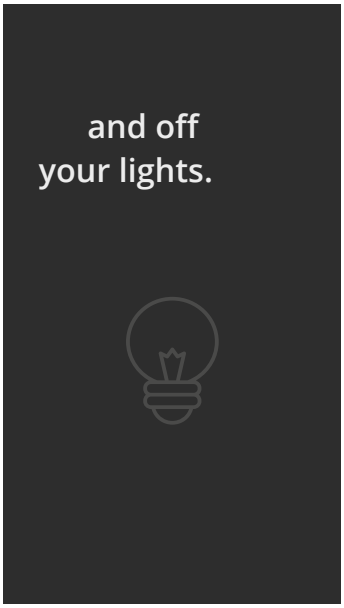


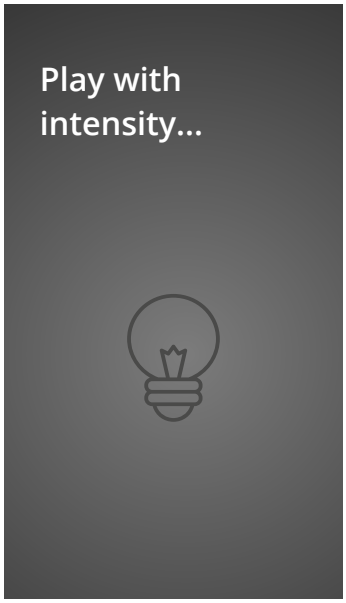


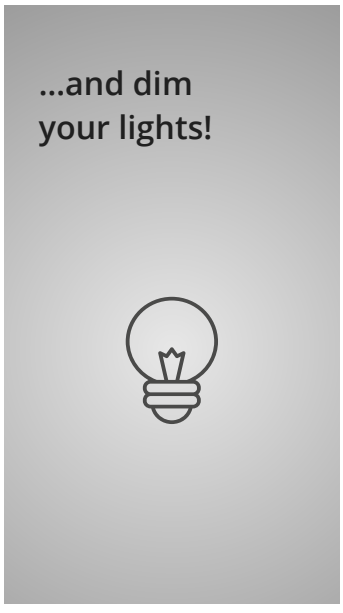


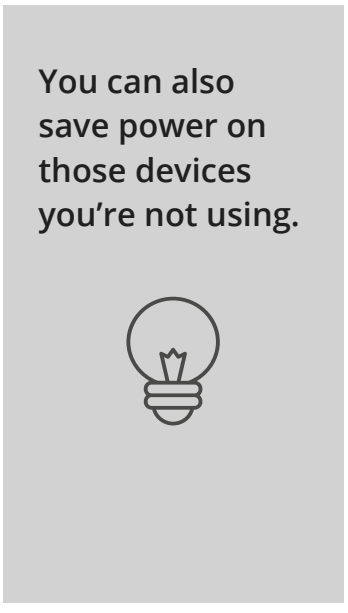
APPENDIX J: Screens Redesign Concept

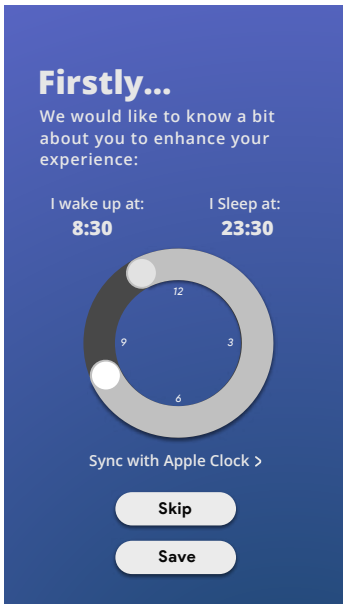












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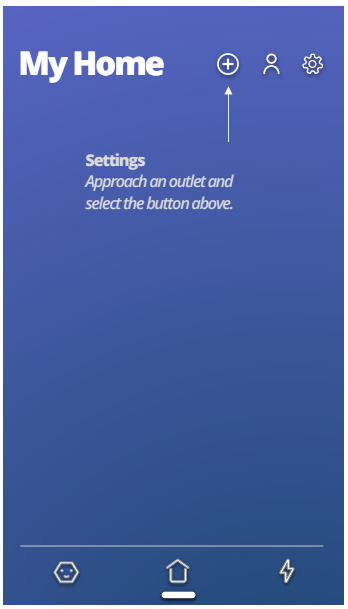

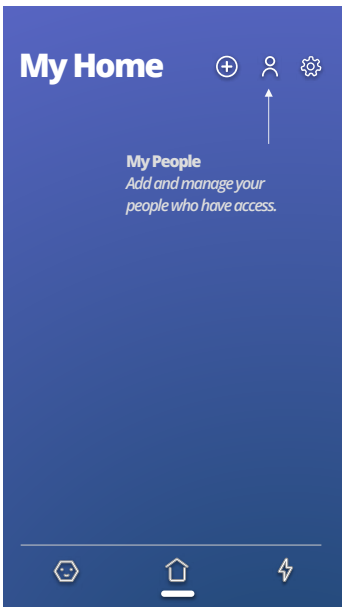

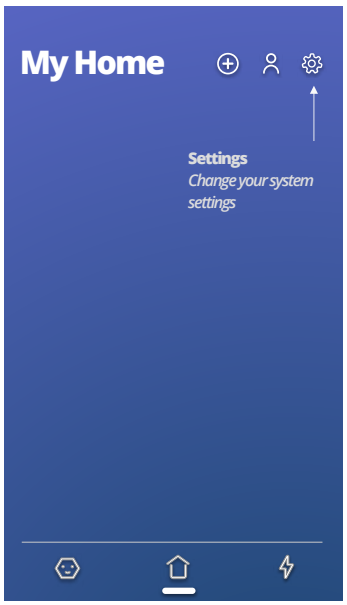

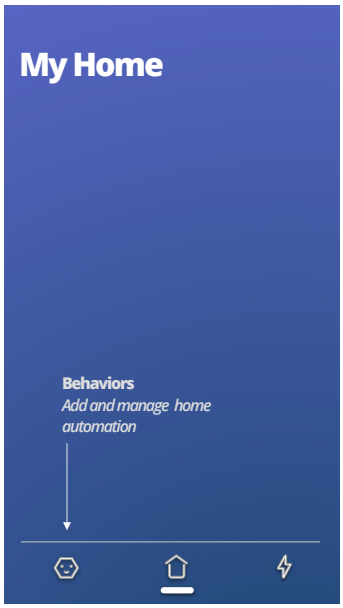

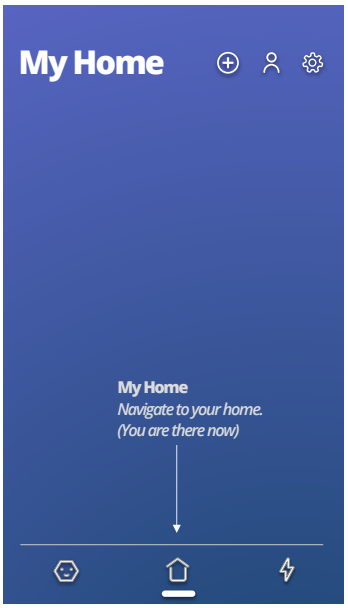

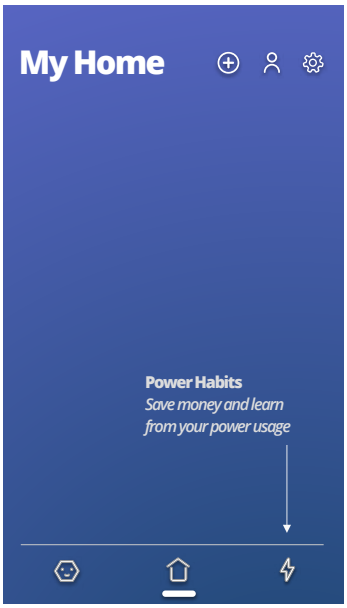

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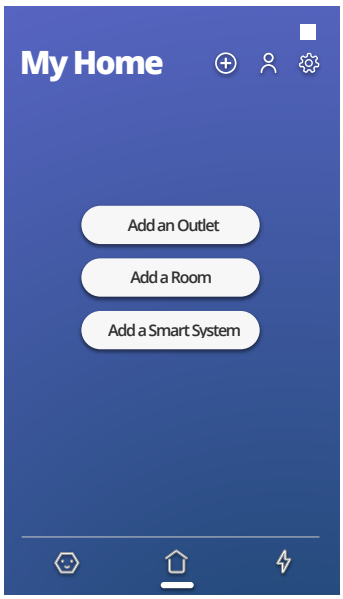

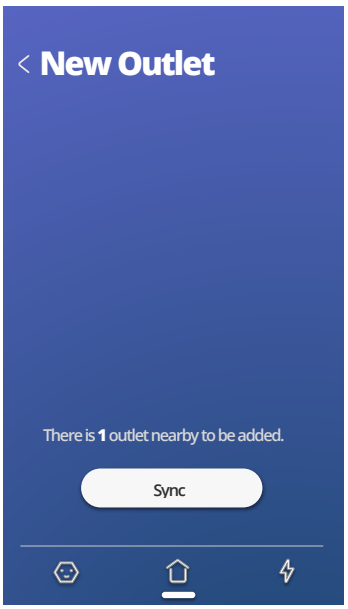

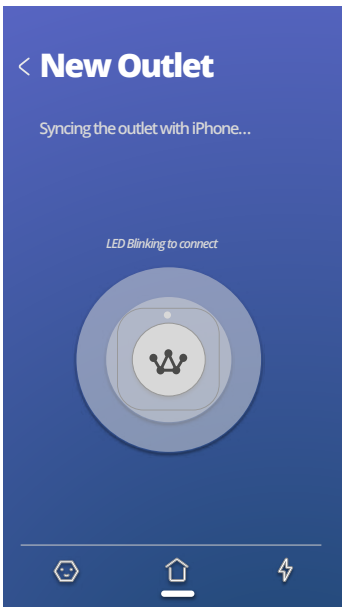

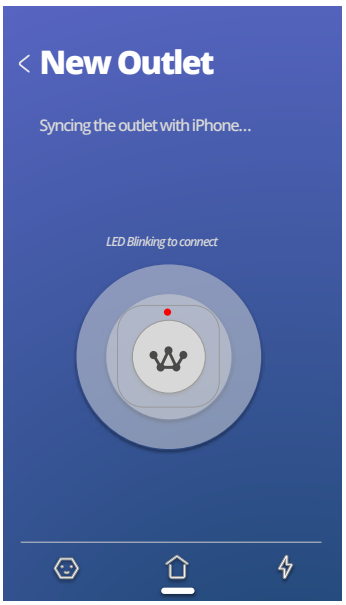

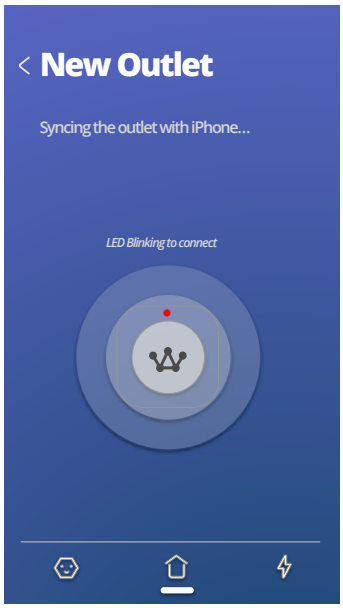

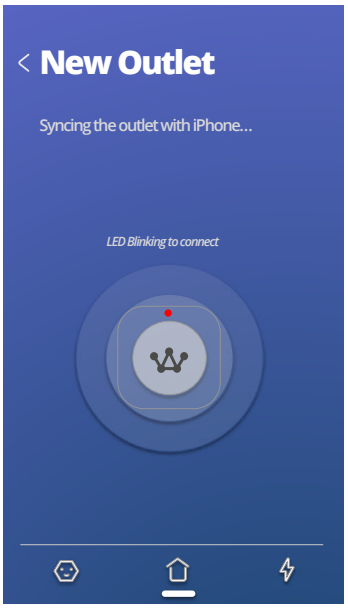

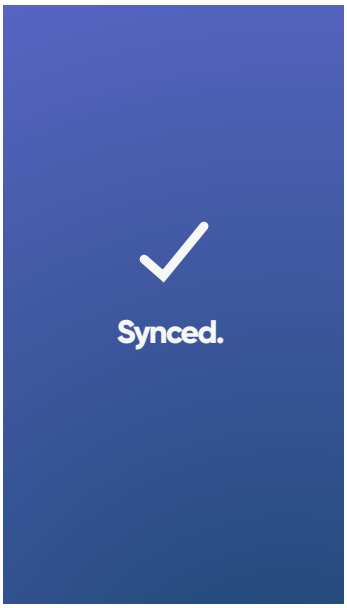

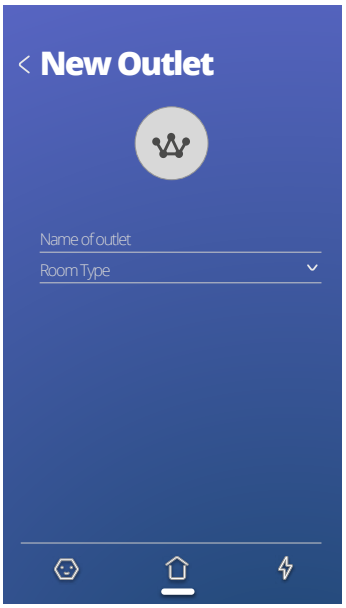

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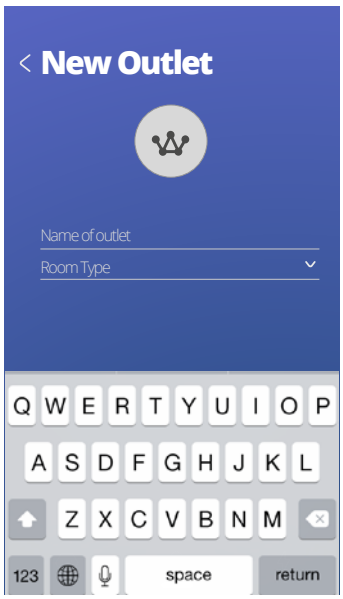
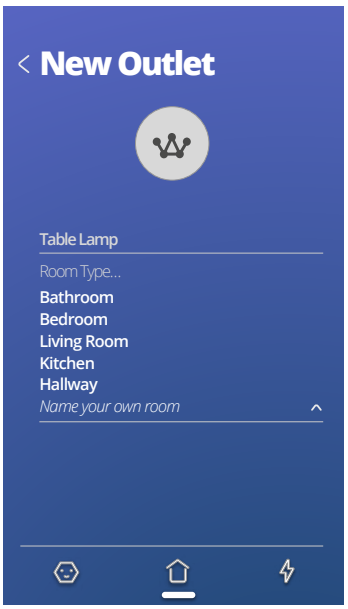
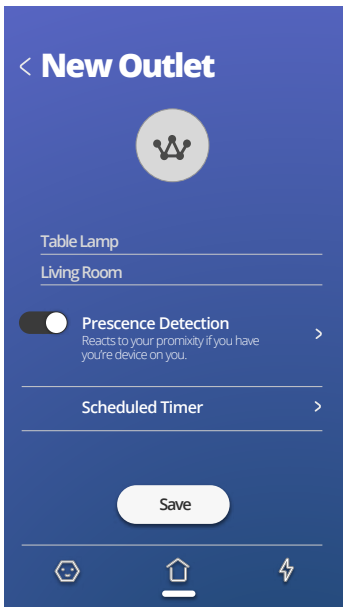
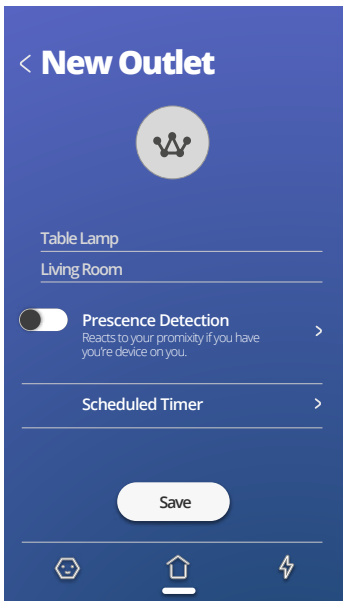
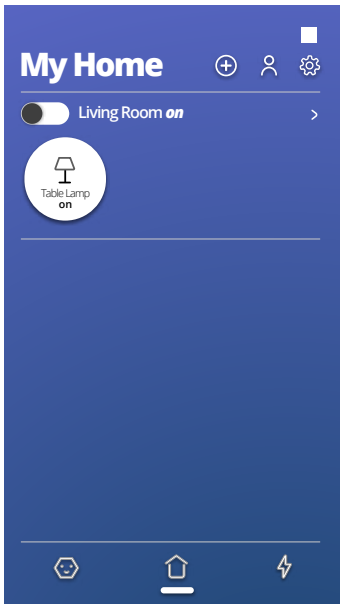
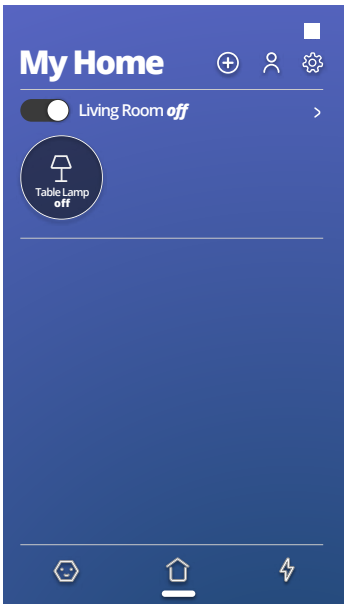


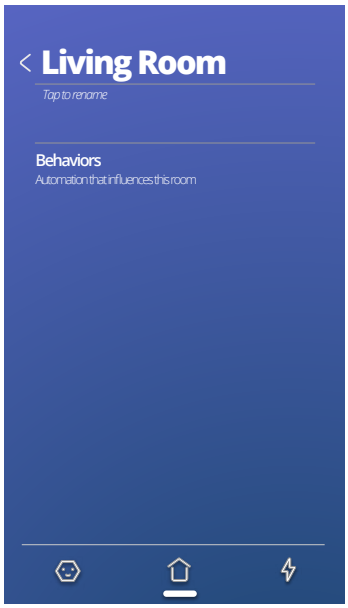


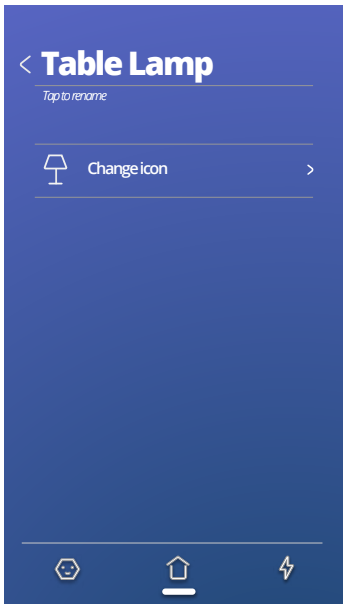




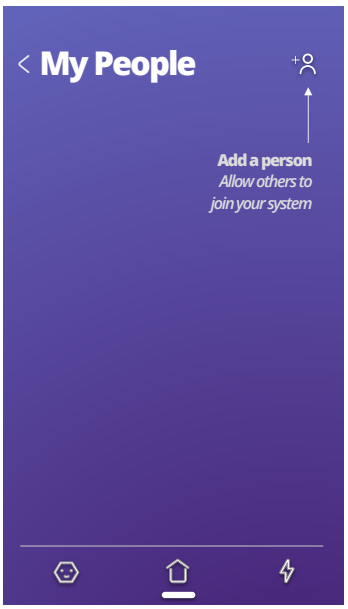


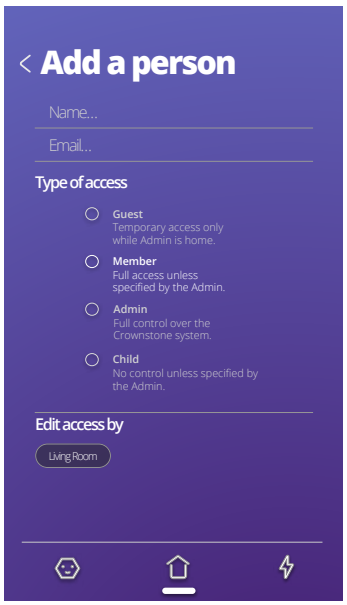


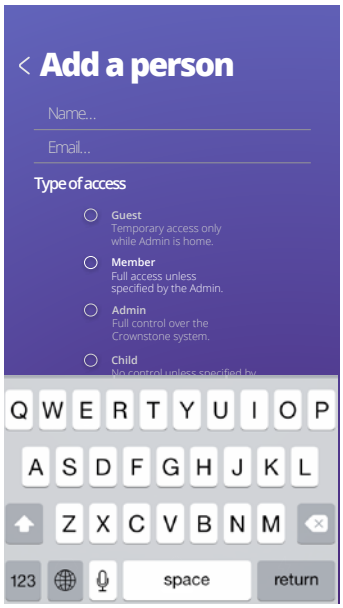


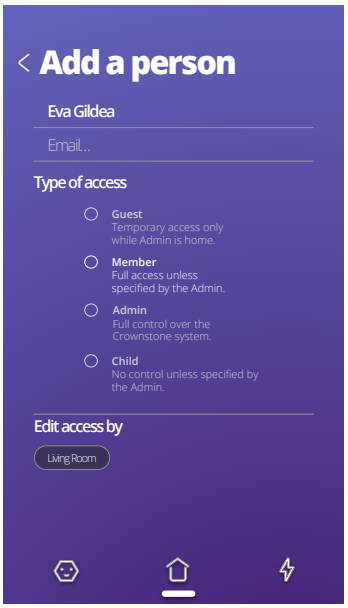


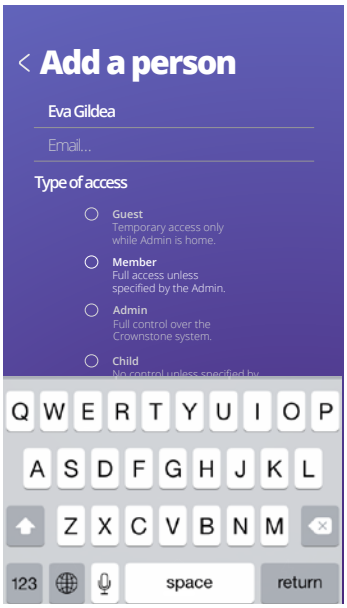
APPENDIX J: Screens Redesign Concept

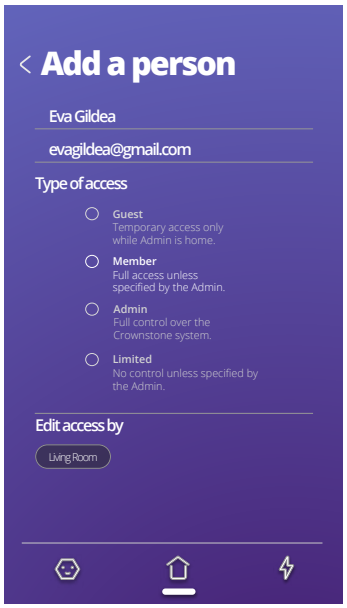












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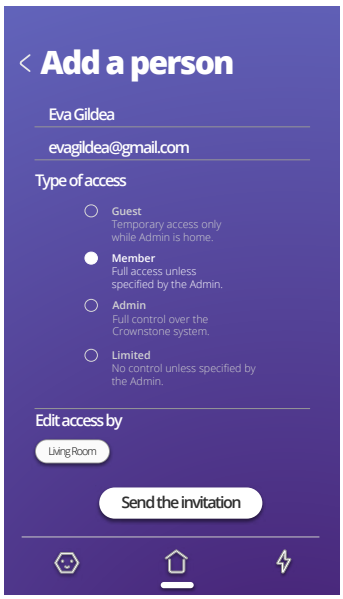

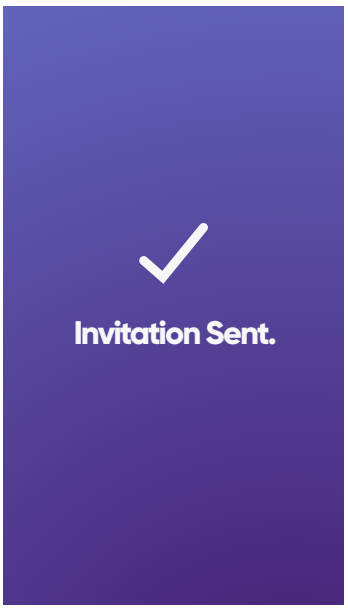

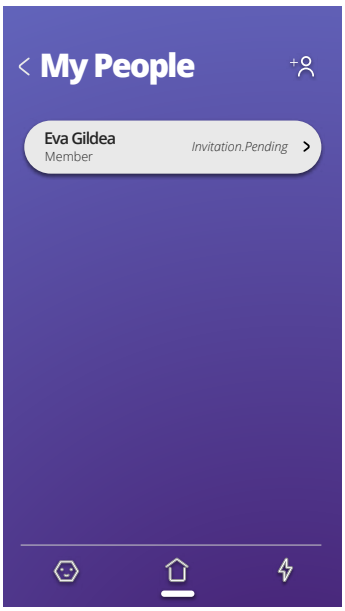

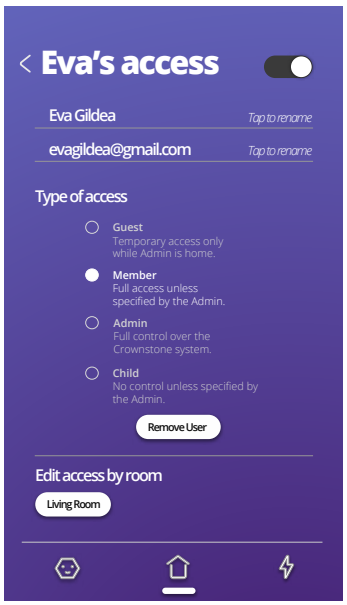

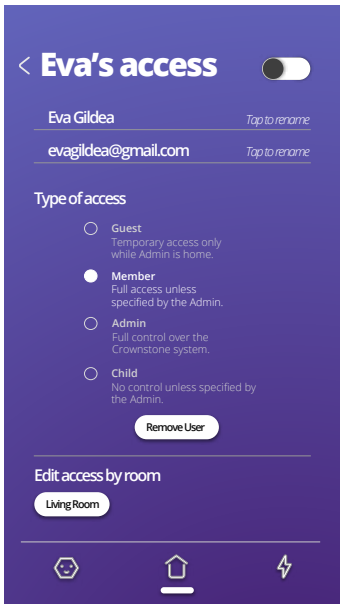

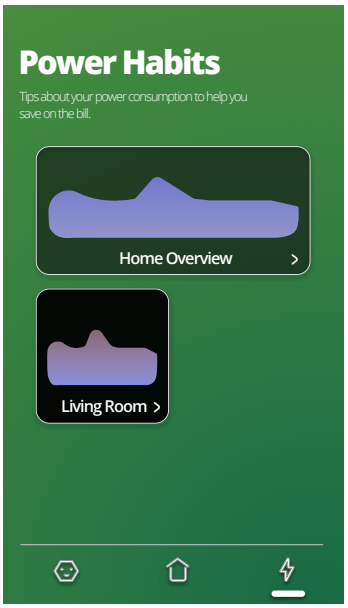

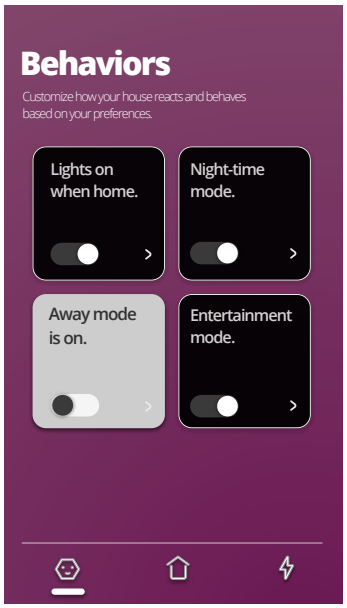

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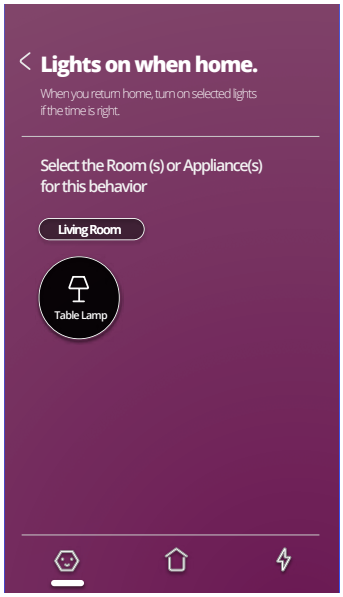
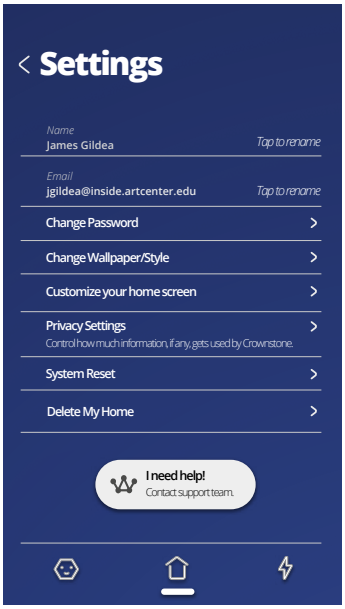




APPENDIX K: Introduction Booklet

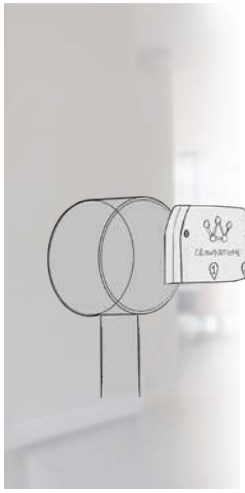
WELCOME

Hi, welcome home! We have installed Crownstones in your house and left you this booklet. We will show you the ways in which you are now able to control your home. If you are ready, let's get started!

Something unclear or not working? Please don't hesitate to contact us.

Contact

team@crownstonerocks
010-3073955



THE PRODUCT

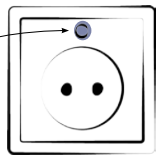
So "Crowstones", what are we actually talking about?

A Crownstone is a smart product installed **behind an outlet**.

With the help of the Crownstone you can **control your outlets** with your smartphone.

But if it is behind my outlet, how do I see it?

Every outlet, with a Crownstone behind it, has a **led light**.



FUNCTIONS

What can you do with the system?

Switch on and off your devices remotely.

Be able to control and **dim** your lights.

FEATURES

What are the added benefits?

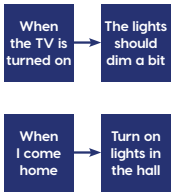
Keep track of your **power consumption**.

Set the **behavior** of the system to your wishes (see next page).

APPENDIX K: Introduction Booklet

BEHAVIOR

The behavior of the system, what does that mean?



Behaviors are **personal preferences** you set to the system.

So for example: you can set timers for devices to indicate when they should turn on, or you can let lights react to your presence.

Use the **presence detection** to make the system react to your current location.

Don't worry if you don't want to use the presence detection, you can also set your own **scheduled times**.

WHAT TO DO

Steps to follow to set up the system

Download the app 'Crownstone' from the Play Store or App Store.

Sign in to your account or **create** one.

Make sure that the **bluetooth** on your smartphone is switched on.

Answer some setup **questions** to adjust the system to your lifestyle and preferences.

Connect to different outlets in your home.

The led light will start **blinking** when you try to connect or program it to give you feedback.

Set the preferences or **behaviors** for the different outlets.

If applicable, **add a member** to your system and be able to control the outlets together!

If you want, you can also check out your **power consumption** and keep track of it.

THANK YOU

We hope you **enjoy** the use of the system and will experience the comfort of it.

Thank you for choosing Crownstone!

Something unclear or not working? Please don't hesitate to contact us.

Contact

team@crownstonerocks
010-3073955

APPENDIX L: Script User Test 2

1. Hi ____, thanks for coming in and helping us perform a usability test. I am _____ and my other team members are _____. Please drop your stuff if you like. (Have some small talk. I'll be running the test with you and the others will be able to watch the test from a different room on a computer. I'll tell you a bit more about our product. We're design master students at TU Delft, and are currently doing a project for a StartUp named Crownstone on one of their newer products, a smart plug that you can use to control your lights and the power of your devices at home..I'll explain more about it in a bit.

2. During the tasks we like you to think out loud, which means you speak out whatever you are thinking about, what you feel and mention everything that stands out or catches your attention, since every insight you give us can help us improve the product. For the whole evaluation I will be your point of contact. Do you have any questions so far? Are you comfortable doing this? It will take a maximum of one hour and after using our prototype I'd like to ask you some questions.

3. We wrote down in this form what we will do with the information gathered during the test. It says that we'd like to record this test on both audio and video, to be able to get as much data out of it as possible. We won't use the recordings outside of academical settings. We will only show, not give, the videos to our coaches, the company and our fellow students working on this case. Afterwards we might use it in academical settings, but we will make sure your face is not recognisable.
   Please read this consent form and let me know if you have any questions. If you agree, please sign the form and we will start the test. (Make sure that they understand it and feel free to ask any question they have about it.)

4. Before we start the test, I'd like to ask you some questions about the use of technology. This way we can understand what type of user you would be for this product.

1. How do you spend your time; do you work? Study?
Full-time?
2. Can I ask you how old you are?
3. What kind of house do you live in?
4. Do you own a smartphone?
5. What apps do you use most often?
6. How comfortable would you say you are with figuring out new things and applications on your phone?
7. Do you own a smart home system/product? If yes, of which elements does it consist?
8. How experienced are you with technology?

5. As I mentioned before, currently we are working on a project in which we will improve the User Interface of an existing product. The product we are improving is the Crownstone, which is also the name of the company producing them. Crownstone is a smart plug/switch installed in your home that can be controlled remotely thanks to the use of bluetooth signals that your smart device/wearable sends out.

APPENDIX L: Script User Test 2

We'd like you to pretend that you are moving to a new house/smart home with a partner or a friend. There are crownstones installed behind your outlets, which have turned your outlets into smart outlets. Right here you can see a wall that represents a wall in your home. Behind this outlets are crownstones installed. Imagine walking into your new home and finding this information booklet about the product on the table. Please read it carefully, as it includes information about the functions and about how to set up the system. In the booklet there is a step by step plan on how to do this and I'd like to ask you to follow these steps.

- We provided you with a smartphone where the app is already installed and the bluetooth is switched on
- The name of your partner/friend is Eva as a member
- Here is a lamp you'd like to start using in your new living room
- Not all the screens are fully functional yet, but I'll mention it when you encounter them

Please feel free to ask questions at any point during the test and I'd like to ask you again to think out loud, since any insight is valuable to us. Do you have any questions so far? Here is the phone and start your setting!

6. You've now completed all tasks! I'd like to ask you to to make sure this table lamp switches on when you enter the door. You need to change some settings and afterwards you can check whether it works accordingly.

I'd now like to ask you to

7. Fill in and discuss questionnaires

8. Questions

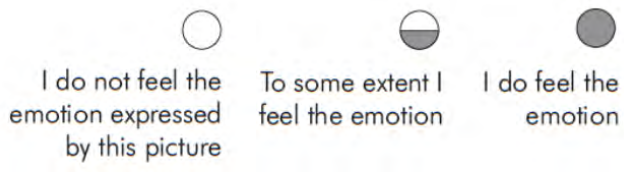
- How did the procedure go?
- What are aspects that you liked? Why?
- What are aspects that you didn't find convenient? Why?
- Would you consider using Crownstones in your own house? Why?
- How would you prefer to set up this system?
- What do you think of the whole smart system experience?
- Did you feel guided by the booklet and the app during the use? (ask about specific aspects)
- How easy to use was the system for you? (ask about causes)
- Do you feel like you have control over the outlets you tested?
- Are you confident/comfortable using this system?

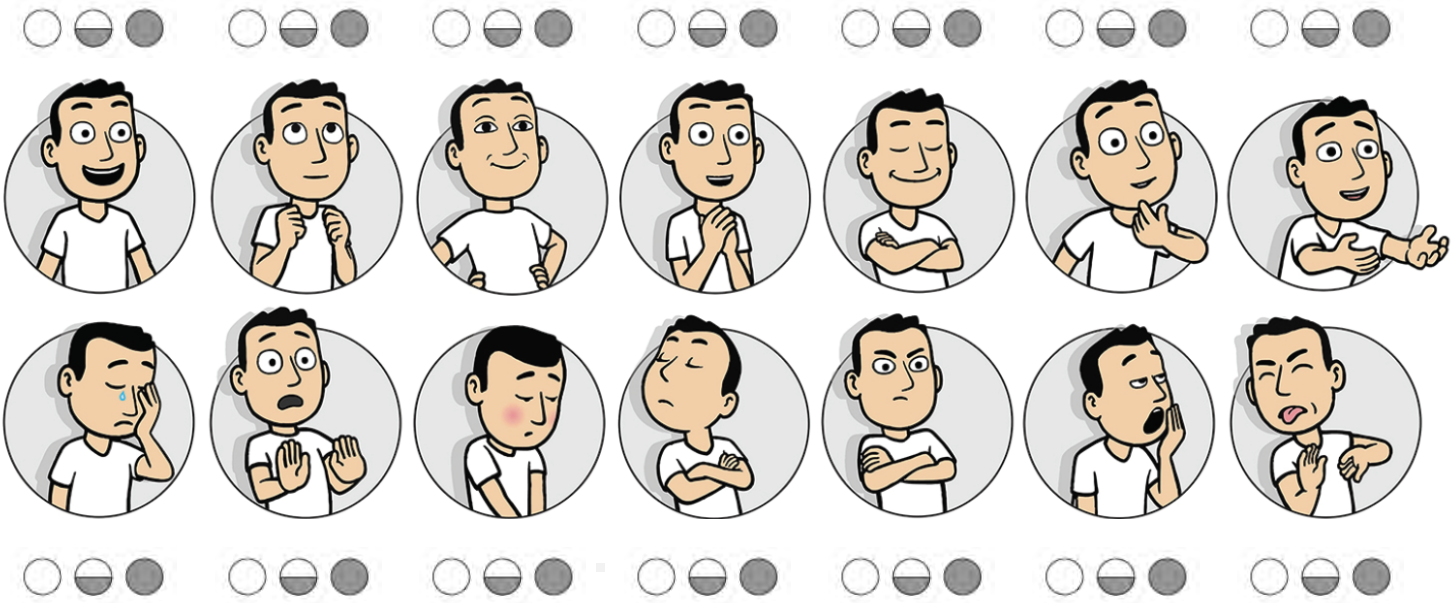
- Do you have any other questions for me?

9. Thank you very much for coming in and helping us with the test.

APPENDIX M: Questionnaire User Test 2

Please mark how much you feel the emotion





APPENDIX M: Questionnaire User Test 2

Rank the degree that you think about the Crownstone (from 1 to 5)

1. I think that I would like to use this system frequently.

   strongly disagree ○ ○ ○ ○ ○ strongly agree

2. I found the system unnecessarily complex.

   strongly disagree ○ ○ ○ ○ ○ strongly agree

3. I thought the system was easy to use.

   strongly disagree ○ ○ ○ ○ ○ strongly agree

4. I think that I would need the support of a technical person to be able to use this system.

   strongly disagree ○ ○ ○ ○ ○ strongly agree

5. I found the various functions in this system were well integrated.

   strongly disagree ○ ○ ○ ○ ○ strongly agree

6. I thought there was too much inconsistency in this system.

   strongly disagree ○ ○ ○ ○ ○ strongly agree

7. I would imagine that most people would learn to use this system very quickly.

   strongly disagree ○ ○ ○ ○ ○ strongly agree

8. I found the system very cumbersome to use.

   strongly disagree ○ ○ ○ ○ ○ strongly agree

9. I felt very confident using the system.

   strongly disagree ○ ○ ○ ○ ○ strongly agree

10. I needed to learn a lot of things before I could get going with this system.

    strongly disagree ○ ○ ○ ○ ○ strongly agree

APPENDIX N: Results User Test 2

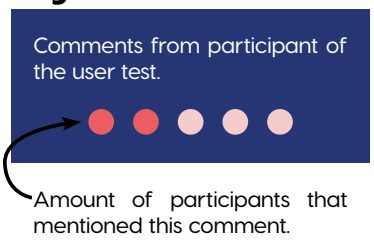
User Test Results

On the following pages the results of the second user test are shown. Only the screens that were commented on, are displayed.

On the right you can see the legend of the visualization. Comments, own input and tasks will be shown with the accompanied screens.

Below you can find some general information about the four participants that performed the user test.

Legend



Participant 1

Master student
Industrial Design Engineering
man, 29 years

Lives in studio
with his girlfriend/partner

Grew up with technology
Owns a smartphone
Doesn't own a smarthome system

Participant 2

Master student
Industrial Design Engineering
man, 24 years

Lives in an apartment
by himself

Grew up with technology
Owns a smartphone
Doesn't own a smarthome system

Participant 3

Working
for 3,5 years
man, 28 years

Lives in house
with roommates/friends

Grew up with technology
Owns a smartphone
Does own a Chrome Cast

Participant 4

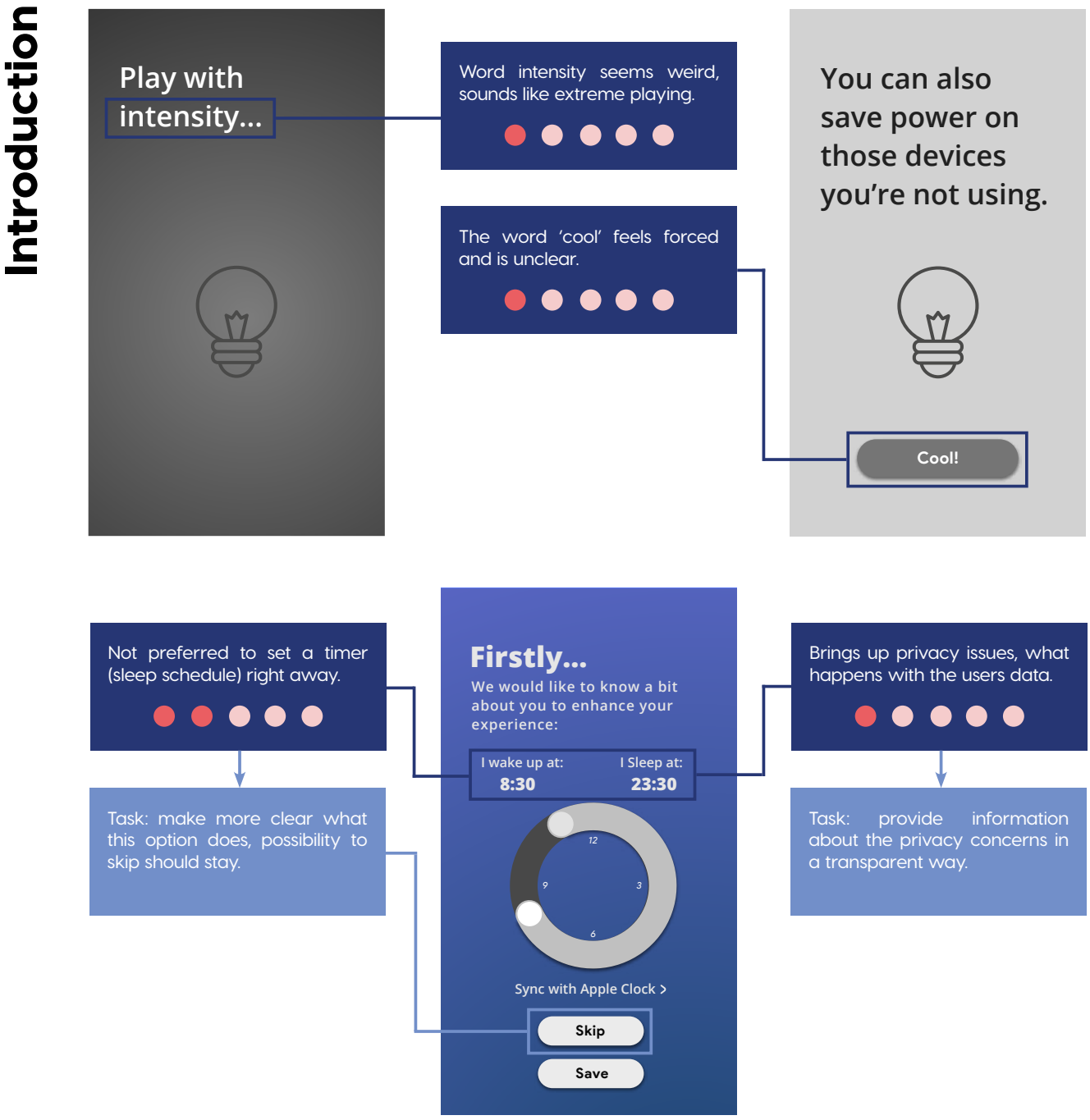
Working
in human resources
woman, 47 years

Lives in house
with her boyfriend/partner

Familiar with technology
Owns a smartphone
Doesn't own a smarthome system

APPENDIX N: Results User Test 2

APPENDIX N: Results User Test 2

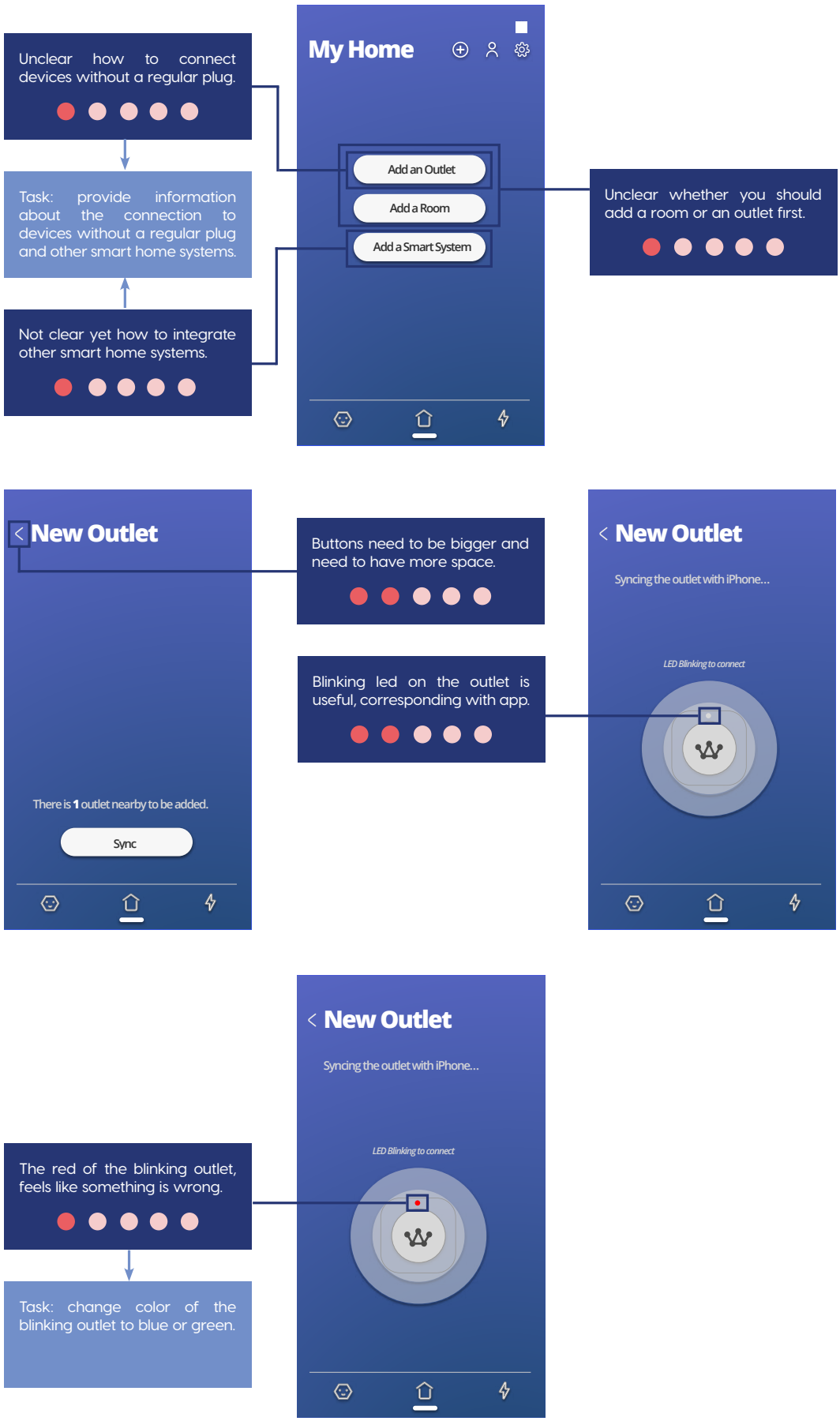


APPENDIX N: Results User Test 2

Home Screen

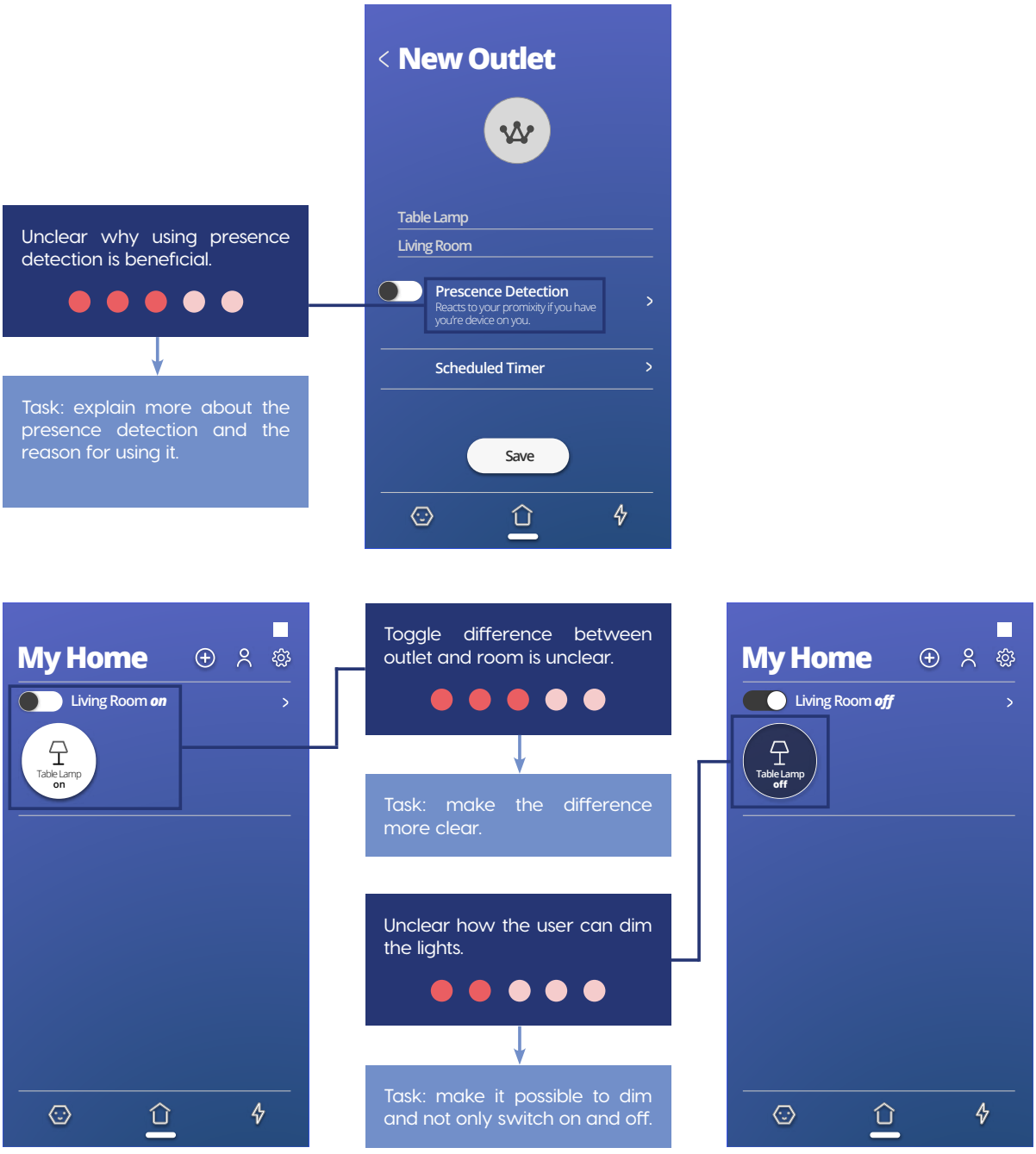
APPENDIX N: Results User Test 2

Adding an Outlet



APPENDIX N: Results User Test 2

Adding an Outlet

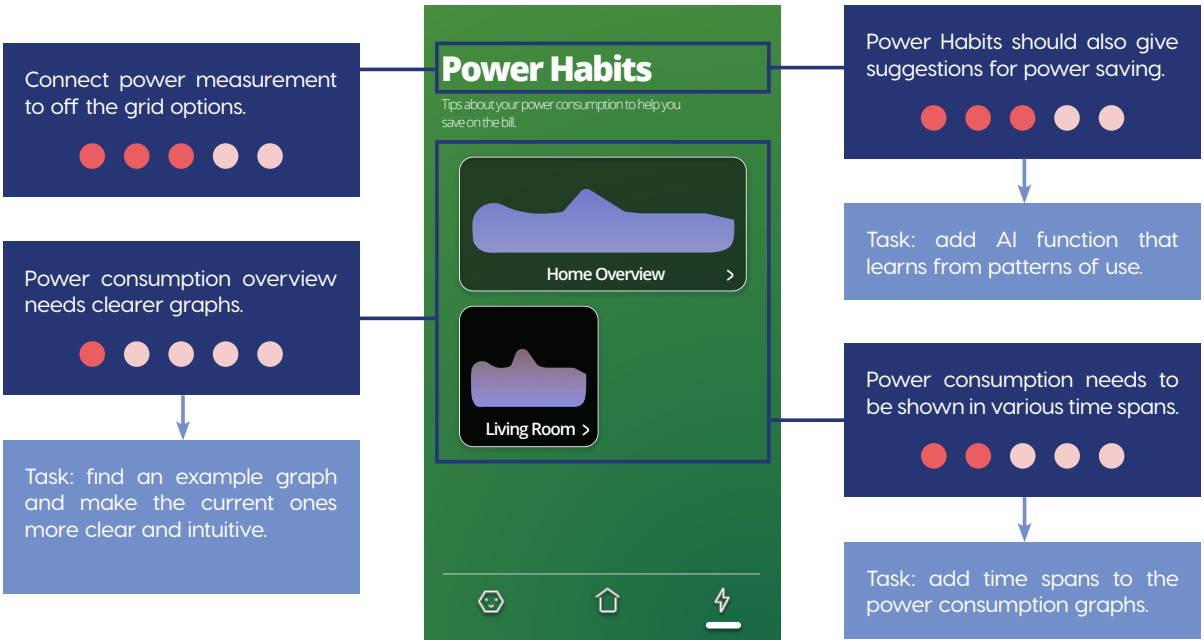


APPENDIX N: Results User Test 2

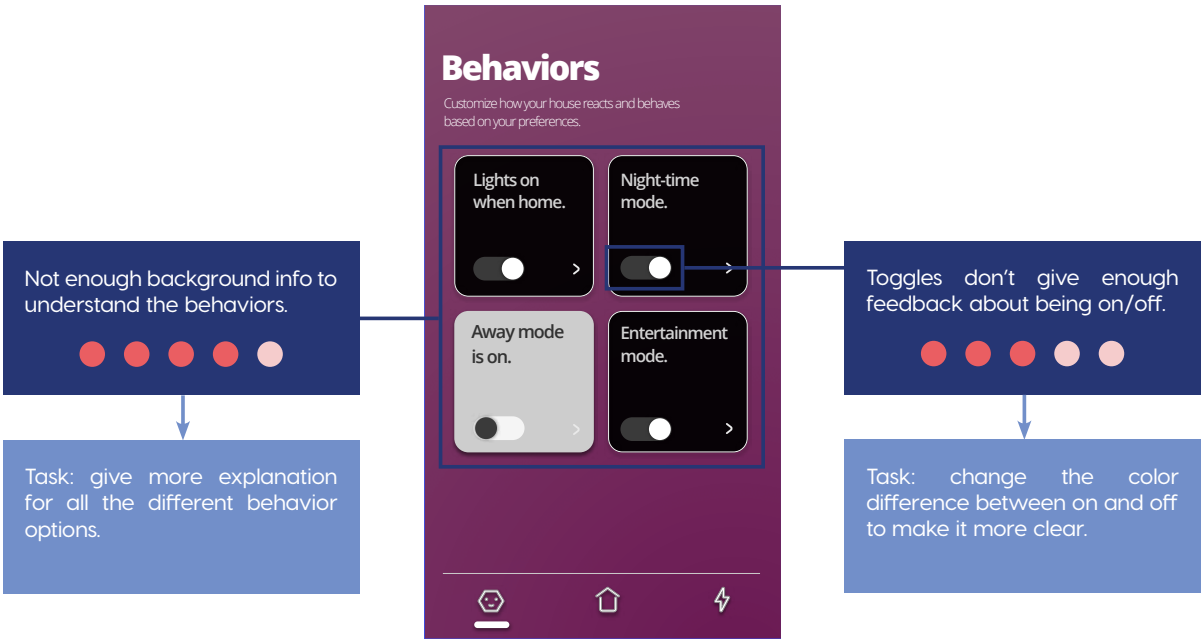
Adding a Member

APPENDIX N: Results User Test 2

Power Habits



Behaviors



APPENDIX O: Screens of Final Redesign

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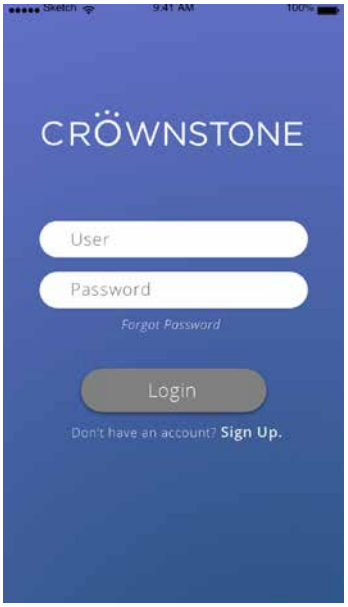

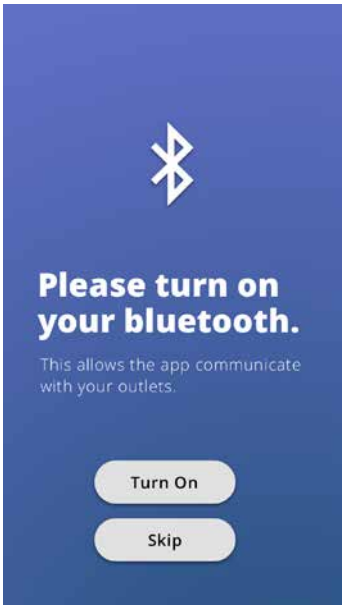

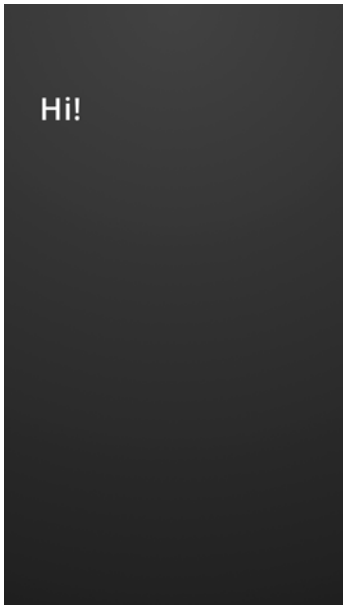

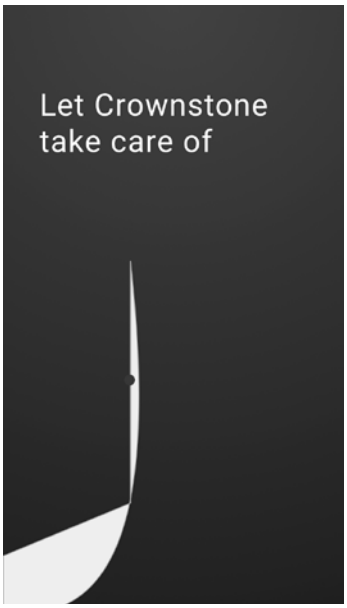

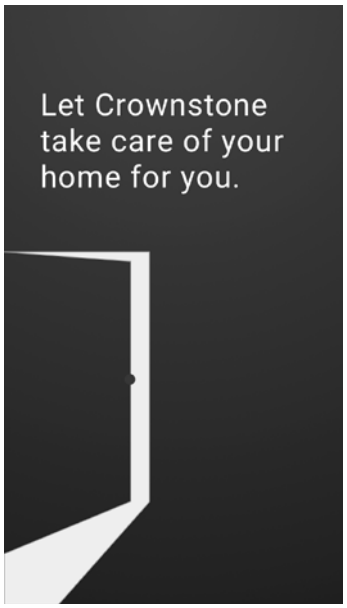

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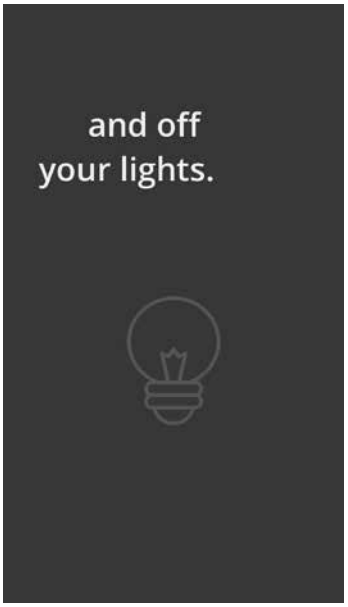

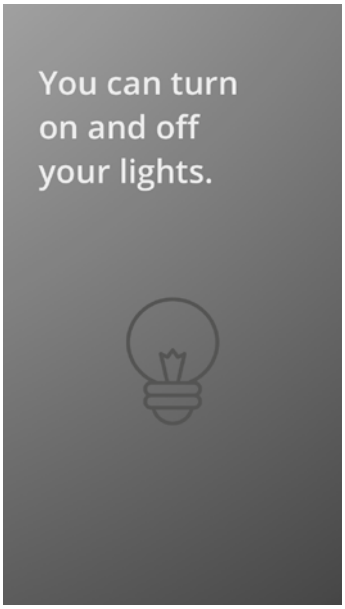

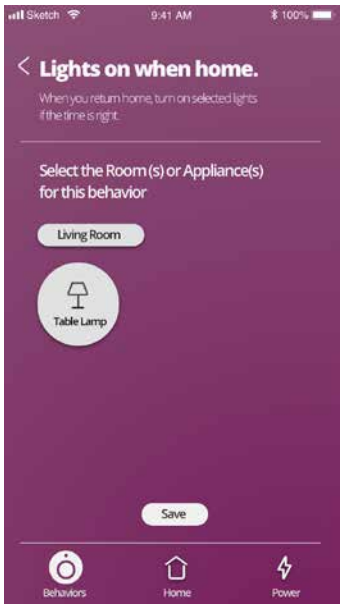

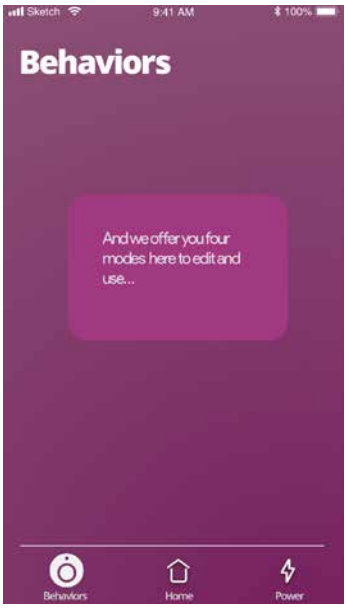

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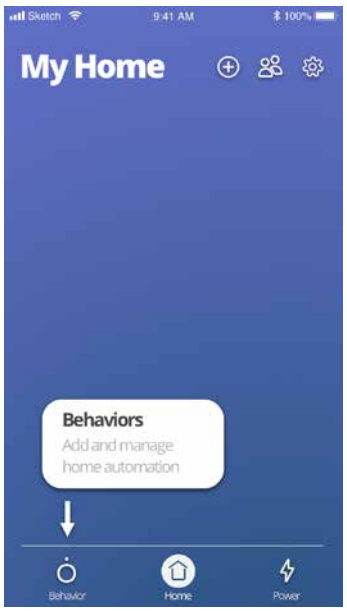

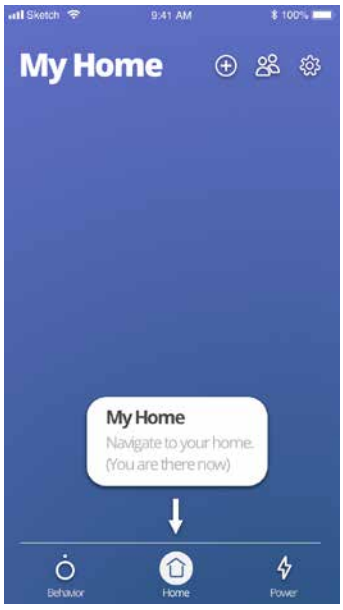

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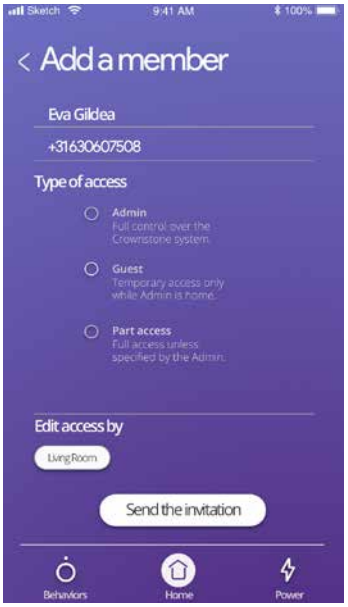

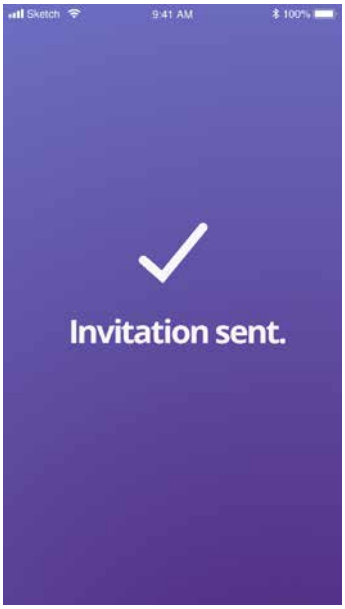

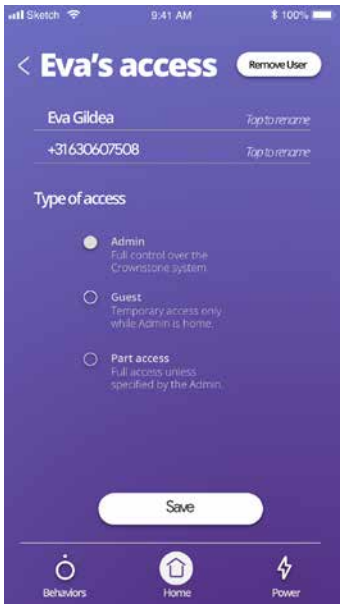

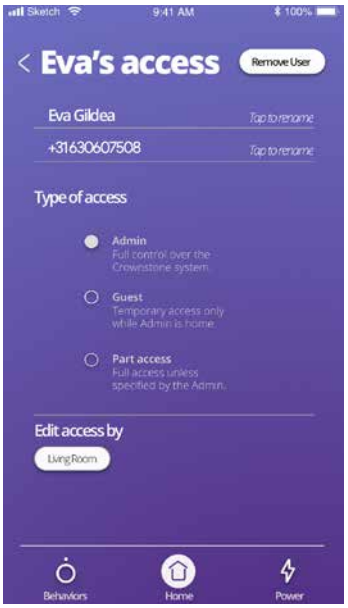

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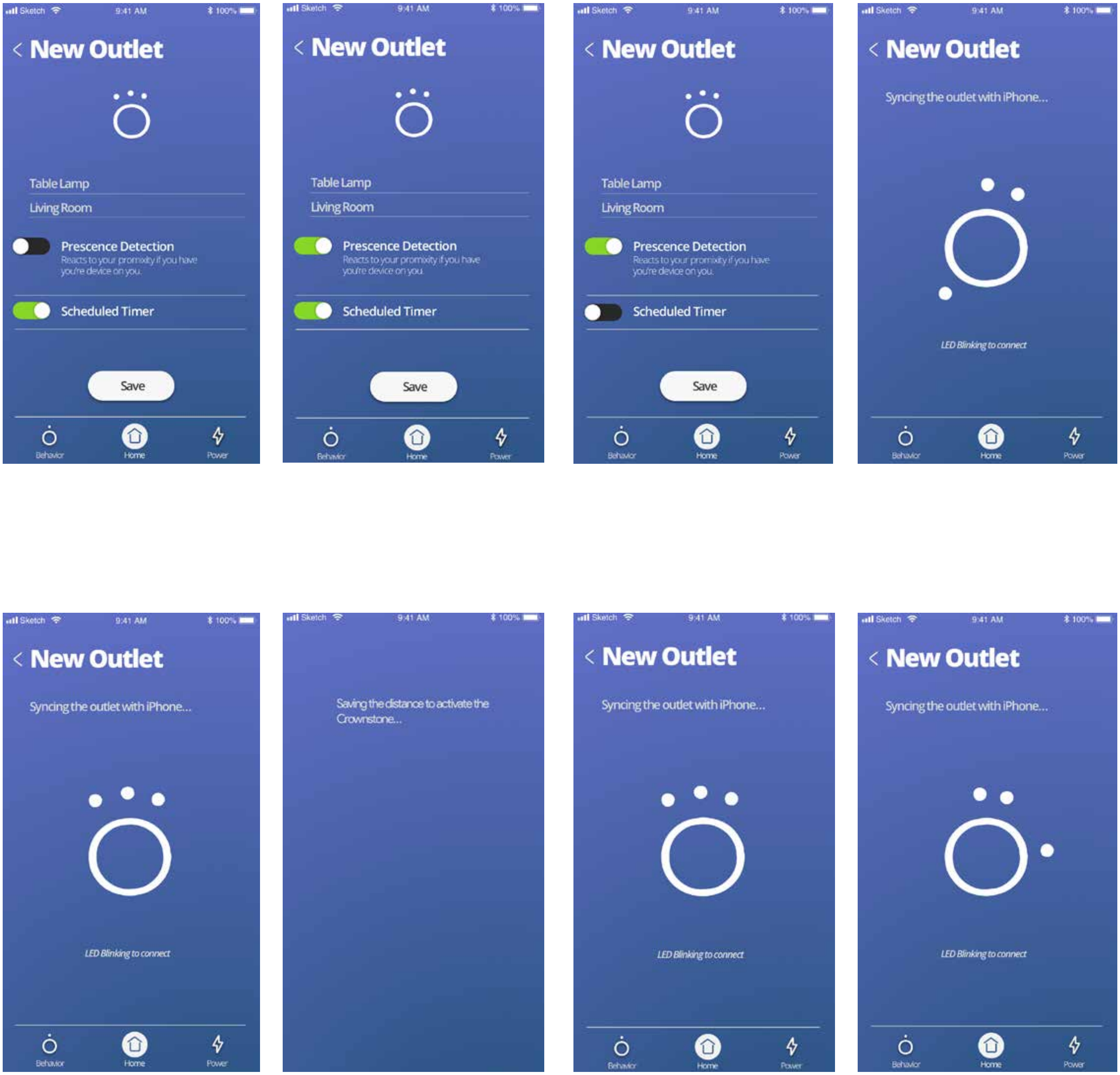

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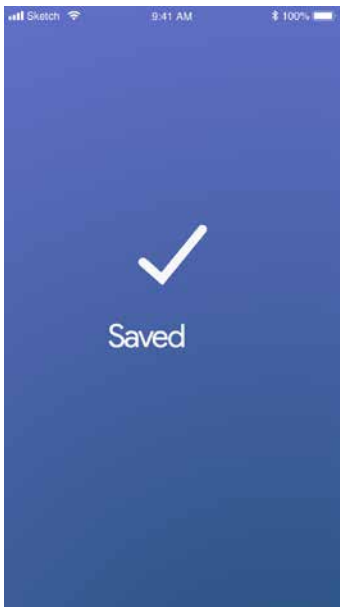

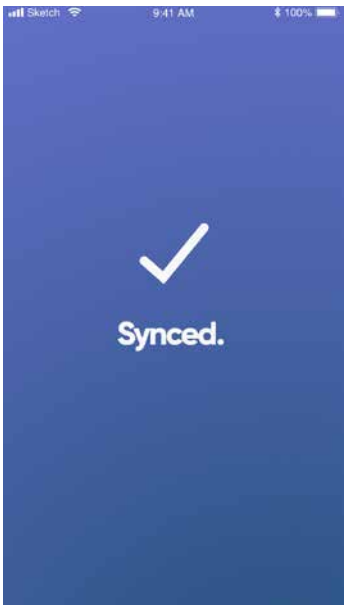

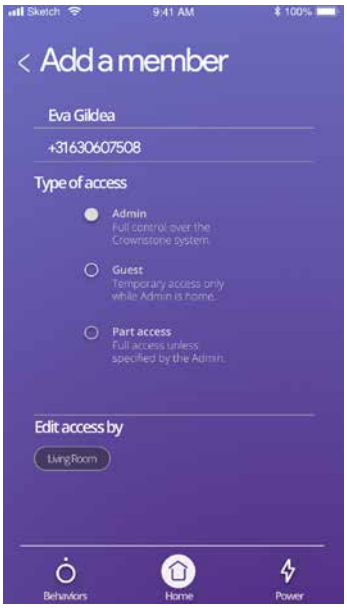

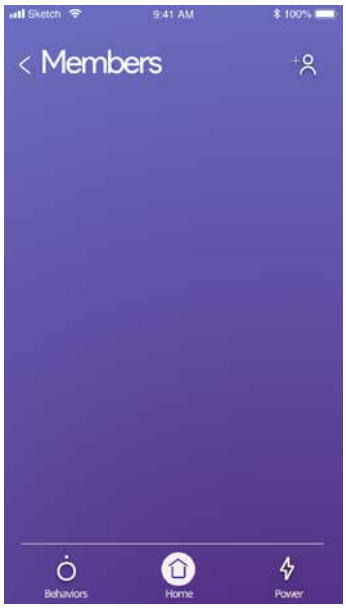

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