ROULI

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DIGSIM Squad

DPB210 Project 02 Design

CONTENT

INTRODUCTION

This report is about the design process of Rouli, a design made by three B2.1 Industrial Design students in the DIGSIM squad. We started project 2 with a design brief given by a client of the squad. The design brief meant that we had to design a 'Home Dashboard' in automated homes for the aging society.

From the design brief on we conducted interviews and did research to come to the design focus in which the 'home dashboard' desired by United Streets of Nuenen was the starting point for this focus. In these interviews we asked the participants about several issues regarding autonomous living, among which their evening routine.

A solution to make this 'evening routine' easier and more efficient then became our focus. However, during the interviews the participants also mentioned that the new digital technologies can be difficult to understand for some of them (personal communication, September 26, 2019). So this was a new challenge to bring into our design focus.

Eventually our design focus was to make a design that helps the aging society in automated homes doing their night routine more efficient and making it easier with the design made in such a way that it bridges the gap between doing the night routine in an physical, old-fashioned way, and the innovative, digital way.

Eventually this led to Rouli. In this report you will read in more detail about the process towards Rouli, what exactly Rouli is and how it works. Moreover, the final design will be discussed and concluded.

However, in order to design a product which fits within the boundaries and guidelines of the project squad, it is necessary to know what terms and ways of design are used in this particular squad. Getting familiar with new terms and design techniques is going to let the design process run smoother and more efficient, in order to reach a more satisfactory end result. In the next paragraph the DIGSIM squad will be explained to have a better understanding in why particular design choices have been made for Rouli.

DIGSIM

The 'Designing for Growing Systems in the Home' (DIGSIM) squad enables students to explore the connection between design, connectivity and interactive systems. Focussing on these new topics introduces the student to 'the Internet of Things' (IoT), which is the main driving power behind the concept of the squad.

While working and designing for the DIGSIM squad, we simultaneously design for a family that lives in a miniature house. This house, also called the 'IoT Sandbox', provides a new way for the students to connect their own design to someone else's. The connectivity within the home of the mundane family who lives there should give a broader view on what design can be. The IoT Sandbox was designed by Frens, Funk, van Hout & Le Blanc and in their research (2018) they describe the IoT sandbox as a special tool that can be used to explore rich interaction within a dynamic smart home.

Our client, United Streets of Nuenen aims home adaptation and automation in the context of aging citizens who desire autonomous living in their homes. The challenge they and the DIGSIM squad gave us was to design a 'home dashboard'. What is special about this design challenge is that the client was able to get us into contact with real citizens and that their view on the result of this challenge was a product that could be on the market in a few years.

LITERATURE

Smart Homes - The concept 'smart home' is something familiar for the DIGSIM squad. Mennicken, Vermeulen and Huang (2014) argue in their research about the future of smart homes:

> We envision such homes to be context-aware domestic spaces that leverage automation to support inhabitants with the burdens of domestic routines, while at the same time keeping people from being disengaged and allowing them to maintain important values (e.g., have children contribute to household chores) (Mennicken, Vermeulen & Huang, 2014, pp. 112-113).

This concept envisioned in their research has also been a core value for our design project since we are focussing on the evening routine with the aim of supporting the user. From a questionnaire that we gave to our deployment user we found that one of the most important values for our target group: the aging part of society, is safety (personal communication, December 15, 2019). Rouli aims to assist and maintain important values.

However, safety can be interpreted in multiple ways. Strengers, Kennedy, Arcari, Nicholls, and Gregg (2019) state in their research that smart home technologies offer quite some design challenges such as internal threats to household protection: "there were also significant concerns about how smart technologies might compromise security or privacy through hacking attacks" (p. 6) is one of the findings from their research. Data privacy in smart home design, such as our Rouli is very important and also an aspect of safety that we took into account while designing our product.

An example of a smart home technology is NEST. Yang and Newman (2013) researched how people interact with intelligent systems, such as NEST. They found that the design challenge for such an intelligent system is to bridge the gap between the difference between what the smart system can sense, and what the user actually intents (Yang & Newman, 2013).

Especially for our target group this can be a major challenge. We can design a system, but we can not design an elderly human. A study conducted by Vaportzis, Clausen and Gow (2017) showed that participants between 65 and 76 were willing to adopt new technology. However, some barriers in this eagerness were discussed (lack of knowledge and confidence; too much and too complex technology) (Vaportzis, Clausen, & Gow, 2017). Those barriers also comply with the research of Yang & Newman (2013) about intelligent systems in general. This problem is something that we try to tackle with Rouli as well.

System Design - Designing within the DIGSIM squad requires more than just interaction design. To design for a smart home, or the Internet of Things it is necessary for us to take an extra step in order to achieve system design. This required us to keep in contact with the

other groups in the squad.

Our process was quite similar to the framework that Ryan (2014) described in his research on Systemic Design. He defines a systemic design methodology consisting of "six main activities: framing, formulating, generating, reflecting, inquiring and facilitating" (Ryan, 2014, p.1). Keeping in contact with stakeholders, going out in the field, reflecting and tangible concepts in the real world are according to Ryan (2014) important factors that occur within those six main activities.

Tangible concepts in the real world is something that can be connected with what Frens and Overbeeke (2009) argue for in their research when designing highly interactive systems: "an experiential approach is essential" (Frens & Overbeeke, 2009, p. 8), and "We have to undergo the experience of living with these systems while we are designing them to make value judgements on the direction the solution should take" (Frens & Overbeeke, 2009, p. 3). This idea translated in our project is what we call user deployment. We had a target-user use our product for 5 days in order to get valuable insights.

Rich Interaction - Another interesting concept that this squad taught us is the concept of Rich Interaction. Joep Frens (2006) defines rich interaction as "A paradigm for interactive consumer products that results in a unity of form, interaction, and function and taps human skills (perceptual-motor skills, cognitive skills, and emotional skills) for information-for-use thereby setting the stage for aesthetic interaction" (Frens, 2006, p. 212).

In another paper Frens (2017) wrote about rich interaction and home IoT, he tweaks the definition of rich interaction a bit since it contradicts with the nature of smart home IoT. He argues that: "the unity should be released, but not left" (Frens, 2017, p. 10). With this in mind, 4 design approaches have been researched by Frens (2017) to succeed in designing for rich interaction in home IoT.

While trying to understand this definition and concept we tried a lot of exploration methods suggested by our coach Mathias Funk and Joep Elderman. We can argue whether Rouli fully embodies rich interaction and whether we chose the completely right approach, but we learned that this concept of integrating form, interaction and function is a powerful tool in the DIGSIM squad.

Sleep, habits & evening routine - Research has shown that by keeping up with daily routines, the sleep quality of the elderly is positively influenced in the form of reduced insomnia (Zisberg, Gur-Yaish & Shochat, 2010). This means that Rouli will also contribute to better sleep, since the purpose of Rouli is to successfully complete the evening routine.

Woo and Lim (2015) researched how participants use and experienced Do-It-Yourself (DIY) smart home products in order to come up with a usage cycle. In the second phase of this cycle: motivation, they state the following: "Enabling people to reflect on the problems in their routines will be a starting point for improving daily routines through the use of DIY smart home products" (Woo & Lim, 2015, p. 9). This is exactly what we hope to achieve with Rouli. The aim of assisting our target group users in their evening routine should therefore, according to this research, be accomplished by letting the user reflect on their problems. This is, indeed, an aspect of the reasoning behind Rouli.

APPROACH

In this section our design process will be described. We start off with the problem statement of the design challenge that we tackled, followed by the most important design steps categorized in 10 steps: first iteration concept, interview stakeholders, concept definition, data mapping, second iteration concept, midterm presentation, third iteration concept, making functional prototype, deployment and final demo-day.

PROBLEM

According to our client: people who are part of the aging part of society and who still live at home are experiencing more and more troubles regarding autonomous living (personal communication, September 13, 2019). From personal experience and reasoning: during the 'evening routine' the aging part of society take a stroll through their home just before going to bed, in order to check whether any lamps or devices have been accidently left on or there are still some doors open or not locked. This causes issues in several aspects: it takes some time to do this round through the house and it may cause fatigue because it is just before going to bed. Therefore, the design challenge regarding this project is to design in such a way that we can make the evening routine more efficient and give a clear overview of the data from one central place of operation.

In order to design a solution for this problem we keep the wishes and requirements of the stakeholders in mind as well as those which belong to the squad. Next to this we want to design regarding our own design visions and implement these in the design as well.

Designing with all these aspects in mind can be challenging at some points.

DESIGN PHASES

First iteration concept - In order to get started with the project, several brainstorm sessions were conducted. From an interior brainstorm for the rooms in the Sandbox Home to brainstorms about the design of a dashboard for the stakeholders. Repeating the dashboard brainstorms gave insights into what direction we were going with our potential designs. For pictures and sketches view Appendix F. All concepts generated had a commonality which was to make sure certain things were being controlled from a stationary place in the home, ranging from controlling all devices in your home to receiving an overview of how the day of the user is going to look.

Interview stakeholders - During a meeting arranged by our stakeholder, an interview has been conducted in order to gather more valuable information from the potential users of our design. We gathered data like: what does the aging society value from such a 'dashboard design' or what aspects of such a design they think should definitely not be included. For the detailed questions, view Appendix C. The stakeholder meeting together with the interviews gave clear insights in what specific direction we needed to go. From these interviews we concluded that the 'evening routine', the final round the aging society makes throughout the house in order to check every door, light and device before going to sleep, is of great importance to them (personal communication, September 26, 2019).

We decided to focus on this 'evening routine' from this point onward.

Concept definition - While designing from the viewpoint of needs and wishes, we switched to designing from the point of values, the so-called 'design values'. While brainstorming about which design values our design should include we came to the conclusion that the design should include the value of trust, safety and efficiency. Together with these design values we started to shape the concept definition. The concept definition consists out of one or two sentences which perfectly capture the goal of the concept. "*By making use of light, electricity and locks of doors & windows in one design, we make people aware of the mentioned applications in their evening routine in order to make this more efficient in a trustworthy and safe way.*"

Data mapping - What data do we want to display? How do we visualise this data? Is there a specific way to group this data? These questions came up while we started to think about data mapping. In order to design from the point of design values, it was valuable to know how the information is going to mapped and being communicated towards the user. This resulted into the mapping of zones in the house. Rooms in the house of the user would form one zone and the information displayed will be of this zone in general at first and should get more elaborated when needed.

Displaying this information in a specific way and making sure it is based on the value of trust was a challenge. We wanted to decrease the 'trust learning curve', as we like to call it. In our opinion, in order to trust new technology every user goes through a so called 'learning curve'. Fedorowicz and Berger (1992) define a learning curve as: "expressed by a mathematical equation that describes the relationship between practice and performance" (p. 802). They also state that: "Learning curves are useful because they indicate changes in performance based on experience" (Fedorowicz & Berger, 1992, p. 803). We think that with Rouli we can create trust after experience.

From our interview we learned that this learning curve can be noticeably bigger within the aging society (personal communication, September 26, 2019). It is simply impossible to take this learning curve away, therefore we wanted to decrease it instead. The information is being communicated with the user via a screen, which can display information in various ways and forms, would therefore be most reliable and trusted by the aging society and make the 'evening routine' more efficient.

Second iteration concept - Brainstorming about the concept again and coming up with new concepts gave us more options to choose from. So we decided to rank each concept per value. How well does this concept perform in terms of safety? How well does this concept perform in terms of trust? etc. This resulted in taking features from each number one concept and merging these into two concepts. During the midterm presentation, these concepts were presented. For pictures and sketches view Appendix F.

Midterm presentation - During the midterm presentation we presented two cardboard models of how our concept could be translated into a design. For pictures and sketches of the cardboard models, view Appendix F. One design was a device with which you could have interaction by using the tokens and the touch screen. The second concept was given shape by a screen which simultaneously acts as a painting when

not in use. Together with sketches of the designs (figure 01 & 02), the concept could be explained to the coaches. With the feedback of the coaches together with the feedback of all the other squad groups, we concluded that both designs needed more work and improvement.

Third iteration concept - In order to improve our design and concept even more a new iteration phase started. While taking the midterm presentation feedback into consideration the concept and the design had been given another look.

Ultimately we chose to go with a form of the 'token-concept' in which each token will represent a zone (a room or group of rooms) in the house of the user. However, instead of using loose tokens, which could easily get lost, a so-called 'token board' had been developed (figure 03). A board which has been divided into multiple parts which each contain their own stationary token. This token board comes together with a mobile night lamp and a seperate screen. The night lamp functions as an indication light to provide the user with information without interacting with the design. When the user wants to get more information and therefore use the device, the night lamp can be put on the first stationary token on the token board and the night lamp will give you feedback in terms of colour and any further detailed information will be displayed on the separate screen.

Imagine having a large house which consists of more zones than the original 3 on the token board. These consumers would like to add more zones to the

FIGURE 01 – SKETCH MIDTERM TOKEN CONCEPT

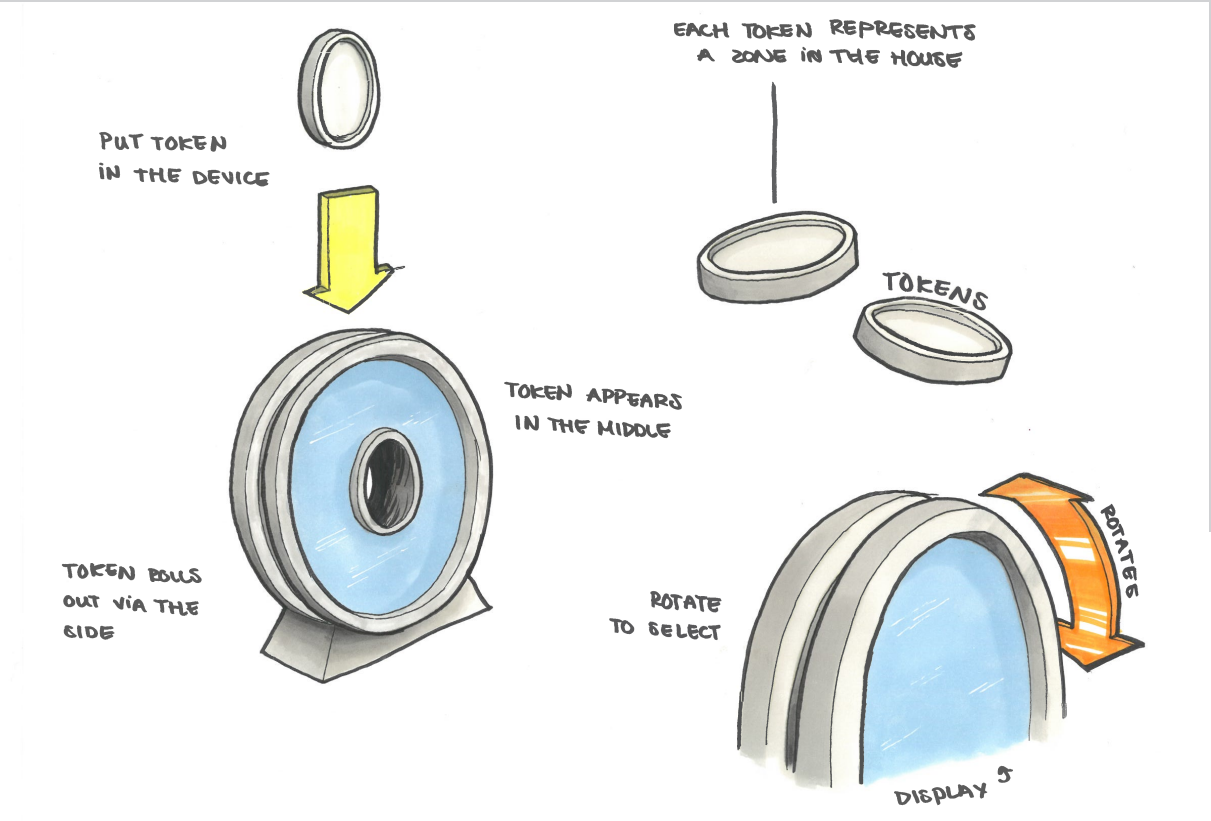


FIGURE 02 - SKETCH MIDTERM SCREEN CONCEPT

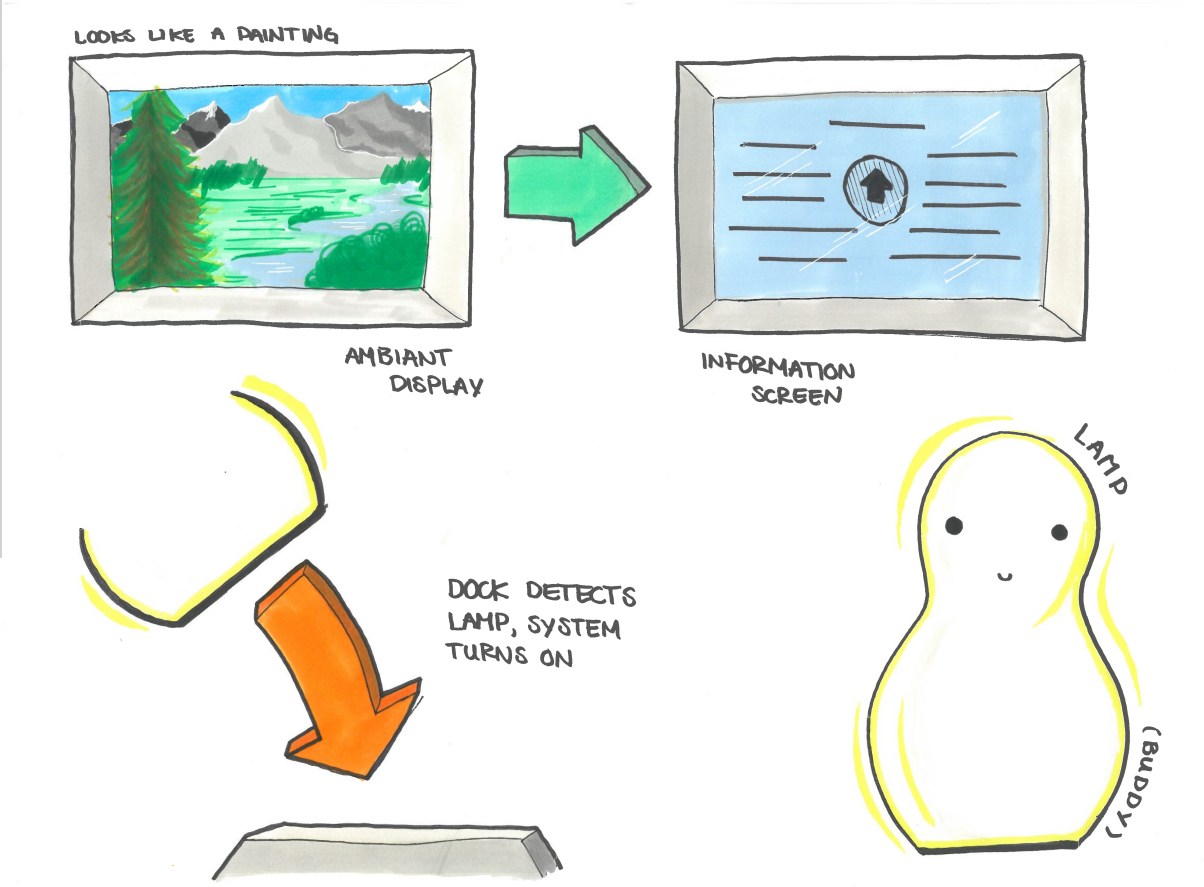
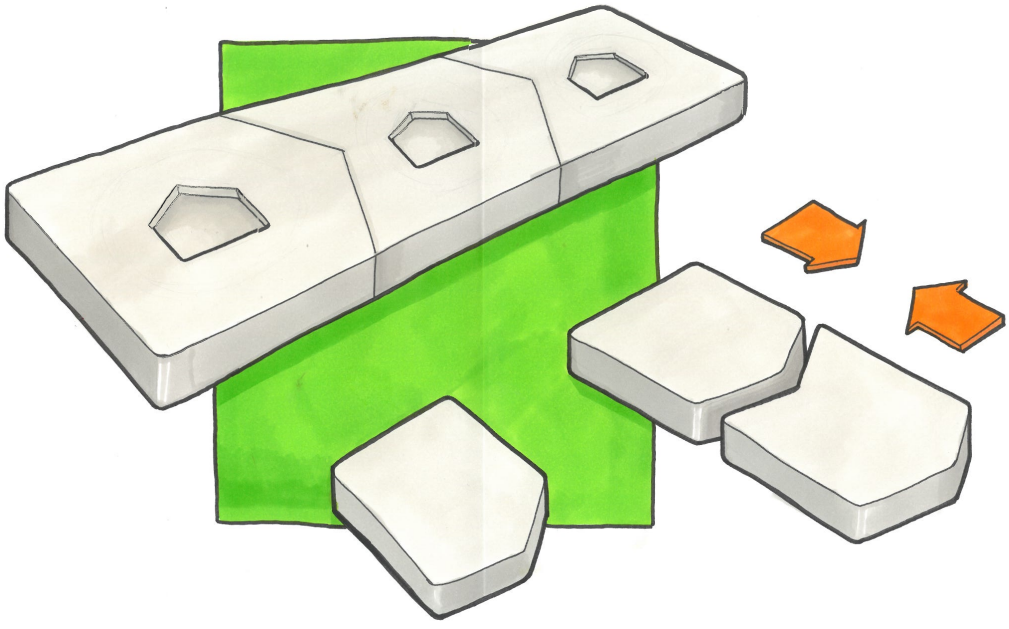


FIGURE 03 - TOKEN BOARD



board to create a clearer overview of their house and therefore do their evening routine more efficiently. That is the reason why we designed the token board in such a way that it could be expanded at any point to add more zones to the system. Because the token board consists out of multiple parts, a new piece can be added at any time, just like a puzzle piece.

This created a great business opportunity when Rouli would become available on the market. These expendable parts would be sold apart from the 'starter package' which includes the token board with 3 pieces (start middle and end piece) and the Rouli light (figure 03).

The device functions as a way to give the user information about the states of their doors, lights and devices by letting the night lamp shine. When it shines white light, there is still something turned on. When no light shines, everything is turned off and the user is ready to go to bed. Next to that it functions as a way to turn the remaining devices and lights off and close any open doors.

Making functional prototype - The functional prototype consists out of three parts: the software, the hardware, and the sandbox-prototype. For images of this process, see Appendix F.

The prototype is going to be used during the deployment phase, a phase in which the prototype is installed into the home of a user. Because of the deployment and limited time we chose not to prototype the separate screen.

The hardware consists out of the token board, which is made of laser-cutted MDF material. It contains three parts which each contains their own stationary 'token'. A house-like shape has been cut out in the middle of the token in order to fit the night lamp into a specific position. The bottom of the night lamp consists out of the same shape: not cut out, but sticking out. So the piece at the bottom of the night lamp fits perfectly into the cut out shape on the token board. Due to the house-like shape the night lamp only fits in one particular way onto the token board. This is important, because there are pins in the cut-out shape on the token board which will press a certain button in the bottom of the night lamp when it is put on the token board in order to provide of the required zone-data.

The night lamp is 3D printed in a bowling pin-like shape from half-opaque material. According to Solarski (2012) circular shapes are considered friendly. By using the round shapes of the night lamp we desire to evoke more compassion and trust with the night lamp and trust will be earned more easier.

Inside the 3D printed night lamp, the technology is located. A Sparkfun ESP 32 microcontroller is used together with a RGBW LED strip, 3 push buttons and one big arcade reset button. These are all connected to the ESP with the right circuits on a PCB board.

Due to the limited amount of time of this project the system only controls a set of lights instead of lights, doors and devices. Three Philips Hue lights are connected to the system. By using the design, the Philips Hue lights can be separately turned off.

The software of the system is written on Arduino IDE. For the final code and the circuit view Appendix B. A switch case is used to let the design follow through different states when interacting with the design. By putting the design on a dock, a button is pressed and the product goes to a different state simply by an if

statement. The same holds for pressing the arcade button on top to turn off the Hue lights.

To some extent the code operates on a domain model that takes the need of the user in a smart home system as an input signal and gives outputs accordingly as described by Funk, Chen, Yang and Chen (2018). Rouli senses when something is left on and reacts accordingly: it turns white. When the user has the intention to turn off lights or devices the user interacts with Rouli and the device turns off these lights and/or devices. Again Rouli senses whether these devices are turned on or off, and because the user has just turned them off Rouli reacts accordingly: The light turns off.

The system is also located in the sandbox: the life-size system is connected to the miniature system in the sandbox. The hardware of the miniature system consists out of three LEDs, an ESP and some wires which connect all the parts. OOCSI (Funk, 2019) is used to make the connection between the ESP from Rouli and the ESP in the sandbox. A message is send from Rouli's ESP to the sandbox ESP to turn off the LEDs in the sandbox when the Philips Hue lights are turned off with Rouli.

Before installing the device in the user's home, it needed to be checked on its safety. After this so-called safety check the device was ready for deployment.

Deployment - The deployment had been started and our device has been installed into the user's home for five days. We asked the user to, for each day, keep a notebook. The user's experience with the device is noted down in the notebook for documentation. Before the user is going to use the device, we performed a questionnaire with the user For the questionnaire questions, view Appendix E. After the deployment we performed an interview in order to get more insights into the user's experience and the interaction of the user with the device For the detailed interview questions view Appendix E.

Final Demo-day - In order to prepare for Final Demo-day we shot some high quality pictures of Rouli (figure 05, 07 & 08), how we named our design. Two posters were made to promote our design, an A2 poster which was purely promotional and an A4 poster which included the general information about Rouli.

During the day we performed our pitch for coaches, stakeholders, fellow students and other guests. The guests were able to use and interact with Rouli. After the guests had completed the routine and all the Philips Hue lights, which were scattered throughout the squad space, were turned off, the guests could check the state of the LEDs in the sandbox (figure 06). However, we asked the guests if they trusted the system. If their answer was 'yes', there was no need to double check in the sandbox.

FIGURE 04 - FINAL DEMO-DAY SETUP

DESIGN

MEET ROULI

Rouli has been designed as a tool to assist the older part of society with their evening routine. This so called evening routine, for us, consists of taking a stroll around the house to check lights, doors and locks and electrical devices to see whether they are turned off and locked. From interviews we learned this process is very common among members of the aging society and executed every single day (personal communication, September 26, 2019). So how does Rouli help with this routine?

Rouli consists out of a physical design remote, which simultaneously acts as a night lamp (figure 07). This night lamp will be most likely located in the bedroom of the user and it will only be lit up whenever there are still any doors, devices or lights not properly turned off up, Rouli will shine white and indicates that there is still something turned on or unlocked. In order to turn off the night lamp, the 'night routine' will need to be performed. Rouli is a reminder tool for after the user has already completed the evening routine and has forgotten something. When this is the case, Rouli will shine white.

Next to the night lamp, Rouli also consists out of a docking station together with a docking board. This board will be the key part in terms of giving the night lamp specific information. Each part of the board goes with a specific colour, which is connected to a specific zone in the house of the user. When the night lamp is moved onto a specific place on the docking board, the lamp will shine in the corresponding colour and when it does, that shows the user that there is still

FIGURE 05 - ROULI TOP VIEW

something left on or open in that zone of the house. Pressing the button on top of the night lamp will shut down all devices and lamps in that specific zone and lock unlocked doors. By putting the night lamp onto another part of the docking board, the process starts again. When all the lights, devices and doors in the house are checked, the night lamp can be put on the docking station again and will slowly drain its own light until there is no light left. The 'night routine' has been completed and Rouli will not shine white anymore: it will be turned off.

ROULI IN YOUR HOME

Rouli is not just a device, it also functions as a piece of home decoration. The friendly form of the lamp fits in the interior of the target group and this was confirmed by our deployment user (personal communication, December 15, 2019). Where to put Rouli and the docking station is a free choice for the user. Also, the docking station can be expanded by adding more docks for more zones in the house, which means that our device is highly customizable and tailor made for each household. The different zones that the docking pieces resemble are generalized, for example, the living room, the kitchen, the toilets, the bedrooms etc.

ROULI IN SANDBOX

During Demo-day, Rouli has been presented to the public and to convey our most important value, trust, the sandbox has been used to test the audience. Three Philips Hue lights have been used and for each light that was spread around the squad space, a light has been implemented in each one of Michael's rooms. Michael is one of the mundane characters created by the squad students to live in IoT Sandbox. His bedroom, living room and bathroom had been installed with an LED (figure 06). The sandbox is normally open, but to test the trustworthiness of the system those three rooms were covered. When finished with demonstrating Rouli, the listeners have been asked whether they trusted the system and have gotten the opportunity to look underneath the 'roofs' of the three rooms. How the audience reacted was in line with what our deployment user also found: the system earns trust over time (personal communication, December 15, 2019). The sandbox provided a real-life setting and a confirmation of insights.

FIGURE 06 - MICHAEL'S ROOMS IN THE IOT SANDBOX

FIGURE 07 - ROULI

FIGURE 08 - ROULI

DISCUSSION

After having completed this project some points of discussion emerged as well as learning points.

The first point of discussion has to do with the requirements regarding the squad, the stakeholder and additional wishes we set for ourselves. In the first few weeks of the project we struggled with what to design which fits the vision we have and the requirements of the squad and the stakeholders. At first we designed for the stakeholders. However, the teacher coaches told us that there are also other requirements and base lines on which we should focus, which emerged from the squad (personal communication, November, 2019). This confused us as we did not want to disappoint the squad in terms of a final design, and we did not want to disappoint the stakeholders either. Next to that we wanted to integrate our own visions into the design, which meant to make sacrifices. A learning point in this is to communicate with all parties at an early stage in the design process. Make clear, especially to the stakeholder, that the design does not necessarily need to be as they have imagined it. In order to communicate this clearly in future projects we have learned to give clear reasoning and argument for the choices we have made as designers.

The communication with the stakeholder did not go as well as we had hoped. In the beginning stage of the project we had great communication with our stakeholder and got clear responses. However, towards the final stage of the project we noticed that the stakeholder was not responding to our emails. After making phone calls, the stakeholder did reply but further communication was hard and we struggled to keep properly in touch. We learned that maintaining clear communication is key to reaching a satisfying end result.

Another learning point has to do with the design process. We started to ideate from the perspective of what the stakeholder wanted and how it should be given shape. However, later in the design process, our teacher coach inspired us to ideate from the perspective of the design values. We discovered that this way of ideating was way more useful and gave us significantly more ideas and a wider range of diverse designs. In future projects, designing from the perspective of design values is certainly going to make the design process more efficient.

At the end of the project we successfully delivered a finished design. However, due to time constraints we were not able to make any connections within the sandbox home with other designs within the squad. When there was more time, we would have made a connection with Clair, the design of E. Roodbergen (2020): this design is implemented in the bed of the user.

This connection would be in terms of safety. Imagine the scenario that both Rouli and Clair were implemented in a home for aging people. Since Rouli is made for supporting with the night routine, after interacting with Rouli, the user would usually go to bed. When the user is done interacting with Rouli, this could be send to Clair. If after a particular time Clair does not notice that the person has gone into bed there could have happened something with the user.

The user could have fell on the floor and cannot get up by itself for example. Because of the connectivity between the systems it could for instance trigger an alarm which would be sent to the home care.

Ultimately, our initial final design existed out of three parts: a night lamp, a token board and a separate screen. This separate screen has not been implemented due to the complexity and the time constraint. However, in the interview we conducted after the deployment, we discovered that when more zones and devices are added to the system, a screen with greater details would be necessary (personal communication, December 15, 2019). Therefore the design should include a separate screen which displays more detailed information about the connected devices, lights and doors in order to give a better overview and greater trust.

CONCLUSION

The working design shows that Rouli truly can be an addition to the automated homes of the aging society. However, the discussion shows that improvements can be made in terms of design and that additions can be made to the design. These design additions should go through several design iterations in order to achieve a satisfied result.

Our client was satisfied with the product we designed, but also saw room for improvement and moreover room for multiple additions to the design. These additions could indeed all be implemented and the product would become the 'Home Dashboard' our client was looking for. However, we came up with a design focus that slightly differed from the 'Home Dashboard' and we believe we held on to this design focus to eventually create the final product: Rouli.

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This extended report is made by three students from the faculty of Industrial Design at the University of Technology in Eindhoven in the context of Project 02 Designing for Growing Systems in the Home. This report has been written in context of the research and development of our design, Rouli.

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- The deployment user for letting us install our design into their home for five days.

This project has been educative to us all, we have learned a lot and developed ourselves as designers. It has been a time of fun, educative moments, but sometimes adversity as well. We have managed to work together as a team in order to finish this project. We hope that the amount of effort which has been put into this project reflects in this report and has resulted in a finished and satisfied result.

Thank you.

January 09, 2020

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Y.J. Thijssen - During B2.1 I have rounded of project 2 within the DIGSIM Squad. Together with 2 fellow students I have made a product called Rouli. Rouli is a tool that assists the older part of society with their evening routine. It is a night lamp that connects with all smart systems in the home and can turn these systems off at a central place when interacting with Rouli.

The DIGSIM squad matches my vision in terms of a connected future. When I got the confirmation that I was admitted to design a product within this squad I was very excited. Especially the fact that an deployment is included within the project time was appealing to me. In my PDP I did set the goal that I want to make aesthetically pleasing designs starting with project 2. With the deployment I saw a great opportunity to get feedback on an aesthetically pleasing (working!) prototype that also I had worked on.

On top of that, the use of the Sandbox within the DIGSIM squad made me very excited as well. At first it wasn't clear to me how we should use the Sandbox apart from showing the working of our product on a smaller scale. But the particular workshop gave me insights in what great opportunities laid ahead for connectivity in the Sandbox. I was very eager to work on these opportunities together with all student squad members that had the same goal: a connected house.

Unfortunately, I cannot say that I had the same excitement for our own project at the start. Other experience descriptions sounded more challenging to me and therefore were more appealing. We had a meeting right away and told our expectations for the project and in terms of group dynamics. This meeting showed me that, even though there was not much excitement at the start, the motivated me to deliver a great design for our stakeholder, my group members and also for myself.
In the beginning phases of the project I have contributed in such a way that I have kept it realistic. Having the idea in mind that we had to make a working prototype, I sometimes argued about the fact that an idea is not reachable with our own expertise. Moreover, multiple times during meetings throughout the project I set the three of us a step back in a way that we first come up with a solution for the discussed issues before entering other issues.

Once we agreed on a final design I focused on the technical part of this design. I did research on which parts we could best use and also how they are used. I experimented with the parts on an individual level but also wrote the code for the final prototype in which all these parts are connected. Because I am the only person of our three who did understand the working of the prototype I also did the installation in the participants home during the deployment.

During this project I have learned practical knowledge, but also gained knowledge about myself. In the early stages of the project I have noticed that me being the realistic person in a group is a way I act quite often in group projects. Therefore, I feel that I have not been able to take on a different role as for instance an chairman who takes responsibility for the planning and organizing of the group. However, it became very clear in the beginning that Lisa would take this role on her and I was fine with that.

The practical knowledge I have learned has to do with that I focused on the technical part of the design. I have learned to create a system that works on an ESP and can communicate with

a Philips Hue bridge. Moreover, I have learned how an LED strip and its code works. All this code is written in Arduino IDE in which I have learned to code in a different way then was usual for me which was just in the loop. Now that I learned how switch cases work I can implement and share this knowledge in projects to come.

I felt that I was only broadening my Technology and Realization expertise area and I was not achieving my goals I did set in my PDP. Therefore, I have done little tasks together with Ries and Lisa to broaden my knowledge in other Expertise Areas and to do a little grasp in achieving my PDP goal. Together with Lisa I have conducted interviews before and after the deployment, and during the installation of the deployment I have sat down with the participant to explain the working of the product. Together with Ries I have seen and learned how (easy) laser cutting works which belonged to achieving my goal.

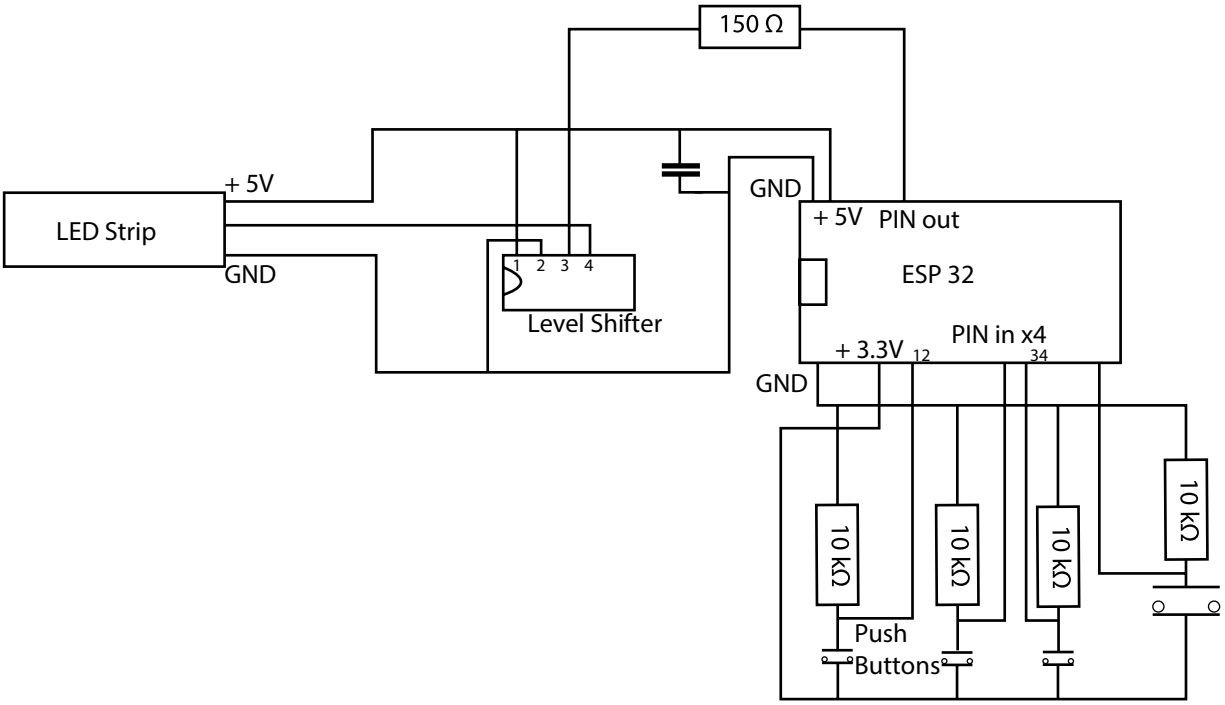
The most important aspect I have learned is decision making when dealing with different perspectives. We had to design one product that fits the requirements of the squad, the stakeholder and additional wishes we set for ourselves. We had serious troubles in making decisions in what would become the final product. A learning point in this is to communicate with all parties at an early stage in the design process and give clear reasoning and arguments for the choices we eventually make as designers.

At the end of the project I can conclude that when I learn more advanced code instead of simple examples, I like it. When there is a finished and working product of which I can be proud of, it gives me a feeling of satisfaction, especially when it amazes others. That is the reason why I am going to follow the course DBSU10 Technologies for Connectivity in which I want to find out of making these type of product is something I want to dive in deeper.

Moreover, I have not fully achieved my goal in making an aesthetically pleasing prototype. This goal still stand for future projects.

APPENDIX B - CODE + ELECTRICAL CIRCUIT

Electrical Circuit



Code Rouli

```
/*************************************************************************
****
   This code is made for Rouli, a device that supports the aging society in
doing their night routine in automated homes.
   - The main purpose is to demonstrate how Rouli works and that is done by
switching off Philips HUE lights.
   - The device itself also uses light as an information source, and that
is done by using a RGBW LED strip.
   - For demonstrating purposes there is also a connection via Internet
that turns off LEDs connected on another ESP.

  For the mentioned 3 purposes various example codes are studied and
adapted to use in this code. These are:

  Philips Hue:
  Poor Man's Hue Switch made by Gelstronic retrieved from :
https://www.instructables.com/id/Poor-Mans-Hue-Switch/#imadeits

  RGBW Led strip:
  Adafruit NeoPixel Überguide by Phillip Burgess retrieved from :
https://learn.adafruit.com/adafruit-neopixel-uberguide/arduino-library-use

  OOCSI :

  Funk, Mathias. (2019, May). OOCSI. Zenodo.
http://doi.org/10.5281/zenodo.1321220
  Retrieved from: https://github.com/iddi/oocsi



*************************************************************************
***/




#include <NTPClient.h>
#include <WiFi.h>
#include <WiFiClient.h>
#include <WiFiServer.h>
#include <SPI.h>
#include <WiFiUdp.h>
#include <Adafruit_NeoPixel.h>
#include "OOCSI.h"



IPAddress ip(192, 168, 1, 5);
IPAddress gateway(192, 168, 1, 1);
IPAddress subnet(255, 255, 255, 0);

int light1 = 1; // number of the light to be switched
int light2 = 2;
int light3 = 3;

#define LED_PIN 25
#define LED_COUNT 48
Adafruit_NeoPixel strip(LED_COUNT, LED_PIN, NEO_GRBW);
```

```
unsigned long previousMillis = 0;        // will store last time LED was
updated

// constants won't change:
const long interval = 1000;           // interval at which to blink
(milliseconds)


char ssid[] = "UPC37975";  //  network SSID (name)
char password[] = "VLALLTMG";       // network password

const long utcOffsetInSeconds = 3600;
WiFiUDP ntpUDP;
NTPClient timeClient(ntpUDP, utcOffsetInSeconds);
OOCSI oocsi = OOCSI();
WiFiClient client;

const char* OOCSIName = "Rouli_Sender";
const char* hostserver = "oocsi.id.tue.nl";


const char hueHubIP[] = "192.168.1.3";  // Hue hub IP
const char hueUsername[] = "GHgXdp2bxmLERVkponXIdRzF8dvBsNvyT8TK6OGu";  //
hue bridge username
const int hueHubPort = 80;
const int buttonZone1 = 17;
const int buttonZone2 = 15;
const int buttonZone3 = 18;
const int bbp_button = 19;


String formattedTime;
int buttonState = 0;
int buttonState2 = 0;
int buttonState3 = 0;
int bbp_button_State = 0;
boolean HueState1 = false;
boolean HueState2 = false;
boolean HueState3 = false;

boolean PrevHueState1 = false;
boolean PrevHueState2 = false;
boolean PrevHueState3 = false;

enum deviceStates {
  IDLE_STATE,
  HUE_LIGHT_ON,
  BBP_ON_DOCKINGSTATION,
  BBP_BUTTON_PRESSED_ON_DOCKINGSTATION,
  BBP_COMPLETED_ON_CURRENT_DOCK_POSITION
} currentState;


int prevBT1 = 0;
int prevBT2 = 0;
int prevBT3 = 0;
```

```
void setup() {
  // put your setup code here, to run once:
  Serial.begin(115200);
  Serial.println("Begonnen");

  //  WiFi.config(ip, gateway, subnet);
  WiFi.begin(ssid, password);


  Serial.print("Connecting");
  while (WiFi.status() != WL_CONNECTED)
  {
    delay(500);
    Serial.print(".");
  }
  Serial.println();

  Serial.print("Connected, IP address: ");
  Serial.println(WiFi.localIP());

  oocsi.connect(OOCSIName, hostserver, ssid, password, processOOCSI);

  timeClient.begin();

  pinMode(buttonZone1, INPUT);
  pinMode(buttonZone2, INPUT);
  pinMode(buttonZone3, INPUT);
  pinMode(bbp_button, INPUT);

  strip.begin();           // INITIALIZE NeoPixel strip object (REQUIRED)
  strip.show();            // Turn OFF all pixels ASAP
  strip.setBrightness(255); // Set BRIGHTNESS to about 1/5 (max = 255)

  handleState();

}

void loop() {
  prevBT1 = buttonState;
  prevBT2 = buttonState2;
  prevBT3 = buttonState3;

  buttonState = digitalRead(buttonZone1);
  buttonState2 = digitalRead(buttonZone2);
  buttonState3 = digitalRead(buttonZone3);
  bbp_button_State = digitalRead(bbp_button);
  getHue1();
  getHue2();
  getHue3();

  // Serial.println(currentState);

  if ( HueState1 != PrevHueState1 || HueState2 != PrevHueState2 ||
HueState3 != PrevHueState3) {
    Serial.println("hue state changed");
    handleState();
  }
  if (buttonState != prevBT1 || buttonState2 != prevBT2 || buttonState3 !=
prevBT3 || bbp_button_State == HIGH) {
    handleState();
  }
```

```
  unsigned long currentMillis = millis();

  if (currentMillis - previousMillis >= interval) {
    // save the last time you blinked the LED
    previousMillis = currentMillis;
    handleState();
  }

}

void handleState() {

  switch (currentState) {

    case IDLE_STATE:
      //do stuff for state
      handleIdleState();
      break;

    case HUE_LIGHT_ON:
      //put nightlight on
      handleHUE_LIGHT_ON();
      break;

    case BBP_ON_DOCKINGSTATION:
      //checks light and if button on top is pressed go to next state
      handleBBP_ON_DOCKINGSTATION();
      break;

    case BBP_BUTTON_PRESSED_ON_DOCKINGSTATION:
      // do animation and turn specific hue off
      //handleBBP_COMPLETED_ON_CURRENT_DOCK_POSITION();
      handleBBP_BUTTON_PRESSED_ON_DOCKINGSTATION();
      break;

    case BBP_COMPLETED_ON_CURRENT_DOCK_POSITION:
      // if lifted off dock, go to idle state
      handleBBP_COMPLETED_ON_CURRENT_DOCK_POSITION();
      break;
  }
}
void handleIdleState() {
  Serial.println("Device is in IdleState");

  //  while (!timeClient.update()) {
  //    timeClient.forceUpdate();
  //  }




  if ( HueState1 == true || HueState2 == true || HueState3 == true) {
    currentState = HUE_LIGHT_ON;
    handleState();
  }
  if ( HueState1 == false && HueState2 == false && HueState3 == false) {
    currentState = BBP_BUTTON_PRESSED_ON_DOCKINGSTATION;
    handleState();
```

```
  }


}


void handleHUE_LIGHT_ON() {
  Serial.println("Device is in HUE_LIGHT_ON state");

  for (int i = 0; i < strip.numPixels(); i++) { // For each pixel in
strip...
    strip.setPixelColor(i, 0, 0, 0, 255);     //  Set pixel's color (in
RAM)
    strip.show();                             //  Update strip to match
    delay(10);                               //  Pause for a moment
  }
 // if ( HueState1 != PrevHueState1 || HueState2 != PrevHueState2 ||
HueState3 != PrevHueState3) {
    if (HueState1 == true) {
      oocsi.newMessage("Michael_Rouli");
      oocsi.addInt("Hue1_State", 1);
      oocsi.sendMessage();
      oocsi.check();

    }
    if (HueState2 == true) {
      oocsi.newMessage("Michael_Rouli");
      oocsi.addInt("Hue2_State", 1);
      oocsi.sendMessage();
      oocsi.check();

    }
    if (HueState3 == true) {
      oocsi.newMessage("Michael_Rouli");
      oocsi.addInt("Hue3_State", 1);
      oocsi.sendMessage();
      oocsi.check();
    }

    if (HueState1 == false) {
      oocsi.newMessage("Michael_Rouli");
      oocsi.addInt("Hue1_State", 0);
      oocsi.sendMessage();
      oocsi.check();
    }
    if (HueState2 == false) {
      oocsi.newMessage("Michael_Rouli");
      oocsi.addInt("Hue2_State", 0);
      oocsi.sendMessage();
      oocsi.check();
    }
    if (HueState3 == false) {
      oocsi.newMessage("Michael_Rouli");
      oocsi.addInt("Hue3_State", 0);
      oocsi.sendMessage();
      oocsi.check();
    }
//  }
  if ( HueState1 == false && HueState2 == false && HueState3 == false) {
    currentState = BBP_BUTTON_PRESSED_ON_DOCKINGSTATION;
```

```
  }

  if (buttonState == HIGH || buttonState2 == HIGH || buttonState3 == HIGH)
{
    Serial.println("button is high");
    currentState = BBP_ON_DOCKINGSTATION;
  }


}


void handleBBP_ON_DOCKINGSTATION() {
  Serial.println("Device is in BBP_ON_DOCKINGSTATION state");


  if (buttonState == HIGH) {
    getHue1();

    if (HueState1 == true) {
      for (int i = 0; i < strip.numPixels(); i++) { // For each pixel in
strip...
        strip.setPixelColor(i, 255, 0, 0, 0);     //  Set pixel's color (in
RAM)
        strip.show();                             //  Update strip to match
        delay(10);                               //  Pause for a moment
      }

      //      oocsi.newMessage("Michael_Rouli");
      //      oocsi.addBool("Hue1_State", true);
      //      oocsi.sendMessage();
      //      oocsi.check();
      //      delay(10);
    }


    if ( HueState1 == false) {
      currentState = BBP_BUTTON_PRESSED_ON_DOCKINGSTATION;
      //      for (int i = 0; i < strip.numPixels(); i++) { // For each
pixel in strip...
      //        strip.setPixelColor(i, 0, 0, 0, 0);     //  Set pixel's
color (in RAM)
      //        strip.show();                           //  Update strip to
match
      //        delay(10);


      //      oocsi.newMessage("Michael_Rouli");
      //      oocsi.addBool("Hue1_State", false);
      //      oocsi.sendMessage();
      //      oocsi.check();
      //      delay(10);
    }

    if (bbp_button_State == HIGH) {
      Serial.println("BBP is pressed");
      String command1 =  "{\"on\": false}";
      setHue1(command1);

      currentState = BBP_BUTTON_PRESSED_ON_DOCKINGSTATION;
    }
```

```
  }

  if (buttonState2 == HIGH) {
    getHue2();

    if (HueState2 == true) {
      for (int i = 0; i < strip.numPixels(); i++) { // For each pixel in
strip...
        strip.setPixelColor(i, 0, 255, 0, 0);     //  Set pixel's color (in
RAM)
        strip.show();                             //  Update strip to match
        delay(10);                               //  Pause for a moment
      }
      //      oocsi.newMessage("Michael_Rouli");
      //      oocsi.addBool("Hue2_State", true);
      //      oocsi.sendMessage();
      //      oocsi.check();
      //      delay(10);
    }
    else {
      //      oocsi.newMessage("Michael_Rouli");
      //      oocsi.addBool("Hue2_State", false);
      //      oocsi.sendMessage();
      //      oocsi.check();
      //      delay(10);
      currentState = BBP_BUTTON_PRESSED_ON_DOCKINGSTATION;
    }

    if (bbp_button_State == HIGH) {
      Serial.println("BBP is pressed");
      String command2 =  "{\"on\": false}";
      setHue2(command2);

      currentState = BBP_BUTTON_PRESSED_ON_DOCKINGSTATION;
    }
  }

  if (buttonState3 == HIGH) {
    getHue3();

    if (HueState3 == true) {
      for (int i = 0; i < strip.numPixels(); i++) { // For each pixel in
strip...
        strip.setPixelColor(i, 0, 0, 255, 0);     //  Set pixel's color (in
RAM)
        strip.show();                             //  Update strip to match
        delay(10);                               //  Pause for a moment
      }
      //    oocsi.newMessage("Michael_Rouli");
      //    oocsi.addBool("Hue3_State", true);
      //    oocsi.sendMessage();
      //    oocsi.check();
      //    delay(10);
    }
    else {
      // oocsi.newMessage("Michael_Rouli");
      //    oocsi.addBool("Hue3_State", false);
      //    oocsi.sendMessage();
      //    oocsi.check();
      //    delay(10);
      currentState = BBP_BUTTON_PRESSED_ON_DOCKINGSTATION;
```

```
    }

    if (bbp_button_State == HIGH) {
      Serial.println("BBP is pressed");
      String command3 =  "{\"on\": false}";
      setHue3(command3);

      currentState = BBP_BUTTON_PRESSED_ON_DOCKINGSTATION;
    }
  }

  if (buttonState == LOW && buttonState2 == LOW && buttonState3 == LOW) {
    Serial.println("button is high");
    currentState = IDLE_STATE;
  }

}


void handleBBP_BUTTON_PRESSED_ON_DOCKINGSTATION() {
  Serial.println("Device is in BBP_BUTTON_PRESSED_ON_DOCKINGSTATION
state");

  //  oocsi.newMessage("Deployment_BBP");
  //  oocsi.addInt("State", "4");
  //  oocsi.sendMessage();
  //  oocsi.check();
  //  delay(10);

  for (int i = 0; i < strip.numPixels(); i++) { // For each pixel in
strip...
    strip.setPixelColor(i, 0, 0, 0, 0);     //  Set pixel's color (in RAM)
    strip.show();                          //  Update strip to match
    delay(10);                            //  Pause for a moment
  }

  currentState = BBP_COMPLETED_ON_CURRENT_DOCK_POSITION;
}


void handleBBP_COMPLETED_ON_CURRENT_DOCK_POSITION() {
  Serial.println("Device is in BBP_COMPLETED_ON_CURRENT_DOCK_POSITION
state");

  //  oocsi.newMessage("Deployment_BBP");
  //  oocsi.addInt("State", "5");
  //  oocsi.sendMessage();
  //  oocsi.check();
  //  delay(10);

  // if (buttonZone1 == LOW && buttonZone2 == LOW && buttonZone3 == LOW) {
  currentState = IDLE_STATE;
  // }
  //device is off on dock, if lifted go to idle state

}

void processOOCSI() {
  // don't do anything; we are sending only
}
```

```
void getHue1()
{
  if (client.connect(hueHubIP, hueHubPort))
  {
    client.print("GET /api/");
    client.print(hueUsername);
    client.print("/lights/");
    client.print(light1);
    client.println(" HTTP/1.1");
    client.print("Host: ");
    client.println(hueHubIP);
    client.println("Content-type: application/json");
    client.println("keep-alive");
    client.println();
    while (client.connected())
    {
      if (client.available())
      {
        client.findUntil("\"on\":", "\0");
        PrevHueState1 = HueState1;
        HueState1 = (client.readStringUntil(',') == "true");
        break;
      }
    }
    client.stop();
  }
}

void getHue2()
{
  if (client.connect(hueHubIP, hueHubPort))
  {
    client.print("GET /api/");
    client.print(hueUsername);
    client.print("/lights/");
    client.print(light2);
    client.println(" HTTP/1.1");
    client.print("Host: ");
    client.println(hueHubIP);
    client.println("Content-type: application/json");
    client.println("keep-alive");
    client.println();
    while (client.connected())
    {
      if (client.available())
      {
        client.findUntil("\"on\":", "\0");
        PrevHueState2 = HueState2;
        HueState2 = (client.readStringUntil(',') == "true");
        break;
      }
    }
    client.stop();
  }
}

void getHue3()
{
  if (client.connect(hueHubIP, hueHubPort))
  {
    client.print("GET /api/");
```

```
    client.print(hueUsername);
    client.print("/lights/");
    client.print(light3);
    client.println(" HTTP/1.1");
    client.print("Host: ");
    client.println(hueHubIP);
    client.println("Content-type: application/json");
    client.println("keep-alive");
    client.println();
    while (client.connected())
    {
      if (client.available())
      {
        client.findUntil("\"on\":", "\0");
        PrevHueState3 = HueState3;
        HueState3 = (client.readStringUntil(',') == "true");
        break;
      }
    }
    client.stop();
  }
}



void setHue1(String command1)
{
  if (client.connect(hueHubIP, hueHubPort))
  {
    client.print("PUT /api/");
    client.print(hueUsername);
    client.print("/lights/");
    client.print(light1);
    client.println("/state HTTP/1.1");
    client.println("keep-alive");
    client.print("Host: ");
    client.println(hueHubIP);
    client.print("Content-Length: ");
    client.println(command1.length());
    client.println("Content-Type: text/plain;charset=UTF-8");
    client.println();  // blank line before body
    client.println(command1);
    client.stop();
  }
}

void setHue2(String command2)
{
  if (client.connect(hueHubIP, hueHubPort))
  {
    client.print("PUT /api/");
    client.print(hueUsername);
    client.print("/lights/");
    client.print(light2);
    client.println("/state HTTP/1.1");
    client.println("keep-alive");
    client.print("Host: ");
    client.println(hueHubIP);
    client.print("Content-Length: ");
    client.println(command2.length());
```

```
    client.println("Content-Type: text/plain;charset=UTF-8");
    client.println();  // blank line before body
    client.println(command2);
    client.stop();
  }
}

void setHue3(String command3)
{
  if (client.connect(hueHubIP, hueHubPort))
  {
    client.print("PUT /api/");
    client.print(hueUsername);
    client.print("/lights/");
    client.print(light3);
    client.println("/state HTTP/1.1");
    client.println("keep-alive");
    client.print("Host: ");
    client.println(hueHubIP);
    client.print("Content-Length: ");
    client.println(command3.length());
    client.println("Content-Type: text/plain;charset=UTF-8");
    client.println();  // blank line before body
    client.println(command3);
    client.stop();
  }
}
```

Code Rouli Sandbox

```
/*************************************************************************
****
   This code is made for the Sandbox connection with Rouli, a device that
supports the aging society in doing their night routine in automated homes.
   - The main purpose is to demonstrate how Rouli works on a small scale in
the Sandbox

  For the mentioned purpose example code is studied and adapted to use in
this code:

   OOCSI :

  Funk, Mathias. (2019, May). OOCSI. Zenodo.
http://doi.org/10.5281/zenodo.1321220
  Retrieved from: https://github.com/iddi/oocsi



*************************************************************************
***/


#include "OOCSI.h"

// use this if you want the OOCSI-ESP library to manage the connection to
the Wifi
// SSID of your Wifi network, the library currently does not support WPA2
Enterprise networks
const char* ssid = "UPC37975";
// Password of your Wifi network.
const char* password = "VLALLTMG";

// name for connecting with OOCSI (unique handle)
const char* OOCSIName = "Rouli_Receiver";
// put the adress of your OOCSI server here, can be URL or IP address
string
const char* hostserver = "oocsi.id.tue.nl";

// OOCSI reference for the entire sketch
OOCSI oocsi = OOCSI();


int Ledpin1 = 12;
int Ledpin2 = 13;
int Ledpin3 = 14;

int Hue1_State = 0;
int Hue2_State = 0;
int Hue3_State = 0;

// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin LED_BUILTIN as an output.
  Serial.begin(115200);
  Serial.println("begonnen");
  pinMode(Ledpin1, OUTPUT);
  pinMode(Ledpin2, OUTPUT);
  pinMode(Ledpin3, OUTPUT);
  oocsi.connect(OOCSIName, hostserver, ssid, password, processOOCSI);

  // subscribe to a channel
```

```
  oocsi.subscribe("Michael_Rouli");
  // check if we are in the client list
  Serial.print("is ");
  Serial.print(OOCSIName);
  Serial.print(" a client? --> ");
  Serial.println(oocsi.containsClient(OOCSIName));

  digitalWrite(Ledpin1, LOW);
  digitalWrite(Ledpin2, LOW);
  digitalWrite(Ledpin3, LOW);

}

// the loop function runs over and over again forever
void loop() {
  oocsi.check();


  if (Hue1_State == 1) {
    digitalWrite(Ledpin1, HIGH);   // turn the LED on (HIGH is the voltage
level)
  }
  if (Hue2_State == 1) {
    digitalWrite(Ledpin2, HIGH);   // turn the LED on (HIGH is the voltage
level)
  }
  if (Hue3_State == 1) {
    digitalWrite(Ledpin3, HIGH);   // turn the LED on (HIGH is the voltage
level)
  }
  if (Hue1_State == 0) {
    digitalWrite(Ledpin1, LOW);   // turn the LED on (HIGH is the voltage
level)
  }
  if (Hue2_State == 0) {
    digitalWrite(Ledpin2, LOW);   // turn the LED on (HIGH is the voltage
level)
  }
  if (Hue3_State == 0) {
    digitalWrite(Ledpin3, LOW);   // turn the LED on (HIGH is the voltage
level)
  }

}

void processOOCSI() {


  Hue1_State = oocsi.getInt("Hue1_State", Hue1_State);
  Hue2_State = oocsi.getInt("Hue2_State", Hue2_State);
  Hue3_State = oocsi.getInt("Hue3_State", Hue3_State);

  Serial.println(Hue1_State);
  Serial.println(Hue2_State);
  Serial.println(Hue3_State);



  // use this to print out the raw message that was received
  oocsi.printMessage();
}
```

APPENDIX C -
STAKEHOLDER INTERVIEW QUESTIONS

Dutch

Vraag 1: Beschrijf uw dag (zo gedetailleerd mogelijk)

Vraag 2: Voor het slapen gaan, wat controleert u zoal?

Scenario: Wat zou u er van vinden als alles geautomatiseerd zou zijn?

Vraag 3: Heeft u liever digitale of fysieke interactie? Oftewel een afstandsbediening om het apparaat mee te besturen of iets digitaals?

English

Question 1: Explain what a normal day looks like for you (as detailed as possible)

Question 2: Before going to bed, do you check anything in particular?

Scenario: What is your opinion on automation of everything?

Question 3: Do you prefer digital or physical interaction? In other words: use a remote to control a device or something digital?

APPENDIX D - CONSENT FORMS

For filled in consent forms contact L.E.S. Brand at l.e.s.brand@student.tue.nl

Toestemmingsformulier

Hulpmiddel automatisering in het huis van ouderen

Beste,

Voor een project willen wij, Industrial Design studenten aan de Technische Universiteit van Eindhoven, een manier vinden om ouderen te helpen die hun huis hebben geautomatiseerd of willen automatiseren.

Om verder te komen in ons project en om de juiste stappen te maken, hebben wij een interview afgenomen. Tijdens dit interview hebben we een aantal vragen gesteld die ter plekke zijn beantwoord beantwoord. Deze hebben we genotuleerd en opgeslagen voor later gebruik.
Wij gaan zorgvuldig om met uw gegevens.
De informatie zal alleen voor dit onderzoek met academische doeleinden gebruikt worden.

U mag natuurlijk altijd de door u gegeven toestemming intrekken. Zonder toestemming zullen wij uw informatie niet meer gebruiken.

- Ik heb voldoende informatie gekregen en ik begrijp waar de informatie uit de interviews voor gebruikt gaat worden. Ook kon ik vragen stellen. Mijn vragen zijn voldoende beantwoord.
- Ik weet dat meedoen vrijwillig is. Ook weet ik dat ik op ieder moment kan beslissen om mijn toestemming in te trekken. Daarvoor hoef ik geen reden te geven.
- Ik weet dat de informatie die verkregen is verder anoniem verwerkt zal worden. Ook weet ik dat deze gegevens tot 10 jaar bewaard kunnen worden.
- Ik weet dat sommige mensen deze gegevens kunnen inzien. Deze mensen zijn enkele leden van de DIGSIM squad van de Technische Universiteit Eindhoven. Dit is een groep van studenten en docenten die werken aan projecten die gaan over automatisering.
- Ik geef toestemming voor het gebruik van gegeven informatie voor academische doeleinden.

Datum: .....

Naam: .....

Handtekening: .....

Toestemmingsformulier

User test deployment

Introductie: Voor het project Designing for Growing Systems in the Home moeten wij, drie studenten aan de Technische Universiteit van Eindhoven, een deployment uitvoeren. Een deployment is een soort onderzoek dat plaatsvindt bij een gebruiker in huis. Het doel van dit onderzoek is om uit te vinden of ons concept het gewenste doel bereikt, hoe de gebruiker hier mee om gaat en wat we zouden kunnen verbeteren om zo tot een compleet en volledig design te komen. Om tot deze inzichten te komen zullen wij een enquête afnemen, een deployment doen met een logboek en een interview houden. Hierbij zullen eventueel ook foto's en videobeelden gemaakt kunnen worden. Als u hier niet herkenbaar op wilt staan / hoorbaar, dan kunt u dat aangeven.

Omschrijving onderzoek: Tijdens het deployment zullen 3 lampen vervangen worden met Philips Hue lampen. Ons prototype zal met het wifi-netwerk van u thuis worden verbonden via de modem en het prototype zal gedurende 6 dagen in het stopcontact moeten zitten wanneer u het prototype wil gebruiken.

Vertrouwelijk & datagebruik: Van de videobeelden kan een video worden gemaakt die zal worden ingeleverd via Canvas (online omgeving van de TU/e) en deze zal ook voor open publiek te zien zijn op de demo-day. De resultaten van de enquête, deployment met logboek en interview zullen worden gebruikt om tot een herziene versie te komen van ons design. Deze resultaten zullen ook verteld kunnen worden in een pitch op de demo-day. De resultaten zullen ook gebruikt worden in het final report dat wij zullen schrijven. Deze resultaten zullen dan anoniem zijn.

Data opslag: De data zal minimaal 5 jaar bewaard worden (academisch vereist). Alle data zal lokaal op een computer worden opgeslagen en de rauwe data zal na 5 jaar verwijderd worden. De resultaten, echter (report en video) kunnen wel bewaard blijven.

Recht tot weigeren: U heeft op ieder moment het recht om uw toestemming in the trekken. Zonder uw toestemming zullen wij uw informatie niet meer gebruiken.

Contact: Als u vragen heeft over deze studie, contacteer Yorn Thijssen - 06 11414826

Informed Consent: Ik heb alle bovenstaande informatie gelezen. Ik heb de mogelijkheid gehad om vragen te stellen en de vragen die ik had zijn voldoende beantwoord. I stem vrijwillig in met het meedoen in dit onderzoek.

Datum:.....

Naam:.....

Handtekening:.....

APPENDIX E - DEPLOYMENT FILES

Questionnaire

Als u uit de volgende waarden moet kiezen, welk van deze waarden vindt u dan het belangrijkst als het om de avond-routine gaat? **Kruis 1 antwoord aan.**

- ☐ veiligheid
- ☐ vertrouwen
- ☐ controle
- ☐ zekerheid

Voert u ‘s avonds een ‘avondroutine’ uit (denk aan: lampen uit, deuren op slot doen etc.)?

- ☐ ja
- ☐ nee

Zo ja, kunt u in chronologische volgorde beknopt opschrijven hoe dit rondje dan verloopt?

1……

2……

3……

4……

5……

6……

7……

8……

9……

10……

Is uw avondroutine vrijwel iedere avond hetzelfde?

- ☐ ja
- ☐ nee

Geef hieronder een inschatting van hoe lang uw avondroutine ongeveer duurt

……

Op een schaal van 1 tot 5, hoe vaak heeft u het gevoel dat u iets vergeten bent in uw avondroutine?

	1	2	3	4	5	Vrijwel
Zelden	O	O	O	O	O	altijd

Wanneer u er achter komt dat u iets had vergeten in de avondroutine, kruis hieronder aan wat het beste overeenkomt met hoe u zich dan voelt:

- ☐ Onzeker
- ☐ Ongerust
- ☐ Boos
- ☐ Teleurgesteld
- ☐ Neutraal
- ☐ Blij
- ☐ Opgewekt

Interview naderhand

1. Vragen over hoe de afgelopen week is gegaan.

2. Een aantal vragen stellen:
    a. Kunt u uw ervaring met het product delen met ons? Hoe vond u het product in gebruik?

    b. Kunt u ons beknopt de functie van het product uitleggen?

    c. Kunt u ons vertellen wat het doel van de kleuren in het lampje op uw kamer is?

    d. Gaat u met een veilig gevoel naar bed, nadat u alle HUE Lights uitgezet heeft met ons product?

    e. In hoeverre heeft u het systeem vertrouwd? Ging u na de handelingen nog zelf checken?

    f. Bent u tevreden met de mate aan informatie die het systeem u geeft. Is het misschien te abstract of is het precies genoeg?

    g. In hoeverre zou u dit systeem willen gebruiken in het dagelijks leven?

    h. Wat vindt u ervan als er een scherm toegevoegd zou worden waar gedetailleerde informatie te zien is over wat er nog aan is? Zou dit helpen?

    i. Ziet u verder nog enige verbeterpunten?

3. Einde van interview, mocht de user nog vragen hebben dan mogen deze gesteld worden.

4. Bedankt user voor het mogelijk maken van de deployment.

Wat vindt u van de vormgeving van het product?

Hoe is het om alle handelingen uit te voeren?

Liggen de vormen fijn in de hand?

APPENDIX F - IMAGES

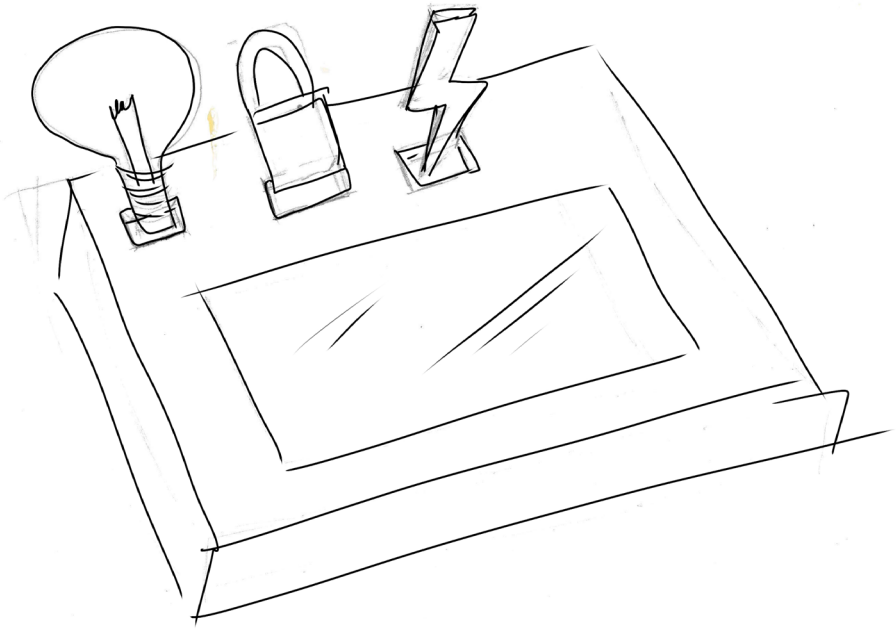


FIGURE F.1 – EARLY SKETCH DASHBOARD IDEA

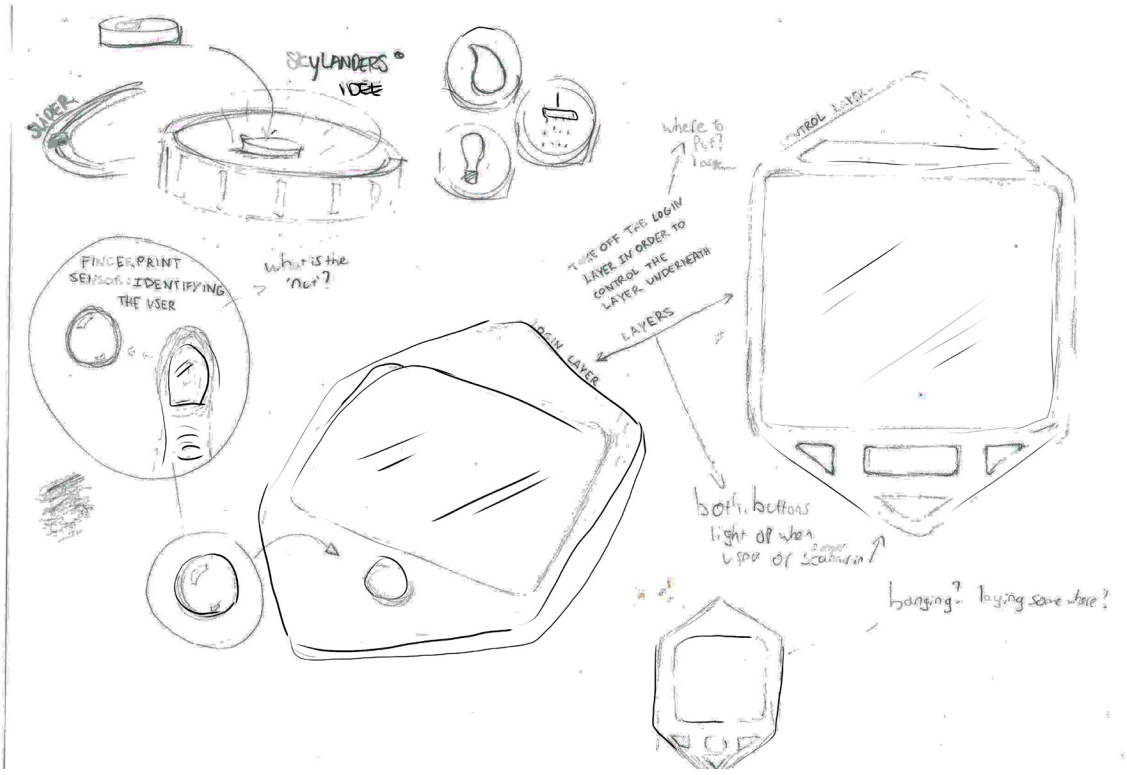


FIGURE F.2 – BRAINSTORM SKETCH DASBOARDS

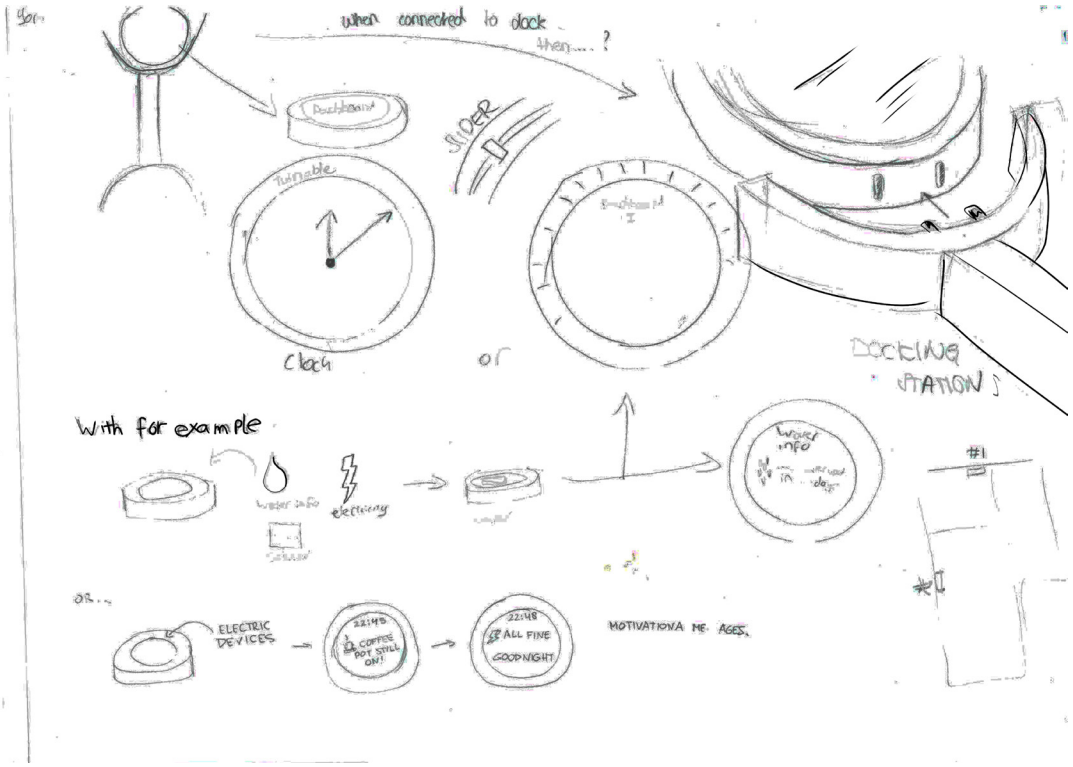


FIGURE F.3 – BRAINSTORM SKETCH DASHBOARDS

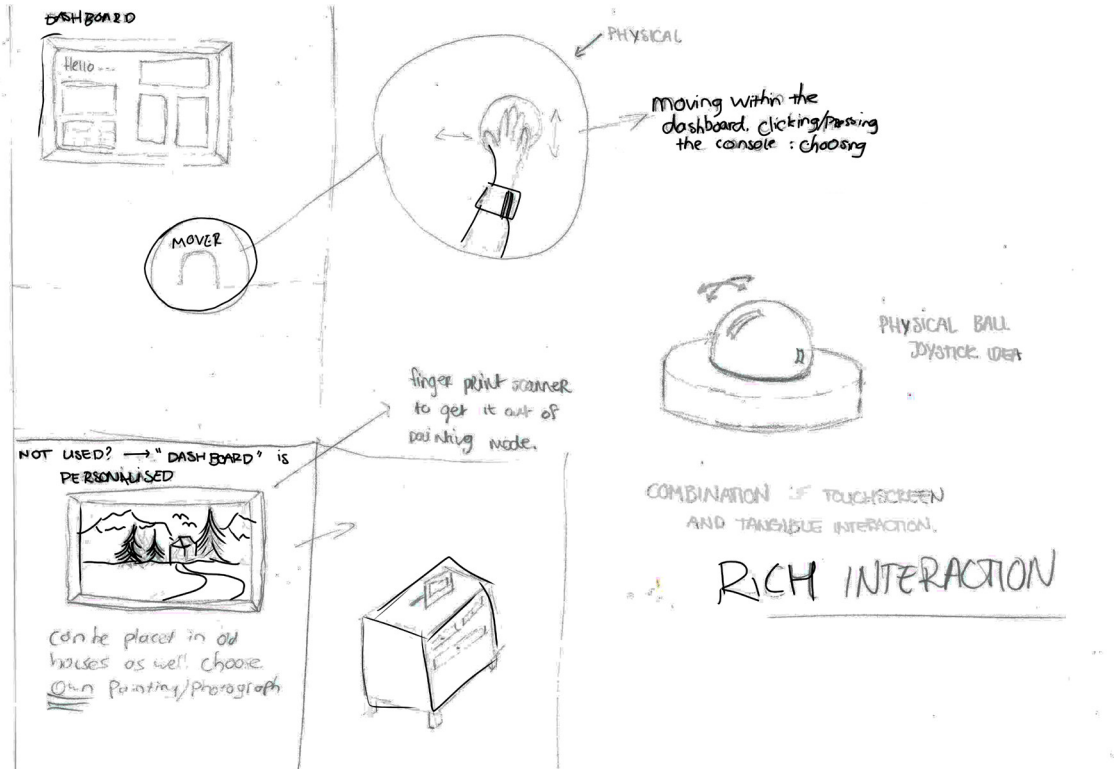


FIGURE F.4. – BRAINSTORM SKETCH DASHBOARDS

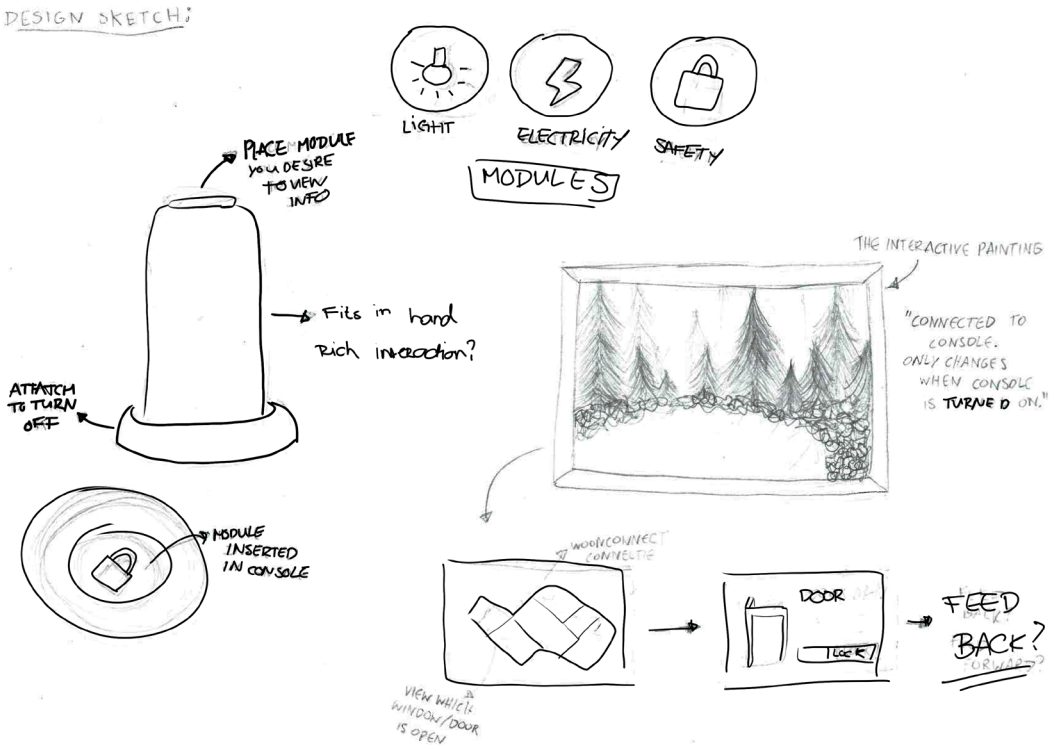


FIGURE F.5 – DESIGN SKETCH CONCEPT

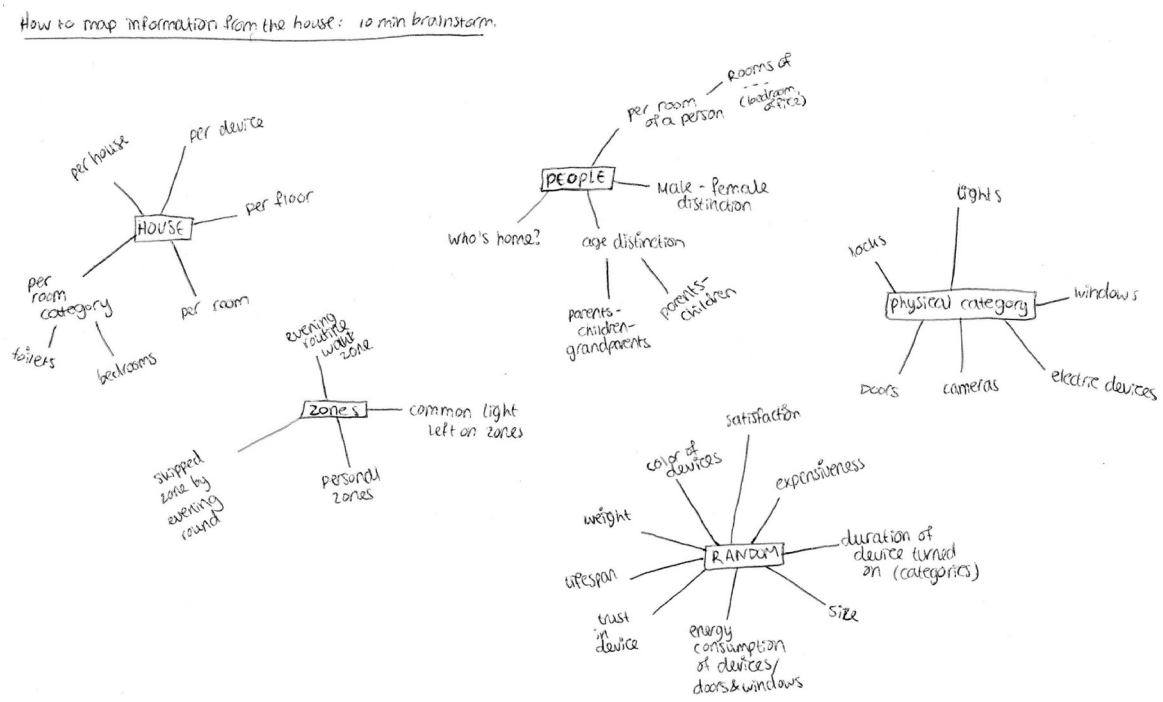


FIGURE F.6 – DATAMAPPING

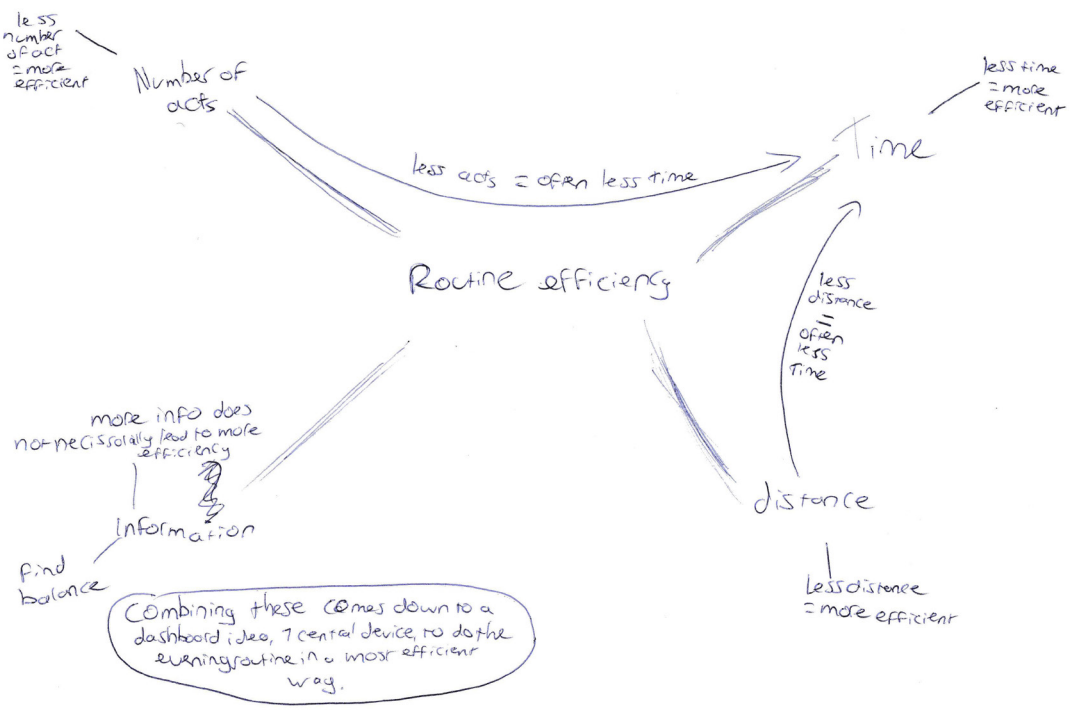


FIGURE F.7 – BRAINSTORM MINDMAP

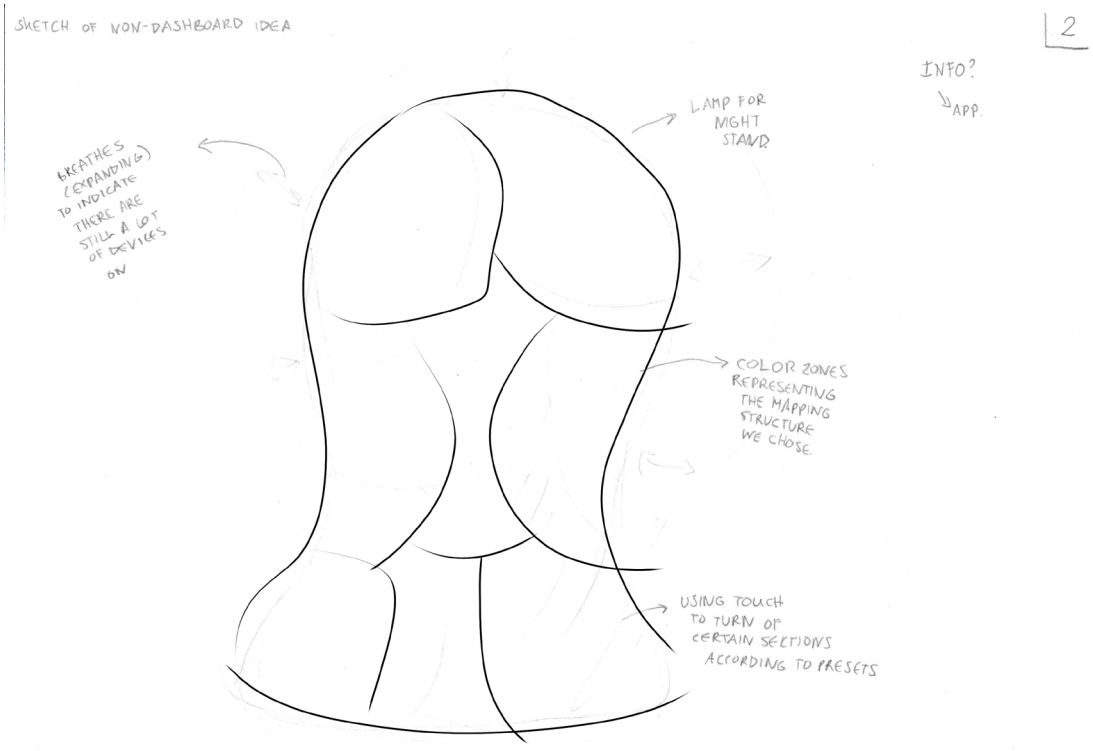


FIGURE F.8 – NON-DASHBOARD CONCEPT SKETCH

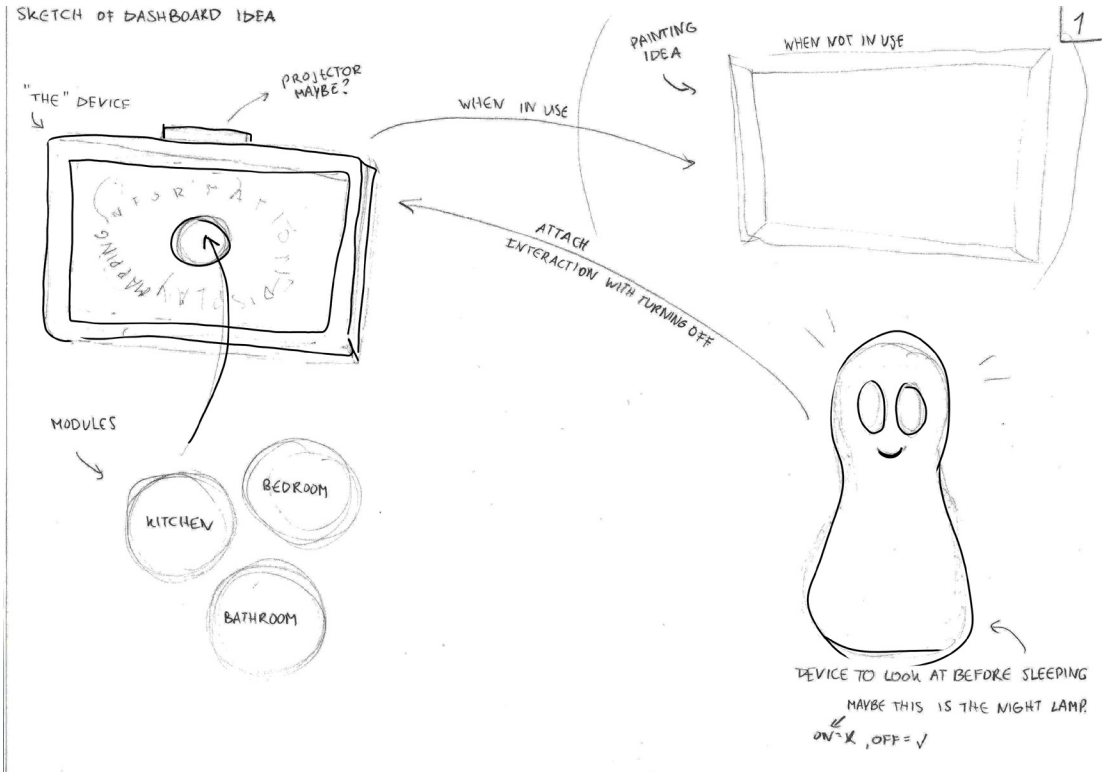


FIGURE F.9 – SKETCH DASHBOARD IDEA

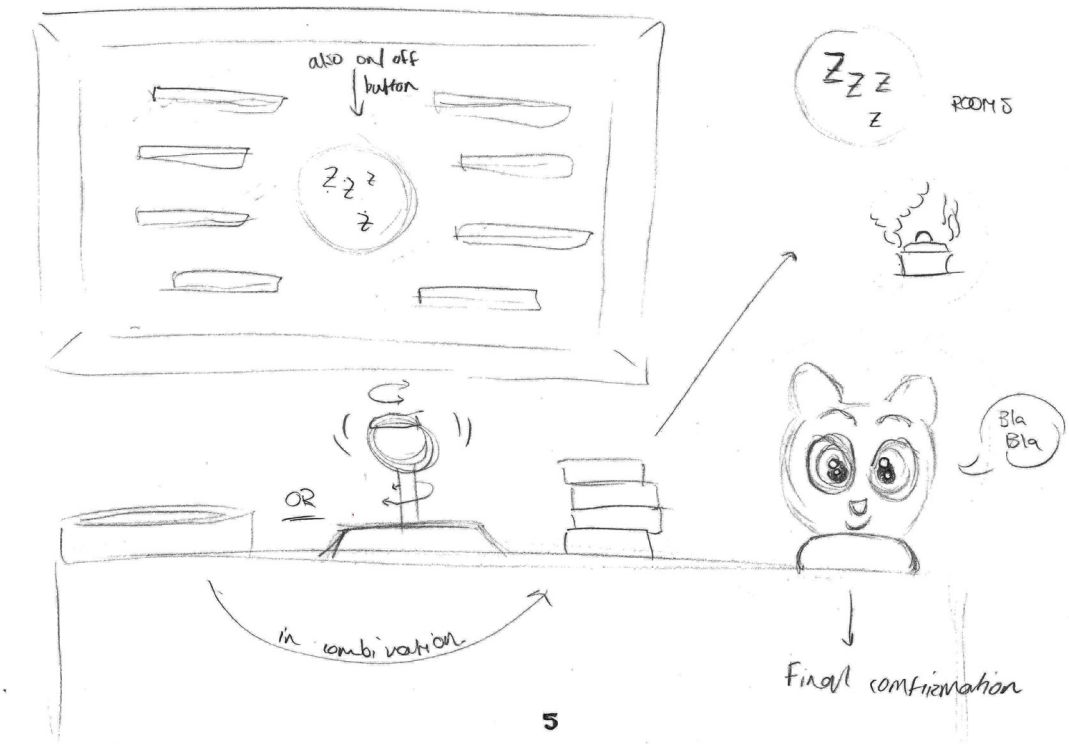


FIGURE F.10 – CONCEPT SKETCH

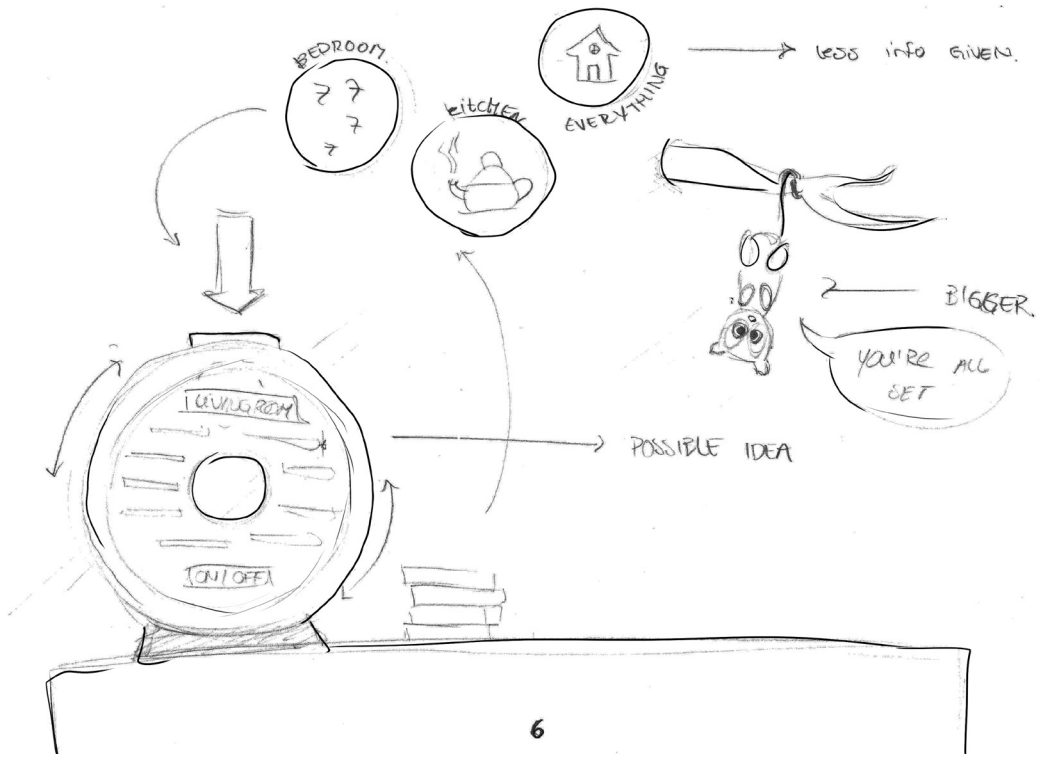


FIGURE F.11 – CONCEPT SKETCH

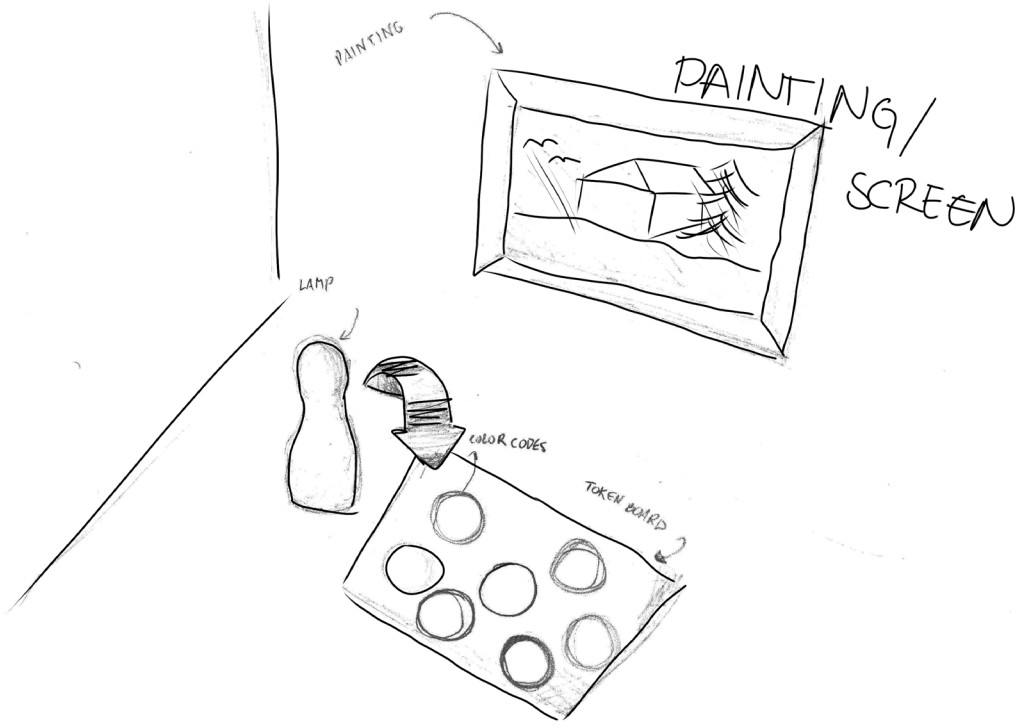


FIGURE F.12 – CONCEPT SKETCH

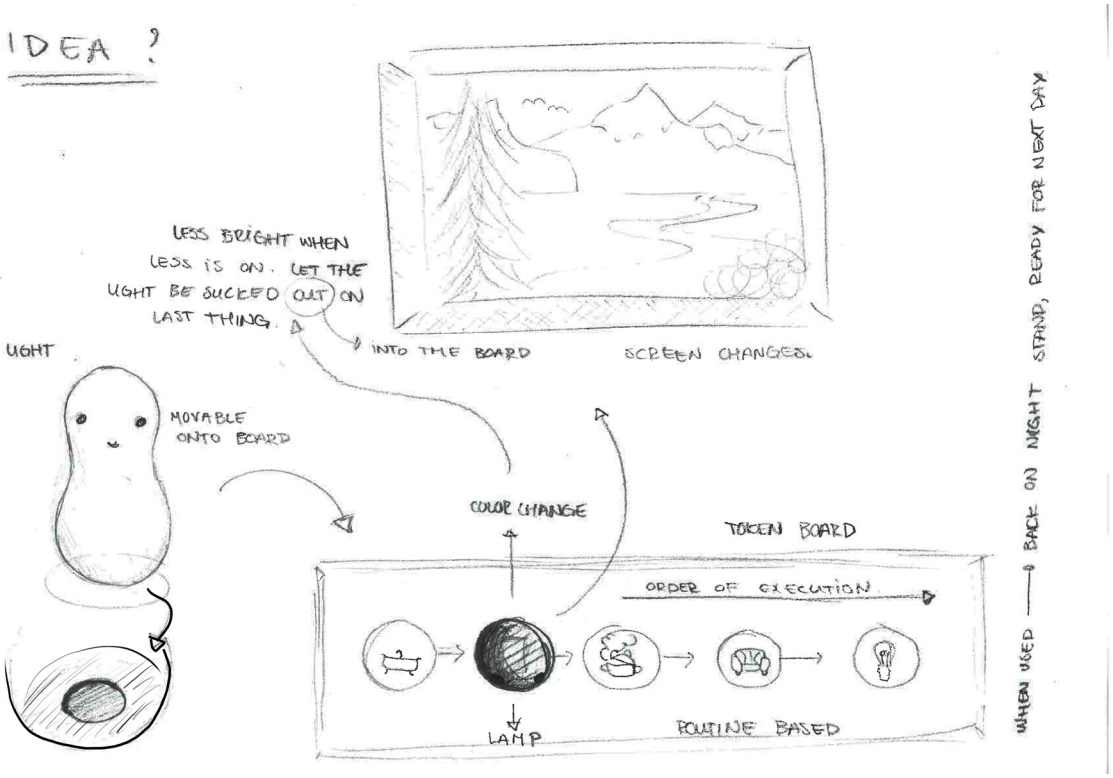


FIGURE F.13 – CONCEPT SKETCH

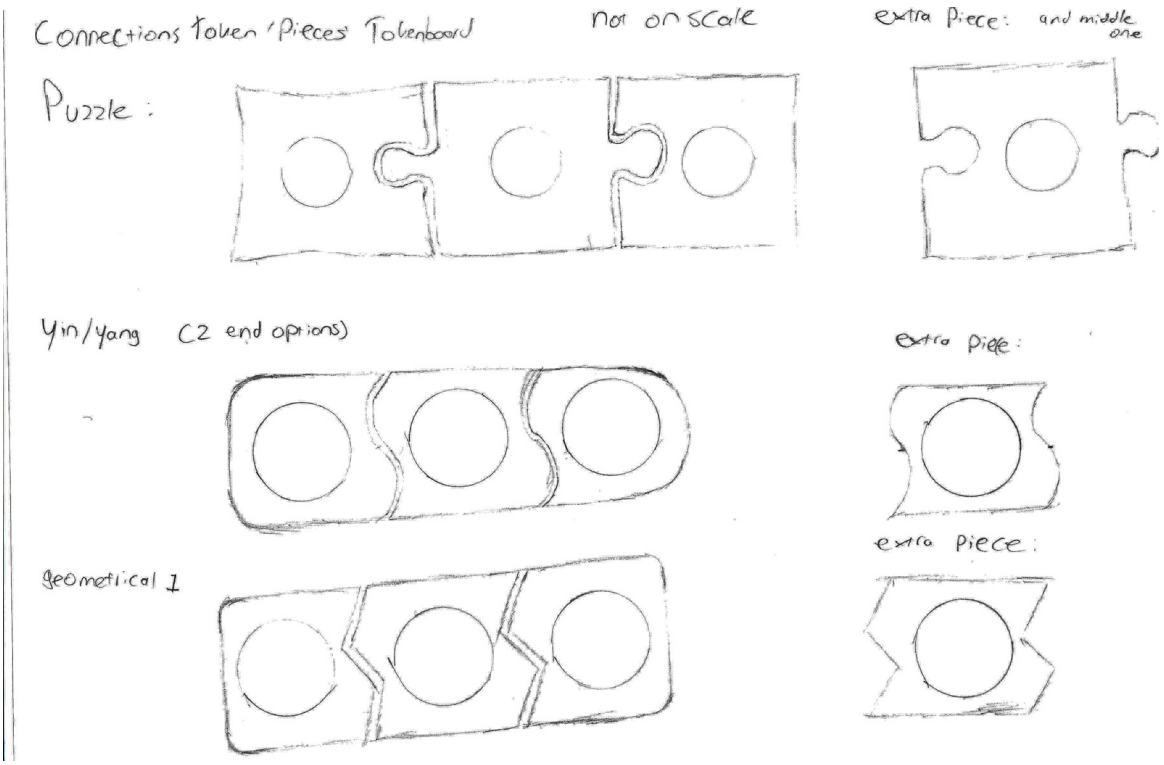


FIGURE F.14 – TOKEN BOARD SHAPES

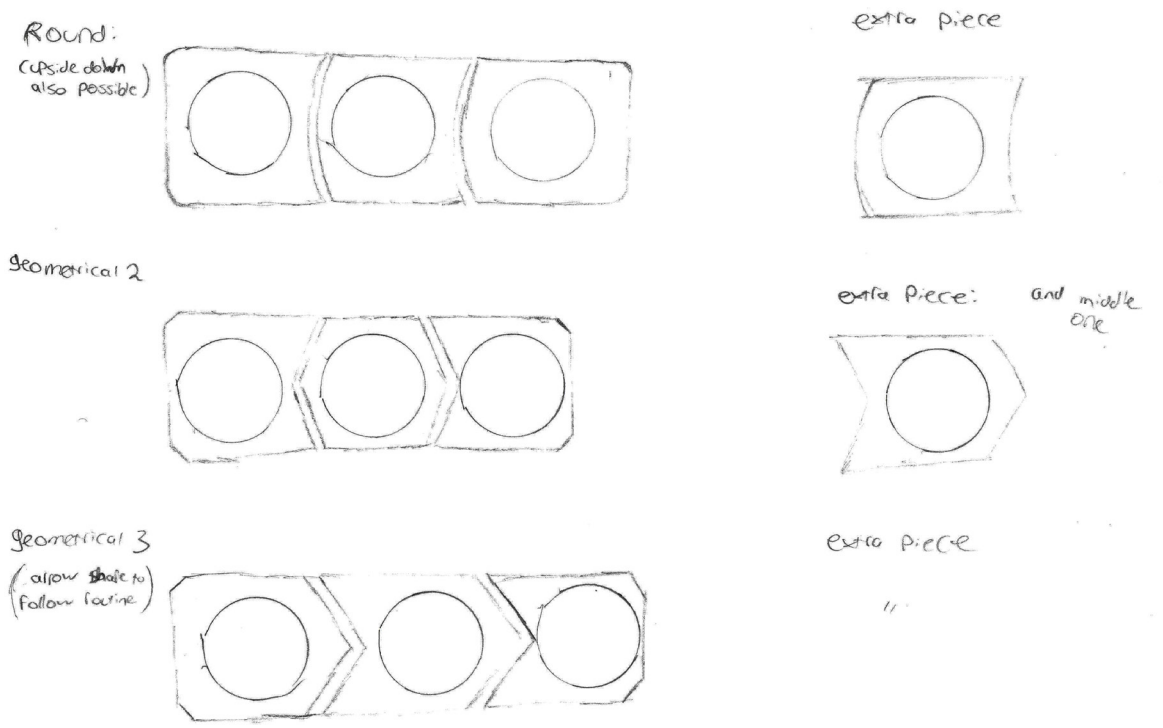


FIGURE F.15 – TOKEN BOARD SHAPES

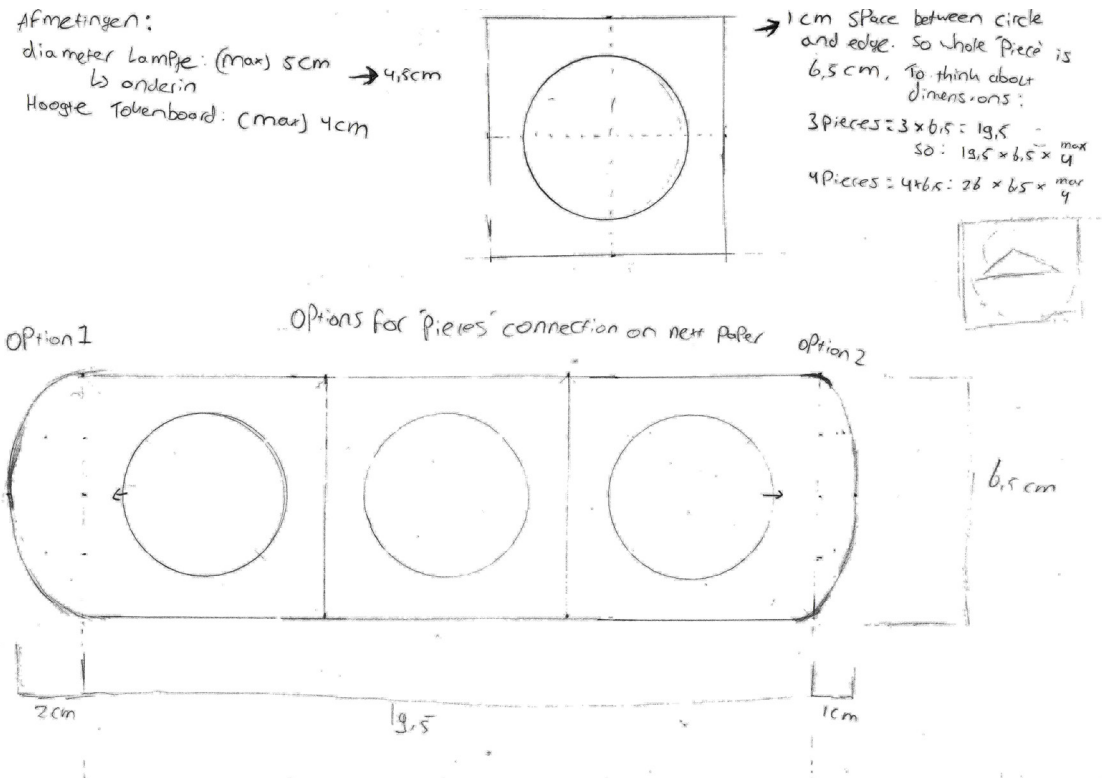


FIGURE F.16 – TOKEN BOARD PROTOTYPING PLAN

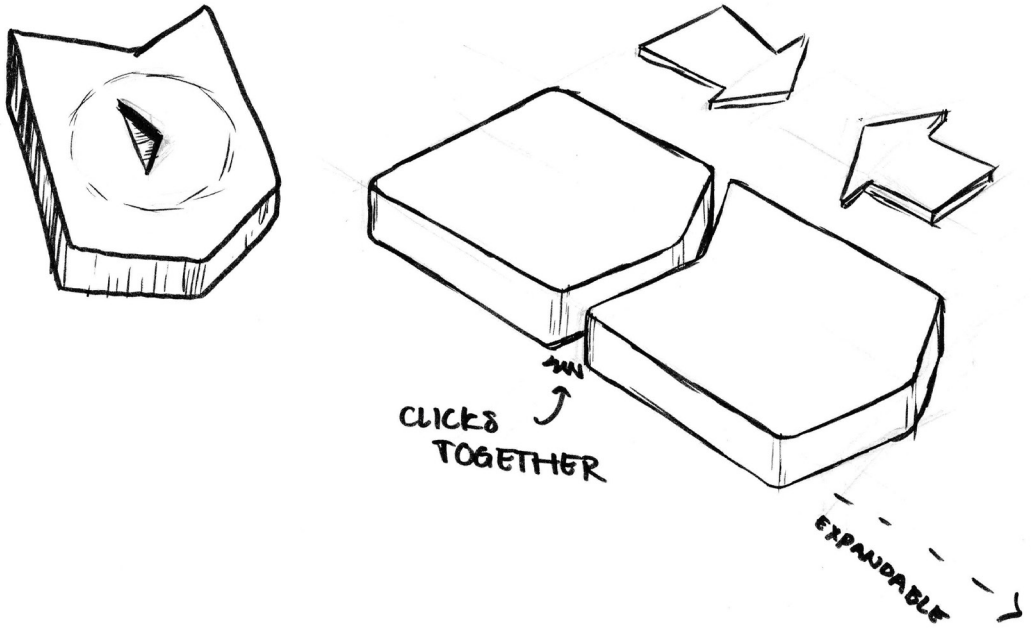


FIGURE F.17 – TOKEN BOARD EXPANSION SKETCH

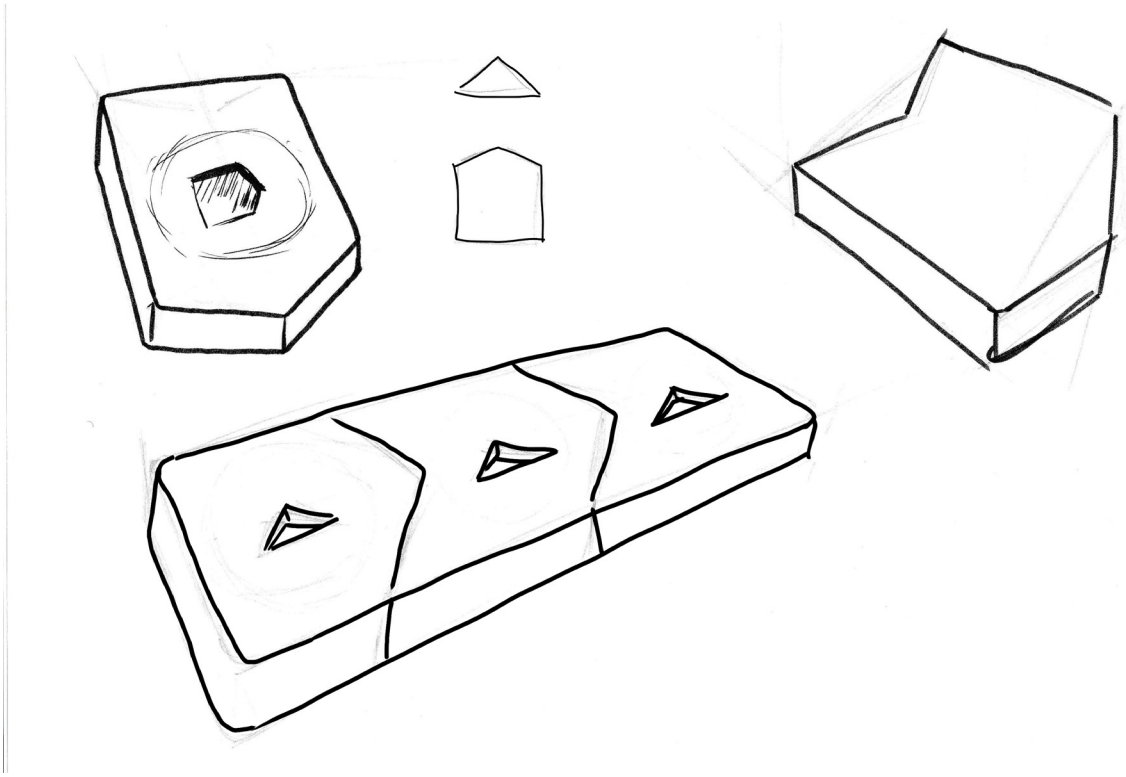


FIGURE F.18 – TOKEN BOARD SKETCH

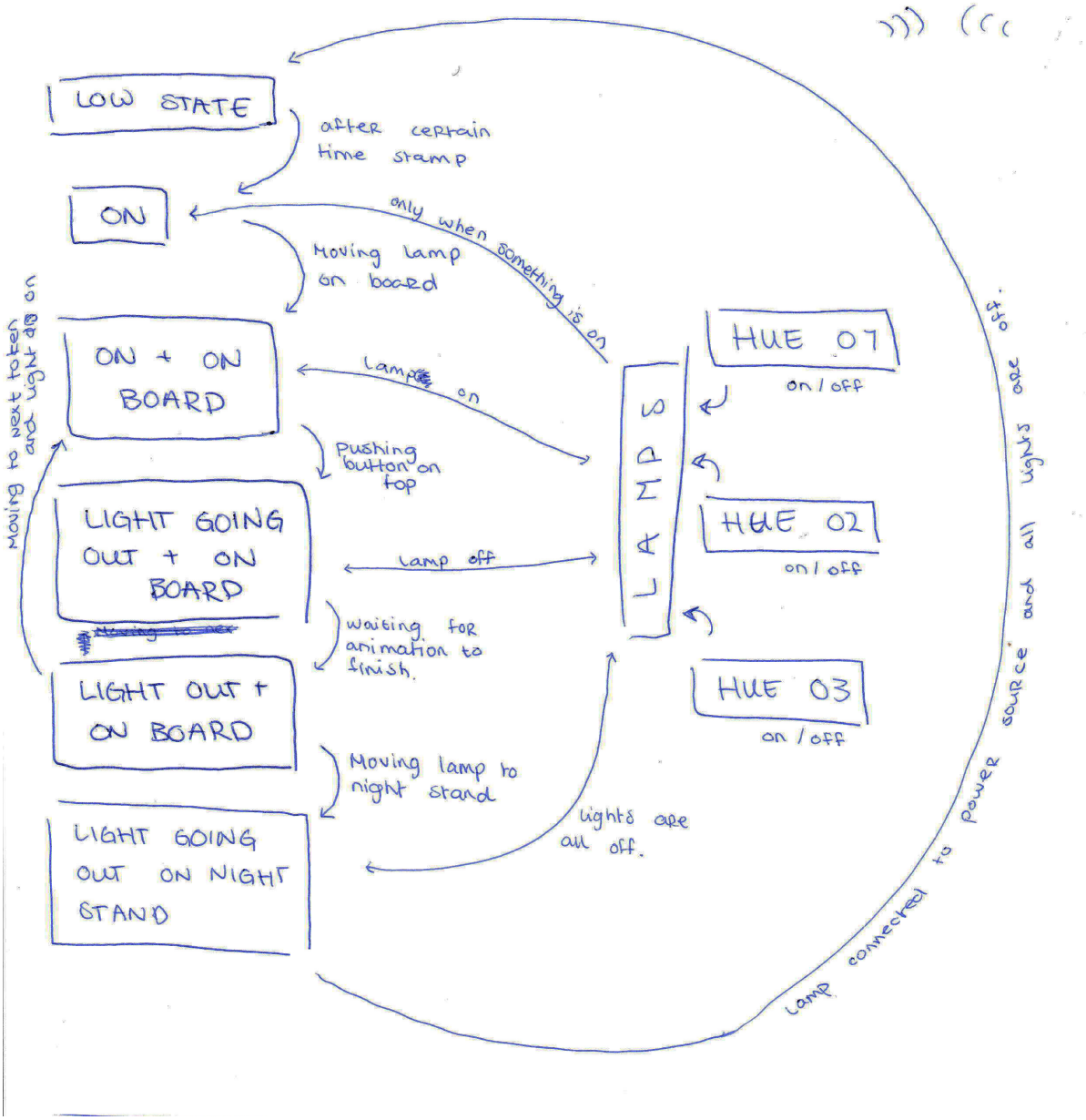


FIGURE F.19 – STATE DIAGRAM DRAFT

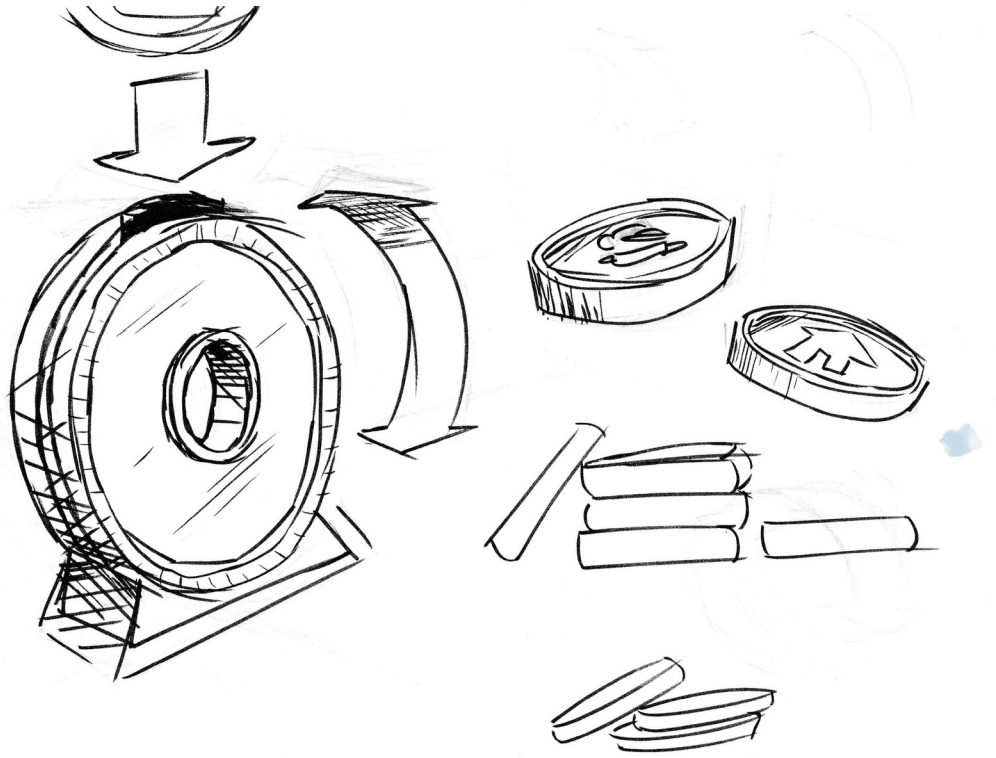


FIGURE F.20 – CONCEPT SKETCH

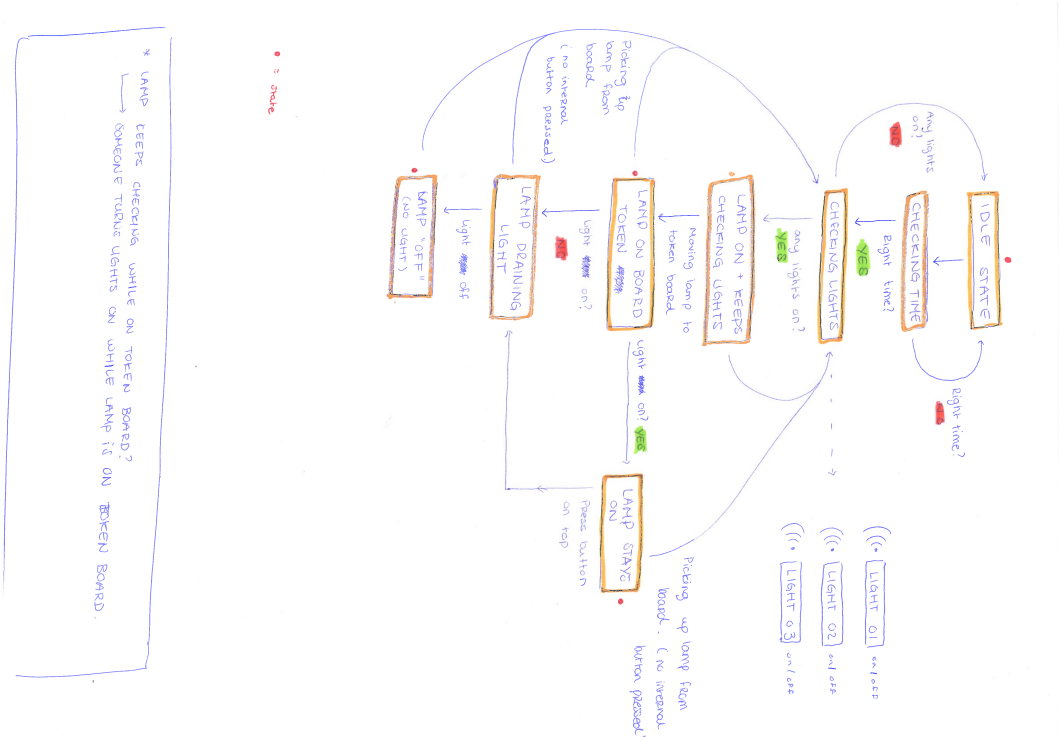


FIGURE F.21 – STATE DIAGRAM

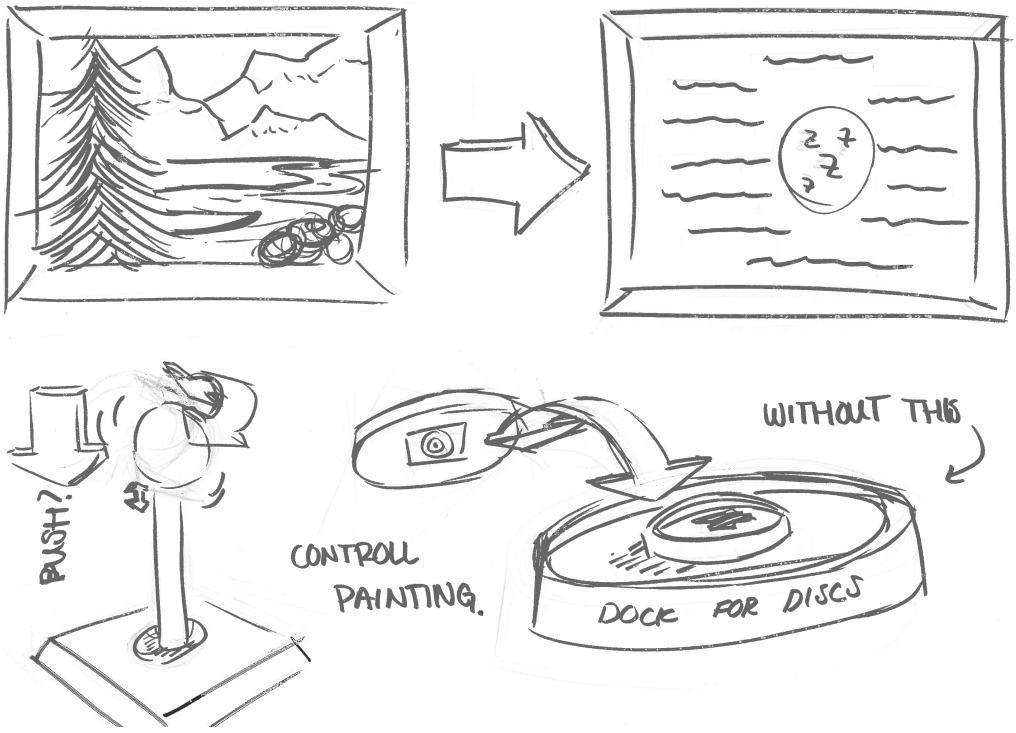


FIGURE F.22 – CONCEPT SKETCH

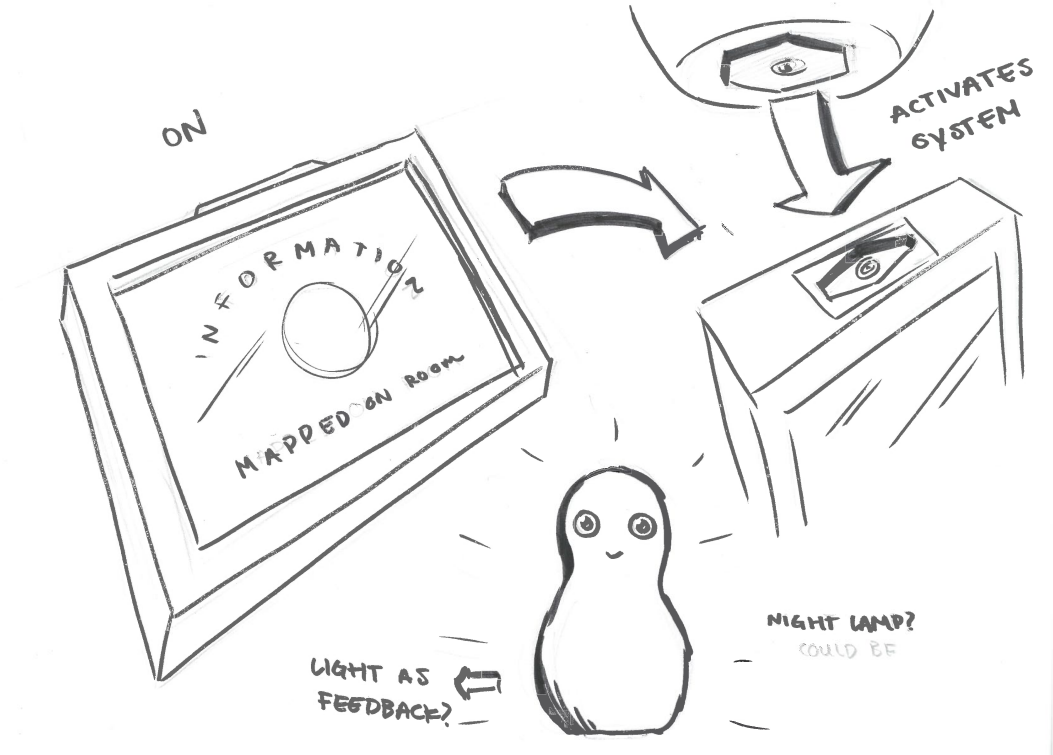


FIGURE F.23 – CONCEPT SKETCH

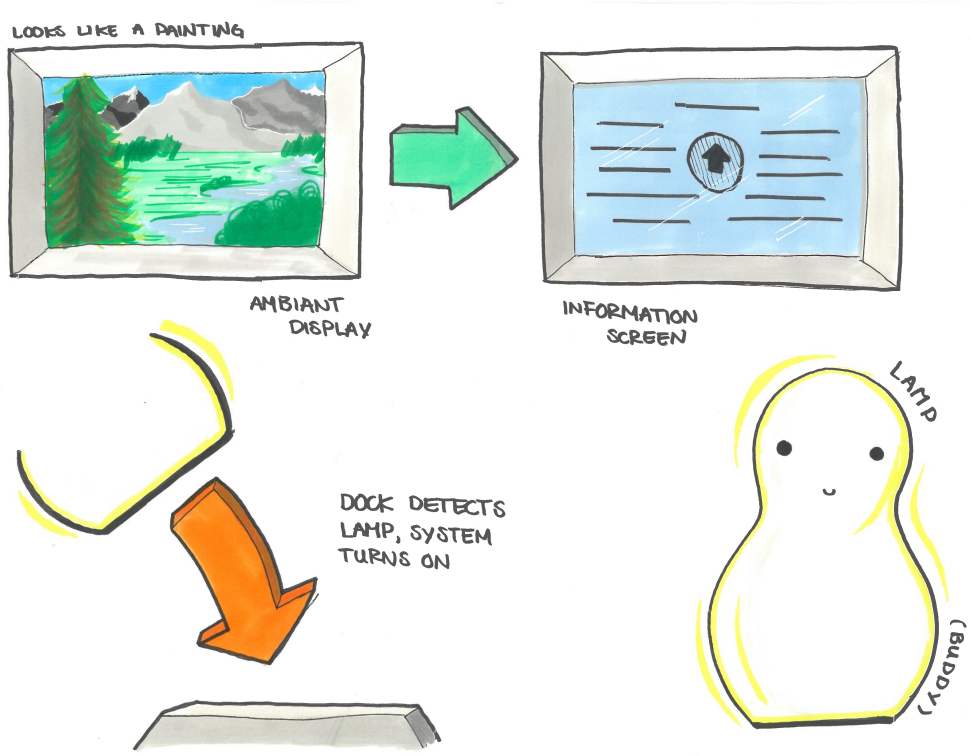


FIGURE F.24 - HIGHER QUALITY CONCEPT SKETCH

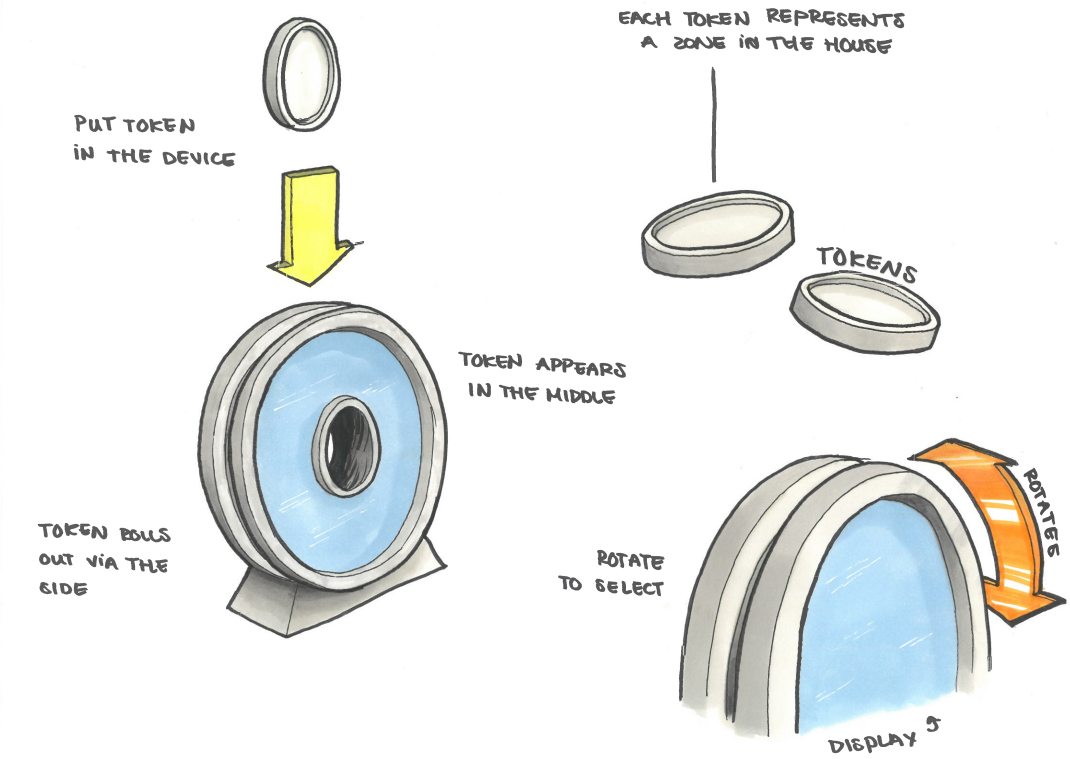


FIGURE F.25 - HIGHER QUALITY CONCEPT SKETCH

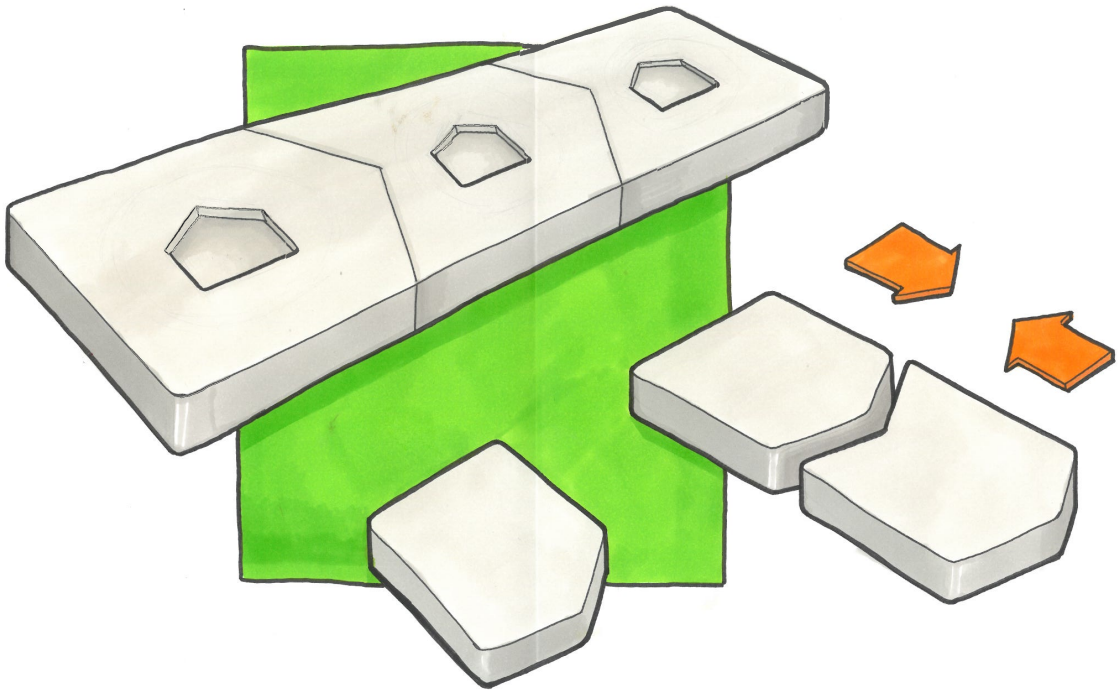


FIGURE F.26 – HIGHER QUALITY TOKEN BOARD SKETCH

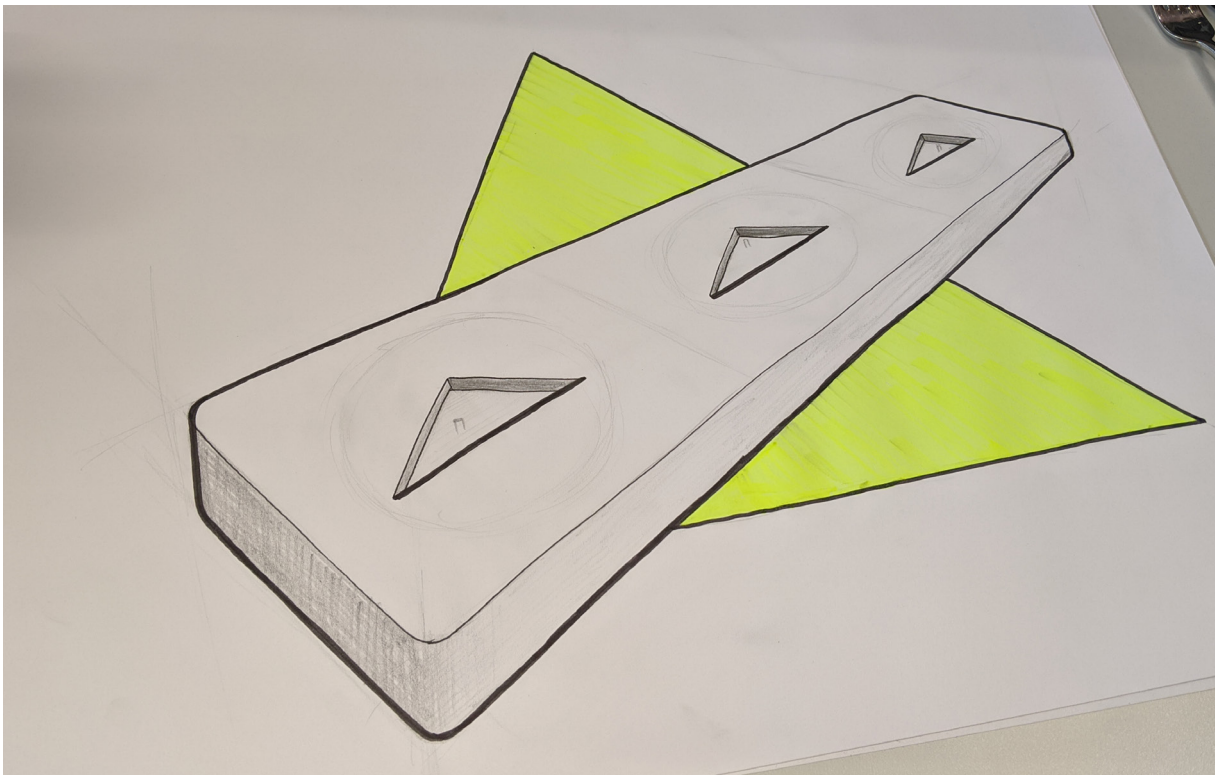


FIGURE F.27 – TOKEN BOARD SKETCH

FIGURE F.28 - WORKING WITH IOT SANDBOX

FIGURE F.29 - CARDBOARD MODELING

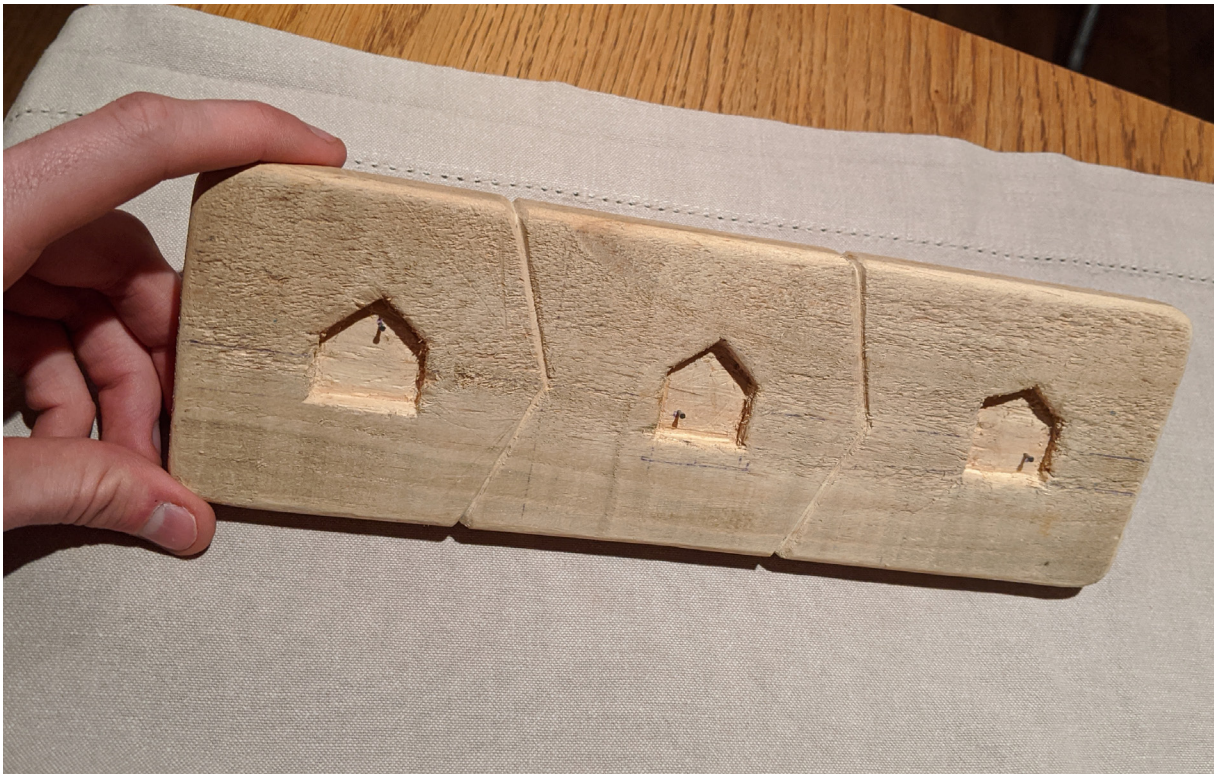


FIGURE F.30 – FIRST PHYSICAL ITERATION TOKEN BOARD

FIGURE F.31– PROTOTYPING OF TOKEN BOARD

FIGURE F.32 - FINAL DEMO-DAY SETUP

FIGURE F.33 - FINAL DEMO-DAY SETUP

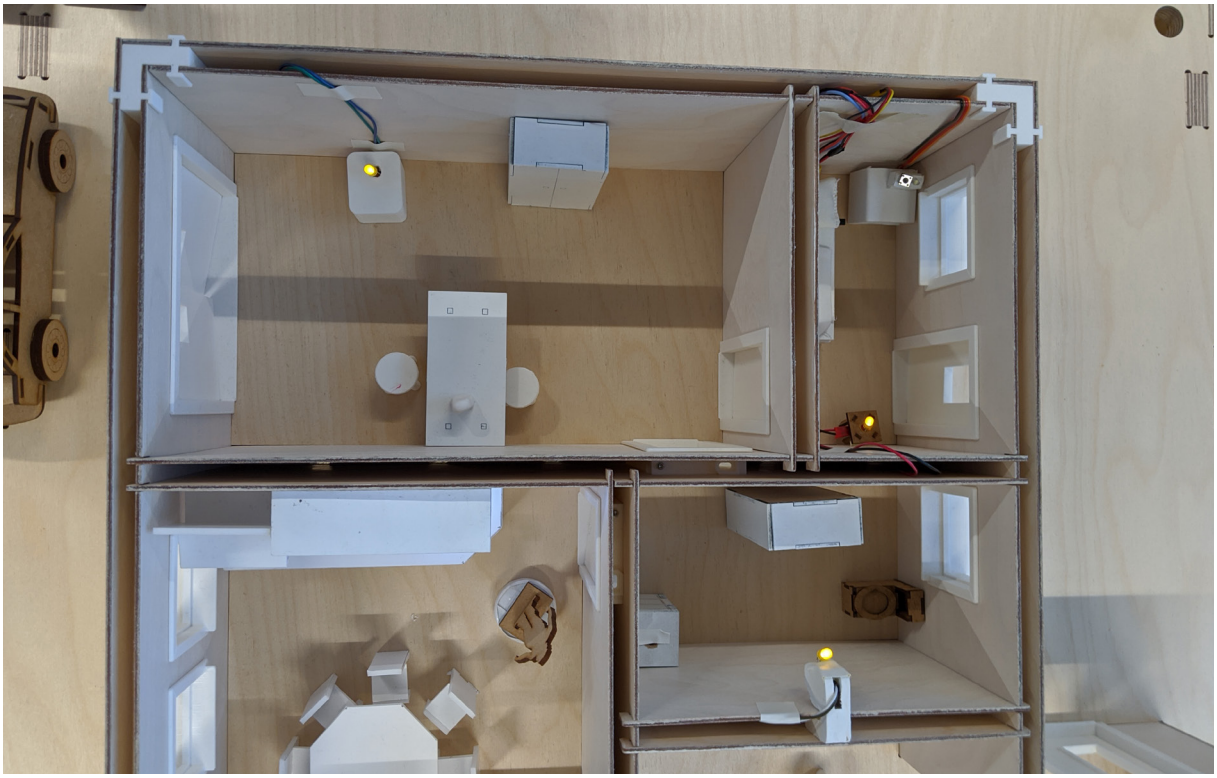


FIGURE F.34 – IOT SANDBOX LED SETUP

FIGURE F.35 – FINAL DEMO-DAY GROUP PICTURE

FIGURE F.36 - MIDTERM CONCEPT

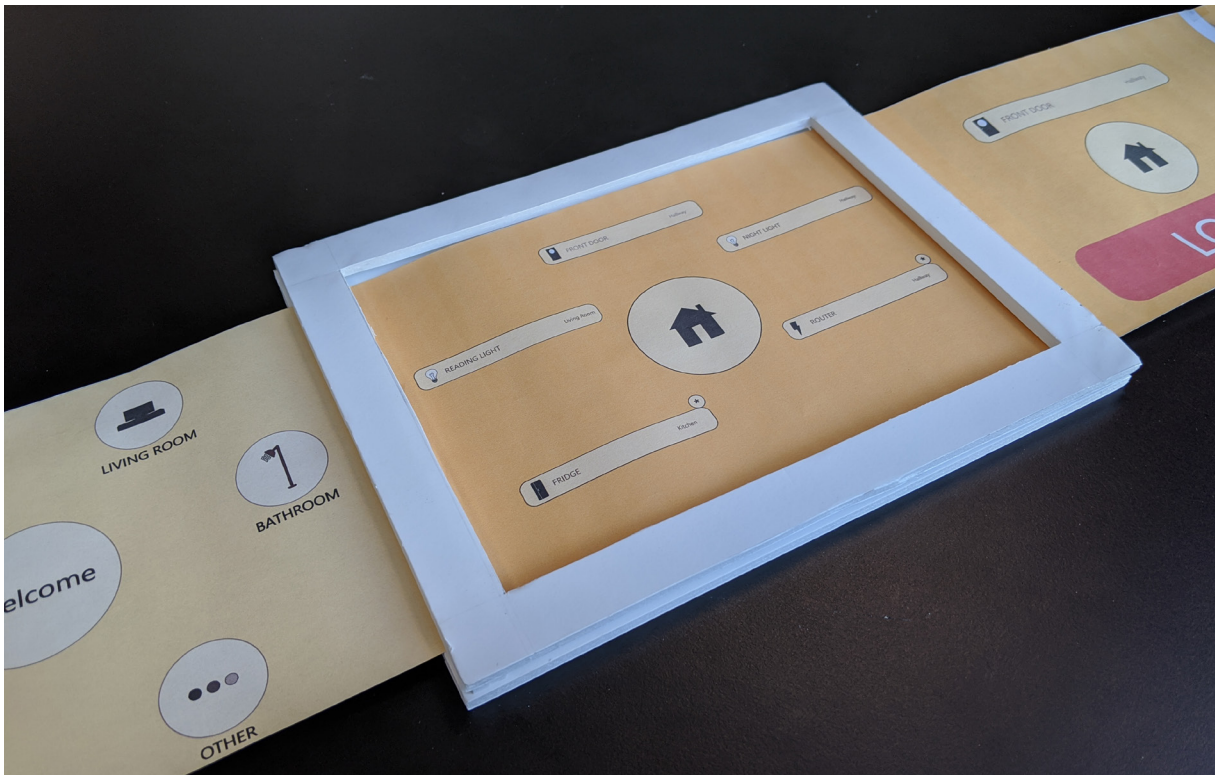
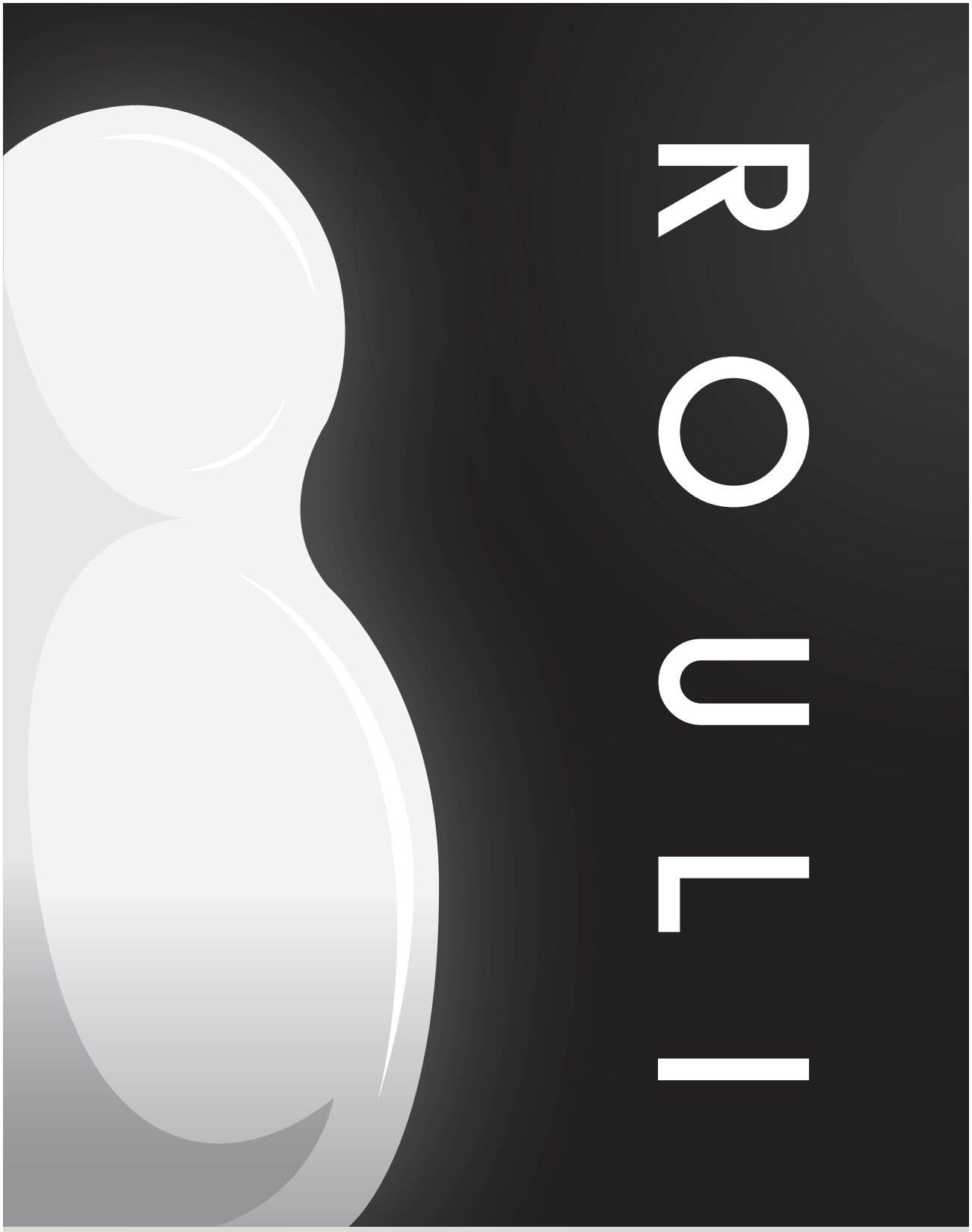


FIGURE F.37 - MIDTERM CONCEPT



DIGSIM
Designing for Growing Systems in the Home

B2.2 - Design project:
L. E. S. Brand
Y. J. Thijssen
N. T. van de Ven

Project coach:
M. Funk

Experts:
J. Elderman
J. Frens
L. Kuijer

FIGURE F.38 – A2 POSTER

FIGURE F.39 – A4 POSTER

B2.1 / DP / DIGSIM Squad
United Streets of Nuenen

ROULI

United Streets of Nuenen aims home adaptation and automation in the context of aging citizens who desire autonomous living in their homes. The primary focus is a 'home dashboard' that combines and fuses all information from the house in terms of energy, safety/security, connectivity, etc.

With Rouli we make the aging society more aware of their evening routine in a trustworthy and safe way in order to make this routine more efficient. Just before going to bed the aging society often take a stroll around the house in order to check lights, doors and devices. Rouli makes use of light in order to show the user which devices, lights or doors are still receiving power or unlocked. By physically moving the remote, which simultaneously acts as a night lamp, the user is able to control the devices from one central place and perform the night routine. from there.

Student(s): L.E.S. Brand, Y. J. Thijssen & N.T. van de Ven

Project Coach: M. Funk

Expert(s): J. Elderman, J. Frens & L. Kuijer

Client: United Streets of Nuenen