FOOD GUARD

FINAL REPORT PROJECT 1 GROUP 1C

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PROJECT INFO

EINDHOVEN UNIVERSITY OF TECHNOLOGY

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Words **+/- 8800**

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SUMMARY

This first-year project is made with the theme of intelligent agents. An intelligent agent views the environment around it using different sensors and it acts on what it observes using actuators. It behaves using all the data it has perceived and acts using the data it already has. They act as intelligent assistants that will help humans by automating certain tasks and will make decisions based on their environment.

Our interpretation of the theme is that the intelligent agent should take over tasks in a home environment. With the home environment, we concluded after several brainstorms and iterations that our vision was to create an agent that helps users in managing their food inventory at home.

Our approach to creating the final product involved many iterations based on feedback, ideation research, and brainstorming. We chose to begin by taking the research approach to create a definitive definition of intelligent agents and our own concept. The second approach was a hands-on approach that involved making our hands dirty and iterating using several techniques on the final design. Even more by collaborating with another group, we had a unique opportunity to learn more about collaborating and a different design with the same subject, food. When dividing the tasks, we created tasks that involved creating actual working technology and visually representable prototypes of our product. As a result, the Final concept, Food Guard, was realized.

Food Guard is an intelligent agent that will help users to keep track of the food inventory. Consisting of cameras, an app, and a phone holder. The cameras are rotatable and Wi-Fi connected, which can be put inside the top of every cabinet. They will recognize the products with artificial intelligence and a premade data-base. By tracking what is put inside the cabinet and taken outside of the cabinet, Food Guard will know what needs to change in the inventory. Together with an app, Food Guard will show the type of product, the amount, and the estimated expiration date. The app also shows your food inventory, meal suggestions, and a shopping list. The additional phone holder will make the experience of Food Guard easier in situations such as putting the products in the cabinets or cooking. Food guard is about your storage, your footprint, and your peace of mind.

OUR TEAM

We are a team of five dedicated designers working on a project to improve food management. We aim to use all our competences to arrive at a beautiful and professional product

THIJS REIJNDERS
Creative Director and Programmer

JOOST DE VRIES
Project Coordinator

HANNE BOS
Executive Director

BORIS VAN KROONENBURG
Marketing Director

TING ZHOU
Product Designer

PROJECT GOAL

As the project started to slowly lift off the ground, we came to realize some factors in our teamwork were missing or lacking. Goals were set to achieve better teamwork and greater end results (for future projects also). These goals are:

1. Learn the correct process to take as a group for (varying) design briefs
2. Clear, informative and fast team communication
3. Push for input from everybody and thus create a creative thinking space during sessions

INTRODUCTION

In today's society, we have a lot of information and data at our disposal. We are getting better and better at developing and applying technology. In many different places in society, such as factories and companies, tasks that previously had to be performed by humans are automated and taken over by agents. More specifically, intelligent agents. An intelligent agent is a digital or physical system that views the environment around it using different sensors and acts on what it observes in order to reach a certain goal. The design objectives for an intelligent agent can be very diverse.

In addition to intelligent agents being used in, for instance, the medical sector or entertainment, it is also increasingly being used for private purposes. Think of Alexa and Google Home. They provide you with information, and can take over tasks to make your life easier and more pleasant.

Intelligent agents like Google Home can give the user information and take over tasks to make the user's life easier. To put this shortly, the assistance that the agent can offer is very broad. In this project we want to focus on a specific purpose, food inventory. We want to achieve easy food storage, organization and management at home.

To achieve this goal, we came up with an intelligent agent in the form of a camera scanner. The camera scanner is installed on the top or side of the inside of a refrigerator or drawers in which food items are stored, and connected to an app via a QR code. The camera registers which products go in and out of the drawers. All the items you have, what expiration date they contain, and what recipes you can make with them are available on the app to know anywhere and anytime what your kitchen contains.

DESIGN PROCESS

Before we could define a problem that we wanted to solve during project 1, we did research on what intelligent agents are, in which types of environments intelligent agents could be in, and how intelligent agents could operate. We made an infographic to summarize our findings. By means of Miroboards, we found our personal interests, and brainstormed on a variety of problem areas. As a group we discussed the created Miroboards after brainstorming, and we came to the conclusion that we wanted to focus on the problem of food waste.

Afterwards we looked into existing intelligent agents and existing intelligent agents specialized in the food industry to find inspiration, to counter food waste, and to gather strong and weak points to see if we can make an agent that does not have these weak points. We brainstormed on different design concepts and selected one.
In the conceptualization phase, we created a target audience, and made fitting persona's and a storyboard. In addition, we made a SWOT analysis to better understand our product's strong points and shortcomings. We adapted our first design concept, and created a low-fidelity prototype for the midterm Demo Day.
After the midterm Demo Day, we reflected on our progress so far with respect to the initial theme 'food waste'. As a result we changed our product goal to 'Achieve easy food storage, organization and management at home'.

During the Demo Day we received feedback, thus in our second ideation / research phase we took the feedback into account, we again did research on existing services and products to understand our market position better, and we looked into the marketing of our product. We created a business model canvas to better understand and to have a structured overview of our business model. As a result of the second ideation and research phase, we changed our product concept accordingly.

In the realization phase we started working on our prototype for the final demo day. For the final demo day, we had a partially working prototype which was programmed during the realization and validation phase, and real sized and physical prototypes. The real sized and physical prototypes consisted of a 3D printed camera scanner, a cabinet to mimic the environment our intelligent agent is supposed to be in, a mobile phone holder, and an app interface. Our final design consist of all the prototypes combined, which we presented on Demo Day.

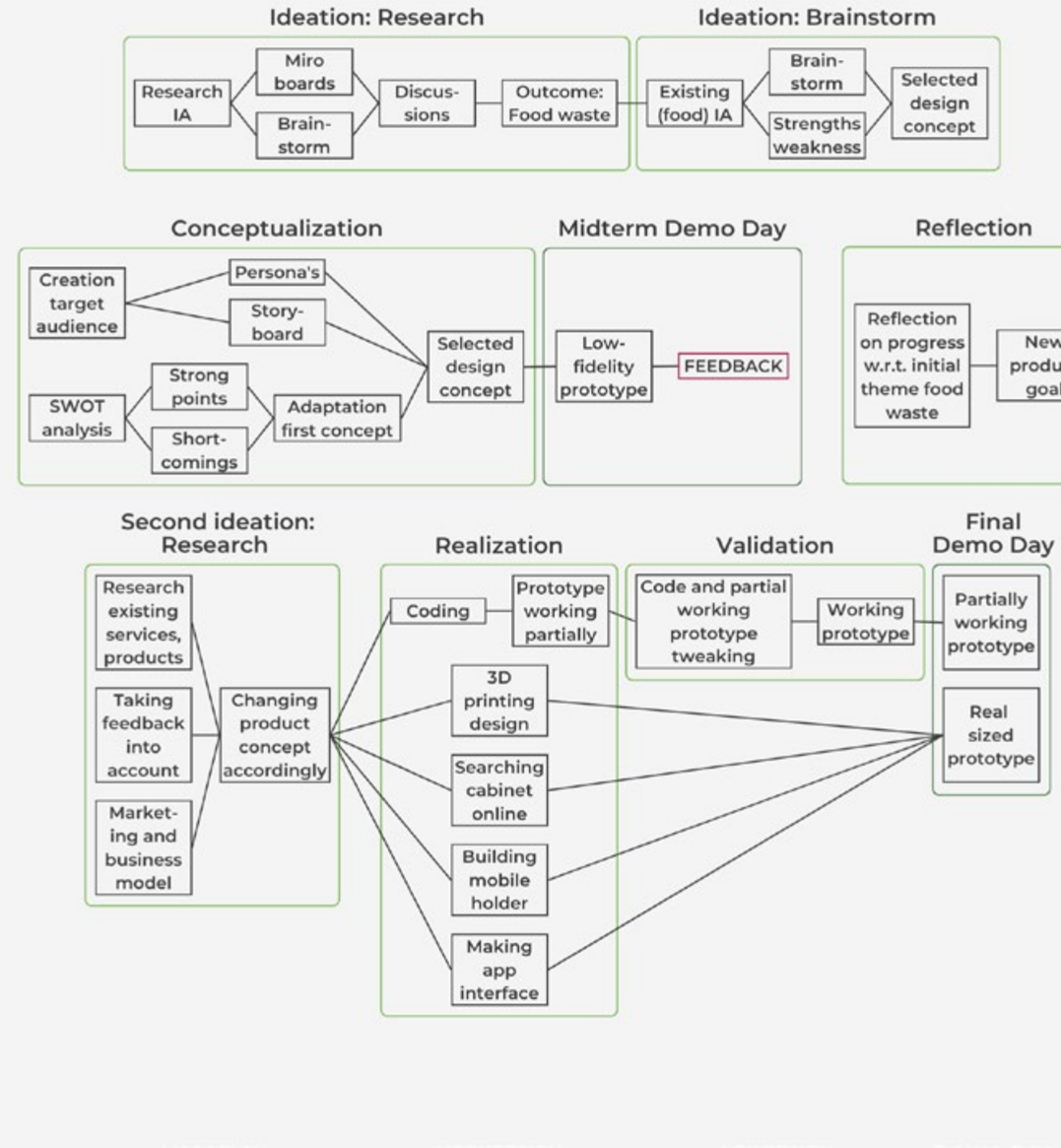


DIAGRAM ABOUT DESIGN PROCESS

CHAPTER 1

EXPLORE

CHAPTER 1: Explore
In this chapter we started researching our project theme Intelligent Agents. Through reading about their definition and usage we generated some ideas of possible problems we want to tackle.

INTELLIGENT AGENTS

For our own awareness, we decided to do research about intelligent agents to broaden our knowledge. This because we wanted to get the same clear idea of our project direction intelligent agents, so this could be a good start. In the next few paragraphs, a summery of the previous research is documented.

An intelligent agent views the environment around it using different sensors (camera's, movement sensors) and it acts on what it observes using actuators (motors). It behaves using all the data it has perceived and acts using the data it already has. Intelligent agents can come in three forms, Human-Agent, Robotic Agent, and a Software Agent.

The human-agent has human body characteristics. They use sensory organs to sense and percieve information from their environment. As actuators they use limbs and vocal tract for actions based on the information they gained. The sensors of robotic agents are cameras and infrared radars to record information. These robots use reflex motors as actuators as output to the environment. The software agent uses audio commands and keypad strokes as sensors for the input and screens as actuators.

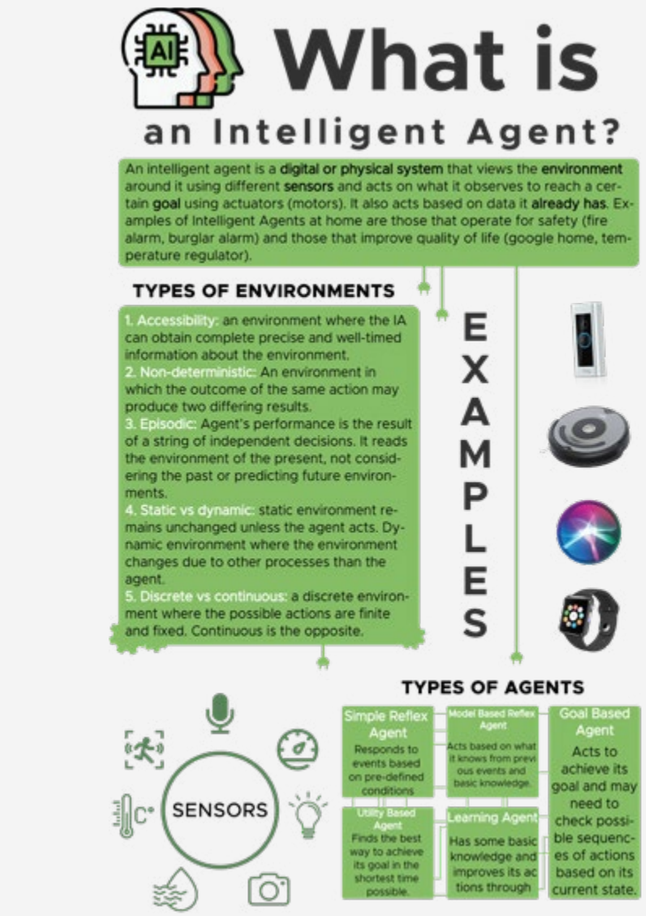
These are five types of Agents classified . The classification of these Intelligent agents are based on their extent of intelligence and capability range.
1. Simple Reflex Agents
2. Model-Based Agents
3. Goal-Based Agents
4. Utility Agents
5. Learning Agents

For a system to be defined as an Intelligent Agent, there are a few rules:
Rule 1: The Agent must be capable to use its sensors to percept information from the environment.
Rule 2: To make decisions the agent uses its collected inputs or the observation from the environment.
Rule 3: Some tangible action should be the result from their decision based on observation.
Rule 4: The tangible action should be rational

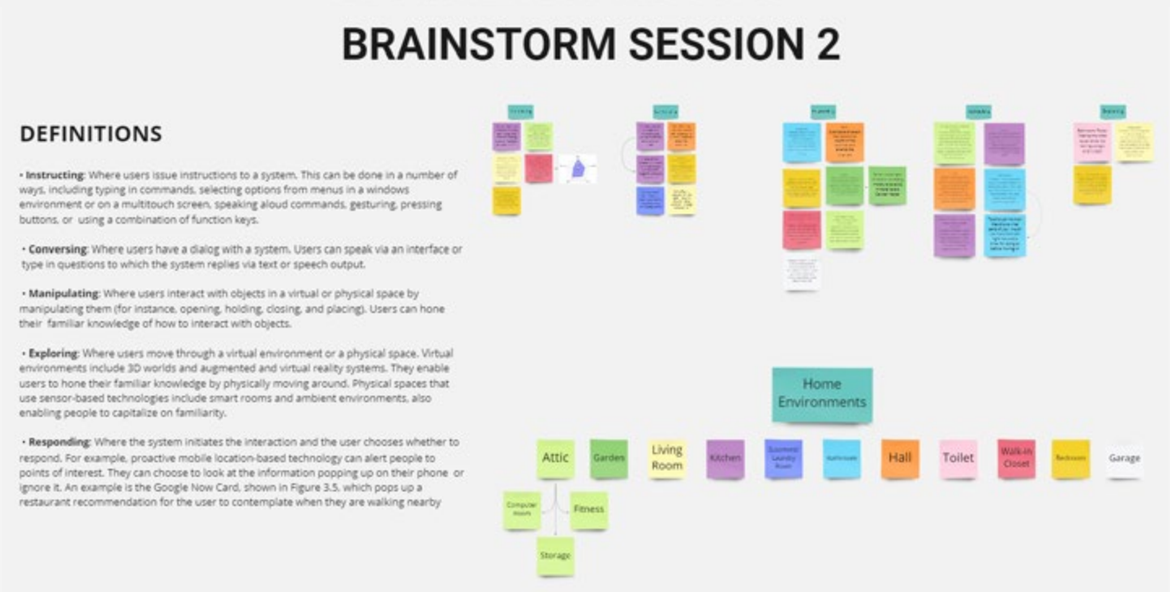
Conclusion of our research

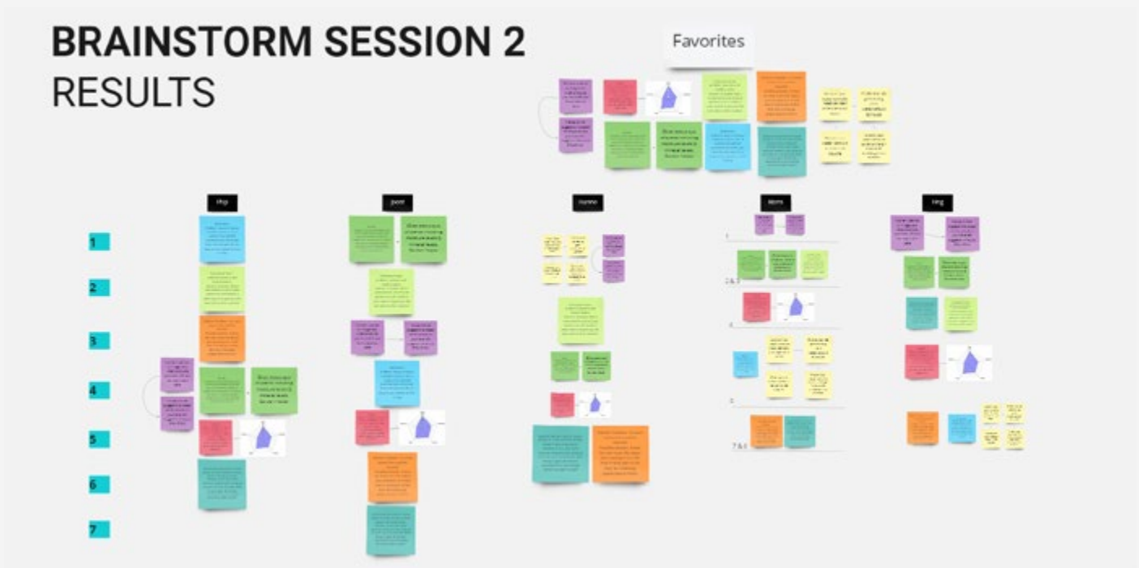
The goal of any agent is to take over tasks that would otherwise be must be done by humans. They act as intelligent assistants that will help humans by automating certain tasks and will make decisions based on their environment.

Once all the research was done, we wanted to make sure we were all on the same track when it came to the definition of an intelligent agent. This is why we created an infographic. In this infographic you can see the most important elements of an intelligent agent at a glance. For example, it contains the definition of an intelligent agent, but also the different types that are available and the different sensors that an intelligent agent can use. In addition, it also contains existing intelligent agents, so that we had examples that we could use when developing an idea.



INFOGRAPHIC ABOUT INTELLIGENT AGENTS





DECIDING OUR DIRECTION

When we all had a clear definition of an intelligent agent, we started brainstorming ideas. First, we thought about problems that could be solved by intelligent agents, after which we discussed these problems and came up with a potential solution. We ended up choosing five problems to address and brainstorm ideas. The problems were being bored while brushing your teeth, not knowing what to cook, decorating the house, limiting water use, and lastly wet clothes due to rain. We brainstormed by giving everyone five minutes per problem to come up with ideas or to build on other ideas as we exchanged. The last step we took during this session was to assess whether a specific idea within a problem statement is an IA or a suggestion.

With the direction of the home environment in mind, we started our second brainstorming session. First, we wrote down all the places in a house, from the living room to the bathroom to the garage. In addition, we also looked at the (definitions of) different types of interaction, and started coming up with ideas based on these different types of interaction. The idea of this brainstorm session was that you take a colored sticky note (each color was one specific room in a house) and write down a problem that could occur in that specific room and a corresponding solution. This would then be placed in the group of the corresponding interaction type, and these steps would be repeated.

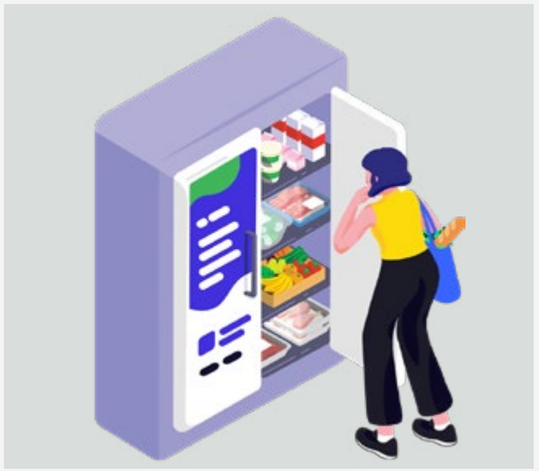
After one hour of brainstorming, we ended up with five groups (the five types of interaction) with all kinds of ideas. You could see exactly in what area of the home the problem arose and how we wanted to solve it.

We all selected our favorites. After which, we had seven ideas left. To reduce the number of problem spaces left, we decided that we would rank our personal favorites from 1 to 7 individually. Following this, the top three we ended up with were: Water wastage / posture / not knowing what to cook.

To arrive at our final problem space, we voted and decided to go with the problem not knowing what to cook. After some discussing, this issue was morphed into ‘food waste’ as this is similar, but manages to encapsulate more. We decided to use the ‘not knowing what to cook’ part as a feature that we could add to our final

EXISTING INVENTIONS ANALYSIS

In order to visualize what kind of invention could help with food wastage, we compiled some already existing inventions along with their strengths and weaknesses. These inventions can then be used for inspiration, with additional insight into future inventions to be gained from the weaknesses and strengths that are noted.



FLASHFOOD

Flashfood is a service that allows grocers to take pictures of almost expired food and mark the price down to be sold in a specific area of their store. Customers can see these marked down prices with the Flashfood app.

Website link: https://www.flashfood.com/

Strengths:
1) Negates food wastage by consumption
2)Informs customer on stores in their area with marked down products

Weaknesses:
1) Requires the grocer to locate almost expired products.
2) Not all stores provide this service

BLUAPPLE™

BluApple™ is a fridge insertable plastic blue apple that absorbs ethylene gas, a signal that plants use to ripen their fruits. BluApple therefore prolongs the shelf life of any fruit or vegetable.

Website link: https://thebluapple.com/

Strengths:
1) Prevents food wastage by extending the best before date

Weaknesses:
1) Limited to fruits & vegetables
2) BluApple only lasts for three months, needing to be refilled if used for longer than three months.
3) Takes up (albeit miniscule) space in your fridge

CONCLUSION PRODUCT ANALYSIS

Having reviewed these products, we observe that they fall into one of two categories. That being 'preventing'(food spoilage) and 'extending' (the best before date). To create the perfect counter-food waste product we should make it applicable in both categories

OVIE SMARTWARE™

Ovie Smarterware™ is a collection of intelligent expiration date tracking devices. Their lineup consists of intelligent bins, clips (to be used for carrots and similar products), and a belt that can be fastened around jars.

Ovie has their own app and their product works as follows: You inform Ovie in the app or via Alexa what product it's dealing with, after which Ovie starts an expiration date timer. This timer is dependent on the product that you indicated. Ovie will then notify you if your products are about to expire.

Website link: https://www.ovie.life/

Strengths:
1) Ease of use
2) Negates food wastage by consumption
3) Flexible products that can be used on a variety of food items
4) interactive with Alexa
5) Keeps you up to date with an app

Weaknesses:
1) Food containers come in one shape
2) Food inserted needs to be fresh for tracking to work

APEEL™

Apeel™ is a company that invented a tasteless, plant-based layer to apply on top of fruits. This layer keeps moisture inside, and oxygen outside. Thus making the produce last longer.

Website link: https://www.apeel.com/

Strengths:
1) Tasteless, 'invisible' product
2) extends produce's shelf life

Weaknesses:
1) Solution is only viable for fruit & vegetables.
2) Layer has to be applied to every single fruit/vegetable

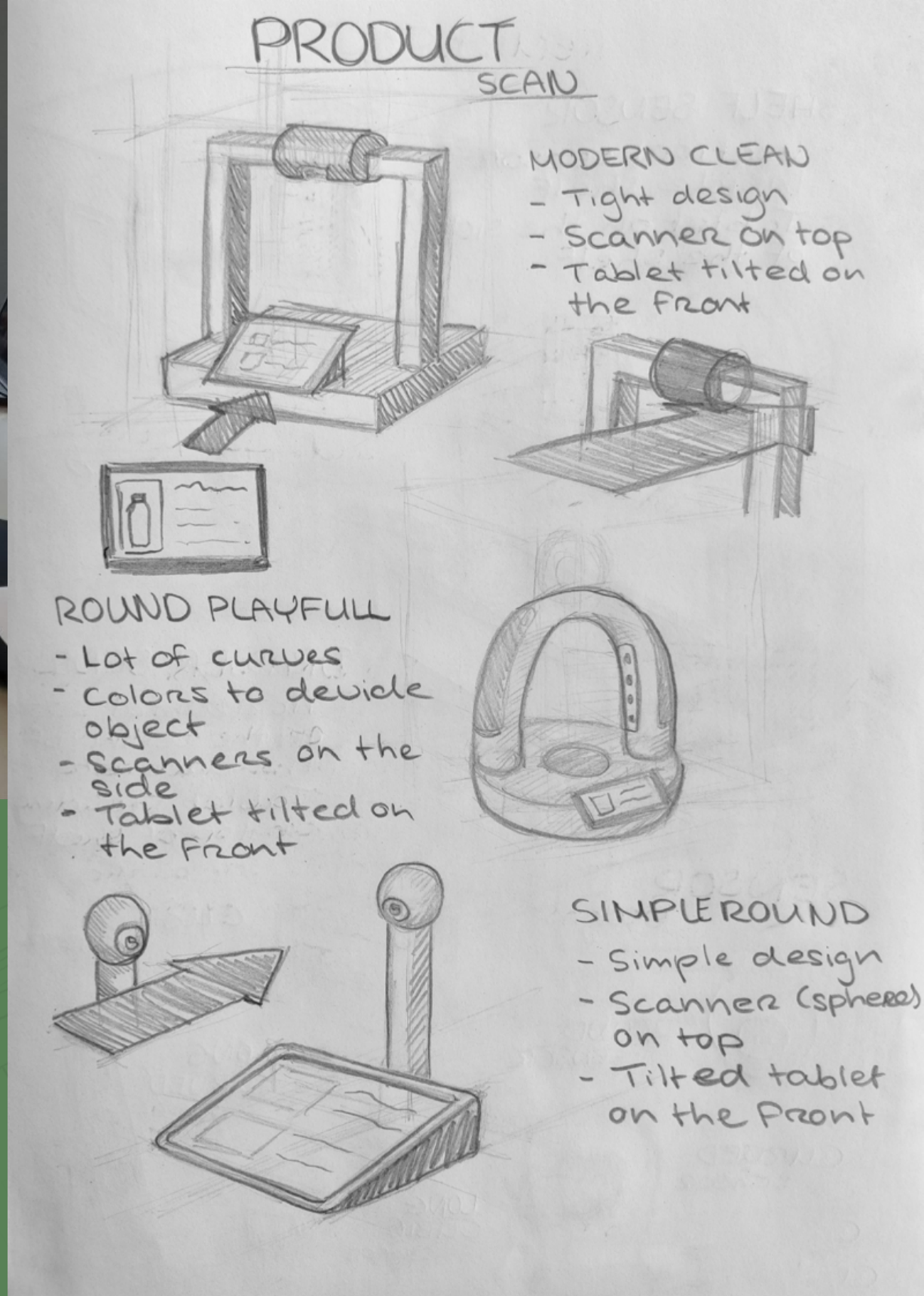
CHAPTER 2

IDEATION

CHAPTER 2: Ideation
In this chapter we took our research and started brainstorming ideas. We took these ideas and reflected on them to create a product that could solve our chose problem

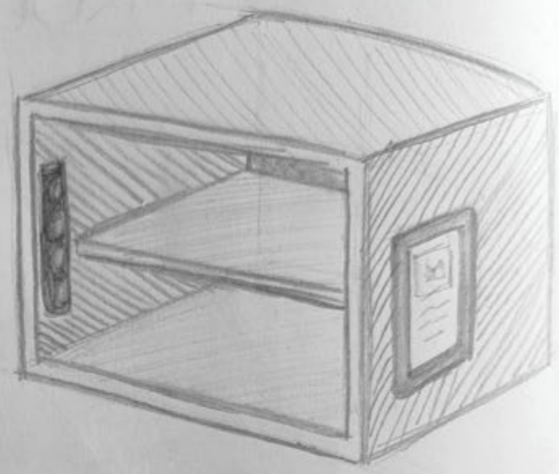
IDEATION

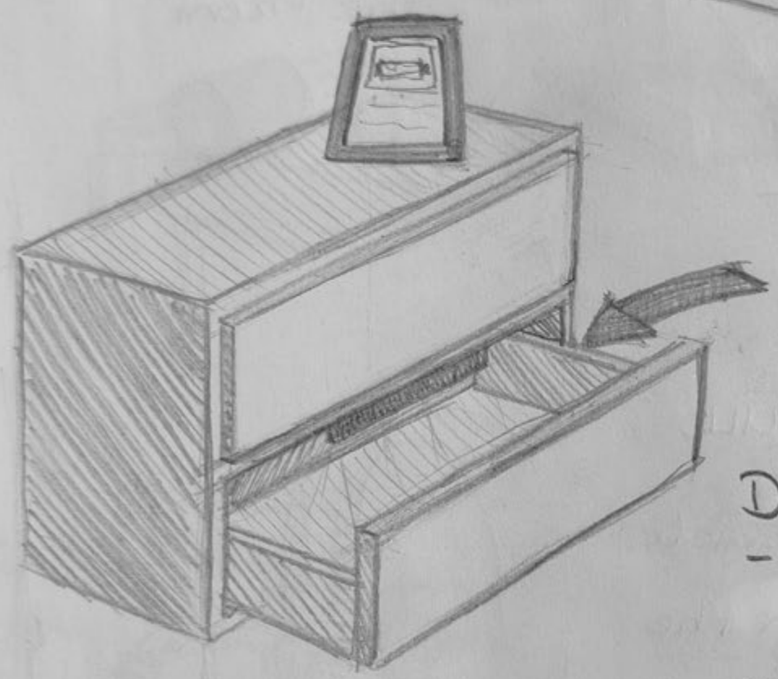
Until this point, all the work done has led us to the problem space: food wastage. Now, we still had to find a solution in this area, which is why we needed to brainstorm again. We had already accumulated some ideas throughout the course of our research, so we noted them down and sketched visualizations. In addition, we had also determined that everyone would think carefully about new ideas for a few days, by looking at the existing ideas, but also by simply being busy with quick prototyping and sketching. As a result, we had a lot more ideas than before and we also saw whether we were on the same page or whether everyone had different thoughts about the project. Some of our sketches and the results of our dirty prototyping workshop are shown on the next few pages.

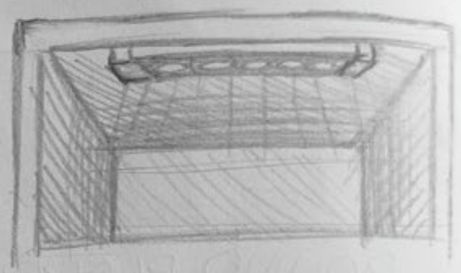


SHELF SENSOR

- Vertical sensor inside shelf
- Tablet on the side of the shelf



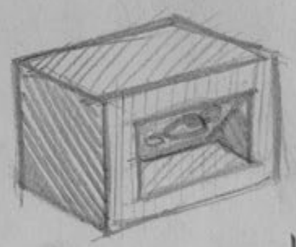




DRAWER SENSOR

- Horizontal sensor on the 'ceiling' of the drawer
- Tablet standing on top of shelf

SENSOR Designs

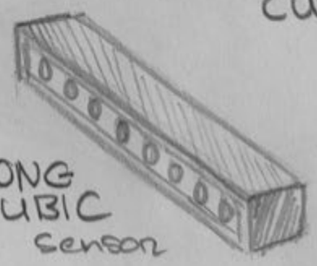


CUBIC Sensor

ROUND SENSOR

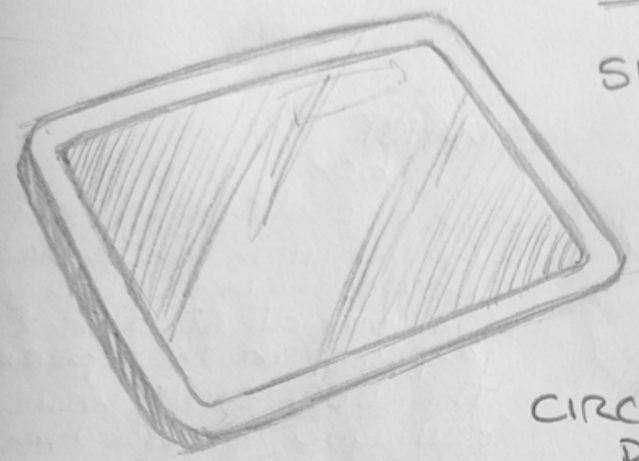
LONG CURVED sensor

CURVED sensor



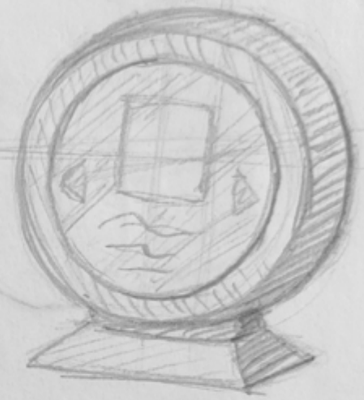
LONG CUBIC Sensor

DISPLAY Designs



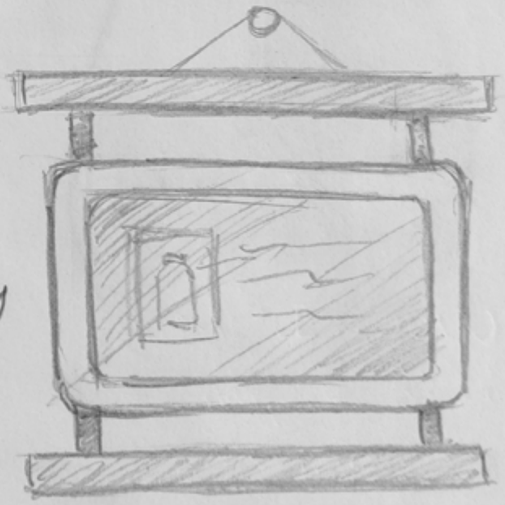
SIMPLE Tablet

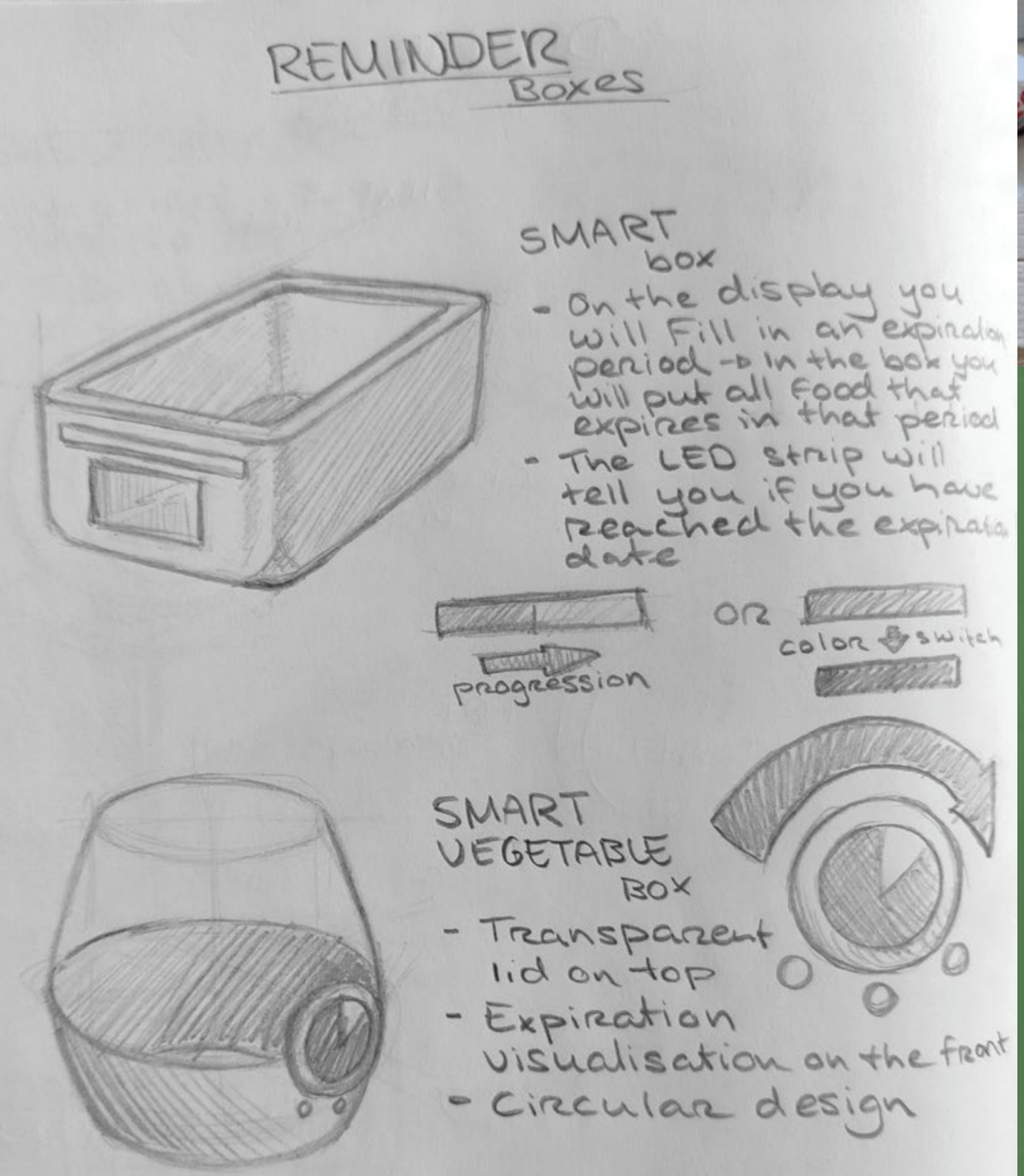
CIRCULAR Display



POT Display

STYLISH FRAME Display





QUICK & DIRTY PROTOYPING

The quick and dirty prototyping workshop helped us a lot with ideating in our design process. The workshop encourages the shift from research to creation. Its purpose is to get designers into the mind space of creating and help open up possible ideas just by creating. During the workshop you had to create as many low fidelity prototypes as you can in limited time. Because you have to work so quickly and come up with ideas, you really get into the creative mindset, which means you also come up with ideas that you hadn't thought of before. Below are listed some of our results. The workshop got the creative juices flowing in interesting and previously unseen ways. In our process, it helped to visualize some of our ideas and iterate on those visualizations.

CONCLUSION OF THE EXPLORATION

Looking at the sketches of the ideations, they all look quite similar and they all are focused on the same direction. We were very happy with this and it also showed that we worked a lot better because of the new approach, and that we were finally on the same line. After discussing about the ideas, we all agreed upon the midterm concept of a camera strip (sensor of the intelligent agent) that can be placed in your fridge or drawer, anywhere where you can store food, so that the system can keep track of your food.

MIDTERM CONCEPT

Our midterm concept consists of an intelligent agent in the form of a thin strip with built-in smart cameras and a database. The camera strips are mounted on the sides of the inside of a refrigerator or drawers in which food items are stored. The cameras detect which products go in and out of the drawers; products will be checked in and out of the database.

The database consists of all the products that have been ‘checked in’ by the camera strip. The database keeps track of your food inventory. In addition, the database knows per product what the average expiration period is. In this way, when a product is checked into the database, the database can make an estimation of the expiration date. If this estimation is wrong, the user can manually change the estimation to the correct expiration date on a display. The intelligent agent keeps you informed of your food inventory and expiration dates in order to prevent food wastage.

Finally, the agent provides options and inspiration for recipes on the display, based on the products (the agent knows) you have at home. The agent estimates the expiration dates per scanned product, and keeps you informed in order to prevent food wastage

DESIGN CHOICES

In this section, we elaborate on why we have made certain design choices by asking and answering three questions.

Why implement cameras into a strip (instead of different shapes)? And should two strips be mounted on both sides of a food drawer?

By using a camera strip (instead of a sensor strip), and mounting these strips to both sides of the inside of the refrigerator or food drawer, the agent can see and register exactly what products are check in and out, and can update its database more accurately. It ensures the intelligent agent will register all the products accurately, as a result can make a more accurate estimation of the expiration date, and thus to meet it design objectives better.

Why does the intelligent agent make an estimation of the expiration date, instead of registering the actual expiration date on the product itself?

Although scanning the actual expiration date on the products themselves would be more accurate, it would have made this design brief more challenging. All products contain a barcode, and an expiration date. The intelligent agent could be able to scan the barcodes with the camera strips. However, the expiration date is not included in these barcodes. If we want to scan the specific expiration date of each individual products that we want to store, we have to design for example an expiration date sticker for all the individual products. These stickers should contain a chip, which must be scannable by the agent. The disadvantage of these stickers is that the user has to fill in or write the expiration date on each sticker, and stick the correct sticker to the corresponding product. It's also a lot more challenging and time-consuming for the user to find and scan every expiration date on their products.

We asked ourselves, 'what is the most important?': Having an intelligent agent that knows the exact expiration date of each product, whereby the user has to perform more actions in order for that to happen. Or, an intelligent agent that makes an estimate based on general data of expiration dates per product, so that the user has to perform fewer actions.

Since our goal is to make life easier with the intelligent agent, we chose to let the intelligent agent make an estimation of the expiration dates in order to limit the number of actions the user should perform, and thus to make life easier. It could occur that the agent has made an wrong estimation, then the user can manually change the expiration date of the specific product on the display or via voice instruction.

Why does the intelligent agent have the feature of giving options or inspiration for recipes?

The main reason of implementing a feature of giving options or inspiration for recipes, is to save money and to prevent food wastage. The database knows exactly (the amount of the) products you have at home. Looking at our own experiences, as students, and talking to other people, we noticed that many have no inspiration of what to cook for dinner, they do not have the time or inclination to go to the supermarket, or they are short on money or want to save money. Since we want to attract a wide range of people, and to make life easier with the intelligent agent, we wanted to implement a feature that solves many of these problems. This resulted in the feature of giving options or inspiration for recipes.

REFLECTING ON OUR DESIGN

To take our project to the next level, we often evaluate what we've accomplished and identify opportunities for improvement. We also did this after receiving a lot of helpful criticism on our midterm. Personas, a storyboard, and a SWOT analysis were used to reflect on our midterm concept.

PERSONAS

Personas are a depiction of what a potential customer might look like. That entails their living situation, daily struggles, wants & needs, age, occupation and other defining personality traits. Below can be found our personas, that encounter the problems that we try to solve.

Helen van der Veen

Helen's persona represents families that have busy working parents and children. She is a mother of a lovely young family. She wants the best for her family, for example by cooking healthy meals, but has little time to do so because of her job. As a consequence, she has difficulty keeping track of her storage at home. Therefore she is a persona that fits with our design Food Guard. With the intelligent management system, she can easily get an overview of her cabinets with the little time she has, get recommended healthy recipes, and spend less money on buying too many products.

Joe Clarkingson

Joe's persona is based on the elderly users that may want to use Food Guard. Because he is of the retired age he does not have a lot of energy to keep track of what he has at home and often forgets the items in the cabinets. He often buys items twice and spends too much money, which he prefers to give to his grandchildren. That is where ' Food Guard' can give him the overview he needs, with the easy to install system and app.

PERSONA VISUALIZATION

DIAGRAM ABOUT DESIGN PROCESS

STORYBOARD

Our storyboard functions to convey a situation in which a persona can find and purchase our product. This storyboard can thus be used to better understand our product and its appropriate context. what recipes you can make with them are available on the app to know anywhere and anytime what your kitchen contains.

SWOT VISUALIZATION

SWOT ANALYSIS

At this point in our project, the design is far from perfect. The design can use some improvements, to sharpen our strong points, but especially to improve on the weak points. Therefore, we did a SWOT-analysis. SWOT stands for strengths, weaknesses, opportunities and threats.

This analysis is all to get a better insight on:
- Where the strong points in our design are
- Where the weak points in our design are
- Where we're missing potential
- Understanding our goals
- The threats to our design

After a brainstorming session, we found that our design has some flaws that should be considered and removed in future iterations.

Beginning with the strengths of the product. It saves money because you will never accidentally buy things twice again because you always know what's in your inventory. Our intelligent agent also gives inspiration for what to eat, it provides recommendations based on what you have in your inventory. And lastly, our product also prevents food wastage. This is because it keeps track of the expiration dates of the food, so when it's almost expired it warns the user and can give meal recommendations with these particular ingredients.

When looking at weaknesses, a scenario where we can find weaknesses is when the camera is bumped and falls, potentially scanning items already in the drawer/fridge.

Furthermore, when a product is put in for the second (or more) time, the expiration date is calculated like it's put in for the first time. What we can learn from this is that there are almost always flaws when the concept is put in the practical world. That is why we need to keep testing it in practical, realistic situations.

With the opportunities of the design, we see potential collaboration with companies that already stand strong in our market. This would give a boost to the name of our product in the market and enter the market along with some of the big names. That is why it is in our own interest to look for potential collaborations. This will be an important step to bring the product to market. We'll get into this later with a more in-depth look at our business model.

Finally, the threat we have found. Privacy has become an increasing problem with the development of technology. There must be ensured that the cameras on our product can exclusively see things in the cabinet. If this is not the case, this would not only cause serious doubts among our consumers before they buy anything, but it could also advance to legal issues.

DESIGN CHANGES

New product goal

Before we started to make the final product, we had to make a clear decision on what our goal is. To get a fresh, less broad perspective on our topic, we shifted our goal from: “Make life easier by easily keeping track of your food inventory, with the additional goal of preventing food wastage.” to: **“Achieve easy food storage, organization & management at home.”** With this goal, we could build up further the product and have a clearer target so that we can head straight for our final product. We moved into this direction because we found our product to be more targeted towards management, whereas preventing food wastage was a side effect to our product being used properly.

So after the midterm, we decided to make a change to the final product. After we rewrote our goal to: “Achieve easy food storage, organization & management at home’’, we decided to make some changes to our design to better fit this goal. We created new sketches and added some additional features, these can be seen on the next few pages.

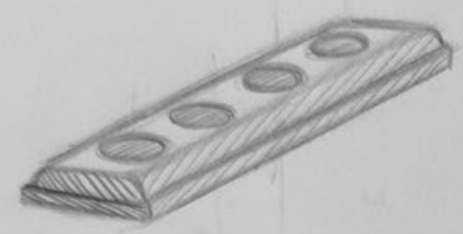
Mount

Based on the feedback we got on the midterm, we decided to remove the whole tablet idea. This would cost even more money, and our product is supposed to be cheap. The fact that one of our main target groups are students, who usually can’t spare a lot of money, plays a major role as well. Thus we introduce the mount. Your phone can be put into the mount, and the mount can stand on the counter, or be hung up on the wall. Now your own phone functions as the tablet because it displays everything the tablet would have displayed. This way we can make the purchase of the additional (expensive) tablet optional for the customer.

After some brainstorming and sketching, we had chosen our design for the stand, we wanted to stick with an as simple as possible design for the mount. Clean, simple, and very handy.

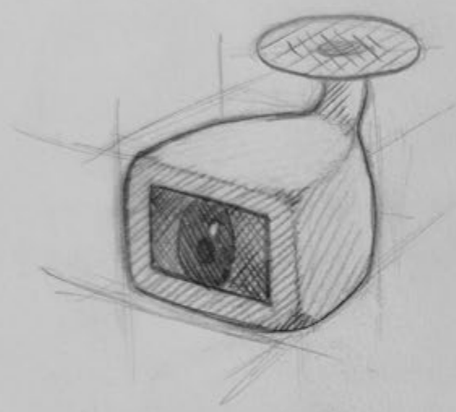
SENSOR sketches

- Starting plan

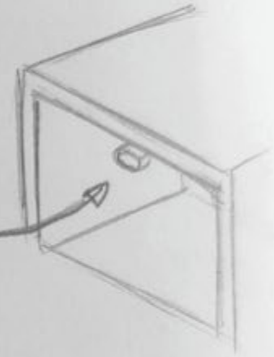


-> Long strip with 4 camera's
POINTS OF IMPROVEMENTS:
- Too long
- 4 camera's
- Simple design?
- Need 2 of them
- To abitious maybe?

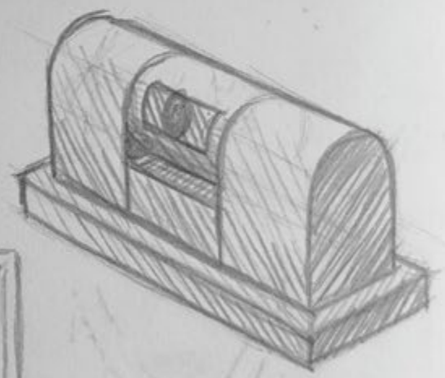
- New plans

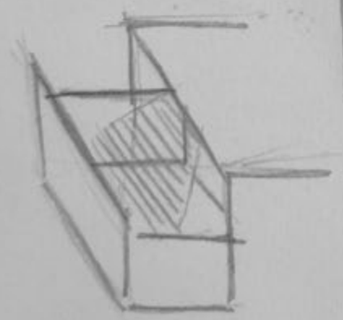


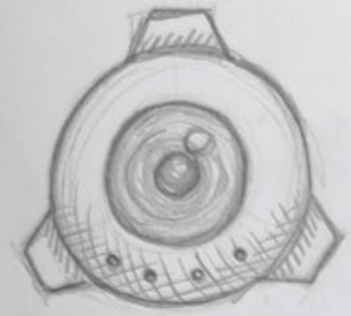
1. Sensor 1
- Top of cuboard
- 1 camera
- Adjustable
- Easy installable



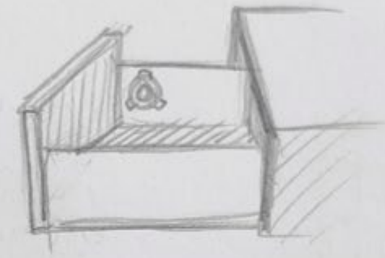
2. Sensor 2
- Top of cuboard
- 1 camera
- Small design





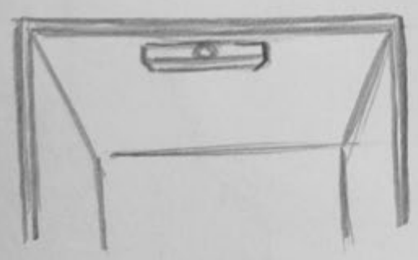


3. Sensor 3
- 1 camera
- Small / circular
- On the side of the cuboard
- LED for battery
- Easy installation



4. Sensor 4
- small camera
- Rectangulair
- LED for battery
- Not too visible
- Side of cuboard

5. Sensor 5
- 1 camera
- LED for battery
- Rectangular
- Slim design
- Top of cuboard

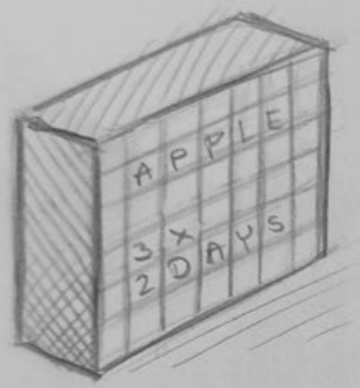


DISPLAY sketches

- Starting plan

→ Simple tablet
- Not original
- Not a lot of user-interaction
- Non-interesting design

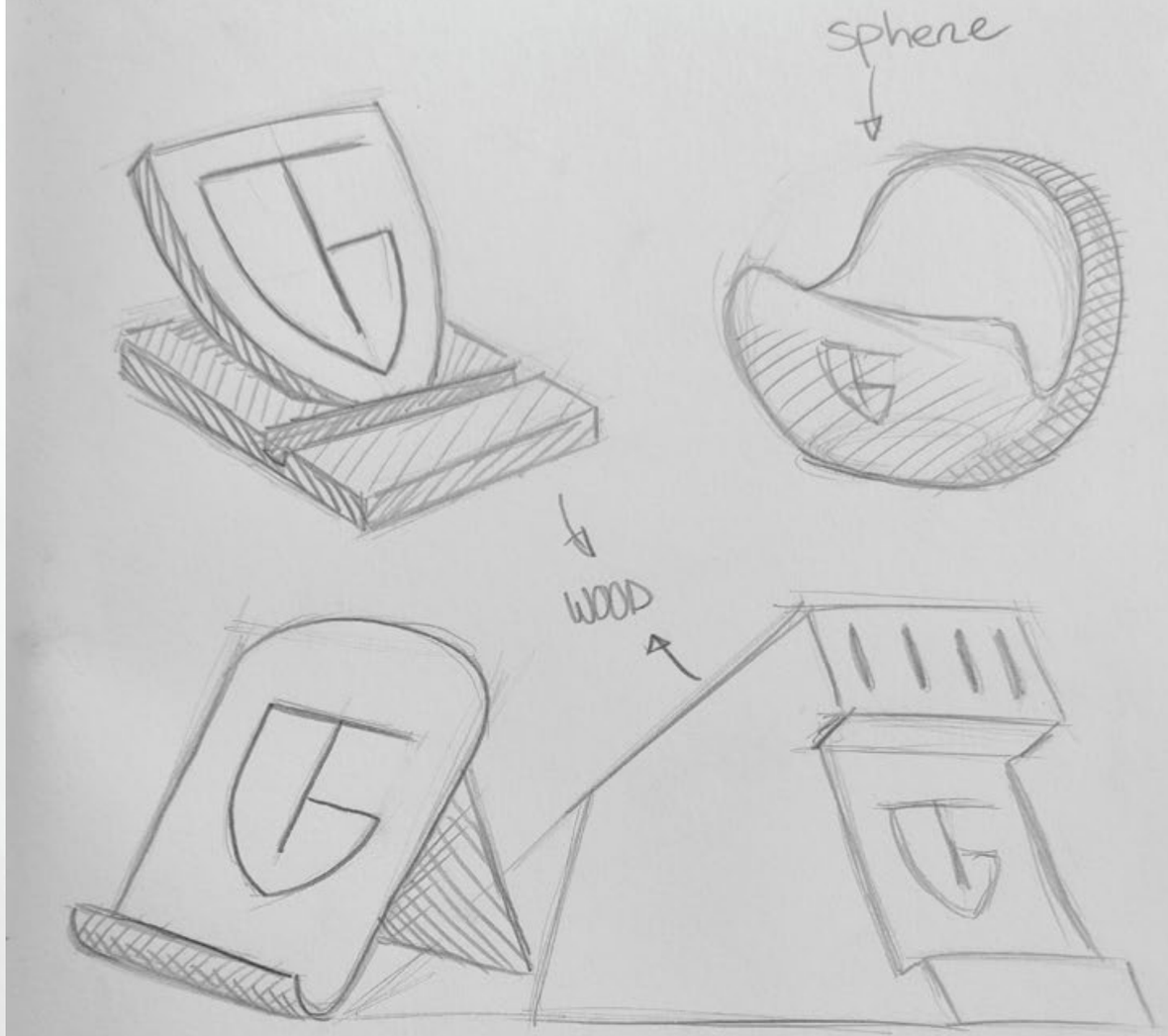
- New plans

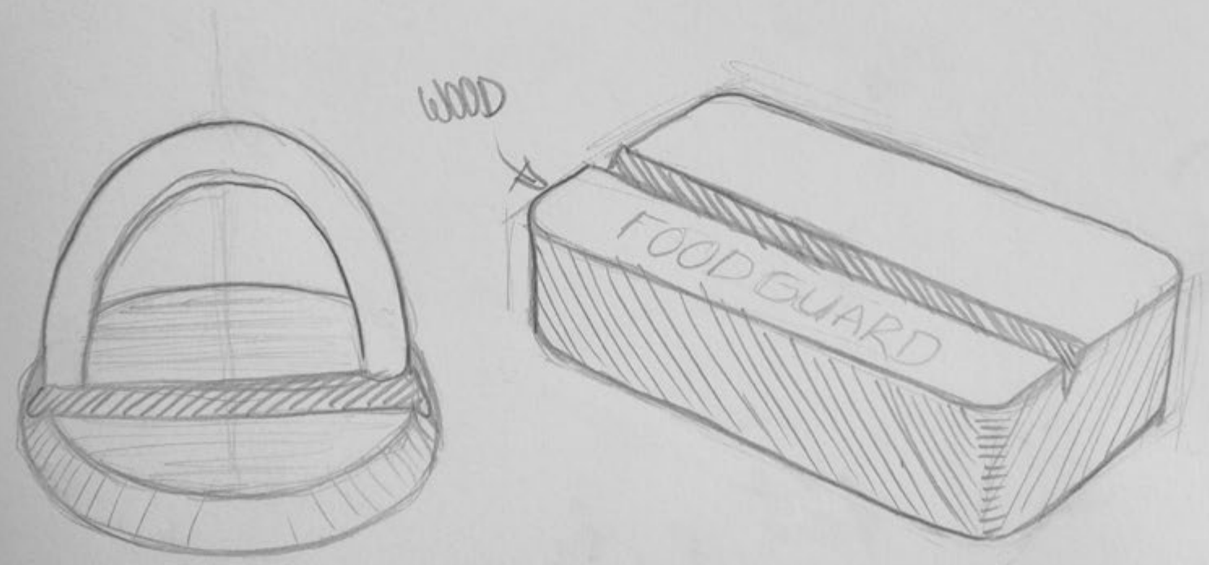


1. Display 1
   - Digital/Physical
   - Box Format
   - Turning letters / numbers

2. Display 2
   - Little assistant
   - Speech agent
   - Make conversations
   - Emotions

PHONE HOLDER sketches





REDESIGNS

Camera

The last change big change to our design we made after the midterm was the camera. In the midterms, a camera strip was used. The idea behind this was a strip containing about 4/5 cameras to scan the food as accurately as possible. The feedback given to us in the midterms was that this was difficult to realize technically (because you need to connect and let co-operate all cameras at once) and physically (too long) and it is also too expensive. That is why we decided to use one single camera.

After brainstorming and sketching some possible designs for the camera, we concluded that option 2 of the sketches. This is a simple design, and it can scan every item that is put in the drawer. The camera is housed in a rotatable holder, so you can adjust it if you need to.

App

The second change we made was the focus on the app. At this point, where the phone plays a much bigger role now the tablet is gone, we could give the app some changes.

We decided to remove the whole voice assistant system. This is because the tablet is not in our design anymore, so there is no settled assistant to talk to. The purpose of the voice assistant was to make it easier to find out things about your products, otherwise, you always have to go to the tablet to find out. In our new design, you can access the information about the products on your phone, which can be executed faster than with the tablet. Talking to your phone seemed in our eyes exaggerated and also difficult to realize.

CHAPTER 3

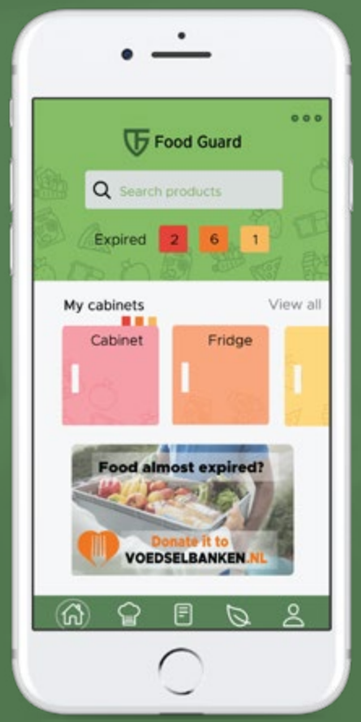
FINAL PRODUCT

CHAPTER 3: Final Product
After a lot of research and iterations we finally came to our final idea. In this chapter we describe more about this final product and how it works.

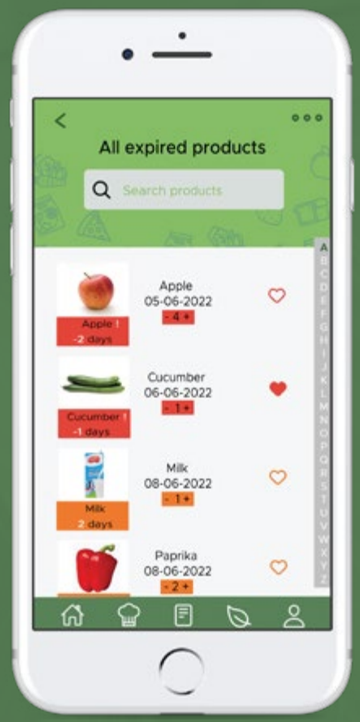
FINAL PRODUCT

Food guard is an intelligent agent that will help users to keep track of the food inventory. Consisting of cameras, an app, and a phone holder. The cameras are rotatable and Wi-Fi connected, which can be put inside the top of every cabinet. They will recognize the products with artificial intelligence and a premade database. By tracking what is put inside the cabinet and taken outside of the cabinet, Food Guard will know what needs to change in the inventory. Together with an app Food Guard will show the type of product, the amount, and the estimated expiration date. The additional phone holder will make the experience of Food Guard easier in situations such as putting the products in the cabinets or cooking. The app gives the user an overview and visual feedback when the system is used.

The app shows the food inventory, meal suggestions, and a shopping list. The main use of the app is to show the almost expired products and an easy overview. As a result, the user will waste less food and spend less money. In the app, the meal suggestions are based on the products you have the most at home and the products that are the closest to the expiration date. The shopping list will automatically list the products you already have at home and is able to connect with a chosen recipe. Food guard is about your storage, your footprint, and your peace of mind.

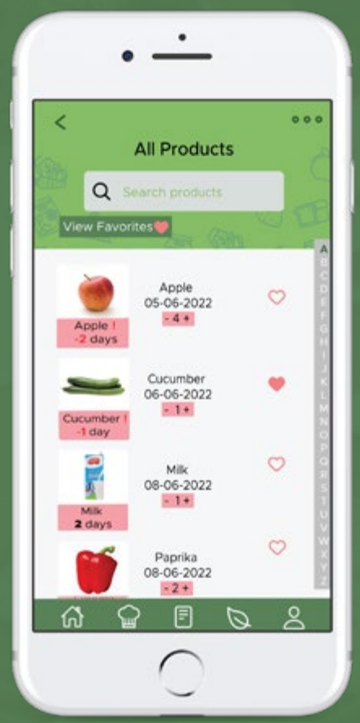


APP FIGURE 1



APP FIGURE 2

APP FIGURE 3



APP FIGURE 4

THE APP

The app is the part of the design that gives feedback to the user. The app is mostly centred around the expiration date of certain products. On the home screen, there are three colours representing the types of products that are expired (red), are almost expired (orange), and those that are within the time period of a week to two weeks (yellow). The number indicates how many different products are involved.

Home screen & inventory

To get an overview of the storage spaces, visual representations in the shape of cabinets are used. These cabinet icons are customizable, by changing the name and colour of the cabinets. For example, ‘cabinet’ and ‘Fridge’ as names. The labels on the cabinets of choice are bookmarks for the labelled expired products indicated by the colour scheme (figure 1).

Foodbank

When the expired squares with the three different colors on the home screen are clicked, the user will be directed to the list of ‘All expired products. The same color scheme is used to indicate the differences between the expiration date of products (figure 2).

The advertisement for ‘Voedselbank’ is placed on the home screen to make people aware of their food wastage and to motivate them to donate their food to others who may need it more. When clicking on the picture the user will be directed to the website link of ‘Voedselbank’ (figure 3).

Inside the cabinet tabs, an overview is given based on categories to easily sort the items and the type of expiration. The type of expiration date is based on the color scheme. The expired (red bookmark) and the items that are almost expired within the time period of a day to two weeks (orange and yellow bookmarks). They are ordered from the closest to the expiration date to the furthest away (figure 4).

Cooking & Recipes

The heart/favorite option, is included to be able to customize the app and feel more connected to it. When clicking on the button to view all products, the recipe order for your most expired products is shown first, and then the other items are ordered by alphabet for easy searching (figure 4 and 5).

For the cooking option, the top 10 is based on the products that are the closest to the expiration date and the most items you have at home. By giving fun cooking tips for holidays underneath the page, the user will feel more connected to the app. When scrolling down the page the user is able to see different recipe options for cooking at different times during the day (figure 6).

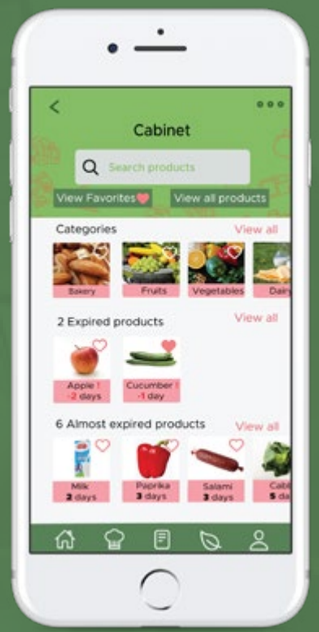
On the dinner option to view all, you can get an overview of all the options ordered by the alphabet (figure 7).

When the user has clicked on a recipe, it shows everything you need, for how many people it is, and a list of which products you already have and which you do not have yet. This page has the option to add the recipe to the shopping list for a better overview (figure 8).

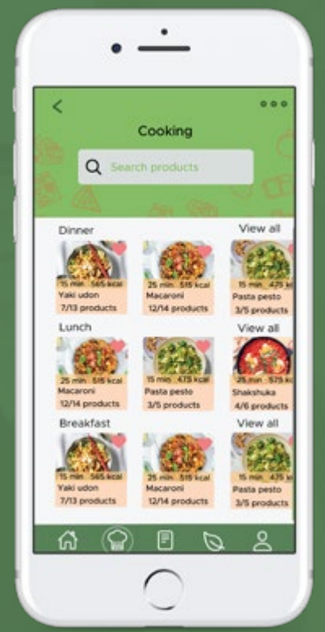
The benefit of adding the recipe to your shopping list is that the products you already have at home are already checked for you. This makes for less hassle for the user by not having to add every single item they need and check what they already have at home (figure 9).

Loading your products

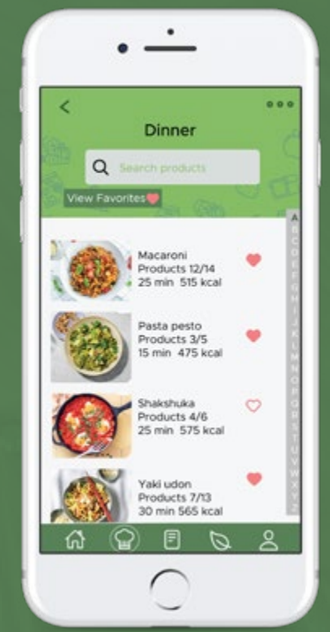
When a new product is recognized inside the cabinet the phone will vibrate as feedback and shows the add screen (figure 10) that will automatically add the product in three seconds if the information is not edited by the user. There is a delete option and an edit function for the date and product. The screen will stop the countdown when editing and will remember the edited product if a similar product is added (figure 10).



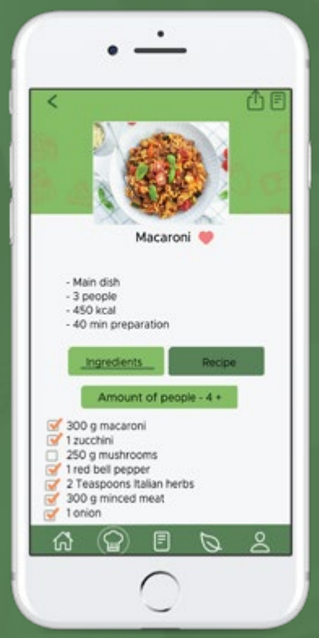
APP FIGURE 5



APP FIGURE 6



APP FIGURE 7



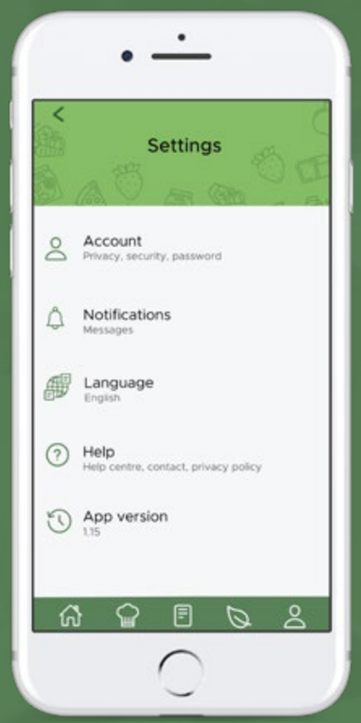
APP FIGURE 8

APP FIGURE 9

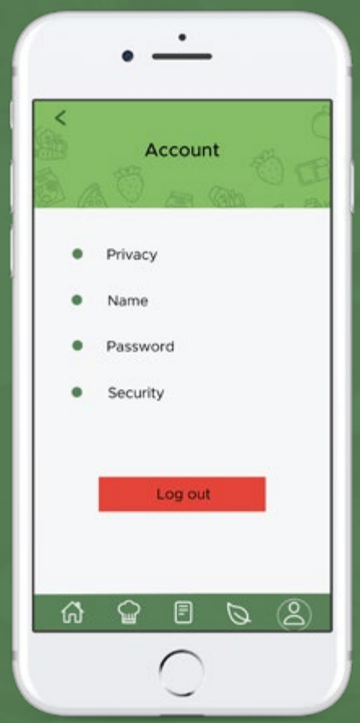
APP FIGURE 10

APP FIGURE 11

APP FIGURE 12



APP FIGURE 13



APP FIGURE 14

Daisy

The leaf icon in the bottom menu is the collab between Food Guard and 'Daisy'. Daisy has a different approach on the matter of food waste, they are using an emotional-based strategy. Which could fit with Food Guard, a tool that can provide them data. In addition to this, the collaboration helps us reach our target audience better. Because we share the same target audience, that being families, daisy can act as the emotional binding material to these families, bringing us into the family as well. Something which is further elaborated on in the chapter 'Marketing realization'.

If the user decides that they want to be more aware of their food wastage they could buy Daisy additionally with Food Guard, if they choose not to, then the leaf on the app does not serve any purpose (figure 11, 12).

Settings

On almost every screen there are three dots in the right corner. They represent the settings option. With that option, the user will be able to adjust certain elements of the app. (figure 13) This includes access to their accounts and the ability to change privacy options; Turning their notifications on/off; Setting the language of the app; An help function if the user does not understand how part of the app works and the user can also see the app version.

Account

The account page is used to edit the account as preferred and get information about its usage. (figure 14)

FOOD SCANNING SYSTEM

The most significant aspect of our product is our food scanning system. Here is because this is where our app gets its data and where your food is actually scanned. The system consists of a camera that must be attached to the interior of your cabinet or fridge with an adhesive strip and that can be adjusted by rotating the central component. In addition to the camera, we've created a software that utilizes artificial intelligence to detect food products using the camera and shows them in the app.

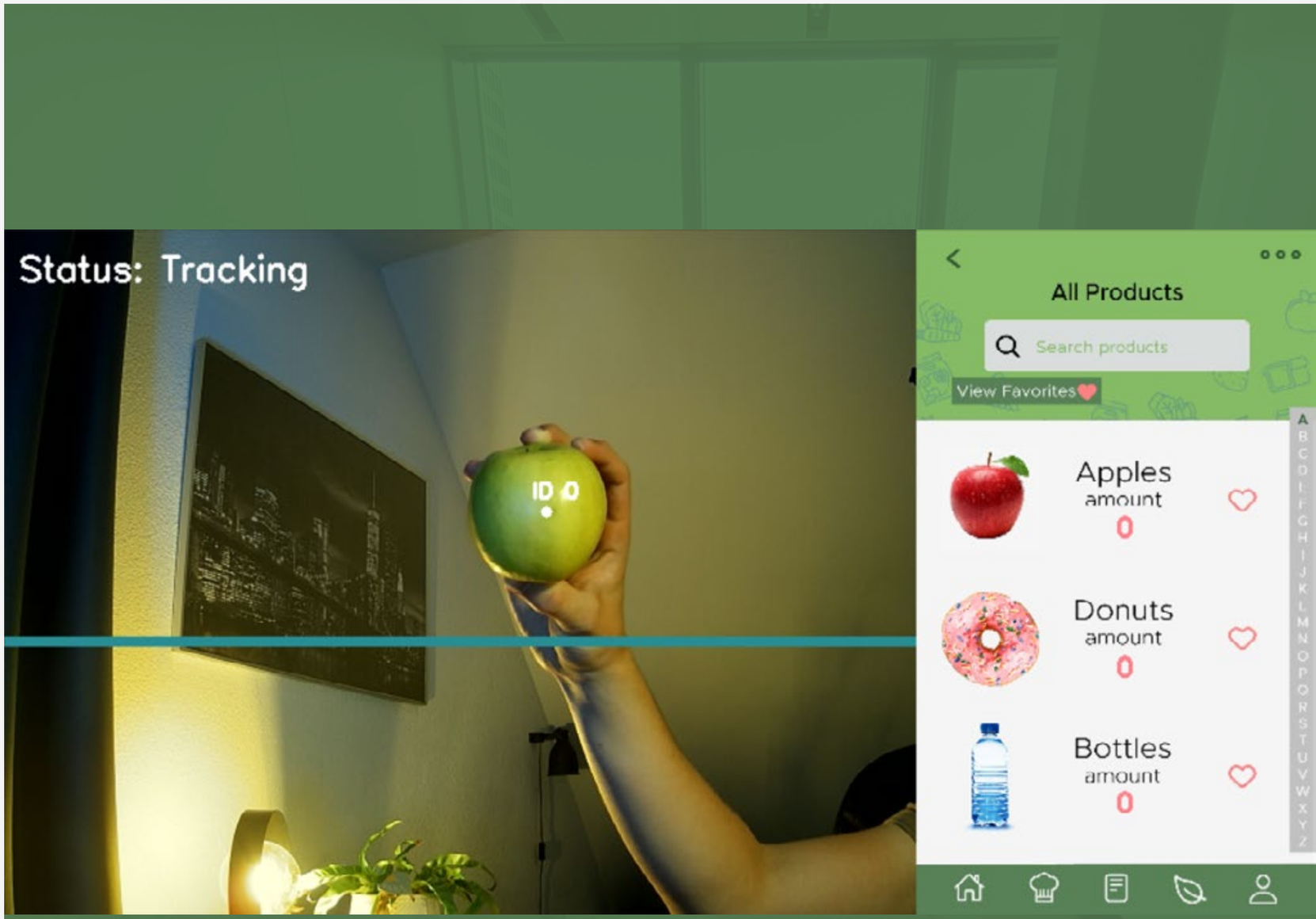
HOW DOES IT WORK?

Our system was created using the Python programming language, with the addition of numerous libraries such as Tensorflow and OpenCV to achieve our goal. All of these libraries are required for an AI to run on your laptop, which is precisely what we intended. Tanner Gilbert's guide and code were used to construct the code (see acknowledgments). He demonstrates how Real-Time Object Recognition works and how you can program it on your laptop in this video. Real-Time Object Recognition refers to the ability to scan items using artificial intelligence and your laptop camera. We then tweaked the code to make it fit with the concept we had in mind.

The system begins by retrieving models, which means it pulls information from a library that corresponds to the various items you intend to scan. This data contains hundreds of images of the relevant object, and artificial intelligence utilizes these models to check whether it identifies the objects from the library in your filmed image via the laptop camera, or in our case, an external webcam.

When the system detects an object, it assigns it a unique id. This allows him to see if the object has previously been scanned, as well as continue to track the relevant object. This is the Real-Time Object Recognition section. The system recognizes the objects you intend to scan using the camera.

However, we did want our device to be able to detect if something was being put in or taken out of a cupboard. This was accomplished by placing a horizontal line in the center of the webcam, which separates the camera input into two boxes. The system then tracks the object to check if it goes from top to bottom or vice versa through the line. It then decides whether to put the thing in the cupboard or remove it based on that information. After that it enters this information into a Python app that looks precisely like our real app.



FOOD SCAN SYSTEM BY THIJS

CHAPTER 4

MARKET REALIZATION

CHAPTER 4: Market Realization
Although our design’s main target group is busy middle-class income people, we don’t actually know how to get our product to reach them. Therefore, in this chapter we explore theoretical ways that our product can reach customers and how we can establish a foothold in the industry.

EXISTING FOOD MODELS

In order to incorporate our product into the market space better, we take a dive into existing products/services and explore their features, downsides & strategies.

By finding out how other companies use their products and/or services to stabilize their market position, we take inspiration on how we can cater our product to insert ourselves more sturdily into the market as well.

ALBERT HEIJN

We looked at Albert Heijn (supermarket chain) their app as its concept is similar to our app. We noticed for example, the ever-updating features on the app, with new suggestions on what to purchase being relevant to what's happening in the world.

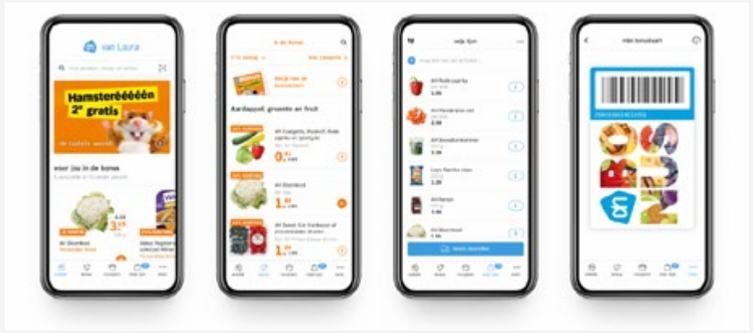
This extends not only to the collection of products on sale, but also social and cultural happenings: such as products for Koningsdag, Moederdag, spring etc. This ensures that customers have a reason to come back to the app and strengthens the bond with the customer.

Albert Heijn uses a very human language in their app, breaking that seriousness and professionalism and establishing a more personal relationship with the customer, along with the previous features this creates a feeling that is akin to friendship.

Also notable is their delivery expansion that now extends to Etos and Gall & Gall. Driving even more traffic towards the app.

Lastly, Albert Heijn does a great job on pushing their delivery system. Quickly adapting to the new business model of quick access and adding onto their reliability factor. Also making it a lot easier to do groceries, especially for the bedridden or elderly.

We found the values Albert Heijn pushes with their app are:
- Reliability
- Ease of use & accessibly



Smart Fridge SAMSUNG

Smart Fridge SAMSUNG is a fridge that contains a screen with a multitude of features, and they like to emphasize that. The fridge is marketed as a family product, not only is a family always visible in their commercials, but they have specific features catered to a family, such as a sticky board that allows for pictures of you and your family to be stuck onto the fridge screen.

The fridge really wants to be a part of your family and integrate itself into something that is permanent: family.
With its multifunctionality, the Samsung smart fridge advocates itself to be a hub of the home, a place where you can see your calendar and also what's in front of your doorbell. It wants users to use it as a hub and as a replacement for a google home for example. This increases customer retention as customers who bought a smart fridge before and used their features often, will be more likely to start seeing the fridge as an essential part of the home.

It also contains a look inside your fridge function, and a meal planner & suggestion function. Thus making it a direct competitor of ours. Its downsides however are there, such as being very expensive and not expandable like our product. Users also take up a lot of valuable space and time in the kitchen when performing time consuming tasks on the fridge such as planning meals or making notes.

We found the values SAMSUNG pushes with their Smart Fridge are:
- Family
- Multifunctionality & being the hub of the home

JAMIX & MarketMan

JAMIX and MarketMan are two companies that offer the same thing: restaurant management software. This means keeping track of your food inventory and costs, managing food orders, and seeing purchase history.

Due to their product being such a niche, every sale is a milestone. They know this and use it to improve upon their ethos as a company. On their websites they both show how many companies are using their system and JAMIX also boldly displays their user statistics.

This authority gives them the power to push their product and its main upsides, that being saving time and money.

Though their product is used in the background and doesn't constantly remind the company of its presence like a crying child who hasn't gotten their food yet, it manages to stay relevant and up to date by providing their customers with relevant articles and even podcasts (only MarketMan) on their website.

Furthermore, their product tracks your restaurant's waste. This caters to restaurant owners who want to reduce and track their waste output.

We found the values JAMIX and MarketMan push with their website and product are:

- Time and money saving
- Ease of use
- Sustainability

CONCLUSION

Having discovered what other similar companies are doing to push themselves into the customers hands and maintain relevancy, we can extract a couple of useful insights.

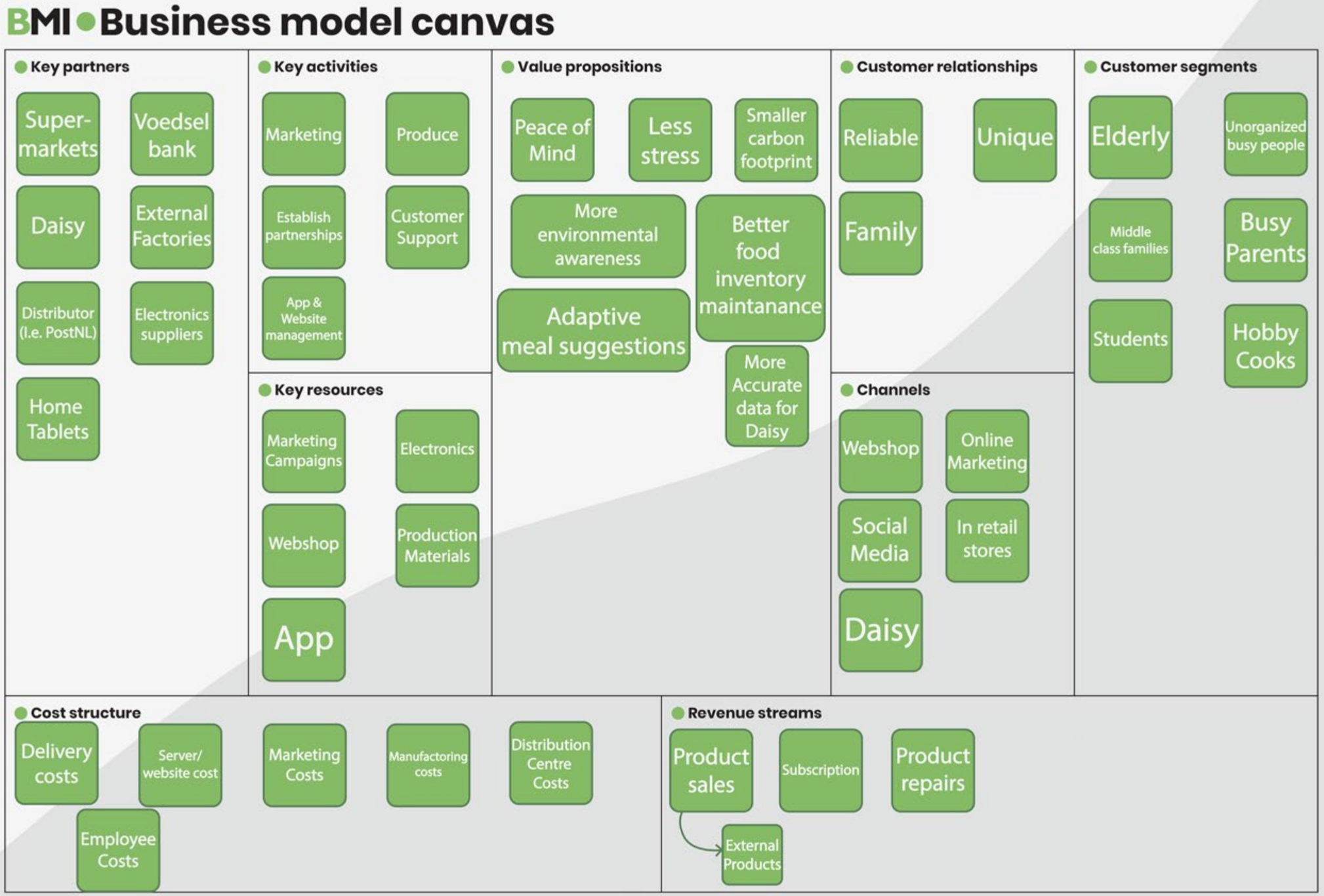
The first being that in order to engage customers, we should push our ease of use in both our product and app usage. This will make our seemingly complicated product be a lot more accessible and useable in daily life.

We can also learn from Samsung, who's smart fridge has made itself to be an integral part of a home and what's more: a family. We should make our product also integrate well into the family and seem like an irreplaceable thing in the home.

Almost all companies researched here use a constantly updating website or app to maintain their relevancy and engage their existing customers more. Considering we have an app that users have to open when using our product, we have plenty of opportunity to engage our user more with relevant articles, podcasts or other features.

BUSINESS MODEL CANVAS

Looking at other companies has taught us a lot, but we can't copy an entire business and apply it to ourselves. To understand our own business and how it could thrive, we've filled in a business model canvas. This basic blueprint of our company structure is shown below and explained accordingly.



BUSINESS MODEL

Strategy

So how do we reach our main customers? We've found multiple solutions to this that can be combined. The first is the cooperation with group 6D from sustainable foods, through their product 'Daisy'. Daisy is a (plastic) plant that measures people's food wastage and adjusts the happiness state of the plant accordingly. If the user isn't wasting (a lot of) food, the plant is happy, if they are, the plant is sad.

Because this product plays into the emotion and empathy of the user, and requires food waste data to function, it's the perfect fit for our product to be sold alongside it. Daisy will form a connection to the user, thus being very hard to get rid of, especially when placed in a family setting, because children are capable of quickly forming relationships with ordinary objects. Our handy product will therefore feel akin to family.

Key partners

Secondly, we'd like to see our product sold on grocery shelves, where we'd buy our own themed section of the store that contains a barebones, easily understandable demo of our product as well. This will make our product stand out and not look like an off-brand non-food product in a grocery store.
Another cooperation method is through home tablets, devices such as Google home or Alexa can include us inside their tablets as a widget (a small application that enables the user to perform a certain function, or review information) or a voice command option. Think: "Hey Alexa, when does my milk expire?" This will give them more features, give us exposure, all the while not creating competition with big names in the voice-controlled agent market.

Campaigns

Thirdly, we will push our product to the customer through marketing campaigns. Where we can target the (busy) parents and families with adverts on their frequently used platforms.
The main goal of these campaigns is to keep our product in the mind of the customer, we're not claiming to be sold in the stores as an impulse buy or for somebody to click our advert after viewing it once. Rather, we'd like to obtain relevancy and spread through word of mouth.

Other target groups

Now that we've established how we're going to reach our target audience, it's important for us to note some customers that might not be reached by these aforementioned strategies. These target audiences require special attention and below is shortly noted how we could reach them.
Home cooks
We also target the home cook community to spread our product. This community has shown to be quite large, with influencers such as Binging with Babish having near 10.000.000 followers as of the time this is written. We can thus reach their/our audience through sponsorships and advertisements.

Elderly

The elderly are also a part of our target audience. We believe that technology can improve the wellbeing and capability of an elderly person who lives by themselves. Being capable of improving the self-sustainable, independent segment of their lives. Research by Fontys (2016) shows that the elderly like to explore technology at their own pace, be it slow or fast. If they aren't given this freedom, they're way less likely to adapt the technology into their daily lives.
We therefore want to make instructional videos at a slow pace. Additionally, a tech support system would be optimal, where a confused customer can reach out and talk to or message a representative of our company.

Revenue

Our revenue comes mainly from product sales. However, alternatives do exist, and we want to explore and experiment with them. With this goal in mind, we conceptualize the idea of external products to be sold alongside the food guard IA. Such as a recognizable, custom labelled container in which to store your leftovers, home cooked meals or other products that are hard to recognize by food guard.
This product can serve as a solution to the incorrect recognition of food due to the human habit of recycling food containers. For example: using an old ice cream container to store pickles, which the system then falsely identifies as ice cream.

Additionally, a subscription-based revenue model is imagined. One where doubtfull customer can subscribe for a monthly fee and try the product. The customer can then decide if they wish to buy the product or not afterwards. All these revenue streams weigh up to an in-store cost of circa €50,-. This takes into account the camera, the packaging and the stand. This package would contain one camera scanner, with the option of adding more cameras for comparatively cheaper to one camera.

The potential

For future endeavours, we'd like to explore the possibility of completely pivoting to a subscription-based model. Additionally, we see potential in product repairs. Much like an Apple store repairs apple products for a large markup, we could perhaps do the same.

SWOT ANALYSIS

In this chapter we examine a SWOT (Strengths, Weaknesses, Opportunities & Threats) analysis of our business. A previous SWOT analysis can also be found in this report, this one, however, is about the business and not the product. With this analysis we wish to see how our business can grow, and what still stands in its way.

Observations and explanations

Only addressing the initially unclear points, we start with the lack of diverse features. In a day and age where we carry devices around that are miniscule and carry around more features than a computer of 15 years ago, we expect electronics to have many features and can be appalled by them if they don't. Especially when the industry example for smart home devices are diverse agents such as Alexa and Google Home.

This also comes back in the last point from Threats. Because of the similarities between our products, and our apparent lack of features, a particularly good move for them would be to buy our concept or evade our (theoretical) patent to incorporate our object recognition into their fridge. Seeing us more as a potential feature instead of a competitor.

SWOT VISUALIZATION

CHAPTER 5

REFLECTION

CHAPTER 5: Explore
In this chapter we reflected on our project both as a team and indiviually. We also made a discussion to adress some improvements for our product.

DISCUSSION

On the marketing side of the project, we've found some missed opportunities. Such an example would be the lack of packaging for store shelves. If this was designed beforehand, we could showcase our marketing physically and find more flaws and feedback on our marketing strategies.

The marketing could've also improved had we chosen to add more humanity to the IA. This humanity quickly faded after removing the voice feature. This lack of humanity, however, doesn't fit well with our business model of becoming a part of the family.
When it comes to our target audience, more in-depth testing on our target audience's desires would be favourable. Thus far we collected our target audience's desires from our relatives, a source that can be biased. In addition to this, no user testing was performed.

For the future there's things that can be done to improve our current product. Among these things would be making a slow-paced instructional video/manual/medium to allow the elderly to learn the product at their own pace. Something which will open them up more to accepting us into their daily lives. Another thing we might want to implement is a working application that interacts with the camera, for an even better demonstration for our product.

We also should have chosen a different, better-fitting, stakeholder instead of 'Voedselbank' on our mock-up app. The users are less inclined to donate food if it is in small proportions. An alternative could be to create a community in which people come together with their neighbourhood to donate in larger proportions.

TEAM REFLECTION

Our project has seen ups and downs throughout its course. The most notable down part in our progress and learning points stems from our lack of qualitative communication. This was an especially bad combination with our planning. Which led us to a vague direction of our project and misunderstandings after meetings. Attributed to short-term planning we failed to envision a better course of action.

On the contrary, there were ups. Our integration of certain expertise areas, lessons learned from previous courses, and experience in other projects helped us put together a nice result. There was also a sense of openness and creativity which made sharing ideas and concepts common. An environment which encouraged learning from the coaches and each other. One we would all like to recreate in our future projects.

An approach to fix the issues, would be using a more steadfast structure. Not only for planning but also for meetings. A steady structure, in an environment that supports proper, initiative-taking communication, would be quite effective at making the road forwards clearer.

Although we had employed such a structure after the mid-demo day, it eventually fell apart and the (personally set) deadline to finish all the report writing was not met by some of us. We reflect and think this happened because of our still sub-optimal communication and lack of initiative. A problem that arose from the project fell into the back of our minds at times. This could have been prevented with a plan that spreads work evenly per week and changes the type of work in correct time intervals, so as not to lose relevancy. Our planning and main direction were not up to these standards and thus fell flat. Even though the last problem is a shame. The overall process went well, and we learned a lot from each other while being able to ask each other for help when needed.

REFLECTION

THIJS REIJNDERS: 1699237

The past semester has been a rollercoaster of emotions. From stress to relief and from frustration to joy. I can therefore say that during this semester, during the project, I learned a lot of new things, not only in terms of skills but also about myself.
I went into the project with some goals I wanted to achieve. One of the goals was to improve my programming skills (T&R), while another was to apply my sustainable design vision to the project. My main goal was to learn how to work in a group. As an introverted and independent person, I found it tough to delegate tasks and not do everything myself. This skill will also be important later in my career as a designer, as you will frequently work in a group as a designer.

Because we were thrown into the deep end right at the start of the project, my communication skills and my skills to work in a group were immediately tested. I saw that I quickly developed my own ideas and attempted to do things on my own. However, as the weeks went on, I saw that my group dynamics were suffering as a result of this. The project went pretty well, but I was here to learn to work in a group, not do what I wanted. My other personal goals, however, have been met thanks to my independence. For any assignment that I have, I always give it my all. During the brainstorming stages of the project, I was able to put my new Exploratory Sketching skills to use (C&A), and I am really happy with the results. Next time I would also like to make these sketches digitally because that is where I can add even more perks to the sketches. During the project, I also learnt Python, a new programming language (T&R). My objective for the project was to learn a little more about programming, but I didn't anticipate learning an entirely new language. I'm proud of myself for succeeding, and I'm excited to see what more I can learn from this programming language in future projects. So, in my opinion, I have accomplished the majority of my objectives.

But, to be honest, it required a lot of effort for me to change my independent workstyle and trust people and collaborate with my group. It wasn't until after midterm that I learned that other individuals could be better or have more expertise with various things. I realized that working in a group means trusting each other's thoughts and qualities and coming up with a great product together. However, I did not quite achieve my goal since I also realized why I dislike working in a group when designing the report and preparing for the demo days. It was quite unorganized, and not everyone was completing their task, which I found extremely frustrating. Now that I think about it, I see that this isn't necessary, I'm a perfectionist, and I want everything to be of professional quality, but it's not required. "The result is only a by-product," my coaches reminded me. It's more essential that I learn something and discover what more I can learn. And now that I've finished the project, I can see what I've accomplished as well as what I still have to learn, since the most essential thing, in my opinion, is that you never stop learning.

As a result, I've set new goals for the upcoming projects. Learning to let the user think along with the project and incorporating the user's feedback into the design process (U&S), for instance. I'd also like to learn more about the business side of product development (B&E), as this is a skill that would come in handy if I ever want to market my items.

REFLECTION

JOOST DE VRIES: 1690884

This project has been an exciting, challenging, and at times tedious road. Full of small and big learning points that will go over my head if I don't reflect on them here, I therefore bring a concise reflection of my project 1 experience. Although this reflection may seem somber, I create it to learn. Consequently I will bring up more negative aspects of our project experience. I did however greatly enjoy my project and think of it as a great first experience.

Being given only the theme 'intelligent agents' and nothing else, was really like being cast into the deep end. As an extroverted and enthusiastic person, I was keen to take the lead on the project. Our group stumbled to find a path to create something that had a thorough reasoning for being the way that it is, as was to be expected. As a leader, I led thinking on the short term. A lot of the things we did had a reasoning behind it at the time, however a combination of changing though processes and short term thinking, left some items made unused or not utilized to their fullest potential.
My leadership was logical but at times erratic. I even realized this at the time, making attempts to fix this problem also. Creating a planning and giving meetings a semi-fixed structure. These practices, unfortunately didn't last. I think this is because we didn't hold each other accountable a lot, and at times my motivation for the project would fade, sadly having an impact on our performance.

To fix these problems in the future, I intend to maintain a more thorough structure from the start. Establishing ground rules, advocating for more team communication, creating a planning that goes two weeks ahead, and keeping our project more dynamic and alive. I'd especially like to touch a bit more on the latter.
I think a big part of this aforementioned lack of motivation was the at times tediousness and boringness of our project, we were thinking way too much and doing way too little. We should've been exploring with sketches and exploring with creating instead of repetitive brainstorm exercises. This would help us think in different ways and stimulate more creativity.

Our communication wasn't the best it could be also. I noticed that we could absolutely misinterpret each other at times and come back with different results than intended, something which improved towards the end of the project. For future endeavors I will inform rigorously of what we're doing and how, in addition I'll ask questions to confirm if we all understand.

This project has taught me a lot about leadership and gave me more professional and social skills to implement in future projects and personal undertakings. I intend to create a brief 'game plan' before the start of project 2 for the next year, where I'll take points made in this reflection and prepare myself to create a better final deliverable and process.

REFLECTION

HANNE BOS: 1654896

During project 1 I was able to apply some of my qualities. I was mainly involved in ideation, brainstorming, research, taking notes, and the report. In my opinion it is good to apply your qualities where possible in a project such as project 1. In this way, you can go for quality and a good result, and at the start of project 1 it appeared that everyone wanted to go for that. However, because of this, I have noticed that I stay with the known and the safe. I did not challenge myself or I challenged myself less to learn something new, resulting that I developed less in certain areas as a designer. For example, during project 1 I wanted to learn how to program and create an interactive prototype. However, with the team we had decided to work on the parts of the project you are good at. If I wanted to learn something new anyway, I had to do it myself in my own time.

I would have liked to program and tried to make the system myself in my own time, but during the semester my physical and mental health deteriorated sharply. As a result, I had little energy to do such external learning activities. In addition, I deliberately took a step back after the midterm and took on fewer tasks which was why I was mainly involved in ideation, brainstorming, research, visualization and the report.

Additionally, I want to reflect on communication. As mentioned in my professional identity, I am very social, and I find good communication is essential. Not only communication between human and products/devices, but also communication between humans. However, during the project 1 noticed and experienced that the communication within the group was deficient. This was partly due to a poor, short-term planning, and a poor approach to the project as I, as well as the others, had difficulty figuring out a design process. I have learned that the approach we have taken is not the best and most efficient approach for a large project. In a subsequent project, I would make a long-term planning at the start of the project and define a meeting setup that makes it clear what is expected of everyone before, during and after the meeting.

Lastly, during project 1 I had a good and instructive introduction to the expertise Business and Entrepreneurship. This was mainly owed to Joost and Boris, because they had immersed themselves in this area through the Business design course causing that they could share their knowledge with me. As a group was decided we wanted to look into the market and market realization. For me it became clear that in order to get insights about our customers or target group, what value propositions are offered through what channels, and how our brand or company could make money, it is important to an structured overview: a business model canvas.

We looked into customers channels to reach our customers. In order to reach our target group, we did a collaboration with another project group who had a similar product goal as ours: preventing food waste. Through the collab, both groups could benefit from each other's product or app to meet the company's values and to strengthen our market positions. To put it shortly, the collaboration with another project group attributed to my understanding of an entrepreneurial attitude, even though we both are not real companies.
Given my current circumstances, I find it difficult to set goals for the next project, but if I am able to work on the next project, I would:

- Learn how to apply the right technology to make an interactive prototype.

- Make a long-term planning at the start of the project and define a meeting setup that makes it clear what is expected of everyone before, during and after the meeting.

- Not stay too long in the ideation and research phase, because during project 1 I realized that you need a lot of time to realize an (interactive) product.

- Involve users in the design process and gather data which could enable me to improve my products or systems, make better design decisions which could lead to better user-experience and usability. During project 1 we did not involve users, but we made personas and storyboards instead. I noticed for myself that creating and using personas helped me to know whether certain decisions (such as implementing a certain feature) would help or hinder the user. However since we did not involve real users in our design process, we do not know about the real user experience and usability since we designed the product ourselves and thus we know thoroughly how the concept functions. We designed it in a way we think would be useful and meaningful, but is it really?

REFLECTION

TING ZHOU: 1693018

In the beginning, I had only made one goal. But new ones were created throughout the project. The goals were related to the expertise areas, whereas my personal goals were related to my vision and my own interest.
The first goal was related to the expertise area of business and entrepreneurship, where I wanted to learn more about the topic by asking the team and implementing bits of the area in the project. The project did involve the business model in the end, but I could have been more active in asking around about it or researching it myself.

My second goal had to do with the area of creativity and aesthetics, I developed this goal throughout the process, where my interest in 3D applications and other design tools such as InDesign began to picky my curiosity. Even more, because I developed a better definition of my vision, about visual communication, I wanted to work harder on the storyboard and app interface. The goal of using the new applications was not realized, because of a lack of good planning. Next time I want to learn it in my free time and plan it SMART.

However, I did succeed in communicating through the storyboard and the app. I learned that it is very tedious and time-consuming to make both. While making the app I learned that researching existing apps, designs, and icons was important to create a good working and looking app. Even more, I learned through trial and error that I should wait with colors until the interface is done. Choosing the colors took too much time and was distracting the creation of the main use. As for the storyboard, I already knew how to make one, but never have I made one that explained how a certain product works. That is why I have learned how to explain the concepts better using arrows and different colors.

As for the start of the project, I was lost as we had a lot of freedom to choose what we wanted to design. The course felt hectic and I had no grasp on what had to be done and what we should do in the beginning. After a while, I learned the hard way that communication and planning are very important to work well in a team. The next time I certainly want to be aware of those aspects when working in a group. While working in the group I learned that I was not able to voice my opinion very well in the beginning but after a while, I started to loosen up more and became more confident and comfortable stating my opinion on subjects. In the future, I want to be able to stand more confident in my own shoes and try taking on new roles in a group.
For the midterm, the task division was not fairly divided and the planning was not optimal. After discussing the workload and planning we created a better planning and task division for the final demo day. I learned that I had a preference to get more tasks and that my value of fairness is very important.

In the project, I was helping in creating the prototypes. Where I learned more about the tools in the Vertigo workshop, for example, certain saws create a black edge on wood or how you could creatively solve a problem with the materials they sell. The tasks appointed to me were not out of my comfort skill zone, the app was the most challenging one to make but the storyboard was not. Next time I want to challenge and experiment more to grow and learn more fields of interest. Overall, I enjoyed the process and it was different to work on a project for such a long time. There were new goals I developed and aspects I learned about myself when working with a group.

REFLECTION

BORIS VAN KROONENBURG: 1657046

Expectations
Project 1 was a whole new course in our program. Before I started this course, I did not know exactly what to expect. The only thing I knew before was that you had to work on a project in a group for two quartiles, ending with presenting your design on demo day. Furthermore, I expected that this project was going to be a sort of long version of the course: from idea to design.

In reality, it was a bit different than expected. We were thrown into the deep as we had no guidelines where we had to hold on, so we could go our whole own way. I liked this because this gives a sneak peek at how designing a real product would be. This was a big difference from how I thought it would be, but other than that it was pretty much what I expected, but it was a challenge.

In the next paragraphs, I'm going to tell the things I did, what went well and where I can learn from.

Brainstorming
I think brainstorming is really important as an industrial designer because it is a good tool for ideation. At the beginning of our project, we used different brainstorming methods. One of them I call ''pass on'' and is a method that worked out well for me in the course from idea to design. It begins with a few problems and every group member has a few minutes (with a timer) to ideate ideas for these problems. This helps you focus on one idea per time and I think this is more effective than another brainstorming method we experimented with, which was in Miro.

This method had the same goal as the previously mentioned method, but it seemed in my eyes more chaotic. This is because we still had to ideate ideas for some problems, but now we had more problems and no focus on one problem, so you just could ideate for every idea. In the beginning, I did not know where to start and I eventually came back to the ''pass on''method we did earlier. I still liked the time-limited format with the timer so you needed to make sure you have to write everything down, but also not to carry on for too long. So for the next time, I know how to approach this kind of brainstorming, by just focusing on the problems one by one, time-limited.

Different from the previous two brainstorming methods, we also used two different sketching brainstorming methods later in the project. The first method we used was taking 30 minutes to sketch as many (in this case) phone holders. I can understand this method can be useful for some people, but this was not in my case. I am not a good drawer, so I need to take the time to draw something good. For me, I always have to have a full idea in my head and then I can draw the things, but I need to take the time for that, so a time-limited brainstormingturned out not to be a good method for me. Increasing the length of the time limitation, is not a good option in my eyes, as I found 30 minutes long and my concentration was decreasing.

The other sketching brainstorming method was also time-limited, but with a few days. This is especially for me way more comfortable, as I can focus on my ideas way better because I need more time for my sketching. So for the next time, I need enough time to sketch my ideas and keep this method open as an option.

Improving electronic skills
I, as a designer, want to make products that help people and make life easier and these products mostly contain electronics in them and I think this going to be even more in the future. That is why I set my goal to improve my electronic skills in my PDP, by doing the electronic part of project 1.

After the demo day, I could start with the electronic part of the project: the camera. The approach I took was just to look on the internet and see what I can find. This approach always takes me somewhere and it worked out for me this time as well. By implementing the skills I learned from the course creative electronics, I managed to get the thing programmable, but the camera was not working. My coach referred me to another student who got the camera working, and from him was the most I learned. He was open to meet some day, and that's where we got the camera working, and more importantly, I understood how the camera itself all worked.

So the things I learned from this adventure are: just ask for help from somebody who already knows the area, they can explain it the best. This is because you can ask things you don't understand, unlike (most of) the internet. I now am more advanced in electronics, because now I know the basics better and I can implement this in future projects.

Implementing skills
In project 1 we were free to do what we wanted, so here we got the chance to implement the skills that we have learned in our previous courses. To begin with the personas and the storyboard. When learning this technique in the course itself, I was not convinced about this method.

My teammates wanted to implement it in our project and I was fine with it. After these were done, I was surprised by how useful they were in practice. They give a clear quick view of how the product can be implemented and can be very useful to use in the future as well.

We also filled in a business model canvas, which I found useful before, but unfortunately in this case I decided to focus on the electronic part, so I haven't worked further on this canvas. Furthermore, I have implemented some brainstorming skills and electronic skills which I already explained before.

Communication
Before this course, I did not know any of my group members, so in the group app, we were all a little shy. But as the project continued, we still did not communicate enough in the app, so miscommunications started to pile up, ranging from simple meetings to reports. This is very unsatisfying and not to be repeated.

Secondly, a planning is also handy to have. In the beginning, we did not have a planning and our whole work structure got messed up. After the coach heavily recommended keeping up a planning, this got better. As we further moved along the project, slowly but certainly we let go of the planning and in the end, it again got pretty messy.

Next time it is useful for me to communicate the methods and ways I like to use, but even more important the ones I don't like to use. I am always open to new things to experiment with, as I am here to learn things. Making sure that there is a planning and the communication is sufficient, so there will be no miscommunications is also important, as I caught myself being too little communicative as well, so that is also a point for myself

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CHAPTER 6

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CHAPTER 6: Explore
In this chapter we noted down all our references used and created our appendix.

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RESEARCH

An (intelligent) agent is a computer system situated in an environment, and is able to act flexible, independently, and autonomously in this environment to meet the design objectives, and faces the decision which action to perform to meet the design objectives. In this context, the flexible means:

- **Social ability** – The ability to interact with other systems / agents (and humans) through cooperation and/or negotiation.
- **Pro-activeness** – The ability to show goal directed behavior. This includes recognizing opportunities and taking the initiative.
- **Reactivity** – The ability to perceive and, thereafter, to respond to changes in the environment the intelligent agents is in.

Other properties of an intelligent agent:
- **Mobility** – Being able to move around an electronic environment.
- **Veracity** – False information won't be knowingly communicated by the agent.
- **Benevolence** – The agent will not have goals that are contradictory, and the agent will always perform the actions that have been asked for.
- **Rationality** - If the agent's beliefs permit, the agent will always try to achieve his goals.
- **Learning/adaptation** – The performance of the agent will improve over time.

The properties / characteristics above are always true for (intelligent) agents. However, there are more characteristics of intelligent agents which can be true for some agents:
- **Being social** – Interacting and communicating with other intelligent agents.
- **Being customized, or adaptive** – Intelligent agents that adapt their behavior based upon earlier experiences. To put is shortly, the learn.
- **Being mobile**
- **Being believable** – The intelligent agent is audible or visible for users, and maybe they have aspects of personality and/or emotions.

An (intelligent) agent assist people. They are needed to assist in filtering and searching for information, customizing information, and automating / taking over tasks that people could have done themselves.

Agents can be situated in different environments. The environment of the agent is based on properties that can influence the decision-making process of the agent. The types of environment include:

- **Accessible vs inaccessible** – An accessible environment is one where the agent can obtain complete, precise, and well-timed information about the environment. It is less complicated to build agents that will operate in a more accessible environment.
- **Deterministic vs. non-deterministic** – An non-deterministic environment is one in which the outcome of the same action may produce two differing results.
- **Episodic vs. non-episodic** – in an episodic environment, the agent's performance is the result of a string of independent decisions. There is no link between the performed actions of the agent in different scenarios.
- **Static vs. dynamic** – A static environment remains unchanged unless the agents acts. A dynamic environment is one where the environment changes due to other processes than the agent.
- **Discrete vs. continuous** – A discrete environment is one where the possible actions are finite and fixed. A continuous environment is the opposite.

Intelligent agents can be applicated in several domains:
- **Industrial applications**, such as manufacturing, process control, or air traffic control.
- **Commercial applications**, such as information management (to filter and gather information), business process management (to assist with management of business processes), or electronic commerce (to perform commercial decision making).
- **Medical applications**, such as monitoring patients, or applications in health care.
- **Entertainment applications**, such as games, or cinema and interactive theater.

APPENDIX

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