Experiencing the impact of food choices through a playful, interactive supermarket environment.

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Abstract

Food production is a big part of the total greenhouse gas emission. Therefore, it is important that our food choices become more sustainable. The first step to this is making people aware of the impact of their food choices. After this, they need to know how to make sustainable food choices. Therefore, this thesis aims to make children aware of the impact of their food choices through using interactive technology. The creative technology design process will be used to create and evaluate an interactive installation that can be used in the supermarket. This is to gain insights on how to use interactive technology in a playful way in the supermarket environment to make children more aware of their food choices.

First research was performed on what factors influenced the food choices of children and how children's food choices can be changed. After this, research about sustainable food was performed. This data was used to make an effective prototype. Thereafter interviews with the stakeholders were performed to get insights into their needs. After this, interesting technologies were researched to use as a starting point for the ideation. A mind map of interesting concepts was made. The interesting concepts were picked, and an initial idea was made. After this, a prototype was made. The effectiveness of this prototype was tested in the supermarket environment.

The result of this research was that the children did like to use the prototype that was made based on the data that was collected, but they did not pay attention to the information about sustainable food choices. Because of this, they did not become aware of the impact of their food choices by using the prototype. Therefore, more research needs to be performed on how to display the information in a child-friendly way.

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Chapter 1 Introduction

The eating habits of people are getting worse. The number of people with obesity in the Netherlands is rising over the years [1]. According to the WHO, the number of people with obesity has nearly tripled since 1975[2]. This means that obesity is a rising problem in the whole world. Obesity can be a consequence of unhealthy food choices.

Another problem that comes with the eating habits of people is sustainability. 26% of the total global greenhouse gas emission comes from the production of food [3]. Most people are not aware of the impact of their food choices on the environment. They can reduce their footprint by being aware of the impact of their food choices. They need to change their eating habits. This can be achieved by making people more aware of the impact of their food habits on the environment.

The place where people buy most of their food is the supermarket. Dutch supermarkets do have a 51% revenue share of the whole food and drinks market [4]. This makes it a nice place to make people aware of the impact of their food choices on their health and the health of the environment. Currently, the supermarkets are not informing their customers enough about the impact of their food choices [5].

To change make their food choices more sustainable, they should become more aware of the impact of their food choices. This is important to increase the health and wellbeing of people and can decrease the prevalence of diseases of the population [6]. It is also important due to the sustainability issues that come with food choices. Research has shown that encouraging people to eat more sustainably has a significant impact on the overall emission reduction [7]. Children are the most appropriate people to change their food choices. This is because children are still developing their food habits and starting to make their own food choices [8]. Research by Van 't Riet, Sijtsema, Dagevos and De Bruijn has shown that making habits are easier than changing habits [9]. Therefore, it is more effective to use people who start creating their food habits than changing the food habits of people. This makes children the right people to change the food choices of society.

The generation of people that can have the most impact on this is the children because they have the most years of life left. Therefore, a solution that makes children more aware of the impact of their food choices on the environment and their health is a first step that needs to be made. This research will be performed with the support of the research team of ACHIEVE [10]. ACHIEVE stands for "Altering habits from Childhood on, promoting Healthy and environmentally sustainable food choices in Interactive Embodied play environments for Vitality and the Environment. The goal of ACHIEVE is to make children more aware of the impact of their food on the environment and their health. The research question that will be answered is:

"How can interactive technology be used in the supermarket in a playful way to make children more aware of the impact of their food choices on the environment?"

To answer the research question and provide a solution several steps need to be performed. First, we perform research about how children's decisions making works. Then we will research the current situation in supermarkets to make people aware of the impact of their food choices. After these interesting technologies to use for the prototype will be researched. This background research will be used as a starting point for the prototype. Thereafter prototypes will be developed and tested to come up with the most optimal solution that can be used in the supermarket.

Chapter 2 Background research

This chapter is about the background that is relevant to our research. The first aspect that will be researched is which factors have an influence on the food choices of children. This is to gain insights into how children make food choices and how these choices can be influenced. This information will be considered for the rest of this project.

The second part of the background research will be about the sustainable food chain. This research will be about how the food chain looks and what steps can be taken to make the food chain more sustainable. This information will be used to educate children about sustainable food chains.

The following part of this research will be about the state of the art. The state of the art consists of what our stakeholders are already doing in the field and what they expect from the project. Here the information of the conducted interviews will be presented.

After this related work will be researched. Here several projects done in the field will be researched. These projects will be used as an inspiration for the further development of this project.

The last part will be about interesting technologies that can be used within this project. The aim of this is to research different projects that use different technologies. These technologies will be used as a basis for the further development of the prototype.

2.1 FOOD CHOICES OF CHILDREN

2.1.1 Factors of children's food choices

Several factors influence the food choices of children. The factors can be divided into three main categories. These categories are food characteristics, children's internal beliefs and the environment of a child.

Food characteristics are the first factor that influences the food choices of children. Waddingham, Shaw, Van Dam and Bettiol show that texture, pleasure and eating context (hot drinks on cold days) are criteria for the food choices of children [11]. Their research also suggests that pleasure is the most important criteria for the food choices of children. Research conducted by Scaglioni, Arrizza, Vecchi and Tedeschi suggests that liking these food characteristics is shaped by genetics [12]. Genetics have an influence the appetite and taste of children. This has a strong impact on the food choices of children. Research by Ventura and Worobey also discovered that the perception of flavour is strongly influenced by genetics [13]. These research show that food characteristics are a factor that influences the food choices of children.

Children's internal beliefs are another factor that influences their food choices. Research by Ogden and Roy-Stanley proposed a model of three themes [14]. Two themes can be related to internal beliefs of children. These themes are drivers and polarized reasoning. The key influences of the drivers are hunger, emotion, health, liking and availability. A child will take this into account when deciding which food to choose. Polarized reasoning is about what children think about the food (bad, good or more nuanced). Children will make food choices based on this polarized reasoning. Waddingham, Shaw, Van Dam and Bettiol states that the internal beliefs of children are about the versatility of food and knowledge about food [11]. In general children have a lack of knowledge about food. Therefore, the knowledge criteria have less impact on their food decision making. This shows that children's beliefs about food are factors that influence the food choices of children.

The social environment around the children can also influence the food choices of children. The environment has an influence on the food choices of children in different ways. Ogden and Stanley call this source of food [14]. Sources of food are about where children can get their food from for example their parents, peers or routine. According to Waddingham, Shaw, Van Dam and Bettiol, the environment can impact the food choices of children by social acceptability [11]. Children will be making food choices based on the acceptability of a certain food within their environment. Another research conducted by Scaglioni, Arrizza, Vecchi and Tedeschi claims that the environment has a strong impact on the food choices of children [12]. Children's environment can impact them in different ways. The most important is the influence of the parents on food choices. Parents influence what their child eats by how they teach their children about their food habits. There is strong evidence that the diet and weight status of children and parents' correlate. The perception of body mass index (BMI) also influences the food choices of children. Children take over the perceptions of what society thinks the healthiest BMI is and change their food choices based on that [12]. Research by Ventura and Worobey shows that exposure to different flavours at an early age will also determine the food choices of children [13]. Their environment is mostly the source of exposure to different foods. Parents have the biggest influence on the early exposure to different flavours. This shows that the environment is an influencing factor in the food choices of children.

2.1.2 Food preferences of children

Children like certain food characteristics. Food characteristics can be split up into texture, taste, and colour. Children prefer a smooth texture over a lumpy texture with pieces [15]. They also like textures that facilitate mastication [16]. The dishes that children like the most are to some extent sweet and are low in bitterness and sourness. Flavour intensity and variation is positively associated with the liking of food. Research shows that children prefer food in the colours red, green, orange and yellow, in that order [17].

Children also have specific internal beliefs about food. Children like food that is positively accepted by their environment for example [16]. Research conducted by Marty, Chambaron, Nicklaus and Monnery-Patris shows that children will be more likely to eat a specific food when others like the food too [17]. Children find vegetables unappealing, and they do not like that vegetables that look unfamiliar [16]. This is supported by research conducted by Scaglioni, Arrizza, Vecchi and Tedeschi. They state that food neophobia plays a role in the food choices of children [12]. Food neophobia is about only eating foods that children know. This means that children prefer to eat food that they are familiar with. Food neophobia is formed at an early age. Because of the familiarity, children know if they like the food and if the food is potentially harming or can cause sickness. This shows children do like food that is familiar, appealing, accepted by their environment and harmless.

2.1.3 Improvement of children's food choices

Several techniques can be used to change the food habits of children by taking the factors that have an impact on the food choices of children into account. These techniques can be used on different levels. Levels that can have an impact on children are social, parental and societal.

The first level is social. The social level is about how the social environment (friends, acquaintances, family etc.) influence the eating habits of children. The first technique they can use is exposure. Involving children in food preparation and exposing them to the new food will improve the dietary quality, intake of specific foods and dietary related perceptions among children [18]. Several learning paradigms can be used to encourage children to change their eating habits [19]. Familiarization is one learning paradigm that can be used to change the eating habit of children and has many similarities with exposure. Familiarization is also about constantly exposing children to a certain food to decrease food neophobia and to make them familiar with these foods. The main difference between exposure and familiarization is about the goal. The goal of exposure is to develop the eating behaviour of children by exposing them to different types of food. The goal of familiarization is making children eat specific food types by exposing them to that type of food. Associative learning is another paradigm that can be used [19]. Associative learning is about linking known behaviours to new behaviours. Associative learning around food can be categorized into three forms: flavour-consequence, flavour-flavour, and flavour-context. Flavour-consequence is about connecting the physical consequences (illness, allergy, more energy etc.) of the food with a new flavour. Flavour-flavour learning is about connecting known and liked flavours to new flavours. Flavour-context learning is about connecting the new flavours to a positive context. This shows that the food choices of children can be impacted on the social level. Techniques to influence the food choices on social level are familiarization, exposing, encouragement, involvement, and modelling.

The second level is the parental level. Parents can have a direct impact on the food choices of children [12]. Strategies that they can use are modelling, encouraging, exposing, explaining the benefits, involving children in the preparation or selection [20]. Modelling is about showing how certain behaviour is performed. Parents can create positive associations with different foods using modelling. Therefore, modelling is a type of associative learning. The risk of this is that children will take over the negative habits as well. The most effective way of modelling is eating meals together. This is a form of flavour-context learning [19]. Another strategy that can be used while eating together is encouraging to try a small amount of food. Parents can also make use of the exposing strategy. Exposing children to a different variety of foods is an effective way of exposure to use as a parent. Giving the children the opportunity to choose will increase their willingness and their intake of the vegetable choice [21]. Explaining the benefits of food is also a way to encourage children to eat a certain food. This is a form of flavour-consequence learning [19]. The risk of this is that it will increase food neophobia. Involving children in food preparation or selection is also an effective way to make

children aware of their food choices. This can be done through shopping with children, growing food at home or preparing a meal with a child. This research shows that parents can use different techniques to improve the food choices of children. Techniques that parents can use to have an impact on the food choices of children are modelling, encouragement, exposing, explanation, involvement, and familiarization.

The last level is the societal level. The societal level is about how society can impact the food choices of children. The first place where society can impact the food choices of children is the schools. Educating children about food and the impact of their food choices can have a positive impact on their health. This is a form of flavour consequence learning [19]. The healthy highway program is a program that tries to improve the healthy eating knowledge of children [22]. Healthy food literacy education, physical education classes and cafeteria activities about healthy food have shown to be an effective method to improve the food habits of children. Society can also have an impact on the food choices of children. A Portuguese study shows that the government can have an impact on the food choices of children [23]. The government made laws that focused on making the lifestyle of all the Portuguese people healthier. Strategies that the government used to help people make more healthy food choices are changing the availability of certain food, exposing, promoting, educating, and changing the regulations. These were effective strategies to change the food choices of the people. This shows that society can have an impact on the food choices of children. Exposing, educating, regulating, and promoting are techniques that can be used on the societal level.

2.1.4 Conclusion

The goal of this part of the background research was to find out how to improve the food habits of children in general. This review shows that improving the food habits of children can be done by looking at the factors influencing the food habits and using techniques to improve the food habits of children. Factors influencing the food choices of children are food characteristics, children's internal beliefs and their environment. Furthermore, this research shows that children can improve their food habits with the help of three levels, namely the parental level, social level, and societal level. Several techniques can be used on these levels to influence the food choices of children. Based on these findings the framework shown in figure 1 is made. This framework can be used as a tool to improve the food habits of children effectively.

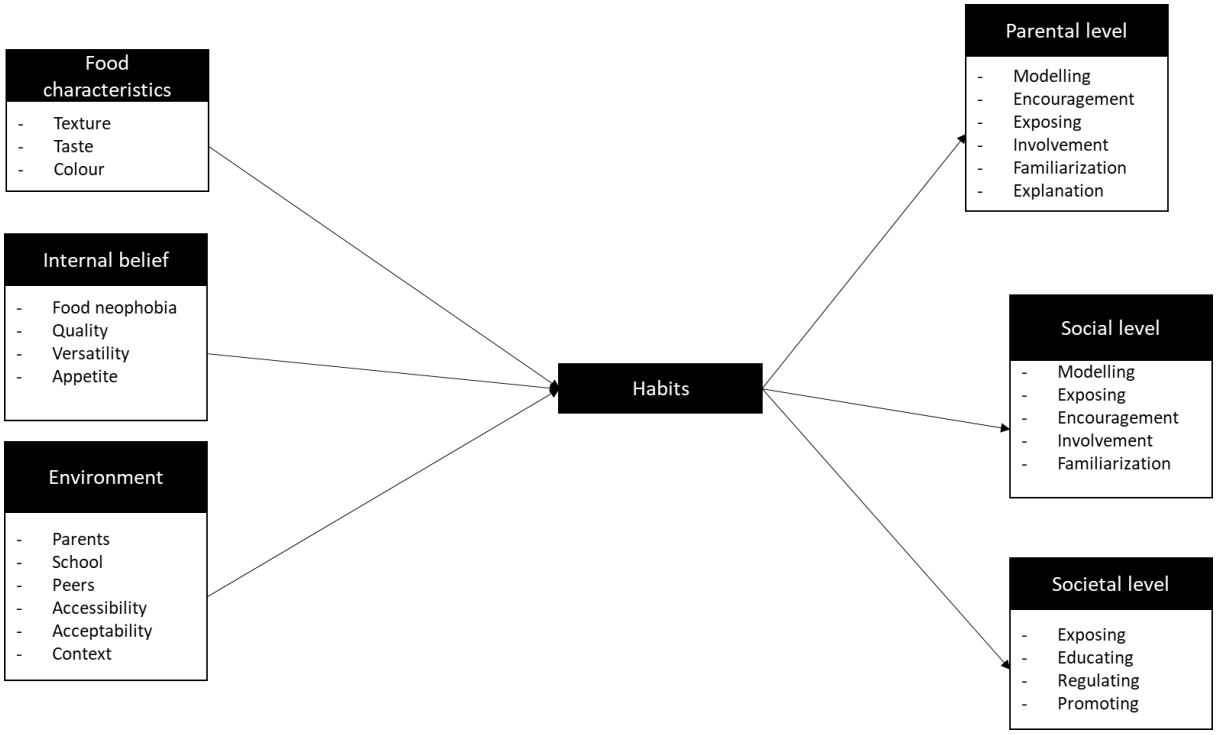

FIGURE 1: FOOD HABIT CHANGE MODEL

2.2 SUSTAINABILITY OF FOOD

2.2.1 Food chain

The food chain can be very complex. Therefore, a model needs to be made to make it easier to understand. There are several foods chains models. Some of these models will be discussed. The first model is made by Too Good to Go [24]. The model consists of producers, handling and storage, processing and packaging and sales and distribution. The first step of the food chain model of Too Good to Go are the producers of the food. Thereafter the products need to be stored and treated. After this, the food needs to be processed and packed. Now the products are ready to be distributed to the shops and sold to the people. Nikolicic, Kilibarda, Atanaskovic Dudak and Ivanisevic proposed a simpler model while they researched the impact of RFID technology on logistics process efficiency in the retail supply chains [25]. They made the processes that food goes through before it lies in shops, into fewer steps. This is mainly because the research focused on the distribution. These steps are shown in figure 2.

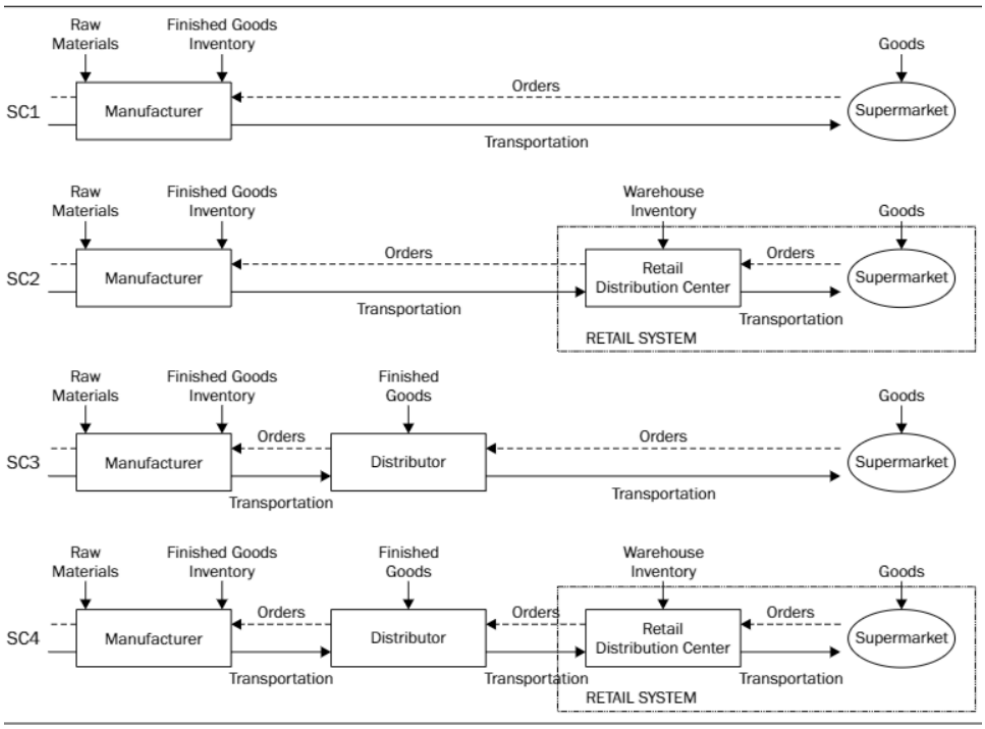

FIGURE 2: DISTRIBUTION PROCESS IN THE SUPPLY CHAIN OF SUPERMARKETS [25, FIG 1].

Another model was made by researchers called Garcia-Oliveira, Fraga-Corral, Pereira and Prieto [26]. According to them, the supply chain consists of the food production system, distribution and consumers. They also mention the sustainability challenges of each step of the food chain. The model is shown in figure 3.

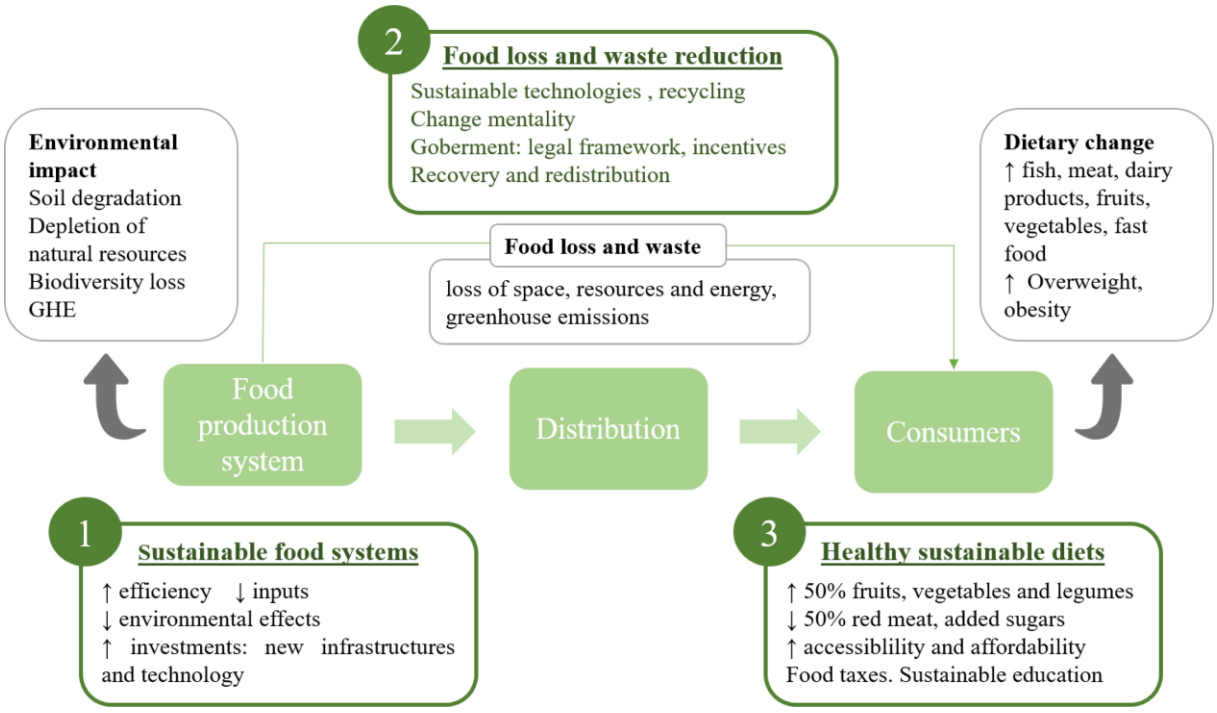

FIGURE 3: GLOBAL CHALLENGES TO ACHIEVE SUSTAINABLE FOOD SYSTEMS [26, FIG 1]

From these models can be concluded that food production consists of three general steps. These steps are food production, distribution, and consumers. Food production consists of producing, handling, and treating the food. Distribution consists of receiving, packaging, and distributing the food. Consumers consist of buying and consuming the food. Challenges occur on all levels of the food chain. that come with these steps are the destruction of land ecosystems, loss of nature, food loss, greenhouse emissions and poor diets.

2.2.2 Improving the food chain.

These challenges can be addressed on all levels. Research conducted by Garcia-Oliveira, Fraga-Corral, Pereira, and Prieto mentioned a method to prevent food loss with the help of all levels [26]. This method is called Agroecology. Agroecology is a system that consists of three parts. These parts are society, farmland, and livestock. Farmland and livestock are the producers of the food and the society the consumers. All the by-products of society are used in other parts of the system. The livestock is fed with the leftovers of the farmland and the society, and the farmland uses the manure of the livestock. Using by-products will also reduce the food waste. Agroecology can be seen as a sustainable way of producing food. This is mainly because of the food waste reduction and the fact that they make use of a short food chain.

There are also several options to reduce the impact of food on the production level. A method that can be used is the reduction of greenhouse gasses. This can be done through the reduction of enteric formation for example. This can be achieved by varying the type and amount of food consumed and using feed supplements that inhibit the methanogenesis (the formation of CH_4 in the stomach of livestock) [26]. The development of food with resilience through genetic modification is also a method to reduce the impact of the food on the ecosystem [26]. This will make crops less prone to diseases and take less energy to produce.

The impact of food can also be reduced on the distribution level. One method that can be used is the redistribution of safe discarded food [26]. The consequences of this are that there will be less food waste. This will decrease the need of producing other food. Improving the food storage and expiration labels is another option to reduce food waste. Increasing the self-lifetime and safety of food can also reduce food waste. This can be achieved by rationalizing the expiration dates, better planning and using preservation techniques [26]. Another method that can be used is the distribution of local food [27]. This will decrease greenhouse gas emission and increase food security because of the short distribution system. Some important challenges need to be looked at to decrease the impact of distributing local and organic food to the environment. These challenges proposed by Baez, Sequeira and Hlletofth are [27]:

#	*Challenge*
1	Maximizing the distribution of local and organic products in the long term
2	Optimization of the route distance and delivery time for producers
3	Accessibility in terms of location
4	Accessibility in terms of hours and days of operation
5	Reducing the time and distance for a customer to access the market/shop
6	Availability of infrastructure, capacity, and equipment on the distribution channel to meet demand requirements for local and organic foods
7	Transferring logistics and best practices from the conventional supply chains to improve efficiency and effectiveness.
8	Bringing positive contribution to the ecosystem, biodiversity and landscape in sustainable food production distribution and consumption

Food impact can also be reduced on the customer level. This can be achieved by picking the most sustainable food options. The life cycle assessment is a tool to use to look at which type of food has the least impact on the environment [28]. There are two main types of impact of food on the environment according to the life cycle assessment. These types are the use of resources and the emission of pollutants. The use of resources is about the land used for the production and use of fossil energy. The emission of pollutants

is about acidification, eutrophication, and emission of greenhouse gases. Another method that can be used on the customer level is reducing food waste. This can be achieved by eating food with expired expiration dates. Expiration dates ensure the quality until a certain date [29]. Most of the times the food is still eatable. Before eating these foods, the customer has to check the quality by using his senses. The customer can still eat the food when the food still smells, looks, and tastes right.

2.3 STAKEHOLDERS

Four companies are involved in this project. These companies are Jumbo Leussink, LTO Noord, Mineral Valley and UW-s. LTO Noord and Mineral valley are organisations that financed the project. LTO Noord is a representative of the farming sector in the north of the Netherlands [30]. Mineral valley is tries to connect farmers to improve the soil quality in Twente [31]. Jumbo Leussink is a retail group that owns 7 different supermarkets in the east of the Netherlands. The specific supermarket that we are going to work with is the Jumbo in Goor. This is a new location that focuses on sustainability. UW-s is a company that focuses on using technology in the supermarket environment to communicate with customers.

2.3.1 Jumbo Leussink

Jumbo Leussink is the supermarket that we collaborate with to make an interactive installation. The interactive system has to make children aware of the impact of their food choices. The interactive system is part of the new supermarket they opened in Goor [32]. According to Jumbo Leussink, this is the most sustainable supermarket in Benelux. They have a circular shop interior. Circular interior is about using materials that have the least impact on the environment. They also have a local product range. This product range is called Noaberschap. Noaberschap only has a supplier that is close to the supermarket. All suppliers are within a reach of 15 kilometres from the supermarket. This makes the supply chain of these product very short. Furthermore, they sell products with sustainability quality marks. Examples of these quality marks are Beter Leven Keurmerk, Respeggt, ASC or MSC quality marks and the PlanetProof quality mark. Furthermore, they have a “Samen Minder Verspillenschap” [33]. Here the customers can find product are close the expiration date. This is to reduce food waste.

Besides the fact that the supermarket makes use of different techniques to make their supermarket more sustainable, they also make use of various technologies within their supermarket. They have screen and interactive price tags in whole the supermarket. These technologies can be used in the combination with our interactive system. They make use of the technological solution that UW-s has to offer to make their supermarket more interactive. Examples of this are the KidsClub and the big screens that display information within the supermarket [34].

2.3.2 UW-s

The other company that we are going to work with for this research is UW-s. UW-s provides us information about the technologies they use in supermarkets that are focused on children called the KidsClub[34]. The KidsClub consists of three technologies: the touchwand, the interactive shopping cart and the tablet tables. The technology we are going to focus on is the interactive shopping cart. The interactive shopping cart consists of a shopping cart with a tablet attached at the front. On the tablet, children will be able to play games and see information about certain products for example. All the games are run on the shopping carts themselves. Therefore, it does not make use of Wi-Fi while children are playing. Wi-Fi is only used to update the games or add new features. The shopping carts can display different information on the screen based on Ibeacons[35]. These beacons can detect with a Bluetooth low energy signal if the cart is nearby and send a signal based on this. This signal can change the information that is displayed on the screen of the shopping cart. The signal normally has a reach of around 10 metres but can change based on the settings. The UW-s determines the signal strength based on the supermarket environment. Sometimes they struggle to calibrate all the sensor correctly. This is mostly because of the position of each beacon opposite to another beacon.

The software is built with Adobe air. Another important aspect of the shopping carts is the sound system. The system provides voice explanations and sound feedback. This is made for children that are not able to read. They also try to keep the shopping carts as simple as possible. This is to make the shopping cart accessible for all the children. UW-s are missing some aspects. They want to make their shopping cart more informative instead of only being able to play games on the tablets. They also did not do an extensive user test with children. Therefore, they want to focus more on children in the redesign process. UW-s want us to make a system where they can take inspiration from.

2.4 RELATED WORK

The goal of this research is to create an interactive technology that can be used to make children more aware of the impact of their food choices on the environment in a supermarket. Therefore, it is important to research what is already done in the field of technology in supermarkets and programs that make children more aware of the impact of their food choices.

The supermarkets have done several things to make people more aware of the impact of their food choices. One example project is the supermarket of the future of Microsoft [36]. Microsoft and the Coop in Italy made an interactive supermarket environment with the help of 250 Kinect devices and several screens. The Kinect devices will detect the movement of the customers and display information about the products on the screen based on the movement of the customers. The screens were able to display information of around 1500 products. The information that got displayed was about allergy, sustainability, and the food chain.

FIGURE 4: SUPERMARKET OF THE FUTURE [36]

Another project is the Färmoscoop [37]. This is a Belgian project. The project is about stimulating people to consume more biological, local and moralistic. The project makes use of special labels which display information about sustainability and a sustainability score based on 11 sustainability criteria. The product gets a point when a criterion is met. These criteria are:

1. Products from bio-agriculture.
2. Products from unlisted companies.
3. Products from Belgian companies.
4. Products for Belgian producers and processors.
5. 80% of the ingredients have to be local.
6. Belgian and European brands mention the origin of each ingredient.
7. Brand in the possession of the producer or collaborate with known food chains.
8. Products that go beyond the bio labelling.
9. Raw and less energy-consuming products.
10. Products with deposit or 90% out of paper.
11. Products in bulk.

A product gets a point based on the fulfilment of one or more criteria. This score is called the Färmoscore. With this, they want to make the food industry more sustainable, more ethical and fairer for every company.

Another interesting project was done by the researchers Kim, Kogan, Dasgupta, Novitzky and Do [38]. They made a mobile game for children to combat obesity. The game is called Grocery Hunter. The goal of the game is to teach children to make smart nutritional choices at the grocery store while shopping with their parents. Children have to search for healthy food in the grocery store. The app will only show the food that is nearby the child. This is to keep the children near their parents while shopping. The child has to scan the correct item. The app will provide nutritional information if the correct item is scanned. Otherwise, it will say that the item scanned is incorrect and it will give another clue.

Another interesting project is made by Studio Dip [39]. Studio Dip created an interactive surface that could recognize fruit and vegetables. The system makes use of a projector, a camera and image recognition software. The surface will display recipes based on the fruits or vegetables that are on the surface. This technology was implemented into the supermarket environment. With this, they try to show how computer vision can be included in our daily life.

Antle, Matkin and Warren also proposed an interesting technology to make children aware of the impact of certain products [40]. They had an idea to make children aware of the impact of a certain product through hands-on interaction. For this they wanted to use a finger-tip sensor, back-of-the-hand touch display and controller, augmented reality contact lenses, a tablet application and a crowd-sourced database. The finger-tip sensor

was to determine the composite of the real-world materials. The user will see information about the product they touch based on the composite. The information displayed is about the materials used, production process, impact to their body, how it will be disposed of, the environmental or social right challenges of the product and how they can take positive action. This was to make children understand how the products around them have an impact on the environmental footprint and how they can make the world better or worse with their choices.

2.5 TECHNOLOGIES AND TECHNIQUES TO USE TO FOSTER CHILDREN'S FOOD CHOICES

This part will be about technologies that can be used for the interactive installation that will be implemented in the supermarket. The installation will consist of hardware, physical aesthetics, digital aesthetics and a story. Hardware is about the electronics and other components that will be used; physical aesthetics are about how the installation is going to look from the outside; digital aesthetics are about how the digital environment of the installation looks like, and the story is about which information will be displayed and how the information will form a story.

Several hardware components can be used for the interactive installation. A technology that can be used is sensor fusion. A layer model can be used to implement sensor fusion successfully [41]. Sensor fusion is using multiple sensor inputs. A layer model is a model that breaks up all the task into different layers. This will make clear which data is sensed and which steps it takes to process that data. The tangible user interface is a specification of sensor fusion. Research conducted by Revelle, Zuckerman, Druin and Bolas show that tangible user interfaces are promising for children [42]. Tangible user interfaces are about using real physical objects that are relevant to a task. These real physical objects are used as a controller of the game. This will support the traditional learning of exploring how something works by being able to play with the object.

Several physical aesthetics aspects can be used to make children more aware of the impact of their food choices. Targeted shopping cart decoration is one technique that can be used. Research performed by Huitink, Poelman, van den Eynde, Seidell and Dijkstra showed that shopping cart decoration focusing on purchasing fruit and vegetables will increase the purchase of fruit and vegetables [43]. Because of this, you can suggest that focussed decoration has a positive impact on the purchasing behaviour.

Another technique that can be used is data sculpturing [44]. A data sculpture is a data-based physical artefact. It is having a mix of artistic and functional qualities. It aims to increase the understanding of data among the audience.

There are several digital, aesthetical aspects that children like to see on digital displays. One of these aspects is cartoons. Research of Gonçalves, Ferreira, Conceição, Machado, Boyland and Vaz showed that cartoons can be part of health promotion campaigns [45].

Another technique that can be used is emotionally persuasive icons [46]. These icons include sight, sounds, smells, ideas and words which are connected to negative and positive effects or feelings through learning and experience. This can increase empathy.

There are also several techniques to display and create a story for children. One of these techniques is advergames. Advergames are games where the product and brand are the central feature of the game in a fun and playful environment [47]. The goal of an advergame is to persuade children to adopt a certain behaviour. Making a story about a specific product or concepts is an effective way to improve the knowledge of children about that. Another technique that can be used is interactive narratives. Interactive narrative is systems that use narrative generation techniques to create multiple story variants [48]. This will make it possible to create multiple different stories with the help of a database.

Chapter 3 Methods and techniques

During this project, the Creative Technology Design Process will be used to develop an interactive installation [49]. The four stages of this process will be followed to develop the interactive installation. These stages are Ideation, Specification, Realization and Evaluation.

The ideation aims to create a product idea based on prior knowledge, user needs, stakeholder requirements and technological possibilities. Several creative thinking methods can be used as inspiration. This project will make use of a mind map. The mind map will consist of different concepts on how a shopping cart can be made interactive. The best aspects of these concepts will be combined at the end. The outcome of this will be the product idea.

The specification phase aims to specify the project idea further. During this phase, the component that can be used will be tested. This will be done by making small, simplified prototypes of different aspects of the final product. The goal of testing the components is to get global requirements for the final concept.

The realisation phase is about making the final prototype based on the findings of the specification phase. The prototype will be made based on the requirements that are found during the specification phase. All the concepts will be combined into one prototype at this phase. This will result in an interactive shopping cart that children can use within the supermarket environment.

During the evaluation phase, the prototype will be evaluated. The aim is to test if the interactive shopping cart will be used by the children in the way that the requirements of the specification phase are met. The prototype can be improved with the results of the evaluation phase.

Chapter 4 Ideation

During the ideation phase ideas will be developed. These ideas will be used to come up with a prototype. The ideas will be generated by making a mind map that consists of different concepts. Some of these concepts will be picked and implemented into the final prototype.

4.1 MIND MAP

A mind map was made to start the ideation. This mind map is shown in figure 5. This mind map was made to identify different possible concepts for the interactive installation. The concepts are marked blue on the mind map. All the concepts contain different parts. These parts are marked orange. The white boxes contain how these parts of the concepts can look like.

All concepts will be evaluated after making the mind map. All the strong points of all the concepts will be written down and used in the process of developing a final concept. The goal is to combine the strong point into one final concept. This concept will be used to develop the interactive installation.

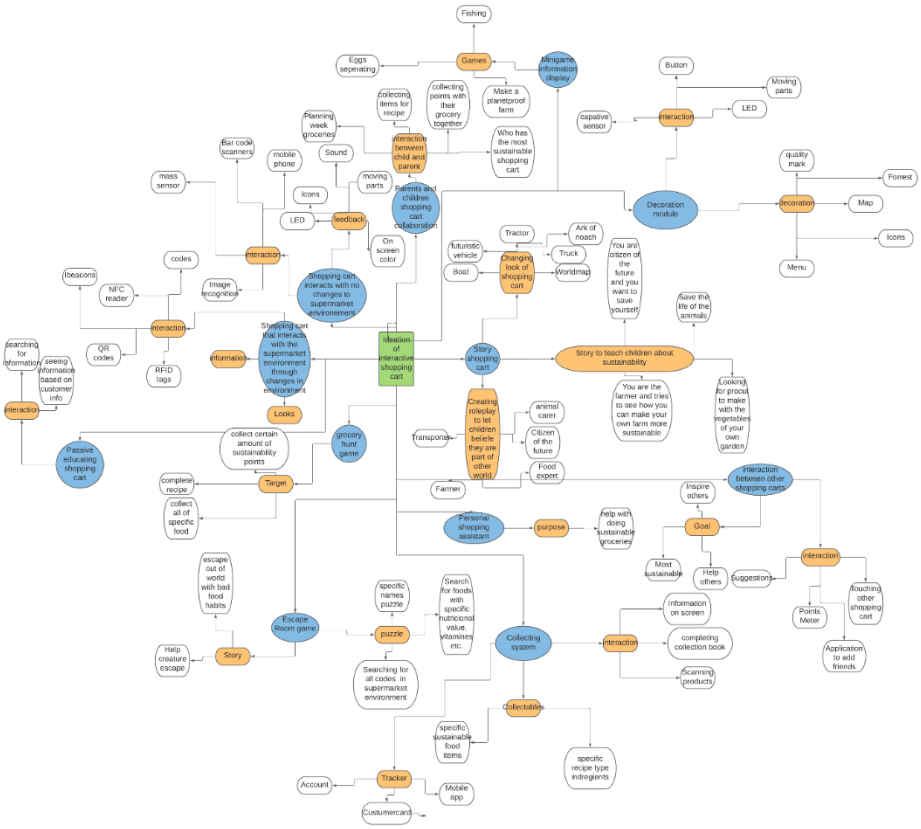

FIGURE 5: IDEATION MIND MAP

4.2 CONCEPT DEVELOPMENT

The concepts of the mind map had different strong points that can be used for the final concept. These strong points are used for the development of the final concept. These concepts will be combined into one final concept. The final concept consists of a total of 6 mind map concepts.

4.2.1 Interaction with the supermarket

the first concept that had to be used was the interaction with the supermarket. This is building on the fact that using tangible user interfaces are a nice way to learn children about concepts. [42]. The interaction module will function as the tangible user interface of the prototype These modules consist of objects that children can use to interact with the shopping cart. This module will be in the supermarket environment at specific points. Information about these points will be displayed on the screen when children interact with them.

4.2.2 Interactive information display

Interactive information displays will also be used for the final concept. Interactive information displays are displays that show information based on where the user presses. These displays will be used to display different information about sustainability and food choices. Children will be able to explore the information by clicking on different icons or objects on the screen. Each item will display different information in different ways. The information will be displayed in a child-friendly way. Furthermore, a cartoonish style will be used. This because it has been effective to promote a better lifestyle for children [45].

4.2.3 Personal shopping assistant

A personal shopping assistant will be used to explain different aspects to children. This shopping assistant should help the child with finding sustainable food products. The assistant will help the users through explanations and giving feedback. This feedback will also make use of interactive narratives [48]. This enables the system to display information based on the interaction the child has performed with the system.

4.2.4 Decoration module

A decoration module will also be used for the final concept. Research has shown that targeted shopping cart decoration can increase the willingness to buy a certain product [43]. The decoration module will be made around local foods. This is because local foods make the food choices of children more sustainable [27].

4.2.5 Collection system

A collection system will also be implemented to show the progress of the children. Children will be able to collect items to track their process and give them the possibility to look back at any point.

Chapter 5: Specification

This chapter is about the further specification of the ideation phase. The findings of the ideation phase will be used to specify the interaction of the user and the component of the interactive shopping cart. The purpose of this chapter is to list the prototype requirements.

5.1 INITIAL DESIGN

The initial design consists of different parts of the ideation. These parts will be attached to the current shopping carts of the supermarket. These parts are listed in this part of the chapter.

5.1.1 Tablet

The first part of the system is the tablet. The tablet will be used to display the application. The tablet will be attached to the front of the shopping cart.

5.1.2 Interaction module

The interaction module will enable the user to interact with the supermarket environment. This is a form of a tangible user interface [42]. This module will connect the shopping cart and the supermarket environment. Therefore, the interaction module will consist of two parts. The first part will be attached to the supermarket environment. This part will consist of something that can be read by the second part of the interaction module. The second part will be a reader who can read with which interaction module is interacted. The values will be used to display information on the screen.

5.1.3 Decoration module

The decoration module will consist of three parts. The first part is the aesthetics of the decoration module. The goal of the aesthetics is to communicate where the decoration module is about. The aesthetics are shown in figure 6. Focussed decoration will increase the likeliness of people buying local products [43]. The decoration module show which button belongs to which product category. The decoration will also have buttons. These buttons will enable the children to interact with the decoration module. information about certain local products will be displayed based on the button that is pressed. The Led strip on top of the decoration module will give feedback if the interactive shopping cart is near a shelf with an interaction module.

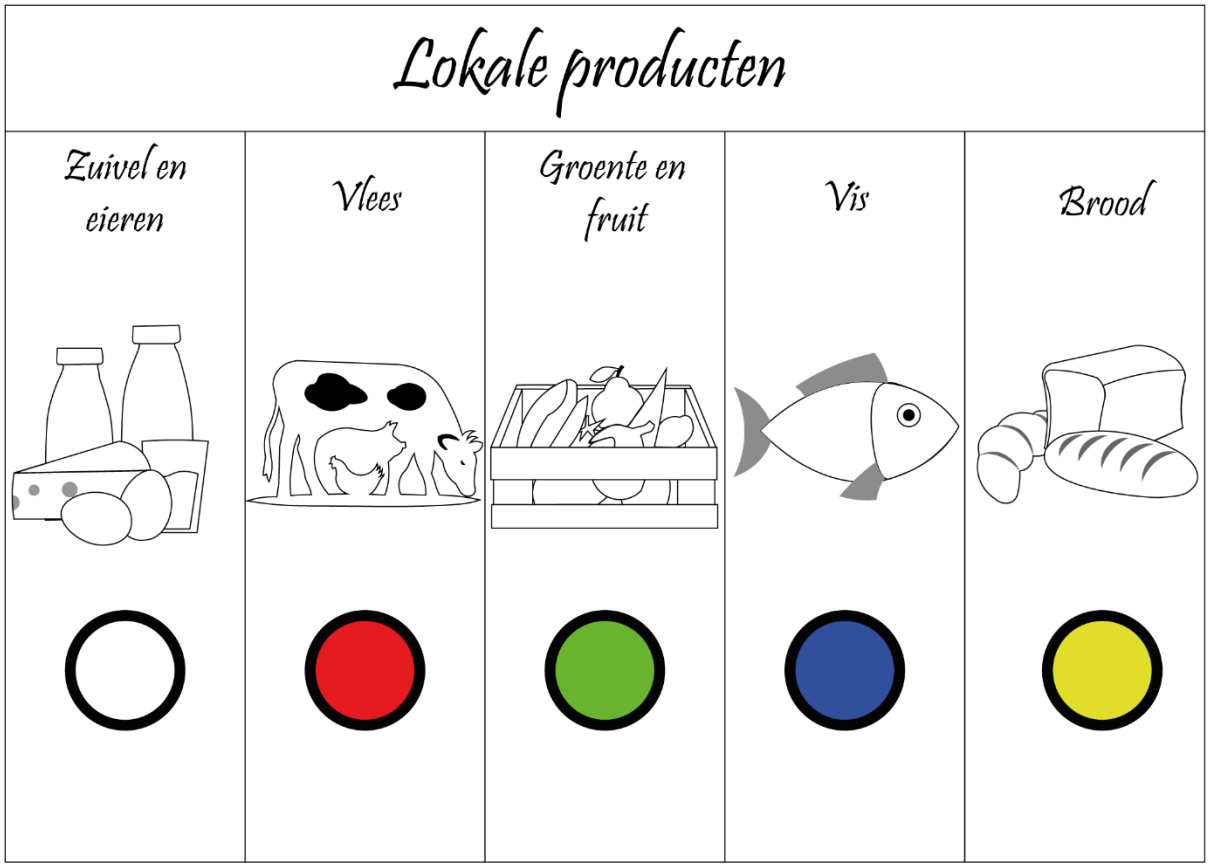

FIGURE 6: DECORATION MODULE

5.1.4 Ibeacons

The function of the Ibeacons is to determine the position of the shopping cart within the supermarket environment. The Ibeacons are placed in the supermarket environment. They will send out a signal to the system. The system will determine where it is based on the signal strength of the Ibeacons.

5.1.5 Application

The application will be the brain of the system. The aesthetics style will be cartoon. This because cartoons have been an effective way to make an application for children [45]. The application consists of different parts. The application will start with an introduction to the problem. A buddy will inform the user about the impact of their food choices on their direct environment. The buddy will tell that the user can reduce the impact by making sustainable food choices. After this, the buddy is going to tell that he is going to help with this. The last part of the introduction is about how to use the installation to make more sustainable food choices. The introduction screen is shown in figure 7.

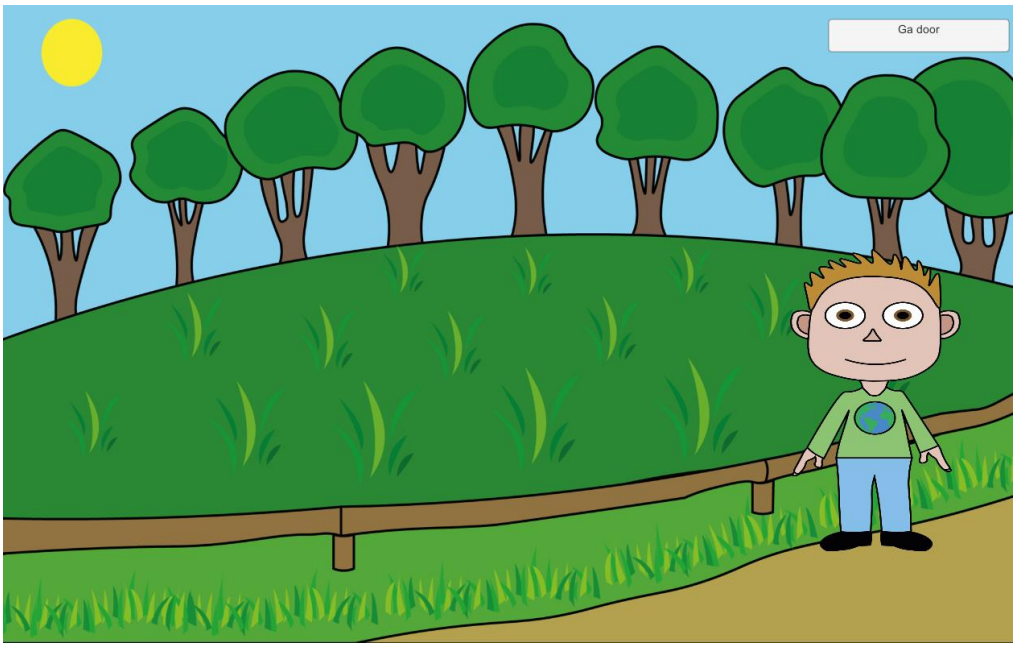

FIGURE 7: INTRODUCTION SCREEN

The user will be guided to the sticker book after the introduction. The sticker book will display the collected stickers. A screenshot of the sticker book screen is shown in figure 8. The stickers can be collected by interacting with the system. For example, clicking on specific items at the meat scene will give the user a sustainable meat sticker. The user can see where the sticker is about by clicking on the stickers. A summary of the information of where the sticker is about will be displayed by clicking on the sticker. The sticker book will also handle the interactions. It will read if a button of the decoration module is pressed, or a specific interaction module is read.

FIGURE 8: STICKER BOOK SCREEN.

A button press will guide the user to the Noaberschap information page. This page belongs to a certain product category. The category is based on the product that is pressed. Information about how certain Noaberschap entrepreneurs produce their products and how this is sustainable. A screenshot of such a screen is shown in figure 9.

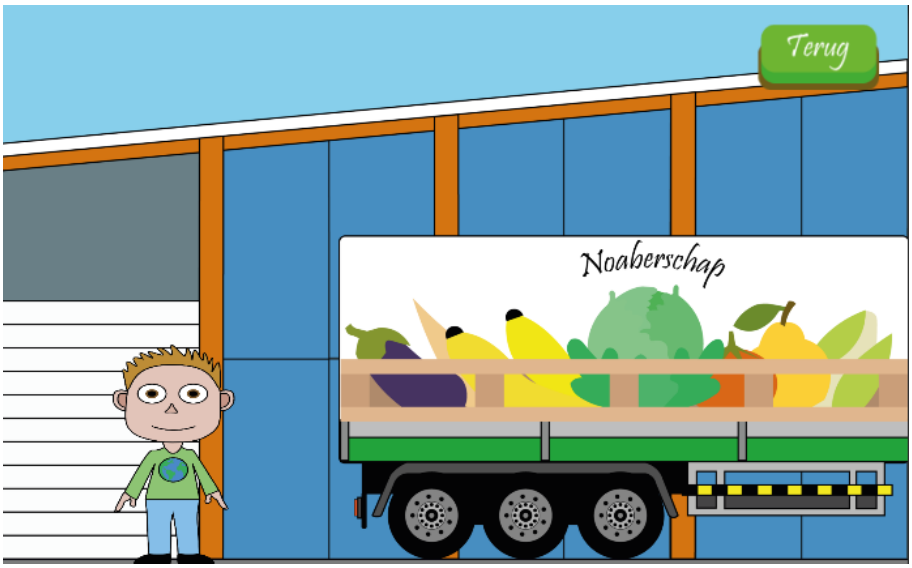

FIGURE 9: FRUIT AND VEGETABLE SCREEN OF NOABERSCHAP.

An interaction module interaction guides the user to the general information pages. The information screen will be chosen based on the interaction module that is read. The user will see interactive information pages. They will be able to click on different objects on the screen. A buddy will tell something about sustainable food choices based on the interaction with an object. An example of an information screen is shown in figure 10.

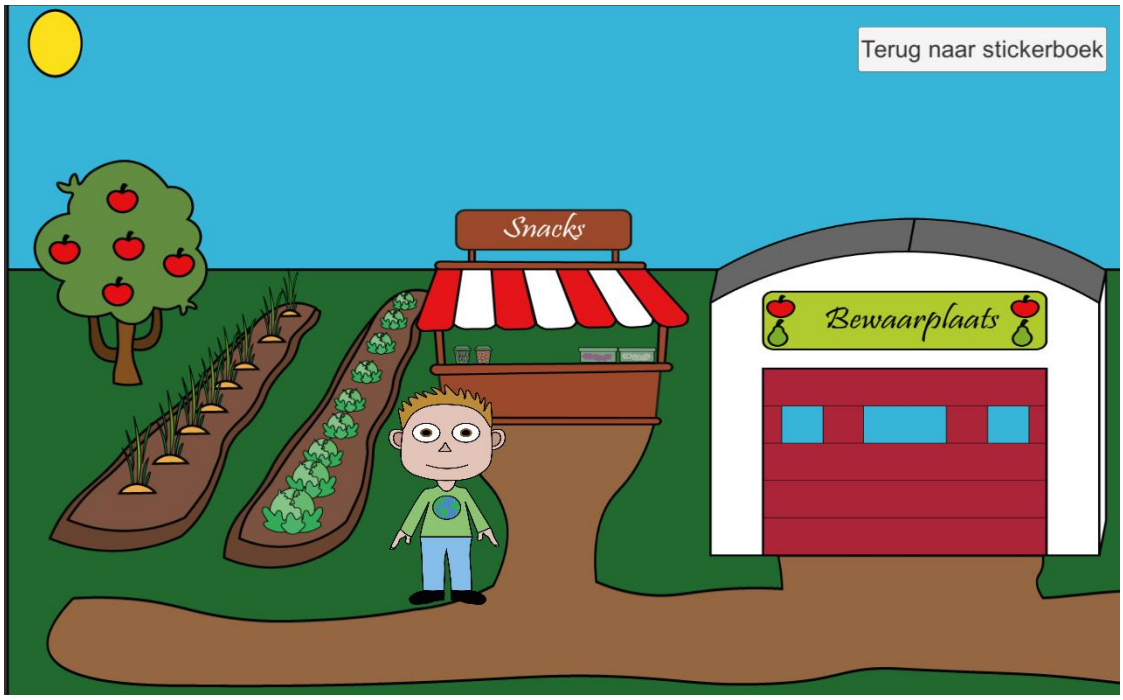

FIGURE 10: FRUIT AND VEGETABLE INFORMATION SCREEN.

At the end, the system will display feedback information. Interactive narrative will be used, so the information can be based on the stickers that are collected [48]. The feedback will be about what the user has learned, what can be done with this information at home, how many stickers they have collected and what is still left to learn. The feedback screen design is shown in figure 11.

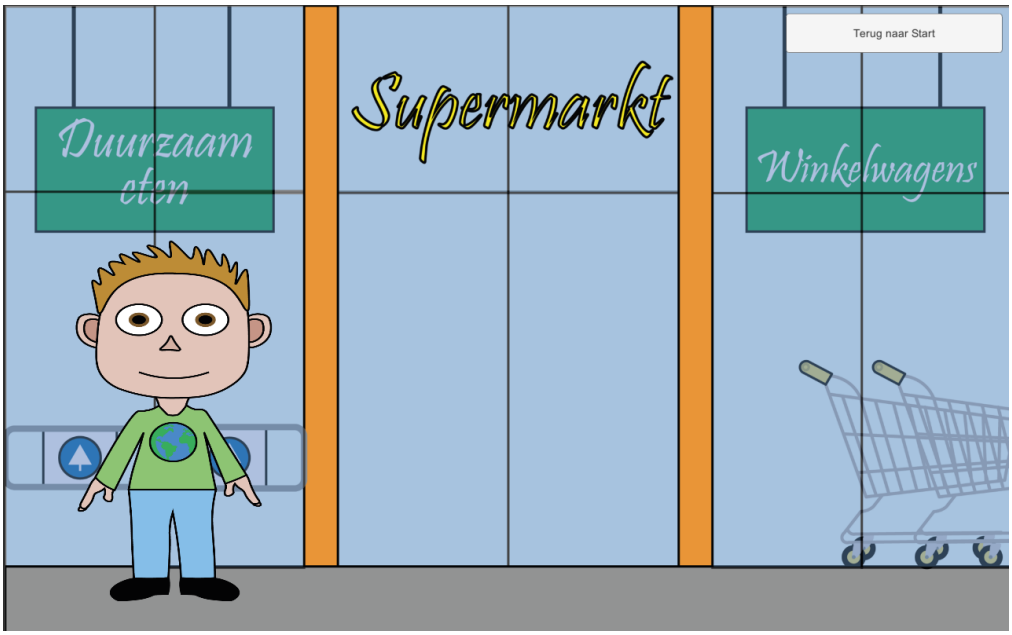

FIGURE 11: END SCREEN.

5.2 INTERACTION

This part will be about the possible future interaction methods that can be used for the prototype. For this a model proposed by van Delden, Jansen, Loos, Tetteroo, Vel and Zijsling will be used [50]. According to this model, interaction methods consist of an initial situation, action performed by a user, the reaction of the system to the action and the new situation of the system. After this, the reason for the interaction needs to be thought about to see if an interaction is useful for the prototype.

5.2.1 Decoration module (DM)

Interaction 1:

Initial situation:

led strips are off which means that no products related to Noaberschap, or sustainability are nearby.

Action performed:

Walking past Noaberschap product

System reaction:

LED strip turns on in the colour of the correct button.

New situation:

The correct lights are on.

Rationale:

The child becomes aware that he is near to a product of Noaberschap or sustainability product.

Interaction 2:

Initial situation:

Led strips are on indicating that you are near to a Noaberschap or sustainable product.

Action performed:

Child presses the button.

System reaction:

System goes to the page of Noaberschap company. It gives sound feedback to indicate that the screen state changed.

New situation:

The screen displays information about the Noaberschap company.

Rationale:

Make the children aware of where their food is coming from by actively interacting with the buttons on the decoration module and seeing the product in the supermarket.

Interaction 3:

Initial situation:

Led strips are off which means that no products related to Noaberschap, or sustainability are nearby.

Action performed:

Child presses a button to explore what it does.

System reaction:

LED strip turns on in the colour of the corresponding button. The system also goes to the page of Noaberschap company. It gives sound feedback to indicate that the screen state changed.

New situation:

The correct lights are on, and the screen displays information about the Noaberschap company.

Rationale:

The child becomes aware that he is near to a product of Noaberschap or sustainability product.

5.2.2 Interaction module (IM)

Interaction 1

Initial situation:

Child walks with the shopping cart in the supermarket environment.

Action performed:

Child sees an interaction module and walks to the module.

System reaction:

System puts on the led strips in the correct colour.

New situation:

Child is in front of the interaction module.

Rationale:

Children can find different interaction modules by making the interaction module easy to recognize within the supermarket environment. This will make the interaction with the modules easier for the children.

Interaction 2

Initial situation:

Child is standing next to an interaction module ready to interact.

Action performed:

The user puts the chip of the interaction module against the reader.

System reaction:

Displays information on the screen based on which chip is detected. Sound feedback will be given to make the child aware that he or she performed the correct action.

New situation:

Information about the sustainability of certain parts of the supermarket will be displayed on the screen.

Rationale:

Children have to actively interact with the supermarket environment to display different information to let them more actively search for how they can decrease the impact of their food choices by connecting the supermarket environment with the information on the screen.

5.2.3 Tablet (T)

Interaction 1:

Initial situation:

The start screen is shown. and the child has to choose between returning user or not used before.

Action performed:

Child presses not used before.

System reaction:

The system introduces the child to the sustainability problem of their food choices. This will be done by the buddy.

New situation:

Child reads the information.

Rationale:

The child will be introduced to the problem to make them aware of why it is important to make sustainable food choices.

Interaction 2:

Initial situation:

The start screen is shown, and the child must choose between returning user or not used before.

Action performed:

Child presses returning user button.

System reaction:

The system displays a welcome back message.

New situation:

Child will be able to walk around in the supermarket environment and interact with it.

Rationale:

This function is implemented to reduce the repetitiveness of the system because the returning user is aware of the impact of their food choices and does not need an introduction anymore.

Interaction *3:*

Initial situation:

The screen shows a page about a certain aspect of sustainability based on the interaction with the interaction modules.

Action performed:

Child presses a certain part of the screen. For example, pressing the cow at the meat section.

System reaction:

The system will show information based on what the child pressed. For example, what the Beter Leven quality mark means to the cow (type of food he gets, how long the cow is walking outside, what modifications are done to the stables).

New situation:

Child sees information about certain aspects of what he pressed on.

Rationale:

The child will actively search for information because he has to press something. This will possibly increase the willingness to search for more information because they have to explore it by themselves.

Interaction 4:

Initial situation:

Child has not collected any stickers.

Action performed:

Child interacts with a place to get a sticker.

New situation:

The child has a new sticker and sees a sticker pop up.

Rationale:

The aim of the sticker collecting system is to make children more aware of what they are doing. The stickers represent a piece of information they got through interaction. By using the correct sticker name, the child becomes aware of which information he or she already got through interaction with the system.

Interaction 5:

Initial situation:

Child sees stickers on his screen.

Action performed:

Child presses one sticker

New situation:

Information about where the sticker is about is displayed on the screen.

Rationale:

Displaying information by clicking on a sticker will give the child the possibility to look back at the information of points he/she interacted with earlier. This will give the child the possibility to check earlier information and connect it with new information.

5.2.4 categorization

These interaction methods can be divided into two different categories. These categories are attention attracting interaction methods and user-system interaction methods. Attention attracting interaction methods are methods that are designed to attract the attention of new users. User system interaction methods are methods that provides means for the user to use the installation. Table 1 shows how the interactions are divided amongst the two categories.

ATTENTION ATTRACTING INTERACTION METHOD	USER-SYSTEM INTERACTION METHOD
DM 1	DM 2
IM 1	DM 3
T1	IM 2
T4	T2
	T3
	T5

TABLE 1: CATEGORIZATION OF INTERACTION METHODS

5.3 COMPONENTS

This part of the chapter will be about which components are used. These are divided into Hardware, Sensors and actuators. and System. Hardware is about the components that the user can see. Sensors and actuators are about the sensors that are used and how they are read out. The system is about what system is used to run the application.

5.3.1 Hardware

The hardware of the interactive shopping cart does exist of different parts. The first part is the tablet. The tablet will be used to display the application and it will enable the user to interact with the shopping cart. The second part is the decoration modules. These modules will be attached to both sides of the shopping cart. The decoration module will consist of a box with the components of the decoration module attached to it. Another part is the interaction module. The components used for this are an NFC card and a pulley.

5.3.2 Sensors and actuators

Several sensors and actuators will be used to enable the user to interact with the shopping cart. These components will be controlled by an Arduino Mega [51]. This microcontroller can control several actuators and sensors. The first sensor that will be used is an RC522 RFID reader. This enables the system to read the NFC cards of the interaction modules. Furthermore, the HC-05 Bluetooth module will be used. This enables the Arduino to interact with the tablet and detect the Ibeacons. The ibeacons are to determine the position of the interactive shopping cart by reading their signal strength. The E5 location

beacons of minew will be used for this [35]. Ten arcade 32mm buttons will be used to enable the user to interact with the decoration module. The Arduino can detect if a button is pressed, and display information based on this. The button all has a led that turns on based on the position in the supermarket environment. The last actuator that will be used is a 12V led strip. This led strip can change colour based on the RGB value that the Arduino sends to it.

5.3.3 Application

The application will be built with the help of Unity [52]. This is a program that can be used to make games on different platforms. This program is chosen because of the possibility to make an android application and because it is very intuitive to use. The application will consist of different scenes. The application will switch between scenes based on the interaction. The structure of the program is shown in figure 12. furthermore, the application will make use of different libraries. The first library that will be used is the ArduinoBluetoothAPI [53]. This library is to get a Bluetooth connection between unity and Arduino. FMOD is another library that is used for this project [54]. FMOD is a library that is used for the sounds of the system.

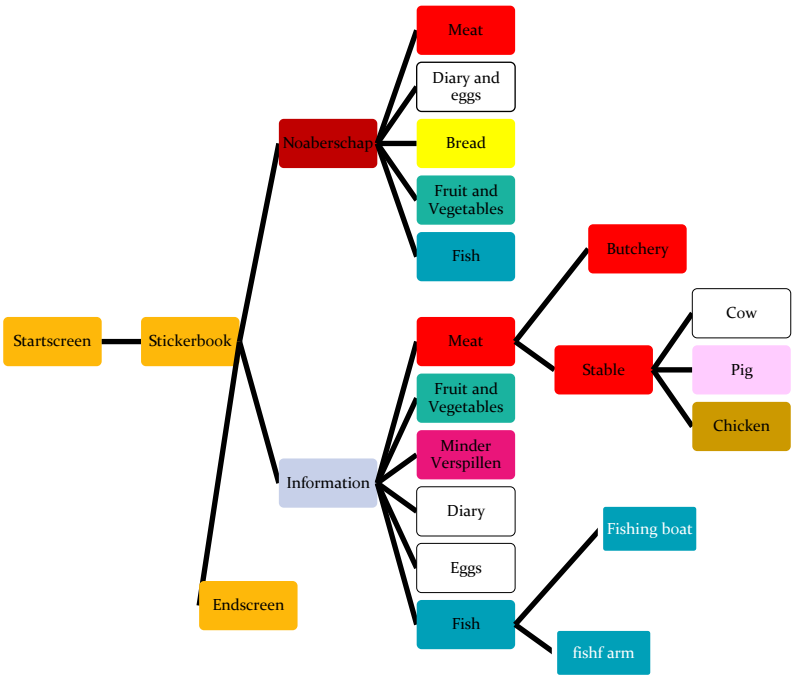

FIGURE 12: SCENE STRUCTURE DIAGRAM

Chapter 6: Realisation

During this phase, the prototype was developed. This prototype will be developed based on the previous chapters. This chapter will be divided into three parts. The first part will be about how the hardware is structured and how it works. The second part will be about the design choices made to make the prototype functional. The last part will be about how the software of the prototype works.

6.1 HARDWARE

The prototype is built with several different components to make the interactive shopping cart work and create a functional system. This section will sum up all the hardware components that were used for the prototype.

6.1.1 Tablet

The tablet that was used for the prototype is the Samsung Galaxy Tab A [55]. The tablet had two functions. The first function of the tablet was displaying. The tablet had to display the application based on the interaction with the other components. The second function of the tablet was to enable users to interact with the information. The tablet had to enable the users to interact with the application and play the correct information based on the interaction.

6.1.2 Sensors

There are different sensors used for the prototype. The system had to enable the users to interact with the supermarket environment. Therefore, the system has to be able to sense interaction. For this, the MFRC552 RFID reader was used [56]. This reader enables the system to read RFID chips that were in the supermarket environment. This reader is able to read the UID of the chips. Different information will be displayed on the tablet based on the UID of the RFID chips.

Furthermore, the system has to enable the user to interact with the decoration modules. This is achieved through using arcade buttons. A button press can be sensed with these buttons. This is achieved through reading the output of the buttons.

6.1.3 Actuators

There is one actuator used for the prototype. This is a 12V RGB LED strip. This LED strip is able to change colour based on the values sent to it. This is used to give the user feedback on his interaction with the system. The LED strip has to change colour based on the position within the supermarket environment and the interactions.

6.1.4 Bluetooth modules.

Two Bluetooth modules were used to enable all the system components to communicate with each other. The HC-05 Bluetooth modules were used for this. These modules enabled the system to create communication between the tablet, sensors, and actuators. The first module has to enable the communication between the hardware component and the application run on the tablet. The second Bluetooth module was to enable the researchers to change the colour of the led strip and display different screens.

6.1.5 Power supplies

Two hardware components need an external power supply. These are the Arduino and the LED strip. The Arduino needs a power supply to power the controller. A power bank was used for this. The LED strip needs a 12V power supply. An Arduino is only able to give a 5V power supply. Therefore, a 12V battery power supply was used to power the LED strip.

6.2 DESIGN

The design is about the construction of the prototype. This is about how the hardware components are held together so the prototype is ready to be used within the supermarket environment. The prototype is an extension of the current interactive shopping cart that is developed by UW-s [34]. This is a well build shopping cart that can be used as a basis of this prototype. The prototype consists of the shopping cart of the UW-s with the hardware components of this project attached to it.

6.2.1 Decoration module

The decoration module will consist of a wooden box that will be attached to both sides of the shopping cart. This box will be made through laser cutting. Because of this, the size of the box can be determined very accurately. It will be a box so the buttons can be mounted on it. It can also function as a place to hide the wiring. The led strip will be attached to the top of the box, so it is clearly visible for the user. The final decoration module is shown in figure 13.

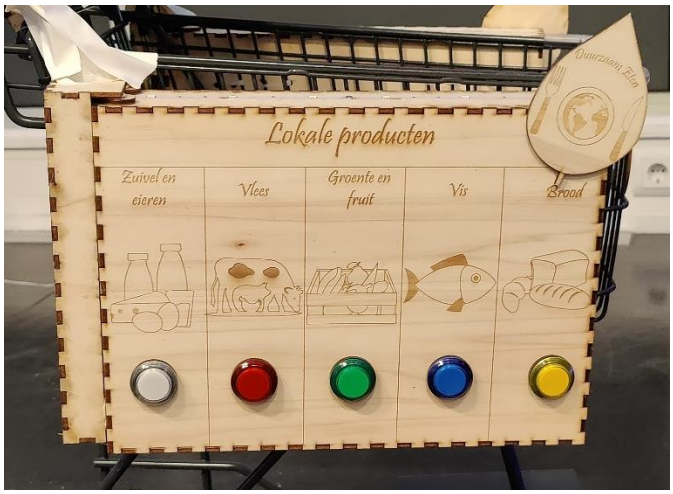

FIGURE 13: DECORATION MODULE

6.2.2 Interaction module

The interaction modules have to enable the user to interact with the supermarket environment. This is achieved by using an RFID chip. The chip will be attached to the module using a pulley. This enables the user to put the RFID closer to the interactive shopping cart without the RFID chips getting lost. Furthermore, the user has to recognize the interaction modules. Therefore, a logo has been designed and laser cut. This logo is the same for all the interaction modules, so the user is able to recognize them within the supermarket environment. The interaction module will have holes at the back. Rope or tie ribs can be used to attach the interaction modules to the supermarket environment. The interaction module design is shown in figure 14.

FIGURE 14: INTERACTION MODULE

6.2.3 RFID reader

The RFID reader is an important part of the prototype. This is because it enables the user to interact with the supermarket environment. Therefore, the reader has to be clearly visible and easy to use. Because of this reason, the reader will be attached to the front of the prototype besides the tablet screen. The RFID reader will use the same logo as the interaction modules. This is to make a connection between the RFID reader and the interaction module. This is to make it easier for the user to understand where he has put the RFID chip against. A picture of the reader will be shown in figure 15.

FIGURE 15: RFID READER

6.2.4 Cable management

Cable management is important to make the installation safe to use for children. Therefore, as few cables as possible need to be visible. This is achieved through using different techniques. Firstly, the cables that can be hidden in the decoration module will be hidden in the decoration module. Furthermore, the cables will be attached tight to the shopping cart using tie ribs. This to prevent loose hanging cables. Special boxes will be used to hide the rest of the cables.

6.3 SOFTWARE

The prototype consists of two software components that function as a control of the system. This section will sum up the software components of the prototype.

6.3.1 Arduino

Arduino Mega was used to control all the hardware components. This microcontroller enabled the system to read the output of the sensors, control the led strip and communicate with the Bluetooth modules. Table 2 shows which pins of the Arduino are used and what they are used for.

Arduino Pin	Component	Component pin
5	MFRC 522	RST
6	Led strip	B
7	Led strip	R
8	Led strip	G
16	HC-05	RX
17	HC-05	TX
18	HC-05	RX
19	HC-05	TX
50	MFRC 522	MISO
51	MFRC 522	MOSI
52	MFRC 522	SCK
53	MFRC 522	SDA
A0	Arcade button	Output
A1	Arcade button	Output
A2	Arcade button	Output
A3	Arcade button	Output
A4	Arcade button	Output

6.4 TABLE 2: ARDUINO PIN DISTRIBUTION

The Arduino will be able to send and receive data from the application using Bluetooth. Data will be sent based on the values the Arduino gets from the sensors. Examples of this are using the UID of an RFID chip or the input of a button will be a certain value to determine the screen state. The Arduino will send the screen states to the application, so the application knows which screen it has to show. The Arduino will also handle the colour of the LED strip. This is based on two aspects. The first one is the screen states. The Arduino knows the screen state by reading the sensor data. Based on this it will change the colour of the LED strip. It will also turn off the LED if it receives a signal from the application.

The Arduino is also able to talk with the Wizard of Us application. The wizard of us application is used to change the colour of the LED strips. This can be used to give user feedback during the evaluation of the prototype. The application that is used is made by an administrator of electronicshub.org [57]. The application can send characters to the Arduino. The colour of the LED strip will change based on the character that is sent. The code that handles all these events is shown in appendix A.

6.4.1 Application

The application is responsible for what is displayed on the tablet screen. It communicates with the Arduino, so it knows which screen to display. It knows this based on the string that is sent by the Arduino. This string is sent over a Bluetooth connection. The code to make the Bluetooth connection is made by using a tutorial of Zaidan[58]. Furthermore, it will keep track of the interactions of the user. The system track this using scriptable objects [59]. Scriptable objects are able to store values from different scenes. This is used to keep track of the sticker book and for the logbook. The dialogue boxes are made using the tutorial made by Thirslund [60]. The information that was shown in these boxes can be found in appendix B The sounds of the system were handled by FMOD studio [54]. Appendix C shows which sounds are used and where they were found.

Chapter 7: Evaluation

This chapter is about evaluating if the prototype met the purpose. The test will focus on if the user shows playful interactions, become aware of sustainable food choices, and learn from sustainable food choices. This will be achieved through the evaluation of the prototype in the supermarket environment. The results of this test will be evaluated to see if the prototype met the purpose. This can be used to answer the research question.

7.1 EVALUATION PLAN

This section is about the evaluation plan used during the evaluation. This plan is approved by the EEMCS ethical committee. The request can be found in Appendix D.

7.1.1 Research question

1. What playful interaction do children show?
2. To what extent do children learn about sustainable food choices by using the interactive shopping cart?
3. To what extent does our interactive shopping cart make children aware of sustainable food choices?

7.1.2 Hypothesis

H1- What playful interaction do children show?

Predicting what playful interactions are shown is very difficult. Therefore, only playful interactions that possibly can be shown can be predicted. Playful interactions that can be shown are:

- Searching for interaction modules.
- Trying to collect stickers.
- Searching for products based on the system information.
- Searching for information by pressing on an object on the screen.
- Sharing the information with their parents

H2 - Children will be learning something about sustainable food choices.'

Learning about sustainable food choices is about if a child knows why some products are sustainable or how to use the food waste reduction techniques. This is about knowing what the makers of the product did to make it sustainable and knowing what to think about when using a food waste reduction technique. Children are still developing knowledge. Therefore, the information will be displayed in a way that children are able to understand. Metaphors and jokes are used to make the information more appealing to children. The information will be aimed at children. Therefore, the expectation is that children will be learning something about sustainable food choices.

H3 – Children become more aware of the impact of their food choices on the environment.

Becoming aware of the impact of their food choices will be about if children will change their shopping behaviour based on the information that is displayed on the screen. A child will be aware of the impact of their food choices if he uses his knowledge about sustainability to make his food choices more sustainable. The information is focused on how to recognize sustainable food products in the supermarket. Therefore, the expectations are that children will be aware of the impact of their food choices and will pick other products based on the information that is displayed on the screen.

7.1.3 Participants

The participants are children (age 5-12) and their parent(s) or caretaker(s)who are going to do their groceries. The children will be the participants who will be using our interactive shopping cart in the supermarket environment. The parent(s) or caretaker(s) are the people who are doing the groceries with the child. Their groceries will most likely be influenced by the interaction of the child with the interactive shopping cart. They will be recruited by asking them to participate in the supermarket.

7.1.4 Material

The hi-fi prototype will be tested. This prototype consists of the shopping cart with a screen, RIFD reader and decoration module attached to it. A mobile application will be used to stimulate the Ibeacons within the supermarket environment. Furthermore, a notepad will be used to take notes during the observation.

7.1.5 Evaluation design

The experiment will consist of observation, a logbook, and an interview. The observation will be about the playful aspects of the interactive shopping cart. Examples of this are:

- Searching for interaction modules.
- Trying to collect stickers.
- Searching for products based on the system information.
- Searching for information by pressing on an object on the screen.
- Sharing the information with their parents

The logbook will be used to track the interaction on the screen. The logbook will show how many objects a child has clicked, how many stickers are collected, how many interaction modules are found and how much is interacted with the decoration module. Some questions will be asked after the observation. These questions will be used to answer the evaluation questions.

7.1.6 Procedure

7.1.6.1 Prototype

The interactive shopping cart consists of a screen, RFID reader, decoration module and the interaction modules. The screen will function as a display. The RFID reader will be the bridge between the shopping cart and interaction modules. The interaction modules will consist of a pulley with an NFC card. The decoration modules will be attached to the side of the shopping carts. The modules will be the same on each side of the shopping cart. They consist of five buttons with light feedback on each side and an LED feedback strip. A logbook will also be included within the prototype to track the interactions.

7.1.6.2 Setting

The experiment will take place in the supermarket environment. The interaction modules will be placed in the supermarket environment in front of the correct shelves.

7.1.6.3 Protocol

When asking people to participate, we will give the parent(s) or caretaker(s) information about our experiment. We will tell them what we are researching and ask them if they allow us to ask their child to participate. After the permission, we will be telling the child about the installation and ask them if they want to participate. After the permission of the child and parent(s) or caretaker(s), we will be asking the parent(s) or caretaker(s) to sign a consent form. The form is included in appendix E.

After this, children will be using the interactive shopping cart within the supermarket environment. They have to press the buttons on the decoration module, search for interaction modules, react to the feedback of the system, interact with the information and make sustainable food choices with this information. There we will be observing them interacting with the interactive shopping cart. Children will be using the shopping cart

until they are finished doing their groceries. After these children will be asked some questions. After this, they will be debriefed about the possible deception. This because we were not able to include all the information about all the products of the supermarket. This can cause a bias towards certain products.

7.1.6.4 Measures

Several aspects will be measured during this experiment. The first measure is the observation of how children interact with the installation in a playful way. This framework will be made around the plex framework [61]. These cards consist of categories of playful experiences. The categories relevant to the project will be used. These categories are finding something unknown(exploring), investigating an object(investigating) and sharing an emotional feeling. Finding something unknown is about how the child is exploring how the interactive shopping cart works and how the child can interact with the shopping cart. Investigating an object is about what the child does with the information of the interactive shopping cart for example investigating a product based on the information. Sharing emotional feeling is about how the child involves their parent(s) or caretaker(s) in the process of making sustainable food choices. The scheme will keep track of which of these playful interactions are performed by the child in the supermarket by counting them. This scheme is shown in appendix F. The child has shown a playful interaction when he or she performs one of the interactions of the observation scheme.

The second measure will be about what the children say while interacting with the shopping cart. Here we will be looking at what children say about the interaction with the installation. The goal is to get deeper insights into how the child experiences the interactive shopping cart. We will especially listen to quotes of the child about sustainable products and how the child communicates with their parent(s) or caretaker(s). This is important to get insights about if children will make food choices, advice their parent based on the information to test the awareness and if they like the installation.

The last measure is the answers to the questions of the interview. The goal of these questions is to ask if the children learned something from the information and if they changed their food choices by using the interactive shopping cart. This data will be used to answer the research questions if children are more aware of sustainable food choices and if they learned something from the information. The questions that were asked can be found in Appendix G.

7.2 RESULTS

This part is about the results of each evaluation test that was performed. All the results will be discussed independently. At the end, all results will be combined to answer the research questions of the evaluation.

7.2.1 Evaluation 1

Evaluation test 1 was used as a pilot test. This test was performed on another day as the other tests. The participants were a family with a child aged 5. The child was given an introduction at the start. The child did press a button immediately. This causes that she skipped the introduction. She was walking through the shop and her dad helped with the search. In the first interaction module, the dad helped with putting the chip in front of the reader. After this, the child did this by herself. She was only busy searching for the interaction modules. She did not know that she could interact with the object on the screen. She did accidentally press a correct object once and she listened to the voice over. During the use of the interaction module, she said: “I only want to search for those things.”. The dad was constantly looking over the shoulder of his child. He also tried to read aloud what was on the screen. The child did not pay much attention to this. One of the interaction modules was attached at a big cow. This is shown in figure 16. The child did like that the interaction module was attached to the cow. She was constantly searching for new interaction modules and did remember which she already interacted with except for one. She did not remember that she interacted with this after walking past the same module from a different direction. Another thing that stood out was the use of the buttons. The child mostly immediately pressed a button after interacting with the interaction modules. They also did not understand the buttons on the screen. They did never go back to the sticker book and did not press continue on the information dialogues. She answered that she liked using the shopping cart. She mostly liked the searching and the colours of the shopping cart. She liked the buttons of the decoration module. Furthermore, the parents mentioned that the child was learning to read. This made it difficult for her to read all the text. She would have liked to be able to read the information.

FIGURE 16: COW STATUE WITH INTERACTION MODULE

7.2.2 Evaluation 2

This was the first proper evaluation test that was performed. The participants were a dad shopping with his three children. The children were aged 6, 8 and 10. Two children (6,8) were continuously walking behind the shopping cart, while the older child was helping them a bit. They are attentively listening to the introduction. First, they only understand how to use the buttons. The child of 8 is trying to read the information on the screen. She is mostly looking down at the screen during the groceries. They notice that they collected one sticker when going back to the sticker book. They walk past an interaction module and the oldest child is saying:" Is this something" while pointing to the interaction module. The two children behind the shopping cart answer with no. After walking past another interaction module, the researcher decides to explain that they have to search for the interaction modules. After this, they enthusiastically start searching for the modules. The youngest child runs to the interaction module she spotted while saying:" over there!". They do not seem to look at the led feedback while searching. The dad looks at the screen and asks if they find it difficult. The children answer with no. At the end, the end screen is displayed. The child aged 8 is trying to read and clicks through the end screen. After this,

they click on the end button and go to the logbook screen. They did like the data of the logbook.

These observations also came back in their answers to the questions. They did enjoy the interactive shopping cart. they did enjoy the possibility to search for stickers and interaction modules and how the shopping cart looked. The child of 8 was looking at the information, but she finds it difficult to say what she learned from the information. They did enjoy the possibility to choose which button they want to press. The dad mentioned that there was too much text used and that more pictures and videos have to be used to get the message across to his children. He also mentioned that the text was too fast, but the child of 8 disapproved and said that she was able to go through the information at the pace she liked.

There was also a logbook captured from this test. The logbook values are shown in table 3. This shows that the children did click on the information 5 times. They also collected 5 stickers with this. They did not click the sticker to look back at the information. They found all 6 interaction modules and pressed a button of the interaction module 6 times.

Info interactions	5
Sticker info interactions	0
Stickers collected	5
Interaction modules interacted	6
Decoration modules pressed	6

TABLE 3: LOGBOOK EVALUATION TEST 2

7.2.3 Evaluation 3

This evaluation test was performed with a child aged 10. This was a very messy test because the interactive shopping cart was not working half of the time. This was discovered too late because the child did not understand what to do after the introduction. This was mainly because she did not pay full attention to the introduction. After additional explanation and fixing the interactive shopping cart, the child wanted to search for interaction modules. The problem was that there were not many interaction modules left at the part of the supermarket where she was. Due to this, she was not able to find an interaction module. She was looking for the interaction module at the wrong places. She was looking at the shelves and not next to the shelves where the interaction modules were located. She did press a button of the interaction module and did try to read the information on the screen. She did say that she liked that she could search for interaction modules, the information, and the led feedback. She mentioned that she did not know what the term sustainability meant. Therefore, she did not get the message of the interactive shopping cart.

7.2.4 Evaluation 4

Evaluation test 4 was performed with a family who did their weekly groceries. The child was 6 years old. First, they walked through the supermarket and did not know what they had to do. They walk past the first interaction modules. Therefore, the researchers explain what they have to search for. After this, the child immediately starts to search with his father. The father first puts the chip at the reader. It did not work, and the researcher had to reset the Arduino. After this, it works, and it displayed the correct screen. the parent clicks on the screen and interacts with the information. The child has no interest in this. He seems a bit impatient. After this, the child continues searching with his dad. The child puts the chip in front of the reader at the second interaction module. He does not know when he can stop putting the chip against the reader. He also pusses the chip very hard against the reader. At the fourth interaction module, the child is curious about what is on the screen. He asks the dad what does all of this mean. The dad did not answer and says that he has to search for another interaction module. They stand still for a moment. The child is exploring what he can press on the screen. He presses a sticker, but he does not pay attention to the displayed information. The child and the dad keep searching until they found everything. While doing this he starts to run. They are not busy with doing the groceries. This is the task of the mother. The child proudly explains to his mother what he is doing with the interactive shopping cart. The child did not interact with the decoration module at all. He only touches the buttons at the end of their groceries, but he did not press a button. The child did answer that he enjoyed using the interactive shopping cart. This was mainly because he enjoyed searching for the interaction modules. The dad did state that it was not clear what they had to do before the explanation of the researcher. There was no logbook captured during this evaluation test.

7.2.5 Evaluation 5

Evaluation test 5 was performed with people who did quick groceries. Two children were using the shopping cart. The children were at an age of 4 and 7. Because of the results earlier, the researchers decided to explain more about how the system work and what the children had to search for. This caused that the parent pointed to an interaction module at the start and that the children went to the module. After this, they saw another module, but the parent said that they first had to choose what they wanted to eat. After choosing they directly went to the interaction module. Here the older child tried to click on the objects, and he tried to follow the information. While following the younger child pressed the buttons of the decoration module. This caused that another screen was displayed. The older child was a bit irritated and said do not do that. The children also noticed that they were near an interaction module, because of the LED feedback of the decoration module. The younger child lost attention over time, while the older child was still interested in the information on the screen. The younger child was only searching and pressing the buttons of the decoration module. The older child started clicking through the end screen but did not finish it. The answers to the questions were that they liked the searching of the interaction module and the possibility to see the information. The older child was not able to express what he learned from the information. The parent stated that was caused that too much text was used, and that the younger child was not able to read this. The results of the logbook of this test are shown in table 4. This shows that the children have interacted with 4 info objects. Furthermore, the children have collected 4 stickers and did not click on them to look back at the sticker information. They did find 3 interaction modules and pressed 1 decoration module.

Info interactions	4
Sticker info interactions	0
Stickers collected	4
Interaction modules interacted	3
Decoration modules pressed	1

TABLE 4: LOGBOOK TEST 5

7.3 CONCLUSION

In this part, the research questions of the evaluation will be answered. The research questions were:

- What playful interaction do children show?
- To what extent do children learn about sustainable food choices by using the interactive shopping cart?
- To what extent does our interactive shopping cart make children aware of sustainable food choices?

The children did show different playful interactions in the supermarket environment. The playful interaction that was shown the most is searching for interaction modules. All the children did search for interaction modules after they were aware of the possibility. The playful interaction that belongs to this is discovery. Some children were also pressing the objects on the screen and investigating the information. The playful interaction that belongs to this is exploration. Furthermore, some children were also forgetting that they were doing groceries. They were only searching for the interaction modules. The playful interaction that belongs to this is captivation. Another playful interaction that was shown is completion. Some children were searching for all the interaction modules. After they found all the modules they stopped searching. They completed the task of searching for all interaction modules. A child mentioned that she liked that she could control when and what button she wanted to press. The system allowed her to control what she wanted. Control is also a playful interaction. Furthermore, most of the children also involved their parents in searching for the interaction modules. They were sharing what they were thinking at that moment. They were asking their parents to help them read, put the chip against the reader and search for interaction modules. The playful interaction that belongs to this is sympathy.

Children did not pay much attention to the information. The children who did pay attention to the information were not able to explain what they learned. Therefore, can be concluded that the children did not learn about sustainable food choices using the interactive shopping cart. This can have different reasons. The first reason is that the children could not read. This was mentioned by the parents during some of the evaluation tests. This makes it difficult for the children to follow the information and learn from it. Another reason can be that the information was too difficult. One child mentioned that she did not understand the term sustainability. Understanding this term is crucial for the information. Therefore, it was difficult for this child to learn from the installation. Another reason can be that the children were not aware of the possibility to see the information. Some children did not press objects or listen to any of the information. Because of this, they did not see any information. This makes it impossible to learn something. The last reason can be the knowledge of the children. Children do have little knowledge in general. Therefore, they did not have the assumed pre-knowledge. This

makes it difficult to understand the whole context of the information of the installation. This makes it also difficult for them to learn.

The last question was about awareness. Children had to show some awareness about sustainable food choices by using the interactive shopping cart. Children did also not show any form of awareness during the evaluations. They did search for quality marks or country of origin on the food packaging. Furthermore, they also did not advise or guide their parent to buy a specific sustainable product. This is mainly because the children find it difficult to interpret the information. As discussed earlier, children found it difficult to understand the information. This makes it difficult for them to connect the information to the supermarket environment. Furthermore, it can be because of the information on the interactive shopping cart. The information only explicitly mentioned what to search for in the supermarket environment. It can be that the children did find it difficult to recognize this in the supermarket environment.

7.4 REMARKS

In this part, some useful observations that were not part of the research questions will be discussed. The information on the screen did not come across very well. Nice tips that the parents gave was using more pictures, animation, videos, and as little text as possible. This needs to be implemented to get the information across to most of the children. The expectations were that the children did not pay any attention to the information on the screen, but most of the children did look at the screen when it switched scenes. This gives possibilities to display the information differently, so the children were able to understand. Furthermore, was assumed that children did get basic sustainability knowledge at their schools. This was also disproved by a child saying that she did not understand the term sustainability. Therefore, the information needs to be more thought about.

Furthermore, children did like the searching. Nearly all children did find all the interaction modules in the supermarket environment. This indicates that children did understand how the modules work and wanted to search for them. There was one problem. There were not enough interaction modules in the supermarket environment. The shopping cart can become repetitive because of this. Therefore, more interaction modules need to be implemented to make the use of the interactive shopping cart less repetitive.

Another interesting observation was done around the aesthetics of the interaction module. During the first test, an interaction module was attached to a big cow statue. The child did enjoy that interaction module the most. There was also no problem recognizing it. The child immediately recognized the logo of the interaction module on the collar of the cow. This indicates that aesthetics based on the shelve the module belongs to are liked

by the children. Therefore, this can be used. The placing of the interaction module also can be different. The interaction modules were now placed next to the shelves. A child did look at the shelves after explaining that she had to search for interaction modules that can be recognized by the logos. Attaching the interaction modules on the shelves maybe makes it easier to connect the information to the correct products. The height of the interaction modules also maybe needs to change. Most of the time the children did not immediately recognize fact that there was a pulley inside of the module. They struggled with putting the chip against the reader for the first time. After they recognized the pulley, it was easy for them. This was mainly because they had to pull the chip sideways out of the module and the pulley was on the button. Attaching the pulley, the right way makes it easier to understand from the start how to use it.

The children did also not all react to the led feedback. Therefore, the system of the led feedback needs to be clearer for the children. This can be by using other led strips that can blink in patterns or using additional sound feedback.

Chapter 9: Conclusion

The goal of this research was to research how interactive technology can be used in a playful way in the supermarket environment to make children more aware of the impact of their food choices on the environment. Based on the literature review, a prototype was developed that consisted of interactive technology and had to be used in a playful way in the supermarket environment. The prototype was tested to research how the system is used and how works within the supermarket environment. The test was based around observing playful interactions, testing if children became aware of the impact of their food choices and if they learned something from the information of the prototype. This will be used to try and answer the research question.

First, the interactive technologies used have to be summed up. The interactive technology that is used is a tablet in combination with the decoration and de interaction module. The evaluation showed that these technologies could be used in the supermarket environment. furthermore, the evaluation also showed that playful interactions were shown using these interactive technologies. Therefore, these technologies can be implemented in a playful way in the supermarket. The last part of the research question was about making children aware of the impact of their food choices with these interactive technologies. The evaluation showed that the interactive technologies used did not make children aware of the impact of their food choices. The information on the interactive technologies did not come across. This was mainly because the information was difficult to understand for the children.

More research is needed to know how to make children aware of the impact of their food choices. There needs to be deeper research into how to get a difficult message across to children. There need to be looked at different ways to display the information for example.

This need to be researched to properly answer the research question.

To conclude, using a tablet, an interaction module and a decoration module can be effective to get the attention of children in a playful way. Children were able to use it and did enjoy searching for interaction modules and pressing the buttons of the decoration module. These interactive technologies can be used in the supermarket environment with children. Making children aware of the impact of their food choices was more difficult. Further research needs to be done to create a display method that effectively gets the message about the impact of food choices across to the children.

Chapter 10: Recommendations

Some recommendations can be made after performing this research. Some factors can be improved, used to create interactive technology for supermarket environments.

10.1 IMPROVEMENTS

Some aspects can be improved upon. These aspects will be discussed here.

10.1.1 Information display method

The displayed information did not come across. Therefore, this needs to be improved. Methods of displaying the information need to be researched further. The display methods need to be researched and tested with children to test the effectiveness. Methods that the parents named during the evaluation are using video, animation, and picture. They also pointed out that too much text was included. Therefore, these named methods need to be investigated and ways to display less text need to be looked at. The information was also too difficult for some children. the information needs to be carefully reconsidered, so children can understand the information. The information of the introduction also needs to be clearer. All the children needed additional explanation about that they had to search for the interaction modules in the supermarket environment. This need to be made clearer with the introduction, so children can autonomously use the interactive shopping carts. The only aspect of the information that need to be saved are the cartoons. Cartoons are still an effective method to display data to children [45]. The cartoons only need to be used more effectively.

10.1.2 Minigames

Advergames have been effective to learn children about specific concepts [47]. Therefore, the system can be improved by implementing minigames around certain sustainability concepts. An example of this is a minigame around where to keep your fruit and vegetables. In this game children can drag the fruit and vegetables to place where they have to keep that specific fruit or vegetable. Another example is the place where fish are caught. Displaying a world map where children can press on all the water. Information about the fish that are caught on the spot that is pressed will be displayed. This are only two ideas, but more minigames can be implemented to learn children about certain concepts. More research needs to be performed on how to effectively use advergames to teach children about certain sustainable concepts.

10.1.3 Feedback

Most of the children did not notice that they got LED feedback when they were close to an interaction module. Therefore, this need to be clearer that the interactive shopping cart also provides feedback. More feedback methods can be used for this. Sound can be used to make children aware that something is happening for example. Most children did also not notice the possibilities to gather more stickers. Feedback can be used to make the children more aware of the possibility to collect more stickers. Emotionally persuasive icons can be used to increase the empathy of the installation [46]. This are sights, sounds, smells, ideas and words connected to negative and positive effects or feeling through learning and experience. An effective way to use this need to be researched to increase the feedback of the system. This will most likely increase the empathy of the installation. To conclude, more feedback methods need to be used to make children aware of that something is happening.

Another technique that can be used is emotionally persuasive icons [46]. These icons include sight, sounds, smells, ideas and words which are connected to negative and positive effects or feelings through learning and experience. This can increase empathy.

10.1.4 Interaction modules

Children did like searching for the 6 interaction modules in the supermarket environment. Almost all children did find all the interaction modules. Because of this they have nothing to search for the next time they are in the supermarket. There were also less interaction modules in the last half of the supermarket environment. Therefore, the amount of interaction modules can be increased to make the interactive shopping cart less repetitive and give the children the possibility to search for the interaction modules in the whole supermarket. More information about more specific products can be included by using more interaction modules.

Another finding was that a child liked that an interaction module was attached to a cow statue. This indicates that the aesthetics influence how children experience the interaction modules. Therefore, more research needs to be done on customizing the aesthetics of the interaction modules based on the products the information is about. The concept of data sculpturing can be used for this [44]. Data sculpturing is about using artistic and functional qualities to increase the understanding of data among the audience. This can be used by using interaction module shapes that represent data about certain products. The cow statue represented that milk is coming from the cow for example.

10.1.5 Decoration module

Almost all children did press the button of the decoration module, but they did not read and interacted with the information on the screen that much. Therefore, the decoration modules need to be developed further to make them more effective. There need to be looked into how to integrate the decoration modules more into the system. Their need to be though about a way how the decoration module can have an added value to the total installation.

10.1.6 Ethics

There are ethical considerations that play a role when developing an interactive shopping cart for children with the goal of making them aware towards a difficult topic. These considerations are sum up in a report that can be found in Appendix H.

10.2 FUTURE RECOMMENDATIONS

Some aspects were effective. Children liked to interact with the interactive shopping cart, became aware of sustainable food choices and learned something about sustainable food choices because of these aspects. Therefore, these aspects can be used in the future for interactive technology within the supermarket environment.

10.2.1 Interaction modules

Almost all children did state that they liked using the installation because possibility to search for the interaction modules. This indicates that searching for the interaction module is an effective method to use for making an interactive shopping cart for children. Therefore, interaction modules can be used when making an interactive shopping cart.

10.2.2 Decoration modules

Children were interacting with the decoration module. Therefore, the decoration modules can be used in the future when developing an interactive shopping cart. However, changes to the current decoration module need to be made. The decoration module needs to add more to the whole interactive shopping cart experience.

10.2.3 Food habit change techniques

In chapter 2 food habit change techniques were sum up. This were techniques that can be used to make or change food habits of children. These techniques can be taken into consideration in the future interactive shopping cart to make children more aware of the impact of their food choices.

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Appendix A: Arduino code

```
/* This code is for Arduino Mega only*/


char data = 0;

//boolean test = true;


#include <SPI.h>

#include <MFRC522.h>

//#include <SoftwareSerial.h>

//

//SoftwareSerial Wizard(18, 19);

#define RST_PIN         5          // Configurable, see typical pin layout above

#define SS_PIN          53         // Configurable, see typical pin layout above


//Ledstrip

#define blue 6

#define red 7

#define green 8


//#define greenbuttonLed 2

//#define bluebuttonLed 11

//#define redbuttonLed 3

//#define yellowbuttonLed 14

//#define whitebuttonLed 4
```

```
#define greenbutton A2
#define bluebutton A1
#define redbutton A3
#define yellowbutton A0
#define whitebutton A4

int greenbuttonvalue;
int redbuttonvalue;
int bluebuttonvalue;
int yellowbuttonvalue;
int whitebuttonvalue;

//LED strip
int r;
int g;
int b;
//yellow(255,100,0)
//purple(255,100,0)
//White(255,200,100)
//green(0,200,0))
//red(255,0,0)
//blue(0,0,255)
//String Color;
//boolean LEDON = false;
//boolean arduinostate =true;
```

```
MFRC522 mfrc522(SS_PIN, RST_PIN);  // Create MFRC522 instance
String eggs = "9D 2B C5 3D";
String eggs2 = "06 07 C5 3D";

String zuivel = "9F 82 C4 3D";
String zuivel2 = "ED 0E C5 3D";

String fruitvegetables = "83 CB C4 3D";
String fruitvegetables2 = "3A 67 C4 3D";

String meat = "E6 B0 C4 3D";
String meat2 = "50 8D C4 3D";

String minderVerspillen = "59 AA C4 3D";
String minderVerspillen2 = "15 FC C4 3D";

String fish = "08 B3 C4 3D";
String fish2 = "E2 75 C4 3D";

String off = "FC D1 13 4A";
String endscreen = "0C FC 4C 4A";
String logbook = "37 05 C5 3D";
String stickerbook = "07 14 C5";

String testdata;
```

```
boolean egg_state = false;
boolean zuivel_state = false;
boolean fruitvegetables_state = false;
boolean meat_state = false;
boolean minderVerspillen_state = false;
boolean fish_state = false;
boolean noaberschap_state = false;
boolean endscreen_state = false;
boolean logbook_state = false;
boolean stickerbook_state = false;
boolean noaberschap_zuivel = false;
boolean noaberschap_vlees = false;
boolean noaberschap_vis = false;
boolean noaberschap_brood = false;
boolean noaberschap_groente = false;



void setup()
{
  Serial.begin(9600);
  Serial1.begin(9600);
  Serial2.begin(9600);
  pinMode(13, OUTPUT);
```

```
  while (!Serial);    // Do nothing if no serial port is opened (added for Arduinos based on ATMEGA32U4)

  SPI.begin();      // Init SPI bus

  mfrc522.PCD_Init();   // Init MFRC522

  delay(4);       // Optional delay. Some board do need more time after init to be ready, see Readme

  mfrc522.PCD_DumpVersionToSerial();  // Show details of PCD - MFRC522 Card Reader details

  Serial.println(F("Scan PICC to see UID, SAK, type, and data blocks..."));

  pinMode(red, OUTPUT);

  pinMode(green, OUTPUT);

  pinMode(blue, OUTPUT);

  pinMode(greenbutton, INPUT);

  pinMode(whitebutton, INPUT);

  pinMode(yellowbutton, INPUT);

  pinMode(bluebutton, INPUT);

  pinMode(redbutton, INPUT);


}

void loop()

{

//Serial.println("arduinostate: "+arduinostate);

//Serial.println(String(arduinostate));


  analogWrite(red, r); //writing brightness value to red

  analogWrite(green, g); //writing brightness value to green

  analogWrite(blue, b);
```

```
if (Serial1.available() > 0)
{
  data = Serial1.read();
  WizardofUs(data);
}
ReadingData();
  buttons();
   if ( ! mfrc522.PICC_IsNewCardPresent()) {

  return;
}

// Select one of the cards
if ( ! mfrc522.PICC_ReadCardSerial()) {
  //Serial.println("geen kaart gelezen");
  return;
}
String content = "";
byte letter;
for (byte i = 0; i < mfrc522.uid.size; ++i) { // read id (in parts)

  content.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " "));
```

```
    content.concat(String(mfrc522.uid.uidByte[i], HEX));

  }
  content.toUpperCase();
  ScreenState(content.substring(1));
  Serial.println(content.substring(1));



}
void SendData(String datasend) {
  //if(Serial2.available()>0){
  //String msg = data;
  Serial2.println(datasend);
  //}
}
void ReadingData() {

  if (Serial2.available() > 0) {
    testdata = Serial2.readString();
   Serial.println(testdata);
    if (testdata.indexOf("LEDOFF") >= 0) {
      r = 0;
      g = 0;
      b = 0;
      digitalWrite(13, HIGH);
      egg_state = false;
```

```
    zuivel_state = false;
    fruitvegetables_state = false;
    meat_state = false;
    minderVerspillen_state = false;
    fish_state = false;
    noaberschap_state = false;
    endscreen_state = false;
    logbook_state = false;
    stickerbook_state = false;

   }

  }
}
void buttons() {

  redbuttonvalue = analogRead(redbutton);
  yellowbuttonvalue = analogRead(yellowbutton);
  bluebuttonvalue = analogRead(bluebutton);
  whitebuttonvalue = analogRead(whitebutton);




  greenbuttonvalue = analogRead(greenbutton);

  if (greenbuttonvalue > 1000) {
```

```
if (!noaberschap_groente) {
  egg_state = false;
  zuivel_state = false;
  fruitvegetables_state = false;
  meat_state = false;
  minderVerspillen_state = false;
  fish_state = false;
  noaberschap_state = false;
  endscreen_state = false;
  logbook_state = false;
  stickerbook_state = false;
  noaberschap_zuivel = false;
  noaberschap_vlees = false;
  noaberschap_vis = false;
  noaberschap_brood = false;
  noaberschap_groente = true;

  r = 0;
  g = 255;
  b = 0;

  SendData("noabergroenteenfruit");



}
```

```
}
else if (yellowbuttonvalue > 1022) {
  if (!noaberschap_brood) {
    egg_state = false;
    zuivel_state = false;
    fruitvegetables_state = false;
    meat_state = false;
    minderVerspillen_state = false;
    fish_state = false;
    noaberschap_state = false;
    endscreen_state = false;
    logbook_state = false;
    stickerbook_state = false;
    noaberschap_zuivel = false;
    noaberschap_vlees = false;
    noaberschap_vis = false;
    noaberschap_brood = true;
    noaberschap_groente = false;
    r = 255;
    g = 100;
    b = 0;
    SendData("noaberbrood");

  }

}
```

```
else if (redbuttonvalue > 1022) {
  if (!noaberschap_vlees) {
    egg_state = false;
    zuivel_state = false;
    fruitvegetables_state = false;
    meat_state = false;
    minderVerspillen_state = false;
    fish_state = false;
    noaberschap_state = false;
    endscreen_state = false;
    logbook_state = false;
    stickerbook_state = false;
    noaberschap_zuivel = false;
    noaberschap_vlees = true;
    noaberschap_vis = false;
    noaberschap_brood = false;
    noaberschap_groente = false;
    r = 255;
    g = 0;
    b = 0;

    SendData("noabervlees");

  }
}
```

```
else if (bluebuttonvalue > 1022) {
    Serial.println("redbuttonvalue: ");
      Serial.println(redbuttonvalue);

  Serial.println("bluebuttonvalue: ");
    Serial.println(bluebuttonvalue);

Serial.println("whitebuttonvalue: ");
      Serial.println(whitebuttonvalue);

Serial.println("greenbuttonvalue: ");
      Serial.println(greenbuttonvalue);

Serial.println("yellowbuttonvalue: ");
    Serial.println(yellowbuttonvalue);
  if (!noaberschap_vis) {
    egg_state = false;
    zuivel_state = false;
    fruitvegetables_state = false;
    meat_state = false;
    minderVerspillen_state = false;
    fish_state = false;
    noaberschap_state = false;
    endscreen_state = false;
    logbook_state = false;
    stickerbook_state = false;
```

```
    noaberschap_zuivel = false;
    noaberschap_vlees = false;
    noaberschap_vis = true;
    noaberschap_brood = false;
    noaberschap_groente = false;
    r = 0;
    g = 0;
    b = 255;

    SendData("noabervis");
    Serial.println("noabervis");

  }
}
else if (whitebuttonvalue > 1000) {
    Serial.println("redbuttonvalue: ");
      Serial.println(redbuttonvalue);

  Serial.println("bluebuttonvalue: ");
    Serial.println(bluebuttonvalue);

Serial.println("whitebuttonvalue: ");
      Serial.println(whitebuttonvalue);

Serial.println("greenbuttonvalue: ");
      Serial.println(greenbuttonvalue);
```

```
Serial.println("yellowbuttonvalue: ");
    Serial.println(yellowbuttonvalue);
  if (!noaberschap_zuivel) {
    egg_state = false;
    zuivel_state = false;
    fruitvegetables_state = false;
    meat_state = false;
    minderVerspillen_state = false;
    fish_state = false;
    noaberschap_state = false;
    endscreen_state = false;
    logbook_state = false;
    stickerbook_state = false;
    noaberschap_zuivel = true;
    noaberschap_vlees = false;
    noaberschap_vis = false;
    noaberschap_brood = false;
    noaberschap_groente = false;
    r = 255;
    g = 200;
    b = 100;

    SendData("noaberzuivel");
    Serial.println("noaberzuivel");
```

```
    }
  }
}
void WizardofUs(char data) {
  if (data == '0') {
    r = 0;
    g = 0;
    b = 0;

  }
  else if (data == '1') {
    r = 255;
    g = 0;
    b = 0;

  }
  else if (data == '2') {
    r = 0;
    g = 255;
    b = 0;

  }
  else if (data == '3') {
    r = 0;
    g = 0;
```

```
  b = 255;


}
else if (data == '4') {
  r = 255;
  g = 200;
  b = 100;


}
else if (data == '5') {
  r = 255;
  g = 100;
  b = 0;


}
else if (data == '6') {
  r = 0;
  g = 0;
  b = 0;


  SendData("STICKERBOEK");
}
else if (data == '7') {
  r = 0;
  g = 0;
  b = 0;
```

```
    SendData("ENDSCREEN");

  }

}
void ScreenState(String screenstate) {
  if (screenstate == eggs || screenstate == eggs2) {
    if (!egg_state) {
      egg_state = true;
      zuivel_state = false;
      fruitvegetables_state = false;
      meat_state = false;
      minderVerspillen_state = false;
      fish_state = false;
      noaberschap_state = false;
      endscreen_state = false;
      logbook_state = false;
      stickerbook_state = false;
      noaberschap_zuivel = false;
      noaberschap_vlees = false;
      noaberschap_vis = false;
      noaberschap_brood = false;
      noaberschap_groente = false;

      //led color
```

```
    r = 255;
    g = 200;
    b = 100;
    SendData("EIEREN");


  }
}
else if (screenstate == meat || screenstate == meat2) {
  if (!meat_state) {
    egg_state = false;
    zuivel_state = false;
    fruitvegetables_state = false;
    meat_state = true;
    minderVerspillen_state = false;
    fish_state = false;
    noaberschap_state = false;
    endscreen_state = false;
    logbook_state = false;
    stickerbook_state = false;
    noaberschap_zuivel = false;
    noaberschap_vlees = false;
    noaberschap_vis = false;
    noaberschap_brood = false;
    noaberschap_groente = false;
```

```
    //led color
    r = 255;
    g = 0;
    b = 0;
    SendData("VLEES");

  }
}
else if (screenstate == zuivel || screenstate == zuivel2) {
  if (!zuivel_state) {
    egg_state = false;
    zuivel_state = true;
    fruitvegetables_state = false;
    meat_state = false;
    minderVerspillen_state = false;
    fish_state = false;
    noaberschap_state = false;
    endscreen_state = false;
    logbook_state = false;
    stickerbook_state = false;
    noaberschap_zuivel = false;
    noaberschap_vlees = false;
    noaberschap_vis = false;
    noaberschap_brood = false;
    noaberschap_groente = false;
```

```
    //led color
    r = 255;
    g = 200;
    b = 100;
    SendData("ZUIVEL");

  }
}
else if (screenstate == fruitvegetables || screenstate == fruitvegetables2) {
  if (!fruitvegetables_state) {
    egg_state = false;
    zuivel_state = false;
    fruitvegetables_state = true;
    meat_state = false;
    minderVerspillen_state = false;
    fish_state = false;
    noaberschap_state = false;
    endscreen_state = false;
    logbook_state = false;
    stickerbook_state = false;
    noaberschap_zuivel = false;
    noaberschap_vlees = false;
    noaberschap_vis = false;
    noaberschap_brood = false;
```

```
    noaberschap_groente = false;
    //LEDON = true;



    //led color
    r = 0;
    g = 255;
    b = 0;



    SendData("GROENTEENFRUIT");
  }
}
else if (screenstate == minderVerspillen || screenstate == minderVerspillen2) {
  if (!minderVerspillen_state) {
    egg_state = false;
    zuivel_state = false;
    fruitvegetables_state = false;
    meat_state = false;
    minderVerspillen_state = true;
    fish_state = false;
    noaberschap_state = false;
    endscreen_state = false;
    logbook_state = false;
    stickerbook_state = false;
    noaberschap_zuivel = false;
```

```
    noaberschap_vlees = false;
    noaberschap_vis = false;
    noaberschap_brood = false;
    noaberschap_groente = false;
    //LEDON = true;

    //led color
    r = 255;
    g = 100;
    b = 0;
    SendData("MINDERVERSPILLEN");

  }
}
else if (screenstate == fish || screenstate == fish2) {
  if (!fish_state) {
    egg_state = false;
    zuivel_state = false;
    fruitvegetables_state = false;
    meat_state = false;
    minderVerspillen_state = false;
    fish_state = true;
    noaberschap_state = false;
    endscreen_state = false;
    logbook_state = false;
    stickerbook_state = false;
```

```
    noaberschap_zuivel = false;
    noaberschap_vlees = false;
    noaberschap_vis = false;
    noaberschap_brood = false;
    noaberschap_groente = false;


    //led color
    r = 0;
    g = 0;
    b = 255;
    SendData("VIS");
  }
}
else if (screenstate == off) {

  egg_state = false;
  zuivel_state = false;
  fruitvegetables_state = false;
  meat_state = false;
  minderVerspillen_state = false;
  fish_state = false;
  noaberschap_state = false;
  endscreen_state = false;
  logbook_state = false;
  stickerbook_state = false;
```

```
  noaberschap_zuivel = false;
  noaberschap_vlees = false;
  noaberschap_vis = false;
  noaberschap_brood = false;
  noaberschap_groente = false;

  //led color
  r = 0;
  g = 0;
  b = 0;
  SendData("OFF");

}
else if (screenstate == logbook) {
  if (!logbook_state) {
    egg_state = false;
    zuivel_state = false;
    fruitvegetables_state = false;
    meat_state = false;
    minderVerspillen_state = false;
    fish_state = false;
    noaberschap_state = false;
    endscreen_state = false;
    logbook_state = true;
    stickerbook_state = false;
    noaberschap_zuivel = false;
```

```
    noaberschap_vlees = false;
    noaberschap_vis = false;
    noaberschap_brood = false;
    noaberschap_groente = false;

    //led color
    r = 0;
    g = 0;
    b = 0;
    SendData("LOGBOOK");
  }
}
else if (screenstate == stickerbook) {
  if (!stickerbook_state) {
    egg_state = false;
    zuivel_state = false;
    fruitvegetables_state = false;
    meat_state = false;
    minderVerspillen_state = false;
    fish_state = false;
    noaberschap_state = false;
    endscreen_state = false;
    logbook_state = false;
    noaberschap_zuivel = false;
    noaberschap_vlees = false;
    noaberschap_vis = false;
```

```
    noaberschap_brood = false;
    noaberschap_groente = false;
    stickerbook_state = true;



    //led color
    r = 0;
    g = 0;
    b = 0;
    SendData("STICKERBOOK");
  }
}
else if (screenstate == endscreen) {
  if (!logbook_state) {
    egg_state = false;
    zuivel_state = false;
    fruitvegetables_state = false;
    meat_state = false;
    minderVerspillen_state = false;
    fish_state = false;
    noaberschap_state = false;
    endscreen_state = true;
    logbook_state = false;
    stickerbook_state = false;
    noaberschap_zuivel = false;
    noaberschap_vlees = false;
```

```
    noaberschap_vis = false;
    noaberschap_brood = false;
    noaberschap_groente = false;



    //led color
    r = 0;
    g = 0;
    b = 0;
    SendData("ENDSCREEN");
   }
  }
}
```

Appendix B: Displayed information of the application. StartScene

DUURZAAMHEIDSPROBLEEM

Hallo ik ben Joris. Ik sta momenteel in het in het friezenberg natuurgebied net buiten Goor. Dit gebied kan de komende tijd gaan veranderen door klimaatverandering. Het zou minder gaan regenen. Hierdoor wordt het droger. Door de toenemende droogte worden de bomen minder sterk en vallen ze eerder om. Hierdoor wordt de kant groter dat er bomen uitsterven. Door de stijgende temperatuur wordt het ook makkelijker voor insecten om te overleven. Hierdoor kunnen er meer insectenplagen komen.

IMPACT VOEDSELKEUZES

Deze klimaatverandering kan worden vertraagd. Je kan bijvoorbeeld duurzamere etenskeuzes maken. 30% van de broeikasgasuitstoot binnen Europa komt van de productie van eten. Broeikasgassen zijn een dekentje van de aarde. Hoe meer broeikasgassen hoe dikker het dekentje. Hierdoor kan er minder warmte weg van de aarde en warmt de aarde op. Hierdoor kan het bos veranderen. Door duurzame etenskeuzes te maken en minder voedsel te verspillen, kan de broeikasgas uitstoot lager worden. Hierdoor vertraagd de klimaatverandering. Met deze winkelwagen ga ik je helpen duurzamere etenskeuzes te maken.

INSTALLATIEWERKING.

Je moet opzoek naar interactie punten in de winkel. Ik zou je hiermee helpen door licht te geven als je in de buurt bent. De interactiepunten zijn te herkennen aan de logos die te vinden zijn aan de schappen in de winkel. De logo's zijn hetzelfde als die op de voorkant van de winkelwagen. Bij de interactiepunten zal je een druppel zien hangen. Deze moet je aan de zijkant van de winkelwagen aanhouden. Dit is ook aangegeven op de winkelwagen. Als je de druppel tegen de lezer aan hebt gehouden, komt er informatie op het scherm. Je kan op verschillende objecten op het scherm klikken en ik zou er wat over vertellen. Verder kan je ook nog drukken op de knoppen van de decoratie modules aan de zijkant van de winkelwagen. Door te drukken op een knop krijg je informatie over hoe de boeren in de buurt duurzame producten maken. Tijdens het gebruik van de winkelwagen moet je proberen om stickers te verzamelen. Hoe meer stickers je hebt verzameld hoe meer je weet over duurzame etenskeuzes. Deze stickers kan je zien in je sticker boek. Klik op doorgaan zodat we de winkel kunnen ontdekken en duurzame producten kunnen vinden.

[1] https://biblio.ugent.be/publication/7189716/file/7189717

[2] https://ec-europa-eu.ezproxy2.utwente.nl/jrc/en/science-update/edgar-food#:~:text=The%20JRC%20developed%20a%20new,system%2C%20from%20production%20to%20disposal.
[3] wayf.springernature.com
[4] https://www.knmi.nl/kennis-en-datacentrum/achtergrond/hoe-warmen-broeikasgassen-de-aarde-op

Groente en fruit

DUURZAAM MOESTUIN

Wist je dat je ook je eigen groente en fruit kan verbouwen in de tuin. In Nederland kan je verschillende soorten groente en fruit kweken in de tuin. Ga eens naar de tuinwinkel en kijk welke groente ze verkopen om te verbouwen. Misschien kan je dan straks je eigen aardbeien, tomaten of andere groentes of fruit eten. Je eigen groente en fruit heeft ook voordelen voor de natuur. Je weet zeker dat er geen stoffen zijn gebruikt die schadelijk zijn voor de natuur. Verder hoeven de groente en fruit niet naar de supermarkt gebracht te worden. Dit zorgt ervoor dat er geen broeikasgassen vrijkomen bij het transport. Je moet op een paar dingen letten als je een moestuin wilt maken. Zorg ervoor dat er bloemen in de moestuin staan zodat bijen worden gelokt. Bijen bestuiven je groente en fruit waardoor het gaat groeien. Bloemen maken de kans op een insectenplaag ook kleiner. Je kan ook een vijver maken of een bak met water in de tuin zetten. Dit trekt kikkers en egels aan die de slakken opeten die je planten kapot kunnen maken. Zorg er ook voor dat de bodem genoeg voedingstoffen bevat voor de planten. Dit kan je doen door mest of compost te gebruiken. Je moet ook de planten goed watergeven. Doe dit een keer in de week zodat de wortels diep in de grond gaan zitten. Als je te vaak water geeft gaan de wortels niet diep de grond in.

https://www.natuurenmilieu.nl/blog/duurzaam-moestuinieren-de-beste-moestuintips/

KEURMERK

EKO

De producten met een EKO-keurmerk zijn gemaakt volgens de regels over biologische landbouw van Europa. Het EKO-keurmerk moedigt de makers van het eten aan om nog duurzamer hun eten te maken. Wil je zien hoe de boeren dit doen? Dit kan want ze zijn verplicht om dit te laten zien aan de klanten. Ze kunnen dit doen door een website te maken, een open dag te houden, de producten lokaal te verkopen of groep excursies te houden.

https://www.eko-keurmerk.nl/

Rainforest Alliance

Rainforest Alliance zorgt ervoor dat bos behouden blijft en de boeren kunnen blijven boeren. Ze beschermen de bossen tegen klimaatverandering en ontbossing. Ze willen boeren in tropische arme landen helpen met het opzetten van een goed bedrijf waar ze op duurzame manier hun gewassen verbouwen.

https://www.rainforest-alliance.org/about

EU biologisch

Producten met een Eu biologisch keurmerk zijn verbouwd volgens de europese regels over biologische landbouw. De producten moeten voor 95% bestaan uit biologische ingrediënten. Er wordt ook rekening gehouden met het gebruik van goeie insectenbestrijdingsmiddelen en voeding voor de gewassen.

https://www.voedingscentrum.nl/encyclopedie/europees-biologisch.aspx!%20rel=

Fairtrade

Fairtrade probeert boeren in arme landen te helpen om eerlijke prijs te krijgen voor hun producten. Hierdoor kunnen de boeren in arme landen geld verdienen om een goed leven te krijgen en hun boerderijen te verduurzamen.

https://www.fairtradenederland.nl/?gclid=CjoKCQjw--GFBhDeARIsACH_kdauOF3-3tjr2QuIDdOfGMex9zeeotTqQM7VKSKtV1-5lnS-dGJJUaAaAjzKEALw_wcB

On the way to Planetproof

Het on the way to Planetproof keurmerk is een bewijs dat het product duurzaam is gemaakt. Boeren mogen het keurmerk gebruiken als ze voldoen aan strenge regels. Deze regels zorgen ervoor dat het product duurzaam is. Het gaat niet alleen over het product zelf, maar ook over de verpakking en de verwerkers van het product.

https://www.planetproof.nl/

WAAR BEWAREN

Groente en fruit bederft snel. Het bederven kan vertraagd worden. Maak bijvoorbeeld de verpakking pas open als je het stuk groente of fruit echt gaat opeten. De manier waarop je de groente en fruit bewaard kan het bederven ook vertragen. Fruit soorten die je in de koelkast kan bewaren zodat ze langer goed blijven zijn zacht fruit, druiven, peer, kiwi, appels en voorgesneden fruit. Hierdoor worden ze wel dubbel zolang houdbaar. Dit geldt ook voor de groentes. Groentes die je beter in de koelkast kan bewaren zijn bladgroentes, bloemkool, broccoli, prei, sperziebonen en champignons. Probeer thuis eens te kijken en probeer je groente en fruit op de goeie plaats te bewaren.

https://www.voedingscentrum.nl/nl/thema/kopen-koken-bewaren/eten-bewaren/waar-bewaar-ik-groente-en-fruit.aspx

Vlees

BETER LEVEN KEURMERK

https://beterleven.dierenbescherming.nl/?gclid=CjoKCQjw--GFBhDeARIsACH_kdZuPPnsATTXA-KDM29DsvIYdoYw3NlaDLOpRTfDgqrzWmEQV169y4AaAiHcEALw_wcB

Een ster

Kip

Dit is een één ster beter leven vlees kip. Zij zit met 12 kuikens op een vierkante meter. Haar baasje strooit elke dag voer in haar stal. Als ze moe is kan ze in het stro gaan liggen. Ze krijg natuurlijk licht waardoor ze een normaal ritme heeft. Dit komt doordat 20% van het dak licht doorlatend is. Ze wordt maximaal 4 uur in de vrachtwagen naar de slachterij.

Koe

Dit is een één ster beter leven koe. Hij mag 3 maanden bij zijn moeder blijven na de geboorte. Hij ben geboren op een natuurlijke manier. In mijn stal heeft hij5,4 vierkante meter voor zichzelf. Als hij moe is, kan hij slapen op lekker zacht stro. Hij mag 150 dagen in het jaar 8 uur buiten lopen. Hij is binnen 4 uur bij de slachterij.

Varken

Dit is een één ster beter leven varken. Haar moeder heeft 2,25 vierkante meter ruimte gehad. Zijzelf heeft 1 vierkant meter voor haarzelf. Zij hoeft zich niet te vervelen, want Haar boer is verplicht hem te vermaken. Ze vindt het bijvoorbeeld leuk om met stro en hooi te spelen. Haar maximale transporttijd is 8 uur.

Twee ster

Kip

Dit is een twee sterren beter leven vlees kip. Ze zit met 13 kippen op een vierkante meter. In hun stal kan ze lekker zacht liggen op stro. Ze mag per dag minimaal 8 uur naar buiten. Buiten kan ze dan lekker onder de beschutting zitten. Verder krijgt ze ook daglicht in de stal. Ze krijgt ook elke dag voedsel. Op een leeftijd van 56 dagen gaat ze naar de slachterij. Dit is een reis van maximaal 3 uur.

Koe

Dit is een twee ster beter leven koe. Hij mag 5 maanden bij zijn moeder blijven nadat hij geboren is. Hij is op een natuurlijke manier geboren. In mijn stal heeft hij 6,6 vierkante meter voor hem alleen. Als hij moe is, kan hij op zacht stro gaan liggen. Hij mag 180 dagen per jaar 12 uur lang buiten lopen. Zijn reis naar de slachterij duurt maximaal 4 uur.

Varken

Dit is een twee ster beter leven varken. Haar moeder heeft 2,5 vierkante meter ruimte gehad. Ze mocht vrij uitlopen in het kraamhok nadat ik 5 dagen oud was. Zijzelf heb 1,1 vierkante meter ruimte. Verder is haar boer verplicht om stro in mijn stal te leggen. Hiermee kan zij ook spelen voor afleiding. Ze heeft ook de mogelijkheid om naar buiten uit te lopen. Verder mag haar boer haar staart niet afknippen. Het transport naar de slachterij mag maximaal 8 uur duren.

Drie ster

Kip

Dit is een drie sterren vlees kip. Ze staat met 10 kippen op een vierkante meter. Ze mag ook minimaal 8 uur naar buiten als ze 28 dagen oud is. Hier heeft ze 4 vierkante meter voor haarzelf. Ze krijgt elke dag eten en kan zacht liggen op verse stro. Na 56 dagen wordt ze binnen 3 uur naar de slachterij gebracht. Hier wordt ze verdoofd geslacht. Haar boer houdt zich ook aan de Europese regels voor biologisch produceren.

Koe

Dit is een drie sterren beter leven koe. Hij mag minimaal 6 maanden bij zijn moeder blijven na de geboorte. Hij heeft 8,5 vierkante meter voor hem alleen in de stal. Hij mag ook nog eens 210 dagen per jaar 12 uur per dag buiten in de wei lopen. Verder moet zijn boer voldoen aan Europese regels voor biologisch vee. Hierdoor krijgt hij speciaal biologisch voer.

Varken

Dit is een drie ster beter leven varken. Zijn moeder heeft 2,5 vierkante meter ruimte gehad. Hij mag tussen 39 en 42 dagen blijven bij zijn moeder. Hijzelf heeft 1,3 vierkante meter ruimte. Verder is zijn boer verplicht om stro in mijn stal te leggen. Hiermee kan hij ook spelen voor afleiding. Hij heeft ook de mogelijkheid om naar buiten uit te lopen naar een buitenplaats. Verder mag zijn boer zijn staart niet afknippen. Het transport naar de slachterij mag maximaal 6 uur duren. Hij moet dan in een vrachtwagen waarin er op de temperatuur en het zuurstofgehalte wordt gelet. Verder moet zijn boer ook voldoen aan de biologische regels van Europa. Hierdoor krijg hij speciaal biologisch eten en word hij beter behandeld.

WELKE KEURMERKEN IN DE WINKEL VOOR VLEES EN WAT BETEKENEN ZE

Beter leven

Beter leven keurmerk gaat over hoe dieren worden behandeld door de boer. Het beter leven keurmerk zorgt ervoor dat de dieren genoeg ruimte krijgen, naar buiten mogen en goed behandeld worden. Een ster beter leven producten besteden aandacht aan dierenwelzijn. Bij twee sterren beter leven producten is er meer aandacht voor dierenwelzijn. Dieren hebben bijvoorbeeld meer ruimte of mogen langer naar buiten. Bij drie sterren staan de dieren centraal. De boer doet er dan alles aan dat alle dieren zelf kunnen kiezen wat ze willen.

EKO

EKO is een keurmerk voor biologische producten. Voor vlees betekent dit dat de dieren een goed leven hebben gehad, genoeg in de wei hebben gelopen en genoeg ruimte om zelf te beslissen wat ze willen. Verder zorgen de boeren er ook voor dat er minder energie wordt gebruik door bijvoorbeeld zonnepanelen te gebruiken. Ze proberen er ook voor te zorgen dat er genoeg verschillende planten en dieren in de natuur blijven. Dit doen ze bijvoorbeeld door bepaald voer te gebruiken zodat de koeien minder scheten laten of door bijen te houden. Ze moeten ervoor zorgen dat de klanten weten waar ze mee bezig zijn. Ze kunnen dit doen door een website te maken, een open dag te houden, producten te verkopen bij de boerderij zelf of door excursies te organiseren. Misschien mag jij ook wel een keer langskomen.

Eu biologisch

Eu biologisch zorgt ervoor dat vlees biologisch wordt geproduceerd. Dit betekent dat de boeren verschillende maatregelen moeten nemen om biologisch vlees te maken. Ze moeten de dieren voeren met biologisch voer en ze moeten ervoor zorgen dat de natuur mooi blijft.

VEGA

Vlees is een groot deel van de totale impact van voedselkeuzes. 40% van de broeikasgassen die vrijkomen bij voedselproductie komt van vlees [1]. Vega producten kunnen helpen bij het verminderen van de vleesproductie [2]. Probeer een keer vegetarisch te eten. Er is een speciaal schap met vegetarische producten in de winkel. Neem eens een kijkje. Misschien zit er wel wat lekkers tussen.

[1] https://www.milieucentraal.nl/eten-en-drinken/milieubewust-eten/vlees/

[2] https://link-springer-com.ezproxy2.utwente.nl/article/10.1007/s10584-014-1169-1?post_type=page&error=cookies_not_supported&code=71f5d893-aa29-4daf-8535-1644c6418925

minder verspillen

RESTJES KOKEN

Kijk voordat je boodschappen gaat doen, eerst wat je nog in huis hebt. Probeer dan iets lekkers te bedenken wat je kan maken met de producten die je al in huis hebt. Hierdoor hoef je die producten niet weg te gooien en verspil je minder voedsel. Gerechten waar je makkelijk restjes in kan verwerken zijn soep, salade, omelet, roerbak gerechten, pasta, rijst en smoothies. Er zijn ook verschillende online kookapps die je kunnen helpen met het bedenken van gerechten met je restjes.

https://www.voedingscentrum.nl/nl/thema/kopen-koken-bewaren/eten-bereiden/koken-met-restjes-en-kliekjes.aspx

OPNIEUW OPWARMEN

Eten dat je over hebt na een maaltijd kan je bewaren en opnieuw opwarmen in de magnetron. Laat het eten eerst afkoelen voordat je het in goed afsluitbare bakjes stopt. Bedenk direct wanneer je het op wilt eten zodat je het niet vergeet. Leg de kliekjes in de koelkast en probeer het binnen twee dagen op te eten. Als dit niet lukt kan je het ook in de vriezer stoppen. Dan blijft je eten voor 3 maanden houdbaar. Gooi het eten weg nadat je het nog een keer hebt opgewarmd. Dit eten is niet meer goed om te eten.

WAAR BEWAREN

Zie groente en fruit

Zuivel

HOUDBAARHEIDDATUM VS NOG TE ETEN TOT

Wist je dat de houdbaarheidsdatum op verpakkingen vaak niet kloppen. Je kan vaak eten nog eten nadat de houdbaarheidsdatum verstreken is. Je moet op een paar dingen letten als je iets wilt eten. Eerst moet je weten dat er twee verschillende datums zijn. Ten minste houdbaar tot datums staan op producten die lang houdbaar zijn. Als de datum verstreken is dan gaat de kwaliteit van het eten achteruit. Te gebruiken tot datums staan op producten die niet zolang houdbaar zijn. Dit is de laatste dag dat het nog veilig is om het product te eten. Lang houdbare producten kun je dus nog lang na de houdbaarheid datum eten, maar de kwaliteit is wel achteruitgegaan. Voordat je gaat eten kijk, ruik en proef dan eerst. Je kan het product niet eten als het er raar uitziet, niet goed ruikt en vreemd proeft. Eet het dan niet meer op. Bij producten met tenminste tot datums kan je het beter niet proberen. Hier kunnen ziekteverwekkers inzitten die je niet kan zien, ruiken of proeven. Dit gebeurt vooral bij vlees en vis. Bij groente of fruit kan je wel kleine stukken wegsnijden als het stuk nog niet erg is bedorven.

DUURZAAM MELKEN KEURMERKEN

On the way to Planetproof

Zuivel moet aan verschillende eisen voldoen om het on the way to planetproof keurmerk te krijgen. Deze eisen gaan over zes gebieden: bodem, landschap & biodiversiteit, water, energie, materiaalgebruik en afval, klimaat en dierenwelzijn. Hierdoor houden ze rekening met verschillende dingen. Ze moeten bijvoorbeeld ervoor zorgen dat de grond vruchtbaar blijft. Ze moeten ook goed nadenken over hoe ze water gebruiken zodat er weinig water wordt verspild. Ook moeten ze hun afval recyclen en ervoor zorgen dat ze het klimaat niet belasten.

EKO

Het EKO-keurmerk zorgt ervoor dat producten geproduceerd zijn volgens de Europese regels van biologisch landbouw. Boeren nemen hiervoor verschillende maatregelen. Ze zorgen bijvoorbeeld voor een gesloten kringloop. Dit betekent dat de boeren niks van buitenaf gebruiken. Ze maken het voer voor de dieren zelf en vangen zelf het drinkwater voor de dieren op. Ze moeten er ook voor zorgen dat er genoeg variatie in de plaatselijke natuur blijft. Dit kunnen ze doen door bloemen te zaaien en bijen te houden. Ze moeten ook transparant zijn. Dit mag door een website te maken, een open dag te houden, producten rechtstreeks te verkopen of groep excursies te ontvangen.

Eu biologisch

Een product dat biologisch geproduceerd is, kan een EU biologisch keurmerk krijgen. Zuivel met dit keurmerk is dus biologisch geproduceerd. Dit betekent dat boeren rekening houden met duurzaamheid en dierenwelzijn. Ze kiezen twee thema's waar ze mee aan de slag willen gaan. Ze kunnen bijvoorbeeld ervoor zorgen dat de dieren goed en duurzaam behandeld worden of ervoor zorgen dat er genoeg verschillende planten in de omgeving blijven bestaan.

DUURZAAM KOE HOUDEN BETER LEVEN MELKKOE

Hallo dit is koe kor. Hij wordt op een duurzame manier gehouden door zijn boer. Zijn zuivel krijgt namelijk het beter leven keurmerk. Hierdoor heeft hij een lig plek in de stal en kan hij hem hier ook borstelen. Hij kan ook lekker slapen op een koe matras. Verder kan hij ook minimaal 120 dagen naar buiten om lekker te grazen. De energie die gebruikt wordt in mijn stal is 100% duurzaam. Hij eet vaak voer dat lokaal is gemaakt. Verder moet zijn boer ervoor zorgen dat er niet veel poep van hem blijft liggen om de bodemkwaliteit goed te houden.

Vis

KEURMERKEN

ASC-keurmerk

Het ASC-keurmerk is een keurmerk voor kweekvis. Het keurmerk zorgt ervoor dat de kwekerij de impact op de natuur moet proberen te verlagen. De kwekerijen moeten zo min mogelijk chemische stoffen gebruiken, rekening houden met duurzaamheid en zorgen dat ze de omgeving niet vervuilen. Ze worden ook verplicht om bij te houden hoe duurzaam ze bezig zijn. Hierdoor kan iedereen controleren of ze wel goed bezig zijn.

https://www.asc-aqua.org/nl/alles-over-aquacultuur/hoe-leidt-het-kopen-van-vis-met-het-asc-keurmerk-tot-verandering/

Msc keurmerk

Duurzaam gevangen vis kun je herkennen aan het MSC-keurmerk. Het MSC-keurmerk zorgt ervoor dat vissers rekening houden met de visstanden en andere leven in de zee tijdens het vissen. De vissers moeten zich houden aan 3 kernprincipes. Als eerst moeten ze ervoor zorgen dat de visbestanden op een goed niveau blijven. Dit betekent dat er genoeg vis over moet blijven in de zee. Hierdoor blijft er genoeg vis over in de zee. Ten tweede moeten de vissers ervoor zorgen dat het andere zeeleven zo min mogelijk last heeft van de visserij. Ze moeten ervoor zorgen dat ander zeeleven gezond in hun eigen leefgebied kan blijven leven. Als laatste moeten de vissers zich houden aan de wetgeving en moeten ze zich aanpassen op de veranderende milieuomstandigheden.

https://www.msc.org/nl/msc-standaarden/visserijstandaard'

EU-biologisch

Eu biologisch keurmerk zorgt ervoor dat de vis duurzaam gekweekt is volgens de biologische wetten van de Europese Unie. Dit keurmerk staat alleen op vis dat is gekweekt in kwekerijen. Dit betekent dat deze vis niet is gevangen in de zee of op grote meren. Het keurmerk zorgt ervoor dat de kwekerijen het milieu zo min mogelijk kapot maken. De kwekerij moeten de leefomgeving van de vissen proberen na te maken, vissen genoeg ruimte te geven en ze moeten de vissen zonder bewustzijn slachten.

KWEEKVIS VS GEVANGENVIS

Je kunt twee verschillende soorten vis kopen in de supermarkt. Dit is kweekvis en in de zee gevangen vis. Het vangen van wilde vis kan veel impact hebben op de natuur. Het kan schade toebrengen aan de natuur en kan ervoor zorgen dat al de vis uit de zee wordt gevist. Hierdoor kunnen vissoorten uitsterven. Er is ook een groot risico op het vangen van andere vis die niet gebruikt kunnen worden voor het eten. Tijdens het vissen kan er ook een net afbreken waardoor er afval in de zee kan komen. Kweekvis heeft minder last van deze problemen. Vis kan gekweekt worden in gesloten en open systemen. Hierdoor

hoeft de vis niet uit de zee te worden gehaald. Hierdoor worden er geen schade toegebracht aan de zee, geen extra vissoorten gevangen, niet overbevist en kan er geen afval in de zee komen. Kweekvis heeft dus minder impact op de zee.

https://www.milieucentraal.nl/eten-en-drinken/milieubewust-eten/vis/

WAAR WORDEN BEPAALDE SOORTEN VIS GEVANGEN

Tonijn

Dit is een tonijn. Hij zwem vooral in de Stille en de Indische oceaan. Hij reist ruim 12000 kilometer voordat hij in de supermarkt ben. Dit is heel ver weg. Hierdoor komt er veel CO_2 vrij bij het transport.

Pangasuis

Dit is een pangasuis meerval. Hij zwem in de rivieren in India en Myanmar en in de Mekongdelta in Vietnam. Hij kom dus uit Azië. Hij reist ruim 8000 kilometer voordat ik in de supermarkt ben. Dit is best ver weg. Elke kilometer extra wordt er meer CO_2 uitgestoten worden. Dit heeft een impact op de natuur.

Zalm

Dit is een zalm. Hij wordt gekweekt in Noorwegen en gevangen in China. Vanuit Noorwegen moet hij ruim 1000 kilometer reizen tot de supermarkt en vanuit China reist hij 10 keer zoveel. Hoe minder reizen hoe minder impact op de natuur.

Forel

Dit is een forel. Hij kan gevangen worden in Denemarken. Hij moet ongeveer 500 kilometer reizen voordat hij hier in de supermarkt ben. Elke kilometer tijdens het transport wordt er CO_2 uitgestoten. Hoe meer uitstoot hoe meer impact op de natuur.

Kabeljauw

Dit is een kabeljauw. Hij wordt gevangen in het noordoostelijke deel van de Atlantische Oceaan. Hij moet ongeveer 2000 kilometer reizen voordat Hij in de supermarkt ben. De CO_2-uitstoot hangt af van de kilometers die hij moet reizen. Hoe meer kilometer hoe meer uitstoot. Dit betekent ook meer impact op de natuur.

Garnaal

Dit is een Hollandse garnaal. Hij wordt gevangen dichtbij huis. Hij zit in de Waddenzee en in de Noordzee. Hierdoor heeft hij minder ver moeten reizen naar de supermarkt. Hierdoor wordt de impact op de natuur verlaagd. Heb je een keer een dagje vrij. Ga dan naar de noord of Waddenzee en vaar een keer mee op een vissersboot. Je kan hier zien hoe garnalen gevangen wordt.

https://www.jumbo.com/listers/zoeken?SynchronizerToken=b415b85570faf44a425bdb78dabc3241d8c62c4ba66f2cee47020f364fd1ef64&searchTerms=panga

Eieren

LEGHEN BETER LEVEN

Dit zijn leghennen. Zij leggen de eieren. Ze worden duurzaam behandeld. Dit is te zien aan het beter leven keurmerk. Dit keurmerk zorgt ervoor dat de boer hen goed behandeld. Ze krijgen genoeg ruimte, daglicht, voer en stro onder onze poten. Hoe meer sterren hoe beter ze behandeld worden door de boer.

KEURMERKEN

Respeggt

Respeggt zorgt ervoor dat er geen mannelijke kuikens worden gedood vlak na de geboorte. Elk jaar worden er ongeveer 330 miljoen mannelijke kuikens gedood. Mannelijke kuikens kunnen geen eieren leggen en brengen weinig vlees op. Mannelijke kuikens zijn hierdoor niet goed te gebruiken in de voedselketen. Ze voorkomen het doden van mannelijke kuikens op twee manieren. De eerste manier is het bepalen van het geslacht in het ei. Dit kunnen ze zien door een laserstraal op het ei te richten tijdens dag 9 van het broedproces. Hierdoor komt er een druppel uit het ei in een buisje. Het geslacht wordt bepaald aan de hand van de kleur van de vloeistof. De eieren met mannelijke kuikens worden niet meer uitgebroed. De tweede manier is het groot maken van de mannelijke kuikens en ze worden gebruikt voor vleesproductie Ze worden grootgebracht volgens de respeggt manier. Dit betekent dat er veel aandacht is voor het welzijn van de haan.

https://www.respeggt.com/nl/

On the way to Planetproof

Het On the way to Planetproof keurmerk geeft aan dat de eieren duurzamer zijn gemaakt. De eieren zijn duurzaam door de manier de Planetproof boeren hun eieren produceren. Ze gebruiken alleen groene stroom, stoten minder milieubelastende stoffen uit, zorgen voor goede dierenwelzijn en ze zorgen voor minder afval.

EKO

Het EKO-keurmerk staat voor het biologisch produceren van producten. Producten moeten voldoen aan de Europese regels over biologisch voedsel produceren. EKO zorgt ervoor dat boeren zich nog beter aan de regels moeten houden. Ze moeten beter hun best doen om duurzamer te produceren, de huidige natuur beter te behouden en hun dieren beter behandelen.

EU-biologisch

Eieren met het EU biologisch keurmerk zijn gemaakt volgens de EU biologische landbouw wetgeving. Deze regels zorgen ervoor dat er rekening gehouden wordt met dierenwelzijn en milieu. Kippen moeten buiten kunnen lopen en voor 95% biologisch voer krijgen. Ze mogen ook niet zomaar gebruik maken van chemische stoffen. Het is alleen mogelijk als er geen andere alternatieven zijn.

EI NUMMERS

Op een ei staan verschillende nummers, die wat zeggen over hoe een ei geproduceerd is. Het eerste nummer geeft aan hoe de kip behandeld is. Hoe lager het nummer hoe beter de kip is behandeld. 3 betekent dat het kooi eieren zijn. Kippen zitten hier gevangen in kooien en worden slecht behandeld. 2 betekent dat het scharrelkippen zijn. Kippen zitten hier dicht op elkaar en hebben hierdoor weinig vrijheid. 1 geeft aan dat het vrije-uitloopeieren zijn. Dit betekent dat de kippen vrij kunnen lopen waar ze willen. Deze kippen komen ook buiten en worden goed behandeld. 0 staat voor dat biologisch. Deze kippen zijn behandeld volgens de biologische regels. Ze krijgen genoeg voer, hebben genoeg ruimte en mogen lopen waar ze willen.

https://www.wakkerdier.nl/verantwoord-eten/boodschappen/eieren/

Noaberschap
Noaberschap brood

De voedselketen van brood naar de supermarkt bestaat uit verschillende stappen. Eerst moet een boer graanzaad zaaien en verbouwen. De boer kan zijn graan oogsten als het groot genoeg is gegroeid. Als alles geoogst is, moet hij het eerst wassen. Daarna brengt hij het graan naar de maalmachines om het graan te malen. Na het malen is het graan klaar om naar de bakker te gaan. Daarna maakt de bakker brood van het graan. Als het brood klaar is gaat het naar een verdeelplaats waar de supermarkten brood kunnen kopen voor alle klanten. Hierna moet de supermarkt het gekochte brood naar de supermarkt brengen. Het is moeilijk te controleren of al deze stappen op een duurzame manier verlopen. Bij lokale producten is dit makkelijker. In deze winkel kan je brood vinden van bakkerij Nollen uit Hengevelde. Dit brood wordt gemaakt in de duurzame fabriek van bakkerij Nollen. In deze fabriek maken ze gebruik van duurzame energie en andere duurzame technieken. Verder vinden ze het ook belangrijk dat de ingrediënten van hun producten duurzaam worden gemaakt. Ze kopen de ingrediënten van hun brood bij een groothandel ze zoveel mogelijk ingrediënten lokaal en biologisch verbouwen. Bij bakkerij Nollen ben je dus verzekert dat het brood op een duurzame manier is gemaakt. Dit is in de winkel te herkennen aan de noaberschap logo's boven de schappen.

https://www.lekkervanbijons.be/brood/van-graan-tot-brood

https://www.bakkerijnollen.nl/nieuws/duurzaamheid-bij-bakkerij-nollen/

Noaberschap vis

Vis wordt op verschillende plekken in de wereld gemaakt en gekweekt. De vis moet soms wel 10.000 kilometer afleggen voordat het in de supermarkt ligt. Tijdens de reis van de vis uit verre landen wordt er veel brandstof gebruikt. Dit zorgt ervoor dat er veel broeikasgassen vrijkomen. Dit kan veel impact hebben op de natuur. Deze reizen duren ook lang. Dit zorgt ervoor dat de vis in de winkel minder vers is. Vis die is gevangen in Nederland hoeft niet zo ver te reizen voordat het in de winkel ligt. Om deze vis in de winkel te krijgen wordt er ook minder broeikasgassen uitgestoten tijdens het transport. Dit komt doordat de vis minder ver moet reizen van de visser naar de winkel. Op de verpakking staat vaak waar de vis gevangen of gekweekt wordt. Kijk of vis uit Nederland komt. Bij kweekvis moet op de verpakking staan waar de vis het laatste deel van de kweektijd is geweest. Bij gevangen vis is kan je kijken naar twee dingen. Je kan kijken of er Nederland op staat of dat de vis gevangen is in het noordoostelijke deel van de Atlantische Oceaan. De Noordzee is namelijk onderdeel van het noordoostelijke deel van de Atlantische Oceaan. Kijk waar de vis vandaan komt om te bepalen hoe lang het transport van de visser naar de supermarkt heeft geduurd.

Noaberschap groente

Groente en fruit worden op verschillende plekken in de wereld gekweekt. Op de verpakking kun je zien waar groente en fruit gekweekt zijn. Hoe dichter bij huis groente en fruit zijn gekweekt hoe korter het transport. Dit zorgt ervoor dat er minder broeikasgassen vrijkomen en dat de producten verser zijn wanneer ze in de winkel liggen. Groente en fruit dat in Nederland gekweekt wordt hoeft de kortste weg af te leggen van de kwekerij naar de supermarkt. Dit zorgt ervoor dat er minder broeikasgassen worden uitgestoten en dat de producten verser zijn als ze in de winkel aankomen. Deze groentes en fruit zijn ook volgens de Nederlandse wetgeving gekweekt. Nieuwe kassen moeten bijvoorbeeld klimaatneutraal zijn gemaakt. De boeren moeten er verder ook alles aan doen om zo min mogelijk impact te hebben op de natuur. Kijk dus goed op de labels van het groente en fruit. Kijk naar waar de groente en fruit vandaan komt.

https://www.voedingscentrum.nl/nl/service/vraag-en-antwoord/gezonde-voeding-en-voedingsstoffen/wat-zijn-de-seizoensgroenten-in-de-verschillende-jaargetijden-en-welk-seizoensfruit-is-er.aspx

https://www-rijksoverheid-nl.ezproxy2.utwente.nl/onderwerpen/landbouw-en-tuinbouw/landbouwbeleid

Noaberschap zuivel en eieren

De meeste eieren en zuivel die in de winkel liggen komen vanuit een distributiecentrum. De meeste boeren brengen hun producten naar een distributiecentrum voordat ze in de winkel komen. Dit kan soms lang duren. De producten zijn dan niet meer vers als ze in de supermarkt aankomen. Een distributiecentrum ligt vaak niet precies tussen de boer en de supermarkt in. De vrachtwagens moeten dan omrijden waardoor er meer broeikasgassen wordt uitgestoten. Noaberschap producten worden direct van de boer naar de supermarkt. De vrachtwagens hoeven hier niet om te rijden. Ze gebruiken dus minder brandstof. Als je minder brandstof gebruikt, worden er ook minder broeikasgassen uitgestoten. Noaberschap producten zijn hierdoor duurzamer. De producten zijn ook verser. De Twenteland boer probeert zijn eieren in twee dagen naar de winkel te brengen. De eieren van Twenteland zijn ook nog eens duurzaam gemaakt. Twenteland heeft nieuwe stallen gebouwd. In deze stallen maken ze gebruik van duurzame energie en proberen hun afval ergens anders te gebruiken. Je kan ook lokale zuivelproducten van Keuper kaas kopen. Probeer dus eens lokale producten. Je kan makkelijker uitzoeken hoe de producten gemaakt worden en ze zijn verser dan andere producten. Ze zijn te herkennen aan het noaberschap logo dat je kan vinden in de winkel.

Noaberschap vlees

Vlees komt van over de hele wereld. Dit moet verplicht op de verpakking staan. De afstand bepaald hoe ver het stuk vlees moet reizen voordat het in de supermarkt ligt. Hoe verder weg hoe langer het duurt. Dit zorgt er ook voor dat er meer broeikasgassen worden uitgestoten en het vlees is minder vers als het in de supermarkt is. Vlees dat dicht bij de supermarkt is geproduceerd is duurzamer en verser. Kies dus voor vlees uit de noaberschap productlijn zodat je zeker weet waar het vlees vandaan komt. In deze jumbo ligt vlees van lokale slagers Kastelein en Visschedijk. Deze slagers gebruiken lokale dieren voor hun vlees en leveren direct aan de supermarkt. De weg van de slachterij naar de supermarkt wordt korter. Dit zorgt ervoor dat er minder broeikasgassen worden uitgestoten.

Appendix C sound list

Sound	Source
Stickerbliep1	https://freesound.org/people/InspectorJ/sounds/403007/
Buttonpress1	https://freesound.org/people/pfranzen/sounds/340453/
Buttonpress 2	https://freesound.org/people/Jofae/sounds/367852/
Buttonpress	https://freesound.org/people/JuanFG/sounds/471727/
Sticker 1	https://jfxr.frozenfractal.com/
Sticker 2	https://jfxr.frozenfractal.com/
Sticker 3	https://jfxr.frozenfractal.com/
Sticker 4	https://jfxr.frozenfractal.com/
Sceneswitch 1	https://freesound.org/people/TheBuilder15/sounds/415763/
Sceneswitch 2	https://freesound.org/people/TheBuilder15/sounds/415763/
Sceneswitch 3	https://freesound.org/people/obananao/sounds/195932/
Sceneswitch 4	https://freesound.org/people/fredzed/sounds/416386/
Sceneswitch 5	https://freesound.org/people/InspectorJ/sounds/411460/
endsound	https://freesound.org/people/Fupicat/sounds/521640/
Moo sound	https://freesound.org/people/dobroide/sounds/462770/
chicken	https://freesound.org/people/TitusL108/sounds/269421/
pig	https://freesound.org/people/jammaj/sounds/409014/
leaves	https://freesound.org/people/JonCon_Library/sounds/483123/
fish	https://freesound.org/people/paulprit/sounds/507094/
door	https://freesound.org/people/MattRuthSound/sounds/381963/

Appendix D: Ethical request

1. General

CONTEXT

This research will be part of the graduation project of Melike Oğuz and Joris Jager. The research will be used to gain information about the context of their graduation project.

LOCATION

This research will be performed in the supermarket environment. The supermarket where the research will take place is the Jumbo in Goor. The address of this Jumbo is Van Kollaan 7 in Goor.

DESCRIPTION OF RESEARCH

The testing will be done in two phases, one of them being ideation and the other one prototype testing. The ideation phase will consist of a questionnaire with questions and a semi-structured interview about different ideas regarding the project. This will then be evaluated and used for the prototype phase.

During the prototype phase two interactive shopping carts will be made for the graduation project. The shopping carts will be made interactive through adding a touch screen, buttons and sensors to the supermarket environment. Children will be able to interact with the shopping cart. Information about the impact of the food to their health and sustainability will be shown on the screen based on the interaction. The information of the first shopping cart will focus on the impact of the food choices of children to their health and the second one will focus on the impact on sustainability. This information will be displayed in minigames and on passive screens. During this research the interaction between children and the shopping cart will be tested by anonymous observation and afterwards, a semi structured interview. This will be done through observing children interacting with the shopping carts. Some additional questions will be asked afterwards to support the observations. These questions will be short and simple to maintain low effort for the children. These interviews could be recorded when consent is given to do so.

DURATION

The graduation project will be due at week 26. This research will be used during this project. Therefore this research will end at week 26 and will start as soon as the research is approved.

PARTICIPANTS

During the two phases of testing, three types of participants will participate. The first type are during the ideation phase children with their parents in the supermarket doing their usual business. The second type are acquaintances/family members, of the age between 5 and 12, of the researchers.

The participants of prototype testing are the last type of participants and will contain children that are going to the supermarket. The participants will be recruited through asking people to participate before they are shopping. The number of participants depends on the amount of children that go to the supermarket. The aim is to recruit at least five participants to test each installation. We aim to recruit these participants as fast as possible. The aim is to spend a minimum of one day and a maximum of three days testing at the supermarket. One session will approximately take 5 hours.

CONSENT FORM

The consent form will be in Dutch referred to as "Toestemmingsformulier"(appendix A). This will be in Dutch in order to avoid miscommunication, because the stakeholders mainly speak Dutch. Next to that, the consent form will be signed by the parent(s) or care taker(s) of the child participating in the research. Before signing the consent the researchers will introduce the parent(s) or care taker(s) to the research. They will be introduced to the method used for this research. The researcher will tell that their child has to interact with the interactive shopping cart and that the researchers will observe the interaction of the child with the shopping cart. They will also be told that additional questions can be asked after the interaction of the child with the shopping cart. The researchers will also tell what the rights of the participants are. They will tell the parent(s) or care taker(s) that they can leave the research whenever they want, are participating voluntarily and are not forced to do certain actions.

2. Questions about the research

1. Has this research or similar research by the department been previously submitted to the EC?
   ☐ Yes,

☐ No
If yes, what was the number allocated to it by the EC?
Explanatory notes:

2. Is the research proposal to be considered as medical research (Also see Appendix 4)

☐ Yes
☐ No
☐ Uncertain
Explanatory notes:

3. Are adult, competent participants selected? (§3.2)

☐ Yes, indicate in which of the ways named in the general requirements and conditions this is so
☐ No, explain
☐ Uncertain, explain why
Explanatory notes:
We will be testing the design of an interactive installation that is made for children. Their parent(s) or caretaker(s) will be asked to sign consent for their child.

4. Name all characteristics participants must possess in order to be included in the research, such as gender, age, membership of a specific organization, etc:

The participants have to be children that do go to the supermarket.(age 5-12). The second type of participants are the parent(s) or caretaker(s) from these children and are asked to sign consent.

5. Are the participants completely free to participate in the research, and to withdraw from participation whenever they wish and for whatever reason? (§3.2)

☐ Yes
☐ No, explain why not
☐ Uncertain, explain why
Explanatory notes:

6. Is there a risk for adverse effects of the research for certain participants?

☐ Yes, there will be a screening of the participants, explain how

☐ Yes, but there will not be a screening of the participants, explain why not

☐ No, explain why not

☐ Uncertain, explain why

Explanatory notes:

The installation will not be able to harm children and the research will only be focused around testing the installation.

7. Does the method used allow for the possibility of making an accidental diagnostic finding which the experimental participant should be informed about? (§3.6 and Appendix 4)

☐ No, the method does not allow for this possibility

☐ Yes, and the participant has given signed assent for the method to be used

☐ Yes, but the participant has not given signed assent for the method to be used

☐ Uncertain, explain why

Explanatory notes:

8. Are participants briefed before participation and do they sign an informed consent beforehand in accordance with the general conditions? (§3.2, §3.3, §3.7, §3.8)

☐ Yes, attach the information brochure and the form to be signed

☐ No, explain why not

☐ Uncertain, explain why

Explanatory notes: Since the research is conducted on children, consent needs to be signed by their parent(s) or caretaker(s). Children also have to give permission to participate. This will be done through asking them the questions if they would like to use our installations and if we are allowed to observe them.

9. Are the requirements with regard to anonymity and privacy satisfied as stipulated in (§3.8)?

NB. Make sure to also comply to the General Data Protection Regulation (GDPR), and register the processing of personal data through: https://www.utwente.nl/privacy/.

☐ Yes

☐ No, explain why not

☐ Uncertain, explain why

Explanatory notes:

10. If any deception should take place, does the procedure comply with the general terms and conditions (no deception regarding risks, accurate debriefing) (§3.10)?

☐ No deception takes place

☐ The deception which takes place complies fully with the conditions (explain)

☐ The deception which takes place does not comply with the conditions (explain)

If deception does take place, attach the method of debriefing

Explanatory notes:

Our installation will be based around certain products of the supermarket. The time we have during this project does not allow us to include all products. Therefore we are not able to include all the impact of products in the supermarket. Children could be steered towards a product that is not the best (most healthy/sustainable) in a certain situation. This is a form of a deception. We should let the parents and children know about this deception by adding it to the debrief.

11. Is it possible that after the recruitment of experimental participants, a substantial number will withdraw from participating because, for one reason or another, the research is unpleasant? (§3.5)

☐ No

☐ Yes, that is possible

If yes, then attach the recruitment text paying close attention to what is stated about this in the protocol.

Explanatory notes:

12. Give a detailed description of the research (i.e., What precisely are the stimuli? Or: What precisely is the task? OR: What is the nature of the measurement/interview questions?) Ensure all data relevant for an ethics consideration is given or, if necessary, attach the research protocol.

The research consists of two phases, ideation and prototype testing. The aim of the first phase is to improve and generate the ideas made by the researcher about the solution to the problem of the project. The problem of the project being, experiencing the impact of food choices through a playful, interactive supermarket environment. The evaluation will be done by asking a set of questions that will give an idea of what could be improved and which idea is better than which. These questions will most likely be in the form of formative questions to generate and improve ideas.
The aim of the prototype testing is to test effectiveness of the prototypes of the interactive shopping carts. These shopping carts will be implemented in the supermarket environment. Therefore the tests will be conducted within the supermarket environment. Children have to walk through the supermarket environment and interact with the shopping carts. They have to do the normal groceries and make decisions based on the information that is displayed on the shopping carts. An example of this is choosing the type of bread that is most healthy and sustainable, instead of choosing the bread they normally eat. We will test if children are changing their normal food choices, because they will be more aware of the impact of their food choices. We will ask how they change their food choices. We will also look at which products they pick based on the interaction of the child with our installation. The last aspect that we will be looking at is the interaction of the child and the parent(s) or caretaker(s). We will look at whether this interaction will change based on the interaction of the child with the installation. These food choice changes will be made anonymous during the data collection by categorizing them. Categories are about which type of food they changed to. This is for the privacy of the children. An example of this is choosing more healthy or sustainable food.
There will also be some changes made to the supermarket environment. The change that will be made is adding an interaction module at certain shelves. This will enable children to physically interact with the supermarket environment. These interaction modules will be small. This is to avoid interrupting the shopping experience of other supermarket customers.

ADDENDUM
4. WHY IS YOUR WORK COVID-19 PROOF?
NOTE: CHOICE WITH * REQUIRES EXPLANATION

13. Do you add additional face-to-face contact?

☐ No, I only work in distributed fashion over phone, survey, or telco (Skype, Zoom, Teams, etc)

☐ *No, only existing face-to-face contact, explain below who and how many you include as already breaking within 1.5m guidelines,

☐ *Yes, explain

Explanatory notes:

For the ideation phase children from the nearby circle of the researcher(s) will be asked to fill in a survey. This can be done online or physical with the needed distance. Since children might not be experienced enough with online surveys, physical might be a better option.

For the prototype testing, we will test an installation that has to be used in the physical supermarket environment. Therefore the test has to be performed within the supermarket environment. For this research we plan to only ask children that are in the supermarket. They already went to the supermarket and therefore we are not asking more people to go to that place. Therefore we will not ask more people to come which will not break the 1.5m guidelines

14. * Do you add indirect physical contact? For instance, sharing a tangible device, please explain why and what actions will be done with the device.

☐ * No,

☐ * Maybe,

☐ * Yes.

Explanatory notes:

Children will be using an installation. Children have to interact with the installation to use it. They have to use the tablet and interact with the buttons on the installation. However, the standard cleaning protocol of the RIVM will be followed. The carts and tablets will be cleaned with >70% alcohol. A different tissue will be used after each participant.

15. * Do you put additional burden on people from the care sector that are under pressure?

☐ * No, I work people from another field, explain

☐ * Maybe,

☐ * Yes

Explanatory notes:

This research will be performed with children at home or in the supermarket.

16. * Give a thorough explanation, why you consider your research can be considered COVID-19 proof include any considerations you discussed with your supervisor to address the contingency of any additional risks you identified.
Explanatory notes:

We will ask children to disinfect their hands before using the installation. After using we will be disinfecting the installation after the children have used the installation with disinfection wipes and spray. We also only have to observe how children interact with the installation and therefore we can keep 1.5 meter distance at all times. The supermarket environment will also allow us to keep 1.5 meter distance. We are also forced to wear face masks within the supermarket environment. This all is in line with the guidelines of the RIVM.

Appendix E: Consent form

Toestemmingsformulier

Hierbij verklaar ik dat ik op een voor mij duidelijke manier ben geïnformeerd over de aard en werkwijze van het onderzoek zoals uitgelegd tijdens het introductiegesprek. Mijn vragen zijn naar tevredenheid beantwoord. Ik verklaar dat ik bevoegd ben te tekenen voor deelname van het kind aan het betreffende onderzoek. Ik ga vrijwillig akkoord met de deelname van het kind aan mijn zorg aan dit onderzoek. Ik behoud het recht voor het intrekken toestemming zonder een reden op te hoeven geven en ik ben me ervan bewust dat het kind zich kan terugtrekken uit het experiment op elk moment. Als de onderzoeksresultaten van het kind onder mijn hoede worden gebruikt in wetenschappelijke publicaties of openbaar worden gemaakt dan worden ze volledig anoniem gebruikt (denk aan quotes of observaties). De persoonlijke gegevens van het kind zullen niet openbaar gemaakt worden gemaakt.

Gesigneerd op xx-06-2021:

Naam ouder/verzorger …….

Handtekening:

Naam onderzoeker: Joris Jager

Handtekening:

Appendix F: Observation scheme

Interaction module:	**Decoration module:**
Parent interaction:	**Exploring:**
Investigating:	**Overig:**

Appendix G: Evaluation questions

ALGEMEEN: WARMUP:

1. Heb je de interactieve karretjes wel eens gebruikt?
2. Vond je het leuk?
3. Wat vond je leuk?

AWARENESS:

1. Waarom heb je product x gekozen?
2. Waarom deed je… <wat een kind bij een interactiemodule deed>?
3. Hoe kan je ervoor zorgend dat je etenskeuzes duurzamer worden?
4. Wat heb je geleerd van de informatie van de winkelwagen?
5. Zie je mogelijkheden om de informatie van de winkelwagen ook thuis te gebruiken
6. Algemene vragen over info:

- Waar staat keurmerk x voor?
- Waar moet je op letten als je duurzame vis wilt eten?
- Welke groente en fruit moet je in de koelkast bewaren?
- Waarom zijn lokale noaberschap producten verser?
- Wat doet de boer om zijn dieren goed te behandelen?

PLAYFUL GATHERING OF INFORMATION:

1. Welke informatie viel jou op tijdens het lopen in de winkel?
2. Wat vond je van de <interactiemodules> in de winkel?
3. Wat vond je van de versiering aan de zijkant van de winkelwagen?

GENERAL:

1. Wat vond je het stomst aan de winkelwagen?
2. Wat kan er verbeterd worden aan de winkelwagen
3. Aan ouder: heeft u kind uw ergens tijdens het boodschappen op gewezen, zo ja waarop?
4. Aan de ouder: en wat vindt u van het idee om kinderen al bewuster te maken over duurzaamheid en eten.

Appendix H: Reflection Report

Creating sustainable food choices

Experiencing the impact of food choices through a playful, interactive supermarket environment.

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Project description

A common problem is that people are not aware of the impact of their food choices. This is a problem because 26% of the total greenhouse gas emission comes from the production of food [1]. Our food choices need to change to reduce the impact of the food choices on the environment. Therefore, this project aims to make people more aware of the impact of their food choices.

This project will aim at children. This is because research has shown that it is difficult to form new habits [2]. Children are people who still need to develop new habits. This makes them the right people to develop new and more sustainable food habits. The technology of the project will be developed for the supermarket environment. This is because people buy half of the food they consume at the supermarket [3]. The technology will be built on the interactive shopping carts of the UW-s Kidsclub [4]. These are shopping carts that are now used for entertainment purposes within the supermarket. Our vision is to make the shopping carts more educative. Our vision is to learn children about the impact of their food on the environment with the help of an interactive shopping cart within the supermarket environment.

Our interactive shopping cart will enable children to interact with the supermarket environment and with their shopping cart. Different information about sustainable food choices will be shown on the screen based on the interaction with the supermarket environment. This interaction takes place through interaction modules that children can find within the supermarket environment. This information is displayed in a child-friendly way to make children more aware of the impact of their food choices. Another way to interact is through the decoration module. The decoration module is a module on the side of the interactive shopping cart. This module will have five buttons. Children can press the buttons. Information about how local farmers sustainably produce their products will be displayed on the screen after children press one of the buttons. Each button is connected to a certain food category (meat, fruit and vegetables, bread, dairy, and fish). The experience aims to gather as many stickers as possible. These stickers all represent a different interaction with different information about sustainable food choices. Children can collect the stickers by interacting with the whole system. All the stickers end up in the sticker book. Children can press on the stickers and see the information about where the sticker is about. At the end of the experience, children will get feedback on how they interacted with the different parts of the supermarket environment, a small summary of the information they gathered and tasks they can do at home.

Moral principles

Several moral principles come with this project three important ones are autonomy, fact-checked information and accessibility. These moral principles all have an impact on the project in different ways.

Autonomy is about the ability of children to control what they want to do without getting influenced by something else. With the installation of this project, children have to be able to choose where they want to go themselves and what food they want to choose. The installation does not have to influence the children. The installation only has to be a tool for the children to learn about sustainable food choices. It does not have to be the determining factor of their food choices. The installation must not control the decision making of the children.

Another moral principle that is important to the displayed information is always fact-checked. This is about always basing your information on scientific facts or other trusted sources. Important is that children can understand the information. This needs to be considered when writing the information that will be displayed. The displayed data about the impact of their food choices need to be correct. This is because children do not have much knowledge about the impact of their food on the environment. This makes it difficult for them to judge if the displayed data is correct. Therefore, it is important that the information displayed is always fact-checked, so the installation does not create an understanding of the impact of their food choices.

The last important principle is accessibility. Accessibility is about the possibility of a child to make use of the installation independent from their economic status, gender, disability, education etc. The installation is aimed to change the food choices of society. Society consists of people with different characteristics. Therefore, the installation must be accessible for all people with different characteristics.

Ethical cycle

This part of the report will discuss the ethical cycle made by Poel and Royakkers [5]. The cycle consists of a moral problem statement, problem analysis, options for actions, ethical judgement and reflection.

Moral problem statement

A moral problem statement consists of two or more positive moral values or norms that cannot be fully realized at the same time. Moral values that can conflict within this project are autonomy and the fact that all the displayed information need to be fact-checked. Children need to be able to choose what they want to do, but they tend to follow what their environment says and what they believe is good for them [6]. Using information that is fact-checked can create beliefs about what is right and what is wrong. Therefore, fact-checked information can influence the food choices of children. The moral problem that comes with this problem is:

Is it morally acceptable to indirectly determine the food choices of children by displaying information that can create belief about what sustainable food choices are?

Problem analysis

Stakeholders

There are several stakeholders involved in this project. These stakeholders can be separated into users, developers, and supporters. The users are the people who use the interactive shopping cart and will suffer or profit from the consequences. In this case, these are the children and the family of the children. The child will profit or suffer from this by using the shopping cart and changing their food choices. The installation is aimed at children between the age of 6 and 12. The family of this child will profit or suffer through the changing food choices of the child. These changing food choices will mean that the food choices of the family will also slightly change.

The developers are the people who develop the installation and who determine the information that is displayed. The first and most important developer is the person who makes the installation and searches for information about sustainable food. This is the developer of the installation. The second developers are the local food companies. The installation will also display information about how different local companies sustainably produce their food. Local food companies will tell what they are doing for this and therefore determine what information will be displayed.

The last stakeholders are the supporters. These are the stakeholders who enable the children to use the installation in the correct environment. This is the supermarket where the children will use the installation. They determine the way the child will use the interactive shopping cart by the layout of the supermarket. The way their supermarket is and which product they provide will determine the way the developers make the installation look.

Stakeholder interests

The interest of the users is that they want to enjoy the shopping experience through using the interactive shopping cart and that they want to improve their food choices towards sustainability. The most important for them is that the installation works and that the children can fluently use the interactive shopping cart within the supermarket environment. How well the user can use the installation differs because of the different characteristics of each user. An example of this is the age of the child. How older a child how more knowledge they have. Therefore, they will pay more attention to the information that is displayed. This makes it more important for them that the information is correct. On the other hand, very young children will not pay that much attention to the information. They also do not have much knowledge about sustainability. Therefore, the information needs to be aimed to enable these children to also make sustainable food choices. For them, it is about exploring the supermarket environment and having a playful experience. For these children, the playful aspects of the installation must be designed well. Some families do not have the freedom to purchase what they want. This can have different reasons. The first reason is money. Some families are not able to buy more expensive products. Therefore, the installation needs to include a broad product range, so they also have something to choose from. Another reason can be an allergy. People with very severe allergies cannot eat everything they want. Therefore, the installation needs to provide them with a broad range of products where they can choose from.

The interest of the developers is that the children will be more aware of the impact of their food choices through using the installation. This is the goal of the project and therefore the interest of the developers of the interactive shopping cart. The local food companies also have different interest. They want to sell more products by providing information about the production process of their food. This they want to achieve by stating that their products are produced sustainably.
The interest of the supermarket is to create a sustainable brand.

The supermarket that will implement the interactive shopping cart states that they are the most sustainable supermarket of the Benelux. Therefore, sustainability is

important to them. Therefore, these interactive shopping carts will increase their position towards sustainability.

The moral values

Several moral values come with this project. Firstly, children have to be able to choose their food by themselves. This means that the installation has to provide different options to make children able to choose by themselves. This will also solve the moral principle of not guiding children towards specific products, so they will sell more. The last moral value is that information does not have to mislead the children about sustainability. Therefore, the developers of the installation have to perform good background research, fact checks the displayed information and filters out the marketing of the local food companies. Working with information from companies that can promote them can cause misinformation to make their company look better.

Options for actions

Options for actions is about what can be done to minimize the impact of the moral problem that is stated in the moral problem statement section. Therefore, this section needs to find options that can be used to reduce the possibility for children to be steered towards certain products while using the interactive shopping cart.

The first action that can be taken is creating different interaction possibilities. By creating more possibilities children can get more information. This makes them able to judge better about what they want and whatnot. Another option is to only use objective information. This can be done by implementing different aspects. The first aspect that will be implemented is not saying that something is wrong. Because these children will not think that they are doing things wrong. Another aspect that will be implemented is trying to leave out judging terms. This will exclude opinions about certain information. Another action that can be taken to not guide children is leaving out a task that has to be done to use the installation effectively. Therefore, the sticker book system does not have to make children believe that they have to do certain things. Therefore, the sticker book will only serve as a medium to read back information that you interacted with and not indicate what you have to do to collect a certain sticker.

Ethical judgement

This section is about if the option for actions is morally acceptable. Therefore, a moral framework will be used. The framework that will be used is the mediation theory [7]. This framework is about the relation between humans and technologies. This framework states that technologies connect humans to the world. Technologies can help humans to shape the relationship between themselves and the environment. For

this project, this mediation is about what sustainable food choices are for children. The information on the screen changes the way the children look at sustainable food choices. Does the option for action shape the belief of children about the impact of their food choices in a wrong way?

The first action was about creating enough possibilities to interact to enable children to look at a problem from different viewing points. This will enable children to create the way they look at sustainable food choices. This makes those children are not steered towards one truth.

The second action was about only using objective information. This enables children to judge what they think the information means. This makes them able to create their idea of what sustainable food choices are with the help of objective information.

The last action was about not including tasks that need to be done to use the installation effectively. This will reduce the need to go to certain points. As a result, children can choose their path within the supermarket environment. This enables them to interact with the information that they want. This will enable them to shape their own belief about sustainable food choices. Therefore, the installation will mediate between the child and how he experiences what the impact of their food choices are on the world.

Reflection

The reflection is a reflection on ethical judgement. The ethical judgement was about how the mediation theory impacted the options for actions. The central question was about how the options for actions mediated between the child and how the child experiences the impact of their food choices on the environment. The mediation theory states that the interactive shopping cart shapes the way children look at how their food choices impact the world. The installation does shape the belief of children about how food impacts the world around them. The options for actions are ways to decrease the strength in which the children are shaped. The purpose of the installation was to help children create beliefs about sustainable food choices. By creating these beliefs, children can make more sustainable food choices. The option for actions supports the possibility for children to create their own beliefs. Therefore, the meditation theory succeeds in selecting features that are morally relevant to the project. These are relevant to enable children to shape their own belief about what sustainable food choices are. This will reduce the impact of their food choices to the environment.

Code of ethics

In this part of the report, a code of ethics will be developed. The IEEE code of conduct will be used as a starting point for this [8]. This because the goal of my project is to develop an interactive shopping cart that has to be used for children in a professional environment. During this project, many organizations work together. The IEEE code of conduct is about the ethical behaviour of people who act on the organization behalf of IEEE.

Interactive shopping cart graduation project code of conduct

We, as people who will work on an interactive shopping cart for children, recognize the importance of our technology affecting the behaviour of children and how they see the world. We will accept our obligation to act ethically. This will be ensured by following the following rules:

1. Be respectful of others.
    - We will treat each other respectfully at each time. This includes the members of the project and users.
    - We will respect the privacy of every member involved within this project and we will protect the personal information and data of each other.
2. Treat people fairly.
    - We will not discriminate against any people that are involved in this project. This means that we will not exclude people based on their characteristics.
    - We will treat each member the same.
3. Avoid injuring others, their property or employment.
    - We will not use the data of members of the project without having permission.
    - We will not use data in a way that can harm the reputation of project members.
    - We will not be participating in spreading confidential data of other project members outside the project.
    - We will not use technology that can injure the user.
4. Avoid misleading users.
    - We try to only use information that is fact-checked and from trusted sources.
    - We will not change the information in our favour.
    - We always try to be objective.
    - Treating children ethically.

- We will always follow the ethical procedure made to protect children. This means that we will always:
    a) Ask parents' permission to participate in research.
    b) Avoid harming the children.
    c) Do what is in the best interest of the child.
    d) Promote autonomy of the child.

6. Follow the laws of the Dutch law book.
    - We will comply with all applicable laws, rules and regulations that are always relevant for our project.

Reasoning behind the code of conduct

1. Being respectful is important working together within project groups. During this project, I will work together with the research group ACHIEVE, another graduate student and 4 companies. Being respectful to each other is important to effectively work together. This project will also include users. They need to be treated respectfully to make a solution that they will like.
2. Treating each other fairly is also very important for this project. This is because of the different people involved in the project. They all want to be treated fairly to get the feeling that they are involved in this project.
3. During this project I will work together with different companies. They all have company secrets that are important to them. They need to be respected and therefore it is important to guarantee this within the code of conduct. Furthermore, our solution must also not harm any users. Therefore, this also needs to be included within the code of conduct.
4. This project will use data about sustainability that is very complex to children. Children do not have the pre-knowledge to filter out misinformation. This makes them very prone to deception. Therefore, the code of conduct needs to protect them from this deception. This can be achieved by setting requirements for the displayed information that every project member has to follow.
5. Children will be the end-user of the solution of the project. As mentioned before, children do not have the knowledge that we have. We, as researchers have the power to form our knowledge about sustainability. Therefore, the code of conduct has to include values about protecting children from the misuse of the power of the researchers. This is done by forcing the researchers to treat children ethically.

6. The goal of the project is that the solution will be used within the supermarket environment. No laws can be violated when implementing solution into the real world. Therefore, following the laws is important for our project.

Ethical analysis

Flow chart

In this section, a flow chart is created to ensure that the solution is implemented morally. This is an ethical design problem-solving technique developed by Fledderman [9].

The flowchart is shown in figure 1. The flowchart consists of four yes, no statements. Each statement represents the moral value of the project. The moral values that are represented in this flowchart are autonomy, children will not be misled by the displayed information, accessibility and that the shopping experience of other people is not interrupted. The technology can be implemented into the supermarket environment if all these requirements are met. Aspects of the design need to be reconsidered when these requirements are not met.

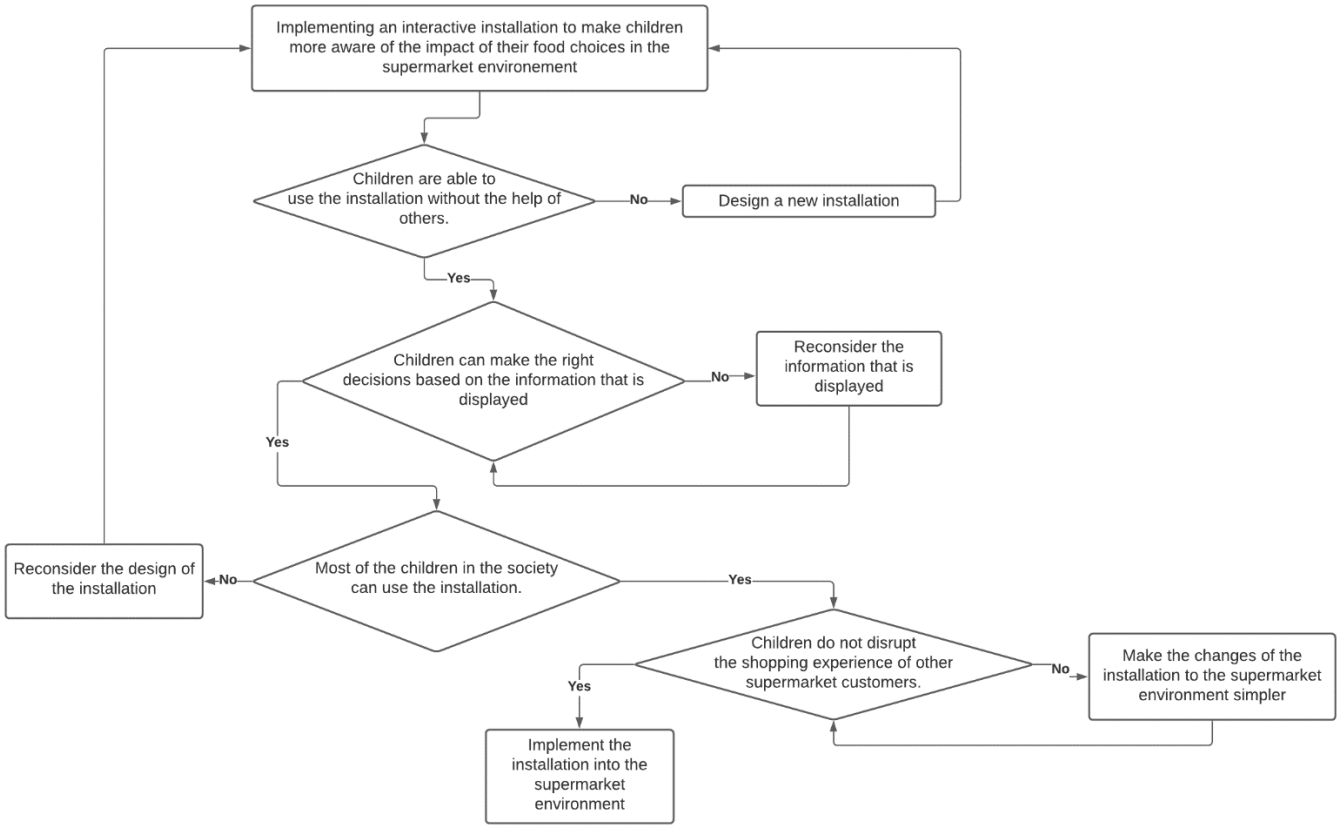

Figure 1: Flowchart of implementing an interactive installation in the supermarket environment.

Next need to be checked if the current installation is ready to be implemented within the supermarket environment. The system is designed to be used by children. The interactions are simple, and children are most likely to be able to understand the interaction. How to use the installation will also be explained in the introduction. This makes those children can use the installation without the help of others. The information that is displayed will be fact-checked, made understandable for children, and kept objective. This makes it that the children will be able to understand the information. This will most likely make sure that children can make the right decisions based on their internal beliefs. Furthermore, the installation will include information that can be relevant to most of the products within the supermarket environment. Therefore, products that are accessible for all people will be included. This makes it possible for the general supermarket customer to use buy products that match the information on the screen. This makes it that most of the children can use the installation. There will be changes made to the supermarket environment. These changes will be minor to avoid disrupting the shopping experience of the other customers.

Consequentialism vs non-consequentialism

This section is about two broad categories of ethical theories. The first one is consequentialism. Consequentialism is about deciding what is right or wrong based on the consequences of the action [10]. The second one is non- consequentialism. Non-consequentialism denies that right or wrong can solely be determined by looking at the consequences of action [11].

At first, must be determined what our project is doing. The project is trying to make children aware of the impact of their food choices on the environment. This will be done by providing information on an interactive shopping cart within the supermarket environment. This shopping cart creates an interactive experience for the children and will teach them about sustainable food choices.

Now needs to be determined if the project is moral. Consequentialist will say that you can determine this by looking at the consequences. There are several consequences of the use of the interactive shopping cart. The first consequence is that children will learn about sustainable food choices. This knowledge they can use to make sustainable food choices. This will reduce the impact of their food choices on the environment. This consequence has a good outcome in the first place because their impact on the environment will decrease. This makes it morally justifiable according to the consequentialists. Non-consequentialist say that this is not the right way to determine if something is right or wrong. The consequence of the installation may be right, but there are other factors that you have to think about. According to them you also have to look at the wrong sides of the installation before determining if it is right or wrong. A possible factor of the installation can be that children will get a wrong image about their future life on this planet. Another factor is that children will only learn about one side of sustainability. This can create a wrong picture of how sustainability works. Non-consequentialist state that an installation needs to minimize the wrong outcomes and maximize the right outcomes. Therefore, the installation needs to minimize the possibility to mislead children with the displayed information. This will be achieved through using trusted sources, fact-checking the data and only displaying objective data. The factor that cannot be avoided is that not all products of the supermarket can be included within the scope of this project. The question is if this impact is larger than the impact of teaching the children about sustainable food choices. This is the cause because there are measures taken against this. Therefore, the impact of learning children about sustainable food choices will be bigger. This makes it that the installation is morally justifiable.

Well-Grounded food choices

Making sustainable food choices is the centre of the interactive shopping cart. The aim is to let children make more sustainable food choices. Höglund has made a framework that can be used to assess food choices [12]. She states that there are four parties affected by food choices. These parties are animals, nature, producers, and consumers.

The animals will profit from more sustainable food choices. This is through educating children on how to recognize animal-based products where the animals are treated ethically. This can be done by making them aware of certain quality marks.

Nature will profit from sustainable food choices in the same way the animals do. The impact on nature will also be reduced by making children aware of how to recognize products that are produced sustainably. The installation is focused on sustainability and therefore nature and animals are the most important.

The rights of the producers are considered occasionally. This because some quality marks not only focus on animal and nature but also human rights. In other situations, the rights of the producers are neglected.

The installation aims to improve the food choices of the consumers. This takes away a part of their autonomy by determining which products are sustainable and saying to them that they have to make more sustainable food choices. This forces them towards those sustainable products. On the other hand, it can improve their lives and make them better. This is because they will reduce their impact on the environment. This can give them a good feeling and a better living environment around them. Here the values of autonomy and making more sustainable food choices conflict with each other. This conflict can be solved from different ethical perspectives.

The first one is looking at the duties. This is about looking at what we have to do because it is the right thing to do. The question that arises is what the duty of the consumer towards nature and animals is. The duty of the consumers is to protect nature and giving the animal the right to live. Therefore, the consumers need to eat food where the producers took care of their animals and minimalized their impact on nature. This makes making sustainable food choices a duty for the consumers and therefore it will be ethically justifiable to steer people towards more sustainable food choices.

Another perspective is looking at the consequences. This is about what are the consequences and for whom should the consequences be good. The consequence of more sustainable food choices is that our food choices will have less impact on the environment. This has a positive impact on nature and the animals. This is also the aim of the project. The aim is to make people aware of the impact of their food choices. By

making them aware we hope to reduce their impact on the environment. Therefore, the aim is to positively increase the importance of animals and nature when making food choices. Therefore, helping people to make more sustainable food choices is the right thing to do.

Another perspective to look from is the virtues. This is about what a good person should act like. This can be done by looking at the two extremes. The first extreme is making food choices that harm the environment, but the consumers can eat everything he likes. The other extreme is that the consumers only eat food that has no impact on the environment, but he does not like the food. The middle of these two extremes is how a good person should act. The middle is making food choices that the consumers like but also trying to minimize the impact on the environment. Consumers get to eat something they like and the impact on the environment will be minimized. Therefore, the right thing to do is to give the consumers a tool that they can use to minimize their impact on the environment and eating what they like.

The last perspective is the perspective of care. This is about looking at the needs of others for which we are responsible. In this case, it is looking at how the consumers and producers are responsible for nature and the animals. The consumers and the producers make sure that the animals enjoy their life and that they will be able to live with the nature around them. Therefore, they need to treat animals fairly and reduce their impact on nature. This can be done by producing food more sustainable and consuming sustainable food. This makes it right to make an installation that is focused on making more sustainable food choices.

Creating an installation around sustainable food choices is well-grounded according to Höglund. This will balance out the needs of the animals, nature, consumers, and producers. Therefore, making sustainable food choices is well-grounded.

Environmental responsibility

The installation is about making a child aware of the impact of their food choices on the environment. This is important because the way people make food choices can have an impact on the environment. Can you say that the child can be seen as someone who can be responsible for this impact? This question is important because children are the users of the installation. The system can make them feel that they are responsible for the current environmental problems. Droz argues that you can see an individual as responsible for environmental problems [13]. He states that environmental problems are caused by the actions of individuals. Therefore, he states that individuals now have to take actions to solve the problems. He states that the current way individuals live is a cause of environmental problems. Therefore, individuals need to change their habits.

Children currently do follow the food choices of their parents. Therefore, their food habits can be seen as a cause of the environmental problem. This makes it that children are also responsible for the harm of the environment. Therefore, these children need to change their food habits towards a more sustainable one. This is the aim of the installation. An installation to help children reduce their impact on the harm of the environment can be a good tool to help them reduce this harm.

You can also look at this from another perspective. This perspective is the one from the supermarket. The question that arises in this situation is are the supermarkets responsible for helping their customers to make more sustainable food choices? Supermarkets do have more impact on the food choices of society. Therefore, they are more responsive to the current harm to the environment than children are. The supermarket can change the food they provide to their customers and therefore they can change the way the customers make food choices. This makes it that supermarkets have a lot of responsibilities to reduce the harm of the food choices. This because supermarkets have a lot of power within the food industry. Dutch people buy more than half of their food at a supermarket [3]. Therefore, the supermarket needs to take actions to help people make more sustainable food choices. Implementing an interactive shopping cart around sustainable food choices is a great thing to do in this case.

Theoretical discussion

This section will be about how the interactive shopping cart will cause a transformation. The interactive shopping cart is trying to change the food choice behaviour of children. interventions that aim to change the behaviour can be complex. according to Tromp, Hekkert and Verbeek, several influences play a role in these interventions [14]. An aspect to look at what is the best for the larger context versus what is the best for the individual. The interactive shopping cart tries to contribute to solving the sustainability problems by motivating the children to make sustainable food choices. This is good for the whole society. On the other hand, the installation is trying to let children decide themselves what food they want to consume. The child may do not want to choose sustainable food. from the viewing point of the society, this is a minor change of the diet of children, but the children themselves like to eat food that is familiar to them [6]. Therefore, the design needs to teach children about sustainability, but not force them to eat sustainably. By doing this, children will transform their behaviour based on their own needs and comfort. Another influence that needs to be looked at is how the design tries to transform the behaviour of the children according to the research of Tromp, Hekkert and Verbeek. The current design will transform the behaviour of the children by encouragement. The installation tries to encourage the children to choose more sustainable foods by teaching them how to recognize the products easily. This encouragement is chosen over discouragement because children do not have developed that many habits that can be discouraged yet [2]. Another question that can be asked is what type of influence the change of the food choice behaviour of children is? Children do know little about sustainability and therefore most of the information of the interactive shopping cart will be new to them. This makes it properly will have a strong influence on how children think about sustainable food choices. Children will get introduced to the problem and will be told that the system buddy will help them making sustainable food choices. This makes children aware that they are changing their food choices with the help of the interactive shopping cart. This makes it that this is not hidden. The interactive shopping cart is therefore a coercive design according to the model of Tromp, Hekkert and Verbeek. This means that the children will experience the influence of making more sustainable food choices as a strong force. This makes the installation a driver to change the food choice behaviour of the children.

Summary

This report was about the ethical context of the project. The project is trying to make the food choices of the people more sustainable. This will be done by making children aware of the impact of their food choices within the supermarket environment. An interactive shopping cart will be used to create an interactive experience where children can learn about how they can make their food choices more sustainable. This will make the food choices of the society more sustainable. This because children will be the next generation and that children have a big influence on the food choices of the families [15].

Working with children makes the ethical context of the project difficult. This is because children are still developing. This means that they do not know yet to make well-thought-out decisions. Therefore, the designers need to be careful with the information that is displayed. This is to avoid creating the wrong image about sustainability and allowing them to autonomously explore sustainable food choices. There are also social norms that come with working with children. Researchers have to be more careful when designing for children. They have to ask the parents or caretakers for consent for example. Children are also less aware of the risks they are taking. Therefore, the researchers need to think more carefully about the possible risks for the children.

The project is part of a larger change within society. Sustainability is more important than ever. The project is trying to make the food choices of children more sustainable. This will change the food choices of the children. The project is also solving some sustainable development goals [16]. The first goals that are met are responsible consumption and production. This is done by trying to make children consume more sustainable products. This makes that children will consume more responsibly. The second goal is good health and well-being. It is commonly known that your diet has an impact on your health and wellbeing [17]. Children's diets will change by making their food choices more sustainable. This can make their diets healthier and increase their well-being. The last goal that is met is climate action. Children will be making more sustainable food choices. This will reduce the impact of their food on the climate. Therefore, action is taken to combat climate change.

Some aspects need to be done differently next time. The first aspect is the number of products that were included. The scope of the project did not allow to include all the information of all the products. This can create a wrong picture about certain products within the supermarket environment. Furthermore, better sustainability data have to be included. The current data is made by the engineer of the

installation. He does not have the expertise in sustainability. Therefore, next time an environmental scientist with a lot of knowledge about sustainability needs to be included within the project. This will make the displayed information ever more meaningful.

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Appendix I: Ideation mind map