BEYOND ILLUMINATION AND BACK

The use of the Internet of Things in the design of circular supermarket lighting

APPENDICES

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The use of the Internet of Things in the design of circular supermarket lighting

Master Thesis: Appendices

Integrated & Strategic Product Design

Delft University of Technology

Signify: Philips Retail Lighting

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APPENDIX A: OVERVIEW NEEDS & WANTS

	Task	Needs	Wants
Signify	**Sell products & services**	**Increase of profit**	**long term relationship with client**
Account Manager	Contact person for supermarkets	contact with supermarket, propositions to be sold	Sell additional products to current clients
Lighting Designer	Design lighting plan	wants of formula manager + details of luminaires	Luminaires with many possibilities
Data Analyst	Gather and analyse data	Data	Access to useful data
Service Designer	Create service propositions	Design criteria	Insights from the supermarket
Product Designer	Design luminaires and accessories	Design criteria	Insights about products
PLUS	Supermarket Cooperation	collaboration of different supermarket owners	Show of their corporate social responsibility
Formula manager	Design supermarket formula	Brand identity & strategy	Insights about the effects of his design, consistent execution of formula
BWI Manager	Translate formula in building plan	Formula & measurements supermarkets	future costs in terms of maintenance & energy usage
Franchise Owner	Run supermarket	High turnover and conversion rate	Less operational costs, to buy product, a convienent and appealing store
Supermarket Employee	Help shoppers	Clear task description	Less work pressure, efficient tasks
Shopper	Buy groceries	Find needed groceries	A sustainable store, personal advice, experience groceries
Installer	Install & repair luminaires	Up-to-date lighting plan	Higher efficiency of operations, product passport
Outliner	Line luminaires out	Education, Lighting plan, measured luminance	Earn more money
Recycling company	Gather and recycle luminaires	Products to recycle, Information about toxics	Material passport
Manufacturer	Produce luminaires	Design of a luminaire or accessories	Insight in production mistakes

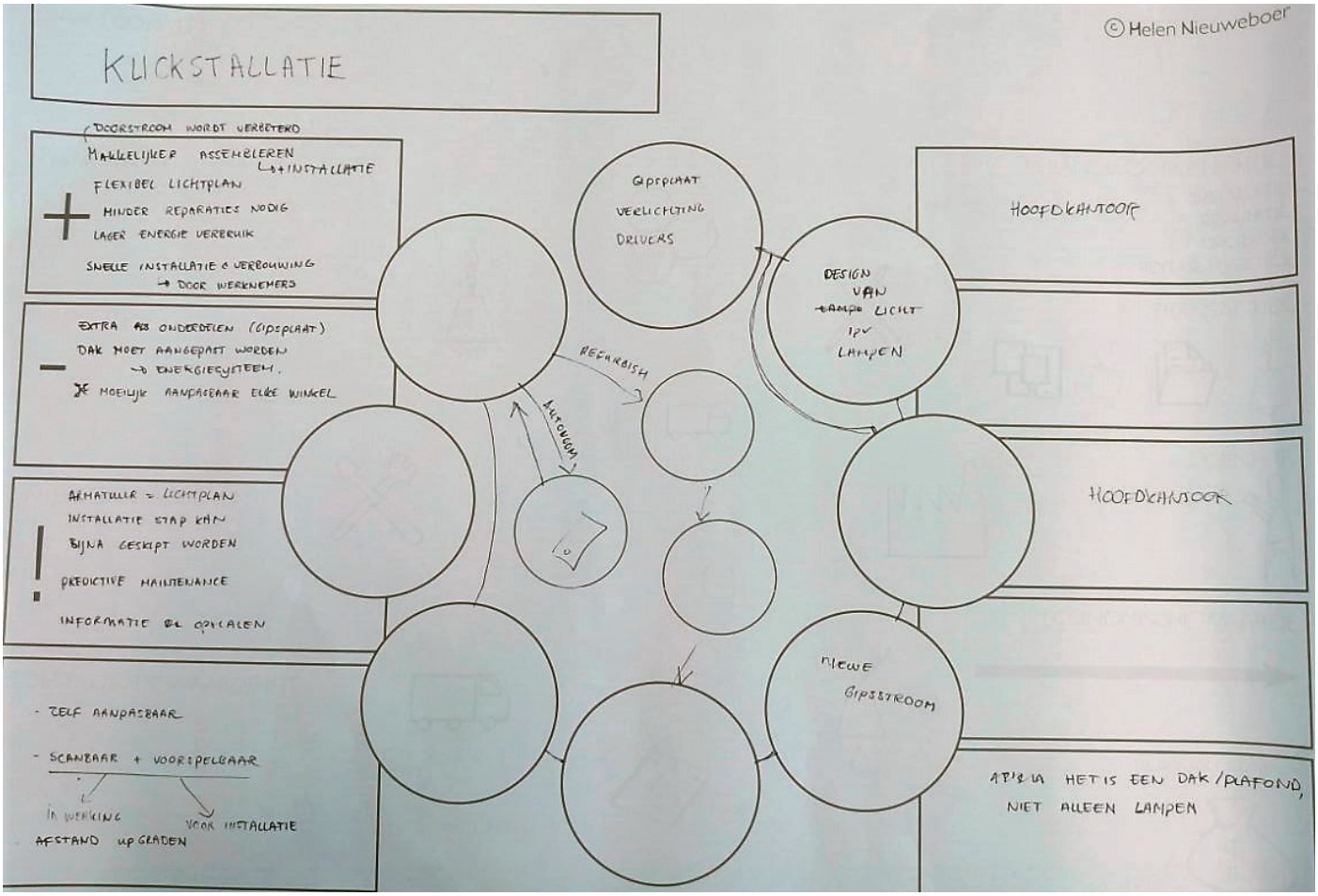
APPENDIX B: CREATIVE SESSION

A creative session with students that were not involved in the project before was held to break loose from the criteria (fig. B.1). The idea was that these students would provide more out of the box ideas than people being aware of restrictions. The session plan used for this session can be found in later in this appendix.

Figure B.1 Participants in action

During this session more than 150 ideas and 3 elaborate ideas were created. A lot of ideas that were generated during creative session were similar to the ideas already given by Signify employees. The to help the participants to combine smaller ideas into more elaborated ideas, a template was provided. The ideas that resulted from these templates are explained next..

Figure B.2 Template klickstalatie



De Klickstalatie: A plug-and-play lighting system

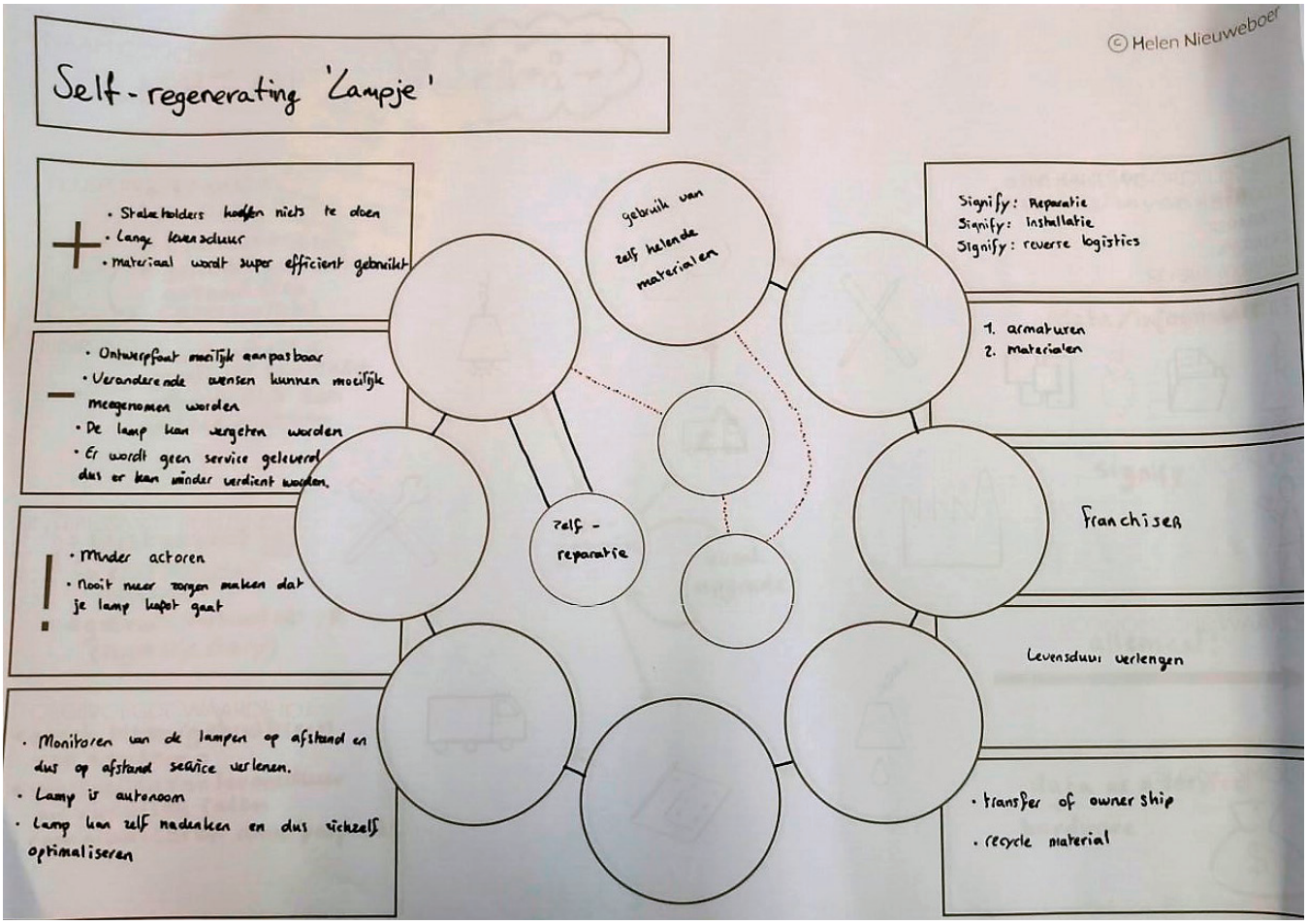
The idea of the klickstalatie (fig. B.2) is based on a recessed ceiling. The klickstalatie cosnsists, instead of plasterboards, of LED panels. These panels can be clicked in the ceiling system by the supermarket employees themselves. The microchips in the panels allow the supermarket employees to scan them and get to know were these panels should be installed in the store. The supermarket employee only needs to click the panel in the system at the desired location, pushes two buttons to make the lighting work. The only thing that Signify needs to do is create the best lighting ever. The idea of the participants was: "if it does not break down, it does not need to be repaired" The panels are very future proof to allow Signify to focus on making people happy with other functions like changing lighting colors or emphasizing bonus products. Additionally, these panels are very smart and are also able to indicate were shoppers walk in the store and recognize problems in the layout of the store. The panels are designed in a such a way that if one light source breaks downs, the other light sources will take over. This will reduce operational costs for repair. The system will send a signal if a light source breaks down. The store owner can order a new panel himself and click it in. The luminaires will gather information about increasing temperature and vibration to be able to let the store owner know they are going to break down. The system has no power inlet because the panels work as an induction cooker: It will only work if a panel is clicked in the system. This allows the employees to easily move the panels. If the store is refurbished the panels can easily be removed and disassembled to be able to reuse parts in other buildings and stores. In the klickstalatie idea, the supermarket has a LAAS contract with Signify. This means the store owner orders new panels but does not directly pay for them.

\+ The plug-and-play system decreases operational costs

\- Retailers do not like service contracts

? Is it possible to make the panels completely future proof?

Figure B.3 Template Self-regenerating lampje



Self-regenerating lampje: A self-healing luminaire
The lifetime of this luminaire is endless because it can repair itself (fig. B.3). According to the participants is a completely care free concept, because the luminaires do not break down. However, design mistake might require the complete renewal of the luminaire. In this case the supermarket will buy the luminaires that come with lifelong warranty. The idea behind buying the system instead of subscription is that the luminaires cannot be upgraded and with a subscription model people expect the newest version. The participants had the idea to enable retailers to sell their luminaires to Signify in case they want a newer product. The luminaires are connected to a smartphone application that shows the retailer what the status of the luminaire is. Since the luminaires have lifelong warranty, Signify is responsible for repair. If a luminaire cannot be repaired, the luminaires can be bought by a recycling company.

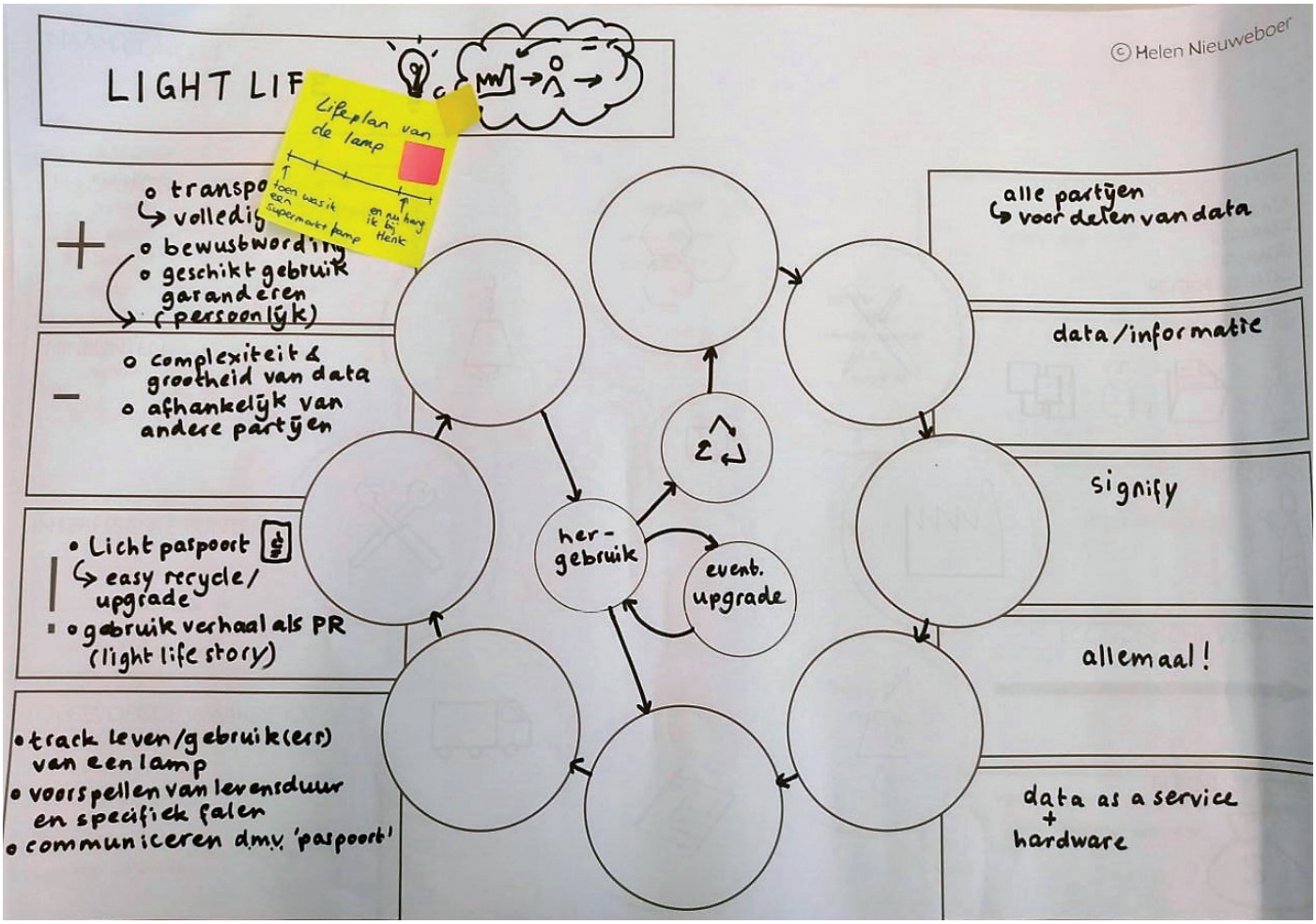
\+ Retailer does not have to worry about failure of the luminaires

\- The business model conflicts with producing everlasting luminaires.

? What is the function of IoT in this idea?

LightLife: A digital lighting passport
In this idea the luminaires are connected to a kind of passport (fig. B.4). This passport provides insights in the production of the luminaire, the parts, who has made it, where it is made and who where owners of this luminaire. This allows trancparency about the complete life story of the luminaire. It will create transparancy, suplly chain controll and awareness about the toxics a luminaire might contain. When a supermarket is refurbished, Signify is able to tell based on the passport for which application the luminaire can still be used. The amount of data requires the right data management. Additionally, the stakeholders need to collaborate to gather this data. The data will also allow Signify to do predictive maintenance and trace back why a luminaire failed. Signify owns all these luminaires in this case. The life story of the luminaire can also be used as marketing to resell luminaires: “First I was in the PLUS, now I’m at Henk’s place” In this idea only data is been gathered about the luminaire itself.

Figure B.4 Template light life



+ Data enables Signify to reuse the luminaires

- Supermarket luminaires are not suitable for home use

? What happens at end of life?

The participants selected ideas only a few ideas to elaborate. The elaborated ideas provide a lot of inspiration, but are not completely realistic, do not guarantee the closure of the loop or do not use the benefits of IoT. Therefore was decided to look into the 150 generated ideas again and clustered them (fig. B.5). As can be seen in figure B.5, the ideas could be clustered as answers to multiple relevant subproblems. To create an integrated PSS these answers needed to be combined.

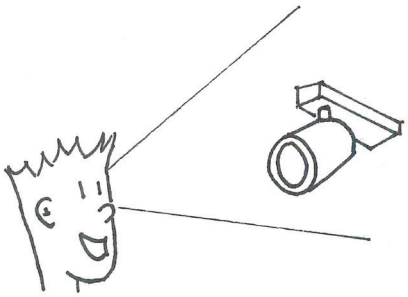
Clustering

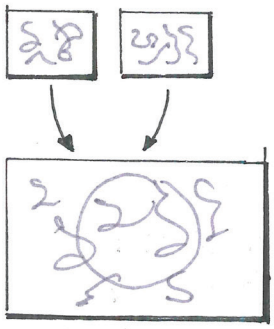
With the elaborate ideas and the ideas from Signify (fig B.5) in mind, three different combinations were made:

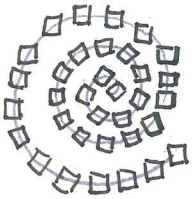
- circular business models + minimizing energy usage + prevent end-of-life + store-experience + store optimization = Care free lighting service
- recycling + using less parts + prevent end-of-life + change the design of the luminaire = Modular plug-and-play products for do-it-yourself adaptability
- cascading + second life + using less luminaires + share information + sustainability = Platforms for reuse of products, parts and materials

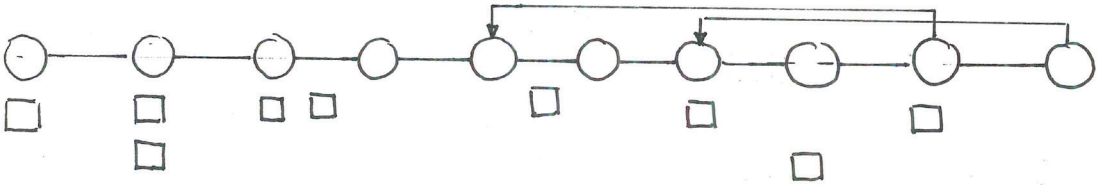
Figure B.5 Clustered Ideas

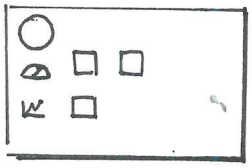
CREATIVE SESSION

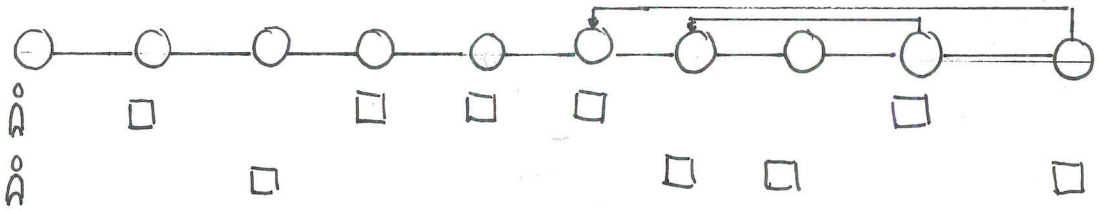


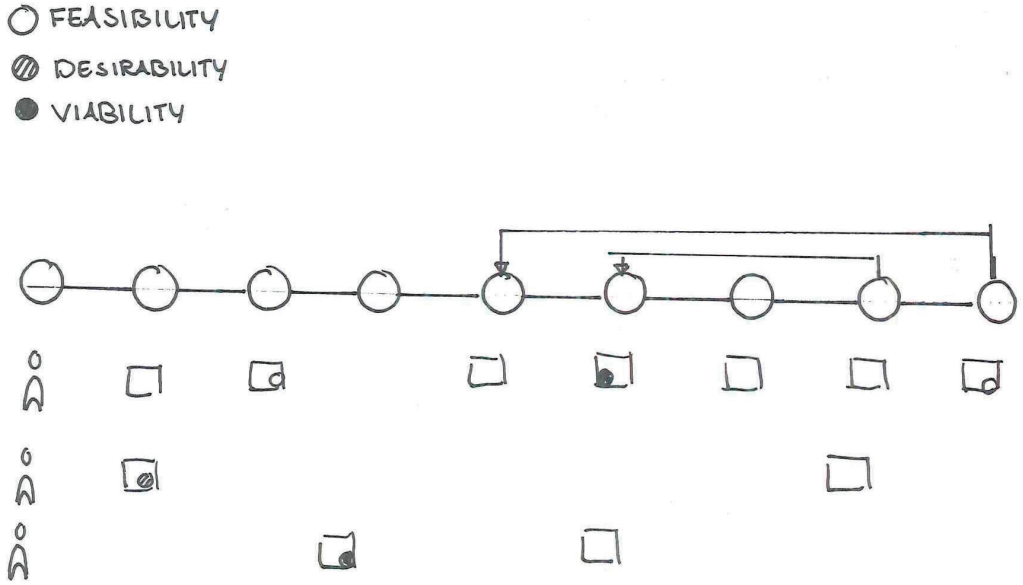


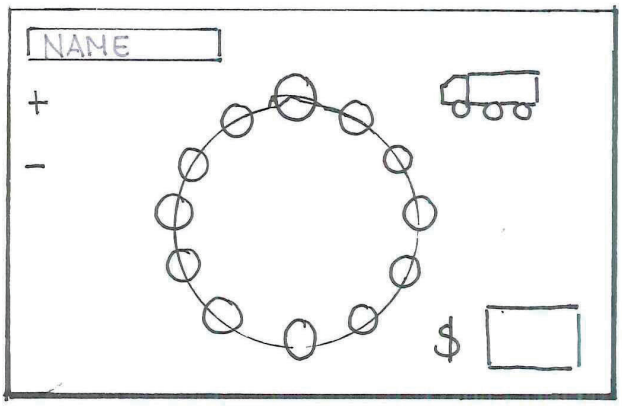








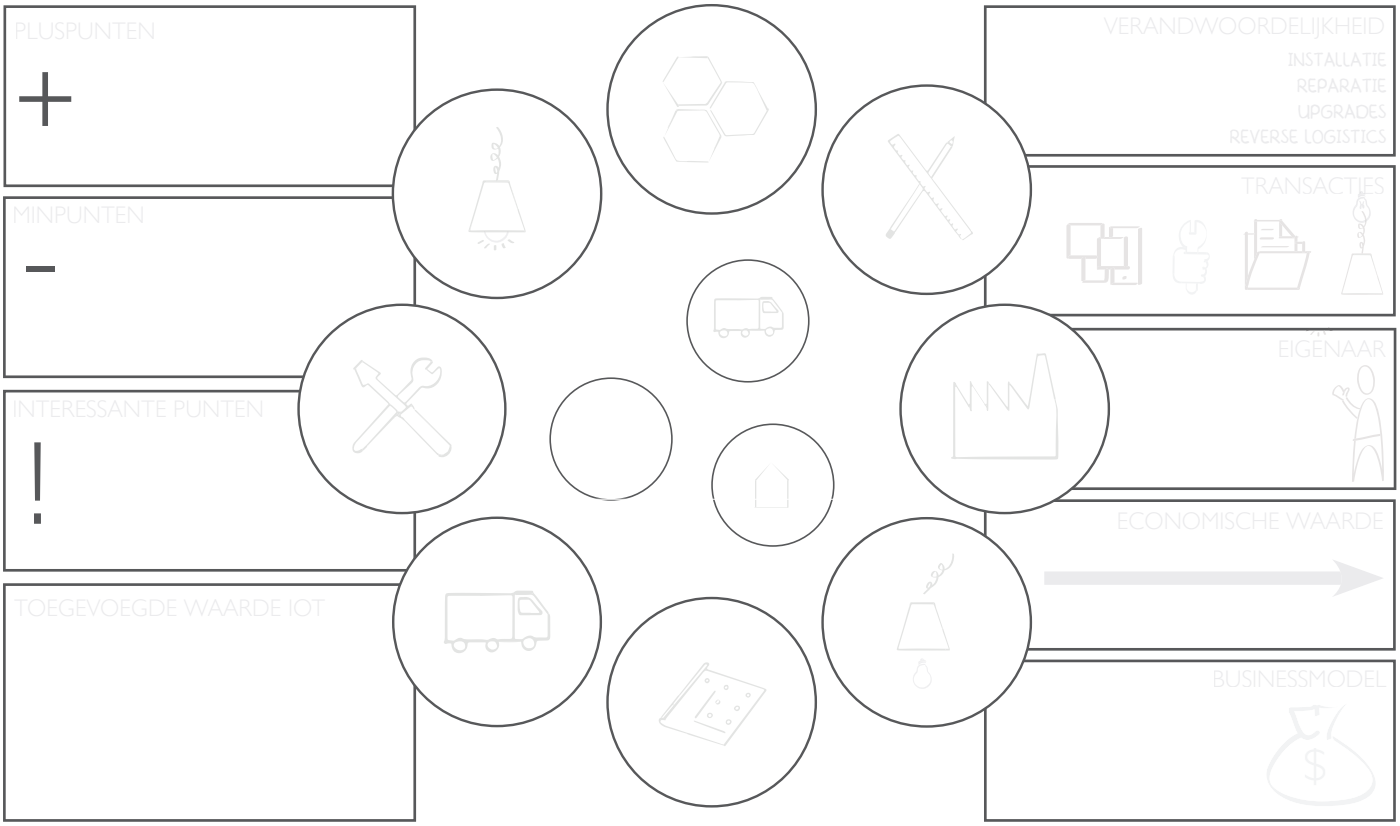

FEASIBILITY
DESIRABILITY
VIABILITY


NAME
+
−
$

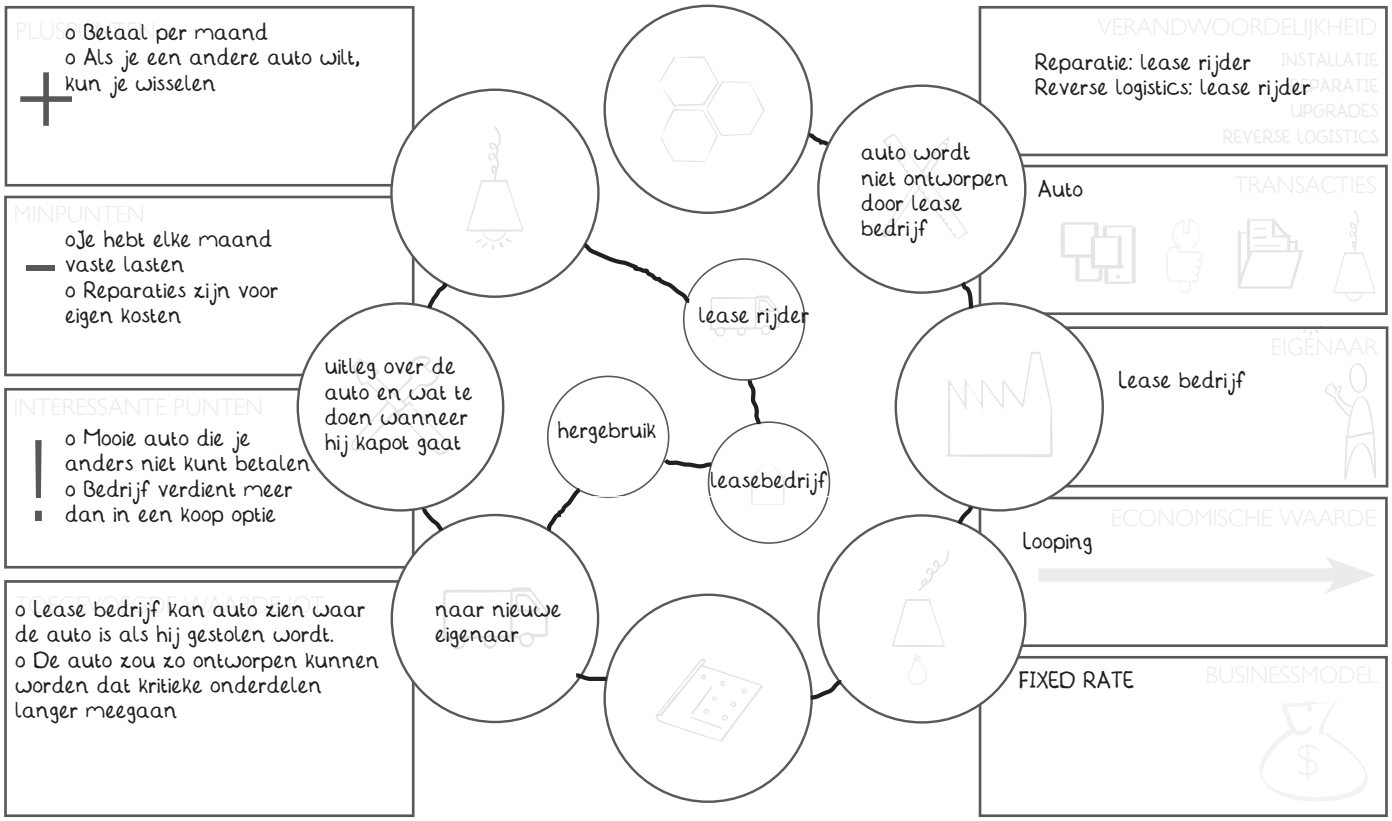
Creative Session: Circular Supermarket Lighting

Time	Duration	Step	Task	Results	materials
Before	week	Invitation	Invite people for the session. If they are willing to join, send them an email with time and location and homework exercise.	Resource Group	Email
Before	week	Homework Exercise	Ask people to look to the ceiling of a supermarket. Ask them to think about the system behind the lighting?	Prepared Resource Group	Email
HEAR					
9.00	10 min	Introduction Session	The problem will be introduced first. Secondly the (vague) planning will be shown. Finally the rules of the session will be discussed and permission for filming is asked.	Prepared Resource Group	Slides with problem, planning and rules, camera.
9.10	5 min 5 min	Introduction resource group	Resource group writes down a moment of enlightment and puts it in a jar. Resource group stands up one by one guess whos moment it was. Person explains.	Motivated Resource Group	moment of enlightment, leaflets, (stop)watch, jar
9.20	1 min	Devide teams	Resource group is devided in two teams	2 Resource Groups	teamdivision
9.21	14 min	Draw the problem	Resource groups discuss the insights they got in the supermarket and the toughts they already had about the topic using a drawing. During the drawing, they can ask questions.	2 drawings of the problem	A5 cards, Flipoversheet, Markers
9.35	10 min	Circular race on ideas	During 8 minutes, the resource group will generate ideas on how to make supermarket lighting circular. The post-its will be placed in circels	Lots of ideas on the problem in general (post-its)	Slide with problem, (stop)watch, post-its, example post-its
9.45	5 min	Introduction Product Journey	Explain the product journey.	Resource group knows about the product journey	(Slides with) product Journey
CREATE					
9.50	15 min	Clustering	The ideas from the race on ideas will be clustered allong the Product Journey. If there are missing stages or catagories, they can add them	Ideas (post-its) clusered on the (linear) product journey	Template of the product Journey
10.05	5 min	Introduction IoT	Explain the capabilities of IoT.	Resource group knows about the capabilities of IoT	Slides with capabilities of IoT
10.10	20 min	DataStorm	phases and IoT capabilities will be combined. The resource group will generate ideas on dat based on these combinations.	Data (on post its) generated during different phases	Template of the product Journey Phases with IoT capabilities
10.30	10 min	Break			Circulair lighting related snacks and drinks (light)
10.40	5 min	Enegizer Circulairity	1. Giving a lightbulb trough as quick as posible without using your hands. 2. Circulating a lightbulb as ofthen as possible within one	Energized resource group	Lightbulbs

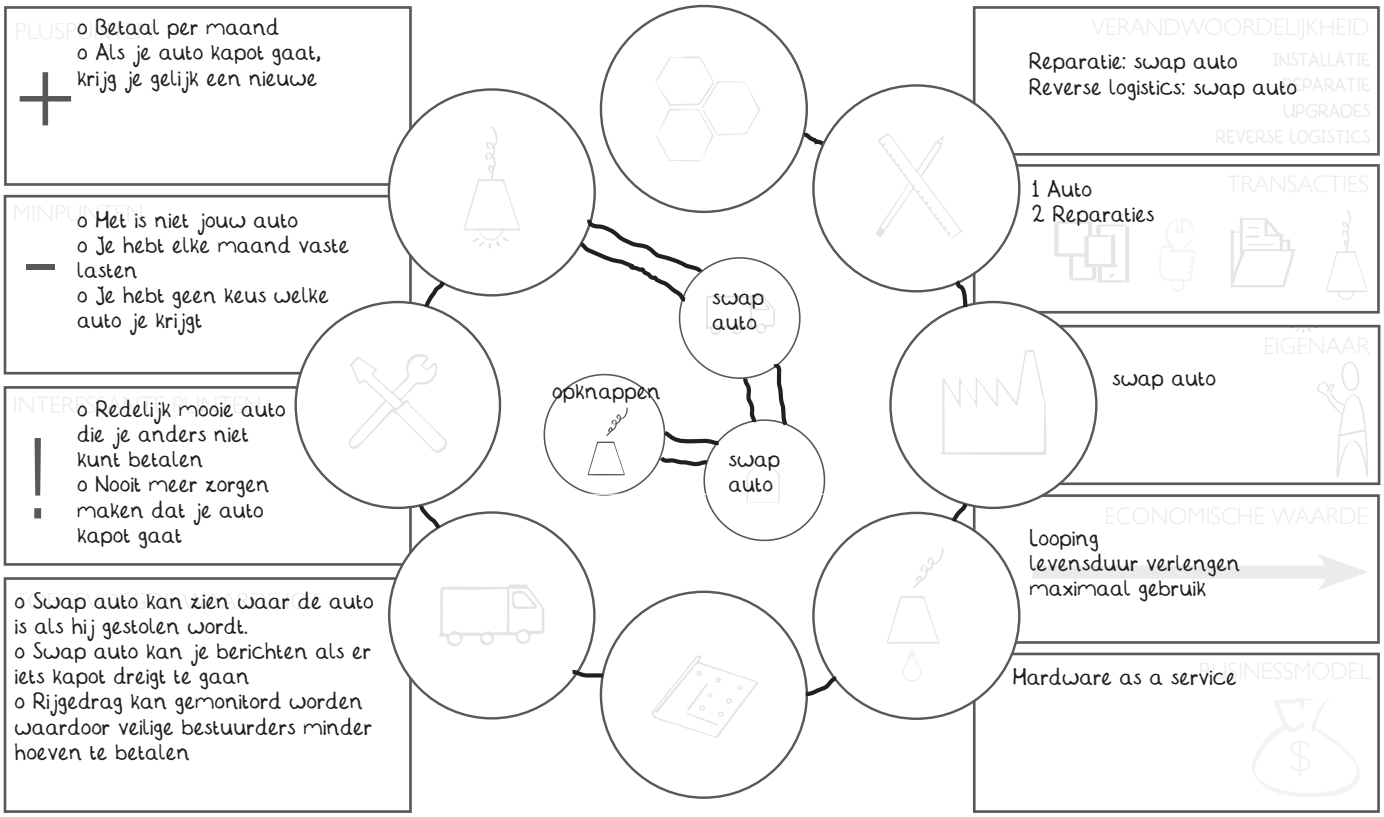
			minute.		
10.45	5 min	Introduction Stakeholders	Introduce the different stakeholders.	Knowledge about the different stakeholders	Slides with stakeholders
10.50	15 min	Stakeholder Ideation	Map the data over the phases and stakeholders on the JourneyMap. Add aditional ideas to the stakeholder map	Data (on post its) clustered by stakeholder.	Template of the product Journey with stakeholders
11.05	10 min	Selection	Give everyone tow dots for each criteria: feasibility, desirability, feasibility	Selection of ideas	criteria
11.15	5 min	Combining ideas	Split each group in 2 or combine groups in new team. Let them Select different ideas from every stage in the product journey and the additional catagories and combine them.	Combination of ideas. 3/4 teams	Examples of cars, Morphological overview. Template
11.20	15 min	Creating concepts	Let them fill the empty spots in the template.	Concepts	Templates with concepts
11.35	5 min	Break			Circulair lighting related candy and drinks, Templates with H2'S
DELIVER					
11.40	20 min	Presentations	Groups present different concepts. Resource groups asks questions.	Concept Presentations	Camera


PLUSPUNTEN
+
MINPUNTEN
–
INTERESSANTE PUNTEN
!
TOEGEVOEGDE WAARDE IOT
VERANDWOORDELIJKHEID
INSTALLATIE
REPARATIE
UPGRADES
REVERSE LOGISTICS
TRANSACTIES
EIGENAAR
ECONOMISCHE WAARDE
BUSINESSMODEL

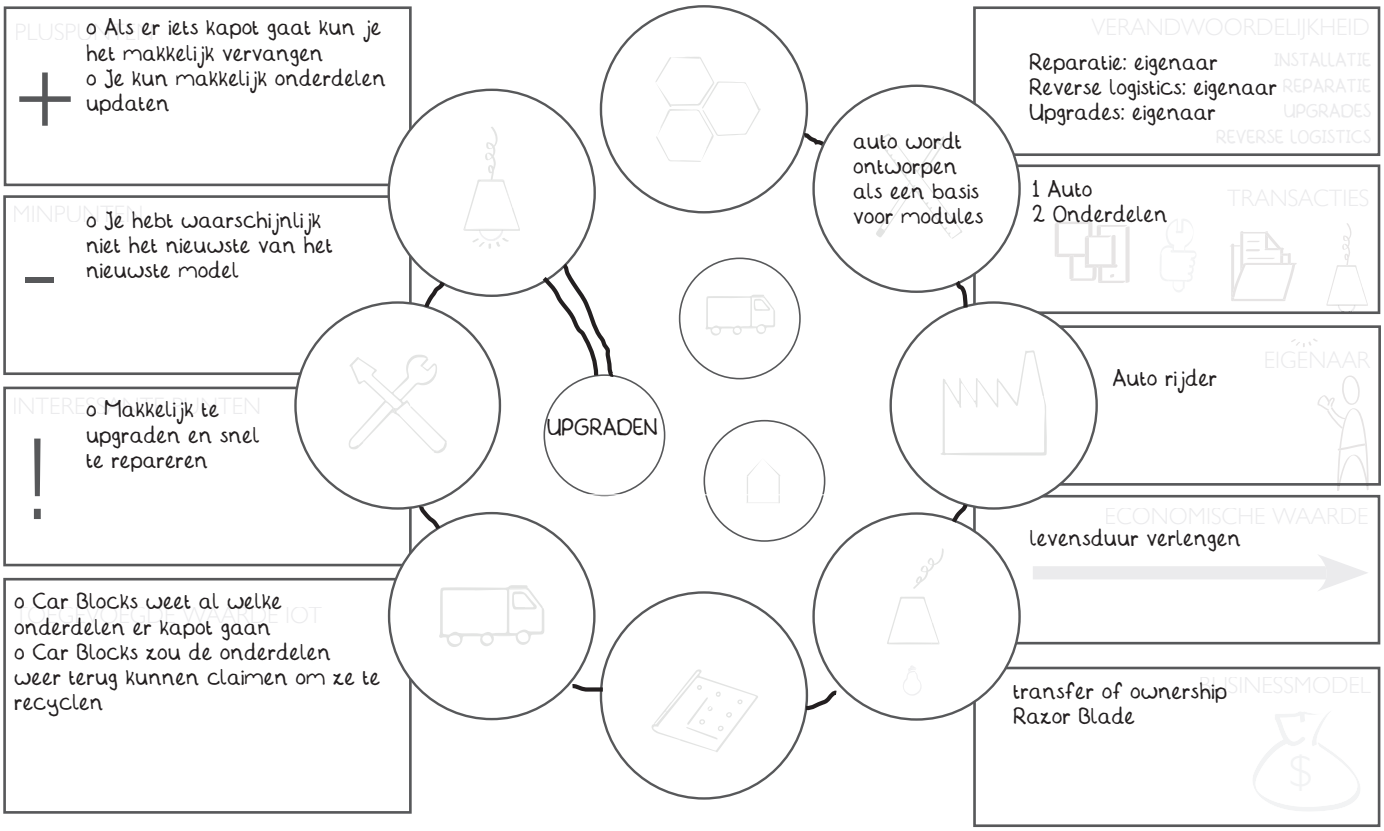
LEASE CAR


+
o Betaal per maand
o Als je een andere auto wilt, kun je wisselen
–
oJe hebt elke maand vaste lasten
o Reparaties zijn voor eigen kosten
!
o Mooie auto die je anders niet kunt betalen
o Bedrijf verdient meer dan in een koop optie
o lease bedrijf kan auto zien waar de auto is als hij gestolen wordt.
o De auto zou zo ontworpen kunnen worden dat kritieke onderdelen langer meegaan
VERANDWOORDELIJKHEID
Reparatie: lease rijder
Reverse logistics: lease rijder
TRANSACTIES
Auto
EIGENAAR
Lease bedrijf
ECONOMISCHE WAARDE
Looping
BUSINESSMODEL
FIXED RATE
auto wordt niet ontworpen door lease bedrijf
lease rijder
uitleg over de auto en wat te doen wanneer hij kapot gaat
hergebruik
leasebedrijf
naar nieuwe eigenaar

SWAP AUTO



CAR BLOCKS



APPENDIX C: MORPHOLOGICAL CHART

In the design of a complete PSS, combining solutions for the subproblems from appendix A only, would not result in an clear ideas. To define which elements needed to be defined additionally, a look was taken at PSS design literature. To be able to use these insights a morphological chart (Roozenburg & Eekels, 1998) was created.

* In a morphological chart the different aspects or subproblems of a concept are listed vertically and the different solutions for each of the aspects horizontally. By connecting different solutions for subproblems, concepts can be created.

Lay et al. (2009) created a morphological chart of the features of different B2B product-service systems. The provided features and options are based on mapping the differences between existing product-service systems. The morphological box of Lay et al. described solutions for Ownership, Personal, Location of the operation, Single/multiple customer operation and Payment model. Since the morphological box from Lay et al. did not cover all imagined differences in PSSs, a look was taken at the morphological chart from Hellek et al. (2013). The morphological chart from Hellek et al. (2013) included benefits is oriented towards, transfer of ownership, responsibility during use, management of life cycle activities, Availably of offering, Expansion of benefits and Economical value based on. By combining the morphological chart from Lay et al. (2009) with the morphological chart from Hellek et al. and adding additional business models and value drivers for CE, the morphological chart from figure C.1 was created.

Transactions
This characteristic defines which values moves from one stakeholder to the other. A product relates to a physical object, an application to software, data to numerical data, information to information generated by one of the stakeholders and service to manual labour.

Lay, G., Schroeter, M., & Biege, S. (2009). Service-based business concepts: A typology for business-to-business markets. European Management Journal, 27(6), 442-455.

Roozenburg, N. and Eekels, J. (1998, 2nd ed.) Product Ontwerpen: Structuur en Methoden, Utrecht: Lemma.

K. Hellek, T.C. McAloone, V. Avlonitis, A. Garcia i Mateu, J.B. Andersen, K. Mougaard, L. Neugebauer and J. Hsuan (2013) PSS Tool Book: A workbook in the PROTEUS series. Retrieved on 18-04-2018 from: http://www.proteus.dtu.dk/-/media/Centre/PROTEUS/Downloads/PROTEUS-workbook-series-PSS-Tool-Book.ashx

Figure C.1 Created morphological chart

characteristics					
transactions	product	application	data	information	service
transfer of ownership	after delivery	after installment	returns to company at eol	never	other user at end of cycle
economical value based on	extending the useful life	efficient utilisation	maximising the utilisation	looping	regenerating natural capital
businessmoddel	pay-per-acces	pay-per performance	hardware as a service	two-sided marketplace	proffessional services
	pay-per-use	transfer of ownership	fixed rate	subscription	e-comerce
RESPONSIBILITY					
installation	producer	installer	consumer	brand	recycler
repair	producer	installer	consumer	brand	recycler
upgrades	producer	installer	consumer	brand	recycler
reverse logistics	producer	installer	consumer	brand	recycler

Transfer of ownership
This characteristic defines when the owner of the transacted value changes. This can for example be after delivery (e.g. often the case with web shops) or never (e.g. with a rental car). Return to company at EOL means that the user returns the product to the company.

Economic value based on
The options for the 'economic value based on' characteristic are in this case the CE value drivers as described in the introduction.

Business model
The business model is related to the previous characteristic and defines the way value is captured. The given options in this morphological chart were based on the business model library from reason street (2018).

Responsibility
The final characteristic is the division of responsibility for different tasks over the different stakeholders. In a as-a-service construction brands are for example often responsible for all tasks (installation, repair, upgrades, reverse logistics).

By selecting sub solutions for the directions mentioned in B.1 the following combinations were created:

1. Store Experience As A Service: An all-inclusive lighting service (fig C.2)
2. ModuLuminaires: a modular lighting system (fig C.3)
3. SecondLightLife: A platform for used retail luminaires (fig C.4)

Figure C.2 morphological chart Store Experience as a service

characteristics					
transactions	product	application	data	information	service
transfer of ownership	after delivery	after installment	returns to company at eol	never	other user at end of cycle
economical value based on	extending the useful life	efficient utilisation	maximising the utilisation	looping	regenerating natural capital
businessmoddel	pay-per-acces	pay-per performance	hardware as a service	two-sided marketplace	proffessional services
	pay-per-use	transfer of ownership	fixed rate	subscription	e-comerce
RESPONSIBILITY					
installation	producer	installer	consumer	brand	recycler
repair	producer	installer	consumer	brand	recycler
upgrades	producer	installer	consumer	brand	recycler
reverse logistics	producer	installer	consumer	brand	recycler

Figure C.3 morphological chart ModuLuminaires

characteristics					
transactions	product	application	data	information	service
transfer of ownership	after delivery	after installment	returns to company at eol	never	other user at end of cycle
economical value based on	extending the useful life	efficient utilisation	maximising the utilisation	looping	regenerating natural capital
businessmoddel	pay-per-acces	pay-per performance	hardware as a service	two-sided marketplace	proffessional services
	pay-per-use	transfer of ownership	fixed rate	subscription	e-comerce
RESPONSIBILITY					
installation	producer	installer	consumer	brand	recycler
repair	producer	installer	consumer	brand	recycler
upgrades	producer	installer	consumer	brand	recycler
reverse logistics	producer	installer	consumer	brand	recycler

Figure C.4 SecondLightLife

characteristics					
transactions	product	application	data	information	service
transfer of ownership	after delivery	after installment	returns to company at eol	never	other user at end of cycle
economical value based on	extending the useful life	efficient utilisation	maximising the utilisation	looping	regenerating natural capital
businessmoddel	pay-per-acces	pay-per performance	hardware as a service	two-sided marketplace	proffessional services
	pay-per-use	transfer of ownership	fixed rate	subscription	e-comerce
RESPONSIBILITY					
installation	producer	installer	consumer	brand	recycler
repair	producer	installer	consumer	brand	recycler
upgrades	producer	installer	consumer	brand	recycler
reverse logistics	producer	installer	consumer	brand	recycler

APPENDIX D: FEEDBACK SESSIONS

Feedback from the Signify employees
The group with Signify employees consisted of an IoT expert, a product expert, a sustainability expert, a lighting expert, a customer expert and a proposition expert. Below the feedback from the employees on the ideas are summarized. The feedback is separated in plusses (+), minuses (-) and interesting points (!).

Store Experience As A service

+ Improves the shopper's experience, which is becoming important in attracting shoppers

+ Results in less risks and surprises for the retailer in terms of costs

+ Supports retailer in a more flexible use of the store

+ Makes Signify less dependent on selling luminaires.

- Requires a change in the mindset of the retailers

- Is not completely new to us because it reminds of StoreWise and Retail Analytics

- Does not fit with the fact that Signify does not like outsourced hardware on their balance sheet

- Requires dynamic lighting

! Could enable personalized highlights for shoppers

! Is going to happen if the value is bigger than the costs

! Enables Signify to learn about lighting effects

ModuLuminaires

+ Takes out costs and environmental impact of full product replacement

+ Enables the look and feel to change at low costs

+ Empowers the retailer to control the lighting system

+ Reduces amount of components needed

- Is not in line with our safety protocols because retailers are not educated to install lighting

- Requires a stock with different 'blocks'

! Creates value by updating the design while keeping the electronics in place

! Has the possibility to extend to other segments

! Enables Signify to increase their market share further

SecondLightLife

+ Creates a great possibility to offer A/B luminaires for starting or low budget retailers

+ Creates an imago boost for Signify in terms of sustainability

+ Optimally employs the life span of luminaires

- Increases the risk on dropouts

- Requires detailed information on the status of the luminaire we do currently not have

- Is not in line with our large customers, who see more value in reliability than in low investment costs.

- Requires the luminaires to have a long lasting good look

! Creates insights & learning about product and use

! Is already done, but Signify is not part of it and therefore

! Increase the choices for retailers

! Allows us to increase our market share

Feedback from the students
Below the summary of the feedback from the students is shown. The feedback is separated in plusses (+), minuses (-) and interesting points (!).

Store Experience As A service

+ Retailers do not have to worry about the lighting
+ Influence the buying behaviour with lighting
+ Adaptable to the needs and wants of the retailer
+ More collaboration with other stakeholders

- Expensive
- Research needed on the effect of lighting on sales
- Supermarket has less feeling of control

! Pay based on sales improvements
! Expand beyond lighting
! Selling a result will not age
! Signify will be stimulated to produce good products

ModuLuminaires

+ Fits with the wants of the target group
+ Reuse of specific parts of a product, not the whole product
+ Clear financial benefits for Signify

- Everything has to fit
- Retailer can sell parts to each other
- Retailers can still buy cheaper parts from China

! Many possibilities makes it interesting for the supermarket

SecondLightLife

+ Cheap
+ Second hand is a trend: sell it to home-users as well
+ Awareness among customers
+ Show of sustainable mindset of the supermarket

- Problems as similar to Leap's might harm Philips brand
- Lot of effort to send back
- Supermarket might start own initiatives

! Connect to an initiative
! Sustainable

Creative Session: Concept Crunch

Time	Duration	Step	Task	Goal	materials	To Do's
Before	month	Invitation	Ask Elena to invite people for the session.	Resource Group	Expertise list	Done
Before	week	Reminder	Ask Elena to send the resource group a reminder to make sure they are coming and know what the workshop is about. Ask them to ask their collegues about ideas/opinions about CE lighting. And ask them to think about which product they would like to see as a service.	Prepared Resource group	Mail	send mail
Before	2 weeks	Prepare Mirte	Discuss the sessionplan and devide tasks	Prepared facilitators	SessionPlan	Done
HEAR						
9.00	5 min	Introduction Session	First, Mirte and me will introduce ourselves. The problem will be introduced. Secondly the (vague) planning will be shown. Finally the rules of the session will be discussed and permission for filming is asked.	Prepared and accepting resource group (phsychological contract)	Slides with problem, planning and rules, camera.	Bring nice home made coockies or something?
9.05	10 min	Icebreaker	Let everybody introduce themselve and ask a weird question?	People know eachother, heard their voice in the room, are a team	slide with question: what would you like to see as a service?	
9.15	15 min	Purge	Let everybody write the ideas they already have about circular supermarket lighting and IoT on post-its.	openess for new ideas, questions they have, answers I have to give at the end	Post-its. Markers, Flipover sheets	Think of helpfull H2's, A race or just a simple brain storm?
9.30	15 min	Presentation Concepts	I will present the concepts I currently made.	openess for new ideas, questions they have, answers I have to give	Sheets with concepts, prepared presentation	Visuals maken en presentatie oefenen
9.45	10 min	Feedback writing	Let them write down the feedback. Ask them for the plusses, minusses and interesting points for each of the conepts.	feedback, hidden criteria, prioritization of criteria	Slide with the three concepts next to eachother	
09.55	10 min	Feedback discussion	Let them discuss about the feedback. We will rephrase their feedback into criteria. I will provide examples to help Mirte. Other option is to let them cluster the feedback…	feedback, hidden criteria, prioritization of criteria	Own feedback ready	Have own feedback ready
CREATE						
10.05	20 min	Prioritise criteria	Let them write down 10 criteria on post its. Create Harris Profiles and lead the discussion	prioritization of criteria	Post-its. Markers, Flipover sheets	Template Harris Profiles
10.25	20 min	Concept Improvement	Let them based on the concepts, make one improved concept and let them possibly used their own ideas from the purge and add new ideas	New concept	Template	Create a template?
DELIVER						
10.45	15 min	Discussion	Do these concepts fit the criteria? What do they need to know to move on with these concepts?	discussion of the criteria, questions to be answered	Post-its. Markers, Flipover sheets	Have questions ready

APPENDIX E: REASONING IDEA SELECTION

Store Experience As A Service
It could be said that this idea includes an IoT element that could support circularity, because the IoT allows Signify to do predictive maintenance. However, it is not really clear from the idea how that works. Additionally, As the analysis showed, making Signify responsible for the end of life does not guarantee minimization material input. However it does prevent resources from ending up as landfill. This idea focusses on the result of store experience and is therefore result oriented. By letting the retailers pay a fixed rate per month, Signify has a stable income. The fact that a service contracts works over a longer period of time, makes sure Signify creates a long-term relationship with retailers. By improving the result of the service, the idea strengthens the relation with the retailer. Signify has the freedom to adapt the service whenever they want, as long as they deliver the same result. Without IoT it is difficult to improve the store experience based on data. This idea allows Signify to control the lighting, monitor lighting and optimise energy usage. To deliver the result, in this idea luminaires and stakeholders that maintain and install the lighting are needed. The improving store experience helps franchisers to attract people to their store. It completely focusses on the store experience as a result and is therefore rather a desired solution than a combination of possibilities. The idea takes in account all the needs of the stakeholders and helps franchisers to keep their lighting up to date.

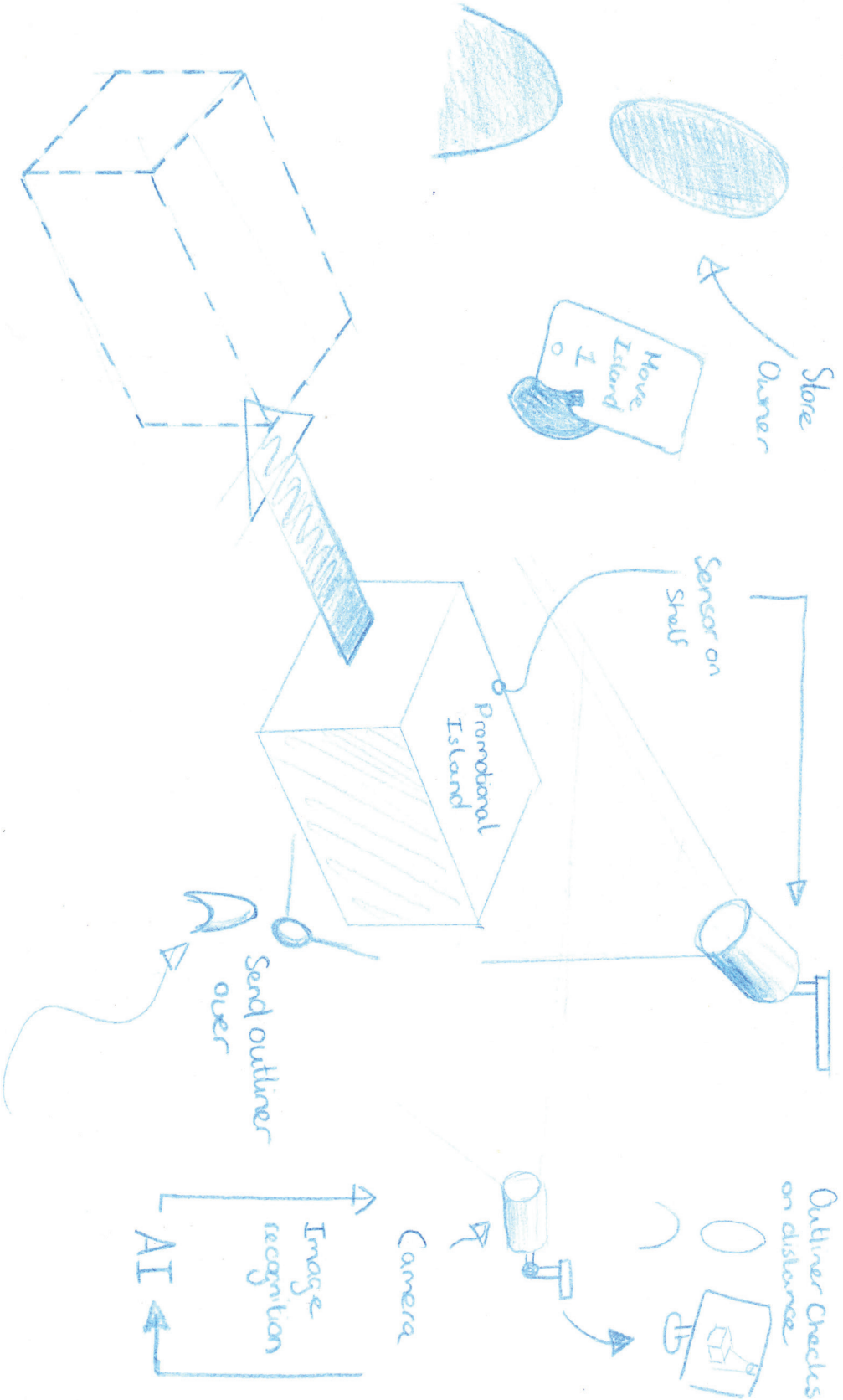
ModuLuminaires
Similar to the SEAAS idea, it could be said that this idea includes an IoT element that could support circularity, because the IoT allows Signify to do predictive maintenance. However, it is again not really clear from the idea how that would work. Because the products can be upgraded (maintaining/refurbishing) the idea uses resources more efficiently than a non-circular alternative. This idea does in contrast to the SEAAS idea not prevent resources from ending up as landfill because retailers buy the concept. However the 'blocks' offered are the similar to the technologies in SEAAS idea, the idea is not build around the result of store experience. Store owners can also buy only a very basic system. This idea is therefore not result or use oriented. This idea creates value in the same way selling luminaires does right now. The fact that a fixed rate is paid for the application makes sure Signify creates a long-term relationship with retailers. By adding blocks over time the result of the service, the idea strengthens the relation with the retailer. Signify is able to adapt the service by adding different blocks. Without IoT it is difficult to provide an overview of all installed products. In this idea both hardware blocks are needed as service blocks. The modularity of this ideas allows franchisers to update the look of their luminaires more often. It is questionable whether this idea is a combination of possibilities or a desired solution. At least the upgradability of the luminaires is a desired solution. The idea takes in account all the needs of the stakeholders and helps franchisers to keep their lighting up to date.

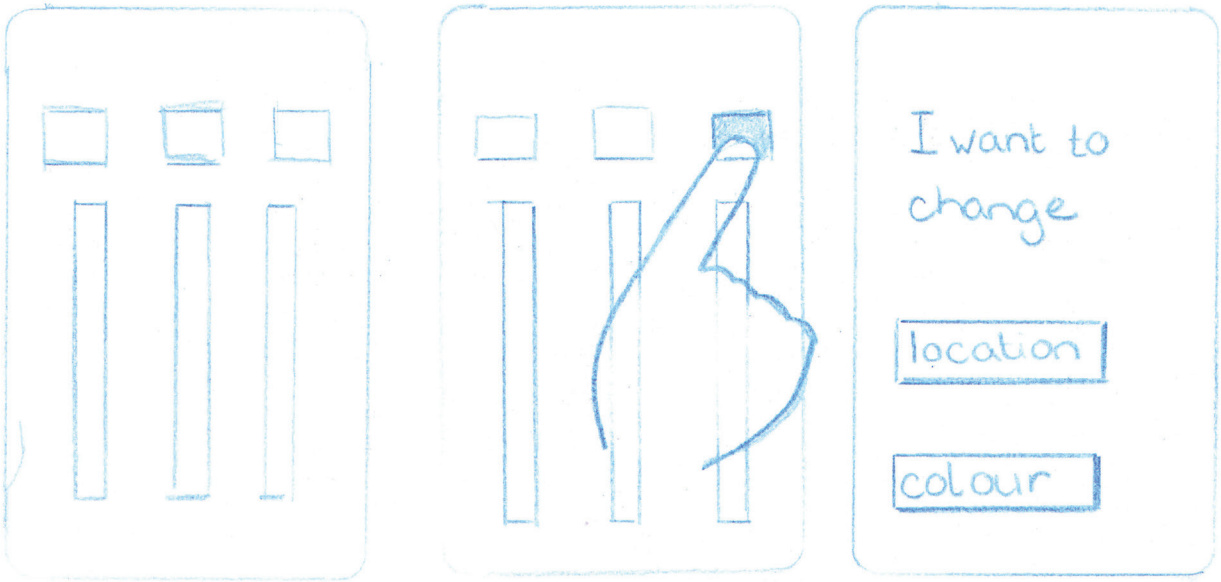
SecondLightLife
The lighting passport in this idea supports the circularity because it provides stakeholders with more details in status of the luminaires. By enabling reuse of luminaires, resources will be used more efficiently. However, it does not exclude the chance of ending up as landfill. A deposit fee will probably stimulate retailers to return their products to Signify, but will not guarantee this. This idea does therefore not meet the requirement of not ending up as landfill. The same counts for the control of the end-of-life of the luminaires. Signify has influence on the end of life, but is not able to control it. The value that will be saved by reusing the luminaires, creates value that can be captured by Signify in this idea, but the communication with the customer ends once luminaires are sold. This idea does therefore not meet the requirements of a long-lasting relationship with the retailer. Additionally, Signify is not able to change anything to the offering once the product is sold. This idea does therefore also not meet the requirement of adaptability. This idea does create more value for the retailer than the same idea without IoT. The information about the status of the luminaire provides retailers with more certainty about the remaining lifetime of the luminaire. This value is created by the monitoring, tracking and communication capabilities of IoT. It could be said that this idea consists of tagged luminaires and a take back service and so is a bundle

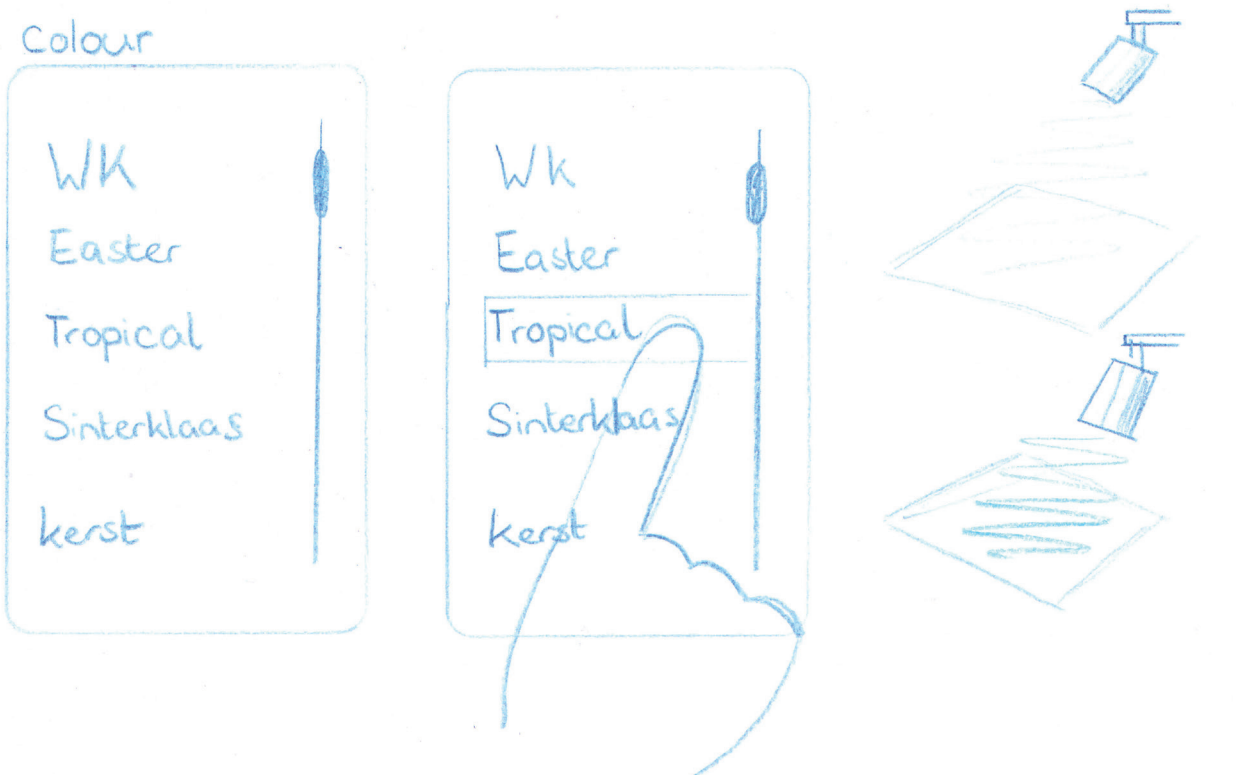
	SEAAS	ModuLuminaires	SecondLightLife
1. The designed concept should include an IoT element that supports circularity	?	?	✓
1a The designed concept should use resources more efficient than a non-circular alternative	?	✓	✓
> The designed concept should minimise the material input by maintaining, reusing, refurbishing and recycling.	?	✓	✓
1b The designed concept should prevent resources from ending up as landfill.	✓	?	?
> To enable Signify to control the end of life of their products, the designed concept should be use or result oriented.	✓	✗	✗
2. The designed concept should create value for Signify.	✓	✓	✓
2a The designed concept should create long-term relationships with customers	✓	✓	✗
> The designed concept should strengthen the relation with the retailer.	✓	✓	✗
> The designed concept should be adaptable to the changing needs and wants of retailers.	✓	✓	✗
3. The designed concept should provide a lighting solution for franchise supermarkets (Chapter 1.1 & 3.4)	✓	✓	✓
3a The designed concept should deliver a desired result not a combination of (technical)possibilities.	✓	✓	✓
3b The designed concept should take the needs of Signify, Plus, Installer, Outliner, Recycler and Manufacturer into account.	✓	✓	✓
3c The designed concept should facilitate adaptation of supermarket lighting to changes in the layout of the store.	✓	✓	✓
4. The designed concept should be an integrated bundle of product(s) and service(s)	✓	✓	✓
5. The designed concept should create more value for the customer than a lighting solution without IoT	✓	✓	✓
5a The designed concept provides stakeholders access to data that is useful for them.	✓	✓	✓
5b The designed concept takes the privacy of shoppers into account.	✓	✓	✓
5c The data gathered in designed concept is secured.	✓	✓	✓

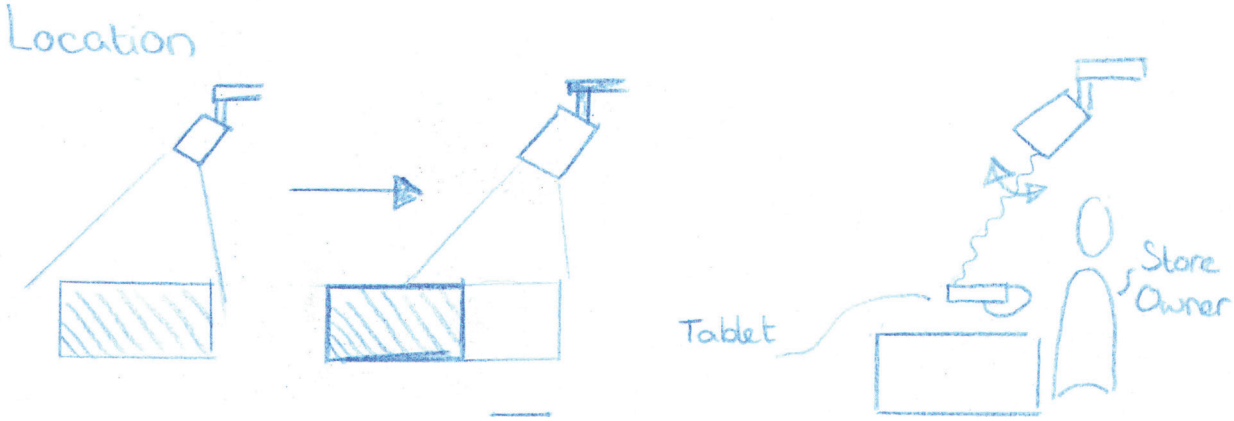
of products and services. The idea provides a solution for franchisers that are not able or willing to invest in the newest available lighting solutions. The fact that these luminaires are cheaper provides them with the possibility to change the lighting earlier than with a more expensive solution. The idea takes the needs of the stakeholders into account and is based on the fact that these loops already exist a desired solution.

APPENDIX F: IDEAS LIGHT DIRECTION

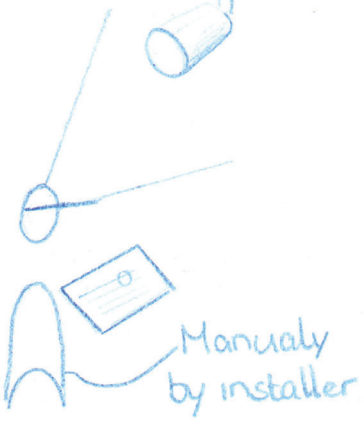


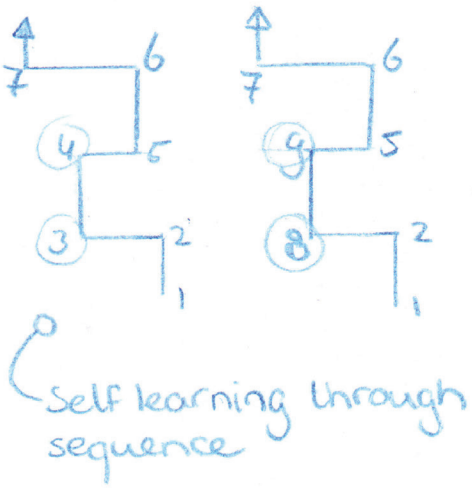

I want to change
location
colour

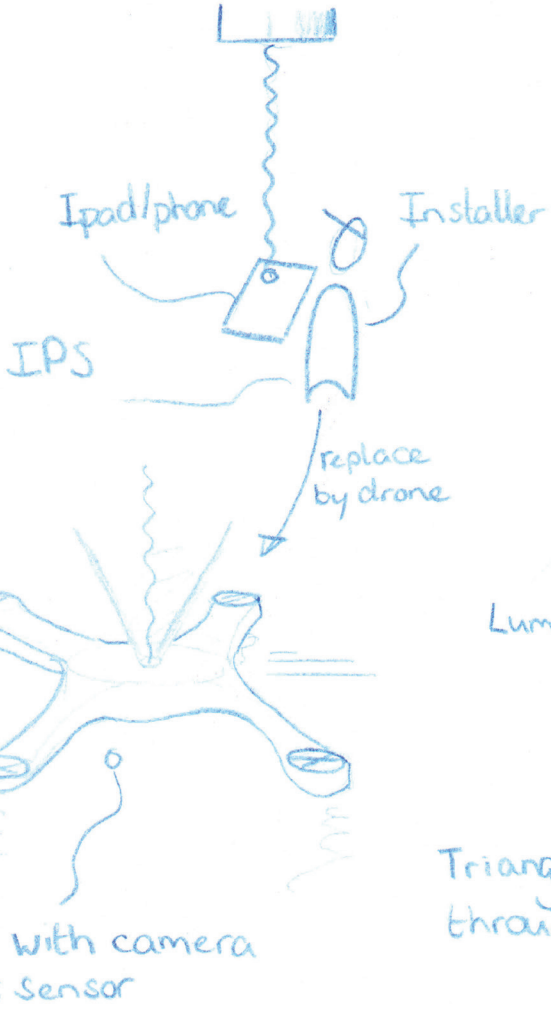

Colour
WK
Easter
Tropical
Sinterklaas
kerst
Wk
Easter
Tropical
Sinterklaas
kerst

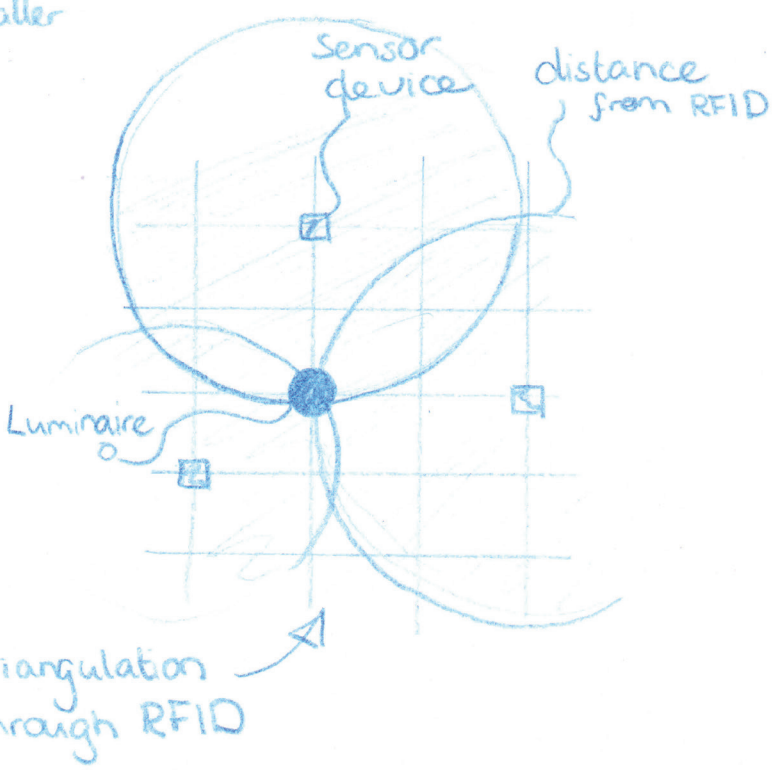

Location
Tablet
Store Owner

APPENDIX G: IDEAS LOCATION LUMINAIRES









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&
Signify