VIEW BY SØ

PRODUCT REPORT

MSc04 - Industrial Design
Aalborg University - May 2016

Team 5
Mads Peter Hilligsøe
Jon Søgaard

TITLE PAGE

Title:	VIEW by SØ
Project module:	Master Thesis
Project period:	1st February - 25th may 2016
Theme:	Smart Cooking
Project group:	MSc04 ID - Team 5
Supervisor:	Finn Schou
Technical supervisor:	Ewa Kristiansen
Pages:	24
Number of reports:	6
Education:	Aalborg University, Department of Architecture, Design and Media Technology Industrial Design, Spring 2016

PROJECT TEAM

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ABSTRACT

Dette speciale er udarbejdet af Tools by SØ bestående af to afgangsstuderende på Industriel Design ved Aalborg Universitet i foråret 2016.

Projektet startede ud med indledende vidensindsamling omkring markedet og brugergruppen. Til det følger designprocessen og udviklingen af produktet, som bliver præsenteret i en produkt rapport sammen med implementeringsstrategien for produktet.

Fokus under projektudarbejdelsen har været på Smart Cooking hvor den valgte retning er tilberedning af langtidsstegende mad, der tillader at brugeren kan være fraværende i køkkenet.

Dette udvikles med henblik på at maden bliver korrekt tilberedt samt at give brugeren mere tid til valgfrie aktiviteter samt frihed under tilberedningsprocessen.

Resultatet af projektet er View, som er et produkt der muliggør at observere maden på sit smart device. Produktet tilbyder ydermere kernetemperatur samt aktuel ovntemperatur. Produktet er udstyret med tre målepunkter, der gør det lettere for brugeren at ramme kernen af kødet og derved gør det lettere at tilberede den perfekte ret.

INTRODUCTION

View is a product, designed to make the cooking experience more simple. It is addressed to the gadget guys and helps the user with visual feedback of the food in real time whether the user is in the living room, or out in the garden, it doesn't matter. View is always there for you, to help you keep an eye on your food.

View is mounted on your oven door with the provided magnets. It has a build-in camera providing the user with visual feedback. The wireless probe is for measuring the meat's core temperature. The feedback is sent wirelessly to the users smart device, where he/she can keep track of the process. View is designed with the users needs in mind, and provides the user with the abilities to:

- Customize the final core temperature
- See the food visually anywhere
- See a two decimals core temperature
- Never have to worry about the wire, as it isn't there
- Relax, View alerts the user, when the food is done


RETAIL PRICE
1125,- DKK

VIEW BY SØ

DIMENSIONS
56 x 182 mm

WEIGHT
300 g

DESIGNER
Tools by SØ

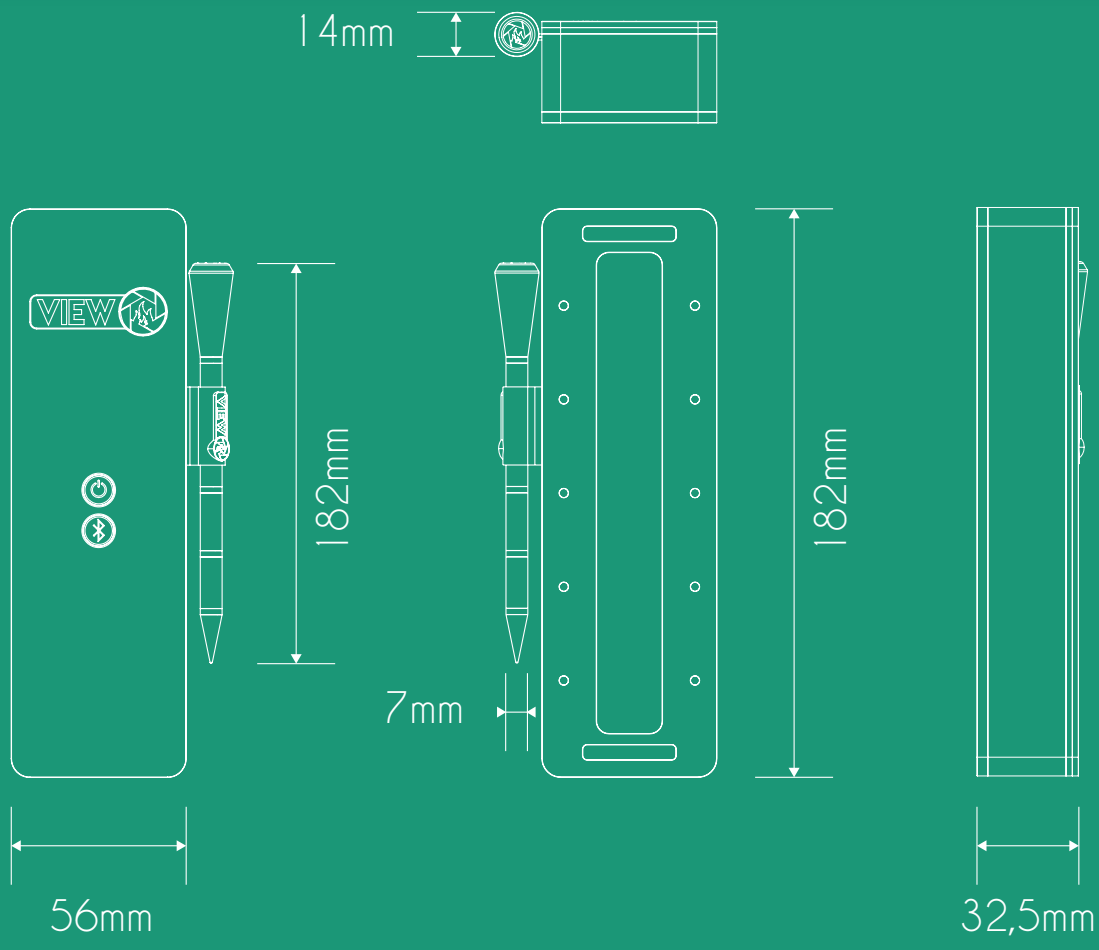
CAMERA
1080P 30 FPS
Adjustable camera height of 150mm

COLOURS
Matt black, shiny silver

CONNECTIVITY
1 x Micro USB

BLUETOOTH
Bluetooth 4.1

WIFI
IEEE802.11 b/g/n 2,4 GHz



VIEW APP
Compatible with Android and Apple devices

BATTERY
Camera unit:
Up to 30 hours of video streaming
Probe: Up to 25 hours

MEAT THERMOMETER
3 temperature sensors
1 oven temperature sensor
Sensor precision of 0,01 °C
Water prof up to 1 meter

LIGHT
Oven light
View indicator light

INCLUDED IN THE BOX
Quick setup guide
Micro USB to USB-A cable
Magnetic mounting kit
5V wall charger
Oven cleaning kit

SPECIAL FEATURES
Wireless
Video stream
Magnetic mounting
Customizable done stage

ZOOM
Digital zoom


35

EYES IN THE KITCHEN

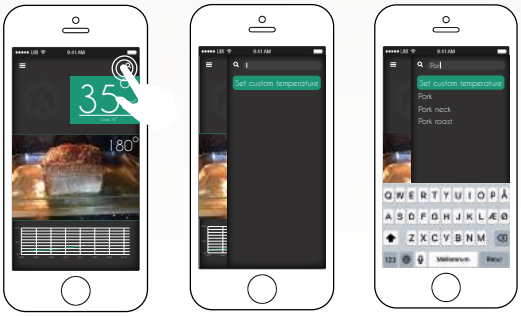
View helps the user by extending their kitchen senses, giving them the ability to mingle with friends and families, without having to worry about the food in the oven. View helps you cook the juiciest roasts perfectly every time, for every occasion. And hey, there is an app for that!

APP

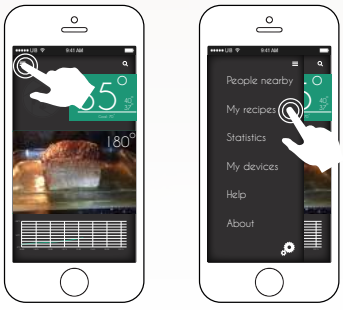
View comes with a free to download app from where the camera can be controlled. Every information that the user needs is provided through the app. The navigation of the app and the overall gestures are explained on the following illustrations.

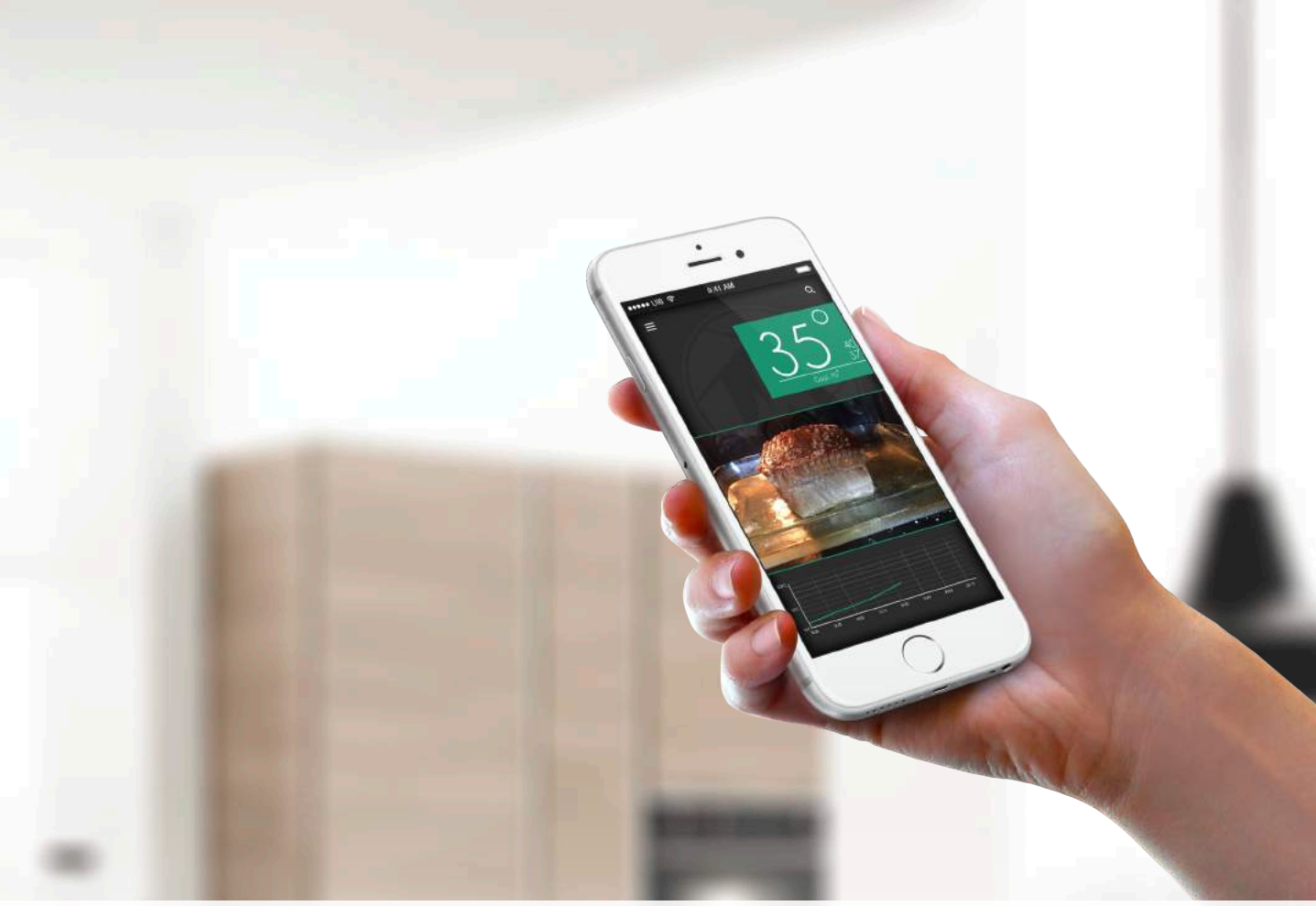
FIRST TIME USE

SETTING A TEMPERATURE

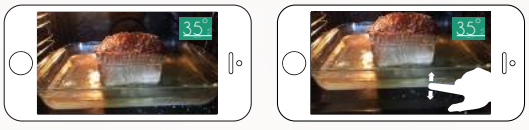


CUSTOM TEMPERATURES ARE SAVED



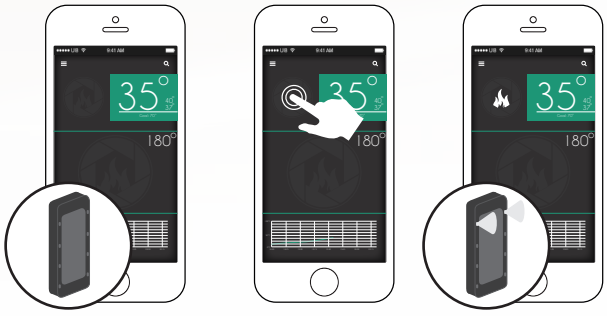


SWIPE TO MOVE THE
CAMERA UP AND DOWN

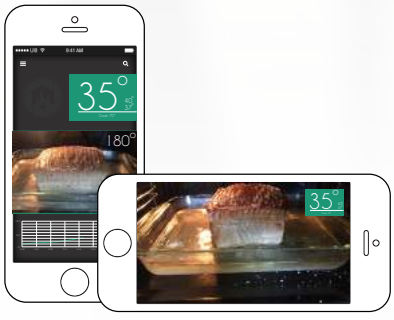


PINCH TO ZOOM

ADD LIGHT BY A SINGLE TOUCH



WORKS IN HORIZONTAL
AND LANDSCAPE



USER SCENARIO

First the roast is prepared

Then the roast is put inside the oven.

The user can then freely go anywhere, as long as the WIFI connection is maintained.

They can sit comfortably and keen an eye on their food, right where they are. Weather they are watching a movie or having guests over, a peak at the food is never more that a touch away.

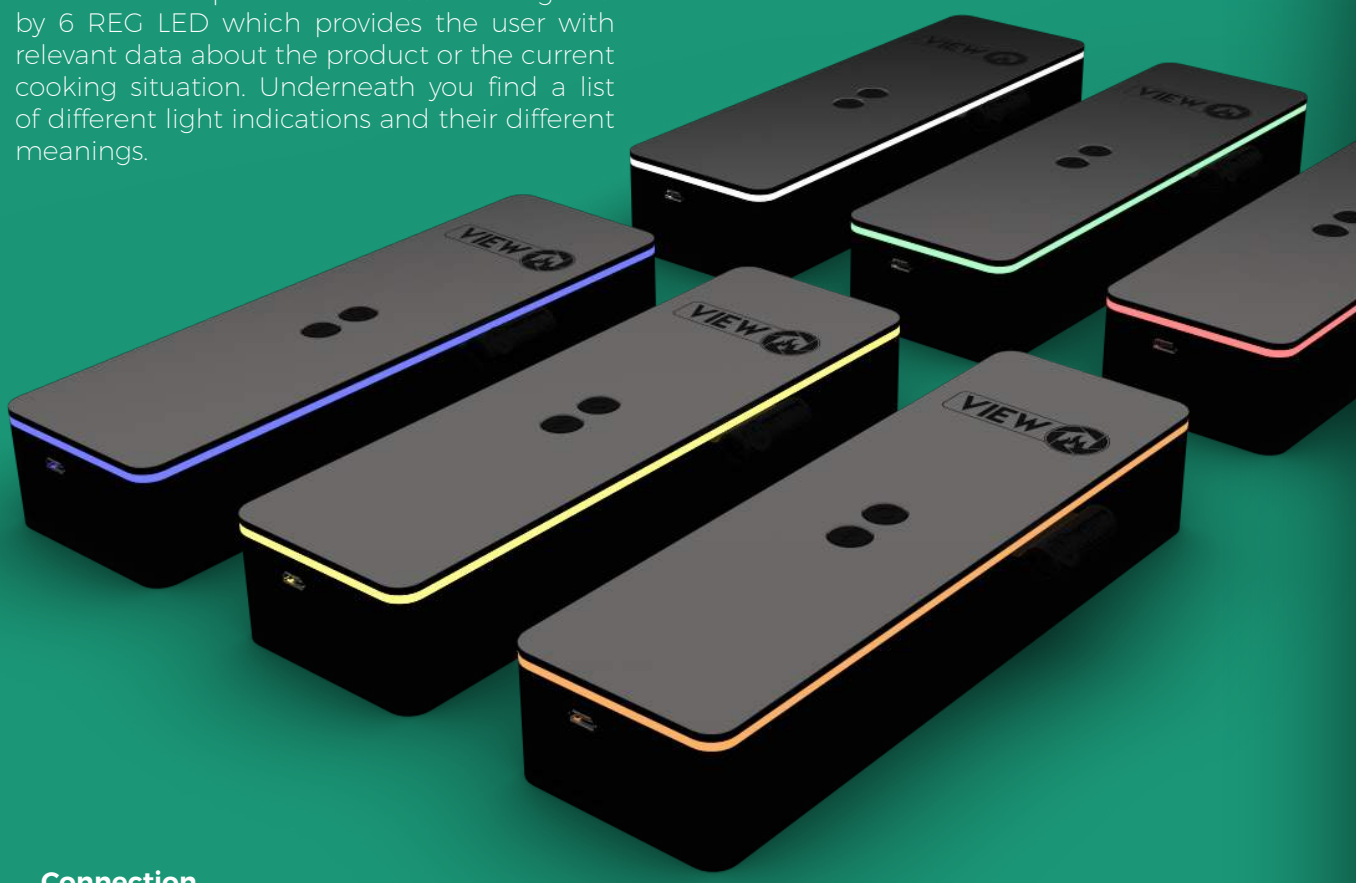
When the food is done the user receives an alert, and can see right on their smart device, if e.g. the pork rinds needs a little extra time before they are perfect.

So when the user goes to the kitchen, to get the food out the food is always just right, No more wasted trips back and forth from the kitchen.

LIGHT INDICATIONS

Besides all the feedback the user gets on his/hers smart device the unit itself also informs about its current status.

The clear ABS part in the middle are lighted by 6 REG LED which provides the user with relevant data about the product or the current cooking situation. Underneath you find a list of different light indications and their different meanings.



Connection

· Stable white light	Turning device off // reset is complete.
· Stable blue light	Pairing with new device is confirmed.
· Blinking blue light	Establishes pairing // no alarm is set.

Peak Preset

· Stable Green	Initial temperature.
· Stable Yellow	5° C until target temperature is reached.
· Stable Orange	5° C until target temperature is reached.
· Blinking Red	Target temperature is achieved.
· Stable Red	Target temperature reached and alarm notification has been confirmed.

Range Preset

· Stable Green	Temperature internal range.
· Blinking Red	Temperature external range.

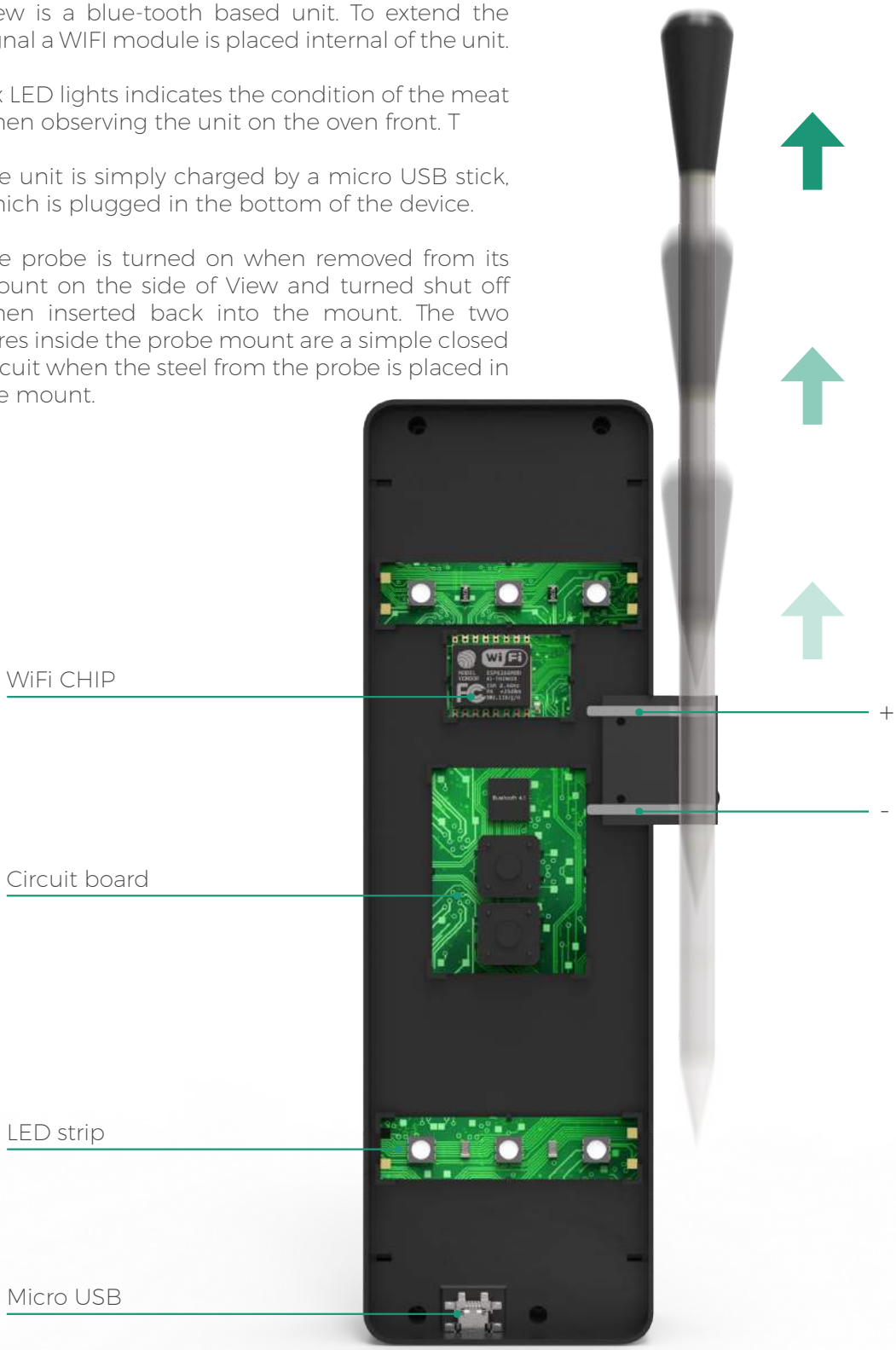
ELECTRICAL CIRCUIT

View is a blue-tooth based unit. To extend the signal a WIFI module is placed internal of the unit.

Six LED lights indicates the condition of the meat when observing the unit on the oven front. T

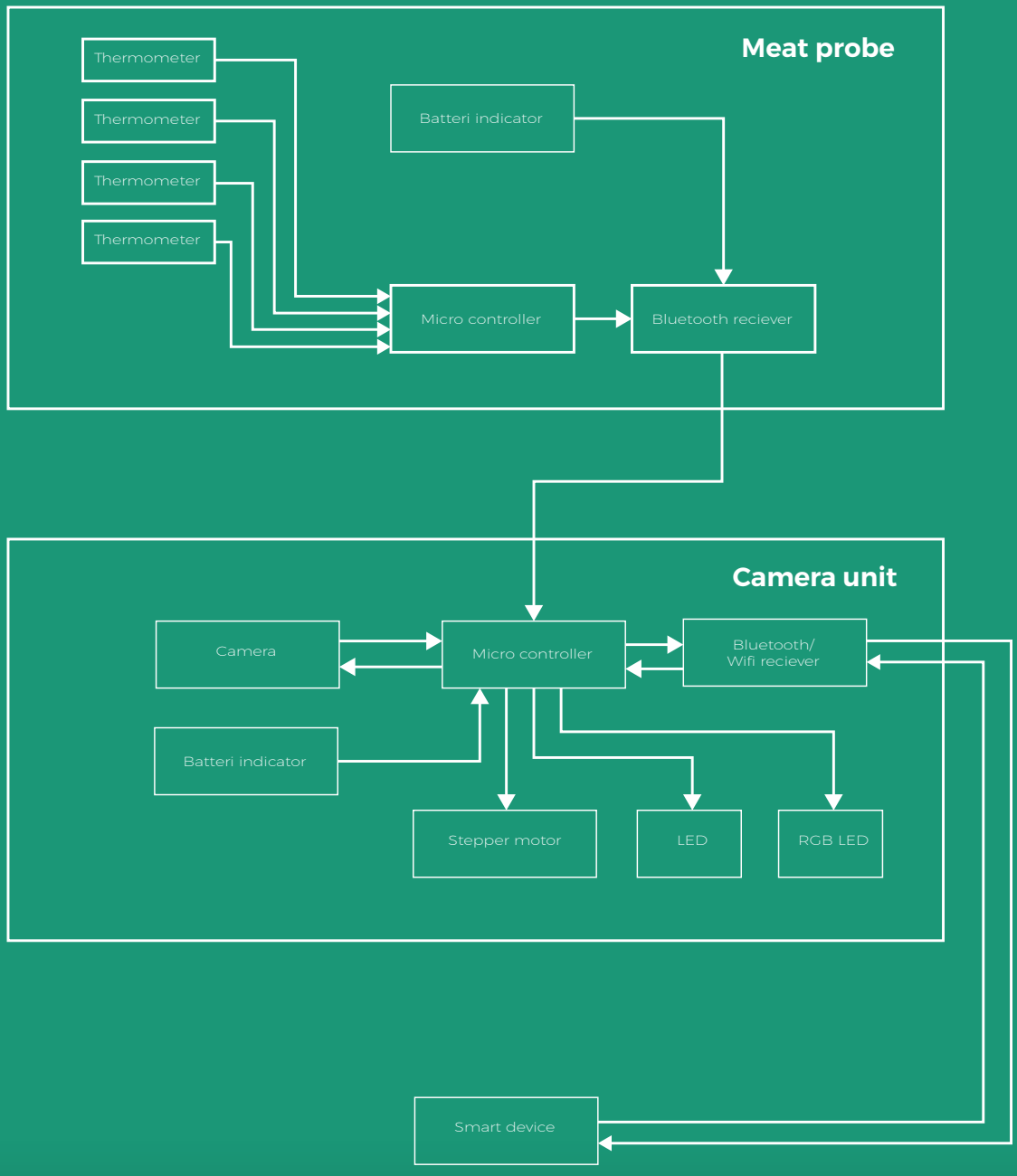
The unit is simply charged by a micro USB stick, which is plugged in the bottom of the device.

The probe is turned on when removed from its mount on the side of View and turned shut off when inserted back into the mount. The two wires inside the probe mount are a simple closed circuit when the steel from the probe is placed in the mount.



FLOW CHART

Beneath is a simplified flowchart of how the internals of View are connected and interacting. The boxes represent components and the arrows are the direction of the data the components are either sending or receiving.

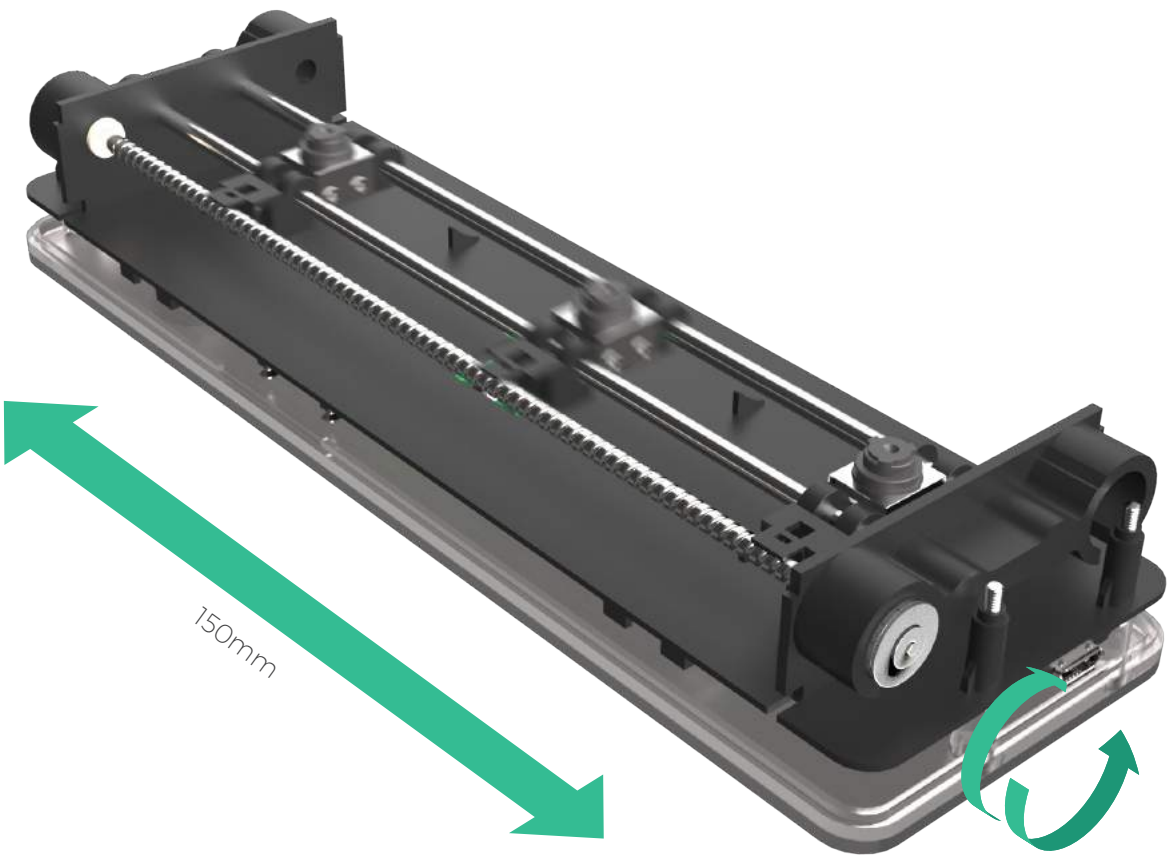


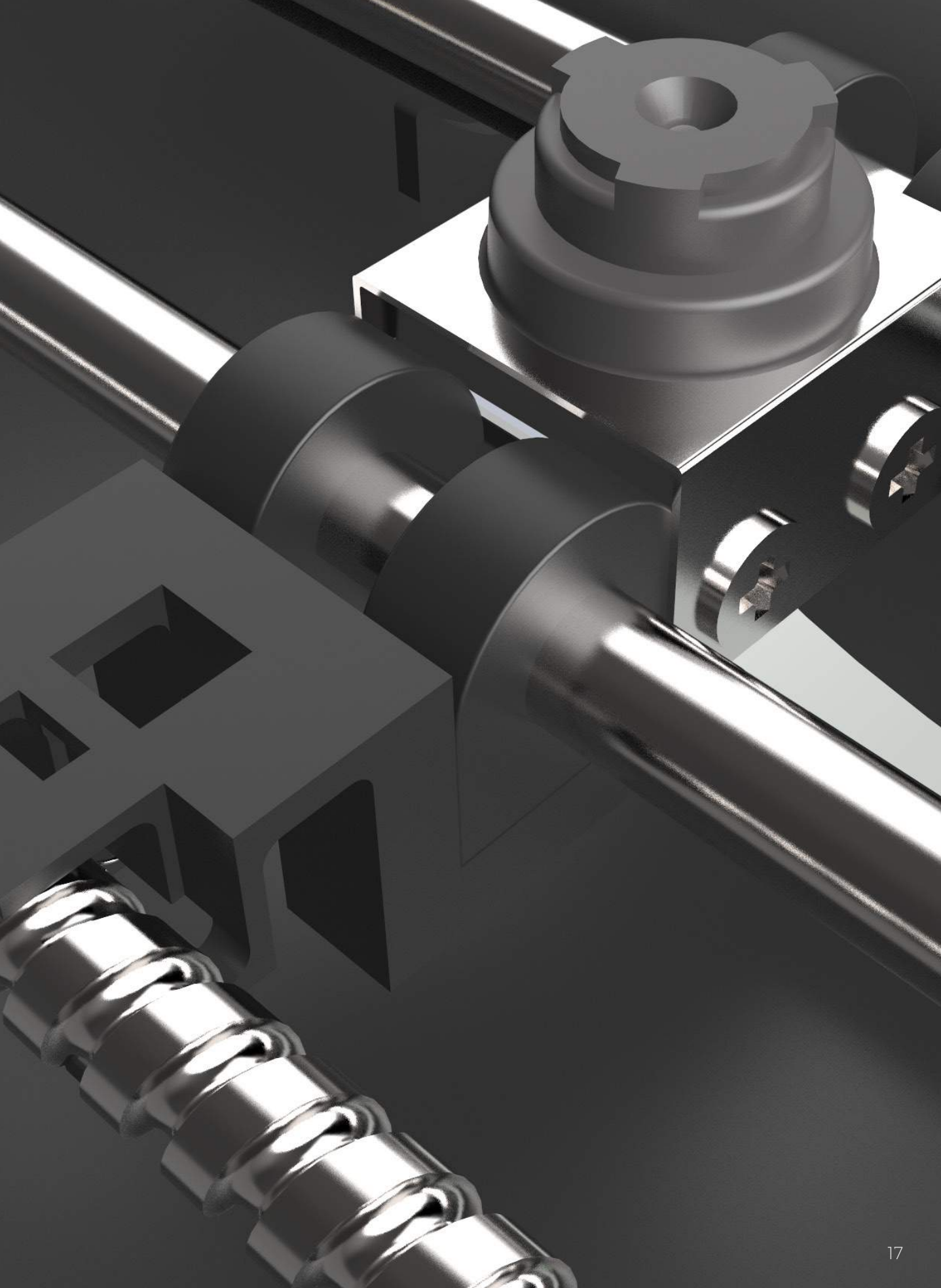
ADJUSTABLE CAMERA HEIGHT

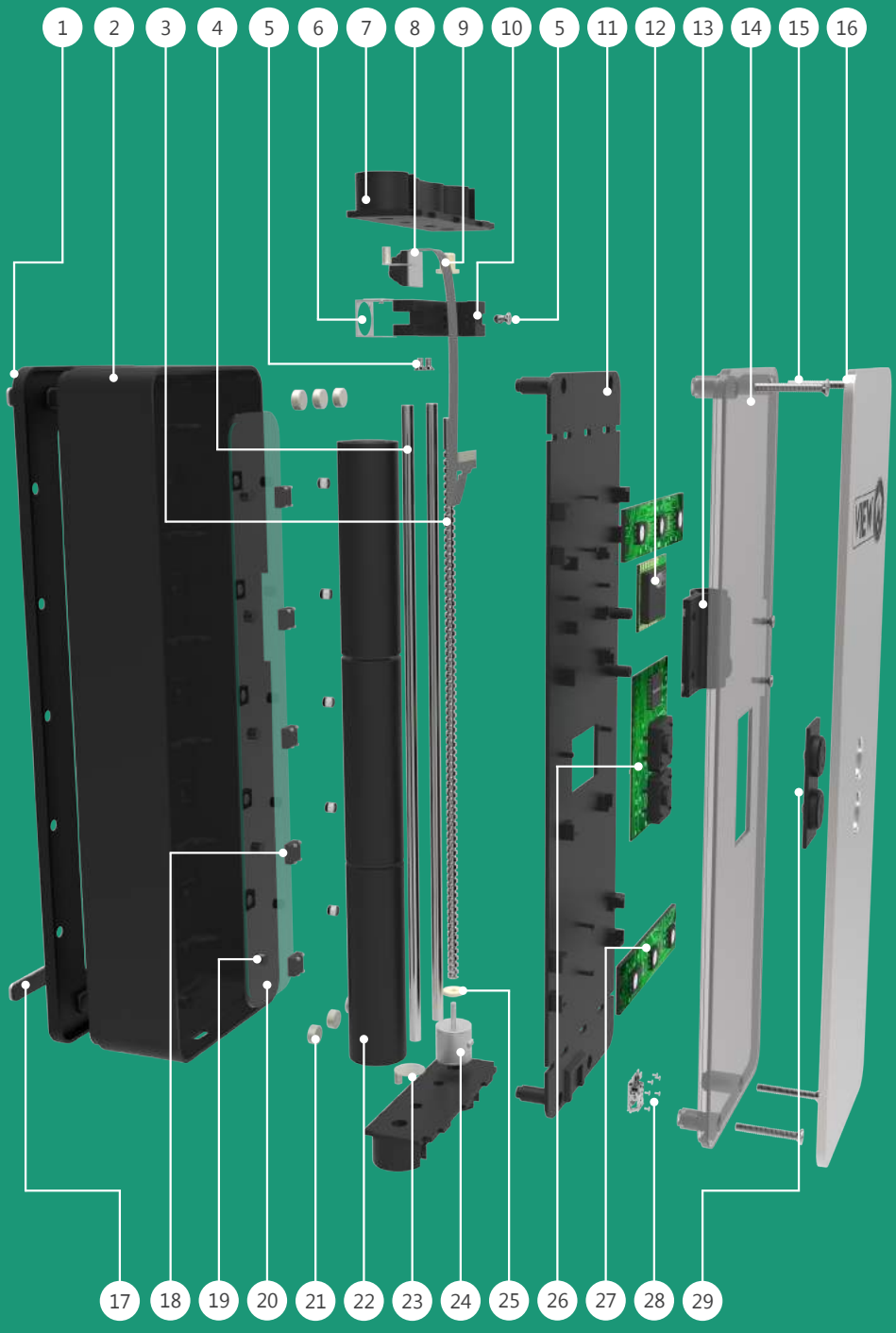
The camera unit is placed on two parallel rails, which is controlling the direction of the camera. By activating the stepper motor with a simple swipe on the phone, the user can adjust the camera height. The motor is attached to a threaded rod which by turning are moving the camera unit up and down.

The ribbon cable for the camera is nicely aligned up against the middle plate and are securing a total travel freedom of 150mm.

SWIPE TO MOVE THE CAMERA UP AND DOWN



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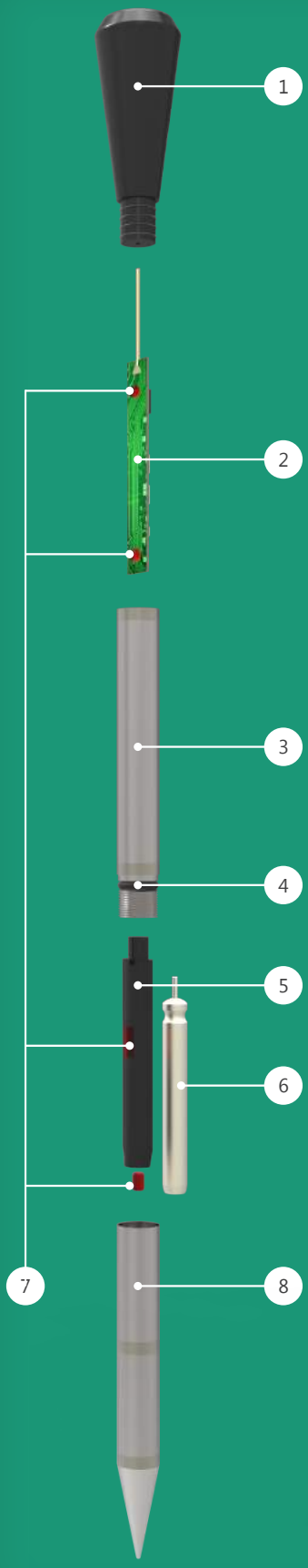
BILL OF MATERIALS - MAIN UNIT

NR.	NAME	PIECES	MATERIAL
1	Rubber front	1	EPDM rubber
2	Core View	1	ABS
3	Threaded rod Ø3 x 152mm	1	Stainless steel
4	Rail Ø3 x 164mm	2	Stainless steel
5	Countersunk M1.6 x 3 screw	3	Stainless steel
6	Camera mount	1	Stainless steel
7	Top botton mount	2	ABS
8	OV5640 5MP camera	1	-
9	Washer head Ø6 x 5mm	1	ABS
10	Rail slider	1	ABS
11	Middel plate View	1	ABS
12	WIFI modul	1	-
13	Probe mount	1	Silicone
14	Cap plate	1	Clear ABS
15	Countersunk M2 x 16 Screw	4	Stainless steel
16	Back plate	1	Stainless steel
17	Mounting plate	2	Stainless steel/glue
18	LED light	10	-
19	LED lens	10	-
20	Front glass	1	Tempered glass
21	Magnet Ø5 x 2mm	6	Cobalt
22	Battery 2300mAh 3,7V	3	Li-ion
23	Power plate	2	Stainless steel
24	Stepper motor 3,7V	1	-
25	Washer Ø6 x 1mm	1	ABS
26	View curict board	1	-
27	LED board (3x LED)	2	-
28	Micro USB connector	1	-
29	Power/Bluetooth buttons	1	EPDM rubber



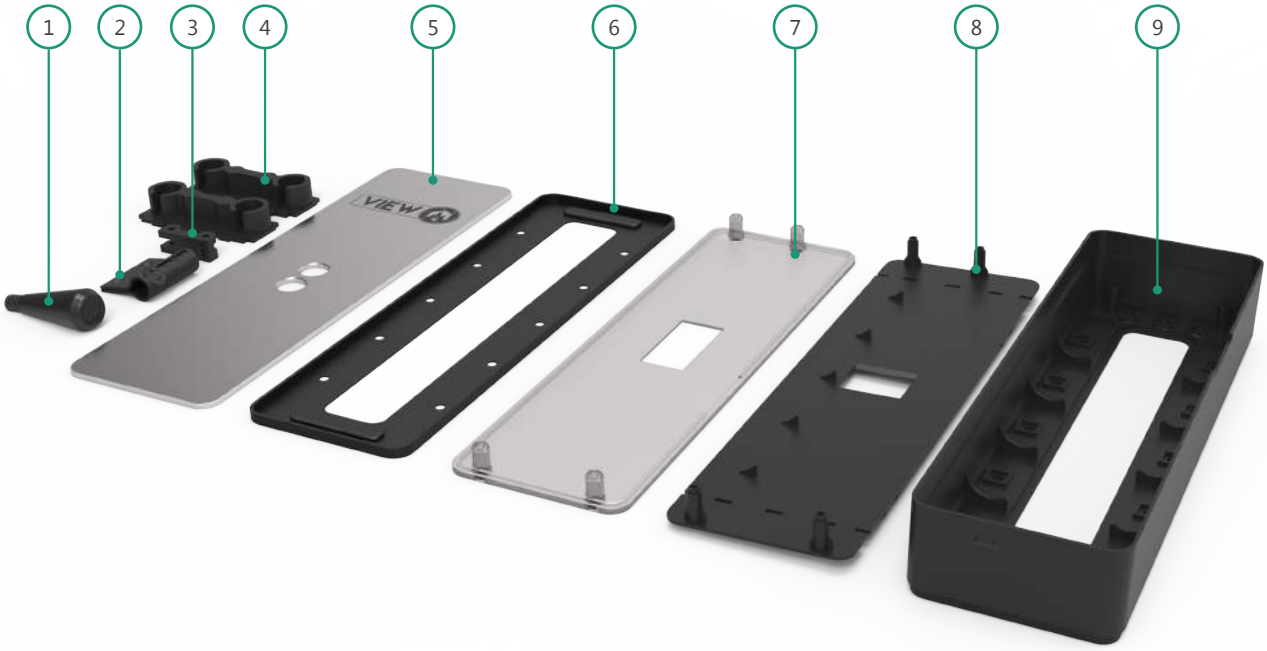
BILL OF MATERIALS - MEAT THERMOMETER

NR.	NAME	PIECES	MATERIAL
1	Probe head	1	LCP
2	Circuit board	1	-
3	Male part Ø7 x 50,5mm	1	Stainless steel
4	O-ring	1	Silicone
5	Battery mount	1	ABS
6	BR-435 - pin battery Ø4,2mm	1	Stainless steel
7	Resistors (temperature sensor)	4	-
8	Female part Ø7 x	1	Stainless steel

POWERING THE PROBE

The meat thermometer is powered by a 50mAh pin battery. Whenever the probe is running out of power the user then simply unscrew the probe cap and replace the battery with a new battery. The cap is secured by a o-ring, which seals the to parts. The battery are powering the probe for minimum 20 hours of consciously use.

PRODUCTION



LIQUID CRYSTAL POLYMER

Part no. 1 is made from LCP plastic and also injection molded. This is the head of the probe, which goes inside the oven. LCP was chosen because of it's high heat tolerance.

SILICONE

Part no. 2 is injection molded and made from silicone. This is the probe mount on the side of the camera. Silicone was chosen because of it's flexibility and durability.

AKRYLONITRIL-BUTADIEN-STYREN

Part no. 3, 4, 7, 8 and 9 are all injection molded and made from ABS. These are all the fixation parts as well as the shells of the construction. ABS is a widely known thermoplastic known for its high quality compared to it's price.

STAINLESS STEEL

Part no. 5 is laser cut and laser engraved. This part is the back plate of the product. Stainless steel was chosen to add some contrast to the product, and to make the product more appealing

ETHYLENE PROPYLENE DIENE MONOMER

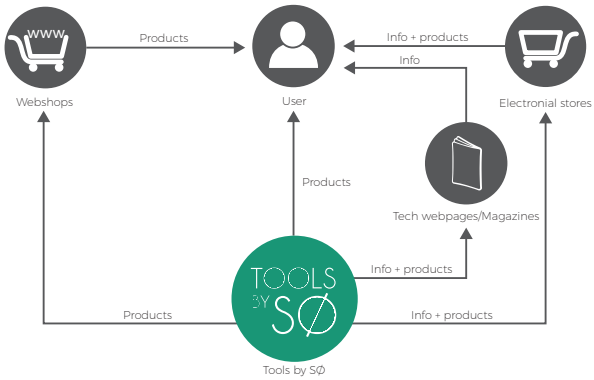
Part no. 6 is injection molded and made from EPDM rubber. This is the rubber part, that goes up against the oven glass. EPDM is heat resistance, making it ideal to put up against the hot oven glass.

BUSINESS PLAN

ACTOR NETWORK

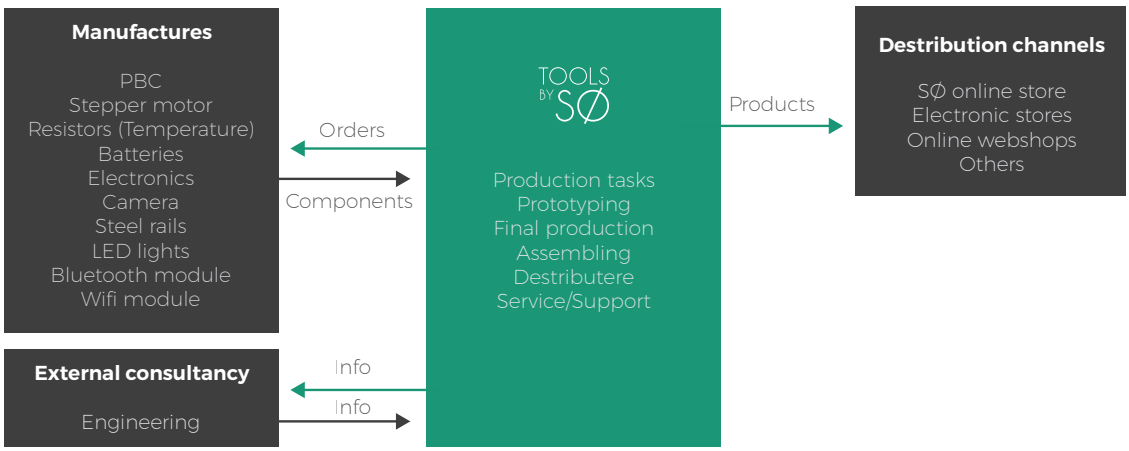
The actor network illustrates where the user can purchase the product and how to gain information about it.

Tools by SØ will brand the product through tech webpages and magazines, and get information about to the users mainly that way. The product is also going to be sold at electronical stores, where the user can get info about the product, and even try it.



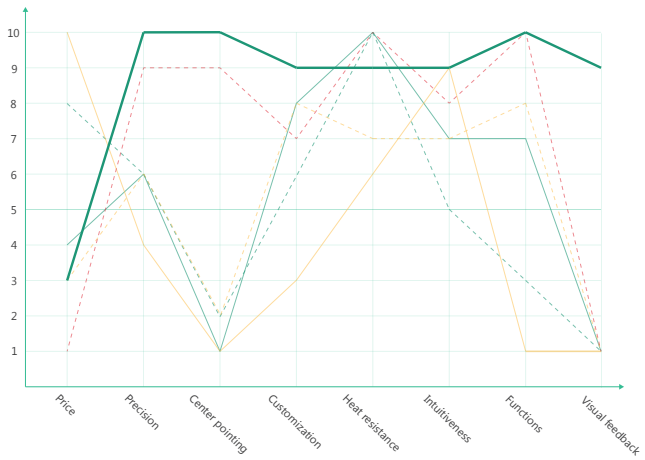
DESTRIBUTION CHAIN

The distribution chain shows the different actors and what their tasks are, within the collaborate. Tools by SØ is acting as a middleman between the manufacturers and the distribution channels. However, Tools by SØ is also doing a lot of the production itself, and are assembling the product, as well as providing service for the customers



BLUE OCEAN

The blue ocean analysis below shows View's strengths compared to the competitors. View is by far the best product, in almost all categories. The visual feedback is by far the place where the product differentiates.



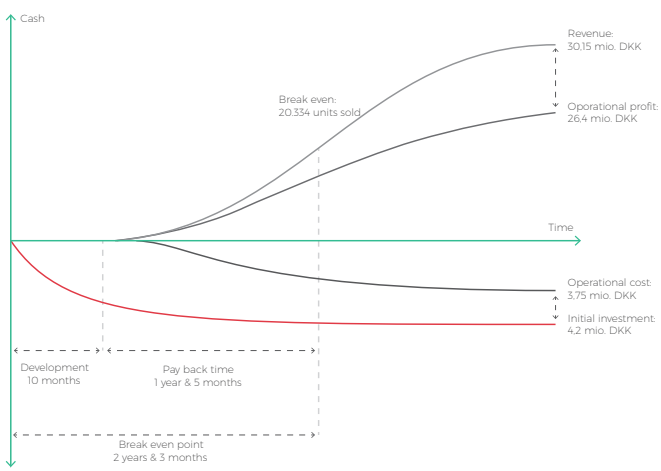
SALES NUMBERS

Units sold:	
Units year 1:	5.000
Units year 2:	10.000
Units year 3:	27.000
Units year 4:	35.000
Retail price:	1125 DKK

PROFIT

Production price/unit:	150DKK
Profit/unit:	300DKK (200%)
Costs:	
Profit year 1:	-2.700.000 DKK
Profit year 2:	300.000 DKK
Profit year 3:	8.400.000 DKK
Profit year 4:	18.900.000 DKK
Break even time:	2 years & 5 months

This is only by selling View alone. A lot of revenue is also going to be through selling the batteries for the probe. This is a big after sales market.



CONCLUSION

View helps the user overcome the needs, that no other meat thermometer can overcome. It has a wireless probe, eliminates the fear of yet another broken probe wire. That in combination with the ability to see the food wherever you are, generates a lot of value for the end user. Now they do not have to leave their guests, to be in the kitchen, and don't have to worry about how their food looks. A regular meat thermometer can alert you when the core temperature reaches a certain threshold, but with the lack of visual feedback, you are never quite sure, how your food are on the outside.
View also comes with oven temperature measurement, which is a very important factor, if the end user has cooking as a hobby. Conventional ovens regulate a lot in temperature, throughout the roasting process, and now the user has the ability to monitor that.

AALBORG UNIVERSITY

ARKITEKTUR & DESIGN

VIEW BY SØ

PROCESS REPORT

MSc04 - Industrial Design
Aalborg University - May 2016

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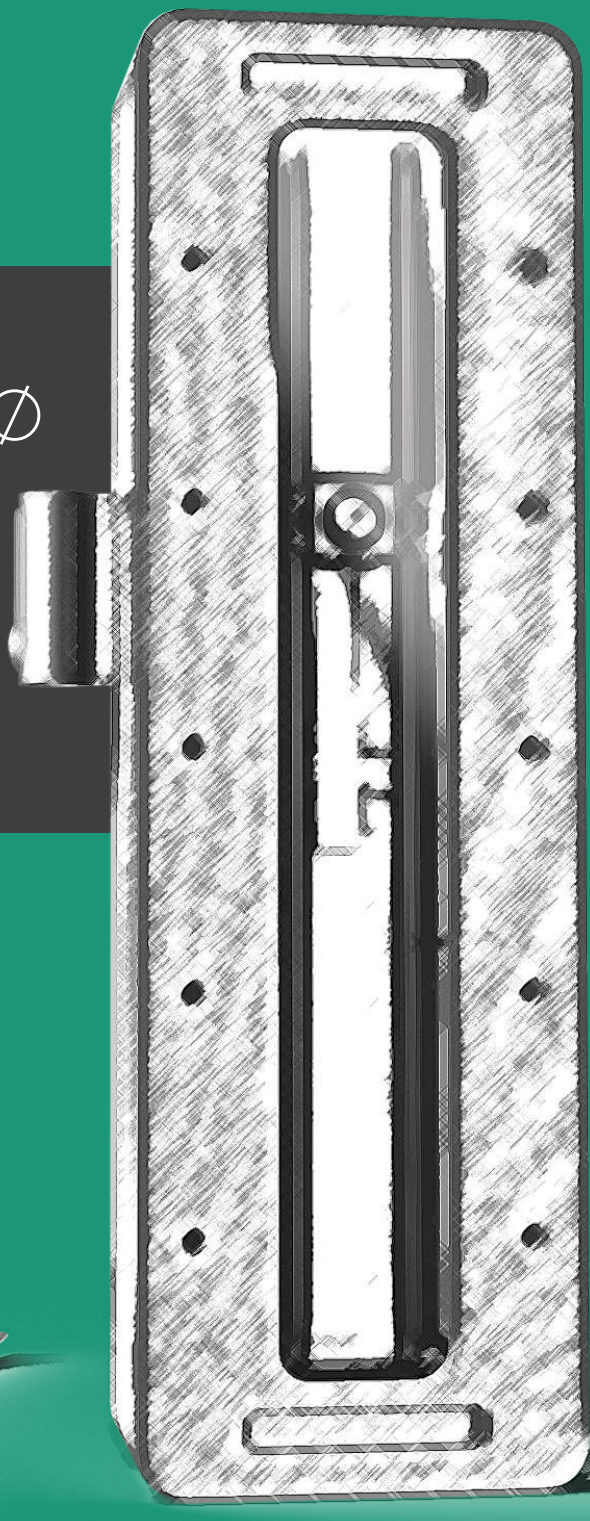

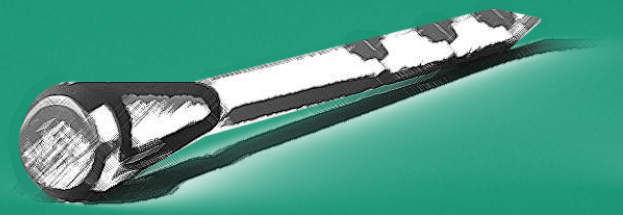


TOOLS
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PROJECT TEAM

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ACKNOWLEDGMENTS

A special thanks to Finn Schou and Ewa Kristiansen for supervision and valuable feedback throughout the project.

We would also like to thank all the people who have helped us throughout the project with interviews, inputs, various tests and analysis. None mentioned, none forgotten.

PHASE 0.0

PREFACE

This project was carried out by Tools by SØ as a MSc04 Industrial Design, Architecture and Design department.
The theme of the project is Smart Cooking,and are mainly structured by the students with guidance from the supervisors.

During the project period Finn Schou has been the main supervisor, and Ewa Kristiansen has been the technical supervisor.
The written part of the project is split into three parts. The process report, which guides the reader through the development process of the final concept based on the worksheets compendium. The product report shows the final concept, features, user guide, construction, characteristics as well as business case. And finally the worksheets compendium consists of all the research, tests, analysis, interviews and calculations done throughout the process.

0.1 READING GUIDE

The process report starts with an introduction, and are then split into the different faces of the design process; Research 1.0, Framing, Market insight, Concept development, Research 2.0, Concept refinement. There is also a chapter about heat transfer, as it is very relevant for the concept development. To make the report extra transparent, we will refer to the relevant worksheets, which will further detail a subject, if you have the need or interest.
The technical drawings can be found in the attached appendix. All the pages, both in the reports, appendix and worksheets are numbered to prevent any confusion.
The references are noted in the text as (Reference title - Year of publication) and are referring to the complete list of references at the back of the report, noted according to the Harvard method. All illustrations are numbered and listed at the back of the report. Appendix material is referred to as (Appendix#). Illustrations are referred to as (ill. X), and in the end of the report there is an illustration list. In the end of each section a summary is marked with an icon. Throughout the entire report boxes are marked with icons meaning:


Summary


Finding


Framing


Technical findings

0.2 ABSTRACT

Dette speciale er udarbejdet af Tools by SØ bestående af to afgangsstuderende på Industriel Design ved Aalborg Universitet i foråret 2016.

Projektet startede ud med indledende vidensindsamling omkring markedet og brugergruppen. Til det følger designprocessen og udviklingen af produktet, som bliver præsenteret i en produkt rapport sammen med implementeringsstrategien for produktet.

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Resultatet af projektet er View, som er et produkt der muliggør at observere maden på sit smart device. Produktet tilbyder ydermere kernetemperatur samt aktuel ovntemperatur. Produktet er udstyret med tre målepunkter, der gør det lettere for brugeren at ramme kernen af kødet og derved gør det lettere at tilberede den perfekte ret!

0.3 GOALS FOR LEARNING

The list below is an excerpt with the learning goals in accordance to the official Semester Description *(www.moodle.aau.dk)*

Knowledge:

- Account for the relevant design related knowledge and identify design relevant problems within the chosen subject
- Account for the appropriate research-based knowledge in the design process
- Demonstrate a high degree of awareness regarding the main experiments, tests, proposals and evaluations affecting the decision-making in the design process and thoroughly account for the scientific validity of test, investigations and other type of data used in the design process
- Demonstrate a high degree of awareness regarding the main critical issues in the design proposal and the appropriate course of action to amend these

Skills:

- Able to design by integrating a desired expression and experience through form and function into technical sound products, constructions and solutions, with due consideration to state of the art technology, manufacturing abilities, costs and configuration of supply chain
- Demonstrate the ability to frame the design assignment using professional tools and methods and generate a design proposal based on clearly defined values, user needs and or business plan that meets predefined criteria, target values and cost range
- Demonstrate the ability to select, use and reflect on the appropriate methods for analysing problems, users, technologies, constructions, competitors, markets, products, strategies, companies and own design based product or solution proposals
- Demonstrate the ability to select and use the appropriate method, technique and tools for carrying out experiments and synthesizing design based product or solution proposals
- Demonstrate the ability to navigate a design process, by continuously driving the design process forward by focusing on the most relevant part of the project and delimit the scope accordingly
- Demonstrate high skills in communicating complex problems and solutions to both peers and non-specialists

Competencies:

- Achieve a high degree of integration of selected appropriate aspects of the subject of choice, in a coherent proposal for a solution within the broad field of design engineering
- Able to independently and professionally manage and facilitate a design process that integrates engineering disciplines in order to design innovative solutions that include both technical rigor and design features
- Able to review the final proposal while taking into account both engineering, design and business perspectives

0.4 TOOLS BY SØ

Tools by SØ is a design company with focus on the male customers, and therefore focusing on making the products appealing both visually and physically to the male end user. It is a stand alone company which consists of two Industrial Design students from MSc04. The company is intended as a fictional start-up that has to loan all the money for production in the bank.

0.5 CONTENTS

Appendix

APPENDIX A - INTERVIEWS

A1 - Online questionnaire
A2 - Tupperware consultant
A3 - Claus Fuglsang (Electrician)
A4 - H. C. Westergaard (Electrician)
A5 - Mathias Lassen (Chef)
A6 - Anonymous (Chef)
A7 - Jakob Kondrup (Gadget guy)
A8 - Joachim Ankerstjerne (Gadget guy)
A9 - Kristoffer Simonsen (Gadget guy)
A10 - Uffe Sjøgren (Gadget guy)

APPENDIX B - MARKET RESEARCH

B1 - Market research 1
B2 - Market research 2
B3 - Compact cooking
B4 - Kitchen gadgets
B5 - Future kitchens
B6 - Open source cooking

APPENDIX C - RESEARCH AND ANALYSIS

C1 - Kitchen tips
C2 - Kitchen tips - Products
C3 - S-curve analysis - (Smart) ovens
C4 - Oven functions - Price list
C5 - S-curve analysis - Meat thermometers
C6 - Using a meat thermometer
C7 - How to cook meat properly
C8 - Tear down of meat thermometer
C9 - Patents
C10 - Power consumption of components
C11 - Price estimate

APPENDIX D - INDUSTRIAL SOLUTIONS

D1 - Extreme components
D2 - Industrial oven cameras
D3 - Thermal cameras

APPENDIX E - IDEATION

E1 - Ideation 1
E2 - Brain pool writing
E3 - Forced relationships
E4 - Ideation 2
E5 - Determine meat condition
E6 - Form studies
E7 - Form principles
E8 - Camera point value

APPENDIX F - HEAT INSULATION

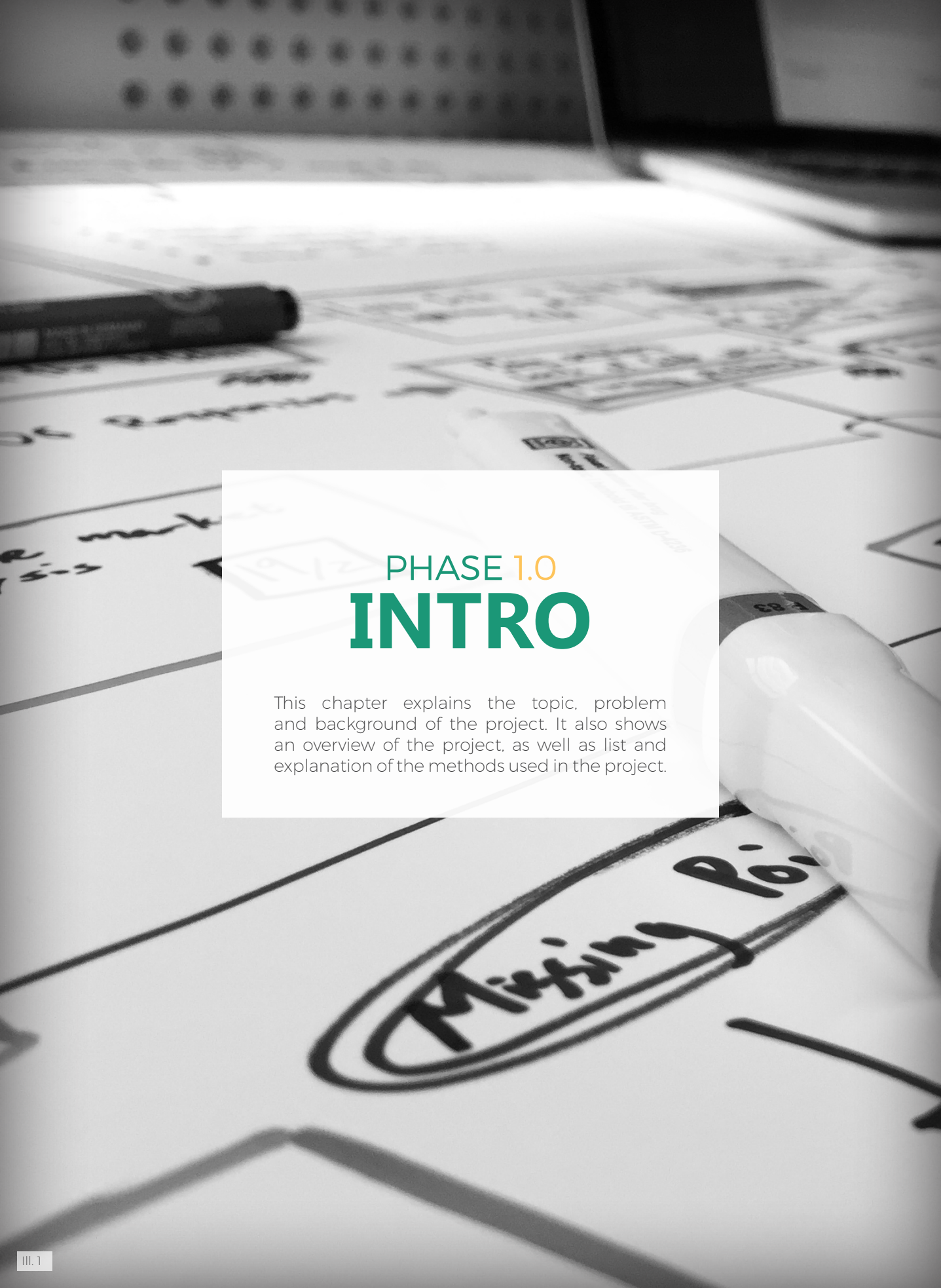
F1 - Heat insulation

APPENDIX G - TESTS

G1 - Oven measurements
G2 - Camera angle
G3 - Test of Pyrogel
G4 - Test of signal strengh
G5 - Patterns on oven front
G6 - Light through oven door

APPENDIX H - DATASHEETS

H1 - Data sheets for insulation materials



PHASE 1.0
INTRO

This chapter explains the topic, problem and background of the project. It also shows an overview of the project, as well as list and explanation of the methods used in the project.

1.1 THE PROBLEM

Through brainstorm and evaluation of the outcome, smart cooking became the main topic. The main problem became the one described below.

Whenever you are making a roast in either an oven or grill, you have to keep an eye on it to make sure that it doesn't get burned and have the correct core temperature. In an oven you can look inside through the glass, but you have to be in the kitchen do to that, and with a grill you can't even do that.

You can also easily get distracted if you have company, even if you are alerted about the core temperature. You still have to go all the way to the kitchen, to actually see what the roast looks like, and to see if e.g. the pork rinds could use a little extra. This can lead to ruined food, because you just "took a shot", and stayed for the interesting conversation you were just having, meanwhile your food got ruined.

PROBLEM SCENARIO 1

Whenever you roast something in the oven, you don't get all the feedback needed right where you are. This can lead to burned food.

Ill. 2

PROBLEM SCENARIO 2

If you have company, you end up running back and forth from the kitchen to see how the food looks. If you get caught in an interesting conversation, your roast might end up getting burned.

Ill. 3

1.2 METHODOLOGY

The table below describes the different methods used, what activities they were used in, with what approach and to what purpose. It gives an overview of what the outcome were from using the methods.

METHOD	ACTIVITY	APPROACH	PURPOSE
Scrum Board	Process navigation	Task listing and categorizing under "To do", "Doing" and "Done"	Making sure the team has an overview of what has to be done, what is work in progress, and what is actually done
Design Brief	Expectation agreement	Correspondance between group and supervisor	To ensure that both parties agrees on the expected outcome of the project
Surveys	Evaluation	Asking others about their kitchen habbits	To find and validate the problem
Desk research	Collecting knowledge	Internet research and physical litterature consulting	To reach a higher level of understanding
Interview	Collecting knowledge	Talking to the targeted group as well as field experts	To reach a higher level of understanding of the targeted group as well as validating the gathered information
Field research	Collecting knowledge	Field trips to retail stores	To get an overview of what is sold in physical stores
Personas	Collecting knowledge	Map the complex information collected from desk reseach and interviews	To map the things observed during interviews
Brainstorming	Ideation	Conversations, evaluations, drawings and post-its,	To start the design process on a divergent level
Point Value	Evaluation	Rating concepts based on parameters	To get a more tangible approch when evaluating the concepts
3D print + simulation	Concept test and evaluation	3D print different shapes and models and testing them	Testing out different sizes and shapes
S-curve analysis	Collecting knowledge	Analysing the development phase	To ensure, that the solution isn't outdated
Mock-up	Knowledge collection	Testing camera viewing angles	To ensure, that the user gets the best visual feedback

1.3 PROCESS TRACKING

ALIGNMENT

Smart Living

- Healthy eating
- Waking up
- Knee/joint problems
- Traffic safety
- Losing keys
- Smart cooking
- Levitating (speaker, display and light)

Project starts
01.02.2016

Specialization: **Smart home**
Working title: **Smart cooking**

PROBLEM AREA

Online survey

Kitchen habits and related problems

206 responses

Main problems

Lack of table space:
Messy kitchen
Too small working space
Too many machines

Timing problems:
Burn the food
Overcook food
Making more than one dish

FRAMING

Market position

HIGH TECH

Target audience

Provide the end user with relevant cooking information
(Gadget guys)

Design Brief

MARKET INSIGHT

Interviews

Mathias Lassen
Professional chef at Brühlmann
Problems:
Handel's break
Storage problems

CONCEPT DEVELOPMENT

Brainstorm & Brain pool writing

- Pot/pans with scale and thermometer
- Thermal camera
- Bar-code scanner
- Intelligent cooking top

Temperature in focus

Word association + brainstorming

3 concepts
- Pot/pan dock with scale and temperature sensor
- Disc with thermometer and aroma sensor
- Oven camera plus meat probe

Milestone 1

Docki

The disc

Buddy V. 1.0

CONCEPT DEVELOPMENT

Buddy V. 2.0

Thermal camera outside the oven to measure the core temperature in the roast

EVALUATION

Thermal camera (expert knowledge)

It is not possible to see through regular glass with a thermal camera.

THERMAL CAMERA

REGULAR CAMERA

CONCEPT DEVELOPMENT

Buddy V. 2.1

Flipped 90° for better camera angle
Wireless meat probe inside the oven

RESEARCH 2.0

Competitors analysis

- iGrill
- Meater
- SteakChamp
- Roasting Sensor Plus

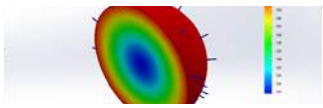
Mock up of scenario

Test of camera angle

HEAT TRANSFER

Simulations of heat transfer

To validate if the concept was durable the team simulated and calculated the heat transfer of the insulations.



Experiment

Validation of calculated and the simulated test results

RESEARCH 1.0

Market insight

- Competitors
- Product categories
- Trends
- Pricing

Visiting retailers:

- Elgiganten
- HTH Køkken
- Kop & Kande
- IKEA

Competitors


649DKK


1149DKK


1349DKK


840DKK

Future kitchen/trends

Providing the user with Informations

- Temperature
- Time
- Steam/extractor
- Adding additional water
- Prevent over boiling

Interviews

Claus Fuglsang - Electrician
Hans Christian Westergaard - Electrician

What can smart Installations control at this point:

- Light
- Sound
- Air
- Heat
- Picture
- Internet

MARKET INSIGHT

Functions

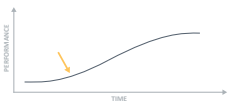
Pricing: functions in a smart oven

Open source kitchen appliances

Nothing on the market.
(Cooking top, oven, refrigerator)

Market analysis

S-Curve analysis:
Cooking top
Smart oven



Interviews

Anonymous
Professional chef at
A Hereford Beefstouw

Quote ***"Experience is key"***

CONCEPT DEVELOPMENT

Placement of camera

Internal measurement of Ovens at Skousen

No room for a fixed camera-unit on the baking plate

Interviews with gadget guys

Jakob Komdrup Sørensen - Amateur chef
Joachim Ankerstjerne - Amateur chef
Uffe Sjøgren - Retired chef
Kristoffer Simonsen - Biologist

Use products such as: Sous vide and actifry
Willing to pay a high price for the right gadget

User needs and requirements

- A customizable "done stage"
- A wire that doesn't break
- Provide the relevant data to the user
- Core temperature with two decimals
- Guidance during cooking
- Visibility of the food

CONCEPT DEVELOPMENT

Revised focus (Buddy V. 3.0)

The camera needs to be placed inside the oven for optimal video overview

Milestone 2

RESEARCH 2.0

Market analysis

S-Curve analysis:
Meat thermometer

Hasn't changed much.
Suitable for innovation.

Slow roasting recipe

Worst case scenario:
Roasting a 6 kg goose at 220°C for one hour plus 9 hours at 80°C

EVALUATION

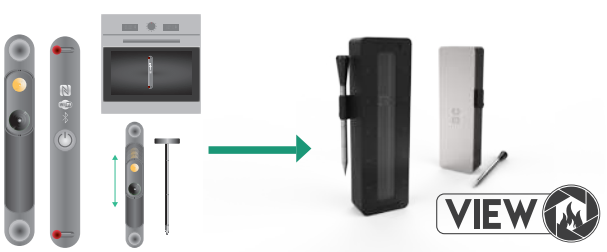
Requirements revised

Camera placement

Inside the oven ✗

Outside the oven ✓

CONCEPT REFINEMENT



Project hand in
25.05.2016

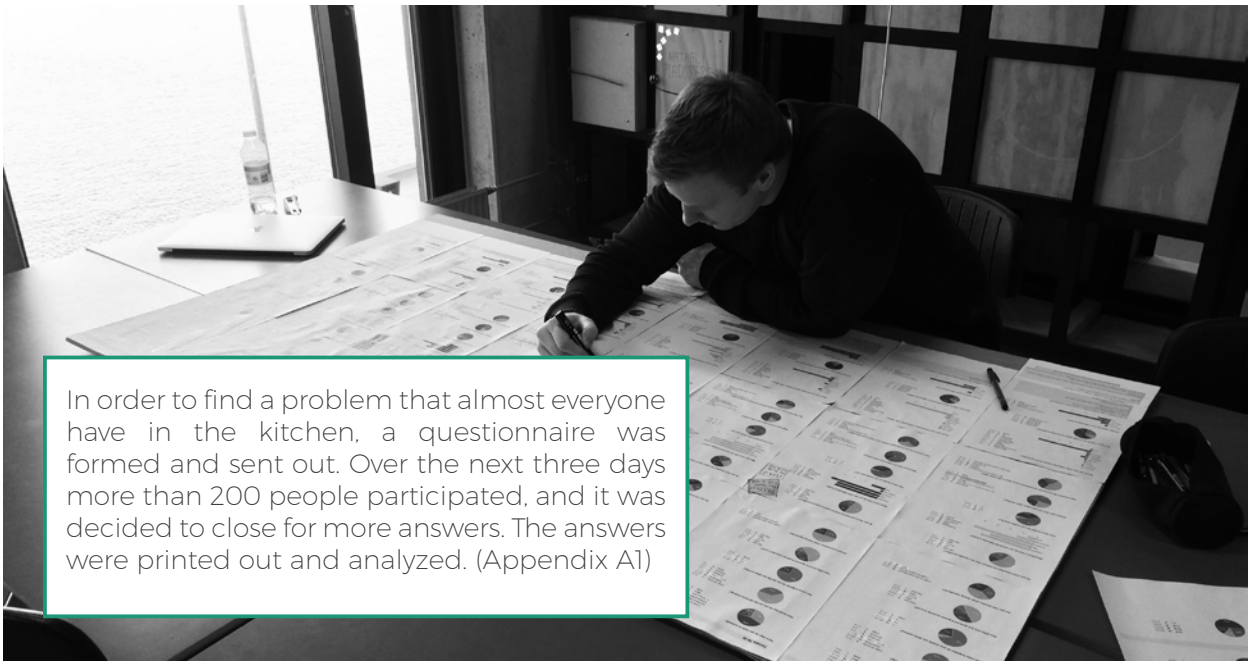
III. 4

PHASE 2.0

RESEARCH 1.0

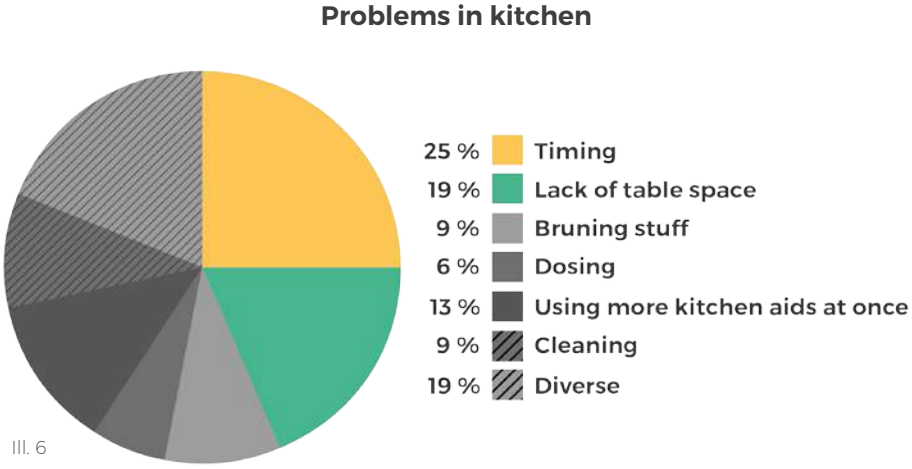
This chapter explains the market research done at the beginning of the project, how it was used, and why it was done.

2.0 **RESEARCH AREA**



In order to find a problem that almost everyone have in the kitchen, a questionnaire was formed and sent out. Over the next three days more than 200 people participated, and it was decided to close for more answers. The answers were printed out and analyzed. (Appendix A1)

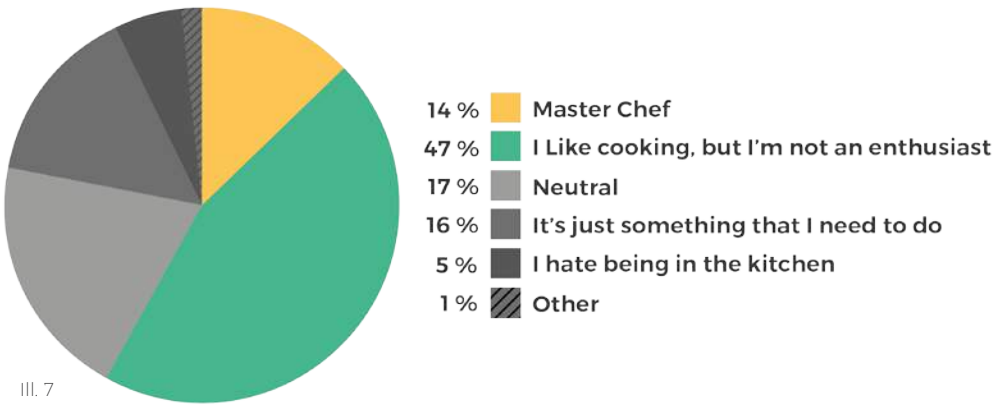
From the analysis it was concluded that there were two major problems in the kitchen; Lack of table space and timing problems. Lack of table space being not having enough space for both kitchen appliances and the space required to make food. Timing problems meaning not knowing when your food is cooked enough leading to over- or undercooked food, or even burned food. The problems can be seen in the pie-chart at the top right.



Ill. 6

Another interesting thing was that people actually liked cooking, meaning, that a fully automatic solution isn't the way to go. From this, we decided to go with the timing problems as a more technological solution were preferred, and this direction had more potential technologically. Some of the problems stated in the questionnaire are listed below.

What is your level of enthusiasm, when cooking?



Ill. 7

> *Having to **stay in the kitchen,** to make sure, that the food isn't getting burned*

> *Sometimes **I overcook** the chicken just in case, because I don't want it raw"*

> *"**I burn my food** a lot, because the water vaporises"*

Statements from questionnaire

Summary of questionnaire

From the questionnaire with over 200 participants, timing problems were chosen, as it had more technological potential. The solution can't be fully automatic, as people enjoy cooking.

2.1 MARKET ANALYSIS

With the main problem in mind, an overall market research was made, where the leading brands and products were found.

Ill. 8

Desk research

Through desk research a quick overview of the market was made. (Appendix B1) The products were then divided into categories depending on their functions. To the right is one of the slow cookers, and one of the coffee brewers, on ill. 9 and 10 respectively.

Ill. 9 - Slow cooker

Ill. 10 - Cofee brewer

Products like the Actifryer and the SousVide are also worth mentioning, as they are products that are getting more and more popular on the Danish market. They are showed to the right, on ill. 11 and 12 respectively.

Ill. 11 - Actifryer

Ill. 12 - SousVide

Most of the products were made to help with only one thing, like the Philips soup maker and the OBH Nordica Pizza Dragon which can be seen to the right on ill. 13 and 14 respectively.

Ill. 13 - Soup maker


Ill. 14 - Pizza Dragon

The team also looked at some of the products on Kickstarter, to also get some of the products that were still in development, but not yet available.
The first one to the right on ill. 15 is OneCook. You put in a cartridge with the ingredients for a certain meal, and it will then cook the meal for you by heating and mixing the ingredients.
The second one on ill. 16 is pan-telligent, which basically is a pan that sends the temperature of the pan to your smart phone.

Ill. 15 - OneCook


Ill. 16 - Pan-telligent

On ill. 17 is MAID. An oven with build in recipes. Kind of a modern cooking book.
The one next to it on ill. 18 is MEATER. A completely wireless meat thermometer that sends you the core temperature directly to your smart phone.


Ill. 17 - MAID


Ill. 18 - MEATER

From the desk research it was learned that products usually only help with one thing, e.g. making soup or coffee.

Field research

A trip into the field showed what products that was already on the market, and what brands that were the leading ones, according to the salesmen.

HTH was the first place visited, and here a salesman was interviewed (seen on ill. 19). More details can be found in appendix B2. He was asked what products he thought were the "smartest" ones, and which brands he thought were furthest ahead technology wise.
The only products that he would classify as smart were the ovens that they had. You could basically just tell the ovens what you are putting inside them, how much it weighs and the oven will do the rest for you. And the top of the line brand were clearly Siemens, according to the salesman.

Elgiganten were the next target on the list. Once again a salesman were asked about what products they had that he thought were the "smartest", and he showed us the Crockpot, which can be seen on ill. 20 to the right. This is basically an electric pot, where you can put in your ingredients and slow cook them.

The trip also went to IKEA and Kop & Kande, where a search for products that stood out and eased the cooking experience were initiated among their kitchenware. We quickly learned, that kitchenware made to ease the cooking experience only helped with one thing, e.g. making soup like the one on ill. 21.

Ill. 22 shows a feeling that were just too good to not get any attention at all. Silicone lids for pots, making them completely silent. This also raised the understanding of the importance to keep the noise level low in the kitchen.

The trip to IKEA basically gave an understanding of what you can get at a price range that is for everyone. The only thing here that eased the experience just a bit, were the "I'm moving away from home" starter-kit with plates and cutlery. These can be seen on ill. 23-24.


Ill. 19 - HTH salesman

Ill. 20 - Crockpot

Ill. 21 - Soup maker


Ill. 22 - Silicone against metal

Ill. 23 - IKEA plate set

Ill. 24 - IKEA cuttlery set

Compact cooking

To get the more extreme aspect of cooking, cooking in the wild was also investigated to see how little equipment is actually needed to be able to cook. Different outdoor stores were visited, where the top of the line outdoor products were discovered. Some of them can be seen below. Of course the classic Trangia set were found in the stores, as seen on ill. 25-26.


Ill. 25 - Trangia set

Ill. 26 - Trangia set

How the products were made as compact as possible was also something that could be used later on in the product development. From the questionnaire is was clear that people didn't have much table space, so the solution has to be taking up as little space as possible. The Trangia set is also a good example of how this can be done. Other ways to do this can be seen on the ill. 27 and 28.

Ill. 27


Ill. 28

The most important feature of these products were that they could boil water to cook with. When you are in the wild, this is the key thing to be able to do. A brand called Jetboil has specialized in doing that as compact and quickly as possible. You can see the product on ill. 29. A lot of other interesting products were also found. These can be found in appendix B3.


Ill. 29 - Jetboil

Tupperware

A very popular brand in the kitchenware department is Tupperware an interview with one of their consultants were evident to find out what they did different from others with their products, besides not selling them in stores or online. (Appendix A2)

The consultant showed the most popular products, and explained how their products in general differs from others.

"The products in general can do the same as everyone else, plus one additional clever thing."

The most popular products from Tupperware are shown on ill. 30-31.
If the end solution ends out being low tech, it is very important that it doesn't just blend in with the tons of cheap and unknown equipment on the market. The product should build on good basic values.


Ill. 30 - EcoPure

Ill. 31 - Silicone copcake form

Kitchen gadgets

In addition to the market overview made earlier a more specific overview of the gadget part of the market needed to be made.
Some of the leading products can be seen below.

Ill. 32 - Egg minder

Egg minder (ill. 32) - Tells you, if you are missing eggs in the fridge or if the eggs are turning bad.

Ill. 33 - iGrill

iGrill (ill. 33) - A meat thermometer that sends the core temperature and alerts you via your smart device.

Ill. 34 - Drop

Drop (ill. 34) - A kitchen scale that cooperates with your smart device when cooking by scaling and guidance.

Ill. 35 - SteakChamp

SteakChamp (ill. 35) - A completely wireless meat thermometer that tells you the state of the steak by flashing.
The products in general are focusing on feeing time for the user and providing additional knowledge in the kitchen via the users smart device. They are focusing on kitchen users in general, both males and females in the private households. A more detailed description of more products can be found in appendix B4.

Summary of market analysis

- Bringing expert knowledge to the user is a key feature
- Doing the same things as the competitors with one extra thing can also be the way to go
- A lot of products specialize in doing one thing really well like e.g. making soup

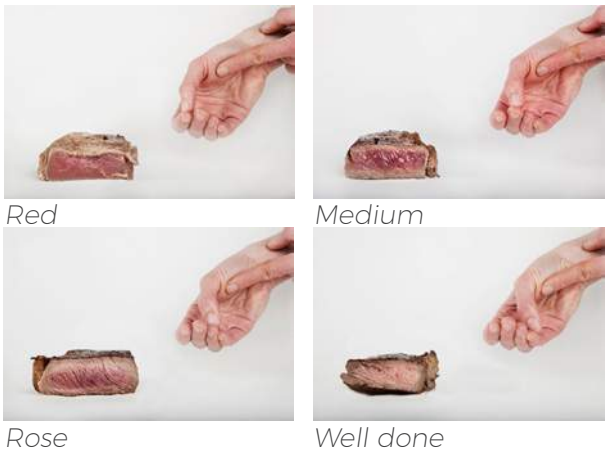
The top brands are:
- Siemens (Technological the farthest ahead, when it comes to adding new functions)
- Trangia (Scout cooking - The old-timer in this category. A runner up is JetBoil)
- Tupperware (Non technological - The most durable with most functions)

2.2 KITCHEN TIPS

The last area that were researched, were the old fashioned tips for the kitchen. The general kitchen tricks that were found were:

- How to feel if your steak is done
- How to boil your rice without burning them
- How to cook pasta al dente
- How to check if a baked potato is done
- How to know when the chicken is done

The first one is the most interesting one that might be useful in future concepts. The idea is that you can feel when the meat is done by pressing on your own hand. You have to relax your hand, and let your thumb and index finger, middle finger, ring finger or pinkie meet. Press lightly with your left index finger on the "pillow" underneath your right hands thumb. The pressure that you feel, should be the same on the stake. The conditions can be seen on ill. 36 below.
The rest of the tricks can be found in appendix C1.



Ill. 36 - Meat conditions

Bringing expert knowledge

As part of the old fashioned kitchen tips area, a product search also had to be done to find products that actually solved some of the problems discovered in the section above. Here once again the solution for the steak is highlighted. Even though it doesn't solve the problem completely, it does a very good job a guiding you, but you still have to keep an eye on the machine yourself. The product is called OptiGrill and can be seen on ill. 37. It can tell you, how your steak is on the inside. The indicator shown in the picture shifts colour to show the condition of the steaks. What the machine overall does is bringing the knowledge of a professional chef to a regular kitchen user. Other products can be found in appendix C2.

Ill. 37 - OptiGrill

Summary of Kitchen tips

- Years of experience is a key factor when cooking.
- A lot of products, like the OptiGrill, are trying to bring that experience to every user.

2.3 FUTURE KITCHEN/TRENDS

To get an idea of what the new trends on the market are, several future kitchen concepts were analyzed.

Future trends
Some of the future trends which are slowly hitting the market are making everything connected, making everything available from a distance and providing the user with all the information required. (Appendix B5)

IKEA concept kitchen 2025

This concepts builds on an intelligent tabletop which are able to recognizance what ever your put on the table, admittedly can it inform the user about the content and what can be done with it. The table have build in weight and induction used for the pots and pans plus charing your smart devices. The graphic on the tabletop is being generated by an projector in the ceiling. The concept can be seen on ill. 38.

Ill. 38 - IKEA concept

Robotic kitchen

Moley Robotics is a concept building on human behaves when it comes to cooking, The two robotics arms are mimicking the uploaded recipes and the execution of the meal done by human. The only thing the user has to do is to feed the machine with the different groceries and serve the meal afterwards. This solutions is really useful for a busy person who doesn't have time for cooking and those who hate being in a kitchen. The whole idea of taking the industrial robots into the daily life is something we will see in a near future, and it can solve a lot of different problems. Especially people with disability should be able the benefit from this technology, which can be seen on ill. 39.

Ill. 39 - Robotic kitchen

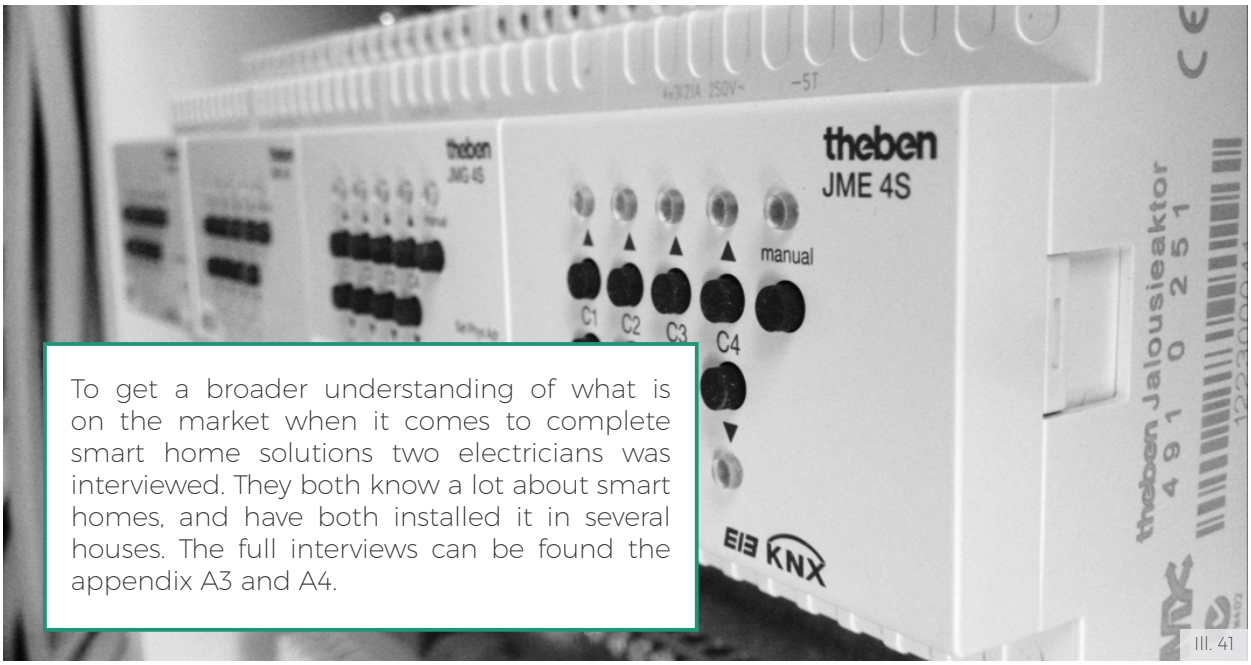
Whirlpool Bauknecht futuristic stovetop

Is a cook-top building on a touchscreen amok with a lot different informations. It is basically a big tablet which you can connect with your apps such as spotify, twitter and so on. The screen informers the user about recipes, temperature, weight and content of the food. The whole top is an infinite induction field which can, by magnets, detect where the pots are located on the cook-top. This concept can be seen on ill. 40.


Ill. 40 - Whirlpool concept

- Informations to user about the food
- Informations directly on the working area
- Fully automatic systems
- Technology driven

2.4 INTERVIEWS



To get a broader understanding of what is on the market when it comes to complete smart home solutions two electricians was interviewed. They both know a lot about smart homes, and have both installed it in several houses. The full interviews can be found the appendix A3 and A4.

III. 41

III. 42

Claus Fuglsang
26 years old electrician.
Currently studying service engineering

"It is quite common to see intelligent house these days. The price different between an intelligent system and a normal system is not high"

"The system provides the user with relevant informations about the status of their home."

"Easy and intuitive platform to control your home. Mainly used for: light, temperature, indoor climate(windows and ventilation) and alarms

III. 43

Hans Christian Westergaard
23 years old electrician.
Has smart installation in my own home

"Smart installations is all about making the house cleaver."

"I can control different things with my smart installation: light, sound, air, heat, picture, Internet. It is possible to control with both smart devices and computer."

"It is possible to attach a control unit on your power outlet which can handle up to 16 amperes. Thereby yea can make old electrical articles smart with a simple touch of your smart device.

On ill. 44 beneath the three main smart home installations platforms are listed. IHC is the most common platform to find in Danish houses. But the platform is not an open standard which is lacking them in terms of development. ZenseHome is much like IHC, but a bit further developed. KNX on the other hand is a worldwide standard and a platform everyone can access. The platforms were evaluated and rated in collaboration with the Electricians, based on their knowledge.

III. 44

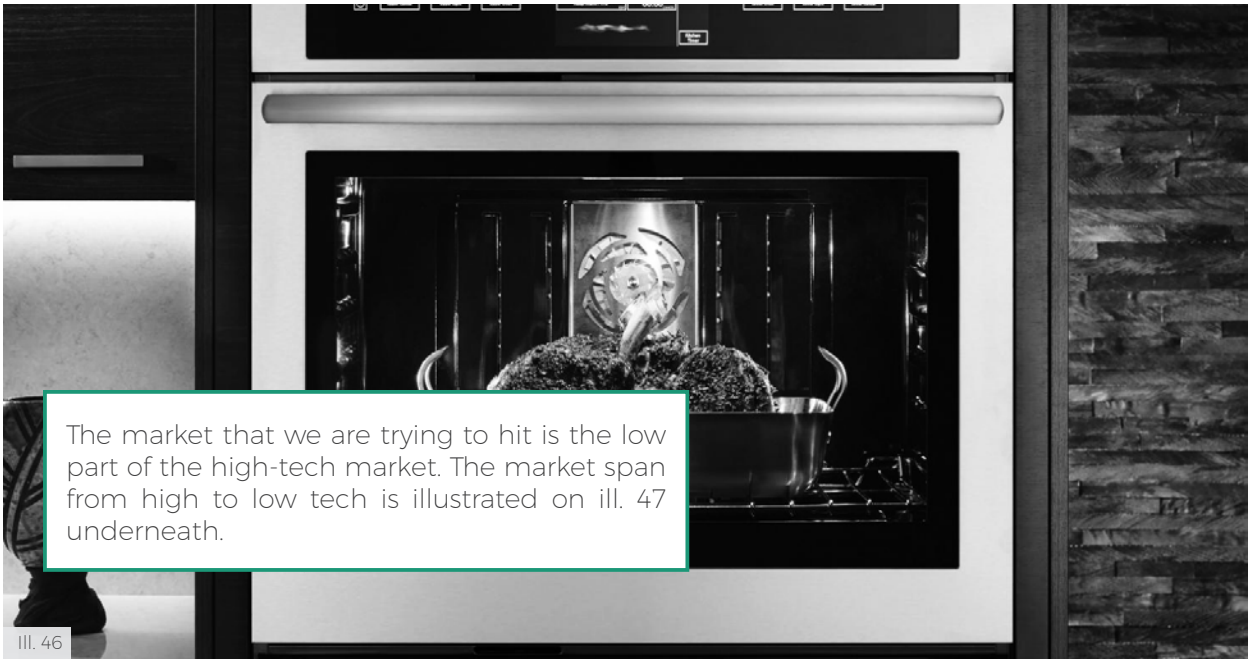
Summary of Interviews

- KNX is the most developed smart installation platform by its open standard it allows every company to join in.
- Smart houses is getting more and more normal as the pricing is coming down, and the number of functions is going up.
- With a smart home you are able to control things like: light, sound, air, heat, picture and Internet.
- You can install it in any house, it doesn't have to be a new house.

PHASE 3.0
FRAMING

This chapter shows how we framed the project, what boundaries we put of and what direction we took.

3.1 MARKET



The market that we are trying to hit is the low part of the high-tech market. The market span from high to low tech is illustrated on ill. 47 underneath.

Ill. 46

The left side (High-tech) shows the high technology driven products. Most of them are providing the user with security by taking over the hard part of the cooking. E.g. in the oven this is choosing the correct temperature and time.

The right side (Low-tech) shows products without any technology inside. E.g. a bowl with a spoon-holder. They have a smart function, but isn't dependent on any technology.
In between are the products arranged from high-tech to low-tech.

Ill. 47

3.2 TARGET AUDIENCE

To begin with the target audiences were insecure male kitchen users and families with children. But it quickly became clear that the wrong target group were targeted, as the project indirectly were targeting gadget guys. The target group were then revised with gadget guys as the main target group.

The secondary target group are; gadget girls, Female bloggers and conventional kitchen users. This makes the buyers of the product; gadget guys and girls, female bloggers, stores who are selling our product as well as conventional kitchen users. An overview can be seen on ill. 48.

Primary:
Gadget guys

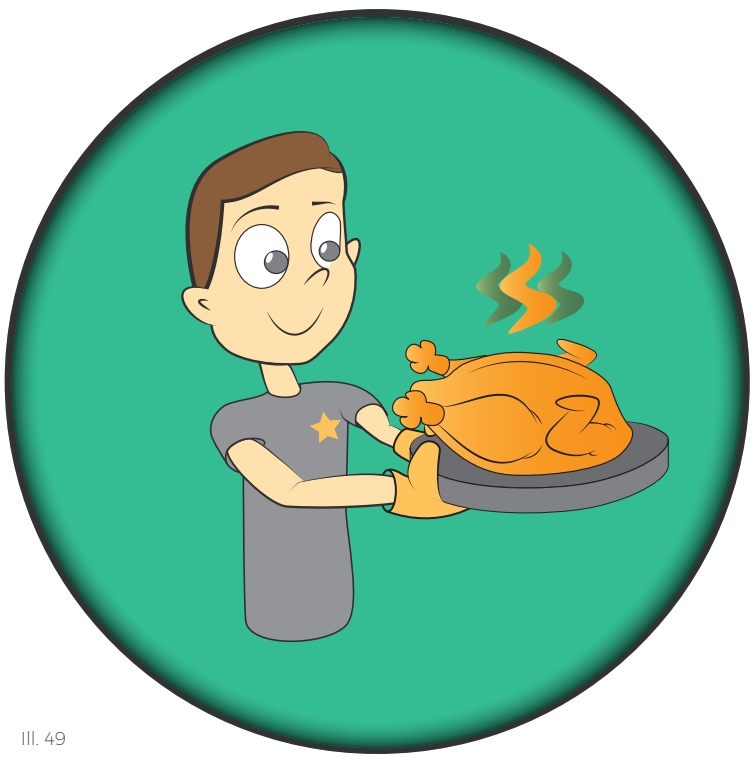
Secondary:
Gadget girls
Female Bloggers
Conventional kitchen users

Buyers:
Gadget guys
Gadget girls
Female Bloggers
Stores
Conventional kitchen users

Ill. 48

3.3 MISSION STATEMENT

Our vision is a scenario, where the user don't need to worry about what is in the oven and gets all the needed data right where he is, meaning no running back and forth to the kitchen. (Can be seen on ill. 49)



Ill. 49

Mission statement

"We want to improve the end user's cooking experience with monitoring and guidance throughout the roasting/baking process"

PHASE 4.0

MARKET INSIGHT

In this chapter a deeper look into the market is obtained. Both into the professional aspect of the market, but also with a twist of history.

4.1 PROFESSIONAL APPROACH

To get a broader understanding of the market when it comes to profesional kitchen use, two professional kitchen chefs were beeing interviewed. One of them is very experienced according to his many years in the business and the other one is with his young age more into tools and machines that can optimize the cooking process. The full interviews can be found in appendix A5 and A6.

III. 51

III. 52

Mathias Lassen
24 years old - Educated Chef
F&B manager on a conceptual stage

"When frying something, and all of a sudden, the meat sticks to the pan. This is very annoying, because you ruin not only the food, but sometimes the pan as well"

"if we have to cook for at lot of people, we then measure the precise amount needed, if we dose by eye, we easily use 10% too much."

"By following certain food-related rules. We cook minced meat, the temperature has to be 75 degrees to make sure all the bacterias are gone."

III. 53

Anonymous
59 years old - Professional chef
Restaurant owner for 24 years

"After 24 years of experiences, I always find a way around a problem"

"By my experiences I know the exact needed cooking time in the oven for specific meat conditions."

4.2 MARKET

Open source cooking

The initial thought were making a solution that could talk to the oven, stove or cooking hubs. That requires the oven to either be open source or to start a collaboration with the company building the oven. However no open source solution has been made so far (appendix B6).

A lot of other kitchen products are made open source like the smart fridge from Samsung that can be seen on ill. 54 below. With that conclusion in mind, it was decided to make an external solution. This was decided as the possibility to hit a broader audience were geater if the solution worked with all ovens or cooking hubs and not just one brand.

Ill. 54 - Open source fridge

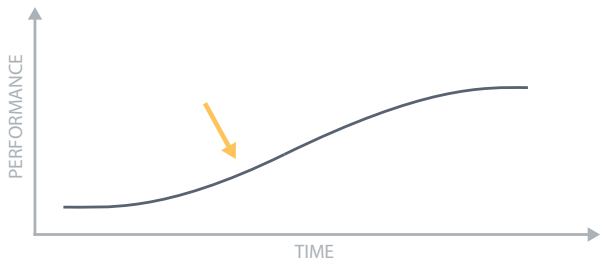

Ill. 55 - Oven in 2016


Ill. 56 - Oven in 1990

S-curve analysis of ovens

If the development of the oven throughout the years is analyzed, not much has happened for a long time until very recently. Smart ovens has started to pop up everywhere and are getting more popular, but they have a very steep price tag compared to a conventional oven. However it is also to be noticed that the curve has flatted out a bit and isn't as exponential as it was a few years ago. For the solution it is very important, that the shape of the oven stays the same, otherwise there would be a lot of factors that wouldn't be accounted for. This analysis also tells that the shape of the oven front has a very flat s-curve. In the top right on ill. 55 and 56 are two oven represented. One from 1990 and one from 2016.
Not much has happened in 26 years. There is still a window at the front and what has happened has basically been styling. The same goes for the shape of the inside, where you still put plates in the same way with rails on the sides. But further investigation has to be made to find the small differences.

However a flat s-curve makes the development of the solution a lot more future proof. The s-curve of the ovens can be seen on ill. 57 below. A more detailed analysis of the ovens can be found in appendix C3.



Ill. 57

Price list of oven functions

After validating that the shape of the ovens most likely is going to stay the same for a long time, an analysis of the prices of the smart oven functions were made to get a feeling of the price range. (Appendix C4) An idea of incorporating some of the smart oven functions into conventional ovens had slowly arisen as a possibility, so finding the price of the different functions were obvious. Using a Siemens catalogue the prices of the ovens were compared, and the price differences and the function differences were noted leading to the pricing of the desired features of our solution. An extract of the table can be seen below.

Function(s)	Oven price (DKK)	Function price (DKK)
Basic oven	6339	-
3D -> 4D air + Touch display + 14 programs	9.809	3.470
Pyrolysis	11.869	2.060
Better screen + 80 programs + build-in meat thermometer	13.429	1.560
Semi-Steam	15.489	2.060
Microwave (No semi-steam)	17.049	3.620
Full-Steam + Baking sensor	20.669	5.180
Semi-Steam + Microwave + Baking sensor	24.689	7.640

The functions that solution aim for are about the same as build-in thermometer adds to the smart ovens, which is 1560,- DKK. This makes our max price 1500 DKK.

Summary of market insight

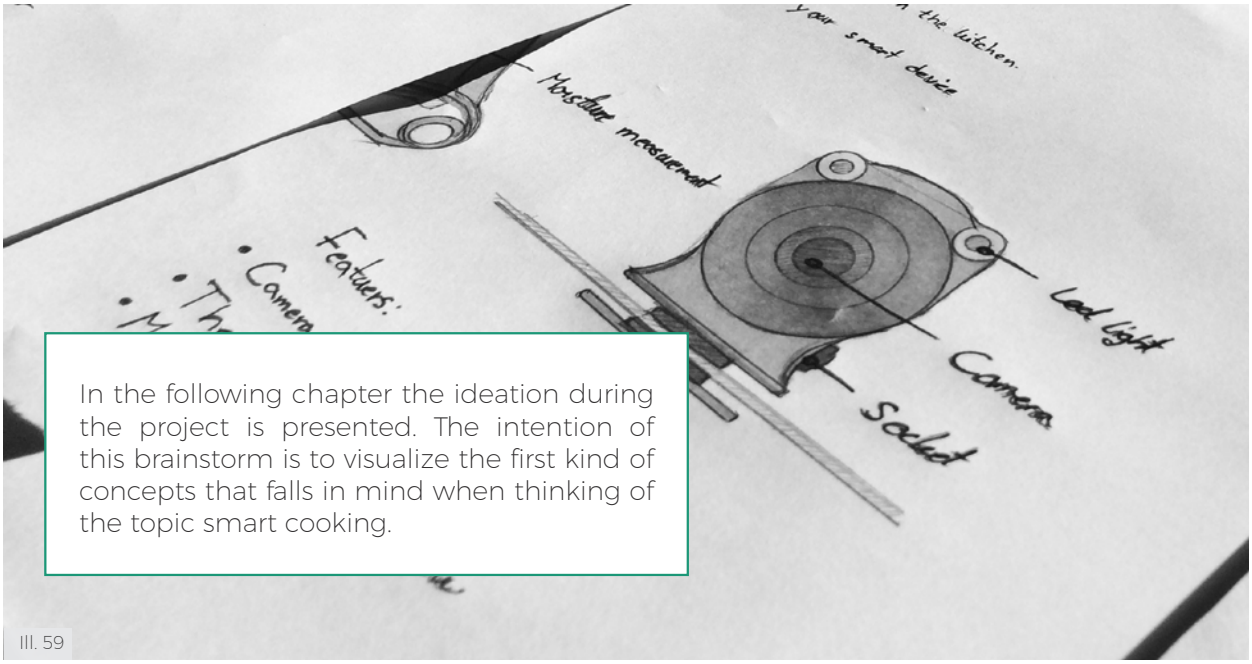
- Once again it was established that years of experience is key when cooking.
- There are no open source stoves or cooking hubs.
- Oven development has hit a steady raise and isn't exponential anymore.
- Our max price is 1500 DKK.

PHASE 5.0

CONCEPT DEVELOPMENT

This chapter contains the first ideation, target group insight, user needs, refined requirements, as well as further development of the chosen direction.

5.1 IDEATION



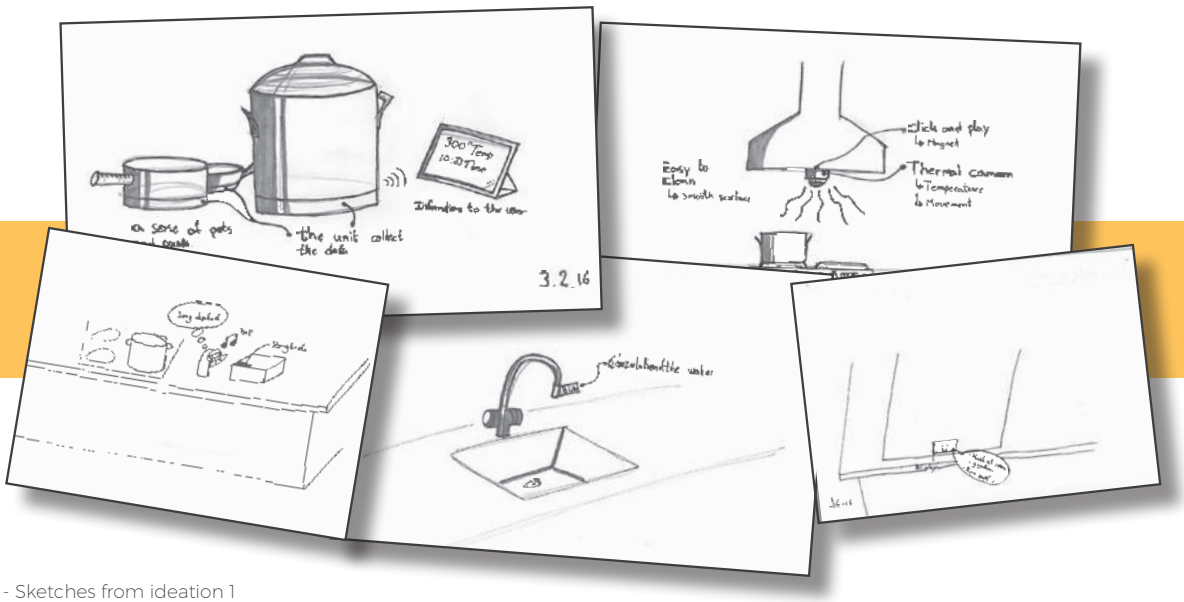
In the following chapter the ideation during the project is presented. The intention of this brainstorm is to visualize the first kind of concepts that falls in mind when thinking of the topic smart cooking.

Ill. 59

All the concepts in this ideation (extract can be seen on ill. 60 below) are aiming for an easier work-flow in the kitchen mostly throughout guidance of the different cooking process, Processes such as temperature, control, time and weight settings. Other informations such as nutrient content were an important part of this ideation as well.
In alignment with the trend and future kitchen the ideas are building on the four principles concluded from the research from future kitchen/trends.

- Informations to user about the food
- Informations directly on the working area
- Fully automatic systems
- Technology driven

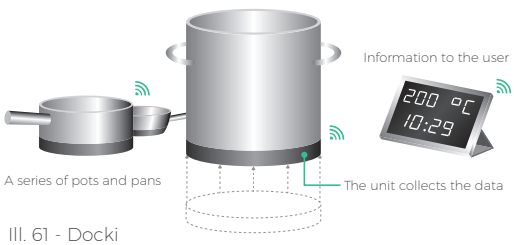
Detailed concept descriptions can be found in appendix E1-E4.



Ill. 60 - Sketches from ideation 1

5.2 DIRECTION

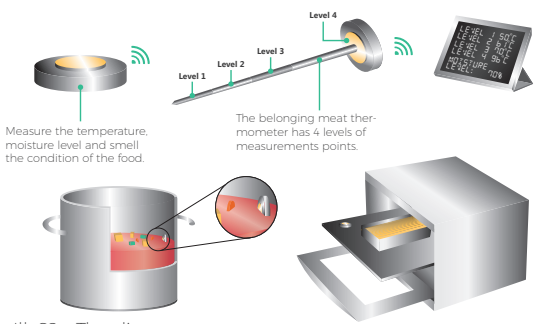
At the first milestone the following three concepts were presented. Based on the feedback and the point value evaluation the last concept were chosen to be the one with most market potential. The table can be found in ill. 64 at the bottom of the page. 0 is bad and 5 is good. More details about the combination can be found in appendix A4.



Ill. 61 - Docki

1

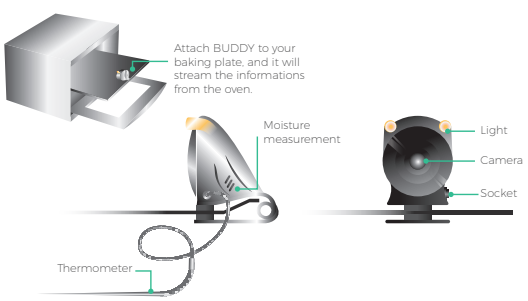
DOCKI - Your new kitchen helper
The concept is based on a series of pots and pans with integrated scale and temperature sensor. (Ill. 61)



Ill. 62 - The disc

2

THE DISC - Measurements for you
A measurement disc that can measure: temperature, moisture level and smell the condition of the food. Along with the included meat thermometer it measures the most relevant things during cooking. (Ill. 62)



Ill. 63 - Buddy

3

BUDDY - You eyes in the kitchen
By attaching the camera unit on the baking plate it is possible for the user to follow the progress from a distance. The camera has a meat thermometer connected to determine the meat temperature. (Ill. 63)

Parameters	1 - Docki	2 - The Disc	3 - Buddy
Level of innovation	2	5	4
Functions	2	3	3
Feasibility	3	2	4
Complexity	4	3	4
in all:	11	13	**15**

Ill. 64

Direction

- As mentioned in appendix E4, the smart ovens are getting more and more popular, and the functions of these ovens, are what the team wants the end user to have in conventional ovens.
- In all concept 3 are the one with highest score in the point value table.
- When comparing innovation and feasibility the concept has the best overall score.
- This lead to the direction of surveillance of the roasting process combined with a meat thermometer.

Space measurements inside ovens

A very important factor for the concept were to find out how much space there actually were inside the oven for the concept. To find out the space of more conventional ovens and not smart ovens, Skousen were visited and all of their different kinds of ovens were measured. Below the distance between the glass and the oven plates were measured.

Ill. 65 - Measurement of ovens

The results were inserted in a table and the minimum space requirements were found. An extract from the table can be seen on ill. 66 below.

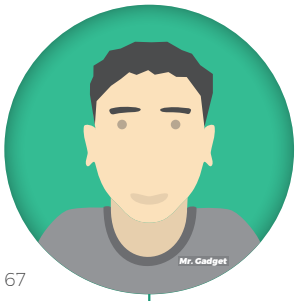
Model name:	From glass door to baking plate (mm)	From side walls to baking plate (mm)	Size of the rubber sealing (mm)
AEG (BP5004325M)	25	2	5
Voss (IEL9302RF)	12	2	3
Summary (lowest distance)	12	2	3

Ill. 66

The entire table and pictures of all the ovens can be found in appendix G1.
The conclusion of the findings were that the unit can't fit between the front glass and the baking plates or between the side walls and the baking plates.

The solution can't be between the front glass and the baking plate, or between the side walls and the baking plates as there is barely any space.

5.3 TARGET GROUP INSIGHT



Ill. 67

Gadget guys

To the right are statements from the interviews with the target group. They are essential insights that are going to be used as an important ingredient for personas. The full interviews can be found in the appendix (appendix A7 - A10)

> *I'm the trendsetter among my friends, and I always have the best*
>
> Uffe Sjøgren, Gadget guy

> *I don't want the predefines done. I want to decide when it is done*
>
> Joachim Ankerstjerne, Gadget guy

> *I want control of what i'm doing and I want to monitor it*
>
> Jakob Kondrup Sørensen, Gadget guy

> *It would be nice to see if the food is getting burned*
>
> Kristoffer Simonsen, Gadget guy

> *I want to spend time with my guests, when I have people over, and not run back and forth from the kitchen*
>
> Jakob Kondrup Sørensen, Gadget guy

5.4 PERSONAS

In the following section three fictive characters are presented. Each of them have a huge interest in gadgets and are obligated to have the newest and smartest products.

Personal information

Jens is 31 years old, married, doesn't have any kids, and are employed in a production company. He is educated electronics engineer.

Ill. 68

Jens Thomsen
ENGINEER

"I don't want my food raw, but I hate it, when my food is overcooked"

EVERYDAY KITCHEN USE:
- I'm using my oven a lot, as I like long term cooking
- It is important to me to keep an eye on the core temperature
- I use my Suis Vide, if I have the time for it and sometimes my crockpot. This adds a requirement to my meat thermometer, as it has to show two decimals.
- My kitchen is pretty big, but my oven is just above the floor, which is a very annoying hight.

MOTIVATION

I enjoy cooking and like the benefits and confidence you get from making the food from scratch yourself. I also like spoiling my wife with really tasty food. I use a lot of kitchen products, and it is important to me that I know how they work, and that the learning curve isn't to steep.

Personal information

Johannes is 34 years old, has a girlfriend, and has a full time job at a test center. He is educated biologist.

Ill. 69

Johannes Bech
BIOLOGIST

"I need guidance when I'm cooking"

EVERYDAY KITCHEN USE:
- Me and my girlfriend cook equally often.
- We cook a lot in the oven
- I'm getting more and more fond of the few gadgets we have in the kitchen, even though I weren't a huge gadget guy in the past.
- I lack a product that helps me keeping and eye on, what I have in the oven, as the core temperature sometimes isn't enough for me.

MOTIVATION

My stove is VERY old, so it has some flaws. E.g. it doesn't heat evenly, making cooking a challenge, as I quite often have to look at the food in the oven to make sure that it doens't get burned in one side.

Personal information

Thomas is 28 years old, single, and has his own electrician company. He is educated service engineer.

Ill. 70

Mathias Green
ELECTRICIAN

"I need control over what I'm doing"

EVERYDAY KITCHEN USE:
- I only use the the best of the best equipment. Pricing doesn't matter, as long as it is the best
- I cook everyday, and I use all the help I can get from my devices
- I'm the leading gadget guy among my friends, and I always have the latest and greatest
- I like being in the kitchen, but not when I have guensts. When ever I have friends or family over I hate being stuck in the kitchen to keep an eye on the food.

MOTIVATION

There is something satisfying about cooking food yourself. When I get the money, I'm buying a complete smart home, but until then I'm buying the smartest gadgets I can find. It is important to me that the "done" stage on the device, no matter if it is baking or whatever is customizable, as I don't always like my food the way it is preset on the devices.

5.5 USER NEEDS

Based on the interviews and personas a set of user needs were established:

- A customizable "done stage"
- A wire that doesn't break
- Provide the relevant data to the user
- Core temperature with two decimals
- Guidance during cooking
- Visibility of the food

5.6 REQUIREMENTS

Based on the user needs a list of requirements were established. The requirements were divided into qualitative and quantitative requirements as well as need to have and nice to have.

	Qualitative	Quantitative
Need to have	· Easy to clean · Easy to setup · Easy to use · Measure core temperature with two decimals · Show the food on a smart device · Show the food clearly, even in low light environments. · Configurable "done stages" · A wire, that doesn't break · Rechargeable · Compatible with all ovens · Provide the user with relevant the different temperatures · Guide the user during cooking	· Sent out a signal in a 30m radius · Has to last a minimum of 10 hours on battery · Heat resistant up to 350°C
Nice to have	· Appealing design · Show temperature of the oven · Expansion opportunities · Measure moisture level · Charging dock with Wi-Fi · Measure degree of burn · Has to consist of standard components · Adjustable camera focus · Measure oven temperature	· A maximum weight of 200g

Extreme cameras

Heat resistant cameras are widely used in the industry. They are used both by firemen, as well as fixed inside ovens and for inspection. Firecam, which can be seen in ill. 71, is a camera designed for firefighters. It can withstand heat up to 480°C for short periods of time. More details can be found in appendix D1.

Ill. 72 shows an industrial camera with active liquid cooling. The camera is for fixation inside industrial ovens and can withstand heat up to 400°C over a long period. The length of the housing is 400mm.

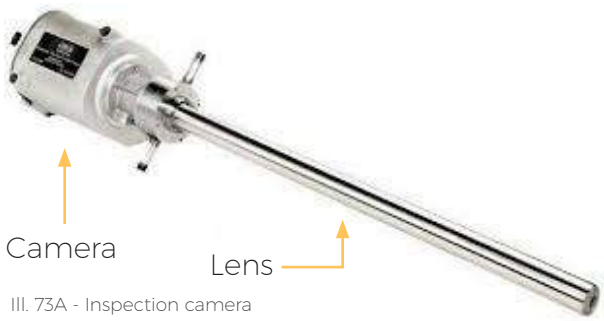
Ill. 73A shows an liquid cooled inspection camera, which can withstand heat for a short period of time. It can withstand up to 2000°C. As illustrated, the thick end is the camera while the long end is a special heat resistant liquid cooled lens that makes sure that the heat has a very long travel time towards the camera.

Ill. 73B shows a passive cooled inspection lens that can fit on e.g. a GoPro like on the photo. It can withstand heat up to 1000°C for up to 10 minutes. Just like the one before that, it is only the very tip of the lens that goes inside the oven. Further information about cameras in the industry can be found in appendix D2.

Ill. 71 - Firecam

Ill. 72 - Industrial oven camera

Ill. 73B - Heat resistant inspection lens for GoPro



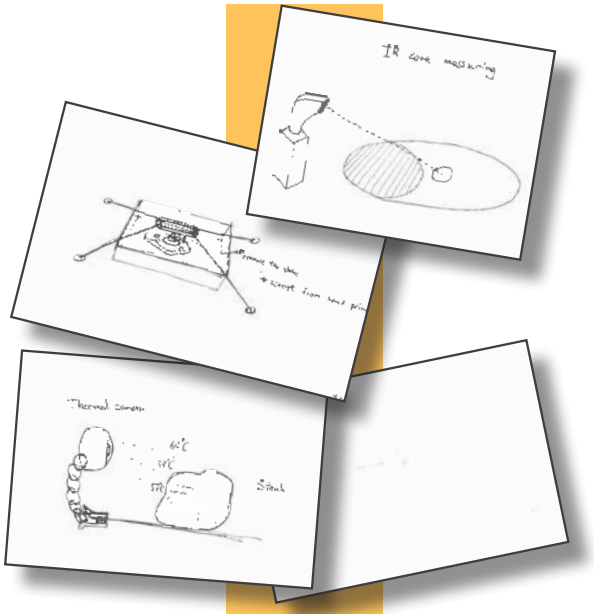
Ill. 73A - Inspection camera

Heat resistant cameras in the industry are very big and bulky and are not suitable for private use.

Ways to determine meat condition

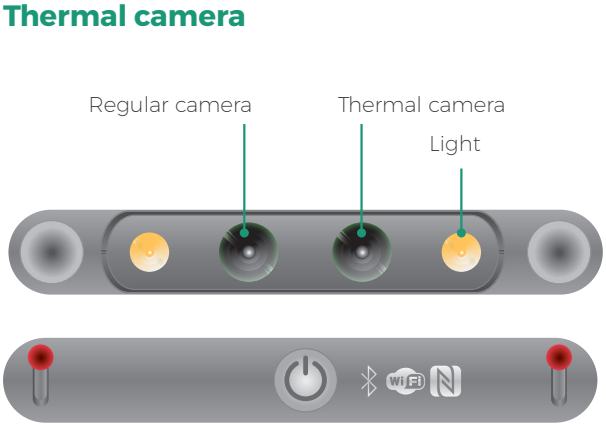
By choosing the direction of including a meat thermometer it led to a sketching section aiming for new ways to determine the meat condition besides the regular meat thermometer (appendix E5). The ideas can be seen on ill. 74, and are listed below.

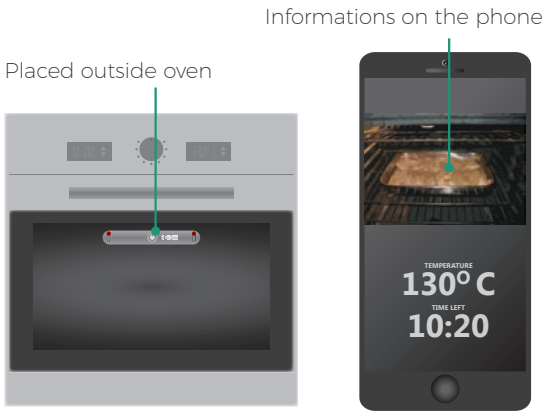
- Taking the pressure principle also mentioned earlier and using a mechanical solution to determent the condition.
- Measuring the electrical resistance in the meat.
- Scanning the meat either by Infrared or with a thermal camera.



Ill. 74

Thermal camera





Ill. 75 - Thermal camera concept

On of the most interesting ideas were measuring the core temperature without inserting anything in the meat using a thermal camera, as seen on ill. 75 above. To find out if this was actually possible, a further investigation were made. (Appendix D3) It didn't take more than a phone call to an expert in thermal dynamics, before a very interesting statement were found.

After a second phone call with Henrik Quist a week later, it was quite clear that measuring core temperature using a thermal camera was a very hard task, and the struggles with heat insulation were challenge enough. So from this it was decided to go towards the regular way of measuring core temperature by inserting an awl into the meat. The second statement from Henrik Quist can be found to the right.

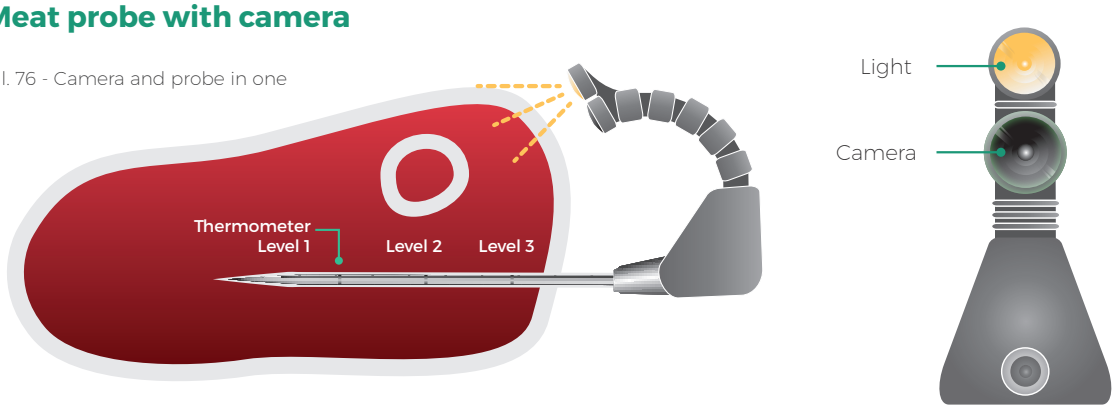
> *You can't see through glass using a thermal camera, it only sees the thermal profile of the glass itself. You can however buy special glass that you can see through,*
>
> Henrik Quist, Sales Director, Pro Instruments

> *A thermal camera only sees the surface, but you can however calculate the heat transfer. This makes it possible to e.g. see heating pipes 80cm down into the ground. If you should do the same thing with meat, you would have to see it dynamically and see how the heat is transfered into the meat, also called the heat transfer towards the center. It can be done, but it is not at all a simple process. You have to know the heat transfer in all the different kinds of meat, and then make a lot of tests from this.*
>
> Henrik Quist, Sales Director, Pro Instruments

Way to advanced to determent the meat condition by thermal images.

Meat probe with camera

Ill. 76 - Camera and probe in one



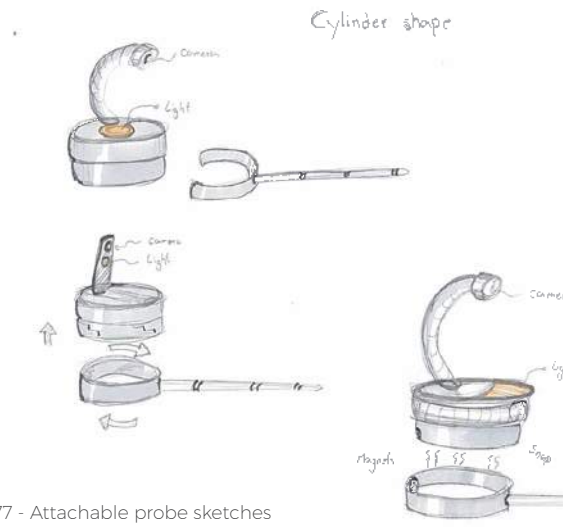
After concluding that it is way to advanced to determine the meat condition by thermal images, it was decided to use the normal meat thermometer as measuring tool and thereby making a product that would go inside the oven.

The concept above shows the idea of making a combined solution where the camera and the meat probe is integrated. As former concepts the concept needs further investigations in terms of durability in the oven.

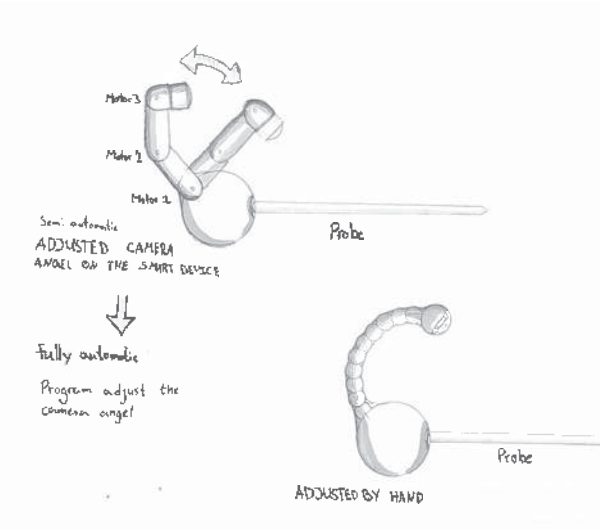
It is possible to make a camera including the different components that can withstand the heat from the oven over time?

Giving form

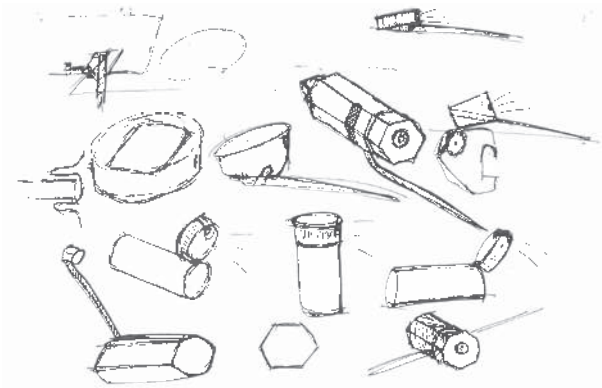
The concept were then visualized through a drawing session where various shapes and ideas were drawn. The drawings with explanation can be found below on ill. 77 and 78 and on the next page on ill. 79 - 81. More drawings can be found in appendix E6.



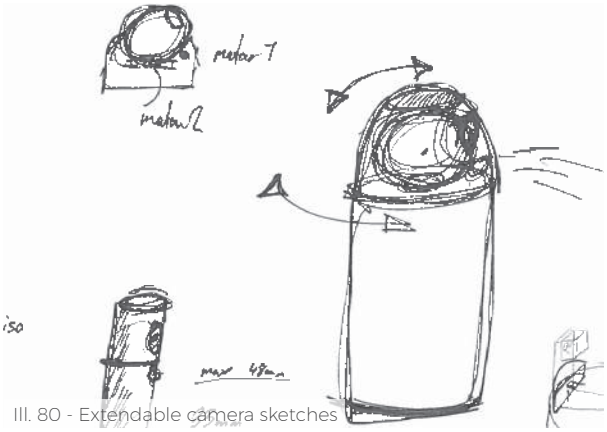
Ill. 77 - Attachable probe sketches



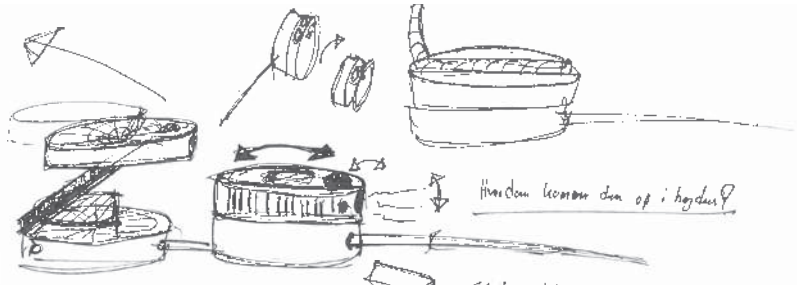
Ill. 78 - Flexible camera sketches



Ill. 79 - Different shapes were investigated

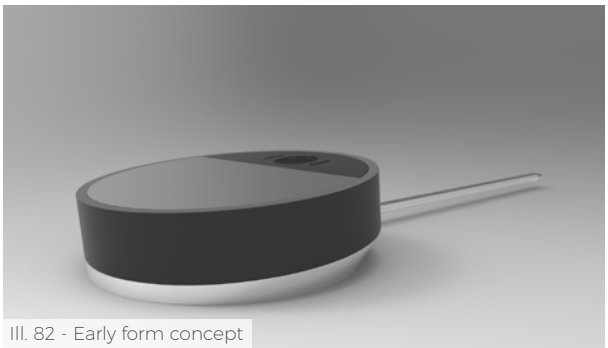


Ill. 80 - Extendable camera sketches

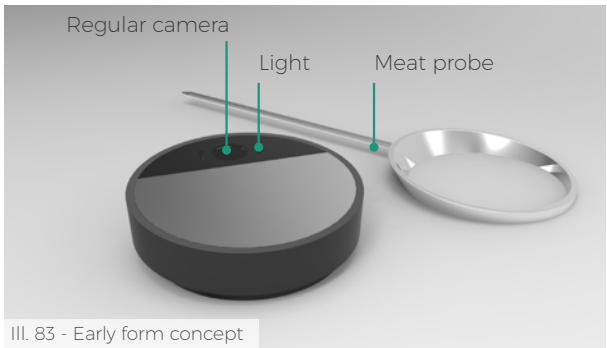


Ill. 81 - Rising camera for hight

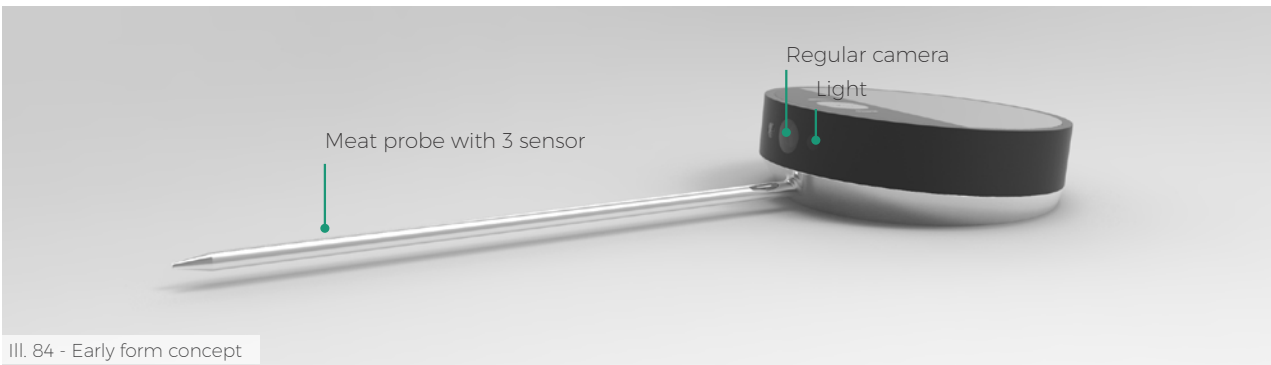
After various attempts an early form of the concept were found. The form can be seen below on ill. 82-84 in early 3D renderings.



Ill. 82 - Early form concept



Ill. 83 - Early form concept



Ill. 84 - Early form concept

PHASE 6.0

RESEARCH 2.0

This section contains the second round of research done with focus on meat thermometers.

6.1 MEAT THERMOMETER

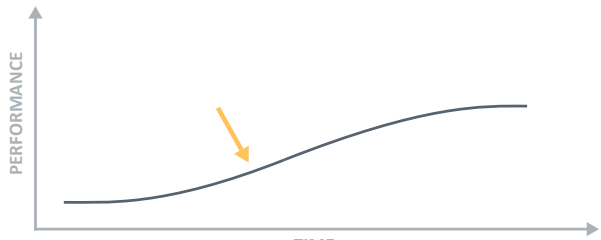
S-curve analysis of meat thermometers

Because meat thermometers were decided as a main category, an s-curve analysis were made to get to know the pace.
Below is the original classic meat thermometer from 1942 on ill. 86 and to the right on ill. 87 is a wireless app based version from 2016.

Ill. 86 - Classic meat thermometer

Ill. 87 - Modern meat thermometer

Of course the product isn't analog anymore, but the product has also quite recently become completely wireless again. The basics hasn't changed at all, it is still an awl that you insert into the meat. However the features have changed, which is why the innovation is still going strong, and why the s-curve looks like illustrated to the right. The s-curve has just hit a steady up going state, meaning that the innovation has almost just begun. (Appendix C5)



Ill. 88 - S-curve

Using a meat thermometer

With the latest ideation more knowledge about how to use a meat thermometer was needed. And who is better to explain this than a professional chef? It turns out that even chefs are disagreeing on how to use it. There is a video on Bilka's web page, where they had one of their chefs explaining how to use it properly. He had three main rules:

- The end of the meat thermometer in the center of the meat
- The meat thermometer is inserted from the side and not from the end, so I don't ruin too many slices of meat (seen on ill. 89)
- You have to have the correct core temperature when your meat is done

A chef at Scheelsminde explained that he had never heard anything like that, and that he couldn't see how you could ruin some of the meat by inserting the prob from the end and why you shouldn't insert it through the marbling. From this it was concluded that there were no right or wrong way to use it if even professional chefs can disagree like that. One thing they did agree on though was that the meat thermometer had to be at the core of the meat. (Appendix C6)

Ill. 89 - Meat probe inserted from the side

Roasting meat

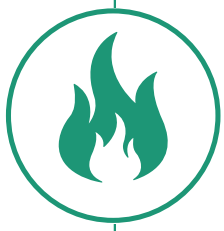
The chefs agreed that the meat thermometer has to be in the center of the meat, but how do you reach the desired core temperature the right way? That is the next very important question and along with it, what is the worst case scenario that the solution has to be able to withstand?

A German food stylist and cooking book writer named Proebst made a large table of how you should cook your meat properly, [Proebst, 2016] to get the most desired result. It contains almost every type of meat and all the most common types and how you cook them. In this table the worst case scenario for the solution could also be found. The worst case scenario can be seen in the extract below.

Under poultry the 6kg goose is quite a challenge to cook. It needs a total of 10 hours in the oven. Fortunately the last 9 hours are only at 80 degrees. With this in mind, the requirement of 8 hours in an oven with 200 degrees were set. This way the security buffer before the solution would break completely were large enough to make this a reasonable consumer product. The complete list of roasting times can be found in the appendix C7.

Animal	Type of meat	Frying time	Time at 80 degrees C	Core temperature
Poultry	Chicken breast fillet	2 min. each side	45 min.	70
	Duck breast fillet	5-6 min.	45 min. - 1 hrs.	65
	Goose breast (Skinned, 500g)	6-7 min.	2 hrs.	65
	Roast turkey (800g)	5-6 min.	3 hrs.	70
	Roast turkey (1.2 kg)	7-8 min.	5 hrs.	70
	Baby turkey (3 kg)	40 min (220 degrees)	4 hrs. 30 min.	70
	Turkey (4.3 kg)	40 min (220 degrees)	7 hrs.	70
	Duck (2.5 kg)	1 hr. (220 degrees)	5 hrs.	70
	Goose (4 kg)	1 hr. (220 degrees)	7 hrs.	70
	Goose (6 kg)	1 hr. (220 degrees)	9 hrs.	70

Ill. 90



WORST CASE SCENARIO
Roasting a 6 kg goose at 220°C
for one hour plus 9 hours at 80°C

Competitors

From the more general gadget analysis made, a deeper and more thorough analysis of the meat thermometers were needed to get a better understanding of the direct competitors.

The top of the line products were found and analyzed in terms of functions, aesthetics, frequency and price. The different product analysis can be seen below.

Product	Analysis
iDevices iGrill  Ill. 91	**Functions** · Measuring core temperature · Easy to use · Sending the data to a smart device · Alerting at a certain temperature · Connect up to 4 probes **Aesthetics** · Good build quality · Clean lines · Grill appealing choice of colouring · Plastic **Frequency** · Every time a roast has to be made · 1-3 times a week **Price** · 699 DKK
apptionLABS MEATER  Ill. 92	**Functions** · Measuring core temperatures · Easy to use · Sending data to a smart device · Alerting at a certain temperature · Completely wireless · Connect up to four probes · Easy to clean **Aesthetics** · Wood · Metal · Clean lines **Frequency** · Every tome a roast has to be made · 1-3 times a week **Price** · 1199 DKK

Product

Tecpoint GmbH
SteakChamp

Ill. 93

Analysis

Functions:
- Measuring core temperature
- Easy to use
- Easy to clean
- Completely wireless
- Alerting at a certain temperature
- Not rechargeable

Aesthetics:
- Industrial looking.
- Rough look

Frequency:
- Every time a roast or steak has to be made
- 2-4 times a week

Price:
- 399DKK

Siemens
Roasting Sensor Plus

Ill. 94

Functions:
- Can only be used, with a Siemens smart oven
- Measuring core temperature 3 places making it easier to find the core, and not just finding a hollow chest, like in e.g. a chicken
- Easy to use
- Easy to clean

Aesthetics:
- Industrial looking.
- Silicone
- "Boring to look at"

Frequency:
- Every time a roast has to be made
- 1-3 times a week

Price:
- 677,50DKK (13.429+ DKK for the oven)

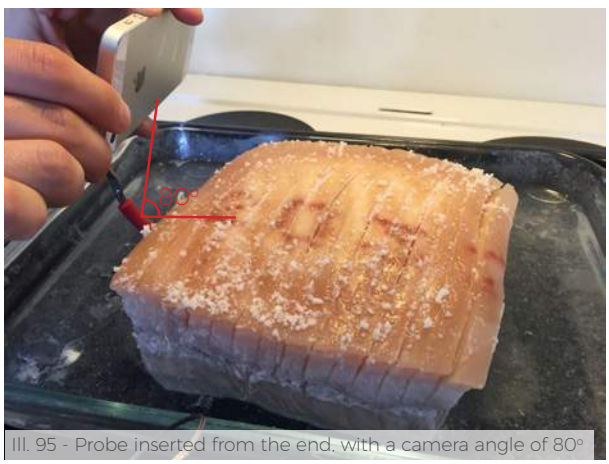
Keywords from the analysis: Easy to clean, easy to use,

From the analysis it can be concluded that all the products are easy to clean and easy to use, making this a must in our product. An other important finding is that you can't buy a meat thermometer with multiple measure points that you can use without a smart oven, which is one of the features of one of the early concepts.

Distance from camera to meat

To find out what angle the camera had to be placed at to give the user the desired visual feedback a mock-up of the situation were made. On ill. 95 a picture of the setup with an angle of 80° directly on the probe is shown. On ill. 96 is the view from the camera at that angle. Ill. 97 is how the cameras sees the meat at a 20cm distance from the roast. The setup was also testet with ofther angles that can be found in appendix G2. From this it was concluded that the camera and the probe had to be two separate units to be able to get the desired distance to the meat, and thereby get the best view of the roast.

Ill. 96 - Camera view



Ill. 95 - Probe inserted from the end, with a camera angle of 80°

Ill. 97 - The roast from a distance of 20cm

The camera and the probe have to be two separate units to get the best view of the meat.

PHASE 7.0

HEAT TRANSFER

This section contains the calculations, simulations and testing of the different heat insulating materials to determine if the concept is possible or needs some adjustments.

7.1 HEAT TRANSFER BASICS

An important question of the project is; Can it actually stay inside the oven and still keep the heat away from the components inside? That's the question this chapter is going to answer.
The target requirements of the insulation design are:

- Keep a core temperature below 70°C for 8 hours in a surrounding heat of 200°C
- The diameter of the product can't exceed 75mm.

But before getting into that a general understanding of heat is presented. [Youtube1, 2014]
First of all, here are the basic therms and units:

Heat = Total Energy
(in Joules)

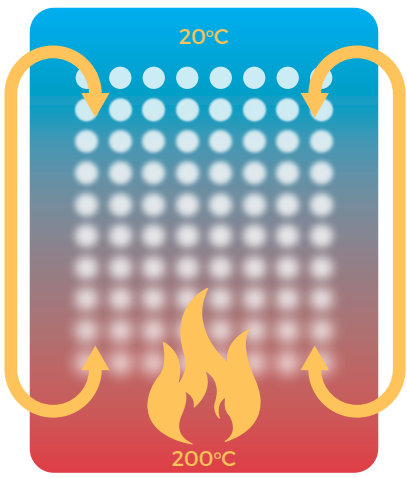
Temperature = average energy of an object
(in Celsius, Fahrenheir or Kelvin)

There are three types of heat transfer:

- Convection which is what happens in fluids and gases
- Conduction which is what happens in solids
- Thermal radiation which is how the sun heats up the earth via infrared radiation

Convection heat

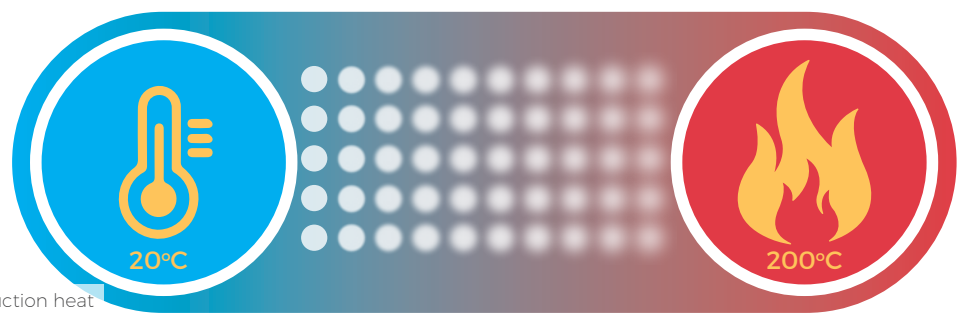
Convection heat, is how heat transfers in fluids. If there is a fire in the bottom of a room, then the air around the fire is going to be heated up and go upwards towards the sealing. New air is then going to come closer to the fire and when that air is heated, it is also going to go upwards. When air at the top of the room cools down again, it is going to fall down, closer to the flame and are heated up again, and this circle continues. This is how heat transfers in a fluid and also how the heat is reacting in an oven, which is why it is relevant to the project. An illustration of this can be seen on ill. 99.



Ill. 99 - Convection heat

Conduction heat

In solids, the atoms are very close together and they vibrate. The hotter they are, the more they vibrate. So if a solid is heated in one end the atoms are going to vibrate a lot faster and are going to bump into the other atoms and transfer heat that way. This is how heat is transfered in solids, also illustrated in ill. 100. This is how the heat is going to transfer in our insulation material.



Ill. 100 - Conduction heat

Thermal radiation - Heat and colours

To understand what colour the product is going to have, it has to be understood how the different colours react to heat [Youtube2, 2014]. If a box with different coloured sides are filled with boiling water, the sides is going to emit heat very differently. The sides are going to do like this:

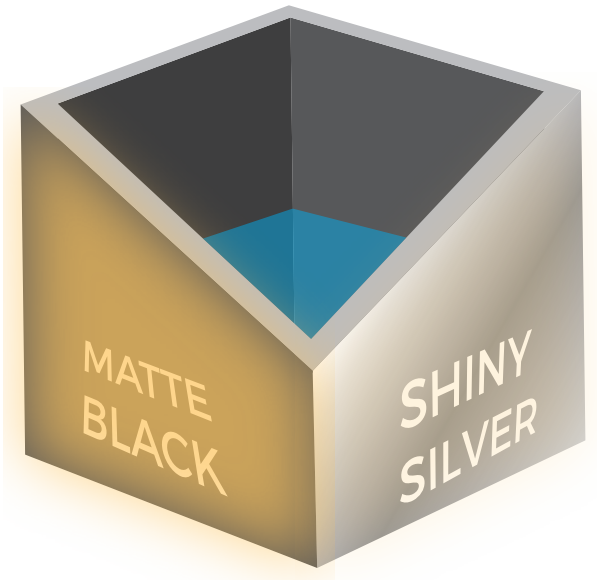
- Shiny silver will be bad at emitting the heat radiation
- Matte black is by far the best at emitting the heat radiation

This is also shown on ill. 101 to the right.
If the opposite function is important and apply heat is applied to the matte black side and the shiny silver side of the box, the colours is going to react like this:

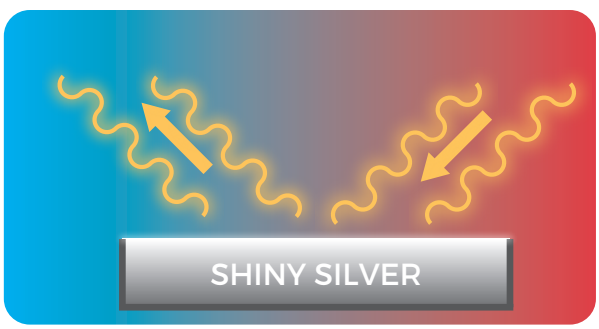
- Shiny silver will reflect much of the heat radiation and take a long time to heat up
- Matte black will absorb all the heat radiation and heat up much faster.

This is shown on ill. 102 and 103. So how can this be used in the product, if the insulation is only going to be experiencing conduction heat? It can be applied to the outer surface of the product to make it cool down a lot faster. Or it can be applied to the outside to make it able to reflect the radiation heat for at much longer time, but then it will stay hotter for longer.

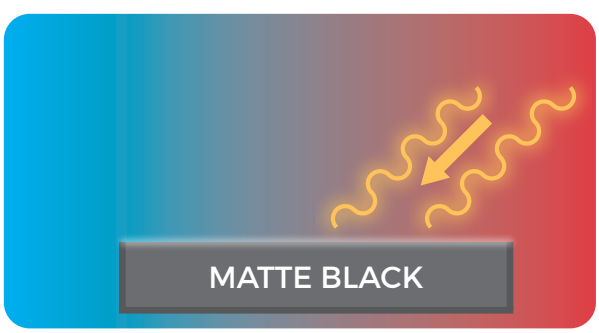
As the insulation is going to be a solid and heat conduction is what happens in solids, heat conduction is what is interesting in this instance.



Ill. 101 - Emitting heat



Ill. 102 - Heat reflection

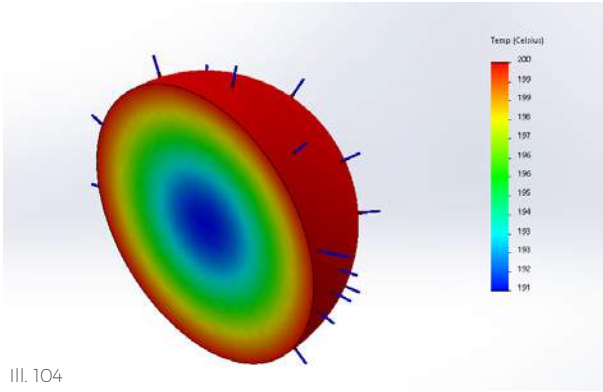


Ill. 103 - Heat absorption

7.2 INSULATION MATERIALS

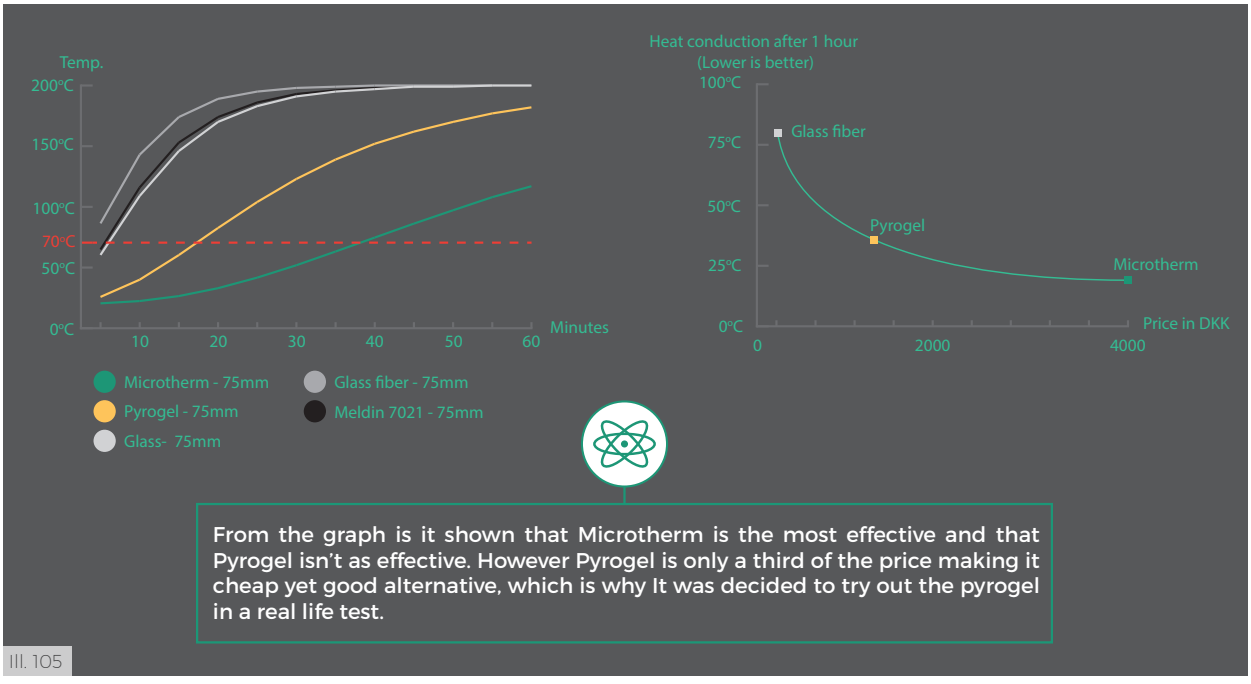
Simulations

Calculations of heat transfer in different materials were calculated with Solidworks and to validate the results, both tests and calculations by hand were made. A sphere were used for calculation, as in a sphere there is symmetry at the center making it easier to calculate on. An example of a Solidworks simulation can be seen on ill. 104. The scale to the right is the temperature in Celsius throughout the material after 1 hour in 200°C with an initial temperature of 20°C with a radius of 75mm glass fiber.



Ill. 104

Five different materials were calculated on. The five materials were chosen from their insulation capabilities. Microtherm and Pyrogel both claim to be the best on the market, glass fiber in the industry standard and meldin 7021 is a high temperature plastic that would be suitable for the shell of a product like this and lastly the glass were chosen to have a reference point. Based on the calculations a graph was made over the different insulation probabilities of the materials. The core temperature is measured over one hour, the initial temperature at the core being 20°C. One hour is the longest the product has to be in the oven at 200°C, according to table of roasting times found in the research 2.0 chapter. The diameter of the sphere is set to 75mm, as this is the size requirement listed earlier. The graph can be seen below on ill. 105 to the left. The max tollerable core (70°C) are marked with red on the graph. The different materials and the diameters are shown below the graph. From this one is was concluded that Microtherm clearly had the best insulating materials, however it was very expensive. A graph of price vs. heat conduction was also made to find a cheaper alternative. This one can be seen below on ill. 105 to the right. On the X-axis is price pr. m^3 and on the y-axis is the heat conduction after one hour. Different materials are listed along the graph.



Ill. 105

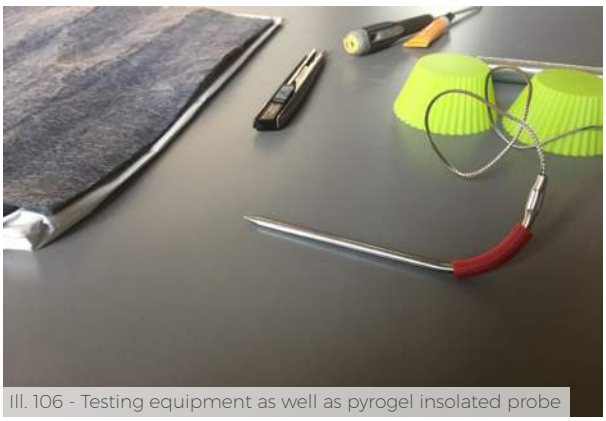
Experiment

The setup of the tests can be seen on ill. 106 - 108. More pictures can be found in the appendix (appendix G3).

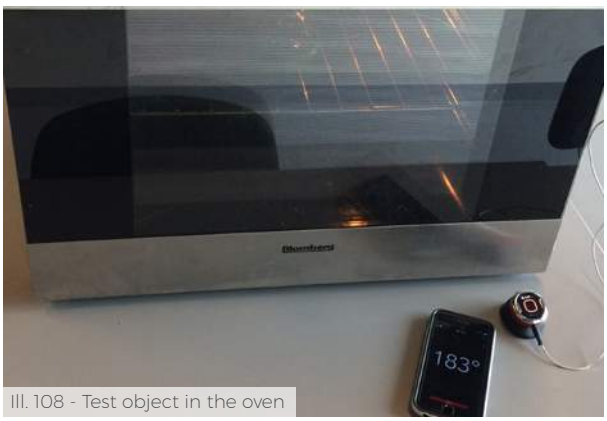
The first test were made with 75mm insulations of Pyrogel in diameter. The second test was based on the same amount of pyrogel plus a layer aluminum foil. The test results of this can be seen in the graph below.

The test results were then put in the same graph as the simulated results to see how they compare. The comparison can be seen on ill. 109,

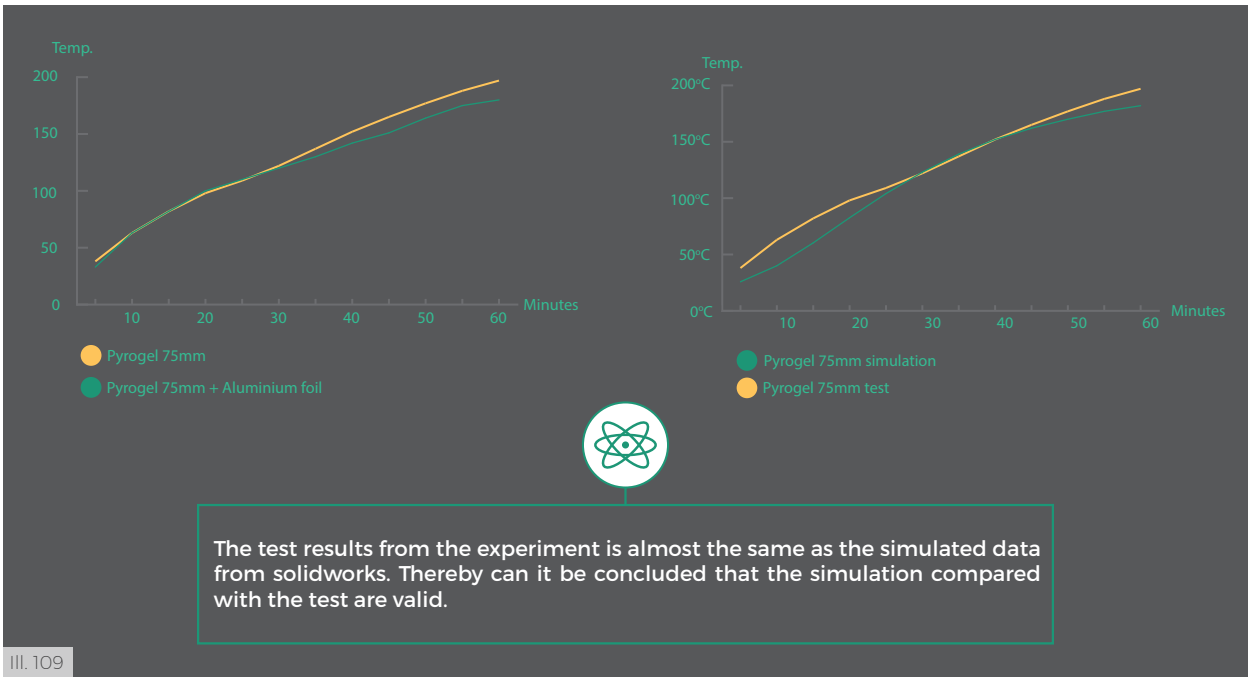
Ill. 107 - 75mm pyrogel insolation



Ill. 106 - Testing equipment as well as pyrogel insolated probe



Ill. 108 - Test object in the oven



Ill. 109

Validation

The results from Solidworks still seemed a bit strange, so to validate it even more it was also compared with hand calculations.

To calculate the heat transfer in the insulation materials by hand, it must be assumed that:

- The oven temperature is constant
- The temperature to the time 0 in the product is a given starting temperature
- There is symmetry in the center of the product.

With this assumption calculating it as a sphere can begin using the following formula for transient heat transfer of a sphere:

$$\theta_{0,sph} = \frac{T_0 - T_\infty}{T_i - T_\infty} = A_1 e^{-\lambda_1^2 \tau}$$

The parameters in the formulas are shown below along with an illustration of the parameters on ill. 110 below:

T_0; *Temperature in center of sphere at the given heat transfer time*

$T_\infty = 200[^\circ C]$; *Oven temperature*

$T_i = 20[^\circ C]$; *Starting temperature of center of sphere*

$A_1 = 2$; *Value from table**

$\lambda_1 = 3.1416$; *Value from table**

$t = 3600[s]$; *Heat transfer time*

$r_0 = 0,0375[m]$; *Radius of sphere*

$k = 0,028[W/m^2K]$; *Heat conductivity coefficient*

$\rho = 200[kg/m^3]$; *Density of Pyrogel*

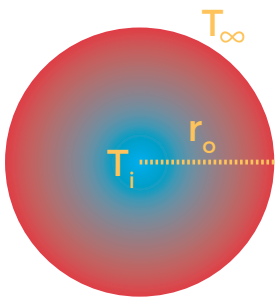
$Cp = 1046[J/kgK]$; *Specific heat*

$\tau = \frac{\alpha}{L^2} t$

$L^2 = r_0$

$\alpha = k/\rho Cp$

*See appendix F1 for the table.



Ill. 110

The formula is the rewritten to:

$$T_0 = (T_1 - T_\infty)\left(A_1 \exp\left(-\lambda_1^2 \frac{\alpha}{\rho} t\right)\right) + T_\infty$$

The calculations for Pyrogel and competing products are then made in excel to get the results for comparison with the simulations. A cut out of the table found in appendix F1 can be seen on ill. 110.

Pyrogel XT

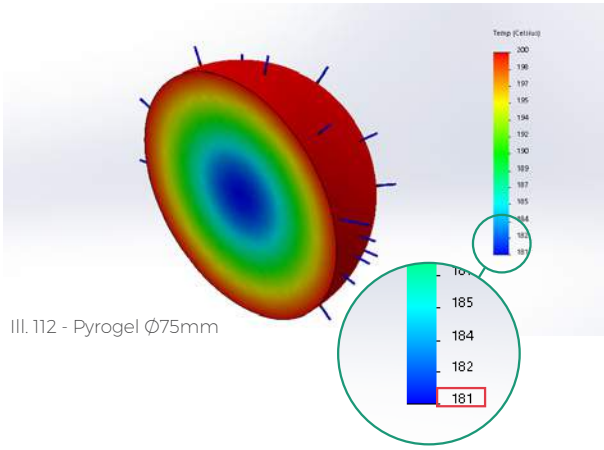
T∞	200	degrees C
Ti	20	degrees C
A1	2	
l1	3,1415927	
t		
a	1,338E-07	
r0	0,0375	m
k	0,028	W/m2 K
r	200	kg/m3
Cp	1046	J/kg K

tid (s)	t	Temp.
3600	0,34	187,76
7200	0,69	199,58
14400	1,37	200,00

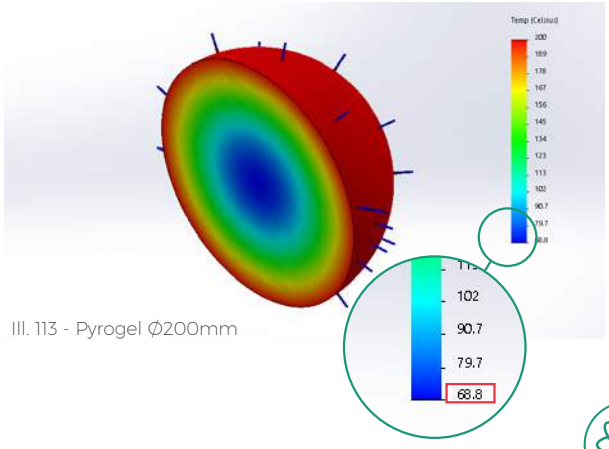
Ill. 111

The results marked above on the table are then compared with results from Solidworks (marked on ill. 112 on the next page) to validate the results. Because the numbers are the same, it means that the results we get from Solidworks are valid, and we can use the other results from Solidworks for more detailed comparisons of the different materials like the graphs showed earlier. Some of these numbers couldn't be calculated using our formula, as the formula is only valid, if τ>0,2 . Solidworks can now help overcome this problem by giving temperatures at much lower seconds.

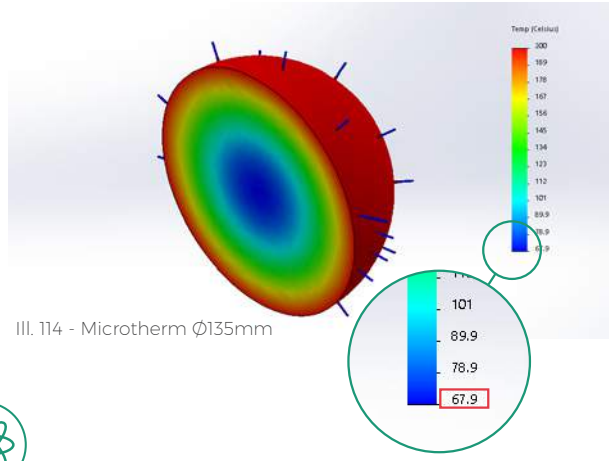
The data sheets for the different materials can be found in appendix H1. The conclusion of the results are that unfortunately non if the insulation material, even though they are the top of the line, can't be used to get out product inside the oven. The internal components are overheating at 70°C, so a core temperature of 187°C after just one hour would be catastrophic. The size requirements of the product don't compare to what is actually needed if the product has to be without an active cooling system. If the core temperature has to be low enough for the worst case scenario describes earlier, a wall thickness of 200mm Pyrogel is nessesary. If we however switch over to the very expensive Microtherm, a wall thickness of 135mm is still nessesary. The simulations of the two scenarios can be seen on ill. 113 and 114 below (Ø=diameter).



Ill. 112 - Pyrogel Ø75mm



Ill. 113 - Pyrogel Ø200mm



Ill. 114 - Microtherm Ø135mm

Summary of Heat transfer

- The best insulating material is Microtherm
- With value for money Pyrogel is by far the best alternative at a price of 1300,- pr/m² compared to 4200,- for Microtherm.
- The requirements of a max diameter of 75mm can't be met with any of the insulation materials
- To keep the heat out for 8 hours, the wall thickness has to be 200mm if it is Pyrogel and 135mm if it is Microtherm
- The requirements stated in the beginning of the heat transfer section can't both be fulfilled. The design can't both have a maximum diameter of 75mm and also be able to keep a core temperature of 70 degrees over 8 hours. It is either or.
- The before mentioned bullets makes a passive cooled solution inside the oven impossible

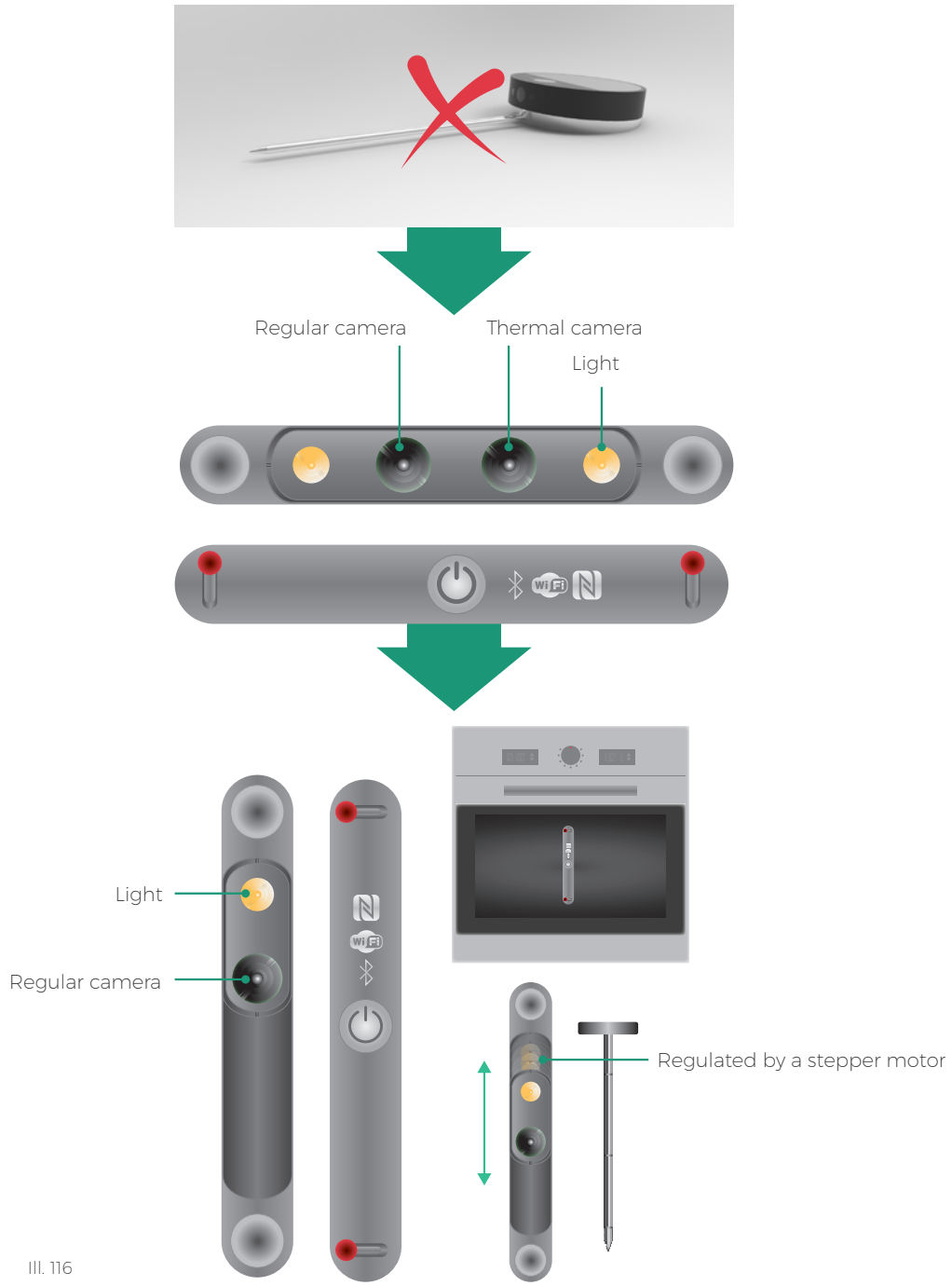
PHASE 8.0

CONCEPT REFINEMENT

This chapter contains the Refinement of the concept, as well as the testing and investigation made towards further concept detailing.

8.1 CONCEPT 1.0

With the new technical findings a new concept were developed based the older concept with thermal camera from the ideation section. The older concept, which can be seen on ill. 116 below, has gotten a quick overhault and has been turned 90° and is now adjustable in hight. The concept are to be placed outside the oven with either a wireless or wired probe going inside the oven. The camera is adjustable via a stepper motor for it to be able to see the different plates, if more are placed inside the oven. This quick concept is further developed throughout the detailing section.

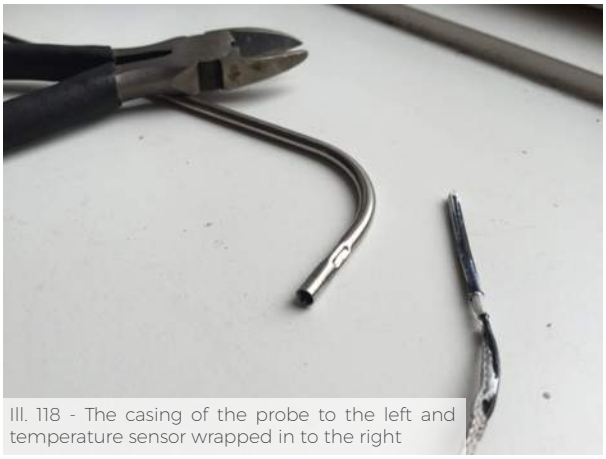


Ill. 116

8.2 INVESTIGATION

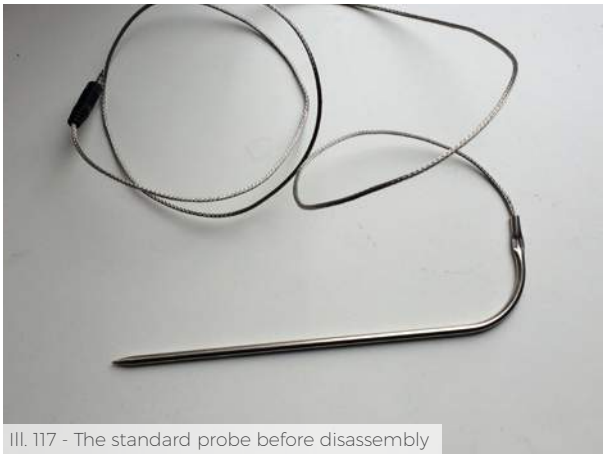
To develop the concept, It was needed to get an understanding of how a regular meat thermometer works and how some of the competitors works. To get this a tear down of a regular digital meat thermometer probe as well as the main unit in iGrill was made. Ill. 117 to 119 are the tear down of the probe and ill. 120 and 121 are the tear down of the iGrill main unit.
First of all the probe were disassembled to see what was needed to measure the temperature. Then the iGrill which had exactly the functions that was needed, except the ability to maybe handle a video stream giving a understanding of how big the PCB (printable circuit board) had to be.

The complete tear down can be found in appendix C8 with even more images.

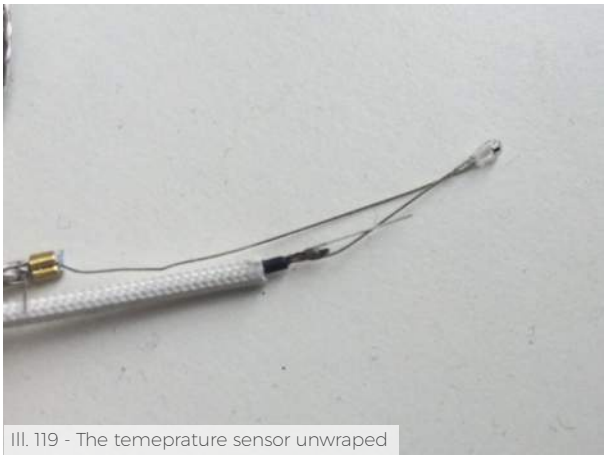


Ill. 118 - The casing of the probe to the left and temperature sensor wrapped in to the right

Ill. 120 - iGrill main unit before disassembly



Ill. 117 - The standard probe before disassembly



Ill. 119 - The temeprature sensor unwraped

Ill. 121 - iGrill main unit disassembled

1 and 2 are the shell and the batterycap.
3 are the PCB.
4 are the screws as well as the reset button.
5 are the front cap.
6 are the battery.

Test of signal strength in different ovens

Now that the size of the PCB with bluetooth was known, the signal strength of the bluetooth inside different kinds of ovens had to be tested. The setup were as seen below on ill. 122 and 123, where a phone was paired with a bluetooth speaker and the speaker then was placed inside both a conventional oven as well as a microwave oven to simulate if people had a combi oven.

The distance from the phone to the oven were then slowly increased until the speaker started to stutter.
In the test with the microwave oven, the speaker played just fine until about a meter away from the, it started to stutter like crazy,and stopped playing just after. This meant that in a combi oven some kind of signal extention would be needed.

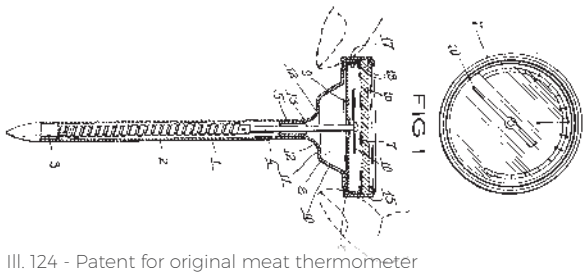
This wasn't the case with the conventional oven. The music kept playing as the distance was increased and even at 4 m the signal was still perfect. The entire test can be found with more details in appendix G4.

Ill. 122 Microwave oven signal test Ill. 123 - Regular oven signal test

To ensure that the range of the signal were decent enough, even in a combi oven, some kind of extender outside the oven is needed.

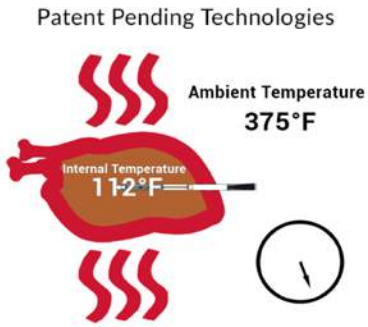
Patents

To make sure that whatever solution the team came up with didn't break any patents a search among them were made. Searches were made both on "espacenet.dk" and "uspto.gov" to get the broadest search possible. The first patent found were the very first meat thermometer, but because of it's age it isn't something that we are going to struggle with. The patent can be seen on ill. 124.



Ill. 124 - Patent for original meat thermometer

The second patent found was however quite a hurdle. The patent isn't final yet, It is still in the patent pending stage and if the company doesn't do anything about the patent for two years after the patent were applied then it gets annulled. The application were nowhere to be found, but a description of the patent were found on their website and can be found in ill. 125.



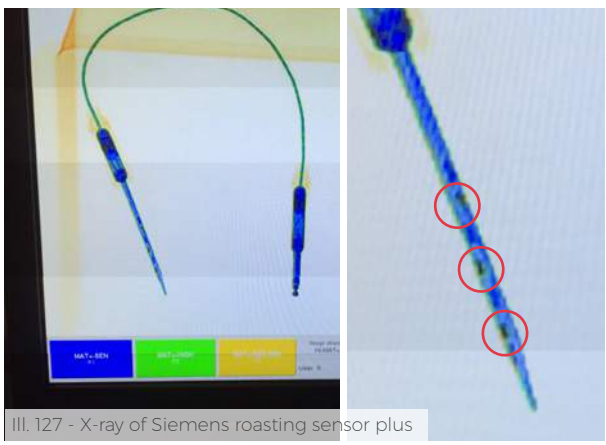
Ill. 125 - Patent pending

However since the patent is no where to be found just yet an assumption must be made that it is still work in progress. And since the company is a startup company based in the US, we can assume that the patent is only going to be taken i the US. (Appendix C9)

The MEATER patent isn't applied yet, making it very hard to take into account. However we must assume that it is only taken in the US, with the company size taken into account.

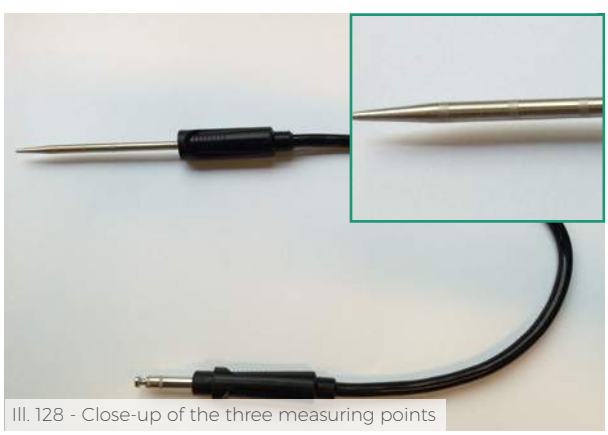
Tear down of Siemens roasting sensor

As mentioned earlier one of the most interesting nice to haves are the probe with three measure point. But how could this be done without the temperatures interfering? Siemens had already solved that problem with the "Siemens roasting sensor plus" probe for their smart ovens, so it was evident to find out how they did it.
The team bought one of their probes and put it through an X-ray scanner. The photo can be seen below on ill. 127. The blue on the photo are metals, the orange are organic things, and the green are a combination.



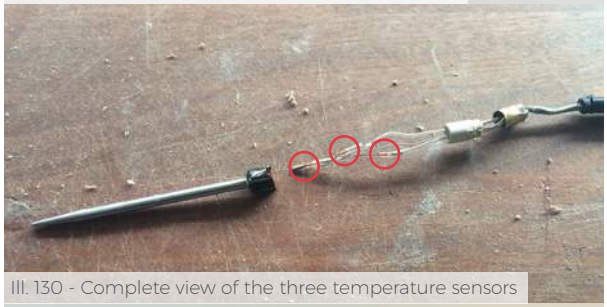
Ill. 127 - X-ray of Siemens roasting sensor plus

The photo to the right shows a close-up of the probe itself. Here the temperature sensors can be seen as the little black dots highlighted on the image. Unfortunately this didn't solve the entire problem. Below on ill. 128 is an image of the probe itself, and in the corner is zoomed in on what looks like a transition of the metal that keeps the heat from transferring heat from one measuring zone to another but what it is? To get the answer to this question, a tear down of the probe had to be made. The pictures of the tear down can be seen below on ill. 129 to 131.

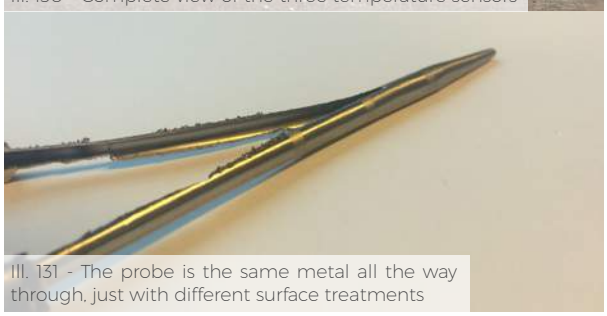


Ill. 128 - Close-up of the three measuring points

Ill. 129 - Cut out of the silicone housing the probe



Ill. 130 - Complete view of the three temperature sensors



Ill. 131 - The probe is the same metal all the way through, just with different surface treatments

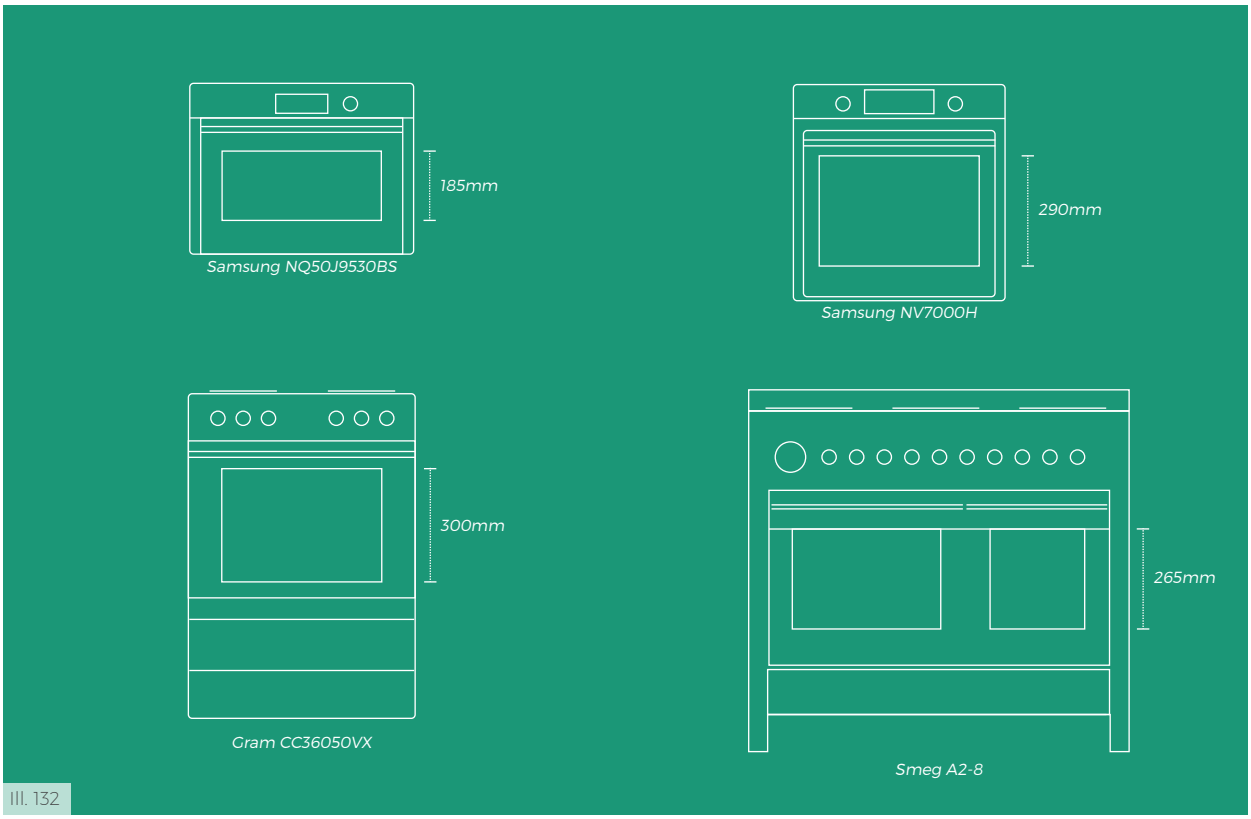
The probe turned out to be the same metal all the way through, and the lines that were on the probe were a different surface treatment from the rest. This means that all that Siemens does to seperate the temperatures from one another is taking the heat transfer of the metal into account when calculating the temperatures. The sensors are highlighted on Ill. 130 above.

- The probe contains three temperature sensors
- The probe is the same metal all the way through
- The three points on the probe is only surface treatments

8.3 **OVENS**

By placing a camera unit on front of the oven it sets some requirements to the length of the camera.

By analyzing the most common oven types: build in ovens and regular stove ovens, which can be seen below, it can be concluded that the lowest glass front are 185mm and the highest are 300mm. As stated in the requirements it has to fit all oven fronts. Thereby the product can't be be taller than 185mm in total length.

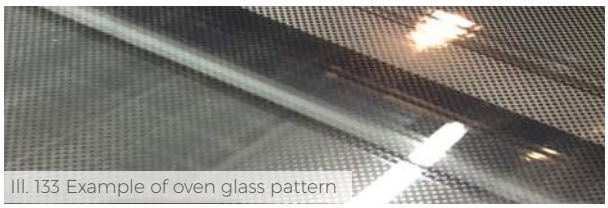


Ill. 132

Because of the size of the glass fronts on the different types of ovens, the main unit can't be taller than 185mm

Patterns of oven fronts

With the conclusion that the solution has to be outside on the oven glass, it was very important to test the visibility through the glass as the ovens has different patterns on the glass to make the dirt on them less visible. An example of an oven front pattern can be seen in ill. 133.


Ill. 133 Example of oven glass pattern

Therefore a test of the visibility were established. The only variable parameters were of the camera had auto-focus or manual focus. This was to see which one were better at focusing on the object inside the oven and to see if the picture that you got from the outside on an oven with a very visibly shielding pattern were decent enough to see the food. To simulate a worst case scenario, the photos were taken through a microwave oven door, which has the same pattern as a combi oven. To the right are two photos through the door. Ill. 134 is with auto-focus, and ill. 135 is with a manually fixed focus point. More details can be found in appendix G5.


Ill. 134 - Auto-focus


Ill. 135 - Fixed focus

A camera with fixed focus is needed as auto-focus makes impossible to see past the glass patterns.

Light through an oven door

When lighting through an oven door reflection is a very big factor, as the door usually has between two or three layers of glass.
In that context some testing were needed to be able to get the best picture without too many disturbances. The test was done using a smartphone camera and an LED light. The camera were moved further and further away form the light to see how much distance were needed. It turns out that the distance needed is a minimum of 5 cm. Photos of the set can be seen on ill. 136 - 138. An expert from Polyteknik was also consulted for information about filters that could eliminate the reflection from external glass, however no such thing existed, so it was decided to go with regular glass. Further details about the test can be found in appendix G6.


Ill. 137 - Camera right next to light source


Ill. 136 - The test setup


Ill. 138 - Camera 5 cm from light source

8.4 REQUIREMENTS REVISED

Based on the new findings and mainly on the fact that the solution now had to be outside the oven, a new set of requirements were established. Some of the requirements has just been rephrased, while others has been added or changed quite a lot.

Adjustable camera focus has been changed to fixed camera focus based on the findings in patterns of oven fronts section, A few other requirements has been changed to match the new placement outside the oven. The changes have been marked in bold italic below.

	Qualitative	Quantitative
Need to have	· Easy to clean · Easy to setup · Easy to use · Measure core temperature with two decimals · Show the food on a smart device · Show the food, even in low light environments. · Configurable "done stages" · A wire, that doesn't break · Rechargeable · Compatible with all ovens · Provide the user with relevant temperatures	· Sent out a signal in a 30m radius · Has to last a minimum of 10 hours on battery • ***Adjustable camera hight of 150mm*** • ***Heat resistant probe up to 350°C***
Nice to have	· Appealing design · Show temperature of the oven · Expansion opportunities · Measure moisture level · Charging dock with Wi-Fi · Measure degree of burn · Has to consist of standard components • ***Fixed camera focus*** · Measure oven temperature • ***Guide the user during cooking*** · Three measure points for easier core finding	· A maximum weight of 200g

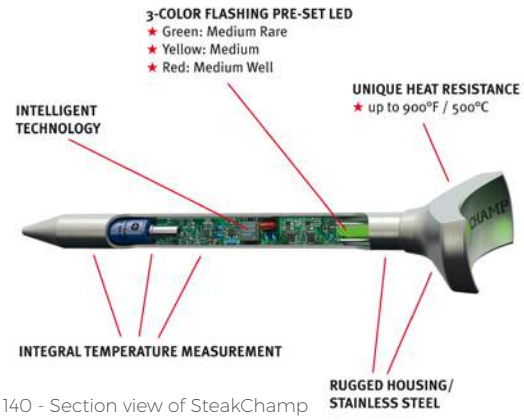
Ill. 139

8.5 WIRELESS PROBE

A user need is “a wire that doesn’t break”, leading us in a direction of a wireless probe. There for it was evident to look at already existing product in that category and figure out how they are doing it.
The only two on the market were SteakChamp and MEATER. While SteakChamp has been in sale for a few years, MEATER is still an Indiegogo project, making MEATER impossible to get hands on until Juli, when it ships, meaning that all the info collectible is found on their webpage. SteakChamp on the other hand, are very open about their product and have even put a section view of their product op on their own webpage. (Seen on ill. 140)

SteakChamp

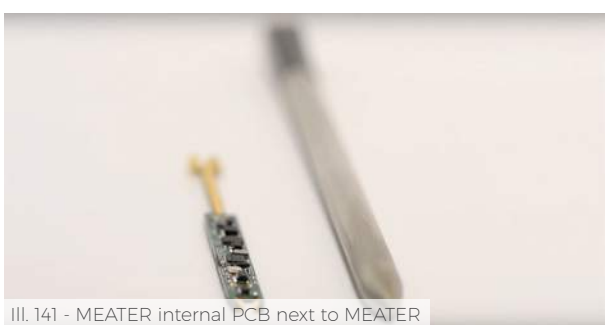
As it is stated on their own web page [Anon, 2016] SteakChamp can be used for about 1.000 times and their battery can not be replaced or recharged. They use an internal 50mAh pin battery, which can be seen at the pointy end of the section view. They have the main PCB at the center of the probe, as well as a colour LED to send light of the end of SteakChamp. As the section view says, the housing is made from stainless steel and the unit is heat resistant up to 500°C. What they don’t say is that they use the heat as insulator to shield inner components from the heat.

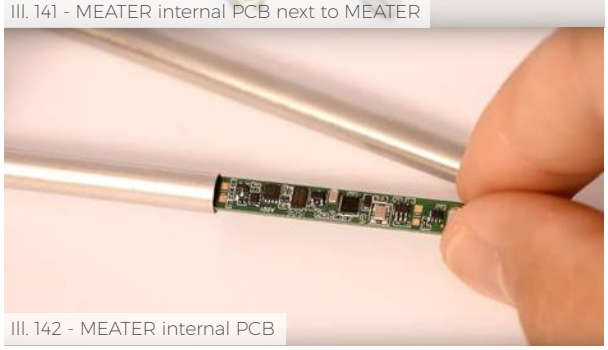


Ill. 140 - Section view of SteakChamp

MEATER

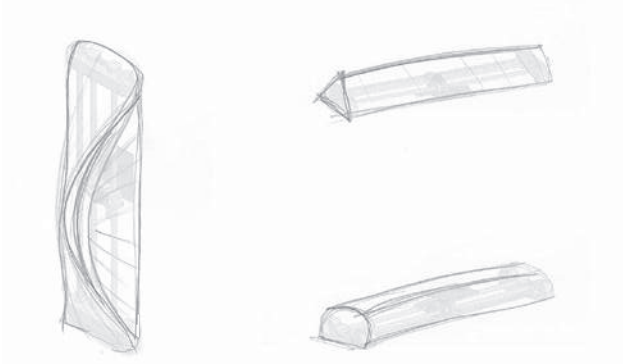
MEATER is unlike SteakChamp completely rechargeable. It uses the same to keep its internals cool by using the meat as insulator. As mentioned in the patents section earlier the company behind MEATER, Apptionlabs, is trying to patent the technology [Cruz, 2016]. Other internals than what is shown on ill. 141 and 142 are only known by the developers as they keep their cautious about what they show others, making it very hard to figure out how they are doing. A service engineer and two electrical engineers were call in for support, but neither of those had any idea how the product were powered. The only thing they could say were that it was some kind of internal battery and not capacitors.


Ill. 141 - MEATER internal PCB next to MEATER

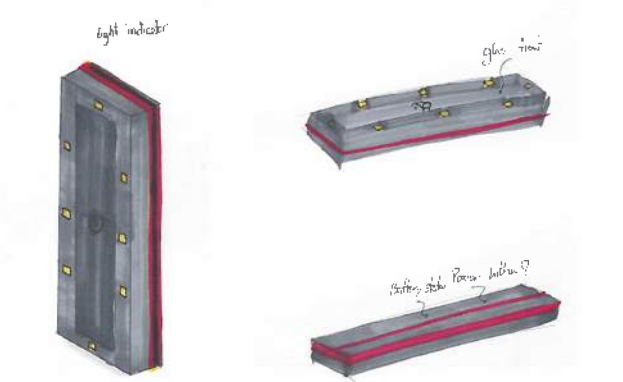

Ill. 142 - MEATER internal PCB

8.6 FORM PRINCIPLES

To ensure that the design appealed to the target group, a number of form studies were done. From the studies different principles were extracted that were then used as guidelines when giving form to the concept. The guidelines can be seen on the illustrations to the right (ill. 143). The entire analysis can be found in appendix E7.
Below are some of the sketches made towards the final shape of the product (ill. 144 - 145), as well as 3D models from size studies (ill. 146).



Ill. 144



Ill. 145

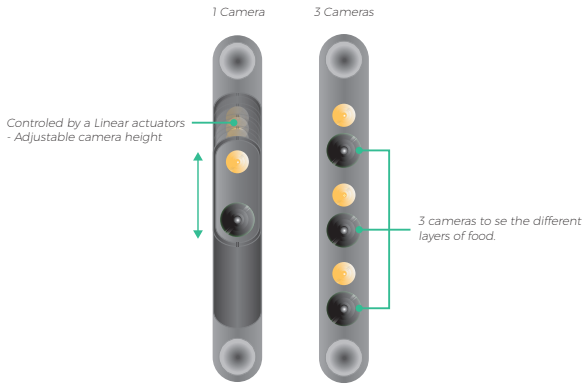
Ill. 146 - 3D size studies

Ill. 143

8.7 DETAILING

1 camera vs. 3 cameras

The concept came to a very tough decision; three cameras or one movable camera? The two concepts can be seen to the right and both solutions would work with multiple plates inside the oven. To make this decision the two concepts were put op against each other in point value and rated on the following parameters: price, functions, user friendly, complexity, added value and feasibility. The scores can be seen in the table to the right below the two concepts.
From the scores it was decided to go with the solution with one adjustable camera. A more detailed description can be found in appendix E8.



III. 147

Parameters/ Concept	1 Camera	3 Cameras
Price	3	3
Functions	4	3
User friendly	5	3
Complexity	3	4
Added value	4	3
Feasibility	4	5
In all:	**23**	21

III. 148

Electrical components

For the concept to work the following components were needed:

Camera unit:
- Camera
- Light
- PCB
- Bluetooth
- Stepper motor
- Battery
- Wifi unit

Probe:
- 4x temperature sensor
- PCB
- Battery

To find out what the capacity of the batteries had to be for the requirement of 10 hours to be fulfilled, a service engineer was asked for advice. The calculations can be found in appendix C10.

Because the heat requirements for the battery in the probe were strict, an expert were consulted for final approval. The data sheet for the final battery can be found in appendix 10.
The battery capacity needed to be:

Camera unit:
- 2090mAh

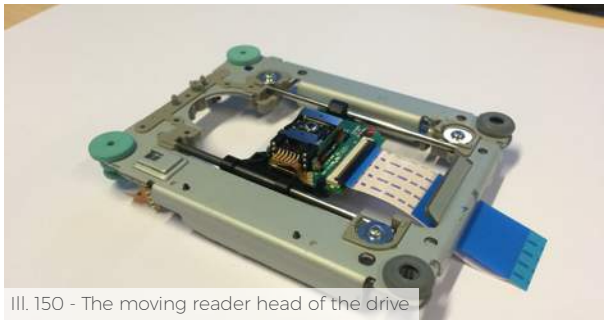
Probe:
- 20mAh

The final components is shown in the product report.

Fixation of camera unit

To the fixation of the main camera unit, it was decided to use the same mechanism as used in a DVD-drive as seen on ill. 149. It is needed for the camera to be able to go up and down mechanically in a very stable manner, so it was evident to copy this way of moving up and down, as it had been used successfully for decades. Moe precisely the way the laser head is moved, is the same way as the camera is going to move. The laser is grinding on rails on the sides as seen on ill. 150 and is moved by a stepper motor in one of the sides.
The rails are calibrated with springs at the ends for a more smooth movement. Can be seen on ill. 151.
The entire laser mount is connected to a threaded rod on the side, which moves the entire thing back and forth as seen on ill. 152. This is the same way the product is going to be moved up and down.
The movable part of the concept can be seen on ill. 153 and the final product with details about the movement system can be found in the product report.

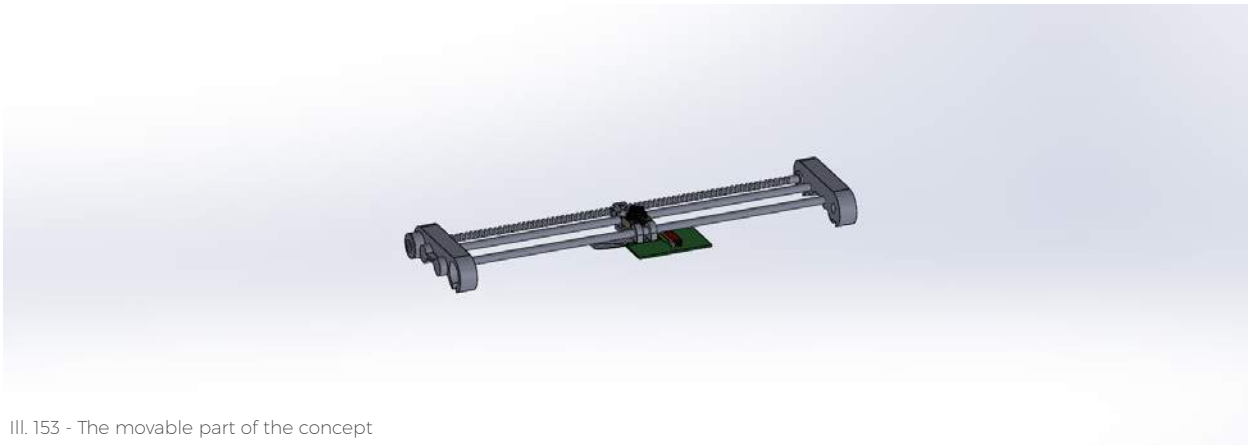
Ill. 149 - A regular DVD-drive



Ill. 150 - The moving reader head of the drive

Ill. 152 - Connection to threaded rod

Ill. 151 - Spring for calibration of rails



Ill. 153 - The movable part of the concept

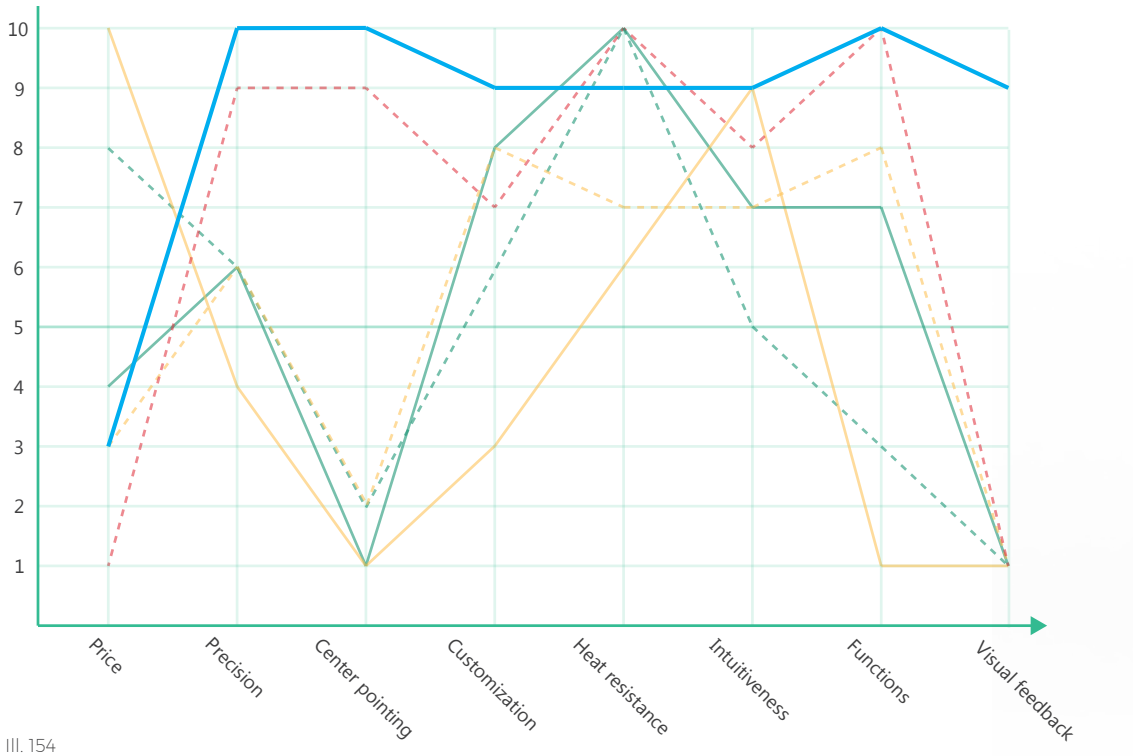
Business plan

Before making a business plan it was important to find out where the product stood out from the competitors. To figure this out a blue ocean analysis were made to compare the product with the competitors. The analysis can be seen on ill. 154 at the bottom of the page. From this is was concluded that the key selling points, besides the visual feedback also were more precise measurements, as well as hitting the core of the meat was a lot easier.

The business plan is to start by hitting the Danish Market. Then when the product is well established on market, the plan is to start expanding throughout Europe in year three.
The plan is to brand the product via the diverse Internet forums and tech pages through reviews. The pages that should start reviewing the product should be mandesager.dk and euroman.dk, as it is two pages that reaches broard audiences and hits out target group as well and many other groups.

The product is going to be sold in both online shops as well as retail stores. It is important that the product is also sold in physical stores, as it gives the users the ability to see and try the product without having to buy it first.

The batteries for the probe is going to be sold at the same places as the product and is only going to be branded by us. This ensures extra profit through after sales, as well as giving us the ability to indirectly control the price level for the batteries. The batteries isn't going to be expensive, as this would scare away some customers when they see that the probe isn't rechargeable.



Ill. 154

8.8 CONCEPT 2.0

View is a concept designed to improve the cooking experience with monitoring and guidance throughout the roasting/baking process.

View is easily mounted on the glass on the oven lid with the included magnets. The camera unit is turned on by the “on” button the back. It can be used with or without the probe and proves a live videostream of the food, directly to the user’s smart device.
The probe is turned on when removed from it’s mount on the side of View and turned back off when inserted into the mount again.
With View you never have to leave your guests to go check on your food or worry about your food getting burned as you always have visibility of your oven, right from your pocket.

Ill. 155

Construction

An understanding of the construction would help with the overall design, as it would put op a boundary of how small the product could be and what the basic shape had to be. To do this the internals were modeled Solidworks and put together. This also helped building everything up in a production friendly manner. The entire inner construction as well as most of the outer construction can be injection molded with the exception of the outer metal parts of both the probe and the camera unit, as well as the probe head which is compression molded.

All the electronic components are standard components and are bought from a third party retailer. A list of all the components, both electrical and mechanical and how they are produced or obtained can be found in the product report.

Choices of plastics:
ABS:
Since there were no particular requirements for the properties of internal mounting plate and the walls of the product ABS was chosen. It is a widely used thermoplastic, which is knows for it's high quality compared to it's price. [plast.dk, 2015]

EPDM rubber:
The Surface touching the glass on the oven front are made from EPDM rubber. This was chosen as it has a more "forgiving" surface than hard plastics. This ensures that the glass on the oven doesn't get scratched. Further more EPDM has a nonslip surface which in combination with the magnets ensures a secure attachment to the oven. EPDM is also very good with heat making it ideal to put op against the hot oven glass. [Aag-gummi.dk, 2016]

LCP:
Because of the heat requirements for the probe LCP was chosen for the head of the probe. This thermoplastic can withstand heat up to 240 degrees [Plastuddannelse.dk, 2016] and cools down faster than a metal head would, as plastic is less heat conductive than metal. The user can thereby touch the probe almost immediately after it comes out of the oven without getting burned.

Price estimate

When calculating the construction price a lot of things had to be taken into account. Payments for materials but also salaries, molds, machine costs, rent of the premises, power consumption, overhead, interest when loaning money etc. Based on the start op production of 5000 units the production costs has been calculated.

Danish production:
If the production is kept in Denmark and the start-up company Tools by SØ have to take a loan for the initial capital the unit price it going to be:
- 229 DKK

Chinese production:
If the production is outsourced to China instead, more precisely Ningxia, still with the same loans then the unit price is going to drop to:
- 150 DKK

The reason it doesn't drop more, is because the main expenses is laying in the electronics inside, however the price difference is still worth taking into account.

Retail price:
The company is earning 200% on each unit when the product is sold to a retailer and the retailer earning is 100% before VAT. This makes the estimated retail price:
- 1125 DKK with production in China
- 1725 DKK with production in Denmark

When outsourcing the production the price is a lot more as expected and this is how the production is going to be.

Break even analysis:
A break even analysis was made based on the first 5 years, to see when the product could start to generate profit. The analysis showed that a profit would start to show after merely two years. The year would end with a profit of 300.000 DKK. After just 3 years the profit would hit 8.4 million DKK, mainly based on the expansion of the market without any extra costs related to the expansion. The details can be found in appendix C11.

PHASE 9.0
OUTRO

This chapter describes the further work needed, a reflection over the process, a conclusion, as well as a reference list and an illustration list.

9.1 CONCLUSION

The process and the concept shall through the conclusion meet the demand of the mission statement, design brief and requirements.

In order to solve the problems that gadget guys had in the kitchen it was through research discovered that they needed the ability to leave the kitchen during the roasting process. Both when having visitors but also just in general. They also needed a better meat thermometer, which was both customizable and where the wire didn't break.

Mission statement

"We want to improve the end user's cooking experience with monitoring and guidance throughout the roasting/baking process"

View solved this problem by providing the user with visual feedback of the food as well as the core temperature. Now the user can see the food right where they are and don't just have to rely on the core temperature. View also solved the problem with the probe-wire, that keeps breaking by providing the user with a completely wireless probe. The probe connects directly to the camera unit via. bluetooth. The camera unit is then connected to the home Wi-Fi making the data reachable in the entire home and not just within a certain radius of the product.

The requirements put up for the product are based on the growing knowledge of the user group, which is developed along the process. Therefore the product meets the need to have requirements but in one case less that the other. E.g. it is only the camera module that is rechargeable, and the probe is not. The product also fulfills the following nice to have requirements: fixed camera focus, three core temperature measure points and measure oven temperature.

9.2 FURTHER WORK

A design process is always subjected to further development. And this project is no different. Even through we made renderings of the product, defined production methods and even set a retail price, the product isn't ready to hit the market just yet. It needs further development and refinement. A list of the potential areas that needs development are listed below.

- Further developing of the battery capacity for the probe or even make it rechargeable. Even though the company would make a lot of money on after sales, it isn't the ideal solution for the consumer.

- The light that already is inside the oven can damage the view from the camera quite a lot, and that is something that needs to be worked on. Further studies is needed, as the only thing tested at the moment are a polarizer, with mixed results.

- The possibility of sound as an indicator for when the food is done. Instead of just a regular alert on the phone, the sound of bacon frying or something similar could start coming from the kitchen.

- The charging as it is now, is done via a standard micro USB, and this isn't the ideal solution. The ideal solution would be charging by the heat coming from the oven, however this would require a very small heat generator. A more feasible way to charge it would be via induction charging.

- Cleaver way to place the mounting magnets on the oven. As it is now, the user have to place the magnets either using their own tools, or by hand, and that can become tricky, and the user might not get the ideal mount for the product, meaning that the product might end up falling down easily.

- There might be a problem with the glued parts in the product, as the glass of the oven still gets almost 70°C, and the heat might force the glued parts to let go of each other. A hook solution might therefore be needed instead.

- Sound needs to be tested as a feedback type to see if this is an all new way to call people to the kitchen.

- As mentioned earlier the product is going to be shaped again towards the exam to get a more visually appealing product.

- The product needs to be presented to the users to see what they think and to get their angle on the further development of the product. This is also something that is going to be done towards the exam.

- Patents were quite an issue and as the probe is made at the moment it probably can't be released in the US, as it might break an upcoming patent. This problem has to be solved with a different solution. In worst case scenario the probe can't use the meat as heat insulator for the components.

- Heat transfer through the probe have to be detailed, as the sensors has to be calibrated before they can give the correct temperatures. The materials surrounding them are going to interfere and that interference has to be accounted for.

9.3 REFLECTION

The project has been challenging in terms of defining the problem as well as finding the right target group. The lack of framing at the beginning of the project made it hard to find the right direction, as it at times became a hit and miss situation. This lead to a lack of precision in the problem definition and target group. There should have been a lot better framing at the beginning of the project to ensure that the group were actually heading in a direction. It is called the fuzzy front end for a reason, but it still need to be controlled a lot more than it had been in this project, and this is done by better framing.

The choices made in the project should have been more user involved. The rating of the different products and tough decisions were only done by the group members and not by the users, which would have given more valid ratings. The only user feedback that the group got on concepts were when the users were interviewed to get the user needs, and they at the same time were shown a very early concept. This also needs to be done with the later concepts and when making hard decisions. In general the users should have been a lot more involved, both to get the feedback on the later concepts, but also to get a deeper understanding of the user group.

Next time a project is this technology driven and technology dependent it is evident to research about the technology a lot more at first to be sure that it is actually possible. Otherwise the project can turn out to be useless. It is important to remember that it is a lot cheaper to fail early in a project than in the final stages.
On combination with the above, a need for quicker validation of the concepts' possibility, with todays technology. This can be done by talking to experts earlier on, instead of keep trying to solve the problem on our own, and in general search more for external help. If this had been done more, the idea of changing the main focus to grill, and having weber as a collaboration partner might have come earlier, and might actually had been doable.
In general searching for external expert help should have been done a lot earlier, instead of wasting valuable hours researching by own hand.

During the project period scrum was used as an organizer of what needed to be done, what was being done, and what was actually done. This worked very well. It gave a clear overview of the project period that the team were in. However the targets on the scrum board were at times too large and too hard to keep track of. Next time some goals should be divided into smaller goals.
Next to the scrum board a Gant chart should also have been used to keep track of the project overall. Instead a regular timeline were used, which became a bit unclear at times and made it a bit hard to follow.

Using the group room to show the project to students outside the group worked quite well. The things that were on the walls were relevant and reflected the stage of the project very well, making it fairly easy to explain how far in the process the group were.

The decision making in the group were at times not existing, because no one were confident enough about which decision were the right one. Again here it would make sense to search for external help, either in other students, experts, the user group or the supervisor.

The skill level in the group were too alike meaning that a lot of competences were overlapping and that some of the competences needed in the group, were absence.

The process tracker in the beginning of the report is made to give the outside spectator an overview of the process, and not how the actual process has been. It is set up to make sense to the outside viewer. The actual process were a bit more messy, as we didn't dive enough into the target group to begin with. This meant, that we didn't get an understanding of their needs, until a second dive were taken into the user group. That in combination with the earlier mentioned problem with validation of the technology necessary for the product to

work, lead to a project that changed direction back and forth quite a lot. From the product being inside the oven to outside the oven to inside to finally outside again. We found out, that the insulation needed for the product to work didn't existed with todays technology. Throughout the process whenever the team discovered a new insulation material that looked like it would work it didn't get investigated far enough, to see if it actually worked. The team just assumed that it would work. This lead to the final decision about staying outside the oven, being taken very late in the process.

Concept reflection

The batteries in the probe only lasts about 25 hours and isn't rechargeable which isn't the ideal solution. However batteries is something that's researched and developed a lot. There is a solution out there because MEATER is coming with it in a few months and they have it. We just haven't been able to find it, even though we talked to engineers and experts about it.

The production were weighted over the visual appeal of the product, which can be discussed if it was the right decision. This were again decided because of the lack of time and overview towards the end of the project. A detailed Gant chart could have solved this problem, if not completely, then at least have improved the planning a lot.

The magnets detailed for the camera unit might not be strong enough for when someone is opening the oven door vigorously. This can result in the camera unit falling of the door and breaking. Some stronger magnets might solve this.

9.4 REFERENCES AND ILLUSTRATIONS

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Illustrations

Intro
Ill. 1 - 4 - Own illustration

Research 1.0
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AALBORG UNIVERSITY

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VIEW BY SØ

APPENDIX

MSc04 - Industrial Design
Aalborg University - May 2016

Team 5
Mads Peter Hilligsøe
Jon Søgaard

0.5 CONTENTS

The appendix consists of the different worksheets and technical drawings from the project. The numbering starts with the appendix letter and ends with a counting number.

Project title View by SØ		
Title: Online Questionnaire		Date: 08.02.2016
Activity: Questionnaire analysis	Worksheet no.: A1	Responsible: Jon Søgaard

Objective:

The objective here, was to validate the assumed problems, that people don't like to cook, and aren't good at dosing, in the kitchen, and find out, if there were other problems, and if it differed depending on gender and age.

Experiment/data:

Using Google forms, we made an online questionnaire, where people were divided into groups depending on age and gender. The questions were made as multiple choice questions, and were:

How often do you cook by yourself?
1 time a week, 2-3 times a week, 4-5 times a week, 6-7 times a week, never, Other.

How much time do you usually spend on cooking?
Under 15 minutes, 15-30 minutes, 30 min - 1 hour, 2-3 hours, 3-5 hours, Other.

How many hotplates do you usually use while cooking?
1, 2-3, 4, Other.

How difficult is it to dose (ml & grams) correctly in a pot?
Very hard, hard, medium, easy, very easy.

Are you very precise, when dosing ingredients?
I prefer to use measuring tools, I prefer to measure by eye, both.

Do you find it easy/hard to prepare meat to a specific condition?
Very hard, hard, medium, easy, very easy.

What kind of tool do you use while following a recipe?
Cookingbook, tablet, smartphone, calling for help.

How many people do you usually cook for?
1, 2-3, 4+

What is your level of enthusiasm while cooking?
Master Chef, I like cooking but I'm not an enthusiast, neutral, It's just something that I need to do, I hate being in the kitchen, Other.

How important do you find the presentation of your food on the dinner table?
Very important (I use a lot of bowls), Important, Neutral, Not important, Don't care (I eat directly from the pan)

Do you use any of the following helping aids in the kitchen?
Steam cooker, Vacuum,packed boiling, Crock pot, Actifry, Soup-maker, Bread machine, Raclette grill, Smart oven, No, Other.

Project title View by SØ		
Title: Online Questionnaire		Date: 08.02.2016
Activity: Questionnaire analysis	Worksheet no.: A1	Responsible: Jon Søgaard

How much time do you usually spend on washing the dishes?
5-10 minutes, 10-20 minutes, 20-30 minutes, 30-60 minutes, I have a dishwasher.

Are you using any of the following services?
Nemlig.com/Osuma.dk or similar, Aarstiderne, JustEat.dk/Hungry.dk, Other.

Do you experience any of the following problems, during your cooking time?

206 people answered the questionnaire, and we afterwards analyzed the results. Some of the major findings we made through this survey were, that percentage wise, twice as many females, compared to males, find it hard to prepare meat to a specific condition. One thing, that we weren't expecting, was that people in general like cooking. Meaning, that making a completely automatic solution, would be taking the joy completely away, which we wont do. Because of this, we chose to delimit us from this direction, to maintain this part.

The final question was very open, and gave us an insight in peoples struggles in the kitchen. On the next few pages, you can see the final answer in all of the categories.

Male 18-25

Do you experience any specific problems during your cooking time?

ongoing cleaning
when you only have one oven and you need to Cook 2 different things with 2 different temperatur you need to cook one of the things
Messy kitchen/not enough space.
things with the wrong temperature.
managing the waste
no
My room for working is too small, we lack specific tools e.g. blender, vegetable knife, mixer etc. and our oven isn't that good.
No

Male 26-30

Do you experience any specific problems during your cooking time?

Unspeficied question - don't know what to answer.
Coordinating when to do what. When to start boiling the patatos when you also have to fry a steak and make a sauce. The timing in it
I never know how seasoned people like their food. How many spices. How hot.
Nope
That it may take longer than expected and that it is hard to due other stuff
No
The timing in it. What to make from what you have in the fridge. What dish can I make from what currently in my fridge.

Male 31-40

Do you experience any specific problems during your cooking time?

Not really, besides having to stay at the kitchen and watch out for the food not getting burn.
Phone with recipe shuts off. If I don't go in and turn off standby shut off function

Male 40+

Do you experience any specific problems during your cooking time?

No

Project title View by SØ		
Title: Online Questionnaire		Date: 08.02.2016
Activity: Questionnaire analysis	Worksheet no.: A1	Responsible: Jon Søgaard

Female 18-25

Do you experience any specific problems during your cooking time?

Sometimes I forget pans/pots on the stove and burn the food
Burning myself while using the oven..
Never know how much salt to put
Sometimes I overcook the chicken just in case, cause I don't want it raw
No.
A lack of table space in the kitchen
I burn food a lot because the water vaporises
My kitchen is extremely small, so I don't have enough room to work in.
NOT really
No
Stress because of having to make often both potatoes, meet and salad. Especially if more of these things are to be made on the stove.
For lidt bordplads
Yes. The time that I have to cook the food (recipes)for doesn't match up to my reality
To mand tools made im same intention. Great tools like for example Normann Copenhagen are too expensive, why i end up with a lot of sh
a lot of shitty tool All with the same intention. Need some multifunctional stuff

Female 26-30

Do you experience any specific problems during your cooking time?

Just the issue of cleaning :p
Brænder altid ris og pasta på
No
no
No

Project title View by SØ			
Title: Online Questionnaire		Date: 08.02.2016	TOOLS BY SØ
Activity: Questionnaire analysis	Worksheet no.: A1	Responsible: Jon Søgaard	

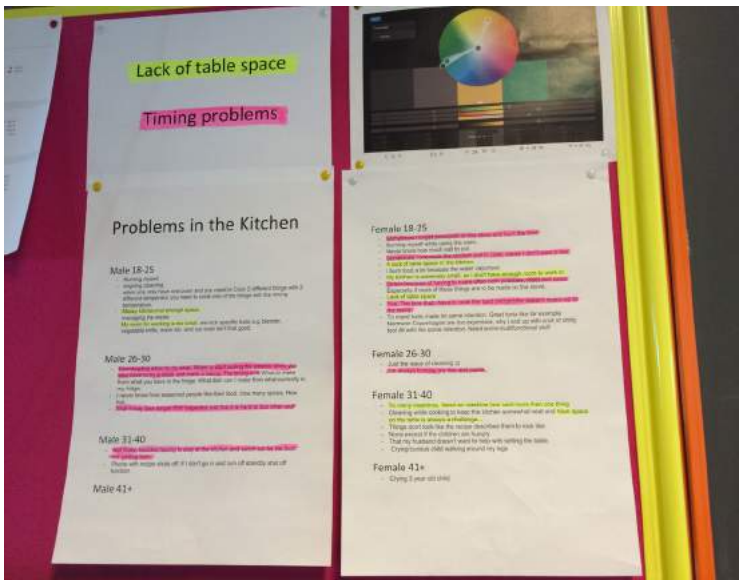
Female 31-40

Do you experience any specific problems during your cooking time?
To meny mashines. Need an mashine how cant more than one thing
Cleaning while cooking to keep the kitchen somewhat neat and have space on the table is always a challenge...
Things don't look like the recipe describes them to look like
Meget bredt spørgsmål! Hvilke slags problemer? Og med hvad? Udstyr, proces, råvarer, opskrifter, ...??
None except if the children are hungry
at manden ikke gider hjælpe med borddækningen
Crying/curious child walking around my legs

Female 40+

Do you experience any specific problems during your cooking time?
Skrigende 3-årig :)
nope :)
No

These answers were divided into categories; Burning stuff, Lack of table space, Dosing, Using more kitchen aids at once, Timing, Cleaning, Diverse. The two biggest categories were by far the timing and lack of table space categories.



All illustrations are own illustrations.

Evaluation

The assumed problem, didn't quite match the results we got, but we got some insights, and found some other problems in the kitchen. Because of the amount of people participating, and the broad age groups, we consider the results valid.

Reflection

People had more problems regarding table space and timing. This we can use, to further narrow down our direction.

Project title View by SØ		
Title: Interview with tupperware consultant		Date: 11.02.16
Activity: Interview	Worksheet no.: A2	Responsible: Mads Peter Hilligsøe

Objective:

The intention of this interview is to stage the popular products from tupperware. Why are these products so popular and in which scale are they helping the user to an easier kitchen experience.

Experiment/data:

Underneath do you find some of the most selling products in Tupperwares product catalog. Each product has a small cleaver thing that make their version just a bit better than there competitors. Besides the clever aspect Tupperware supports their product with a lifetime guaranty and as sales consultant is this a huge selling point.

EcoPure [1]

Silicone baking equipment [2]

A simple thing like the water bottle is a big seller, the simplicity of a bottle that can last a lifetime and at the same time is tolerate for the dishwasher, makes a simple product appealing for the costumer. The clever thing about this bottle is the cap, which allows people dealing with hand hassle to use the product. This is done by enlarging the cap and adding a small flap for grasping.

The silicon baking equipment is also tolerable for the dishwasher. Besides that all the forms are able to go into the oven including the plate on where you are kneading the dough.

Project title View by SØ		
Title: Interview with tupperware consultant		Date: 11.02.16
Activity: Interview	Worksheet no.: A2	Responsible: Mads Peter Hilligsøe

Many of the products has a small mechanical function, a function that may not seem like a big thing but in the situation is really time saving. Underneath do you find a product called speedy chef ii. A product that can make whipped cream faster than the usual methods.

In the middle we have the MicroGourmet, which is a product design for preparing food in the micro-oven. It is building on a steaming concept where the bottom part is filled with water and as you turn on the micro-oven the water evaporates and by that steaming the meal.

To the right we find the VentSmart which is a storage solution for your vegetables and fruit. The clever thing about this product is the ventilation system, which actually just is a valve that allows different amounts of air to pass into the box and thereby keep the goods at the right oxidation level. Besides that the bottom is formed in such way that the goods aren't touching the condensed liquid.

Speedy chef ii [3]

MicroGourmet [4]

VentSmart [5]

Illustration sources:
[1-5] http://tupperware.ipapercms.dk/Tupperware/SouthAfrica/2016/TupperwareCatalogue20161stEd/

Evaluation

The fact that the products are really resistant and all have a lifetime guaranty makes them really valuable for the customer. Small functions such as the cap and the valve is the thing that divides them form their competitors.

Reflection

If the solution has to be low-practice and it shouldn't blend in with the tons of cheap and unknown kitchen equipment that's on the market, it should build on good basic values.

Project title View by SØ		
Title: Interview with Claus Fuglsang		Date: 07.03.16
Activity: Interview	Worksheet no.: A3	Responsible: Mads Peter Hilligsøe

Objective:

The objective with the interview was, to get expert knowledge in the field of smart full house electrical solutions.

Experiment/data:

The interview took place at Fredericiagade 10 9000 Aalborg on the 7th of marts. 2016.
The questions we asked, as well as the answers can be found below:

What is your education?

- Electrician and are currently studding service engineering

How old are you?

- I'm 26 years old

What is your experience with smart homes?

- There are a lot of different Solutions on this field and different systems. All of them are trying to make the house more cleaver and in that way more independent.
- The ideal solution is to establish a network of information; what is the level of the milk in the refrigerator, what am I missing to make a specific dish. When should the coffee brewer start to fit the users morning routines? When must the windows automatically open to get a fresh indoor climate?
- The informations will be send through the wires to the electrical network in the home

Can you name a specific system?

- Carlo Gavazzi, an Italian smart home system with two different inputs. One for the normal power and one for the data.

Do you often see houses with an intelligent electricity network (smart home)?

- It is quite common to see intelligent homes these days. I believe that it is because of the price difference between an intelligent system versus a normal system isn't that big, and when building new houses and renovating the owners wants the newest and smartest to maintain a high value of their house (approximately. 25.000 DKK for a smart system)

- The users interaction has become more intuitive when dealing whit intelligent smart installations. So now is it quite normal for a non gadget family to use the system.

What is the primarily use of a smart system (what can it control)?

- Provide the user with relevant informations about the status of the house.
- Light/heat sensor regulations of the indoor climate is quite common to use in combination with the smart system. Mainly everything you are doing physically with you house when you are coming home from work.

Project title View by SØ		
Title: Interview with Claus Fuglsang		Date: 07.03.16
Activity: Interview	Worksheet no.: A3	Responsible: Mads Peter Hilligsøe

Is there any product on the market where the data cable is in use?

- Some smart ovens use the data cable to remote control the temperature on the oven, normally through an app.
- Some refrigerator concepts are also using the data cable for ordering food and providing the user with a shopping list.

Is there any specific thing you would like to control in your kitchen with such system?

- I would love to control my toaster. In that way i could time it to my morning routines.
- It is needed to control the process with a smart device.

Do you have any specific problems in the kitchen?

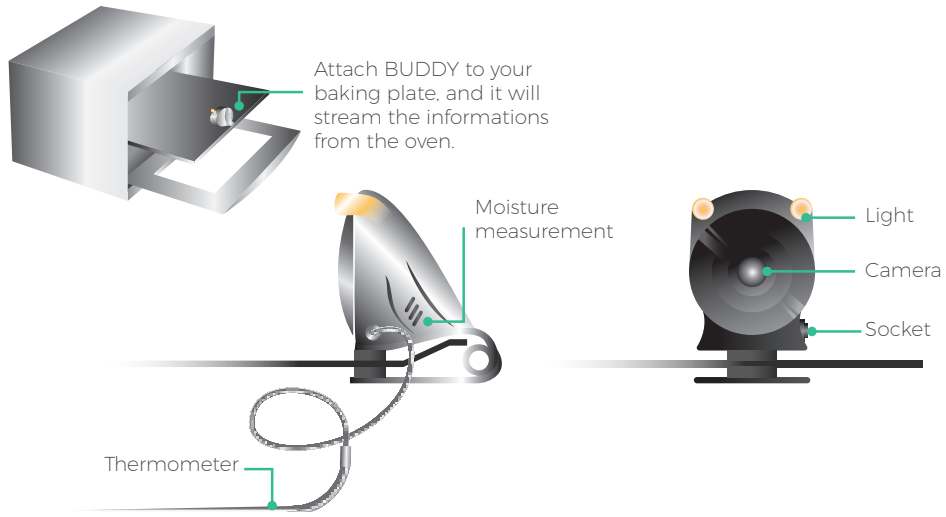
- Lack of table space. I like when things are hidden away and when needed pops up from the cooking top.

Any idea for a future kitchen gadget?

- It would be nice to video stream the cooking top from the extractor hood, so I don't need to worry about the food when leaving the kitchen.

Answer from Jon: that is actually one of our concepts at this moment.

The buddy concept was then showed to Claus.



- Thats a great idea to video stream directly from the oven, that would free up time for many people. I could imagine a gadget guy checking the roast on his smart watch.

- The two biggest problem areas related to cooking as I see it, are the pot/pan and ovens.
- It is most common to burn food on those to things.
- I would love to have this kind of product installed in my oven, if that means that I can get my informations on my TV or smart device.

Project title View by SØ			
Title: Interview with Claus Fuglsang		Date: 07.03.16	
Activity: Interview	Worksheet no.: A3	Responsible: Mads Peter Hilligsøe	

- It might by useful to stream the different information to a screen located in the kitchen, maybe the whole wall?

According to intelligent smart homes, do you the see a progress among the new functions?

- Not really, The providers of the different systems are not willing to make a open source platform.

- IHC is a Danish provider of intelligent smart homes systems, You will find them in most modern houses in Denmark. They includes features such as, wireless remote for the light, connection with your Bang&Olufasen speaker system and many more.

- Zen Home is a easy way to drag information out of your house, when ever it is information about your electricity or heat.

- KNX is currently the best solutions on the market and at the same time is it also the most expensive one. It is a platform where it is free for every supplier to add new functions/products. It is possible to control much more with KNX than a normal smart home. KNX is just a platform, so it is not actually a product. KNX is building on different function modules, which means that you can keep adding functions.

All illustrations are own illustrations.

Evaluation

It seams like Claus has a good understanding of the market and we find the information valid.

Reflection

Most modern homes have some kind of smart installations or is prepared for it. KNX is the most usable solution for an open source solution.

Project title View by SØ		
Title: Interview with Hans Christian Westergaard		Date: 09.03.2016
Activity: Phone Interview	Worksheet no.: A4	Responsible: Mads Peter Hilligsøe

Objective:

The objective with the interview, were to get an understanding of our potential end user, and to get some feedback from a person with expert knowledge on the smart installation market.

Experiment/data:

What is your education?

- Electrician

How old are you?

- 23 years old.

Are you interested in gadgets in general?

- Yes

What areas are you most interested in? (Kitchen, house control (hue, nest), cleaning, tracking, etc.)

- House control, Smart installation also known as smart house.
  I can control different things with my smart installation: light, sound, air, heat, picture, inter net. It is possible to control with both smart devices and computer.
- Smart installations is all about making the house cleaver.

What products do you own?

- I own a sauce tosser and a nicer dicer

Is there anything in the house you would like to control which is not possible at the present time?

- Home appliances such as dishwashers, coffee brewer and stuff like that. I would like the appliances to be more convenient and informative. Do I need to buy milk and eggs e.g..

Are you familiar with iDevices? (Do you own any of their products?)

- I know it, I would like to own one of their meat thermometers.

On a scale from 1 - 10, how much do you care about having the newest and smartest? (1 is "I don't care" and 10 is "I absolutely have to have it!")

- 8

Where do you buy your products (Online or in a store)?

- Both Online and in the physical stores

Are there any of your products, that you feel have been a waste of money (Something that you haven't really used)?

- No

Is there an area in the kitchen, where you feel, that you need a product?

- Not really, but it would be nice to just press a button and thereby present the kitchen tools.

Project title View by SØ			
Title: Interview with Hans Christian Westergaard		Date: 09.03.2016	
Activity: Phone Interview	Worksheet no.: A4	Responsible: Mads Peter Hilligsøe	

What is your least favorite task in the kitchen?
- Cleaning the dishes.

At the end we talked about the buddy concept and the purpose of the product. Hans Christian thought that it was the same as having a smart oven with a perfect cook program. And the product might be a outdated already. But after telling the aim of taking the smart functions from the oven and placing them in a single product the use and coast of the function would be at a more realistic level, than spending 20.000DKK on a new oven with those functions, and Hans Christian agreed.

Hans Christian told us that there is a control unit witch can handle up to 16 amperes. A unit that can be placed between the power outlet and the product. The unit can be set to switch on/off from a smart device. In that way can you take a old product a turn into some kind of smart device, e.g. a coffee brewer, which is switching on in the morning.

Evaluation

Hans Christian is a typical electrician with a huge interest in smart installations. Unfortunately is he not really in the kitchen.

Reflection

This type of guy wants control and informations for the things he are using daily. Especially when it comes to control of his house.

Project title View by SØ			
Title: Interview of Mathias Lassen (Brühlmann)		Date: 18.02.2016	
Activity: Interview	Worksheet no.: A5	Responsible: Jon Søgaard	

Objective:

The objective with the interview was, to get the professional kitchen angle on the project, and to find out, what kind of problems, that they had.

Experiment/data:

We had prepared some questions for Mathias, who work at Bühlmann Hotel og Gastronomi. We then afterwards got a guided tour of their kitchen. The questions we asked, as well as the answers can be found below:

What is your position in the company?

- I'm the F&B manager on a conceptual stage, meaning, that I'm not just manager at this hotel, but also at a lot of other places as well.

What is your education?

- I am educated Chef, and have then worked my way up through the system.

How old are you?

- I'm 24 years old

For how long have you been in the company?

- I started in this position February 1st, and before that I only stood for one of the departments.

What is your most used tool in the kitchen?

- We use A LOT of machines, especially blenders and ovens.

Is there anything, that you find especially annoying?

- Of course it is annoying, when the machines don't work, but when you are frying something, at all of a sudden, it sticks to the pan. This is very annoying, because you ruin, not only the food, but sometimes the pan as well. And a pan is almost a 1000,- DKK. You have to remember, that we use our pans a lot more, that any private person would. We also use gas, which is very rough on the pans, compared to induction and ceramic.

Have you experienced any problems with the tools you are using?

- A specific problem with the pots and pans, is the handles. They keep falling off, usually within the first year. This is as shame, as the pots and pans them self, can last "forever".

Do your dished require a very specific temperature, before serving?

- Yes, we are following certain food-related rules. E.g. when we cook minced meat, the temperature has to be 75 degrees, to make sure, that all the bacterias are gone. Regarding how to cook the meat, to the desired core temperature, the smart ovens that you can buy today, can do that.

Project title View by SØ		
Title: Interview of Mathias Lassen (Brühlmann)		Date: 18.02.2016
Activity: Interview	Worksheet no.: A5	Responsible: Jon Søgaard

Are you using any special seasoning in your dished? (e.g. liquid nitrogen?) And are these easy to handle?

- Yes, we are using dry ice. Because it is so cold, and because of all the steam, it can help us to increase the nuances in e.g. fir as we are actually using at the moment. We are also using nitrous, to get some things more airy. You aren't using this as a private user, because of the cost. The machine used to make ice more airy, costs 40.000,- DKK.

How are you dosing? Are you doing it using measurement tools, or by eye?

- Over at Viktors in Nørresundby, we are using a lot of measuring tools, but we are using spoons, like the ones you use, when you mix your own candy at stores. This might not be the optimal solution, but it is the best solution on the market right now.
  Are we cooling for an entire party, then we use measuring tools, but if we are cooking for someone who is out for dinner, then we do it by eye.
  It is important to us, that if we have to cook for at lot of people, then we measure the precise amount needed, because if we just measure by eye, we easily use 10% too much, and if we do that each time, we end up using 10% more money on the ingredients.

Do you have any trouble with storage, regarding your pots and pans?

- We have plenty of space out here, but other places, they suffer from lack of space. Pots are a mess to stack, and they will always be tilting etc.

Mathias also asked about our thoughts on a product, and were in general very positive, but he also stated, that he thought, that the product should be more for the private kitchen, and not the professional.

We afterwards saw the kitchen. but weren't allowed to take photos. But en general it was a very standard restaurant kitchen, but with some additional machines, to make the food taste even better.

Evaluation

In general, the meeting was very enlightening, and we learned a lot of things about the professional kitchen, just like we expected.

Reflection

We got to learn, what issues they had in a professional kitchen, and can definitely use it further on. Keywords here are, handles break, storage problems and expensive machines.

Project title View by SØ		
Title: Interview with chef at "Hos Boldt"		Date: 25.02.2016
Activity: Interview	Worksheet no.: A6	Responsible: Jon Søgaard

Objective:

The objective with this interview was, to get a second professional angle on the project, to find out, what problems that they have.

Experiment/data:

We had prepared some questions for one of the chefs, who worked at Hos Boldt. We don't mention his name, as we wished to be anonymous. We then afterwards got a guided tour of their kitchen. The questions we asked, as well as the answers can be found below:

What is your position in the company?

-

What is your education?

- Waiter and Chef

How old are you?

- I'm 59 years old

For how long have you been in the company?

- I've been in the company for 24 years

What is your most used tool in the kitchen?

- Knives, grill and oven

Is there anything, that you find especially annoying?

- No

Have you experienced any problems with the tools you are using?

- No. Things can break, but that it what happens. After 24 years, I know how to use the things.

Do your dished require a very specific temperature, before serving?

- Only the normal 200°C

Are you using any special seasoning in your dished? (e.g. liquid nitrogen?) And are these easy to handle?

- Only seldom, and if so, then we use tonnelets.

How are you dosing? Are you doing it using measurement tools, or by eye?

- If it is something completely new, them we use a recipe, otherwise we just measure by eye. It the students are making old fashioned dishes for bigger parties, then they have to use a recipe.

Do you have any trouble with storage, regarding your pots and pans?

- No, not at all.

Project title View by SØ		
Title: Interview with chef at "Hos Boldt"		Date: 25.02.2016
Activity: Interview	Worksheet no.: A6	Responsible: Jon Søgaard

We then afterwards got a tour in the kitchen, where we got to take a few photos.

To the right is the oven used for cooking. Everything is set with a timer, even when cooking a steak on a pan, on the oven, you can see, where they put on the stickers, when they put something in.

Below the storage of pots and pans can be seen. This is underneath tables and cooking hobs.

To the right is respectively the kitchen table with, according to the chef, "plenty of space", as well as a mixer.

Project title View by SØ		
Title: Interview with chef at "Hos Boldt"		Date: 25.02.2016
Activity: Interview	Worksheet no.: A6	Responsible: Jon Søgaard

Above are the cooking hubs. They work perfectly and are 20 years old, which is very rare in the industry.

We didn't god much use of the interview, besides that in this field, experience is very important.

All illustrations are own illustrations.

Evaluation

Reflection

Project title View by SØ		
Title: Jakob Kondrup (Gadget guy)		Date: 09.03.2016
Activity: Interview	Worksheet no.: A7	Responsible: Mads Peter Hilligsøe

Objective:

The objective with the interview, were to get an understanding of our potential end user, and to get some feedback on our concept.

Experiment/data:

Name and age?

- Jakob Kondrup Sørensen and I am 24 years old.

What are your studding?

- I'm studying building and structure

Are you interested in gadgets in general?

- Yes

What areas are you most interested in? (Kitchen, house control (hue, nest), cleaning, tracking, etc.)

- Bicycles and cooking, plus electronics in general: phones, computers and so on

What kind of products do you own?

- 4 different types of bicycles, Sous Vide, expensive cooking knifes, molecular gastronomy combined with chemistry, e.g. make caviar with bacon flavor. It is common for me to use 3-4 hours in the kitchen. Cooking is one of my major hobby's.

Do some of your some of your products small practical details?

- The most important thing for me is that it is something that can withstand the use.

Do all of them function properly?

- It is irritating when my cooking-top with touch buttons are wet. When that happens it is not always possible to use the buttons. Lack of table space.

How big are your kitchen?

- Approximating 20m^2, it is important for my to have space for all my tools. As it is now do I not have enough space. E.g. my Sous Vide are placed in my bedroom.

How do you like the visual appeal of the products? Do they fit into a private/your kitchen?

- I like the industrial look, because it is often related to a product that can withstand a huge amount of use. E.g. when I was looking at mixer, I could easily have chosen the kitchenAid version because of the nice design but based on my use that version would not be enough and a more powerful version was found more suited. I ended up choosing the Kenwood version because of the motor power.
  When taste, quality and design achieves a higher level, then the product really interests for me. If that is the case then I'm willing to pay more than normal.

Project title View by SØ			
Title: Jakob Kondrup (Gadget guy)		Date: 09.03.2016	
Activity: Interview	Worksheet no.: A7	Responsible: Mads Peter Hilligsøe	

If your disposable income were bigger, are there any products that you would buy?

- A smoker machine, to give the food extra flavor. My biggest dream is to design my own kitchen based on my needs. Needs like, a drawer for my mixer, oven in eye hight, electric power outlet at the right spot, etc.
- All in all make it easier to use the kitchen and make sure that every bigger product has its own power outlet in the cabinets.

What kind of meat thermometer do you use?

- I use a simple one, a probe with a screen at the end. I used to have Weber and a OBH nordica version, but the wires kept breaking when I used them in my oven or in my grill.
- There is no warranty on the cable.
- It is really important that the meat thermometer is wireless, which means that I can follow the process for my living room when slow roasting a roast.

Do you know the meat thermometer called MEATER?

- No, but it looks like something I could use. Besides using the thermometer in the meat is it also important for my that I can use it when boiling something.
- On the picture on MEATERs webpage have they placed the meat thermometer in a wrong position. By placing the probe in the end of the meat all the slices have a hole in them.
- I need to have 2 decimals when checking the temperature.
That is needed when working with sous vide at my point.

Are any of your products linked to your smart device? (Phone or tablet)

- Non at this point. At this movement I'm looking at a Sous Vide (steba SV100) with controllable settings through a smart device.
- The sous vide have prefixed recipes. E.g. I want to make a chicken, it has this weight and I want it to be in this condition when done. It also alerts the user when done.

Are you familiar with iDevices? (Do you own any of their products?)

- I am familiar with the iGrill.

What is your opinion about having the informations directly on the product or something you would find through an app?

-I like to have the informations with me, like in an app when I am doing something away from the oven at the same time. I like when the products inform me when my goal is reached.
- When making food for my guest I'm aiming for having the food ready at a specific time. Thereby not using extra time in the kitchen when I could talk to my guests.
-That is actually one of my biggest problems in the kitchen. I really don't want to be caught in the kitchen when having guests.
- When having company and making more than one dish I prefer to stay with my guests rather than going back and forward from the kitchen to check the thing I have in the oven.
-Something i really like about the Sous Vide is that the unit controls itself and are always at a specific temperature.

- Along with the preset temperatures I need manual control settings to determine a specific temperature.
- The app needs to store my temperature settings so I can use them another time. This could be in combination with a picture of the food and the weight.
- If the product could time the done stage to a specific time it would ease some of the planing when have guests.

Jon then said that it might be a problem when storing meat outside the refrigerator for longer periods of time to fit the schedule.

Jakob then said:

- It is not a problem with meat. Because you normally want it to reach room temperature before cooking, and that actually takes a couple of hours.

Do you stick to a specific brand?

- I choose the best product within the category.

Do you feel obligated to/drawn towards buying a product, if one of your friends have it?

- When taking cooking products no, I am the trend-setter among my friends.

On a scale from 1 - 10, how much do you care about having the newest and smartest? (1 is "I don't care" and 10 is "I absolutely have to have it!")

- 8

Where is your limit, regarding price (Specific to kitchen tools)?

- Maximum 3.000 DKK, When I am done studying I think I would be willing to pay half a million for a new kitchen.

Where do you buy your products (Online or in a store)?

- 50/50, At the cheapest shop.

Are there any of your products, that you feel have been a waste of money (Something that you haven't really used)?

- Not rally

Is there an area in the kitchen, where you feel, that you need a product?

- More space in the kitchen.

What are your biggest problems, when you have to start cooking, if you can't use your gadgets?

- Something that can clean the kitchen after use.

What is the most time consuming task in the kitchen?

- Making a lot of small dishes, and chopping the vegetables.
- I love to make food but sometimes I just want to talk to my guests and don't need

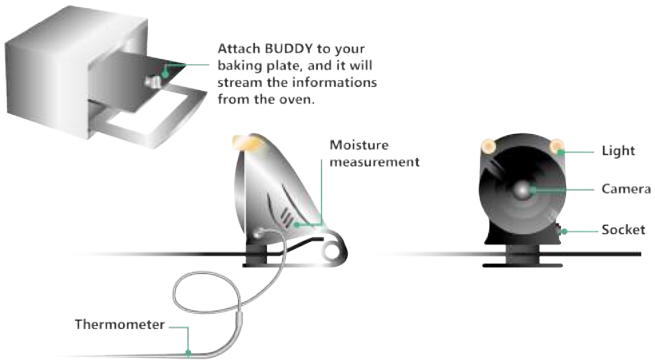
to worry about the status of the food I am making.

- I love to make food but sometimes when having a party I just want to stay with the rest of the group.

What is your least favorite task in the kitchen?

- Doing the dishes.

The first BUDDY concept was then showed to Jakob, to observe his thoughts about the overall idea.



Do you think you could use a product like that?

- If a sensor to determine the surface status was placed in the product it could then alert the user, as it often is a problem in the oven that things get burned. I think it would have market potential if that kind of sensor was included.
- You often forget food in the oven, and thereby burn it.
- I think your target group are busy families with children, because they need to entertain their children under with the cooking process.
- Families that use food service such as Årstiderne and Guldsmedgaard
- If you could make the kitchen more intelligent than it is now you would have a winner.

We afterwards talked a bit about the future kitchen, mostly based on the way to hide away cabinets and electronics.

The last thing we talked about were if it was possible or not to make a camera inside the oven. Jakob suggested that we could make our own oven front including a camera.
The idea was to place the components on the first layer of the glass and then the camera unit on the last layer.

We concluded that it was not possible to make a solution that would fit every one with this replacement of front door, and the idea where thereby skipped.

Another idea was to place the product between the to layers of glass by unscrewing the glass, and

Project title View by SØ			
Title: Jakob Kondrup (Gadget guy)		Date: 09.03.2016	
Activity: Interview	Worksheet no.: A7	Responsible: Mads Peter Hilligsøe	

thereby making it possible to place the camera between the two layers. Sadly not all oven have easily removable glass, and thereby a solution like this would be impossible to fit on all oven types.

The placement of the buddy concept is also a bit problematic because it would take some of the cooking space inside the oven.

The camera would also be really useful in a refrigerator.

General monitoring in the kitchen as the main focus. The placement the units could be: Oven, Refrigerator, Cooking top, freezer.

All illustrations are own illustrations

Evaluation

Based on the feedback further ideation on the camera concept is needed.

Reflection

Jakob has a huge interest in kitchen gadgets and have given us the perspective from a dedicated amateur chef's point of view.

Project title View by SØ		
Title: Interview with Joachim Ankerstjerne		Date: 10.03.2016
Activity: Skype Interview	Worksheet no.: A8	Responsible: Jon Søgaard

Objective:

The objective with the interview, were to get an understanding of our potential end user, and to get some feedback on our concept.

Experiment/data:

It is okay, if we record you?

- Sure

What is your education?

- I'm studying Kant. merc. and I'm writing my master thesis now, just like you.

How old are you?

- 25 years old.

Are you interested in gadgets in general?

- Yes, electronic gadgets. It has almost been too much, when it comes to the kitchenware.

What areas are you most interested in? (Kitchen, house control (hue, nest), cleaning, tracking, etc.)

- Kitchen gadgets, but also gadgets like computers, TV, etc.

What products do you own?

- Sous vide (a home made one), just bought the Anova, Shun Premier kniv (Japansk kok-kekniv, steamer, microplane, gas grill, charcoal grill, Modernest cuisine cooking book (A list of all you need in your kitchen),

Are some of them for kitchen use (Cooking)?

- (All the above)

How do they work?

-

De they function properly?

- I just bought the Anova, but I have to switch out some of the other ones, when I'm done with my studies.

How do you like the visual appeal of the products? Do they fit into a private/your kitchen?

- I like the looks of the Anova, as some of the sous vide sets, looks like chemical sets.

If your disposable income were bigger, are there any products that you would buy?

- Yes, but I need a bigger apartment first ;) Anyway, I want the Quooker (boiling water directly from the tap), Cooler (Cold water, and sparkling water, directly from the tap), A mixer from the brand Teddy (KitchenAid doesn't work), more knives, two ovens (One for

slow cooking, and one for faster cooking), Induction cooking hubs with no "zones". I also want an intelligent fridge.

What kind of meat thermometer do you use?

- I have four. One thing I find annoying in the Danish ones are, that the temperature is preset in temperature even brands like Veber. The danish house wife apparently needs one, that just says meat done, when she looks at it, and not the degrees... I have on for the oven, one for my fryer, one simple one for meat and water, and an old one, that I don't really use, since I bought the new ones.

Are any of your products linked to your smart device? (Phone or tablet)

- The Anova is bluetooth connected. The Anova has the ability to start a timer itself, when it reaches a certain temperature, which I find very fascinating. I can't pre-program it though, so I can't tell it to start at 9am, and then it start by itself, I have to start it myself.

Are you familiar with iDevices? (Do you own any of their products?)

- I know it, but I am actually vary anti apple.

Do you stick to a specific brand?

- No, I just buy the best one. If I buy pans, I buy one brand, and if I buy knives, I buy I different one.

Do you feel obligated to/drawn towards buying a product, if one of your friends have it?

- Very much, but usually it is the other way around.

On a scale from 1 - 10, how much do you care about having the newest and smartest? (1 is "I don't care" and 10 is "I absolutely have to have it!")

- 9, and I have to do without it, until I make some more money.

Where is your limit, regarding price (Specific to kitchen tools)?

- I on SU, and even now some people think, that I spend to much money on it. I would say, that right now my limit is about 2300 DKK.

Where do you buy your products (Online or in a store)?

- I buy it online. I have bought a few things at e.g. Imerco, but they sell just as many appliances, and I don't like that. I mainly buy online, because of the prices.

Project title View by SØ		
Title: Interview with Joachim Ankerstjerne		Date: 10.03.2016
Activity: Skype Interview	Worksheet no.: A8	Responsible: Jon Søgaard

Are there any of your products, that you feel have been a waste of money (Something that you haven't really used)?

- I the beginning you usually buy some stuff, where you think that it is going to be just fine, even though it is at a cheap price point, because you don't know any better. So I have a lot of things, that I would like to swap out, where I am thinking; "why didn't I just buy the right one the first time". The things that I feel is a waste of money, have a quality problem.

Is there an area in the kitchen, where you feel, that you need a product?

- I don't have any oven! I'm using our common oven.

What are your biggest problems, when you have to start cooking, if you can't use your gadgets?

-

What is the most time consuming task in the kitchen?

- The entire Christmas dinner.

What is your least favorite task in the kitchen?

- Doing the dishes.

It is possible for us, to see some of your products?

- I can send you some photos, if you want to? I'll do that right away.

We then afterwards got some photos of his kitchenware. The images can be seen below along with explaining text.

Molecular scale

Wilfa ICM-15 ice machine

Smoke gun

Project title View by SØ		
Title: Interview with Joachim Ankerstjerne		Date: 10.03.2016
Activity: Skype Interview	Worksheet no.: A8	Responsible: Jon Søgaard

Shun Premier 20cm

The meat thermometers

Alligator

Mix microplane

Old Suis Vide (home made)

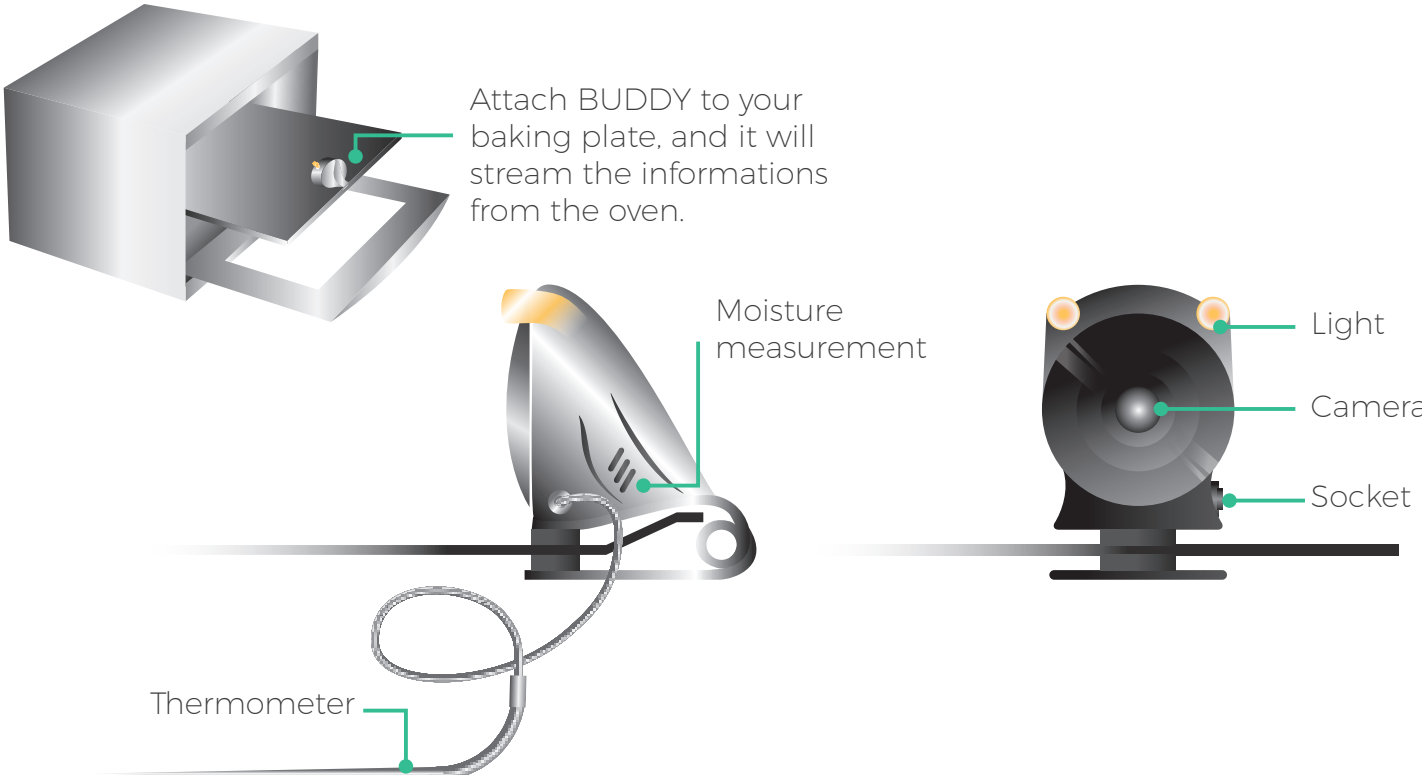
iSi Sifon Gourmet Whip Plus

Anova

Joachim's kitchen

Project title View by SØ		
Title: Interview with Joachim Ankerstjerne		Date: 10.03.2016
Activity: Skype Interview	Worksheet no.: A8	Responsible: Jon Søgaard

We then afterwards showed our concept to Joachim, to get his opinion in the project, and Joachim showed a lot of interest in the concept. The concept we showed him, are the one below, and his responses are as follows:



"I'm sure, that a lot of people will find this interesting, but I wouldn't buy it, as I like to be in the kitchen meanwhile, and like to be a little more in touch with it, and would like a little more customization, than these functions from the smart ovens, usually gives. Appealing to families with children, and families with little free time in their everyday lives, is something, that I absolutely agree on. Because they don't have to learn something completely new, like e.g. the Suis Vide. I believe that the Suis Vide is going to reach a much broader audience eventually, but not at the moment, as it might be too much of a upheaval. This concept is a lot more familiar, and something, that everyone can relate to."

All illustrations are either own illustrations, or pictures from Joachim used with permission.

Evaluation

With the interview we got a good general understanding of one of the end users, as well as some good feedback on our product.

Reflection

We learned, that the price limit were 2300,- which is a lot more than expected. We also learned, that it is a must, for the product to be customizable, as the preset "done stage" not usually is the same as when Joachim thinks it is done.

Project title View by SØ		
Title: Interview with Kristoffer Simonsen		Date: 15.04.2016
Activity: Skype interview	Worksheet no.: A9	Responsible: Jon Søgaard

Objective:

The objective was to get more insight of our target audience, to be able a list of user needs.

Experiment/data:

It is okay, if we record you?

- Of course

What is your education?

- I'm educated Biologist, but I work as an teacher/vice headmaster.

How old are you?

- 36

Are you interested in gadgets in general?

- Yes I am, mostly computers, but also gadgets.

What products do you own?

- An advanced meat thermometer, that has a wireless display, that you can take with you, but it isn't connected to wifi or anything. We also have regular things like a blender and a microwave.

Do you often cook in your oven?

- Yes

Is there anything you feel, that you are missing, when you use the oven?

- It would be nice, if it could tell or show me, if my food were starting to get burned. Maybe something that could keep track of the surface temperature.

At what level is your oven placed?

- The oven is placed on floor level, as it is a regular stove with an oven.

Where is your limit, regarding price (Specific to kitchen tools)?.

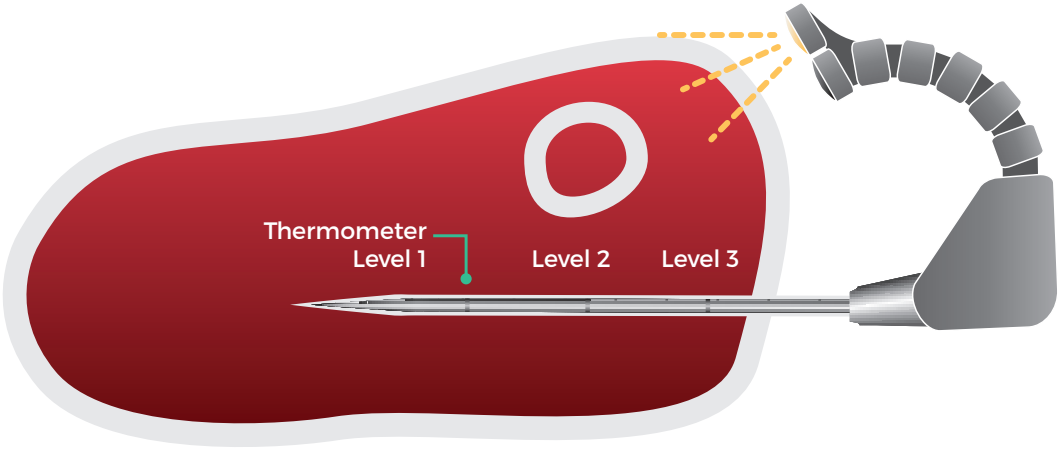
- A stove would be 5-6000 DKK, but if it is something that you put into the oven, I would say 300DKK.

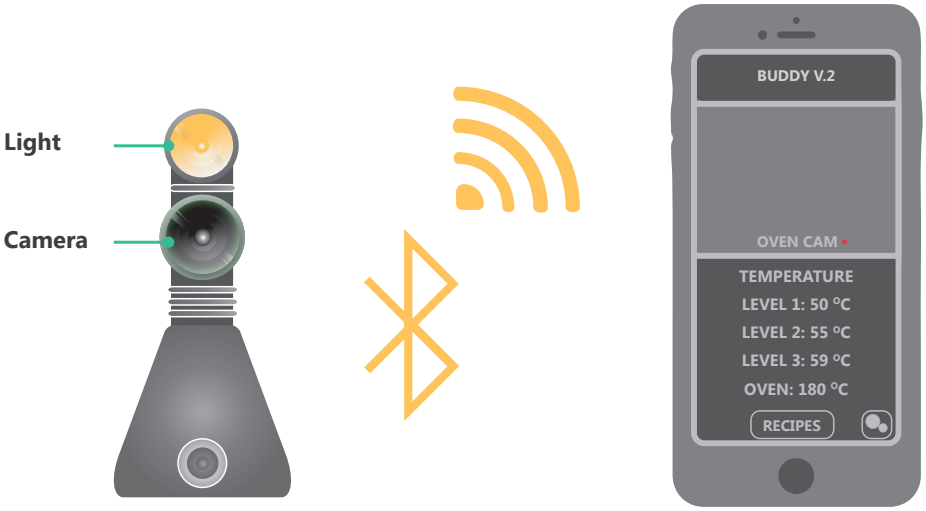
What are your biggest problems, when you have to start cooking, if you can't use your gadgets?

- I hate the different heat levels within the oven, as it doesn't heat evenly. It would be nice, if I were able to control that, also on my cooking hobs. If you have more things in your oven, it is quite hard, to find out the different temperatures in the different areas.

Project title View by SØ		
Title: Interview with Kristoffer Simonsen		Date: 15.04.2016
Activity: Skype interview	Worksheet no.: A9	Responsible: Jon Søgaard

We then afterwards showed Kristoffer our most recent concept, that you can see below, to hear his thoughts about it.





The question is, can you also use the thermometer, to find out, if a cake is done? Sure this is a product that I would buy, the only question is, if the app is going to support the phone I own. I own a Windows phone, and there are barely any app support for it. That would be the most important criteria, for me to invest in it.

All illustrations are own illustrations.

Evaluation

We got what we wanted from the interview, and got a better understanding of the target audience.

Reflection

We learned a few additional things about our target audience, like that at is actually a need, to see if the meat is getting burned. From this we can make a list of user needs.

Project title View by SØ		
Title: Interview with Uffe Sjøgren		Date: 10.03.2016
Activity: Written Interview	Worksheet no.: A10	Responsible: Mads Peter Hilligsøe

Objective:

The objective with the interview, were to get an understanding of our potential end user, and to get some feedback on our concept.

Experiment/data:

What is your education?

- I am a pensioner and have previously been working with food.

How old are you?

- 52 years old.

Are you interested in gadgets in general?

- Yes

What areas are you most interested in? (Kitchen, house control (hue, nest), cleaning, tracking, etc.)

- Kitchen/outdoor kitchen

What products do you own?

- Sous vide, gas grill, charcoal grill, smoke oven, fryer, vacuum packer, actifry, mixer, pasta machine, juicer and a paninigrill

Are some of them for kitchen use (Cooking)?

- (All the above) besides the grills

How do they work?

- All off them are working perfectly for my private kitchen use.

How do you like the visual appeal of the products? Do they fit into a private/your kitchen?

- I would not buy anything that I could not bear to look at.

If your disposable income were bigger, are there any products that you would buy?

- Ice-maker

What kind of meat thermometer do you use?

- Old fashion, but also a wireless version.

Are any of your products linked to your smart device? (Phone or tablet)

- Not yet

Are you familiar with iDevices? (Do you own any of their products?)

- I know them, but I do not own any of their products

Do you stick to a specific brand?

- Nope

Project title View by SØ		
Title: Interview with Uffe Sjøgren		Date: 10.03.2016
Activity: Written Interview	Worksheet no.: A10	Responsible: Mads Peter Hilligsøe

Do you feel obligated to/drawn towards buying a product, if one of your friends have it?

- No. I think I am the trend-setter among my friends

On a scale from 1 - 10, how much do you care about having the newest and smartest? (1 is "I don't care" and 10 is "I absolutely have to have it!")

- 5

Where is your limit, regarding price (Specific to kitchen tools)?

- 3.000DKK

Where do you buy your products (Online or in a store)?

- I buy it online.

Are there any of your products, that you feel have been a waste of money (Something that you haven't really used)?

- My microwave oven

Is there an area in the kitchen, where you feel, that you need a product?

- I am missing a steam oven and the ice-maker

What are your biggest problems, when you have to start cooking, if you can't use your gadgets?

- I do not have any problems. My gadgets make my life easier.

What is the most time consuming task in the kitchen?

- Brisket, 72 hours in all.

What is your least favorite task in the kitchen?

- Peeling potatoes

Evaluation

The interview is based on written answers, which makes it a bit hard to fully express/ understand the meaning and the answers of the questions.

Reflection

Uffe Sjøgren fits the gadget guy target group and are the trend-setter among his friends.

Project title View by SØ		
Title: Market research 1		Date: 02.02.2016
Activity: Desk research	Worksheet no.: B1	Responsible: Mads Peter Hilligsøe

Objective:

The intention of this investigation is to give a quick overview of the products there is on the market and what those products are capable of. (How do they benefit the user in the kitchen)

Experiment/data:

By searching the web it became clear that there are a lot of different products on the market, with the intentions to help the user to make their food more correct and easier.

The help the products are offering are:
Steaming, roasting, boiling, dosing correctly, brewing, temperature control, recipes, etc.

Slow cooker does as the name says cook the food slowly. The idea is that you fill the pot with the desired food. And then the pot is preparing the food to a given time. The pot prepares the food at a low temperature for a long period of 3+ hours, which makes the food really tender. The downside of those slow cookers are the waiting time and the preparation of the food long before the meal is going to be served.

Crock-Pot with WIFI - Slow cooker [1]

Hamilton beach - Slow cooker [2]

Instapot - Slow cooker [3]

Coffee Brewer makes life easier for the coffee people. No need to worry about dosing correctly, the machine has different kinds of programs, which allows the user to switch between different kinds of coffee.

DeLonghi espressomachine [4]

Mr. Coffee smart WIFI [5]

Project title View by SØ		
Title: Market research 1		Date: 02.02.2016
Activity: Desk research	Worksheet no.: B1	Responsible: Mads Peter Hilligsøe

Steam cooker helps the user to prepare steamed meals, such as fish and vegetables

The **fryer** is an easy and well known method to prepare food. Those kind of machines take the advantage from the fast food restaurants and puts it in to the daily homes.

A **boiler** prepare the food in a boiled water tank, the food is vacuum-sealed which keeps the nourishment in the food, after the boiling procedure is the food/meat often fried quickly on a pan.

The **Soupmaker** has one simple task, make soup. The user doesn't need other equipment to make soup besides this machine. The Soupmaker can blend and boil the soup to perfection.

Pizza dragon is a pizza-oven scaled down to the minimum size. The oven helps the user to bake the pizza to perfection.

Samsung induction stove flame lets the user know about the heat of their induction stove. The heat is indicated by flames on the side of the pot.

Philips Steam cooker [6]

Tefal Actifry family fryer [7]

SousVide Supreme - Boiler [8]

Philips Soupmaker [9]

OBH Nordica Pizza dragon [10]

Samsung induction stove flame [11]

Project title View by SØ		
Title: Market research 1		Date: 02.02.2016
Activity: Desk research	Worksheet no.: B1	Responsible: Mads Peter Hilligsøe

Concepts on Kickstarter

OneCook: The Robotic Private Chef to Free Your Cooking Time. It is a concept which is building on a mixing box with a warm plate. The idea is to buy different precooked meals which is inserted into the machine which then automatically mixes and heats to the desired temperature.

Pantelligent is a pan whit an included thermostat which provide the user with the temperature of the pan, which leads to a more efficient and correct preparation of the meat.

Maid is an oven with build in recipes, which makes it easier for the user to prepare food which shouldn't be prepared in the oven. It also provide the user with recipes besides the oven, and in that way has a function as an electronic cooking-book.

Meater is an wireless meat thermometer, that when paired with you smart-phone provides the user with the needed informations.

OneCook [12]

Pantelligent [13]


Maid [14]


Meater [15]

Project title View by SØ		
Title: Market research 1		Date: 02.02.2016
Activity: Desk research	Worksheet no.: B1	Responsible: Mads Peter Hilligsøe

Illustration sources:

[1] https://s-media-cache-ak0.pinimg.com/564x/25/34/df/2534dfaa8e027651a825d3d1aff9b057.jpg

[2] https://s-media-cache-ak0.pinimg.com/564x/97/35/fb/9735fb1ea2197a8e1d3f631e44199c04.jpg

[3] https://s-media-cache-ak0.pinimg.com/564x/42/3b/7c/423b7cd0ffd62d1394281308085O7c9c.jpg

[4] https://s-media-cache-ak0.pinimg.com/564x/e3/6c/f9/e36cf927e76e61057d5183897c08bf5f.jpg

[5] https://s-media-cache-ak0.pinimg.com/564x/f0/0f/9e/f00f9e6ba9d774b96c8d3446388bf973.jpg

[6] https://s-media-cache-ak0.pinimg.com/564x/cb/3c/f7/cb3cf7e1f4f886909c5df723e6814afb.jpg

[7] https://s-media-cache-ak0.pinimg.com/564x/1d/70/c1/1d70c12bc953155101b2617c56301e78.jpg

[8] https://s-media-cache-ak0.pinimg.com/564x/dc/9e/e3/dc9ee36ae04a339c47215877a1144717.jpg

[9] https://s-media-cache-ak0.pinimg.com/236x/2e/65/48/2e654884f3215ddc628390950b9ae5d9.jpg

[10] https://s-media-cache-ak0.pinimg.com/236x/aa/20/42/aa204298e17ae52d591f8081676220d6.jpg

[11] https://ledlamporna.files.wordpress.com/2014/10/samsung-spis-med-led-eld.jpg

[12] https://s-media-cache-ak0.pinimg.com/564x/3f/06/9b/3f069b9344c768e1a76d561e941765ce.jpg

[13] https://s-media-cache-ak0.pinimg.com/564x/ae/de/78/aede789c12f92fc3b392bff5d34d23fe.jpg

[14] https://s-media-cache-ak0.pinimg.com/564x/e1/37/b3/e137b39555377fc9e73cdd72c560e1d7.jpg

[15] https://s-media-cache-ak0.pinimg.com/564x/71/95/a2/7195a2893c52cecd82826e83b71504a2.jpg

Evaluation

The research concludes that there already are different products on the market, which are aiming for an easier cooking experience in the kitchen.

Reflection

We now know that there are different kitchen helping aids on the market, but they are mostly focusing on a specific area.

Project title View by SØ		
Title: Market research 2		Date: 02.01.2016
Activity: Field trip	Worksheet no.: B2	Responsible: Jon Søgaard

Objective:

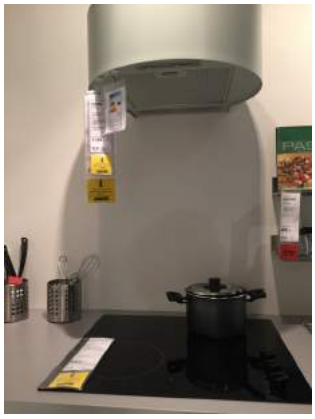
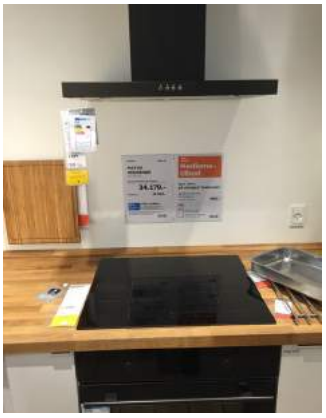
The objective was, to find out, what is already on the market in this area. We needed an understanding of the competition, and to find potential gabs in their products and market coverage.

Experiment/data:

At first we went to IKEA, to see what they had in kitchenware, and how their kitchens were furnished. We took several photos of the different kitchen setups, to see, how a kitchen could look. These can be seen below.









Project title View by SØ		
Title: Market research 2		Date: 02.01.2016
Activity: Field trip	Worksheet no.: B2	Responsible: Jon Søgaard

The trip to IKEA gave us an understanding, of what kitchenware you can get, at a price for everyone.

We afterwards went to Kop & Kande, where we found a different kind of products. Here they had products that could actually ease the cooking experience.

The products here, were mostly designed to help you cook one specific thing, like e.g. soup. We also couldn't let the feeling go, of a silicone lid for a pot. It made it completely silent, making it a joy to put on. This also raised out awareness of how important it is to keep the noise level down in the kitchen.

We then went to HTH køkkenforum, where we looked at different kinds of smart kitchen interior. Mostly smart ovens and clever designed extractors.

Project title View by SØ		
Title: Market research 2		Date: 02.01.2016
Activity: Field trip	Worksheet no.: B2	Responsible: Jon Søgaard










At HTH we also talked to a salesman, who showed us all the different smart solutions, that they had, and told us, what would be nice to have, in the kitchen, which wasn't on the market, and mentioned Siemens, as the leading brand, when it comes to smart kitchen interior. He said, that no one has made something smart for the cooking hobs, and that if we could take the smart part of the ovens, that guided you through the cooking, or did the cooking for you, and put it on the cooking hobs, that would be a very clever and ideal solution.

We afterwards went to Elgiganten to, once again, take a look a consumer kitchenware.



Project title View by SØ		
Title: Market research 2		Date: 02.01.2016
Activity: Field trip	Worksheet no.: B2	Responsible: Jon Søgaard

At Elgiganten we also talked to a salesman, who showed us, the most intelligent kitchenware he had, shown on the photos above. He highlighted the crockpot as the one the thought were the "smartest", as it also had a timer, that you could set. This was basically a electric pot. He also showed an oven from Miele, in the same category, as the one we saw in HTH.

All illustrations are own illustrations.

Evaluation

The field trip gave us a good general understanding of the market, at what it is possible for the consumers to buy in the stores, and what brands are the leading ones.

Reflection

Even though we now know, what you can buy at the stores, we still need to know, what you can buy online.

Project title View by SØ		
Title: Compact cooking		Date: 17.02.2016
Activity: Research	Worksheet no.: B3	Responsible: Jon Søgaard

Objective:

The objective was to get the more extreme aspect of cooking. To see, what people use out in the wild, and how they use it.

Experiment/data:

We went to different scout/outdoor life stores, and looked at what products they had in the outdoor cooking area. We also talked to a few shop assistants, to get their view, on what you need, and which is the leading product on the market.

First we went to Eventyrsport:

Project title View by SØ		
Title: Compact cooking		Date: 17.02.2016
Activity: Research	Worksheet no.: B3	Responsible: Jon Søgaard






Here we found products from a company called Jetboil, who had specialized in efficient and quick boiling of water outside. Of course we also found the mandatory Trangia set.

Project title View by SØ		
Title: Compact cooking		Date: 17.02.2016
Activity: Research	Worksheet no.: B3	Responsible: Jon Søgaard

We then afterwards went to Spejdersport.










Project title View by SØ		
Title: Compact cooking		Date: 17.02.2016
Activity: Research	Worksheet no.: B3	Responsible: Jon Søgaard

The most surprising things, that we found here, were a whole series of thermal generators, with additional auxiliary products. The series were called Biolite, and could transform heat into power for e.g. your cellphone. All you had to do, was to start a fire inside the designated chamber. They even had a small sized grill, that could do the same thing. We got the entire guided tour of the products, by the salesman in the store.

We afterwards went to the third and final place, Friluftsland.

Project title View by SØ		
Title: Compact cooking		Date: 17.02.2016
Activity: Research	Worksheet no.: B3	Responsible: Jon Søgaard





In general, the products all tried to take up less storage and be as compact as possible, combined with being as light as possible. A lot of products, of not all of the products, can be disassembled, and put inside itself, or folded to a smaller scale. Trangia showed the essence of this, by putting an entire "kitchen" into the size of a small pot/pan.

All illustrations are own illustrations.

Evaluation

We got a lot of insight, and it really helped talking to the sales assistants, and having some hands on time, with the products.

Reflection

We got a lot more than we thought we would, and learned a lot, about how to save space when storing products. We can really use this in our future design concepts. We also learned, that a must have feature of out-door products, are the ability to boil water.

Project title View by SØ		
Title: Kitchen gadgets		Date: 15/03/16
Activity: Desk research	Worksheet no.: B4	Responsible: Mads Peter Hilligsøe

Objective:

The intention of this investigation is to get an overview of the gadget market related to kitchen aids.

Experiment/data:

Flame King YSNHTT Hybrid BBQ Temperature Tongs
The Tongs has a build ind thermometer, this makes the cooking easier because you will get the informations as you are cooking and it is not something you have to do additionally. In that way your BBQ meat would be prepared in the right way.

Price: 134 DKK at amazon.com
http://www.amazon.com/gp/product/B00A7V7HRG?adid=1HGQ210266C8BTPZ-BJ7S&camp=0&creative=0&creativeASIN=B00A7V7HRG&linkCode=as4&ref_=as_li_ss_til&tag=hongkiatcom-20

SteakChamp
This steak thermometer indicates by a simply LED lights the condition of the steak. This eliminates the regular big meat thermometer, but this also means, that it doesn't provide the user with specific temperatures.

Price: 402 DKK at thegrommet.com
https://www.thegrommet.com/steak-champ-3-color-thermometer

iDevices - iGrill
iGrill is a series of meat thermometers from iDevices which connect to your smart device. The included app informs the cooking chef about relevant temperatures, time, and alarms when the food is done.

Price: 695 DKK at avXperten for iGrill 2
http://idevicesinc.com/igrill/igrill2/

Project title View by SØ		
Title: Kitchen gadgets		Date: 15/03/16
Activity: Desk research	Worksheet no.: B4	Responsible: Mads Peter Hilligsøe

KitchenAid Artisan mixer
This mixer comes in over 20 different colors, This machine has 10 different speed levels according to mixing, the different speed levels can be used with a huge range of different tools. Tools such as meat chopper, pasta meaker, and different types of mixing tools. KitchenAid has a old school industrial layout (the 60s).



Price: 3117 DKK at power.dk
http://www.kitchenaid.com/shop/countertop-appliances-1/countertop-appliances-2/stand-mixers-3/-[KSM150PSES]-400120/KSM150PSES/

Mellow Sous-vide
Sous-vide is a method used for gently cooking sealed food, inside airtight plastic bags placed in a temperature controlled water steam bath usually for 24-72 hours. This gives a result of delicate texture and flavorful taste because of the pressure and the sealing of the food. The sealing keeps the flavor and the juice inside the comestible while the food is being cooked.


Price: 2676 DKK at cookmellw.com
https://www.cookmellow.com/meet-mellow

Project title View by SØ			
Title: Kitchen gadgets		Date: 15/03/16	
Activity: Desk research	Worksheet no.: B4	Responsible: Mads Peter Hilligsøe	

Egg Minder from quirky
This product connects to your mobile device wirelessly to keep track of your eggs, and tell if the eggs are turning bad. The tray indicates by led the oldest egg. The egg minder sends push notifications to you when you are at the grocery store. This way you will never forget to or buy too many eggs.

Price: 93 DKK at amazon.com
https://www.quirky.com/invent/243958

Drop
Drop is at kitchen scale that works together with your smart iOS devices. The Drop recipes app contains several of different recipes which in combination with the scale makes cooking easier. The app instantly shows the amount on the screen and step by step guides the user through the recipe.

Price: 670 DKK at getdrop.com
https://getdrop.com

Project title View by SØ		
Title: Kitchen gadgets		Date: 15/03/16
Activity: Desk research	Worksheet no.: B4	Responsible: Mads Peter Hilligsøe

Smarter (iKettle & Coffee)
Smarter is a series of boiler and coffee machines. Besides the regular features such as boiling the water and brewing the coffee, the machines be controlled wireless through an app. By that you can save time by programming the machine to be ready at a specific time e.g. the morning.

Price: 964 DKK for iKettle 2.0
Price: 1734 DKK for Coffe Machine
http://store.smarter.am/collections/frontpage/products/copy-of-smarter-iketle-2-0-eu?variant=7301955397

http://store.smarter.am/collections/frontpage/products/smarter-coffee-machine-eu-plug

Vorwerk Thermomix
Thermomix is a multi-functional machine that combines twelve major kitchen appliances in just one unit. It weighs, mixes, chops, grinds, kneads, blends, steams, cooks, whisks, stirs, emulsifies and even has controlled heating. All those functions makes this product really useful when it comes to cooking because of the many functions combined in one single product. This takes less table space and in that way release workspace for the kitchen user.

Price: 8950 DKK
http://denmark.thermomix.com

All the illustrations were found the associated webpages.

Evaluation
The showed products are all trying to ease the workload in the kitchen and thereby free time for the user.

Reflection
There is many ways to save time and provide knowledge in the kitchen. Those product are both aiming for men and woman, gadget direction and private household.

Project title View by SØ			
Title: Future kitchens		Date: 09.02.2016	
Activity: Desk research	Worksheet no.: B5	Responsible: Mads Peter HIlligsøe	

Objective:

The intention of this research is to stage the already existing future kitchen concepts that are dealing with a better and easier work flow in the kitchen.

Experiment/data:

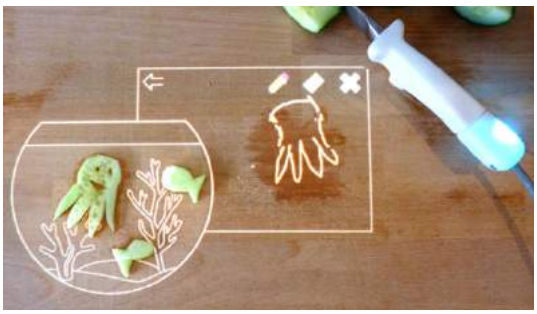
IKEA concept kitchen 2025 - A table for living, is derived from a collaboration between IKEA IDEO, Eindhoven University of Technology and Lund University, where the aim of the task was to show how will we behave around food in 2025.

This concept builds on a intelligent tabletop which are able to recognizance what ever your put on the table. It can immediately inform the user about the content and what you can do with it. The table has build-in weight and induction used for the pots and pans plus charging your smart devices. The graphics on the tabletop is being generated by an projector in the ceiling.



https://www.youtube.com/watch?v=qD60cBQOABY

Creative cook is also a future kitchen concept from the collaboration described above. The concept motivates children to be part of the cooking, and is also aiming for eduction and fun use. The program informs the user about which tool to use when and how.



http://www.conceptkitchen2025.com/student-projects/creative-cook.html

Project title View by SØ		
Title: Future kitchens		Date: 09.02.2016
Activity: Desk research	Worksheet no.: B5	Responsible: Mads Peter HIlligsøe

The world's first robotic kitchen - by Moley Robotics
This concepts is building on human behavior when it comes to cooking, The to robotic arms mimics the uploaded recipes and the execution of the meal done by a human (pic. 1). The only thing the user has to do is to feed the machine with the different groceries and serve the meal afterwards. This solutions is really useful for a busy person who doesn't have time for cooking and those who hate being in a kitchen. The whole idea of taking the industrial robots into the daily life is something we will see in a near future, and can solve a lot of different problems. Especially people with a disability should be able the benefit for this technology.


https://www.youtube.com/watch?v=BSBTCOEdLkA

Whirlpool Bauknecht futuristic stovetop is a cook-top building on a touchscreen with a lot different informations, it is basely a big tablet which you can connect with your apps such as spotify, twitter and so on. The screen informers the user about recipe's, temperature, weight and content of the food. The whole top is an infinite induction field which can by magnesium detect where the pots are located on the cook-top,

https://www.youtube.com/watch?v=QPG9Pk2bbuE

Principles
- Informations to user about the food
- Informations directly on the working area
- Fully automatic systems
- Technology driven

All the illustrations are screenshots of the linked videos.

Evaluation
The future kitchen concepts is mainly dealing with informations, the more the better. It has to be as easy as possible to get the informations about the content of our food.

Reflection
These concepts are really technology driven and the technology isn't fully developed yet. If this succeeds, this could benefit man kind when it comes to education and health.

Project title View by SØ		
Title: Open source cooking		Date: 23.02.2016
Activity: Desk research	Worksheet no.: B6	Responsible: Jon Søgaard

Objective:

The objective was to find out, if there was an open source cooking hob or oven, that we could connect to, with our product, or if it either have to find a collaboration partner, or make an completely external solution.

Experiment/data:

Some appliances in the kitchen are connectible, like the coffee machine, or the refrigerator, but not the cooking hobs or the ovens, and none of these are open source. Below you can see, a smart fridge from Samsung.

We did manage to find a company, who made the entire kitchen creation open source, but not the software, which is what we need.

http://www.open-electronics.org/kitchen-becomes-open-source-valcucines-call-for-ideas-launched/

Google talked about the open source kitchen in 2006, but nothing has come on the market since, regarding cooking hobs and ovens.

http://www.cnet.com/news/a-look-inside-googles-open-source-kitchen/

Illustration source:
http://xgl-coffee.org/wp-content/uploads/2016/04/1459562828_822_Connected-cooking-The-best-smart-kitchen-devices-and-appliances.jpg

Evaluation

The desk research gave a lot of results on the topic, but none regarding cooking hobs or ovens. Several smart fridges were found, along with other "open source" projects.

Reflection

We didn't manage to find any open source cooking hobs or ovens, leading to the product being an external solution, or we need a collaboration partner. An expansion of this research could be, talking to a salesman.

Project title View by SØ		
Title: Kitchen tips		Date: 02.03.2016
Activity: Desk research	Worksheet no.: C1	Responsible: Jon Søgaard

Objective:

The objective was to find new and old tips for the cooking, and from that make an ideation of low tech products, making use of these tips.

Experiment/data:

How to feel on your stake:

Relax your hand, and let your thumb and index finger, middle finger, ring finger or pinkie meet. Press lightly with your left index finger on the "pillow" underneath your right hands thumb. The pressure that you feel, should be the same on the stake. The different conditions of the stake, and what fingers needed, can be seen on the pictures below:

Red

Medium

Rose

Well done

http://samvirke.dk/mad/gallerier/saadan-maerker-boeffen-stegt.html

Project title View by SØ		
Title: Kitchen tips		Date: 02.03.2016
Activity: Desk research	Worksheet no.: C1	Responsible: Jon Søgaard

How to boil your rice, without burning them:

1 person = 1 1/2 dl water and 1 dl rice
2 persons = 3 dl water and 2 dl rice
etc.

First you heat the water to the boiling point, and put in the rice and salt. You let it boil for 11 minutes at low heat with the lid. The pot is then taken off burner, and has to cool off for 11 minutes (still with the lid on)

http://www.flyttehjemmefra.info/koge-ris/

Pasta on the wall method:
Throw a single pasta on the wall, and see if it sticks. At some point the pasta starts to get sticky (when it consists of 80-90% water on the surface, and 40-60% in the center), and the pasta will stick to the wall. When this happens, the burner should be turned off, and the water should be poured out.

http://pdf.samvirke.dk/2008/09/01/SAM20080901X110056.pdf

How you cook pasta al dente:
You choose a large pot, and put a lot of water in it. (1L pr. 100g pasta)
Add a bit of salt to the water.
The pasta should first be put into the pot, when the water is boiling.
The pasta is al dente when you can feel a hard core in the middle, with a soft outer. This combined with no taste of flower.
Fresh pasta should have 2-3 minutes, and dried pasta should have 6-7 minutes.
Use a colander to get rid of the water and serve afterwards.

Myths about pasta:
Do not add oil to the water, as this prevents the water from boiling completely. You can add a little oil after the water is poured out, to prevent it from sticking together.
Do not pour cold water over the pasta, this is only okay, if the pasta is to be used in a cold pasta salad.

http://samvirke.dk/mad/raad-og-tips/raad-goer-pasta-helt-perfekt.html

Project title View by SØ		
Title: Kitchen tips		Date: 02.03.2016
Activity: Desk research	Worksheet no.: C1	Responsible: Jon Søgaard

How to make sure, that your baked potatoes are done:
Press with your index finger on the potato. If it acts like a balloon filled with flower, then it is done.

http://www.gorenje.dk/service-support/tips/gastronomie/faerdigt

How to make sure, that your chicken is done:
The chicken is done, if you can pull of one of the legs, and a clear liquid is flowing from the chest.

http://www.gorenje.dk/service-support/tips/gastronomie/faerdigt

How to know, when your bread is done:
Knock on the bottom of the bread. If you hear a clear and hollow sound, then the bread is done.

http://www.gorenje.dk/service-support/tips/gastronomie/faerdigt

Old house wife advices:
1. A pair of drops from a lemon in the cream, makes it firm quicker and more even.
2. Put your onion in tepid water before you cut it. This makes it easier to peel, and make you cry less.
3. Cut your layered cake without problems, with a knife, that have been under warm water for a minute.
4. Peel a banana, by pressing on the end without the stem.
5. Use dental floss, to cut soft cheeses like brie and goat cheese.
6. Get rid of onion smelling fingers, by rubbing them with lemon juice and salt. - But be careful, if you have dry skin, then you should rub then against stainless steel instead.
7. Prevent the salt from sticking together, by adding some raw rice to the saltshaker.
8. Make a dull grater sharp again, by rubbing it with sandpaper.
9. Keep brown sugar humid by putting it into a airtight container, along with the peel from an orange.

http://www.isabellas.dk/goer-det-selv/i-boligen/9-tips-til-din-rengoering-med-citron

The illustrations were found in their associated link.

Evaluation
There are a lot of advices for cooking, both old and new ones.

Reflection
We found a lot of different cooking advices, that we might be able to use in future concepts.

Project title View by SØ			
Title: Kitchen tips - Products		Date: 03.02.2016	
Activity: Desk research	Worksheet no.: C2	Responsible: Jon Søgaard	

Objective:

The objective is to find products that helps you, like the previously found tips, when you are cooking. From this we hope to find a hole in the tips, where no product is found to aid.

Experiment/data:

Boiling rice:

Rice cooker [1]

Cooking pasta:

Pasta cooker[2]:

Baking a potato

Potato baker[3]:

Baking bread:

Bread baking machine[4]

Cooking a chicken

[5]

The perfect steak

OptiGrill [6]

Al Dente

Brain stream [7]

Basically all the problems have some kind of product trying to solve it, except the pasta. The spaghetti cooker isn't helping you to find out, when it is al dente, but only to make it easier for you to make spaghetti, because of the shape and pour the water our afterwards. We did find the Brain stream, that is a timer, that you cook along with your pasta, but all it does, is what a regular timer can do.

Project title View by SØ			
Title: Kitchen tips - Products		Date: 03.02.2016	
Activity: Desk research	Worksheet no.: C2	Responsible: Jon Søgaard	

Illustration sources:

[1] http://i40.twenga.com/haushaltsgeraete/reiskocher/gastroback-design-reiskocher-»pro-tp_5659647781174946080f.jpg

[2] http://ecx.images-amazon.com/images/I/51kGOf36WmL._SL1000_.jpg

[3] http://ecx.images-amazon.com/images/I/414C-fpFKjL._AC_SL115_.jpg

[4] http://i.ebayimg.com/00/s/MTYwMFgxNjAw/z/fZ0AAOxy4dNSr3AK/$_57.JPG

[5] http://ecx.images-amazon.com/images/I/41cp%2BOTrRcL.jpg

[6] Own illustration

[7] http://cdn.shopify.com/s/files/1/0998/7070/products/Brain_Stream_Al_Dente_pasta_timer_3_1024x1024.jpg?v=1449691967

Evaluation

We found products for most tips, even a specific potato baker, so you don't need to put the potatoes in the oven.

Reflection

The only hole we found were that there aren't any great solutions to tell you, when your pasta is done, only fancy shaped timers.

Project title View by SØ		
Title: S-curve analysis - (Smart) ovens		Date: 24.02.2016
Activity: S-curve analysis	Worksheet no.: C3	Responsible: Jon Søgaard

Objective:

The objective is to analyze the evolution of functions on the oven throughout the years.

Experiment/data:

The first ovens were dates back to the 29.000 BC, but don't get relevant, before the 1851, where the gas oven was showed at the Great Exhibition [Wikipedia, 2016]. The most notable function added to the gas oven was including a thermostat, which assisted in temperature regulation.
The oven has then been improved ever since, and in 1947, the first microwave oven was sold. This was a whole new way of cooking, and opened op for new opportunities.
If we look back at the conventional oven, not much has happened since 1851, until very recently, where regular ovens has got a lot of the functions that the microwave oven has developed over time (e.g. a defrost button). You can also now buy an full size combi-oven (both regular and micro-wave in one), as well as vapor ovens.

First gas oven came in 1851. [1]

First electric oven came in 1893. [2]

The first full size glass door was first shown in 1909. [3]

And has ever since been developed over the years. Here shown 1950. [4]

Electric oven from 1990s. [5]

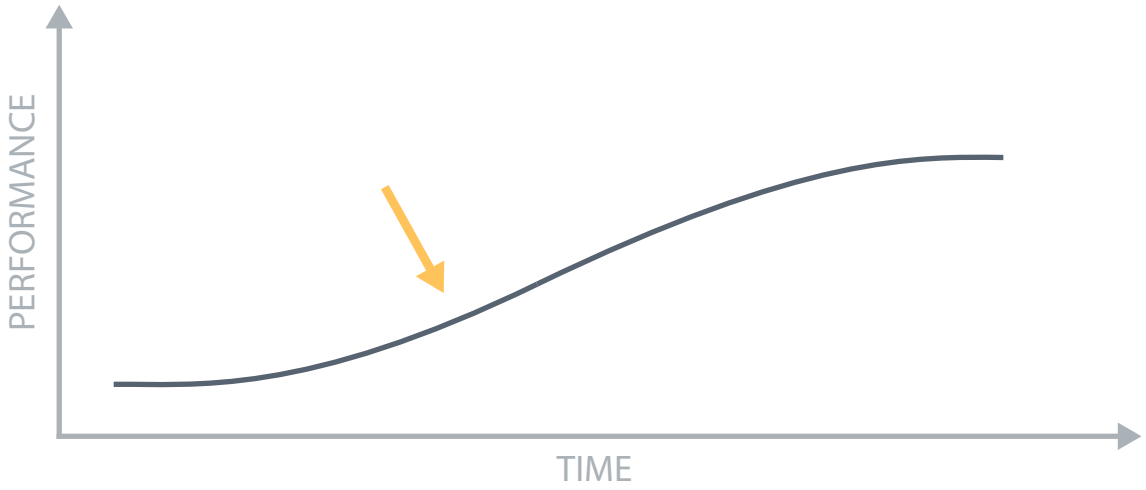
First consumer microwave oven in 1947. [6]

Project title View by SØ		
Title: S-curve analysis - (Smart) ovens		Date: 24.02.2016
Activity: S-curve analysis	Worksheet no.: C3	Responsible: Jon Søgaard

[7]

[8]

Siemens smart oven 2016. Todays ovens have all different kinds of functions, but they come at a price. The price tag of these smart ovens are extremely high, compared to conventional ovens. These features have hit the market in the last 5 years. The problem with these features are the price tag, as almost all users choose to go with a much cheaper alternative, because they don't want to pay that much for something that is only a "nice to have" and not a "need to have".
If we look at the evolution of this, it is a bit further than the cooking hobs. We are where the s-curve has stopped rising exponentially, and is starting to flat out, as marked on the figure below.



Project title View by SØ			
Title: S-curve analysis - (Smart) ovens		Date: 24.02.2016	
Activity: S-curve analysis	Worksheet no.: C3	Responsible: Jon Søgaard	

Sources:
Wikipedia. 2016. *Oven*. [ONLINE] Available at: https://en.wikipedia.org/wiki/Oven. [Accessed 23 May 2016].

Illustration sources:
[1] https://upload.wikimedia.org/wikipedia/en/thumb/e/e9/Gas_stove_1851.jpg/250px-Gas_stove_1851.jpg

[2] http://restsource.files.wordpress.com/2011/07/electric-stove.jpg

[3] http://2.bp.blogspot.com/-oRJ8jWwDMpQ/Ug-e5V53VfI/AAAAAAAAEUM/Eb_xYjgfZNE/s1600/Boss+oven+1910s.jpg

[4] http://thumbs4.ebaystatic.com/d/l225/m/mPerD0XmDS3NAw6MVYMiJlQ.jpg

[5] https://i.warosu.org/data/ck/img/0060/88/1419498627819.jpg

[6] http://img.v3.news.zdn.vn/w660/Uploaded/abfluua/2015_09_01/4.png

[7] http://www.siemens-home.com.au/store/cms_media/a02-b2c/media/_remote/_au/Cooking-ovens-Hero-image-A.jpg

[8] http://www.siemens-home.com.hk/store/cms_media/a02-b2c/media/_remote/_gb/iQ700_screen_1.jpg

The rest of the illustrations are own illustrations.

Evaluation

The evolution of the smart oven has reached a steady point, and isn't exponentially anymore.

Reflection

The evolution of the oven has been slow until now, and with the new smart ovens, both combi and vapor, a more intelligent everyday is at the horizon, also in the kitchen.

Project title View by SØ		
Title: Oven functions - Price list		Date: 23.03.2016
Activity: Price analysis of ovens	Worksheet no.: C4	Responsible: Jon Søgaard

Objective:

The objective was to find out what the prices were for the different functions in the smart ovens, to have something to hold our pricing up against, when we add some of the functions to a conventional oven.

Experiment/data:

From a sales magazine from Siemens, we made an estimated price list of the functions in their smart ovens. We chose Siemens, because we were told, both at HTH and Elgiganten, that they were one of the leading brands, if not the leading brand.

Model nr.	Function No.	Combination of functions	Function(s)	Oven price (DKK)	Function price (DKK)	
HB23AB521S	1		Basic oven	6339	-	
HB635GNS1S	2	1+2	3D -> 4D air + Touch display + 14 programs	9.809	3.470	
HB675G0S1S	3	1+2+3	Pyrolysis	11.869	2.060	
HB876GDS1S	4	1+2+3+4	Better screen + 80 programs + build-in meat thermometer	13.429	1.560	
HR876GDS2S	5	1+2+3+4+5	Semi-Steam	15.489	2.060	
HM676GDW1S	6	1+2+3+4+6	Microwave (No semi-steam)	17.049	3.620	
HS858GXS1	7	1+2+3+4+5+7	Full-Steam + Baking sensor	20.669	5.180	for semi -> full (incl. baking sensor)
HN878G4S1	8	1+2+3+4+5+6+8	Semi-Steam + Microwave + Baking sensor	24.689	7.640	

From this list we can conclude, that you pay an additional 1560,- DKK for the added meat thermometer, along with a better screen and more programs, which is basically 3 things that we aim to add to conventional ovens.

All illustrations are own illustrations.

Evaluation

From a sales magazine from Siemens, we determined the prices of the different smart oven functions, to find an area for our target price.

Reflection

From the magazine we concluded, that if we added the functions that we wanted to, it would cost 1560,- DKK to have it in a smart oven.

Project title View by SØ		
Title: S-curve analysis - Meat thermometer		Date: 04.03.2016
Activity: S-curve analysis	Worksheet no.: C5	Responsible: Jon Søgaard

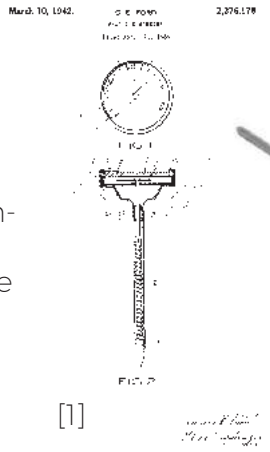
Objective:

The objective was to find out, how the meat thermometer for private use has evolved over the years, to see if this is a place, where there is need for innovation.

Experiment/data:

1942: If we start by looking at the invention of the meat thermometer, a patent was published in 1942, of a meat thermometer. The patent can be seen to the right. You can buy meat thermometers, that are just like that even today. Not that there hasn't been any innovation, but the original one works so well, that we still use it today.

Available at: http://www.google.nr/patents/US2276178



[1]

[2]

2000s: The thermometer has later been digitalized, but still with the same principle. It is still something that you stick into the meat, and it only has one measuring point.

[3]

2000s: The probe meat thermometer has been developed, and has later on been made "wireless". The wireless part is from the base station, to a display that shows the temperature, that you can then take with you. The connection from the thermometer to the base station, is still a wired connection.

[4]

Project title View by SØ			
Title: S-curve analysis - Meat thermometer		Date: 04.03.2016	
Activity: S-curve analysis	Worksheet no.: C5	Responsible: Jon Søgaard	

2016: MEATER is the first completely wireless meat thermometer. No wires at all. You charge it when it is docked in the base station, and it sends the measured temperature directly to your smart-phone.

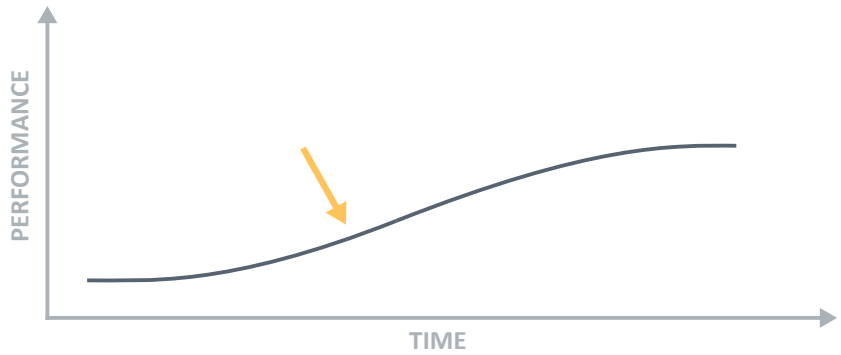
Available at: https://www.indiegogo.com/projects/meater-the-only-wire-free-smart-meat-thermometer#/

[5]

2016: Meat thermometers are starting to get integrated into the smart ovens as well, and some of them even have multi level measure points along the probe.

[6]

From this we can conclude, that a lot of things has changed, but when it comes to the actual measuring of the meat, it is still the same method; you stab an awl into the meat, that measures the core temperature. The basic idea of something that you stab into the meat hasn't changed much, but the design and the features has changed a lot, which is why the innovation is still going strong in these areas. Overall the s-curve is quite flat, like below, and we are still in the accelerating part, like the arrow indicates.



Project title View by SØ			
Title: S-curve analysis - Meat thermometer		Date: 04.03.2016	
Activity: S-curve analysis	Worksheet no.: C5	Responsible: Jon Søgaard	

Illustration sources:

[1] http://patentimages.storage.googleapis.com/pages/US2276178-0.png

[2] https://images-na.ssl-images-amazon.com/images/I/21RwYzhkToL.jpg

[3] http://www.consumerreviewsbuzz.com/wp-content/uploads/2014/12/Digital-Meat-Thermometer-1024x922.jpg

[4] http://ecx.images-amazon.com/images/I/71bHa2kCaUL._SL1050_.jpg

[5] https://www.rakunew.com/images/18/ab1508f09fe4ce93e8e6266a340f4/large.jpg

[6] http://www.discountappliancecentre.com/images/detailed/9/Siemens_HM676G0S6B_iQ700_Oven_With_Microwave.png

All other illustrations are own illustrations.

Evaluation

The research showed, basically what we suspected, that you still measure the core temperature, the same way. There has however been added multi level measurement, which we didn't know about, but only in smart ovens.

Reflection

We learned, that the meat thermometer hasn't changed much, and that this is a place suitable for innovation.

Project title View by SØ		
Title: Using a meat thermometer		Date: 29.04.2016
Activity: Interview/research	Worksheet no.: C6	Responsible: Jon Søgaard

Objective:

The objective is to find out, how you place a meat thermometer correctly, according to a chef. This has an influence on the angle and placement of the camera.

Experiment/data:

We started by started by finding out, what chefs online preferred, and the most interesting one, were a video from Bilka, where they instruct you in how to use your meat thermometer properly [Bilka.tv, 2016]. A screenshot from the video can be seen below;

They use 3 main rules, when they use a meat thermometer:
- The end of the meat thermometer in the center of th meat.
- The meat thermometer is inserted from the side, and not from the end, so you don't go through the marbling and don't ruin too many slices of meat.
- You have to have the correct core temperature when your meat is done.

We then afterwards talked to some of the chefs, that we had talked to earlier, to hear, how they would do it. It turned out, that it was very different.

Project title View by SØ			
Title: Using a meat thermometer		Date: 29.04.2016	
Activity: Interview/research	Worksheet no.: C6	Responsible: Jon Søgaard	

We asked Mathias Lassen once again, to hear how he would use a meat thermometer, and told him, what the other chef recommended. And he had never heard anything like that, not even with his chef education. "I have never heard anything like that. I can't see, why you shouldn't insert it through the marbling, and neither why you can't insert it through the end of the roast. You can't ruin any of the steaks this way."

What we can conclude from this is, that people are going to use their meat thermometers in different ways from person to person in the private kitchen, just like they do in the professional one. This means that we have to take the placement of the meat thermometer into account, when we look at the camera angle and placement, as people are going to place it in different places.

Source:

Bilka.tv. 2016. *Sådan bruger du et stegetermometer - Bilka.tv*. [ONLINE] Available at: https://www.bilka.tv/video/3098521/sadan-bruger-du-et-stegetermometer. [Accessed 22 May 2016].

Evaluation

We found out, that even chefs disagree, when it comes to handling a meat thermometer.

Reflection

People are going to place it in different places, and we have to take it into account, when deciding the camera angle and placement.

Project title View by SØ		
Title: How to cook meat properly		Date: 14.04.2016
Activity: Research	Worksheet no.: C7	Responsible: Jon Søgaard

Objective:

The objective was to find out, how it is recommended from an expert, that you cook meat the best way, but most importantly, how hot the oven has to be, when you cook meat for several hours.

Experiment/data:

We researched how to cook meat the best way, and came across Margit Probst, who wrote a book about cooking, but are also practicing the art of "food styling", as she describes it. She has made a very thorough list of what kind of meat should be cooked for how long, at what temperatures, so obviously we took a look at that. A list of that is what you can find below. [Proebst, 2016]

Animal	Type of meat	Frying time	Time at 80 degrees C (fish =100)	Core temperature
Pig	Medallions	2 min. each side	40 min.	65
	Filet (Whole)	6-7 min.	1 hr. 45 min.	65
	Fillet (Filled)	6-7 min.	1 hr. 45 min.	65
	Loin (800g)	6-7 min.	2 hrs. 30 min.	65
	Loin (1.2 kg)	6-7 min.	3 hrs.	65
	Shoulder roast (1.2 kg)	8-10 min.	4 hrs. 30 min.	65
	Shoulder roast (1.5 kg)	30 min. (240 degrees)	4 hrs.	65
	Pork (800g)	7-8 min.	3 hrs.	65
	Pork neck (1.5 kg)	8-10 min.	5 hrs.	65
	Pork neck (2.4 kg)	8-10 min.	7 hrs.	65
	Suckling (1 kg)	5-6 min.	3 hrs. 30 min.	65
Veal and beef	Veal fillet (all)	5-6 min.	1 hr. 30 min.	60
	Veal medallions	1 min. each side	30 min.	55
	Veal chops	2 min. each side	45 min.	60
	Loin of veal (800g)	7-8 min.	2 hrs.	60
	Viel (1.5 kg)	7-8 min.	3 hrs.	60
	Veal (1.2 kg)	7-8 min.	3 hrs. 30 min.	60
	Veal shank (1.8 kg)	8-10 min.	5 hrs.	60
	Fillet steak rare	1 min. each side	10 min.	50
	Fillet steak medium	2 min. each side	30 min.	55
	Fillet steak well done	2 min. each side	1 hr.	65
	Sirloin (Medium, 600g)	5-6 min.	1 hr. 30 min.	55
	Sirloin (Medium, 1.5 kg)	7-8 min.	2 hrs. 30 min. - 3 hrs.	55
	Chateaubriand (800g)	5-6 min.	2 hrs.	55
	Roast beef (800g)	7-8 min.	1 hr. - 2 hrs.	50 - 60
	Roast beef (1.5 kg)	10 min.	1 hr. 30 min. - 3 hrs.	50 - 60
	Roast beef (2.5 kg)	10 min.	2 hrs. 30 min. - 3 hrs. 30 mins	50 - 60
	High rib (4 kg)	30 min. (240 degrees)	4 hrs. 30 min.	60
Lamb and deer	Venison medallions	1 min. each side	45 min.	60
	Venison fillet	5-6 min.	1 hr. 45 min.	60
	Venison (no Bone, 800g)	5-6 min.	2 hrs. 15 min.	60
	Roast venison (lobe, 1.2 kg)	6-8 min.	4 hrs. 30 min.	60

Project title View by SØ			
Title: How to cook meat properly		Date: 14.04.2016	
Activity: Research	Worksheet no.: C7	Responsible: Jon Søgaard	

	Venison (with bone, 2.2 kg)	30 min. (240 degrees)	3 hrs. 30 min.	60
	Rabbit leg (Boneless)	4-5 min.	1 hr.	65
	Lamb chops	1 min. per side	30 min.	60
	Rach of lamb	5-6 min.	1 hr. 30 min.	55
	Saddle of lamb	4-5 min.	30 min.	55
	Leg of lamb (with bone, 1.8 kg)	8-10 min.	5 hrs. 30 min.	60
	Leg of lamb (with bone, 2.5 kg)	30 min. (240 degrees)	3 hrs. 30 min.	60
	Leg of lamb (1 kg; boned)	7-8 min.	4 hrs.	60
	Leg of lamb (1.5 kg; boned and fillet)	8-10 min.	5 hrs. 30 min.	60
	Venison (with bone, 800g)	6-7 min.	3 hrs.	60
	Venison (with bone, 2 kg)	8-10 min.	6 hrs.	60
	Venison (boneless 1.5 kg)	8-10 min.	4 - 5 hrs.	60
	Venison (bone, 1.5 kg)	8-10 min.	2 hrs. 30 min.	60
	Roast wild boar (800g)	6-7 min.	2 hrs. 30 min. - 3 hrs.	65
	Wild boar (1.6 kg)	8-10 min.	5 hrs.	65
Poultry	Chicken breast fillet	2 min. each side	45 min.	70
	Duck breast fillet	5-6 min.	45 min. - 1 hrs.	65
	Goose breast (Skinned, 500g)	6-7 min.	2 hrs.	65
	Roast turkey (800g)	5-6 min.	3 hrs.	70
	Roast turkey (1.2 kg)	7-8 min.	5 hrs.	70
	Baby turkey (3 kg)	40 min (220 degrees)	4 hrs. 30 min.	70
	Turkey (4.3 kg)	40 min (220 degrees)	7 hrs.	70
	Duck (2.5 kg)	1 hr. (220 degrees)	5 hrs.	70
	Goose (4 kg)	1 hr. (220 degrees)	7 hrs.	70
	Goose (6 kg)	1 hr. (220 degrees)	9 hrs.	70
Fish	Salmon fillet (180g)	1 min. each side	20 min.	-
	Tuna steaks (150g)	1 min. each side	15 min.	-
	Swordfish steaks (150g)	1 min. each side	15 min.	-
	Monkfish	1 min. each side	15 min.	-
	Sea bass (whole, 600g)		30 min. (In the film)	-

The highest temperatures, that they recommend are 240°C in 30 minutes, but 220°C for 1 hour (which is also recommended) is probably going to the harder on the unit. And further more, it has to withstand heat of 80°C for 9 hours afterwards, making this the worst case scenario for our unit. This is when you cook a 6kg goose, as marked in the table above. Our solution has to be able to withstand that.

Sources:
Proebst, M., 2016. *Niedrigtemperatur - Garzeitentabelle*. [ONLINE] Available at: http://www.mar-git-proebst.de/niedrigtemperaturgaren-garzeittabelle.html. [Accessed 20 May 2016].

All illustrations are own illustrations.

Evaluation

We found exactly what we needed, to find out what kind of heat our product has to be able to withstand.

Reflection

We learned that the worst case scenario is, if you have to cook a 6kg goose. It has to be precooked for 1 hour at 220°C, and then afterwards cooked at 80°C for 9 hours. Our product has to be able to withstand that.

Project title View by SØ		
Title: Tear down of meat thermometer		Date: 04.04.2016
Activity: Tear down	Worksheet no.: C8	Responsible: Jon Søgaard

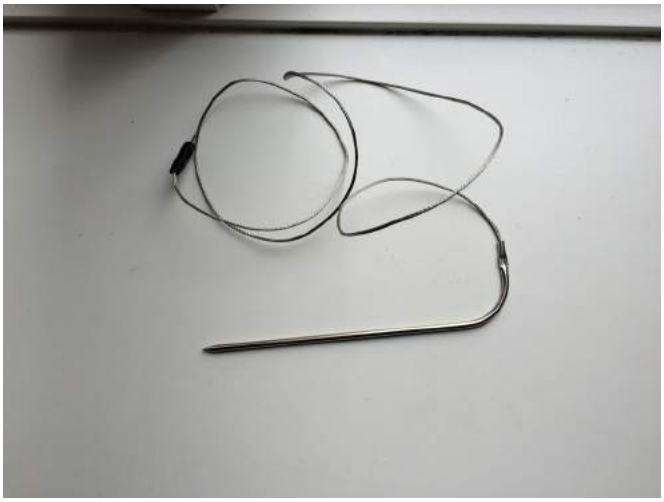
Objective:

To see the technology the competitors are using, we made a tear down of one of the leading meat thermometers on the market, iGrill.

Experiment/data:

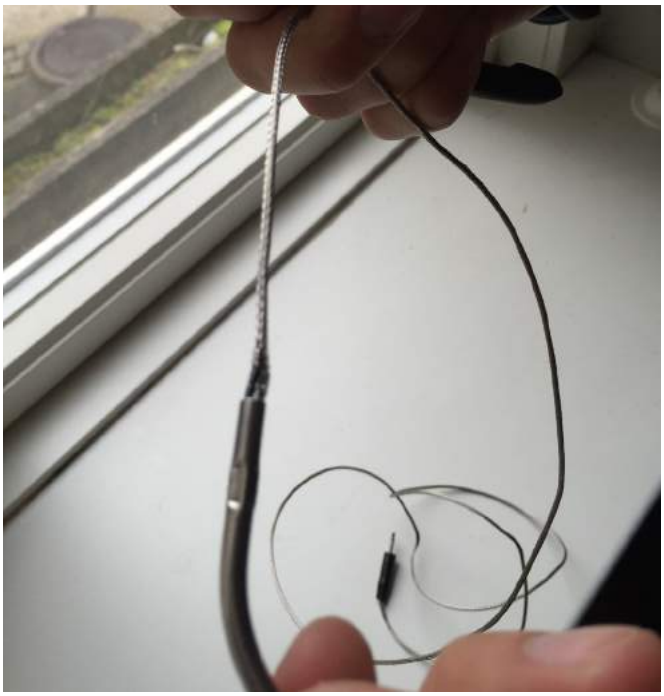
We started by disassembling the probe.

The probe



We started by "unpressuring" the probe

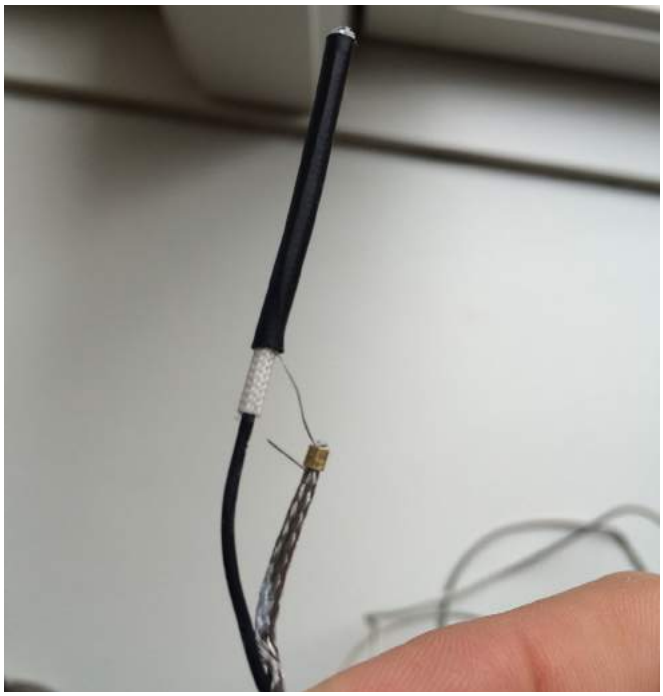
We were then able to pull out the internals.



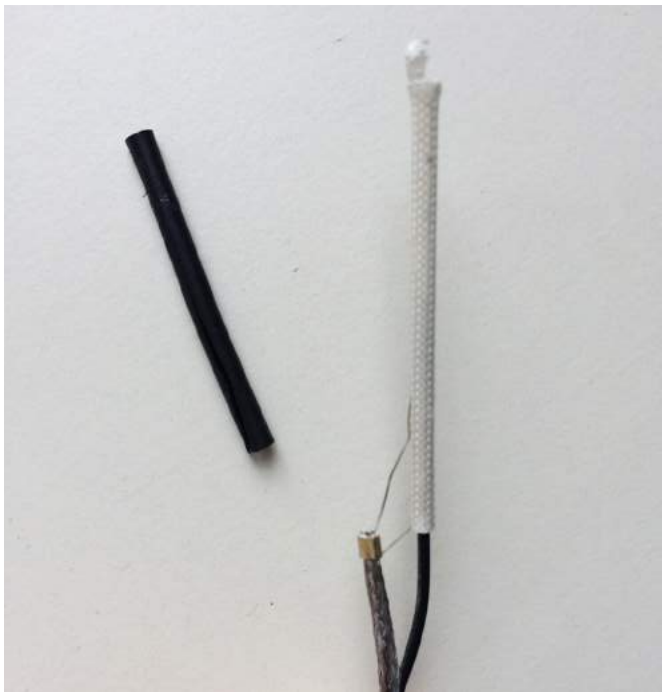
The measuring internals is seen to the right.

Project title View by SØ		
Title: Tear down of meat thermometer		Date: 04.04.2016
Activity: Tear down	Worksheet no.: C8	Responsible: Jon Søgaard

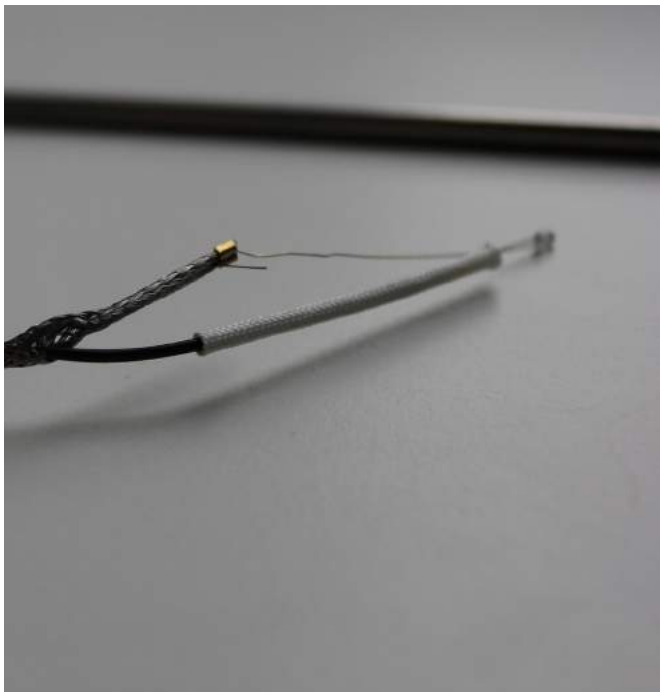
Shrink wrap keeps everything in place.



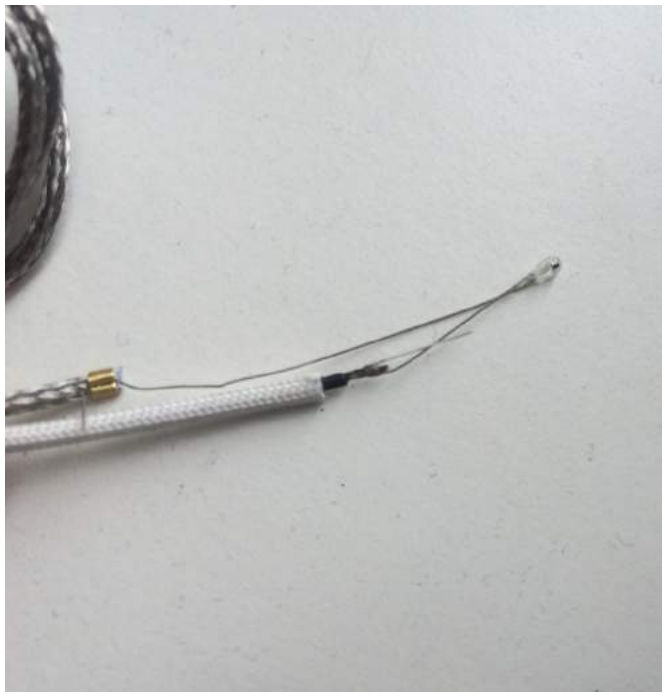
The shrink wrap was removed.



This is what the thermometer in the inside of the probe looks like.



Soldered components isolated with Silica sleeve.

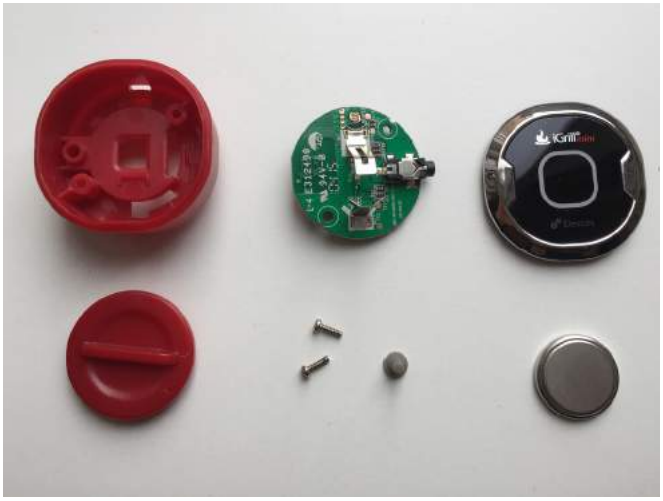


Project title View by SØ		
Title: Tear down of meat thermometer		Date: 04.04.2016
Activity: Tear down	Worksheet no.: C8	Responsible: Jon Søgaard

We then disassembled the main box of the iGrill.

iGrill main box

The inner components.



From this, we were actually able to roughly find out the size, of most of the components that we need in our product. The most of the features, that we want, except for the camera, are found in the iGrill's PCB. However, we don't need things like the mini-jack socket, and can properly make the PCB a lot smaller, than the one found in the iGrill. The next step is to isolate the components from the heat inside the oven. What we learned here were, that you can isolate solder, which has a quite low melting point (typically 90 and all the way up to 450°C) [Wikipedia, 2016], with a silica sleeve, to cover it from the heat.

Sources:
Wikipedia. 2016. Solder - Wikipedia, the free encyclopedia. [ONLINE] Available at: https://en.wikipedia.org/wiki/Solder. [Accessed 22 May 2016].

All illustrations are own illustrations.

Evaluation

We found what we expected inside the products, but at a much smaller scale than we expected. We might be able to use a silica sleeve, to isolate our components.

Reflection

The next move, is to find out, how to isolate the components, so that they can withstand the heat inside the oven, hopefully with a silica sleeve.

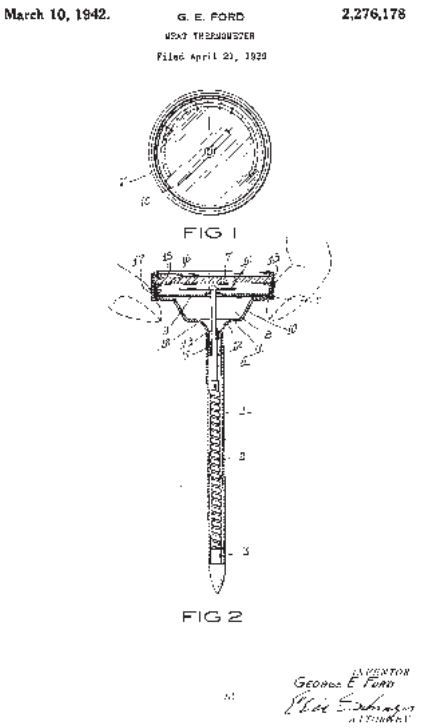
Project title View by SØ		
Title: Patents		Date: 29.04.2016
Activity: Research	Worksheet no.: C9	Responsible: Jon Søgaard

Objective:

The objective were to find the existing relevant patents, to make sure that we don't violate any regulations.

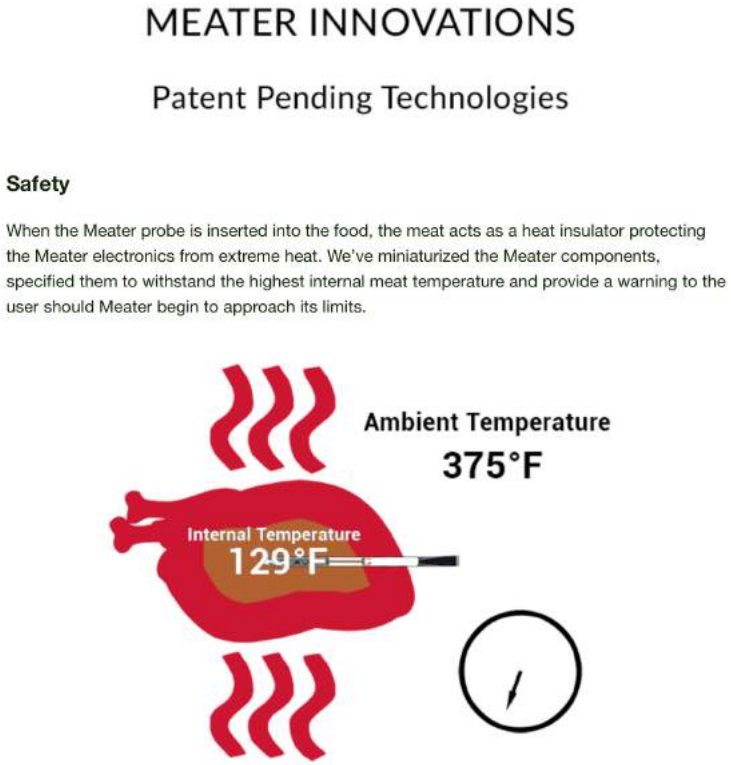
Experiment/data:

The search for patterns were made on both Espacenet.dk and uspto.gov, to get broadest searches. The first patent that we found, were the original meat thermometer, released in 1942. [1]
Due to it being more that 20 years after the filling date, the patent is no hurdle to overcome, and we can use it as we please.


March 10, 1942. G. E. FORD 2,276,178
MEAT THERMOMETER
Filed April 23, 1938
FIG 1
FIG 2
GEORGE E. FORD

The second patent that we found, is a hurdle though.
Even though it is still "patent pending", we are going to have a problem, when/if the patent gets approved.
The idea of the patent is, that you can use the meat inside the oven/grill, as an insulator for the electrical components. This was something that we actually thought about doing, but now we have to find a different way to insulate the components. The downside of using the patent idea, is that the meat thermometer can't go inside the oven, without it being inside meat. Meaning that you can't use it to e.g. see the temperature of a soup. The patent is best explained with the figure below. [2]
Neither the patent nor the application can be found, making it seem like it is still under development. With the company's size (apptionlabs) the patent is most likely taken only in the US.

These were the only two patents that could interfere with our product development.



Project title View by SØ			
Title: Patents		Date: 29.04.2016	
Activity: Research	Worksheet no.: C9	Responsible: Jon Søgaard	

Photos were found at:

[1] http://www.google.com/patents/US2276178

[2] https://www.indiegogo.com/projects/meater-the-only-wire-free-smart-meat-thermometer#/

Evaluation

From our findings, it was clear, that meater patent was going to be a hurdle to overcome.

Reflection

What we have learned is, that if we use the meat as a heat insulator, as we were considering, the product might eventually not be sold in the US.

Project title View by SØ		
Title: Power consumption of components		Date: 13.05.2016
Activity: Calculation	Worksheet no.: C10	Responsible: Jon Søgaard

Objective:

The objective with the worksheet were to calculate the power consumption of the two parts, to find out what kind of batteries were needed.

Experiment/data:

When the components were found the power consumption from the different components were put into an excel sheet, and with help from service engineer the capacity of the batteries were found. When calculating battery capacity, you take the power consumption of the components, and multiply it by the number of hours you want the battery to be able to power the components. [EL-Faglære, 2011].

Component	Consumption		Price		Time	10	Timer
Wifi module	56	mA	0,1	$			
Camera	140	mA	0,1	$			
Light	20	mA	0,01	$			
PCB	20	mA	5	$			
Bluetooth	17,9	mA	3,9	$			
Step motor (500mA)	11,1	mA	4	$			
Total	265	mA	13,01	$			
Battery size	2650	mA					
Component	Consumption						
Temperature sensor	0,4	mA					
PCB	1,6	mA					
Total	2	mA					
Battery size	20	mA					

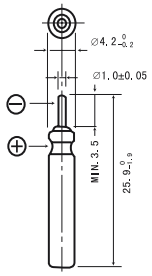
The needed capacities are highlighted in the illustration above.
The needed capacity for the camera unit were 2090mAh, and 20mAh for the probe.

Because the probe needed to go inside the oven, special heat requirements were needed. We called an expert on batteries named Kurt Nygaard, and asked what he recommended. He recommended the one on next page called BR-435, as it could take more heat than advertised. The data sheet can be found on the next page.

Project title View by SØ		
Title: Power consumption of components		Date: 13.05.2016
Activity: Calculation	Worksheet no.: C10	Responsible: Jon Søgaard

2 POLY-CARBONMONOFLUORIDE LITHIUM BATTERIES (BR SERIES)

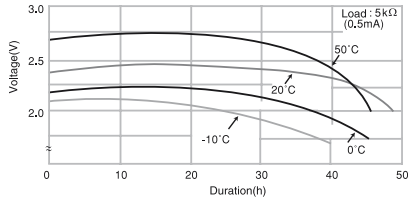
BR-425



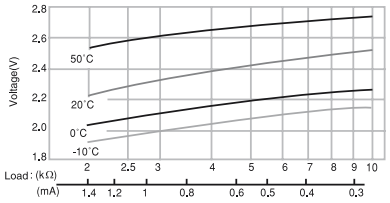
SPECIFICATIONS

Name	BR-425
Nominal voltage (V)	3
Nominal capacity (mAh)	25
Continuous drain (mA)	0.5
Operating temperature (°C)	-30 to +80
Weight (g)	0.6

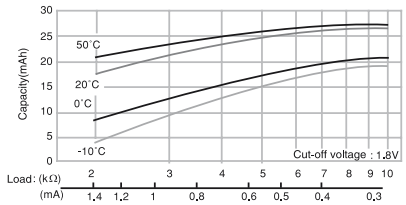
DISCHARGE TEMPERATURE CHARACTERISTICS



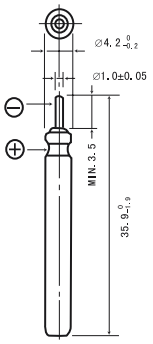
OPERATING VOLTAGE VS. DISCHARGE CURRENT*



CAPACITY VS. LOAD RESISTANCE



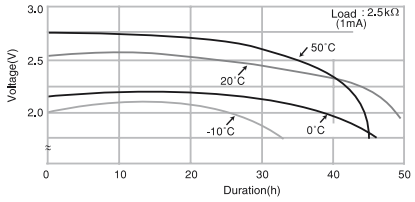
BR-435



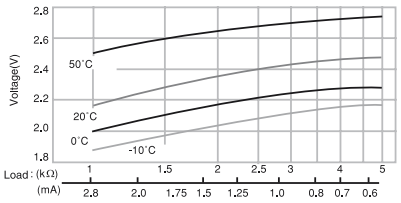
SPECIFICATIONS

Name	BR-435
Nominal voltage (V)	3
Nominal capacity (mAh)	50
Continuous drain (mA)	1.0
Operating temperature (°C)	-30 to +80
Weight (g)	0.9

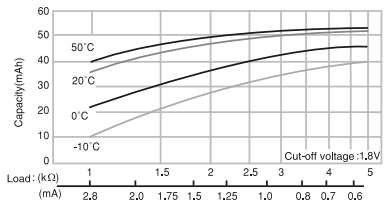
DISCHARGE TEMPERATURE CHARACTERISTICS



OPERATING VOLTAGE VS. DISCHARGE CURRENT*



CAPACITY VS. LOAD RESISTANCE



The data in this document are for descriptive purposes only and are not intended to make or imply any guarantee or warranty.

54 * Voltage at 50% discharge depth.

Project title View by SØ			
Title: Power consumption of components		Date: 13.05.2016	
Activity: Calculation	Worksheet no.: C10	Responsible: Jon Søgaard	

Sources:
EL-Faglære, 2011. *El-Teori*. 11th ed. Svendborg: EVU.

All illustrations are own illustrations.

Evaluation

Expert knowledge were needed for the choice of batteries, so we contacted a battery expert, as well as a service engineer, to help us pick the right ones.

Reflection

The battery needed for the camera unit were 2090mAh and for the probe 20mAh. For the probe we should use the BR-435 battery, because of it's heat tolerance.

Project title View by SØ		
Title: Price estimate		Date: 23.05.2016
Activity: Calculation of production and expenses	Worksheet no.: C11	Responsible: Jon Søgaard

Objective:

The objective were to create a guestimate of the production price of the product as well as break-even time.

Experiment/data:

At first the production price in Denmark were calculated, with as much as possible taken into account. The interest from the bank were even taken into account, as the company would have to load the money for the initial capital. The calculations can be seen below:

Denmark page 1:

Producing 5.000 units the first year in DK

Materials:							
	Specification	Cost € per kilogram	Amount kilograms	Scrap %	Amount Brutto	Cost €	
	ABS	0,69	330,082935	-10,00%	297,074642	205	
	EPDM rubber	0,58	26,96089	-10,00%	24,264801	14	
	LCP	2	22,036617	-10,00%	19,8329553	39,6659106	
	Materials total						259
Salaries China							
	Specification	Salary € per year					
	Person 1	50000					
	Person 2	50000					
	Person 3 (syerske)	10000					
	Software developer	8000					
	Electrician	3500					
	Salaries total						121500
Comsumption							
	Specification	Cost €					
	Electricity	4000					
	Diverse	4000					
	Total comsumption						8000
Rent							
	Specification	Cost per square meter	Yearly rent €				
	Square meters						
	280	55	15400				
	Rent total						15400

Body	Volume		Type
Core	33776,45	mm^3	ABS
Middle plate	10001,34	mm^3	ABS
Cap plate	11242,02	mm^3	ABS
Top/buttom mount	6822,38	mm^3	ABS
Washer head	49,58	mm^3	ABS
Washer	26,85	mm^3	ABS
Rail slider	711,94	mm^3	ABS
Threaded clip	242,38	mm^3	ABS
Rubber front	4901,98	mm^3	EPDM Rubber
Glass	7318	mm^3	Glass
Probe top	2720,57	mm^3	LCP
ABS all in all	62872,94	mm^3	
ABS all in all	62,87294	cm^3	
ABS g	66,016587	g	
ABS needed in 5.000 pcs	330082,935	g	
LCP	2,72057	cm^3	
LCP g	4,4073234	g	
LCP needed for 5.000 pcs	22036,617	g	
EPDM	4,90198	cm^3	
EPDM g	5,392178	g	
EPDM needed in 5.000 pcs	26960,89	g	

Denmark page 2:

Depreciation						
	Specification					
	Machine type	Initial cost €	Expected lifetime Years	Linear depreciation		
	Injection moulding	35000	5	7000		
	Moulds	50.000	5	10000		
	Diverse equipment	40000	5	8000		
	Depreciation total				25000	
Interest						
	Specification	Interst rate	Interst per year			
	Principal	%				
	500000	6,00%	30000			
	Interst total				30000	
Total expenses					200159 €	
Pr. Unit					20,0158721 €	149,318406 kr
Pr. Unit without interest					17,0158721 €	126,938406 kr

Project title View by SØ		
Title: Price estimate		Date: 23.05.2016
Activity: Calculation of production and expenses	Worksheet no.: C11	Responsible: Jon Søgaard

Afterwards it was tried moving the production to China, to see ho it would effect the unit price. It was expected, that this would make the product a great bit cheaper in production expenses. The China calculations can be found below:

China page 1:

Producing 5.000 units the first year in China

Materials:							
	Specification	Cost € per kilogram	Amount kilograms	Scrap %	Amount Brutto	Cost €	
	ABS	0,69	330,082935	-10,00%	297,074642	205	
	EPDM rubber	0,58	26,96089	-10,00%	24,264801	14	
	LCP	2	22,036617	-10,00%	19,8329553	39,6659106	
	Materials total						259
Salaries China							
	Specification	Salary € per year					
	Person 1	1000					
	Person 2	1000					
	Person 3 (syerske)	1000					
	Software developer	8000					
	Electrician	3500					
	Salaries total						14500
Comsumption							
	Specification	Cost €					
	Electricity	4000					
	Diverse	4000					
	Total comsumption						8000
Rent							
	Specification	Cost per square meter	Yearly rent €				
	Square meters						
	280	55	15400				
	Rent total						15400

Body	Volume		Type
Core	33776,45	mm^3	ABS
Middle plate	10001,34	mm^3	ABS
Cap plate	11242,02	mm^3	ABS
Top/buttom mount	6822,38	mm^3	ABS
Washer head	49,58	mm^3	ABS
Washer	26,85	mm^3	ABS
Rail slider	711,94	mm^3	ABS
Threaded clip	242,38	mm^3	ABS
Rubber front	4901,98	mm^3	EPDM Rubber
Glass	7318	mm^3	Glass
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ABS all in all	62872,94	mm^3	
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ABS g	66,016587	g	
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LCP	2,72057	cm^3	
LCP g	4,4073234	g	
LCP needed for 5.000 pcs	22036,617	g	
EPDM	4,90198	cm^3	
EPDM g	5,392178	g	
EPDM needed in 5.000 pcs	26960,89	g	

China page 2:

Depreciation				
	Specification			
	Machine type	Initial cost €	Expected lifetime Years	Linear depreciation
	Injection moulding	35000	5	7000
	Moulds	50.000	5	10000
	Diverse equipment	40000	5	8000
	Depreciation total			25000
Interest				
	Specification	Interst rate	Interst per year	
	Principal	%		
	500000	6,00%	30000	
	Interst total			30000
Total expenses				93159 €
Pr. Unit				9,3158721 € 69,4964059 kr
Pr. Unit without interest				6,3158721 € 47,1164059 kr

The project were then calculated afterwards, as seen below:

Project budget:

	A	B	C	D	E	F	G	H	I	J	
1	**Business case**										
2											
3											
4	**Project budget**										
5											
6	Salary		(2 men full time for a whole year, one year = 1.900 hours. Hourly wage 500kr./h) **in-house**							kr.	1.900.000
7	Approvals/Travels									kr.	500.000
8	Prototypes/materials									kr.	300.000
9	Consultants									kr.	400.000
10	Tools									kr.	900.000
11	Other									kr.	200.000
12										**kr.**	**4.200.000**
13											

The retail price of the product were then calculated.

Project coverage:

	A	B	C	D		I	J	K
1	**Business case**							
2								
3								
4	**Product coverage**							
5								
6	Retail price (customers)			kr.	1.125			
7	VAT (25%)			kr.	225			
8	Retail price without VAT			kr.	900			
9	Coverage (Retailer 50%)			kr.	450			
10	Retail price ex factory			kr.	450			
11	Coverage (factury 200%)			kr.	300	Full profit by the sale to the factory		
12	Cost price			kr.	150			
13								

The break-even time were the calculated, to see when the company were to expect profit.

Break-even analysis:

	A	B	C	D	E	F	G	H
1	**Business case**							
2								
3								
4	**Budget**							
5				**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
6	**Amount**			5.000	10.000	27.000	35.000	25.000
7	**Price**			kr. 450	kr. 450	kr. 450	kr. 450	kr. 450
8	**Cost price**			kr. 150	kr. 150	kr. 150	kr. 150	150
9								
10	Turnover			kr. 2.250.000	kr. 4.500.000	kr. 12.150.000	kr. 15.750.000	kr. 11.250.000
11	Expenses			kr. 750.000	kr. 1.500.000	kr. 4.050.000	kr. 5.250.000	kr. 3.750.000
12	Gross margin			kr. 1.500.000	kr. 3.000.000	kr. 8.100.000	kr. 10.500.000	kr. 7.500.000
13								
14								
15	**Breakeven analysis**							
16	Investment			kr. -4.200.000	kr. -2.700.000	kr. 300.000	kr. 8.400.000	kr. 18.900.000
17	Coverage			kr. 1.500.000	kr. 3.000.000	kr. 8.100.000	kr. 10.500.000	kr. 7.500.000
18	Remaining			kr. -2.700.000	kr. 300.000	kr. 8.400.000	kr. 18.900.000	kr. 26.400.000
19								
20	**Return (of the project investment)**					**kr. 8.400.000**	**18.900.000**	**26.400.000**
21	**Return on assets**					**200,0%**	**450,0%**	**628,6%**
22								

The components prices can be seen on the next page.

The amount of sales are decreasing in the fifth year. This is if there is no innovation in the product, then hype is going to go down, as the product starts to be outdated. To account for this problem, more innovation and development is needed.

Project title View by SØ		
Title: Price estimate		Date: 23.05.2016
Activity: Calculation of production and expenses	Worksheet no.: C11	Responsible: Jon Søgaard

Component/unit price:

	A	B	C	D	E	F
1	**Camera unit price**					
2						
3						
4	Components				Price/ pice (500 units) dollars	Kr exchange rate 6,63
5	Camera				0,1	
6	Light (16x0,1$)				0,16	
7	PCB				1	
8	Bluetooth				3,9	
9	Stepper motor				3,9	
10	Wifi				0,1	
11	Batteries (3x2,38$)				7,14	
12	Voltage regulator				0,32	
13	Magnets (6x0,012$)				0,072	
14	Threaded rod				0,34	
15	Rails				0,1	
16	Glass				1	
17	Metal plate				1	
18	Diverse (screws etc.)				1	
19	In all				20,132	**133,47516**
20						
21						
22	Assuming that we, due to the quality and neglect of middleman, can buy it for 60DKK					
23						
24						
25						
26	**Probe unit price**					
27						
28						
29	Components				Price/ pice (1000 units) dollars	Kr exchange rate 6,63
30	Temperatur sensor (4x 0,51$)				2	
31	PCB				0,03	
32	Battery				3,47	
33	Metal body				1	
34	Top				0,5	
35	In all				7	**46,41**
36						
37						
38	Assuming that we, due to the quality and neglect of middleman, can buy it for 20DKK					

Sources:
Kinablog. 2016. *Mindsteløn i Kina: Hvor meget tjener en kinesisk arbejder?* | Kinablog. [ONLINE] Available at: http://kinablog.dk/2010/09/22/mindsteløn-hvad-tjener-en-kinesisk-arbejder/. [Accessed 23 May 2016].

Plastuddannelse.dk. 2016. *LCP egenskaber.* [ONLINE] Available at: http://www.plastuddannelse.dk/lcp-egenskaber-2#. [Accessed 22 May 2016].

GmbH, Kaarst. 2016. *Raw Materials & Prices.* [ONLINE] Available at: http://plasticker.de/preise/pms_en.php?show=ok&-make=ok&aog=A&kat=Mahlgut. [Accessed 23 May 2016].

Evaluation

The optimal cost price of the product are 150DKK, making the retail price 1.125DKK. This also told us, that to be competitive, the production had to be moved to China.

Reflection

The production in China is the only way to be competitive on the market as a new comer.

Project title View by SØ			
Title: Extreme components		Date: 11.03.2016	
Activity: Desk research	Worksheet no.: D1	Responsible: Mads Peter Hilligsøe	

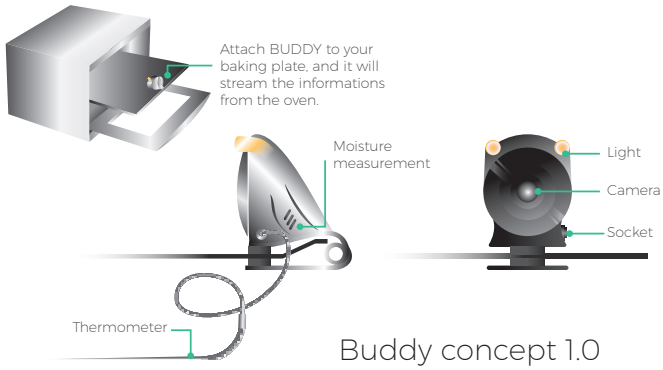
Objective:

To state if the concept is possible the components and the materials needs to be heat resistant up to 300°C. This worksheet establishes an overview of similar products with similar requirements.

Experiment/data:

By placing the camera inside the oven it sets some requirements because of the tough environment. The most critical requirement is the high temperature. When dealing with an environment of 300°C the product obviously needs to be tolerant for this temperature.

To get an idea of the possibility, similar products were analyzed.



Buddy concept 1.0

Fire cam 1080:
The fire cam is a camera designed for the firefighters. A camera which is capturing their battle in the fire. Fire cam can handle up to 480°C for short periods of time and is designed for interior firefighting. The camera is made of heat resistant anodized aluminum with a heat resistant glass lens. The camera is not construed in such way that it can handle the heat for longer periods of time. Which then doesn't fulfill the requirements for the buddy concept.

Price: 1800 DKK
http://firevideo.net/index.php/new-2015-fire-cam-1080.html

Fire cam 1080 with helmet mount [1]

Fire cam 1080 mounted on a fire helmet [2]

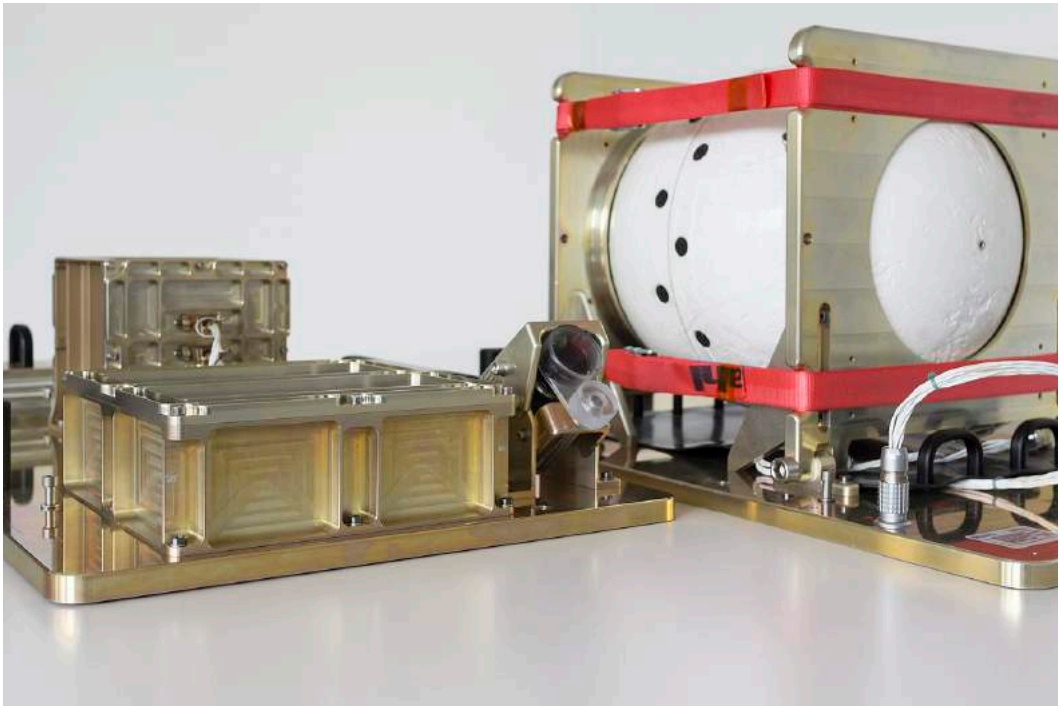
Project title View by SØ			
Title: Extreme components		Date: 11.03.2016	
Activity: Desk research	Worksheet no.: D1	Responsible: Mads Peter Hilligsøe	

Camera in space:
Space travelers have for several decades been an ongoing compensation of being the first and best at sending astronauts to outer space.

European Space Agency engineers are going where no human will ever go. They've put a thermal camera inside an automated spacecraft to see what will happen during its reentry into Earth's atmosphere full of garbage. The two object on the photo beneath are a special infrared camera and a spherical SatCom device, both coated in heat resistant ceramic shielding

The camera is designed to be activated by the acceleration, so it will activate right before the space station junk will burn and thereby capture the last proximately 10 seconds of the spacecrafts as it reenters the atmosphere. Then the footage will be transmitted to the SatCom device which can survive up to 1500°C. During the last 10 seconds the camera and the junk will burn.

Http://gizmodo.com/this-camera-is-going-to-hell-and-will-send-us-pictures-1685227698



Camera setup [3]

Project title View by SØ		
Title: Extreme components		Date: 11.03.2016
Activity: Desk research	Worksheet no.: D1	Responsible: Mads Peter Hilligsøe

Components:
The needed components for buddy concept 1.0 is: Camera, battery, PCB, bluetooth unit, LED light, temperature and moisture sensor. All of them needs protection from the heat. The units will simply melt if the main construction isn't protecting them from the hot environment.

Extreme high temperature silicon
Glass fiber (insulations material)
Extreme high temperature silicon

The idea with the 3 layers of material is to keep a cleanable outer shape and then protect the insulation glass fiber from dirt and liquids. The extreme high temperature silicone can withstand the rough environment in the oven and is easy to clean. (Used for silicone baking forms).

The materials have been chosen based on their properties. Validation of the 3 layers principle is need to determine if it is possible to protected the components in this way.

Illustration sources:

[1] http://photos05.redcart.pl/templates/images/thumb/15956/300/400/pl/0/templates/images/products/15956/901b2121d437b16bdb33cccd64c37e78.jpg

[2] http://blackjackglobal.com/wp-content/uploads/2015/01/Fire-Cam-Helmet2-Side.jpg

[3] http://i.kinja-img.com/gawker-media/image/upload/t_original/oic7x5bacfxhx08ssisf.jpg

All other illustrations are own illustrations

Evaluation
The two product described in this worksheet can handle the heat for small periods, but can't withstand the heat for longer periods. Which is needed for buddy concept 1.0

Reflection
Calculations of the heat transformations is needed to conclude if it is possible to protect the components with those 3 layers.

Project title View by SØ		
Title: Industrial oven cameras		Date: 17.05.2016
Activity: Desk research	Worksheet no.: D2	Responsible: Jon Søgaard

Objective:

The objective with this worksheet it to look into the industry, and see how they are solving the problem of having a camera inside an oven.

Experiment/data:

In the industry heat resistant cameras are widely used. There are two types. Those who has to stay inside the oven, which are active cooled with both liquid and air (seen to the left)[Anon1, 2016]. And those that are just used to peep through the hole of a kettle or oven with just the tip, for a short amount of time (seen to the right)[Anon2, 2016]. The one to the right can only withstand 1000°C for 10 minutes, and is a passive cooled solution for e.g. a GoPro like on the photo. It is only the very tip of the lens, that goes inside the oven, keeping the heat away from the camera itself.

The ones to the left are installed inside ovens or very hot environments, to see what is going on, while the one to the right are usually used for short inspections. Most inspection cameras looks like the one below [Anon3, 2016]. As illustrated, the thick end is the camera, while the long end is a special heat resistant liquid cooled lens, that makes sure, that the heat has a very long travel time towards the camera.

Project title View by SØ		
Title: Industrial oven cameras		Date: 17.05.2016
Activity: Desk research	Worksheet no.: D2	Responsible: Jon Søgaard

The camera housing below shows the back and forth of a liquid cooled camera. The size of this unit is 375*163*185 mm, which the about the normal size for these kinds. [Anon4, 2016]

Sources:
Anon1. 2016. *Lequid cooled camera housing.* [ONLINE] Available at: http://www.tecnovideoc-ctv.com/liquid_cooled_camera_housing_ssh168_lc.php. [Accessed 17 May 2016].

Anon2. 2016. 69 high temperature endoscope lenses. [ONLINE] Available at: https://www.rvasynergies.co.uk/industrial-inspection/rigid-endoscopes/69-high-temperature-endo-scope-lenses. [Accessed 17 May 2016].

Anon3. 2016. *FireSight® - Lenox Instrument Company, Inc.*. [ONLINE] Available at: http://www.directindustry.com/prod/lenox-instrument-company-inc/product-60033-397142.html. [Accessed 22 May 2016].

Anon4. 2016. *Temperature Resistant Camera Housing,Furnace Monitoring Product.* [ONLINE] Available at: https://www.alibaba.com/product-detail/top-10-made-in-china-high_60030668652.html. [Accessed 22 May 2016].

All the illustrations were found at the associated source.

Evaluation

The cameras used in the industry is a lot bigger, than what we can allow out product to be, and are all active cooled if they have to be in an oven for more than 15 minutes.

Reflection

We can't use the same principle as the active cooled cameras, because they are way to big to fit into a conventional oven.

Project title View by SØ		
Title: Thermal cameras		Date: 23.03.2016
Activity: Desk research	Worksheet no.: D3	Responsible: Jon Søgaard

Objective:

We made this market research, to find out, if it was actually withing our price range, and to find out, what the capabilities of the thermal cameras were.

Experiment/data:

We started by trying to find a cheap thermal camera, within our price range. The retail price of the product had to be a maximum of 1000 DKK.

We found different thermal cameras, but at sky high prices. We started looking at the prices for regular thermal cameras, like the one to the right, which costs 8000,- DKK.

[1]

We knew, that the size of these were way to big, and that the specifications were a complete overkill. it had to be quite small, to fit in our device, so we started looking at thermal cameras for phones, and found different kinds.

To the right you see the FLIR ONE for the iPhone. The price tag of this product is 2000,- DKK, which still is out of our price range.
However, we found a smart phone from CAT, with this technology integrated. They had made an collaboration with FLIR, to get their camera in their phones, presumably at a much lower price tag, at the phone is sold for only 4000 DKK, which is a relatively cheap price for a smart phone. The phone is called CAT S60, and can be seen below.

To the left is the thermal image, that the phone displays, in the middle are the actual camera itself. The footprint of the camera is approximately 1 cm^2, which is perfectly for our concept. The image to the right is the back side of the phone.

[2]

[3]


[4]


[4]

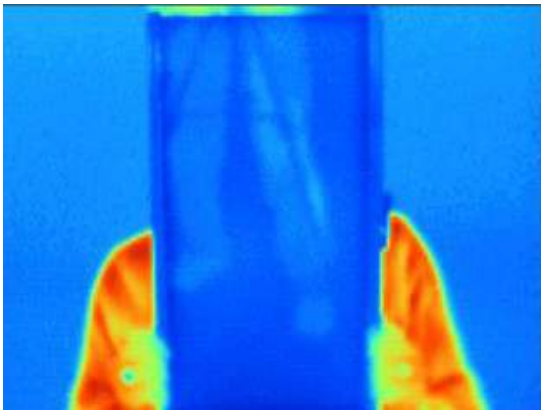
[5]

Project title View by SØ		
Title: Thermal cameras		Date: 23.03.2016
Activity: Desk research	Worksheet no.: D3	Responsible: Jon Søgaard

We the started researching, what these cameras were actually capable of.

Thermal cameras are already used in the food industry, as a safety, when inspecting cooked food. They are used, to make sure, that the food (mostly meat) has reached the desired temperature. [SPI Corp. 2016][Vadivambal, 2016]
Even with this in mind, we weren't quite sure, if it could still work. There were a lot of sayings about thermal cameras, and we didn't knew, how much of it were true, like can you actually see in the dark, or through walls?
Unfortunately the latter one isn't true. In fact, thermal cameras can't even see through glass, as it has it's own thermal profile, which is what the camera sees.[P&R Technologies, 2016] An example of this, can be seen below.


[6]


[7]

Just to be sure, we asked an expert in the field of thermal cameras, named Henrik Quist.
"You can't see through glass using a thermal camera, you can however buy special glass, that you can see through" Henrik Quist - Pro Instruments.

This were a quite a hurdle to run into, as ovens always has glass doors, meaning, that if we place the camera outside, then it won't be able to see inside the oven, and if we place it inside, the solution is going to be extremely expensive, because it has to be heat resistant at high temperatures for hours.

A week later we contacted Henrik Quist once again, to hear if he knew anything about how if you could measure the core temperature in a roast using a thermal camera:
"Well, a thermal camera only sees the surface, but you can however calculate the heat transfer. This makes it possible to e.g. see heating pipes 80cm down into the ground. If you should do the same thing with meat, you would have to see it dynamically and see how the heat is transfered into the meat, also called the heat transfer towards the center. It can be done, but it is not at all a simple process. You have to know the heat transfer in all the different kinds of meat, and then make a lot of tests from this. They use the same technic at Vestas to check the quality of their lacquer"

Project title View by SØ			
Title: Thermal cameras		Date: 23.03.2016	
Activity: Desk research	Worksheet no.: D3	Responsible: Jon Søgaard	

Sources:

[1] SPI Corp. 2016. *Thermal Cameras for Food Safety & Production Inspection*. [ONLINE] Available at: http://www.x20.org/thermal-cameras-food-safety/. [Accessed 22 May 2016].

[2] Vadivambal, R., 2016. *Bio-Imaging*. 1st ed. Florida: CRC Press.

[3] P&R Technologies. 2016. *Thermal Imaging - Facts Versus Fiction*. [ONLINE] Available at: http://pr-infrared.com/about-thermal-imaging/thermal-imaging-facts-vs-fiction/. [Accessed 23 March 2016].

Illustrations:

[1] http://ecx.images-amazon.com/images/I/71yJDVL%2BB%2BL._SL1500_.jpg

[2] http://store.storeimages.cdn-apple.com/4662/as-images.apple.com/is/image/AppleInc/aos/published/images/H/J1/HJ102/HJ102?wid=1000&hei=1000&fmt=jpeg&qlt=95&op_sharpen=0&resMode=bicub&op_usm=0.5,0.5,0,0&iccEmbed=0&layer=comp&.v=hStlb3

[3] https://istuff.pt/wp-content/uploads/2015/12/HJ102_AV1.jpeg

[4] http://imagens.canaltech.com.br/124889.211945-Destaques-MWC.jpg

[5] https://pbs.twimg.com/media/Cb5p1RWWEAADAPV.jpg

[6] http://www.moistureview.com/wp-content/uploads/2010/12/IR20071228_0106vl.jpg

[7] http://www.moistureview.com/wp-content/uploads/2010/12/IR20071228_0106ir.jpg

Evaluation

We considered using a thermal camera for measuring core temperature of the roast, and looked at different solutions. However, we found out, that you can't see through glass with a thermal camera. We also found out, that core temperature can be measured with thermal cameras, but it is a VERY hard thing to do.

Reflection

We can't use a thermal camera for measuring core temperature, as we are looking from the outside of the oven and in through glass. And unfortunately thermal cameras can't see through glass. We also learned, that thermal camera can be used to calculate core temperature, but it requires a lot of work and tests.

Project title View by SØ		
Title: Ideation 1		Date: 03.02.2016
Activity: Ideation	Worksheet no.: E1	Responsible: Mads Peter Hilligsøe

Objective:

This is the first ideation on the topic smart cooking. The intention of this ideation/brainstorm is to visualize the first kind of concepts that comes to mind.

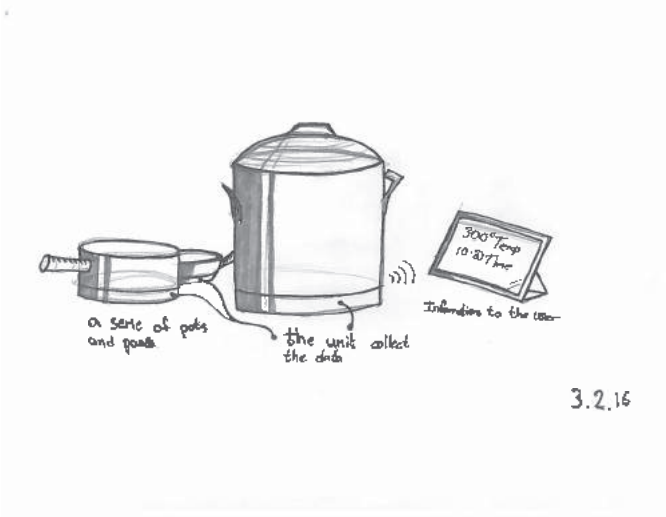
Experiment/data:

The first concept is a bottom module which can be place underneath either the pot or pan.

This module has two main functions:
1. Thermometer, which informs the chef about the current temperature of the dish. Some commodity needs to be prepared at a specific temperature, because of that this function could really benefit the chef.

2. Weight. Often when you have to dose in a pot is it pretty hard to pour the right amount. That means that there could come a mis match according to the recipes your are following.

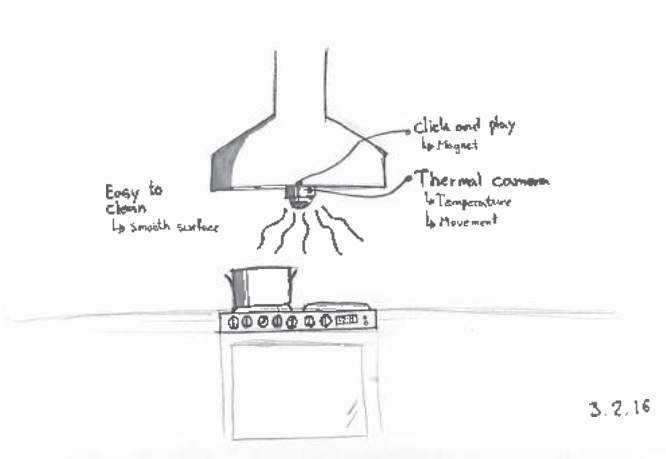
By incorporating this features the chefs workflow in the kitchen would be optimized and in that way release time for some other tasks. The informations from the module could either be send to a smart device such as a tablet or being displayed directly on the module.



Module base concept.

This concept is building on a thermal camera placed underneath the extractor. The camera then analyses the temperature of the pictures it has been given. On the illustrations the camera are analyzing the temperature of the dish, and can by those informations tell the chef if the dish is at the right temperature or if has to be either lowed or raised.

Those informations can give the chef a more relaxed experience in the kitchen as the temperature informations gives the chef a clear overview.



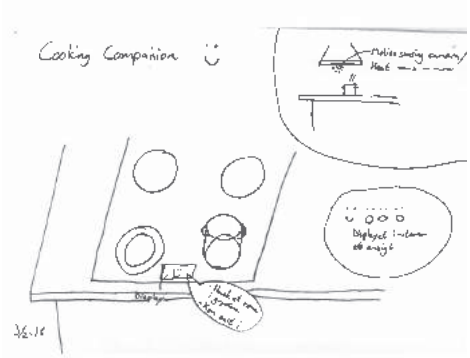
Thermal camera concept.

Project title View by SØ		
Title: Ideation 1		Date: 03.02.2016
Activity: Ideation	Worksheet no.: E1	Responsible: Mads Peter Hilligsøe

This concept is all about registration, before you add something to your pot or pan you are going to scan the barcode on the ingredients, in that way the product knows the nutrient content of the dish. This can leads to a more healthy lifestyle.

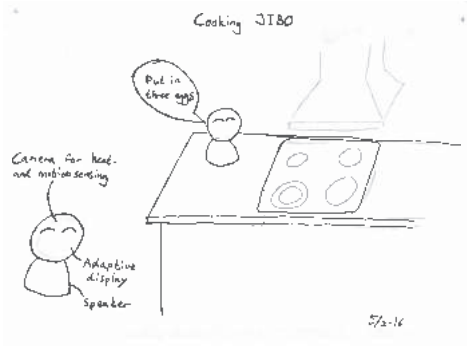
Barcode scanner.

Another concept is based on an intelligent cooking top which in corporation with the extractor and a thermal camera can give guidance during the cooking time. The cooking top displays if the food is at a stable and controlled condition. The function from the module base concept could easily be incorporated into this concept. In that way the hole cooking top becomes a weight plate.



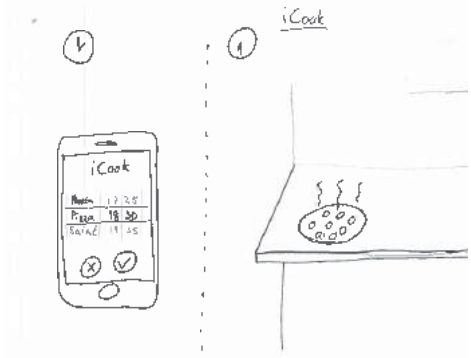
Intelligent cooking top

Jibo is current a kickstarter concept, where this little robotic fellow is interacting with the humans and in that way becomes a part of the family. This concept is building on the same aspect as Jibo but adds the function of cooking guidance in the kitchen.



Jibo cooking guidance.

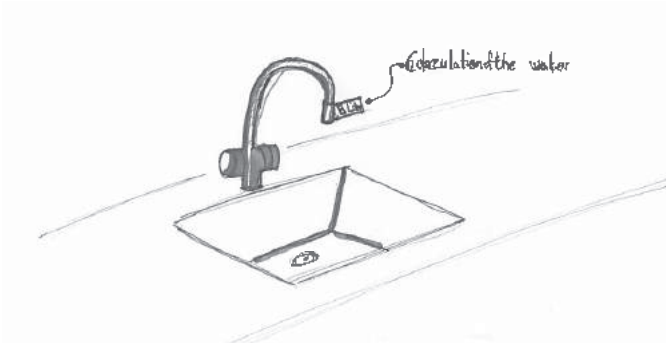
The iCook concept is taking the advantages of fast food service such as just-eat and hungry.dk. The idea is simply to set the settings in the app and you will then receive home made food at that time. The product then has to have the possibilities of cooking everything by it self. The only thing the user has to do is to feed the machine with the needed ingredients.



iCook concept.

Project title View by SØ			
Title: Ideation 1		Date: 03.02.2016	
Activity: Ideation	Worksheet no.: E1	Responsible: Mads Peter Hilligsøe	

The last concept is an add-on to your faucet. The idea is to visualize the volume of water, that is being poured into e.g. a cup directly from the faucet, in that way is it not needed for the chef to find any other tools i terms of dosing water. The awareness of water consumption could as well lead to a more subdued usage and thereby help the user save money on the water bill.



Info Faucet concept.

All illustrations are own illustrations.

Evaluation

This concepts is from our first brainstorming and is the first step against a more specific ideation.

Reflection

The idea of guidance to the chef is becoming more trendy in the cooking environment. And we want to follow that trend.

Project title View by SØ		
Title: Brain pool writing		Date: 03.02.2016
Activity: Brainstorming	Worksheet no.: E2	Responsible: Mads Peter Hilligsøe

Objective:

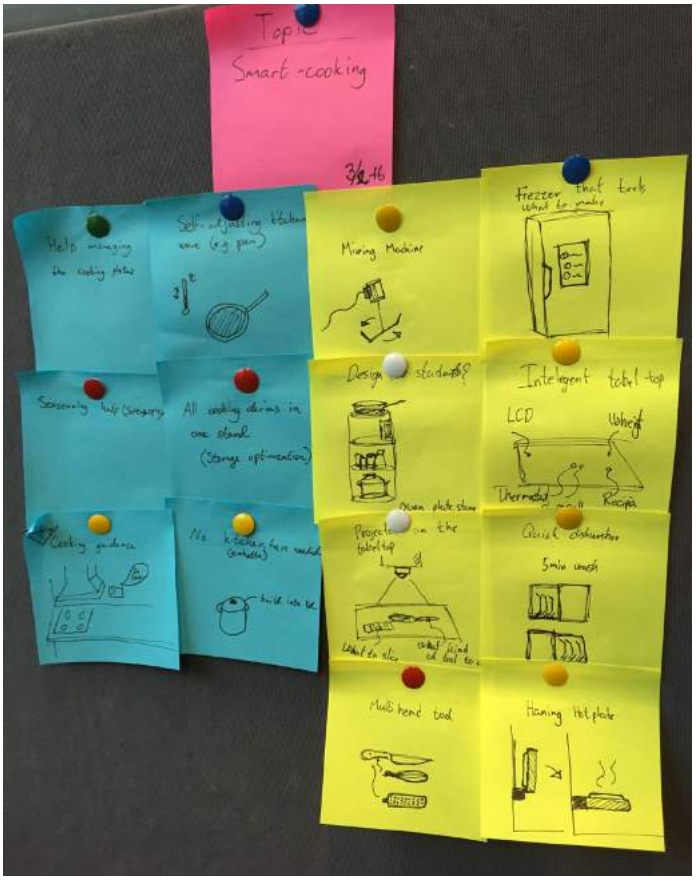
The intention of this brainstorm is to clear our minds of ideas and concepts on the topic smart cooking. With the concepts on the paper it should be easier to talk about the topic and our first ideas.

Experiment/data:

The ideas are building on the problem areas we are facing in our daily work in the kitchen.

Most of the concepts are building on guidelines through the different cooking steps. The product could either talk to the user, or illustrate by icons and illustrations the task. Another solution could be informing the user about relevant informations during cooking. Informations such as temperature, volume, recipes, etc.

Another problem area could be the lack of table space, where some of the concepts are trying to optimize the space in the kitchen. Either by hanging the hotplate on the wall or optimizing the kitchen furnitures for a better storage solution. It could as well be a really small dishwasher which could fit into the small students apartments, or be beneficial in a small restaurant.



All illustrations are own illustrations.

Evaluation

The exercise is aiming for emptying the mind of any upcoming idea in the beginning of the project phase. The ideas is all aiming for a better workflow in the kitchen.

Reflection

The outcome of this exercise has given us an impression of the problem area. The next step would be a bigger investigation on the problem area.

Project title View by SØ		
Title: Forced relationship		Date: 22.02.2016
Activity: Forced relationships	Worksheet no.: E3	Responsible: Jon Søgaard

Objective:

The objective was to get new ideas, that we wouldn't come up with, using regular brain-storm, or brain pool writing.

Experiment/data:

Word	Goals/values
Sky	"A sky of functions"
Blue	Help defrosting food
Red	Help heating food
Accident	A warning when a mistake happens/a dangerous situation
Bike	The product is running on manual power
Sporty	Cooking is going to be a competition
The Olympics	Eat at the same level, as athletes/professional chefs
Competition	Sharing and rating recipes
Tryouts	Recipe of the month
Defeat	Has to reduce the number of "defeats" during cooking
Medal	The product has to be innovative and approved
Recognition	The product has to create recognition among friends
The Nobel price	Reduces the food waste
Ecologists	The product has to be all-round
Fruit and Vegetables	Make fruit and vegetables more interesting to eat
Healthy lifestyle	Has to create a healthier lifestyle
BMI	Has to help you reach your desired BMI
Control	You can track your dining automatically
Monarcy/dictatorship	You don't need anything other than the product
Slaves	It has to create time for more important things

Evaluation

This helped us come up with a lot of different goals/values, for our product.

Reflection

We got a lot of goals/value for our product, that we wouldn't have come up with, otherwise. Even though they might need some sorting, this was very helpful, and will help us make the requirements.

Project title View by SØ		
Title: Ideation 2		Date: 24.02.2016
Activity: Concept development	Worksheet no.: E4	Responsible: Mads Peter Hilligsøe

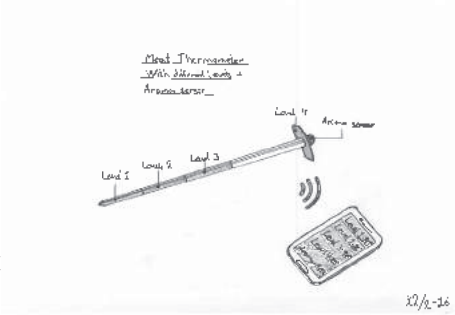
Objective:

The intention of the ideation is to state some concepts based on a more simplified version of the intelligent pot or pan with incorporated thermometer and weight scale.

Experiment/data:

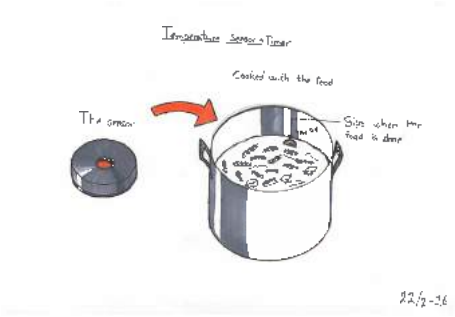
Meat thermometer

The first concept is building on a regular meat thermometer where the idea is to add different measuring levels, which allows the chef to get more specific informations about the meat they are cooking. Level 4 on the drawing illustrates the a plate which can measure the skin temperature of that level, this can be useful when grilling a steak. The thermometer also includes an aroma sensor, a sensor which can "smell" if the meal is getting burned. All those informations is wireless transfered to your smart device, where an app collects the data and analyses if the meal is prepared to perfection.



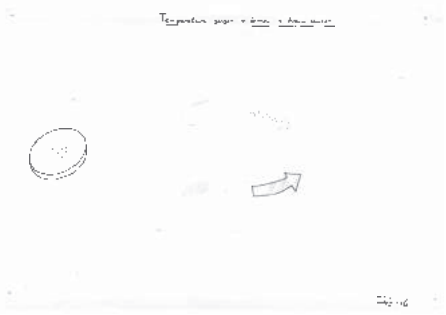
Cooking disc

This cooking disc provides the chef with informations about the condition of their dish. The idea is that you start by informing the disc via. an app which kind of dish or veggies you are going to cook. By that the disc knows what the temperature needs to be before the e.g. the veggies achieves the right condition. That feature together with an alarm from the app, makes a perfect cooked meal. The disc needs to be waterproof and resistant to the really hot environments.



Baker disc

This baker disc has some of the same functions as the cooking disc. It measure the temperature in the oven, but it also has a kind of aroma sensor that can tell if e.g. the bread or cake is being burned. The disc can also measure the moisture level in the oven. The disc is simply attached via. magnets and will fit any oven or baking plate. The informations from the disc is wireless being transfered to your smart device where all the relevant informations is being shown.



Project title View by SØ		
Title: Ideation 2		Date: 24.02.2016
Activity: Concept development	Worksheet no.: E4	Responsible: Mads Peter Hilligsøe

Combination of the concepts.
The fact that smart ovens is getting more intelligent and more common in the new and renovated kitchens, makes us believe that the features of those ovens are getting more mainstream and is somehow needed on the market. Those smart ovens are really price and can easily have a cost of 20.000 DKK. The idea is to provide the kitchen user with some of the features from the smart oven with an add on product. The price of the product should be in the lower end of the price scale e.g. 1.000 DKK. The concepts consist of different control tools according to the cooking time. Tools such as; Camera, thermometer, moisture measurement and aroma sensor.

June - Smart oven with camera [1]

According to the tough environment in the oven, the product need to be resistant to the high temperatures. A huge challenge is the minimum of space in the oven. Is there room for this kind of product?

To the right on the top is a picture of June, which is a smart oven with different advantages. Advantages such camera in the top of the oven to follow the process of the meal and self regulation of the temperature according to the condition of the meat.


Meater - Wireless thermometer [2]

Beneath we find the Meater, which basically just is a wireless thermometer. In that way is there no need of wires sticking out of the oven.

Boddy
Finally we have the Buddy concept. The idea is to take the camera feature from June and turn it into a single product. In that way most people would be willing to pay for it. Besides the camera the unit also includes a thermometer and a moisture measurement tool.

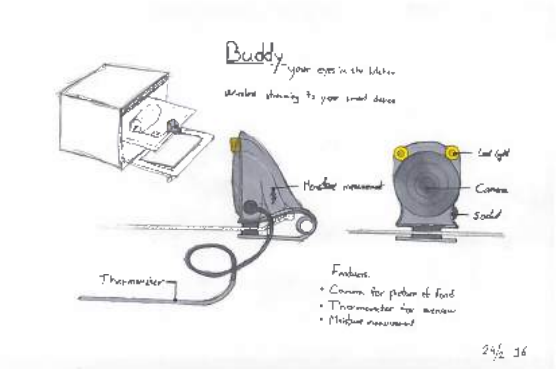


Illustration Sources:
[1] https://consumermediallc.files.wordpress.com/2015/06/june_oven.png
[2] http://cdn.thegadgetflow.com/wp-content/uploads/2016/03/MEATER-The-Only-Wire-Free-Smart-Meat-Thermometer-06.jpg

All other illustrations are own illustrations

Evaluation
During those 4 concepts the direction of the product has become more clear. The outcome of the first 3 concepts is the last combined one(Buddy). the combination of the different features gives more value for the user

Reflection
This ideation has given us an idea of how we are going to help out the user in the kitchen. In which manner we want give guidance.

Project title View by SØ		
Title: Determine meat condition		Date: 14.04.2016
Activity: Ideation	Worksheet no.: E5	Responsible: Mads Peter Hilligse

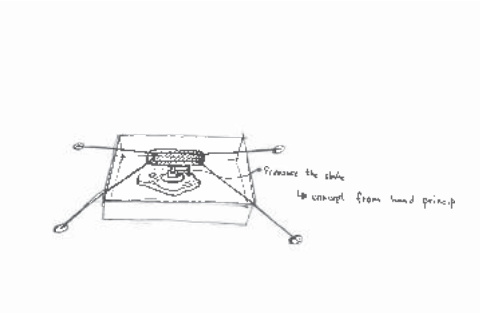
Objective:

The intention of this ideation process is to determine the meat condition in different ways. The process is based on a 1 hour ideation section building on knowledge from the professional chefs and different meat analyzing methods found on the Internet.

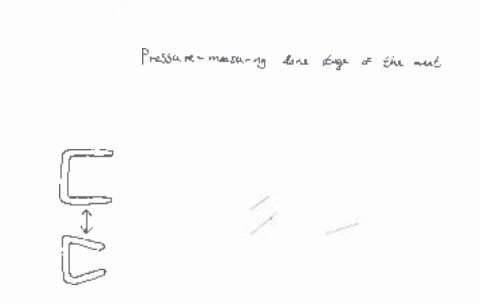
Experiment/data:

The advanced chef knows a trick to determent the meat condition. You simply press on the meat with you index finger and by comparing with you own hand you can determine the condition of the meat. (Se full description in appendix C1)

The first concept is a **pressure machine** which pressures a small piston on the meat, The measured resistance can then be used to determinate the condition. By covering the top of the meat the product blocks the heat from the heat element in top of the oven, and thereby gives an uneven finished to the roast.



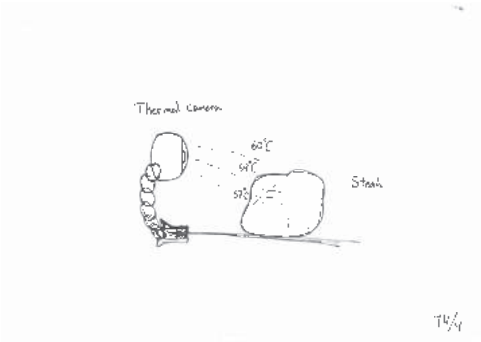
Another version of the **pressure concert**. A pressure clip which is attached the roast and then clamps on the roast to determine the condition.



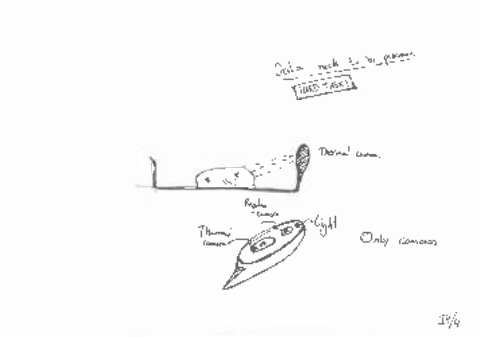
Project title View by SØ			
Title: Determine meat condition		Date: 14.04.2016	
Activity: Ideation	Worksheet no.: E5	Responsible: Mads Peter Hilligse	

Different camera Solutions could also be useful for a new meat thermometer.

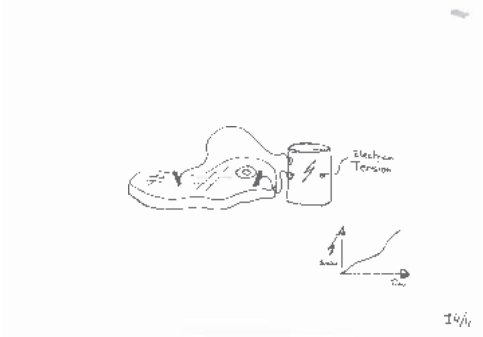
Thermal Camera scans the roast and thereby determines the core temperature.



Infrared camera is a cheap way to determine the temperature. Unfortunately it only scans the surface of the object and not the core.

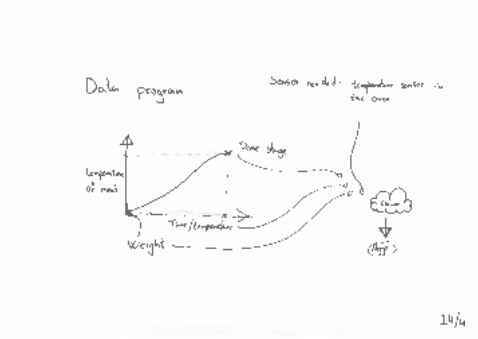


Electrician scanning works by sending the electricity through the roast and by calculation of the resistance it should be possible to determine the condition of the meat.

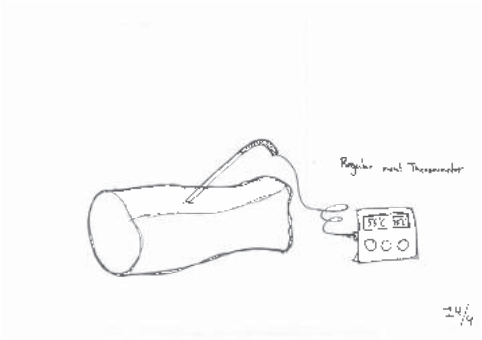


Project title View by SØ		
Title: Determine meat condition		Date: 14.04.2016
Activity: Ideation	Worksheet no.: E5	Responsible: Mads Peter Hilligse

Oven temperature in combination with a data app it should be possible to determine the condition of the meat. Needed for the calculation is the weight of the roast, type of roast and the oven temperature.



At the end is there is a **regular meat thermometer,** which is using a single temperature sensor to determine the core temperature.



All illustrations are own illustrations

Evaluation

The ideation provide us with different ways to determine the meat condition.

Reflection

Beside the thermal camera is the easiest way to get the core temperature by placing the probe in the roast. The thermal camera needs input about the meat before it can calculate the condition.

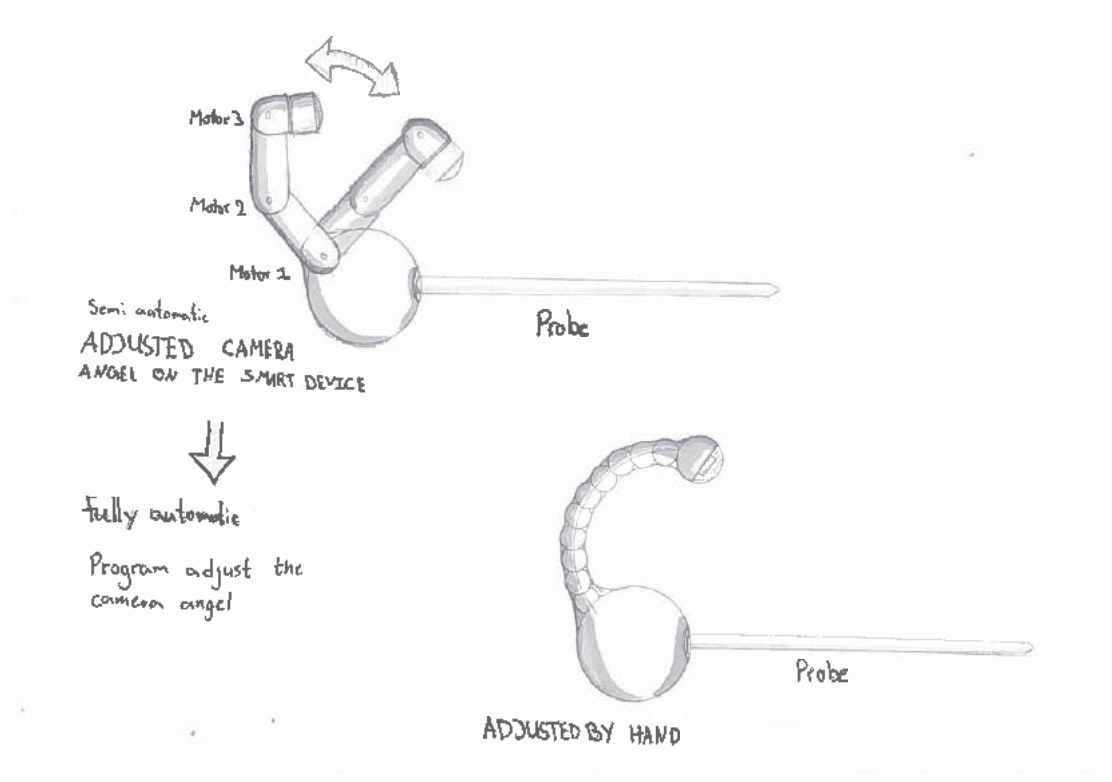
Project title View by SØ		
Title: Form studies		Date: 14.04.2016
Activity: Ideation	Worksheet no.: E6	Responsible: Mads Peter Hilligsøe

Objective:

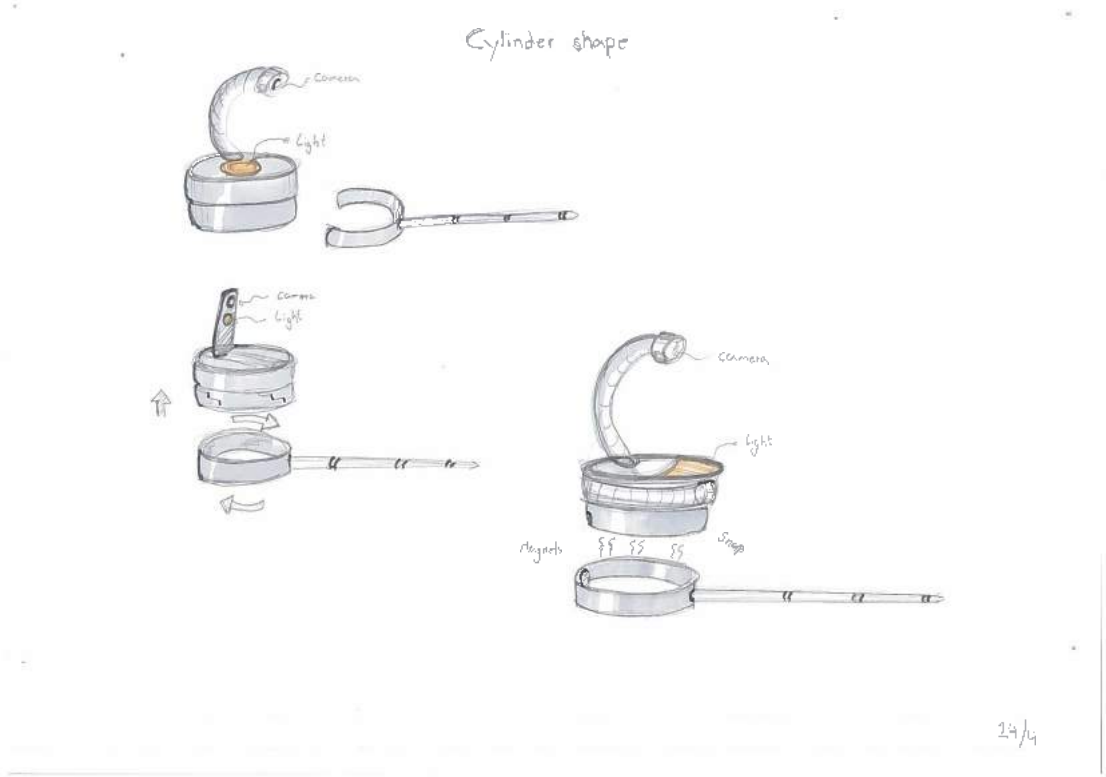
This ideation section is focusing on the camera placement and the overall size of the product.

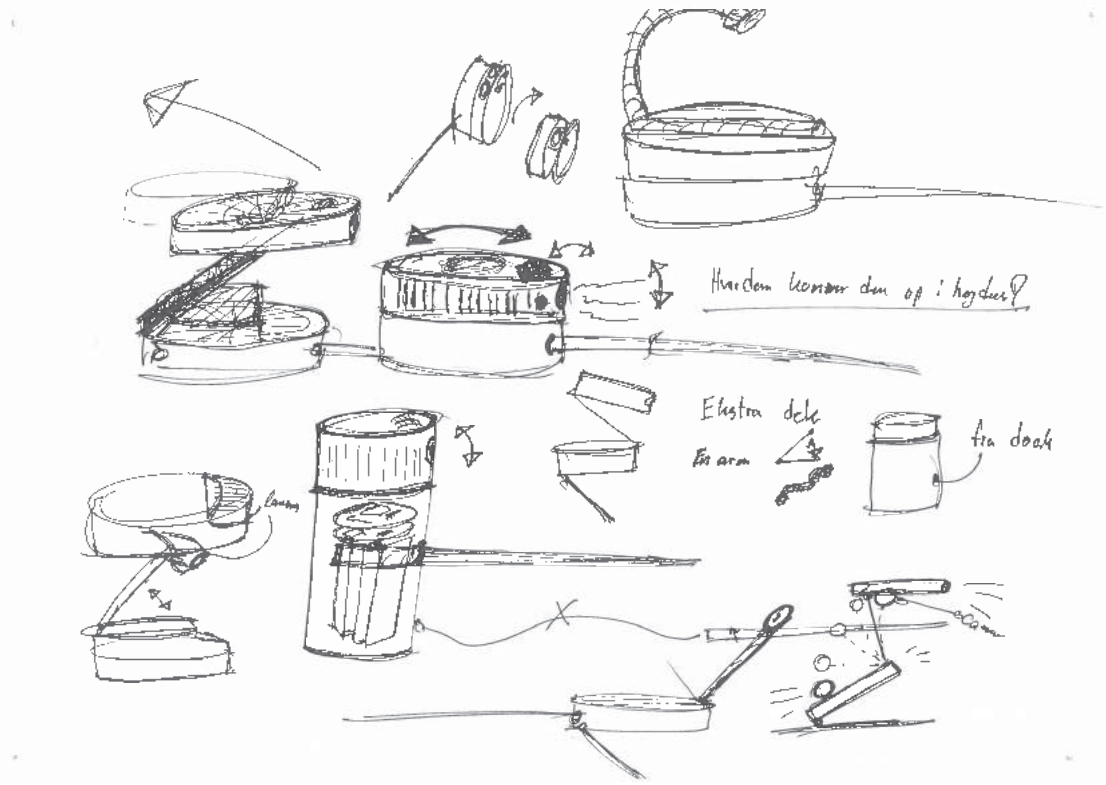
Experiment/data:

According to our measurement of the ovens from Skousen, the oven does not leave must room for external devices. This was a very important factor, when coming up with a new form for the concept. The sketches from the shaping section can be found on the following pages.

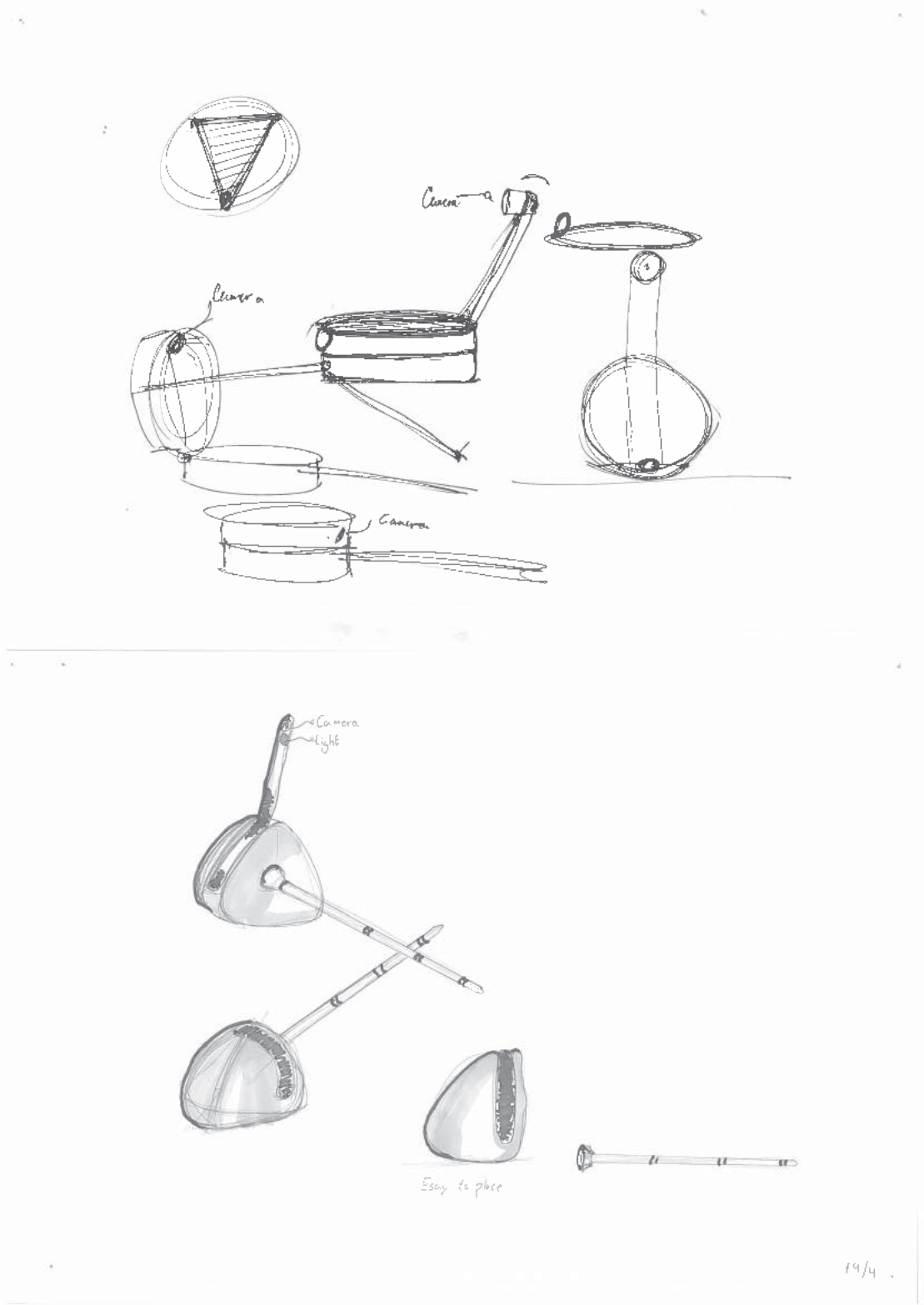


Project title View by SØ		
Title: Form studies		Date: 14.04.2016
Activity: Ideation	Worksheet no.: E6	Responsible: Mads Peter Hilligsøe





Project title View by SØ		
Title: Form studies		Date: 14.04.2016
Activity: Ideation	Worksheet no.: E6	Responsible: Mads Peter Hilligsøe



Project title View by SØ			
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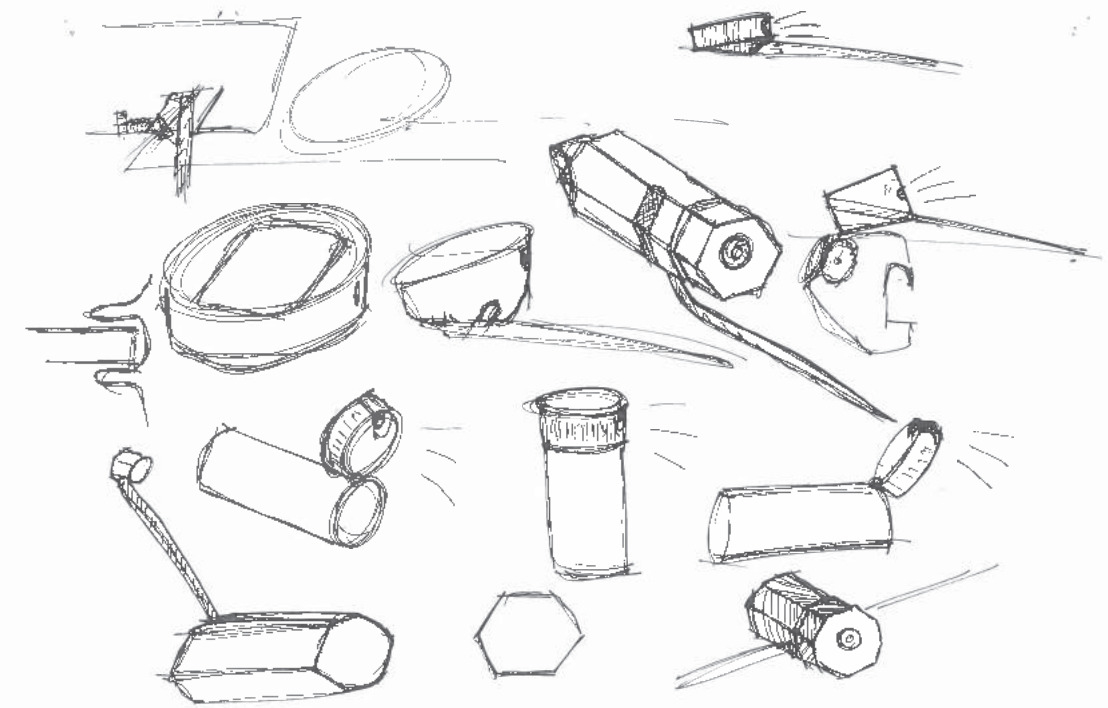
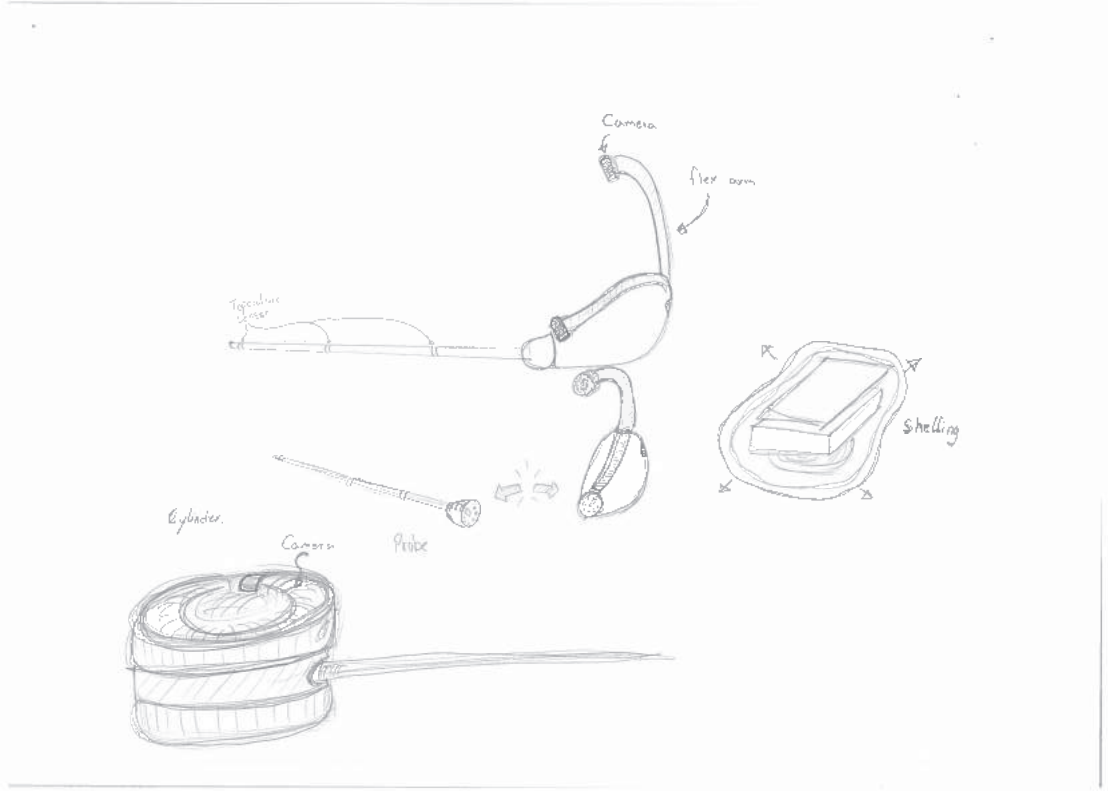
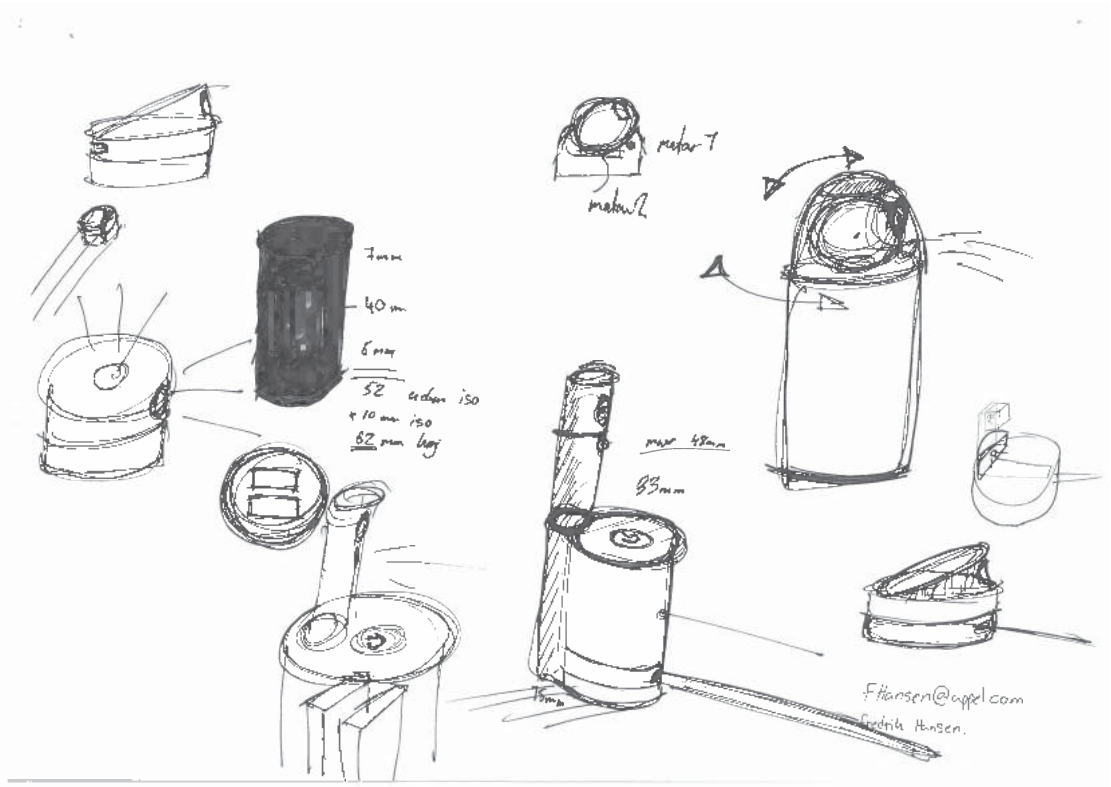
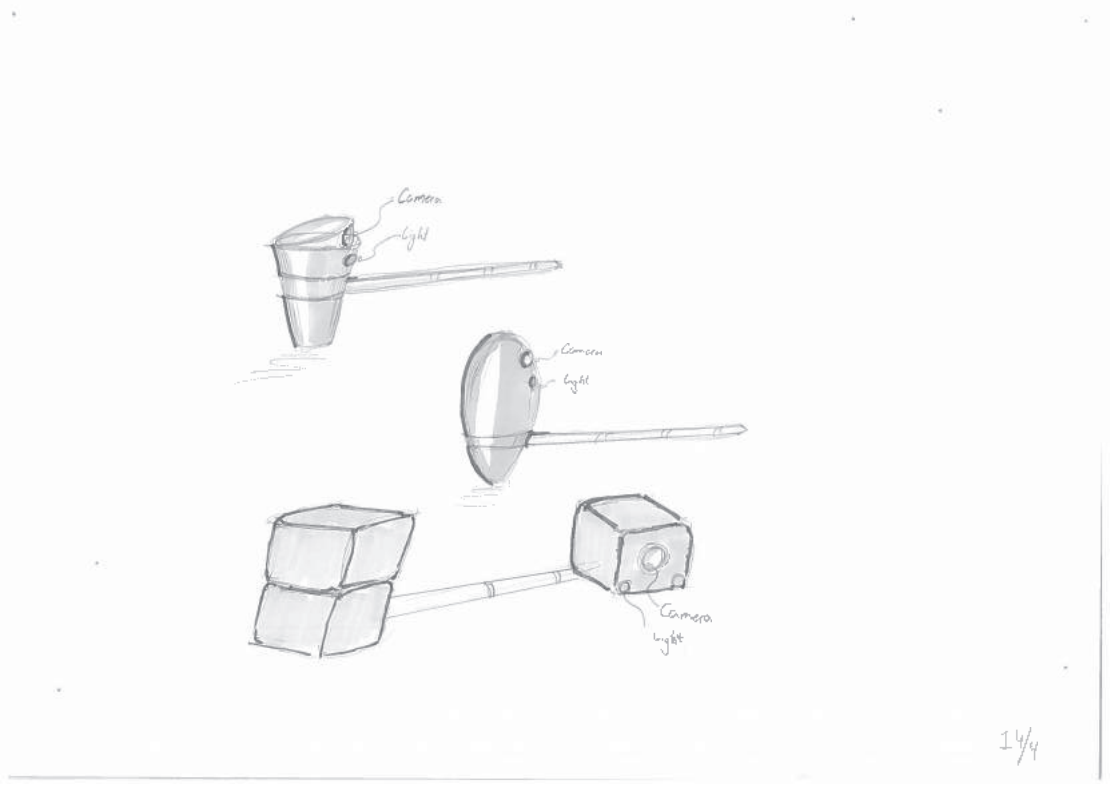
Activity: Ideation	Worksheet no.: E6	Responsible: Mads Peter Hilligsøe	



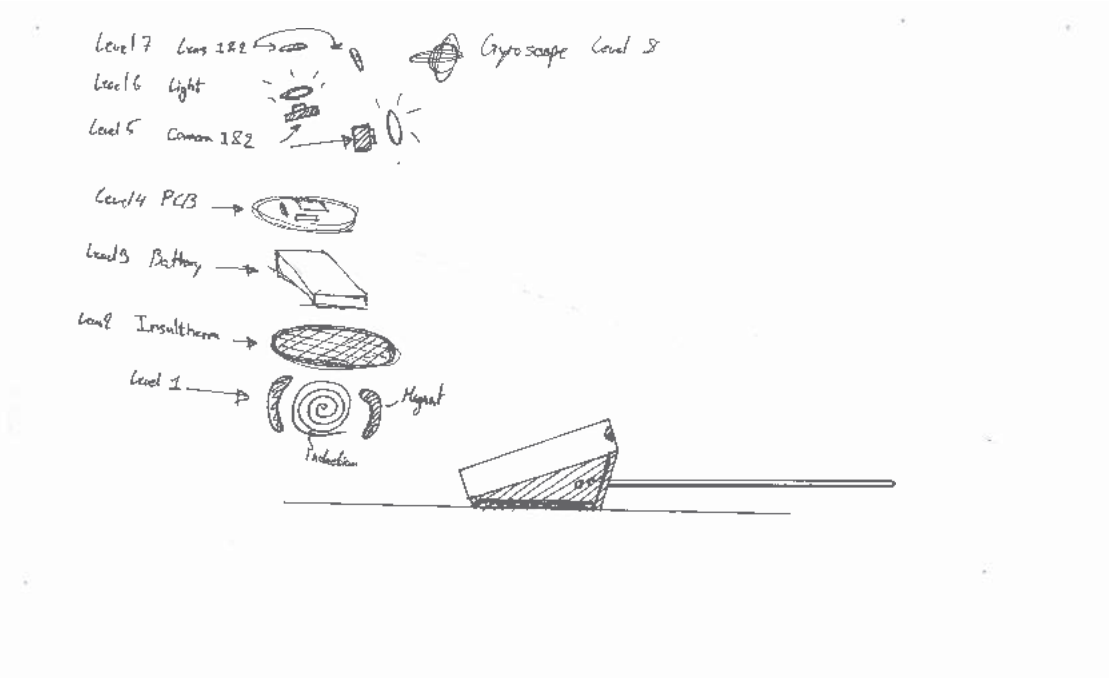


Project title View by SØ		
Title: Form studies		Date: 14.04.2016
Activity: Ideation	Worksheet no.: E6	Responsible: Mads Peter Hilligsøe





Project title View by SØ			
Title: Form studies		Date: 14.04.2016	
Activity: Ideation	Worksheet no.: E6	Responsible: Mads Peter Hilligsøe	



All illustrations are own illustrations.

Evaluation

As the unit had to be low, different solutions with extension in hight were investigated.

Reflection

The product has to be very compact, and has to be mountable on the sides of the oven, if only the camera is used, and not the probe.

Project title View by SØ			
Title: Form principles		Date: 05.05.2016	
Activity: Form analysis	Worksheet no.: E7	Responsible: Mads Peter Hilligsøe	

Objective:

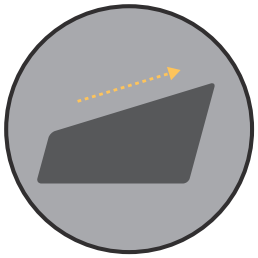
To state the form principles on current trending male products the principles have been dragged out of the following products.

Experiment/data:

In this worksheet you find the form principles when looking at current trendy male products.

General principles:

Direction:
The direction of a product indicates how it is supposed to be placed and the working direction. The direction can as-well provide support to the construction.



iGrill mini [1]

Bang & Olufsen BeoSound 5 Encore [2]

Shiny surface:
It is almost essential to have a shiny surface when targeting the male users. The surface provides the product with a feeling of quality and is usually used on electronics, such as speakers, phones, etc.

Mac Pro [3]

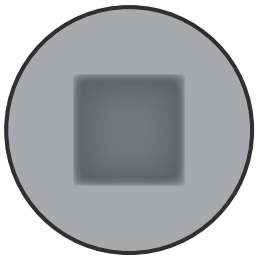
Creative Woof - speaker [4]

Project title View by SØ		
Title: Form principles		Date: 05.05.2016
Activity: Form analysis	Worksheet no.: E7	Responsible: Mads Peter Hilligsøe

Matte surface:
In contrast to the shiny surface are the mat surface as-well a trendy solution. Many male products have this kind of surface. E.g.. cars and electronics.

Audi R8 RS in dark mat [5]

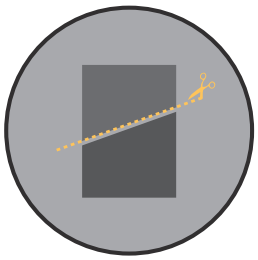
Matte coated headset [6]



Clean cuts:
The products is usually build by simple geometry with a clean cut or transition between the different shapes and materials.

HP bluetooth speaker [7]

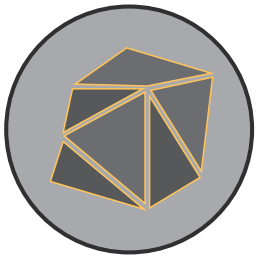
Samsung refrigerator [8]



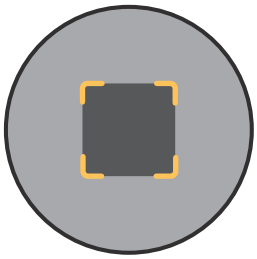
Origami shaping:
The old paper folding method is one of the most trendy things these days. In all from furnitures to lamps, it is quite common to see an origami construction. The shape is really strong and gives the product a futuristic look.

Bluetooth speaker [9]

Origami lamp [10]



Project title View by SØ		
Title: Form principles		Date: 05.05.2016
Activity: Form analysis	Worksheet no.: E7	Responsible: Mads Peter Hilligsøe



Two materials:
I terms of detailing and providing the product with a feeling of value, an extra material element is often placed like e.g. a big rubber button for a pocket speaker or protection flaps for a computer mouse


Logitech MX Master [11]


TDK A34 [12]

Illustration sources:

[1] http://thumbs2.ebaystatic.com/d/l190/m/mVwBM74AAiLzekYTi5d9pog.jpg

[2] http://mb.cision.com/Public/MigratedWpy/80426/622798/addb0bd9555c308e_org.jpg

[3] http://macland.de/media/pics/TW1028ZZ_3.jpg

[4] https://images-blogger-opensocial.googleusercontent.com/gadgets/proxy?url=http%3A%2F%2F4.bp.blogspot.com%2F-lb88joTZ87k%2FVK2AtljAqHI%2FAAAAAAAABRA%2F7Aea1Z5N_G4%2Fs1600%2FMain1.jpg&container=blogger&gadget=a&rewriteMime=image%2F*

[5] http://www.powertuning.it/ebay/articoli/apa_nero_opaco_03.jpg

[6] http://3.bp.blogspot.com/-IHUGv13D6Ns/TjIhATBUwiI/AAAAAAAAA-I/g3UfG5OMdJU/s1600/tma1_1.jpg

[7] https://encrypted-tbn3.gstatic.com/images?q=tbn:ANd9GcSSA8VavNClwQMMy-Hr1TDui4DSLP_IXY0k7a-zuZrWtGOngz83

[8] http://cdn.cosedicasa.com/wp-content/uploads/2014/04/samsung-Food-Showcase-2-frigorifero.jpg

[9] http://0zz.org/wp-content/uploads/2016/04/featured-image-turtle-speaker.jpg

[10] http://www.polyvore.com/cgi/img-thing?.out=jpg&size=l&tid=77277095

[11] http://icdn3.digitaltrends.com/image/logitech-mx-master-mouse-hero1-1200x630-c.jpg

[12] http://www.soundguys.com/wp-content/uploads/2014/10/trek-max-sg-08.jpg

All other illustrations are own illustrations.

Evaluation
To validate the trends completely a much larger analysis is needed.

Reflection
It gave overall understanding of the form principles used, The form principles will be used to defined the outer design for the final product.

Project title View by SØ		
Title: Camera point value		Date: 12.05.2016
Activity: Point value	Worksheet no.: E8	Responsible: Mads Peter Hilligsøe

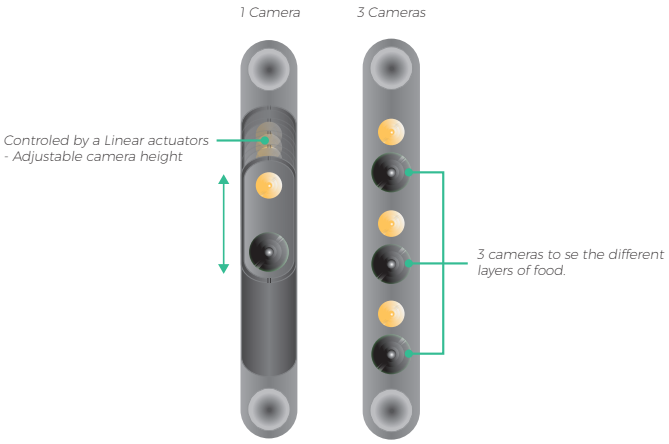
Objective:

With the need of a camera in different heights, two concepts were being validated by different parameters, to determine the right solution.

Experiment/data:

0 is low 5 is high.

Parameters/Concept	1 Camera	3 Cameras
Price	3	3
Functions	4	3
User friendly	5	3
Complexity	3	4
Added value	4	3
Feasibility	4	5
In all:	**23**	21



By placing the camera on a linear actuator/stepper motor it provides the user with the possibility to control the camera height by themself. As the target group is gadget guys with a huge interest in electronic and mechanical solutions, it makes great sens to make a function which allows the user to control it by them self.

By investigation the different oven types from Skousen it is concluded that there isn't a fixed distance between the different baking-plates. That makes the 3 fixed cameras a bit unusable because of the risk of pointing directly into one of the plates.

All illustrations are own illustrations

Evaluation

The intention of this evaluation was to determine the way of looking of at different plates at ones. The evaluation succeeded.

Reflection

From the point value method the adjustable camera angle was chosen,

Project title View by SØ		
Title: Calculations of heat insulation		Date: 07.05.2016
Activity: Hand calculations	Worksheet no.: F1	Responsible: Jon Søgaard

Objective:

The objective of the worksheet is to get hand calculations, that can be compared to the simulations from Solidworks in the report.

Experiment/data:

To calculate the heat transfer in the insulation materials by hand, it must be assumed that:

- The oven temperature is constant
- The temperature to the time 0 in the product is a given starting temperature
- There is symmetry in the center of the product.

With this assumption, we can start calculating it as a sphere using the following formula for transient heat transfer of a sphere:

$$\theta_{0,sph} = \frac{T_0 - T_\infty}{T_i - T_\infty} = A_1 e^{-\lambda_1^2 \tau}$$

The parameters in the formulas are shown below, along with an illustration of the parameters to the right:

T_0; *Temperature in center of sphere at the given heat transfer time*

$T_\infty = 200[^\circ C]$; *Oven temperature*

$T_i = 20[^\circ C]$; *Starting temperature of center of sphere*

$A_1 = 2$; *Value from table**

$\lambda_1 = 3.1416$; *Value from table**

$t = 3600[s]$; *Heat transfer time*

$r_0 = 0,0375[m]$; *Radius of sphere*

$k = 0,028[W/m^2K]$; *Heat conductivity coefficient*

$\rho = 200[kg/m^3]$; *Density of Pyrogel*

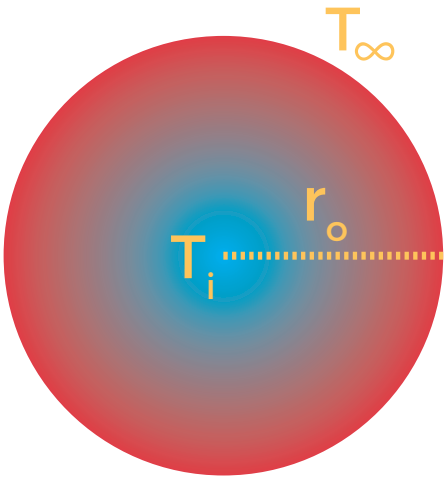
$Cp = 1046[J/kgK]$; *Specific heat*

$\tau = \frac{\alpha}{L^2} t$

$L^2 = r_0$

$\alpha = k/\rho Cp$

*See the table on the next page



Project title View by SØ			
Title: Calculations of heat insulation		Date: 07.05.2016	
Activity: Hand calculations	Worksheet no.: F1	Responsible: Jon Søgaard	

TABLE 4–2

Coefficients used in the one-term approximate solution of transient one-dimensional heat conduction in plane walls, cylinders, and spheres (Bi = hL/k for a plane wall of thickness $2L$, and Bi = hr_o/k for a cylinder or sphere of radius r_o)

	Plane Wall		*Cylinder*		*Sphere*	
Bi	λ_1	A_1	λ_1	A_1	λ_1	A_1
0.01	0.0998	1.0017	0.1412	1.0025	0.1730	1.0030
0.02	0.1410	1.0033	0.1995	1.0050	0.2445	1.0060
0.04	0.1987	1.0066	0.2814	1.0099	0.3450	1.0120
0.06	0.2425	1.0098	0.3438	1.0148	0.4217	1.0179
0.08	0.2791	1.0130	0.3960	1.0197	0.4860	1.0239
0.1	0.3111	1.0161	0.4417	1.0246	0.5423	1.0298
0.2	0.4328	1.0311	0.6170	1.0483	0.7593	1.0592
0.3	0.5218	1.0450	0.7465	1.0712	0.9208	1.0880
0.4	0.5932	1.0580	0.8516	1.0931	1.0528	1.1164
0.5	0.6533	1.0701	0.9408	1.1143	1.1656	1.1441
0.6	0.7051	1.0814	1.0184	1.1345	1.2644	1.1713
0.7	0.7506	1.0918	1.0873	1.1539	1.3525	1.1978
0.8	0.7910	1.1016	1.1490	1.1724	1.4320	1.2236
0.9	0.8274	1.1107	1.2048	1.1902	1.5044	1.2488
1.0	0.8603	1.1191	1.2558	1.2071	1.5708	1.2732
2.0	1.0769	1.1785	1.5995	1.3384	2.0288	1.4793
3.0	1.1925	1.2102	1.7887	1.4191	2.2889	1.6227
4.0	1.2646	1.2287	1.9081	1.4698	2.4556	1.7202
5.0	1.3138	1.2403	1.9898	1.5029	2.5704	1.7870
6.0	1.3496	1.2479	2.0490	1.5253	2.6537	1.8338
7.0	1.3766	1.2532	2.0937	1.5411	2.7165	1.8673
8.0	1.3978	1.2570	2.1286	1.5526	2.7654	1.8920
9.0	1.4149	1.2598	2.1566	1.5611	2.8044	1.9106
10.0	1.4289	1.2620	2.1795	1.5677	2.8363	1.9249
20.0	1.4961	1.2699	2.2880	1.5919	2.9857	1.9781
30.0	1.5202	1.2717	2.3261	1.5973	3.0372	1.9898
40.0	1.5325	1.2723	2.3455	1.5993	3.0632	1.9942
50.0	1.5400	1.2727	2.3572	1.6002	3.0788	1.9962
100.0	1.5552	1.2731	2.3809	1.6015	3.1102	1.9990
∞	1.5708	1.2732	2.4048	1.6021	3.1416	2.0000

The table above is an extract from the book Heat and mass transfer written by Çengel (2006: 231).

The formula is then rewritten to:

$$T_0 = (T_i - T_\infty)\left(A_1 \exp\left(-\lambda_1^2 \frac{\alpha}{\rho} t\right)\right) + T_\infty$$

The calculations for Pyrogel and competing products are then made in excel, to get the results for comparison with the simulations. Screenshots of the excel files can be found on the following pages.

Project title View by SØ		
Title: Calculations of heat insulation		Date: 07.05.2016
Activity: Hand calculations	Worksheet no.: F1	Responsible: Jon Søgaard

Pyrogel XT					Microtherm g			
T≈	200				T≈		200	
Ti	20				Ti		20	
A1	2				A1		2	
l1	3,141592654				λ1		3,1415927	
t								
a	1,33843E-07				a		6,033E-08	
r0	0,0375	m			r0		0,05	m
k	0,028	W/m2 K			k		0,0222	W/m2 K
r	200	kg/m3			ρ		400	kg/m3
Cp	1046	J/kg K			Cp		920	J/kg K
tid (s)	t	Temp.			tid (s)	t		
3600	0,3426386	187,763829	1 time		3600	0,0868696	47,260205	1 time
7200	0,6852772	199,584100	2 timer		7200	0,1737391	135,19599	2 timer
14400	1,3705545	199,999520	4 timer		14400	0,3474783	188,33455	4 timer
28800	2,7411090	200,000000	8 timer		28800	0,6949565	199,62199	8 timer
57600	5,4822180	200,000000	16 timer		57600	1,389913	199,9996	16 timer
115200	10,9644359	200,000000	32 timer		115200	2,7798261	200	32 timer
230400	21,9288719	200,000000			230400	5,5596522	200	
460800	43,8577438	200,000000			460800	11,119304	200	
921600	87,7154876	200,000000			921600	22,238609	200	
1843200	175,4309751	200,000000			1843200	44,477217	200	
3686400	350,8619503	200,000000			3686400	88,954435	200	
7372800	701,7239006	200,000000			7372800	177,90887	200	
14745600	1403,4478011	200,000000			14745600	355,81774	200	
29491200	2806,8956023	200,000000			29491200	711,63548	200	
58982400	5613,7912046	200,000000			58982400	1423,271	200	

Project title View by SØ		
Title: Calculations of heat insulation		Date: 07.05.2016
Activity: Hand calculations	Worksheet no.: F1	Responsible: Jon Søgaard

Glass						Glass fiber			
a		0,0000004				a		6,5E-07	
r0		0,05	m			r0		0,05	m
k		0,8	W/m2 K			k		1,35	W/m2 K
ρ		2500	kg/m3			ρ		2580	kg/m3
Cp		800	J/kg K			Cp		805	J/kg K
tid (s)	t					tid (s)	t		
3600	0,576	198,77712	1 time			3600	0,9360104	199,96498	1 time
7200	1,152	199,99585	2 timer			7200	1,8720208	200	2 timer
14400	2,304	200	4 timer			14400	3,7440416	200	4 timer
28800	4,608	200	8 timer			28800	7,4880832	200	8 timer
57600	9,216	200	16 timer			57600	14,976166	200	16 timer
115200	18,432	200	32 timer			115200	29,952333	200	32 timer
230400	36,864	200				230400	59,904666	200	
460800	73,728	200				460800	119,80933	200	
921600	147,456	200				921600	239,61866	200	
1843200	294,912	200				1843200	479,23732	200	
3686400	589,824	200				3686400	958,47465	200	
7372800	1179,648	200				7372800	1916,9493	200	
14745600	2359,296	200				14745600	3833,8986	200	
29491200	4718,592	200				29491200	7667,7972	200	
58982400	9437,184	200				58982400	15335,594	200	

Plastic	Meldin 7021		
a		4,378E-07	
r0		0,05	m
k		0,72	W/m2 K
ρ		1430	kg/m3
Cp		1150	J/kg K
tid (s)	t		
3600	0,6304652	199,28562	1 time
7200	1,2609304	199,99858	2 timer
14400	2,5218607	200	4 timer
28800	5,0437215	200	8 timer
57600	10,087443	200	16 timer
115200	20,174886	200	32 timer
230400	40,349772	200	
460800	80,699544	200	
921600	161,39909	200	
1843200	322,79818	200	
3686400	645,59635	200	
7372800	1291,1927	200	
14745600	2582,3854	200	
29491200	5164,7708	200	
58982400	10329,542	200	

The data sheets of the different materials can be found in appendix (Appendix H1).

Project title View by SØ			
Title: Calculations of heat insulation		Date: 07.05.2016	
Activity: Hand calculations	Worksheet no.: F1	Responsible: Jon Søgaard	

Sources:
Çengel, Y. A., 2006. *Heat and mass transfer.* 3rd ed. Singapore: McGras-Hill.

All illustrations are own illustrations

Evaluation

The numbers are calculated according to the numbers found in the data sheets, and are ready for comparison with the simulations.

Reflection

The hand calculations can only be used for calculating high temperatures, so validation of the solidworks simulations are needed, and then solidworks can be used for the low temperature calculations.

Project title View by SØ		
Title: Oven measurements		Date: 09.03.2016
Activity: Research	Worksheet no.: G1	Responsible: Mads Peter Hilligsøe

Objective:

The desired result of this investigation is to validate if there is any placement room for a camera in the oven. To validate this, all the ovens from Skousen, Jyllandsgade 30 9000 Aalborg have been measured, according to the needed dimensions.

Experiment/data:

Beneath we find the collected numbers from Skousens oven portfolio.

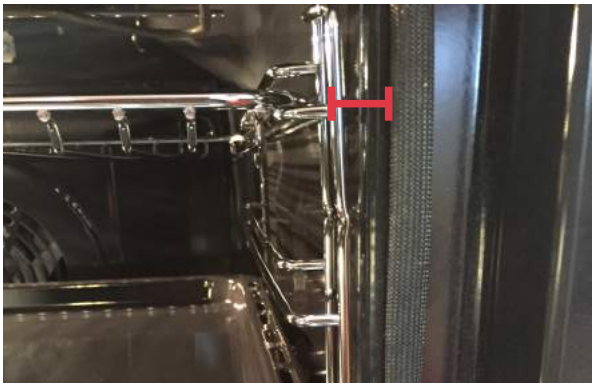
Model name:	From glass door to baking plate (mm)	From side walls to baking plate (mm)	Size of the rubber sealing (mm)
AEG (BP5004325M)	25	2	5
Asko (OP86365)	25	3	4
Asko (CI9664W)	34	2	8
Bauknecht (BLPMS8100PT)	12	2	3
Blomberg (BE09566W)	23	2	4
Gorenje (EC4616E17WKT)	35	3	6
Gram (12KP630-40)	25	4	4
Gram (12KI654-40)	25	4	4
Gram (12OI630-42)	20	4	4
Voss (ELK14321HV)	12	3	4
Voss (IEL9302RF)	12	2	3
Summary (lowest distance)	12	2	3

The lowest distance sets the parameter of placing a camera inside the oven. When looking at the first column which is the distance from the glass door to the baking plate, The Voss ovens has the lowest cap of 12mm, which then is the maximum size the camera can offset from the baking plate. When jumping to the next column we find the distance from the side walls to the side of the baking plate. The ovens are varying from 2-4 mm of space in each side. That assigns 2mm to mount a camera in that area. The last column shows the size of the rubber sealing which assures less heat loss. The smallest size of this sealing is 3mm, again the oven doesn't leave much room for placement of such device.

Project title View by SØ			
Title: Oven measurements		Date: 09.03.2016	
Activity: Research	Worksheet no.: G1	Responsible: Mads Peter Hilligsøe	

Measuring the distance from the baking plate to the glass door

Measuring the size of the rubber sealing



Measuring the distance from the baking plate to the side walls

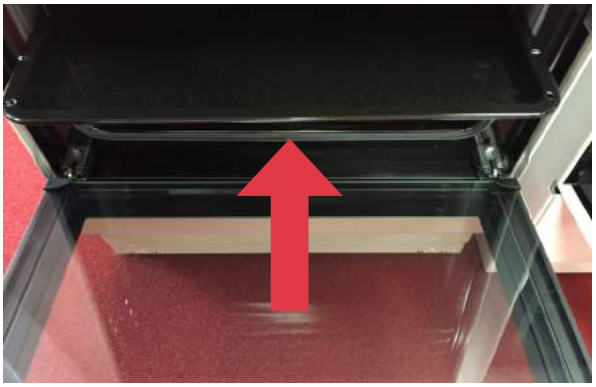
A section of the ovens at Skousen.

In the ceiling of the ovens is the heat element located, which doesn't allow any room for placement.

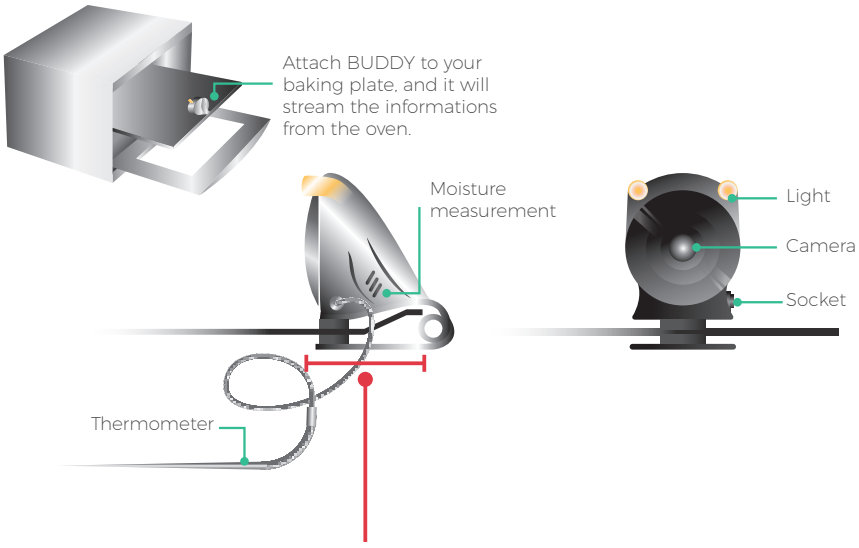
Ceiling of Voss (ELK14321HV)

Project title View by SØ		
Title: Oven measurements		Date: 09.03.2016
Activity: Research	Worksheet no.: G1	Responsible: Mads Peter Hilligsøe

The most optimal placement inside the oven is still on the middle of the baking plate



The camera will then take some of the baking area, because the camera is overlapping the area with the camera house.



Overlapping area

All illustrations are own illustrations

Evaluation

The collected numbers gives an overview of the free space in the oven, and together with the placement of the heat element, it doesn't leave much room for placing a unit inside the oven.

Reflection

With a minimum space for external devices inside the oven, it can be concluded that the camera unit can't be placed between the glass and the baking plates or between the side walls and the baking plates.

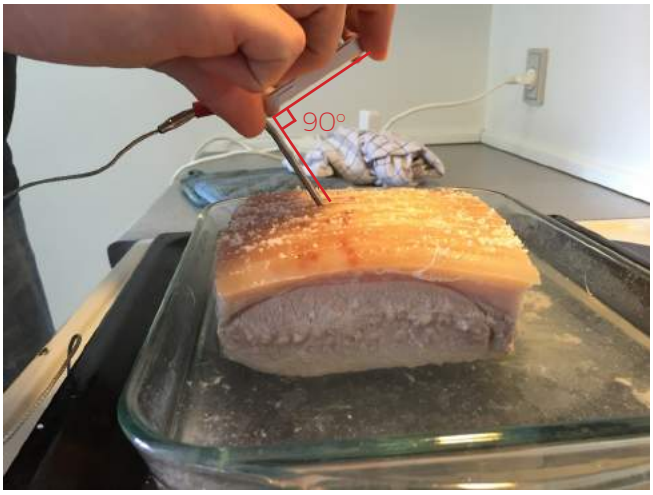
Project title View by SØ		
Title: Camera angle		Date: 06.04.2016
Activity: Mock-up	Worksheet no.: G2	Responsible: Jon Søgaard

Objective:

The objective was to ensure that the end user got the best possible viewing angle and or placement from the camera.

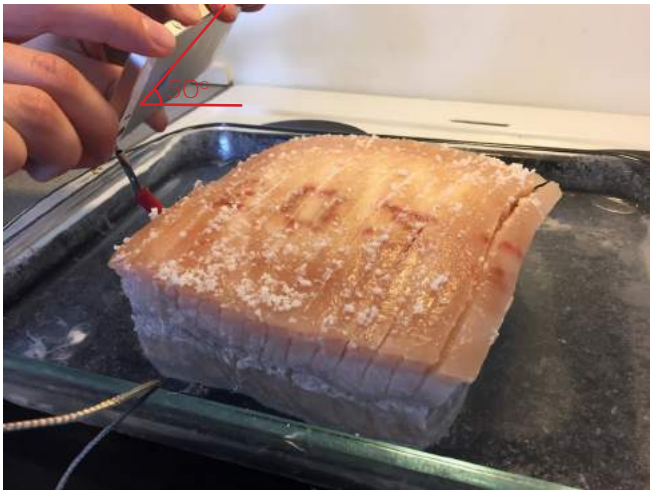
Experiment/data:

To find out what camera angle the camera had to be at on the probe a mock-up of the situation was made. We tested different angles, with the camera directly on the probe. We tried inserting the probe both from the top and from the end, to see, how it made a difference. The results can be seen below.



Probe inserted from the top, with a camera angle of 90°

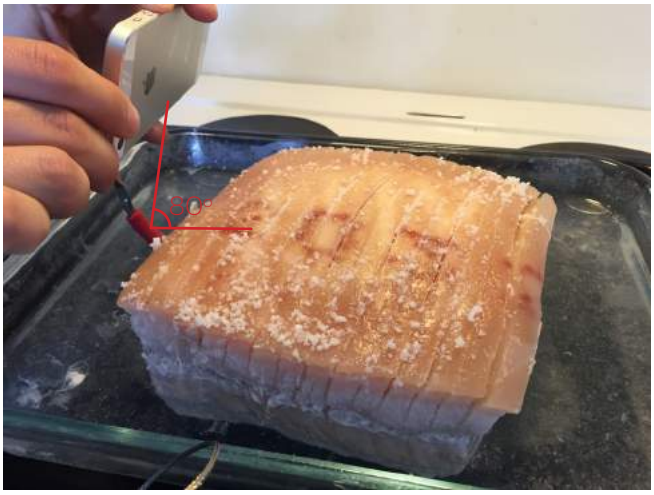
Picture at 90°



Probe inserted from end, with a camera angle of 50°

Picture at 50°

Project title View by SØ			
Title: Camera angle		Date: 06.04.2016	
Activity: Mock-up	Worksheet no.: G2	Responsible: Jon Søgaard	



Probe inserted from end, with a camera angle of 80°

Picture at 80°

The roast from a distance of 20cm.

From the test it was concluded, that if the camera was placed directly on the probe, the picture would be way too close-up, to see, how the roast is looking. On a pork roast, it would be fine to see the rinds, but you can't see, how it looks from the side. A view like the picture taken from a distance of 20cm, is definitely what it preferred, to see how far your roast is. This means that the camera unit and the probe has to be two separate units.

All illustrations are own illustrations

Evaluation

The results shows, that if the camera is places directly on the probe, no matter at what angle, and where you place the probe on the meat, you would only see a fraction of the roast.

Reflection

We learned, that the camera unit and the probe have to be two separate units, to give a desired visual feedback.

Project title View by SØ		
Title: Test of pyrogel		Date: 12.05.2016
Activity: Test	Worksheet no.: G3	Responsible: Mads Peter Hilligsøe

Objective:

The scope of the experiment is to validate the calculations from the simulations in solid-works and the hand calculated results.

Experiment/data:

By using the iGrill probe for temperature measurements, it was possible to validate the calculated and simulated results.

How it was done:
1. The probe was wrapped in pyrogel and then locked with a wire.
- First setup was with approximated 35mm of pyrogel.
- Second setup was with approximated 75mm of pyrogel.
- Third setup was again with approximated 75mm of pyrogel plus a layer of aluminum foil.

2. The starting temperature before placement in the oven were for each test 30°C

3. The probe with insulation was placed in a 200°C warm oven.

4. The total length of each test was 1 hour, and results were collected each 5th minute.

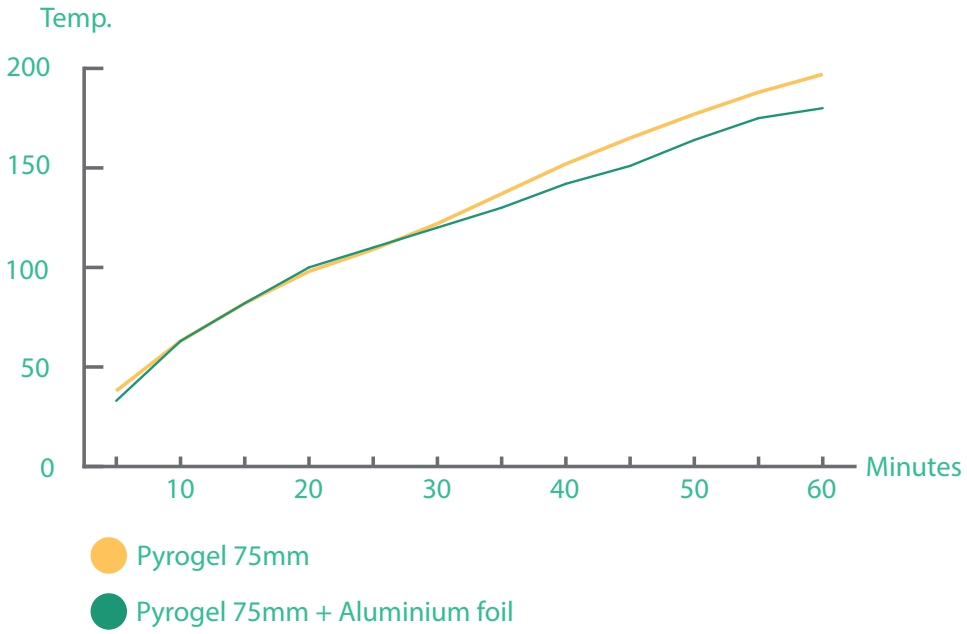
In the table below are the collected results listed:

Insulation	35mm	75mm	75mm + (alu)
Ovn temperature (C)	200	200	200
Starting temperature (probe)	30	30	30
Temperature 5 min intervals	-	-	-
5 min	54	38	33
10 min	91	63	63
15 min	133	82	82
20 min	164	98	100
25 min	181	109	110
30 min	190	122	120
35 min	195	137	130
40 min	200	152	142
45 min	200	165	151
50 min	200	177	164
55 min	200	188	173
60 min	200	197	180

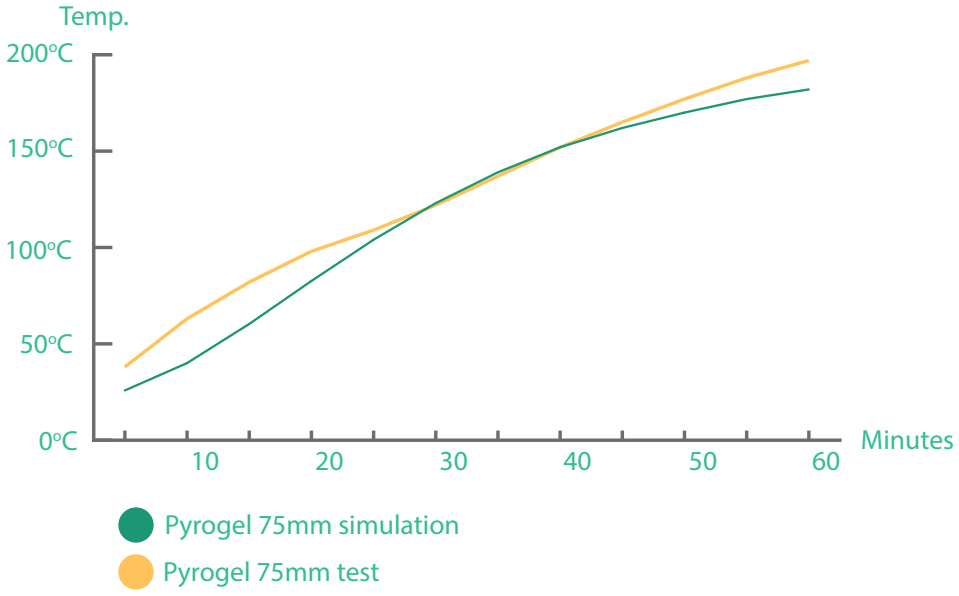
Project title View by SØ			
Title: Test of pyrogel		Date: 12.05.2016	
Activity: Test	Worksheet no.: G3	Responsible: Mads Peter Hilligsøe	

The experiment with 75mm of pyrogel plus aluminum foil was to determine if the fact of covering the pyrogel against the air flow inside the oven would give a different test result.

As it can be seen in the graph below the effects of the foil are minimal.



On the graph below are the test result compared with the simulated test result from solidworks.



As it can be seen the to graphs are almost equal, meaning the experiment, must be valid.

Project title View by SØ			
Title: Test of pyrogel		Date: 12.05.2016	
Activity: Test	Worksheet no.: G3	Responsible: Mads Peter Hilligsøe	

Test setup:

35mm of Pyrogel

75mm of Pyrogel

75mm of Pyrogel plus
Aluminum foil

Setup in the oven.

All illustrations are own illustrations

Evaluation

By comparing the test with the simulations, it was concluded that the results were valid, and thereby not a suable solutions for the concept.

Reflection

Error sources to the result:

- The oven doesn't keep an constant temperature of 200°C
- The probe not 100% covered by the alu. foil.

Project title View by SØ		
Title: Test of signal strength		Date: 04.04.2016
Activity: Testing	Worksheet no.: G4	Responsible: Jon Søgaard

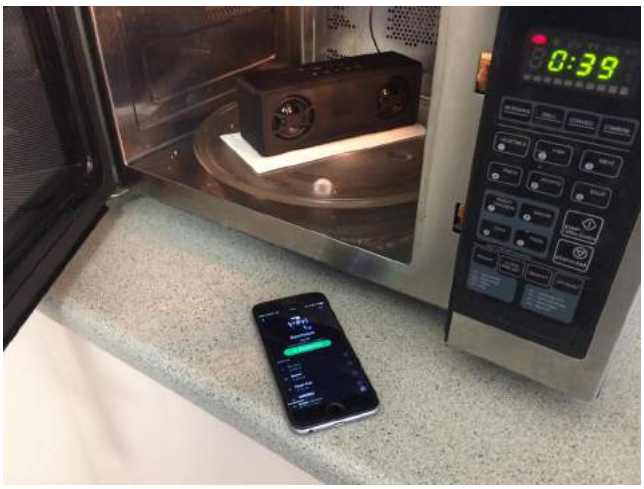
Objective:

The objective was to test the signal strength inside an oven, to see how far regular bluetooth, are able to cover under these conditions. This is helping us decide, if e.g. a dock is needed, to extend the signal.

Experiment/data:

To start with, we tested a microwave oven, to see how much effect the principle of Faradays cage [https://en.wikipedia.org/wiki/Faraday_cage] actually had on the bluetooth signal. We paired a smart phone with a bluetooth speaker and turned on some music. We then put the speaker inside the microwave oven, and closed the oven door. We recorded a video of the test, and have made a breakdown below. We afterwards did the same thing, with a conventional oven.

Testing setup with the microwave



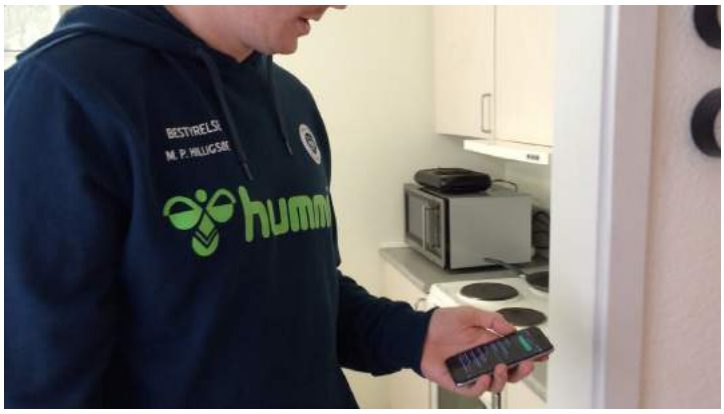
Testing setup with the conventional oven

We turned on the music, waited for it to play inside the oven, and started walking away.

Project title View by SØ		
Title: Test of signal strength		Date: 04.04.2016
Activity: Testing	Worksheet no.: G4	Responsible: Jon Søgaard

The first meter the signal was just fine, and the music played perfectly.

But when we increased the distance by another meter, the music started stuttering.



And when we increased the distance just a little bit further, the music stopped completely.

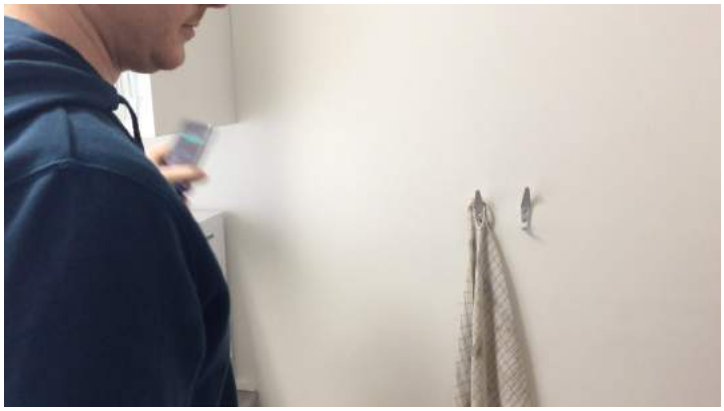
This meant, that if we wanted the device to fit inside a microwave, then we need some kind of signal extender. We also checked, if the interference were specific, to just one side of the microwave.

Project title View by SØ		
Title: Test of signal strength		Date: 04.04.2016
Activity: Testing	Worksheet no.: G4	Responsible: Jon Søgaard

We started by checking the top of the microwave, but the music played just fine here.

We then checked the side, with the same result.

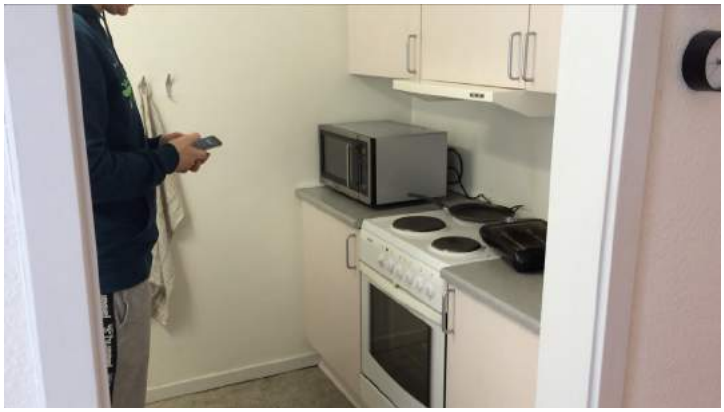
We also checked further away, with a different angle, but here we god the same result, as the first test, where the music stopped at a certain distance.



We then made the same test on a conventional oven.

Project title View by SØ		
Title: Test of signal strength		Date: 04.04.2016
Activity: Testing	Worksheet no.: G4	Responsible: Jon Søgaard

The music played just fine inside the oven, at approx. 1 meters distance.



We then started walking away, and at 2 meters, the signal was still completely fine.

We kept walking, and the signal stayed the same.

Even at a distance of 4 meters, the signal was still perfectly fine.

Project title View by SØ			
Title: Test of signal strength		Date: 04.04.2016	
Activity: Testing	Worksheet no.: G4	Responsible: Jon Søgaard	

The tests showed, that if we want to use our product in the micro oven, or maybe even in a combi oven, then we need some kind of signal extension.

All illustrations are own illustrations

Evaluation

We learned, that in order to keep micro-waves in, a Faraday cage is created, blocking a lot of the signal as well. In a conventional oven, the signal strength is just fine.

Reflection

We learned, that we need some kind of signal extender, is the product has to work, in a combi oven.

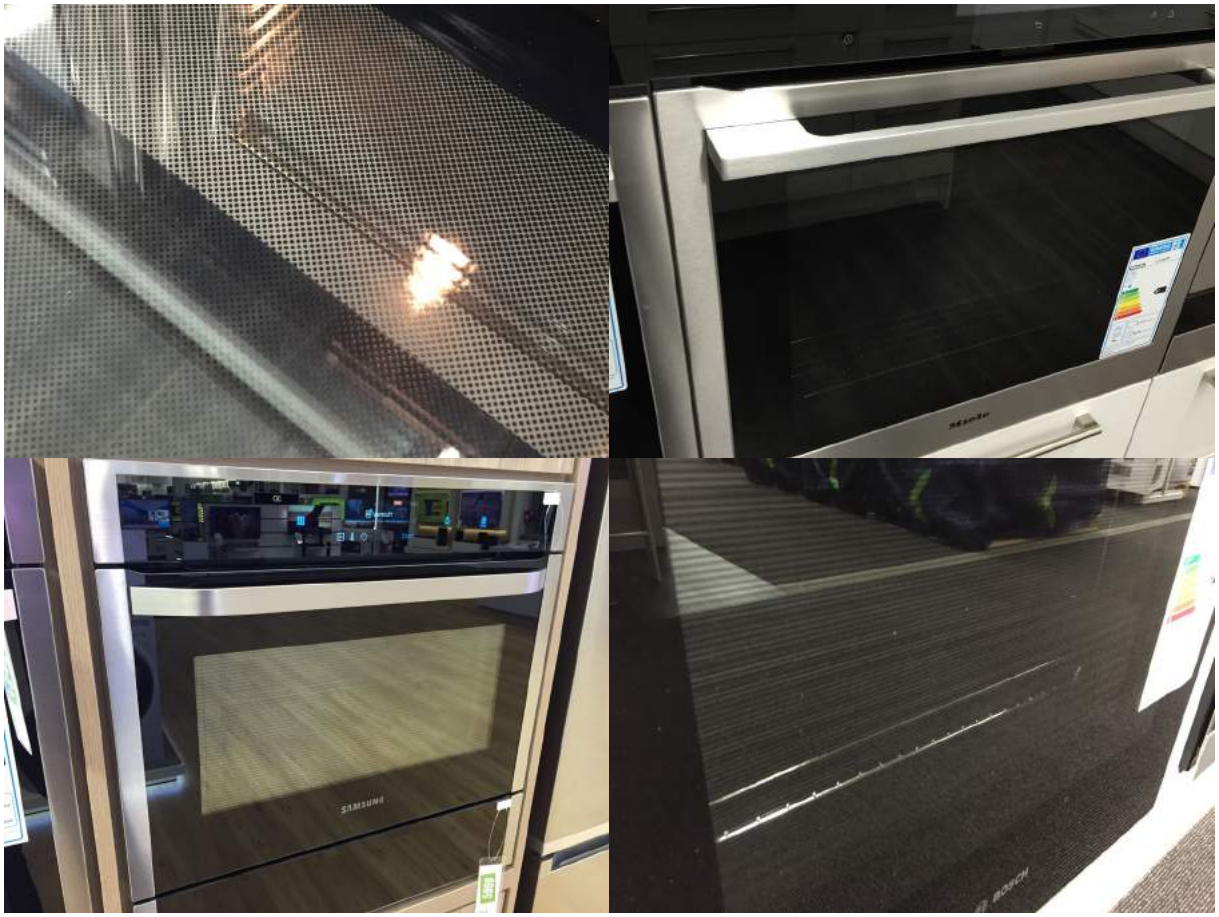
Project title View by SØ			
Title: Patterns on oven front		Date: 28.03.2016	
Activity: Test	Worksheet no.: G5	Responsible: Mads Peter Hilligsøe	

Objective:

By observing the oven market it came clear that not all ovens have 100% transparent front door. Especially the combi ovens have some kind of patterns on the inside of the glass door. These patterns makes it difficult to see what is inside the oven. This investigation examines if it is possible to see clear through those patterns with a camera.

Experiment/data:

The combi and the microwave ovens has a protected pattern on the inside of there front door. A pattern of metal which are placed to act like a faraday cage [1] to prevent transmission beyond the boundary of the screen. Beside the blocking function the pattern are well placed to cover the glass door from looking dirty. Because the pattern are imitating dirty particital from the cooking.



Combi ovens observed with pattern metal mesh in Elgiganten, City Syd Aalborg

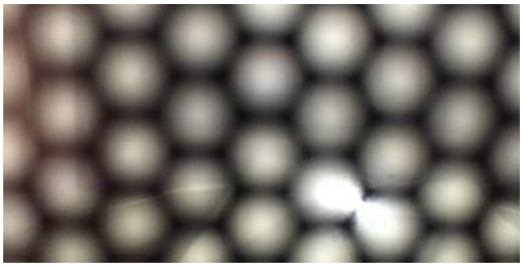
Project title View by SØ		
Title: Patterns on oven front		Date: 28.03.2016
Activity: Test	Worksheet no.: G5	Responsible: Mads Peter Hilligsøe

The scope of this investigation is to see if it is possible to see through the mesh with a camera and what kind of parameters it sets for the light source. The test is building on two microwave ovens from Aalborg University, Rendsburggade 14 9000 Aalborg, kitchens.

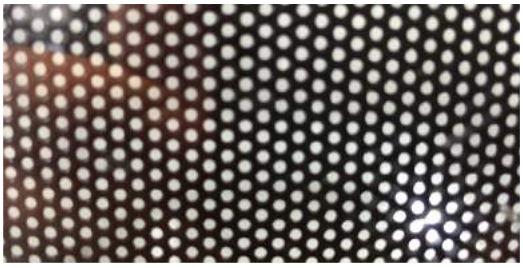
At first a phone with light was placed inside the microwave oven to light the room when the microwave oven is shut off. The following pictures is from outside the oven.

Phone with light inside the microwave oven.

Camera directly on front door.
The camera has build in auto focus which makes it hard to focus on the inside. If there is a mesh like this on the oven front does the camera function simply not benefit the user.



With a distance of 8cm is it still not possible to see clearly through the front door

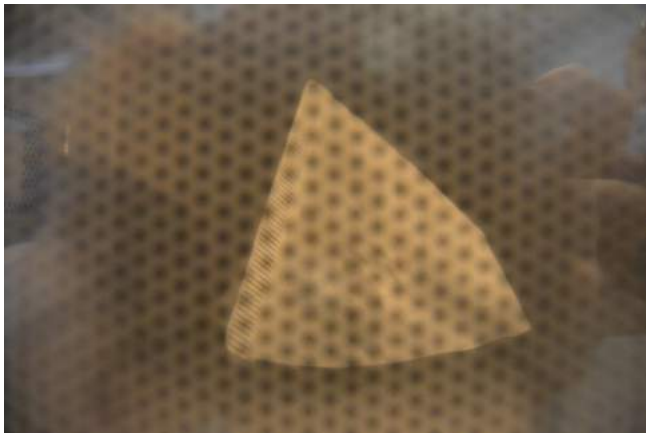


With a distance of 14cm the mesh is 100% in focus and thereby is it still not possible to see through the front door

With a distance of 20 cm is the mesh still 100% in focus.

Project title View by SØ			
Title: Patterns on oven front		Date: 28.03.2016	
Activity: Test	Worksheet no.: G5	Responsible: Mads Peter Hilligsøe	

With a DSLR camera with manual focus is it possible to take a sharp photo trough the glass front. This concludes the fact that a camera outside the oven need to either have a fixed focus point or manual focus adjustments.



Sources:
[1]https://www.reddit.com/r/explainlikeimfive/comments/2mu4e0/eli5_why_do_microwave_ovens_have_a_metal_mesh/

All illustrations are own illustrations

Evaluation

It can easily be concluded that the camera needs adjustment options according to the focus point.

Reflection

By placing the camera on the outside is it not possible to get a crystal clear image with auto-focus. Therefor the focus has to be fixed.

Project title View by SØ			
Title: Light through oven door		Date: 18.05.2016	
Activity: Testing	Worksheet no.: G6	Responsible: Jon Søgaard	

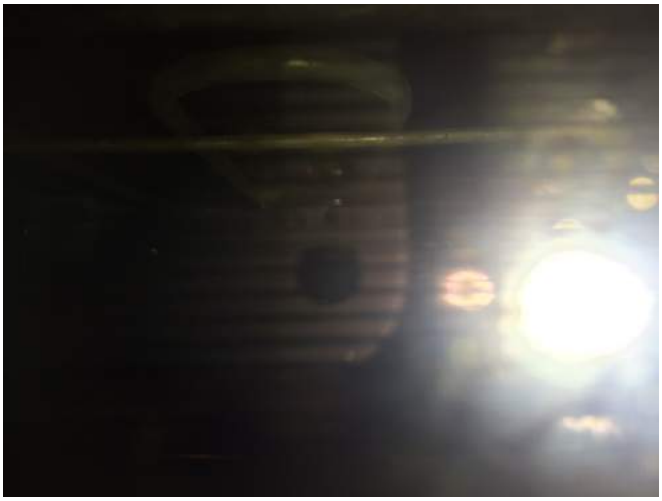
Objective:

The objective were to see how the light reflected in the different glass layers in the oven door, to find the best distance from the light to the camera.

Experiment/data:

A LED light were used as light source, and the pictures were taken with a cellphone. The set-up looks like the photo below to the left.
The the camera were then moved slowly away from the light source, and the distance were measured. The pictures can be seen below and the distance is shown on the photos.

Test setup



Camera right next to light source

Camera 5 cm away from light source

Camera 10 cm away from light source

Project title View by SØ			
Title: Light through oven door		Date: 18.05.2016	
Activity: Testing	Worksheet no.: G6	Responsible: Jon Søgaard	

From the test it could be concluded, that the light source and the camera can't be right next to each other. The results at the distance of 5 cm is acceptable, but the 10cm distance is ideal.

All illustrations are own illustrations

Evaluation

The test showed, that the greater the distance from the light source to the camera, the lesser the reflection is.

Reflection

The camera and the light source has to have a distance of 5 cm from each other, in order for the reflection of the light to be acceptable.

Project title View by SØ		
Title: Data sheets for insulation materials		Date: 15.05.2016
Activity: Data sheets	Worksheet no.: H1	Responsible: Jon Søgaard

Objective:

In this worksheet are the data sheets for the different materials used in the heat transfer section.

Experiment/data:

Pyrogel XT page 1

Pyrogel® XT

aspen aerogels®

PRODUCT DATA SHEET

FLEXIBLE INDUSTRIAL INSULATION FOR HIGH-TEMPERATURE APPLICATIONS

Pyrogel® XT is a high-temperature insulation blanket formed of silica aerogel and reinforced with a non-woven, glass-fiber batting.

Silica aerogels possess the lowest thermal conductivity of any known solid. Pyrogel® XT achieves this industry-leading thermal performance in a flexible, environmentally safe, and easy-to-use product.

Ideal for insulating piping, vessels, tanks, and equipment, Pyrogel® XT is an essential material for those seeking the ultimate in thermal efficiency.

Physical Properties

Thicknesses*	0.20 in (5 mm)	0.40 in (10 mm)
Material Form*	1,500 ft² rolls	850 ft² rolls
Max. Use Temp.	1200°F (650°C)	
Color	Beige	
Density*	12.5 lb/ft³ (0.20 g/cc)	
Hydrophobic	Yes	

*Nominal values. Thicknesses measured using a method derived from ASTM C 518 and another proprietary method to provide resolutions an order of magnitude smaller than ASTM C 167.

Advantages

Superior Thermal Performance
Up to five times better thermal performance than competing insulation products

Reduced Thickness and Profile
Equal thermal resistance at a fraction of the thickness

Less Time and Labor to Install
Easily cut and conformed to complex shapes, tight curvatures, and spaces with restricted access

Physically Robust
Soft and flexible but with excellent springback, Pyrogel® XT recovers its thermal performance even after compression events as high as 100 psi

Shipping and Warehousing Savings
Reduced material volume, high packing density, consistent roll sizes, and low scrap rates can reduce logistics costs by a factor of five or more compared to rigid, pre-formed insulations

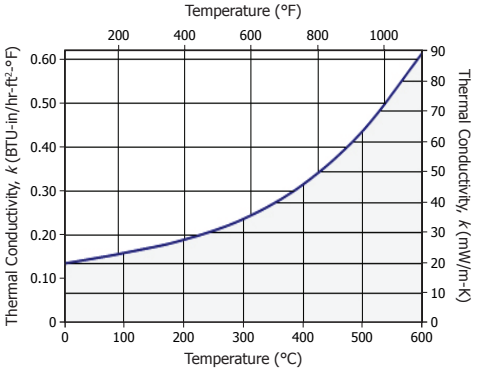
Simplified Inventory
Unlike rigid pre-forms such as pipe cover or board, the same Pyrogel® XT blanket can be cut to fit any piece of piping or equipment

Hydrophobic Yet Breathable
Pyrogel® XT repels liquid water but allows vapor to pass through, helping to prevent corrosion under insulation

Environmentally Safe
Landfill disposable, shot-free, minimal dust with no respirable fiber content

Thermal Conductivity†

ASTM C 177 Results



Mean Temp.	°C	0	100	200	300	400	500	600
	°F	32	212	392	572	752	932	1112
k	mW/m-K	20	23	28	35	46	64	89
	BTU-in/hr-ft²-°F	0.14	0.16	0.19	0.24	0.32	0.44	0.62

† Thermal conductivity measurements taken at a compressive load of 2 psi and standard atmospheric pressure.

Pyrogel XT page 2

Pyrogel® XT

asp

Product Performance Data

Test Procedure	Property	Results
ASTM C 1728, Type III, Grade 1A	Standard Specification for Flexible Aerogel Insulation	Complies
ASTM C 165	Compressive Strength	Stress at 10% strain = 14.8 psi (102 kPa) Stress at 25% strain = 26.6 psi (183 kPa)
ASTM C 356	Linear Shrinkage Under Soaking Heat	< 1.3% @ 1200°F (650°C)
ASTM C 411	Hot Surface Performance	Passed
ASTM C 447	Estimation of Maximum Use Temperature	1200°F (650°C)
ASTM C 592-04 (Section 11.11, Modified)	Heat and Vibration Aging	-0.19% mass change after 6 hr vibration
ASTM C 795	Insulation for Use Over Austenitic Stainless Steel	Passed
ASTM C 1101	Classifying the Flexibility of Mineral Fiber Blankets	Class: Resilient Flexible
ASTM C 1104	Water Vapor Sorption	2.25% (by weight)
ASTM C 1338	Fungal Resistance of Insulation Materials	Passed
ASTM C 1511	Liquid Water Retention After Submersion	<6% (by weight)
ASTM E 84	Surface Burning Characteristics	Flame Spread Index = 0 Smoke Developed Index = 0
ASTM E 1354	Cone Calorimetry	No ignition at 50 kW/m^2
BS EN 13501-1: 2007	Reaction to Fire Performance	Passed Euroclass A2
ISO 1182:1990	Non-Combustibility	Meets criteria outlined in ISO 1182:1990

Characteristics

Pyrogel® XT can be cut using conventional cutting tools including scissors, tin snips, and razor knives. It is recommended gloves, safety g
worn when handling material. See SDS for complete health and safety information.

Safety Data Sheet

Scan with mobile device or go to http://bit.ly/1v60D8o

Project title View by SØ		
Title: Data sheets for insulation materials		Date: 15.05.2016
Activity: Data sheets	Worksheet no.: H1	Responsible: Jon Søgaard

Meldin 7021

Meldin® 7021

A self-lubricating grade, Meldin® 7021, has 15% by weight graphite fillers, encapsulated by the base polyimide resin. With its low coefficient of friction and high heat resistance, Meldin® 7021 provides a very good choice for high temperature bearings, seals and other low-wear applications.

Property	Test Method	Units	Meldin® 7021
Mechanical			
Tensile Strength	ASTM D638	psi	9,500
Elongation	ASTM D638	%	4.7
Flexural Strength	ASTM D790	psi	15,800
Flexural Modulus	ASTM D790	psi	522,000
Compressive Stress @ 1% Strain	ASTM D695	psi	4,300
Compressive Stress @ 10% Strain	ASTM D695	psi	18,000
Compressive Modulus	ASTM D695	psi	450,000
Coefficient of Thermal Expansion 73°F to 500°F	ASTM E831	in/in/°F	2.2×10^{-5}
Thermal Conductivity	ASTM F433	BTU-in/hr-ft^2-°F	5.0
Electrical			
Dielectric Strength, .08"	ASTM D149	V/mil	280
Dielectric Constant 100 Hz 10 KHz 1 MHz	 ASTM D150 ASTM D150 ASTM D150		 - - -
Surface Resistivity	ASTM D257	ohm/square	$10^8 - 10^9$
Other			
Specific Gravity	ASTM D792		1.51
Hardness, Rockwell E	ASTM D785		25 - 40
Water Absorption, 24 hrs	ASTM D570	%	0.19
Water Absorption, 48 hrs	ASTM D570	%	0.50
Deformation Under Load, 2000 psi	ASTM D621	%	0.1
Limiting Oxygen Index	ASTM D2863		100
Mechanical Properties @ 500 °F			
Tensile Strength	ASTM D638	psi	5,700
Elongation	ASTM D638	%	3.2
Flexural Strength	ASTM D790	psi	8,600
Flexural Modulus	ASTM D790	psi	3,500,000
Specification Qualification			
ASTM D-6456-99		Satisfies	Type II Class 1P
SAE AMS 3644E		Satisfies	Class 2 Form P
MIL-R-46198		Satisfies	Type II Class 1P

Values in this table are for compression molded material.

NOTE: The information contained herein are typical values intended for reference and comparison purposes only. They should NOT be used as a basis for design specifications or quality control. Contact us for manufacturers' complete material property datasheets. All values at 73°F (23°C) unless otherwise noted.

7600 Anagram Drive | Eden Prairie, MN 55344 | Phone: 952-934-2303 | Toll Free: 800-776-7769 | Fax: 952-934-2314 | www.plasticsintl.com

Project title View by SØ		
Title: Data sheets for insulation materials		Date: 15.05.2016
Activity: Data sheets	Worksheet no.: H1	Responsible: Jon Søgaard

Microtherm page 1

MICROTHERM
THERMAL INSULATION SOLUTIONS

Microtherm® Standard Block
High Temperature Microporous insulation

Microtherm® Block
is the basic form of Microtherm® high temperature thermal insulation. It is available in a range of grades and densities and it is supplied without any coating or covering materials for final shaping or machining by the customer.

Properties
- Formulation based on pyrogenic silica with a mineral oxide opacifier and E-glass filament reinforcement
- Microporous insulation offering close to the lowest theoretically possible thermal conductivity at high temperatures
- Microtherm® Super G grade capable of continuous operation at temperatures up to 1000 °C (1832 °F)
- Non combustible
- Environmentally friendly
- Free of harmful respirable fibres

Typical applications
- Compact, high temperature protection
- Flight and accident recorders for air, rail, and sea - best protection in smallest volume
- Data loggers - stable and cyclable protection
- Fuel cells and reformers.

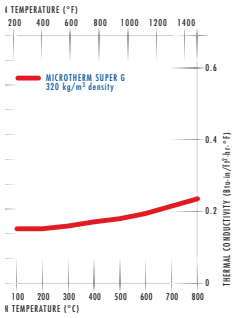
Microtherm is a world leader for thermal insulation solutions • info@microthermgroup.com • www.microthermgroup.com

Microtherm page 2

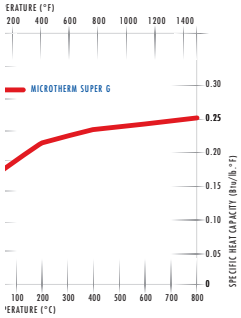
MICROTHERM
THERMAL INSULATION SOLUTIONS

·otherm® Standard Block

Conductivity



Heat Capacity



TYPICAL PRODUCT CHARACTERISTICS

Size Availability

Normally specified by customer but limited by available tooling.
Thickness in the range 3 - 80 mm (1/8" to 3 1/8") in 1.0 mm steps.

Performance

Maximum temperature limits Microtherm® Super G - 1000 °C (1832 °F) for long term exposure
Thermal conductivity (ISO 8302, ASTM C177) - Microtherm® Super G @ 320 kg/m³ density
- 0.0221 W/m.K at 100 °C mean
- 0.0222 W/m.K at 200 °C mean
- 0.0230 W/m.K at 300 °C mean
- 0.0244 W/m.K at 400 °C mean
- 0.0260 W/m.K at 500 °C mean
- 0.0281 W/m.K at 600 °C mean
- 0.0343 W/m.K at 800 °C mean

Specific heat capacity
- 680 J/kg.K at 0 °C
- 920 J/kg.K at 200 °C
- 1000 J/kg.K at 400 °C
- 1040 J/kg.K at 600 °C
- 1080 J/kg.K at 800 °C

Compressive Modulus (ASTM C 165) @ 350 kg/m³ density - 4.4 MPa
Resistance at 10% deformation (ASTM C 165) @ 350 kg/m³ density - 0.42 MPa

Manufacturing Tolerances

Tolerance on block dimensions typically
- ± 3 mm (1/8")

Tolerance on thickness
- ± 0.5 mm (± 0.02") below 10 mm 3/8")
- ± 0.8 mm (±0.03") 10 - 29.9 mm (3/8" to 1 1/8")
- ± 1.5 mm (± 0.06") 30 - 49.9 mm, (1 1/8" to 2")
- ± 2.0 mm (0.08") for 50 mm (2") or above.

Density

Microtherm® Super G 320 - 400 kg/m³.

Standard finish styles available

Plain uncoated block.

Typical Values

Performance values quoted here are for general guidance.
For additional information and assistance with design please contact our materials specialists.

microthermgroup.com

Issue ref.121108/02

ı NV • België, Industriepark Noord 1, BE-9100 Sint-Niklaas, T +32 (0)3 760 19 80, F +32 (0)3 760 19 99, info@microthermgroup.com, BTW-BE-0407.566.878 – RPR Sint-Niklaas
ı Inc • U.S.A., 3269 Regal Drive, Alcoa, Tennessee 37701, T +1 865 681 0155, F +1 865 681 0016, sales@microtherm.us
:rotherm Co. Ltd. • Japan, Korakuen Shinjuku Bldg, 4-15-7, Nishi-Shinjuku, Shinjuku-ku, Tokyo 160-0023, T +81 3 3377 2821, F +81 3 3378 2821, sales@microtherm.co.jp

Project title View by SØ			
Title: Data sheets for insulation materials		Date: 15.05.2016	
Activity: Data sheets	Worksheet no.: H1	Responsible: Jon Søgaard	

Additional needed information which were missing from the data sheets were found on google. The properties for glass and glass fiber were found on the following pages:

Glass:
http://www.saint-gobain-sekurit.com/glossary/glass-properties

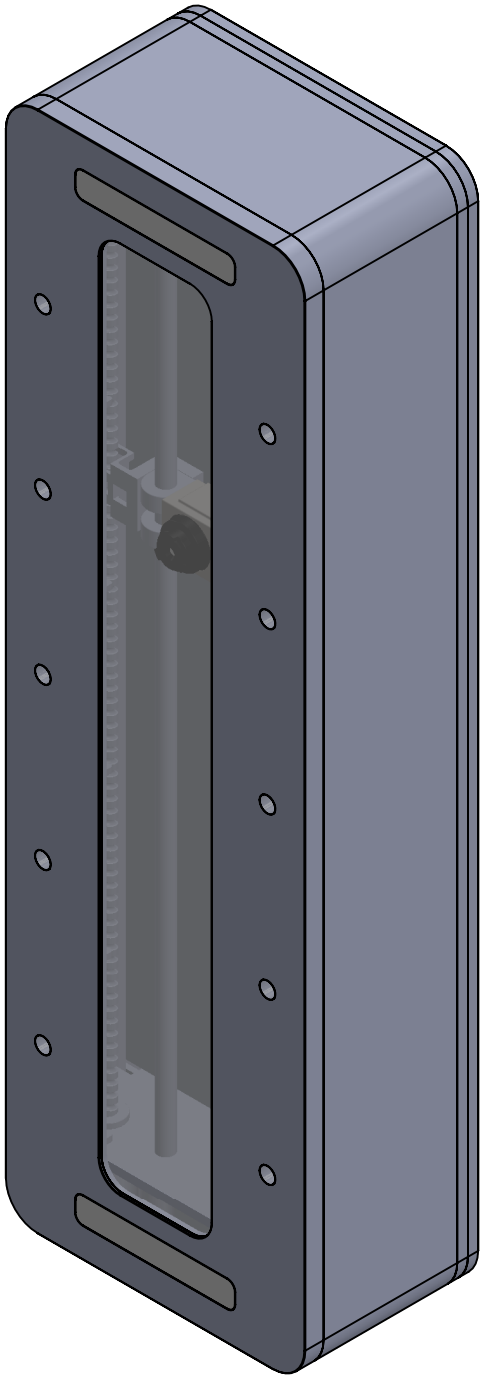
Glass fibre:
https://en.wikipedia.org/wiki/Glass_fiber

Evaluation

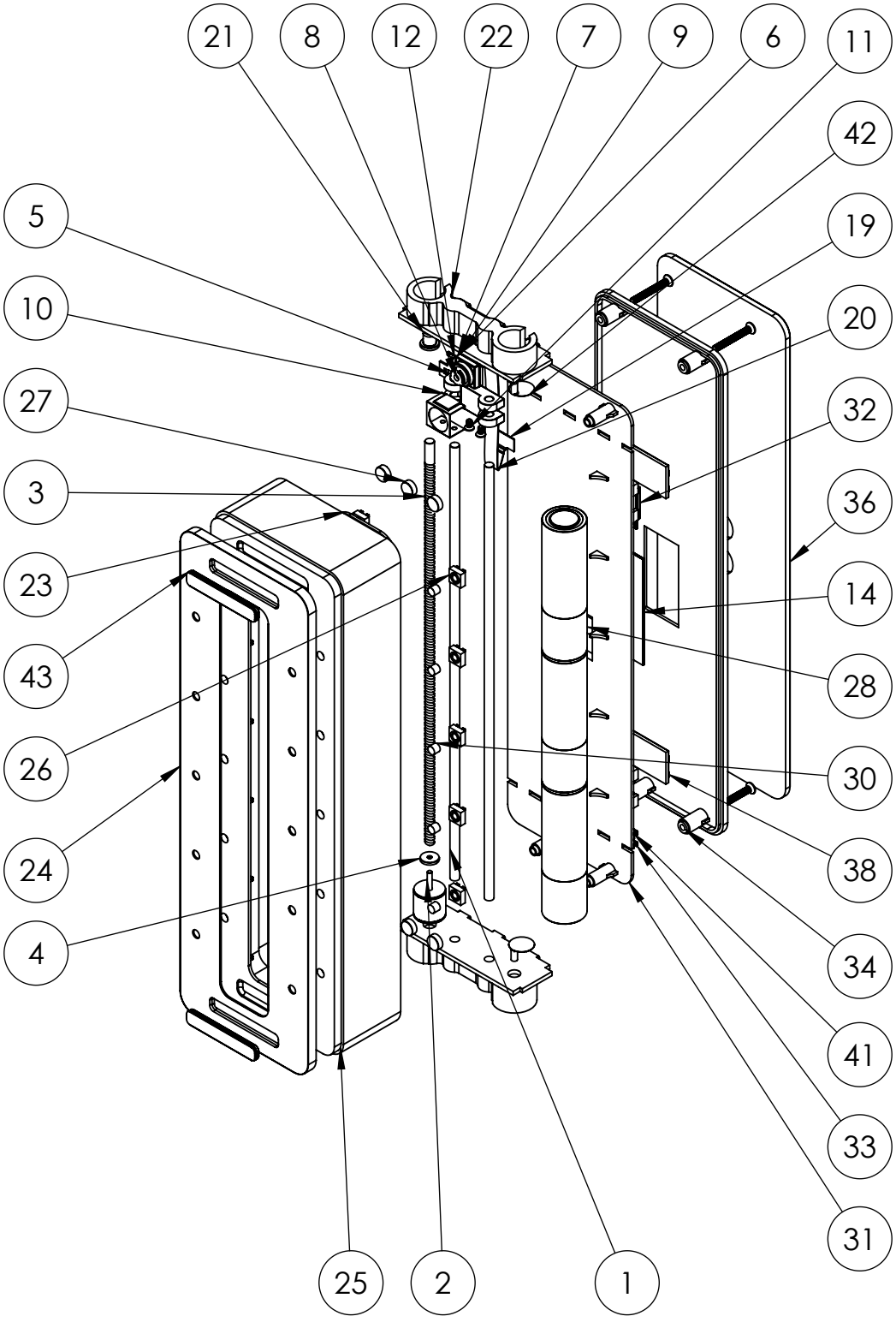
The data needed for the calculations were found.

Reflection

The needed data were found.



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
DATE: 25.04.2016		TITLE: View assembly	
NAME Tools by SØ			
MATERIAL:		DWG NO. A01	A4
		SCALE:1:1	SHEET 1 OF 10



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
DATE: 25.04.2016		TITLE: Exploded	
NAME Tools by SØ			
MATERIAL:		DWG NO. A01	A4
		SCALE:1:2	SHEET 2 OF 10

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	A01.1	Rail (Ø3mm x 164mm)	2
2	A01.2	Stepper motor	1
3	A01.3	Threadded rod (3mm x154mm)	1
4	A01.4	Washer (D6 - d1.3 - 1mm)	1
5	A01,5	Rail slider	1
6	A01.6	OV5642 - Back panel	1
7	A01.7	OV5642 - Lens	1
8	A01.8	OV5642 - Lens head	1
9	A01.9	OV5642 - Cable 24pin ribbon	1
10	A01.10	Camera mount	1
11	A01.11	Screw (M1.6 x 3mm)	3
12	A01.12	Threaded clip	1
13	A01.13	Torsing spring (Ø2 x 4mm)	1
14	A01.14	Circuit board (30mm x 40mm)	1
15	A01.15	24pin lock	1
16	A01.16	24pin female connector	1
17	A01.16	Bluetooth chip	1
18	A01.17	Push botton switch	2
19	A01.18	24pin male connector	1
20	A01.19	Ribbon cable	1
21	A01.20	Washer head (Ø3 x 5mm)	1
22	A01.21	Rail mount	2
23	A01.22	Glass	1
24	A01.23	Rubber front	1
25	A01.24	Core view	1
26	A01.25	LED (5mm x 5mm x 2mm)	10
27	A01.26	Magnet (5mm x 2mm)	6
28	A01.27	AA Battery	3
29	A01.28	Battery sleeve	1
30	A01.29	LED lens	10
31	A01.30	Middle plate	1
32	A01.31	WIFI Unit	1
33	A01.32	Micro USB	1
34	A01.33	Cap plate view	1
35	A01.34	Screw (M1.6 x 16mm)	4
36	A01.35	Back plate	1
37	A01.36	Power button	1
38	A01.37	StripPad	2
39	A01.38	LED 5050	6
40	A01.39	Resistor 1206	4
41	A01.40	Micro rivet	6
42	A01.41	Power line plate (Ø8 x 4mm)	2
43	A01.42	Mounting plate	2
44	A01.43	Probe mount	1
45	A01.44	Screw (M1.6 x 6mm)	2

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MILLIMETERS
SURFACE FINISH:
TOLERANCES:
LINEAR:
ANGULAR:

DEBURR AND BREAK SHARP EDGES

DO NOT SCALE DRAWING

REVISION

DATE: 25.04.2016

NAME Tools by SØ

TITLE: Bill of material

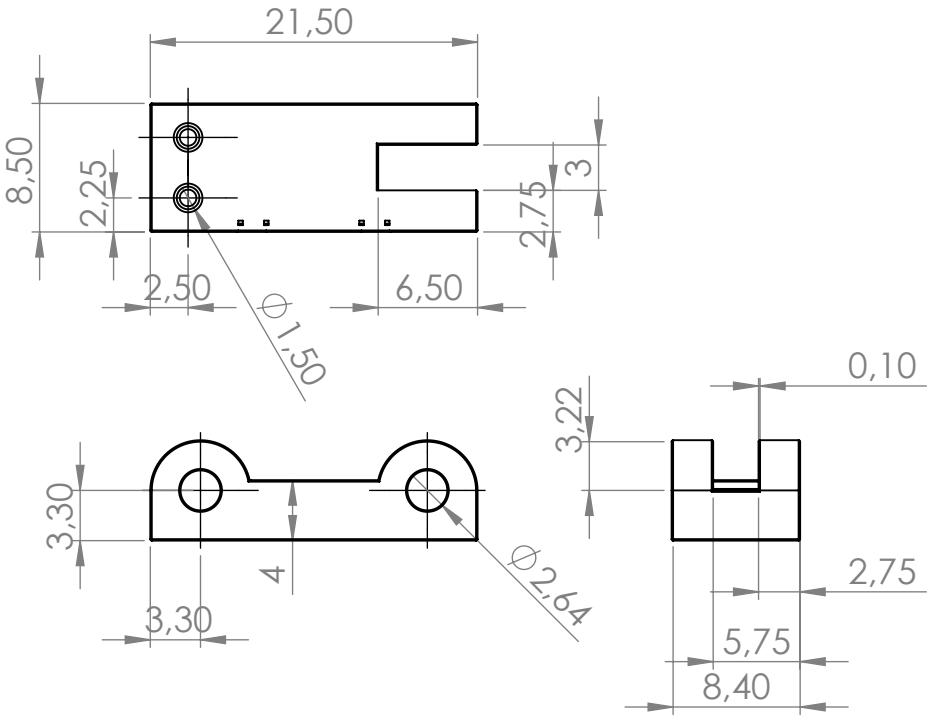
MATERIAL:

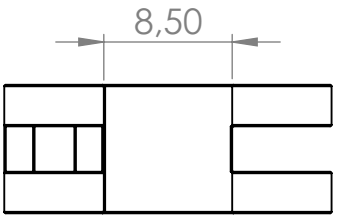
DWG NO. A01

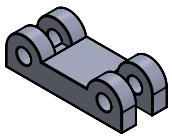
A4

SCALE:1:2

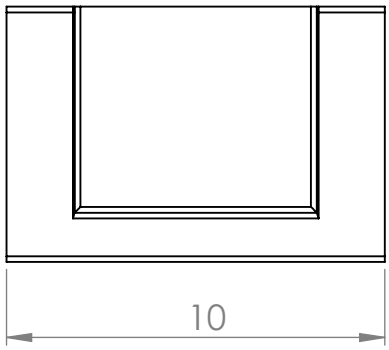
SHEET 3 OF 10

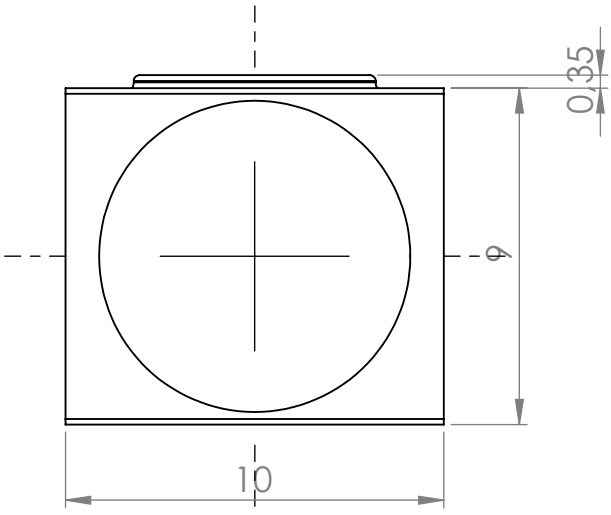


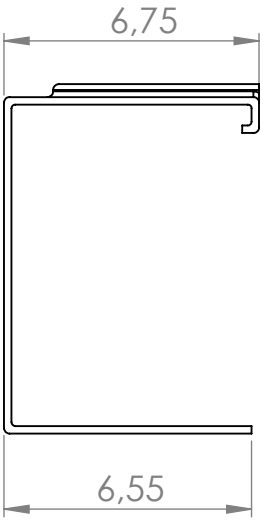


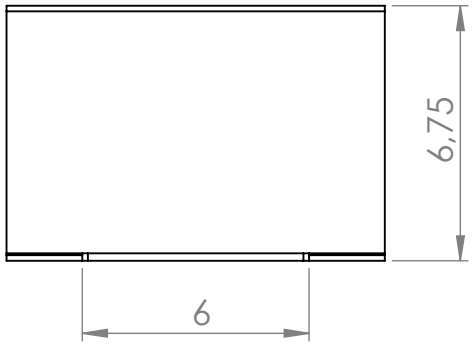


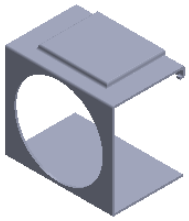
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: DS/ISO 2768-1f LINEAR: ANGULAR:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
DATE: 25.04.2016		TITLE: Rail slider	
NAME Tools by SØ			
MATERIAL:		DWG NO. A01.5	A4
		SCALE:2:1	SHEET 4 OF 10



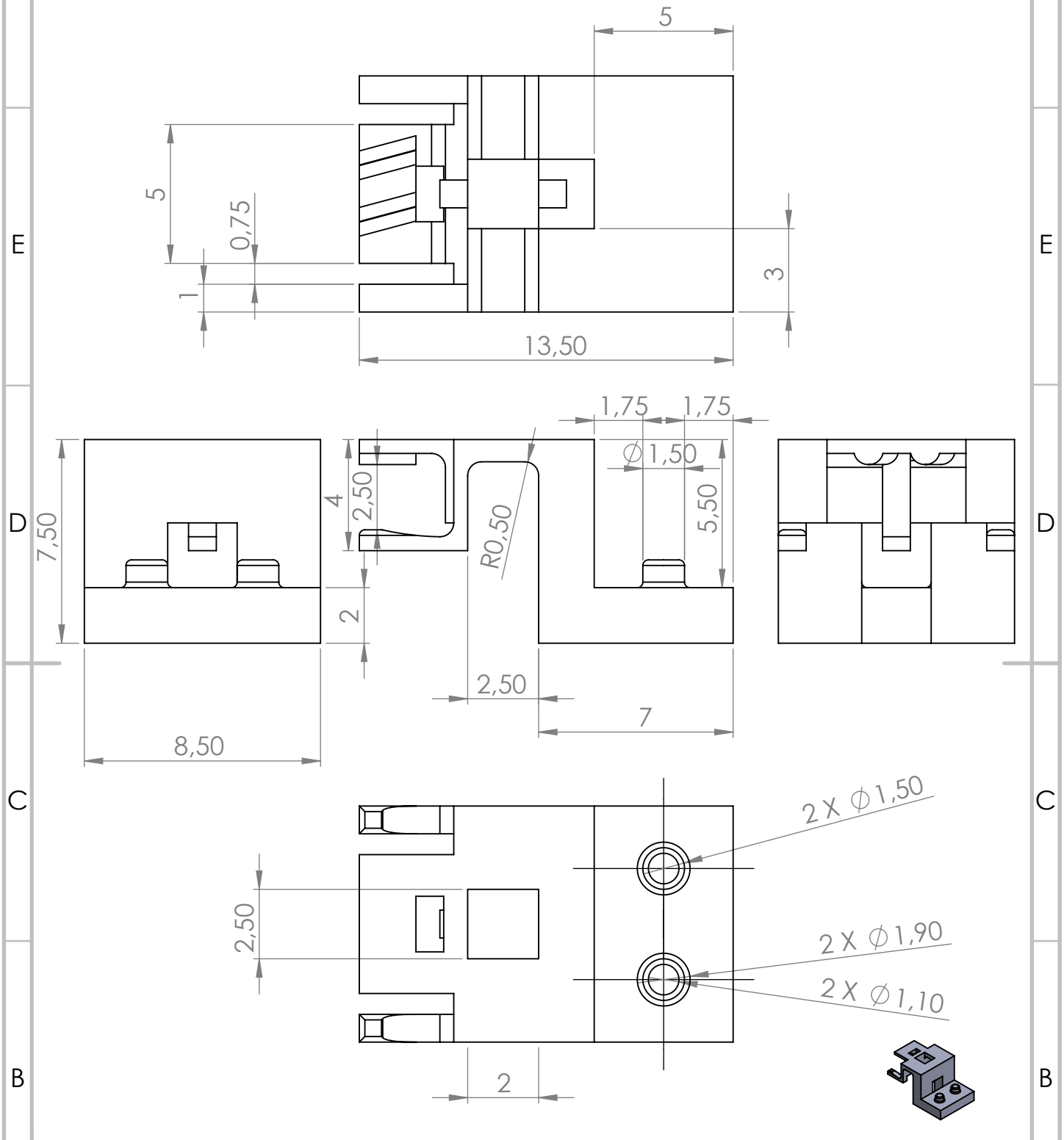








UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: DS/ISO2768-1F LINEAR: ANGULAR:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
DATE: 25.04.2016		TITLE: Camera mount	
NAME Tools by SØ			
MATERIAL: Stainless steel		DWG NO. A01.10	A4
		SCALE:2:1	SHEET 1 OF 1



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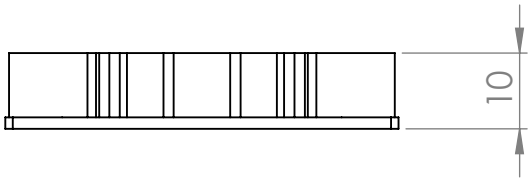
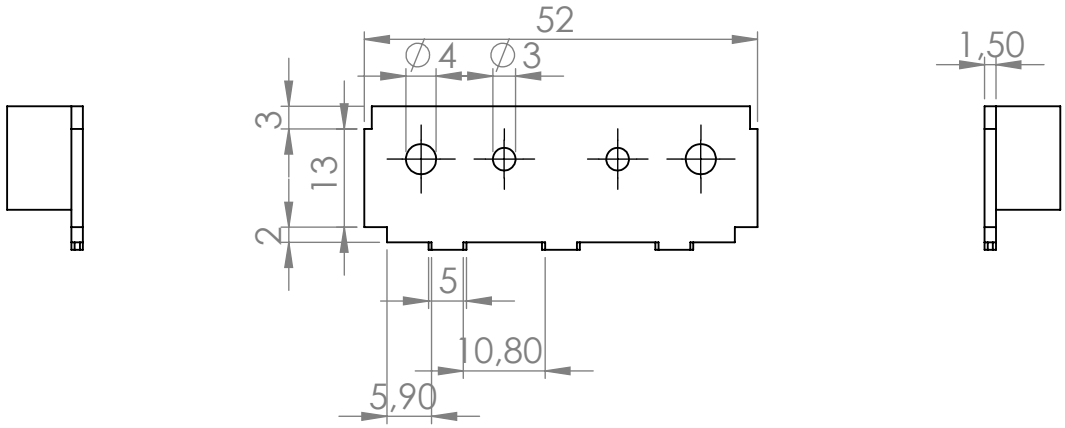
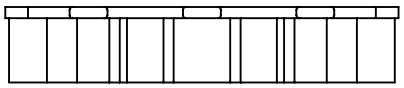
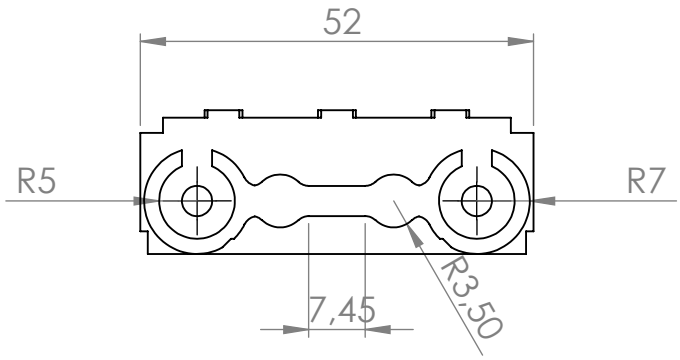
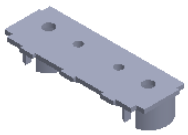
DATE: 25.04.2016		TITLE: Threaded clip	
NAME Tools by SØ			
MATERIAL: ABS		DWG NO. A01.12	A4
		SCALE:5:1	SHEET 5 OF 10



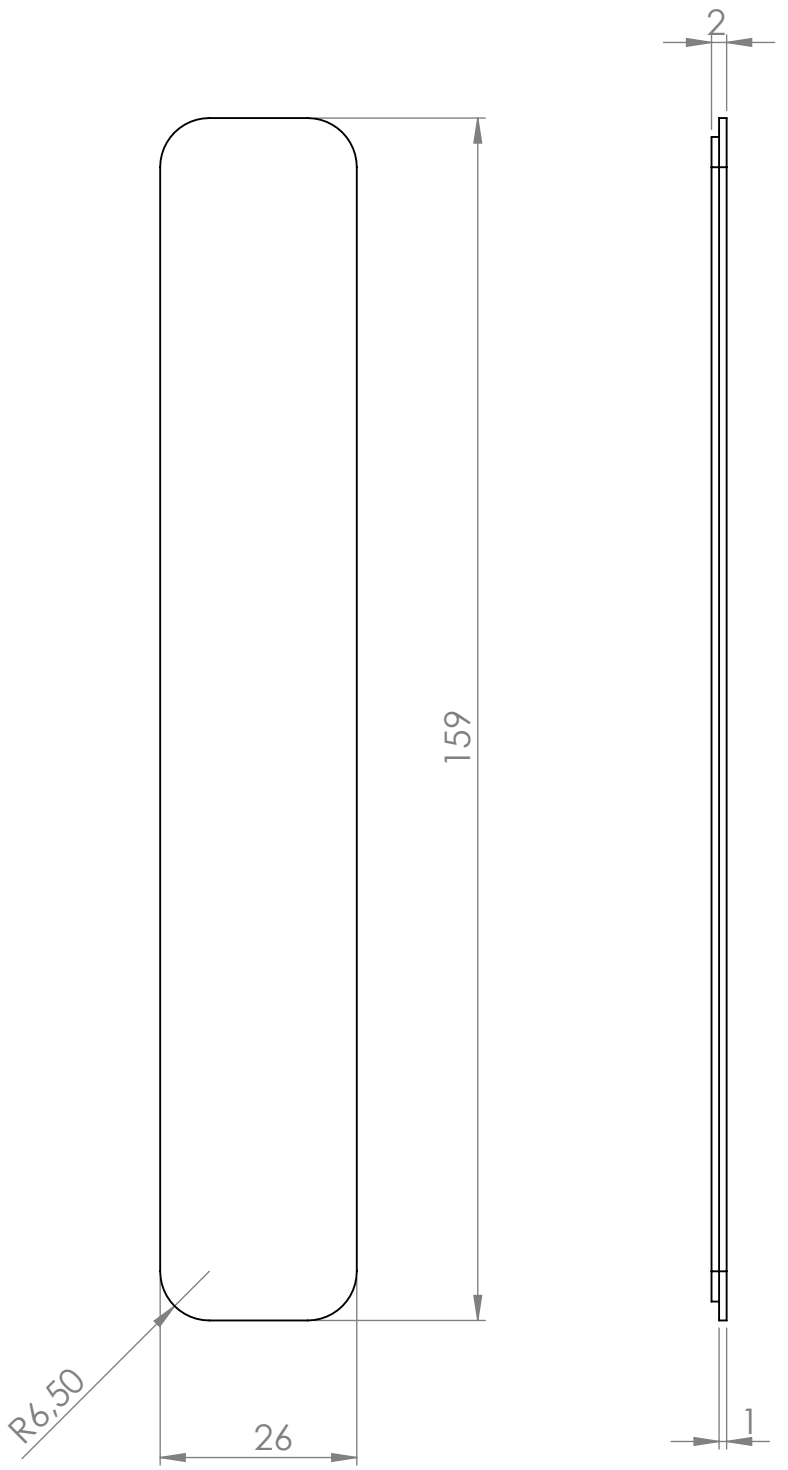




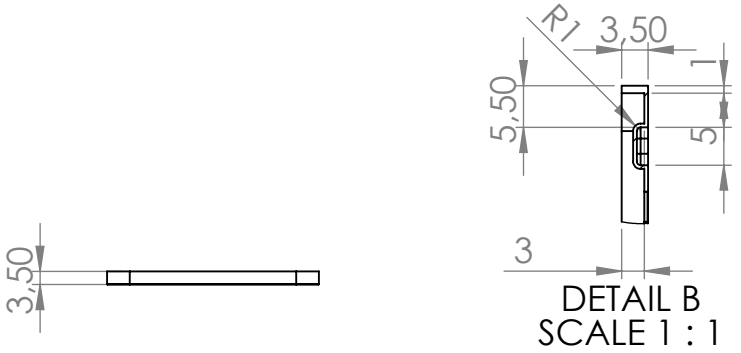




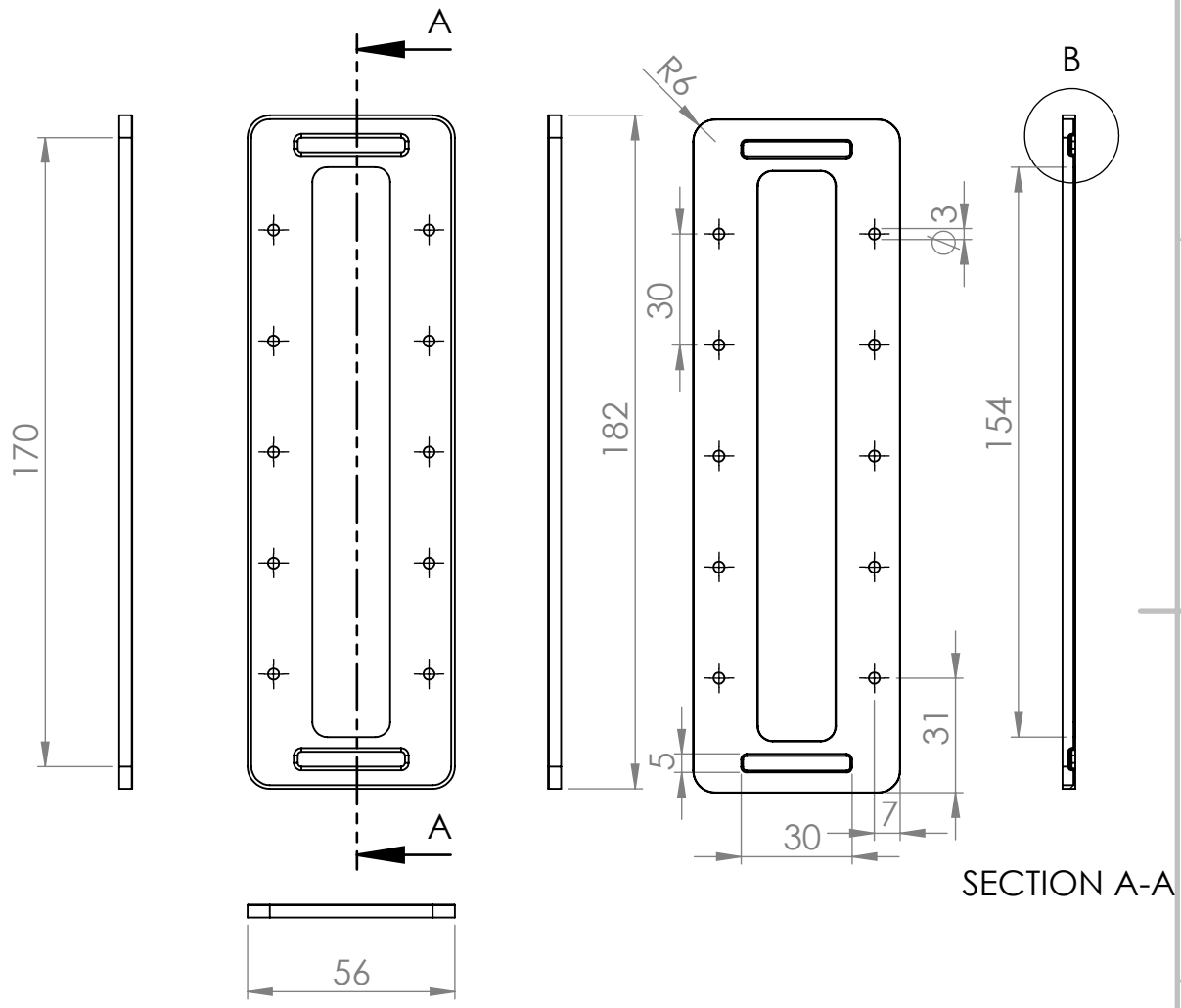
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES:DS/ISO 2768-1F LINEAR: ANGULAR:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
DATE: 25.04.2016		TITLE: Rail mount	
NAME Tools by SØ			
MATERIAL: ABS		DWG NO. A01.21	A4
		SCALE:1:1	SHEET 1 OF 1



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: DS/ISO 2768-1f LINEAR: ANGULAR:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
DATE: 25.04.2016		TITLE: Glass	
NAME Tools by SØ			
MATERIAL: Tempered glass		DWG NO. A01.22	A4
		SCALE:1:1	SHEET 6 OF 10

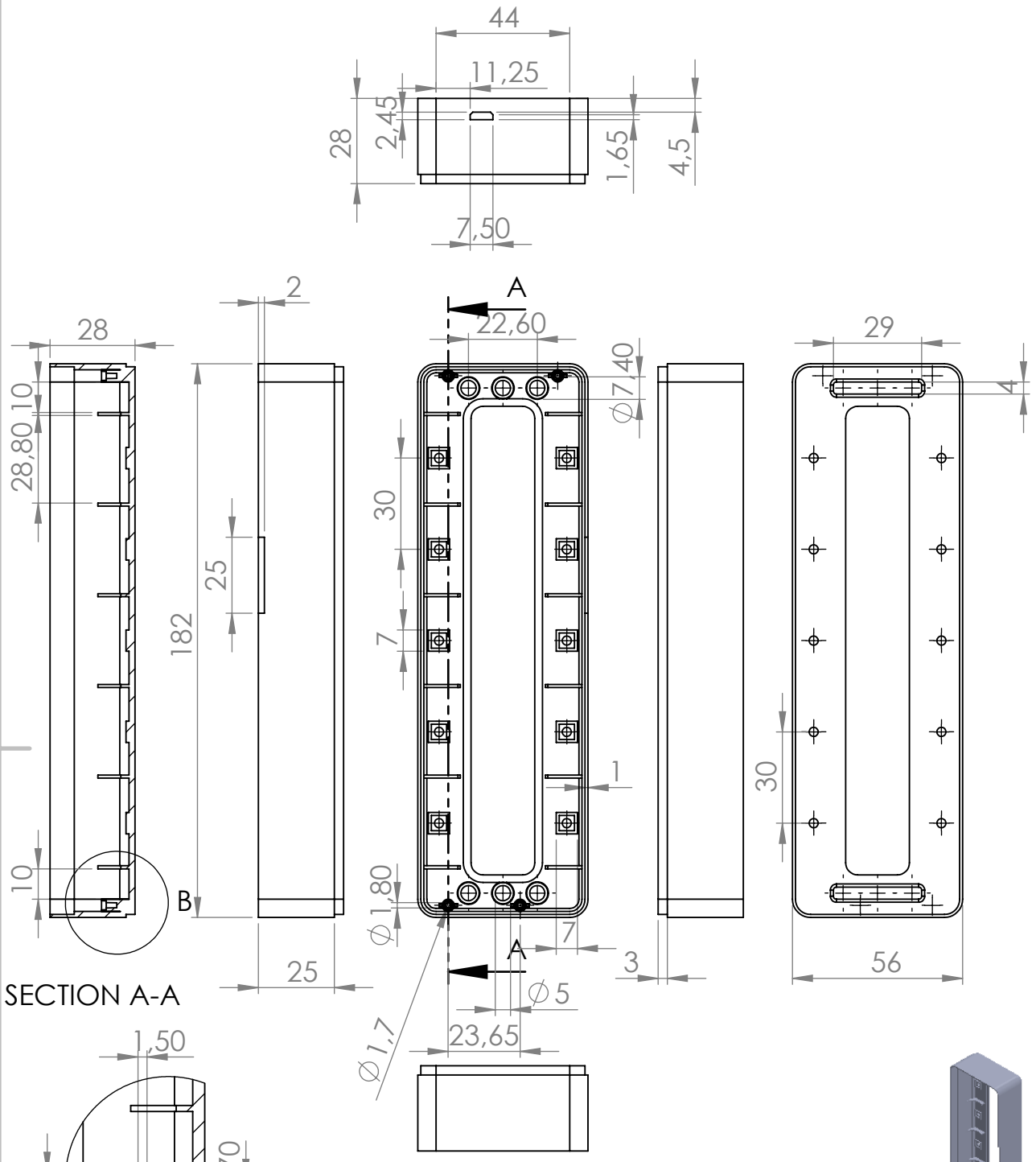


DETAIL B
SCALE 1 : 1

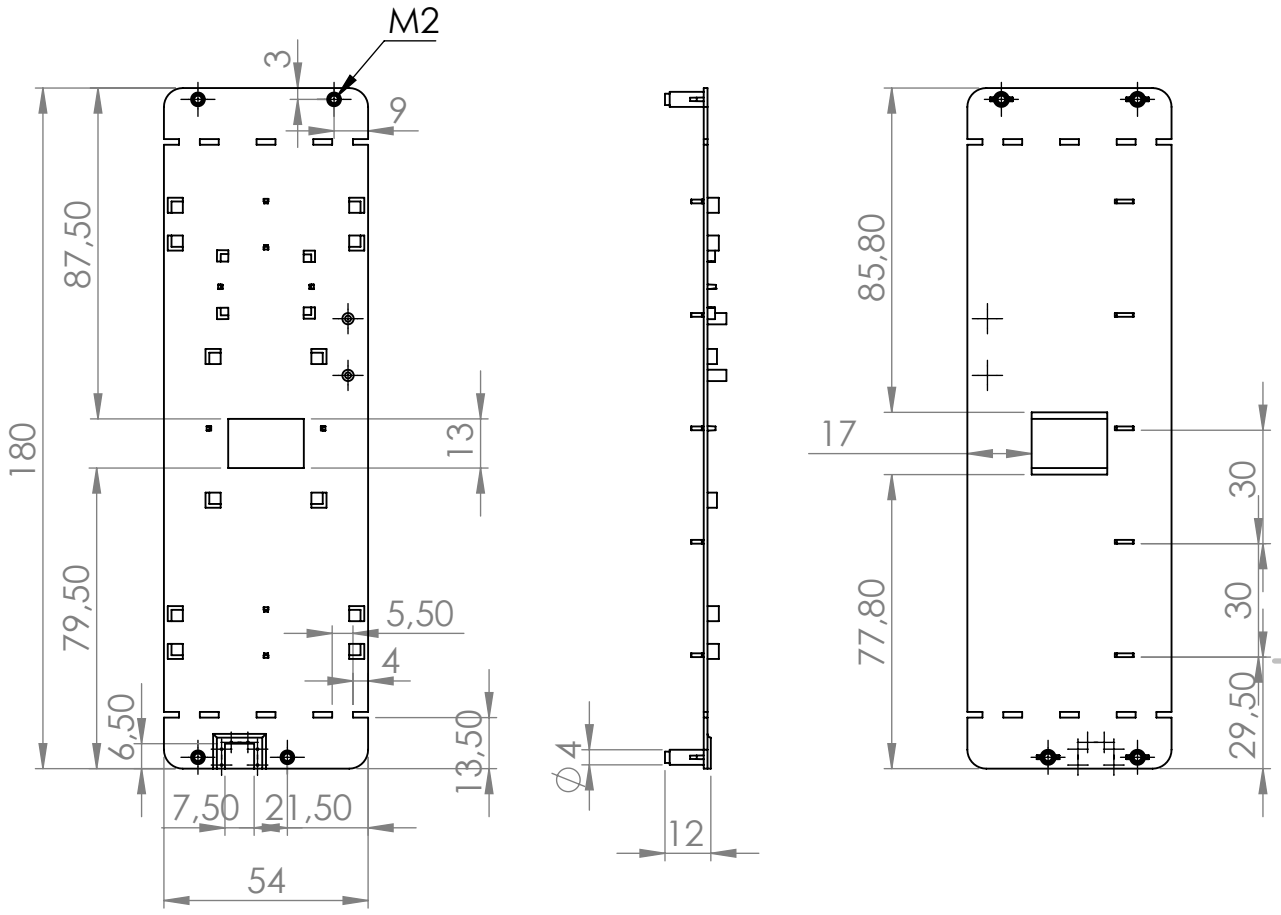


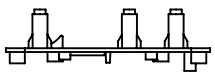
SECTION A-A

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: DS/ISO 2768-1F LINEAR: ANGULAR:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
DATE: 25.04.2016		TITLE: Rubber front	
NAME Tools by SØ			
MATERIAL: EPDM		DWG NO. A01.23	A4
		SCALE:1:2	SHEET 1 OF 1

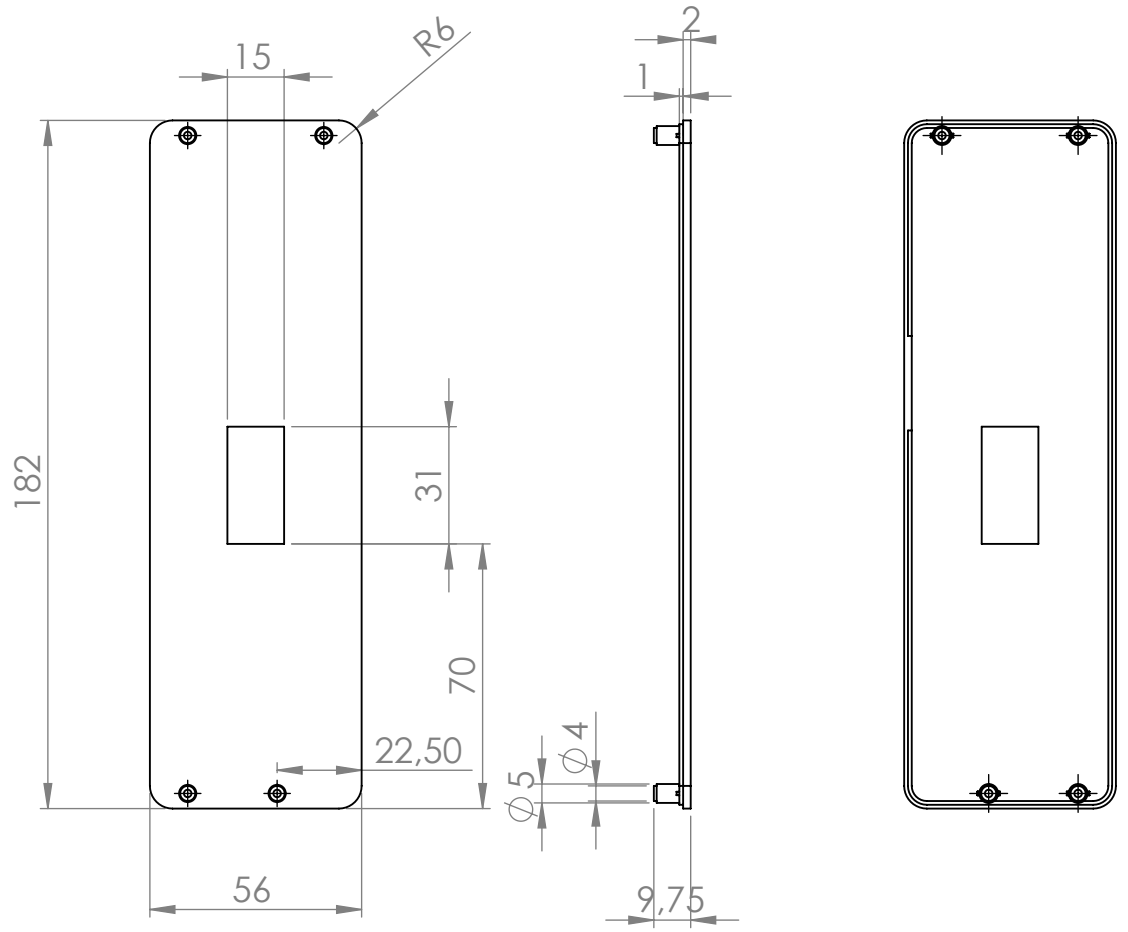


UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: DS/ISO 2768-1 LINEAR: ANGULAR:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
DATE: 25.04.2016		TITLE:	Core View
NAME	Tools by SØ		
MATERIAL:	ABS	DWG NO.	A01.24 A4
		SCALE:1:2	SHEET 1 OF 1





UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: DS/ISO 2768-1f LINEAR: ANGULAR:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
DATE: 25.04.2016		TITLE: Middle plate	
NAME Tools by SØ			
MATERIAL: ABS		DWG NO. A01.30	A4
		SCALE:1:2	SHEET 7 OF 10



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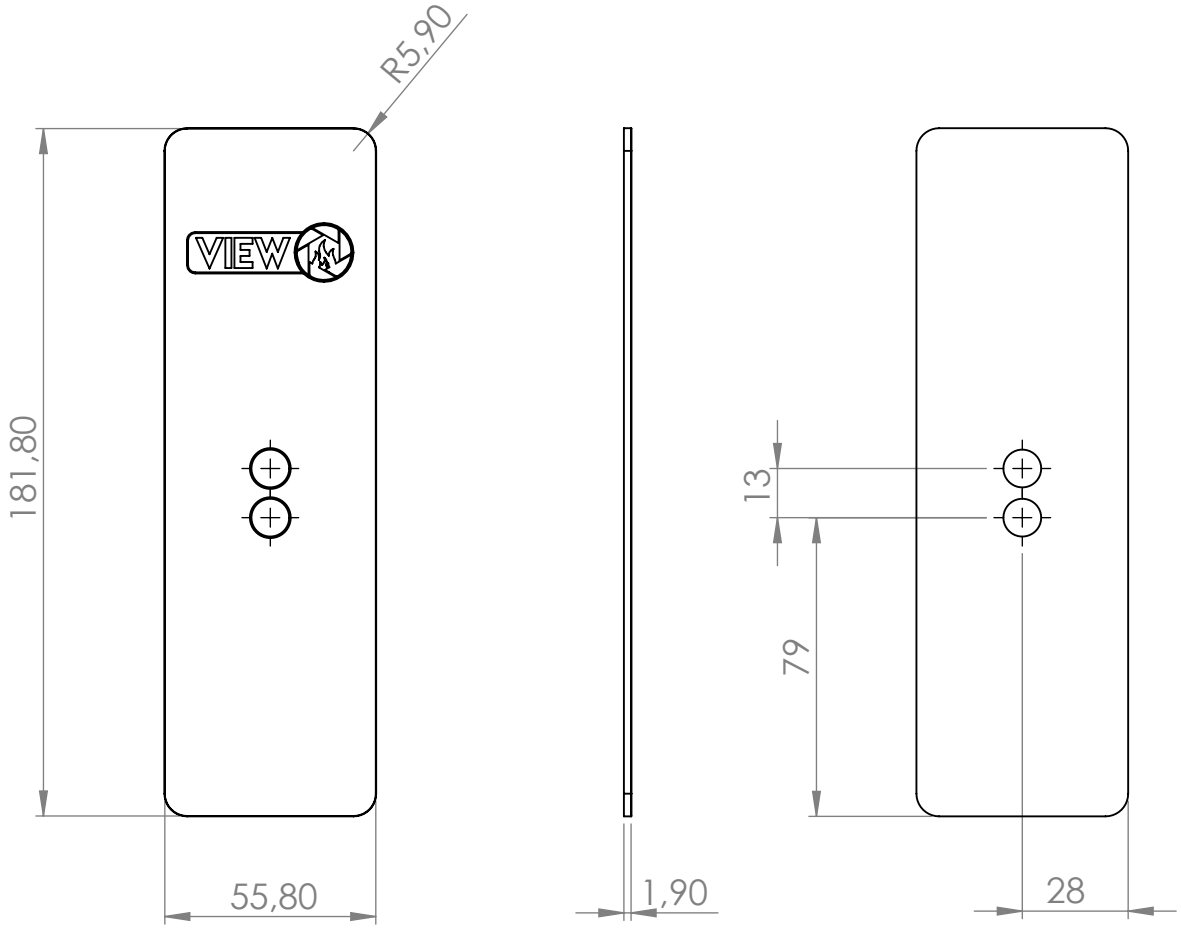
DATE: 25.04.2016		TITLE: Cap plate	
NAME Tools by SØ			
MATERIAL: Clear ABS		DWG NO. A01.33	A4
		SCALE:1:2	SHEET 8 OF 10



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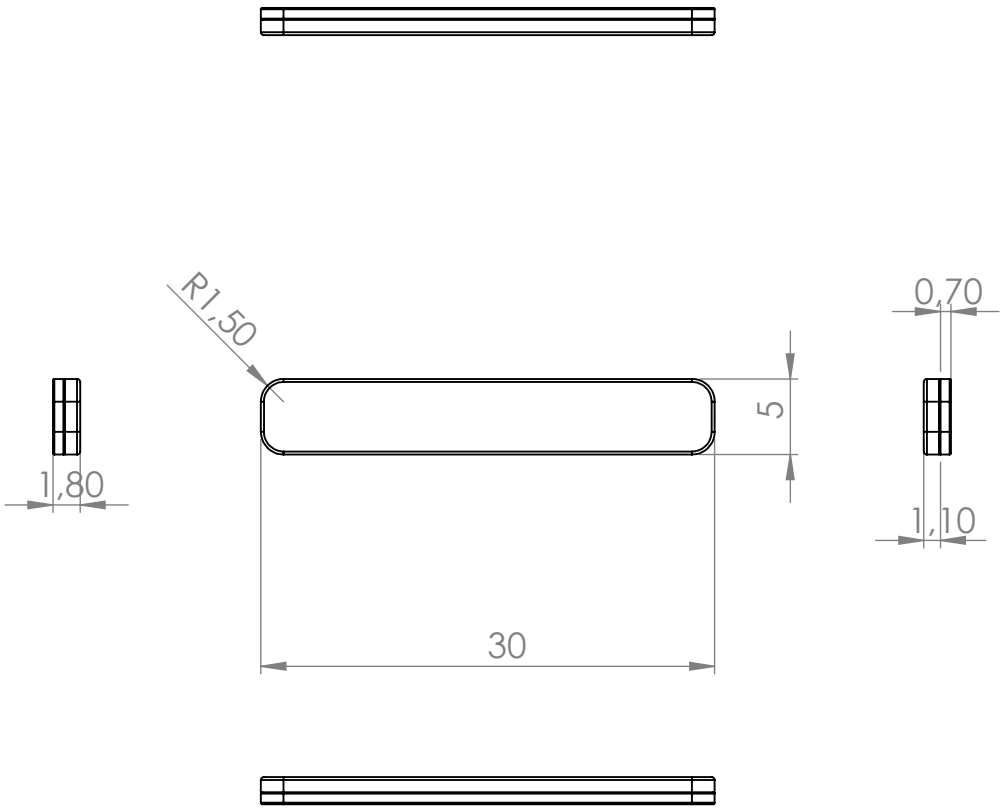
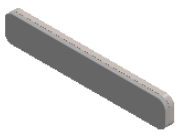
DATE: 25.04.2016		TITLE: Back plate	
NAME Tools by SØ			
MATERIAL: Stainless Steel		DWG NO. A01.35	A4
		SCALE:1:2	SHEET 9 OF 10





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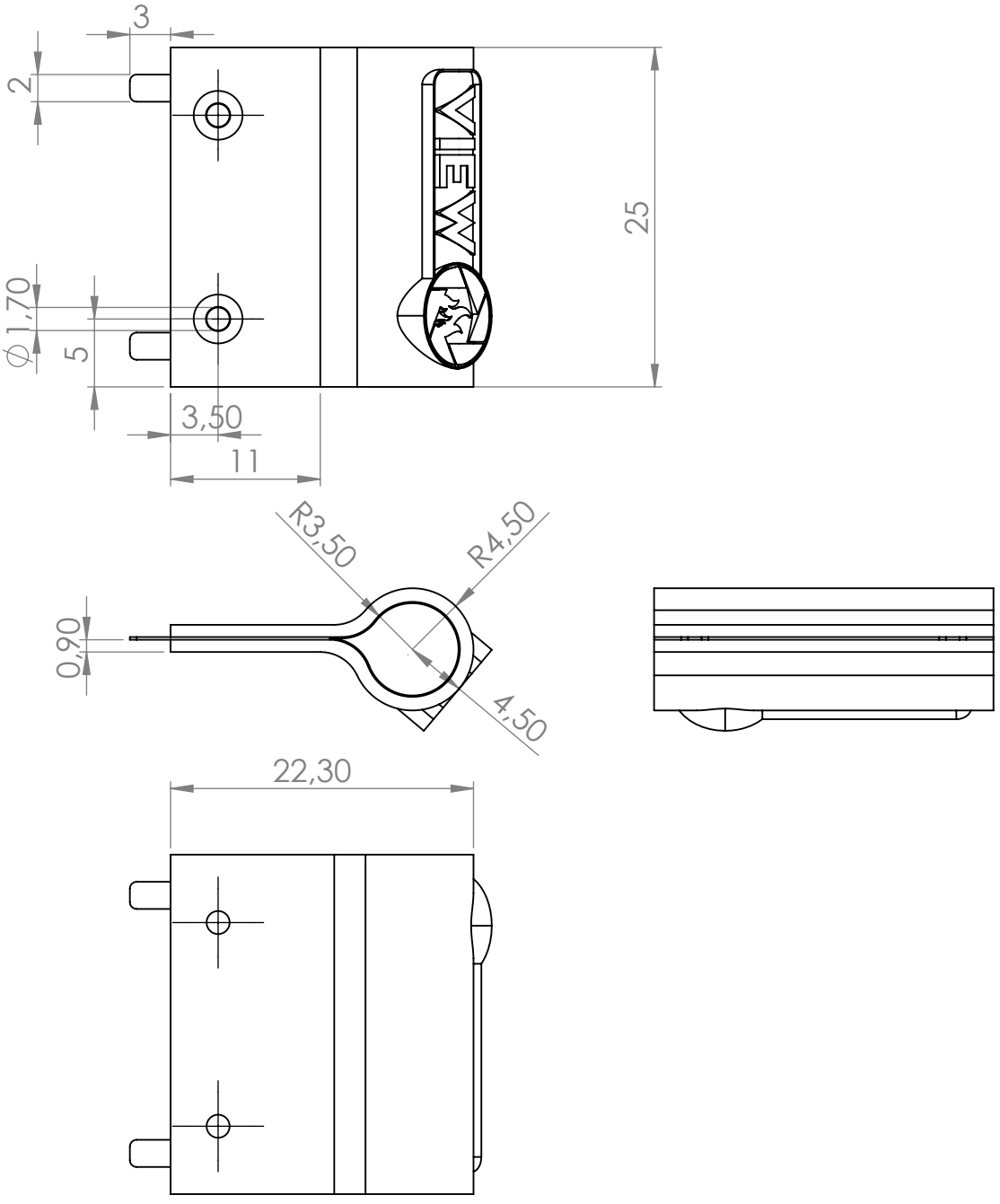
DATE: 25.04.2016		TITLE: Mounting plate	
NAME Tools by SØ			
MATERIAL: Steel and glue tape		DWG NO. A01.42	A4
		SCALE:2:1	SHEET 1 OF 1



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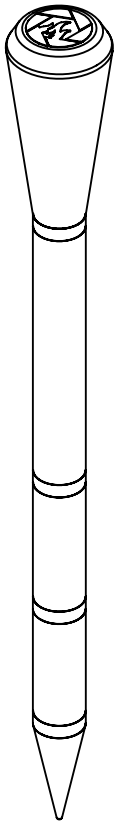
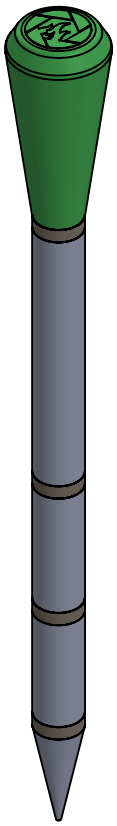
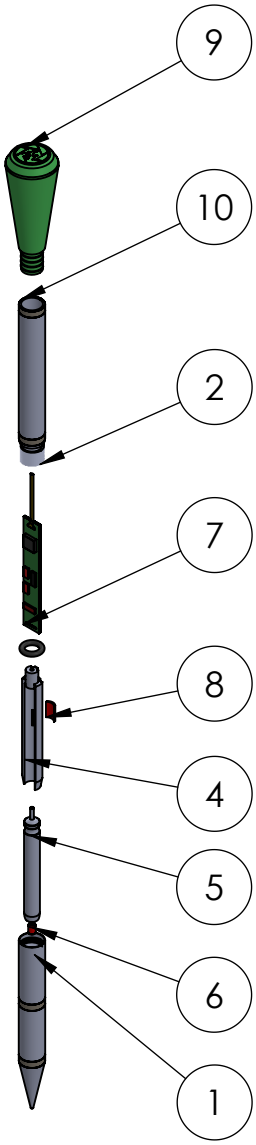
DATE: 25.04.2016		TITLE: Probe mount	
NAME Tools by SØ			
MATERIAL: EPDM		DWG NO. A01.43	A4
		SCALE:2:1	SHEET 10 OF 10





UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
DATE: 25.04.2016		TITLE: Probe assembly	
NAME Tools by SØ			
MATERIAL:		DWG NO. B01	A4
		SCALE:1:1	SHEET 1 OF 6



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	B01.2	Female shell	1
2	B01.3	Male shell	1
3	B01.4	O-ring	1
4	B01.5	Battery mount	1
5	B01.6	BR-435 pin battery	1
6	B01.7	Resistor	1
7	B01.8	Circuit board probe	1
8	B01.9	Resister	1
9	B01.10	Probe head	1
10	B01.11	Probe ring	4

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN MILLIMETERS
SURFACE FINISH:
TOLERANCES:
LINEAR:
ANGULAR:

DEBURR AND BREAK SHARP EDGES

DO NOT SCALE DRAWING

REVISION

DATE: 25.04.2016

NAME Tools by SØ

TITLE: Probe exploded

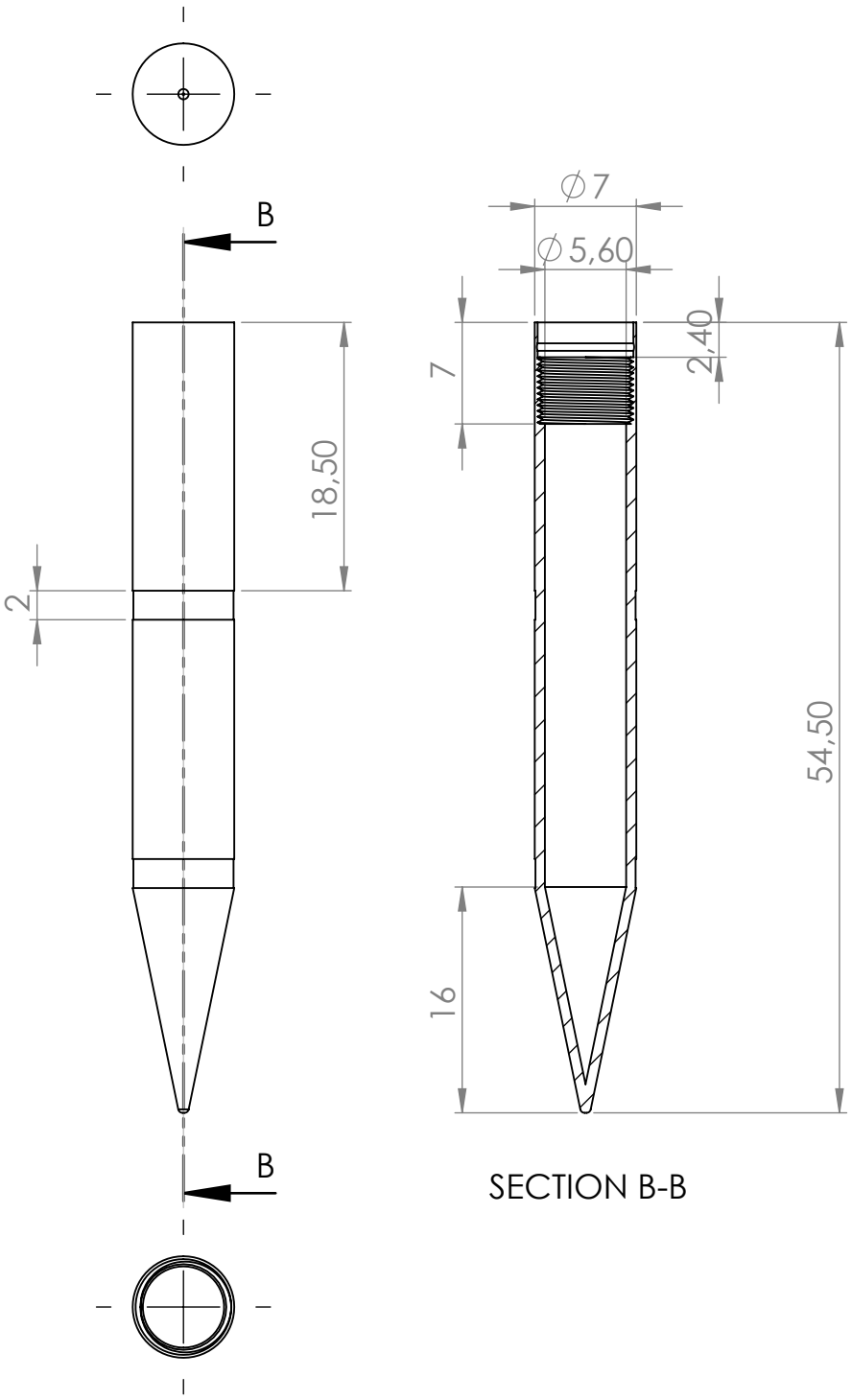
MATERIAL:

DWG NO. B01.1

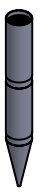
A4

SCALE:1:2

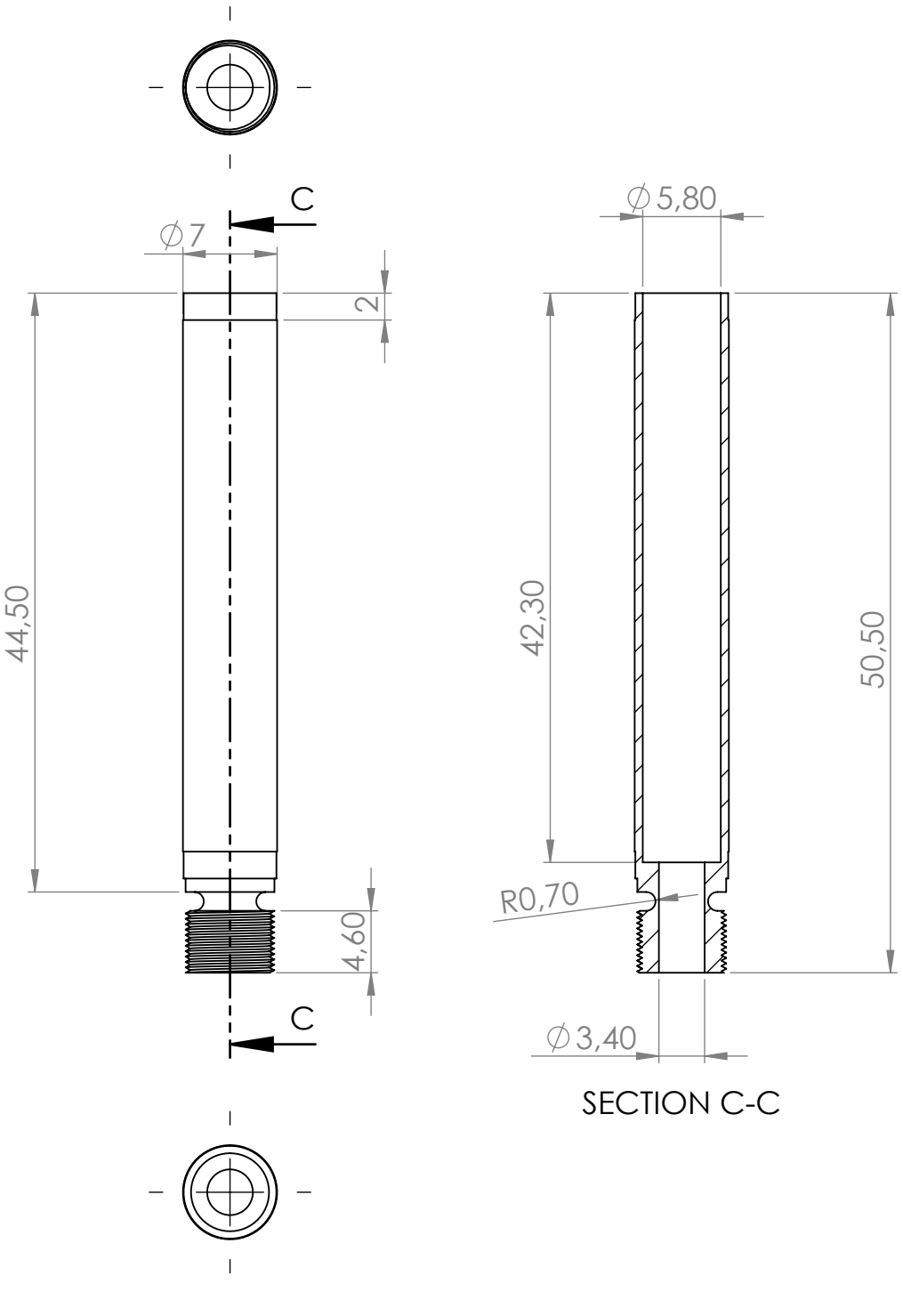
SHEET 2 OF 6



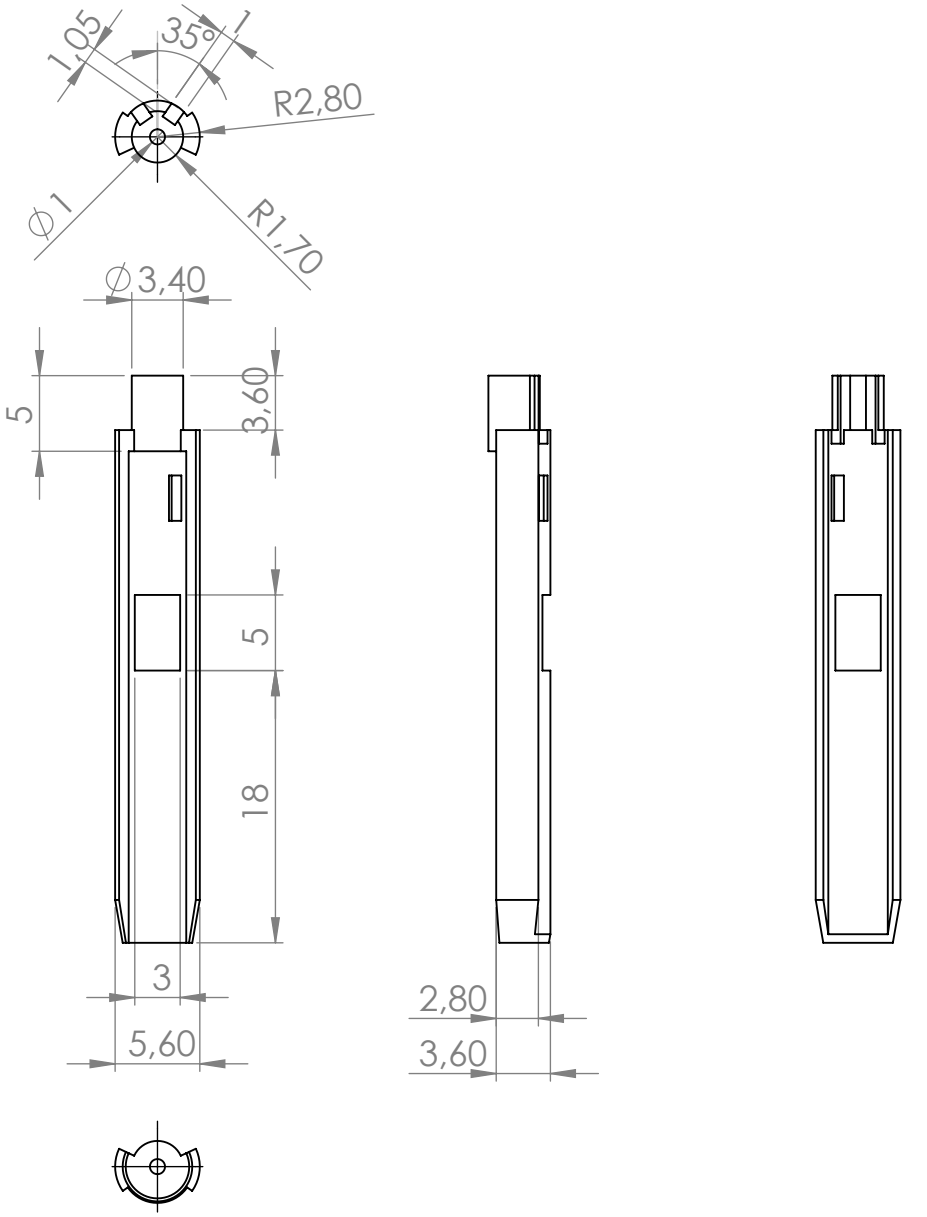
SECTION B-B



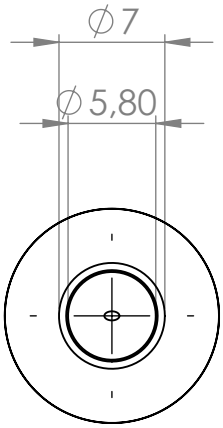
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: DS/ISO 2768-1f LINEAR: ANGULAR:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
DATE: 25.04.2016		TITLE: Female shell	
NAME Tools by SØ			
MATERIAL: Stainless steel		DWG NO. B01.2	A4
		SCALE:2:1	SHEET 3 OF 6

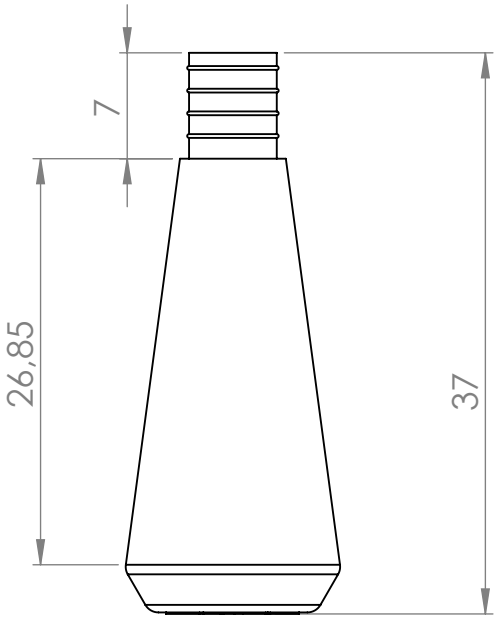


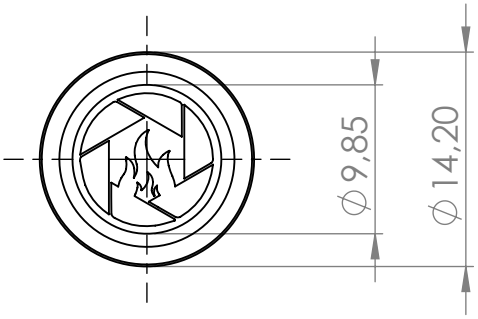
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: DS/ISO 2768-1f LINEAR: ANGULAR:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
DATE: 25.04.2016		TITLE: Male shell	
NAME Tools by SØ			
MATERIAL: Stainless steel		DWG NO. B01.03	A4
		SCALE:2:1	SHEET 4 OF 6



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: DS/ISO 2768-1f LINEAR: ANGULAR:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
DATE: 25.04.2016		TITLE: Battery mount	
NAME Tools by SØ			
MATERIAL: LCP		DWG NO. B01.05	A4
		SCALE:2:1	SHEET 5 OF 6







UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
DATE: 25.04.2016		TITLE: Probe head	
NAME Tools by SØ			
MATERIAL: LCP		DWG NO. B01.10	A4
		SCALE:2:1	SHEET 6 OF 6