LUT University

School of Engineering Science

“Software Engineering” OR “Software and Systems Engineering” Degree Program

FOOD QUEING AND ORDERING

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1 PLAN

For this report, our group chose the interesting subject of food queueing and ordering. It included the question “How to discover when the student union or main building street café have less queues and enable people at campus to order items for takeaway?” We decided at this stage to slightly modify the assignment to apply for the university lunch restaurants in general.

The motivation for this project therefore has its grounds in the problem of long queues forming during peak hours at university lunch restaurants/cafeterias, and in the limitation of not being able to order takeaway in advance. The students, teachers and visitors who come for lunch e.g., sometimes do not get their lunch completed due to waiting in the queues. We see a need for an easy solution to track queues and offer a way to order takeaway.

The goal for this project is to create an app to help students, teachers, and guests of the university to get their food as quickly and efficiently as possible, so that they don’t waste their time standing in queues.

1.1.1 PROBLEM MAPPING

To understand our problem and the users better, we first did problem mapping using a simple affinity diagram (Dam and Siang, 2023a). A more detailed description of affinity maps can be found in part 0. Since we work remotely, the easiest platform for us to do this part was to use a word document, where we listed the problems regarding the user groups we had thought of through the lenses of the PACT-framework (Knutas, 2023). Then we grouped the problems into logical categories. The problem mapping helped us to define our problem and see the motivation and goals for our project. In defining the problem and the goal, we took into consideration that according to Interaction Design Foundation (Dam and Siang, 2023b) the definition needs to be “human centred”, “broad enough for creative freedom” and “narrow enough to make it manageable”.

Primary problems:

- Long queues

Secondary problems:

  - Long waiting time to get lunch.
  - Don’t know beforehand, from which place you get food the fastest.
  - Physical disability: can be tough to stand in line a long time.
  - Wasting time if you must switch place because of queues.
  - Not finishing meals due to waiting in the queue so long → negative health impact.
  - Stressful lunchbreak for students & teachers when they need to rush to lunch.
  - Surprised and annoyed guests at the University who did not expect the long queues.
  - Uneven distribution of customers between the lunch restaurants.

- No way to order takeaway.

  Secondary problems:

  - Takeaway customers must queue in the same line as the ones eating in

- Only available technology is for seeing the menus and opening times

1.1.2 BENCHMARK RESEARCH

For our benchmark research, we investigated different food takeaway sites, existing student lunch restaurant applications or sites, as well as tried to find applications that provide queue management.

The most known takeaway applications in Finland are Wolt (2023) and Foodora (2023). Both have the same journey as a core: you can browse restaurants, choose a dish of your choice, pay in the app, and choose either delivery or pickup. Existing student lunch

applications are e.g., Unicafe (2023) and Kampusravintolat (2023). They both display the available restaurants, the opening hours, and the menu for the week.

We could not find a student lunch restaurant application that would solve the queuing problem, nor one that had the opportunity to order takeaway. There were a few ready queue management programs (Aseem, 2020), but they all cost money and work on a ticketing basis, which could be seen as too clumsy. Queue management through queue cameras is in use in many ABC car wash stations (ABC!, 2023). This works by having the ABC app on your phone, from where you can see the queue at the carwash of your choice in real time. The picture updates about every minute.

Our benchmark research shows that there is a possible market gap for a student lunch application that considers queues and takeaway possibilities.

1.1.3 USER RESEARCH

The user groups we were able to define through the problem mapping and benchmark research were the following: primary user groups are students, teachers, and guests, in this order. The secondary user group is the student lunch restaurant staff. Based on our user groups, we decided to have a user survey for the students and teachers, and another one for the lunch restaurant staff. The surveys could be conducted through e.g., Google Forms. For this project, we have designed the survey for students and teachers, which can be found in Appendix 1.1.

1.2 UNDERSTAND

1.2.1 CONTEXT OF USE

In this case we create a food queuing and ordering app that aims to address the issues of long queues at the University's cafeteria or dining areas during peak hours. Our application aims to provide the user with information about queues in real-time which creates a

solution for students, teachers, staff members and guests to plan their meals more efficiently.

1.2.2 USER RESEARCH

User research findings: We found in user research findings that queuing can have significant impact on user experience.

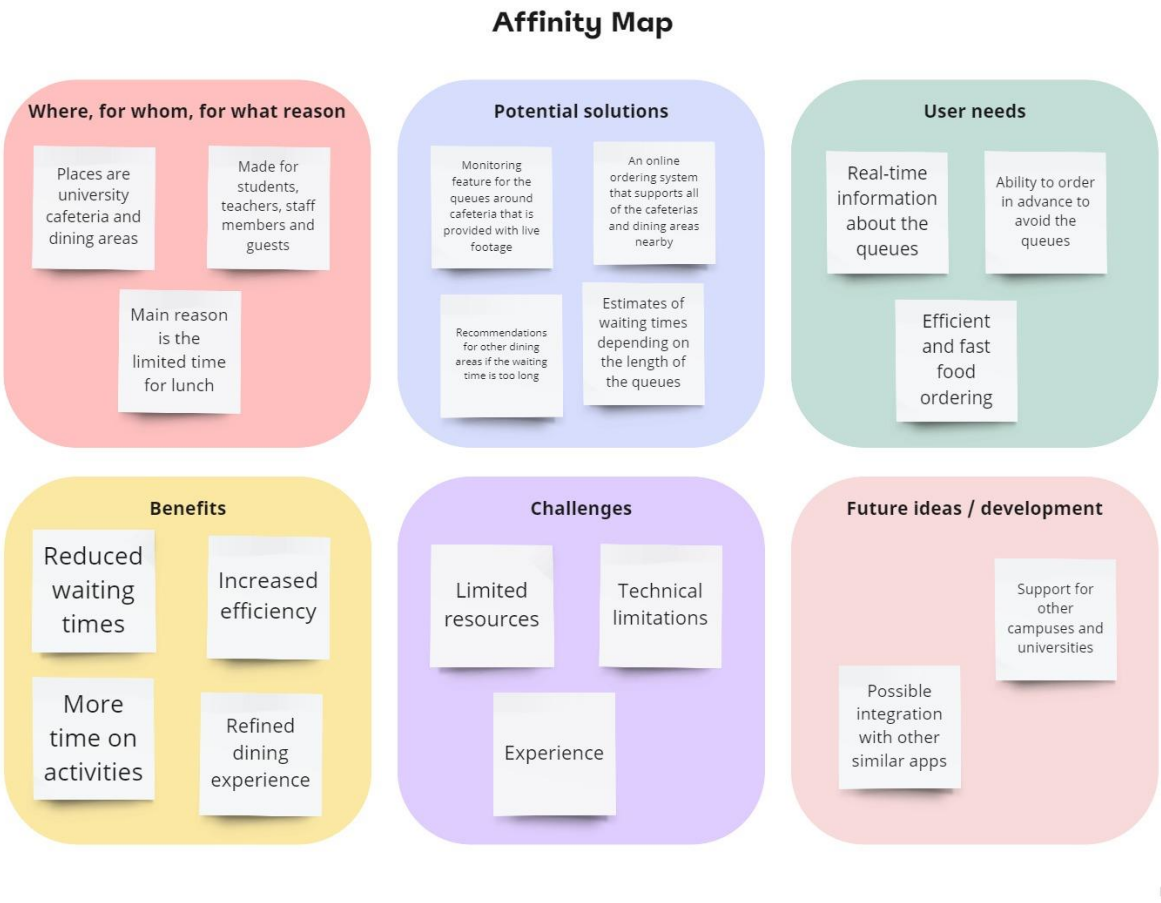
First, waiting in line can be frustrating for users. In research we found that one of the most common complaints among users is that waiting in a queue is frustrating, especially when you have limited time between lectures.

Second, in user research we found that that queuing system can be optimized to improve user experience. We came to conclusion that for example we can create queue length tracking system via camera or sensors.

Third. We must consider that users have different perceptions of time. User perception of time is highly subjective. Some users can see that 30 minutes is enough time to eat and stand in a queue other see that this time is too short for them. (Interaction design user research)

1.2.3 AFFINITY MAP

Affinity map is a visual tool to help organize information from a brainstorming session. One can think of affinity maps as bunch of post-it notes that have been made from a brainstorming session and organized into groups so that they make sense. (Interaction design affinity maps, Miro)

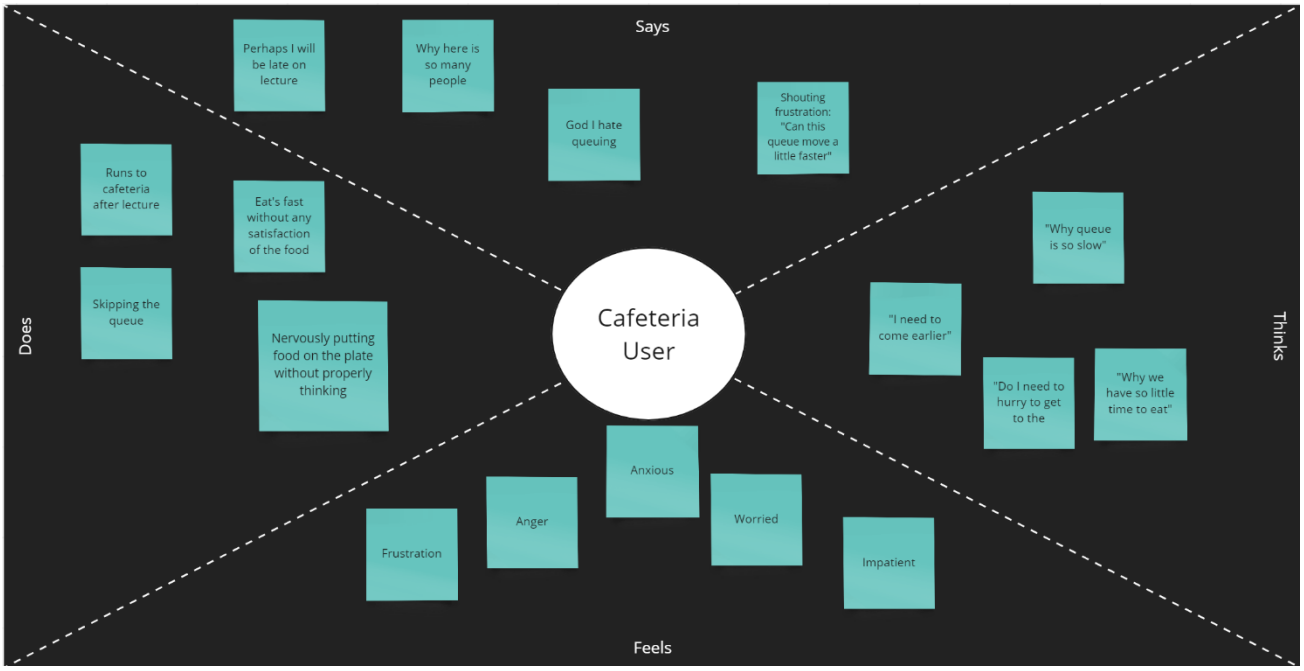


With the help of this image, we can understand the key elements more clearly and develop further with the project.

1.2.4 EMPATHY MAP

Traditional empathy maps are split into 4 quadrants (*Says*, *Thinks*, *Does*, and *Feels*), with the user or persona in the middle. Empathy maps provide a glance into who a user is as a whole and are **not** chronological or sequential. (Sarah G. Empathy maps).

Below is our created empathy map to summarise.



With this map we can understand cafeteria users in a hurry time especially in queue and their needs and their behaviour.

1.2.5 PERSONAS

Our user personas are based on the data we have collected in our (fictive) user research, empathy map and affinity map. We created personas to better link our research material to real users by understanding their behaviour, needs & goals and frustrations. We used Miro's readymade template, that matches well with Interaction Designs explanation to what a user persona should be (Sarah G., Interaction design personas).

Persona - Teacher

Demographics

Milla Miettinen is 52 years old. She works as a teacher in electrical engineering at LUT, Finland, for the fifth year.

Behaviors & Habits

Milla's hobbies are hikes in the nature with her dog, cross-country skiing in the winter and playing boardgames with her friends.
She likes to have time to plan her schedule and be organized. During lunch, she likes to have time to discuss and connect with her fellow colleagues.
She dislikes being late and in a rush.

Pain Points & Frustrations

Milla has a hard time holding her work schedule due to the long queues in the lunch restaurant. That's why she often pre-buys a salad from a store for lunch, but its nutrition is not good and makes her tired and easily annoyed in the afternoon lectures. This frustrates her, because she does not want to show this side of her to the students, and it limits the time she can spend with her coworkers.

Needs & Goals

Milla wants to help students become experts in electrical engineering by having well put together lectures.
Milla hopes to be kind and compassionate to the students and be her best version of herself, as well as connect better with her fellow colleagues.
One of Milla's goals is to take better care of herself by optimising her time and eating more nutritious food for lunch.

Persona - Student

Demographics

Ville Virtanen is 24 years old. He is a fourth year student in industrial engineering at LUT. Finland.

Behaviors & Habits

Ville's hobbies are workouts in the gym and cycling. He likes to hang out with his friends after the gym. Ville is a very busy person due to free time activities so he dislikes delays in any group projects or other activities.

Pain Points & Frustrations

Ville is struggling with his time consumption due to the long queues at cafeterias. That's why Ville makes his own food in advance for the next day but it starts to wear him out more and more every day. The weariness is starting to bother Ville because his sleep patterns have completely collapsed and one day it will impact his studies significantly.

Needs & Goals

Ville wants to success in his studies but also in his free time hobbies. That is why he hopes that he doesn't have to make any food in advance so he can get back to good sleeping schedule and improve his nutrition by consuming more diverse food at the student cafeteria.

Persona - Visitor

Demographics

Jorma Erä is 35 years old from Perniö, Finland. He is a visitor in LUT. He came to give the students a speech about working life and experience.

Behaviors & Habits

Jorma is a worker in a big tech industry. His passion is about developing new solutions in chemical indsutry. His hobbies are competitive skiing and he likes to read scientific articles in his free time. He also likes to hang out with his friends and participate in skiing competitions with his friends. Jorma's life is packed with a lot of activities so he dislikes delays or queuing because he is impatient.

Pain Points & Frustrations

Jorma has just entered the university for the first time and his speech is starting soon. Before that, he needs to grab something to eat to make sure, his speech will go well. After the speech, Jorma also has to get in time to the leaving train. Due to the long queues, Jorma misses his lunch and the speech left a bad impression from his point of view. As well after lecture, Jorma hasn't had enough time to eat before leaving train and he goes to the train with an empty stomach.

Needs & Goals

Jorma wants to give a good impression of him and his current career path. That is why he hoped to eat well before the speech so that it would have gone more fluently.

Next, we will describe a lunch restaurant staff persona as a secondary user:

Persona - Lunch restaurant staff

Demographics

Kalle Kallio is 40 years old. He is working as a lunch restaurant employee at LUT. Finland

Behaviors & Habits

Kalle's hobbies are painting and orienteering in nature. In his free time, Kalle likes to make paintings of nature and try cooking different dishes for his family. Due to his nature, he want's to take his time on everything and that is why he dislikes being rushed.

Pain Points & Frustrations

As a secondary user has his main pain points in students well-being and nutrition. Long queues at the university make students skip their lunch due to mandatory lectures. Kalle wants to do his best to prevent queues from getting too long, but he has to process each student's order one student at a time, which makes it impossible to prevent long queues.

Needs & Goals

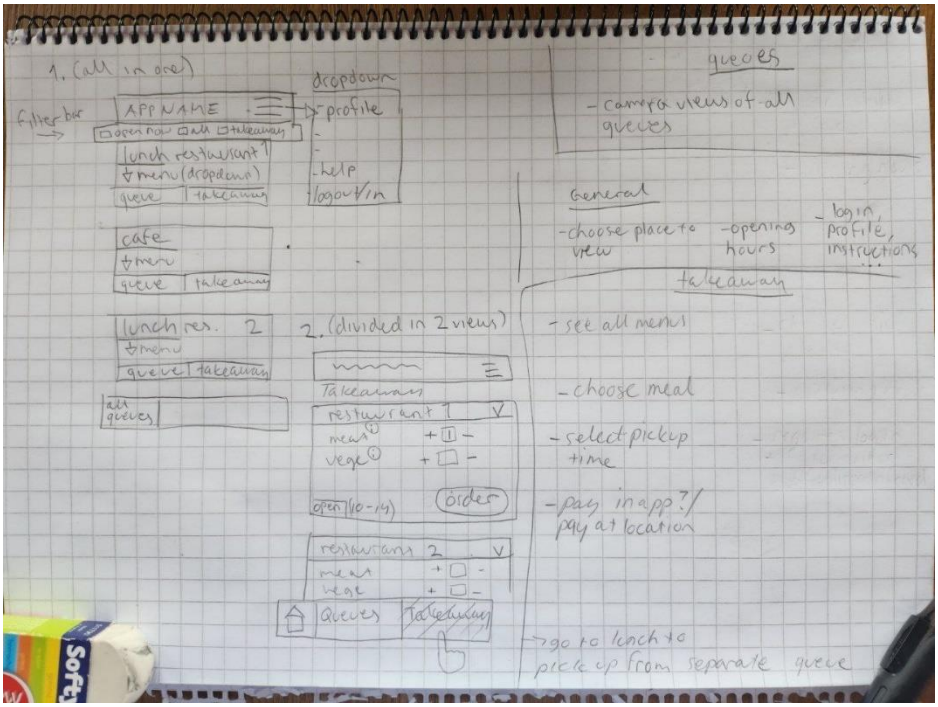
Kalle is very passionate about his work and wishes the best for the students' health. That's why he wishes that there was a system where he could take orders in advance and approve takeaways so that all students would have enough time to eat before lectures.

1.3 DESIGN

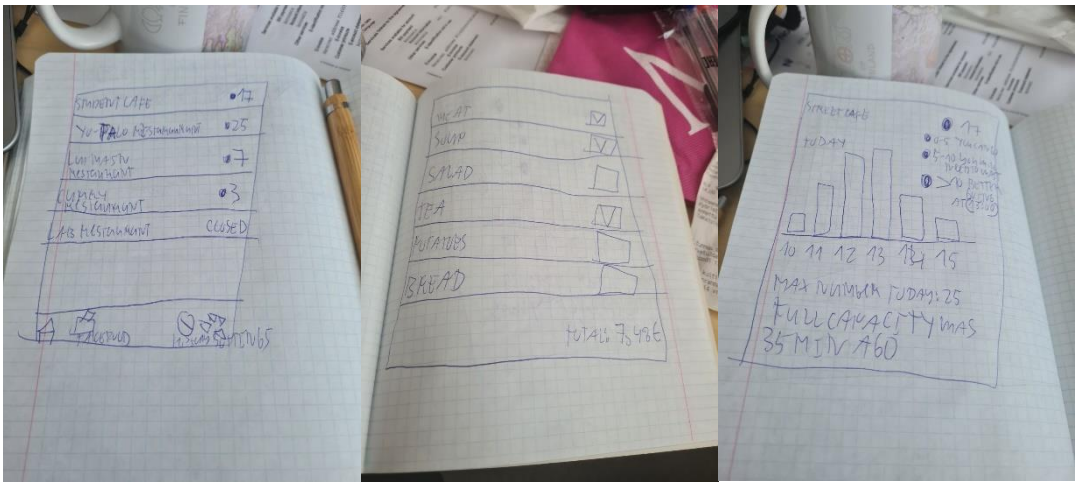
1.3.1 IDEATE

Our team came up with 5 possible solutions to the problem regarding the food queues and ordering with different sketches which differ from each other. Finally, our group came chose the fifth document as our final solution because it was minimalistic and easiest to understand (Interaction design stage 2):

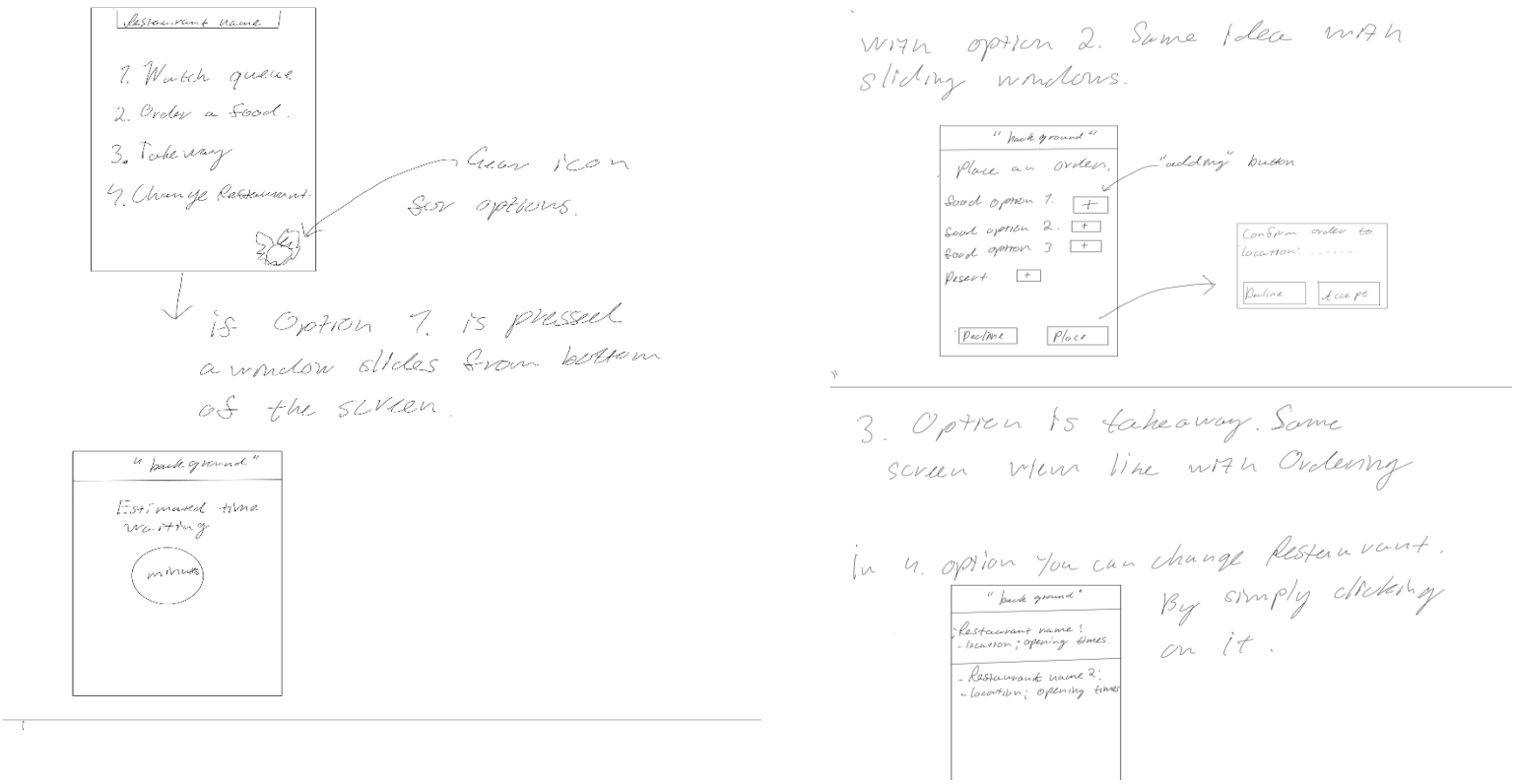
1. Document:



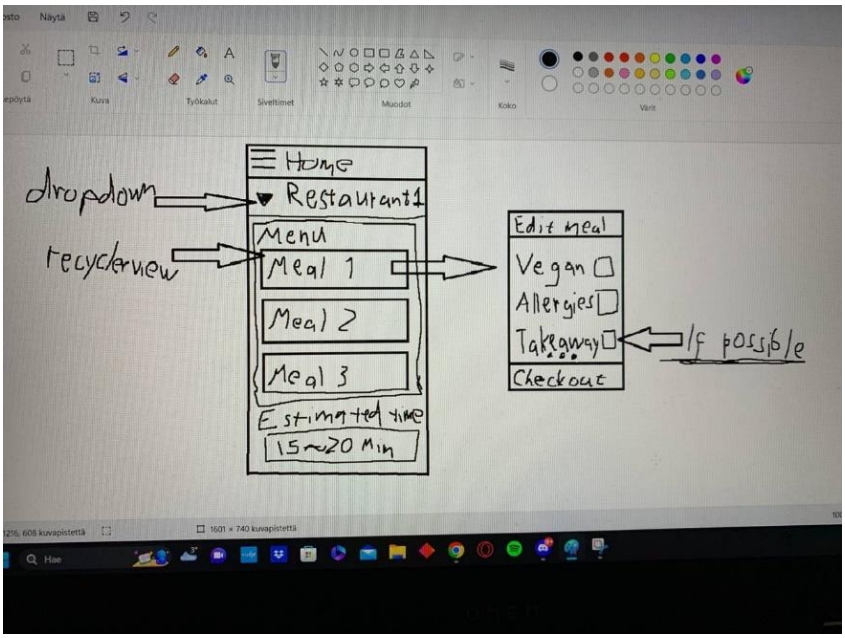
2. Document:



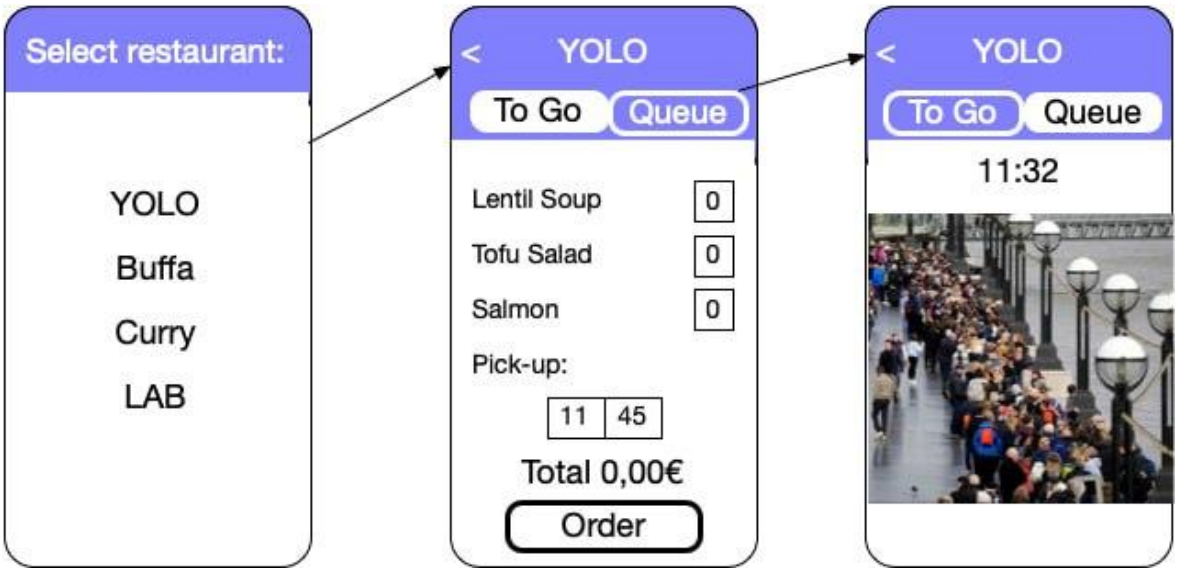
3. Document:



4. Document:



5. Document (Final solution)



1.3.2 User Journey

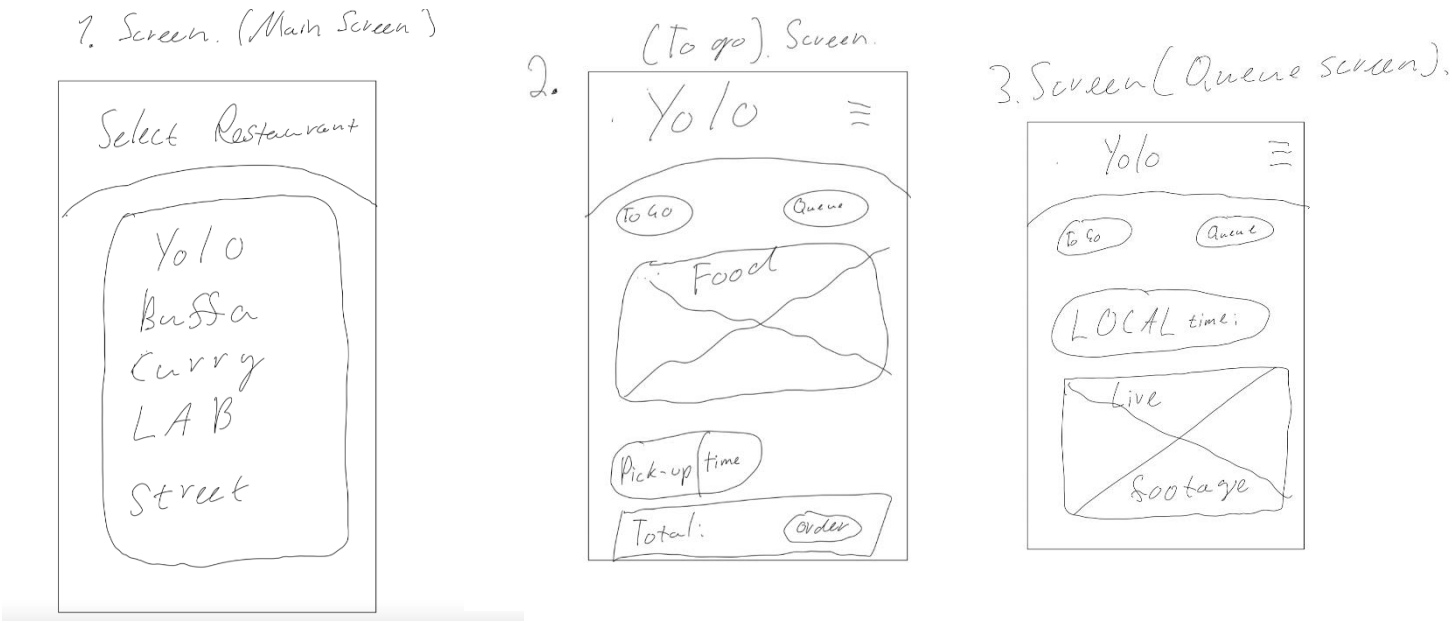
We created a User Journey for our LunchQ app to demonstrate the different stages and bring together our research to our prototype. The User Journey can be found in Appendix 1.2. (Gibbons, 2018)

1.3.3 PROTOTYPE

Our prototypes consist of three views in which the first view is the restaurant selection menu, second view is the ordering view, and third view is for tracking the queues and local time. (Interaction design chapter 12 & 13)

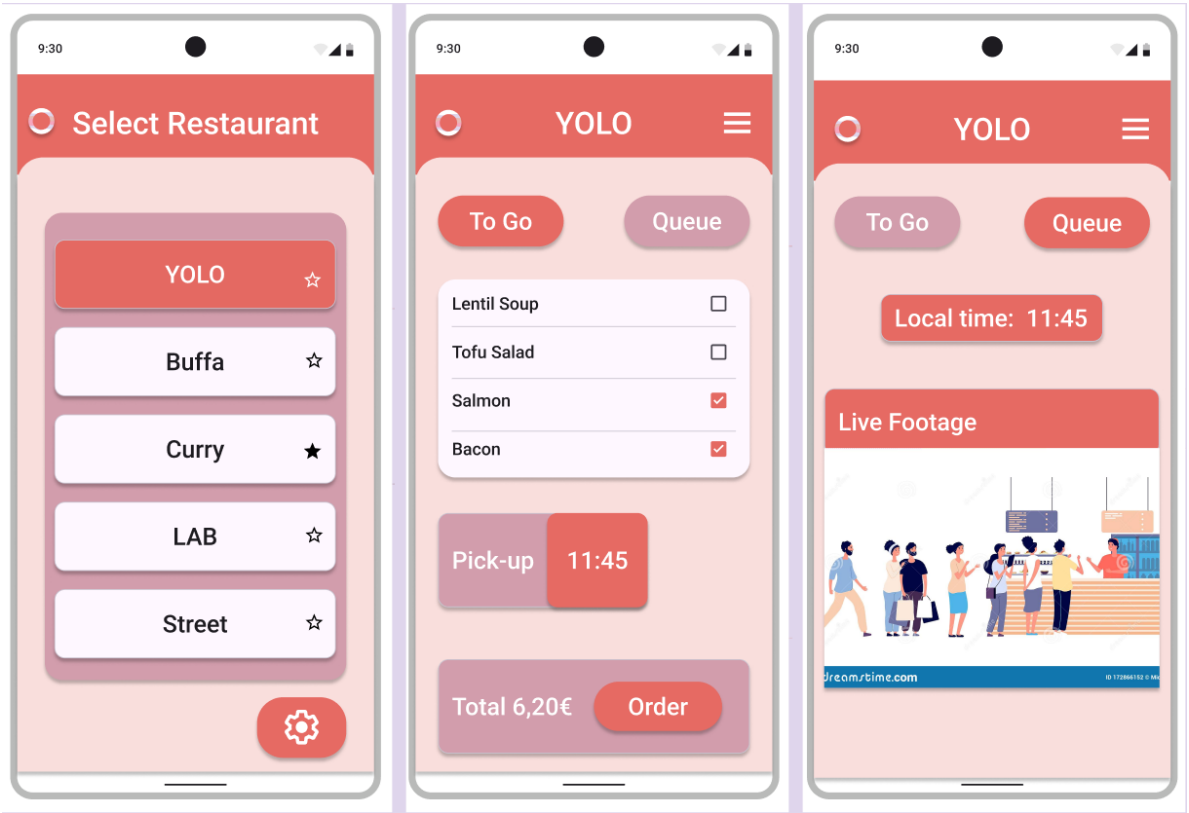
1.3.4 Part A: Paper prototype (hand drawn)

Below is a quick paper sketch of our prototype:



1.3.5 Part B: Digital prototype

Digital prototype of our app made in Figma (Team 21, 2023):



For the colour palette, our team came up with a mix of different shades of red, because red is often represented as life or vigour in different cultures. In a user interface standpoint, it

can be a bit aggressive colour and that is why we chose to use a lighter, coral color for the background but a brighter vibrant coral red for the buttons to have a balance in contrast. For the typography, we used bolding in many text elements because it enhances the readability and emphasizes the important information for the user. We also use a mix of white and black in text elements to make them stand out in different background colours. Other design choices we made was the font size to be large enough so that it can be accessible to users with visual impairments. (Interaction design chapter 12)

For the iconography, we have provided symbols such as the cog wheel for the settings tab and the three stripes for the restaurant navigation menu which are in accordance with the standard and principles. The cog wheel is seen as a symbol for settings and the three stripes if a symbol for navigation. We used these icons because they are one of the most recognizable UI elements providing many benefits for both users and designers. For having icons in our app, we can communicate complex ideas in a simple and easy-to-understand way. (Interaction design chapter 12 & 13)

For the design pattern, our team used reveal patterns, favourites, and home link patterns in our app. We chose the reveal pattern for the menu navigation icon in the top right corner (three stripes) because it helps the user navigate through different restaurants in a clear and organized way and it also hides the information when it isn't needed. We used the favourites design pattern in the restaurant selection view because it allows users to save their favourite restaurant choice for future reference so that the restaurant is auto-selected the next time, the user opens the app. We chose the favourites design pattern because we though that it enhances the user experience by making the restaurant choices pre-selected for the user if the user has marked one of the restaurants as favourite. Finally, we used the home link design pattern that goes to the starting screen that is the restaurant selection view and we chose this design pattern because it allows easy navigation, it helps to create a consistent and user-friendly user experience and lastly it improves accessibility for those who find it difficult to navigate a site without a clear link to the homepage. (Interaction design chapter 12 & 13)

For the shape of UI elements, we used rounding in our app design. Rounded elements can create a softer and more approachable or friendly feeling for the user when compared to

sharp, angular elements. Our visual focus is to make the UI look minimalistic and welcoming for the user and the rounded shape for the UI elements play a big part in the and it works well with the red theme. Rounded UI elements also play a big part in user-friendly design because it can reduce the risk of accidental clicks or taps. (Interaction design chapter 12)

Here is a demo video of our digital prototype:
Application instruction.mp4

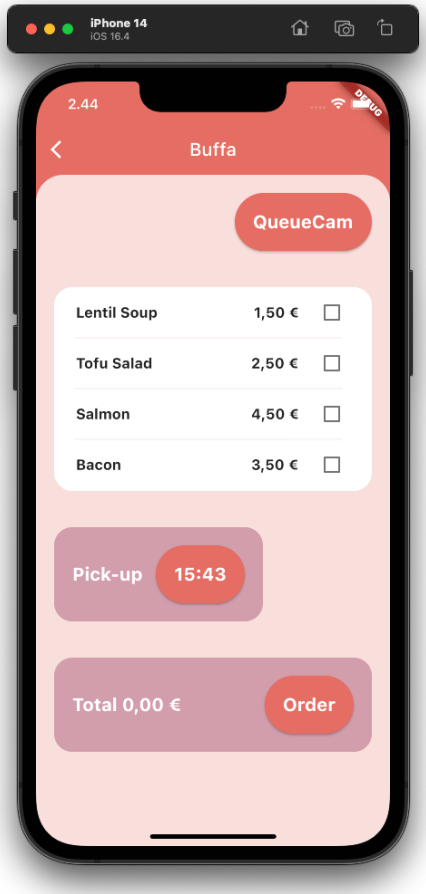
1.4 PRODUCE

Practises of Material design are described in section 1.3.3.

In our flutter prototype we created 3 pages. In the first page we created possibility to choose your restaurant and make it favourite one. As well on the second page that is “food ordering” page we implemented food choosing ability that shows total of the order and pick-up time method. Ordering is not yet possible. In the third page we created a static picture (for now) of a queue and widget that shows current time.

Separated buttons for “queue” and “to go” buttons they turned out to be impractical.

The majority of the Flutter widgets were for organization and layout control: Column, Row, Container, Center, Align and so forth. Quite a bit effort was spent on achieving the rounded graphic design for the AppBar. The user interface was implemented with Text, ElevatedButton, Listview with CheckboxListTile and TimePicker. Some of the higher order widget classes (pick-up and total) were StateFul, because they had to be updated in-place.



The class structure is in the appendix.

The source code is available at https://github.com/riihikallio/lunchq.git

The demo video is available at LunchQ.mp4

1.5 EVALUATE

Usability survey

We conducted a usability survey with the System Usability Scale (Lewis, 2018) on Microsoft Forms. The tabular summary of the survey can be found in Appendix 1.3. We got 12 answers on all of the questions, from which we can make some conclusions. Half of the questions the people answering were in quite a consensus (+/- 1), and those answers were positive: Could easily use the system without the support of a technical person, very little to no inconsistency in the system, did not need to learn a lot of things beforehand, the system was quick to learn, feeling of confidence while using the system. The other questions answers varied a lot subjectively, from agreeing to not agreeing. Some thought that the system was unnecessarily complex, and that the functions were not that well integrated. We would need further research to fully determine, if these parts are something we need to modify, or if they are just personal preferences.

Reflection on the findings of the heuristic evaluations.

Two heuristic evaluations of our solutions:

Heuristic evaluation one:

	Heuristic Criteria					
Page	Visibility of system status	Match between system and real world	Consistency and standards	Recognition rather than recall	Flexibility and efficiency of use	Aesthetic and minimalist design
Select restaurant				Not sure where favorites are located		
YOLO To Go					No button for returning to "Select restraurant"	
YOLO Queue					No button for returning to "Select restraurant"	The local time provides little value if the footage is live

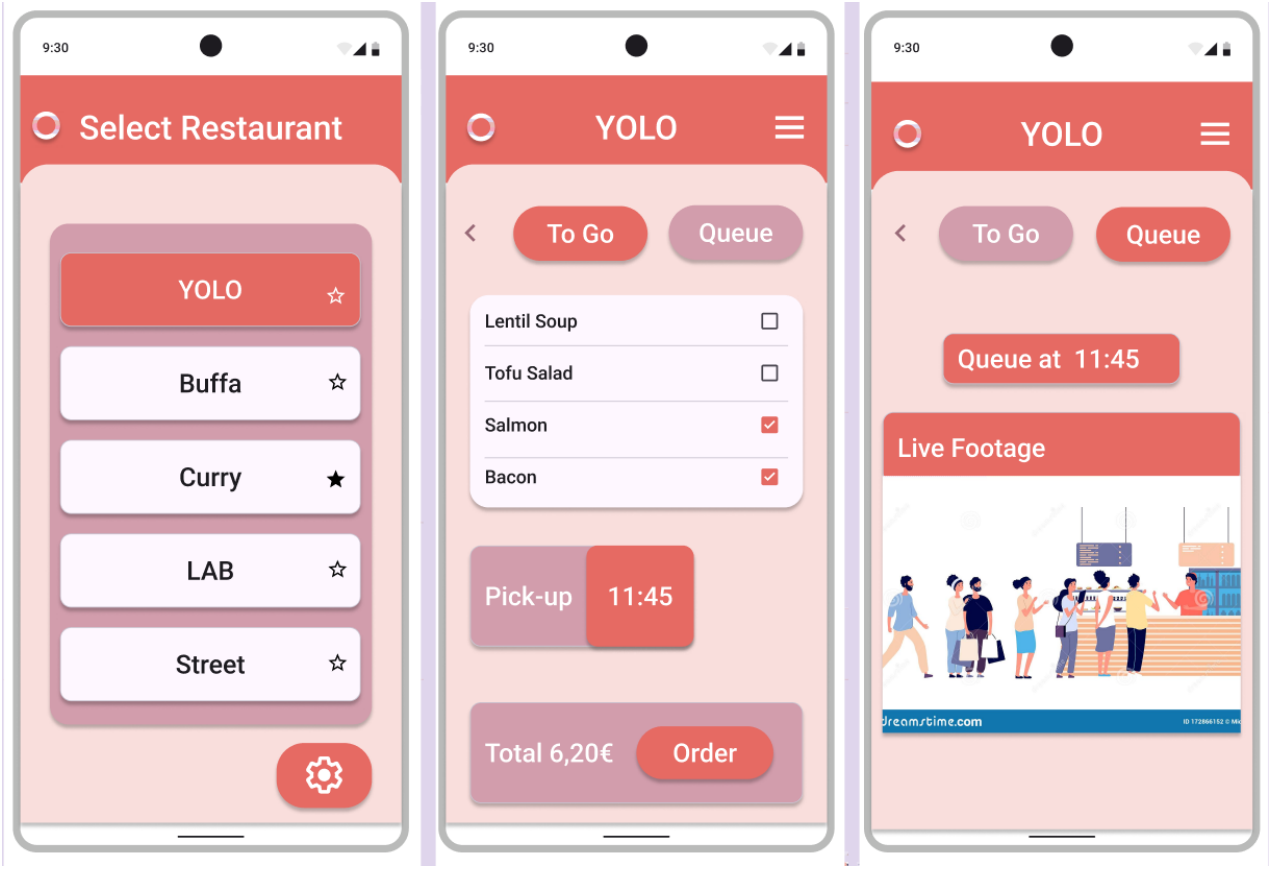
Heuristic evaluation two:

		Heuristics criteria					
		Visibility of system status	Match between the system and the real world	Consistency and standards	Recognition rather than recall	Flexibility and efficiency of use	Aesthetic and minimalist design
Page	Select restaurant		Doesn't show where restaurants are located.			No ability to sort restaurants by name or food type.	
	To go			Doesn't show prices for each food.		Unclear whether "To go" is the only option to choose, meaning no eat in option.	Pick-up icon looks like a slider
	Queue	Doesn't show if ordering the food was successful.	Unclear what is the purpose of the live footage.	Doesn't show the actual queueing time.			

Based on provided heuristic evaluations. We need to provide more information to user and be more flexible. More information needed: Such as price on each product, location of restaurants and response to user from visibility of system status. Many users were complaining about lack of "back" button in flexibility field. We suppose to add "back" button especially into "choose your restaurant" view. As well seen, some complains in unnecessary function such as local-time function. Also, in flexibility field we shall add more filters to filter restaurants by food and prices. In "To Go" view we received some feedback, that we need to add information about order and order confirmation feedback.

Final product

Here is the final product with a back-button added, as well as a small change to clarify the time of when the queuing footage has been taken.


9:30
Select Restaurant
YOLO
Buffa
Curry
LAB
Street
9:30
YOLO
To Go
Queue
Lentil Soup
Tofu Salad
Salmon
Bacon
Pick-up
11:45
Total 6,20€
Order
9:30
YOLO
To Go
Queue
Queue at 11:45
Live Footage

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APPENDIX

Digital prototypes

Appendix 1.1:

Student Café user survey	
How often do you eat at student cafés?	○ Daily ○ Multiple times a week ○ Multiple times a month ○ Seldom ○ Never
What do you do if there is a long queue?	○ Wait in the queue ○ Go elsewhere ○ Starve
Would you use an app to check the queue length?	○ Every time ○ Occasionally ○ Never
Would you pre-order a meal to-go?	○ Every time ○ Occasionally ○ Never
What is your role at the university?	○ Student ○ Faculty ○ Teacher ○ Guest
If you eat at student cafes, what time do you prefer to do it?	○ 9 – 10 ○ 10 – 11 ○ 11 – 12 ○ 12 – 13 ○ 13 – 14 ○ 14 – 15 ○ 15 – 16 ○ 16 – 17
	Submit

Appendix 1.2.

See map in better quality:

https://miro.com/welcomeonboard/ZjFVdVVtMERCbUhWMllTQUJ0SjVYTVpGZVFneEtKZUd3OUFEMkxiMzB0QzdUdDZOZGozZmZ0eWdyYUJOT09jZHwzNDU4NzY0NTUwMTA5MTMzMjU5fDI=?share_link_id=753847487811

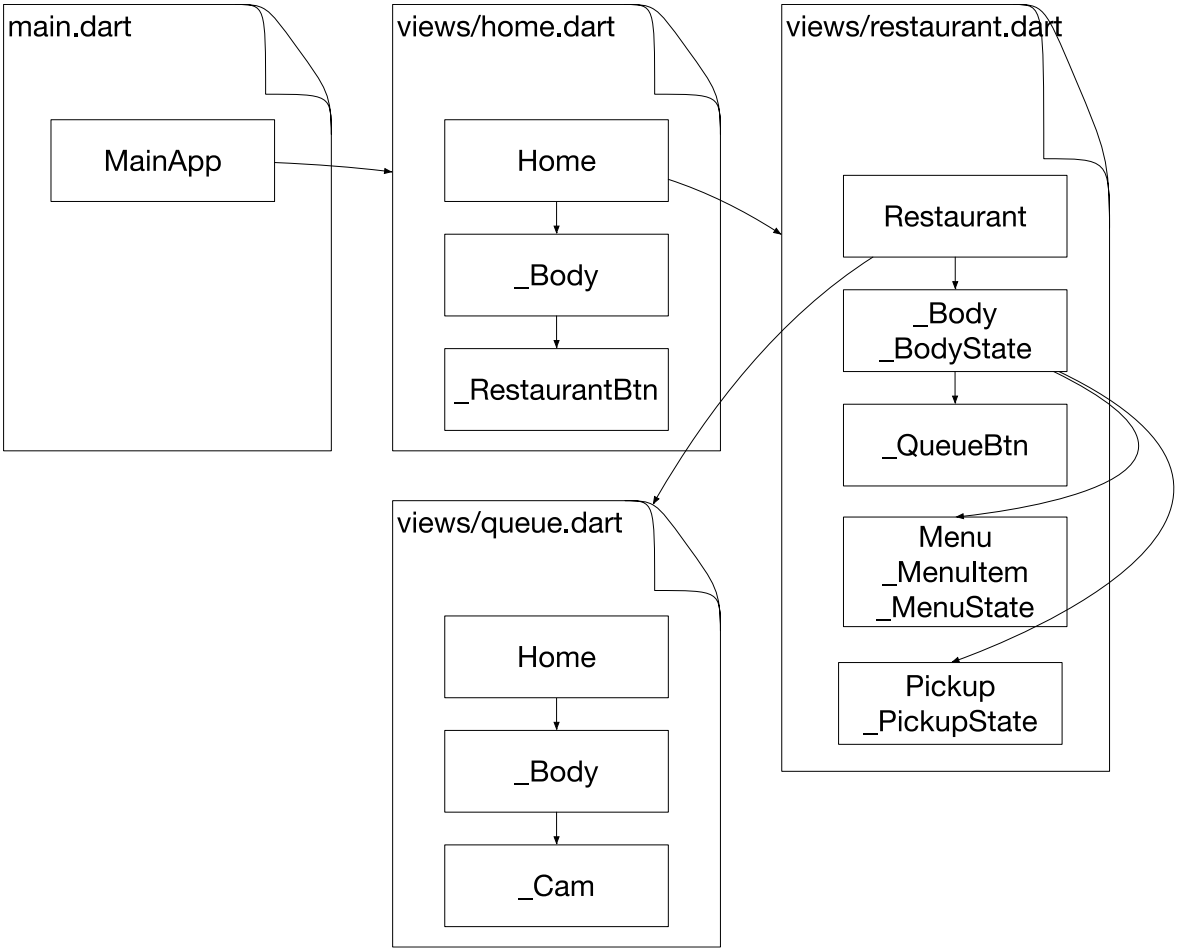
Appendix 1.3.

Usability survey answers. 1=disagree, 5=agree.

I think that I would like to use this system frequently.	I found the system unnecessarily complex.	I thought the system was easy to use.	I think that I would need the support of a technical person to be able to use this system.	I found the various functions in the system were well integrate
5	1	5	3	5
3	1	4	1	4
4	1	5	1	4
3	2	5	1	3
4	2	1	2	4
3	2	4	1	4
4	4	2	2	4
2	2	4	1	4
4	2	5	1	3
4	1	4	1	4
3	4	4	1	2
3	2	3	1	1

I think that I would like to use this system frequently.	I found the system unnecessarily complex.	I thought the system was easy to use.	I think that I would need the support of a technical person to be able to use this system.	I found the various functions in the system were well integrate
5	1	5	3	5
3	1	4	1	4
4	1	5	1	4
3	2	5	1	3
4	2	1	2	4
3	2	4	1	4
4	4	2	2	4
2	2	4	1	4
4	2	5	1	3
4	1	4	1	4
3	4	4	1	2
3	2	3	1	1

Flutter project class diagram



Team participation

	PLAN	hours	UNDERSTAND	hours	DESIGN	hours	PRODUCE	hours	EVALUATE	hours
Hannah										
	Reading project description	0,5h	Review Affinity & Empathy maps, additions to text	0,25h	contribute to the brainstorming	0,5h	Give feedback on produced native prototype	0,25h	create usability survey in microsoft forms	0,5h
	attend meeting	1h	Teacher persona + intro to personas	1,75h	create a paper prototype	0,75h			Heuristic & usability peer reviews	2,5h
	benchmark research	1,75h			review and give feedback on the chosen prototype	0,5h			usability survey response analysis & tabular summary	1,5h
	User groups & user research	0,5h			Material design based figma prototype	2h			Changes to the final digital prototype	0,25h
	problem mapping	1,25h			user journey	3h				
	project participation excel	0,25h								
	motivation&goal	0,5h								
	introduction	0,25h								

Petri											
	attend meeting	1									
	survey form, proofreading	1.5									
			attend meeting	0.5							
					design sketch	1.5					
					work on prototype	1					
					work on prototype	1					
									Peer review	3	
							Flutter prototype	25			
							Flutter support	4			
							Documentation	1			
							Attend meeting	1			

Elias											
	attend meetings	4h	User Research	1h	paper prototype	0,75h	Problem mapping	0,5h	Heuristic review and reflection	2,5h	
			Empathy Map	2h	Make a proper design with the help of Tommi	2h	Produce section writing	0,5h	Final project review	0,25h	
	project participation excel	0,25h	Make a persona map of visitor	1h	Adding all design sheets to design section	1h					
	problem mapping	0.5h			Drawing prototypes	1,25h					
	proofreading	1,00h	Make a secondary persona map for the teacher	0,5h							

Tommi											
	attend meeting	1h	Contexts of use	1h	Paper prototype	0,5h			Heuristic & usability reviews	2h	
	Goal and motivation planning during the first meeting		Affinity Map	2h	Make a proper design with the help of Elias so that it can be produced	3h			Final project document review	0,25h	
	project participation excel	0,25h	Make a persona map of student	1h	Digital protyping text	2h					
			Make a secondary persona map for the lunch restaurant staff	1h	Added references to the whole DESIGN section	1h					
			Added references to the whole UNDERSTAND section	1h							

Danila											
	writing down the report on first meeting, attedning meetings, writing the reports and instructions, and making a video (possibly) how to use it. Sending final files to Moodle.	7h	Additions to survey	1h	contribute to the brainstorming, and either paper or digital prototype	1h	Review the code and send to Moddle	2 h	Heuristic and usability reviews, answer quesstions about surveys and videos	2.5 h	
									Final project review	1 h	