

HUMAN COMPUTER INTERACTION



DeltaPlan

Eat good, Plan better

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1 Problem/solution overview

An application that helps the user manage the products he purchases through an inventory, used to suggest to the user a list of recipes, suitable for his needs, chosen from an archive. A calendar supporting the application helps the user to organize his meals during the week in a balanced way, taking into account his schedule, saving him time.

2 Needfinding

2.1 Domain

Nutrition for students and workers offsite

Nutrition, in addition to physical activity, directly impacts the health, well-being, and daily choices. Especially for students and workers the meal planning is different than others, often balancing a limited budget with the need for a nourishing diet.

2.2 Interviews

2.2.1 Methodology and procedure

- **Participants:**

We have selected interviewees from our network of contacts, in a varied way trying to form a heterogeneous group of students and workers, at the first experiences or living alone for several years. Before starting, we asked to sign our CONSENT FORM.

- immediate users: 5 (primary target audience directly involved, students and workers at the first experience in living alone)
- lead users: 4 (students or workers who have been living alone for several years)
- extreme user: 1 (an erasmus student, that represents challenging and unconventional needs that go beyond the mainstream)

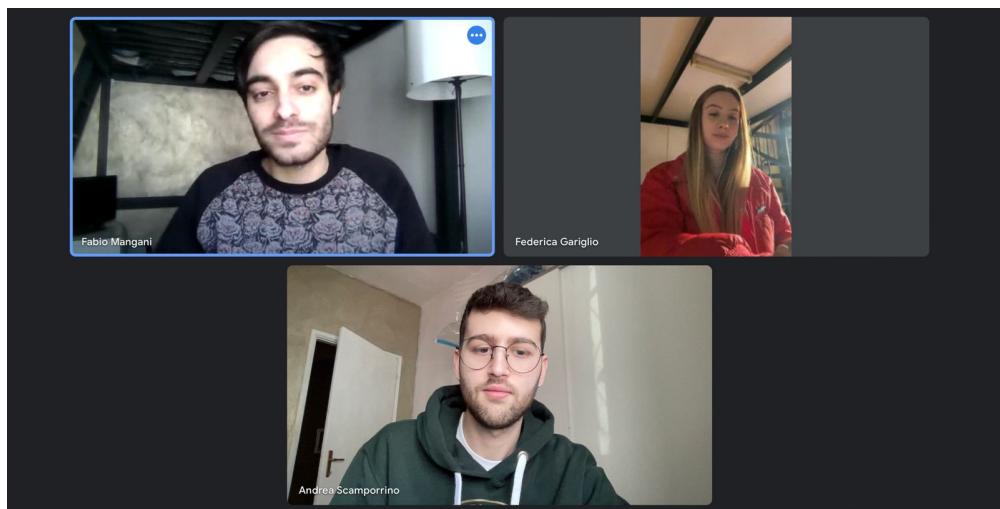


Figure 2.1: Picture of one interview

- **Materials:**

We used a smartphone to read the questions to be asked of the user and at the same time to record

answers so that we could listen to them again later in case of ambiguity; in addition, we used a second device (a tablet) to take notes.

- **Questions:**

List of questions asked during the interviews:

1. How long have you lived alone?
2. Why did you start living alone?
3. At least 3 positive and 3 negative aspects of living alone?
4. Tell me about your typical day.
5. Do you ever stay at the university/office all day? How do you manage your meal in these cases?
6. How many meals do you eat in a day?
7. How do you organize meals during the week?
8. How often do you grocery shop?
9. Where do you go grocery shopping?
10. What products do you often buy?
11. How much do you order for delivery?
12. How often do you eat out?
13. How much physical activity do you do during the week?
14. What has changed since you started living on your own?

- **All interviews:**

1. **Interview #1**

Interviewer: Gabriele Medica

Co-interviewer: Fabio Mangani

Participant: A male, 22 years old, student from University of Catania. He has been studying for 4 years, so he is a lead user.

Where: Video call

Key quotes:

- From Q3 : “I have too many commitments and sometimes lack time to cook.”
- From Q7 : “If I have lunchtime class I prepare lunch the night before, if I have to go to the gym I try to prepare things faster but still aimed at the diet.”
- From Q8 : “I shop at the supermarket once a week to optimize time.”

2. **Interview #2**

Interviewer: Andrea Scamporrino

Co-interviewer: Fabio Mangani

Participant: A male who works in Turin, 23 years old, living alone for a year, so he is an immediate user.

Where: Participant's home

Key quotes:

- From Q5: “I used to cook packed lunch but now working they give me food stamps and then I use them.”
- From Q7: “I do not have a weekly organization but I try to alternate the ingredients.”
- From Q9: “I would like to go to specific places like bakers or butchers but for a matter of time I almost always go to the supermarket. It rarely happened that I went to the market to buy fruits and vegetables.”

3. Interview #3

Interviewer: Fabio Mangani

Co-interviewer: Gabriele Medica

Participant: A male student of Unical, 22 years old, he is an off-site student for 2 years, although living not too far from home, so he is an immediate user.

Where: Video call

Key quotes:

- From Q5: “When I’m at university all day, I don’t have a plan, I decide on the moment.”
- From Q6: “I’m not good at cooking, I prefer to prepare something simple.”

4. Interview #4

Interviewer: Gabriele Medica

Co-interviewer: Fabio Mangani

Participant: A male, 20 years old, student from UniTo. He has been studying for 1 years, so he is an immediate user.

Where: Participant’s home

Key quotes:

- From Q3 : “I can’t fit my schedule together well.”
- From Q5 : “I happen to stay at the university several times during the week, and sometimes I eat in the cafeteria or bring a sandwich from home, but I find that going to the cafeteria I can’t eat what I would like and that the sandwich is not the best.”
- From Q13 : “I joined a gym , but I don’t follow a diet or anything, I go two or three times a week just to keep myself moving, I would like to improve this aspect.”

5. Interview #5

Interviewer: Andrea Scamporrino

Co-interviewer: Fabio Mangani

Participant: A male who works in Germany, 28 years old, living alone for nine years, so he is a lead user.

Where: Video call

Key quotes:

- From Q3: “you don’t have parents who control you but you have to do all the housework that they would do on your own and this is something that helps you mature.”
- From Q14: “I had little money when I went to live alone, I couldn’t manage my time well and I tried to take care of my diet but with poor results.”

6. Interview #6

Interviewer: Fabio Mangani

Co-interviewer: Andrea Scamporrino

Participant: A foreign female student of the Politecnico of Turin, 24 years old, she has lived in Italy for 7 years, so she is an extreme user.

Where: at Politecnico of Turin

Key quotes:

- From Q5: “Very often I stay at university all day, I’m tired and I prefer to go to the cafeteria.”
- From Q11: “I don’t order at home often, only when I have little time.”
- From Q14: “I learned to order less at home, but I still struggle to organize.”

7. Interview #7

Interviewer: Gabriele Medica

Co-interviewer: Andrea Scamporrino

Participant: A male, 23 years old, student from University of Pisa. He has been studying for 5 years, so he is a lead user.

Where: Video call

Key quotes:

- From Q3: “Difficulties in managing money related to supermarket shopping.”
- From Q13: “I follow a diet and if I work out I eat some dried fruit in addition.”
- From Q14: “you have to sacrifice some time in the evening and prepare something healthy to bring to class if you want to follow a strict diet.”

8. Interview #8

Interviewer: Fabio Mangani

Co-interviewer: Andrea Scamporrino

Participant: A female student of the University of Parma, 19 years old, living alone for a year, she is at the first experience to live alone, so she is an immediate user.

Where: Video call

Key quotes:

- From Q7: “I honestly don’t plan my meals during the week, I look at what I have in the fridge.”
- From Q9: “I only shop at the supermarket, I don’t know where else to go.”

9. Interview #9

Interviewer: Gabriele Medica

Co-interviewer: Andrea Scamporrino

Participant: A male, 24 years old, student from University of Milano. He has been studying for 4 years, so he is a lead user.

Where: Video call

Key quotes:

- From Q3: “It’s difficult to schedule nutrition, study and houseworks.”
- From Q14: “Now I know how to cook a lot of meals, but at first I was always using food delivery apps, I would have liked some initial guidance.”

10. Interview #10

Interviewer: Andrea Scamporrino

Co-interviewer: Gabriele Medica

Participant: A female who works in Germany, 27 years old, living alone for two years, so she is an immediate user.

Where: Video call

Key quotes:

- From Q3: “I have to take care of everything, no one cooks for me and I have to arrange the household chores by myself”
- From Q7: “I don’t plan my meals weekly but everyday I try to have balanced meals”
- From Q10: “I often buy bio products that are on offer. I also try to buy products with little packaging”

2.2.2 Results

- **Relevant artifacts:**

Dieta n°1		grammi	01/08/2022
Cena: secondo a scelta			
Mozzarella	100	(<i>che aveva</i>)	
Bresaola	100		
Piselli in umido	200	senza contorno	
Spigola	150		
Parmigiano	150		
Hamburger	100		
Salmone affumicato	100	o fresco 150 g	
Cena: contorno a scelta			
Fagiolini lessi	200		
Radicchio rosso	150		
Patate	200		
Rucola	100		
Lattuga	200	(<i>che aveva</i>)	
Cavolo cappuccio verde	200		
Insalata di pomodori	200		
Aggiungere			
Pane, tipo 00, pezzatura da 50g	80	<i>f 4 0</i>	
Olio di oliva	10	4 10 2 cucchiaini da thé	

Dieta n°1		grammi	01/08/2022
Pranzo: primo a scelta			
Pasta di semola con il pomodoro	60	<i>dal 04.10.2022 + 40 g</i>	
Risotto ai piselli	60		
Pennette al tonno	60		
Bucatini all'amatriciana	60		
Pastina in brodo di carne o pollo	60		
Linguine ai frutti di mare	60		
Fusilli al pesto	60	(<i>che aveva</i>)	
Pranzo: secondo a scelta			
Frittata al prosciutto	80	O 1 uovo+1 albumine una volta la s	
Tonno sott'olio, sgocciolato,1 volta la settimana	80	(<i>che aveva</i>)	
Prosciutto crudo, magro	80		
Filletto di vitellone	100		
Gamberetti surgelati	200		
Ricotta di vacca,1 volta la settimana	100		
Petto di pollo ai ferri	100		
Pranzo contorno a scelta			
Lattuga mista	200	es bonduelle	
Zucchine al vapore	200		
Fiori di zucchine	200	o crudi	

Figure 2.2: Part of the diet of interview #7

- **Best Key quotes:**

- “I’m not good at cooking, I prefer to prepare something simple.” from #3
- “I joined a gym , but I don’t follow a diet or anything, I go two or three times a week just to keep myself moving, I would like to improve this aspect.” from #4
- “Difficulties in managing money related to supermarket shopping.” from #7
- “You have to sacrifice some time in the evening and prepare something healthy to bring to class if you want to follow a strict diet.” from #7
- “I honestly don’t plan my meals during the week, I look at what I have in the fridge.” from #8
- “Now I know how to cook a lot of meals, but at first I was always using food delivery apps, I would have liked some initial guidance.” from #9

2.3 Synthesis

2.3.1 List of brainstormed user needs



Figure 2.3: Brainstormed user needs

2.3.2 Deep user needs

1. Need a way to manage time between lesson/work and other activity

Many users have reported difficulties managing their time, especially due to commitments like university or work, which often left them with insufficient time to focus on their nutrition.

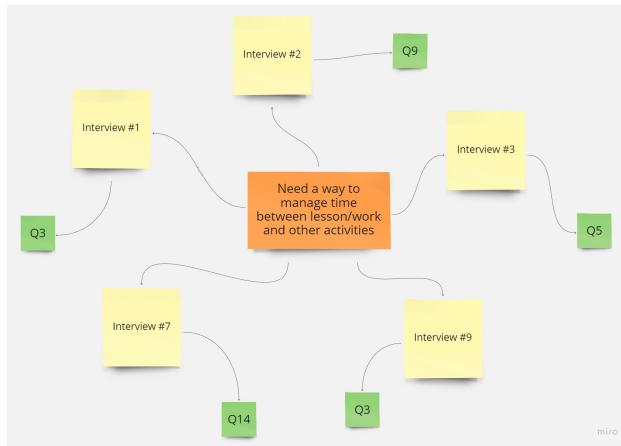


Figure 2.4: Deep user need 1

2. Need a way to manage meals during the week

Many users have mentioned that they didn't keep track of what they ate in the previous days and often didn't plan their meals for future days.

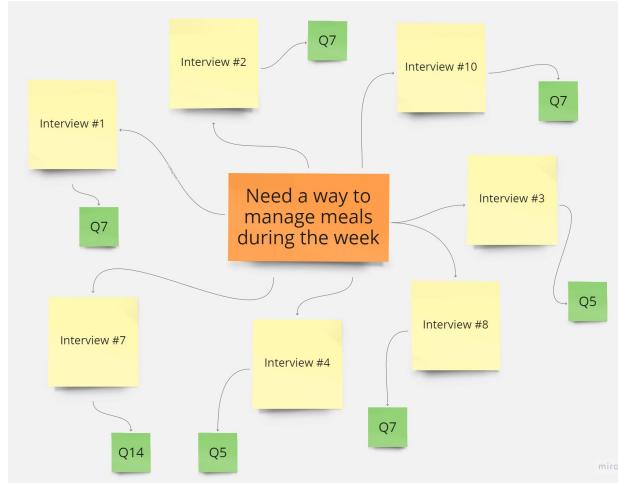


Figure 2.5: Deep user need 2

3. Need a way to eat something fast to obtain and healthy

Many users have confessed their lack of experience in the kitchen, leading them to prefer ordering food delivery over preparing a healthier meal.



Figure 2.6: Deep user need 3

2.4 Solutions

2.4.1 Solutions for each deep user

Each of us proposed several solutions for each deep user need, and in the end we voted on everyone's proposals by selecting the most concrete and related ones (as can be seen from the image 2.7). After that, we tried to combine them into a solution that could best implement them.

	Need a way to manage meals during the week	Need a way to manage time between lesson/work and other activities	Need a way to eat something fast to obtain and healthy
ANDREA	<ul style="list-style-type: none"> Taking an inventory of what you have at home, and update it everytime you shop. ★★ 	<ul style="list-style-type: none"> Use a to-do-list with reminders ★ 	<ul style="list-style-type: none"> Archive with easy recipes ★★ Course where you can learn to cook Map where you can find healthy ingredients to cook ★
FABIO	<ul style="list-style-type: none"> Take notes of what you eat daily 	<ul style="list-style-type: none"> Create a routine schedule Set priorities ★ 	<ul style="list-style-type: none"> Choose any pre-prepared meal Learn to cook an easy and healthy dish
GABRIELE	<ul style="list-style-type: none"> Use a calendar in order to take track of calories consumed during the day 	<ul style="list-style-type: none"> Plan your time with a calendar ★★ Set goals 	<ul style="list-style-type: none"> Cooking guide

Figure 2.7: Brainstorming to choose a solution

2.4.2 Top solutions picked

Based on this top solutions:

- taking an inventory of what you have at home and update it everytime you shop
- plan your time with a calendar
- archive with easy recipes

We choose the following solution:

Students and workers are assisted to plan their nutrition over the week fitting it with other activities.

Description: for example, users could plan their meal using a calendar and receive recipe recommendations based on the ingredients they have at home and they could keep track of them by creating an inventory.

3 Tasks and Storyboard

3.1 List of tasks

- First Task (Simple):** Check what you should eat today.
- Second Task (Moderate):** Plan a meal for tomorrow by seeing what you have in inventory.
- Third Task (Complex):** Plan a day, meals and activities, adding to the shopping list what you don't have in your inventory

These three activities are important because they cover different daily needs related to food and activity management. The first task, it is essential to provide a quick and intuitive experience for users when choosing their daily food, this will solve their immediate needs; the second and third tasks, on the other hand, emphasize the primary goal of planning, but also involve the user to interact with inventory and shopping list.

3.2 Storyboard

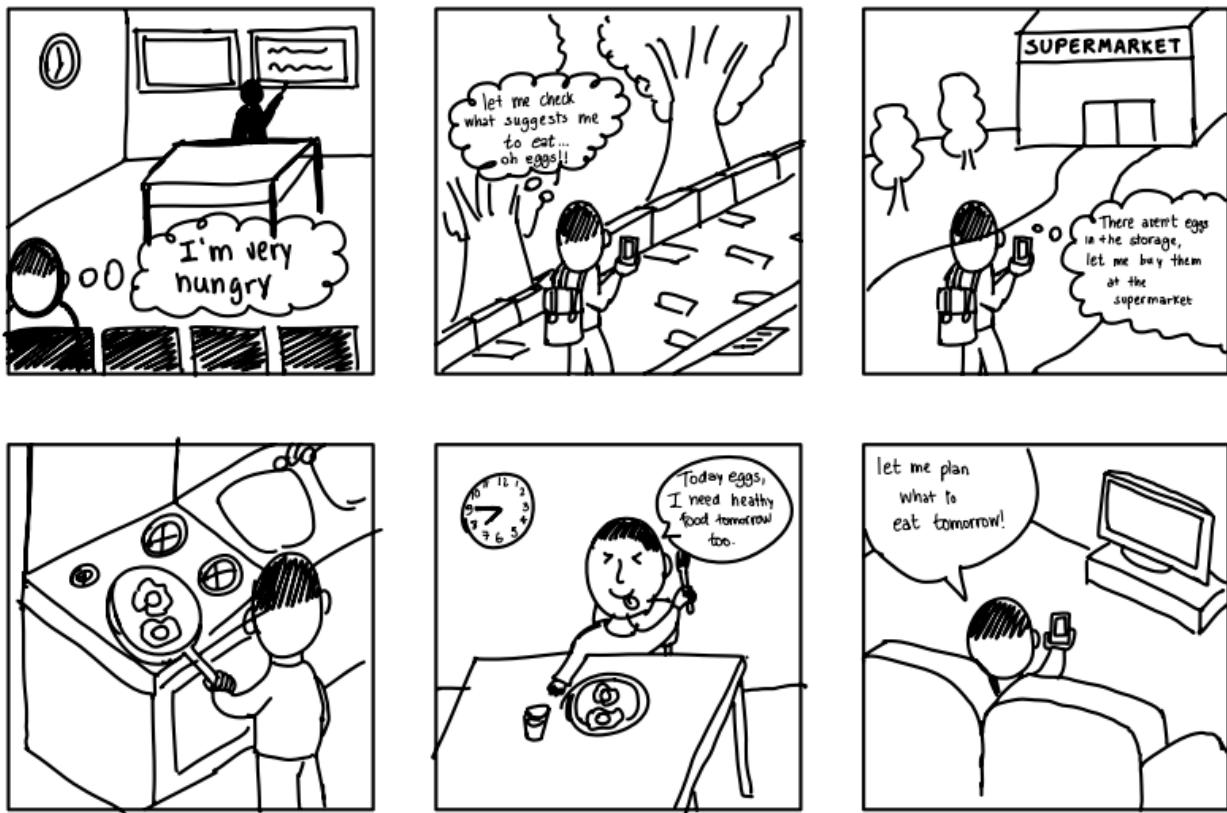


Figure 3.1: Storyboard

How you can see in the figure 3.1, we chose a student's point of view, at the end of their university's day, because we think that's a common situation in which many user could understand and fit.

Strengths:	Weaknesses:
The time flow, described by clocks, shows how fast the process is.	There is no demonstration about the process' facility.
It shows user's satisfaction at the end of the process.	

Table 3.1: Strengths and weaknesses of the storyboard

User satisfy his needs in a short time, without ignoring any other activity, in fact he checks what he should eat in a easy way, while he is coming back home; then he plans what to eat tomorrow while relaxing.

4 Low-fidelity Prototypes

4.1 Modalities exploration

We considered two alternatives:

1. Mobile application

Prototype for a mobile application on a smartphone. It suits perfectly with the solution's goals, user can always rely on it wherever he is with his smartphone, so he can perform some operations on the fly.

2. Web application

Prototype for a web application on a browser. Many people use computer to work and even to study, they can check it easily, moreover it does not require any installation.

4.2 Paper prototypes

4.2.1 Prototypes' Scans

In this section we will show the two paper prototypes realized for each chosen alternative presented above. Each group of images will have a caption to explain what part of the mobile/web app is shown.

- **Mobile Prototype:**

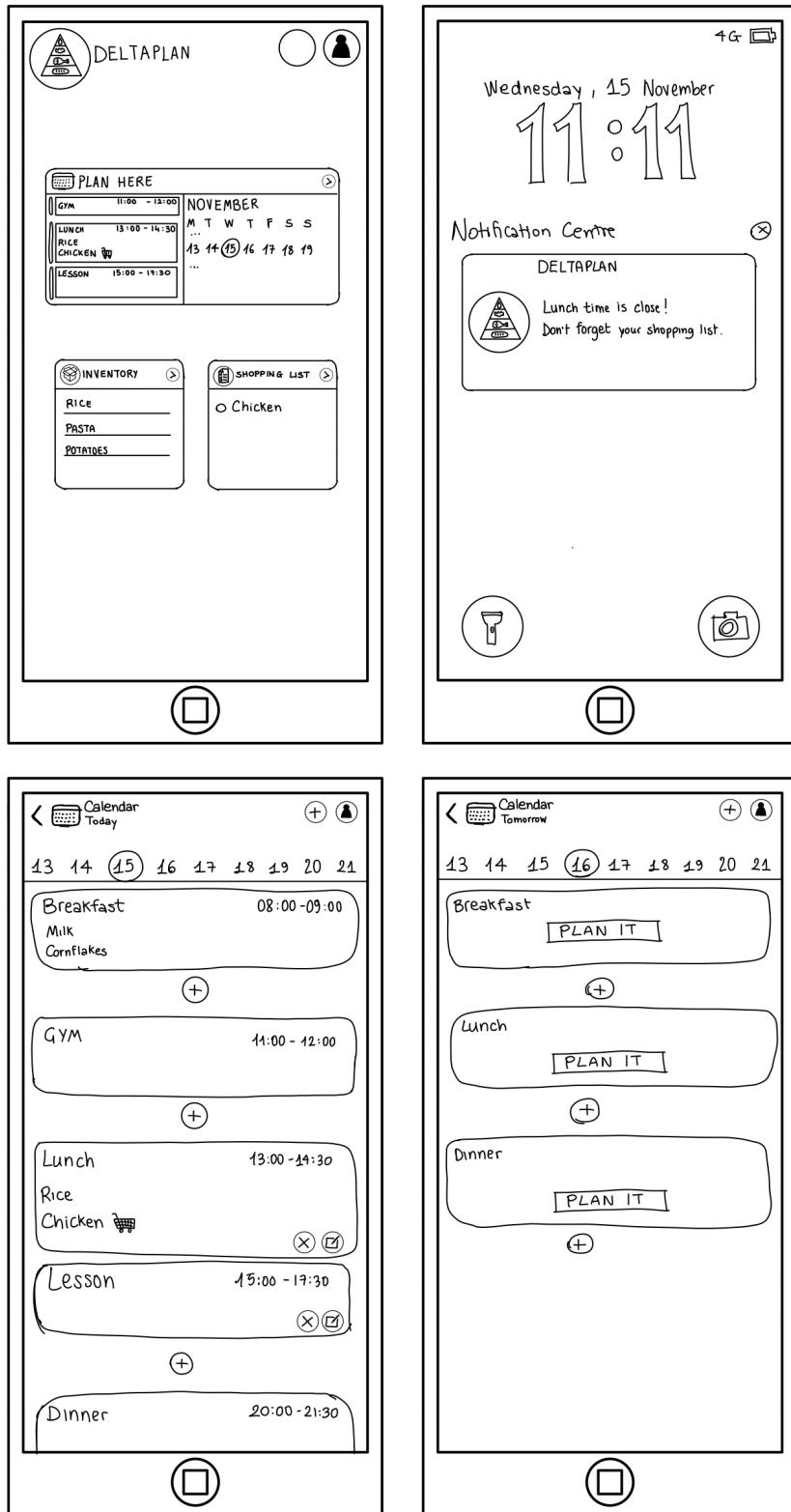


Figure 4.1: Notification, Home Page, Calendar Page

The figure consists of four wireframe screens arranged in a 2x2 grid, illustrating the steps of adding a meal form.

Top Left Screen:

- Header: Calendar Tomorrow
- Date: 13 14 15 (16) 17 18 19 20 21
- Form Fields:
 - UNDO Breakfast SUBMIT
 - Start: 00:00
 - End: 00:00
- Text: What to eat:
 - Choose by yourself
 - Choose from our suggestions
- Text: Repeat: never
- Buttons: (+), PLAN IT, (+)
- Section: Lunch
- Section: Dinner
- Bottom: (□)

Top Right Screen:

- Header: Calendar Tomorrow
- Date: 13 14 15 (16) 17 18 19 20 21
- Form Fields:
 - UNDO Breakfast SUBMIT
 - Start: 07:30
 - End: 00:00
- Text: What to eat:
 - Choose by yourself
 - Choose from our suggestions
- Text: Repeat: never
- Buttons: (+), PLAN IT, (+)
- Section: Lunch
- Section: Dinner
- Bottom: (□)

Bottom Left Screen:

- Header: Calendar Tomorrow
- Date: 13 14 15 (16) 17 18 19 20 21
- Form Fields:
 - UNDO Breakfast SUBMIT
 - Start: 00:00
 - End: 00:00
- Text: What to eat:
 - Choose by yourself
 - Choose from our suggestions
- Text: Choose products from your inventory:
 - milk x cornflakes x
 - apple
 - orange juice
 - banana
- Text: Choose one recipe:
 - milk and cornflakes
 - orange juice and biscuits
 - porridge
- Buttons: (+), PLAN IT, (+)
- Section: Lunch
- Section: Dinner
- Bottom: (□)

Bottom Right Screen:

- Header: Calendar Tomorrow
- Date: 13 14 15 (16) 17 18 19 20 21
- Form Fields:
 - UNDO Breakfast SUBMIT
 - Start: 00:00
 - End: 00:00
- Text: What to eat:
 - Choose by yourself
 - Choose from our suggestions
- Text: Choose one recipe:
 - milk and cornflakes
 - orange juice and biscuits
 - porridge
- Buttons: (+), PLAN IT, (+)
- Section: Lunch
- Section: Dinner
- Bottom: (□)

Figure 4.2: Adding a meal form

Calendar
Tomorrow

13 14 15 (16) 17 18 19 20 21

Breakfast

Start
End

What to eat:

- Choose by yourself
- Choose from our suggestions

Choose one recipe

milk and cornflakes	✓
orange juice and biscuits	✓
porridge	

Ingredients:

oats	✗
milk	✗
water	✗
cinnamon	✗
vanilla yogurt	✗
honey	✗

Repeat:

Lunch

Dinner

PLAN IT

PLAN IT

Calendar
Tomorrow

13 14 15 (16) 17 18 19 20 21

Breakfast

Start
End

What to eat:

- Choose by yourself
- Choose from our suggestions

✓

Repeat:

Lunch

Dinner

PLAN IT

PLAN IT

PLAN IT

Figure 4.3: Adding a meal form

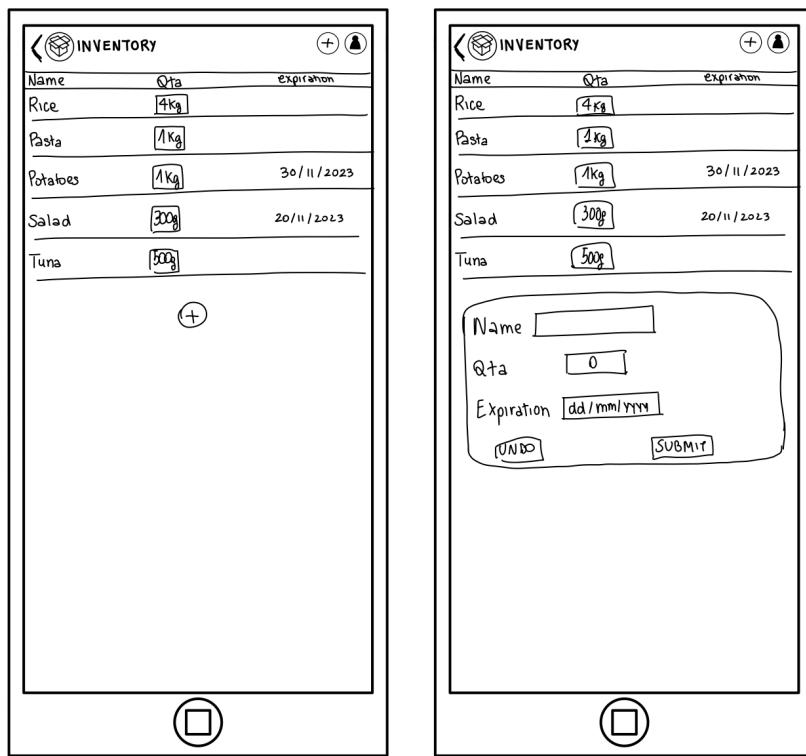
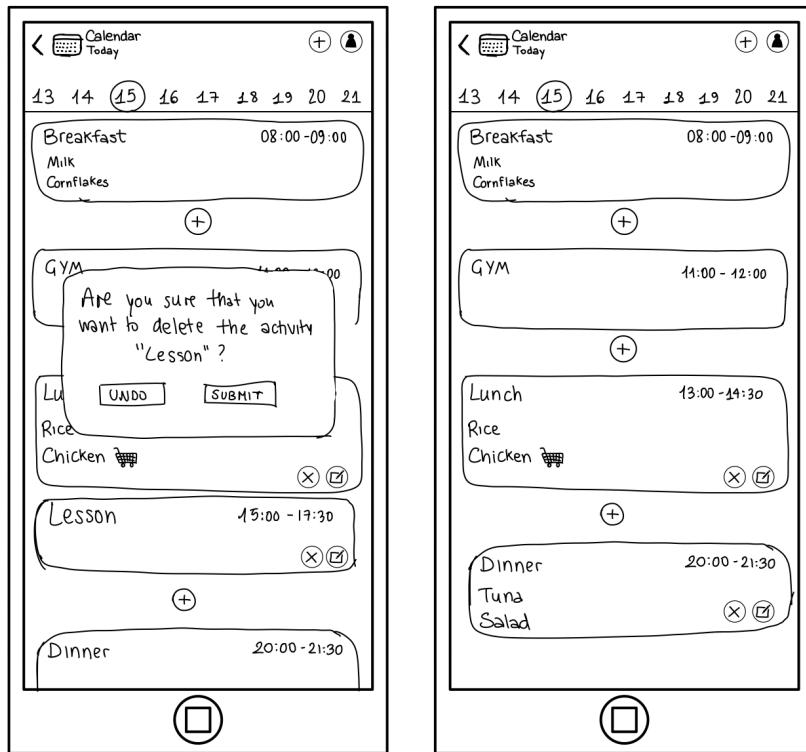


Figure 4.4: Deleting a meal, Inventory Page

INVENTORY

Name	Qty	expiration	
Rice	500	1kg	✖
Pasta	1kg		✖
Potatoes	1kg	30/11/2023	✖
Salad	300g	20/11/2023	✖
Tuna	500g		✖

(+)

(□)

Name	Qty	expiration	
Rice	500	1kg	✖
Pasta	1kg		✖
Potatoes	1kg	30/11/2023	✖
Salad	300g	20/11/2023	✖
Tuna	500g		✖

(+)

(□)

Name	Qty	expiration	
Rice	500	1kg	✖
Pasta	1kg		✖
Potatoes	1kg	30/11/2023	✖
Salad	300g	20/11/2023	✖

(+)

(□)

Figure 4.5: Inventory options

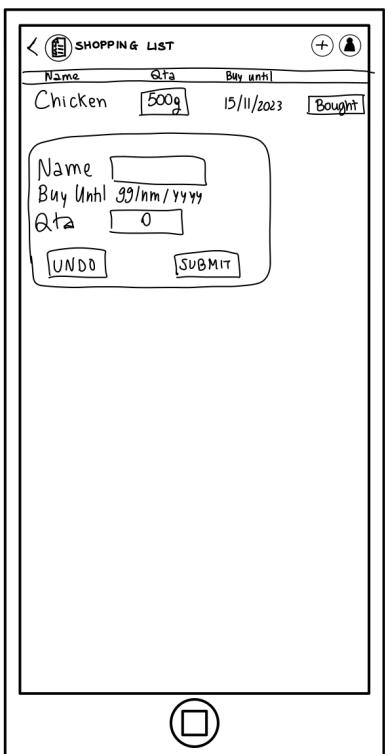
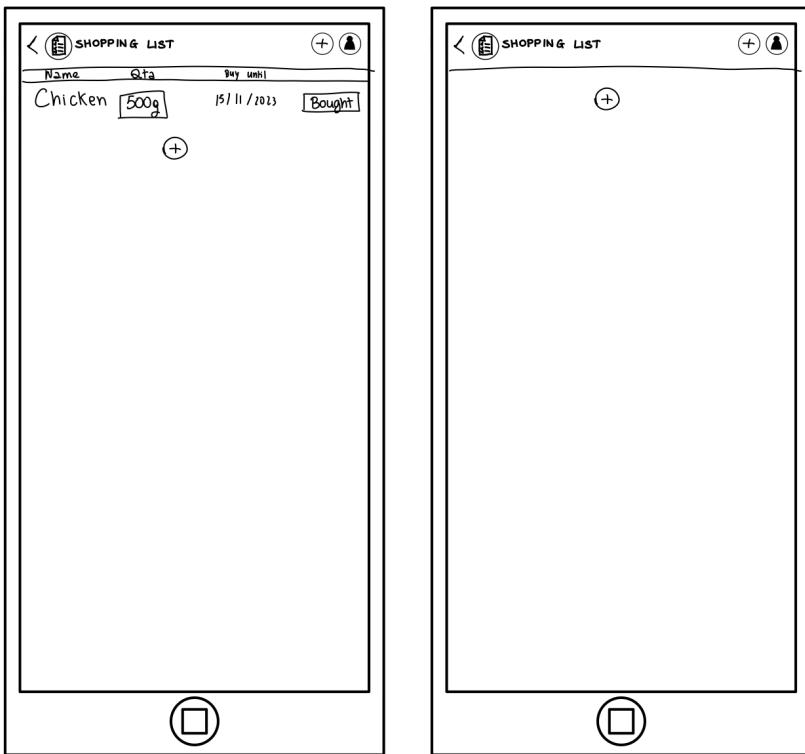


Figure 4.6: Shopping List Page and its options

• Web App Prototype:

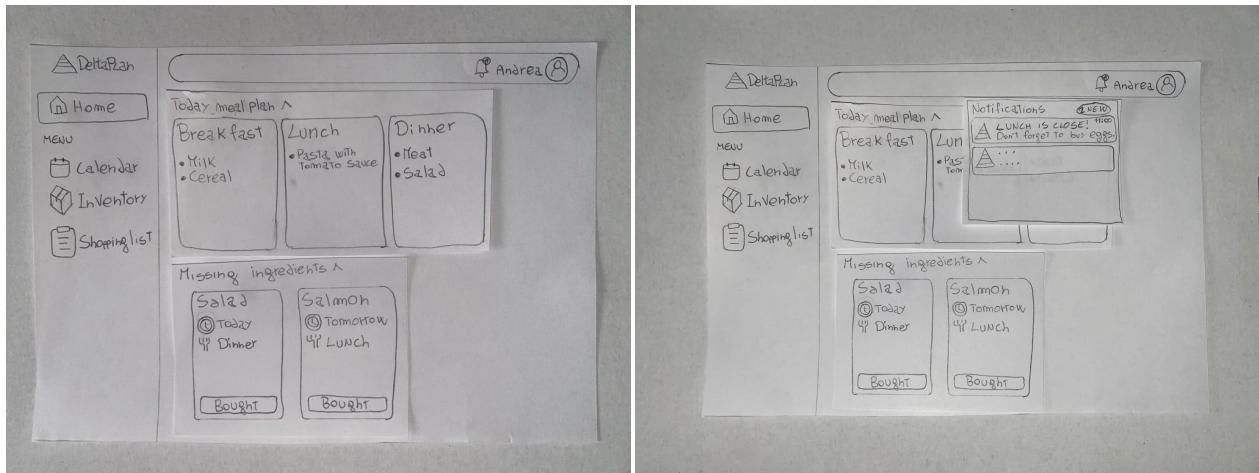


Figure 4.7: Home Page

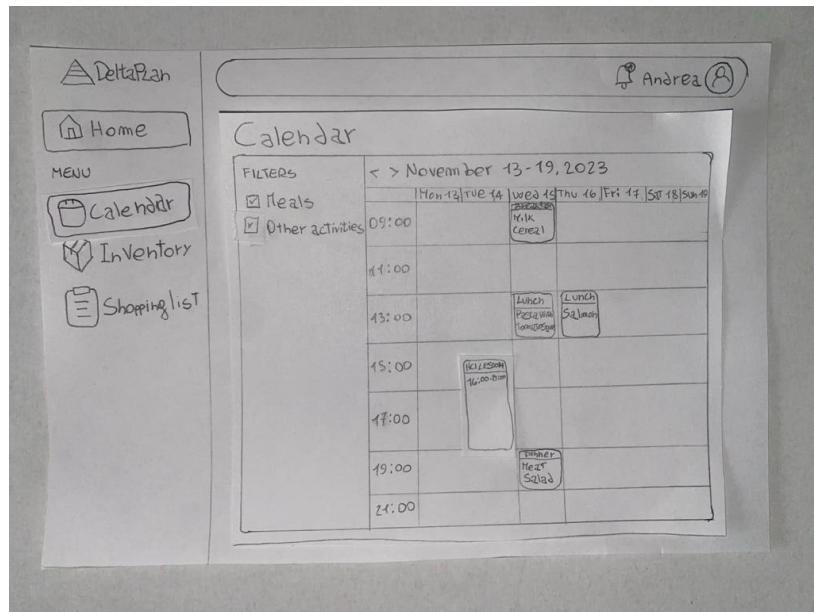


Figure 4.8: Calendar

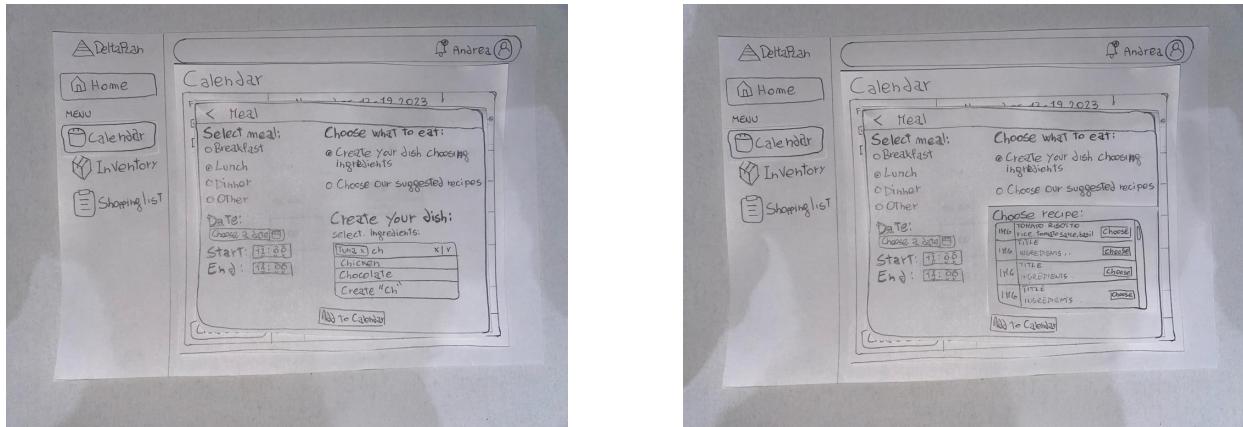


Figure 4.9: Adding Activity Form

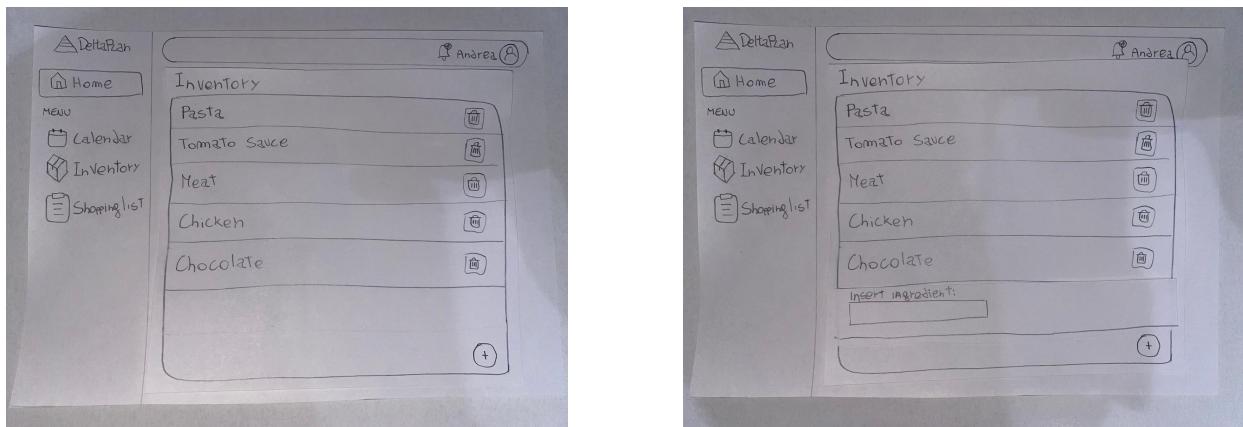


Figure 4.10: Inventory

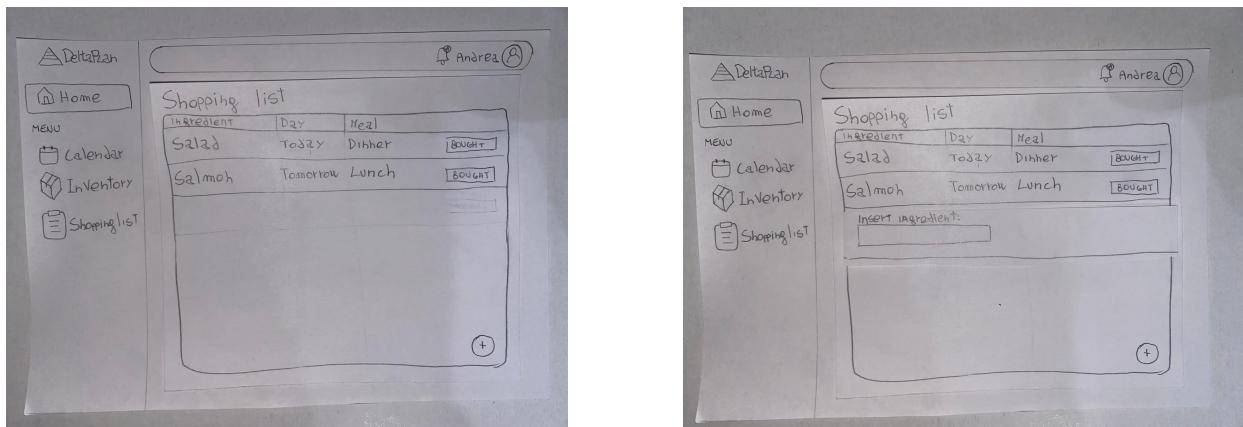
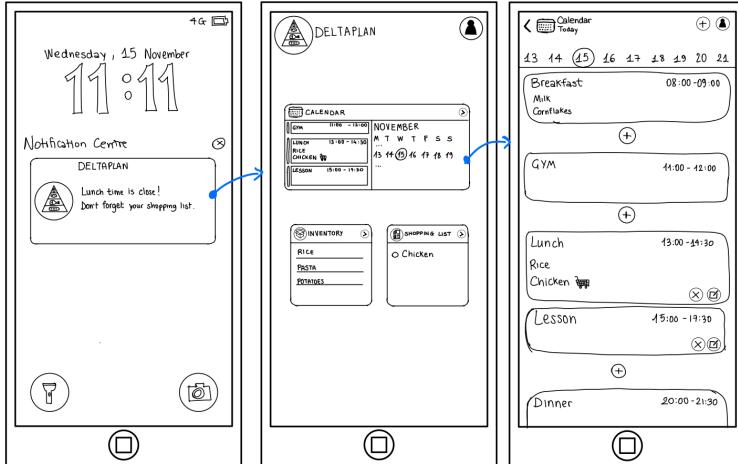


Figure 4.11: Shopping List

4.2.2 High-level flow

In this section we will show the high-level flow of both paper prototypes presented above, including their connections to the storyboard, the project goal and the three tasks. The project goal it's reached through the Calendar, as shown in the screens it helps the user to plan every day with the meals and the activities. Inventory and Shopping List don't help the user directly to reach the application's goal, but they are helpful tools to support Calendar's functionalities.

- **Mobile High-level flow:**

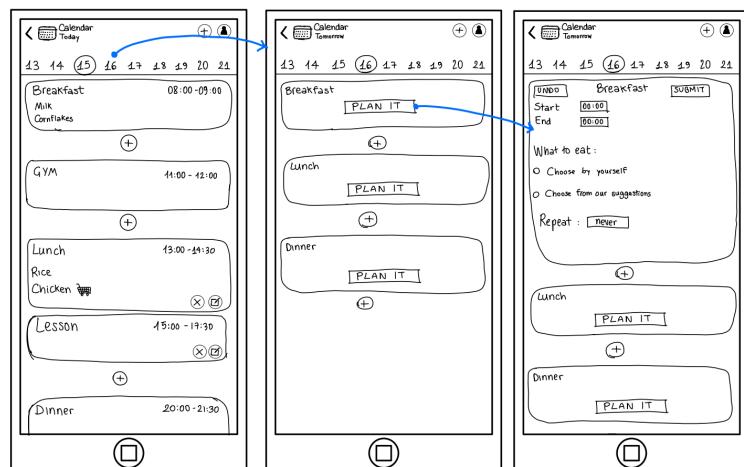


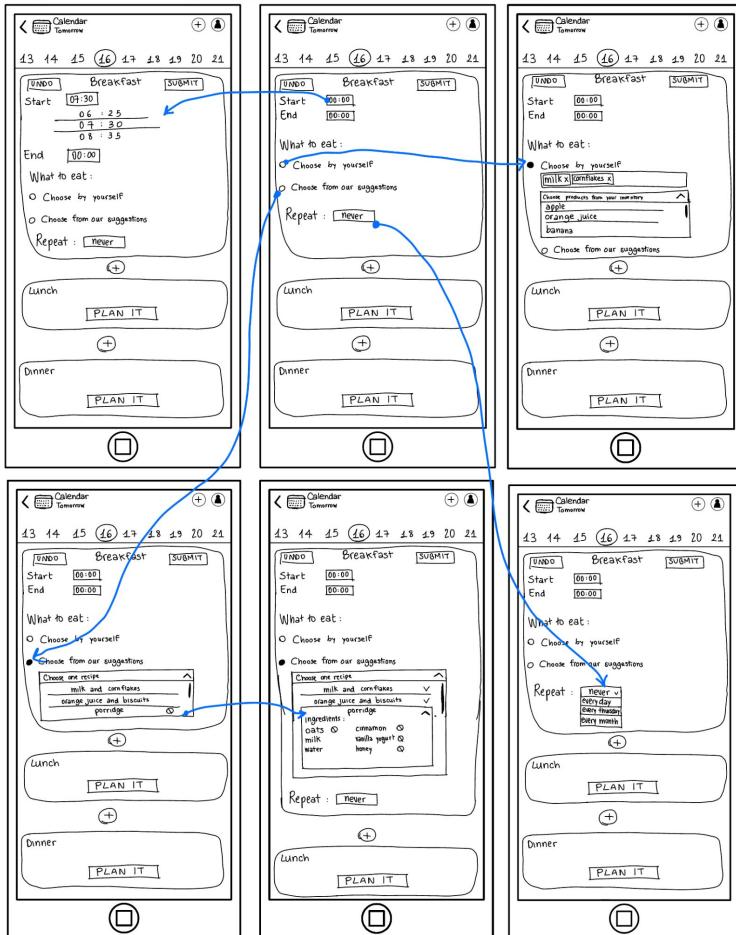
Referring to Storyboard and Task 1:

Task 1 asks to check what the user should eat today, and this is the same action that the student at lesson does in the storyboard. As we can see the notification will appear in the smartphone screen, then tapping it the user will be redirected to the Home Page, where he can check what to eat today watching at the Calendar. In the activity, there's also a "shopping cart" icon next to an ingredient, that indicates that it misses.

Referring to Storyboard and Task 1 & 2 & 3:

Task 1 can be accomplished also by opening the Calendar Page, there if the user wants also to plan a meal, as requested by the Task 2, he can tap on the next day and then on "plan it". In the storyboard, after dinner, the student plans the next day, that is also one of the goals of the Task 3. This goal can be reached by planning all the next day's meals (tapping on "plan it") and also the activities (tapping on "+" button).



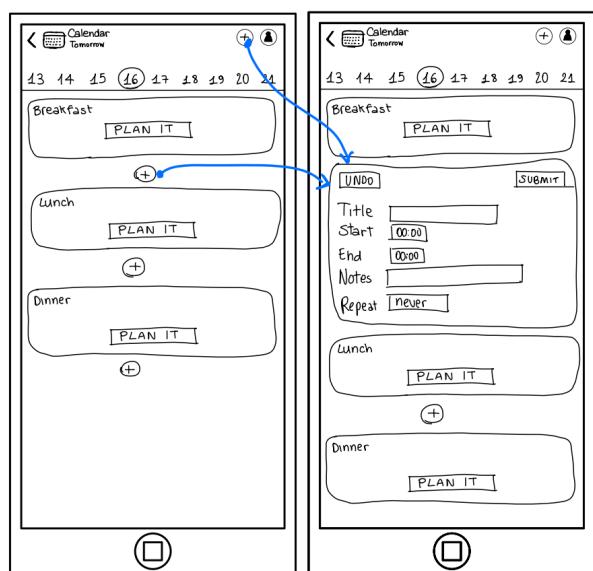


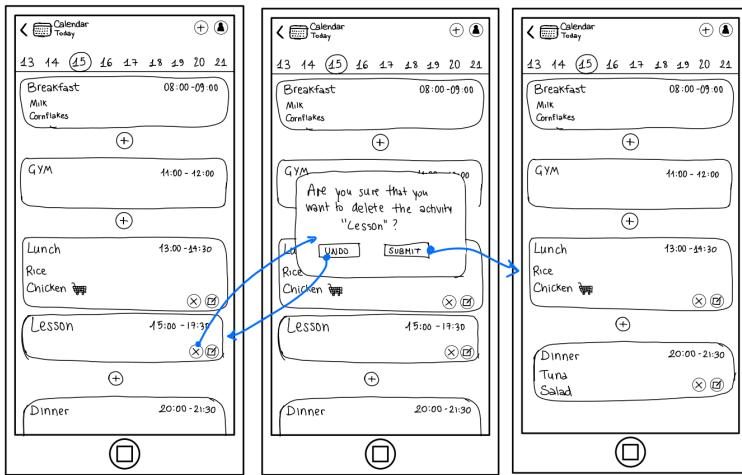
Referring to Storyboard and Task 2 & 3:

To plan a meal, as shown by the screen beside, there is a form to fill where the user can choose what to eat (choosing by himself or from our suggested recipes), at what time and if he want to make this meal habitual or not.

Referring to Task 3:

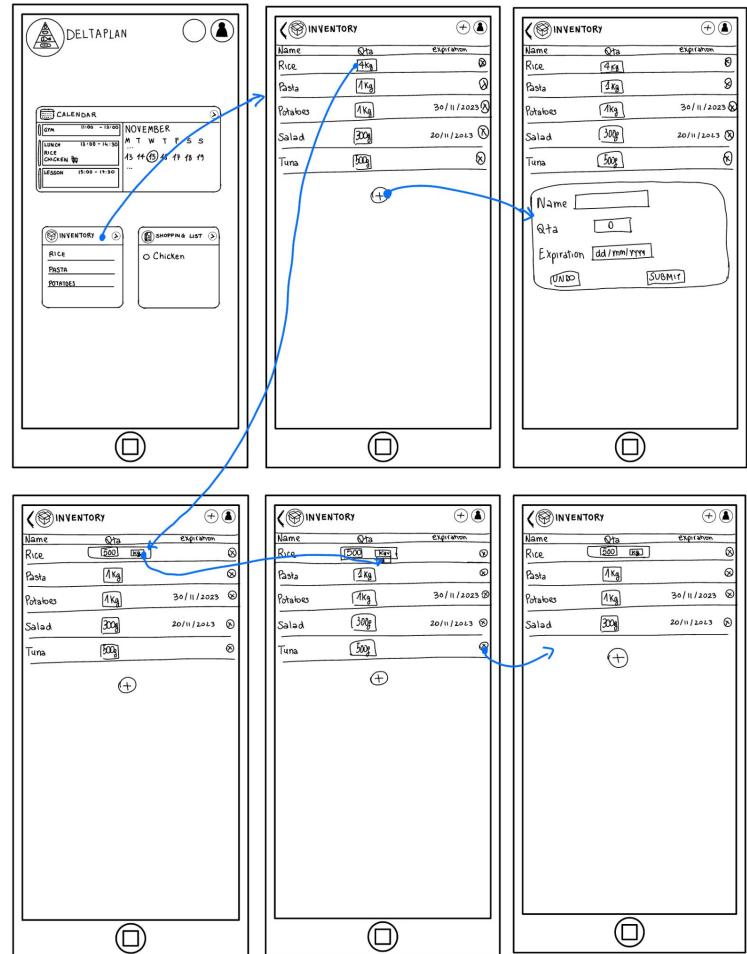
As said before, tapping on "+" button the user can plan an activity. It will be possible filling the form shown in the screen, inserting what activity (Title), at what time, some notes if needed and if he wants to make this activity habitual or not.





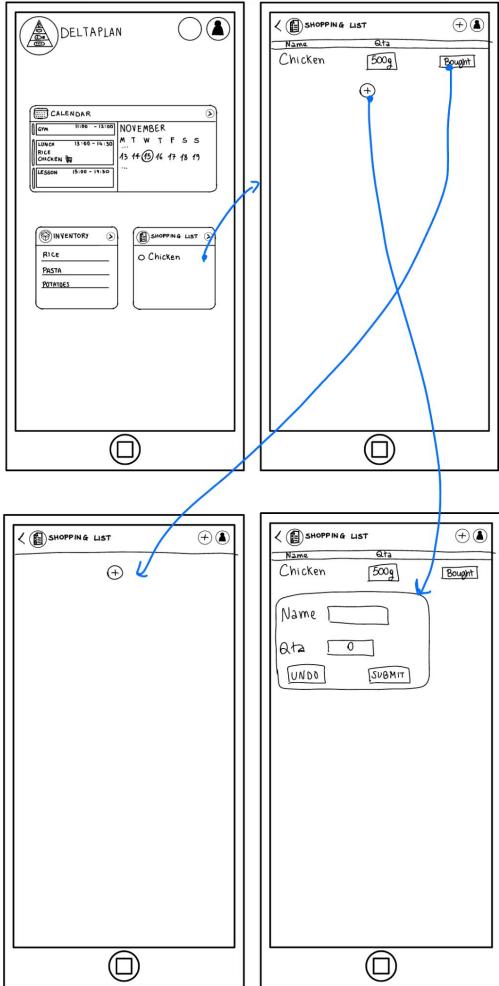
Related to Task 2 & 3:

After a user have planned a meal or an activity, if he want to delete it's possible by tapping on "x" button as shown beside.

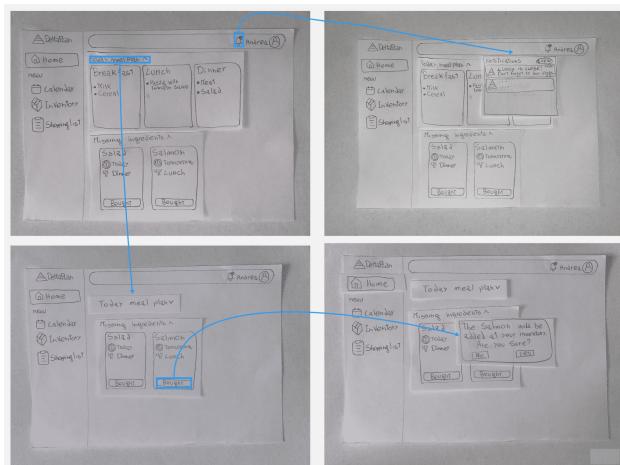


Referring to Storyboard:

In the storyboard the student goes to the supermarket, when he return at home he can add what he bought. It can be possible by opening the Inventory Page, and tapping on "+" button and filling the form to add something. It's also possible to modify items by deleting them or changing their quantity.



- Web App High-level flow:

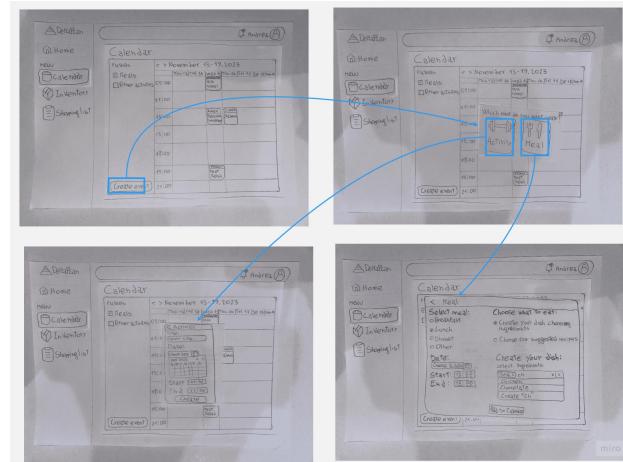
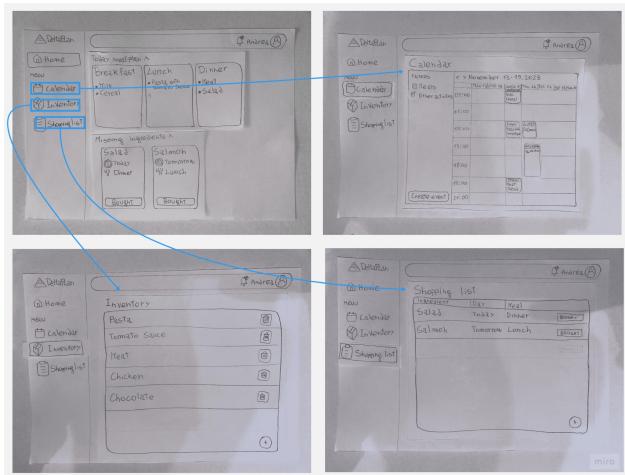


Referring to Storyboard and Task 3:

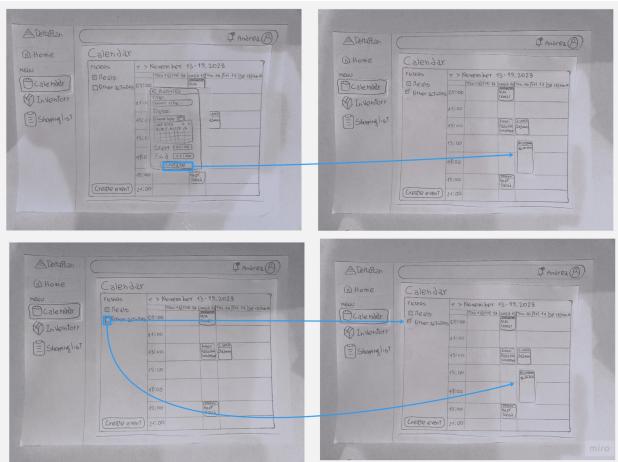
In the storyboard the student checks what he have to buy. After buying what he needed he can remove it by the shopping list tapping on "bought". Task 3 in addition to asking to plan the next day also asks to add what was planned to eat, it can be done by tapping on "+" button and filling the form.

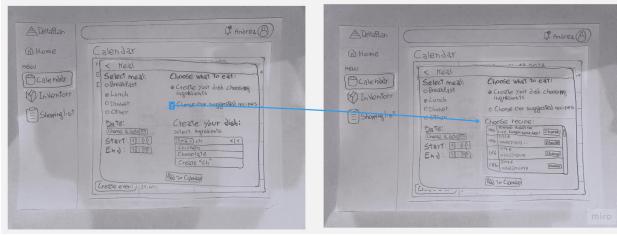
Referring to Storyboard and Task 1:
Task 1 asks to check what the user planned to eat for today, this is the same action performed by the student in the storyboard. He logs in and he looks what he should eat today looking at "Today Meal Plan" Card.

Referring to Storyboard and Task 1:
User can navigate through the application using the sidebar, he can accomplish Task 1 navigate to the Calendar page and looking at what he planned for the current day.



Referring to Task 3:
The user plans an activity, as requested on Task 3, afterwards he can choose whether or not to make it viewable in the calendar, by tapping on the filter to the left of the Calendar.





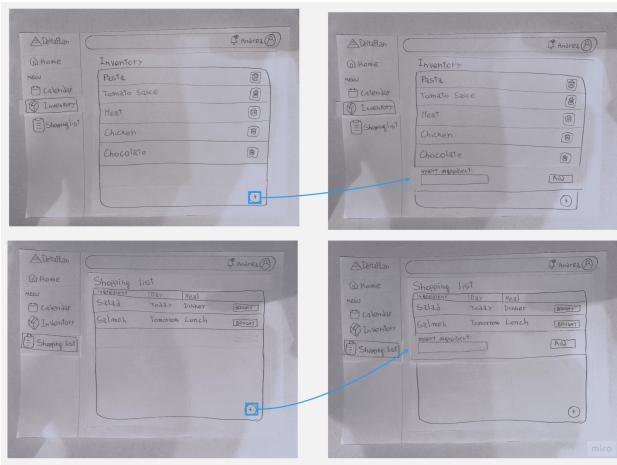
Referring to Storyboard and Task 2 & 3:

The user, planning tomorrow's meals as shown in the storyboard, can either choose to use ingredients in his inventory, as required in Task 2, or a recommended recipe, as required in part of Task 3.



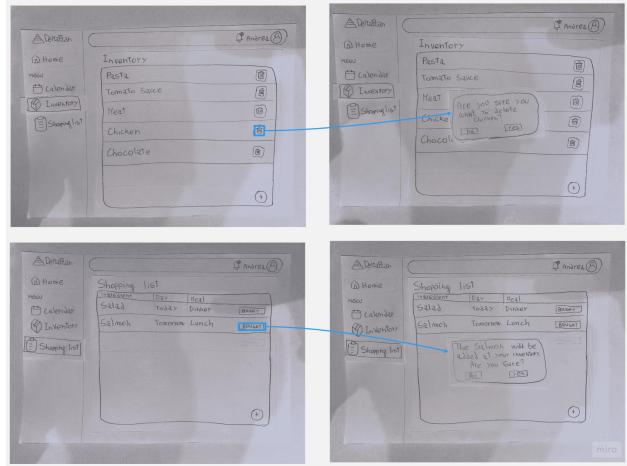
Referring to Storyboard and Task 2 & 3:

While the user schedules a day, he can make mistakes, however, he can delete an event as shown beside.



Referring to Storyboard and Task 2 & 3:

In the storyboard, the user goes to the supermarket and uses the application to check what he should buy, afterwards he can add in the inventory what he bought. Additionally, the user can review his inventory for Task 2 or add any missing ingredients to the shopping list for Task 3.



Referring to Storyboard:

After the user came back from the supermarket, he can remove the items he has purchased from the shopping list, by tapping on "bought". Additionally, he can remove ingredients from the inventory, tapping on the thrash icon.

4.3 Heuristic Evaluations

4.3.1 Description

To facilitate the evaluations, we printed the screens of our mobile application prototype, while the web application prototype had already been hand-drawn on paper, then we met with evaluators in classrooms at Politecnico or at our homes. About our roles, one team member played the role of 'computer', responsible for simulating interaction with the system by changing slides, while another one acted as 'facilitator', providing explanations about goals and tasks to the evaluator. After briefly outlining the goal of our application and contextualizing it within the domain, we gradually introduced the evaluators to three tasks: we began with the simple task, progressively presenting the medium and difficult tasks upon the completion of the preceding ones. During the heuristic evaluation sessions we closely observed their interactions with the prototypes, we noted instances where users navigated effortlessly, indicating a presumably intuitive and user-friendly design, but we also noticed moments when the evaluator seemed confused, by something unfamiliar or not present at all.

We report the RESULTS gathered from the evaluations.

4.3.2 Violations

- Mobile High-level flow

- H1 Visibility of system status

- i **Where:** Planning of a meal.
What: There is no information about the progress of the creation of the meal.
Why: It seems like the user could submit an incomplete form for the planning of a meal.
Severity: 3

- H2 Match between system and the real word

- i **Where:** Home page of the app, in the planning box.
What: The app uses the entire box as button to go to the calendar, even if I click to the specifics activities of the day.
Why: It is inconsistent to open the entire calendar if it is selected a specific activity.
Severity: 2

- H4 Consistency and standards

- i **Where:** Planning of a meal.
What: It isn't clear if the student can select ingredients that aren't in his inventory.
Why: In the page calendar page it is shown a meal with an ingredient "to buy" (chart icon), but in the planning of a meal seems not possible to choose ingredients that aren't in the inventory.
Severity: 4
- ii **Where:** Planning of a meal.
What: It is not clear the meaning of the icon near some recipes.
Why: Near some recipes there is a button with an ambiguous meaning: I cannot select that recipe, or it contains ingredients that aren't in my inventory?
Severity: 3
- iii **Where:** Adding a new inventory item.
What: There isn't the possibility to choose a unit of measure for the quantity added.
Why: The user doesn't know if he is adding kilograms, grams, liters, ... of a certain item.
Severity: 2
- iv **Where:** Adding a new shopping list item.
What: There isn't the possibility to choose a unit of measure for the quantity.
Why: The user doesn't know if he is adding kilograms, grams, liters, ... of a certain item.
Severity: 2

– H5 Error prevention

- i **Where:** Adding a new activity.
What: There is the possibility to insert any start and end time for an activity between two meals.
Why: The user can insert any start and end time, even if they are outside the time slot of the 2 meals.
Severity: 2
- ii **Where:** Planning of a meal.
What: After the click of a delete button, the elimination is irreversible.
Why: There isn't a way to counteract accidental clicks on the delete button.
Severity: 1

– H7 Flexibility and efficiency of use

- i **Where:** Inventory page.
What: The '+' button to add a new inventory item is at the top of the page.
Why: The button isn't easily reachable if the phone is used with a single hand. It could be fixed at the bottom of the page.
Severity: 1
- ii **Where:** Shopping list page.
What: The '+' button to add a new shopping list item is at the top of the page.
Why: The button isn't easily reachable if the phone is used with a single hand. It could be fixed at the bottom of the page.
Severity: 1

– HN Ambiguous operation

- i **Where:** Shopping list page.
What: The 'bought' button is used to mark an item as 'bought' and to cancel an item from the list even if not bought.
Why: If the user wants to cancel an item from the shopping list, he can't, because the only option to remove it is mark it as 'bought'
Severity: 4

• Web Application Prototype

- **H2 Match between system and the real word**
 - i **Where:** Calendar page.
What: The activity icon can be misleading.
Why: The user may associate the activity to a workout only.
Severity: 1
- **H3 User control and freedom**
 - i **Where:** Inventory and Shopping list pages.
What: It's not possible to close the dialog section when adding an item to the list.
Why: The user may click the '+' button by mistake and then the section cannot be hidden again.
Severity: 2
 - ii **Where:** Inventory and Shopping list page.
What: It's not possible to edit items inside the list.
Why: The user may want to edit an item entered by mistake or containing a typo.
Severity: 3
 - iii **Where:** Shopping list page.
What: It's not possible to delete items inside the list.
Why: The user may want to delete items based on their different needs for that day.
Severity: 4
 - iv **Where:** In the Home page.
What: Suggested recipes can only be accessed when creating new meals.
Why: The user may want to check a recipe without scheduling a meal.
Severity: 3
- **H4 Consistency and standards**
 - i **Where:** Calendar page.
What: The text used on the button for the creation of an activity/meal is different.
Why: The user may be confused when they see different buttons that perform the same action.
Severity: 1
 - ii **Where:** Calendar page.
What: The icon ‘j’ contained in the top-left of the creation modal is ambiguous.
Why: The icon may confuse the user as it typically signifies going back to the previous page, which, in this case, remains visible underneath it.
Severity: 3
- **H5 Error prevention**
 - i **Where:** Inventory and Shopping list pages.
What: The ‘Add’ button is clickable even without writing anything.
Why: The user may accidentally add a blank item when inside the list.
Severity: 2
- **H6 Recognition rather than recall**
 - i **Where:** Almost everywhere except the Calendar page.
What: In multiple pages the current date is missing.
Why: The user is not able to know the current date at a glance and is forced to rely on memory.
Severity: 4
 - ii **Where:** Inventory page.
What: There is no way to view the items already inside the list when inside the page.
Why: The user may want to check the items inside the list when adding a new one.
Severity: 2

- iii **Where:** Shopping list page.
What: There is no way to view the items already inside the list when inside the page.
Why: The user may want to check the items inside the list when adding a new one.
Severity: 2
- **H7 Flexibility and efficiency of use**
 - i **Where:** Home page.
What: There is no shortcut for creating events directly from the Home page.
Why: The user needs to go to the Calendar page every time they want to create a new event.
Severity: 2
 - ii **Where:** Inventory and Shopping list pages.
What: It's not possible to search for items or filter by day/meal type.
Why: The user may need to quickly check whether an item is already in the list or not.
Severity: 2
 - iii **Where:** Shopping list pages.
What: It's not possible to sort items.
Why: The user may need to sort items to have a better overview of the items inside the list.
Severity: 2
- **H8 Aesthetic and minimalist design**
 - i **Where:** In the sidebar.
What: The text 'MENU' is not needed.
Why: The user can see that the sidebar contains sections without requiring any further context.
Severity: 1
- **HN Non-Heuristic issue**
 - i **Where:** Calendar page.
What: It's not possible to create an all-day event.
Why: The user may want to add a new event that does not contain a start and end time.
Severity: 4
 - ii **Where:** Inventory and Shopping list page.
What: There is no way to add quantities to the item.
Why: The user may want to put multiple quantities of a single item instead of creating multiple items with the same name.
Severity: 1
 - iii **Where:** Inventory and Shopping list page.
What: There is no way to add notes to the item.
Why: The user may choose to write notes to help them identify a particular feature of an item.
Severity: 1

4.4 Selection

After reviewing the reported violations in our two prototypes, we have decided to proceed with the development of the mobile application one. This decision is based on the following enhancements:

1. It received fewer violations and with generally less severity, most of which were easily resolved.
2. It offers greater functionality and convenience compared to a web application, for users who use it daily. It can be consulted in any situation, such as checking the shopping list at the supermarket.

We decided to export two features from the web application to the mobile one:

1. The shopping list will now specify the date for which each ingredient is needed.

- When creating a meal, users will have the option to include ingredients not currently present in the inventory. These additional items will be seamlessly added to the shopping list once the meal is confirmed.

5 Medium to High-Fidelity Prototype

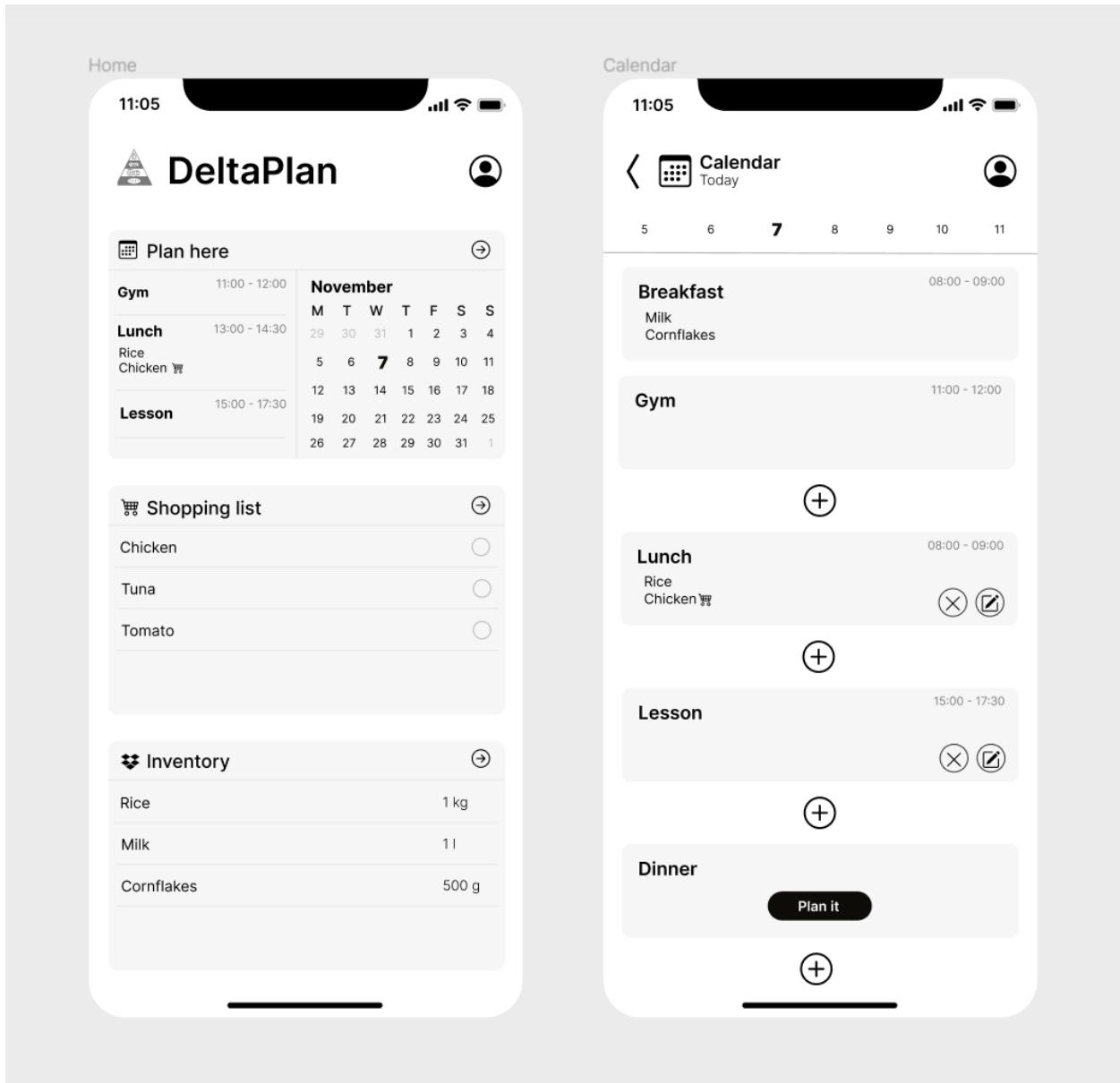


Figure 5.1: Screens created with Figma

5.1 Why/How we choose those two screens

We analyzed our Paper Prototype and we chose two pages from it, then we represented them into the two screens on figure 5.1 created using "Figma". We chose the former, that is the "Home Page", because it's

visualized by the user at the beginning opening the application and it also shows all the offered features. The latter represents the "Calendar's Page" and we chose it because it's the core of the application, in fact it's where the user will plan all meals and activities.

5.2 Figma's Project Link

This is the Figma Mid-Fi, that will redirect to the interactive Figma project.

5.3 How we planned to solve the violations

Referring to the list of violations reported on Section 4.3.2 we choose to do the following changes:

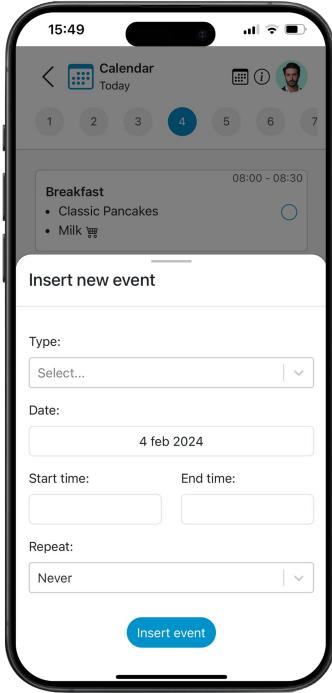
- **H1 Visibility of system status:** We agree with this violation, but we believe that the problem is not an H1 but an H5 (Error Prevention), so it will not be possible to be able to enter a meal until the form it's completed (e.g., if the time slot is not entered). We will modify the confirmation button so that it doesn't appear or it won't allow you to perform its purpose before inserting all right values.
- **H2 Match between system and the real word:** In the home, clicking on a task rather than opening the calendar will display a popup that will allow you to view the selected task.
- **H4 Consistency and standards:**
 - i This functionality is one of two that will be imported from the web application, so the violation will be resolved as explained on Section 4.4.
 - ii We have chosen to remove the previous icon, because it could lead to ambiguity, letting the user to tap on the activity in order to see which ingredients are missing from his inventory.
 - iii We will allow the user to select multiple unit types.
 - iv We will allow the user to select multiple unit types in the input form.
- **H5 Error prevention:**
 - i Inserting a new activity, it will not be possible for it to collide with another one already present or insert it in a past time.
 - ii We do not consider this a violation, the deletion is yes irreversible, but the system asks the user if they are sure they want to delete the event, perhaps we could mark the irreversibility of the operation in the message where we ask for confirmation, or we will implement an undo system with notifications.
- **H7 Flexibility and efficiency of use:** Top right button eliminated both in the inventory and in the shopping list.
- **HN Ambiguous operation:** We will add the ability to remove an item from the shopping list without buying it by swiping to the right.

6 High-fidelity Prototype

6.1 Tool used

We realized the High-fidelity Prototype using Visual Studio Code and JavaScript as programming language, and we developed it basing on iPhone's screen proportions and design. We chose this framework and this language because they are the ones we are most familiar with.

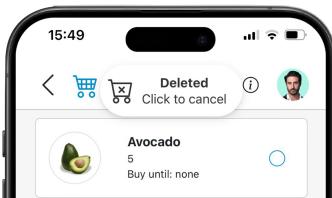
For frontend development we used libraries like react and react-bootstrap and their components e.g. Row, Col, Modal, Card, Form and so on. Among the most interesting components and libraries there are:



Modal with dialogClassName="modal-dialog-bottom modal-open"

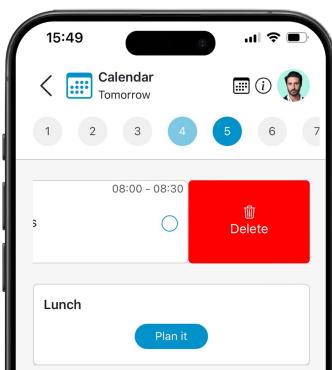
We chose to create a new class, "modal-dialog-bottom", from scratch, in order to emulate iOS environment.

We used it for "forms" and "info menu" visualization.



react-hot-toast

This is a library created to manage notification, that we used to signal to the user every event, like deleting, adding or update something and to give him the possibility to undo by tapping on the notification.



react-swipeable-list

This is a library that implements another iOS like behavior, as we can see in the screen beside we can swipe to the left on items like activities to delete them (or to the right in order to modify).

For backend development, we chose to create a NodeJS server, as a JavaScript runtime environment, we also integrated Express to handle HTTP requests. Time is determinant for our application, which we managed through the dayjs library, finally we chose to use SQLite3 as a relational database to store and retrieve application data and thus make it persistent.
 We collaborated and developed the project on GitHub

6.2 Most significant screens

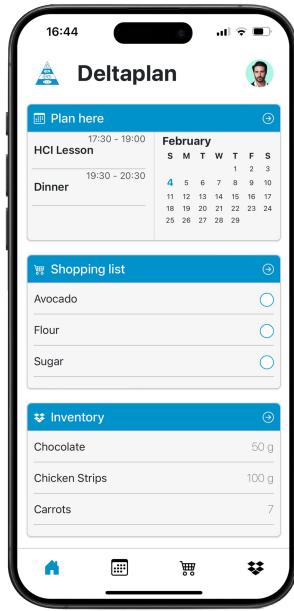


Figure 6.1: HomePage

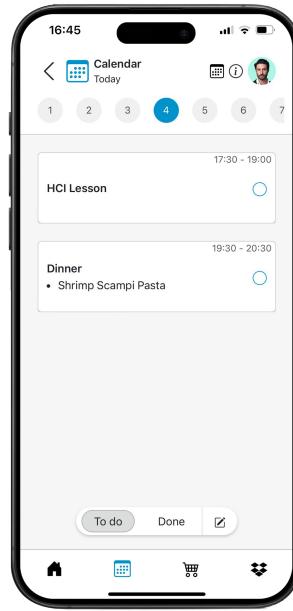


Figure 6.2: Calendar

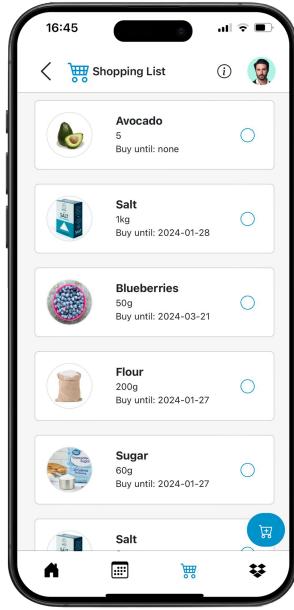


Figure 6.3: Inventory

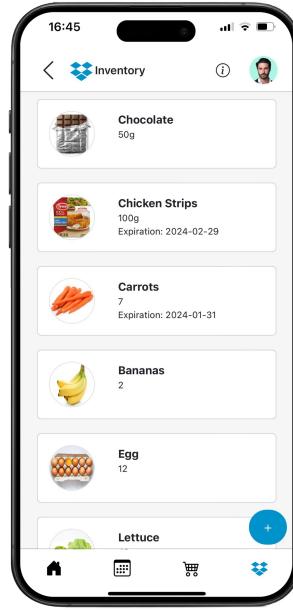


Figure 6.4: Shopping List

We chose these screens because in our opinion they represent the application in its entirety. In fact, we can see in order:

- the Home Page on figure 6.1, the beating heart of the application from where you can access all the features.
- the Calendar on figure 6.2, which allows you to meet the goal of the application by planning meals and activities.
- the Shopping List on figure 6.4 and the Inventory on figure 6.3, which work in synergy with the calendar, and are two indispensable tools to facilitate the user's life.

6.3 Comment and limitations of the prototype

We have no hard-coded code, the whole application works interactively and according to the input provided by the user. The database contains pre-stored data, comprising a collection of commonly used ingredients and a series of simple recipes along with their requisite ingredients. As a limitation, our prototype currently lacks full automation. There is currently no mechanism in place to automatically remove an ingredient that hasn't been purchased by a specific day from the shopping list, or to eliminate an expired ingredient from the inventory, this application is designed so that users create their own account and can access their personal calendar, this multi-user functionality was not implemented by us in this prototype.

7 Usability testing

7.1 Preparation and run

Before initiating the usability testing process, we chose some objectives and task that are important, then we chose a couple of people to participate in the test, we invited them at our home, asking them to sign the CONSENT FORM before starting. During the Usability test process, we played 3 different roles: one member played the role of facilitator, who conducted the test, introducing the application to the participant and introducing him to the various tasks; another member played the role of observer and technical support, watching how the participant performed the tasks and in case of problems trying to help him; finally, the last member took notes about the process and about the difficulties encountered by the participant.

In conducting the test, we followed a SCRIPT, previously written by us, in which we defined the tasks to be performed by the participants and established metrics of success, and we took note of them into a SHEET previously prepared by us. During the test each respondent was asked to fill out two QUESTIONNAIRES that would be used as evaluation metrics.

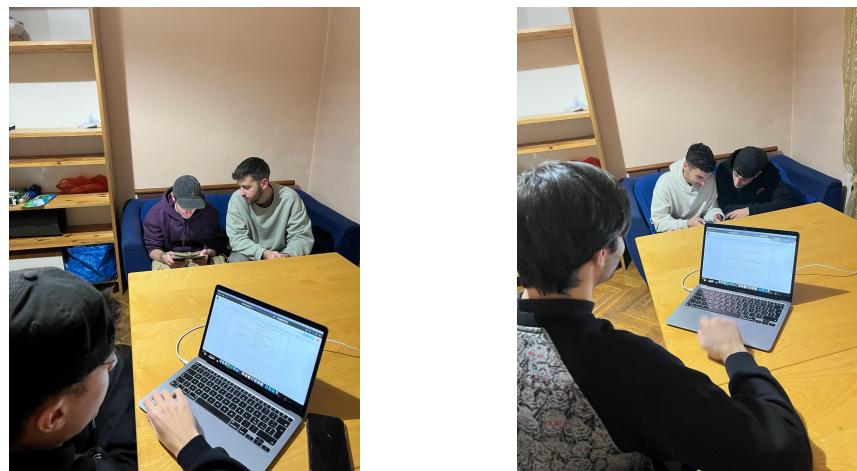


Figure 7.1: Two photos showing the usability test set up

7.2 Results

7.2.1 Summary

The RESULTS of the interviews and questionnaires are crucial to our final evaluation, which led us to understand the strengths and weaknesses of our prototype.

- **Weaknesses:**

1. **From task 5:** In this task the user has to delete an item from the shopping list. When some of the interviewees were faced with completing this task, if they had not previously read the info section explaining how to delete/edit an item, they encountered a difficulty in finding the mechanism to do so. As shown on Figure 7.4. Specifically: one respondent read the info box and managed to successfully delete, the other two did not, and while one after a brief reflection managed to find the way, the other had to explicitly ask for our help.

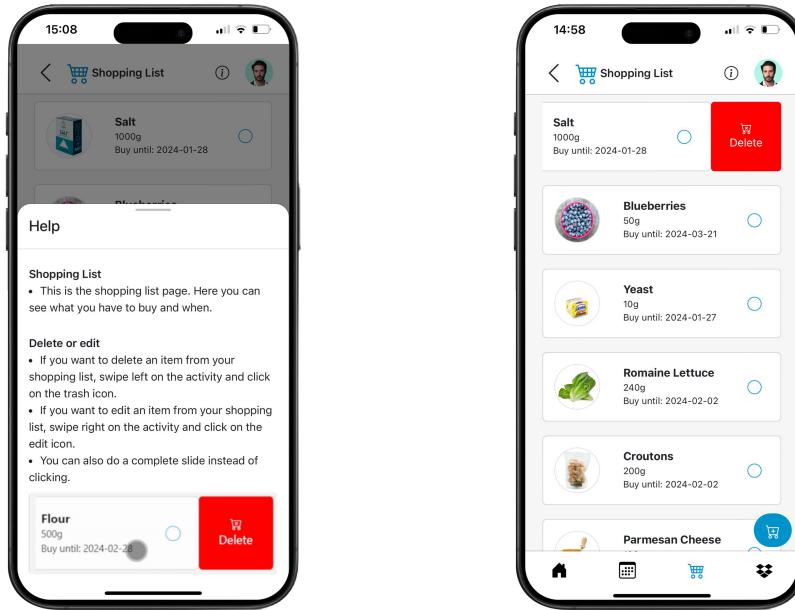


Figure 7.2: Task 5 actions

2. **From task 8:** In this task the user has to delete an activity from the calendar. Two of the respondents did not initially understand the difference between "deleting" and marking an activity as "Done".
3. **From task 9 to 12:** In these tasks, users were asked to plan meals and activities. As simple as the process was, users pointed out how the mandatory time entry made the process slower.
4. **From task 12:** In this task the user has to insert a new activity. To accomplish this task the user has to fill a form, and one of the requested information is the "Type" section of the form where he has to choose "General Event". When the participant had to do it, he thought that he had to write the name of the activity in the "Type" section (instead of in the "Title" section), as shown on Figure 7.3.

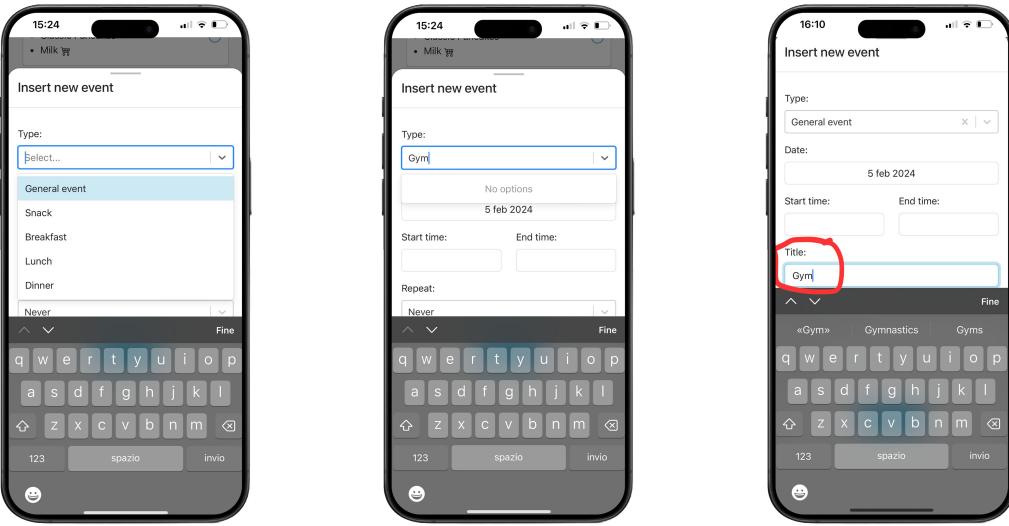


Figure 7.3: Task 12 actions

- **Strengths:**

- From task 0 & 1:** In these tasks the user has to take a look to the home page and navigate the app, these actions are aimed at understanding the purpose of the application and get the user acclimatized. All interviewees immediately understood what the application was designated for and were familiar with navigating through the application.
- From task 2 to 12:** Leaving aside the errors mentioned above, when asked to do a task, the participant always found the right section of the application where it should be done, this in our opinion is therefore a sign of high intuitiveness of the application.
- From task 3 & 9 & 10 & 11:** In task 3 the user has to mark lunch as completed, while in the other 3 tasks (9,10,11) the user has to plan 3 different meals. After finishing task 3, the application informs the user that the consumed foods have been removed from the inventory, while after planning a meal in the other tasks, the application alerts the user that the missing foods from the inventory have been added to the shopping list (as shown in Figure 7.4). Upon reading these notifications, all participants were surprised by the degree of automation offered by the application.



Figure 7.4: Automation strength

The interview was useful to obtain a user's perspective rather than a developer's one for our prototype. Since we were familiar with the components and functionalities, we wouldn't have easily highlighted the strengths or weaknesses. During the interview, as mentioned earlier, we had the participants fill out questionnaires (found in RESULTS), from which we derived scores as an evaluation metric. Specifically, we had them complete the SEQ (Single Easy Question) during the interview to understand the most challenging tasks.

After completion, we used the SUS (System Usability Scale) to get a more specific idea of how the user experienced the application. From the second questionnaire, we also obtained the SUS Scores, which are respectively 57.5, 95, and 62.5 for the three interviewees.

We have understood that the idea is appealing, thanks to participants' reactions during the test, and that automation is a strong value point of our prototype. From the average SUS Score, we have also found that the prototype can be evaluated as average, and to increase that score, in our opinion, it would be sufficient to implement some changes, which we will explain in the next section.

7.2.2 Potential Changes

After a group briefing about all weaknesses, we found some possible changes that we can implement to the prototype to improve it.

- **First Weakness:** Since we used the iOS environment as a development model for the prototype, we implemented the ability to delete an item through a left swipe, as well as to modify one through a right swipe (a common feature in iOS). We had already introduced an info section to showcase this functionality to new users. However, our mistake was not making this "info" automatically visible to those using the application for the first time, thereby encouraging them to learn about this functionality in advance. Therefore, a change that could address many issues might be this. Furthermore, based on a participant's suggestion, it is advisable to reduce the amount of information within the info section, perhaps leaving only the GIFs and omitting the text that some users might find tedious to read.
- **Second Weakness:** The solution to this weakness could be connected to the previous one. If some users find the distinction between deleting an event and marking it as "Done" ambiguous, it might be due to both an unclear info section and the choice of the "radio button" component for marking an event as "Done." Therefore, the earlier proposed change combined with opting for a better and more intuitive component could eliminate any ambiguity.
- **Third Weakness:** In this case, users pointed out that the mandatory time entry slowed down the process. We could introduce a mechanism that suggests an ideal time slot in advance, eliminate unavailable time slots directly in the form selection or make them non-mandatory. This way, users wouldn't need to wait for the application to check time slots, potentially making the process faster.
- **Fourth Weakness:** We find this weakness easily fixable because the user's misunderstanding, thinking that he had to write the name of the activity in the "Type" section (rather than the "Title" one), is, in our opinion, a result of how we configured the component. Simply removing the option to input text (which can be easily done with a component setting) and guiding the user to choose from existing options, rather than entering something new, could resolve this issue.

8 Conclusions

8.1 Main learnings

This semester, taking the Human Computer Interaction course, we improved our skills and knowledge in creating a good application.

A good project comes from a good idea, and no one could help us realize it better than the users who are supposed to use our application. Through a process of needfinding we found and interviewed users, asking targeted questions to understand their needs and desires, after a long process of brainstorming we derived deep needs, on which we later built solutions, including precisely DeltaPlan.

During the design phase, we realized that creating a successful application requires more than just writing code. We learnt that it is essential to create an idea that not only solves a problem but is also inherently useful. Our guiding principle became usability, reminding us that a truly impactful application seamlessly

integrates into users' lives.

Through heuristic evaluations, we received critical feedback that helped us steer our solutions in the right direction. We worked together to develop and evaluate paper prototypes, constantly refining our ideas to ensure they were user-centric.

After obtaining the valuations, and understanding the critical points of our prototypes, we thought about how to solve the problems. We chose the solution, which most appealed to us, developing a medium fidelity prototype that arose from the critiques we received.

Perhaps the most profound takeaway was the understanding that successful application development is a holistic process. It involves a marriage of creativity, problem-solving, and user-centric design. The user testing phase brought our creations to life, offering a firsthand look at the real-world impact of our efforts. Beyond the lines of code, this course has instilled in us the significance of innovation, user empathy, and the gratification that comes with creating not just functional, but truly meaningful applications.

To summarize, at the beginning of the course we had the skills needed to develop an application. But to create a good application this is not enough, the user must always remain at the heart of any project. We've learned that a successful application must embody two key qualities: usefulness and usability. After all, an application is useless if it fails to meet a real need or if it proves cumbersome for its intended users. By prioritizing the needs and experiences of our users, we not only ensure the relevance and effectiveness of our creations but also honor the core principles of human-centered design.

8.2 Group feedback

Our experience as a group was positive overall. During the first assignments we worked in person or by video call, and all three group members were always present. For the development of the High Fidelity Prototype, then the application, we preferred to divide the tasks. Respectively Fabio Mangani took care of the backend work, Andrea Scamporrino and Gabriele Medica of the frontend dividing the work. Of course, during the course of the prototype development we always confronted each other and scheduled calls to discuss problems and possible advice to each other.

One positive aspect is definitely that having already worked together during these years, all of our discussions were fluid, everyone felt comfortable being able to have their say, and certainly this benefited the whole work.

9 Appendix

We will write here any link to external documentation, we referred to into this report.

Interviews' Consent Form for Needfinding in Section 2.2.1:

https://drive.google.com/file/d/17WwGyO1dQqM8MUEVp8gRbCbT_s9704H5/view

Heuristic Evaluations' Results in Section 4.3.1:

https://drive.google.com/file/d/1zVQr_HKirvtDtANd6T681a9hJP1ZL5OH/view

Figma Mid-Fi in Section 5.2:

<https://www.figma.com/file/rCuSZXuidkBDAfuaOvOUS7/DeltaPlan?type=design&node-id=0-1&mode=design>

DeltaPlan's GitHub in Section 6.1:

<https://github.com/polito-hci-2023/DeltaPlan>

Usability Test's Consent Form in Section 7.1:

<https://drive.google.com/file/d/1OmSbbMF45ev4iBGdBr6g9mZeYEfYQa4Z/view>

Usability Test's Script in Section 7.1:

https://drive.google.com/file/d/1ipHnMOqiw8tP1eCxUcPijW0BTHVw_6Z0/view

Usability Test's Sheet in Section 7.1:

<https://drive.google.com/file/d/14OT8GjTBqwqiHsriNjTCIUqytbXLNjQ8/view>

Usability Test's Questionnaires in Section 7.1:

<https://docs.google.com/forms/d/e/1FAIpQLSfkEoHlx-R08GW6tNIckRDAIEiMIAZneBKT8DLCpa-7al68w/viewform>

Usability Test's Results in Section 7.2.1:

<https://drive.google.com/file/d/1vlNfdGRL1TTPyoFqz2-qmvJrf4ayOgj1/view>