



POLITECNICO DI TORINO

Final report - KitchenFlow

Less time to cook, more time to eat.

FATGroup

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1 Problem/Solution overview

The main problem we identified is that people in their 20s spend too much time organizing and preparing their cooking tasks due to their inexperience, leading to inefficiencies in the kitchen. Our solution, KitchenFlow, is a tablet application that provides guidance on organizing kitchen tasks to reduce the overall cooking time.

2 Needfinding

2.1 Domain of interest

In the context of Education with AI, we chose the education of inexperienced people on how to cook and manage food as our domain. The target users are individuals aged 20-30 years who live alone and cook for themselves.

We selected this domain because cooking is an essential life skill that is often overlooked in traditional education and this demographic often struggles with time management and lacks confidence in the kitchen. By focusing on this group, we aim to provide a solution that enhances their cooking efficiency and makes their experience more enjoyable.

2.2 Interviews

We conducted interviews with four immediate users, one extreme user, and one domain expert.

The immediate users included:

- **Carlo:** A 24-year-old from Piemonte who studied Finance at UniTo and now works at Intesa San Paolo. He was chosen because, despite not liking to cook at home, he still does it out of necessity, representing the perfect immediate user of our domain. The interview was conducted at his house by Emanuele as interviewer and Samuele as note-writer, and audio-recorded on a smartphone.
- **Francesco:** A 21-year-old from Puglia, who studies Cinema at DAMS in Torino. He was selected because he lives far from home and has little experience in cooking, meaning that he's completely in target with our domain. The interview was conducted at his house by Emanuele as interviewer and Alessandro as note-writer, and audio-recorded on a smartphone.
- **Daniele:** A 22-year-old from Puglia, who studies Economy and Management at Bocconi University of Milan. We chose Daniele because he has been living alone for 3 years, so we think he's a great candidate for this interview. The interview was conducted online, by Alessandro as interviewer and Emanuele as note-writer, and audio-recorded on a smartphone
- **Doruntina:** A 23-year-old pharmacy student from Piemonte. We choose Doruntina because she knows the basic of cooking but still wants to improve and learn more. The interview was conducted at Doruntina's home by Samuele as interviewer and Vincenzo as note writer, and audio-recorded on a smartphone.

The extreme user, **Mario**, is a 25-year-old student of Politecnico, who really likes to cook and is good at it. We chose him because of his cooking abilities, and because we see him as an extreme user in this domain.

The interview was conducted at an aperitif bar, by Vincenzo as interviewer and Alessandro as note-writer, and audio-recorded on a smartphone.

The domain expert, **Xhevat**, is a 25-year-old chef at Gusto Divino in Saluzzo. His long-date experience in the kitchen is the reason why we chose him as a domain expert, as he could give us some insights and recommendations in this sector.

The interview was conducted at the restaurant, by Samuele as interviewer and Vincenzo as note-writer, and audio-recorded on a smartphone.

2.2.1 Methodology and execution

Interviews were conducted both in person and online depending on the location and availability of the participant. Recruitment was carried out by selecting participants in a way that allowed us to obtain a relatively random sample, choosing students from different universities and with varying genders. The participants were informed about the purpose of the interviews and gave their consent for recording.

The interviews included a mix of structured and open-ended questions tailored to each participant's role (immediate user, extreme user, or expert). For example, immediate users were asked about their cooking habits, challenges, and preferences, while the domain expert provided insights into professional cooking techniques and strategies.

Team members took on various roles: one as the interviewer and the other as the note taker. Tools such as smartphones were used for audio recording. In one instance, a contextual inquiry was conducted with Mario, we observed him cook a dish to gather practical insights into kitchen workflows.

2.2.2 Questions for the immediate users

1. First of all, we'd like to get to know you better. Tell us a bit about yourself, how old you are, and what you do.
2. How much time do you spend cooking on a typical day?
3. How would you rate your cooking skills?
4. On a scale from 1 to 5, where 1 means little and 5 means a lot, how much do you want to improve your cooking skills?
 - 4.(1) (If the previous answer is ≥ 3) Which areas would you prefer to learn or perfect?
 - 4.(2) (If the previous answer is < 3) Why is that?
5. If you were to take a cooking class, what would you most like to learn?
6. On a scale from 1 to 5, where 1 indicates rarely and 5 indicates very often, how often do you eat out or order takeout instead of cooking?
 - 6.(1) Could you describe your reasons for this?

- 6.(2) (If the respondent answers with ≥ 3) When you order takeout, what are the main factors you consider?
7. When you eat out or order takeout, what are your favorite dishes?
 8. Have there been any changes in your diet since living on your own? If yes, what are they?
 9. When you plan to cook, where do you draw inspiration from?
 10. What's your experience with planning weekly meals?
 11. How do factors like cost, time, and inexperience affect your culinary choices? Could you rank these three criteria from most important to least important?
 12. Do you use specific strategies or techniques to reduce food waste?
 - 12.(1) (If yes) What are they?
 13. What's your approach when you encounter food that's about to expire? What do you usually do in this situation?
 14. When you cook or choose what to eat, is it primarily out of necessity or for the pleasure of trying something new?
 15. List 3 positive and 3 negative aspects when following a recipe.
 16. What key features do you consider in a recipe before deciding to follow it?
 17. What are the kitchen appliances you use most often?
 18. What are the biggest challenges you face when cooking at home?
 19. How often do you ask for help in the kitchen?
 - 19.(1) In what situations do you do so?

2.2.3 Questions for the extreme users

The same question as the immediate user plus these":

1. What are the 3 easiest and 3 hardest techniques to learn in cooking?
2. What motivates you to cook so often?
- 2.(1) In what situations do you do so?

2.2.4 Questions for the domain expert

1. First of all, we'd like to get to know you better. Tell us a bit about yourself, how old you are, and what you do.
2. How much time do you spend cooking at home on a typical day?
3. Where do you draw inspiration for your recipes?
4. Is there anything that helps you find new motivation in the kitchen, even though it's part of your daily work?
5. What advice would you give to someone with little experience who is approaching the world of cooking for the first time?
6. What advice would you give to someone who already has some experience in cooking?
7. In your opinion, what are the fundamental characteristics a recipe must have to be easy to follow and execute?
8. What's your experience with planning weekly meals?
9. What kitchen appliances do you use most often?
10. In your opinion, what are the best methods for preserving the freshness of a dish?
11. Do you use any strategies to minimize waste in the kitchen?
12. What challenges or difficulties do you most frequently encounter when cooking at home, despite your experience in the kitchen?
13. How do you overcome them?
14. How often do your friends or relatives ask for your help in the kitchen?
15. What are the most common difficulties you notice when helping them?
16. In your opinion, what are the key factors in the successful outcome of a dish?

2.2.5 Contextual inquiry

We also conducted a contextual inquiry on Mario at his house, by watching him cooking Pappardelle ai funghi porcini. Mario decided to make pasta himself, without buying it because fresh pasta is healthier and also has a better taste than pasta from the supermarket. He has learnt this preparation from an online recipe website called Fatto in casa da Benedetta (Figure: 1). Almost at the end of pasta cooking, Mario added it to the pan with the mushrooms. At our request of explanation, he answered that in this way pasta gets more tasty by mixing with mushrooms and sauce.



2.2.6 Artifact

A screenshot of a website for 'Fatto in casa da Benedetta'. The header features social media links, a shopping link, and a search bar. The main navigation includes 'Ricette', 'Raccolte', 'Idee e Consigli', and a menu icon. The page title is 'Pappardelle ai funghi' in red, with a subtitle 'Ricette / Primi piatti'. Below the title is a small image of the dish. The text describes it as a classic and delicious first course that can be prepared quickly and personalized. It lists categories like 'DOMENICA', 'SENZA BURRO', 'SENZA CARNE', 'SENZA PESCE', and 'SFIZIOSE'. A large image of the finished dish is shown at the bottom.

Figure 1: Site where Mario learned the recipe

2.2.7 What we learned from the responses

The interviews revealed a shared need to minimize time spent cooking, as most participants view it as a necessary task rather than an enjoyable activity. Simplicity is crucial, with users seeking clear, step-by-step recipes and easy-to-follow guidance. Many also expressed a desire to feel more confident in the kitchen, whether by improving their skills, experimenting with new recipes, or learning basic techniques for cooking autonomously.

Cost-effectiveness emerged as another key priority, with users striving to minimize food waste and make budget-friendly choices. While practicality is essential, there is

also a desire for variety, users want to occasionally explore new dishes and techniques to diversify their meals.

Other recurring needs include managing kitchen organization, accessing trusted recipes, and finding readily available ingredients. Overall, the responses highlight a strong focus on efficiency, confidence, simplicity, and cost-consciousness, balanced with a desire for occasional creativity and variety in cooking.

2.2.8 Key quotes

- "*Mangiando s'impara.*"
- "*Cucino principalmente per necessità, ma quando ho tempo, per esempio nel weekend, mi piace provare qualcosa di nuovo.*"
- "*Vorrei imparare a cucinare più cose diverse perché spesso sono ripetitiva.*"
- "*Uno dei problemi principali è non avere tempo.*"

2.2.9 Images of the interviews



Carlo's interview



Francesco's interview



Daniele's interview



Doruntina's interview



Mario's interview



Xhevat's interview

2.3 Synthesis

2.3.1 Brainstorming process

For the brainstorm process we used OneNote and wrote for each user the needs that we found (Figure: 2), then analized what were the most common one and chose those as our deep user needs.

2.3.2 List of user needs

Carlo needs to:

- Reduce meal preparation time;
- Make simple dishes;
- Find a way to cook autonomously;
- Have a guideline when preparing dishes;
- Know ingredients quantity;
- Reduce meal leftovers;
- Simplify his cooking process;
- Try new dishes sometimes;
- Feel more confident in the kitchen.

Francesco needs to:

- Make simple and good dishes;
- Reduce food wasting;
- Feel more confident when cooking;
- Simplify his cooking process;
- Keep the cost low when choosing what to eat;
- Be helped while cooking;
- Buy only things he will use.
- Reduce preparation times;
- Occasionally try new and more complex dishes;

Daniele needs to:

- Reduce meal preparation time;
- Improve his cooking skills;
- Eat healthy and good dishes;
- Have a good quality/price ratio when choosing what to eat;
- Eat new dishes sometimes, maybe also more complex to prepare;
- Be able to cook autonomously.
- Organize with expiring food;
- Gain more confidence when cooking something;
- Find a trusted source of recipes;
- Prepare more complex dishes with less difficulty;
- Prepare simple dishes;

Doruntina needs to:

- Reduce preparation time;
- Learn how to cook different dishes;
- Save money when choosing what to buy;
- Prepare good dishes;
- Better use her own kitchen tools;
- Find easy ingredients in shops;
- Be sure of the result when cooking a dish;

- Learn new cooking techniques;
- Find some inspiration for choosing what to eat;
- Know the right ingredient quantities to cook;
- Be guided in the recipe she is following;
- Ask for help when cooking for some recipes.

Mario needs to:

- Improve his cooking skills;
- Experiment with new recipes;
- Experiment with new techniques;
- Program his meals;
- Keep low cost when choosing what to eat;
- Ask for help with complicated recipes sometimes.

- Keep on a healthy diet with vegetables and proteins;
- Have clear and well-structured cooking instructions;
- Keep his kitchen organized while cooking;
- Follow recipes without technical problems;



Figure 2: Needfinding brainstorming

2.3.3 Deep user needs

By analyzing all of the interviews, we found different needs in users. The most important and most common needs are:

- The user needs to minimize time spent in the kitchen;
- The user needs to diversify his meals.
- The user needs to keep his expenses low;

2.3.4 Linking user needs to the questions

The user needs to minimize time spent in the kitchen

- **Carlo:** In his typical day (question 2), Carlo said that he prefers to spend "as little time as possible" in the kitchen. He emphasized that time is his primary concern when preparing food (question 11). He further explained that cooking is more of a necessity for him rather than a pleasure, and he tries to keep the time spent in the kitchen as low as possible (question 14). He also expressed frustration when recipes take too long to complete (question 15).
- **Francesco:** In his interview (question 2), Francesco mentioned that he spends roughly one hour per day cooking his main meals. He acknowledges that his primary reason for cooking is survival rather than enjoying the process (question 14), suggesting a desire to minimize kitchen time.
- **Doruntina:** During her interview, Doruntina repeatedly expressed a desire to learn something quick and easy (questions 5, 8, 11, 15, 16, and 18). She consistently emphasized that, since she is often busy with university commitments, she doesn't have much time to dedicate to cooking. Some of the responses were: "I'd like to learn simple, quick, but tasty recipes," "I cook dishes that are fast because I have classes," and "One of the biggest challenges is not having much time."
- **Daniele:** Daniele isn't very passionate about cooking. He primarily cooks out of necessity and prefers to minimize the time spent in the kitchen. We gathered this from the fact that he often cooks the same dishes and doesn't follow many recipes. We discovered this from his responses to questions 11 and 14, where he ranked time as his top priority and said: "I mainly eat out of necessity, but when I have time, I'd like to prepare something new."

The user needs to keep his expenses low

- **Francesco:** Francesco pointed out that cost has a significant impact on his meals, ranking it higher than both time and inexperience (question 11).
- **Doruntina:** As a university student, Doruntina doesn't have a large budget for cooking, so she needs to prepare cheap dishes (questions 5 and 11). She considers cost as a major factor when deciding what to cook.
- **Daniele:** Daniele ranked cost as the second most important factor, which shows it holds some significance for him, especially since he is a university student.
- **Mario:** Mario considers cost pretty important (question 11), as he only tends to spend more when he occasionally wants to try something new.

The user needs to diversify his meals

- **Carlo:** While Carlo mentioned that if he follows a recipe, it should be something different from his usual meals (question 16). This indicates a desire for variety.
- **Francesco:** Francesco enjoys the idea of trying new flavors (question 14), though most of the time he cooks simply for survival. Despite this, he acknowledges that discovering something new can be appealing, showing a willingness to diversify his meals when possible.
- **Mario:** Answering question 5 and 9, Mario expresses the need to improve his abilities with new techniques, which would increase his possibilities to vary his diet and try new dishes.
- **Doruntina:** Despite her lack of time, Doruntina expressed a willingness to try something new, especially during moments when she has more free time. She also mentioned that she tends to be repetitive with her recipes, so she wouldn't mind adding more variety. From questions 4 and 14: "I'd like to learn to cook more varied dishes because I tend to be repetitive," "I mainly cook out of necessity, but when I have time, for example on the weekend, I enjoy trying something new."
- **Daniele:** Despite not being an experienced cook, Daniele expressed a desire to vary his meals and try something new without drastically changing his daily diet, especially when he has more free time. This was evident from his responses to question 10 and the subsequent follow-up, "If you could vary more, would you?" where he replied, "Not too much, but yes, definitely when I have more free time." Additionally, in question 14, he stated, "I mainly eat out of necessity, but when I have time, I'd like to prepare something new."

2.4 Solutions

For the solutions each one of us thought about different solutions for each deep need and then we combined them using MIRO (Figure: 3), after that we voted 2 times, once for the best solution for each user need and once for the best solution out of the three remaining ones.

2.4.1 Proposed solutions

Minimize time spent in the kitchen

- Suggest preparing similar meals ahead of time.
- Provide guidance through 3D instructions while cooking.
- Offer quick and easy recipes that are simple to follow.
- **Provide guidance on organizing kitchen tasks to reduce overall time spent.**
- Share tips to save time during preparations.

Keep expenses low

- Assist the user while shopping.
- Track the price of products.
- Monitor the expiration dates of products.
- Provide low-budget recipes.
- **Enable interaction with grocery stores to discover promotions and discounts.**

Diversify meals

- Allow users to see what others nearby have cooked for inspiration.
- Facilitate delivery of fresh and different ingredients to the user's home.
- Offer a set of new recipes from around the world.
- Encourage experimenting with different cooking techniques.
- **Keep track of users' meals and recommend new dishes.**

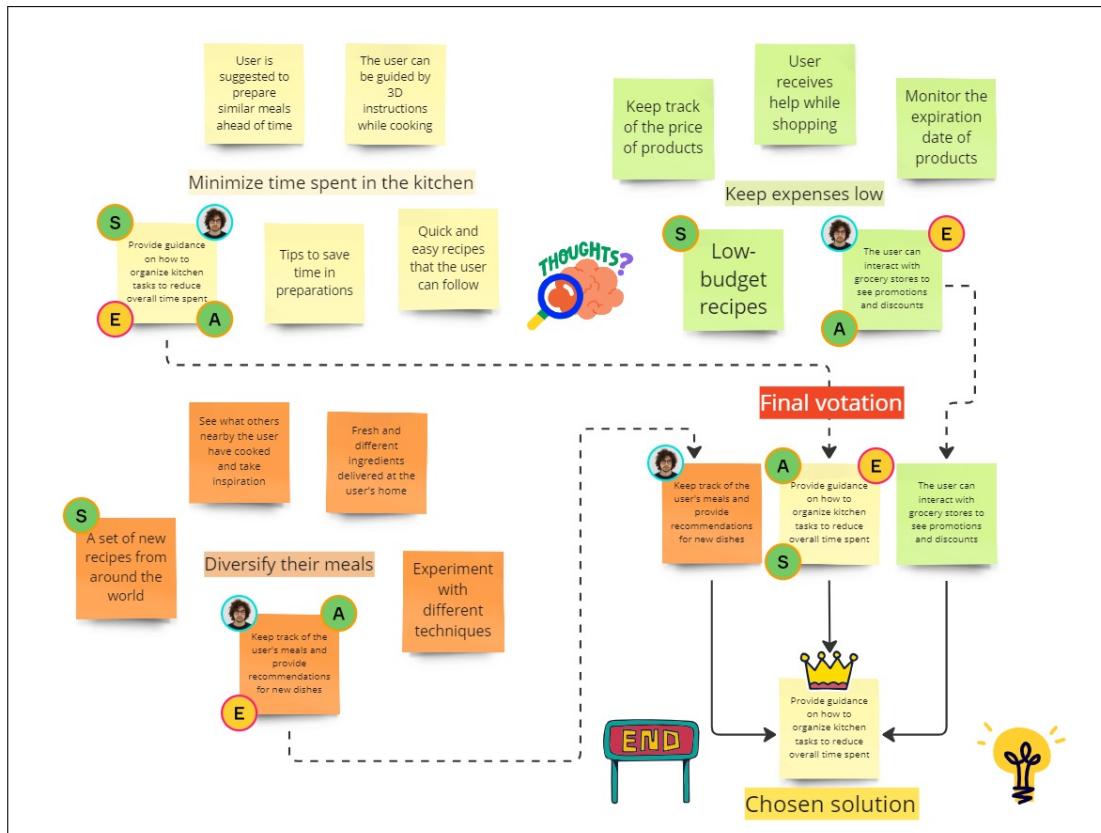


Figure 3: Solutions brainstorm

2.4.2 Selected solution

At the end we choose the solution: **Provide guidance on how to organize kitchen tasks to reduce overall time spent**, which consists of helping the user by giving him clear and easy to follow instructions so that he can save time in the kitchen while cooking the dish he wants.

We made this choice because it solved the first need, which was the deepest one for all users interviewed and because we think it's possible to improve their experience at cooking by guiding them. The other solutions were referred to less common needs, so we preferred to choose the one related to the deepest and most common one.

3 Tasks and Storyboard

3.1 Tasks

Simple Task: Ask for guidance on a meal preparation

- The user specifies what they want to eat, and a recipe with preparation steps is suggested.
- **Why we chose this task:** This was chosen as the simple task because it represents the main goal and the most frequent action the user will take. It is important for the target population because it allows them to reduce time spent in the kitchen and learn new techniques.

Moderate Task: Redeem in-app badges if the user manages to complete a preparation quickly

- The user is able to redeem rewards if they complete a set of achievements.
- **Why we chose this task:** We chose this task because we wanted to motivate the target population to improve their timings by giving them something to strive for. It is considered a moderate task because the user can also choose to cook by simply following the recipe without focusing on rewards, for example when trying a new recipe.

Complex Task: Personalize a suggested preparation

- The user is able to modify the preparation steps or the ingredients required to better suit their preferences and needs.
- **Why we chose this task:** We chose this task as the complex task because it requires more interaction from the user. Unlike the simple task, which only involves selecting a meal, this one needs active engagement with the recipe details, such as altering quantities or adding steps. This is important for the target population because some more advanced user or user with particular dietary needs may want to modify the AI's recipe. We also added this task to help with AI's undeterministic behaviour.

3.2 Storyboard

We chose it to represent what we think would be the average experience with our solution, based on what emerged from the interviews. The main need for the interviewees was to save time while cooking, because of their tight schedules of work/university. (Figure: 4)

Strengths	Weaknesses
<ul style="list-style-type: none">• Shows 2 of the 3 tasks.• Shows how to solve the main user need.• Conveys the typical usage of the application.	<ul style="list-style-type: none">• Does not show the moderate task.

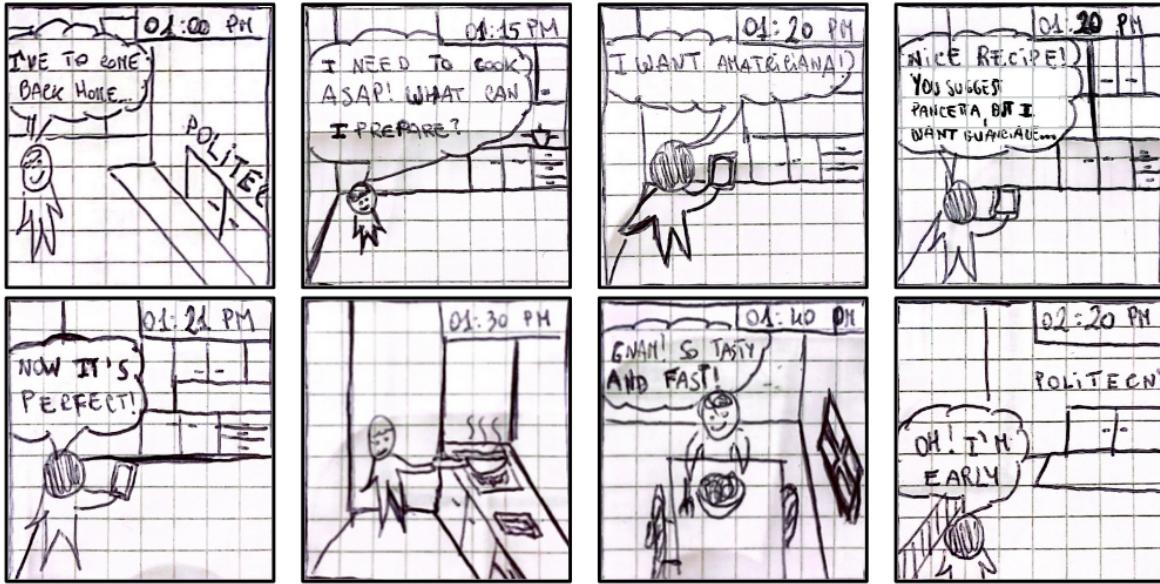


Figure 4: Storyboard

4 Low-Fidelity Prototypes

4.1 Modalities exploration

During the exploration of different modalities, we considered various devices to determine which would be most suitable for our domain. The devices examined were smartphones, tablets, smartwatches, and AR glasses, each with its own pros and cons.

Smartphones turned out to be a highly practical choice since almost every user already owns one, and they are easy to use in the kitchen. However, their smaller screen can be limiting, especially if the user needs to see more detailed instructions or follow longer steps.

Tablets, while commonly owned by students, offer a larger screen that allows for clearer visibility of instructions. However, they are less practical compared to smartphones, especially for those who don't use them regularly, and they may be less maneuverable in a kitchen setting.

Smartwatches, unfortunately, presented significant drawbacks. While they are convenient for receiving notifications, their small display size and reliance on voice commands make them less suitable for use in the kitchen. Moreover, they are not as widely used as smartphones, making them a less reliable option for our target users.

AR glasses, on the other hand, provide an immersive experience and the ability to view real-time information. However, they are still expensive and not widely adopted, making them an unrealistic choice for the majority of our users, given their limited budget.

In the end, we decided to focus on **smartphones** and **tablets**. The main reason for this choice is that both devices are already widely owned by our target users, ensuring immediate adoption without the need for additional investments. Additionally, both provide a good balance of usability, portability, and the ability to display instructions clearly, meeting user needs without introducing technical complications or high costs.

4.2 Paper Prototypes

Tablet Prototype



Figure 5: Main screen of the application, from here the user can chose if he want to access his profile, with the badges and statistics or the cooking time menu with the recipes to cook. The home icon present in the next screens will always lead to this page

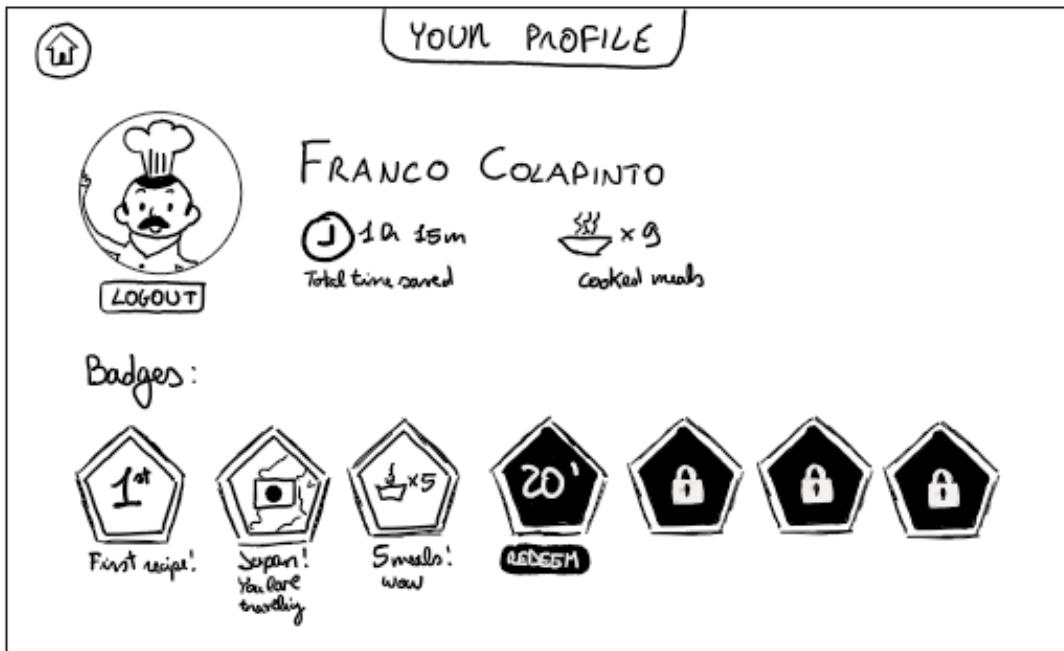


Figure 6: This is the profile page for the user where he can check out his statistics, and with achivements he has completed

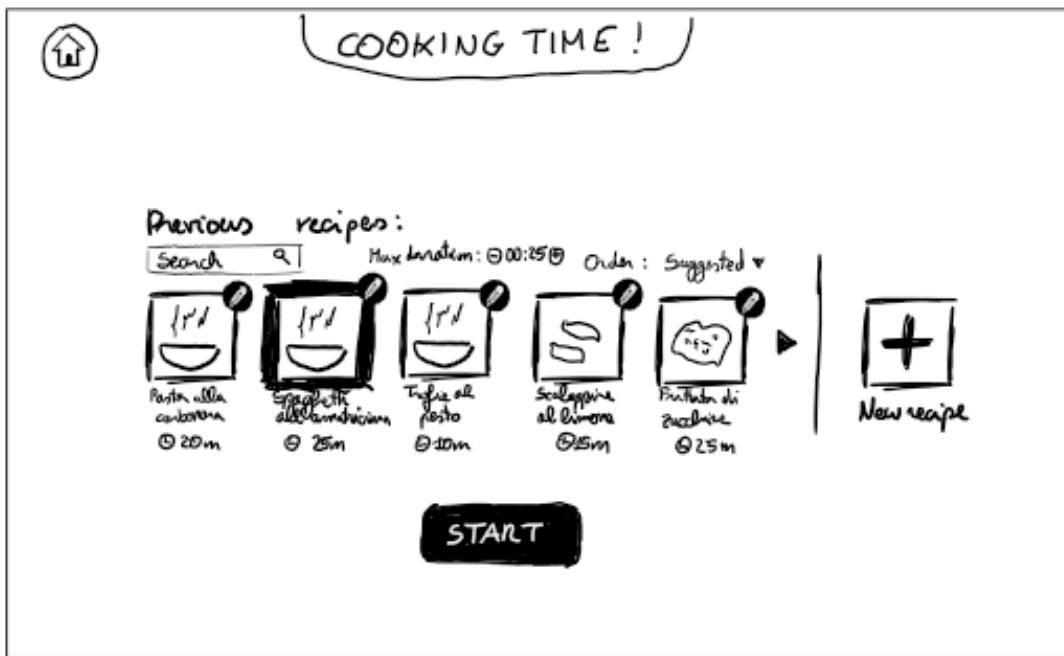


Figure 7: In this page the user can create a new recipe by clicking on the "New recipe" button, or choose one of the existing ones. To help the user in his search he can use various filters or the serch bar. The user can also modify the recipe by clicking on the pencil icon

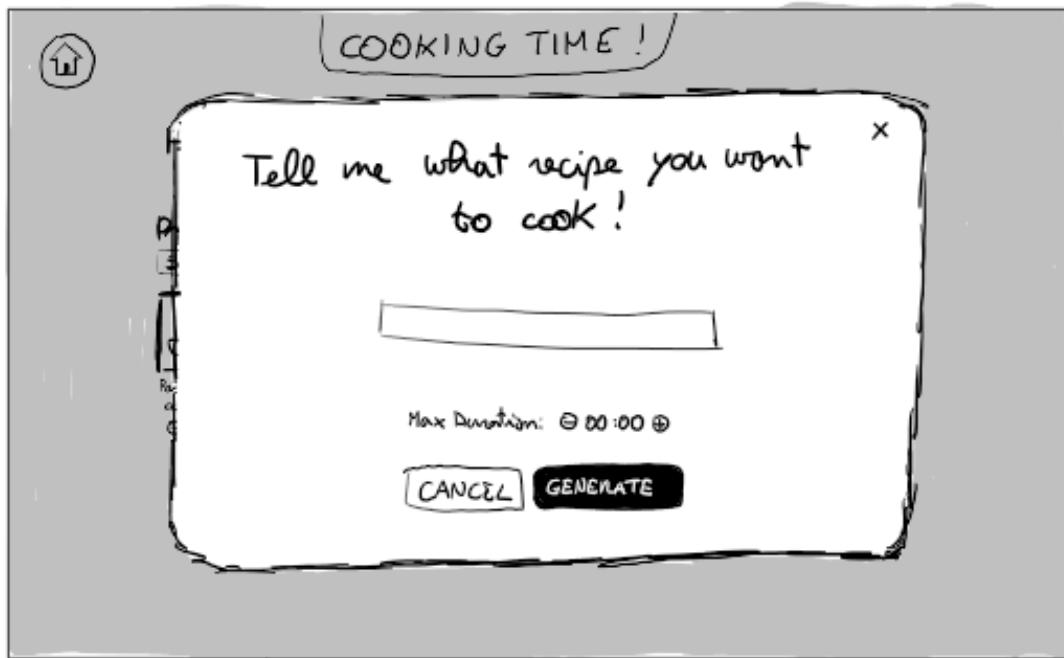


Figure 8: By typing the name of the recipe the app will generate one unsing AI, the user can also set the maximum duration, if he wants something less complex to make

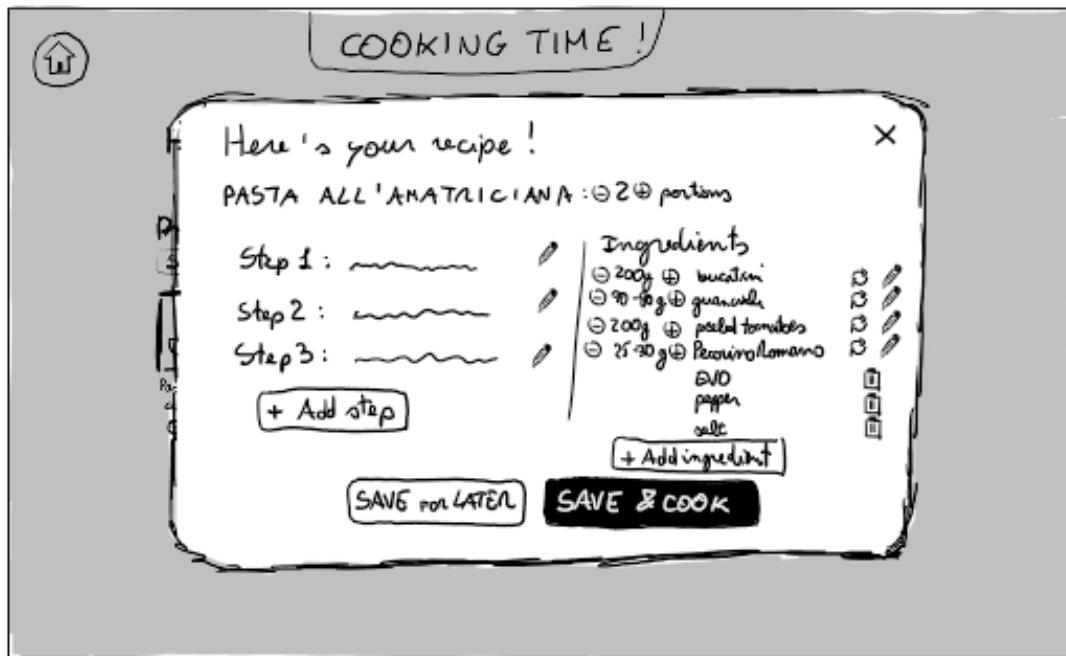


Figure 9: In this screen the user can modify the recipe to his likings by adding new steps, modifying the existing ones, the same actions he can do for the ingredients. He can also let the ai modify some ingredients using the double arrow icon



Figure 10: In this screen the user is cooking the recipe he choose and following the various steps at the right, he can check a step as completed by using the checkbox next to the step name. He can mute/unmute himself and the assistant, and set up a timer for the current step if needed. The user can also click on "See Flow" to check out the flow diagram that tells him how to parallelize the steps.



Figure 11: In this screen if the user clicks on the home icon a popup is shown to prevent misclicks



Figure 12: in this screen we can see a step that has been crossed out (Prep. guanciale) and a timer that has been set for the second step



Figure 13: In this screen we can see the ability for the user to switch from voice to keyboard interaction with the AI assistant

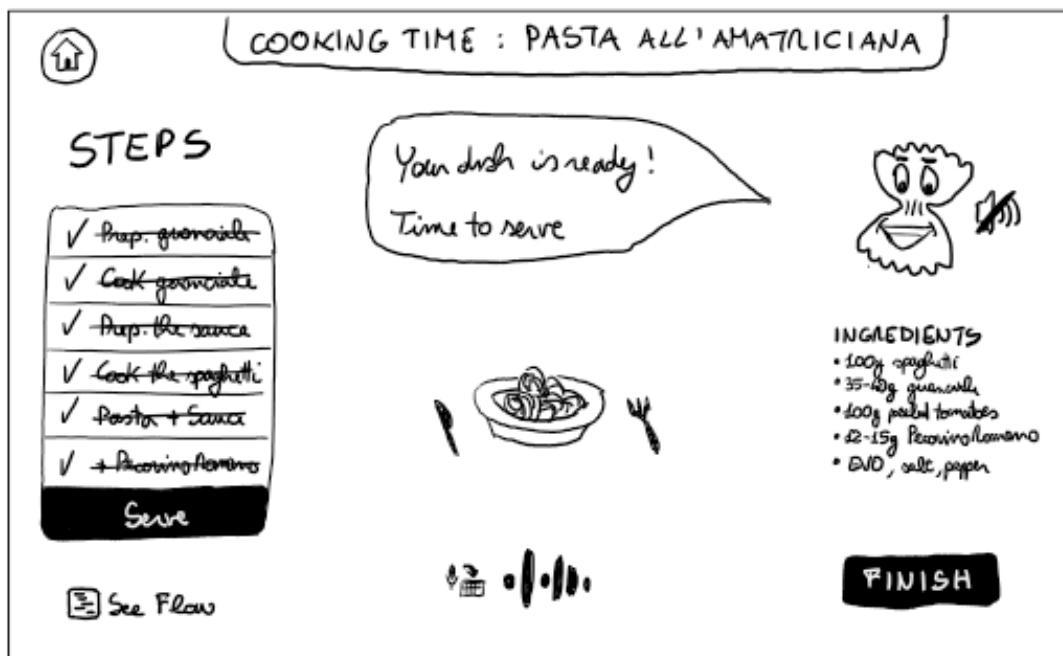


Figure 14: The last step is for the user to serve the recipe

COOKING TIME : PASTA ALL'AMATRICIANA

TIME

19 min (6min saved)

EARNED BADGES



Cook in less
than 20 minutes

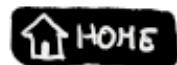
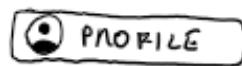


Figure 15: In this screen is the main screen of the application, here the user can create a new recipe by telling the AI what we wants, or choose one of the recipe he has created. In the bottom we can see a menu, the button on the bottom right is for reaching the users recipes, the bottom left for the user achievements and the bottom center for the actual cooking of a recipe

Smartphone Prototype

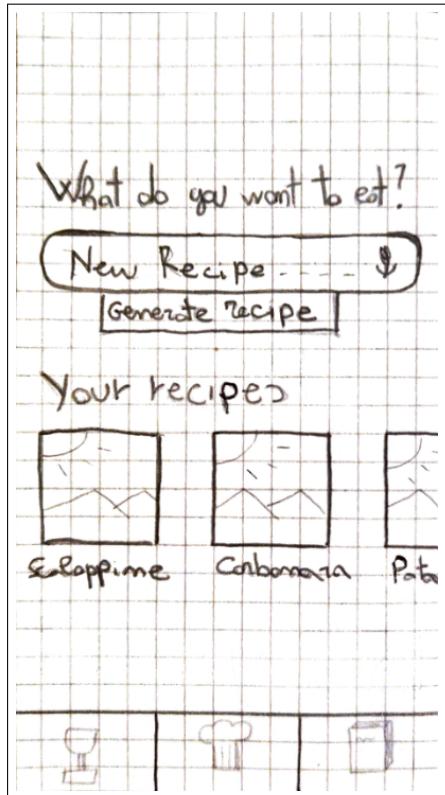


Figure 16: Main screen of the application. From here, the user can choose whether to access their profile, with badges and statistics, or the cooking time menu with recipes to cook. The home icon present on subsequent screens will always lead back to this page.

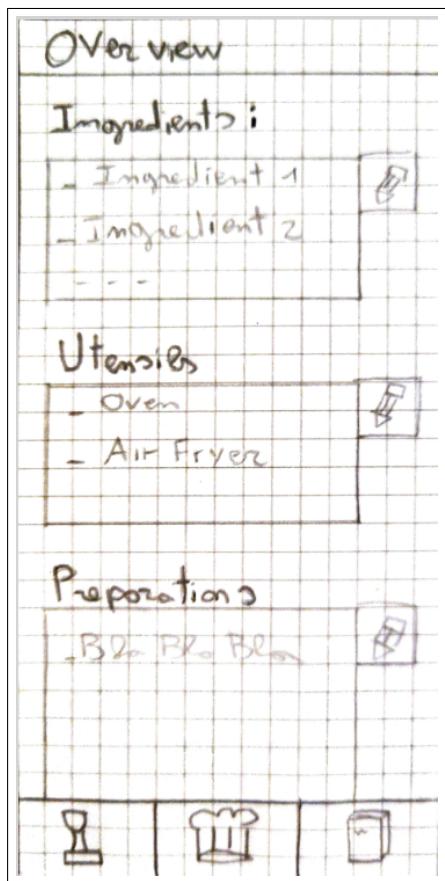


Figure 17: When the user generates a new recipe then he sees this screen that is an overview of the recipe. Here the user can modify the steps of the recipe, modify the ingredients and the utensil used

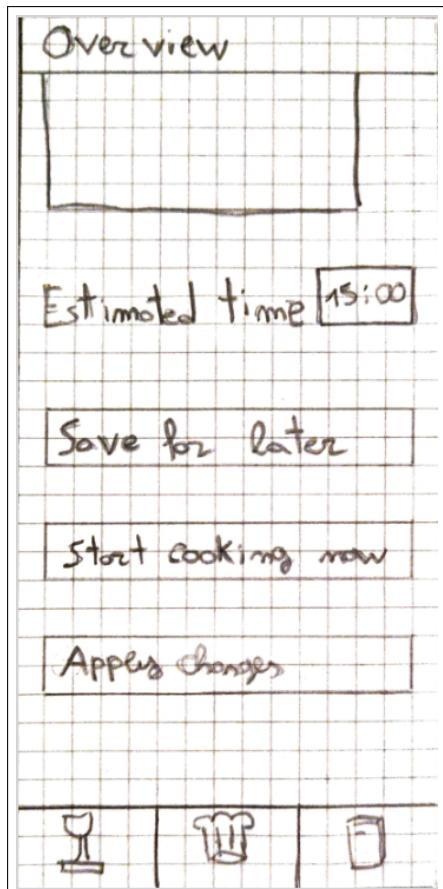


Figure 18: This is part of the overview and the user can access it by scrolling down from the previous screen, here the user can see the estimated time and decide if he wants, to cook the recipe now or save it for later. If he has made any changes he needs to save them with the "Apply changes" button

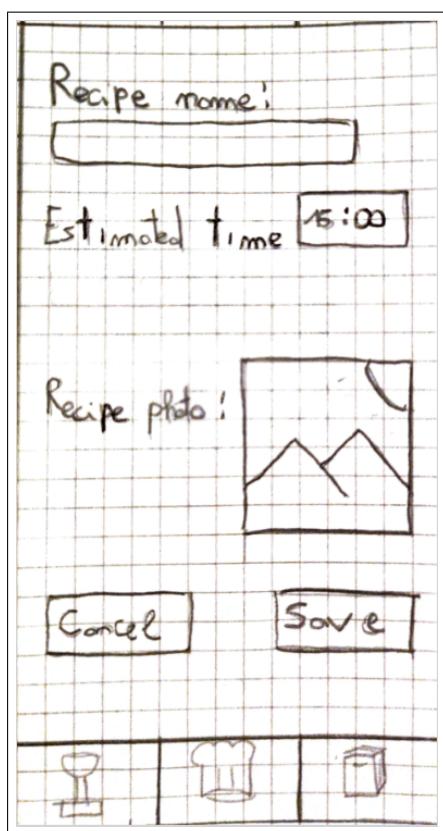


Figure 19: When the user decides to save the recipe, in the previous screen, it is showed this screen, where he can give a name to the recipe, modify the estimated time and choose a photo for the recipe.

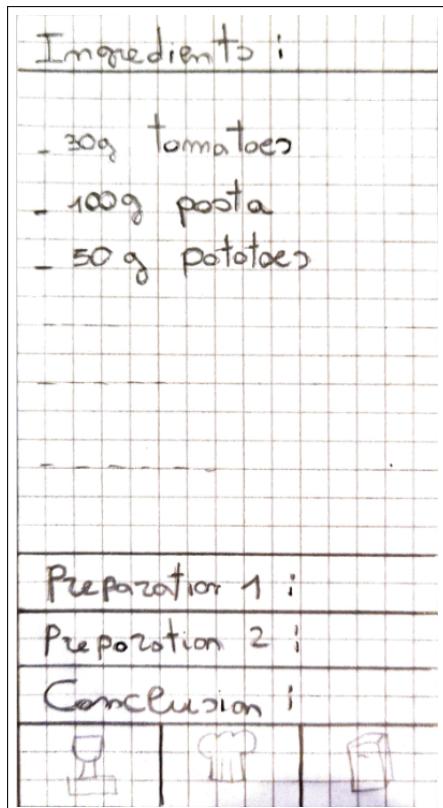


Figure 20: When the user starts the recipe preparation he access this screen. The next Figures are all responsible for giving instructions to the user on how to cook his recipe. We thought about this interface so that the user has everything under control and can access each step instantly by just clicking on it. Clicking on a step expands it while collapsing the others.

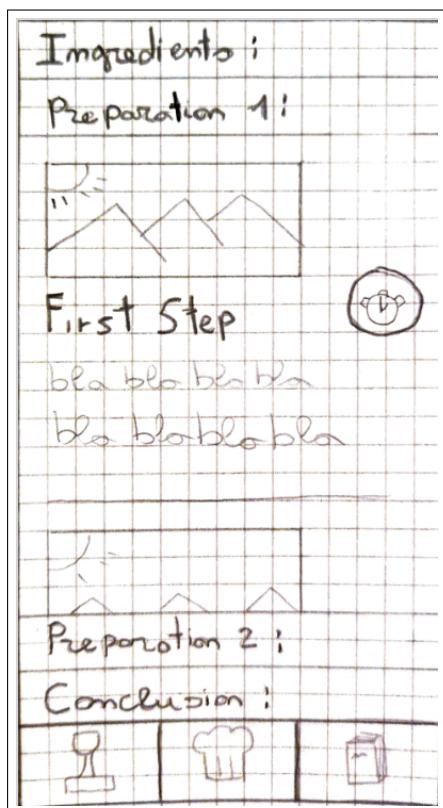


Figure 21: In this screen we can see the first part of a praparation, where the user is ablet to see al the steps for this part and is able to set a timer for them by clicking on the clock icon

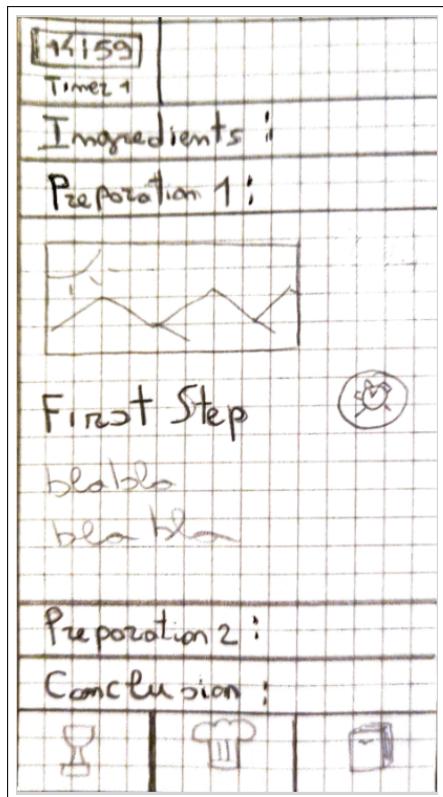


Figure 22: In this screen we can see where the timer set by the user will end up. We decided to put it in this location so that it is always visible, even if the user goes to the next preparation

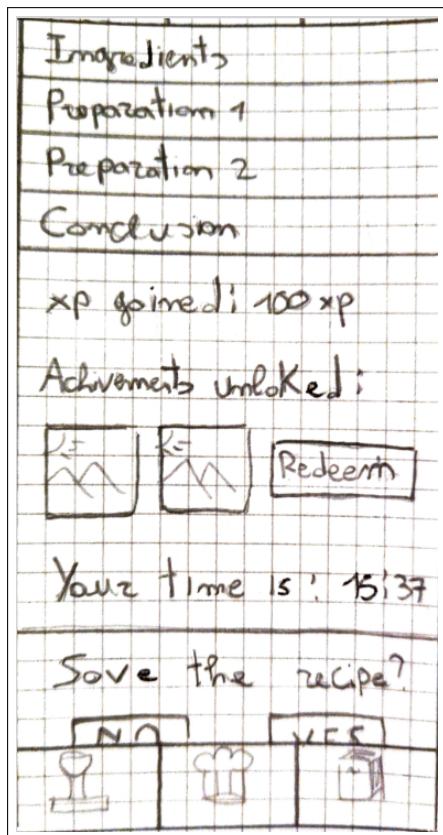


Figure 23: When the user has terminated the recipe he can access the conclusion menu, where he can see some statistics and eventually some badges if he managed to complete the achievements. He can also save the recipe if he hasn't already done it

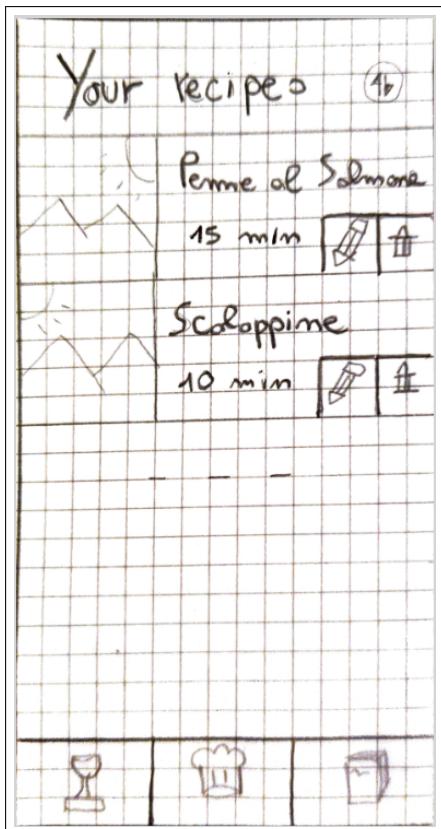


Figure 24: This screen is accessible by clicking on the bottom right icon and here the user can see a list of all his recipes. He can modify them or remove them. The user is also able to start cooking one of this recipes by clicking on the recipe itself

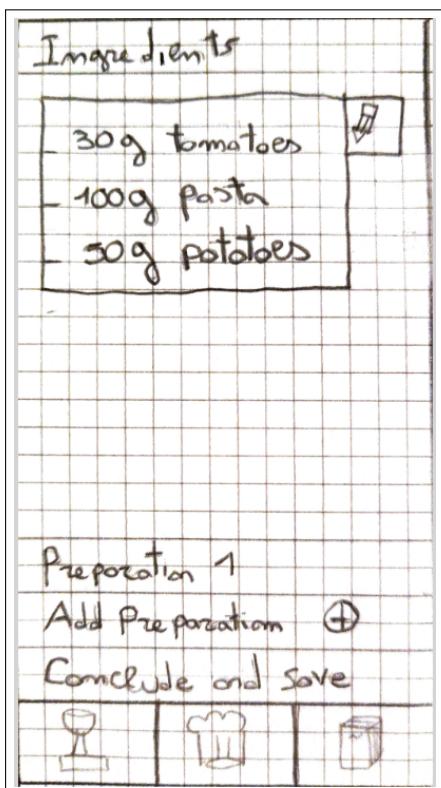


Figure 25: If the user decides to modify one of the recipes he is brought to this screen where he can modify ingredients, add preparations and modify steps (see next screens)

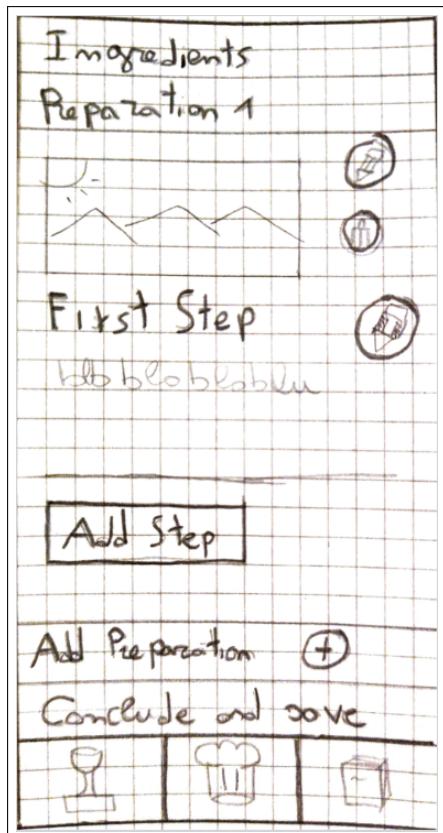


Figure 26: The layout follows the same of the one for cooking the recipe, so that there is consistency across the application, here the user can modify the steps that are present or add new ones

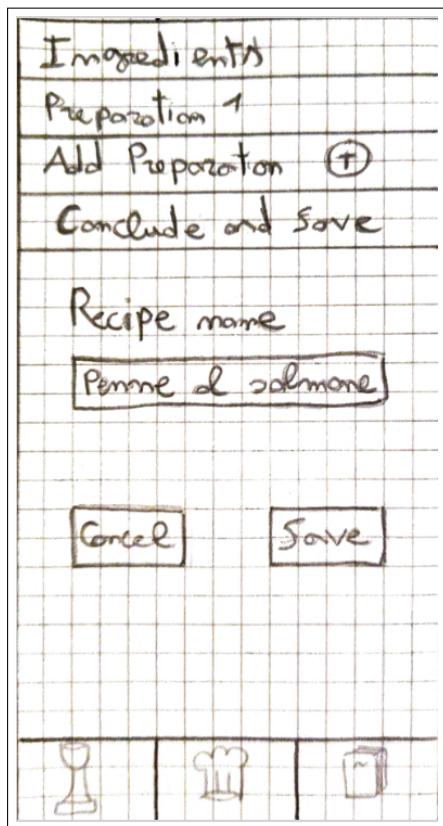


Figure 27: As before there is a conclusion screen where the user is able to save the recipe, and if he desires changing the name

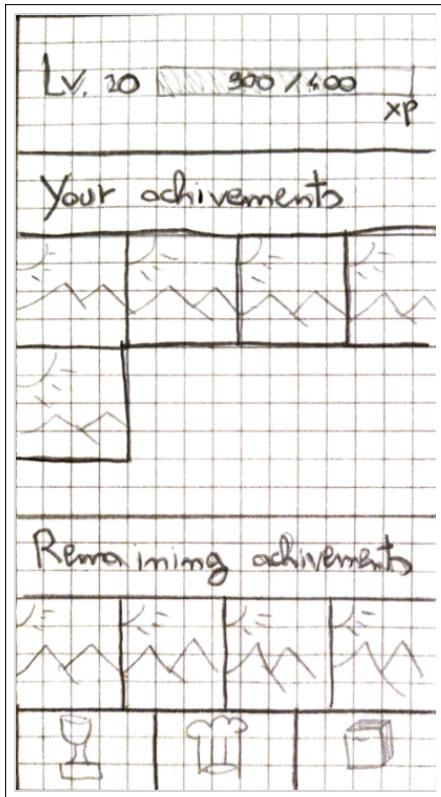


Figure 28: This screens is so that the user can see his badges, and check out the remaining achievements and what to do in order to obtain them

4.2.1 Connection to the tasks

For the **Tablet Prototype** Figures 8, 10, 11, 12, 13 and 14 refer to the simple task, here the user has to follow the recipe that the AI generated for him and can ask for help and instructions.

Figures 6 and 15 refer to the moderate task, they represent the ability for the user to obtain badges if he managed to complete the achievements.

Figure 9 refers to the complex task, here the user can make changes to the steps and the ingredients, by adding something that he likes and removing something he dislikes or cannot eat.

For the **Smartphone Prototype** Figures 20 to 22 refer to the simple task, here the user has to follow the recipe that the AI generated for him we couldn't implement an assistant as for the tablet prototype because of the space restrictions of the smartphone.

Figures 23 and 28 refer to the moderate task, they represent the ability for the user to obtain badges if he managed to complete the achievements.

Figures 17 to 19 and 25 to 27 refer to the complex task in this screen the user is able to modify each part of the recipe to tailor it to his likings.

4.2.2 Connection to the storyboard

In every prototype, the user is able to ask the AI for a custom-generated recipe, as shown in the storyboard where the character asks for an "Amatriciana" and then follows the recipe suggested by the application. Additionally, in both prototypes, it is possible to replace ingredients that the user does not want for any reason.

4.2.3 Flow of screens

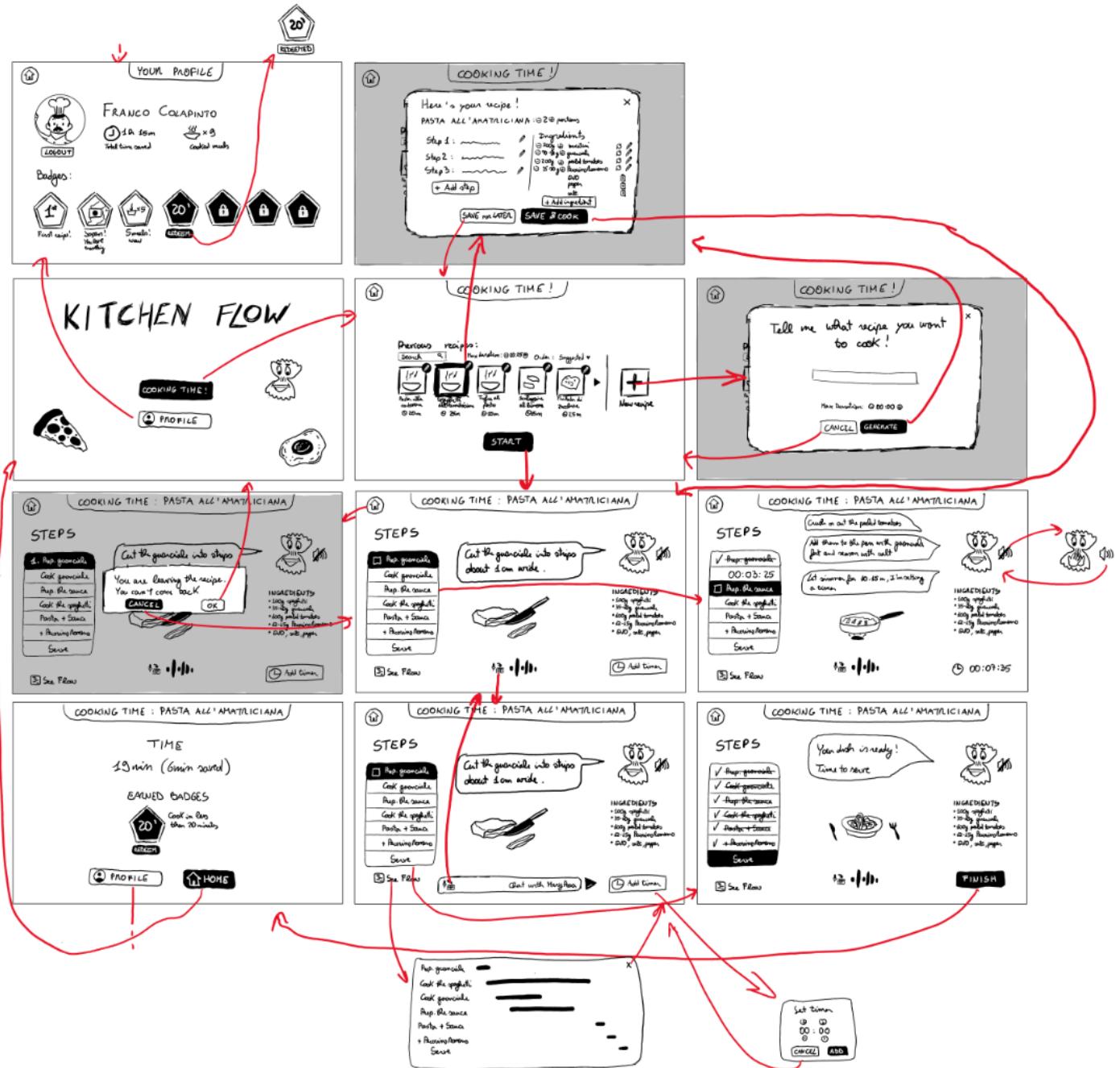


Figure 29: Flow of screens of the tablet



Figure 30: Flow of screens of the smartphone

4.3 Heuristic Evaluations

4.3.1 Preparation and execution

As a group, we prepared the paper prototypes for both devices including various popups that are not available in the flow screens. During the lab hours, we met with students from other groups to conduct the evaluations. Since Samuele and Alessandro had worked on the smartphone prototype, while Vincenzo and Emanuele focused on the tablet prototype, each group presented their respective prototype for the evaluations.

For each evaluation, one group member explained the functionality of the prototype, while another acted as the "computer". We then switched roles for the next evaluation.

In every evaluation, we provided a comprehensive description of our domain and clarified which tasks users were expected to complete through the prototype. Depending on the evaluator, some tried all the features quickly, while others took a more detailed approach, carefully reviewing each function to ensure they identified all relevant heuristics before moving on to the next one.

The evaluators asked many questions to ensure they fully understood the features and processes of both prototypes, which helped improve the evaluation process. We found the feedback valuable, as it gave us useful insights into the usability and potential improvements for both the smartphone and tablet versions of our prototype.

4.3.2 Summary of evaluations

For the **smartphone**, the main issues identified by the evaluators are largely a result of the device's limited form factor. One key problem is the absence of a back button, which forces users to rely on the tap bar for navigation. This lack of a dedicated back option makes it harder to move between screens efficiently and freely. Additionally, important time-related information, such as how much time each step in a recipe takes and how much time has passed since starting the recipe, are missing. This creates difficulty in managing time effectively while preparing the recipe.

The evaluators also noted several inconsistencies throughout the prototype. For example, the experience of modifying a recipe differs depending on where the user is making the changes whether from the main recipe page or from the list of saved recipes. This inconsistency can confuse users and disrupt the flow of the app. Furthermore, the button labels are often unclear. Buttons like "Save changes" and "Apply changes" do not provide enough clarity about their specific functions, leaving users uncertain about their actions. Similarly, the "Estimated Time" information is presented inconsistently, adding to the confusion.

Another notable issue is the behavior of popups, there are multiple buttons used to close a popup which is not the best for usability. All of these inconsistencies and unclear elements contribute to a less intuitive and more confusing user experience overall.

For the **tablet** version, several issues were identified by the evaluators, many of which stem from inconsistencies, unclear labels, and confusing interactions.

There's an issue with the audio icon, which is displayed with the opposite label. Additionally, it's unclear how users should proceed to the next step after completing the current task on the cooking page, leaving users uncertain about what to do next.

Some of the button labels are also problematic. The "Ok" and "Cancel" buttons are not self-explanatory, and their functions are unclear to the user, especially in the Cooking time context and in the popups triggered by the home button. Furthermore, the line drawn through completed tasks is redundant, as the icon on the left already indicates task completion.

The badges users earn are also an issue. There is no explanation of what each badge means, making it impossible for users to understand the criteria behind their achievements.

The ingredient quantity picker does not provide a precise value, which creates confusion when adjusting ingredient amounts. Another confusing aspect involves the ability to delete ingredients that have no quantity (like salt), but not those that do, without a clear reason why. Additionally, the two edit buttons for ingredients are not distinguishable, as their icons do not communicate their specific functions.

The timer-related issues are also notable while the interface allows to set timers, the text says "set a timer of 10-15 minutes", which is problematic because the timer should have a precise duration, not an interval. Timers are also inconsistently placed on top of the step name overwriting it.

When a timer finishes, there is no notification to inform the user, leaving them unaware of when their task is complete. Once a timer is set, there is no option to delete or modify it, which adds another layer of frustration for users.

The microphone remains always on, and there's no option to mute it without opening the keyboard.

Additionally, some buttons have an icon on the left, while others do not, such as the "Cooking time" and "Profile" buttons, leading to inconsistency across the app. Users also have no way to remove recipes they no longer want to replicate, making it difficult to manage their recipe list.

The evaluations are all based on Nielsen's ten heuristics and Nielsen's severity ratings:

Nielsen's ten heuristics

HID	Heuristic Title
H1	Visibility of system status
H2	Match between system and the real world
H3	User control and freedom
H4	Consistency and standards
H5	Error prevention
H6	Recognition rather than recall
H7	Flexibility and efficiency of use
H8	Aesthetic and minimalist design
H9	Help users recognize, diagnose, and recover from errors
H10	Help and documentation
HN	Non-heuristic issue

Nielsen's severity ratings

Rating	Description
0	I don't agree that this is a usability problem at all
1	Cosmetic problem only: need not be fixed unless extra time is available on project
2	Minor usability problem: fixing this should be given low priority
3	Major usability problem: important to fix, so should be given high priority
4	Usability catastrophe: imperative to fix this before product can be released

4.3.3 List of all the evaluations for the smartphone

VID	HID	Description	Where	Severity
1	H3	It is not provided the button to go back if not by clicking on the Home button.	Presentation of the ingredients and the preparation of the chosen recipe	1
2	H3	After saving modifications on a recipe you cannot restore the original one.	Presentation of the ingredients and the preparation of the chosen recipe	3
3	H6	After having modified the recipe it is impossible to see which was the original recipe.	Presentation of the ingredients and the preparation of the chosen recipe	3
4	H5	Unclear buttons "Save for later" and "Apply changes".	Presentation of the ingredients and the preparation of the chosen recipe	2
5	H1	There is no indication of the time spent until that moment.	Preparation of the recipe	3
6	H1	There is no indication of how much time each step requires.	Preparation of the recipe	2
7	H3	Once the preparation is started, it is not possible to abort it.	Preparation of the recipe	2
8	H5	You can exit this page without claiming the badges.	Summary of the finished recipe	3
9	H4	There is "Estimated Time" information as in the preparation page, but this time you can modify it.	Page for saving recipe	2
10	H6	There is no indication of the actual time in order to properly modify the estimated one.	Page for saving recipe	2
11	H4	Different standards for modification of the recipe in the page of presentation and in the page of modification opened from the list of already cooked recipes.	Personalization of an already cooked recipe	3
12	H3	There is no indication of the estimated time nor the possibility to modify it.	Personalization of an already cooked recipe	3
13	H3	There are no settings.	Main page	2
14	H4	Unclear button to undo an action.	All the pop-ups of the application	1

15	H5	The downbar menu goes back to one of the three main pages without saving.	Downbar menu	4
16	H5	There is no confirmation before starting preparation from the "recent recipes" list.	Main page	3
17	H6	There is no presentation of the recipe before starting preparation from the "recent recipes" list.	Main page	2
18	H8	The cross button to close the pop-up is useless and its action is unclear.	All the pop-ups	1
19	H8	The recent recipes list in the main page is useless because the app already provides a section with all the recipes and a filter to order them in a chronological way.	Main page	1
20	H10	There is no guide nor tutorial.	Downbar menu	2
21	H4	Recipes appear differently in the home page compared to other pages.	Recipes in home and other pages	2
22	H2	Certain preparation terms are difficult to understand for users.	Preparation terms	3
23	H4	The "Save for later" page is missing an overview header.	"Save for later" page - overview header	2
24	H4	The timer icon is not understandable or consistent with other pages.	Timer icon	3
25	H7	Timers positioned on top of the page require sliding, which is not user-friendly.	Timers positioned on top of the page	3
26	H4	There is inconsistency between step descriptions and the preparation section.	Steps and preparation section	3
27	H8	A new page is suggested for the conclusion, along with a button to conclude the recipe.	Recipe conclusion	1
28	H3	Clicking a button provides badges without a clear reason or explanation.	Badge acquisition button	2

29	H2	Timers are shown inside a tab rather than on the preparation banner.	Timer display on preparation banner	3
30	H5	When pressing lightly on the timer, no gray pop-up appears with guidance on deleting steps.	Low pressure on the timer	2

4.3.4 List of all the evaluations for the tablet

VID	HID	Description	Where	Severity
1	H4	The selection is made in two steps, while the standards on tablet is a single-click selection	"Cooking time!" selection	2
2	H4	Disable audio icon (with or without slash)	Main page (Cooking time)	3
3	H3	Is not clear how to proceed to the next step when the actual is completed	Main page (Cooking time)	3
4	H4	"Ok" and "Cancel" are unclear labels for the action	Main page (Cooking time), popup shown on home button press	1
5	H8	The line drawn on the text is redundant since the fact that the task is already completed is clear from the icon on the left	Main page (Cooking time)	1
6	H8	The full list of ingredients is needed at the startup, but then is useless information while cooking	Main page (Cooking time)	1
7	H10	The meaning of each badge is not written anywhere, so the user cannot understand how task was completed to obtain it	Profile page	1
8	H3	Ingredients quantity picker must indicate a precise value	Recipe overview	4

9	H2	It is not clear why the user can delete ingredients that have no quantity (e.g., salt), but not the others	Recipe overview, list of ingredients, buttons on the right	2
10	H2	The two "edit" buttons are not distinguishable in their function by the icons themselves	Recipe overview, list of ingredients, buttons on the right	1
11	H4	The text says "set a timer of 10-15 minutes", but it cannot be an interval, since the timer set automatically must have a precise duration	Main page (Cooking time)	4
12	H6	In a single interface, several timers could be present, and the only difference between them is their location	Main page (Cooking time)	2
13	H4	Timers are located in the left bar if set automatically by the app, or in the bottom right corner if required by the user, that is inconsistent	Main page (Cooking time)	1
14	H7	Users can have the necessity of using several timers, but the current interface does not allow adding a custom timer if another one is running	Main page (Cooking time)	2
15	H1	When a timer finishes, there is no notification to the user	Main page (Cooking time)	3
16	H3	Once set, a timer cannot be deleted or modified	Main page (Cooking time)	2
17	HN	The layout with the opened keyboard was not defined	Main page (Cooking time)	2
18	H3	The microphone is always on, but there is no option to mute it without opening the keyboard	Main page (Cooking time)	3
19	H7	Moving the time with only "+" and "-" buttons is difficult	Time pickers (on new recipe and when adding a new timer)	2

20	H4	The picker on the "new recipe" page has only one pair of buttons, while the one on "new timer" interface has two different pairs for minutes and seconds	Time pickers (on new recipe and when adding a new timer)	2
21	H4	Some buttons have an icon on the left, and some others do not (e.g., "Cooking time" and "Profile" buttons on the first page)	All the pages	1
22	H3	Users can have some recipes that they no longer want to replicate: there is no way to remove them	Recipe selection page	1
23	H3	There is no straightforward way to undo the changes made on the current recipe other than the "x" button on the top	Task 3: Edit recipe page	1
24	H3 H5	There is no confirmation message after pressing the "x" button	Task 3: Editing a recipe	2
25	H7	Implementing possible smart gestures could improve ease of navigation throughout the app	Task 1 + Task 3: Cooking phase page / The whole app	1

4.4 Device selection

At the end we decided to choose the **Tablet** prototype because it had a fewer number of violations and there were some in common between the two evaluators. Another important reason is that we were limited by the smartphone dimensions quite a bit in solving the heuristic violations; whereas by choosing the tablet we can solve almost all of them and still follow the original concept of the application, without any major redesign. We also think that having a larger screen can help the user to see better the instructions while cooking. In the smartphone prototype we were not able to insert a virtual assistant that helped you during your recipe preparation, in the tablet this is present and can create a more immersive experience and give useful responses to inexperienced cooks questions.

5 Medium to High-Fidelity Prototype

5.1 Tools and screens

We used Figma to make the Medium fidelity prototypes. We chose these screens as they were central to most of the level 3-4 heuristic violations and are a core part of the user experience with the application since most of the interaction are done on this screens. In the **first screen** (Figure: 31) there is the interface for choosing the recipe, where the user can edit (complex task) or delete a recipe. The user is also able to apply filters in order to find the recipe he wants, he can set a maximum duration, order the recipes, or search for the recipe directly.

In the **second screen** (Figure: 32) there is the core part of the application, that guides the user in the preparation of the recipe that he choose (simple task). Here the user can follow the different steps and see how the steps overlap for a better multitask experience. [Here is the figma interactive prototype.](#)

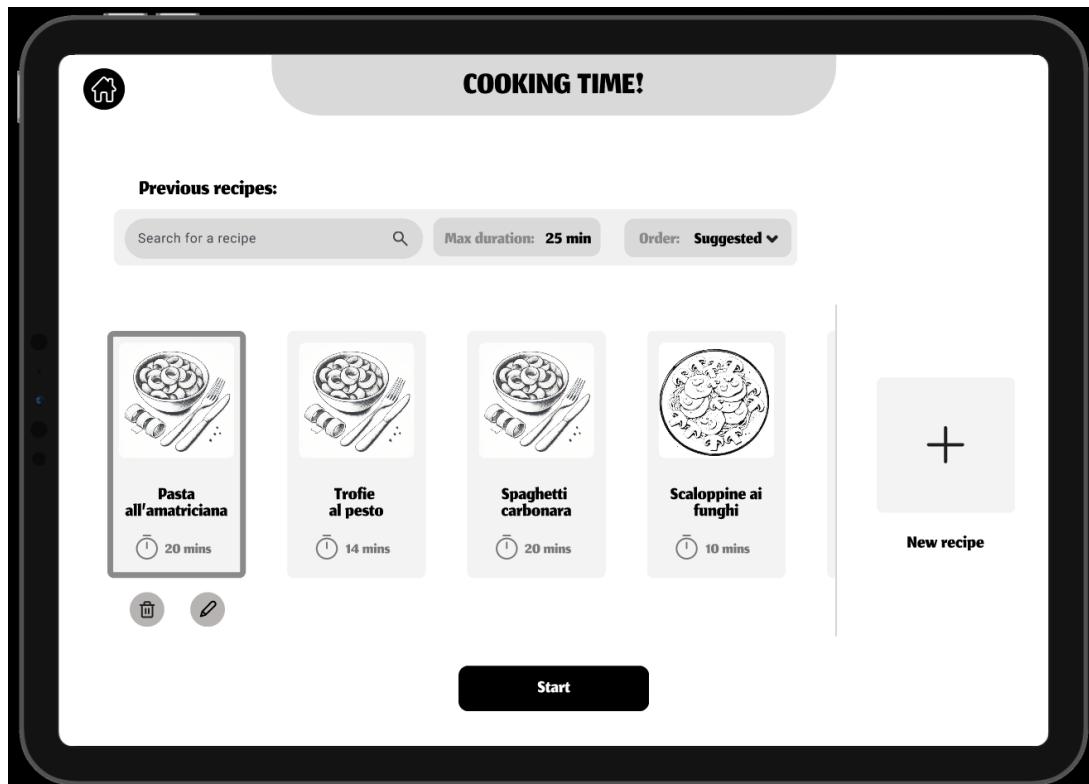


Figure 31: Choosing the recipe

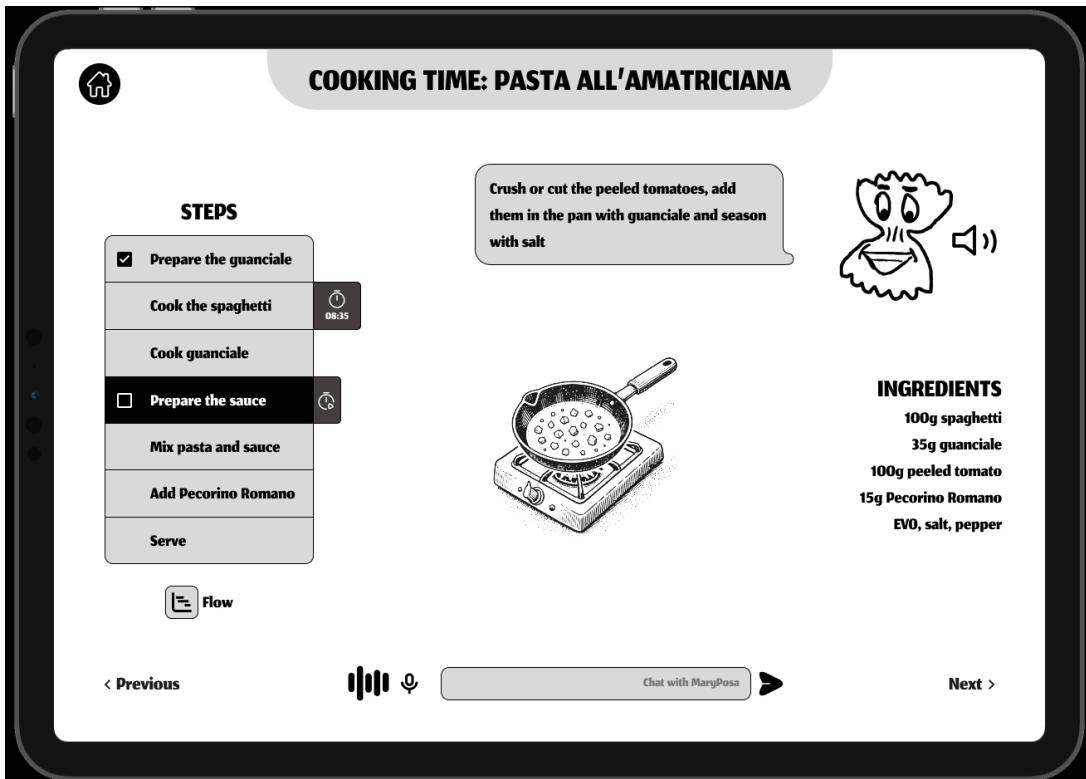


Figure 32: Cooking the recipe

5.2 Fixed Violations with severity 3 and 4

We managed to fix almost every evaluation with a severity of 3 and 4 in the Figma prototype, except for evaluation 15 because we were limited by the Figma workspace so we made plan to solve it in the Hi-Fi prototype. A lot of lower severity evaluations were fixed too

Here is how we solved the rest:

VID	Description	How we fixed it	Severity
2	Disable audio icon (with or without slash)	We changed the audio symbol near Maryposa to the correct one and made it more clear with an updated Maryposa (see Figma interactive prototype)	3
3	Is not clear how to proceed to the next step when the actual is completed	We added "Next" and "Previous" buttons	3
8	Ingredients quantity picker must indicate a precise value	Now the ingredients indicate a precise value (see Figma interactive prototype)	4

11	The text says "set a timer of 10-15 minutes", but it cannot be an interval, since the timer set automatically must have a precise duration	Maryposa will now give more clear instruction to the user to cause less confusion	4
18	The microphone is always on, but there is no option to mute it without opening the keyboard	Now a user can see both the chat box and the microphone mute/un-mute button	3

5.3 Non-admitted violations and their justifications

Every other evaluation has been fixed in the Mid-Fi or in the Hi-Fi prototype, here is a list of the others that were not solved and discarded.

VID	Description	Why it was not admitted	Severity
1	The selection is made in two steps, while the standards on tablet is a single-click selection	The additional "Start" button is a deliberate choice to enhance usability in certain scenarios. It provides a confirmation step, which helps prevent accidental actions that could occur due to user errors or external factors, such as water on the display. Removing the button could result in unintended recipe starts.	2
6	The full list of ingredients is needed at the startup, but then is useless information while cooking	The list of ingredients is intentionally kept visible throughout the recipe steps. It is useful for the user to have quick access to this information at every step, as it helps ensure that all required ingredients are available and can be checked while cooking. Removing it could reduce convenience and increase the risk of missing an ingredient in a further step.	1
14	User-defined timers is unique	The design intentionally supports a single timer for each step, as every step is atomic and self-contained. Allowing multiple timers could complicate the interface and confuse the user. The single-timer approach aligns with the goal of guiding the user through one focused action at a time.	2
17	The layout with the opened keyboard was not defined	The behavior of the screen when the keyboard is opened is managed by the operating system and does not require manual handling.	2

5.4 Moved features

We didn't find the need to move any feature from the smartphone prototype to the one for the tablet.

5.5 Plans for High-Fidelity Prototype

Here are the only two evaluations that we didn't solve in the Mid-Fi because they were referring to other screens so we made plan in order to fix them in the Hi-Fi:

VID	Description	Resolution	Severity
7	The meaning of each badge is not written anywhere, so the user cannot understand how the task was completed to obtain it	We will implement a pop-up that appears when the user taps on a badge. If the badge has already been unlocked, the pop-up will display information about how the badge was achieved and the date it was unlocked. For badges that are still locked, the pop-up will provide a hint to guide the user on what actions are required to unlock it.	1
21	Some buttons have an icon on the left, and some others do not (e.g., "Cooking time" and "Profile" buttons on the first page)	We will remove the few icons next to the buttons to ensure consistency across the app. This will result in a uniform appearance for all buttons without icons, simplifying the interface and maintaining visual consistency. Adding icons to every button would complicate the design unnecessarily, so this approach ensures a clean and cohesive user experience across all pages.	1

6 High-Fidelity Prototype

6.1 Tools and libraries

In this project, various tools and libraries were utilized to facilitate both front-end and back-end development. Below are the key tools and libraries used and why they were selected.

6.1.1 Back-end

The back-end of the application is built with Node.js, utilizing several libraries for routing, server management, and database interaction:

- **express:** A fast, minimal web framework for Node.js that simplifies routing and middleware integration, making it easier to handle HTTP requests and responses;
- **cors:** Used for handling Cross-Origin Resource Sharing (CORS), allowing the front-end to communicate with the backend when they are hosted on different domains or ports;

- **http-status-codes**: A utility for managing HTTP status codes in a clean and readable manner, improving the clarity and maintainability of the back-end code;
- **sqlite3**: A lightweight database solution used to store app data.

6.1.2 Frontend

The front-end of the application is built using React, with a combination of libraries to manage user interaction, and styling:

- **react-speech-recognition**: A speech recognition library for React, enabling voice-based interaction within the app;
- **react-tooltip**: A library for displaying tooltips, improving the user experience by providing additional context when users hover over certain elements;
- **react-modal**: A library used to create modals, which are crucial for displaying popups for user interactions or notifications;
- **react-icons**: Provides a set of customizable icons for React applications, enhancing the visual appeal and usability of the interface;
- **sass**: A CSS preprocessor that allows for more dynamic and maintainable stylesheets with features like variables, mixins, and nested rules;
- **@fortawesome/react-fontawesome**, **@fortawesome/fontawesome-svg-core**, and **@fortawesome/free-solid-svg-icons**: These libraries provide access to Font Awesome icons, which were used to enhance the UI with widely recognized and visually appealing icons.

6.2 GitHub Repository

[Here is the GitHub code repository.](#)

6.3 Design Choices

We decided to maintain what we had done in the medium-fidelity prototype created in Figma. Specifically, we defined a color palette and chose to adhere to it throughout the prototype. This decision is reflected, for example, in the consistent use of colors for the primary and secondary buttons, ensuring visual consistency through the entire application.

6.4 Significant screens

These screens are significant to us because represent the main part of the application and the main task that the user is able to complete using our app.

Figure 34 and 35 represent the user ability to choose a recipe of his likings and modify it according to his preferences which was the complex task.

In the **Figure 36** we can see the various step that the user has to complete in order to prepare the recipe. If the user has doubts he can ask question to the assistant using

the chat or voice commands. This is the screen where we think the user will spend the most amount of time on the application.

Figure 37 and 38 represent the moderate task, the ability of the user to collect badges if he manages to complete achievements.

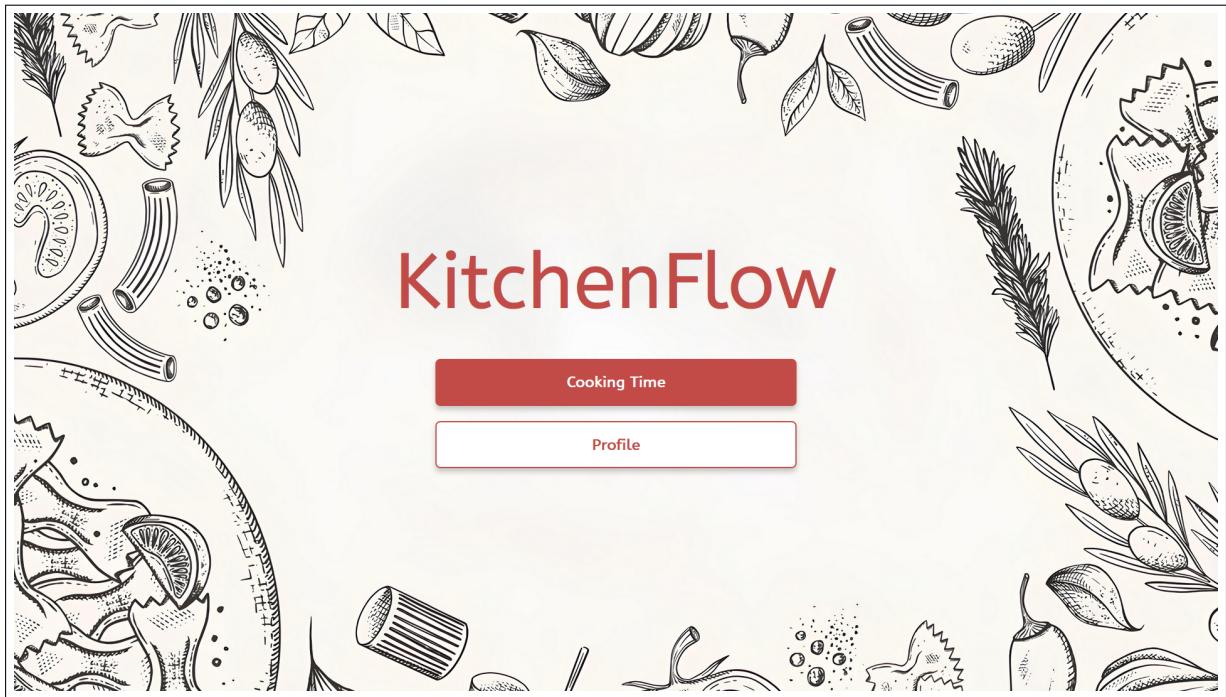


Figure 33: Home screen

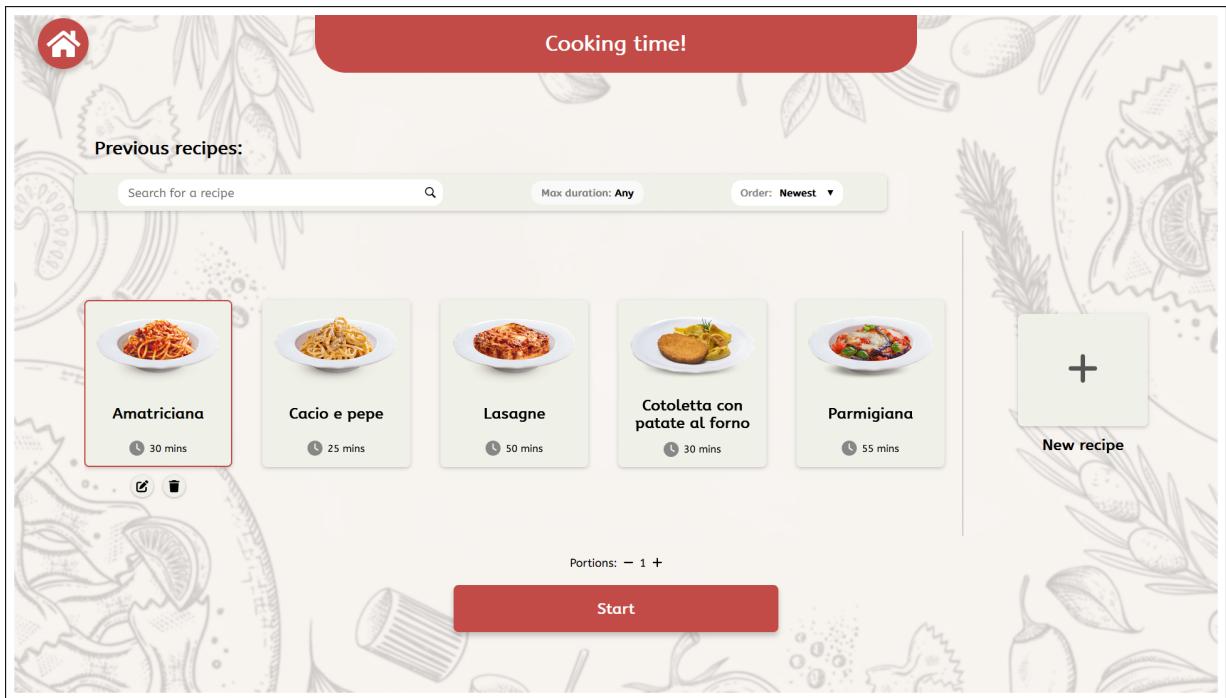


Figure 34: Choosing the recipe

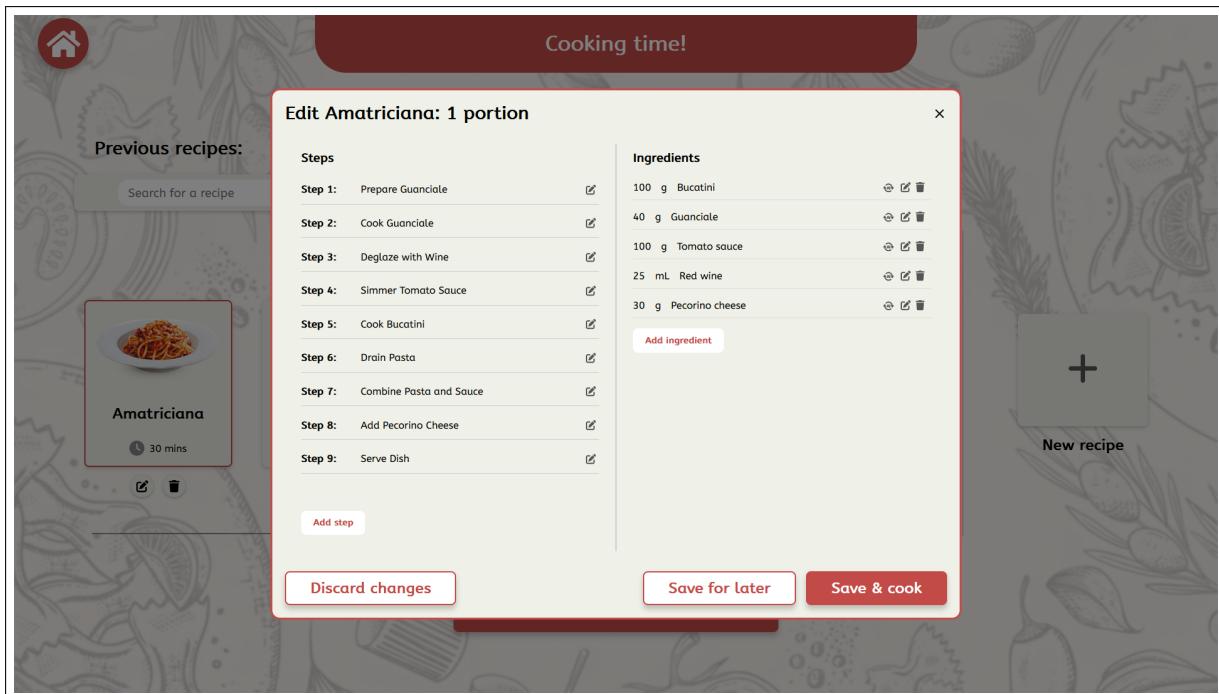


Figure 35: Editing the recipe

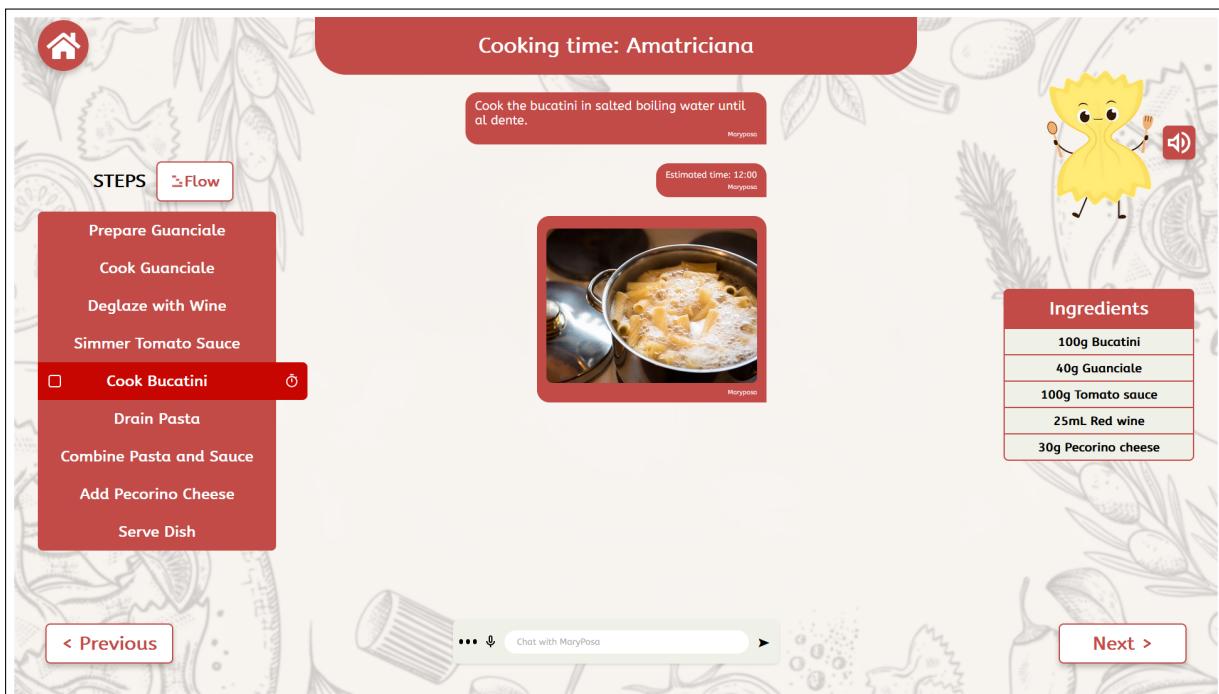


Figure 36: Cooking the recipe

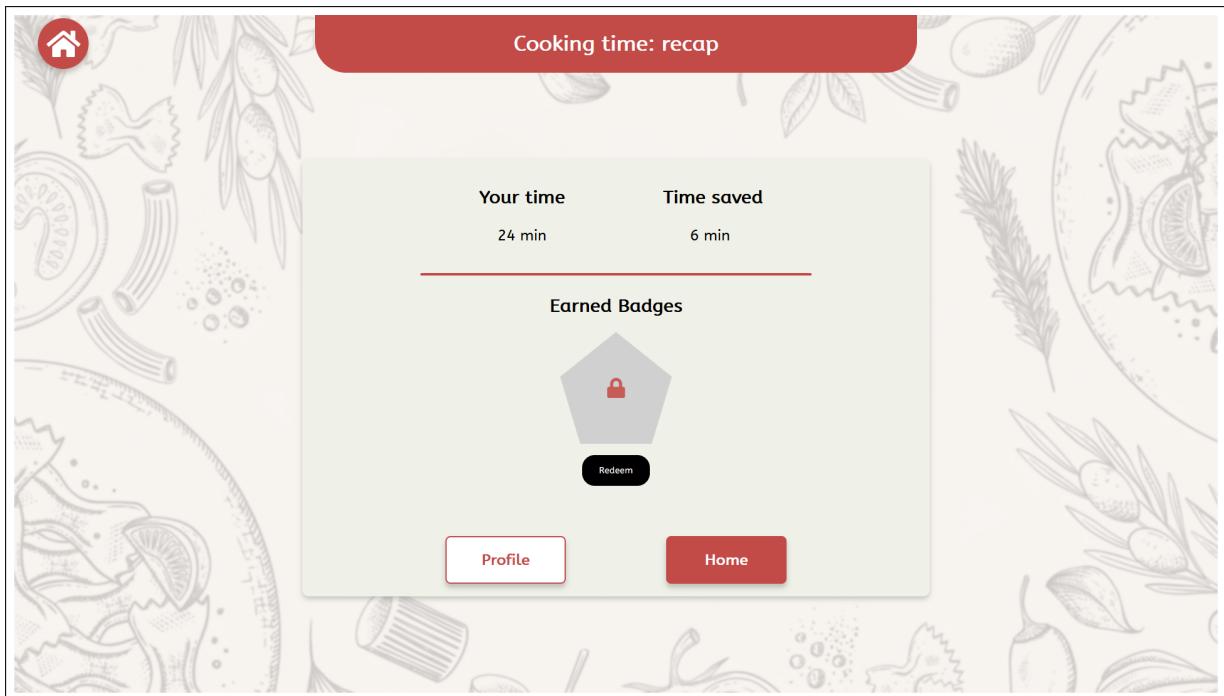


Figure 37: Finished cooking recap

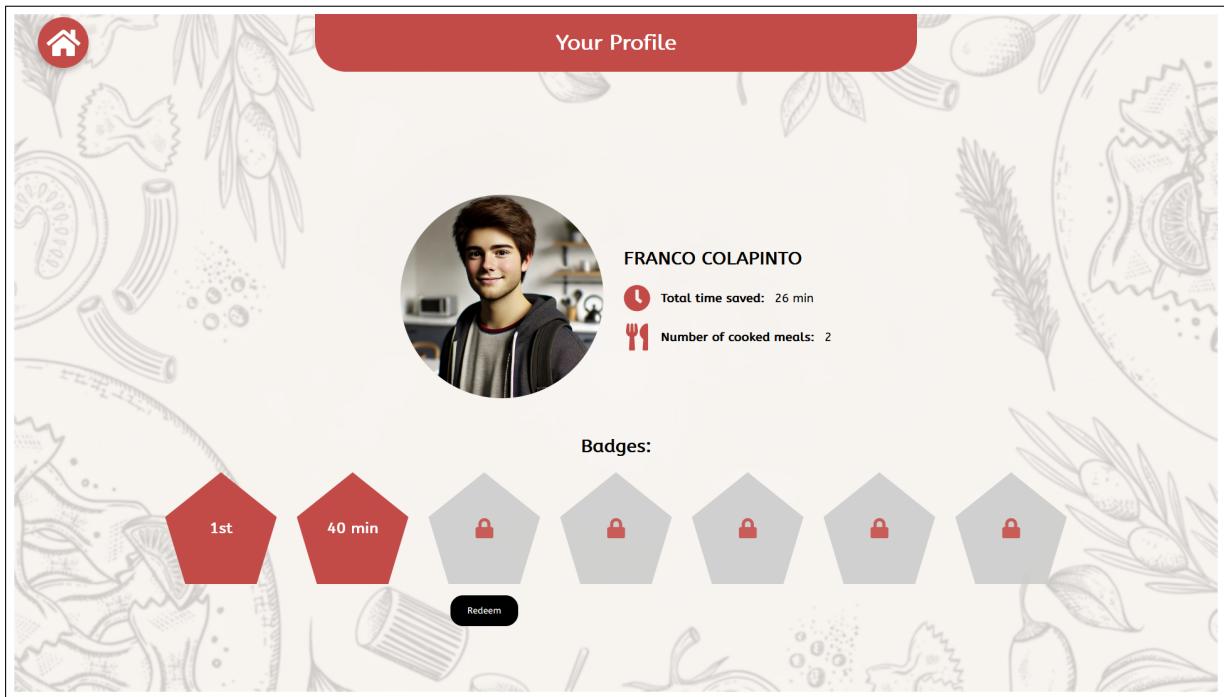


Figure 38: Profile with obtained and unobtain badges

6.5 Fixed violations

We removed any icon from the buttons, in order to achieve a more uniform UI throughout the application. For the badges, we added a popup that appears when clicking on one. If the badge was obtained, the popup tells you what you did to get it (Figure 39); otherwise, if it is still locked, it provides a hint on how to obtain it (Figure 40).

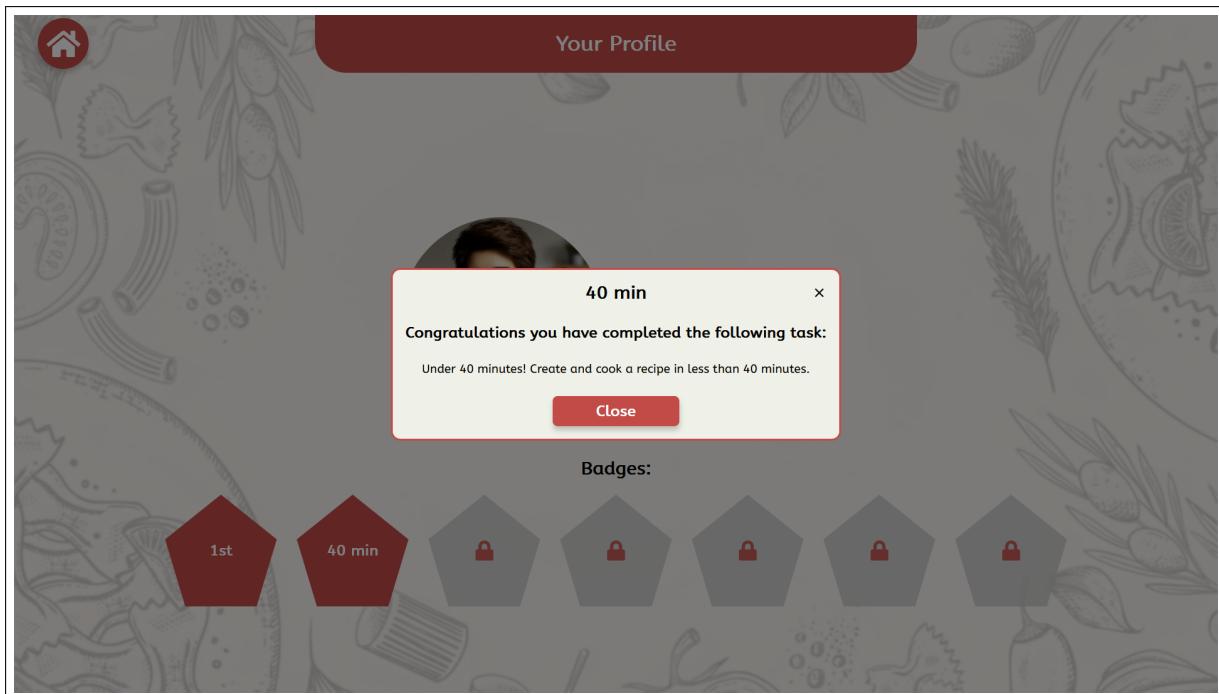


Figure 39: Obtained badge popup

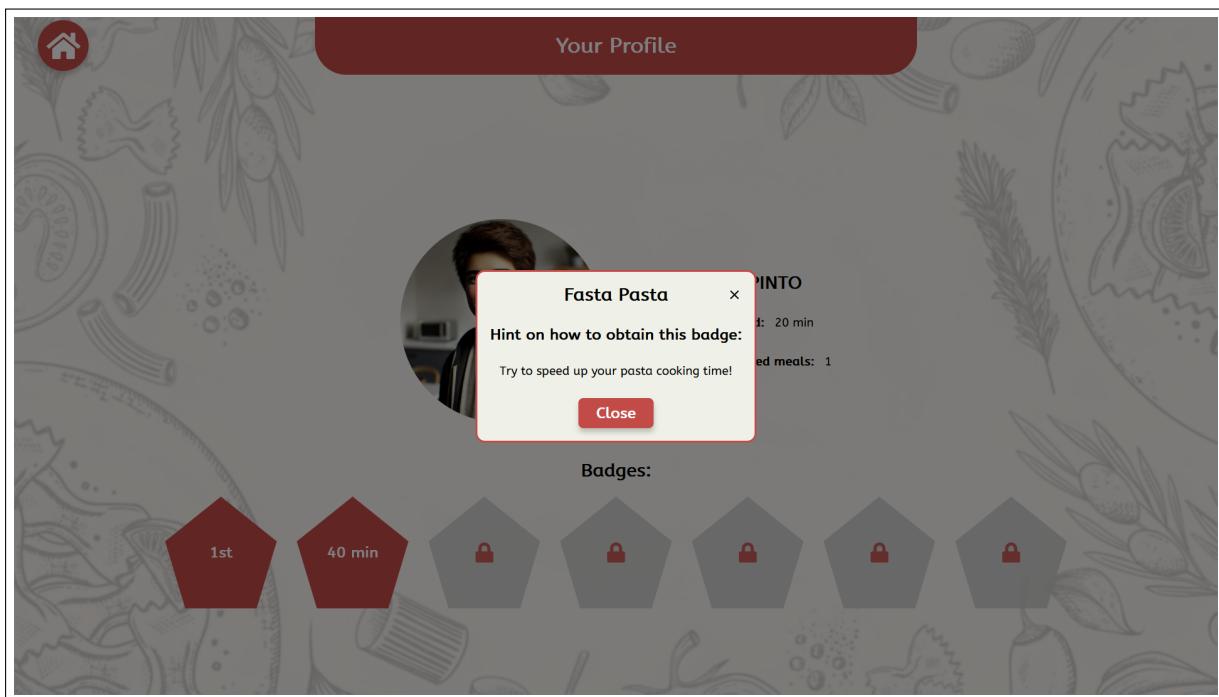


Figure 40: Hint popup for unobtain badge

6.6 Standards and Constraints

The prototype was developed while considering key standards and constraints specific to tablet devices:

- **Screen resolution and dimensions:** The UI was optimized for medium and

large screens typical of tablets, employing a responsive layout to ensure clear and balanced visuals;

- **Touch-friendly design:** The interface is touch-friendly, with buttons and icons designed to ensure precision and ease of use, even for users with larger fingers;
- **Voice assistant compatibility:** The integration of the voice assistant was designed according to general voice recognition guidelines, although certain functionalities may vary depending on the operating system support (e.g., Android or iOS).

6.7 Limitations

- **Hard-coded data:** Some data, such as recipes and badge information, are pre-stored in the prototype to simulate functionality, even though the database is fully functional. The AI capabilities of the application are hard-coded, including the recipes that can be created and the responses to user questions. Additionally, the answers are limited to a small set of questions. The badge that the user earns is also hard-coded and is only awarded after completing the Amatriciana recipe. The statistics in the profile are also hard-coded, with the time saved being static and not recalculated each time.
- **Voice assistant limitations:** The voice assistant functionality includes predefined responses for specific interactions. It lacks full dynamic understanding and contextual adaptation;
- **Partial compatibility:** The app was tested on multiple tablet devices, but it may not function as intended on all devices with different operating systems or hardware specifications.

7 Usability Testing

7.1 Preparation and run

We conducted four usability testing, but due to logistical constraints, not all interviews could be conducted in person. In each session, the observer participated remotely, while the facilitator was present with the participant in person. [Here is the PDF document for the script.](#)

We communicated using Discord, enabling video and screen-sharing features so the observer could follow the participant's actions in real time.

7.1.1 Participants

All participants are aged between 20 and 30 years old. They have basic cooking knowledge and no prior experience with other cooking apps. However, they are familiar with using voice interaction and have experience using a tablet. [Here is the link for the modules of consent.](#) [Here is the link for the pretest questionaries.](#)

- **Gabriele:** A 23-year-old university student majoring in Psychology at the Università di Parma. He has been living alone for one year and started cooking when he moved to Parma. He is a good candidate because he has limited kitchen experience

and a lack of free time. Additionally, his background in Psychology can provide valuable insights during our usability testing. The evaluation was conducted by Vincenzo as the facilitator and Samuele as the observer;

- **Marco:** A 22 years old university student majoring in DAMS (Disciplines of Arts, Music, and Performing Arts) in Torino. He is passionate about cooking, but lacks a bit of experience, practical skills and motivation. We thought he could be a great candidate also because of his field of study, which could provide valuable insights into our design. The evaluation was conducted by Samuele as the facilitator and Alessandro as the observer;
- **Francesco:** A master's student in Computer Engineering at the Politecnico di Torino. He has been living alone for three years. Francesco is an excellent candidate for usability testing because of his strong technical background, which allows him to provide insights into both the user interface design and functionality from a developer's perspective. Additionally, he enjoys cooking, although he doesn't have much time for it. The evaluation was conducted by Emanuele as the facilitator and Samuele as the observer.
- **Luca** is a 22-year-old guy who lives with his parents because he works. However, he often cooks for himself when his parents are not around, also to follow his diet, which leads him to eat different things

7.1.2 Tasks

Here is the set of tasks that the participants were asked to complete:

- **T1:** Choose the newest recipe available with a duration that is less than 40 minutes.
- **T2:** Edit the recipe you just selected, changing bucatini with something suggested by the AI and increasing its quantity.
- **T3:** Begin preparing the recipe.
- **T4:** Check the distribution of the steps over the preparation time.
- **T5:** Set a timer of 30 seconds for the second step and stop it when it reaches the end.
- **T6:** Ask the assistant for more precise instructions for the current step, using text chat.
- **T7:** Set the first 2 steps as completed.
- **T8:** Ask the assistant for info on the next step, using vocal interaction.
- **T9:** Complete the recipe and claim the obtained reward.
- **T10:** Check the statistics and the remaining rewards of the current user.
- **T11:** Look for “Carbonara” and if it does not exist, ask the AI to create it.
- **T12:** Add some ingredients and steps, modify some existing steps, and discard the changes at the end.

Explanation for asking this tasks

Task T1: This task is designed to have the user interact with various filters to select a recipe. It helps us determine whether this part of the application is intuitive and does not cause confusion.

Task T2: This task aims to clarify whether users understand the difference between a regular edit and one performed by the AI. It helps us evaluate whether our buttons are clear and intuitive.

Task T4: This task is designed to determine if users understand how to follow a recipe and whether the information conveyed by the flow diagram is clear.

Task T5: This task evaluates whether users can correctly interact with the timers, which were a weak point in the low-fidelity prototype.

Tasks T6 and T8: These tasks assess whether users can successfully interact with the assistant and identify any uncertainties regarding its functionality.

Tasks T3, T7, and partially T9: These tasks primarily serve to progress the evaluation process.

Task T10: This task is intended to assess whether the profile page is clear, whether the information presented is sufficient, and whether the badges are functional within the application and their acquisition process is well-understood.

Tasks T11 and T12: These tasks allow users to modify and interact with a recipe, highlighting potential issues that may arise during editing operations.

7.1.3 Metrics

For each task we have a success criteria that establishes if we can consider the task completed or not. Then we established a series of critical and not critical error that tell us if the user was not able to complete the task (critical) or it was able to do it but not in the best way possible (non critical).

Task T1:

Success criteria:

- The participant correctly selects “Amatriciana” after applying the “Newest” filter and correctly setting max duration to 40.

Critical errors:

- The recipe has a duration longer than 40 minutes.
- The selected recipe isn’t the newest.
- Order filter not set to newest.

Non-critical errors:

- Max durations set to a value higher than 40 minutes (including Any).

Task T2:

Success criteria:

- The participant correctly clicks the AI button and increases the quantity.

Critical errors:

- Edit bucatini manually.

Non-critical errors:

- Quantity decreased.

Task T3:

Success criteria:

- The participant clicks on “Save & Cook” or the participant clicks on “Save for later” and “Start”.

Critical errors:

- Clicks discard changes.

Non-critical errors:

- Closes the recipe edit popup and then starts the cooking process from the other page.

Task T4:

Success criteria:

- The participant correctly opens the “Flow” popup.

Critical errors:

- Doesn’t open the “Flow” popup.

Non-critical errors:

- None.

Task T5:

Success criteria:

- The participant opens the correct timer, selects the right time, starts the timer, and mutes it when it rings.

Critical errors:

- Wrongly sets the timer.
- Doesn’t stop or mute the timer.

Non-critical errors:

- Sets the timer for another step.

Task T6:

Success criteria:

- The participant writes the question and sends it to Maryposa.

Critical errors:

- Doesn't ask for more information.

Non-critical errors:

- Asks for information on other steps.

Task T7:

Success criteria:

- The participant correctly checks the 2 checkboxes.

Critical errors:

- Doesn't set all the first 2 steps to completed.

Non-critical errors:

- Sets as completed also some other steps.

Task T8:

Success criteria:

- The participant tells the question with vocal interaction to Maryposa.

Critical errors:

- Doesn't ask for more information.

Non-critical errors:

- Asks for information on other steps.

Task T9:

Success criteria:

- The participant clicks on Finish and redeems the badges.

Critical errors:

- Doesn't redeem the badge.
- Comes back to the home page before clicking "Finish".

Non-critical errors:

- Redeems the badge from the profile page.

Task T10:

Success criteria:

- The participant navigates to the profile page and clicks on a badge.

Critical errors:

- Doesn't click on a badge.

Non-critical errors:

- None.

Task T11:

Success criteria:

- The participant looks for “Carbonara”, then clicks on “New recipe” and successfully gets the “carbonara” recipe.

Critical errors:

- Wrong value in duration filter field (different from “Any”).
- Doesn't use the search bar to look for “Carbonara”.

Non-critical errors:

- None.

Task T12:

Success criteria:

- The participant performs all the required changes and clicks on “Discard” changes.

Critical errors:

- Saves the recipe.
- Closes the recipe edit popup.

Non-critical errors:

- None.

In addition to the task-specific success criteria, we also utilized the **Error-free rate** and **Subjective measures on think-aloud tasks**. The latter was particularly valuable, as it allowed us to gain deeper insights into participants' thought processes. When participants felt at ease, the think-aloud method provided a clear understanding of what could be improved and the rationale behind their actions.

Finally, at the end of the evaluation, we conducted a **debriefing session**, where participants had the opportunity to express their opinions one more time. They highlighted both the positives and negatives of the application. To conclude the session, participants completed a **System Usability Scale (SUS) questionnaire**, which enabled us to convert these subjective measures into a quantifiable scale.

7.2 Results

7.2.1 Summary of results and findings

We conducted usability testing across four participants. Each participant completed a series of tasks, providing both quantitative and qualitative feedback. Below is a summary of key findings, including successful tasks and pain points:

Quantitative feedback

In the 'Critical errors' column, the number corresponds to whether there was an error or not: '0' means no error, and '1' means there was an error. The letter represents the name of the evaluator.

Task	Critical errors	Non-Critical errors	Critical error free rate	Non-Critical error free rate
T1	0V - 0A - 0S - 0E	1V - 1A - 0S - 0E	100%	50%
T2	1V - 0A - 0S - 0E	0V - 0A - 0S - 0E	75%	100%
T3	0V - 0A - 0S - 0E	0V - 0A - 0S - 0E	100%	100%
T4	0V - 0A - 0S - 0E	0V - 1A - 0S - 0E	100%	75%
T5	0V - 0A - 0S - 0E	0V - 0A - 0S - 0E	100%	100%
T6	0V - 0A - 0S - 0E	0V - 0A - 0S - 0E	100%	100%
T7	0V - 0A - 0S - 0E	0V - 0A - 0S - 0E	100%	100%
T8	0V - 0A - 0S - 0E	0V - 0A - 0S - 0E	100%	100%
T9	0V - 0A - 0S - 0E	0V - 0A - 0S - 0E	100%	100%
T10	1V - 1A - 0S - 0E	0V - 0A - 0S - 0E	50%	100%
T11	0V - 0A - 0S - 0E	0V - 1A - 0S - 0E	100%	75%
T12	0V - 0A - 0S - 0E	0V - 0A - 0S - 0E	100%	100%

Table 8: Critical and Non-Critical Errors and Error-Free Rates for Each Task

From this table, we can see that participants were generally able to complete all the tasks without too many problems. The only issues they encountered were ignoring the duration filters when searching for recipes, as they focused solely on the order filter. Additionally, many participants did not understand that they could click on a badge and only accessed the profile page.

Sus Score:

- Marco: 90
- Gabriele: 95
- Luca: 90
- Francesco: 92.5

Sus Score average: 91.9

[Here is the link for the SUS Questionnaires PDF's](#)

Qualitative feedback

Overall, the participants found the application easy to use and intuitive, as reflected in the error-free rate, with most tasks being completed without issues. The main complaints were about the size of the icons, which some found too small, and the fact that the voice commands popup for MaryPosa disappeared after a few seconds.

7.2.2 Insights on the prototype

The usability test revealed several strengths and areas for improvement in our prototype:

- **Strengths:** The app's design was praised for its intuitiveness and clean layout. The integration of AI features and the flow diagram for recipe steps were standout features. The participants liked the color scheme and the consistency of the UI across all screens.
They also appreciated what the application had to offer and many of them reported that they would like to use it in their daily life.
- **Areas for improvement:** The need for better feedback mechanisms (e.g., a pop-up for timer completion) and larger, more accessible buttons in certain areas was highlighted. Additionally, the voice assistant could benefit from being active for more time for the voice recognition.

7.2.3 Potential changes and justifications

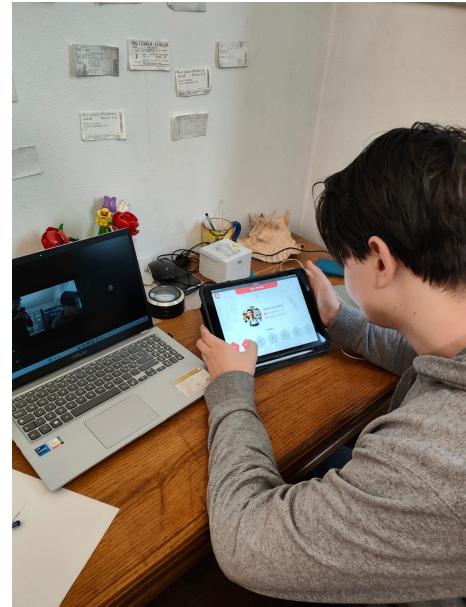
Based on the feedback from the usability test, we propose the following changes:

- **Increase the size of icons in the edit modal:** This change is based on feedback from multiple participants who reported difficulty in clicking small icons.
- **Add a popup notification for timer completion:** This was suggested to improve the user's awareness and ease of transitioning back to the recipe flow.
- **Enable automatic progression to the next step after marking a step as completed:** This feature was requested by participants to streamline the cooking process.

7.3 Images from the interviews



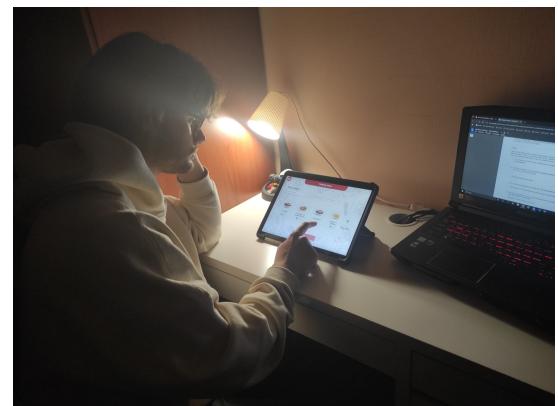
Gabriele's usability testing



Marco's usability testing



Luca's usability testing



Francesco's usability testing

8 Conclusions

8.1 Learnings

We learnt a lot about finding the needs of people, starting from the domain, understanding it and doing the interview, to have a wider view of how people do activities, which tools they use, etc. It was very interesting to understand how to find gaps in the domain, which is very useful also in the market, in order to provide solutions to fill it in a proper way.

We also learnt a lot about creating user-friendly interfaces, which are easy to use and to understand, without having to think a lot about what to do. Moreover we understood that every kind of test activity gives us very important information, about how the prototype is perceived by people using it, and how to improve it by analyzing their behavior and the data we collect

8.2 Group feedback

We worked very well together and always respected each other. We organized properly to do any task, by helping each other when needed. We found that the hardest part was to find people to interview and it was a bit strange at first to perform the interviews, because we're not used to do them.