SAPIENZA
UNIVERSITÀ DI ROMA

FACOLTÀ DI INGEGNERIA INFORMATICA: MASTER OF SCIENCE IN ENGINEERING IN COMPUTER SCIENCE

Tesina - Human Computer Interaction

MyTravel

Presented by:
Francesco D'Abbraccio
Ivano Mazzola
Federico Bianca
Carmine Maria Mansueto

Submitted to:
Tiziana Catarci
Valeria Mirabella

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Chapter 1

Introduction

The idea behind MyTravel

Nowadays, thanks to modern technologies like high speed trains and cheaper solutions for tickets and accommodations, travelling is becoming easier and popular. According to this, many apps were developed to help users in their journeys, each one offering one of these functionalities: finding tickets, looking for accommodations and managing their spendings. The main goal of myTravel is to offer a unique solution including all these tasks, in such a way to have a single handy tool without the need of using different apps.
In particular, myTravel is focused on the financial aspect, helping the user to keep track of both personal and group spendings, in order to provide an overview on all the payments and making easier to manage credits and debits among all the participants of a trip.

Chapter 2

Requirement analysis

2.1 Competitors analysis

These are the main alternatives or competitors to our application:

- Skyscanner
- Trivago
- Acasa
- Google trips

Skyscanner is a website that allows people to search for airplane tickets, hotels/bnb and rent cars.

Trivago is a website offering the possibility to find best solutions for accommodations.

Acasa is a mobile app focused on house management that allows the room mates to manage and split spendings among them, recording all the bills.

Google trips is a mobile app that allows people to add personal trips, find most important places in a city, keep track of your reservations. It also has a function to set up daily plans.

Here it is a table showing advantages and disadvantages of each one, including MatchTravel:

	Skyscanner	Trivago	Acasa	Google trips	MyTravel
Pros	*Easy to use* *Possibility to find cheapest solutions*	*Reviews are verified* *Looks for the cheapest accommodations*	*Nice design* *Possibility to split payments among room mates*	*Daily plans for your trip* *Saves your reservation* *Shows points of interest*	*Modern design (Google material)* *Saves info about your trips* *Possibility to split payments among participants*
Cons	*Doesn't save information about your trips*	*Looks for accommodations only*	*Focused on house spending*	*Lacks spending management*	*Doesn't show points of interest of destinations*
Search accommodations	✓	✓	×	×	✓
Search tickets	✓	×	×	×	✓
Split payments	×	×	✓	×	✓
Save a trip	×	×	×	✓	✓

Figure 2.1: Pros and cons of various competitors.

2.2 Questionnaire analysis

In this section there are the questionnaire results used to understand the target of potential users. These data were useful to validate and improve our original idea.

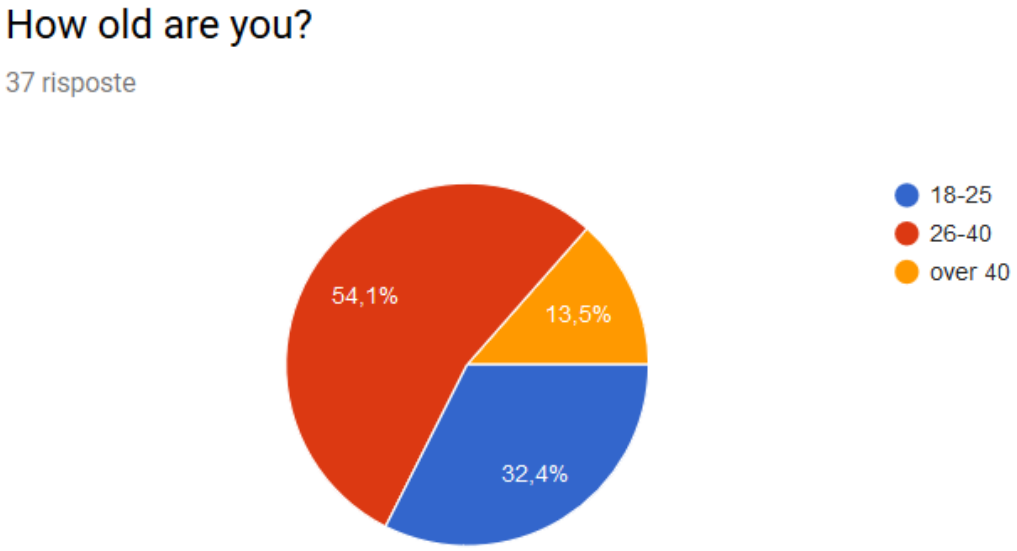


Figure 2.2: Results about the age of the users

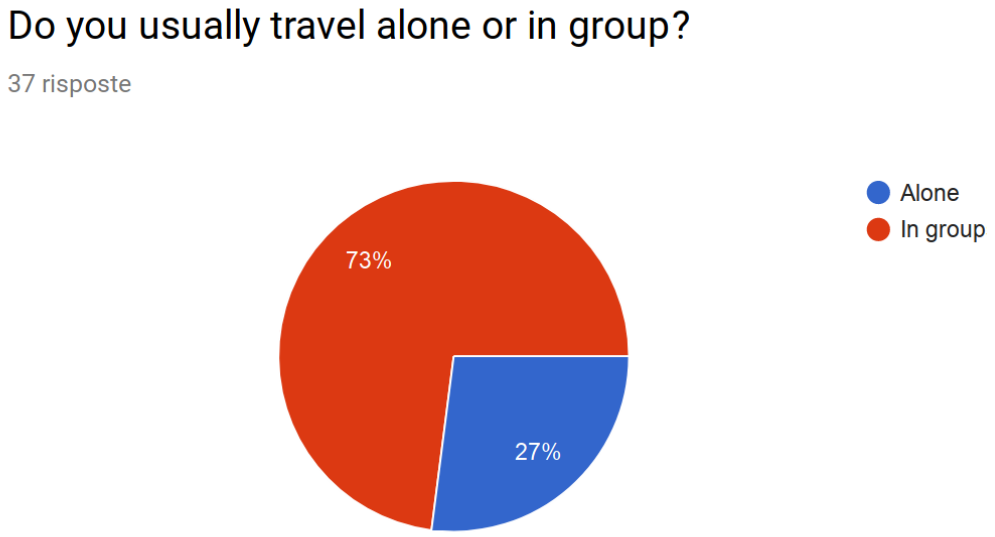


Figure 2.3: Results about single or groups travelers

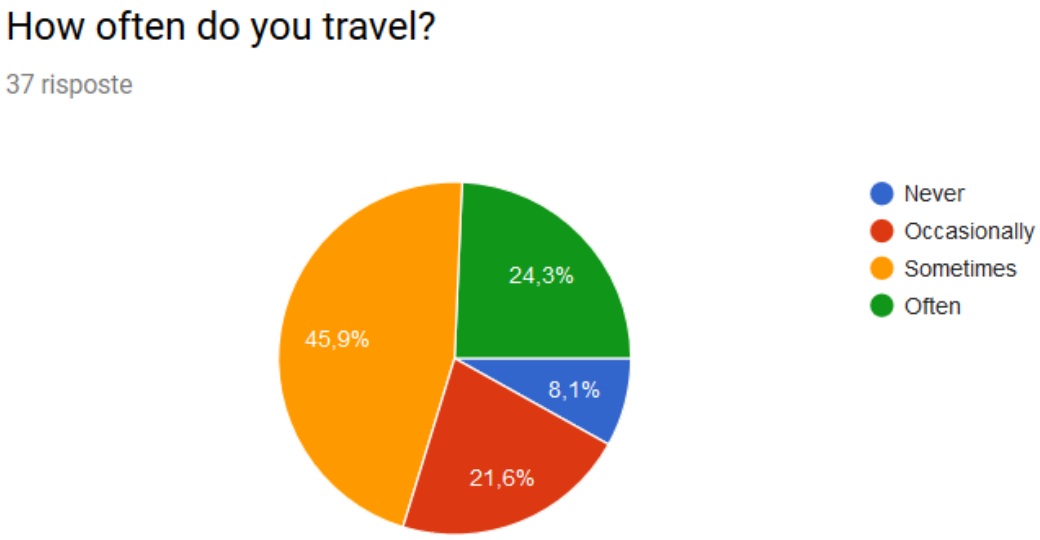


Figure 2.4: Results about the frequency with which users travel

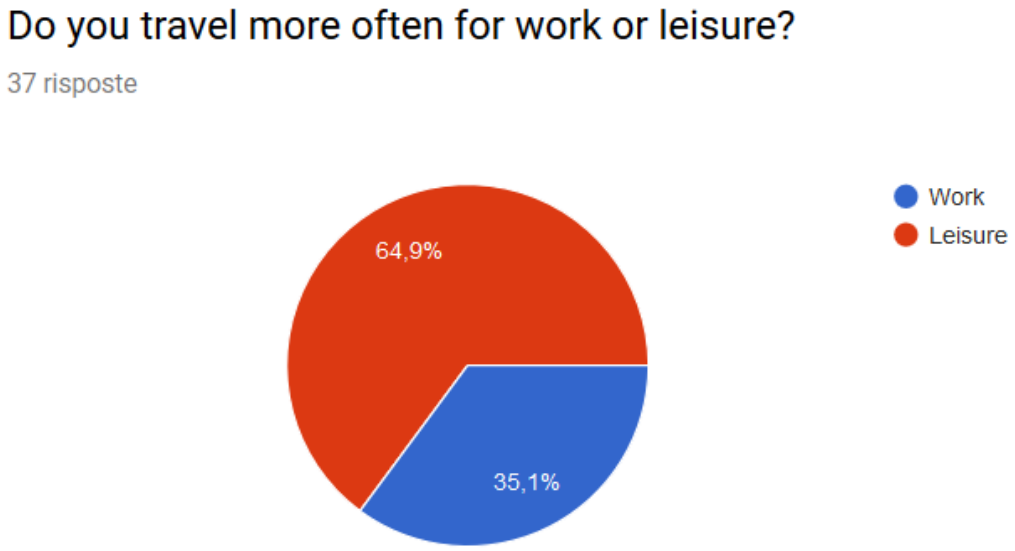


Figure 2.5: Results about the percentage of business travelers

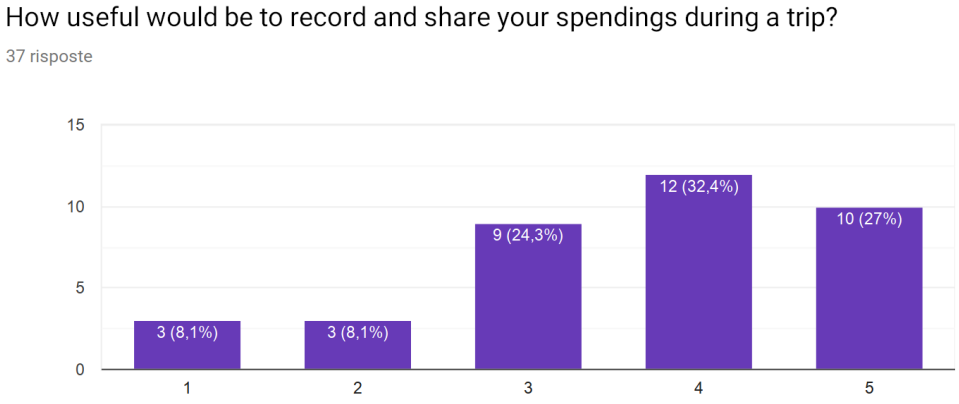


Figure 2.6: Results about the percentage of workers that appreciate a function to manage their payments

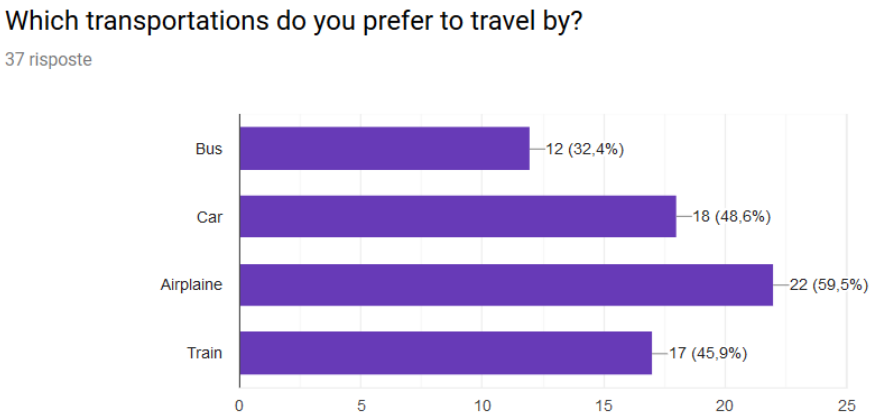


Figure 2.7: Results about favourite transportations

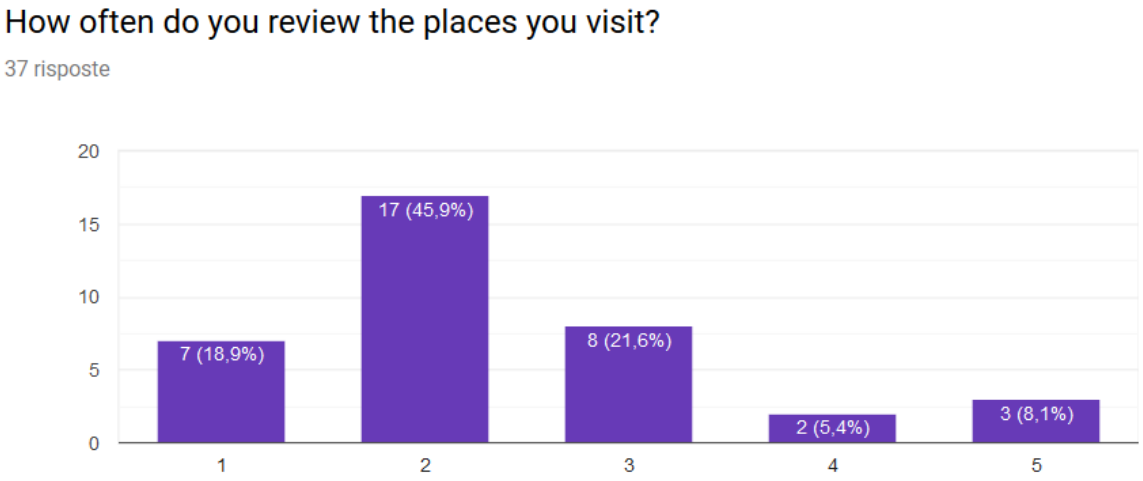


Figure 2.8: Results about how many people are usual to review places they visit

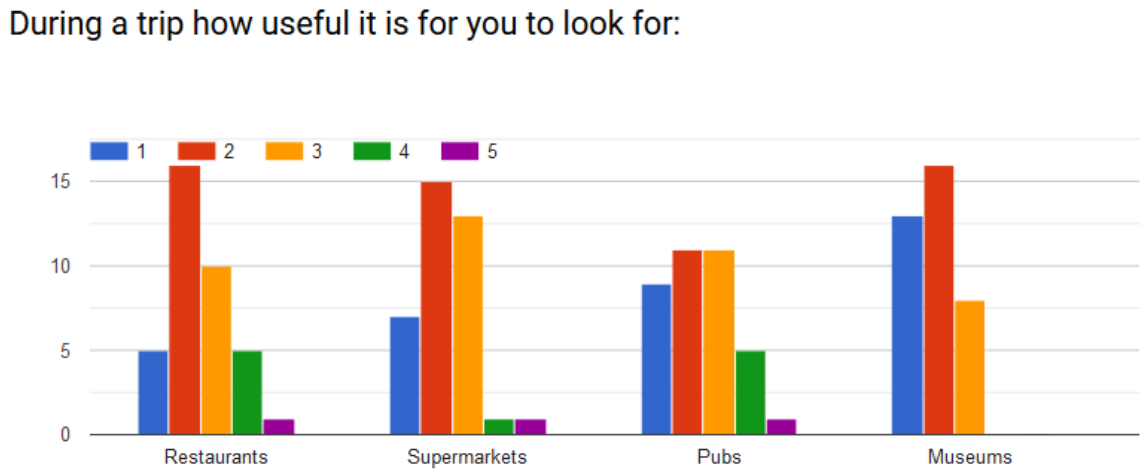


Figure 2.9: Results about most searched point of interests

2.2.1 Conclusions

From the analysis of the data coming from the questionnaires some important conclusions can be taken:

- The people who often travel are mostly from 18 to 40 years old.
- The majority of them travel in group and for leisure purposes, however the percentage of business travelers is not negligible, so it should be taken into account too.
- Among the different means of transport, the most voted is the airplane, however the difference from the others is not so relevant, revealing that the possibility to look for the most convenient tickets is an important feature.
- Given the high interest in recording and sharing payments during a trip, these have been chosen as myTravel's main features.
- On the contrary, the reviews feature and the research of point of interests have been discarded given their poor rank obtained.

2.3 User analysis

To collect the requirements, a questionnaire was published on a private Facebook group, having the possibility to get a sensitive number of responses. Analyzing the results, it was possible to define a good user profile.

- Age: 18 - 40 years old
- Gender: Male - female, equally distributed
- Job title/education: Students or workers
- Technology: Smartphone with GPS and internet connection
- Family: Both single or engaged/married
- Income: Paid by family or medium salary

2.3.1 Persona 1 - Bruno

User profile

Name:	Bruno
Age:	23
Gender:	Male
Job title:	Student
Location:	Rome (Italy)
Family:	Single
Income:	€ 0

Persona

Bruno is a 23 years old guy studying in Rome. He's single and he has lots of friends spread all around Italy that he has known on Facebook groups with which he has some interests in common. He likes travelling and visiting new cities, alone or in group.

Scenario

It's summer and Bruno wants to travel with his friends in Croatia. He has € 500 as budget and wants to save money on the ticket, looking for the cheapest solution. With his friends,

they want to travel by car and share the payments about the gasoline and food. He would like to travel in many cities but he doesn't know yet which ones. He likes cities where you can enjoy the night life, drinking and eating local food.

2.3.2 Persona 2 - Caterina

User profile

Name:	Caterina
Age:	34
Gender:	Female
Job title:	Mechanical engineer
Location:	Milan (Italy)
Family:	Married
Income:	€ 30.000\year

Persona

Caterina is 34 years old. She lives in Milan and works as mechanical engineer. She's married and likes travelling with her husband, she also loves music and plays the piano in her free time. Sometimes she also travels with her colleagues all around the world.

Scenario

Caterina has been sent in South Africa for working reasons with some colleagues. They often go to the restaurant in order to try local cuisine and use the app to split the bill. Since local currency is Rand, she needs to do some conversion in order to better understand how much she's spending, and in the end can show to the company how much they paid to get refund.

Chapter 3

Task analysis: HTA & STN

The HTA and STN that we are going to present in this section are related to the main tasks of our application:

- The user can add a new trip to his list, after creating a new account on the app.
- The user may want to perform a currency conversion before adding a new payment, if he's abroad and using a different currency.
- The user has the possibility to add a new participant to the trip.
- The user can add a new payment related to a specific trip and can choose to split it among the other participants.

3.1 Add a new trip

In order to perform this task, the user must login first. After this operation, he can go to the page showing his trips and create a new one.

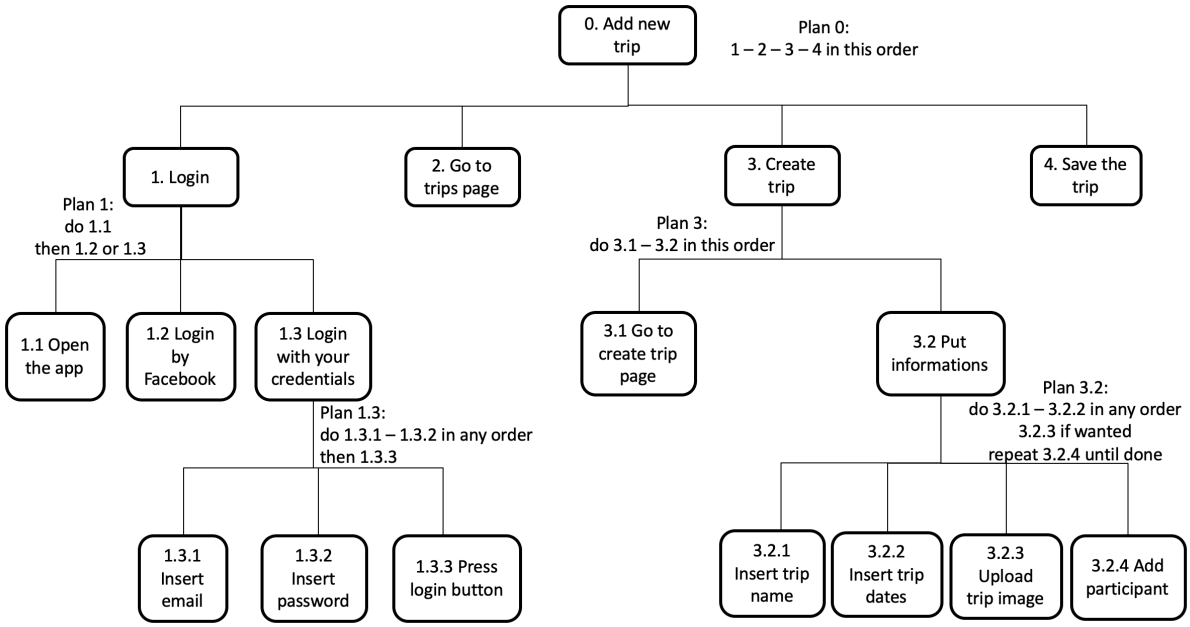


Figure 3.1: HTA: Create a new trip

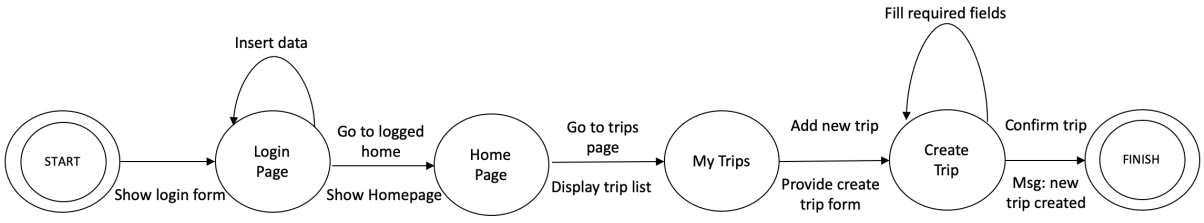


Figure 3.2: STN: Create a new trip

3.2 Perform a currency conversion

To perform this task, the user only needs to be logged with his account and access the page to perform the conversion. In order to execute the task, he only has to choose the input value, input currency and output currency.

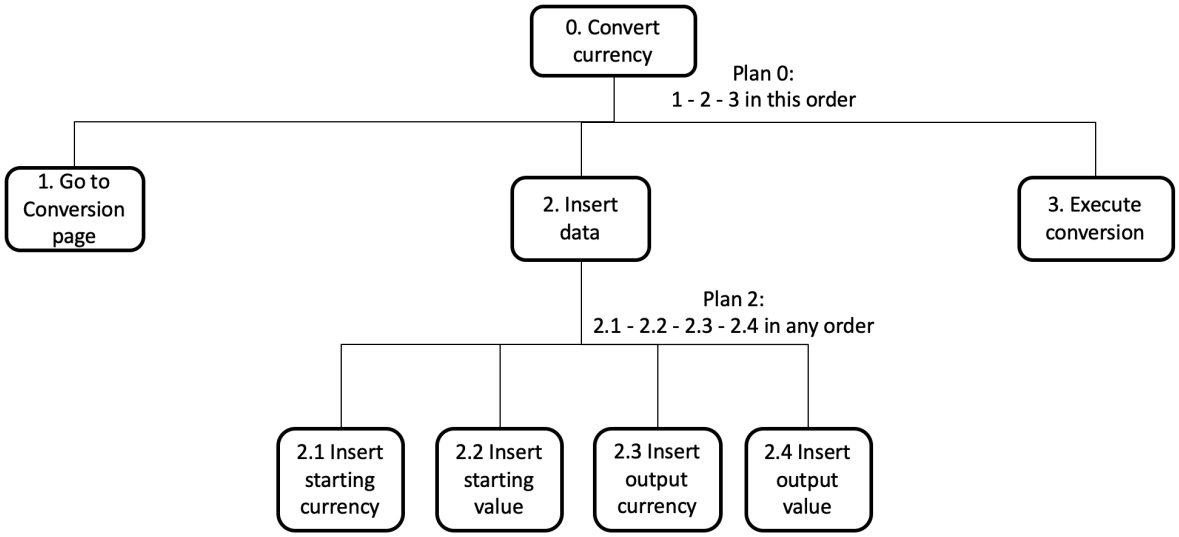


Figure 3.3: HTA: Perform a currency conversion

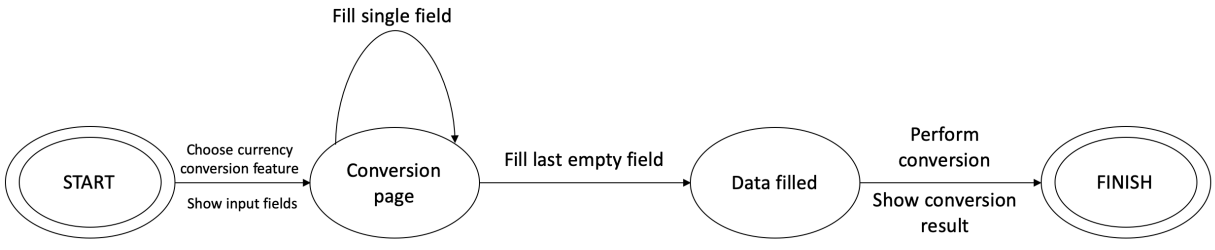


Figure 3.4: STN: Perform a currency conversion

3.3 Add participant to a trip

In order to perform this task the user has to login with his credentials and after this operation he can access to a specific trip from the corresponding page or using a quick link in the home. After this, he can choose from the menu the option to edit trip informations and there he can add a new participant.

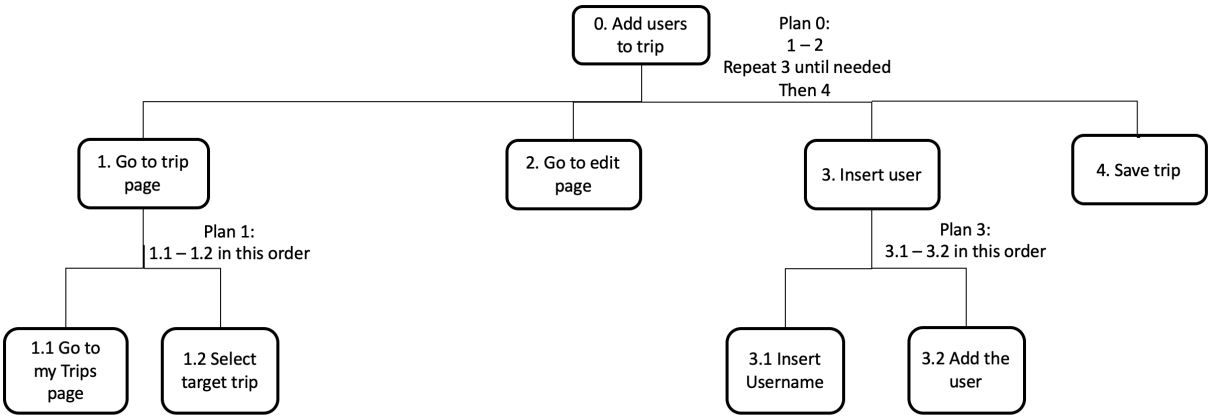


Figure 3.5: HTA: Add new participant to a trip

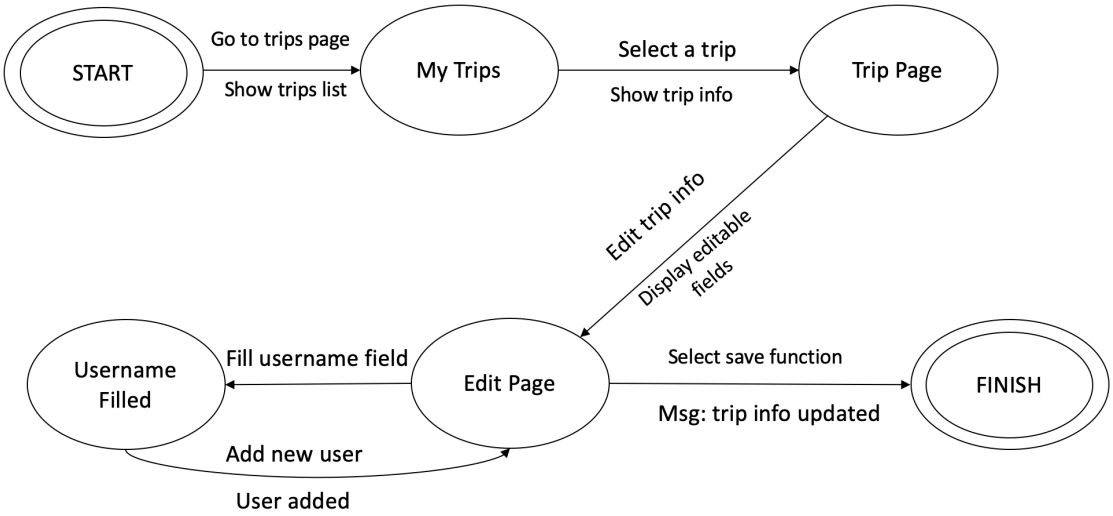


Figure 3.6: STN: Add new participant to a trip

3.4 Add new payment to the trip

To perform this task the user has to login and go the a specific trip page, where he can navigate to the tab related to payments section. From there, he can put informations related to the payment, such as value, currency, category, date and the participants to split the amount with.

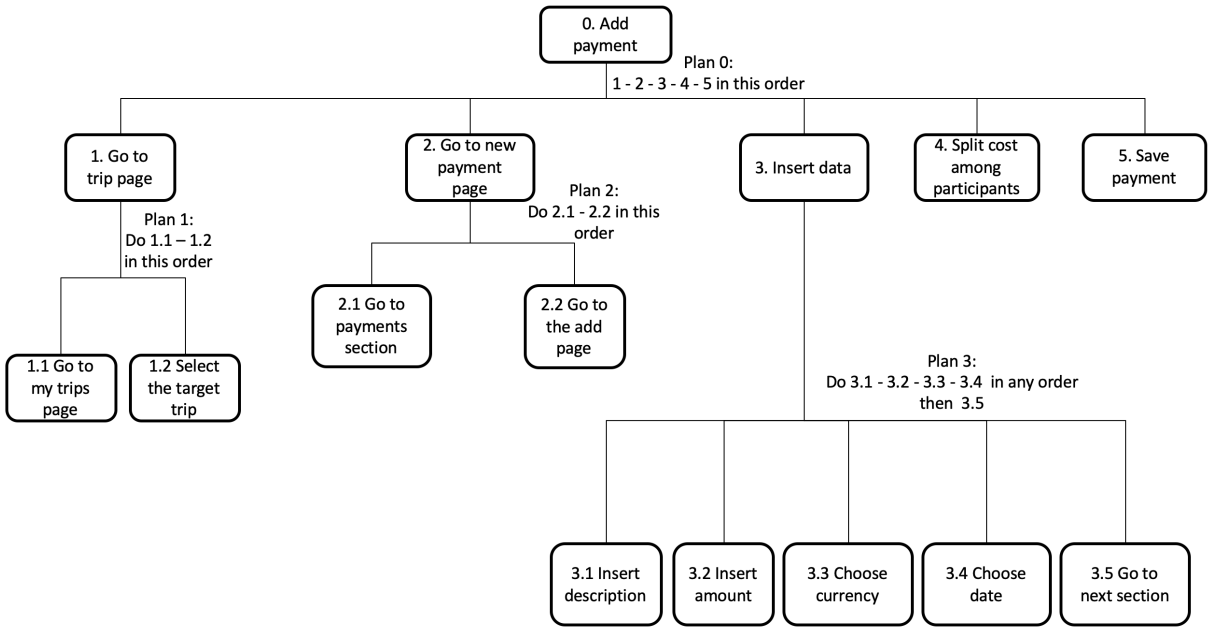


Figure 3.7: HTA: Add new payment to a trip

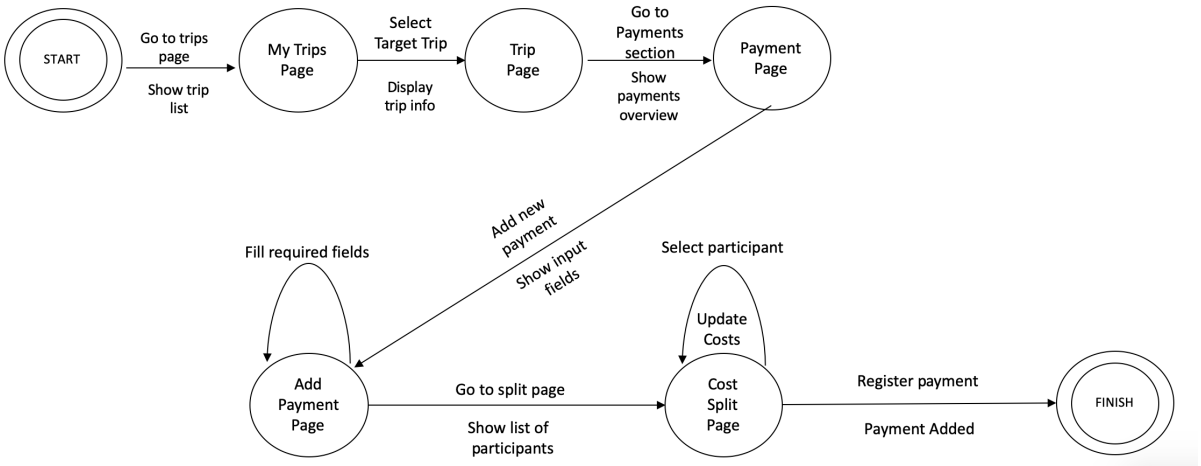


Figure 3.8: STN: Add new payment to a trip

Chapter 4

Mockups and Prototype 1

4.1 Main functionalities

In this chapter we are going to present the mockups of our first prototype; analyzing the results we got from the questionnaires, we decided which functions and features to put in this section.
The HTA and STN section describes the behaviour of the application in a more accurate way.
The mobile application is designed for general user typologies that are planning to travel alone or in group and want to keep track of how much money they spend.
The actions presented in this section are:

1. **Sign up** filling a form inserting required data.
2. **Add a new trip** using the corresponding quick link in the home page, once the user is logged.
3. **Add a new payment** from the trip page, choosing the currency, amount and selecting the participants to split it with.
4. **Pay off a debt**, in order to give back money to another user that paid for you.

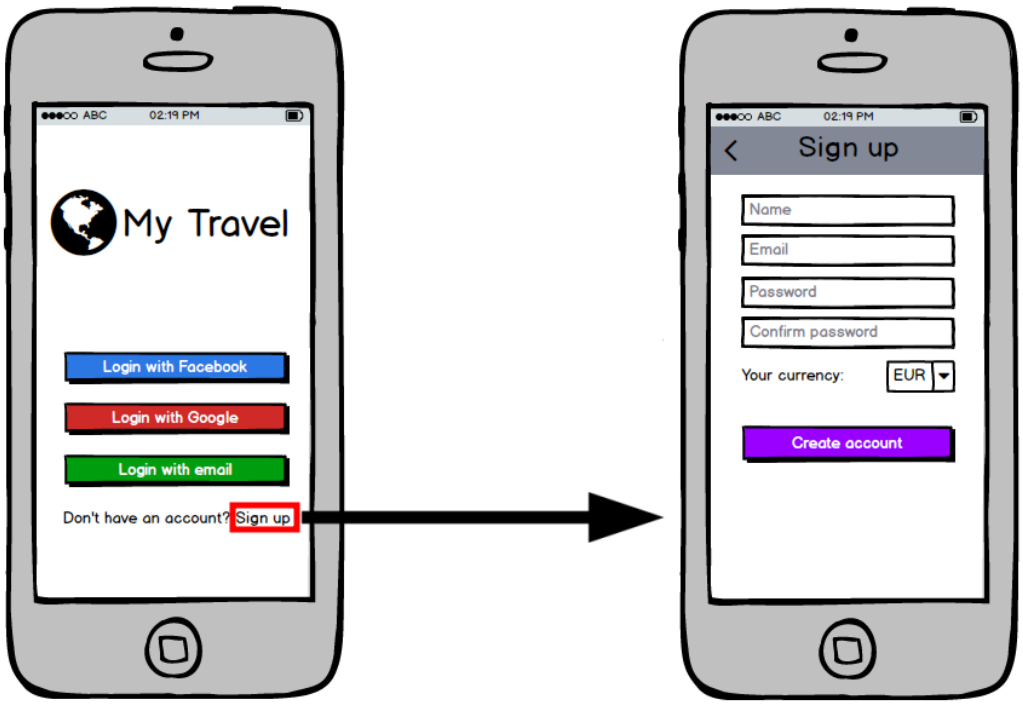


Figure 4.1: 1st task: Create a new account

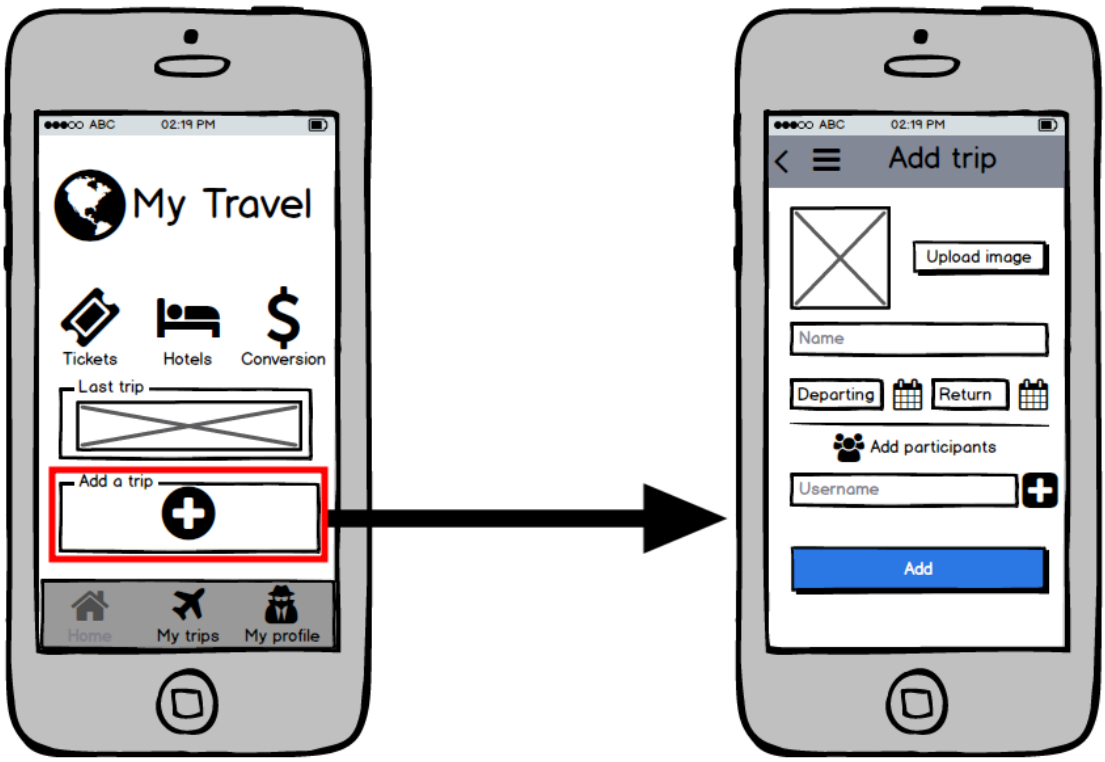


Figure 4.2: 2nd task: Add a new trip to the list

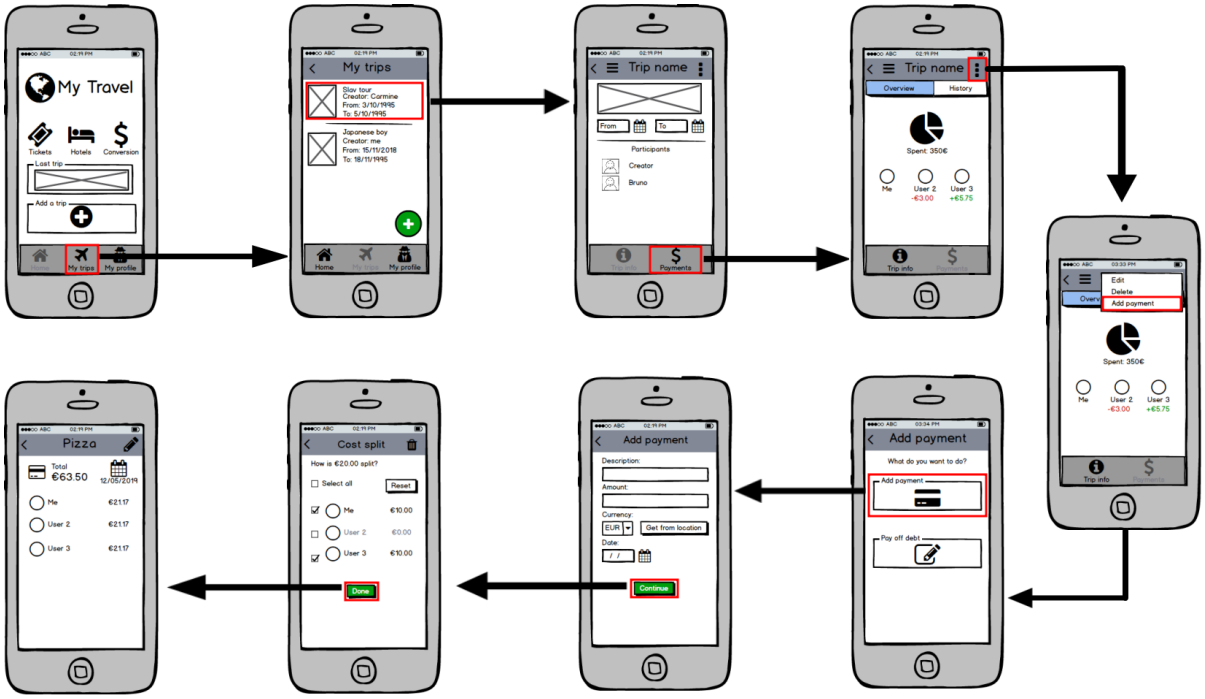


Figure 4.3: 3rd task: Add a new payment

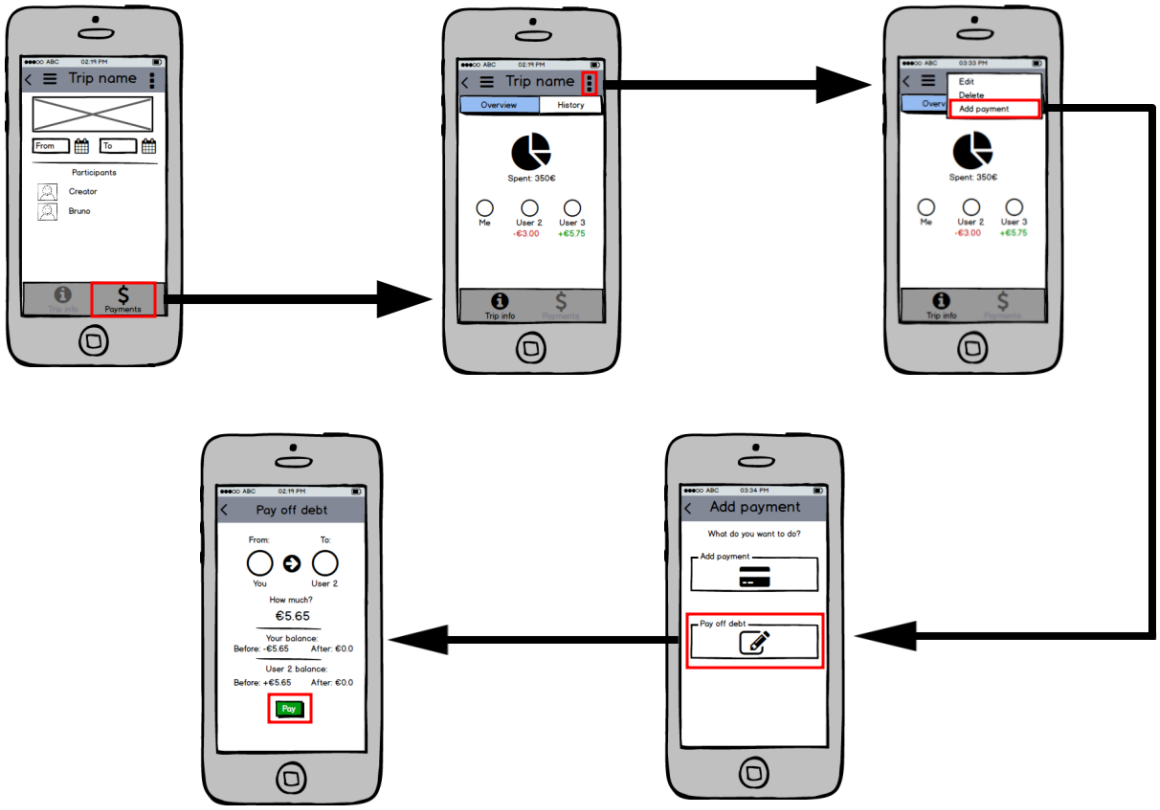
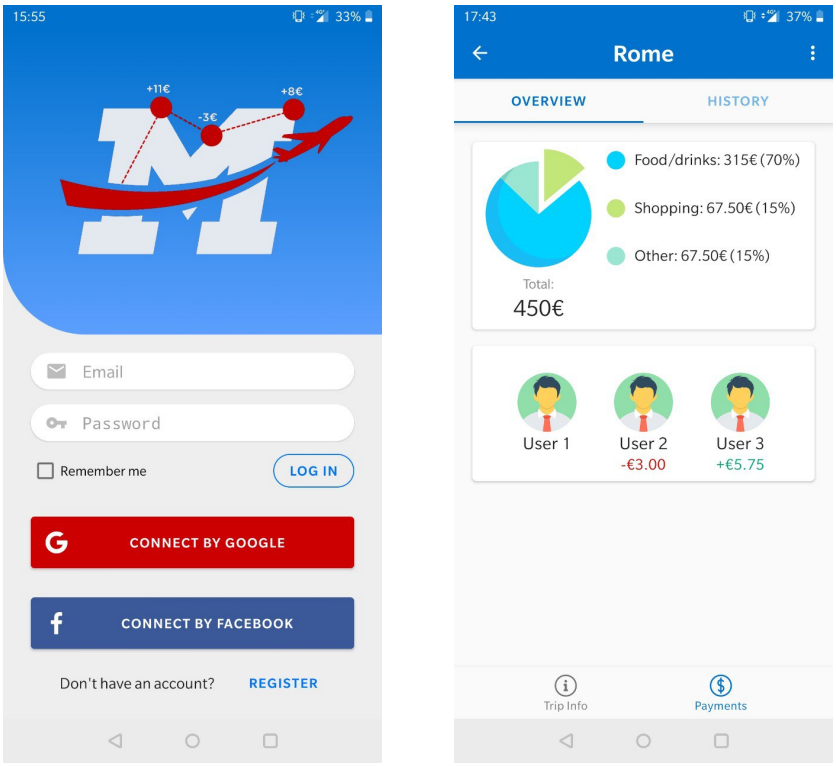


Figure 4.4: 4th task: Pay off a debt

4.2 Prototype 1

The first prototype was developed following both the mockups presented above and the steps described in HTA and STN diagrams.
Moreover, some secondary features were implemented, like performing a currency conversion. This function can be accessed from the main page, where a set of quick links is provided to the user, or through the side menu that allows an easier navigation through the main pages.
Small changes have been applied from the mockups, as shown in following screens.



(a) Login screen (b) Payments section

Figure 4.5: Changes from mockups

Here is the description of changes:

- Login form has been added to the main screen, allowing the user to perform the operation in a faster way.
- The user can associate each payment to a category, in order to have a better overview in the pie chart shown in the corresponding page.

The GUI has been designed according to the following characteristics:

- Google Material Design guidelines
- Colorful icons from `flaticons.com`
- Usage of same colors theme and fonts in all the screens
- Custom logo and background from a graphic designer

Chapter 5

Expert Based Evaluation

Evaluation occurs in laboratory or field, especially in collaboration with the user, that should be considered through the entire development lifecycle, to make tests of the functionalities and usability of the current system. It is useful to evaluate both design and implementation and ideally, the evaluation process should be considered at all stages in the design life cycle.

Evaluation techniques have multiple goals to achieve: the evaluation of a possible extent of system functionalities, like for example the task that users are interested in; the evaluation of the effect of the interface on the user, like for example the user's experience of interaction or how it is easy to learn and to use or the satisfaction of the user; the identification of specific problems, like for example errors, confusion and unexpected results. Heuristic Evaluation and Cognitive Walkthrough are examples of the expert analysis methods.

5.1 Heuristic Evaluation

A heuristic evaluation is a usability inspection method for computer software that helps to identify usability problems in the user interface design. This method was developed by Jakob Nielsen and Rolf Molich and it is basically based on the comparison between your own interface and the usability principles. Given that usability criteria, called "the heuristics", the interface and its compliance will be examined, and the analysis result in a list of potential usability issues.

5.2 Molich and Nielsen's Heuristics

Molich and Nielsen developed a heuristics list which is composed by 10 "heuristics":

1. **Visibility of system status**: The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

2. **Match between system and the real world**: The system should speak the user's language, following real-world conventions, using words, phrases and concepts familiar to the user and making information appear in a natural and logic order, rather than using system-oriented terms.

3. **User control and freedom**: Given that users often make mistakes, choosing the wrong system function, they need a clearly "emergency" exit to leave the unwanted state. Because of that, the system should support undo and redo.

4. **Consistency and standards**: Follow platform conventions so that users don't have to understand if different words, situations or actions mean the same thing

5. **Error prevention**: Having a careful design which prevents a problem from occurring in the first place is better than a good error message, so eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action

6. **Recognition rather than recall**: Minimize the user's memory load by making objects, actions and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate

7. **Flexibility and efficiency of use**: Allow users to personalize frequent actions with accelerators. Accelerators, unseen by the novice user, may often speed up the interaction for the expert user such that the system can provide for both inexperienced and experienced users.

8. **Aesthetic and minimalist design**: Dialogues should not contain information which is irrelevant or rarely needed, because every extra unit of information in a dialogue, competes with the relevant units of information reducing their visibility.

9. **Help users recognize, diagnose and recover from errors**: Error should not be expressed in codes, but in plain language, precisely indicating the problem and constructively suggesting a solution.

10. **Help and documentation**: It may be necessary to provide help and documentation, even though if it is better if the system can be used without documentation. Any information should be easy to search, focused on the user's task, so make a list of concrete steps to be carried out, and not be too large.

5.3 Expert report

In this case the evaluation was done by our professor Valeria Mirabella. After the expert based evaluation, it has been reported that the following heuristics have been violated:

Frame	Heuristic violated	Severity	Description / Comment
Start page	Flexibility and efficiency of use	3	An advanced user will prefer to access the application immediately
Sign up page	Error prevention	3	Ask a confirmation before creating the new account
Add a trip	Flexibility and Efficiency of use	2	Could be useful provide the possibility to add more information
All	Help and documentation	3	Add help and documentation

Figure 5.1: Expert report: Heuristic Evaluation

The "severity" number identifies:

- 0 - I don't agree that this is a usability problem at all
- 1 - Cosmetic problem only
- 2 - Minor usability problem
- 3 - Major usability problem
- 4 - Usability catastrophe

Chapter 6

Prototype 2

After receiving the expert-based evaluation with the heuristics violated in Prototype 1 we made some changes to solve these issues:

- **Problem 1, Frame: "Start page", Heuristic violated: "Flexibility and efficiency of use", Severity: 3**: We found that the initial section describing the main functionalities, when the app starts, was forcing the user to tap the "next" button until reaching the last screen. This would result in a slow interaction for an expert user. According to this, we changed this behaviour and from the first screen the user has the possibility to go directly to the home page, using a "start now" button. Moreover, once logged in, if the user checks the "Remember me" option, he won't see neither the introduction nor the home page.
- **Problem 2, Frame: "Sign up page", Heuristic violated: "Error prevention", Severity: 3**: As suggested by the expert, a popup has been added asking the user to confirm inserted data before creating a new account. In this way, he can check that the inputs are correct and can proceed with his operation. Moreover, we added a function for data validation that checks if the inserted passwords are matching, allowing the user to quickly be aware of his mistakes while typing.
- **Problem 3, Frame: "Add a trip", Heuristic violated: "Flexibility and efficiency of use", Severity: 2**: Initially, when the user was adding a new trip to his list, he could only add participants and choose an image that would represent his experience. According to the expert analysis, we added the possibility to also register information about the destinations of the trip, giving to the user the possibility to add more information.

- **Problem 4, Frame: "All", Heuristic violated: "Help and documentation", Severity: 3**: Initially, no documentation was provided for the application and no option was present in the side menu. This could result in some problems for a non expert user, that would like to have a documentation showing how to perform the basic operations in the app. According to the expert evaluation, we added a full documentation with an index in order to quickly access the sections showing all the operations that are possible in the app.

These are the screenshots of the changes applied to the application:

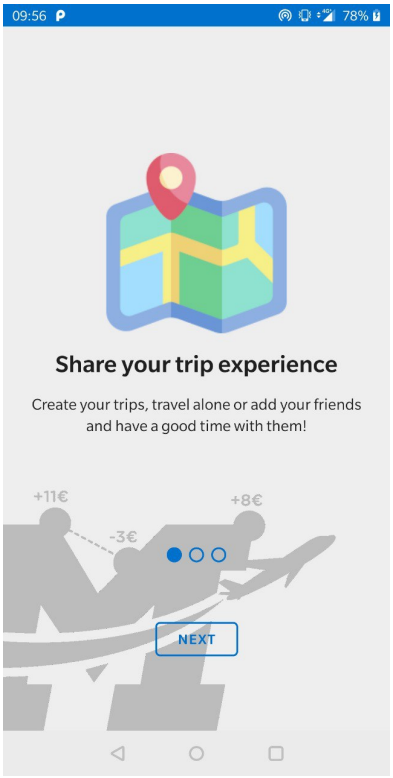


Figure 6.1: Prototype 1 "Start page" frame (before expert evaluation)

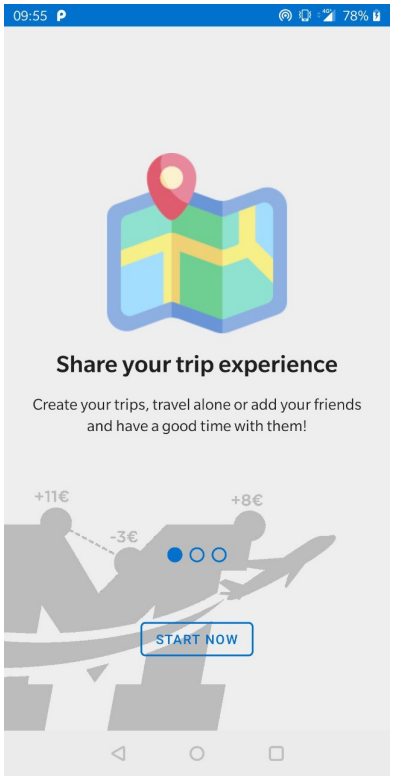


Figure 6.2: Prototype 2 "Start page" frame (after expert evaluation)

Figure 6.3: Problem 1 and relative solutions

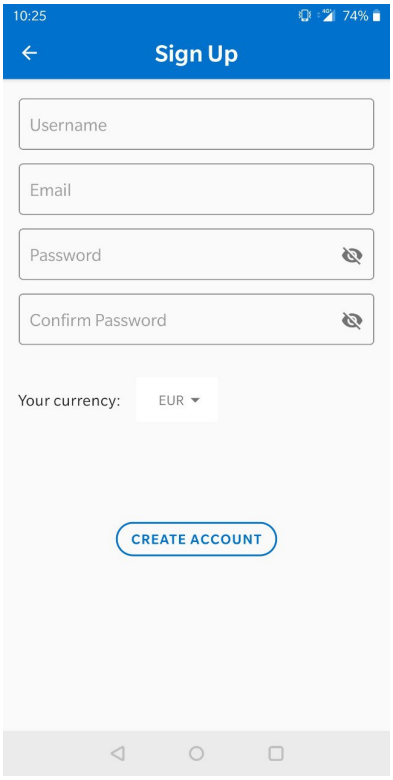


Figure 6.4: Prototype 1 "Sign up page" frame (before expert evaluation)

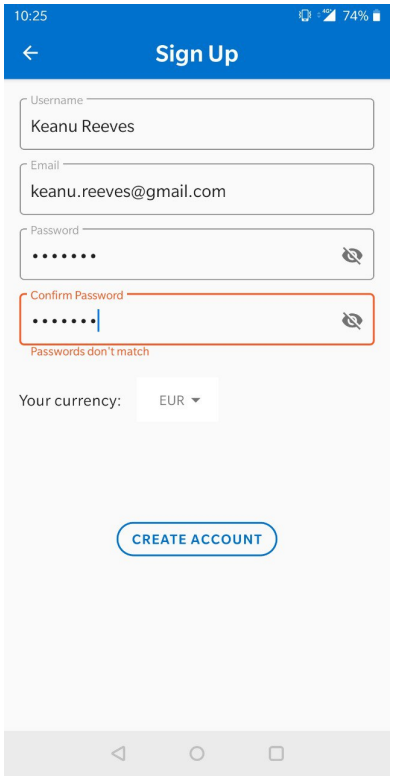


Figure 6.5: Prototype 2 "Sign up page" frame (after expert evaluation)

Figure 6.6: Problem 2 and relative solution (part 1)

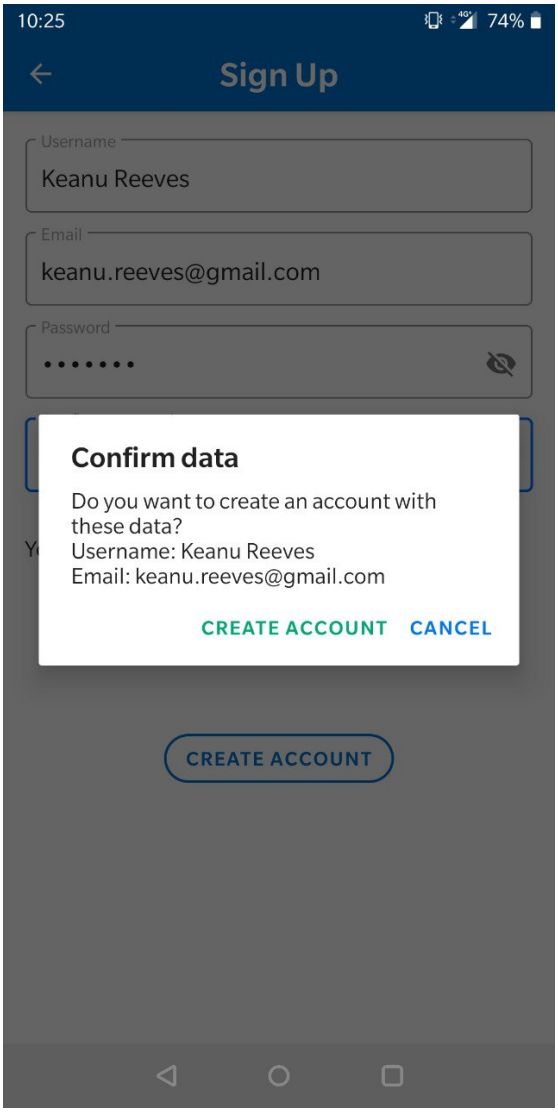


Figure 6.7: Prototype 2 "Sign up page" frame (after expert evaluation)

Figure 6.8: Problem 2 and relative solution (part two)

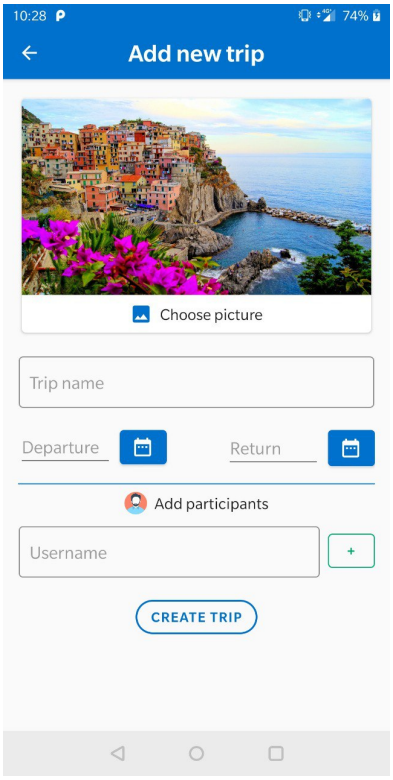


Figure 6.9: Prototype 1 "Add a trip" frame (before expert evaluation)

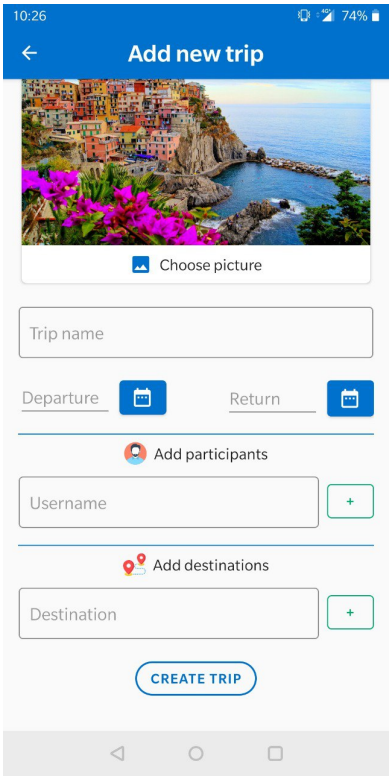


Figure 6.10: Prototype 2 "Add a trip" frame (after expert evaluation)

Figure 6.11: Problem 3 and relative solution

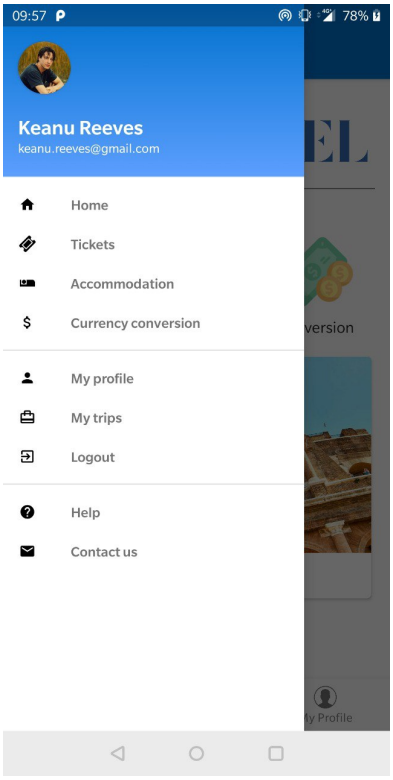


Figure 6.12: Prototype 1 "Sidemenu logged" frame (before expert evaluation)

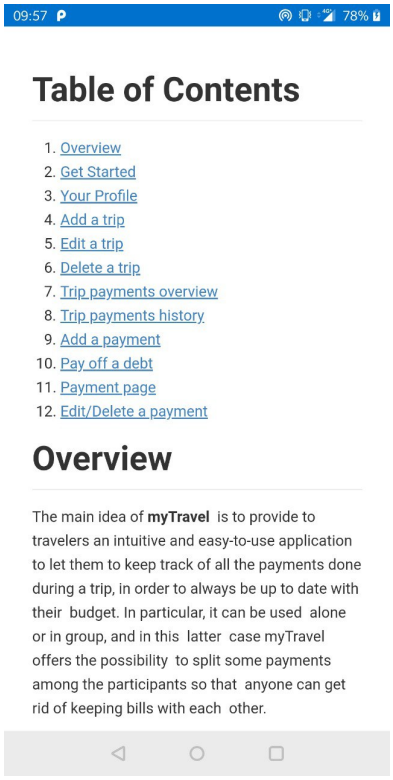


Figure 6.13: Prototype 2 "Help" frame (added after expert evaluation)

Figure 6.14: Problem 4 and relative solution (part 1)

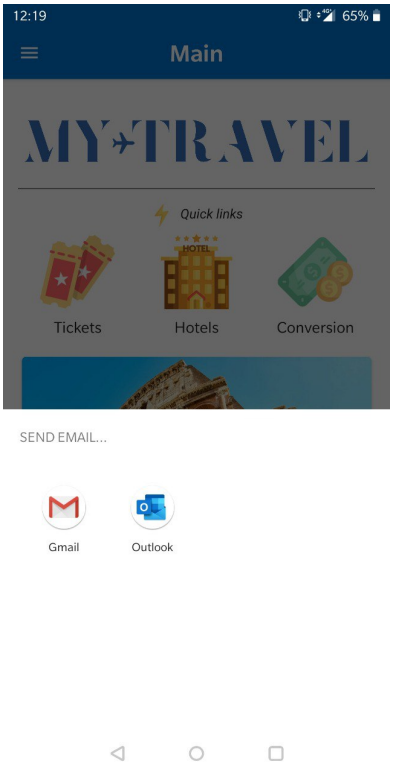


Figure 6.15: Prototype 2 "Contact us" frame (added after expert evaluation)

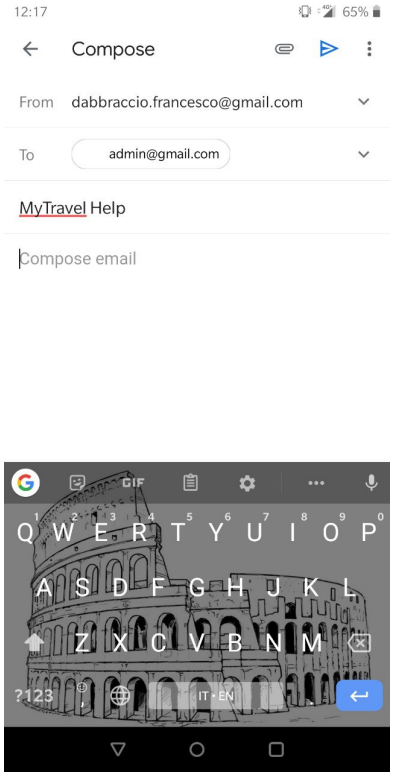


Figure 6.16: Prototype 2 "Contact us" frame (added after expert evaluation)

Figure 6.17: Problem 4 and relative solution

Chapter 7

Think Aloud

The think aloud is a kind of evaluation based on some simple rules. We chose a group of 10 people of different ages, and performed the experiment using these criteria:

- We must explain to the users who we are and what we are doing.
- Each member has to accomplish the same task, **Pay off a debt** to someone, individually.
- We explain that we are testing our application, and not testing them.
- The experiment took place in a room without distractions, and each person had a smartphone with MyTravel installed.
- While executing the task, each user has to say aloud what he's doing, what he thinks it's happening, any doubt etc.
- During the experiment, we took note by pen and paper.

7.1 Brief review of the think aloud session

We chose this task for the think aloud session because it's one of the main feature of our application. Adding payments and paying off a debt are important tasks that came out to be very interesting and requested by users during the questionnaire analysis.

7.2 Conclusions of the think aloud session

The test was made with students, whose age is in a range between 22-26 years old, that fits the age chosen in our user requirements. They found the user interface easy and intuitive to use, and could easily find the way to reach the payments sections of a trip. They appreciated the presence of quick links in the home page that accelerate the process.

Generally speaking, none of them found any problem to accomplish the task, but some people suggested to add a quick link on a user profile picture when I have to pay off a debt to him. According to these suggestions, we added it in the interface.
The results are satisfactory, despite the absence of a quick link none of them found difficult to complete the task using the graphical interface provided by the app.

Chapter 8

Controlled Experiment

8.1 Problem

During the design phase of the "Add payment" feature two different interfaces were developed. The first one, showed in Figures 8.1 and 8.2, expected the user to tap on the "Add payment" option of the top right three-dots menu, go to a new activity and tap the "Add payment" button. We did in this way because it was reasonable for us to include all the possible choices in a single menu. Then we decided to implement a second interface, shown in Figures 8.4 and 8.5, in which we basically replaced the previous solution with a floating button, leaving fewer options in the menu and making the "Add payment" task shorter. Our assumption is that the second solution, the one with the floating button, lets the user to complete the task in a quicker way, due to the intuitiveness of the '+' of the floating button. In order to understand if our assumption is true we need to perform a controlled experiment.

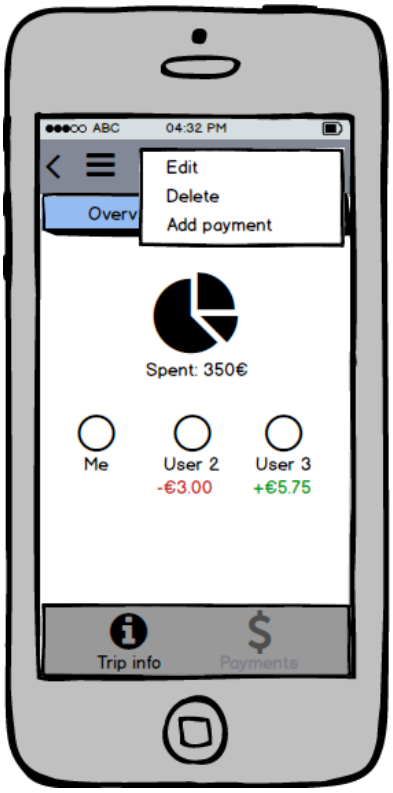


Figure 8.1: Interface style 1 - 1st

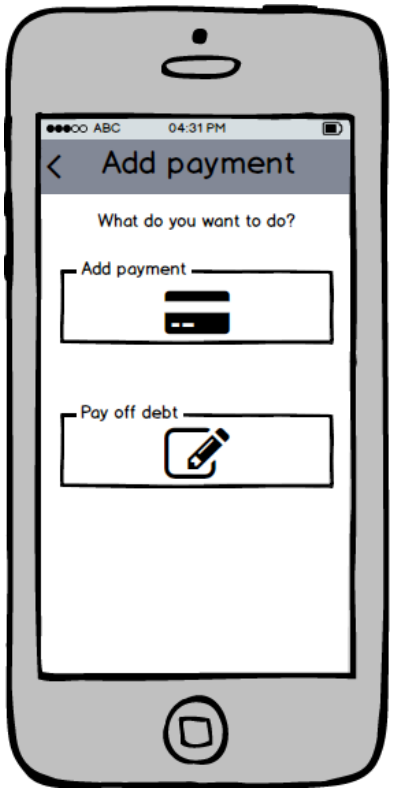


Figure 8.2: Interface style 1 - 2nd

Figure 8.3: Interfaces for ANOVA test (first type)

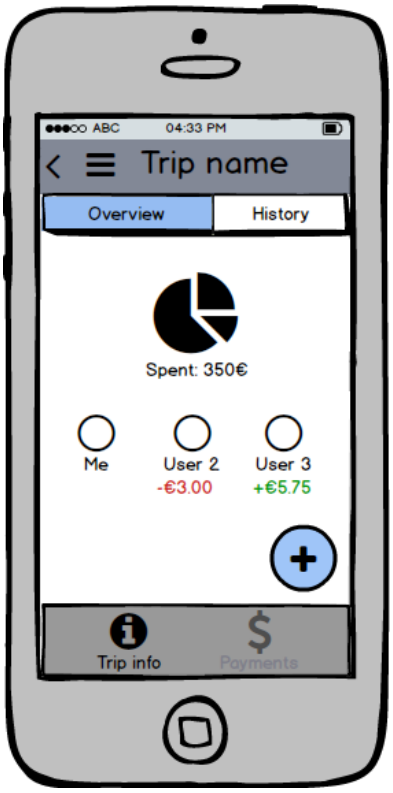


Figure 8.4: Interface style 2 - 1st

Figure 8.5: Interface style 2 - 2nd

Figure 8.6: Interfaces for ANOVA test (second type)

8.2 ANOVA One-Way Analysis

The controlled experiment has been performed with ANOVA One-Way analysis. We asked to 20 different people to perform the task. Each user performs under different conditions (**between groups**), meaning that 10 users will use the first interface and 10 users will use the second one.

- **Who?** (participants): 20 people (in a range of age between 18-40 years old according to user profiles)
- **Variables**
  - *independent*: the two interfaces
  - *dependent*: the time in seconds to execute a task
- **Hypothesis**
  - *null*: there are no differences between the two interfaces
  - *our*: users will complete the task in less time using the second interface rather than the first one
- **Experiment**
  - *task*": "Add a new payment"
  - *assumptions*: user is already logged and in a specific trip page
- **How to apply ANOVA**? We measure with a chronometer how much time each user perform the same task requested with the two different interfaces. All the value are collected in order to compute the analysis.

Interface 1	Interface 2
12,9	7,59
11,3	7,1
10,41	10,18
12,17	7,39
9,39	6,44
10,84	7,22
13,48	10,9
15,85	12,84
9,62	7,41
8,4	6,92

Figure 8.7: Times recorded with different interfaces

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	10	114,36	11,436	4,94123
Column 2	10	83,99	8,399	4,54474

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	46,1168	1	46,1168	9,72317	0,00594	4,41387
Within Groups	85,3737	18	4,74299			
Total	131,491	19				

Figure 8.8: ANOVA results

8.3 Analysis of ANOVA results

The ANOVA analysis was performed thanks to the related plugin offered by Excel. The results showed that the **F > F crit** so the null hypothesis can be rejected, meaning that we can discard the hypothesis for which there are no differences between the two interfaces. In particular for what concerns the first interface, users had troubles to find the "Pay off debt" section.

Chapter 9

Conclusion

After working on this project, it was possible for us to improve a lot our technical skills in developing mobile applications and interfaces. With respect to other projects, this was the first time we had a direct contact with the users in order to collect requirements, suggestions, feedback about general usage concepts. A new way of working has been assimilated.

9.1 Future implementations

Some features were not implemented in this project, and have been left to future development. Here's a list of some interesting features that could be added:

- **Tickets search section**, allowing users to be able to search for tickets applying custom filters in order to save money or find the most comfortable way of travelling.
- **Accommodations search section**, like the ticket search function, the user can apply his criteria to find the best solution for his trip.
- **Extra functions for destinations**, once the user adds a new destination to a trip, he could have functions to find the best points of interest in a certain city or location in order to have a better experience.

9.2 References

- Course's material,
- `https://www.excel-easy.com/examples/anova.html` to build the ANOVA One-Way Analysis,
- `https://www.flaticon.com` for the icons,
- Balsamiq mockups,
- `https://material.io` for Google Material Design guidelines,
- Android Studio, `https://developer.android.com/studio` to build the project.