



BEEHIVE

Tesina - Human Computer Interaction

Facoltà di ingegneria dell’informazione, informatica e statistica
Engineering in Computer Science
Sapienza, Rome, Italy

Presented by: Silvia Bianchini , Riccardo Bianchini, Martina Evangelisti

Submitted to: Tiziana Catarci, Valeria Mirabella

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1 Introduction

Beehive is an experience sharing platform which goal is to be the reference point for meeting new people.

The main goal is to help people in finding new experiences to live but it becomes an easy way to speed up the creation of your network of friends or connections being as productive as a bee building its hive as a community.

With Beehive you have the possibility to participate to events proposed by other or to create your own event, with different categories to choose.

We offer a unique solution to find a new way to spend the free time without having to navigate between dozens of different sites that are specific for one single activity, and a solution to let everyone try new experiences without having to struggle in order to find someone that comes with him.

2 Requirement analysis

2.1 Competitors analysis

The main competitors to our application are:

- Facebook groups and events
- MeetUp
- Unation

We analyzed them one by one, and for each one of them we identified advantages, disadvantages and good tips:

Facebook: is the most famous social network with a lot of different functionalities, but we consider only the part in which it allows to create events and invite people to them and create public and private groups.

Advantages:

- A huge number of users log into the platform every day
- It is easy to create events and invite people to join them

Disadvantages:

- It has a lot of functionalities, it's not an application exclusively focused on events
- An event published on a group is visible only by the group members
- it is strictly focused on the network of friends that you already have

Tip: Chat group is a good idea to have better interactions between users

Meetup: it is a service used to organize online groups that host in-person and virtual events with people having similar interests.

Advantages:

- Groups are categorized by topic
- wide range of possible activities
- possibility to chat with the group members

Disadvantages:

- It creates groups of people with the same interest (ex. reading clubs) and the events are internal to the group
- Build more like a social than a platform for sharing experiences, focused on the virtual reality not on the physical one
- Chat is related to the group members, not for the event participants

Tip: Group events by category is a good idea

Unation: it is an American platform to find nearby events.

Advantages:

- it finds events around your location
- possibility to buy tickets for the events

Disadvantages:

- it's focused on public events (such as festivals, concerts ...)
- Not thought for making new friendships
- Mainly available in USA

Tip: Promotion packets in order to advertise an event is a good feature to offer

To summarize:

	Facebook groups/events 	Meetup 	Unation 	Beehive 
Proposing events	✓	✓	✓	✓
Groups	✓	✓	✗	✗
Chat with event participants	✓	✗ <small>(related to group, not event)</small>	✓	✓
"Around you" search	✓	✗	✓	✓
Categorization of events	✗	✓	✗	✓
Suitable for individuals	✗	✓	✗	✓
Proposing places	✗	✗	✓	✓

2.2 User Profile, personas and scenarios

2.2.1 User Profile

Our user profile has the following characteristics:

- **Age:** 18-50 years
- **Gender:** male/female
- **Job/Education:** student or worker
- **Lives in:** Italy
- **Technology:** Smartphone with GPS and internet connection
- **Disabilities:** No specific limitations

2.2.2 Personas and scenarios

Persona: Sara



Sara is a 23 years old student. She comes from Milan, but she stays in Rome to study for the master degree.

She has a lot of friends in Milan with which she likes to spend time, for example walking around or going out for an appetizer.

She is a girl full of energy, so she loves to make every kind of activities with them.

In Rome she lives in a house with other two university students.

She is a sunny person, but a little shy therefore has a slight difficulty in meeting new people even though she would like to.

Scenario

It's spring, Sara has just moved to Rome and the lectures has just started so she doesn't have much friends in the new city already.

The weather will be sunny in the weekend, perfect to make an excursion or an outdoor activity.

She would like to create a group to make these activities and to share her time with some new friends.

A good way to do that is using her phone to look for an event to participate and know new people.

Persona: Marco



Marco is a 35 years old worker that lives in Turin.

He works as a clerk in an IT company, he is single and has not children.

Then he has a lot of free time in the weekend.

He is a very friendly and nice guy.

He's a guy full of life and since some time, he is thinking about doing some new experiences like excursions or go to the beach.

Since he moved in Turin, he lives alone and, apart from work he spends most of the time by himself, also because his friends are too busy and have a family to spend their time with.

Scenario

It is Friday evening and Marco just got out of work, he is willing to spend a different night out, but his friends are busy.

While coming back home sit in the bus, he takes his phone looking for something to do and some company.

He can filter the possibilities by selecting the type of the event he is looking for, in his case for example he could select “night life”.

Eventually, he finds the event “Take a beer at the Irish Pub” and he decides to join it.

At the end, he spends a beautiful evening and comes back home happy.

Persona: Mario



Mario is 45 years old. He is the Chef of “In front of the Sea”, a restaurant on Ostia beach, near Rome.

He is an easygoing person.

He likes to joke and laugh in good company, especially in front of a glass of good beer.

He has been married for 5 years, but now he divorced and he lives alone near his workplace.

He has got 2 children, Federico, that is 9 years old and Gabriele, that is 11 years old and they both live with their mother.

He spends his whole day between work and home.

Scenario

It is a Summer Monday, and another weekend is over and also this time Mario spent the whole day at “In front of the Sea” and after work he got home.

Fed up with this, he wants to meet new people and break the daily routine that he had in the last years, so he decides to use Beehive on his smartphone in order to find an interesting activity and moreover find new friends.

Since it's sunny and it's his day of rest from work he select the category “outdoor activities” and find out an event in the pinewood of Ostia in the afternoon, he decides to participate.

In the evening, when he gets home, he's satisfied with the experience and decides that he will try it again.

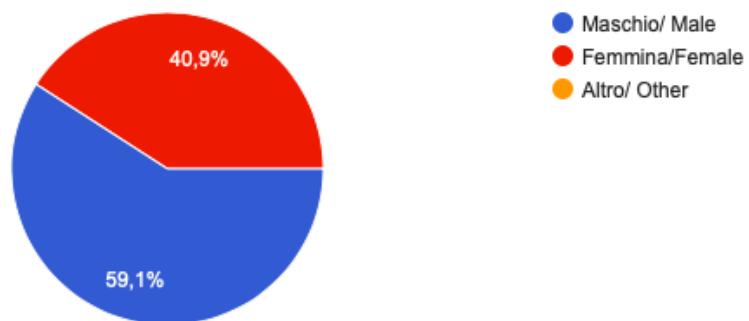
2.3 Questionnaire analysis

In this section there are the questionnaire results used to understand better our targeted potential customers.

We reached 66 persons and these data were useful to validate our assumptions and ideas and to improve.

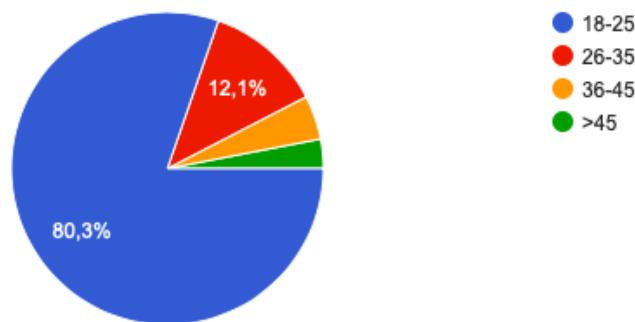
Sesso/ Gender:

66 risposte



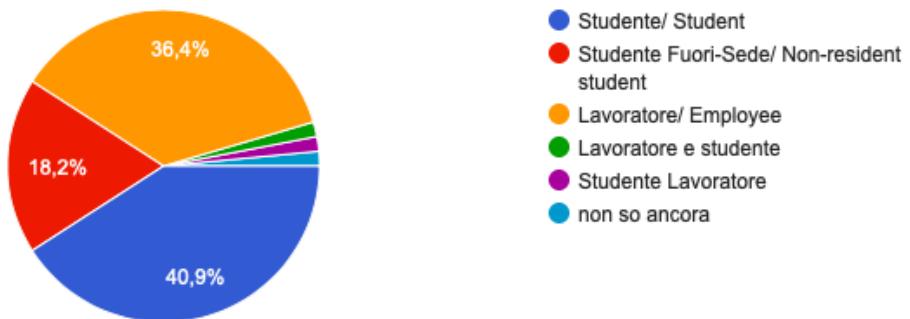
Età/ Age:

66 risposte



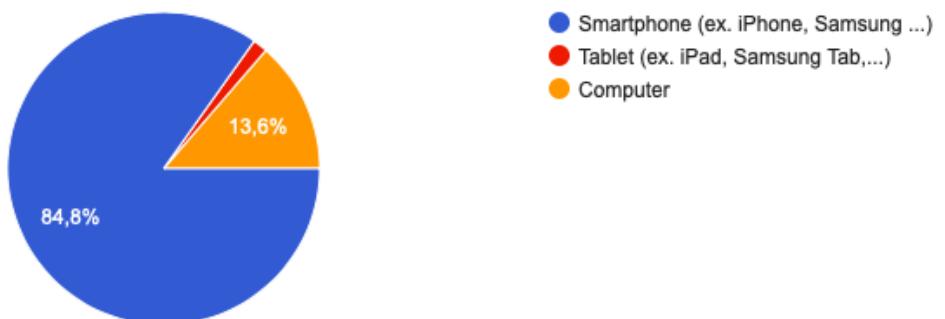
Status

66 risposte



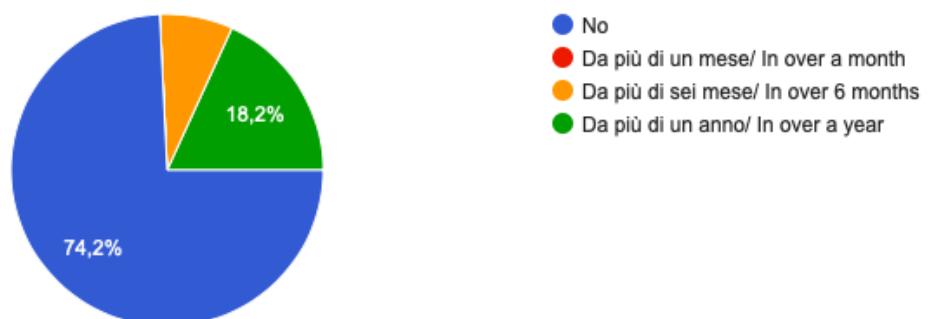
Che tipo di dispositivo usi maggiormente?/ Which type of device do you use most?

66 risposte



Ti sei trasferito in una nuova città da poco?/ Did you recently move to a new city?

66 risposte



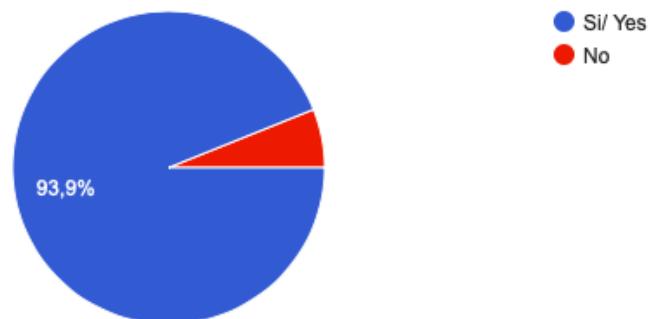
Quanto spesso fai attività ludiche (ex. Bar, passeggiata al parco, visita culturale ...) / How often do you participate to fun activities (eg. Bar, walking at the park, cultural site)

66 risposte



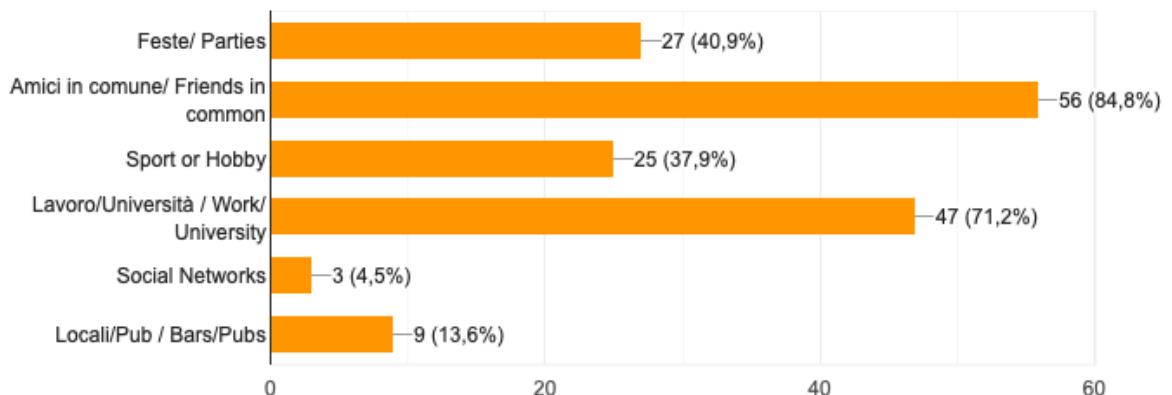
Vorresti conoscere nuove persone?/ Would you like to meet new people?

66 risposte



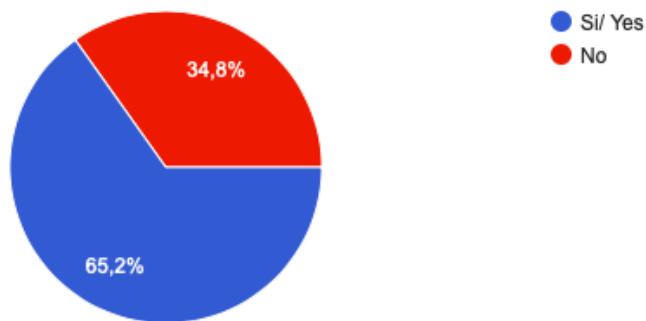
In che occasioni ti capita di conoscere nuove persone?/ On what occasions does it happen to you to meet new people?

66 risposte



Vorresti trascorrere il tuo tempo libero diversamente da come già fai?/ Would you like to spend your free time in a different way wrt your habits?

66 risposte



Come vorresti trascorrere il tuo tempo libero?/ How would you like to spend your free time?

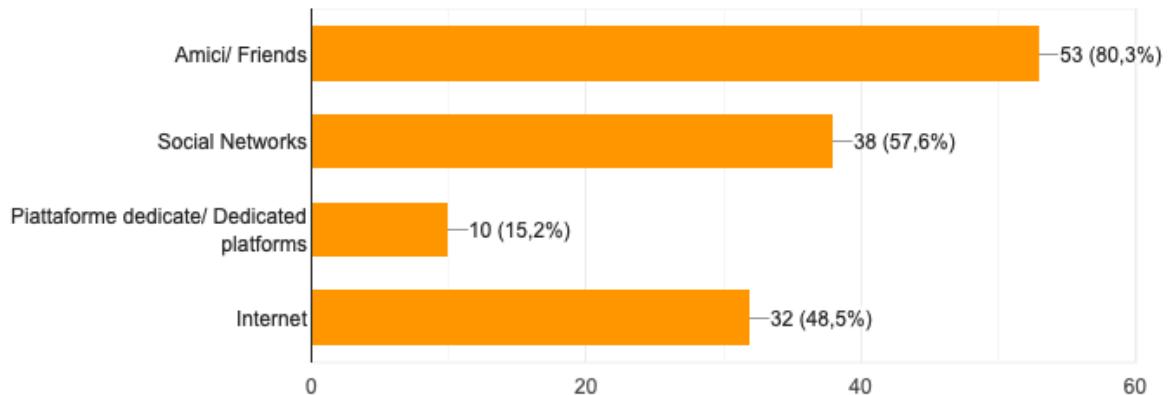
66 risposte

We can summarize the answers to this question in the following categories:

- with people, doing something different, no matter what
- cinema, theater, museum
- sport activity, walking
- bar and pubs

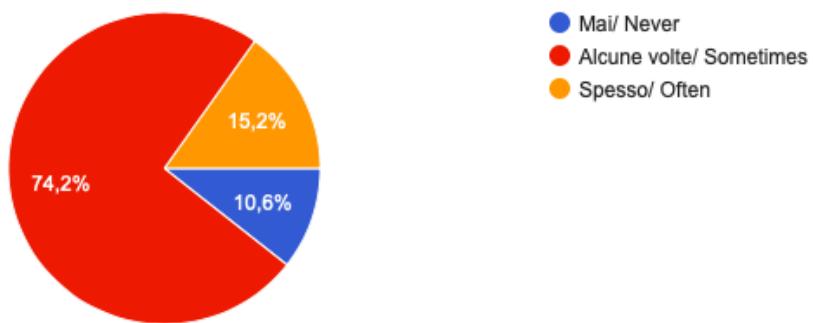
Attualmente, come ti informi su attività da svolgere nel tuo tempo libero? / How do you currently find out info about activities to carry out in your free time?

66 risposte



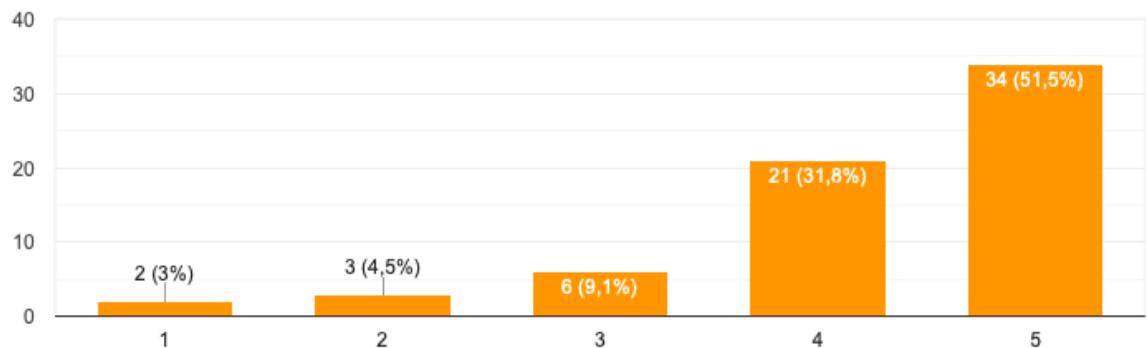
Quanto spesso svolgi un'attività dopo averla conosciuta sui social (o app simili)? / How often do you carry out an activity after having seen it on socials (or similar apps)?

66 risposte



Quanto troveresti utile una piattaforma in cui vengono condivisi eventi? / How much would you find useful a platform where events are shared?

66 risposte



Quali funzionalità suggerisci che renderebbero la piattaforma una risorsa per le tue necessità? / What features do you suggest that would make the platform useful for your needs?

66 risposte

We can summarize the answers to this question in the following categories:

- Possibility to chat
- Possibility to filter events
- Division into categories
- Around you suggestions

Oltre ad eventi come: attività/sport all'aperto, musei e visite guidate, bar dove studiare, pub ed eventi..., quali tipologie di attività vorresti trovare sulla piattaforma? / In addition to events such as: outdoor activities/sports, museums and guided tours, bars to study, pubs and events..., what types of activities would you like to find on the platform?

66 risposte

The categorization of the event that we provided was considered sufficient, the most cited ones were sport activities, places to study together and pubs for aperitifs.

2.3.1 Conclusions

Analyzing the data collected with the questionnaire we can extract the following considerations:

- The age of our possible customers ranges from 18 to 50, but with a greater concentration in the range 18-35.

- The majority of them are students, the idea was considered very useful for the persons who have recently moved to a new city.
- The most used device is the smartphone, so we confirmed the idea of developing a mobile application.
- About the 60% participate to fun activities more than once a week and the 24.2% once a week, so our application can configure itself as an almost "every-day" tool for the user.
- There is an high interest in meeting new people and in knowing new activities, which is Beehive's main feature.
- There is not a clear way in which people today find out info about activities, so Beehive could unify the needs that today are satisfied using different applications into one tool.
- We identified the categories of interest as: sport, study in company, outdoor activities, nightlife events, bar life, cultural events.
- The idea is considered very useful by more than half of the users and useful for another 40%.
- We identified also some additional functionalities (such as the group chat).

2.4 Interview

We performed an unstructured interview in order to understand the needs of our potential customers in order to let the application be really useful for them and guarantee the best user experience.

Interviewee:

- Elena, 23 years old
- born in Cosenza, Calabria
- lives in Rome

Elena told us about the main difficulties that she had to face in making friendship once she moved to Rome and considers our idea really useful to overcome the problems that she had.

As an advice she suggested to consider a category related to events to let people study together and since she doesn't have a car she suggests to introduce filters in the activities in order to reduce the range of distances in terms of km.

She thinks also that knowing in advance the number of participants to an event is necessary to decide if she wants to go or not. Overall she is very satisfied with the idea.

3 Task analysis

Task Models describe how to perform activities to reach users' goals.

Hierarchical Task Analysis (*HTA*) is a technique for task decomposition, in which each task is split and structured in a hierarchy of ordered tasks and subtasks.

State Transition Networks (*STN*) are diagrams that describe the behavior of a system in a particular function, highlighting for each user action, the system response.

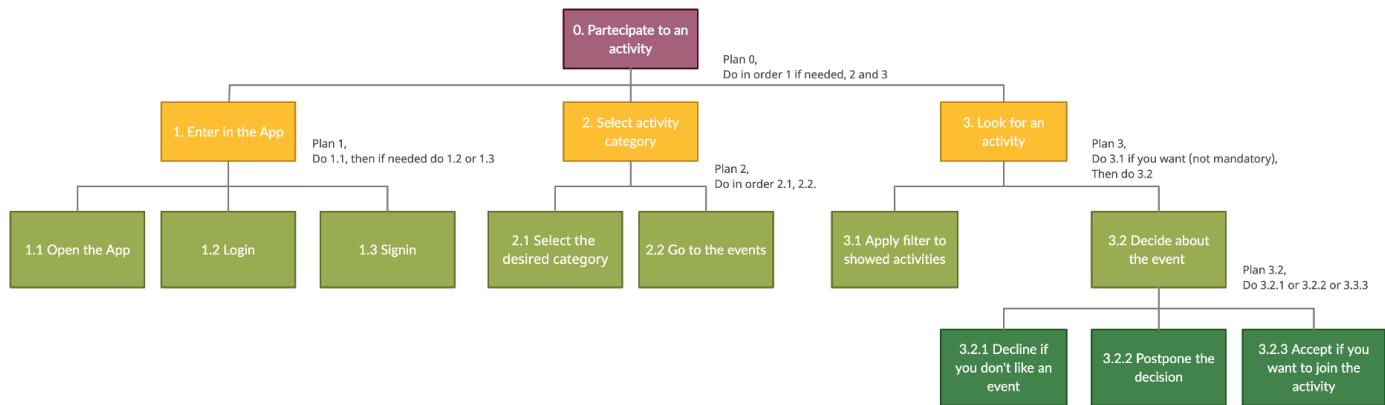
The HTA and STN presented in this section are related to the main tasks of our application:

- Participate to an activity
- Check event's information
- Add a new event

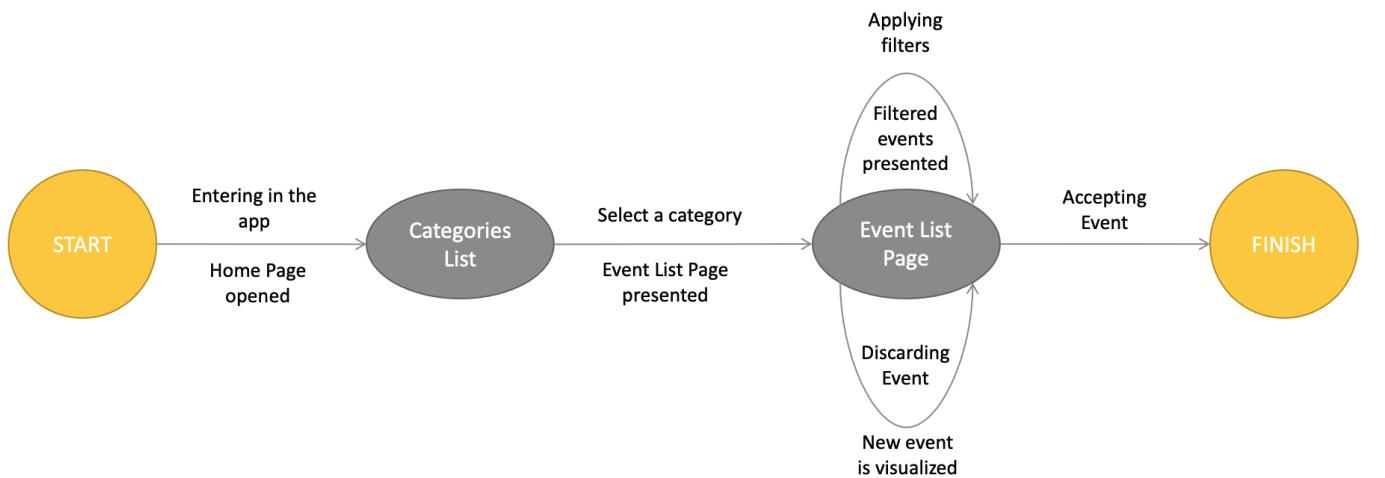
3.1 Participate to an activity

In order to participate to an activity the user, after the login, has to select the category that s/he is interested in and then s/he can choose among the events which are the ones that s/he wants to join.

HTA



STN

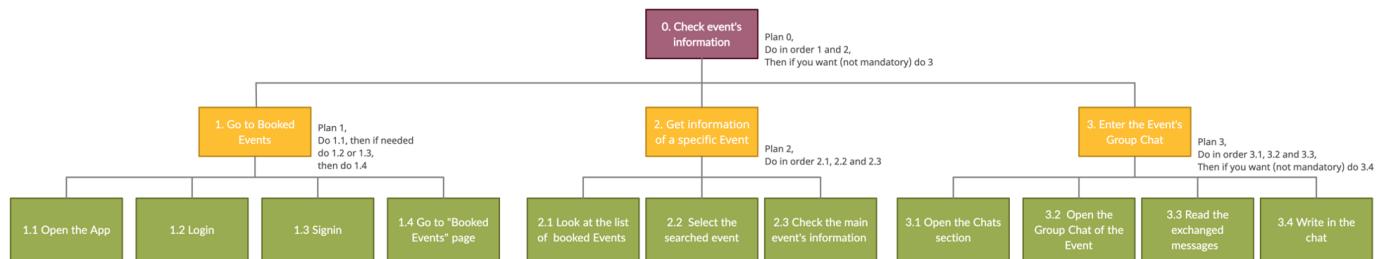


3.2 Check event's information

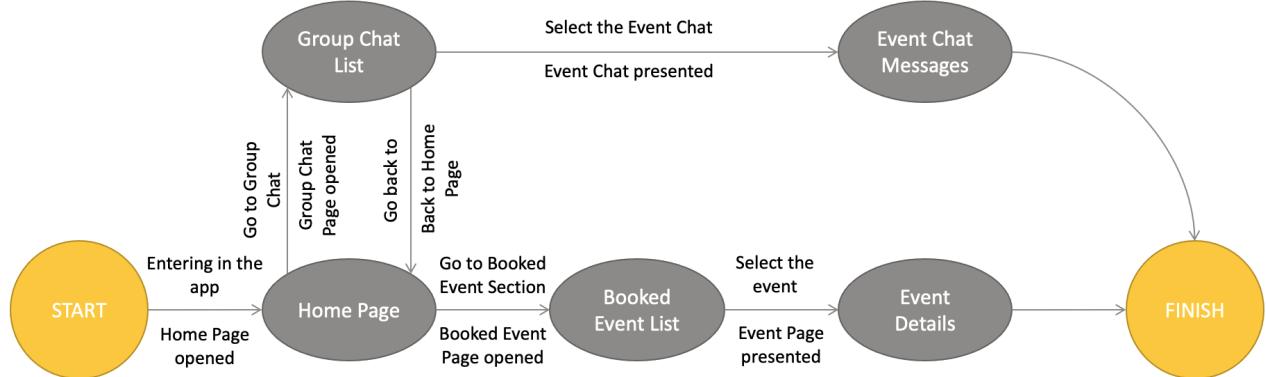
When the user wants to check the event's information of an activity that s/he has previously accepted, after the login, s/he has to go to the "Booked Event" page and select the right event.

Moreover, if s/he wants, s/he can also access the related group chat.

HTA



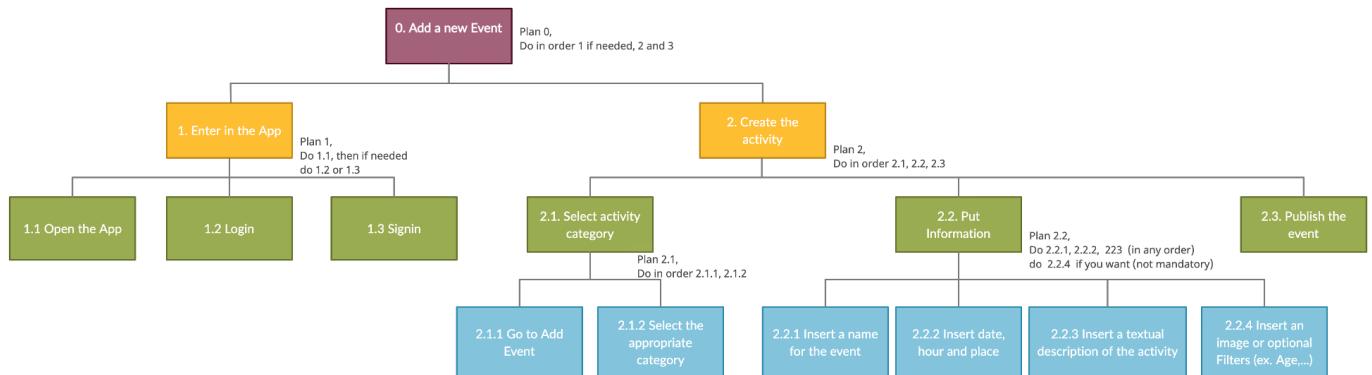
STN



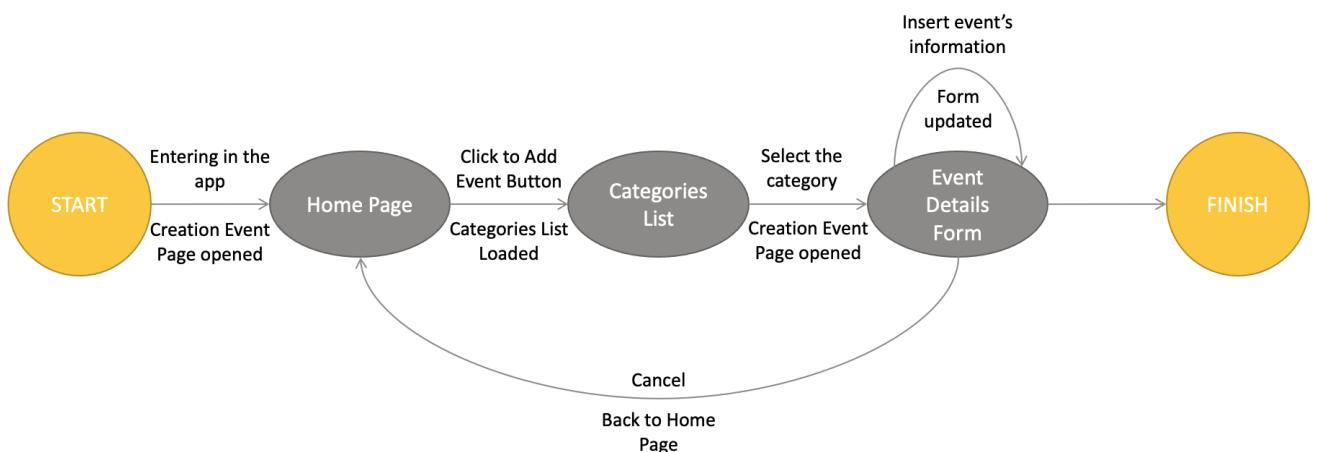
3.3 Add a new event

The user adds a new event on the application in order to share and promote it. After the login, he/she has to select the category of the activity and insert the information (title, date, hour, place, description and optionally image).

HTA



STN



4 Prototype 1

4.1 Main functionalities

In this chapter we present the mockups of our first prototype.

The main features are selected on the basis of the questionnaire's results, in particular the categories in which the events are divided.

For the graphic user interface we followed design patterns of application in a similar domain, the buttons are clear and big and the navigation is based on a static footer with the tab bar to navigate between home section, events section and profile, using widely used and familiar icons.

The mobile application main functionalities are:

- Sing up: filling a form
- Login: with username and password
- Participate to an event in a selected category
- Adding a new event
- View the list of booked events
- View the list of created events
- Chat with the participants of the events you booked

The following mockups have been done using AdobeXD.

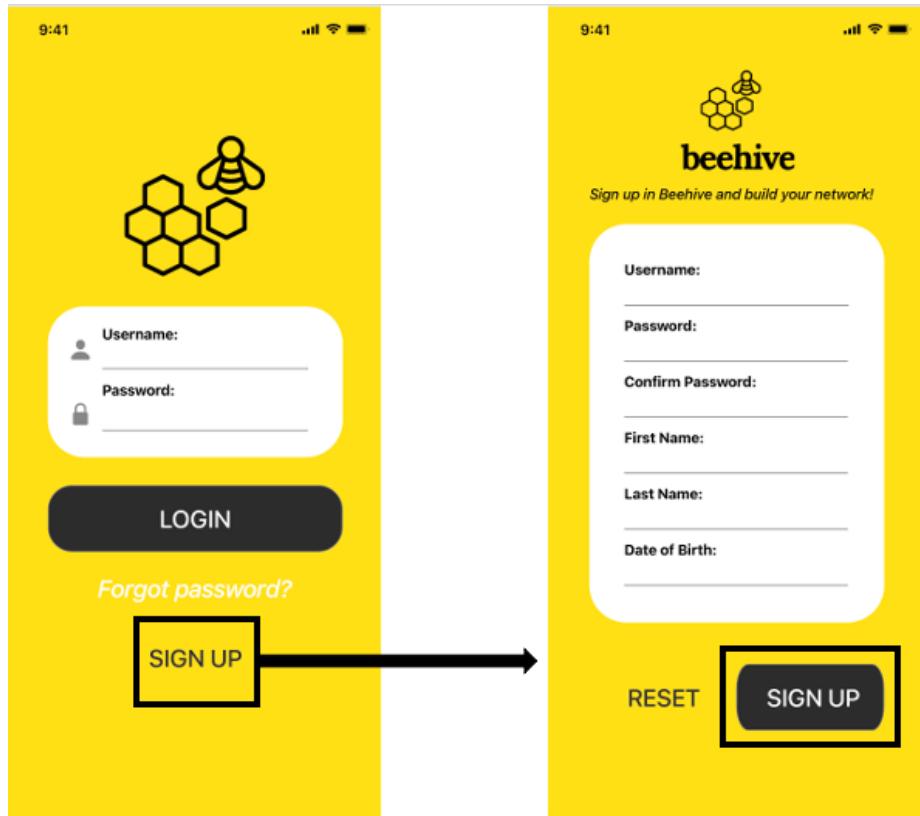


Figure 1: Task: Create a new account

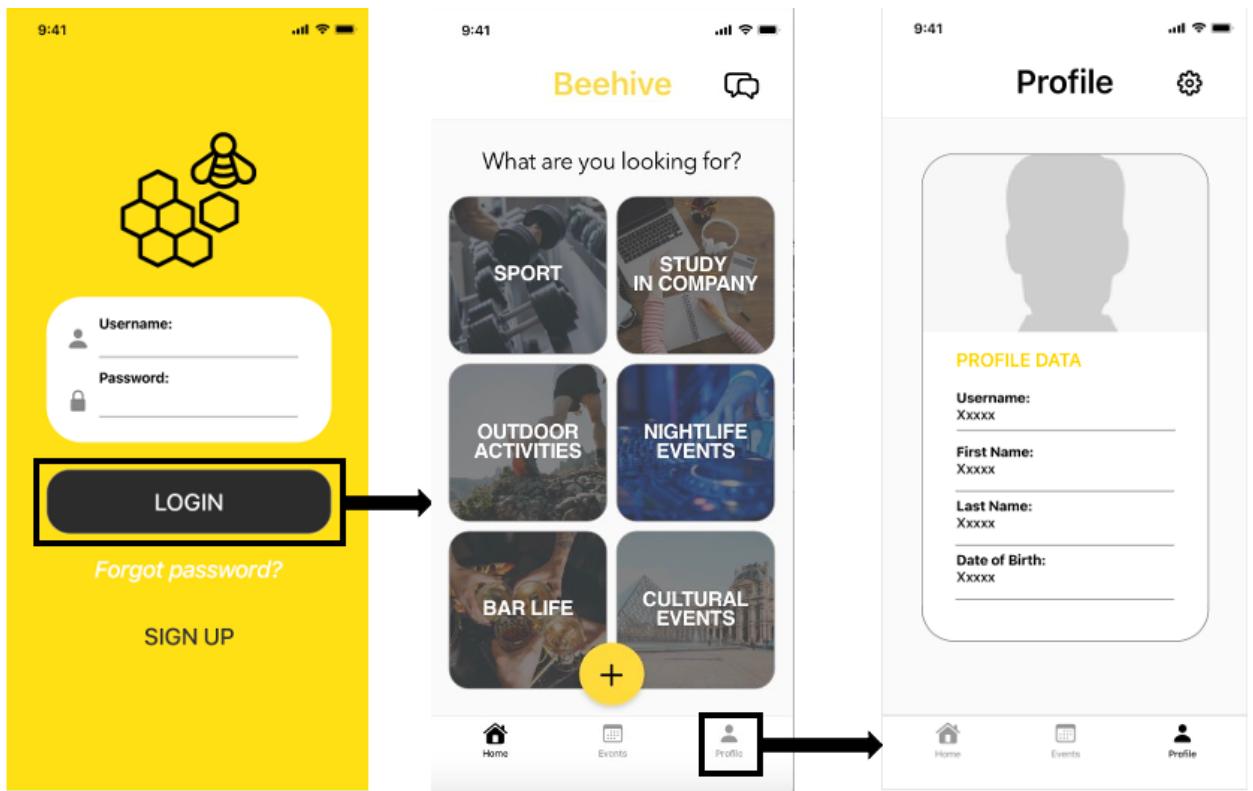


Figure 2: Tasks: Login and view profile

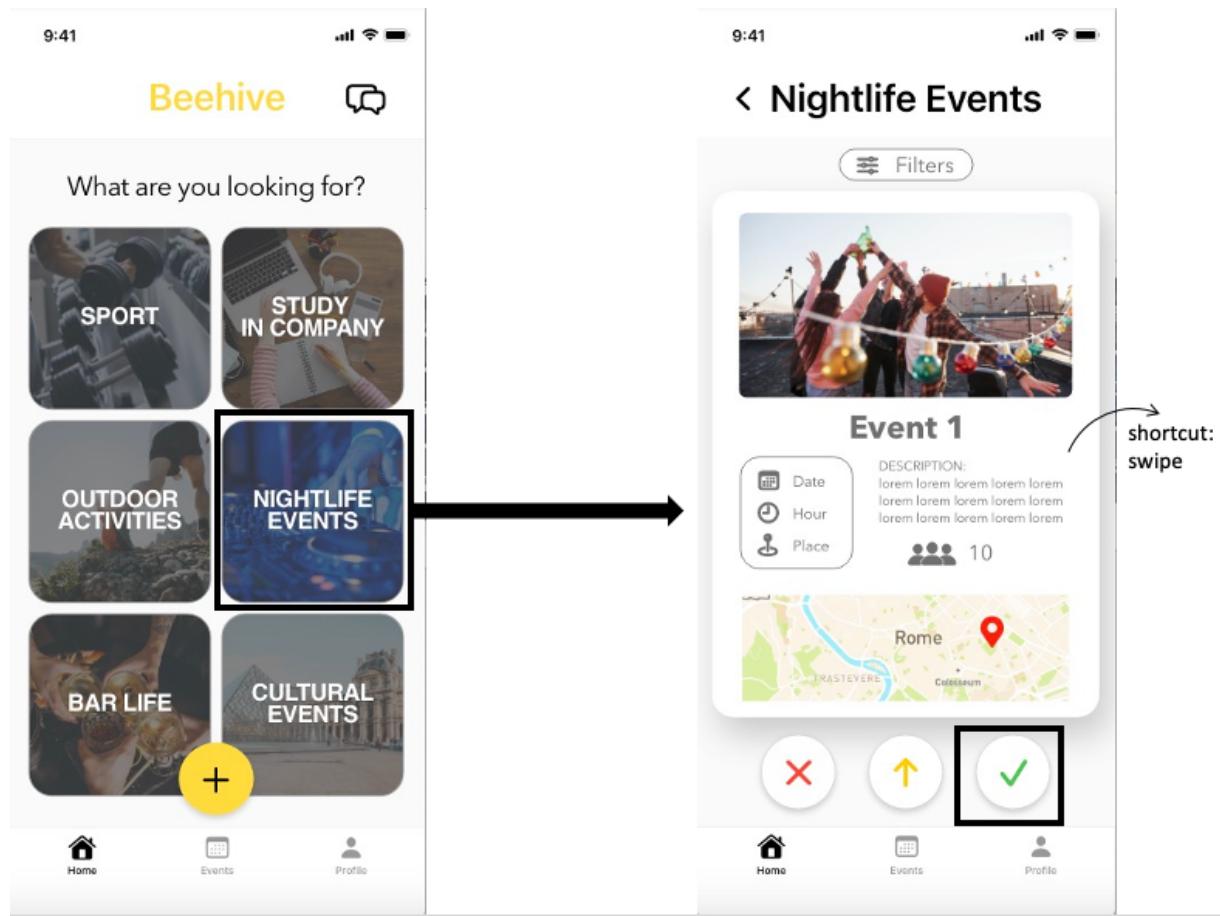


Figure 3: Task: Participate to a "nightlife" event

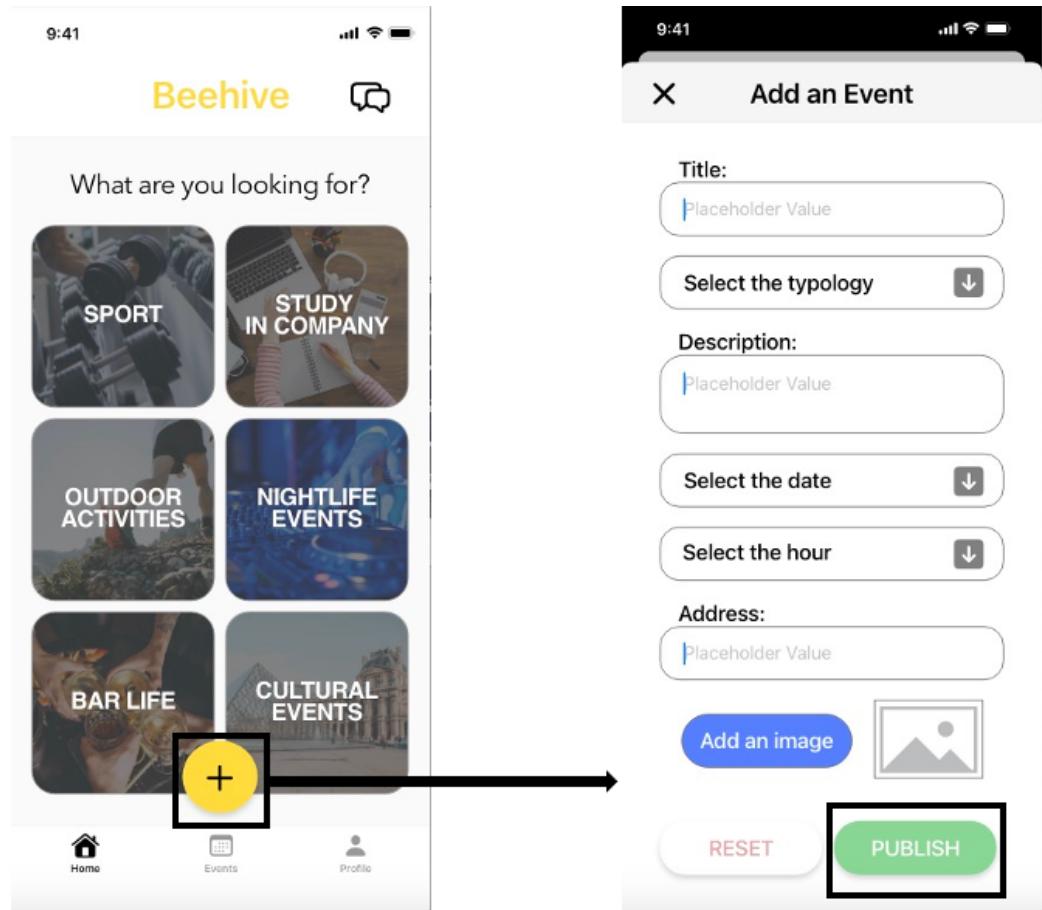


Figure 4: Task: Adding a new event

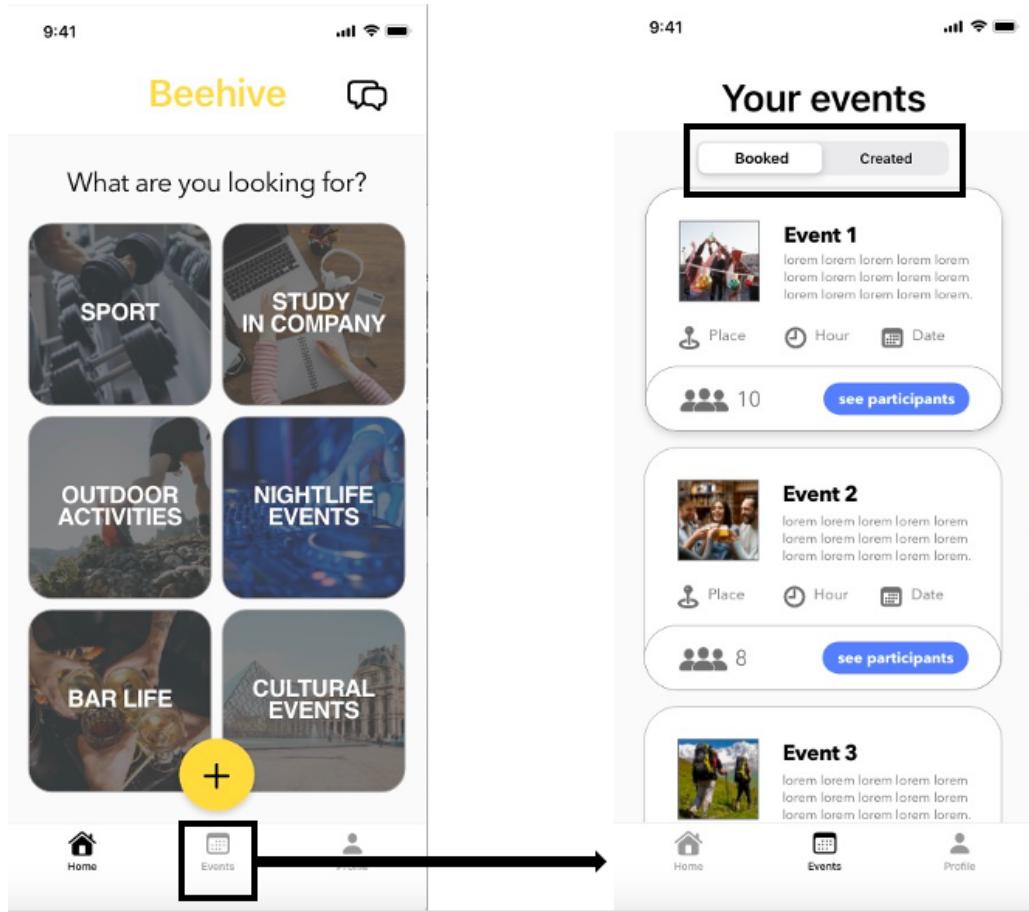


Figure 5: Task: View the list of the booked/created events

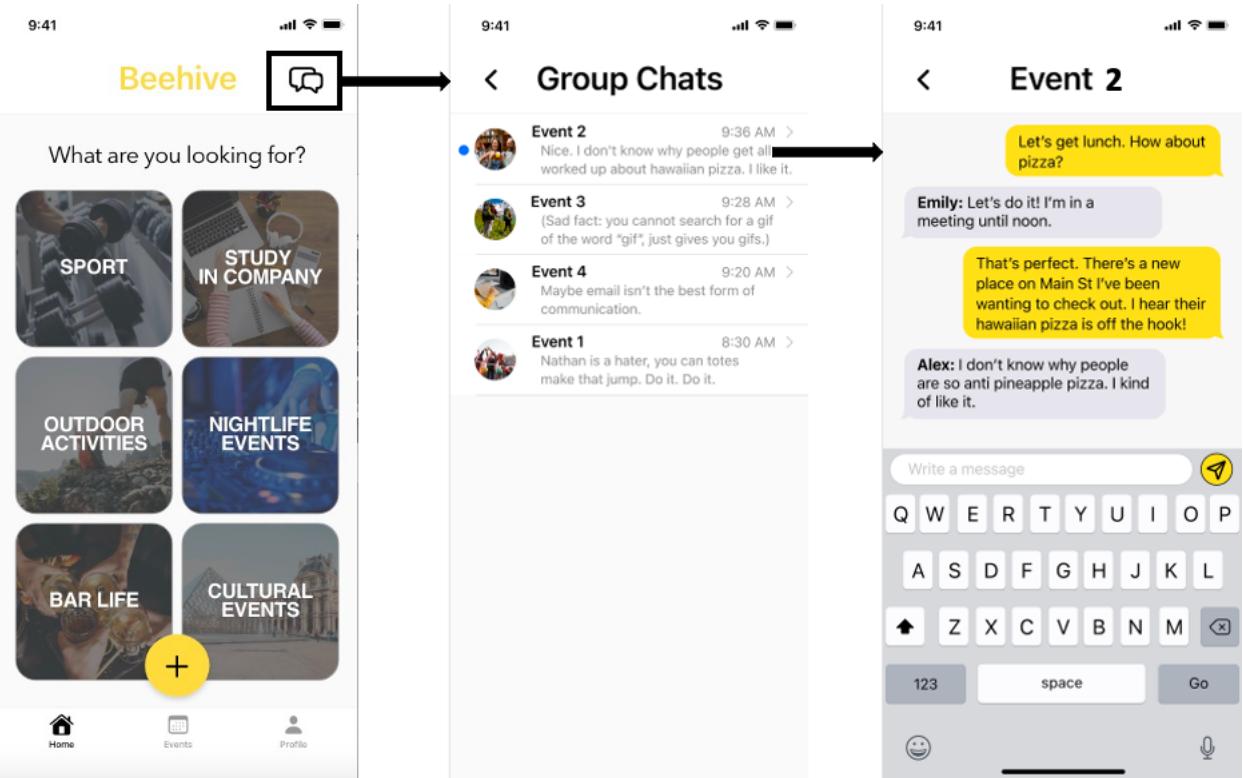


Figure 6: Task: Chat with the events' participants

5 Expert Based Evaluation

Evaluation tests usability and functionality of a system, analyzing both the design and the implementation in order to assess the extent of the functionality of a system, the effect of the interface on user and to identify specific problems.

The expert who performed both Heuristic Evaluation and Cognitive Walkthrough is Dott.ssa Valeria Mirabella.

5.1 Heuristic Evaluation

Heuristic Evaluation debugs the design problems analyzing the usability of the system following the Nielsen's heuristics, which are usability criteria, and reporting when they are violated and how high is the severity of the violation. This is done testing the interface.

5.1.1 Nielsen's 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 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.

5.1.2 Expert Report

Evaluator: Valeria Mirabella

Prototype: Beehive

Date: 24/05/2021

Evaluation

Frame	Heuristic violated	Severity	Description / Comment
Home	Recognition rather than recall	2	Consider to put in the home page some very brief note on the goal of the app
Category	Consistency and standard	3	The red X is used to cancel/delete. Once used the first card disappears, this may cause some concerns.
Category	Consistency and standard	3	The red X, the yellow arrow and the green check, once used have the same behaviour. This is confusing
Event detail	User control and freedom	3	Users often perform actions by mistake, put an "emergency exit"

Severity legend:

- 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

5.2 Cognitive Walkthrough

Cognitive walkthrough evaluates how well the design supports the learning of the task from the user.

The action and the system response are listed and the expert evaluates the task walking through the design considering psychological principles.

It evaluates the impact that the interaction has on the user, the cognitive process that are required and which are the learning problems that the user may have.

The expert has to answer the following 4 questions:

1. Is the effect of the action the same as the user's goal?
2. Will users see that the action is available?
3. Once user have found the correct action, will they know that it's the one they need?
4. After the action is take, will users understand the feedback they get?

The task analyzed by the expert is:

"Publish a "Bar Life" event in order to organize your free-time on the 25/06/2021 at the 16.00."

The screenshot shows a mobile application titled 'Add an Event'. The interface includes fields for 'Title' (placeholder 'Placeholder Value'), 'Select the typology' (dropdown menu), 'Description' (placeholder 'Placeholder Value'), 'Select the date' (dropdown menu), 'Select the hour' (dropdown menu), 'Address' (placeholder 'Placeholder Value'), and an 'Add an image' button with a camera icon. At the bottom are 'RESET' and 'PUBLISH' buttons.

Action 1: press text field input and digit the title of the event "Coffee on the beach"

Response 1: each digit is displayed as typed, flashing cursor moves to next position

Action 2: select the typology of the event, choose "Bar Life" option

Response 2: the system shows the selected category

Action 3: press text field area and digit the description of the event

Response 3: each digit is displayed as typed, flashing cursor moves to next position

Action 4: select the date of the event on the 25/06/2021

Response 4: the system shows the selected date

Action 5: select the starting hour of the event on 16.00

Response 5: the system shows the selected hour

Action 6: press text field input and digit the address of the place where the event will take place

Response 6: each digit is displayed as typed, flashing cursor moves to next position

Action 7: if you want, add an image from your library that represents the event

Response 7: the system shows the selected image

Action 8: press the “publish” button

Response 8: the details are collected by the system and the event is published

5.2.1 Expert Report

Evaluator: Valeria Mirabella

Prototype: Beehive

Date: 26/05/2021

Task

Publish a “Bar Life” event in order to organize your free-time on the 25/06/2021 at the 16.00.

Action 1: press text field input and digit the title of the event “Coffee on the beach”

Response 1: each digit is displayed as typed, flashing cursor moves to next position

Q1: Yes. It is reasonable that a user familiar with event or even calendars would be trying to do this as his first goal

Q2: Yes

Q3: Yes

Q4: Yes

Action 2: select the typology of the event, choose “Bar Life” option
Response 2: the system shows the selected category

Q1: Yes

Q2: Yes

Q3: I think yes, even if I cannot see the complete list of the available category to check if some options could be confusing

Q4: Yes

Action 3: press text field area and digit the description of the event

Response 3: each digit is displayed as typed, flashing cursor moves to next position

Q1: Yes

Q2: Yes

Q3: Yes

Q4: Yes

Action 4: select the date of the event on the 25/06/2021

Response 4: the system shows the selected date

Q1: Yes

Q2: Yes

Q3: Yes

Q4: Yes

Action 5: select the starting hour of the event on 16.00

Response 5: the system shows the selected hour

Q1: Yes

Q2: Yes

Q3: Yes

Q4: Yes

Action 6: press text field input and digit the address of the place where the event will take place
Response 6: each digit is displayed as typed, flashing cursor moves to next position

Q1: Yes

Q2: Yes

Q3: Yes

Q4: Yes

Action 7: add an image from your library that represents the event

Response 7: the system shows the selected image

Q1: We cannot assume that adda the image is a goal for all our users

Q2: Yes

Q3: probably yes

Q4: Yes

Action 8: press the “publish” button

Response 8: the details are collected by the system and the event is published

Q1: Yes

Q2: Yes

Q3: Yes

Q4: No, the system does not have a proper feedback. It is reasonable that the user will not get that point

6 Prototype 2

Prototype 2 was built after receiving the expert-based evaluation and the changes are inserted in order to solve these issues.

6.1 Correction of HE detected defects

From the Heuristic Evaluation the main problem was the absence of a feedback when performing action in the page related to a category. The red X, the yellow arrow and the green check appear to do the same thing (which is let the card disappear).

Moreover an emergency exit is needed when events are added or removed by mistake by the user.

Frame: Category, Heuristic Violated: Consistency and standard

Both problems are solved providing a feedback after the action of the user.

Moreover a temporary undo button is added to directly undo an action made by mistake.

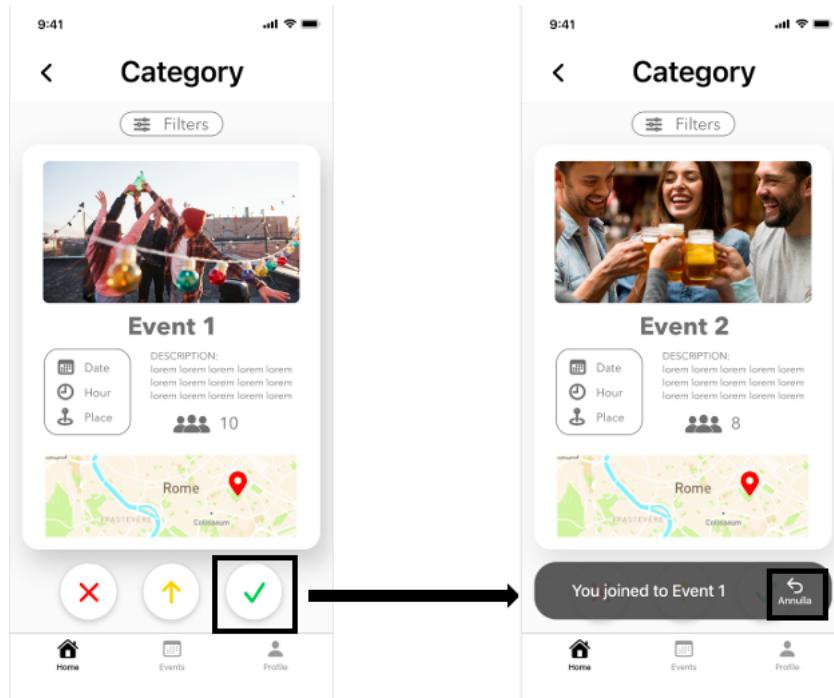


Figure 7: Task: Join an event

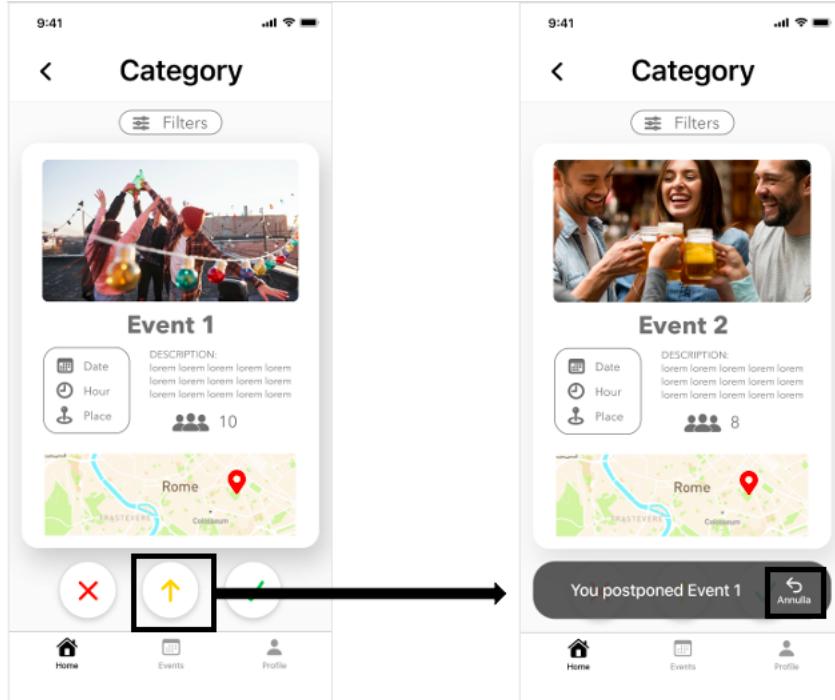


Figure 8: Task: Postpone the decision about an event

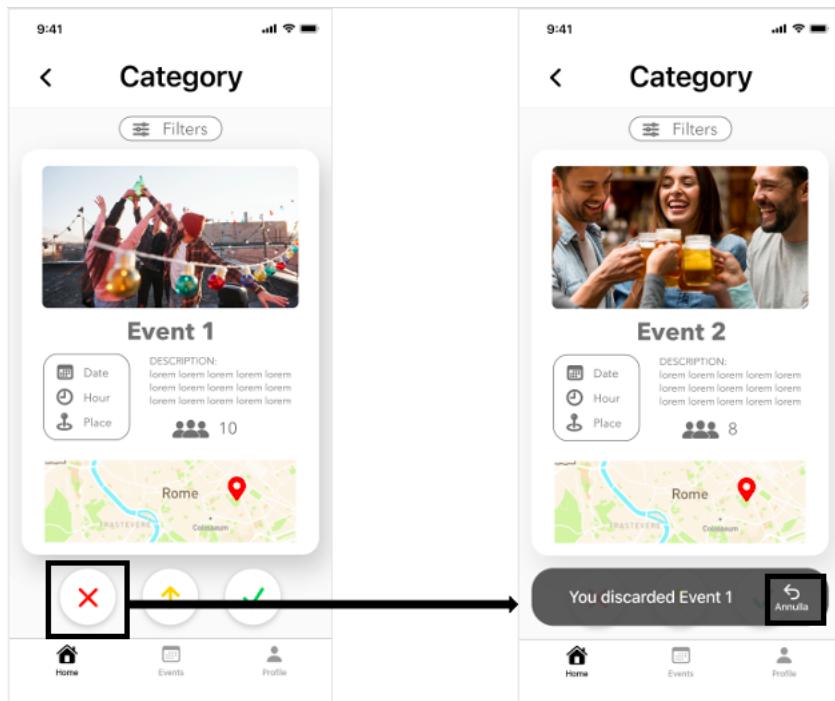


Figure 9: Task: Discard an event

Frame: Event detail, Heuristic Violated: User Control and freedom

User often perform actions by mistake, an "emergency exit" is needed to let the user cancel an event that he has booked by mistake or that he is no more interested in. In the Event page for each event a "leave" button is added.

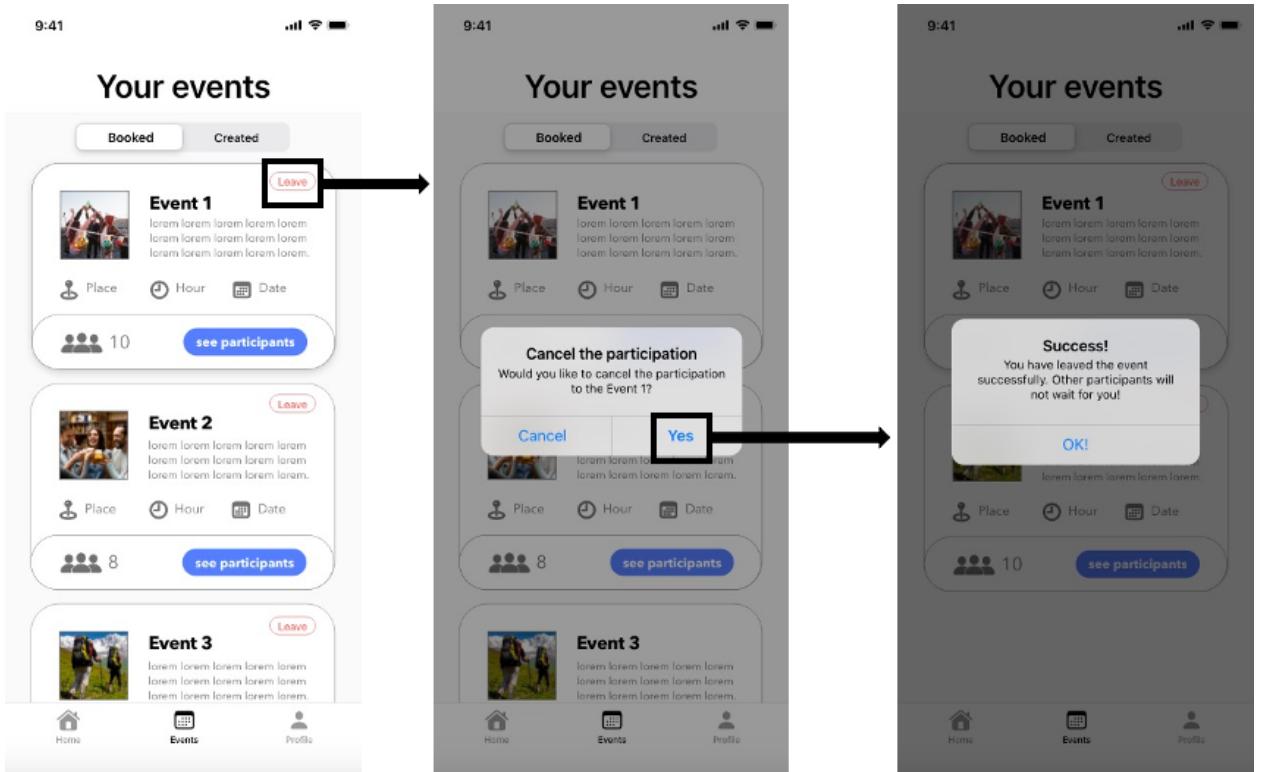


Figure 10: Task: Leave a booked event

Frame: Home, Heuristic Violated: Recognition rather than recall

Regarding that violation to solve the comment to provide a brief note on the goal of the application, in the final product we provide a Tour tutorial that highlights the key features of the application that is presented only the first time a user launches an app.

It is also added an help page that is always available for doubts.

6.2 Correction of CWT detected defects

From Cognitive Walkthrough there were little concerns, here solved:

- in the form to add a new event, when selecting the typology, all the categories are shown in order to let the user not be confused,
- the upload of an image is not mandatory,
- a feedback after pressing the button "publish" is shown to the user as a pop-up

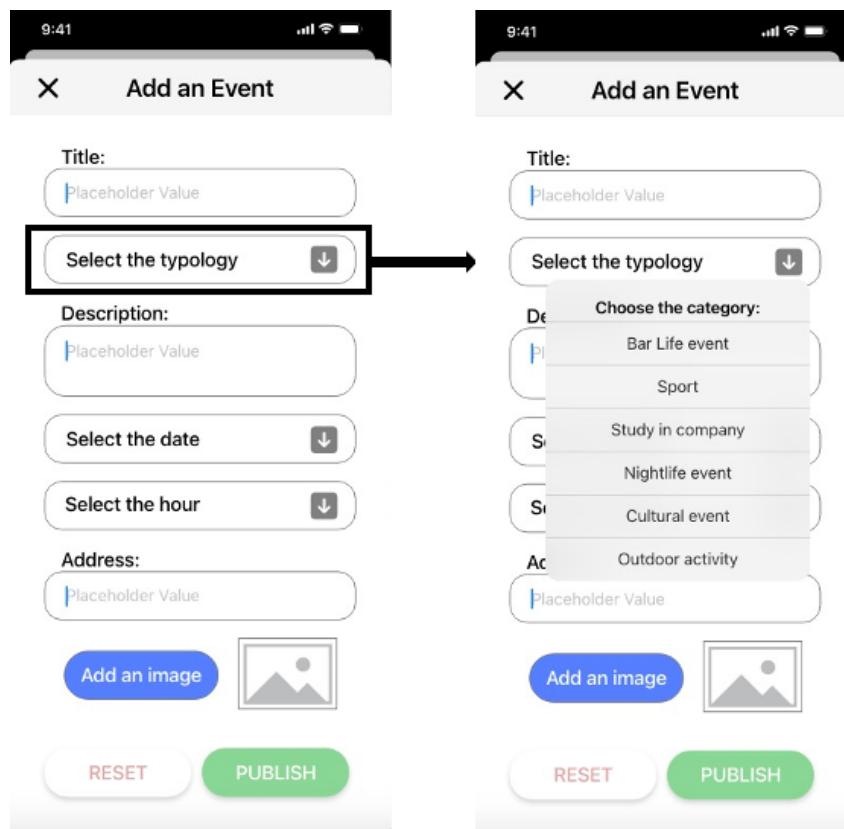


Figure 11: Task: Select the typology when adding an event

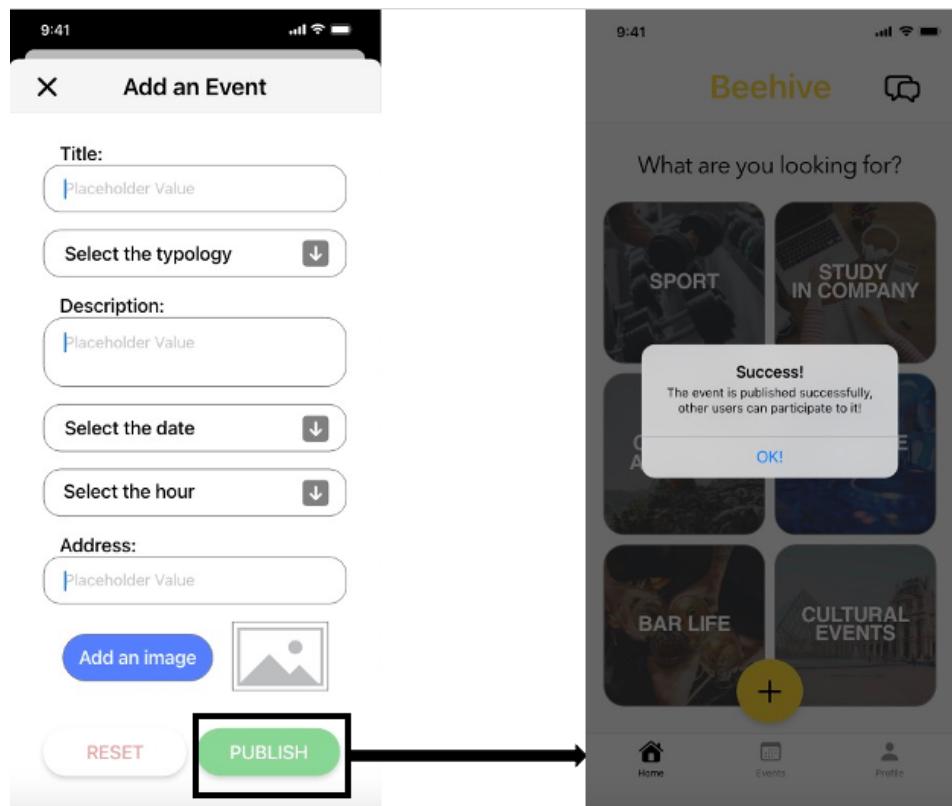


Figure 12: Task: Publish an event

7 Think Aloud

Think Aloud is an observation method based on the help of some potential users of the product.

The user is observed while performing the task and he is asked to describe what he is doing, why he is doing it and what he thinks that is happening.

The evaluator can't give clarification, he can only remind the user to talk.

The great advantage is that it shows how the system is actually used and is simple, but it suffers subjectivity, it's selective and moreover it has to be considered that the act of describing can alter the task performances of the user.

7.1 TA session

We performed the Think Aloud to evaluate Prototype 2.

We chose a group of 12 people of different ages and different familiarity with mobile applications, all with the characteristics described in our user profile.

- We explained who we are and what we are doing
- Each user has to accomplish the following tasks individually:
 - Participate to an event
 - Postpone an event
 - Discard an event
 - See event details and participants
- Each person had his own smartphone and performed the task on the interactive mock-up¹
- Each user talked aloud and during the experiment we took note using pen and paper.

¹The interactive mockup made with AdobeXD can be tested from every device using a link

7.2 Conclusions of the think aloud session

Everyone showed great enthusiasm for the interface which is considered fancy but simple and easy to use.

We noticed that the majority of young people, and the ones that were more familiar with mobile applications, accepted or refused the events swiping the cards while all the 4 people over 40 year used exclusively the buttons.

The task that created problems in being accomplished is the postpone, that they recognized reasoning by exclusion since the accept and discard buttons were clear. To make it more clear we decided to change the icon of the up arrow that appeared to be confusing for the user with a clock that better reflects the concept of "postpone".

We decided also to change, in the page of a specific event, the button from "details" to "see participants" since it's more clear what is the info that you're going to get clicking that button since some user had difficulty in find where the participants are shown.

8 Controlled Experiment

Controlled experiment is one of the most powerful methods of evaluating a design or an aspect of a design.

This provides empirical evidence to support a particular claim or hypothesis. The experiment follows a basic form: the evaluator chooses a hypothesis to test, which can be determined by measuring some attribute of participant behavior. Within this basic form there are a number of factors that are important to the overall reliability of the experiment, which must be considered carefully in experimental design. These include the participants chosen, the variables tested and manipulated, and the hypothesis tested.

8.1 Event Cards

At the beginning we implemented the "event cards" interface without buttons, the user could accept, postpone or reject an event only using gestures. Since we were not sure that the user would understand in a simple and immediate way how to interact with the interface, we decided to run a controlled experiment to understand if the addition of buttons would have made the task easier to execute. In fact, the big advantage of a controlled experiment is that you can eliminate much of the uncertainty about your results.

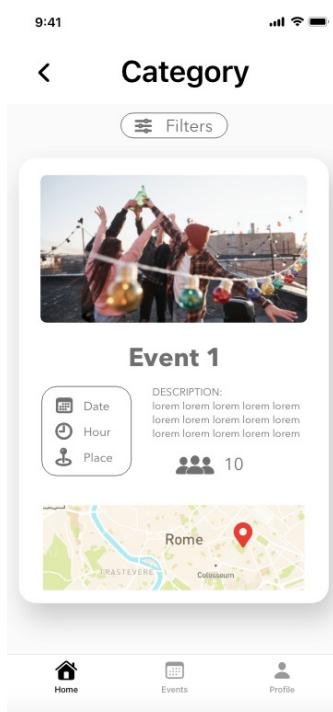


Figure 13: Interface 1

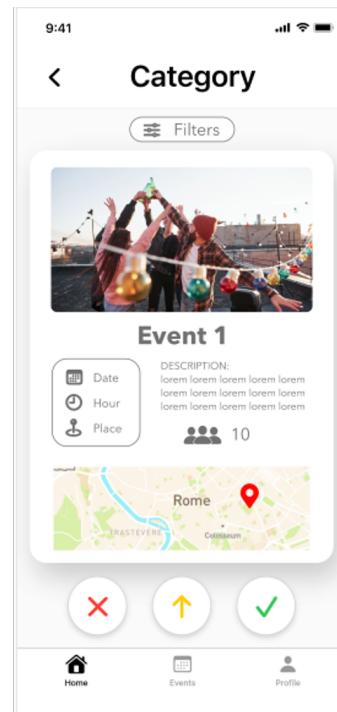


Figure 14: Interface 2

8.1.1 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.

We performed the experiment with the option "between groups", so we divided the users into 2 groups, each one of 10 users, and each user performs the task only under one condition, with no transfer of learning.

- **Who?** we searched for people according to our user profile (18-50 y), also relying on the data collected through the questionnaire.
- **Variables:**
 - independent: the two interfaces;
 - * interface 1: Event card without buttons
 - * interface 2: Event card with buttons
 - dependent: the time in seconds to execute a task.
- **Hypothesis:**
 - null: no differences between two interfaces;
 - our: users will complete the task in less time using the interface with buttons (interface 2).
- **Experiment:**
 - task: "Book an event";
 - assumptions: user is already logged and in a specific event category page.
- **Apply ANOVA:** We measured how much time each user takes to perform the same task requested with the two different interfaces using a chronometer. We collected the values to compute our analysis.

Interface 1	Interface 2
12,3	5,7
25,04	2,13
17,8	3,4
16,3	5,22
23,42	6,1
11,15	4,32
9,3	2,69
32,01	3,75
19,35	4,51
13,8	5,15

Figure 15: Times to "Book an event" with the 2 different interfaces

Anova: Single Factor

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Colonna 1	10	180,47	18,047	50,299001
Colonna 2	10	42,97	4,297	1,6918678

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	945,3125	1	945,3125	36,364559	1,05924E-05	4,4138734
Within Groups	467,91782	18	25,995434			
Total	1413,23032	19				

Figure 16: ANOVA Results

Analysis of ANOVA results²

As shown in the *Figure 16*(ANOVA Results) $F > F\text{-crit}$ and so the null hypothesis, stating that there are no differences between the interfaces, can be rejected. So, our data have statistical relevance and the two examined populations (the groups of times collected using interface one, and the other using interface two) are not equal.

²Performed using the data analysis plugin in Microsoft Excel

The threshold used to perform the analysis is 0.05 significance level. The significance value here is $1.05924 \cdot 10^{-5}$ which is smaller than 0.05.

Analyzing the means of the two population (representing the average time needed to complete the task) we can see that the mean of interface 2 is much smaller than the one of interface 1: $4.297 < 18.047$.

We can so, confirm our initial hypothesis for which the interface 2, the one with the buttons, has better performances compared to the interface 1, without buttons; so we keep interface 2.

8.2 Leave Event

When implementing "Event list" we can't decide between a button with three dots to open a popup to leave the event or a button with written on it "Leave" and then we decided to run a controlled experiment to understand which methods were more easier and faster to adopt it.

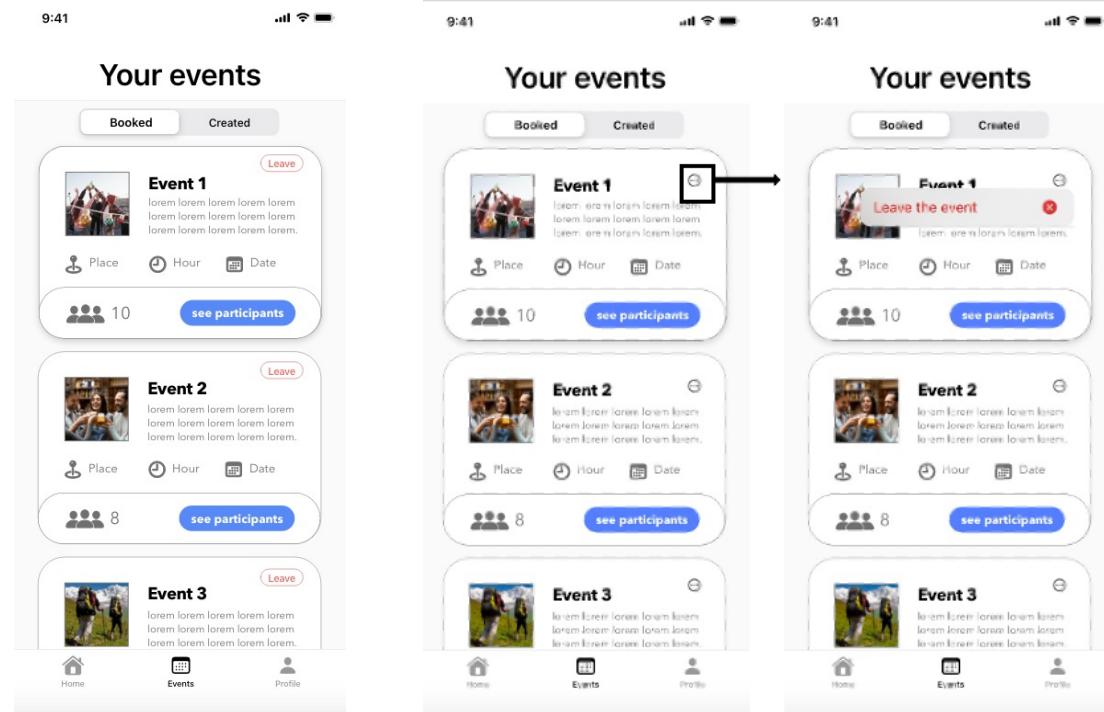


Figure 17: Interface 1

Figure 18: Interface 2

8.2.1 ANOVA One-way Analysis

As in the previous case, the controlled experiment has been performed with ANOVA One-Way analysis. We asked to 20 different people to perform the task. As before, we divided the users into 2 groups.

- **Who?** we searched for people according to our user profile (18-50 y), also relying on the data collected through the questionnaire.
- **Variables:**
 - independent: the two interfaces;
 - * interface 1: Event card with "Leave" button.
 - * interface 2: Event card with three dots button.
 - dependent: the time in seconds to execute a task.
- **Hypothesis:**
 - null: no differences between two interfaces;
 - our: users will complete the task in less time using the interface with "Leave" button (interface 1).
- **Experiment:**
 - task: "Leave an event";
 - assumptions: user is already logged and in the event list page.
- **Apply ANOVA:** We measured how much time each user takes to perform the same task requested with the two different interfaces using a chronometer. We collected the values to compute our analysis.

Interface 1	Interface 2
5,03	9,2
6,22	7,45
5,89	6,53
4,8	5,8
7,56	8,21
8,01	5,44
5,12	6,78
4,93	7,22
6,01	12,1
5,45	9,41

Figure 19: Times to "Leave an event" with the 2 different interfaces

Anova: Single factor

SUMMARY

Groups	Count	Sum	Average	Variance
Column 1	10	59,02	5,902	1,226773333
Column 2	10	78,14	7,814	3,987782222

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	18,27872	1	18,27872	7,010653086	0,016366034	4,4138734
Within Groups	46,931	18	2,6072778			
Total	65,20972	19				

Figure 20: ANOVA Results

Analysis of ANOVA results³

As shown in the *Figure 20*(ANOVA Results) also in this case the $F > F\text{-crit}$ and so the null hypothesis can be rejected.

As in the previous case the two examined populations (the groups of times collected using interface one, and the other using interface two) are not equal.

The significance value is 0.016366034 and then is still smaller than 0.05.

³Performed using the data analysis plugin in Microsoft Excel

This time analyzing the means of the two population we can see that the mean time used to complete the task for interface 1 is smaller than the one for interface 2: $5.902 < 7.814$.

We can so, confirm our initial hypothesis for which the interface 1, the one with the "Leave" buttons, has better performances compared to the interface 2; so we keep interface 1.

9 Final Product

9.1 Technological information

The Final Product has been developed using **Ionic** framework, that provides a way to develop one codebase and have an application that can run on any platform.

It is an open source UI toolkit for building performant, high-quality mobile apps using web technologies such as. HTML, CSS, and JavaScript, integrating them with frameworks like Angular.

The little part of back-end is implemented with **NestJS** that is progressive Node.js framework for building server-side applications.

The information about the users are kept in a localDB implemented with **MongoDB** a document-based database.

9.2 Story Boards

To increase the learnability and help the user interfacing for the first time with Beehive we introduced a Tour tutorial that highlights the key features of the application that is presented only the first time a user launches an app.

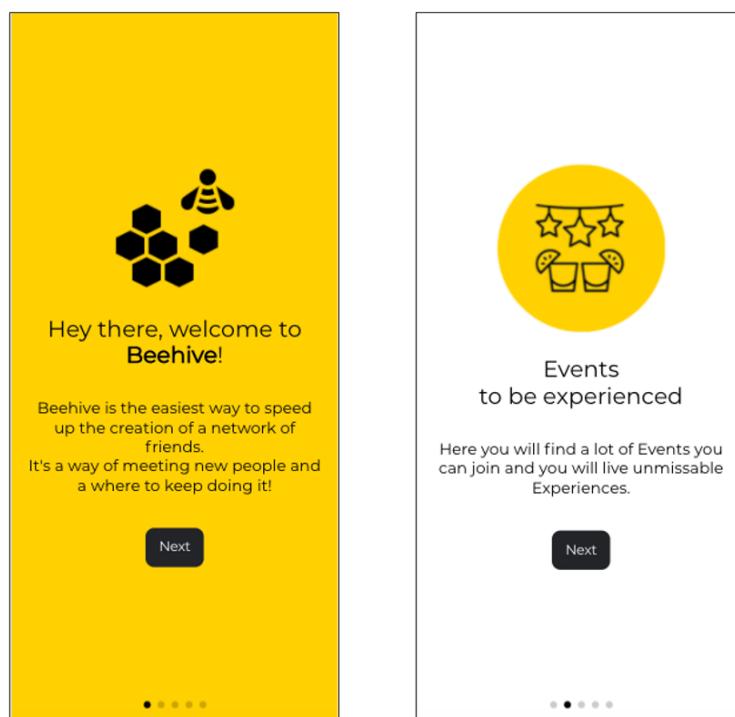


Figure 21: Tour

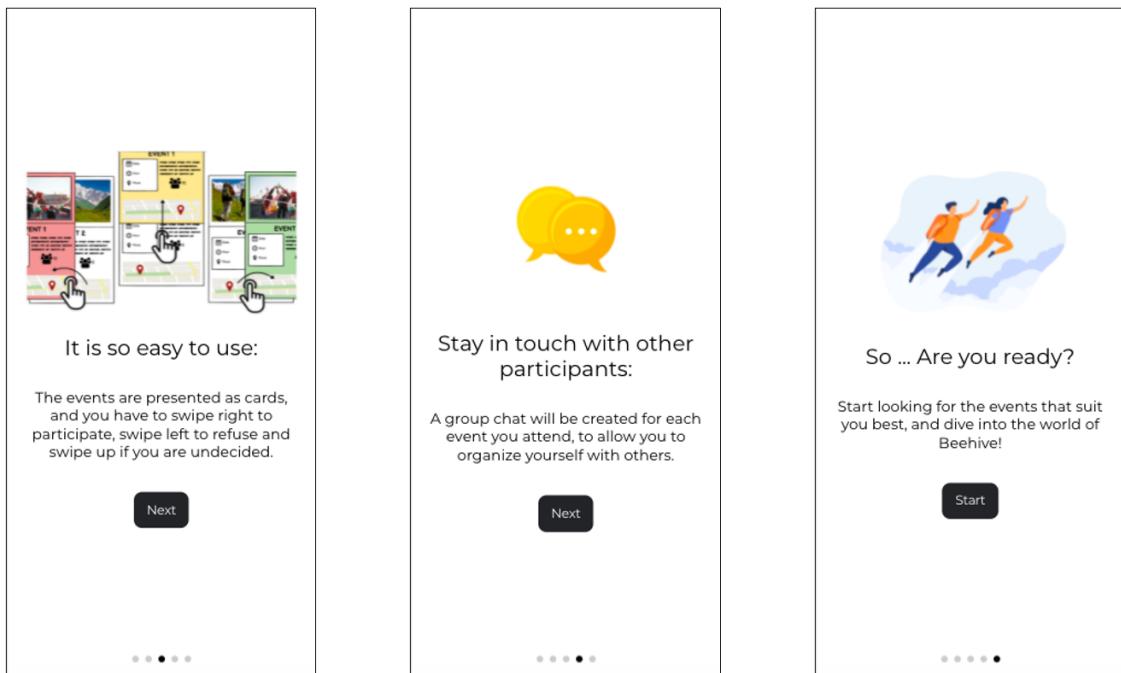


Figure 22: Tour

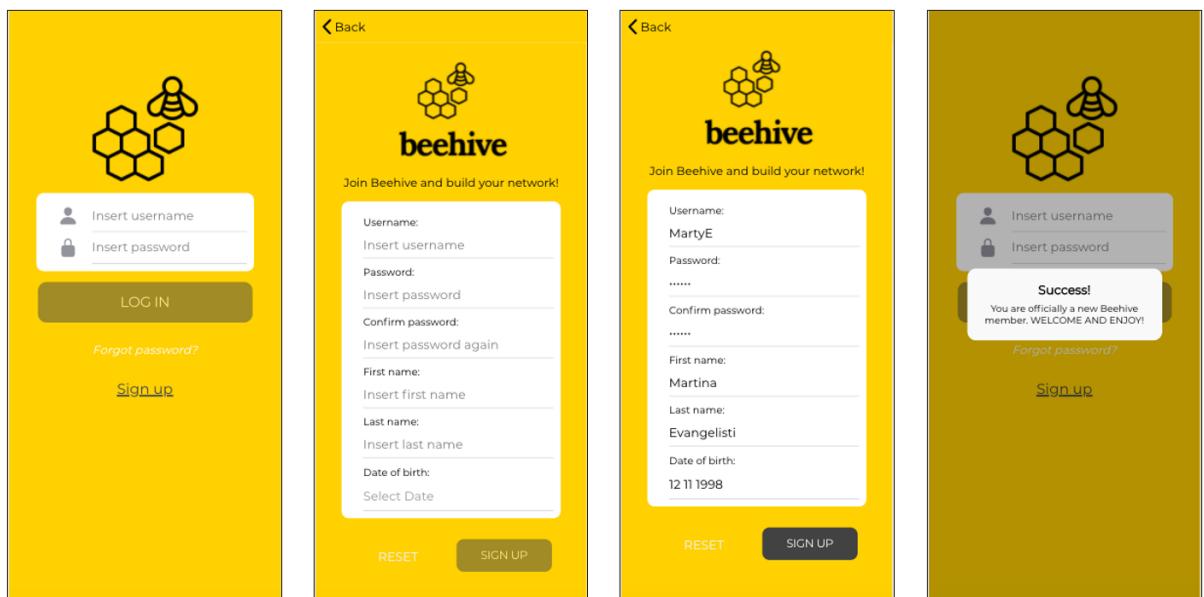


Figure 23: Sign Up

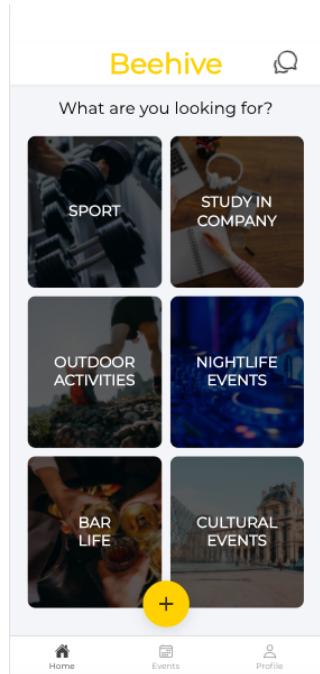


Figure 24: Home Page

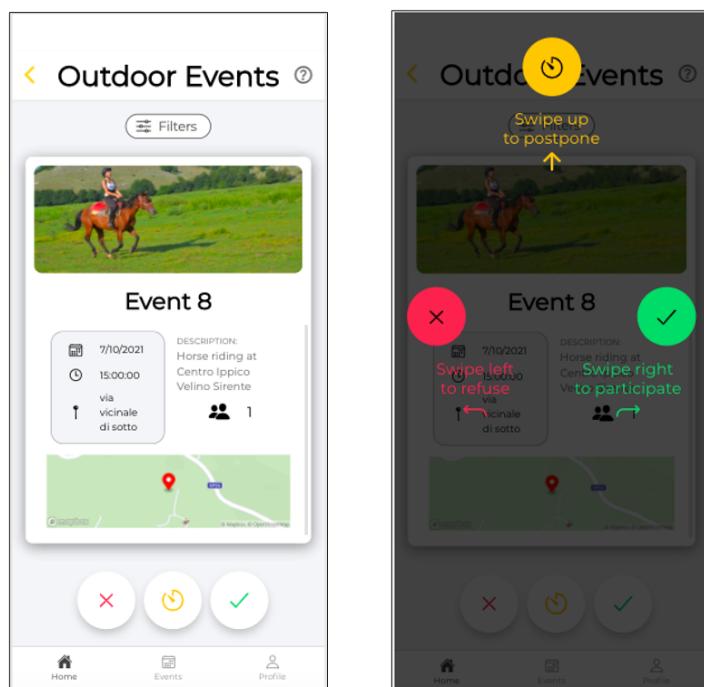


Figure 25: Tip to handle the cards of the events

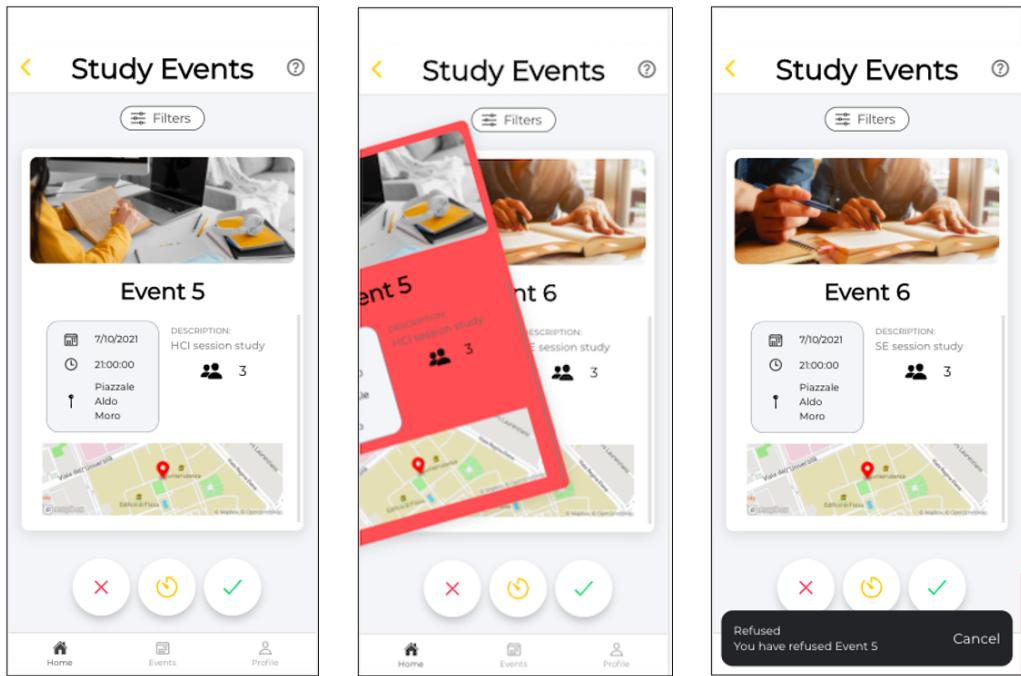


Figure 26: Refuse an event

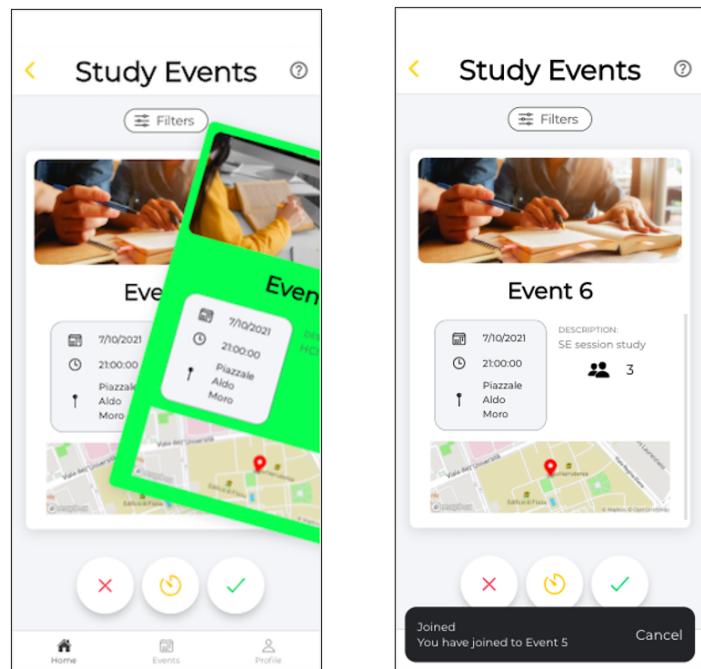


Figure 27: Join an event

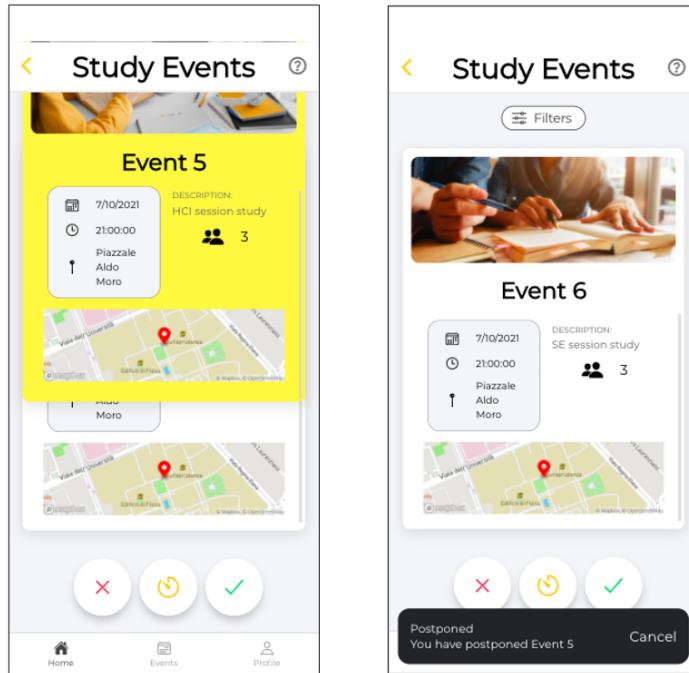


Figure 28: Postpone the decision about an event

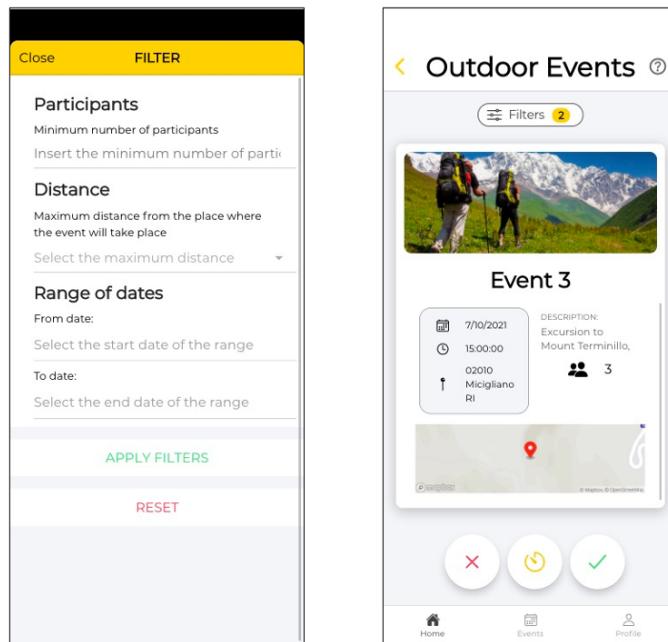


Figure 29: Filter the events

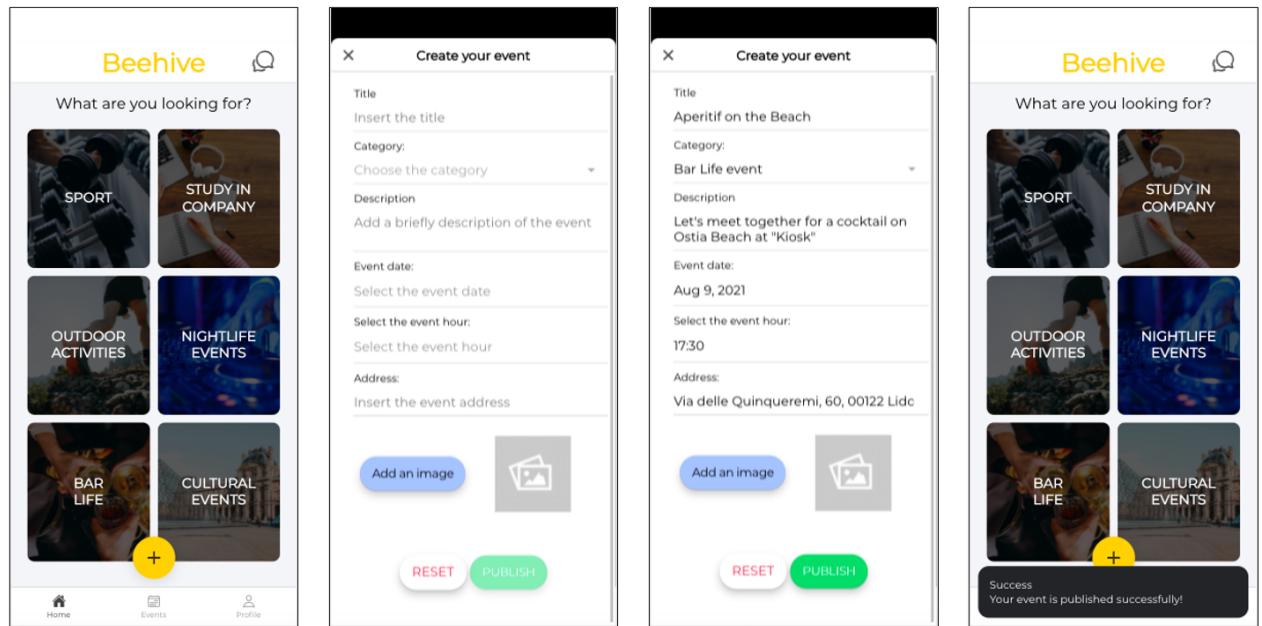


Figure 30: Add an event

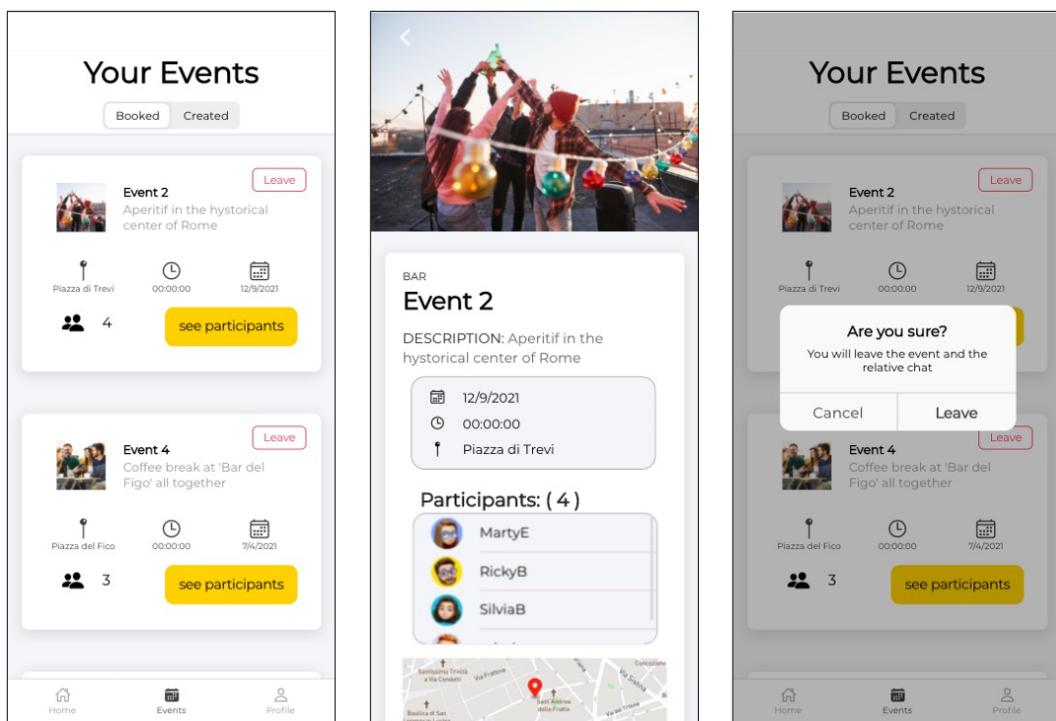


Figure 31: See booked events, event's detail, leave an event

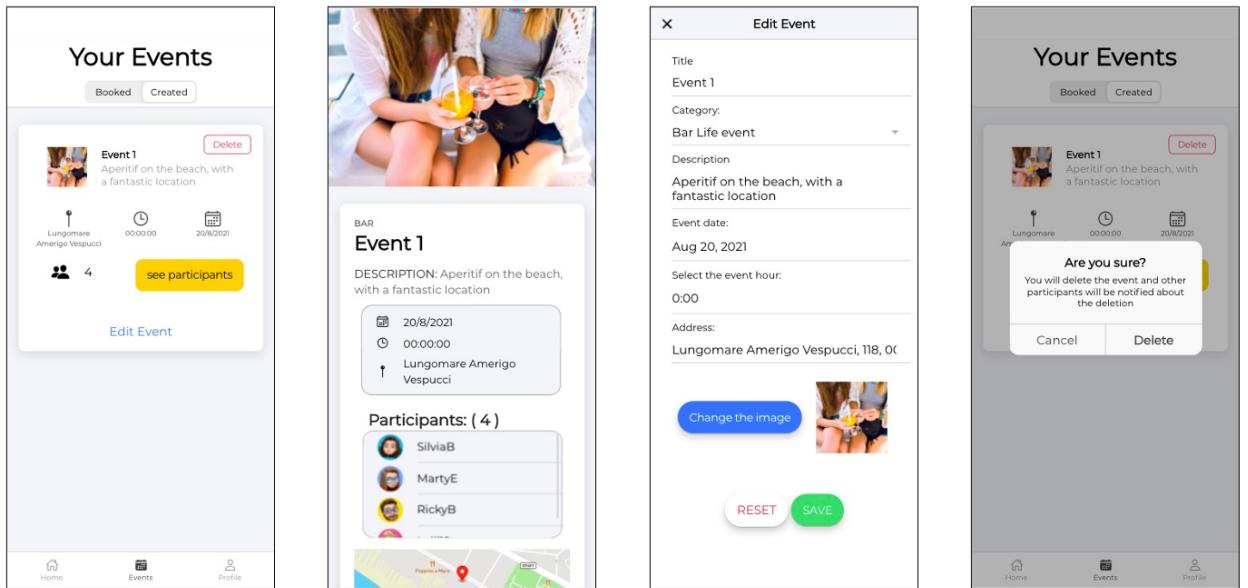


Figure 32: See created events, event's detail, edit event, delete event

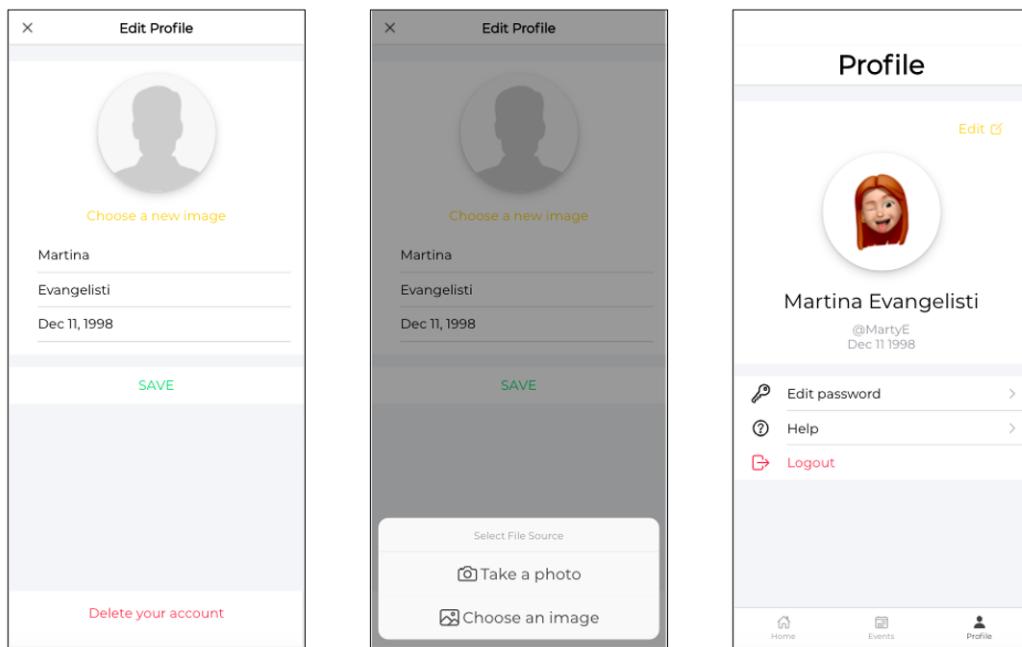


Figure 33: Edit Profile: name, date, picture

Edit Password

Last password:
New password:
Confirm new password:

SAVE
RESET

Help

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2. Get started
3. Your Profile
4. Participate to an Event
5. Add an event
6. Leave or Delete an event
7. Edit an Event
8. Access to a Group Chat

Overview

The main goal of Beehive is to provide an intuitive and easy-to-use application to join and create events. The idea behind the application is to help in meeting new people and live new experiences, it gives the possibility to chat with the other users participating to an event and to keep track of the events that you created or booked.

Figure 34: Edit Password

Help Page

Beehive

What are you looking for?

Group Chats

- Event 1
bar
Aperitif on the beach, with a fantast...
- Event 2
bar
Aperitif in the historical center of R...
- Event 3
outdoor
Excursion to Mount Terminillo,
- Event 4
bar
Coffee break at 'Bar del Figo' all tog...

Chat

Jess
hey whats up?
4/1/19, 5:54 AM

Silvia
All right, want to exercise, you?
4/1/19, 5:55 AM

Simon
It's good that we have
organized the training at the
park
4/1/19, 5:55 AM

Hello
7/9/21, 4:26 PM

I'm coming to exercise

Figure 35: Group Chat

10 Conclusion

Working on this project in a User Centered Design helped in really understanding the user's needs and designing the application to be useful for him.

This was the first time we had a direct contact with the users in order to collect requirements, suggestions, feedback about general usage concepts.

We learned a new way of working and moreover we improved our technical skills in developing mobile interfaces.

The product is yet not ready to be used since it's developed to work locally the machine, so additional work is yet needed in order to distribute it to the users.

10.1 Future Works

As an additional functionality we want to develop an AI algorithm that suggests and prioritize some events, based on the past choices of the user.

Once the product is really finished the goal is to always keep getting feedbacks from the user in order to improve and to spread the application in as much cities as possible.

References

- [1] HUMAN-COMPUTER INTERACTION 3rd edition by Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale
- [2] Course's material
- [3] AdobeX
- [4] Ionic Framework Documentation:
<https://ionicframework.com/docs>
- [5] NestJS Documentation:
<https://docs.nestjs.com>
- [6] MongoDB Documentation:
<https://docs.mongodb.com>