University of Trento

Department of Information Engineering and Computer Science
Human Computer Interaction (2013)

Final assignment report:

Developers' community

9th week delivery

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1 - Introduction

The project built up around this report began with an assessment of the usability of the applications ViviTrento[1] and ViaggiaRovereto, in order to have a first approach with both the principles of usability and interaction defined by J. Nielsen, and also with testers to introduce them to the applications of SmartCampus.

During this initial phase, the testers have been chosen on the basis of certain criteria[2], and the conducted interviews have revealed some shortcomings within the applications analyzed.
In particular the ViviTrento application[3] has proved to be particularly poor for what the usability is concerned. In practice it is difficult to use for end-users who show problems in trying to deal with icons that change meaning among the various screens, menus and counterfactual behaviors and sudden changes in section, that has as result the inevitable loss of data to complete the process of creation of a story.

Afterwards, in the ViaggiaRovereto app review, it has been highlighted the lack of getting directions through direct insertion of the place name, instead of its address. The problem is partially masked by the fact that you can choose a point on the map, but the tests have been conducted by creating a scenario in which the user would most likely need full functionality from an application of this kind to achieve its purpose, that is to reach a destination through the use of public transport.

To complete the initial analysis, there have been evaluated as sources of information the forum[4] of SmartCampus Lab, the wiki[5] that contains general and technical information on the platform and GitHub[6], which contains the source code of the application developed by SmartCampus Lab.

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[1] The one that is in the package of SmartCampus

[2] The people selected to perform tests have been chosen within the University of Trento and in a way that their background in computer science, technology and in general were in the average.

[3] In the “stories” section, the one that is considered.

[4] It is useful to interact with people who use the applications, in order to provide online assistance to them in case of problems and malfunctions. The forum is also used by the users to suggest the development team how to integrate new features or improvements, in order to improve the user experience and, more generally, the usability of the application.

[5] This tool is used by "qualified" people that intend to understand how applications work in order to integrate them. The wiki is in fact a collection of documents where we can understand the architecture of the system and how we can interact with it in order to integrate additional services or functionalities.

[6] This is the main point of contact between users and development team.

The contents, the target of users to whom it is addressed, and the usefulness of the source of information for the general environment have been evaluated in detail. The purpose of this sub-analysis is to create a new environment, not to enclose the existing one, but to connect them, keeping them independent of each other, but closely related from the point of view of the user's usage.

Finally, as the selected functionality is regarded, and considering the initial tests, the choice fell on the improvement of the process that provides directions.

Considering the implemented point of view, to get directions between a starting point and a destination point is equivalent to calculate the route between two points on the map indicated by coordinates of latitude and longitude. The consequence of this premise is that addresses are actually an alias that represents a coordinate pair.

Therefore, starting from this concept the main idea is to enhance the operation of the service, allowing the user to use aliases, not only in the form of address, but also as a place name.

Resuming to the usability tests, the search for the optimal path[7] that will take the user from the railway station to the stadium "Quercia" becomes possible. The improvement occurs not only on the usability side, but also of the interaction, given that the service in this way acquires a language closer to the humans to provide answers to users' needs.

From an implementation point of view, currently the research is address-based in the boundaries of the province of Trento, and only recently the query to Google APIs has been updated to include also the places.
This reflects the basic functionality of the development of the proposal, which evolves with the presence in the results of the places stored in the database of ViviTrento.

The interaction with the places database represents an important aspect of functionality. In the case where a searched place exists on ViviTrento, only this result will be shown, improving the user's perception regarding the used service[8].
Since the information that will appear in the outcome is provided by the ViviTrento's database, it could be accepted as reliable[9].

[7] According to user preferences

[8] In this way the user has the perception of the whole environment within each service

[9] Since the places of ViviTrento should be included and kept up to date by the local community, unlike those of Google that suffer revision processes that do not always lead to an effective improvement of the service, or because they belong to a local database access, users may be more taken to make an update, since Google data could be perceived as an entity too far from the local needs

The algorithm that has been described can be summarised with a graphical representation by the activity diagram below.

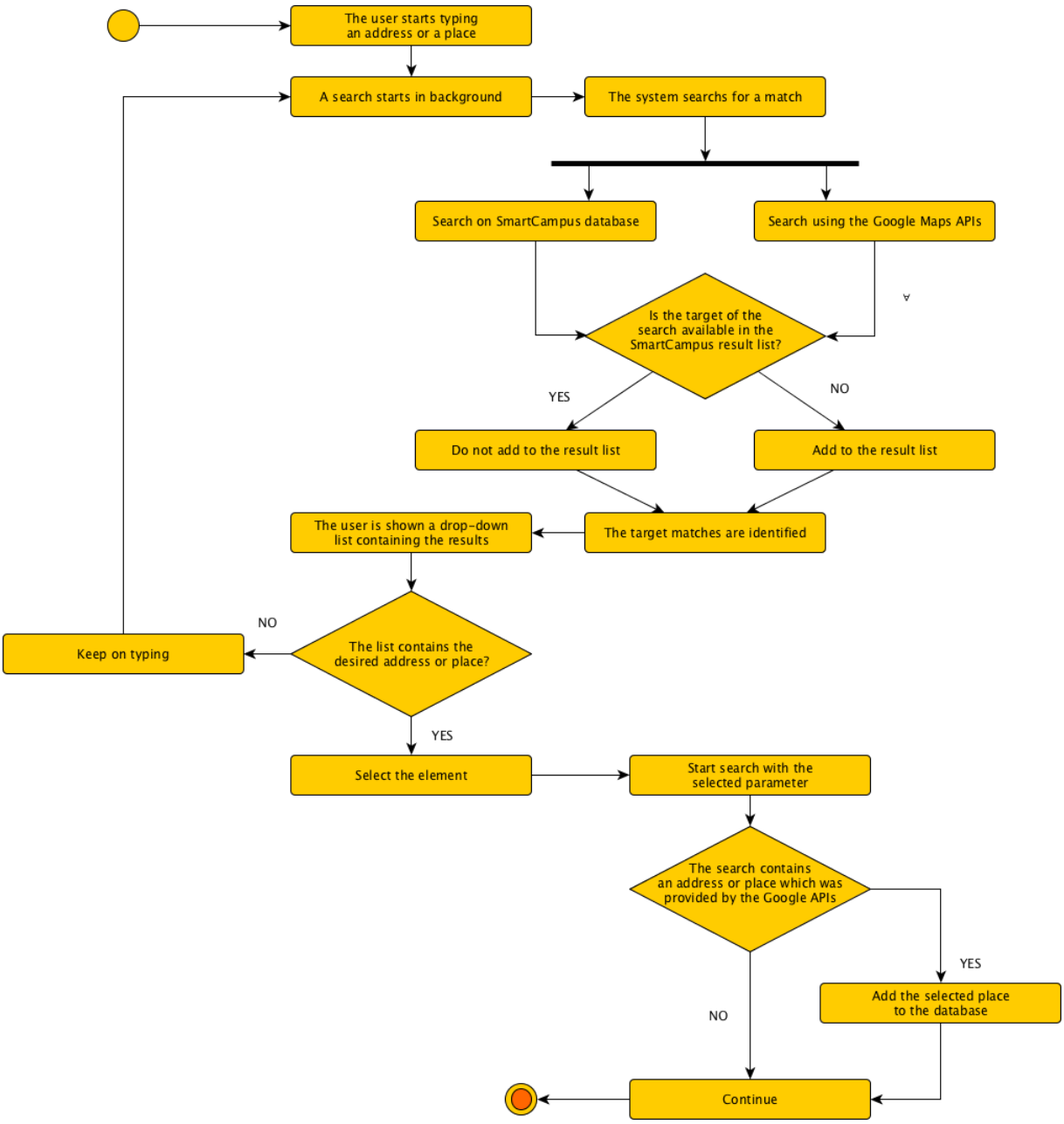


Table 1. Activity Diagram

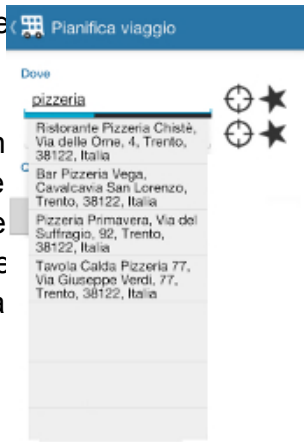
2 - Mockups

For the creation of the front-end the Nielsen heuristics have been considered, in particular the "Visibility of system status" and "Help users recognize, diagnose, and recover from errors" have been applied.

This is the main reason why in our backend functionality the evaluation of the principle shown above led to the creation of a frontend design, indeed the user has to be informed on the processes that will lead to the result required by him/her.

As it can be seen in the mockup on the left side, the first change from the standard view is the animated icon that is presented on the right side of the search bar.
While in the background the process of loading content happens, the animated icon has the external layer with a ring in which a ball loops forever and an internal progress bar is shown as a pie that loads as the process of research goes on.
The icon that has been chosen among others, such as static text[10] or dynamic text with percentage[11] and animated icon with two layers[12]. The external ring has the advantage of giving a visual feedback to the user that is waiting some results from the system, and it can distract the user from the real percentage of the results that is represented by the internal pie.

The internal pie, on the other side, stands for the real loading of the contents.



Another mockup had been considered for the content loading, as can be seen in the mockup on the right; in this one while the places are loaded a charging icon will appear between the search bar and the results. Graphically it will be a very thin bar that will be painted as the research progresses, that has the advantage of giving the user an idea of the research process in accordance with the principles of the Nielsen heuristics, but it has been discarded because it does not respect the android design pattern.

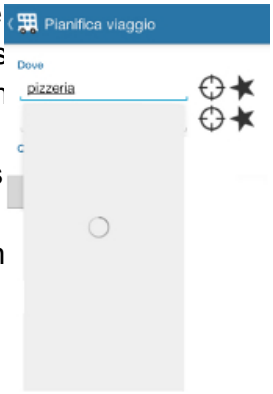
[10] Static text: gives the only advantage of letting the user know that something is happening, not giving the feeling of a working application.

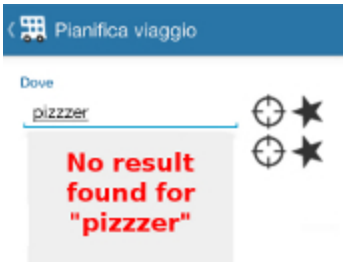
[11] Dynamic text with percentage: it allows the user to known the percentage of the research but in case of a long wait it can become boring.

[12] Animated icon with infinite loop: it shows to the user that the system is working but if the search takes a long time it can give the feeling of a not working application.

The icon on the left side of the result list have been modified this way: the violet ones have been kept, instead the red ones have been dropped after the result of the questionnaire[13].
It seems that the purpose of the red icon was not sufficiently interesting, it did not represent an improvement for most of the users, it is not an information for which they care about, or generally they are not interested to know where the external results come from.
If some places are already present in the SmartCampus database, that would be interesting to known, in fact it can indicate that a place is already present in some other app or that the place is present in some event and, more generally, it is verified or rated.
The places that are already present in the database will be indicated through a violet icon.

If some string is not trapped by the SmartCampus database or the Google API an endless loading icon has been designed, and the mockup provides an empty rectangle with an overlay of an endlessly loading icon colored in gray. The color and icon are in fact common in many applications and therefore known to the average user, and that will not create surprises giving indeed to the user the idea of a reactive application.
Although that is a good mockup, it does not match the android pattern design that binds the circular movement with a progress because in the mockup it is related to a research interruption. This idea does not match the Nielsen heuristics of “Consistency and standards” that suggests to follow the platform conventions: users should not wonder if similar things means different things.





It has been suggested by the testers of the questionnaire[14] that it could be useful to have a warning if the user enters a string that has not matches in the SmartCampus database or in the Google APIs. Therefore a warning should be shown in the result: it would alert the user to modify the entered string because it has not been recognized. The error is highlighted in agreement with the Nielsen’s principle that warns to alert the users of what is going wrong and possibly suggest a solution to them.

[13] The results of the questionnaire will be discussed in the section 3.1
[14] The results of the questionnaire will be discussed in the section 3.1

3 - Evaluation of the functionality

The process of the functionality development has been accompanied by testers' opinion, which took place during the construction phase of the mockups and the revision of the activity diagram.

The targets that have been prefixed were mainly two. It was necessary to know whether the development of the functionality was done in the correct way and if there really was a need for users. Finally, the direct opinions from the users would have definitely improved the work.

Overall, the acquisition of different points of view and opinions, obtained from people with different backgrounds[15], have led to a revision of some aspects that will be highlighted in the analysis of the questionnaire.

Indeed the questionnaire is the way that has been chosen to collect testers' impressions. The choice was evaluated along with the ability to conduct tests through interviews, as it was done during the analysis of usability.

The interview mode was discarded for two linked reasons. On the one hand, the analysis of the advantages and disadvantages of the questionnaire[16] and interview[17], on the other hand the fact

[15] In order to conduct a more reliable test, personal testers has been avoided, collecting from them only information and opinions without a specific pattern, because they are often called into question and not only for specific and unique tests. Furthermore some tester were added in order to reach the number that was planned by the report's guidelines.

[16] Advantages of the questionnaires:

- It allows statistical analysis and mathematical data;
- It is impersonal, it focuses more on what is required;
- It requires less effort for users;
- Having a defined pattern can help users;
- It allows to obtain a defined result.

Disadvantages of the questionnaires:

- Users can respond randomly;
- The questions may be unclear or ambiguous;
- To have a defined pattern leaves no room for secondary impressions;
- The outcome is achieved without the nuances.

[17] Advantages interview:

- It is more personal and interactive for the users;
- The user may be comfortable speaking freely;
- It allows the collection of heterogeneous data and personal impressions.

Disadvantages interview:

- Users may get bored;

[continued on next page]

that although in both situations (usability testing and evaluation of the functionality) the involvement of testers was necessary, the expected outcome is different.

In this case (Evaluation of the functionality) the aim is to collect information regarding the features of the functionality and appearance which concern the interaction with the user. Different solutions are proposed, which correspond to previous elaborations of possible solutions to the same problem.
Therefore, the choice of the questionnaire seemed closer to users and more suited to the needs.

Hence, as far as the structure of the questionnaire is concerned, the considerations are:

- the choices available to users are seven. In particular the choice to the left represents a negative aspect, while the right a positive one. The number taken into consideration is deliberately odd to allow the user to express him/herself in a neutral way, and there are also other 4 selections (excluding the two extremes and the neutral choice) to capture the nuances of impressions.

- text fields have been avoided, not only because they represent a great effort for users in terms of time, but because we preferred to get the impressions and opinions we needed in a more informal way, considering the small number of testers and the relation with them.

- during the development of the functionality we have elaborated three different mockups for the presentation of the information. During the creation of the questionnaire it was initially chosen to show to users the three mockups at the same time, and then let the users choose one of them. To get a more accurate outcome, however, it was decided to present mockups in pairs, that is, if we consider the 3 mockups with A, B and C, to show the pairs AB, BC and AC. In this way, the choice comes down to being binary, it is not necessary to force the user to discard two options and it is possible to get feedbacks based on a more detailed comparison. In addition, the fact that the choice is made on three different screens forces users to pay more attention to details, since they will use their short-term memory.

After the premises, the link where the form can be found (which remains open in order to be visited) is http://goo.gl/6rbZ0I accessible also from the QR code on the right.

- Users may not be comfortable in front of an interviewer, and therefore some important considerations may not emerge;
- The result is undefined, it is often more like a brain storming.

Below a summary of the questions and answers that are available[18]:

Part 1: an overview of the functionality

1. How is it comfortable for you to get directions using only addresses? [1...7]
2. How is it comfortable for you to get directions using addresses and places? [1...7]
3. Would you like to see places that are not in ViviTrento as a result of your search process? [1...7]
4. Would you like to have shortcuts to other apps of SmartCampus during the search process? [1...7]
5. Would you like to know where results come from? [1...7]

Part 2: specific questions to the front-end part

6. In your opinion, what do the icons near each search result stand for?
    1. They are just a graphic element
    2. They differentiate the source of the result
    3. They are a Christmas decoration
    4. They differentiate the importance of each place
7. Mockup comparison

8. What does the loading icon stand for?
    1. Makes the GUI more appealing
    2. Suggests to select an option as soon as possible
    3. Shows the search progress
    4. Allows to update the search with a tap

[18] Some answers are deliberately "not formal" in order to maintain a more informal relation with the participants

9. Supposing the external circle of the loading icon has a clockwise rotation, which purpose does it have?
    1. suggests that search is difficult
    2. suggests that the application is waiting for a user interaction
    3. suggests the application has crashed
    4. suggests the search process is being executed
10. Supposing that the internal circle of the loading icon fills in a clockwise way, what does it mean?
    1. It means that the time is passing
    2. It shows the percentage of the search progress
    3. It suggests the time needed for the search process
    4. It is a countdown at the end of which the outcome disappears

3.1 - Results

As outcome of the questionnaire, for what the first part is concerned it has been highlighted and confirmed the necessity to improve the current implementation in order to have a more usable service, and the proposal to link the results to the places of ViviTrento was received positively.

As far as the second part is regarded, the mockup comparison has failed the last implementation in favour of an intermediate step, that is the screen view in which only the results that are in ViviTrento are highlighted in a different way.

Therefore, according to the testers, although it is necessary to distinguish the sources of information, being the source of binary nature it is sufficient to focus only on one of them, that is the choice that potentially allows more options and in which more information is available.

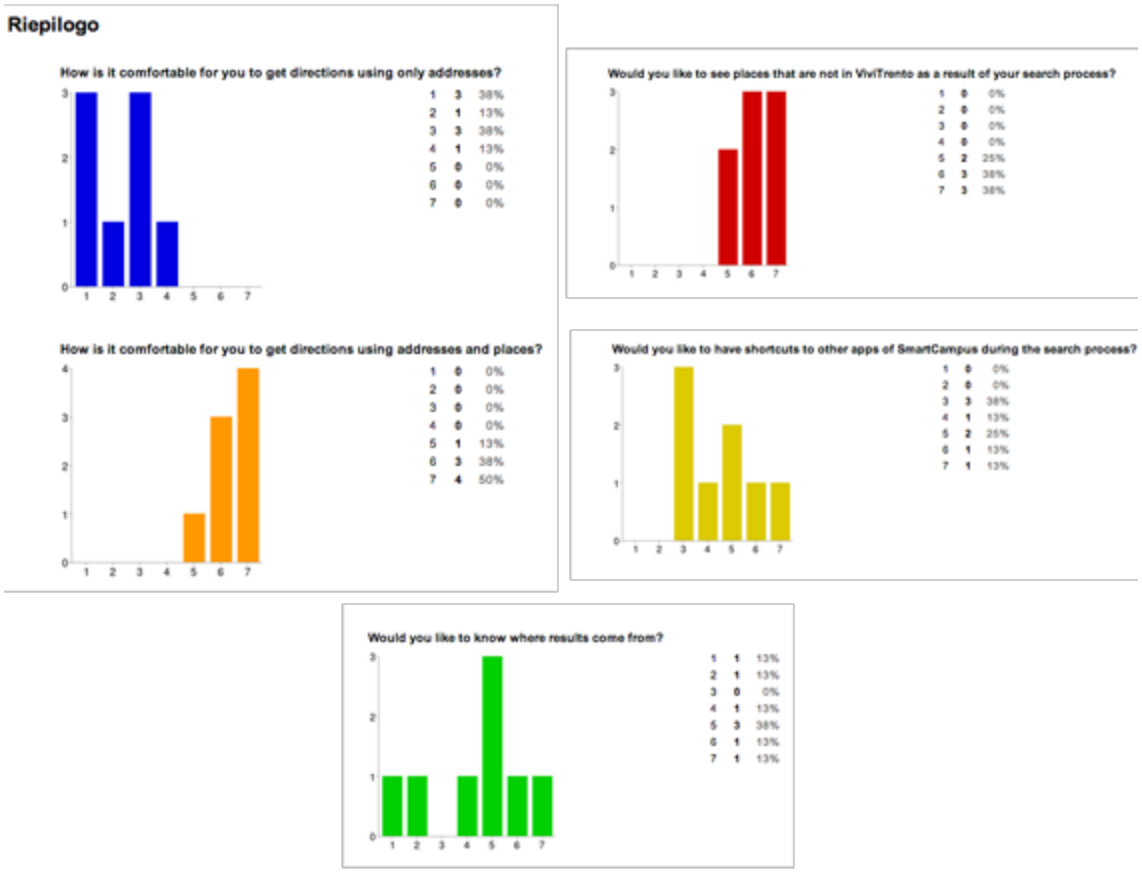
Finally the questions about the icon that indicates the progress of the search process have had a particular result that was not expected. Therefore a more detailed study on the composition of the icon may be necessary, which currently meets as described in the section on mockups and has a simple geometric graphic. In any case, it may not be sufficient for end users.

To conclude with the evaluation of the functionality, an interesting suggestion emerged from the involved testers: some of them wondered what might happen if there are no results. The same testers have therefore suggested that the possible solutions are:
a) show similar results
b) show a message in which the user is invited to write again the location/address that his/her was looking for.

Although the solution A is the one that is closest to the users, the implementation is not trivial and requires a study of the possible cases, because for example there can be various degrees of

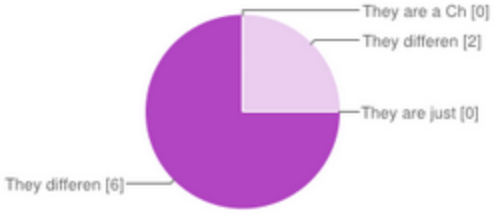
similarity, and also this may also occur in the case where the search process returns a not empty list.

The solution B is instead the easiest to implement, and could be initially chosen to focus the development on the most critical parts of the functionality.



Drop down list icon

In your opinion, what do the icons near each search result stand for?



They are just a graphic element	**0**	0%
They differentiate the source of the result	**6**	75%
They are a Christmas decoration	**0**	0%
They differentiate the importance of each place	**2**	25%

Mockup comparison

Which of these two mockups do you prefer?

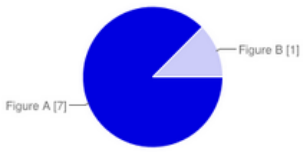


Figure A	7	88%
Figure B	1	13%

Which of these two mockups do you prefer?

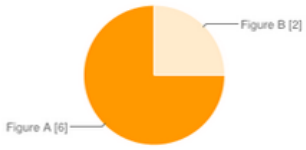


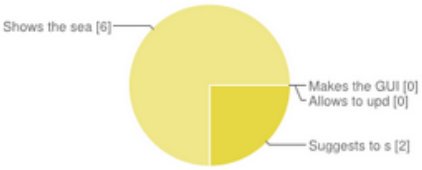
Figure A	6	75%
Figure B	2	25%

Which of these two mockups do you prefer?

Figure A	7	88%
Figure B	1	13%

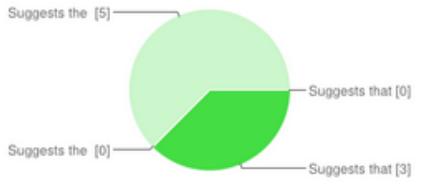
Loading wheel

What does the loading icon, represented above, stand for?



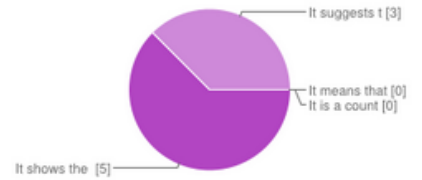
Makes the GUI more appealing	0	0%
Suggests to select an option as soon as possible	2	25%
Shows the search progress	6	75%
Allows to update the search with a tap	0	0%

Supposing the external circle of the loading icon has a clockwise rotation, which purpose does it have?



Suggests that search is difficult	0	0%
Suggests that the application is waiting for a user interaction	3	38%
Suggests the application has crashed	0	0%
Suggests the search process is being executed	5	63%

Supposing that the internal circle of the loading icon fills in a clockwise way, what does it mean?



It means that the time is passing	0	0%
It shows the percentage of the search progress	5	63%
It suggests the time needed for the search process	3	38%
It is a countdown at the end of which the outcome disappears	0	0%

4 - Tutorial

For what the tutorial is regarded, it has been decided[19] to use a solution that is already established on the market, more in details a wiki applications.

The final choice is then DokuWiki[20], which is accessible via open source code and GPL v2 license, and which suits to the current forms of distribution[21] implemented by SmartCampus Lab.

The expected content of the tutorial is heterogeneous, that is composed by text and code for explanations and examples, by multimedia, and also by the connections with other components of the SmartCampus Lab environment.

Regarding the connection with the other components of the SmartCampus Lab environment, this is not only inevitable but also essential, because the documentation platform that will be created will represent only a piece of the puzzle. In particular, the code hosted on GitHub has to be reused inside the tutorials, making a double connection between the considered code and the tutorial page in which it is enclosed. In this way the code can be reachable from the tutorial and viceversa, making a strong relationship.
Finally, the social component represented by the forum is important for the interaction with the developers.

4.1 - Content organization within the tutorial

The content organization that has been chosen for the tutorial is based on the step-by-step methodology.
Sections available are two:

PART A: guide for newbies (developers who have already implemented some other SmartCampus feature may skip this section and go to the next one)

[19] After to have evaluate the possibility to realize a custom application, discarded because this solution presents an elevated manufacturing cost, especially in terms of time and maintainability

[20] The main characteristics are:

- Not having a database (this may increase the efficiency in the reading process, more frequent than the writing one);
- Full support to HTML5;
- Caching systems;
- A rich library of available plugins.

[21] Excluding the goal to make profit with the project, that license does not represent any restriction or legal issue.

0. Preliminary information about SmartCampus and its architecture: the developer should understand how SmartCampus is structured and how it works;
1. Authentications: the developer should register to the involved services in order to be able to start coding;
2. Setup: the developer should be able to setup the environment;
3. In-depth analysis: for further questions the developer can refer to the SmartCampus Lab forum at the “Technical Discussions” section.

PART B: developing an app - libraries and dependencies (explains what to install in order to improve the functionalities of ViaggiaTrento)

4. Reporting: if implementing an enhancement or correcting a bug, the developer should also signal it on GitHub;
5. App selection and libraries: the developer is linked to the wiki’s page pointing to the GitHub repository and to the library dependencies;
6. In-depth analysis: for further questions the developer can refer to the SmartCampus Lab forum at the “SmartCampus apps” section.

Finally, a preview of the tutorial is available at http://hci.gustavosoria.biz.

5 - Conclusions

In reference to the functionality proposed to be implemented as a part of the report’s goals, the analysis developed at the beginning, resulting in the need to have a better search mode (otherwise the service was poorly usable), not only has been confirmed during the final interviews and questionnaires (made even if not explicitly requested to have a better feedback), but also in the last update[22] provided by the SmartCampus Lab it was considered and partially improved.

It is a different implementation from what was designed and expected, since there is the possibility to search for places taken from the Google Maps database, but without a connection with the data and the information of the SmartCampus environment.

[22] Considering the time in which this report has been written

Anyhow, the analysis has been done following a pattern developed and improved during the work process, and it covers several aspects:

- Group and tasks distribution. The group is formed by members that have already worked together and this has allowed to facilitate the initial phase of work and the task distribution, which was held on a voluntary basis, with the figure of a team leader only to supervise the work of the group and make marginal decisions that did not require the approval of the whole group. As a support there have been used technologies to share the drafts, ideas and the work with permission management in real-time[23].

- Interaction with external testers. They were enrolled as volunteers and during the interviews the user centric technique has been used. A lot of freedom was provided to testers, that is only the data and the information necessary to the test has been collected, but without setting boundaries. This allowed us to observe marginal situations related to the target of the tests. With this application it has been considered the idea of the functionality included within the report.

- Interaction with personal testers. In addition to what is described for testers, personal testers have used a lot more the SmartCampus environment and then were summoned to the questions concerning the connection between the information of the various SmartCampus' apps. Since they gained experience through the use of the applications, on the one hand they were able to provide useful impressions for high level topics, but they had learned with the direct and protract use the weaknesses of SmartCampus, and these were ignored unconsciously during the tests.

- Make decisions process. Decisions that concerned the main parts of the work have been taken involving all the groups members, considered at the same level, also the team leader. Since the nature of the work is not strictly related with computer science issues but centered on the user experience, usability and interaction, emotions have been mostly considered in the decision-making[24]; this approach was encountered by the majority of group members for the first time here.

A particular aspect that can be noticed is that, despite the topic is the creation of a tutorial for developers and a description of how a functionality should be implemented it does not contain sections dedicated largely to coding within the report.
Although the absence of code is highly relevant, the motivation is intrinsic in it. The group is composed by computer scientists, most of whom attend the master, thus it is believed that there have the competences in order to achieve a final product.

[23] For this purpose Google Docs has been used, exploiting the possibility to share documents with different permissions (the preliminaries drafts with comments only, while the final version with the write permission), and MindNote, for the organization of the content, creating conceptual trees about the topics to cover in the reports, in order to have a better and organized overview of the work.
[24] http://en.wikipedia.org/wiki/Emotions_in_decision-making

The code has not been written because the aim was to create a prototype for something that is not only functional, but also usable and suitable for a diverse audience, and especially for users with no background in computer science or engineering.

Often we focus a lot on the implementative side, ignoring what will be the end-use and without a clear view of what will be the end-users expectations.

Concepts like the learning curve of the application usage transcend the realization of the code or the execution of the algorithms, the issues of efficiency and scalability, but rather the effort has focused on issues such as usability and interaction.

For what the usability and the interaction are regarded, a study was conducted to see if the component backend application could be considered as the front end component in terms of design principles[25], creating a further abstract connection between the two parties and trying to see what was possible to apply to what concerns the operation of a service (instead of its presentation) of the principles of usability.

In fact normally only principles that affect the efficiency, security, best practices are applied, considering the needs of the front end as one of the secondary modules. Usually the needs of users who will be using the application are not completely considered, since it is uncertain, not completely logic, and in general perceived as a subject in which the computer should not have any responsibility.

The premise of the reasoning was that the frontend can be seen as a consequence of the backend, that thus plays the role of requirement. Therefore the usability should not be considered as an exclusive of the user interface, but the concept has to be extended to the parts in the software engineering design process dealing services for the users, as is the case of the involved functionality.

Therefore beyond the scope that was intended in the report itself, the topic has been exploited for personal growth by the members of the group, taking advantage of the opportunity to have a community of users to observe the different points of view, and testers, to be able to capture their impressions to arrive, in a future perspective, not only to develop the services, but mostly to develop services for people.

[25] Starting from the design principle of a user interface, Jacob Nielsen defines the rule “Matching between system and real world”, described as:

> *“The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than systemoriented terms. Follow realworld conventions, making information appear in a natural and logical order.”*

It means that users have to have the possibility to get directions in the same way, and quoting J. Nielsen, the application has to understand and elaborate the user’s language with words, phrases and concepts familiar to the user, rather than system-oriented terms represented by addresses.