Moving Alarm

Human Computer Interaction project report

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Summary

This report wants to describe the process and the analysis conducted in order to develop a mobile application with distance-based alarm functionality, dependent on a destination chosen by the user. Such application fits itself into the context of the life of commuters and aims to guarantee the sureness of not missing the stop. Firstly, starting from how the initial idea was born, the standard methodologies of need finding and prototyping are described and explained in their use. After that the application is described, both from a functional and a technical point of view, before analyzing the usability tests used to evaluate the results and discussing possible future developments of the project.

1. Introduction

Living in the tuscan countryside, far away from any kind of service, since the age of 10 I have been forced to use public transport services: buses as well as trains were and are part of my every day life. Being an early riser, I have the tendency to easily fall asleep in the evening and this characteristic, combined with my daily use of public transports, can be explosive: more than once I found myself falling asleep on the train route from Florence to Pistoia.
The consequences of such event can vary but in the worst case scenario the waste of time is significant: it takes about 15 minutes to get to Montecatini, the first stop right after Pistoia, and 15 minutes to get back to Pistoia, not considering the amount of time spent waiting for the train back which can vary during the day.
Although it would be theoretically possible to use a traditional time-based alarm, two factors make such approach difficult:

- the common delay, which can lead to waking up too early and falling asleep again before the stop;
- the impossibility to correctly estimate the expected time of arrival when using buses or other public transport services affected by traffic.

The idea to develop an alarm based on the distance of the user from his destination was born to solve these problems. This project tries to combine an effective and reliable service with a simple and immediate interface, so that the users would not be intimidated by using it but could rather set it up quickly and relax while waiting to reach their destination.

2. Prototyping and development

The standard prototyping procedure consists of a well defined amount of steps. Such steps can be seen as phases used to pivot the future development of the application and so are useful as a guide for those who have to implement the initial idea. Further more, the results of this first analysis and the material produced as a consequence become fundamental in a business environment to communicate and discuss the work plan with managers or with who is not a part of the development team and is not familiar with the

technologies used.
These steps are usually to be followed in order, but with the possibility of either repeating one or more, in order to refine the final result, or omit some of them.
They can be summed up as follows:

1. Needfinding: in this first phase the creators try to understand which are the functionalities needed by the users through interviews and targeted observations.

2. Building of Personas: the different classes of users that could be using the app are summed up using archetypes.

3. Identification of Goals: the goals of the application are defined using the personas built in the previous step.

4. Description of possible scenarios: brief stories are created using the personas as protagonists to define the possible use cases.

5. Requirements: as the last step of prototyping, a list is drawn with the requirements that the application would need to have in order to achieve the previously described goals in an optimal way.

During the development of the application, these phases have been followed as well as possible. However the phase of the identification of goals has been particularly fast and simple. I was part of the class of users which the application was going to be designed for and the idea was already clear and precise: building an application fast and easy to use which would wake up the user when getting close to his destination.

2.1. Need Finding

As explained above, the first step has been the understanding of the functionalities needed by the users. The following were identified:

- The user would need to be able to be woken up near his stop and not worry about having to stay awake during his;

- The user would need to be able to do so without guessing the expected time of arrival or remembering the time necessary for his transport to reach the stop;

- The user would need to be able to configure the alarm in just a few taps.

2.2. Personas

During the prototyping, the possible classes of users, who could have been interested in the app, were shrunk to just one in which one user was chosen as a representative for the whole class: Francesco.
The class which Francesco is part of represents that wide range of people who have to make use of public transportation, mostly for long range commuting, and risk missing their stop because of the tiredness deriving by a long day of work or study.
Although people with different levels of technological knowledge could be part of this class, which could theoretically lead to the necessity of shaping the application in different ways, the fatigue common to all the users makes them want something as fast and easy as possible: they just want to set their destination just like they would set the time in a standard alarm clock.

2.3. Goals

Considering the class of users and the deriving persona, it was easy to identify the goal of the project. More precisely the goal was to wake up the user when getting within a certain range of the selected destination and do so with a level of reliability that would let the commuter relax while waiting for the alarm to be triggered.

2.4. Scenarios

As far as the possible scenarios are concerned, we can define the standard scenario by using Francesco.
Francesco works in Florence but lives in Agliana. He wakes up early every day to get himself ready and takes the train that gets him to Florence Santa Maria Novella, from where he reaches his office by walk. In the evening, after finishing work around 18:30, Francesco goes back to the central station to take the train back home. He is tired and the train travels for about 40 minutes before getting to Agliana, which is plenty of time to fall asleep. Furthermore, if he were to miss his stop, he would have to wait 20 minutes in Pistoia for the next train. So he decides to use *Moving Alarm* and set the train station of Montale/Agliana as the destination. He can now relax and rest without any stress caused by the fear of missing his stop.

2.5. Requirements and Wireframes

After defining the scenario, the last step was to identify the requirements:

- The users need to be able to select a destination by looking for it by its name or address, without having to find them manually or by their geographic coordinates. To do so, there needs to be a service which translates the name or address into coordinates, so that the app can compute the distance of the user based on his current position;
- The app has to provide recent destinations to the users without forcing them to repeat the search again in the map, in order to speed up and simplify the whole process and make the app usable even without a data connection available to find the destinations through the previously described service;
- The users have to be able to achieve the previous points with high speed and few taps, so that they do not feel overwhelmed and abandon the app because of their tiredness;
- Since the frequency of stops changes with the different kind of transportation services used, the users need to be able to adjust the triggering range of the alarm to adapt it to the different means of transports.
- It needs to be possible to change the ringtone of the alarm and adjust its volume, so that the users can be both sure of waking up on time for the stop and not disturbing other people too much, especially in very crowded environments which usually characterize these types of transportation;
- The refresh rate of the position needs to be based on the distance of the users to the destination, in order to reduce the battery drain caused by the GPS.

After this analysis, some wireframes were made to give an idea of the general structure of the app and allow to begin working on the logic of the app without necessarily locking the definitive design. Some of the results of this phase can be seen in figures 1, 2 e 3.

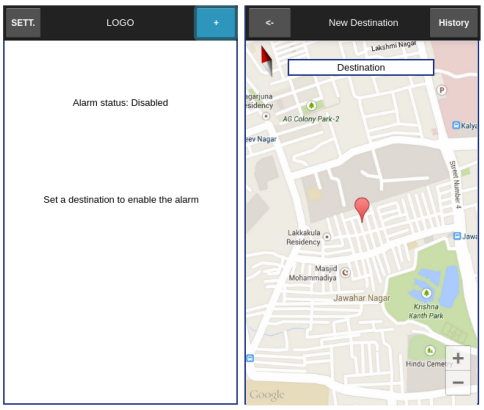

Figure 1. First wireframe

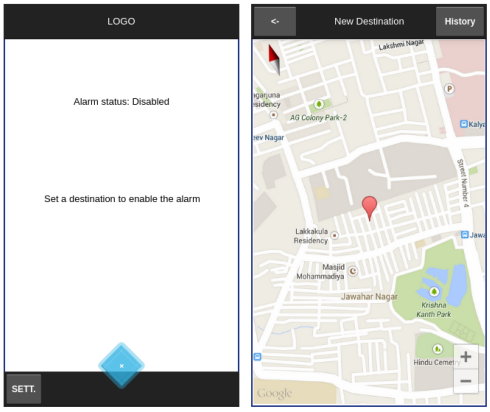

Figure 2. Second wireframe, bottom toolbar added

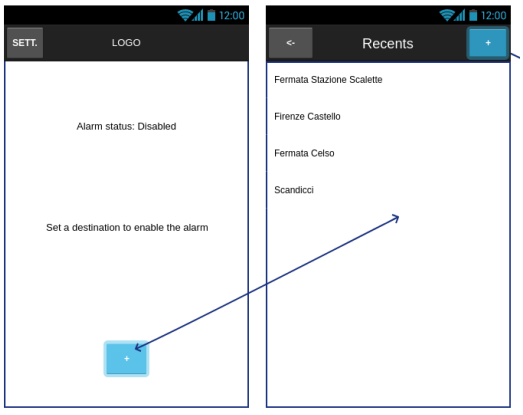

Figure 3. Third wireframe, main floating button

3. Application details

The application has been built trying to make it usable for everyone and that is why, at the first opening, a brief tutorial of 4 slides is shown to present the base steps necessary to set the alarm. After the tutorial, the user is presented with the home page of the app which becomes the first page shown for all the following openings. In this state, a single main button, characterized by the primary color, is pre-

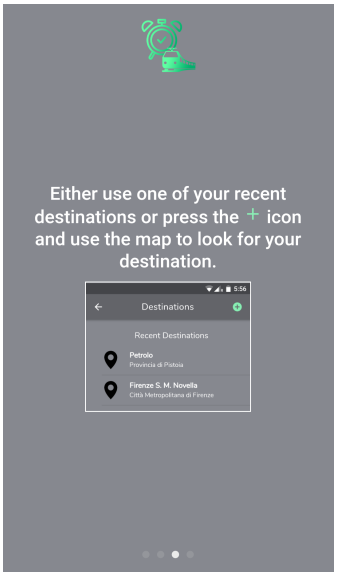

Figure 4. One of the tutorial slides

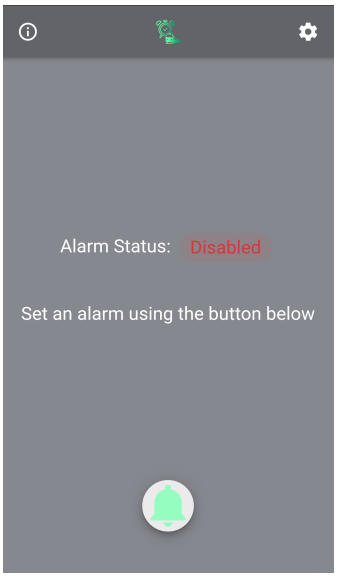

Figure 5. Homepage without an active destination

sented to the user to begin the procedure to set a destination. Before being redirected to the map page to find a new destination, a list of the destinations recently used is shown to let the user speed up the procedure when often using the same destinations. In the top right corner, a + button, again characterized by the primary color is shown to catch the user attention and lead him onto the proper flow of the application to the map page.

Pressing it opens the page containing the Google Maps[1] plugin with a custom made search bar on top of it. This plugin allows the usage of the Google Maps[1] API, a paid service offered by Google[2], which makes possible translating the name or address searched by the user into geographic coordinates and showing the result by displaying a marker and focusing the app view over the resulting location. Tapping on the displayed marker prompts a confirmation alert, in which the user is asked to verify the selected destination, and doing so enables the alarm and redirects the app view to the home page that now displays the distance from the destination, the speed at which the user is moving and the selected ringtone. The button previously used to start the alarm is swapped with a new one which now disables it and, if pressed before the triggering of the alarm while in warn color, requires the user to confirm the early disabling in order to prevent doing so accidentally. When the alarm is triggered, the color of the main button is swapped again to primary and the user can now deactivate the ringtone by simply tapping on it.

Figure 6. Recent destinations page with the + button in the top right corner

Apart from the expected flow, from the home page it is also possible to open the settings page in which the user can tweak to his personal preferences the default values of some

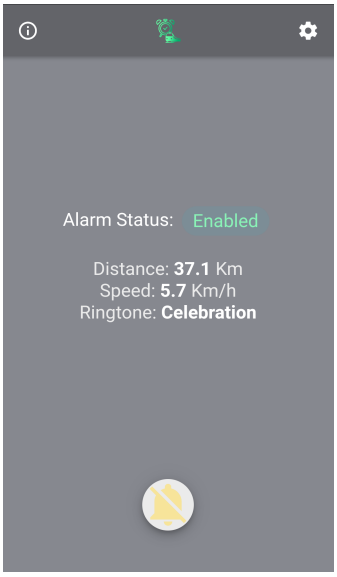

Figure 7. Home page with active destination

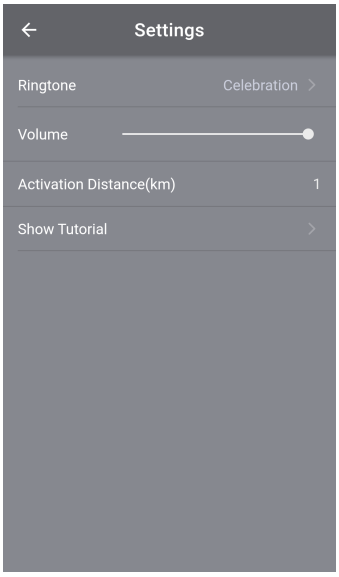

Figure 8. Settings page

parameters. In particular, the user can change the activation range of the alarm, displayed in kilometers, the ringtone of the alarm, from a list of over 20 available ringtones, and its volume. To choose a new ringtone, the user can press the arrow displayed next to its name and then change it to a new one by just tapping on the items of the displayed list. Selecting a new ringtone plays it for a couple of seconds to let the user decide whether to confirm the choice or change it and in every moment the user can see the currently selected ringtone by checking which of the entries of the list has a tick next to its name.
Furthermore, from here the user can access the tutorial again, allowing the "expert" user not to be bothered by it every time he opens the app but leaving the unskilled one the chance to see it again. A particular attention was focused on choosing the colors. It became clear from the start that the colors should not cause strain on the eyes and that they should be able to blend in easily with the color schemes of the evening and night. In order to achieve this, a grayscale background was chosen by applying the principles of Material Design. Following that, to make the main buttons pop and guide the user in the app flow, a light green color was chosen for them, while the light orange color was chosen as warning color and then used only before the triggering of the alarm for the alarm disabling button.

3.1. Technologies

In order to maximize the portability of the application on the many different mobile platforms, Ionic[3], a frontend SDK based on Angular[4] and Cordova[5], was chosen to build the app. Angular[4] is a framework that lets the developer build a web application by using Typescript[6], a typed superset language of Javascript[7], in which every page is created using a combination of files: a *.ts file, a *.html file and a *.scss file. At compilation time, Ionic[3] makes use of Angular[4] to translate this language in Javascript[7] and then feeds the result to Cordova[5], a development framework that converts the mobile app in native language, giving as a result a Portable Web App. The choice was influenced by some factors:

- The previous knowledge of the Angular Framework[4] and Ionic[3] SDK;
- The low level of interaction of the user with the app, which would have made the effort to build full native apps useless, because the little interaction would not have allowed to feel any substantial difference, in the face of a much greater development time;
- The possibility of using the encapsulation of Material Design[8] within the Ionic html tags.

Of the many plugins used in the application, two are fundamental:

- Google Maps[1]
- Background Geolocation[9]

The first, Google Maps[1], makes available to the users the well known Google Maps's [1] map, that gives a feeling of trust based on the certain knowledge of the geolocation app of the american tech giant, and allows the usage of the Google Maps[1] API for the search of a location through its name or address, giving the geographic coordinates back so that they can be used within the app. The second, Back-

Figure 9. Map page

ground Geolocation[9], lets the app update the position of the device without the need for it to be in foreground, allowing the user to either keep the smartphone locked or keep doing whatever they were doing before setting the alarm. This plugin has been connected with a timer that calls an update of the position only with a certain frequency and computes the user distance to the selected destination. Such frequency has been defined using the formula

$$refreshTime = 20000 + (dist^2 * 100)$$

where the refreshTime, measured in milliseconds, is dependent on the distance, in kilometers, of the user to the destination with a baseline of 20 seconds to prevent constant updating when getting close to the stop.
Since there was no need to have external logic or persist data, no backend was built.

4. Usability Tests

In order to validate the correct functioning and a good usability of the application, a session of usability tests has been conducted by submitting a survey to some testers. It is to be noted how, in the following paragraphs, the original scenario presented in paragraph 2.4 has been changed to include sequences of tasks that would walk the user through the whole procedure. The questions have been put into "Single Ease Questions"(SEQ) form, which means they have been refactored as statements to which the user has to assign a level of agreement using a number that ranges between 1 (completely disagree) and 5 (completely agree). The survey was created on Google Forms.
To better test the usage in different environments, the tests have been divided based on the means of transport used by the testers. For each test the survey has been built with a generic section, common to all the tests and presented in paragraph 4.1, and a specific one, dependent on the transport. Tasks and SEQ were then defined for each test. Finally two optional questions were presented to the testers, so that they could provide tips and advice, and they are reported in paragraph 4.5

4.1. General rating

1. The app is not useful.
2. Setting an alarm is slow and complicated.
3. The tutorial is useless and/or badly structured.
4. There are not enough functionalities.
5. You are going to use the app again.
6. The chosen colors do not fit properly.

4.2. Scenario 1

You are in Florence SMN, ready to take the train back home. You have been sitting in the train for about 10 minutes, waiting for it to leave, but it is already 19:30 and you start feeling sleepy. So you decide to open the app, find your stop and set it as the destination. You can now put the app in background and wait for the alarm to be triggered. Once it starts ringing, open the app and turn it off.

4.2.1 Task Scenario 1

1. Open the app
2. Open the map page to set the destination
3. Enable the alarm for your stop
4. Put the app in background
5. Turn off the alarm when it is triggered

4.2.2 SEQ Scenario 1

1. The alarm is not accurate enough to be used when traveling by train.
2. The volume of the ringtone is not high enough to wake me up in this environment.

4.3. Scenario 2

You have just left the university in Florence and you have to take the tram to get to Florence Scandicci. You have found yourself a seat after getting in at the Morgagni stop and have decided not to risk falling asleep and missing the stop by using the app. The frequency of stops using the tram is higher than the one using the train so, to maximize the relax time, you decide to lower the activation distance for the alarm down to 500 meters. You open the app, go into the settings and change this parameter. Then you go to the map page to find your stop and type in its name. Finally you enable the alarm and put the app in background. Once the alarm is triggered, you open the app and turn it off.

4.3.1 Task Scenario 2

1. Open the app
2. Go into the settings page
3. Change the activation distance of the alarm to 0.5 kilometers.
4. Open the map page to find the destination.
5. Enable the alarm for your stop.
6. Put the app in background.
7. Turn off the alarm when it is triggered.

4.3.2 SEQ Scenario 2

1. Changing the settings is complex and not clear.
2. The alarm is not accurate enough to be used when traveling by tram.
3. The volume of the ringtone is not high enough to wake me up in this environment.

4.4. Scenario 3

You are in Florence and it is getting late. There are no more trains back to Pistoia and so you are forced to take the bus. It is winter and the bus is warm and cozy. You get sleepy all of a sudden and decide to prevent any chance of missing your stop by using *Moving Alarm*. You open it and choose, among the recent destinations, the train station in Pistoia. You lock the phone and allow yourself to sleep for 30 minutes while waiting to be woken up by the alarm. When the ringtone is played, unlock the phone and turn it off.

4.4.1 Task Scenario 3

1. Open the app
2. Choose ”Stazione di Pistoia” from the recent destinations.
3. Lock the phone.
4. Turn off the alarm when it is triggered.

4.4.2 SEQ Scenario 3

1. The recent destinations are not very clear.
2. The alarm is not accurate enough to be used when traveling by bus.

4.5. Tips and advice

1. What would you change in the application?
2. How would you modify the current flow of the application?

Section	Question	Average	Variance
General	The app is not useful.	1.2	0.2
	Setting an alarm is slow and complicated.	1.4	0
	The tutorial is useless and/or badly structured.	1.4	0.3
	There are not enough functionalities.	2.2	0.9
	You are going to use the app again.	3.1	0.6
	The chosen colors do not fit properly.	1.3	0.3
Scenario1	The alarm is not accurate enough to be used when traveling by train.	1	0
	The volume of the ringtone is not high enough to wake me up in this environment.	1	0
Scenario2	Changing the settings is complex and not clear.	1	0
	The alarm is not accurate enough to be used when traveling by tram.	3.7	0.3
	The volume of the ringtone is not high enough to wake me up in this environment.	3.3	1.5
Scenario3	The recent destinations are not very clear.	2.5	4.5
	The alarm is not accurate enough to be used when traveling by bus.	1	0
	The volume of the ringtone is not high enough to wake me up in this environment.	1	0

Table 1. Usability tests results

5. Results

The usability tests were conducted with the help of 7 testers, divided between the three scenarios based on the means of transport they were using. They answered both the general questions and the ones specific to their scenario, and were asked for tips and advice. Their age was taken into consideration as well, in order to evaluate the usability of the project over a wider range of users, without limiting it to younger people, more accustomed to technology, but considering also the results coming from two older people.
The results are summed up in table 1.
As shown by the points achieved, the ease of use has been one of the most appreciated aspects of the project. However this characteristic has been also perceived as too binding: some testers said in the tips and advice that they would have liked to have more functionalities, like the possibility to see and adjust the distance activation range in the map or to select multiple destinations.
From a technical point of view instead, the testers pointed out a low accuracy of the geolocalization when using it in an urban environment aboard the tram.
Further indications have been given regarding the colors. While the dark mode has been appreciated, allowing the main buttons to be easily noticed, it was stressed that the gray color did not match very well with the standard colors used in the other applications, which usually use darker colors closer to black. Based on these indications, a new combination of colors, darker than the initial one, was tested and a sample of this new design can be seen in figure 10. Other

than improving the focus on the main elements of the app, the new colors are also more endearing and so they could be effectively used as a valid alternative to the initial gray.

At last, it was pointed out that the names of the recent destinations do not always match the real name of the location. Unfortunately it would be difficult to work on this aspect, as such names are totally dependent on the results provided by the Google Maps[1] API.

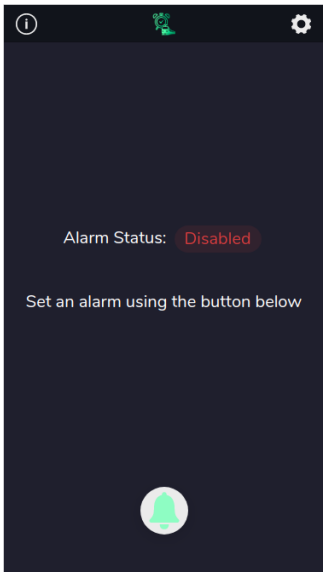

Figure 10. New color sample

6. Conclusions

During the development of this application, the standard prototyping procedure has been applied to achieve a complete system that could be useful and usable by everyone, in order to solve a problem at the root of a high form of stress. The usability tests helped to point out both the good aspects of the project as well as, more importantly, those that could be improved to achieve a higher quality product.

6.1. Future developments

Considering the results of the usability tests, possible future developments could be focused on the following aspects:

- The accuracy within the urban environment. As the accuracy was reported not to be the best when traveling by tram, this problem could be addressed by fine tuning the geolocalization parameters of the plugin or by testing out different plugins;
- Creation of a pro mode, or something that could give the possibility to access more functionalities for the users interested in them;
- The name displayed in the recent destinations. Attempts could be made to replace them by using a different API or by using the name typed by the user.

From a technical standpoint, hidden to the users, future developments would firstly require swapping the Google Maps[1] API with a free service like OpenStreetMap[10] in case of a wide range distribution. This because the first one has been used thanks to the fact that Google[2] offers one year of free usage for those interested in its services, but would create economic disadvantages in the long run because of its high cost.

Finally, a bonus step could be making the app usable as a stop-reminder for tourists. This would require adding the possibility of disabling the alarm and replacing it with a simple push notification shown when getting close to the destination. However such change would need to be carefully considered in order not to slow down and complicate the current ease of use, one of the strong points of the project.

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