

Guidelines for Accessibility: ensuring the usability of mobile applications for visually impaired users

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ABSTRACT

Our current project involves the use of a multistage research method to specify a guideline for mobile applications, which intends to support visually impaired users. This paper discusses the employment of this guideline along the development of a mobile application for personal financial management. Such application was evaluated by a group of visually impaired volunteers and the evaluation results were used as a source of insights to refine the guideline and its requirements. Qualitative interviews show that the guideline ensures a higher level of usability when compared to previous experiences of volunteers with other applications. Thus, such outcomes confirm the guideline potential as a resource to support the development of a brand new set of accessible applications.

Author Keywords

Accessibility; mobile applications; usability.

ACM Classification Keywords

H.5.m. Information interfaces and presentation: Miscellaneous.

INTRODUCTION

The definition of a requirements guideline, which is able to ensure proper usability in mobile applications when they are used by impaired individuals, has not been clearly defined in the literature. Thus, our research has applied the process illustrated in Figure 1 to specify and validate a new guideline called GUAMA [1]. This process has four steps. The *Literature Review* on requirements aimed at identifying and characterizing the main accessibility requirements that are discussed by the current technical and scientific literature, regarding the mobile platform. These requirements composed the first guideline version (Gv_1). The *Observation-based Analysis* was mainly used to collect information about requirements from real users, so that our initial guideline (Gv_1) could be validated and evolved to (Gv_2). The target of the *User-Centered Evaluation* was a mobile application

prototype for financial management, whose development considered the main requirements identified in Gv_2 . This application was evaluated by visually impaired volunteers and the conclusions of this step assisted the specification of a new version Gv_3 . This paper, in particular, is focused on Step 4, whose main aim was to review and generate a new version (Gv_4) of the guideline, based on the experience acquired with the development of a real marked application.

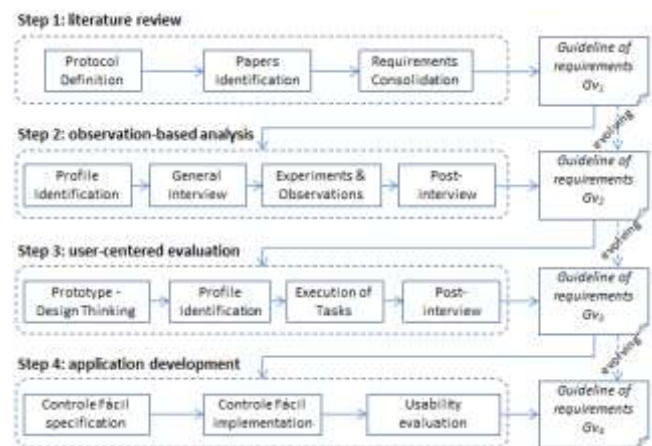


Figure 1. Research method schema.

METHOD

Our object of study is *Controle Fácil* (Easy Control), a mobile application whose function is to support the control of expenses that are carried out with credit and debit cards. Its development was based on the requirements defined in Gv_3 and it was evaluated by 10 volunteers with different profiles, regarding impairment and educational levels.

The same evaluation session was applied to each volunteer. First, a short description and project goals were presented, as well as the evaluation method. After that, a consent form was assigned and the session could start with a short chat "to relax" the volunteers before the evaluation. The next stage was the execution of 12 activities, which were: AT01 - Accept legal terms of use, AT02 - Decide to register an user, AT03 - Register a card, AT04 - Manually Register an expense (x2), AT05 - Edit a card, AT06 - Register an user (email and password), AT07 - Login (email and password already registered), AT08 - Register expense via SMS (x2), AT09 - Access information from the history graph, AT10 - Access information from the category graph, AT11 - Filter

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expenses by period, and AT12 - Remove expenses already registered. Finally, an audio recorded post-interview was individually carried out after the conclusion of all twelve activities. These questions were divided into three blocks. The first block is related to the satisfaction of users regarding the application accessibility (e.g. how do you evaluate the accessibility of this application?). The second block is associated with the facility of use or usability (e.g. was there any situation where you had problems in using the application along the tasks? Could you describe this situation?). The last block is associated with feedback and information received from the application (e.g. how do you evaluate the feedbacks provided by the TalkBack/Voice-Assistant along with the use of the application?). The consolidation and analysis of the results were based on: rate of completeness (measures if users were able to complete the tasks), completeness time (average time that volunteers spent to complete the task) and errors/problems (description of errors or problems that occurred along the interaction with each of the proposed activities).

RESULTS AND LESSONS LEARNED

The main contribution of this work was to show the importance and rationale of the implementation of GUAMA requirements [1]. For example, consider the eleventh requirement from GUAMA and how it was analyzed: R11 - *The component labels and screens with sequential and/or paginated items must inform the interval that is being shown and total numbers of items.* Along with the experiments, we observed that visually impaired users navigate along the interface supported by the feedback that they receive when they touch components. However, interfaces that have pages present a different kind of navigation. In this case, users need to know the page where they are and the total number of pages, so that they could have a better idea of position and time to conclude the navigation. For example, "Page 01 of 03"; "Item 1 of 5"; "SMS 1 of 4". This concept of page is ample and can be also used in screens with several tabs, where the system should read the information "Tab 1 of 5" if users access the first tab of a screen with 5 tabs. This simple requirement gives the notion of the space that can still be explored.

While we could observe the importance of some requirements by means of their effects on the user-smartphone interactions; the importance of other requirements could be demonstrated by the lack of their implementation. For example: R28 - *The keyboard used by the application must be compatible with the context of the field.* The lack of the implementation of this requirement generated several problems along the interactions. In currency text fields, the keyboard was not presenting the comma symbol, so that users could enter with the cents of the value. Actually the text field already had a mask (0,00) for that. However this information was not reported to users. Thus, we should have a keyboard with keys that are compatible with the context field (e.g. "Comma" instead "point" on the numeric keyboard to Brazilian language).

The performance of the 12 activities also demonstrated the importance of the requirements, since they supported the conclusion of such activities by the volunteers. In order, only one activity (AT11) was not easily completed and its level of difficulty was considered as hard by 90% of the volunteers. The main reason was the own concept of information filtering and context menu, which were new to several volunteers. Thus, they had problems to fill the required fields, which are in fact a set of search criteria. For example, a search constrained by a time period requires the insertion of initial and final dates in the respective fields. However this is not obvious if the screen structure cannot be seen. Users may better understand this and other new functions if the application provides audible examples of how to use them. Analyses like that were important to support the evolution of the guideline.

Finally, the post-interview stressed some important aspects. The average score assigned to *Controle Fácil* by the volunteers was 9.0 on a scale from 0 to 10 (min=8.0, max=9.5). We collected answers such as: "I think the application is totally accessible. I do not know other applications that are so accessible" (V01); "The accessibility is very good and the application gives several important feedbacks. However, it could give some other feedbacks that are also important, such as the current amount of characters that were inserted when the text field has a limit" (V02); "Good application. It is different from others that are exclusive for visually impaired users. For example, this one does not have the option to put labels on the buttons" (V03); "It is very good. It could be perfect if the filtering process was easier to use" (V05); "Information is very good in this application. They are clear and this was one of the main advantages of this application". These answers were very motivating, mainly the answer of V01 who has a larger experience with accessible applications (5 years) and considered the *Controle Fácil* as the most accessible application he knows.

CONCLUSION

The experiments showed that our guideline was able to support a development team in creating an accessible application, which had a very positive feedback from testing volunteers. This means, it attended to their needs and desires. The lessons learned from this experience were also important. For example, the volunteers faced some problems with the use of functions, such as information filtering and search, which must be rethinking when applied to visually impaired users. In order, the implementation of any "non-traditional" function must be designed together with ways to assist their understanding by such group of users. More details about this work can be accessed in [1].

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