Results of the Technical Validation of an Accessible Contact Manager for Mobile Devices

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Abstract. The apparition of new mobile phones operating systems often leads to a flood of mobile applications rushing into the market without taking into account needs of the most vulnerable users groups: the people with disabilities. The need of accessible applications for mobile is very important especially when it comes to access basic mobile functions such as making calls through a contact manager. This paper presents the technical validation process and results of an Accessible Contact Manager for mobile phones as a part of the evaluation of accessible applications for mobile phones for people with disabilities.

Keywords: Accessible Contact Manager, Technical Validation, Evaluation, Mobile Phone Contact Manager.

1 Introduction

Nowadays, the emergence of new mobile operating systems like Android, iOS or W7, and the opening of new markets for mobile application (e.g. Android and Iphone markets) have led to the development of many applications sometimes not as accessible as they should be to be used by people with disabilities.

The accessibility of the applications is especially important when trying to perform basic activities with the mobile phone, such as selecting a contact or initiating a voice call. These actions may be difficult or even impossible to be made by persons with disabilities if the contact manager application is not accessible, and/or it is not properly configured and customized.

The European research project AEGIS [1] seeks to determine whether third generation access techniques will provide a more accessible, more exploitable and deeply

embeddable approach in mainstream ICT (desktop, rich Internet and mobile applications). One of the specific deliverables of the AEGIS project is the development of an affordable Accessible Contact Manager application able to fill the accessibility gap of existing contact management applications for mobile phones. Designed for easy use by people with disabilities, in particular users with cognitive disabilities that currently have less presence when designing and developing accessible applications, the accessible contact manager user interface is configurable by: font size, colours with high contrast, position of contacts pictures and size configurable layout, explanatory text, customizable sounds alternative to images, and configurable button size. As shown in figure 1, it is also operable with a touch screen, or with the joystick of the mobile phone keypad.

Fig. 1. Accessible Contact Manager Home page: left image with default configuration and right image with layout and colour theme modification

The development of the accessible contact manager has followed the process of "Design thinking" taking into account the current state of the contact management applications and the needs of disabled users in an iterative process of evaluation and technical validation.

2   Evaluation Plan

To provide a complete validation of the application, an evaluation plan was developed covering three iterative phases, according to the maturity of the application [2]. This

plan contains a technical validation and human factors evaluation plan [3] [4] that follows a common approach. The scope of this paper covers the technical validation of the first phase iteration phase, when the application was still a prototype under development.

The technical validation plan for the first phase was based upon a technical validation research hypothesis according to the maturity of the Accessible Contact Manager and the development of different objectives and technical key indicators. Different scenarios covering several tasks/actions were developed to validate the technical key indicators with different automatic and manual measurement techniques, such as log files or manual verification metrics, to check the fulfilment of the success threshold.

2.1   Technical Validation Research Hypothesis

The Accessible Contact Manager will be considered successful, given that it provides a navigation of a list of contacts and their contact details in an appropriate time, without creating further problems. It should perform as a regular contact manager that is installed in any mobile device with adequate response times. In addition, the application should be able to adapt its layout and contents according to the user preferences taking into account the limitations of the mobile device.

2.2   Main Technical Evaluation Objectives and Key Indicators

The following table shows the technical key indicators, with metrics and success thresholds in order to check research hypothesis made.

2.3   Technical Validation Procedure

The technical validation was carried out in the usability and accessibility lab of Vodafone Spain Foundation. The log files were gathered automatically using a computer connected to the mobile device. The technical test was performed with two different mobile devices: HTC Diamond and Sony Ericsson Xpheria X2. Both devices run a Windows Mobile OS and had a JavaFX runtime installed to be able to run the application. The colour contrast was analysed manually using the Contrast Analyser Version 2.2 and the emulator version of the application that runs on the computer. To evaluate the intelligibility of the sounds, the mobile devices were configured with the system sound at maximum levels.

The technical validation consisted on a series of tasks that evaluated the technical characteristics of the application. Each task was focused on each of the technical key indicators that have been defined in table 1. These are some examples of the tasks carried out:

Task 2 (focused on the second Key indicator of Table 1):

- Open NetBeans 6.8 IDE
- Connect the mobile device to the desktop computer using a USB cable

- Synchronize the mobile device with the computer
- Run the contact manager project on the connected mobile device using NetBeans
- Use touch screen gestures to move up or down of the contact list
- Note down the time logs of the response time in a navigation movement using gestures with touch-screen
- Calculate the average response time

Task 7(focused on the seventh key indicator of Table 1): Go to the settings page and check the correct behavior of the application under these configurations:

- Small image size
- Medium image size
- Large image size
- Small font size
- Medium font size
- Large font size
- Dark background colour
- Light background colour
- Select English language
- Select Spanish language
- Select Dutch language
- Select Swedish language

Table 1. Main technical evaluation objectivs, key indicators, measuring tools and success thresholds for the Accessible Contact Manager

Technical Key Indicators	Metrics (for each indicator) and ways/tools to measure them	Success Threshold (for each metric)
Timeliness – Response time in a navigation movement using the joystick	Log files	2 seconds (0,2 seconds) [1]
Timeliness – Response time in a navigation movement using gestures with touch-screen	Log files	2 seconds (0,2 seconds)
Timeliness – Response time in a modification of the layout	Log files	15 seconds (not available in common contact managers)
Reliability – Number of errors	Log files and manual evaluation	Less than one error message per 50 user interactions with the device

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[1] The response time given in the parentheses is the average response time of common contact managers that are built-in with mobile devices (as estimated for this scope). However, the success threshold for the accessible contact manager are higher, as may noticed, since the application is much more demanding graphically and it takes much more time to navigate.

Table 1. *(continued)*

Accessibility – Text alternatives (WCAG 2.0 Guideline 1.1 [5]) - Provide text alternatives for any non-text content so that it can be changed into other forms people need, such as large print, Braille, speech, symbols or simpler language	Manual Evaluation	Every symbol presented to the user are provided is a text alternative
Accessibility – Time based Media (WCAG 2.0 Guideline 1.2). Provide alternatives for time-based media	Manual Evaluation	An alternative for time-based media (the audio voices of the contacts) is provided that presents equivalent information with other alternatives (textual – names of the contacts and/or graphical – pictures)
Accessibility – Adaptable. WCAG 2.0 Guideline 1.3 - Create content that can be presented in different ways (for example simpler layout) without losing information or structure	Manual Evaluation	The application should be adaptable in at least two of the following: adapting layout, menus, font size, colour themes, language
		- At least one of the colour themes should provide visual presentation of text and images (except images of contacts) of at least 4,5:1
Accessibility – Distinguishable. WCAG 2.0 Guideline 1.4 - Make it easier for users to see and hear content including separating foreground from background	Manual evaluation for adequate sound level of voices and colour contrast analyser application to measure the minimum contrast	- Colour is not used as the only visual means of conveying information
		- Text can be resized without loss of content or functionality
		- Sounds and voices should provide an adequate level of volume to be intelligible

3   Results

The following table shows the results of the technical validation according the Key indicators shown in Table 1.

Table 2. Aggregated evalua tion results of the Accessible Contact Manager

Technical Key Indicators	Iterations (number if available)	Mobile Device	Success Threshold (for each metric)	Aggregated result (per task scenario if more than one)
Timeliness – Response time in a navigation movement using the joystick	5	Sony Ericsson Xperia X2	2 seconds (0,2 seconds)[2]	1,620 seconds
Timeliness – Response time in a navigation movement using gestures with touch-screen	5	Sony Ericsson Xperia X20	2 seconds (0,2 seconds)	1,430
	5	HTC HD 2	2 seconds (0,2 seconds)	1,123
Timeliness – Response time in a modification of the layout of the application	5	Sony Ericsson Xperia X2	15 seconds (feature not available in common contact managers)	13,463
	5	HTC HD 2	15 seconds (feature not available in common contact managers)	4,644
Reliability – Number of errors	100	Sony Ericsson Xperia X2	Less than one error message per 50 user interactions with the device	No error messages
	100	HTC HD 2	Less than one error message per 50 user interactions with the device	No error messages

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[2] The same as in footnote [1]

Table 2. *(continued)*

Accessibility – Text alternatives (WCAG 2.0 Guideline 1.1) - Provide text alternatives for any non-text content so that it can be changed into other forms people need, such as large print, braille, speech, symbols or simpler language	All icons were reviewed	This metric does not depend on a particular mobile device	Every symbol presented to the user are provided is a text alternative	The success criteria was met and all symbols were provided with text alternatives
Accessibility – Time based Media (WCAG 2.0 Guideline 1.2). Provide alternatives for time-based media.	All sounds were reviewed	This metric does not depend on a particular mobile device	An alternative for time-based media (the audio voices of the contacts) is provided that presents equivalent information with other alternatives (textual – names of the contacts and/or graphical – pictures)	The success criteria was met and all audio sounds were provided with text alternatives
Accessibility – Adaptable. WCAG 2.0 Guideline 1.3 - Create content that can be presented in different ways (for example simpler layout) without losing information or structure	12 configurations were tested	This metric does not depend on a particular mobile device	The application should be adaptable in at least two of the following: adapting layout, menus, font size, colour themes, language	The success criteria was met and the application provided 4 methods that allow users to adapt the application to their preferences: layout, font size, colour themes and language
Accessibility – Distinguishable. WCAG 2.0 Guideline 1.4 - Make it easier for users to see and hear content including separating foreground from background	2 colour themes were tested	This metric was tested using the mobile emulator running on a desktop computer	At least one of the colour themes should provide visual presentation of text and images (except images of contacts) of at least 4,5:1.	The success criteria was met and the minimum contrast ratio was 11,6 for the dark colour theme. The other colour theme has a minimum contrast ratio of 4,6 which is also above the threshold

Table 2. *(continued)*

	N/A	This metric does not depend on a particular mobile device	Colour is not used as the only visual means of conveying information	The success criteria was met and all UI elements do not rely only in colour to provide information
	3 font sizes were tested	This metric does not depend on a particular mobile device	Text can be resized without loss of content or functionality	The success criteria was met and the behaviour of the application was the same when the font size was changed by the user
	3 voices of contacts	Sony Ericsson Xperia X2	Sounds and voices should provide an adequate level of volume to be intelligible	The success criteria was met and the sound level was adequate to listen and understand the voices of the contacts
	3 voices of contacts	HTC HD 2	Sounds and voices should provide an adequate level of volume to be intelligible	The success criteria was met and the sound level was adequate to listen and understand the voices of the contacts

The accessible contact manager application has an important number of functionalities that are not included in conventional contact manager applications. Therefore, the response times have not been comparable to these built-in applications but have successfully improved the threshold values. It should be noticed the improvements of HTC HD2 in comparison with the Sony Ericsson X2, not only in response time but also in user navigation which is much more friendly as it uses a capacitive touch screen that does not require the use of a stylus.

The accessible contact manager has proven to be a very flexible and adaptable application for the users. The research hypothesis and the success criteria have been largely met. The prototype has worked without any error messages or further problems. In addition, the application has been able to adapt its layout and contents according to the user preferences taking into account the mobile device limitations.

4 Future Work

The main problems that occurred during the technical validation were due to the use of the resistive touch-screen without using a stylus. The navigation was much better with the capacitive touch-screen of the HTC HD2 in comparison with the resistive touch-screen of the Sony Ericsson Xperia X2. This should be taken into account for future decisions on which devices are going to be used during the trials, because it affects the user experience and especially those who are motor impaired. In the near future the final application of the Accessible Contact Manager will be again evaluated taking into account the results of the human factors evaluation and the technical validation presented in this paper, checking if the improvements made into the applications will fulfil the technical recommendations and users needs.

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