BLINDSHELL – USER INTERFACE FOR VISUALLY IMPAIRED USERS

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Abstract

This paper deals with design and implementation of user interface which makes accessible environment of the mobile operation system Android 4.0 and above for visually impaired users. Interface enables to perform basic operations with the system and common used touch gestures. Voice synthesizer, vibration and sound is implemented as a feedback. Interface was tested with 12 target users following man-machine design process including interviews with focus group and tests in an usability laboratory.

Keywords

user interface, user centered design, Android, visually impaired user, user study, user testing

Goals

Nowadays, majority of visually impaired users still use traditional mobiles with HW keyboard accompanied with special screen reader software (e.g. MobileSpeak or Google touch by explore feature). Despite of fast penetration of smart phones with touch screen there are only few apps targeted on visually impaired users, i.e. Talkback and none of them use exclusively multi-gesture control.

Our primary goal was to design an Android launcher app for addressing basic functions (calls, SMS, contacts, calendar, alarm, reminders) solely via use of simple multi-gestures approach.

User Study

User centered design was applied. First, semi-structure interviews were carried out with 4 users in total (qualitative phase).

Each interview took 60-90 minutes. The questions used in the interviews were designed to identify how the participants used and experienced the BlindShell application in relation to mastering basic functionalities like making call, writing SMS or searching in contact list. Users were divided into 4 groups according their answers:

- Less experienced user – currently uses Nokia mobile phone and basic functions (calls, SMS, book reader, music player). Does not have experience with touch phones.
- Less experienced user with touch phone experience - currently uses Nokia mobile phone and basic functions (calling, SMS, book reader, music player). Has experience with touch phones.
- Experienced user with touch phone experience – currently uses Nokia mobile phone or touch phone with Android or iPhone. Uses advanced functions like web browsing or emails.

Second, quantitative phase followed based on results of qualitative study. This part was accomplished by 30 users.

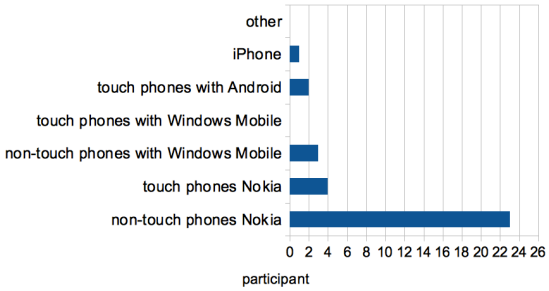

Fig. 1: Penetration of mobile phones.

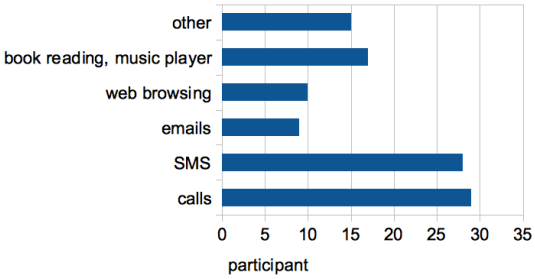

Fig. 2: User activity with mobile phone

The following design principles were postulated:

- Alphanumeric keyboard for text input;
- Personalize and settings environment;
- Control using simple touch gestures;
- Notifications on missed events;
- Assurance of technical support.

Application

BlindShell is implemented as a launcher for Android 4.x devices. Launcher replaces default application for system control. Included applications allow visually impaired users perform basic operations with touch mobile phone as calls, SMS, contacts, alarm, information about state and settings.

Fig. 3: Application screens.

BlindShell can be controlled with 5 basic gestures:

- Touch with one finger to right/left part of display for move to next/previous item in the list;
- Touch with two fingers for repeat last spoken text;
- Long touch with one finger for confirm actual selected item;
- Long touch with two fingers for return back;
- Explore by touch with second finger touch to control alphanumeric keyboard.

Gestures can be performed anywhere on the screen.

User Testing

BlindShell was tested in Usability Lab with 12 participants. Basic scenarios were defined by task covering operations like make call, write SMS, create new contact etc. Each test took 30-65 minutes.

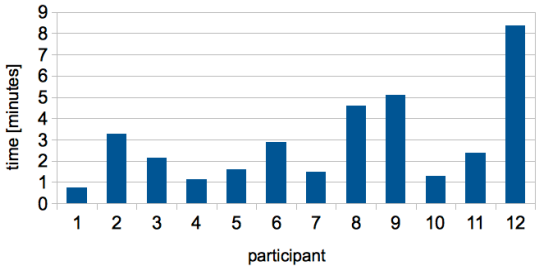

Fig. 4: Usability testing – result of the make call task.

Most of users where able to control application in few minutes. 7 of 12 users even didn‘t have experience with touch devices. Users we asked to use embedded help in case of some problems.

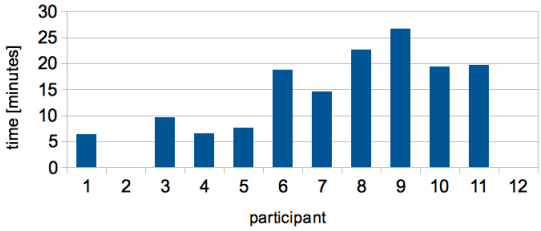

Fig. 5: Usability testing - result of the write SMS task.

Despite of time limit of 30 minutes per task, 6 participants were able to accomplish the whole test. One of the most difficult task text input was accomplished by 10 of 12 users.

Participants were enthusiastic by simplicity of touch gestures. User testing was very important for getting user feedback for next development.

Conclusion

For next development we will focus on implementation of the next applications such as calendar, notes, voice recorder, music player, book reader etc. Great opportunity for extension of BlindShell functionality is ambient intelligence. A pilot study consisting of 10 users will be launched in near future.