Exploring the Interface Design of Assisting Children to Find Books in the Library Using Smartwatches

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Abstract-- **Ever-evolving technologies allow modern libraries to introduce multiple digital devices to enable readers to more easily find their desired books. However, the cognitive abilities of children might bring about incorrect use of these devices. Therefore, it is imperative that libraries pursue innovative service such as smart book-finding specifically designed for children to accommodate their needs.**

In this study we employed expert interviews and current product analysis to examine the informational architecture, graphical user interface and interaction over smaller interfaces, thus formulating guidelines for the design of smaller interfaces. We also designed a book-finding user interface and navigation flow of the smartwatch interface based on the proposed guidelines. These will be applied in children's libraries to enable young readers to complete book-finding tasks with the aid a smartwatch. This development is of great value to children's libraries and serves as reference for smaller interface design.

I. INTRODUCTION

In recent years, libraries try to import a number of digital devices to help readers look for books, so that they don't need to rely on the traditional, complex and cumbersome call numbers. Through looking at the library map on the smartphone, readers can easily find the books they need [1]. In the digital era, children use different kinds of digital products earlier than any generation before. Due to its wrist-watch form feature, smartwatch allows user to access information at the flick of the wrist [2]. Compared to the smartphone, smaller interface of smartwatch present limited information, which is more suitable for children with socio-emotional and cognitive immaturity. Smartwatch provide a better platform for children who look for information and books.

Currently smartwatches for children mainly allow parents to know the situations of their children so as to avoid accidents. However, the small screen size of smartwatch restricts the capabilities for meeting the demands of all children with different situations, such as, the icon needs to be closely related to their own experiences and also highly identified [3] by larger texts and colors contrasting with the background for better readability [4]. Currently there are still very few research of smartwatch interface design for children.

Based on previous research and the existing products, this study summarizes the recommendations for interface design for children and confirms its compatibility of smartwatch with smaller screen size through expert interviews. Taking advantages of the recommendations, we set up a book-finding navigation service flow and graphical interface for children to find books. Thus, instead of relying on complex call number, children can find target books faster and easier. In the future, it will apply to the children's library empirically for user testing to improve the book-finding flow and smartwatch interface.

The results presented in this study provides further reference for smaller interface, and book-finding navigation of related applications at children's libraries.

II. METHODS

There are two stages of research work. Firstly, through literature review and analysis of the existing children's smartwatch interface, we sort out characteristics of the interface design. Secondly, this study conducts expert interviews to confirm whether the characteristics are suitable for the smaller interface, and compares to existing products, as a follow-up reference for interface design.

A. Existing products analysis

From the retail market, we select and analyze three children smartwatches, Doki Watch, Omate K3 and InFocus W201. Two icon styles, simple monochrome and complex, can be found among different watches. All watches are designed with less than three-layer interface. The text size of Doki Watch is the smallest, which could cause reading difficulties. In the next research stage all the three watches will further be examined by expert interviews.

TABLE I
CHILDREN'S SMARTWATCH INTERFACES COMPARISON

Product	Doki Watch	Omate K3	InFocus W201
Interface images			
Icon style	between abstract and figurative	figurative	between abstract and figurative
Information architecture	three layers	three layers	two layers
Control position	bottom	bottom	top & right
Control means	click	click	slide
Text size	small	moderate	big

B. Expert interviews

Based on the literature review and the interface analysis of the existing products, we conducted semi-structured expert interviews. The interviews consist of three parts. First, we asked the general questions about children's interface design, and taking age into consideration when designing different interfaces. Next, the experts were invited to actually use the three children's smartwatches and made feedbacks for the design of the interface. Finally, we asked experts to summarize the factors that needed to be considered in designing smaller interface and give us some suggestions for book-finding navigation interface design.

We interviewed four experts, two user experience designers of children e-learning games and smartwatch, a professor in the
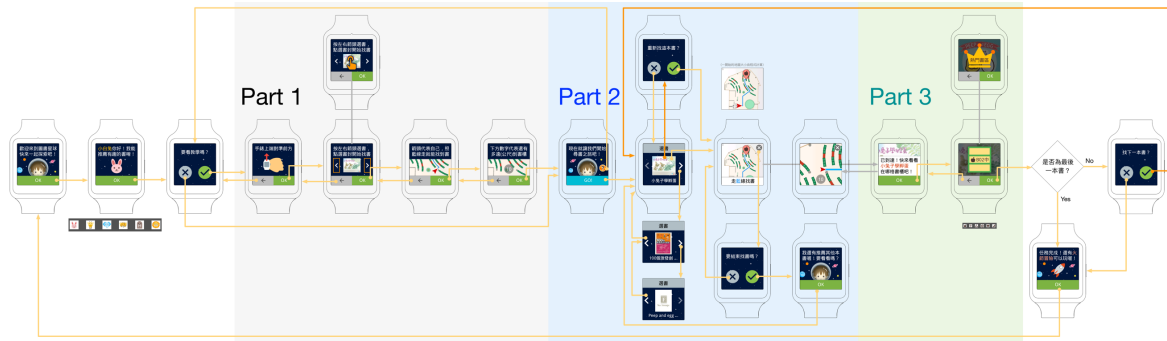
Figure 1. Book-finding flow & smartwatch interface

field of early childhood education software interface, and an elementary school teacher who uses e-learning software to teach. The interview results are summarized as followed.

1) Icons

The design of icons must be consistent with the experience of children's life. The best style is the one between the concrete and abstract. Therefore, the icon design should simply focus on the function, instead of the unnecessary characters to avoid distracting children's attention.

2) Information architecture

The interface should be designed with no more than three layers. Otherwise, children will not know how to correctly go to the next step.

3) Voice guidance

Pre-school children are lack of literacy. Compared to the text, voice guidance will be more intuitive for them. Besides, not all the children are familiar with using digital products, so it is advisable to provide voice instruction at the outset.

4) Gesture

When using these smartwatches, users can slide to the left and right in the meantime. Yet, these complicated gestures will confuse children. It is better to replace "slide" with "click" gesture, as younger children may be less familiar with the "slide" action.

5) Text

The text size for children's smartphone interface must be larger than the adults'. Due to children's limited literacy, those smartwatches with the phonetic support are better.

6) Layout

Children pay attention to the center of the interface, so it will be an ideal place for the most important and prioritized information.

III. BOOK-FINDING SMARTWATCH INTERFACE DESIGN

Based on the results of current product analysis and expert interviews, we gained lots of recommendations for modifying the smaller interfaces, planning the service flow of book-finding and designing the smartwatch interface.

Figure 1 shows the book service process contains three parts. The first part is tutorial. Because children's experience for using smartwatches are different, with tutorial, they are able to know more about the interfaces. The second parts are the book selection and book-finding navigation. In order to fit in the smaller interface, there is only one-line space for displaying book title. However, the book covers will show at the center of the interface to help children identify the right book. In addition,

considering that younger children are not familiar with the "slide" gestures, clicking the left and right arrows can also switch among three books. In the process of navigation, in spite of the devices limitation, we use vibration to replace the voice to remind children of arriving the destination of the book. The third part is the bookcase codes. When children feel the vibration and notice they may arrive, the smartwatch interfaces present the composition of alphanumeric codes for them to follow the codes to find the location of the target book.

IV. DISCUSSION AND CONCLUSION

Smartwatches are with better portability than mobile phones, but constrained to smaller screen size. To visualize the same amount of information will be more difficult for smartwatches. Moreover, children with immature cognitive abilities might use devices with smaller interfaces more incorrectly. Children's smartwatches are still at the development stage and are lacking of relevant research. In the study, we conducted interviews to discuss the essential factors when designing smaller screen, such as icon, information architecture, voice guidance, gesture, text of the interface. Finally, based on the above analysis, we plan for children's book-finding service flow and design the smartwatch interface. Due to the smaller interface size restriction, it shows without Taiwan's phonetic symbol support. Therefore, as designing the watch interface, the wording should be streamlined, and icon design should be close enough to the children's life.

The book-finding interface will be applied to the children's library empirically in the future with user testing. Then, referring to test results, we will make further refinement so that not only children can find the target books more quickly and independently, but also improving library service quality. In conclusion, this study proposes useful reference for smaller interfaces design for children.

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