Towards a Personalized Browser for Elderly Users

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Abstract. This paper discusses primary design issues of an intelligent browser for senior citizens. This work focuses on the study of intelligent interface agents which adapt to the user according to the interactions between the user and the browser.

1.0 Introduction

The World Wide Web opens the possibility for individuals to access information and interact with each other with appropriate computer and telecommunication equipment. However, despite the growing proportion of the senior citizens in society, the population of elderly Internet users is relatively very small. The reasons which has led to this situation could be complicated. Aging in general is related to decrease in functional ability. This decrease can affect functioning of sense organs (vision, hearing, tactile sensation etc.) and the information processing capacity [Include]. Research shows that the user model of elderly in browsing the Web is quite different from regular users and they have difficulties using a normal browser [Meyer 97] [Williamson 96] [Zhao 97]. Some of the suggestions are that the elderly need simpler user interface and that of more readable display: for example, bigger buttons, larger fonts, higher display contrasts, easier-to-use pointing devices. Moreover, due to the decline of short term memory, the older users need some better means of seeing where they are and where they have been to prevent them from getting lost on the World Wide Web.

Because of the rapid growth of Internet users, the information on the Web has been growing tremendously during the last several years, Even an experienced user can sometimes get lost when navigating. To cope with this growing problem, personalized web-based searching has attracted substantial research work and some promising results have been announced. For example, WBI [Barrett 97] [Maglio 97] is an implemented system that provides a loosely confederated group of agents on a user's workstation capable of observing user actions, proactively offering assistance, modifying resulting web documents, and performing new functions, BASAR [Christoph 96] [Christoph 97] is a web assistant providing user-specific help for browsing tasks based on a user, task and domain model. Both of them use agent programs that add their functions to the existing browser. Unfortunately, an inexperienced senior user may have some difficulties in dealing with a browser bundled with agents. We propose a browser with built-in intelligent functions to address the simplicity which is necessary for older users. The intelligence of the browser is based on the dynamic user model which is built by observing the discourse between the user and browser.

2.0 General Design Considerations

Considerable progress has been made in adapting interactive software systems [Kobsa 93] [Fink 97]. The key issue in providing user-oriented adaptability is to acquire a personalized user model. One approach is to require the user to specify her preferences, but this approach

is inappropriate for unexperienced users because they may not have the confidence to change the default setting at an early stage of using a system. An alternative is the stereotype approach [Kobsa 93] that is based on the research results on the general user model. This is feasible, but the general model may not be suitable for everybody and it can not be tailored to personal needs. Another powerful approach is to obtain a usage model by observing the user's interaction with the system as well as the information the user has obtained. The last approach can result in a personalized user model without requiring the active participation of the user. We are prototyping an easy browser with personalized information space by combining the three user model acquisition approaches. A basic general user model is built into the browser; the personalized model can be aggregated by observing the discourse; furthermore, the user is allowed to inspect and modify the model directly.

The browser is designed to have the following features:

- Adaptation of user interface including both layout and functionality to the user's ability and preference but generally keeping consistency
- Adaptation of navigation to provide personalized information space.

2.1 Adaptation of User Interface

Because currently most of the elderly users are not very experienced in Web searching, we put simplicity as our primary design consideration. The following principles are the guidelines to achieve this goal [Wilbert 97]:

- Use progressive disclosure, hiding things until they are needed.
- Provide defaults

We present the basic fundamentals first, and introduce necessary and more sophisticated functions gradually. For example, for a novice user, the simple browser can be provided with only "Back", "Forward", "Home" and "Stop" buttons. After the user becomes familiar with these basic navigating buttons, other functions like "Reload" and "Bookmark" functions can be added. Subsequently, "History List" and "Document Path" can be offered to the user for advanced browsing help.

2.2 Adaptation of Personal Information Space

Research on general user models for accessing the Web suggests that both experienced and inexperienced users think of the web as a physical space [Maglio 98]. It also indicates that individuals focus on key nodes when recalling their searches and these key nodes help to structure memory [Maglio 97]. Moreover, people tend to use the same search pattern over and over. Other research concludes that a Web user exploits bookmark as a personal information space [Abrams 97]. The usage patterns of bookmark are the following:

- Starts small and build incrementally
- Selects only useful items
- Adds value through organization
- Manages with poor structure
- Establishes a personal view

Because older users on the whole have more limited working processing memory and short term memory, it is important to reduce demands on working memory by providing external displays or notebook as much as possible [Include] [Helander 88]. Thus more functions for recalling the browsing history could be helpful. For example, if an elderly user can retrieve the relevant documents by searching her browsing history by keywords, she may benefit from it. Moreover, the path of each document, which includes where she comes from and where she has been can effectively help her in recognizing the trail of her searching.

As a result of the important role of the bookmark in surfing the Web [Abrams 97], bookmark default views are supplied according to the general interests of the elderly. For example, some related information links are provided for the five most popular areas such as sports, the arts, genealogy, gardening and travel [Williamson 96]. In addition, the browser provides information on organizing and updating the bookmark depending on the usage model of the user. For example, suggestions can be given to the user on deleting links which are not valid and less used as well as adding most recently visited pages to the bookmark. Furthermore, a hotlist for the most frequently visited places is updated by the system automatically.

3.0 Architecture

The Architecture (Figure 1) of the browser is based on the Human Agent Interaction by FIPA[FIPA 98]. The User Interface Agent is designed to be the only one which interacts with the user. In other words, the user is unaware of the existence of any of the other agents assisting the browsing. The browser consists of the following components:

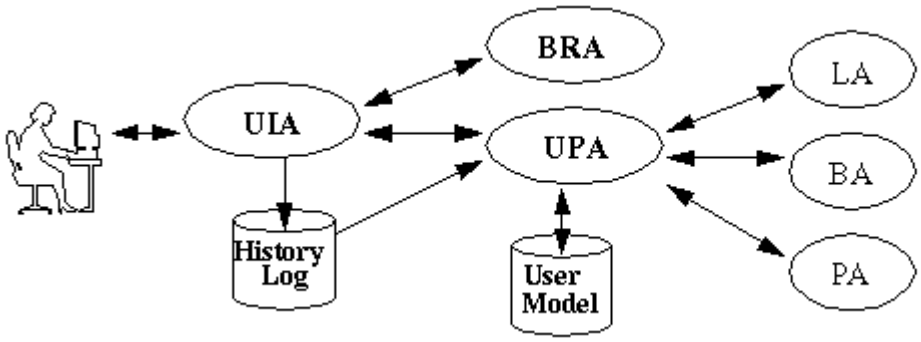

FIGURE 1. The Architecture of the Browser

- Browser Agent (BRA): provides the main browsing functions as a normal browser
- User Interface Agent (UIA): manipulates the active interfaces to the user according to the instructions from the user and UPA. It also records interactions of the user and information about browsing history to the respective log files.
- User Personalization Agent (UPA): instructs the UIA to adapt its active interface while managing and updating the user model by observing interactions between the user and UIA. It comprises several sub-agents to support the dynamic changes of the user model.

  Bookmark Agent (BA): handles bookmarks and hotlists of the user.

  Layout Agent (LA): figures the suitable layout and functionality style of the browser for the user

  Path Agent (PA): maintains the browsing history and clusters the trail of the user's

visited links related to these visited pages

- History log: keeps the history of interactions between the user and the browser as well as information of the browsing history
- User model: contains the system's assumptions about user preferences, capabilities, skills, knowledge and other factors, which are typically acquired by inductive processing based on observations about the user. It is deemed relevant for tailoring the interface of the browser to the user. It is updated dynamically according to the discourse between the user and the browser.

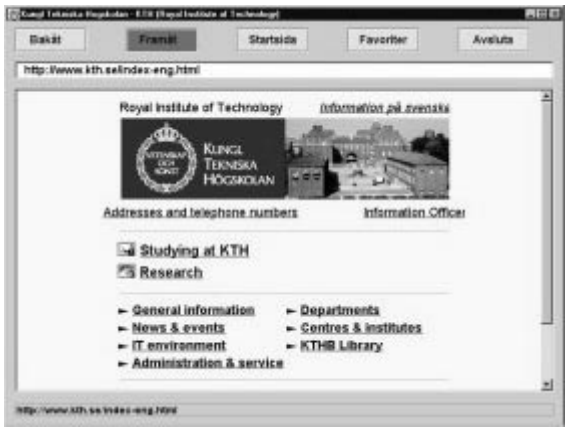

FIGURE 2. The Screen shot of Browser (2)

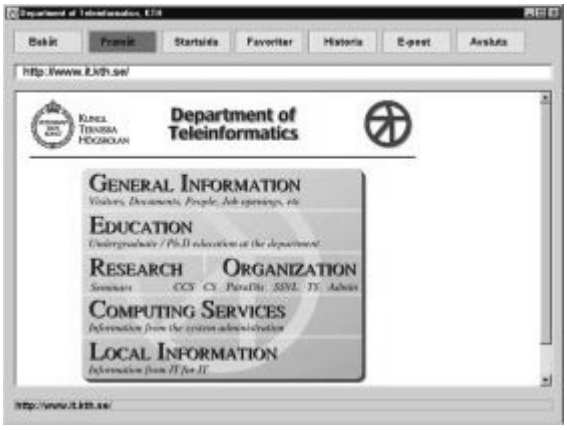

FIGURE 3. The Screen Shot of Browser (3)

3.1 Implementation and Experiments results

The first prototype of the browser was implemented using the Java language [Java]. Three levels of user interface are provided separately. The first is a very simple browser with only five buttons, "Back, "Forward", "Home", "Bookmarks", "Exit" [Figure 2]. The second level has one more "E-mail" button. The third level has one more "History" function added to the second level user interface to facilitate the user for retrieving the browsing history [Figure 3]. The prototype was tested by several seniors and some school children with special needs. The feedbacks from these users show that simplicity is very important for inexperienced users. The first level user interface is adequate for user who is not experienced with using computers. The second level user interface is necessary for user who has already know how to surf the Web. However, there is no positive feedback for the third level interface. In other words, the users seem to seldom use the "History" function. One reason for the neglecting of this function can be due to the fact that none of the user has used the browser enough long time. A promising conclusion through observation is that changing user interface with relative consistency seems to have no obvious negative effect.

4.0 Discussions and Future work

User adaptation has merits for personalizing the application. In the meantime, it raises questions such as how to keep consistency while changing the interface layout by dynamically adding functions [Wilbert 96], and how to balance between user control and the automation of the agent. Our observation is that the dynamism can have positive effect happening when it is required. A proper algorithms on adaptation based on the general user model can be of value. To obtain this model, a proxy server can be utilized to log and analyse the users' interactions. Our future work will concentrate on adaptation of the browser based on the user's usage model and general user model with the active participations of the end users.

5.0 Summary

We have discussed the design considerations of a personalized browser for inexperienced elderly users. The advantage of the proposed browser is that it can be tailored to the personal needs and preferences automatically and achieve personalization by observing the discourse between the user and browser. User interface adaptation and personal information space adaptation are combined to address simplicity and usefulness issues for inexperienced users.

Acknowledgment

This work is funded by the Swedish Transport and Communications Research Authority (KFB) with grant no. 96-125-834.

We wish to thank Diana Sidarkeviciute for the helpful discussions.

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