A personal assistant – a push system to offer relevant information with a minimum of input

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Abstract

To date, the research on usability has focused on offering simple-to-use interfaces, often with forms for input, menus, and buttons. However, an even simpler interface is the input-free version. This idea is explored here in the form of a personal assistant. The task of the assistant is to offer the information that a user needs at any time, preferably without requiring any input. The information is based on user data, such as calendars, contact lists, and email, and on background data from the Web. The selection is based on time, location, and usage patterns. Results are presented on a smartphone display.

Introduction

Much of the research on user interfaces has concentrated on offering easy-to-understand interfaces. These may come in the form of menu systems, forms with fields for input and command buttons, or wizards that support users through a process. These research efforts have recognized that it is important to limit the necessary input, for example by retaining important information from previous encounters with the user, since offering input from a keyboard, mouse, or touch-sensitive screen comes at a cost. The user must provide the input and correct the resulting mistakes. This takes time, and even if the cost (counted as the number of input operations) is low for one operation, it may be quite high if one considers all the operations that a user performs throughout a day. Therefore, it is important to limit the "clicks" whenever possible. The ideal is, of course, the input-free user interface. In fact, such interfaces are actually quite common; a good example is a wristwatch. Similarly, signs offer information without requiring input. While we stand at a platform waiting for a train, a display may tell us when the next train will arrive and its destination; this information is important to the traveler, and can be received without any input. Another example is smartphones that display the name of the caller.

This paper explores the idea of a personal assistant that can push information that is relevant to the user and that can initiate actions that it finds necessary. An example of the latter could be calculating that the user will not be able to catch a flight and that a change of booking is required. The idea is to implement an assistant that can offer relevant information when it is needed, directly on the display of the smartphone.

The idea of assistants is not new – Microsoft had its widely disliked Office assistant and, as early as 1987, Apple CEO John Scully described the "Knowledge Navigator" (Scully, 1987). However, we feel that it is now practically possible to implement this idea.

The job of the push system or "assistant" will be to select information from a repository based on a set of selectors. The selectors that we will use are location, time, and usage patterns. With all data on the user available, and with background data on the Web, it will be possible to select the information that the user needs in many situations.

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Requirements

The danger of any push system is that the information sent is of no value to the user. In order to be of assistance we expect the system to fulfill a set of requirements:

Relevance. Messages should be relevant for the user. However, since the cost of receiving and deleting a message is low, one can accept that a small percentage of the messages are of no or little interest.

Correctness. The information that is pushed to the user must be correct; at least, it must be based on the information that is currently available in digital form.

No serious consequences. If the push system is to perform actions that have direct effects, such as ordering a book or changing a booking, an explicit confirmation from the user is needed.

Personal data. In order for the assistant to do its part, it needs access to all data that is relevant for the user. This may consist of calendars, contacts, bookings, orders, and all other forms of documents. Naturally, this data must be offered in digital form.

Background data. The assistant will need background data, and we assume that this can be found on the Web. For example, the system will need maps, location information, updated transport information, etc.

Formalization. Data must be formalized in such forms as record definitions, XML-coded documents, or in a form that can be used to extract the information that the system needs.

Selectors. With data available, the assistant must select the information that it will provide to the user. This selection is performed based on three selectors: time, location (based on GPS or mobile phone triangulation) and usage patterns.

Extracting and formalizing data

In the simplest form, the user can offer data explicitly to the assistant, such as by typing in the booking information. At the next step, the assistant can be offered the emails, documents, or Web page that confirms the booking and the system can parse these and extract the information of interest. In a more advanced stage, the assistant can supervise email systems and Web browsers and automatically extract information.

The assistant must have access to all user-oriented data, as well as background data; for example, data on the Web. Data may be formalized as database records, may be tagged in XML or similar formats, or may be available only as plain text with layout information. However, many techniques can be used to extract data from less formalized documents (Banko et al, 2007; Sarawagi, 2008). It is likely that data will be presented in a more standard way in the future. Many large sites, such as booking.com, hotels.com, expedia.com, and Amazon, already offer "de facto" standardizations; that is, confirmation messages and other information is automatically generated with a fairly fixed format. In other words, if the system is able to parse one message from one of these sites, it may parse all of them. However, it is reasonable to expect that sites may offer API-interfaces and even more formalized message formats in the future, such as presenting these in XML.

"I feel lucky" display

Messages and information from the system will be presented on the front screen, the screen saver display, on the user's smartphone. We can call this an "I feel lucky" display, using a term borrowed from Google. In most cases, the user will get the information without having to make any clicks. The assistant has calculated what the user needs at any time, and presents

this information on the display. While this information may come with alarms, such as a beep, it will usually be a silent operation.

The idea is that whenever the user feels that he or she needs information, it should ideally be on the phone. For example, when the user is going to an airport, hotel, or meeting, the "I feel lucky" display should present the information that the user needs: flight departure times, directions, place or agenda for the meeting.

Simple user study

We have performed a basic user study (Onorati et al, 2012) in which efficiency has been defined as giving users support for their daily activities and providing helpful information as an early response to their needs. We employed a Wizard of Oz methodology to simulate the assistant (Dahlbäck et al. 1993). The idea is to convey the idea that participants are interacting directly with the system, while there is mediation from a human operator (the Wizard) that simulates the behavior of a theoretical application. The aim of this technique is to identify which basic features the simulated system might include in order to satisfy the user's needs, and to see if the idea works in practice.

ST1	The displayed notification helped me when I needed it.
ST2	The displayed notification was clearly presented.
ST3	The displayed notification was not useful when I received it.
ST4	What other kind of information would you like to receive?

Table 1. Statements for the questionnaire.

The participants in our experiment were 10 students from the Computer Science Department of Universidad Carlos III of Madrid. Although this is a small sample, we consider it to be adequate for a preliminary evaluation. During a day they were sent messages from the "assistant," on transportation, meetings, classes, etc. They were then offered a post-questionnaire. For each notification, the participants were asked to indicate their agreement (or disagreement) with four statements (Table 1). We have analyzed results obtained from the first three statements (ST1, ST2, ST3) comparing the different classes of notifications, and taking into account collected suggestions and improvements from the fourth statement (ST4).

	ST1 (positive)		ST2 (positive)		ST3 (inverted)	
	μ	σ	μ	σ	μ	σ
Transportation	3.96	0.9	4.77	0.39	2.22	1.11
Route	3.31	1.12	4.28	0.74	1.95	1.07
Practices	3.65	0.92	4.20	0.67	2.12	0.78
Calendar	3.75	1.02	4.52	0.56	2.12	0.99

Table 2. Mean (μ) and standard deviation (σ).

Looking at the computed means and standard deviations (Table 2), we can conclude that notifications have been recognized as useful. The best results have been obtained for the understandability of messages (ST2): the high mean and the low deviation represent an overall agreement about the clear language and presentation of the notifications being sent. A higher deviation underlines a less shared agreement for the helpfulness (ST1) and the usefulness (ST3). By analyzing scenarios collected from participants, we have recognized that this is related to different habits and experiences of users.

The suggestions (ST4) indicate several interesting improvements for the "I feel lucky" display. First of all, notifications about transportation, like timetable or directions, have been

considered to be the most helpful, e.g. “the route from the metro station to the train station takes some minutes. Therefore, it is important to know the time left for me to decide whether I have to run.”

Discussion and future work

The participants in the test were enthusiastic about having a personal assistant. Based on the test, we identified several improvements for the assistant, particularly regarding the kind of data to offer. However, the wizard of Oz methodology can only present a first approximation of a user study. As comments from the participants show, we need a dynamic system that can offer updated information at any time, such as counting the minutes until the next bus or train.

We are now working on a system that can supervise all emails to and from a user, as well as developing a plug-in that can supervise Web browsing. In the initial version of this system, the user will have functionality to indicate documents (email, Web pages, etc.) that are of interest.

This will provide the background for experimenting with more automatic systems, systems that can supervise all user activities and present the necessary data without requiring any input from users.

Privacy issues are, of course, a part of such systems. However, with powerful smartphones and broadband connections, a large part of the application and most data, especially position, may be kept only on the smartphone.

Conclusion

Since many of us perform most, if not all, administrative activities on a computer, the important data is available in digital form. In addition, many of the emails we receive or Web pages that we visit are fairly standardized, which makes it possible to extract the important variables from these documents. Most important, while time has always been a selector for information (for example, in any reminder system), we now also have the location of the user. By combining these, we can also see patterns in the users operations. Altogether, we then have a set of selectors that may help an assistant present the right information at the right time.

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