Memojog- an interactive memory aid incorporating mobile based technologies

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Abstract. Memory problems are often associated with ageing and are among the most common effects of brain injury. Such problems can severely disrupt daily life and put huge strain on family members and carers. Electronic devices have been used successfully to provide short and timely reminders to memory-impaired individuals. The Memojog project has developed and evaluated a mobile, interactive communication and memory-aid system with elderly and memory-impaired people. The system utilizes current and easily available technology such as the internet and GPRS mobile telephony. This paper will look at the design as well as the successes and limitations of the Memojog system.

1 Introduction

Independence is a defining attribute of being an adult. We guard and preserve our right to determine how and where we live our lives and the routines that we maintain. Loss of this independence is not only demoralizing for all the people directly and indirectly involved but also increases care costs to the individual, their families and the wider community [1]. One condition that can affect the degree of independence is the extent to which people can remember to carry out simple everyday tasks. Memory impairment is among the most common effects of brain injury and is significantly associated with the aging process [2].

Electronic memory aids, such as pagers, dictaphones, mobile phones and small handheld computers or Personal Digital Assistants (PDAs) have been successfully used to display timely and active action prompts to people with prospective memory problems, either in text or speech form [3]. Typically with electronic aids, either the user or user's carer enter data directly onto the device, or they can contact a centre where reminders are entered into a central paging or calling system, and then transmitted to the memory-impaired user at appropriate times. Ease of interaction is critical for user acceptance, and the NeuroPage pager [4], for example, simply required the touch of a button to acknowledge a reminder [1]. Despite the success of

NeuroPage due to its simple functionality and its subsequent setup as a commercial service, it has limited functionality and the necessity of using a commercial paging company can be costly. It is also a one-way communication system and it is therefore not possible to monitor whether users have received and acknowledged reminders.

The ability for the memory-impaired user to interact with a memory aid would greatly enhance its value, particularly for those without widespread cognitive impairment. Recent progress in appropriate technologies, e.g. palmtop computers with telecommunications ability and mobile phones with touch-screen interfaces, make this a possibility.

2 Memojog

The Memojog memory aid system, developed at Dundee University, is a remote and interactive communication system that provides a prompting device for memory-impaired people. A PDA with mobile telephony is used to deliver text-based prompts announced by an alarm to users. The provision of short cues is usually sufficient rather than a detailed description of the action to remind users of the task [5].

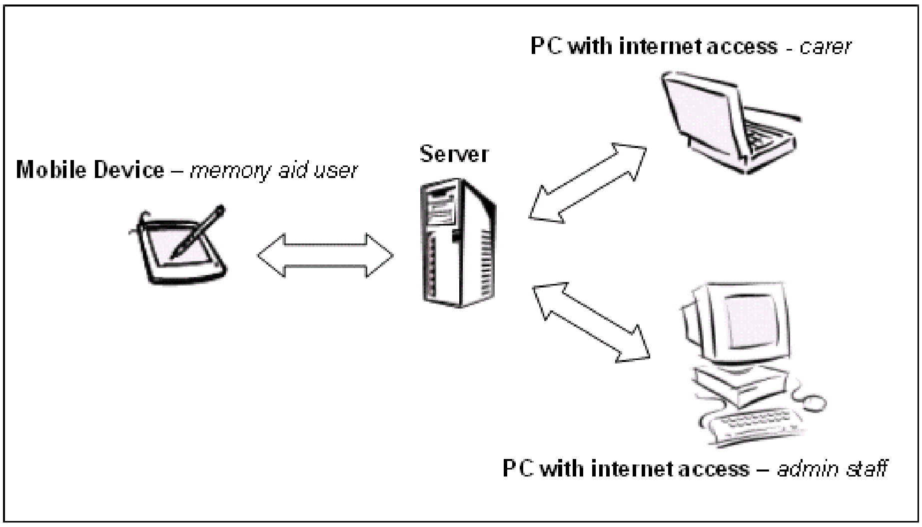

Fig. 1. The architecture of the Memojog system.

In 1998 in the United Kingdom 11,000,000 people were aged over 65 and by 2030 these figures are expected to rise 14,000,000 [6]. Not all of these people will suffer from the memory problems associated with old-age. However, if elderly people could use and become comfortable with an aid such as the Memojog device before any prospective memory-problems occur, they could maintain independence of professional carers, which in turn may result in reduced NHS costs.

Memojog's user prompts or reminders are stored in a remote server and transmitted to the user's device using mobile telephony. The users themselves can add reminders directly onto the device or carers/administrators can add reminders remotely using any internet accessible device. Reminders can also be phoned in by users/carers to admin staff or left as messages on an answer machine. This gives users/carers control over the memory aid system, and also provides the option to involve a third party for data entry if they wish to do so. The prompts or reminders are then wirelessly transmitted from the internet database to the PDA at the appropriate times (see Fig. 1 for the system architecture). The system can monitor users' response to reminders and in case of crucial reminders such as 'Take medication' can act accordingly. If a crucial reminder has not been acknowledged, carers/family members can be contacted by text message, prerecorded phone messages or email automatically sent by the central server.

The main function of the Memojog device is to give action prompts to memory-impaired users. However, other functions such as entering reminders or looking up entries for selected days were implemented. In addition, users could look up information on people such as their birthdays or addresses. It was anticipated that users would use the reminder function predominantly, with all other functions learnt with usage of the device. The device can also be used to store other information such as contacts' information, their pictures and details of any appointments with such people. New versions of the software could be developed for different software platforms and devices such as mobile phones with touch screen capability. The digital camera capabilities of some current mobile devices could be incorporated in the design of future systems e.g. the user could take a picture of a person and then add their details and then include it in their list of contacts.

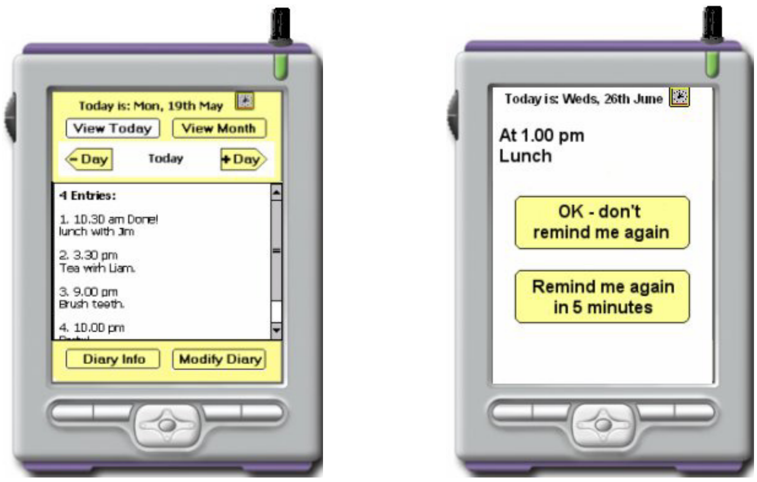

Fig. 2. Two example interfaces

Given the hardware limitations of small handheld devices, such as reduced display size, this can present a major design challenge (Fig. 2). Also, an elderly user group may experience declining visual acuity, contrast sensitivity and reduced sensitivity to colour, particularly blue-green tones [7]. A specific website aimed at the small PDA screen size was also designed for data entry on the devices.

The PDA that used in the user trials as a memory aid was a Siemens SX45, running the Windows CE 3.0 Pocket PC operating system. This PDA is equipped with a touch screen (a non-reflective TFT LCD with 65,536 colours), the size of which is 240 x 320 pixels (approx. 60 x 78 mm). The dimensions of this PDA are 124 x 87 x 26 mm and it weighs about 300 g. It was decided that four major functions should be clearly visible on the default display: 'View Today' – a list of the current day's reminders, 'View Month' – view reminders from any day, 'Diary Info' – users phone book, appointments etc. and 'Modify Diary' – users can add reminders. A menu structure was not implemented to avoid users becoming disoriented on the small display.

3. Memojog User Evaluation

The system was evaluated with a group of elderly and memory-impaired users at the Oliver Zangwill Centre in Ely. The selection criteria included that participants experienced progressive degenerative disorder problems but no major aphasia, visual problems, or severe general intellectual impairments. There were two field evaluations comprising of 6 participants in each evaluation. Different participants were used in each evaluation and were referred by health care professionals. The participants used the device for 12 weeks, after which the device was withdrawn again. These evaluations have been described in more detail elsewhere [8] and demonstrate that the users were receptive to the system and could use the device easily. Clients commented on the ease of use and the versatility of the device. They particularly like the different functionality the device provided (e.g., diary, phone book, appointments). This illustrates that clients do want additional functionality in a memory aid. Clients also commented positively on the hardware (e.g., "It is easy to see what is on the screen while still being lightweight enough to carry.").

A number of negative comments related to coverage problems e.g. the inability to connect to the relevant website for entering data resulted in frustration to the clients and their carers. While attempting to use something they are unfamiliar with, when problems occur e.g. a non-responsive device, the client/carer is often unsure as to whether they are doing something wrong or not.

Two out of the three major United Kingdom network providers failed to provide reliable, 'always on', GPRS (Global Packet Radio Service) coverage in the area surrounding and including Cambridge, England. Dial-up GSM (Global System for Mobile Communication) coverage was therefore applied which proved to be a more reliable, though more expensive, alternative. In addition, network maintenance procedures conducted by the service provider also posed an impairment of coverage.

The users' comments also expressed some hardware-related problems. The touch screen was not sensitive to button presses and occasionally they had to tap the screen a number of times before they could observe a response. Mobile devices tend to have a small screen that requires fine movements when entering a reminder which can be a problem for users with a tremor. The text size could prove a problem for users with poor vision. The devices also have a limited battery life and needed to be recharged at regular intervals. As the PDAs that were used in the trials were running an early version of the Windows CE operating system, the Memojog software was lost and had to be reinstalled if the PDA's batteries ran out before being recharged.

4. Conclusions

The Memojog system has many advantages over current electronic memory aids: while also being a mobile and discreet device it is an interactive service and can automatically monitor users' responses to reminders and respond accordingly. As the system uses standard mobile equipment and contracts the users can also use the device as a mobile phone and take advantage of mobile services such as text messaging. There is also clearly enormous potential in this area for experimenting with more recently emerging technologies to support independent living by people with memory impairments, such as picture and video messaging and positioning systems.

The biggest challenge that was encountered throughout the project was the lack of reliable network coverage. The clients themselves were mobile and therefore could easily move from one location that provided network coverage to one where that was not the case.

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