PERIGRAMMA – A System for the Support of People with Cognitive or Movement Impairments Working in Secretarial Positions

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Abstract In spite of the growing interest in interaction design, there remains a large user population that needs special interest; users with special needs. These users can dramatically benefit from software that better responds to their interaction needs, not mentioning the fact that designing software that takes into account the special needs of such users makes software more easy to use for everybody. In this paper we present PERIGRAMMA, a system designed to offer an integrated environment for the support of people with movement or cognitive impairments who offer secretarial support in a modern office environment. The system is currently in tits final stage of implementation and offers an easily accessible environment of four applications: a word processor, an e-mail client, a calendar and a web publisher.

Introduction

Arguments typically leveling against designing for user with disabilities include the claims that costs are too high, and the benefits serve too small a market. (Glinert & York 1992). The traditional view of people "having a disability" or "not having a disability" is overly simplistic. All users have a range of capabilities that vary across many dimensions depending on the user and his or her life stage, task and environment. People may experience sudden temporary or permanent changes in capabilities at any time in their lives. If a computer user falls and breaks a wrist, he will spend several weeks or more with much the same keyboard capabilities as many people with spinal cord injuries or missing limbs. In fact, a significant number of user requirements for people with disabilities apply to almost any user, given the right circumstance or task context. (Newell & Cairns 1993).

The system addresses primarily people with movement impairments and people with light cognitive impairments offering secretarial support in the environment of a modern office. Word processor, E-Mail Client and Calendar ranked first as the applications used most often in a survey on fully capable people offering analogous services. In addition, we decided to implement the web publishing application in an effort to offer such people the opportunity to easily circulate their documents and diminish in this way the factor of social isolation they face in their everyday life.

By the term "movement impairment" we are referring to disabilities that affect the ability to move, manipulate objects and interact with the physical world (e.g. spinal cord injuries, degenerative nerve diseases, stroke, missing limbs and repetitive stress injuries). Cognitive impairments on the other hand range from dyslexia to difficulties remembering, solving problems, or perceiving sensory information to problems comprehending and using language.

Several applications have been developed for the disabled at a commercial or research level. Applications such as Writing with Symbols[1] address people with cognitive impairments. The teacher or parent builds an on-screen selection window(s) and places the vocabulary in it. The student then writes by clicking on items in the selection

[1] Writing with Symbols 2000. Available at http://www.mayerjohnson.com/software/Wws.html.

window(s). As items are chosen, each selection puts text, or text and pictures, into a writing area above. Multiple on-screen selection windows can be linked together to provide a large vocabulary of pictures. Set ups and writing files may then be saved for later use.

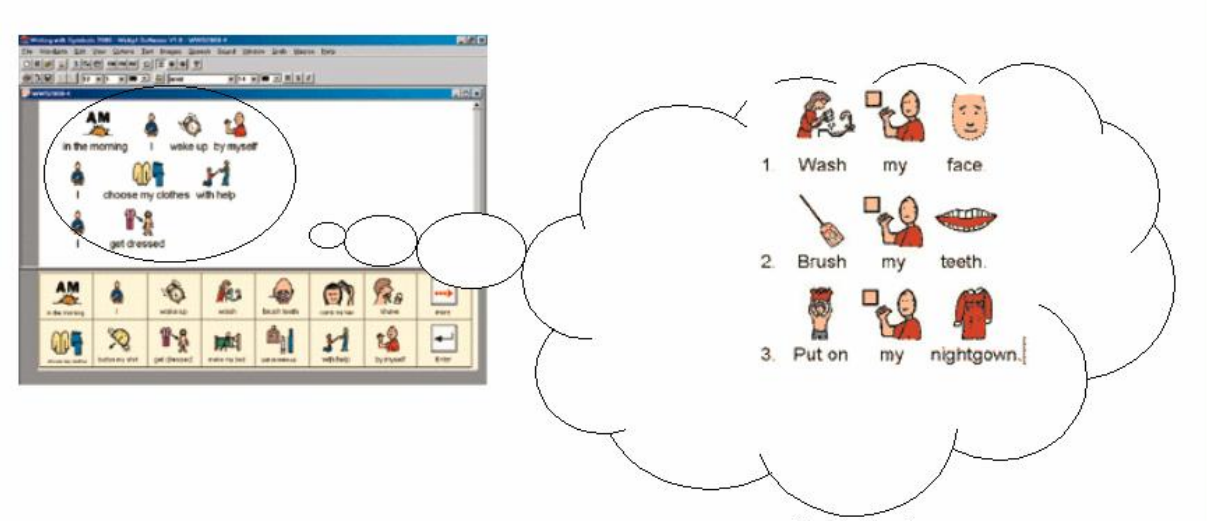

Figure 1. Writing with Symbols

Special Learning Food for Thought[1] introduces the vocabulary of Food and engages learners in activities that challenge and stimulate them at their own level of thinking. It helps them learn and develop skills in language, counting, choice making, matching, identification, vocabulary and visual and auditory discrimination (Figure 2).

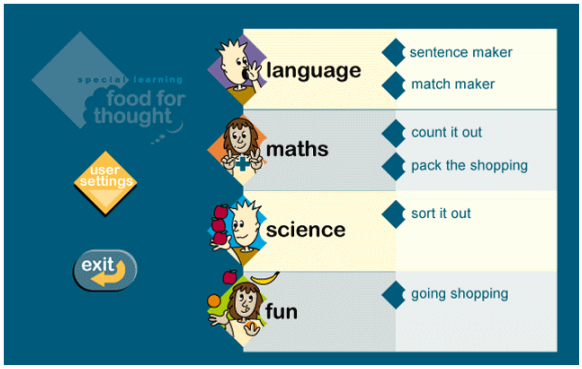

Figure 2. Learning Food for Thought

GRAFIS (Stephanidis 1999) supports the typical word processing functionality, through a simple interface, accessible through conventional as well as alternative input-output devices. The basic characteristics of the interface are: (a) a clear separation between the 'text-input' and 'function' areas, and (b) elimination of overlapping objects on the screen through the grouping of functions in alternative functional areas. In addition to text input (in Greek and English), manipulation and formatting, GRAFIS features a simplified interface for storing, retrieving and otherwise managing document files. The user is supported by an extensive on-line help system, which describes the interface and guides the user in the completion of common word processing tasks. GRAFIS also supports saving and loading documents in Rich-Text Format (RTF), thus allowing users to share

[1] Special Learning Food for Thought. Available at http://www.edbydesign.com/ebdsw/fft.html.

and exchange documents with their able-bodied counterparts employing mainstream word processors. Several other software applications are available for disabled, focusing on case-specific specialities (Sirmakessis 2000).

Design Considerations

In our effort to address as big a percentage of population as possible, we distinguish two main levels of difficulty (novice and expert) in a total of three distinct user profiles, summing up to 6 instances of the system. Each instance is differentiated by the kind and the degree of special needs to be covered and the assistive technologies to be integrated. More specifically, we designed two versions of the system for people with movement impairments and one additional version for people with light cognitive disabilities (see Table 1). Each one of these versions required a different approach as we had to deal with different interaction scenarios (input devices) and screen layout.

Movement Impairments		**Cognitive Impairments**
Profile 1	**Profile 2**	**Profile 3**
✓ Interaction through switches ✓ On-screen keyboard ✓ Scanning ✓ Buttons with graphics and tool-tips, no captions	✓ Mouse interaction ✓ On-screen keyboard ✓ Buttons with graphics and tool-tips, no captions	✓ Mouse interaction ✓ Buttons with graphics and captions

Table 1. Supported profiles based on the user needs (two levels of movement impairments and one level of light cognitive impairment)

People with heavy movement impairments that cannot have control neither over the mouse nor the keyboard, but can use some kind of switch have access to the system via a combined use of an on-screen keyboard and the scanning technique. The system supports three different layouts of the keyboard (QWERTY, horizontal grouping and vertical grouping layout).
The scanning technique is based on two actions: NEXT and SELECT. Action NEXT moves the user to a dialog's next step (steps vary depending on the interaction control encountered by the scanner). Action SELECT is interpreted as the user's wish to actually interact with the control currently activated (optically highlighted) by the scanner. For instance, if the currently highlighted object is a button, NEXT will move on and highlight the object next to this button, while SELECT will activate the button and result in executing the button's operation.
This user profile has posed some very interesting questions on the subject of screen layout, as it is of crucial importance to insure that all buttons and interactive objects are placed and grouped in an ergonomic way, limiting the time required to select and activate any given control (on a most commonly used basis).
People that can use the custom mouse device but not the keyboard, can fully interact with the system via the mouse and an on-screen keyboard activated by the mouse. In this case, no scanning is required. This profile was the easiest –in comparison- to handle, as it was closer to our notion of a usable and ergonomic interaction.
People with cognitive impairments raised serious issues to consider on the design of the user interface, the exact captioning of buttons, the metaphors adapted in the design of the graphics, the presentation of error messages and system messages in general, the learnability and memorability of controls and tasks, as well as the overall design and implementation of the help system.

Architecture and Functionalities

The Word Processor offers the custom set of text editing, formatting and management of text files. The format of the created documents is .rtf so that they are compatible and recognizable by all commercial software. The

user is also offered the capability to import a picture, find/replace a word, print-preview the current document and also save it in html format so that it can be published on the web using the web publishing application of the system.
The E-mail Client supports both POP 3 and IMAP and offers the capability to send/receive, forward and reply to messages, manage mail attachments and interact with the Address Book in order to locate the e-mail address of a recipient or update the Address Book with the e-mail address of the sender in the message currently selected.
The Calendar provides a view of the current month so that the user can locate the day of interest and a daily view of the recorded events. For each event a reminder can be set with the option of an accompanying sound. With every new event entry a check is performed that informs the user of a potential overlapping with a prior entry. A set of secondary calendar applications is also under development, which shall be supported in the expert version of the system: Tasks, Notes, and Address Book (in fact it is the entity mentioned in the E-mail Client, which is updated and accessed by both applications). All the system's individual applications can communicate with one another via the clipboard. A high level representation of the system is depicted in Figure 3.

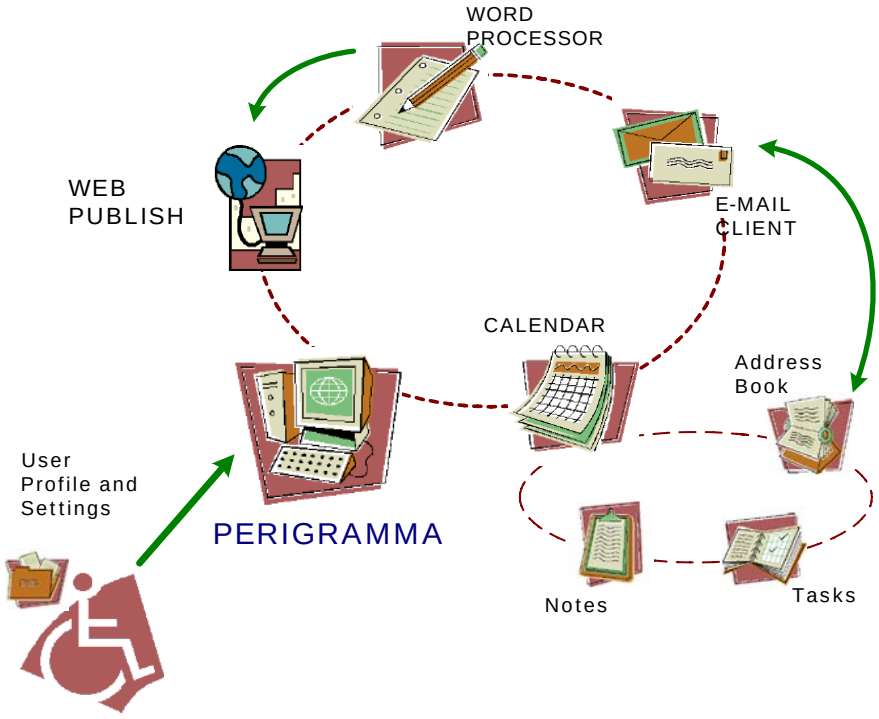

Figure 3. High-level structure of the system

One fundamental feature of the applications that comprise the system is that they have basic functionality, which is common to all of them. This raised the necessity to adopt an architectural model, which takes advantage of this fact not only in the development phase of the system but also during its operation as far as performance is concerned. The model, which is adopted and best fits the above-mentioned system is called component oriented.
According to the component oriented model the applications of the system are broken down to their structural components. The structural components are responsible for the fulfillment of the operational specifications of the system. It is obvious that each structural component implements a set of operabilities. Each structural component must provide access to its operabilities, so as they can be used by the application. This access is obtained through interfaces. Each structural component may provide one or more interfaces. Each interface provides access to a group of operational or conceptual interrelated operabilities. The access is performed either through method invocations relevant to the requested operability or by accessing publicly known properties. It is not necessary to use all the interfaces that a structural component exposes. Each application may use only those interfaces, which provide the needed operability.

The following figure depicts the relations between the applications and the interfaces of the structural components.

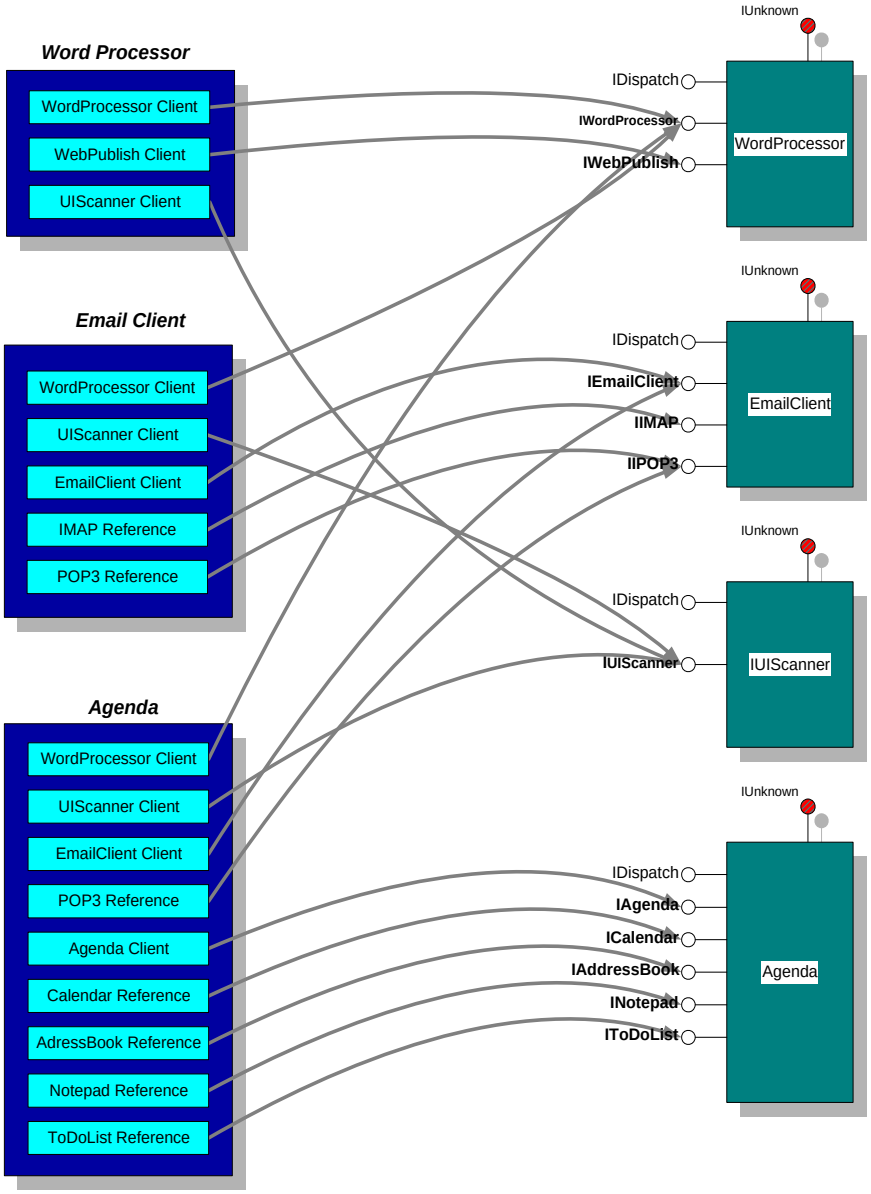

Figure 4. System's component model

The system comprises four main applications. Each one offers a complete set of functionalities that overbalances those identified as typical secretarial needs. As refers to the functionalities that should be left out from the novice version of all applications, the help and guidance from scientists that work with people with special needs and particularly people with cognitive problems was necessary. Certain options from the word processor and the e-mail client were left out, while in the case of the Calendar, the secondary applications were considered too complex for comprehending and using in the novice version of the system.

At the point of installation, there will be two options regarding the kind of the user's special needs (whether there are cognitive or movement impairments) and in the case that movement impairments are selected, there will be an extra dialog about whether or not the user needs to interact through some kind of switch (in which case the scanner must be activated). In addition, either "Novice" or "Expert" must be set according to the level of user's prior experience with the system and with computers.

An option “settings” available at all times will allow the user to change the system’s level of difficulty (novice or expert), fill in and alter data required by the e-mail client and the web publishing application (FTP server, login, password, directory, mail server, etc.) as well as the size of buttons and the size and type of fonts, the number of days a message stays in the trash before being permanently deleted, sound activation/deactivation, etc.

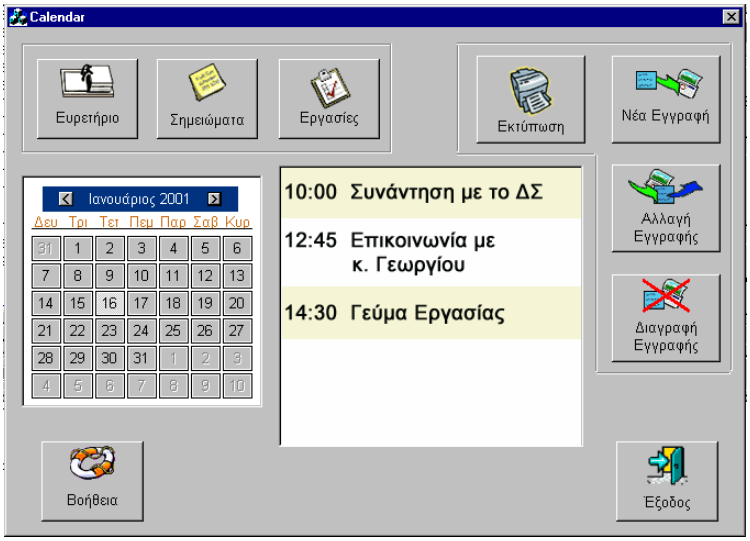

Figure 5. The main screen of Calendar with daily entries presented in the white frame. The system interface is in Greek but the user can enter English as well.

Conclusions and Future Work

PERIGRAMMA is an integrated office environment for people with movement and light cognitive impairments. This environment offers significant potential for increasing their social inclusion. It can be used to fully support teleworking, since through a common environment; one can prepare a document, send it to someone else by e-mail or publish it for generalized access on the web. Moreover, since the interface is designed in a simplified manner and tasks in the profile version are easy and straightforward to execute, the system could be used by inexperienced fully capable users and children.
We have already planned a series of evaluation sessions for the two target groups using a “think aloud” procedure and lab observation. We intend to continue evaluation and system redesign, as feedback from the actual target group in this case is irreplaceable. Our future directions include the further extension of the system so as to expand and foster the needs of more categories of special needs (e.g. low vision problems is our next working hypothesis). In addition, our efforts will focus on extending the degree of system customization to a user’s specific preferences, as well as an English version of the system.

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