WOW – A 'FRIENDLY GUI' FRAMEWORK FOR ELDERLY USERS

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Abstract
We present WOW, a simple GUI platform/framework primarily targeted to elderly users, being developed and used in Vienna Pilot of the SPES project to run various brain stimulation applications designed to help patients with dementia or Alzheimer disease in activating/restoring their memory and recall. This work utilizes our previous experience with similar GUIs in EU projects OLDES and SPES to design a friendly, customizable, easy to install and use GUI platform which allows to install and run small applications. These apps can range from eScrapBook readers and simple games to personalized e-Health support apps, with means to monitor and log incoming data and user activity in order to gain feedback on the user experience with the apps.

Keywords
seniors, user interface, brain stimulation

Background
In past years, many projects were dedicated to find ways how to utilize the technological progress to efficiently provide care and help to the elderly and people with various disabilities, e.g. EU projects K4CARE [1] or MAS [2]. These projects strived to utilize information and communication technologies as a means to support the elderly, patients in reconvalescence or disabled clients in their homes. The focus is on increasing the autonomy and independence of the clients. One of these projects, OLDES (“Older people's e-services at home”) [3], offered experimental low-cost platform which could assist the seniors and enrich their lives, particularly of those seniors living alone. The OLDES platform consists of two main parts. The health monitoring module keeps track of basic physiological parameters, mainly those related to some of the most common health issues typical for advanced age (cardiovascular problems and diabetes). The social (entertainment) module offers (via a web portal) a means to access information about important events, current weather and important health information. The design of the GUI is ruled by the specific needs of the target group (seniors, clients with disabilities), resulting in the need of a simple and intuitive paged GUI with only a few of control widgets, optimized for TV screen resolutions. The GUI should be also easily navigable, configurable and customizable.

Motivation
Designing accessible and friendly user interfaces for the elderly users and users with disabilities was one of key points of the OLDES and SPES projects. From the users' point of view, the OLDES platform consists of a personal computer (a custom mini-desktop PC or a netbook) connected to the Internet, with a TV set used as a display, controllable via simple remote control instead of keyboard or mouse. In the SPES project, all-in-one PCs with a touch screen were used in some settings. The user interface was used to offer the user the view of important events, current weather and important health information. The design of the GUI is ruled by the specific needs of the target group (seniors, clients with disabilities), resulting in the need of a simple and intuitive paged GUI with only a few of control widgets, optimized for TV screen resolutions. The GUI should be also easily navigable, configurable and customizable.

This work represents our contribution to the Vienna Pilot of the SPES project, which was directed to patients with various stages of dementia and/or Alzheimer disease. One of the topics handled here – Brain Stimulation – was dedicated to develop various
software apps to help the target users to reduce fear of computers and to stimulate their brain to help to activate, improve and maintain their cognitive functions. The applications can vary from simple tests and quizzes to games and e-books.

An example of the latter approach (e-books) is eScrapBook [8] (see Fig. 1) which we developed earlier, a data format and also a small portal/CMS developed to aid in reminiscence therapy (RT). Reminiscence therapy is a psychotherapeutic technique, in which self-esteem and personal satisfaction are restored, particularly in older persons, by encouraging patients to review past experiences of a pleasant nature; often used in treatment of Alzheimer's disease when initially long-term memory stores are more intact than short-term and in other forms of dementia. One of popular techniques of RT is scrapbooking, i.e. creating of commemorative albums from bits and pieces of personal nature (photographs, newspaper clippings). The eScrapBook allows the content creator to assemble such digital materials (images, videos, sound clips, text) into digital books, which can be viewed on screen and which proved to be useful tool in the work with patients.

Fig. 1: Screenshot from an eScrapBook viewed from the WOW application.

The Framework

In this work, we present our graphics user interface (GUI) framework designed with respect to the needs of the elderly users with various stages of dementia, codenamed WOW (not affiliated or connected with the game World of Warcraft) [7]. The GUI of the WOW application should be as simple as possible, with multiple means of navigation (mouse/touch screen, keyboard, simple remote control, gamepad). It should accommodate various screen sizes, be customizable and use big fonts and widgets.

Fig. 2: The home page of the wow application.

The GUI is defined as a set of pages (plugins), which are built from reusable components (widgets). There are several basic plugins available: a home page (Fig. 2), YouTube video browser (Fig. 3), page for listening internet radios and several plugins which enable to embed miniapplications (called addons) to the WOW application. As for now, the WOW application recognizes several types of acceptable addons: eScrapBooks, raw apps, games and rule-based games. These types differ mainly in the level of GUI integration, since the embedding page already has some GUI controls present – in case of games, the embedding page contains controls such as “Start/Restart/Pause/Quit game”, so the embedded game can take advantage of these controls (Fig. 4). In case of raw apps, the integration is not implicit and must be specified manually.

We implemented a small collection of example games, with various degree of difficulty – from simple memory games (‘remember picture and later pick from selection’, ‘pexeso’) to more sophisticated puzzles (Sudoku, Sokoban) and arcade games (Arkanoid, Tetris).

Fig. 3: YouTube video search in wow application.

The WOW application can be installed under Windows or Linux and uses web browser (preferably Google Chrome) to render the user interface. It
contains basic administration functions for the caretakers (in the testing setting, the app was used in several day care centers in Vienna and there were typically several users per installation) such as adding users, managing content for them, uploading videos, photos, importing eScrapBooks etc.).

The WOW application also allows for logging user activity data from the app itself and the embedded addons in order to analyze the data later to gain feedback on the user experience and to improve the composition of the content – for instance, in case of eScrapBooks, their creators could see which pages/parts of the books are most frequently viewed (preferred by the user) and which are skipped, thus they can adjust the content accordingly. In the case of various quizzes, games and training apps, the logging of game related data and scores can be useful in determining how the user gets better and improves through time.

**Under The Hood**

The WOW application is composed from two parts: a locally installed server (which serves GUI pages and provides admin functions) and a GUI client. The client utilizes a web browser such as Google Chrome to display pages. Both parts are implemented in Javascript (NodeJS for server part). The client uses SVG (Scalable Vector Graphics) for rendering widgets.

The client and server are bundled together into a single easy-installable package with no additional dependencies (with the exception of image manipulation tool ImageMagick, which is necessary for some parts of admin CMS for generating image and video thumbnails, but not mandatory if we only wish to use the client GUI).

The overall architecture is shown at Fig. 5. The server part manages the application plugins and addons and is based on popular Express framework with Passport middleware for handling user authentication.

The content in the WOW application is represented by **nodes** of various types – a node can be a piece of text, video, image or audio clip. The nodes and the application state are stored in a local TingoDB (a JSON storage, with API similar to popular MongoDB) database.

One of main advantages of the described architecture lies in its extensibility via plugins (individual user pages or sets of pages) and addons. The addons are separately bundled small HTML5/CSS/JavaScript applications, which contain basic descriptive metadata and use some of the addon APIs, with various level of GUI integration. The addons of type 'game' and 'rule game' use custom plugin to embed them, with basic game controls (Fig. 4). The former type represents games with custom implementation, the only requisite being that it implements the Game API of WOW application. The latter ('rule game') represents a specific class of logical games, described declaratively by a set of rules stored in JSON configuration files. We adopted the structure of these rules, together with rule descriptions of several well known logical games which we employed for demonstration purposes, from master thesis by T. Strašrybka [6].
Conclusion

We presented the WOW framework, a platform for development of applications with simple GUIs suitable (mainly, but not exclusively) for seniors with disabilities. The GUIs based on WOW were used during the Brain Stimulation pilot of the SPES project in several day care centers in Vienna and several clients’ homes (Fig. 6). The application was used mainly for viewing eScrapBooks, keeping basic daily agenda, listening internet radios, browsing YouTube videos and playing simple logical games (tic-tac-toe, memory games, various puzzles). The application was positively accepted amongst users, from whom we received valuable feedback on designing GUIs and applications for the elderly.

Future Work

The development of WOW application is an ongoing effort. Some parts of it are quite complete and usable, such as overall architecture, admin GUI and widget framework. In our current work, we aim to provide bigger selection of addons (such as various training games for different types of disabilities, since the currently provided example games are not so suitable for people with advanced dementia), to develop online app store for the addons and also to develop mobile version of the WOW application by using PhoneGap (Cordova) framework. Another possible branch of research, relatively neglected until now, is connected with the data logging from the addons and with analyzing of these data with automated data-mining methods.

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