An Application for Active Elderly Follow-Up Based on DVB-T Platforms

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Abstract. This paper describes the T-CUIDA project, an ongoing collaborative initiative, partially funded by the Spanish Government, which aims at designing and developing an application for promoting active elderly in their habitual environments. The platform takes advantage of the DVB-T infrastructure, the European digital TV broadcasting system, recently deployed in Spain. Design for All principles are applied in a multimodal and personalized approach to provide a complementary set of services that help aged people to keep themselves physically and mentally dynamic. The final system is about to be conveniently evaluated during six months by more than a hundred of potential users in four different locations around the country.

Keywords: active elderly, usability, user acceptance, digital TV.

1 Introduction

Nowadays, long-living population is a rising fact in Spain, as well as in most developed countries where life expectancy has grown [1]. The elderly present specific needs due to their advanced age, and company gets profound importance. Because of western life rhythm, relatives are not always available for them, inducing loneliness feeling that makes them to let go. Moreover, considering their limited mobility, isolation may take old people to hard depression [2]. On the contrary, by helping them keeping physical and mentally active whereas enhancing their integration feeling, they would push themselves to maintain a healthy condition.

One of the most extended technological platforms is TV, and people of any age can easily manage through remote controls. The recent deployment of terrestrial digital TV (DVB-T) in Spain, which includes support for a wide range of interactive services [3], allows the design of applications especially devoted for elderly. The T-CUIDA consortium was shaped for this purpose, engaging complementary partners from technical business, university and assistance provision, supported by healthcare and psychology experts.

The aim of this paper is to present the functionality of the T-CUIDA research project, whose target is to design, develop and evaluate an easy-to-use TV-based application that stimulates cognitive and physical capabilities of the elderly from complementary approaches, trying to improve self-esteem and accompaniment. By

assisting them in the daily organization of their time, promoting healthy lifestyle, a relevant first step is being taken towards the provision of interactive telecare support in the near future. The paper gives special emphasis to describe the user interaction strategy, as the key factor related to system acceptability.

2   Materials and Methods

In order to achieve project objectives, user interface requires an exhaustive analysis, mainly because of the special physical and mental condition of the target population. For this reason, an iterative User-Centered Design (UCD) methodology is being followed [4], involving final users along the whole design process. According to this scheme, a thorough literature revision was accomplished in search of ergonomics and usability design standards and guidelines, especially devoted to the elderly, complemented through an initial proof-of-concept validation phase arranged in Madrid with a dozen of potential users.

According to [5], ageing entails significant changes in individuals that affect their physical and cognitive abilities. In particular, elderly people usually suffer from vision deficiencies (yellowish and blurred image), auditory limitations (especially at high frequencies) and motor impairments (for selection, execution and feedback). Ergonomics design recommendations include clear and accessible environments, objects which are easy to handle and manipulate, large interfaces without superfluous decoration, error tolerant methods, high contrast between figures and background, combined usage of visual and auditory elements, selective acoustic amplification, etc.

The interviewed users put emphasis on simple and reliable applications as well as on non-threatening easy-to-learn technologies. They liked being informed about news, being encouraged to make exercise or being reminded about appointments. TV was considered a very convenient means for service provision due to its friendliness, as long as complicated hardware add-ons are avoided. Complementary sound messages were also highlighted to support accompaniment feeling. Besides, the combination of dark font colors on bright background is mostly preferred than the opposite (i.e. bright font colors on dark background).

According to user needs and preferences, the main functionalities of the T-CUIDA user interface are the following:

− Supply of an adapted interaction for common deficiencies of aged people, so as to motivate them and increase the use of the application.
− Design of a consistent "*Look and Feel*", to facilitate comprehension, legibility and navigation within the application.
− Supervision of exercise performance for each user, in order to follow up improvement/deterioration and personalize training plans.
− Provision of a simple method to communicate text messages through the TV, notifying them even if the device is turned off (e.g. led flickering).
− Protection of user privacy by avoiding messages that include sensitive information (i.e. TV is not a personal communication channel).
− Eventually, distribution of sporadic warnings for risk situations, especially for people who live alone or present mobility problems.

The rationale of the T-CUIDA application is to provide old people with preliminary telecare assistance and to introduce healthy habits into their daily life, as well as to warn people who can react quickly in case of trouble. Psychologists and experts will analyze user performance and determine the idle time to detonate automatic alarms to the telecare center and families. In order to provide this emergency service, the standardized intervention protocols have been established and followed by the assistance center involved.

3   Results

As shown in Fig. 1, the developed system takes advantage of the straightforward way of operation of interactive TV: access to the application is as easy as changing a TV channel with the usual remote control. The only atypical element for most Spanish aged people is the additional digital TV decoder, but once configured and after some minor training, it can be used without difficulty.
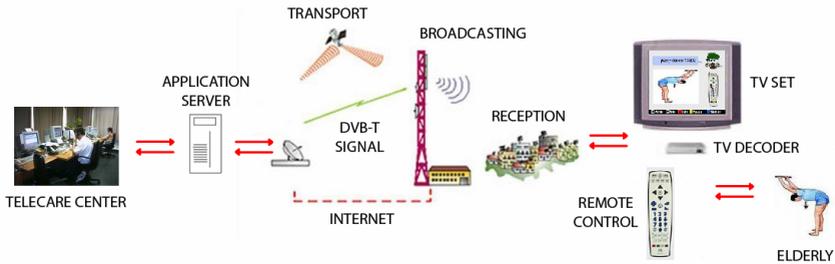

Fig. 1. T-CUIDA system architecture

The TV decoder is a terrestrial twin receiver called FTE Maximal PVR T150[1], which supplies two USB 2.0 high speed ports for connecting external hard drives, where the static part of the application is deployed. The dynamic elements of the application (e.g. videos, messages, exercises) are customized by the assistance center and updated from time to time through the TV broadcasting signal. Thanks to the high tuning sensitivity of the decoder, excellent results come out even with adverse signals. However, one of the drawbacks for this decoder is the low processing capability, so that images suffer from long loading times. It is expected that new models of the decoder will get through these limitations.

A singular remote control has been especially selected to interact with the application (Fig. 2). It is adapted to the common physical and cognitive handicaps of the elderly. It shows less and bigger buttons compared to typical devices. On top of that, the more eye-catching feature is that buttons present raised forms according to each figure (numbers, arrows, plus and minus signs, etc.), adding together the sense of touch to avoid confusions due to eyestrain and clumsiness.

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[1] http://www.ftemaximal.com

Fig. 2. T-CUIDA remote control

The interaction strategy is as simple as the familiar videotext but presenting a more attractive appearance. Simple help messages are shown to support the user in case s/he gets lost while navigating along the application. Although most TV sets are still not available as touch screens, the graphical layout is conveniently prepared in case any user prefers direct tactile interaction modality in the near future.

The first integrated version of the T-CUIDA application comprises the following support services:

− Mental training: interactive intellectual exercises to keep mental activity.
− Physical training: videos of physical exercises to be replicated by the user.
− Agenda: list of relevant messages and appointments for the user.
− Information: updated collection of news, suggestions or general-purpose information.
− Events: compilation of events which may be of interest for the user.
− Health: specific recommendations about healthy lifestyle.

Apart from the dynamic content, the system supports personalization by several means. Two profiles may be selected: the advanced mode holds a small window for watching TV simultaneously and allows using numbers and arrows to navigate through the application screens; the basic mode completely hides the TV and goes sequentially over each option so as the user is just required to press the OK button. This option scanning interval is also customizable in the user profile. Furthermore, the set of services may be adapted according to user preferences, considering age, gender, physical skills, cognitive capabilities, etc. along with particular choices such as religion (e.g. an autonomous rosary praying assistant is included for Christians, as a proof of concept for including market-tailored applications). In addition, the system automatically extracts helpful information from user performance (e.g. number of activities carried out, success ratio, completion time), so as to permit professionals to analyze remotely the physical and mental condition of each user and adjust training plans in accordance.

The T-CUIDA client application is implemented as HTML pages while interaction events are handled through ECMAScript [6], a standardized version of JavaScript.

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The web browser selected for handling this application is ANT Fresco[2], specifically designed for interactive TV, consumer electronics and embedded devices. However, due to the standard-based approach followed, a straightforward deployment of the application is possible in any common web browser. As shown in Fig. 3, a user-friendly style has been adopted for the user interface, incorporating some multimodal elements such as animations, videos and audios, which reinforce user motivation.

Fig. 3. Screenshots of the T-CUIDA user interface

4 Conclusions

This paper has described the application developed in the T-CUIDA project, which concentrates on improving elderly people life quality. Innovation has been sought by developing an inexpensive and easy-to-install solution, taking advantage of the recently deployed digital TV broadcasting infrastructure as a straight way to reach aged citizens. The application makes use of bidirectional communication through DVB-T by exchanging updated data in a seamless way between clients and assistance centers, giving support to non-invasive remote user monitoring as well as personalized services, exercises, information and messages. A careful user interaction design process has been followed, applying accessibility requirements and reinforcement methods coming from other high-interactive domains like Internet.

According to first impressions from elderly users, it appears that the usage of widespread technological devices such as TV facilitates user acceptance and mitigates the initial rejection to use modern technologies. This prototype is expected to be used at home, where people living alone could get proper assistance, while alleviating futility and loneliness feelings. Although the platform could also fit residences, in this kind of centers TV is a very impersonal means, and a priori it seems that people could not benefit from all the T-CUIDA follow-up and reinforcement functionalities.

After the first concept validations, a six-month pilot experiment is being prepared and is about to start with more than a hundred users at different regions in Spain (Valencia, Murcia, Galicia and Madrid), taking into account DVB-T coverage and existing home equipments. Different profiles of elderly users are considered, making

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[2] http://www.antlimited.com

a thorough estimation of each person condition in order to personalize decoders and exercises, configuring the central database which will alert about risky situations. A sort of healthy style monitoring will be arranged to test, not only if users enjoy and make their best with the platform, but also if there are mid-term implications on their physical and mental conditions, self-esteem or isolation feeling. Professional assistants will be also part of the study so as to determine whether they find this kind of applications useful for client/patient supervision.

In the end, the T-CUIDA project intends to serve as a starting point for further implementation of interactive services over digital TV. If the ongoing initiative proves to be accepted by the elderly and assistants while commercially successful, a number of added-value services would shortly arise, including healthcare support videoconference, continuous user monitoring based on wearable sensors, customized social network applications, and so on.

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