Integrating Personalized Health Care and Information Access for Elder People

Diego Gachet Páez, Juan R. Ascanio, Ignacio Giráldez, and Margarita Rubio

Abstract. The concept of the information society is now a common one, as opposed to the industrial society that dominated the economy during the last century. It is assumed that all sectors should have access to information and reap its benefits. Elder people are, in this respect, a major challenge, due to their lack of interest in technological progress and their lack of knowledge regarding the potential benefits that information society technologies might have on their lives. The Naviga Project (An Open and Adaptable Platform for the Elder people and Persons with Disability to Access the Information Society) is an European effort whose main goal is to design and develop a technological platform allowing elder people and persons with disability to access the Internet and the Information Society. NAVIGA also allows the creation of services targeted to social networks, mind training and personalized health care.

Keywords: elderly, wellbeing, ambient assisted living.

1 Introduction

Today, developed countries have great difficulties with effective health services and quality of care in a context marked by the population's ageing. This trend, as seen in Figure 1, has dramatic effects on both public and private health systems, as well as on emergency medical services, mainly due to an increase in costs and a higher demand for more and improved benefits for users, as well as for increased person's mobility.

Diego Gachet Páez · Ignacio Giráldez · Margarita Rubio
Universidad Europea de Madrid, 28670 Villaviciosa de Odón, Spain
e-mail: {diego.gachet,ignacio.giraldez,margarita.rubio}@uem.es

Juan R. Ascanio
Encore Solutions C /Cronos 20, 28037 Madrid, Spain
e-mail: juan.ascanio@encore.es

This demographic change will lead to significant and interrelated changes in the health care sector and technologies promoting independence for the elderly's. As representative data, approximately 64% of the European population is made up of 20 to 64 year olds, while the 65 and over group covers 17%. Thus, there are some 4 working employees to every pensioner. On the other hand, it is estimated that the 20 to 64 year old group will decrease to 55% and the over 65 will increase to 28% by the year 2050, making the proportion 1 to 2 instead of 1 to 4. Spending on pensions, health and long-term care is expected to increase by 4-8% of the GDP in the coming decades, with total expenditures tripling by 2050.

People live longer in developed countries as a result of better living and health conditions. For example, in North America only 4.5 % of population over 65 years old lives in nursing homes, a percentage that has decreased in recent years.
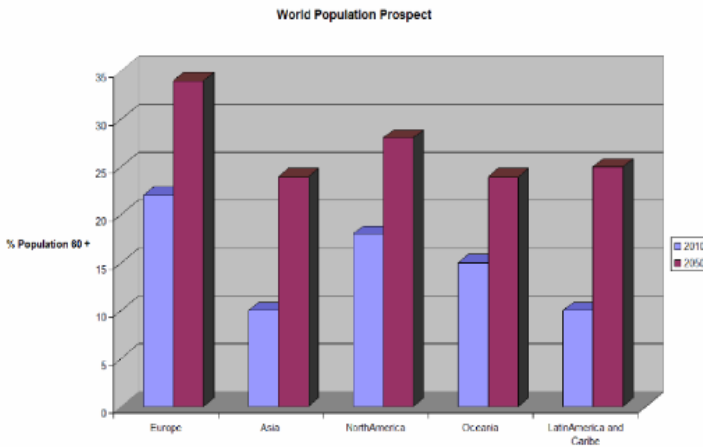

Fig. 1 Demographic change according to the foresight of the United Nations, http://esa.un.org/unpp (access: 06/12/2010)

The elder population is constantly prepared for to age better due to a decrease in disability, resulting in the elderly's being more active in their daily lives. Despite the improvement in conditions for coping with ageing and an increasingly active lifestyle, there are obvious changes that occur in behaviours and skills during the latter part of life.

These changes may include decreases in social relations and physical abilities, loss of memory, comprehensive and cognitive functions. Previous studies have shown that the ageing process is accompanied by a decrease in neuro-motor and cognitive functions. Compared to young people, the elderly's demonstrate poor performance on tests, including reaction times, motor coordination, short-term and

complex or abstract conceptualization. In general, these changes result in a decline in the quality of life for the elderly's.

Another important impact that can be seen particularly in persons living in nursing homes is boredom. Participation in social activities does not necessarily improve this feeling and sometimes creates negative attitudes in participants, although activities based on individual preferences can have positive effects and help to overcome boredom, increasing the quality of life for elderly's. It is a challenge finding innovative activities that involve the elderly's and encourage them to keep practicing with the activity. An adequate understanding of the disuse of motor and cognitive functions can help to prevent the decline in these skills and participation in activities based on individual preferences can reduce boredom. There is a real need for activities that address these two concepts, and these activities may be none other than for example mental exercises and social networks specially designed for elderly's.

The current trend is to improve the quality of life of older people not only extend the lifetime, the "gerontechnology" [1] is a very active discipline focused on improving the lives of elderly's, considered as a special group of users whose particular skills and needs in social and cognitive levels should be taken into account during the design process of any technology solution focused on this group. We must also consider that older people often do not feel comfortable in handling a computer and the use of technological devices seems complicated for them. This problem may be worse considering the decline in cognitive, visual or motor abilities.

The Naviga project (2009-2012) is an European initiative funded by the Eurostar [2] R&D program and whose main objective is to provide these collective tools, devices and methods to enjoy personal autonomy and a better quality of life, to do that, within the project we are developing an integrated technology platform to provide Internet access through a computer or TV. In addition, the proposed platform will facilitate the incorporation of elderly's and people with different functional capacity to the Information Society through the use of special devices, social networks, and applications to improve the cognitive ability or personalized health services. The consortium comprises five SMEs conducting research (investment min. 20% of annual turnover in R & D), a university and two end users (an hospital and a daily care health centre located in Madrid region) are also involved in the project.

2   Objectives of Naviga Project

The Naviga project, through the use of information and communications technology, intended to cover a range of social and health objectives aimed to improving access to Information Society by the elderly's and people with disabilities. Within Naviga we will develop an open platform and adaptive technology for various purposes detailed in the following subsections.

2.1 Technological Oriented Objectives

On the one hand, the development of an adaptive communication interface between user and computer or television, to facilitate the understanding of Internet and new technologies to people with a low-tech profile, while encouraging its use by providing a simple and friendly human machine interface. Also, this interface takes into account the integration with different support products on the market to ensure that users can use those techniques. Furthermore, the development of a platform that allows rapid creation of services and applications specifically for the elderly's and disabled people with a common API.

2.2 Social Oriented Objectives

At the other hand, the main social objectives lies in the attempt to bridge the gap that prevents the elderly's and people with disabilities access the Information Society. To do this, we are developing simple mechanisms for interaction between technical elements (computer, television or special input devices), and people, for example an accessible Web browser to improve usability through the use of alternative hardware to keyboard as for example voice commands. Also, the browser will be compatible with common support and aid products for elder people, also we are developing a social network among people with the same disability, where users can find people with common interests and concerns, and share information, experiences and advices. An example would be evaluate and recommend support products, as these aids often have a high cost and does not respond equally to all profiles of disability.

2.3 Health Oriented Objectives

Similarly, the Project will provides a range of health-oriented goals that help elderly's to keep active through mental training exercises, and otherwise assist staff medical (hospitals, health centres) in monitoring the treatment of these people from homes, in this case developing services and games that allow mental training (mind training), suggesting exercises to keep the mind active, and getting people to communicate and participate to a greater extent in their social community. This will prevent premature degeneration of mental activity, and improves the mood of older people with functional diversity by increasing the feeling of being useful to society around them. Although little is known about the perceived benefits of digital games for the elderly, there is a small but growing body of research evidence in support of the notion that digital games can have a significant positive impact on the elderly`s mental and physical health and wellbeing [3]. Some research [4] has showed the benefits of gaming for elderly people in several domains: stimulation

of social interaction and participation; enhancement of perceptual-motor skills (eye-hand coordination, dexterity, and fine motor abilities); improvement of performance speed (basic movements and reaction time); information processing, reading, comprehension, memory, self-image, etc. and transfer of the skills acquired in the games to other aspects of everyday routine like automobile driving.

Development of personalized health services is also part of the Naviga's objectives, such as warning and reminder system for medication adherence through an automatic smart pill dispenser or rehabilitation physiotherapy through virtual reality applications. In the latter case, the main goal is to recover the functionality of the hand of patients using a glove that makes measurements of the angles of each phalanxes up to 22 degrees of freedom with high accuracy. The device uses a strain sensing technology that transforms the movement of the hand and fingers to digital data in real time.

3 Architecture of Naviga Technology Platform

The technology platform being developed within the Naviga Project, see Figure 2, must solve two major technical challenges:
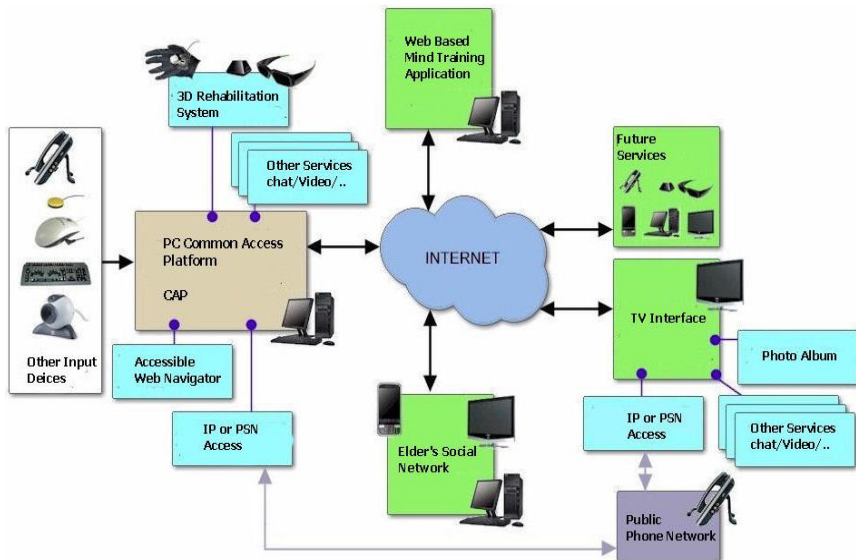

Fig. 2 Naviga's Architecture Technology Platform

Firstly, the connection to the platform in an interoperable way of different support products and communication interfaces, integrating health monitoring devices that generate medical alerts, fall detection systems and security alarms, and devices that enable accessibility to users with motor or cognitive disabilities to

information and entertainment services, and advanced communications such as videoconferencing.

The number of support products available in the market is very high, but often not compatible with each other or have the same degree of utility to different users who share a disability. It is therefore necessary to develop a common multi-modal interface that simplifies the integration between computer and any specific support product. It should also be taken into account the need for multi-channel access, allowing Internet access through the computer, television or mobile devices.
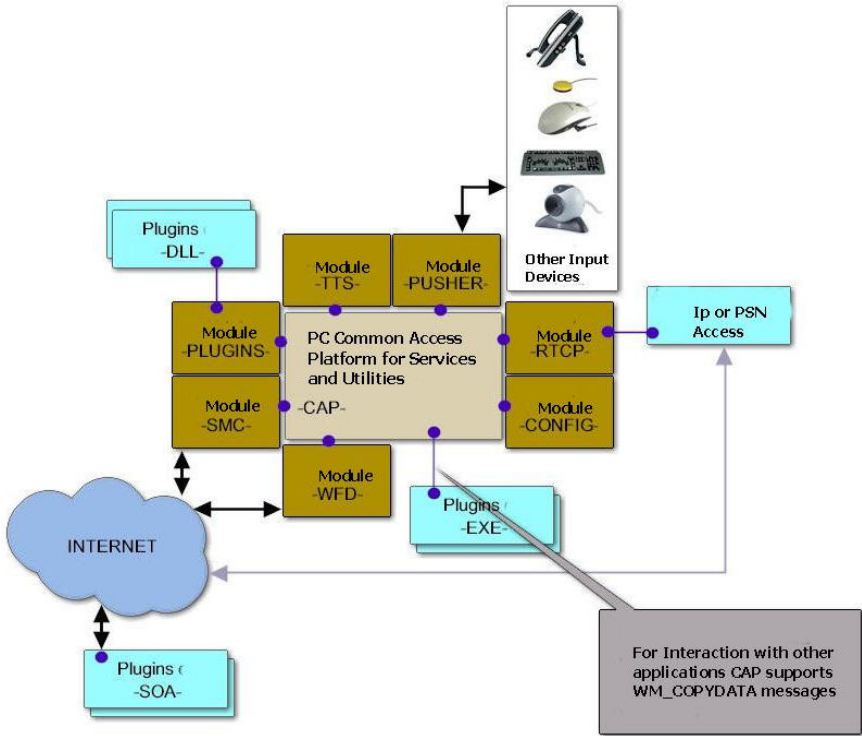

Fig. 3 A detailed High Level view of the Common Access Platform

Second, the development of a set of tools for creating and deploying services and applications to ensure compatibility and rapid integration of new services and devices on the platform, while providing a common adaptive and easy to customize interface for user interaction. That is the function of a very important part in the Naviga's technological architecture as is the Common Access Platform, see Figure 3, a shell running in place of the Operating System that implements several modules for Short Message Commands, Web File Download, Text-to Speech, etc. and all elements for manage future applications and services to be included in the Project.

The Naviga project aims to simplify the integration of new services and applications within the platform using freely available technologies that allow the subsequent adaptation of the code easily, so can still be used for further developments. Among the initial services of the platform, there are technical difficulties related to the application area. For example, the development of an accessible Web browser must be multimodal and interoperable in order to take into account the needs of all members of the group, which greatly complicates the solution given the diversity of users. Also, the use they make of the social network can be very different, both, use objectives (social relationships, share experiences, recommend support products) and access to services, must provide simple user interfaces, easy to use and highly adaptability to the preferences and characteristics of each person.

NAVIGA platform provides an open system based on SOA (Service Oriented Architecture) that enables and facilitates the development of new applications and services that seamlessly integrate with existing modules without need of an expert knowledge of the lower layers architectures and languages. Also, open source implementation based on Java EE and scripting languages like JavaScript, and compliance with accessibility standards of the ISO and the recommendations of the WAI, ensure continuity of service and support the development of the platform.

Designing the platform in conjunction with the devices ensures optimum performance and response to user actions, as adapted interaction mechanisms must play sometimes very complex tasks from very simple input actions. The end-user participation in the project to determine more accurately their needs and desired objectives, and prototype validation during the development process in aspects as interface usability and effectiveness of associated devices, verifying compliance with the requirements.

4 Expected Results

As mentioned above, from the point of view of development, the project's expected results are:

- A hardware interface device adaptable to all seniors and people with disabilities enabling the interaction with computer or television.
- A framework (tools and methods) for creating and deploying services and applications.
- The development of services including a Web browser that allows access for elderly's and disabled people to the Internet.
- Two technology demonstrators in the field of e-Health and entertainment.
- An analysis of business opportunities and business requirements (identifying their strengths and weaknesses) for the successful commercialization of project results.

During the running of Naviga project two case studies /scenarios will be implemented, to demonstrate the functionality of the framework developed. One dealing with rehabilitation at home based on virtual reality, while another scenario will be

developed and evaluated in a care centre for elderly's and people with disabilities aiming their access to the Information Society through the Web browser and in particular social networks and mental training. The scenarios will have real participation of end users to validate the technological advances.

References

1. Burdick, D.C., Kwon, S.: Gerotechnology: Research and Practice in Technology and Aging. Springer Publishing Company, New York (2010), 2004 program Eurostar website `http://www.eurostars-eureka.eu/`
2. Gamberini, L., Barresi, G., Mager, A., Scarpertta, F.: A Game of a Day Keeps the Doctor Away: A Short Review of Computer Games in Mental Healthcare. Journal of CyberTherapy and Rehabilitation 1(2), 127–145 (2008)
3. Griffiths, M.: The therapeutic value of video games. In: Raessens, J., Goldstein, J. (eds.) Handbook of Computer Games Studies, pp. 161–171. The MIT Press, Cambridge (2005)
4. RM-ODP Web site (2010), `http://www.rm-odp.net/`
5. Gartner, Gartner Reveals Five Social Software Predictions for 2010 and Beyond (2010), `http://www.gartner.com/it/page.jsp?id=1293114`
6. Griffiths, M.: The Therapeutic value of video games. In: Raessens, J., Goldstein, J. (eds.) Handbook of Computer Games Studies, pp. 161–171. The MIT Press, Cambridge (2005)
7. Jimison, H.B., Pavel, M., McKanna, J., Pavel, J.: Unobtrusive Monitoring of Computer Interactions to Detect Cognitive Status in Elders. IEEE Transactions on Information Technology in Biomedicine 8(3), 248–252 (2004)
8. Czaja, S.J., Lee, C.C.: Information technology and Older Adults. In: Jacko, J.A., Sears, A. (eds.) The Human-Computer Interaction Handbook, 2nd edn., Erlbaum, New York (2007)