

AGEING AND INFORMATION COMMUNICATION TECHNOLOGY: THE CASE OF MELCO IN CYPRUS

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Abstract

While demographic ageing is increasing rapidly, it is important to consider new approaches to support older people preserve a successful ageing and satisfy their social needs. This article is discussing the issue of demographic ageing in accordance with assistive technologies that could enable someone to maintain active ageing. A project, called *MELCO* (Mobile Elderly Living Community) was carried out among older Cypriots. Its purpose is to function as a safety net to vulnerable older people who are in a risk for falling into social isolation and assist them in order to maintain an active role in their social environment while at the same time is monitoring their position, the lack of any movement and falls.

Keywords: MELCO, older, ageing, needs, assistive technology

Introduction

As the world is facing a demographic ageing, it is important to consider various approaches in order to support the people age successfully and remain active within their social environment. In that sense, societies could avoid dealing with a financial burden in an effort to support the millions of older people who would fall into social isolation and marginalization which could lead to an increase in health care needs.

This article discusses the demographic ageing in accordance with the introduction of modern technologies specifically designed to support older people in various aspects of their daily lives. Among those technologies is *MELCO-Mobile Elderly Living Community*, a system which was developed by the University of Cyprus, Computer Science Department, Cyprus Technological University, Instituto Pedro Nunes, Portugal, Cosine Consultants and Agios Dometios Municipality Senior Citizens Centre. This article is describing the philosophy of the system, as well as the role of Agios Dometios Senior Citizens Centre which was held the responsibility of

establishing two groups of older people who would agree to participate in the pilot study of the system called *MELCO-Mobile Elderly Living Community*.

MELCO supports an innovative social community model encouraging and supporting active participation, communication, socialization, mutual assistance and self-organization of the older people. The model places the older person in the centre of the services, making him/her both a consumer and a producer of assistance. The use of the innovative validated system seems to have a high positive impact in improving the quality of life of older people. Taking into consideration that currently the older people care provision at a national level is lacking substantially on appropriate models and services, MELCO could definitely provide a cost effective solution to address the older people's care challenge.

This document presents the definitions adopted for the particular project; provides an analysis of the user needs, particularly the older people, based a theoretical socio-technological background, as well as health related paradigms. Through the literature review the paper aims to explore the user needs and requirements of older people for various social activities, seeking to highlight the importance of independency and interdependency, and their social living framework based on an innovative friendly-use technology, such as the MELCO system.

Demographic ageing

The 2009 *Ageing Report* states that demographic change is transforming the EU population through longer living, low fertility and inward migration. The report indicates the realities the world today is facing and projects the challenges fifty years from now by emphasizing that low fertility rate among the majority of the member-states is of great concern. The Report indicates that life expectancy at birth for men will be increased by 8.5 years over the projection period (2009), which means that from 76 years in 2008 it will be increased to 84.5 in 2060. For women, life expectancy at birth will be increased by 6.9 years, from 82.1 in 2008 to 89 in 2060, implying a narrowing gap in life expectancy between men and women. Based on the estimates, half of the EU population today is 40 years-old or older and in 2060, half of the population will be aged 48 years or above proving the worries for an aged Europe.

An example of the speed with which the ageing population is increasing, is the statement of the former President of Russia, Vladimir Putin who said, "Demography is Russia's most acute problem today" (Haas, 2007:1) stating that the decreasing of the country's population by almost 700,000 people per year leads Russia to a fast ageing process, since a large number of deaths is among younger people. Russia, however, is not the only country that is getting old. Batini, Callen, and McKibbin (2006:4) report that:

“Before 1900, world population growth was slow, the age structure of the population was broadly constant, and relatively few people lived beyond age 65. This began to change during the first half of the twentieth century as rising life expectancy boosted population growth, although initially there was little change in the age structure of the population. The second half of the twentieth century saw the start of another phase in this transition. Fertility rates declined dramatically—by almost one-half—causing population growth to slow, the share of the young in the population to decline, and the share of the older people to increase.”

At the beginning of the 21st century, population ageing is poised to emerge as a preeminent worldwide phenomenon (Kinsella, 2000). The confluence of lowered fertility and improved health and longevity has generated growing numbers and proportions of older people throughout most of the world. Population ageing is now a phenomenon not only of developed countries (Veras & Murphy, 1991), such as the United States and European countries, but also of developing Third World countries.

It is important to mention that since the beginning of the recorded human history, in a global perspective, young children have outnumbered older people, but very soon this will change. For the first time in global history, people aged 65 and over will outnumber children under the age of five (U.S. National Institute on Aging, 2007), which means that eventually the world’s older population will be larger than the younger population, unless the situation reverses again. Regarding the European Union (European Economy, Ageing Report, 2009), the number of older persons aged 65 or above already surpasses the number of children below 15 years old, but their numbers are relatively close. In 2060, there will be more than twice as many older people than children. As Lunenfeld (2002) indicates, and many demographic studies support, it seems that the numbers of oldest-old people are increasing so fast, that in a few decades, or earlier, they will outnumber any other age group. The 2001 British census results (Seabrook, 2003) indicate that for the first time since the inaugural British census two centuries ago, the number of people over 60 exceeds the number of people below 16 and more than one million people are over 85 years old, which is five times more than it used to be fifty years ago. At the same time, ageing in Cyprus is following the rest of Europe. At the moment, the Cypriot elderly comprise the 11.8% (approximately 105.000 out of a population of a little over than 800,000) of the total population (in the Greek-Cypriot community only) and by the year 2051 the percentage will increase to 28.7% or 236.000 older people.

Indeed, population ageing across the globe represents one of the most remarkable demographic changes in human history (Bengtson & Lowenstein, 2003). Nevertheless, despite the fact that ageing represents a

human success story, in reality there is a concern around the world about population ageing and its consequences. Consequences that made governments realizing of how much population ageing could affect their societies in the long run without providing their older members with the means for successful ageing.

Successful active ageing

What is successful ageing for older people, and how do they perceive it? Is, the process for successful ageing the same for everybody, or there are individual differences? Successful aging is defined as the “Satisfaction with one’s past and present life. Successful aging includes zest, resolution and fortitude, happiness, relationships between desired and achieved goals, self-concept, morale, mood and overall well-being as well as continued social functioning positive interactions or relationships with others, social integration and reciprocal participation in society” (Bowling & Dieppe, 2005, p.1549).

Kahana, Kahana and Kercher (2003) state that successful ageing is an attainable goal within reach of even those aged traditionally relegated to ranks of passive and stigmatized recipients of care. Indeed, and as Phelan, Anderson, LaCroix, & Larson (2004) found after conducting a survey among older people in King County, Washington, USA, older adults’ definition of successful ageing is multidimensional, encompassing physical, functional, psychological and social health. In a similar research carried out in the UK, there were findings of multidimensionality (Bowling, 2006) of the concept. Another research that was carried out in Japan by Matsubayashi, Ishine & Wada (2006) found the same results, as well. That brings us to the conclusion that the concept of successful ageing includes a broad array of dimensions of sense of value, physical, functional, psychological, intellectual, social and spiritual health for older people.

A useful example of successful ageing and how people manage to age well is given by the book *Lives Through the Years: Styles of Life and Successful Ageing* by Williams and Wirths, written in 2006. The book describes the lives of successful *agers*, as it calls the interviewees who participated in the research and, also, it is a helpful guide to those who are looking for ways for ageing successfully.

The growing number of older people worldwide and the interest in how to age successfully (Bowling & Illiffe, 2006, p. 608), led social researchers to pay attention to this particular area in order to develop those guidelines that would assist older adults in achieving and maintaining successful ageing. Research findings show that older people develop their own approach on the issue of successful ageing based on their personal

experiences and the quality of their health. Indeed, successful ageing for many people all over the world is related to good health.

In addition, definitions of successful ageing include the achievement of wellbeing, life satisfaction and high life expectancy; the capacity for self-care, autonomy, productivity and achievement; and a positive psychological outlook (Rowe & Kahn 1998). Research findings show that older people develop their own approach on the issue of successful ageing based on their personal experiences and the quality of their health.

However, despite all the approaches that have been taken so as to describe successful ageing, it is important to note that technology plays a valuable role in supporting older people maintain their autonomy and independence. An example is MELCO, which is based on the existence of a virtual community which can be used a social safety net for any older person is facing the risk for social isolation and provide assistance to any social needs, such as interaction with others.

Defining Virtual Community

Virtual communities are symbolically delineated computer-mediated spaces, whose existences are relatively transparent and open in a way that can allow groups of individuals to attend and contribute to a similar set of computer-mediated interpersonal interactions (Jones & Rafaelli, 2000). Virtual communities are technologically mediated persistent environments which support, multiple interaction styles and provide the capability for real-time interaction and multi-use engagement (Ho, Scraefel & Chingell, 2000).

A virtual community could be created and a development of an innovative Information Communication Technology (ICT) based models and techniques, after identifying each person's needs and creating a unique personalized profile of abilities, special needs and preferences, promoting thus care provision. For example, older people can be informed for upcoming events that they are interested in, via wireless mobile technologies. Further, spirituality is a major issue in Cypriot senior citizens lives. Therefore, a connection with local churches/priests is very important as it could inform the participants for daily church services according to the Greek Orthodox religion.

Defining need

Need is a requirement for some particular kind of reaction and a relationship between problems and responses available. A need is a claim for service (Ewles & Simnett, 2003; Stathopoulos, 1996). As life expectancy increases, the potential impact on health and social care services is likely to be increased in the numbers who require long term care resources. In addition, population demographics have shown that families are not living as

close to one another as in the past, reducing the availability of informal carers. This situation shows the necessity of alternative care models and within this frame, assistive care technology can be contributed the most to the needs of older people.

Theory of Universal Human Needs

Doyal and Gough (1991) criticized the idea of a hierarchy of needs and indicate that there are two basic and universal needs: health and autonomy. An individual needs are representative of the costs of being human in society and feel needy Amongst other intermediate needs described by Doyal and Gough (1991) are: a) adequate nutritional food and water, b) physical security, c) economic security and d) appropriate basic and cross cultural education (Cooke & Philpin, 2008).

According to the above theory, the mission of Agios Dometios Senior Citizens Centre was to provide the elderly people in the community with the necessary means, through various services and activities, in order to maintain their capabilities for addressing their basic needs, personal and social, as well as maintaining good health for successful ageing. The philosophy of the Centre is to enhance elderly citizens' participation in various activities as well as their autonomy. To that direction, the focus of MELCO was to enhance the capability of addressing these needs through a virtual community in a home environment when it comes to older people whose health does not allow them visiting the Centre.

Fundamental Human Needs and Technology Related Needs

Amongst the classification of fundamental human needs, are: a) protection, b) leisure, c) participation and d) creation (Manfred, Max-Neef, Elizalde, Hopenhayn, 1991). Technology related needs is closely related to the higher level needs for health, safety, independence, mobility and participation (World Health Organization, 2002). The study of the relationship between specific needs of older people for technology and their technology use and acceptance has been an increasing important research area since the early 1990s when the field of geronto-technology has been established, through a survey questionnaires and in-depth interviews. However, there is still very limited understanding of older peoples' specific technology-related needs since the methods used have limitations (Malanowski, Ozcivelek, Carbera, 2008).

User needs

For the purpose of this project, user needs were formed based on literature review, theoretical background, discussions with the staff of Agios Dometios Senior Centre and older people aged 65+ who visit the Centre on a

regular basis. The issues that were addressed included: personal needs, activities of daily living, socialization and active participation within the community, physical conditions (mobility). Older people are in the centre of a socio-technological community. Thus, the provision of, as optimum and effective support as possible, highlights the combination of technology and social needs within a community. The use of innovative technology (e.g. special device, phone) can enable the users to satisfy their personal needs, such as a visit to a church.

Mobility, Care and Wellness

Mobility in this project is the independent or interdependent mobilization to and/or from a specific place. Mobility is essential for an independent and self-determined living and social integration. Mobility enables the interaction with the environment (e.g. going to shops or supermarket). Mobility services making use of wireless sensors for outdoor activity such as to enable older people to feel safer, walk to the shops or supermarkets.

Unintentional injuries are a serious problem among older people, such as falls, motor vehicle crashes, fire and poisoning). Of these, falls are the leading contributor, accounting for 74.6% of all unintentional injuries for persons aged 71 years and older, followed by motor vehicle crashes, which account for 13.2 %. The older people are also more at risk from fire due to a poor sense of smell, restricted or slow mobility and less resilience to the effects of smoke and burns.

Further, the consequences non-compliance with drugs may be serious in older patients. Estimates of the extent of non-compliance in the older people vary, ranging from 40% to a high of 75%. Technology could contribute the most for the older people to feel safe. ICT may function as a memory aid. For technology would act as a reminding medicine dispenser which would improve the compliance of patients to long-term medication, reduce the risk of an overdose and would be cost-efficient way to complement home health care service level.

Monitoring immobility with a sensor could be applied on a long-term basis to older people to detect gradual deterioration in their health status (Scanail, Sheilla, Barralon, Norbert, Gerard, 2006). Furthermore, technology could help at the detection of falls; a simple fall detector could automatically call for immediate assistance from a relative. Guidance could be also given through the device for weather conditions and suggest proper clothing for outdoor activities.

Use and acceptance of Assistive Technology

A qualitative study was conducted in Victoria to explore factors affecting the acceptability and use of assistive devices by older people. Four focus groups and fifteen home-based interviews were conducted with older people (mean age 77 years) who had been issued with 2 or more assistive devices. Findings suggested that the equipment and home modifications were safe and easy to use and appreciated the benefits for mobility, confidence and independence. Reasons for non-use were commonly related to changes in functional ability. (Smith Quine, Anderson, & Black, 2002).

Cohen and Biddison, (2007) conducted two focus groups on technology: one with elderly people living in independent living apartment building and one with caregivers in a special care unit. Focus groups findings indicated that the elderly participants had mixed attitudes towards technology, although most participants had interest in specific technology for everyday use. Barriers to use of technology, included lack of interest, need for training, consumer assistance and design problems (Cohen & Biddison, 2007)

De Witt (2009) conducted a study with 17 participants, aged 68-96 years of age (53% women) who had been monitored for at least 6-7 months by a telemonitoring device, lived alone, and were exposed to potential health risks in their own homes. In depth face-to face interviews were conducted, each lasting 90-120 minutes. Questions were asked for participants experiences with their telemonitoring devices followed by a discussion of privacy. (De Witt, 2009).

Another study, conducted by Wilkman, Falthom, & Gard (2008) described the experiences of elderly persons through testing a mobile safety alarm and their reasoning about safety, privacy and mobility. Five elderly persons with functional limitations and four healthy elderly persons from a pensioner's organization tested the alarm for 6 weeks. The alarm had a drop sensor and a positioning device. The intervention was evaluated with qualitative interviews and analyzed with latent content analysis. The result showed four main categories: feeling safe, being positioned and supervised, being mobile and reflecting on new technology. Safety and mobility emerged to be more important than privacy since the safety alarm offered an increased opportunity for mobility in terms of being more active. The mobile safety alarm was a way to keep self-determination and empowerment (Wilkman *et. al*, 2008)

Haigh, Kiff, and Goeffrey (2006) created and tested the Independent Life Style Assistant (ILSA), an agent based monitoring and support system to help elderly live longer in their homes by reducing caregiver burden. Researchers after, an extensive literature review identified the following features and requirements to support the clients and caregivers:

- a) Medication management: verify medications taken, provide reminders to take medications
- b) toileting: monitor toileting activity
- c) mobility: measure activity level, detecting home occupancy, providing path lighting, detecting falls
- d) Security: monitor home environment, panic button, intrusion detection
- e) caregiver assistance: to do lists, provide reminders, provide remote access information, coordination tool for multiple caregivers
- f) Alerting: provide alarms, alerts and notifications if safety is compromised, provide reports of alarms via phone and the Web

In general, the ILSA had the following specific implementation:

- a) Passive monitoring: basic activity, medication compliance, sleeping patterns
- b) Cognitive support: reminders, date/time of day
- c) Alerts and notifications: Automated alerting to caregivers (by telephone)
- d) reports: summary reports to client behavior
- e) remote access: to information via internet or telephone (allowing users to monitor or interact with the system)

Amongst the important findings of the testing period are:

- a) system generated telephone calls were perceived as rude and intrusive, no matter how pleasant the voice
- b) even simple, automated telephone interactions can be cognitively overwhelming for elderly clients. (Haigh *et.al*, 2006)

Although not familiar with advanced technology, except dialing numbers and answering their mobile phones, the participants in the MELCO program in Agios Dometios Centre have expressed their interest to participate in the study and learn how to engage modern technologies in their everyday lives. Their concern of social isolation or dependency on others seems to be trounced through the use of the mobile technology. The participants feel excited for being able to learn how to deal with advanced but friendly-use technology and believe that it will help them maintain an active living in their community.

Project innovation

Despite the fact that different efforts have been undertaken at an international level regarding the development of information technology towards supporting older people, at a national level current developments regarding information technology solutions for the elderly are almost nonexistent. Furthermore, usually the main target of current developments in Cyprus is to provide solutions for elderly persons that are in a rather

advanced disabilities state and are not able any more to have a real independent life. Consequently, MELCO aimed to restore any lost independent living, allowing older people to have a glimpse of independence in a highly controlled and constrained environment.

The approach used by the proposed project took a proactive action providing a solution for elderly persons at the very early stages of capabilities degradation, when they are still capable to have a non-assisted independent living in an outdoor environment. The particular approach went beyond the state-of-the-art by stimulating and prolonging this independent and active living of the elderly persons through innovative cost-effective technology integrating personalized socialization and daily monitoring services taking into consideration real user needs and embedded in an innovative social community model.

The project scope was to go beyond the state-of -the-art in two areas: from one side it created innovative mobile wireless technology able to integrate and support socialization and daily activity monitoring services. At the same time its purpose was to improve the quality of life of elderly people outside the home and from the other hand it develops an innovative social community model stimulating the elderly to adopt and maintain a more independent and active lifestyle of the elderly in Cyprus.

The specific scientific, technological and research innovation involved the following: development of highly innovative ICT based services making use of state-of-the-art mobile wireless technologies giving an answer to the research challenge of how ICT technologies can support in an efficient and effective manner the socialization and daily activity monitoring of the elderly at any time in an outdoor environment. Development of an innovative social community model that places the elderly person in the centre of the services, making him both a consumer and producer of assistance, and actively promotes and provides all the means necessary for the active independent living of the elderly. Creation of innovative knowledge in the area of personalized support for the elderly giving new insight in how integrated personalized ICT services can support day to day activities and improve quality of life for each one of the related stakeholders (that is, not only the elderly but also their families, friends, etc.). Evaluation of the acceptance of the system by running the pilot and investigating whether a well-designed elderly social environment supported by state-of-the art ICT can result in reduce demand for use of care services and consequent care cost savings.

Methodology

The main questions that the project attempted to address in the framework of the proposed research paving the way through the decision of

the needed activities and an appropriate methodology were: What are the socialization and daily monitoring needs and requirements of the elderly in an outdoor environment at any time and any place? What kind of user scenarios need to be defined and how should a social community model be defined in order to capture in the most realistic way the elderly daily living and social activities and interactions? Which ICT based services are needed to fully support the elderly needs and requirements and how such services can be integrated in a user friendly system that takes into consideration each person's different needs, capabilities and preferences?

In order to respond to the above questions and to achieve the proposed project objectives, the scheduled work was approached through seven phases. In the first phase research was carried out regarding the definition of the real needs of the elderly as regards socialization and daily activity monitoring in an outward environment, but also individual privacy protection requirements. In the second phase based on the elderly identified socialization needs, a model was defined which would give the basis of the development of the ICT services, encouraging and supporting active participation, communication, socialization, mutual assistance and self-organization of the elderly. The following phase focused on the analysis and design of the MELCO system including the design of i) the overall system architecture, ii) the ICT services iii) the privacy and security infrastructure and iv) a system database. The next phase concentrated on the implementation of the socialization, the monitoring services and the database. The fifth phase revolved around the integration of the different components of the system to a platform, including the development and integration of the security infrastructure and user interface. The sixth phase included the organization and execution of a system trial and ii) validation and assessment of the system with respect to user acceptance and technical viability and lastly the seventh phase generated publicity of the project both at the national and international level, and ii) work out an exploitation plan of the project outcome.

Mobile Elderly Living Community (MELCO) and its philosophy

MELCO technology, which has been developed by the Department of Computer Science at the University of Cyprus, is an internet based system allowing exchange of information through fast and reliable wireless broadband networks such as Wi-Fi, GPRS and 3G. It employs a central web based database for storage and processing of information and also a local database is kept on each mobile device, guaranteeing thus continuity of system operation. Uniform access to the common database is achieved via the Virtual Team software.

The main aim of the project was the development of Mobile Elderly Living Community (MELCO) system integrating innovative personalized *Information Communication Technology* (ICT) socialization and monitoring services making use of state-of-the-art mobile wireless technologies to improve the quality of life of older people, by stimulating and prolonging independent and active living in an outdoor environment.

MELCO supports an innovative social community model encouraging and supporting active participation, communication, socialization, mutual assistance and self-organization of the older people, promoting seamless integration and interaction of different people (family members, caretakers, medical professionals, friends etc.) from all ages at any time and any place and providing daily activity monitoring. The model places the older person in the centre of the services, making him both a consumer and producer of assistance.

The project creates innovative mobile wireless technology able to integrate and support socialization and daily activity monitoring services able to improve the quality of life of older people outside the home and on the other hand it develops an innovative social community model stimulating the older people to adopt and maintain a more independent and active lifestyle. The project aim is to improve the older care challenge in Cyprus by taking into consideration the real needs of older people at a local level. The philosophy of MELCO is based on the needs of older people as those were defined by the participants in the pilot study.

Older people are facing with health issues more often than younger people and they may require medical monitoring on a weekly basis, which means that they may need transportation to health services for their doctor appointment and medication prescription. The device would enable older people to be connected with a friend or relative for informing them for the need of transportation. The older community is also essential to be connected with a drug store and be informed about the private pharmacies when government and community pharmacies are closed.

A telephone connection for information and services at the City Hall regarding choirs, garbage, flooding, paying taxes and, also, physical access to the City Hall is also consider to be essential for older people and the device will give easy access. Telephone connection to a Senior Citizen Centre is also available through in order for the older person to keep in touch with the daily activities taking place there, other information and also for transportation if it's needed for pick-up services. A reminder can also be sent for upcoming activities.

It is worth noting that older Cypriots are not, yet, familiar with technology for online bill payments. In addition, visiting a bank for bill payment could be a form for socialization for an older person, so an easy

access to a bank for a senior citizen is considered as very important. As a result, it seems important for a system to provide basic information, such as an easy access to telephone numbers for certain services and transportation to services. For instance:

- Drug store
- Bank
- City hall information and services (e.g. city tax payments, garbage collection)
- Social services
- Transportation
- Health Centre
- Other community services

Design

The project team from the University of Cyprus, Computers Department began with the analysis and definition of end user needs and requirements regarding socialization and daily living monitoring in an outdoor environment, but also the definition of user based scenarios. Requirements related to privacy issues were also additionally considered. The project continued with the design of the system's architecture using the well- established *Service Oriented Architecture* (SOA) paradigm for ensuring a high degree of abstraction and transparency between the different services. The architecture was focused on new models and personalization techniques, like Adaptive Hypermedia and Web Personalization, ensuring that each individual could have a unique personalized profile of disabilities and abilities, special needs and preferences promoting thus personalized care provision.

Regarding the implementation of the socialization services the idea was based on the construction of a virtual living community around the older person unifying different communities (age, profession, relatives, friends, etc.) that could assist, collaborate and actively communicate with the older person towards the improvement of their daily life in an informal way through the use of assistive ICT technologies.

Additionally, through the development of a system database all the data necessary for the development of socialization (including user records with their preferences, subscriptions, installed equipment, etc.) was stored, as well as monitoring (including user's sensor data) movements and falls. The database had used state-of-the-art technologies in relational database systems to ensure high performance, robustness and availability. The database had also provided advanced data manipulations, data correlation, analysis and distribution.

In particular, the system analysis, design and development of the project as those were set by the designers of the project have included the analysis and design of the MELCO system include the design of i) the overall system architecture, ii) the ICT services iii) the privacy and security infrastructure and iv) a system database. The architecture has been based on a Service Oriented Architecture (SOA - www.service-architecture.com) integrating socialization and monitoring services by utilizing web services and a robust and persistent database management system. The use of web-services implies that the social and monitoring services were spit into smaller components creating a forest of “web-methods”, allowing a dynamic selection based on user needs and preferences, supporting thus modularity, expandability and flexibility. Wireless mobile network infrastructures, wireless sensor technologies, monitoring devices and powerful but easy to handle wireless mobile devices have been seamlessly integrated and made available to the services. The database has stored user records with their preferences, subscriptions and installed equipment (capabilities), along with other information that has been derive from the above analysis of the user requirements.

Additionally, during this phase, mobile technologies had been examined as regard different characteristics and limitations to (i) support user mobility at any time and any place, (ii) enable the development of user adaptable interfaces capturing the elderly needs and capabilities and (iii) provide security, authentication and interoperability among different services (iv) transmission speed and reliability.

Moreover, this phase has focused on the implementation of the socialization, the monitoring services and the database. Regarding the implementation of the socialization services the idea is that virtual living communities were built around the aged person unifying different communities (age, profession, relatives, friends, etc.) that can assist, collaborate and actively communicate with the elderly to improve its daily life in an ad-hoc and informal way through the use of assistive ICT technologies.

The role of Agios Dometios Senior Citizens Centre

The primary objectives of this project which was running from December 2008 until March 2011, included the organization and execution of a system trial and the evaluation of the system about its effectiveness with regard to its goal, i.e. to ensure that participation in a living community is persisted at a level required for independent and active living of the older people, as well as the efficiency of the system itself to support this goal at a large scale.

A trained social worker with extensive knowledge and expertise on old age from the Centre was assigned the responsibility to lead and train two groups of older adults, one group with individuals between 65-68 year old and another group aged 75-84. Also, the social worker was functioning as facilitator and mediator towards the process and as a link between the designers of the system (University of Cyprus), Agios Dometios Senior Centre and the two groups. Based on the fact that the vast majority of the elderly Cypriots over 70 years old is not familiar with advanced technology, the role of the group leader is considered crucial because is up to him/her to empower the group members to remain active in their commitment. In addition, their limited knowledge on technology created a sense of fear for the new and advanced technology. Yet, they did not express any desire to withdraw from the study. However, the members of the second group (ages 65-68) had a completely different approach to the system, mostly because of their acquaintance with technologies.

Regarding the formation of the groups, the process included the recruitment of six older people (four women and two men), belonging to different categories as regards for example sex, capabilities, daily activities preferences, ICT skills etc., to be involved in the trial. For each one of the selected older person the members of its living community were selected consisting of family members, friends, neighbors etc. representing also different categories regarding age, sex, profession, ICT skills, etc. Emphasis was given on providing training to the users, of how the system operates and how to use it, before the beginning of the pilot operation. In order to achieve a high acceptance of the system at an initial stage of the pilot, two different pilot operation settings were proposed, each of which is described below.

A. Controlled environment pilot operation

In this configuration a small number of users were selected through two groups, one group with five women older than 75 years old and one group of five men between the ages of 65-68 in order to validate the robustness of the system and identify possible problems. There was no particular reason for the gender separation, but that came rather from a random selection from a group of people who had basic knowledge of using regular mobile phones. Therefore, since the researchers wanted to measure any differences on age and use of technology the above two groups were formed without any issues of sexism or any other form of discrimination.

Any problems or difficulties that were identified by the users were, then, alleviated by the development teams. Through weekly meetings, all users were receiving training on how to use the system and were explained at the same time about its philosophy and usefulness. At the same time, in

every group meeting there was an assessment on the level group members to remember and understand how to use MELCO on a weekly basis.

B. Real environment pilot operation

In this configuration the pilot was run on a larger number of older in their real living environment being in communication/collaboration and receiving assistance by their community members. The users had to use MELCO in their home environment and evaluate its functionality as well as been evaluated regarding their capacity to use it. The evaluation assessed the impact of MELCO on older people in terms of quality of life, user satisfaction, user experience and changes in levels of socialization and participation in the community. Evaluation mechanisms/questionnaires were designed in order to be incorporated into the execution of the pilot.

Conclusions from the final evaluation for the utility of MELCO

After two different opinion surveys, a six-month and a twelve-month, all users agreed that MELCO has worked as it was designed and that the pages were displayed as expected and required by them. They all agreed that MELCO is very practical and allows them to keep in touch with their virtual community. A positive affect was the monitoring of the users. Through the use of special sensor the system could send an immediate alert to the responsible *Team Members* in case of detection of a fall. In such an event, the location of the older person was obtained from a GPS device and transmitted to the members in order to assist him in person. The system could also enable video communication between the older person and the team members for a better evaluation of the situation.

Use and acceptance of MELCO by older Cypriots

The adjustment of older people to MELCO was not easy, mainly because of their lack of knowledge on using technology. Despite the fact that all users were using regular mobile phones, it took longer for the female users to adapt to the technology used through MELCO. Although the meetings with the group were held on a weekly basis their weak memory, especially on new skills, was a factor of a more difficult adjustment. Regarding the acceptance of MELCO all users admitted that the system could be very useful to vulnerable older people whose health condition does not allow them to interact with their social environment, especially outside the house, and a tool that would allow them to maintain their social participation and keep them connected with their family. The latter is connected to the alarm system of MELCO that informs a pre-selected member of the virtual community for a fall of the user.

All members of the group agreed that the system is useful in their daily life and makes their communication with virtual community easy by providing them control of their everyday activities. In addition, they all stated that they are very satisfied with the size of letters and images and photos of friends and family members as well as agencies, like City Hall, Hospital, Fire Department, supermarkets, etc.

Conclusion

Overall, through the opinion surveys, all members from both groups expressed their satisfaction for MELCO. Even though MELCO was new to them, they admitted that a wider use of the system will allow thousands of older people feel safer and connected to their friends and family. The fact that many older people are not technology literate does not seem to prevent the use of MELCO which does not require advance technology knowledge. Instead, the use of photos of friends and family members, as well as other images used by the system can help users to follow the instructions step by step without any worries and making it user-friendly.

From a social perspective standpoint, MELCO can be considered as an innovation in the area of social support of vulnerable older people, especially in a time where the older population is increasing rapidly. Although many older Cypriots are not familiar with technology and have low education or no education at all, while most of them are technologically illiterate, the simplicity of MELCO technology makes it user friendly. In addition, for people who are considered as *young-old* (65-74) the MELCO is even easier to handle since most of the people in those age groups have some basic education which allows them to easily adjust to new technologies.

Regarding the functions of MELCO, it is important to mention that when an older person lives alone, they might be in need of some aid to remind them about day, time of day, appointments and activities etc., as well as the weather conditions. Based on the responses, the use of MELCO could be adjusted to the individual needs of users and according to their current circumstances. For example, while someone could request the numbers of particular services (City Hall, Hospital, theatres) someone else could request different services (i.e. Police Department, Fire Department, restaurants, supermarkets).

Furthermore, the project implemented the MELCO system integrating the different ICT services which were operating on different types of mobile devices providing user friendly adaptable interfaces and making use of wireless sensors, providing real time monitoring of user's mobility and physical conditions.

As technology evolves rapidly, making everyday life for many people an easier task, it is important, that older people should also have the ability to

access and use new technologies. In an era of technology it would be imperative that seniors, who face various difficulties in their health, could have the opportunity to remain in their social environment even though in some cases this is virtual social environment.

As a result of the importance for older people to remain in their social environment, MELCO has been designed to serve the special needs of older people in order to maintain their functioning within their social environment. Concurrently, MELCO is a tool connecting the user with family members or friends, thus, creating a sense of security, encouraging older people to adopt and maintain a more independent and active lifestyle.

Finally, the collaboration between users, family, friends (as part of a virtual community) and professionals could be improved by using the MELCO and speed up processes (e.g. transportation, immediate reaction in case of emergency). Through the evaluation of the outcome of this project, it seems that the way MELCO has been designed provides all the necessary and core functional capabilities that would allow it to become a user-friendly technology.

References:

- Bengtson, V., & Lowenstein, A. (eds.) (2003). *Global Aging and Challenges to Families*. Piscataway: Aldine Transaction.
- Bowling, A. & Dieppe, P. (2005). What is successful ageing and who should define it? *British Medical Journal*, 331 (7531). pp. 1548-1551 [online] available from: <<http://eprints.ucl.ac.uk/1559/1/1548.pdf>> [23 January 2009].
- Bowling, A., & Iliffe, S. (2006). Which model of successful ageing should be used? Baseline findings from a British longitudinal survey of ageing. *Journal of Age and Ageing*, 35, 607–614.
- Bowling, A. (2006). Lay perceptions of successful ageing: findings from a national survey of middle aged and older adults in Britain. *European Journal of Ageing* 4, (1) 57-58.
- Cooke, H. & Philpin, S. (eds) (2008). *Sociology in Nursing and Healthcare*. Elsevier: Edinburgh.
- Cohen, M. J & Biddison, J. (2007). The scope and future trends of gerontotechnology: consumer's opinions and literature survey *Journal of Technology in Human Services* 25(3), 1-19.
- De Witt, L. (2009). Many older people felt that electronic care surveillance increased their safety and enabled them to live alone in their own homes *Evidence Based Nursing* 12(1), 32.
- Doyal, L., & Gough, I. (1991). *A Theory of Human Need*. London: The Guilford Press.

European Economy 7/2008. The 2009 Ageing Report: *Underlying Assumptions and Projection Methodologies for the EU-27 Member States (2007-2060)*.

Ewles I. & Simnett I., (2003). *Promoting Health. A practical guide*. Fifth edition. London:Bailliere Tindall.

Gorman M. (2000). Development and the rights of older people. In: Randel J, et al., eds. *The ageing and development report: poverty, independence and the world's older people*. London, Earthscan Publications Ltd.3-21.

Haigh, K.Z., Kiff, L. M & Goeffrey, H. (2006). The Independent LifeStyle Assistant: Lessons Learned *Assistive Technology* 18: 87-106.

Haas, M. (2007). A Geriatric Peace? The Future of U.S. Power in a World of Aging Populations. *International Security* 32 (1), 112-147.

Hadjime, O., Hideki, I. Suzuki, T. Takayuki, H. & Motoji, S. (2006). Reviewing the definition of older. *Geriatrics and Gerontology International* 6(3), 149-158

Ho, J. Schraefel, M.C. & Chingell, M. (2000). Towards an Evaluation Methodology for the Development of Research Oriented Virtual Communities IEEE. [online] available from:

<<http://ieeexplore.ieee.org/ielx5/7094/19118/00883714.pdf?arnumber=883714> [6 February 2009]

International Monetary Fund (2006). The Global Impact of Demographic Change. (Issue Brief No. WP/06/9). Washington, DC: Batini, Callen, and McKibbin.

Jones, Q. & Rafaeli, S. (2000). Time to Split, Virtually: Discourse Architecture and Community Building as means to Creating Vibrant Virtual Metropolises *International Journal of Electronic Commerce & Business Media*, 10(4), 214-223.

Kahana, E., Kahana, B., & Kercher, K. (2003). Emerging lifestyles and proactive options for successful ageing.' *Journal of Ageing International* 28 (2), 155-180.

Kinsella, K. (2000). Demographic Dimensions of Global Aging.' *Journal of Family Issues*, 21 (5), 541-558.

Lunenfeld, B. (2002). The ageing male: demographics and challenges. *World Journal of Urology*, 20, 11-16.

Malanowski, N, Ozcivelek, R. & Carbera , M. (2008). Active Ageing and Independent Living Services: The Role of Information and Communication Technology. JRC Scientific and Technical Reports [online] available from: <<http://www.healthandfuture.org/~healthan/healthandfuture/images/stories/Documents/active%20ageing%20&%20independent%20living%20services%20the%20role%20of%20ict.pdf>> [6 February 2009]

- Malanowski, N, Ozcivelek, R. & Carbera , M. (2008). Active Ageing and the potential of ICT for Learning [online] available from: <<http://ftp.jrc.es/EURdoc/JRC45209.pdf>> [6 February 2009]
- Manfred A. Max-Neef, Elizalde A. & Hopenhayn M. (1991). Human scale development: conception, application and further reflections *Development and Human Needs*. Chpt. 2. p.18. New York
- Matsubayashi, K., Ishine, M., & Wada, T. (2006). Older Adults' Views of "Successful Aging"-How Do They Compare with Researchers' Definitions? *Journal of the American Geriatrics Society* 54 (1), 184-187.
- Rowe, J., & Kahn, R. (1998). *Successful Aging*. New York: Pantheon Books (Random House).
- Scanaill,C., Sheilla.C, Barralon, P., N., Norbert, L., D. & Gerard, L. (2006). A review of approaches to mobility telemonitoring of the elderly in their living environment. *Annals of Biomedical Engineering* 34 (4), 547-563
- Seabrook, J. (2003). A World Grown Old: Finding a Place for Antediluvians in the New World Order. *Harvard International Review*, 25, 22-25.
- Smith, R., Quine, S., Anderson, J & Black, K. (2002). Assistive devices: self-reported use by older people in Victoria. *Australian Health Review* 25(4), 169-77.
- Stathopoulos P. (1996). *Social Welfare. A general overview*. Ellin: Athens
- U.S. Department of State and the Department of Health and Human Services National Institute on Aging, National Institute of Health (2007). Why Population Aging Matters: A Global Perspective [online] available from <<http://www.state.gov/g/oes/rls/or/81537.htm>> [8 June 2007]
- Veras, R., & Murphy, E. (1991) The ageing of the third world: tackling the Problems of community surveys. Part I: Brazil-a young country grows old, *International Journal of Geriatric Psychiatry* 6 (9), 619-627.
- Wilkman, M. A & Falthom, Y. & Gard, G. (2008). Safety vs. privacy: older persons' experiences of a mobile safety alarm Safety vs. privacy: older persons experiences of a mobile safety alarm. *Health and Social Care in the Community* 16(4), 337-46.
- Williams R., & Wirths C. (2006). *Lives Through the Years: Styles of Life and Successful Aging*. Piscataway: Aldine Transaction.
- World Health Organization (2002). Toronto Declaration on the Global Prevention of Elder Abuse [online] available from: <http://0044c40.netsolhost.com/downloads/toronto_declaration_veng.pdf>[1 1 April 2008]