Easy Life, Intelligent Systems, and Life 2.0

European Research on ICT for Aging Adults

Peterson, Carrie Beth; Prasad, Neeli R.

Published in:
Proceedings of (746) Internet and Multimedia Systems and Applications / 747: Human-Computer Interaction - 2011

DOI (link to publication from Publisher):
[10.2316/P.2011.747-009](10.2316/P.2011.747-009)

Publication date:
2011

Document Version
Accepted author manuscript, peer reviewed version

Link to publication from Aalborg University

EASY LIFE, INTELLIGENT SYSTEMS, AND LIFE 2.0: EUROPEAN RESEARCH ON ICT FOR AGING ADULTS

Carrie Beth Peterson, Neeli Rashmi Prasad
Center for TeleInFrastruktur, Aalborg University
Aalborg, Denmark
cbp@es.aau.dk; np@es.aau.dk

ABSTRACT

Lack of access and accessibility have been two of the largest impediments for older adults and Information and Communication Technology (ICT) use, resulting in reduced computer skills, lack of motivation, and aversion to new technologies. By looking at these influential barriers, we can see that this is partially due to technologies being designed and marketed towards the younger generations and do not allow for inclusive design. Aging is usually not considered when designing mainstream products and there can be a distinct lack of industry awareness about the cohort's capabilities. Additionally, even when Assistive Technologies (AT) are developed specifically to help marginalized groups, a lack of interoperability can hamper uptake.

Since the 1990's, the European Union has contributed to the development of eHealth and this has helped to place Europe as one of the leading world investors in the field. As a result, the EU is utilizing industrial, scientific, and social resources to accelerate product and service synchronization. Innovation and development in these areas not only benefits European citizens and residents, but also strengthens the European industry market.

ICT sectors are experiencing a growth in the needs and marketability of tools and services designed specifically for older adults. If a service is offering opportunities to emphasize resources and capabilities already available, research must incorporate design and functionality requirements and preferences of aging adults. This can help to improve or maintain QoL, allow for aging in place and independent living, increase socialization through connection services, and reduce cost of care burdens expected with the increase in aged proportions of global populations.

KEY WORDS

Quality of Life, Aging, Digital Inclusion, Gerontechnology

1. INTRODUCTION

The European Commission (EC) has set out making policy and practice adjustments towards improving the Quality of Life (QoL) for all Europeans. One major aspect of this is the "Information Society," which has tremendous potential for improving QoL in people across Europe. Several of these EC policies utilize ICT in order to affect a wide range of activities and services. One such area of influence is the European Union (EU) healthcare situation, which is discovering the benefits of computer-aided healthcare practices. The EU accepts healthcare as a national responsibility and the EC is fostering faster development and dissemination of eHealth activities by helping organizations within the EU to learn from each other through Member State collaboration.

To narrow the scope of European improvements in QoL, this research explores the aging population, which is rapidly increasing in age and populace. A 40% increase in older adults (those aged 65+) will occur from 2010 to 2030; additionally, 25% of the total European Union population will be older adults already by 2020 [1]. With the resulting increase in needed housing, medical and social care services, as well as the decreasing proportion of taxable workforce, it is apparent that Europe faces substantial challenges for health, society, and economy. The EU action plan on "Aging Well in the Information Society," aims to develop gerontechnological solutions for the purpose of increasing QoL [2]. Accordingly, we can see that these requisites and endeavors have vast implications for social and healthcare sectors, housing and development, reducing the digital divide, increasing inclusive design, and providing access to public and private services.

Historically, lack of access and accessibility have been two of the biggest barriers for older adults and ICT use, further resulting in reduced computer skills, lack of motivation, and even unwillingness to accept new technologies. By looking at these two influential barriers, we can also see that this is partially due to the fact that new and emerging technologies have been largely designed and marketed towards the younger generations who tend to be the largest consumer group. Additionally, aging impairments such as physical functioning, arthritis, macular degeneration, etc. have also served in increasing the digital divide as technologies do not allow for inclusive design. Now, the ICT sector for older adults is experiencing a gerontechnology boom as the needs and marketability of tools and services designed specifically for older adults is taking off. By incorporating design and functionality towards the requirements and preferences of this target group, converging ICTs can help aging adults to improve or maintain their QoL, age in place and live independently, increase socialization through connection services, and reduce care costs.

This paper describes three endeavors following the European Union plan for "Aging Well in the Information Society." All are directed towards developing and providing ICT tools and services, interdisciplinarily designed with and

for aging adults. Groundwork that was laid out in the laboratory is being used in two European Commission-supported projects, one aiming towards enhancing independence and QoL in life with dementia, the other regarding the socialization aspects of QoL in aging adults living in the community and reducing the digital divide. First, state-of-the-art research projects at Aalborg University are presented, followed by a comparison of corresponding research projects also supported by the European Commission where the distinguishing innovative aspects are identified and described, including benefits over existing solutions and cooperation with other projects. The discussion section considers the state of current gerontechnological research, succeeded by the conclusion.

2. INNOVATIVE GERONTECHNOLOGY RESEARCH AND DEVELOPMENT

Previous research and teaching activities at Aalborg University (School of Architecture and Design, Wireless Communications, ICT Entrepreneurship, Health Science Technology) have focused on solutions, services, and activities developed for elderly people. Most recently have been undertakings on user interface development, human-technology interaction, ethics, gerontechnology, and telemedicine and telecare. This has made it possible for the researchers to understand which strategies can be used to support familiarizing elderly people with such technologies.

2.1 Easy Life Laboratory

The Easy Life Laboratory is a Radio Frequency Identification (RFID) lab which aims to make both scientists and the public aware of wireless technology manifolds. Aalborg University Center for TeleInFrastruktur (CTIF) is primarily in charge of the algorithms, whose goal is to make both tags and readers platform-independent and therefore freer to use. The laboratory is designed as a one-bedroom apartment, as a prototype for an elderly or ill person in their home. According to certain patterns of behavior, a SMS is sent to caregivers or emergency personnel if there is a perceived emergency or if the person calls for help. Alternatively, the family can be alerted if their family member has left home or has returned, which helps to ease caregiving by making locating information available. A decision as to whether the system would subsequently turn on the alarm is based on algorithms that contain information collected in different situations. In addition, readers in the home are equipped with a database server, a web server, and a central controller. The latter is Windows-based, while the two servers use Linux. The system is platform-independent, so it can work everywhere; hence, the need for a software connection that translates and makes it a Plug and Play solution with all equipment, allowing for that which will emerge in the future. Additionally, smaller items at the home will be tagged so that it becomes easier to find keys, purse, telephone, etc. The living area has also received a Nintendo Wii set to encourage the participants to exercise their physical mobility. Everything in the lab is connected to the computer and the interface can be blown up on the wall for easy viewing via the Wii interface. The Swiss partner

Melex supplied the tags and readers which communicate over Bluetooth and ZigBee; the sensors are based on the 802.15.4 standard. One of the driving forces of this is that the software should not be dependent on specific technologies; rather, the solution must be easy for anyone to use; another is that the middleware must be optimized so that it can be used with any sensors. The sensors will communicate over the Wireless Local Area Network (WLAN) using a standard asset tag, which has a lifespan of four years on a 3V battery, in addition to standard sensors. The main idea is to use the technologies that already exist and improve their worth and application. The laboratory is being used by students who want to explore wireless and sensing technologies and also functions as a demonstration room.

2.2 ISISEMD

Based on the proof of concept developed in the Easy Life Lab, ICT Policy Support Programme ISISEMD (Intelligent System for Independent Living and SElf-care of Seniors with cognitive problems or Mild Dementia) [3] started in March of 2009 and will run until August, 2011. The focus of this project is on ICT for successful aging with cognitive problems, combining assistive and independent living technologies. It involves a system of readers, sensors, wireless transmitters, data receivers, and user interfaces which helped to build the generic platform. The aim of this project is to provide a pilot of innovative, intelligent, scalable services to support the independent living of elderly people, with a particular focus on those with cognitive impairments or mild dementia and supporting the formal and informal caregivers in their daily interaction with the elderly. The services will improve the ability for self-care by supporting basic daily activities in way that prevents health risks and empowers individuals. Furthermore, services are being developed to reinforce interaction within their social spheres and for cognitive stimulation and training. Another major focus of the project is to measure changes in QoL as a result of gerontechnological intervention.

ISISEMD project delivers innovative ICT-based tools for e-inclusion of elderly persons with dementia, who are particularly vulnerable and require specific information about their involvement in the trials as well as human support. Given its scope, successful results in ISISEMD depend on the collection and processing of personal data of the people involved in the pilot service for the accomplishment of the project goals. To make allowance for the potential ethical issues deriving from the collection and processing of personal data, the project partners have agreed on thorough examination of the European and international regulatory frameworks on the protection of personal data, respecting the relevant legislation, established case law, and legal doctrine (Directive 95/46/EC) [4]. This is also assured by the expertise of partners participating (i.e. North Denmark EU-Office, Aalborg University, Frederikshavn Municipality, Belfast Health and Social Care Trust, Trikala, Lappeenranta City), who already comply with these legislation frameworks.

The participants' homes are equipped with RFID readers, and sensors which allow for restless night activity to be identified, for example, for a more holistic overview of typical daily patterns so that deviations can be assessed in their relation to the individual disease process. The pilot is being validated and tested in home dwellings for a 12-month period in four Member States regions (North Ireland, Denmark, Greece, and Finland). All three target end-user groups of elderly, formal, and informal caregivers will evaluate the services and technology as support interventions, which also helps to address the diverse requirements of end-users and provide insight for better intuitiveness and functionality. The pilot service contains 3 bundles (basic, intermediate, and high level) that allow for adjustments based on the end-user needs, which are expected to change with the progression of their symptoms. By working with medical, social, and technical specialists to identify the needs of patients, relatives, and the healthcare system during the development stages through service management, the goal is to give participants greater freedom to independently carry out their everyday life. ISISEMD has a user-centric focus and offers a range of services that will support the e-Inclusion of elderly people as well as being demand-driven to match the needs of user groups with services.

2.3 LIFE 2.0

LIFE 2.0 is a Policy Support Programme that started November, 2010, and will run 36 months. The project is addressing a crucial social problem in the creation of an economically sustainable model for the assistance of elderly people and for their physical and psychological independence and well-being. It is being designed for older adults to make their own social network more visible and accessible by providing a set of collaborative ICT-based technologies that track and locate the people they distinguish as relevant to them (e.g. relatives, caregivers, walking buddy). This gives them the means to make contact through advanced multimedia content distribution systems. The intention is that this will heighten a sense of safety to elderly people living independently and encourage them to activate the existing resources in the community.

The LIFE 2.0 project will be investigated in four living labs in different geographical, social, and cultural contexts (Denmark, Italy, Finland, and Spain). The living labs will develop a modular platform of services for elderly people based on a tracking system, geographical maps, and social networking applications. During the pilot and prototype phases, the accessibility and use of the service will be offered free to the users. Several companies and local authorities are already using information technologies in other pilot projects or in fully functioning services; the project will provide a platform to support such services, or will add new functionalities to existing services.

The project will be strongly based on users' participation in order to make sure that the proposed services are accessible, transparent, and easily communicated to users. The LIFE 2.0 project aims at exploiting existing technologies or technologies that have moved beyond the final research phase in innovative services and products that support elderly people's independent life.

The specific objectives of the project are to increase the use of ICT among elderly people and their use of social networking applications; allow for personalization of home assistance services; and stimulate business opportunities to promote the Information Society's inclusion of aging adults. One challenge this project will propose consists of an appropriate mix of personal reassurance about safety and privacy and the disclosure of personal information. Another challenge in this area consists of integrating social networking services into elderly-friendly interfaces to be used in association with a tracking system and mapping services. Furthermore, the use of online social networking services will focus on local contexts, rather than a global one. This means that the services will offer opportunities to emphasize resources, information, people's capabilities, and skills, thus augmenting the potential of a local context at elderly people's disposal.

The project will create an open platform that will support services based on the connection of different technological solutions, including: Tracking devices (e.g. GPS-enabled mobile phones or RFID) that give its owner the possibility to choose whether or not to be visible and to select who can have access to their positioning data; Set-top boxes (e.g. IPTV) in order to support access to the multimedia content; Visualization applications (e.g. IPTV interface, Google maps) that allow for an updated representation of the multimedia information as well as the geographical positioning of different objects and people; and Social networking applications connected to both the tracking system and visualization system. The services supported by the LIFE 2.0 platform include services that require *dynamic* real-time update of geographical positioning data and services that provide a *static* view of the geographical positioning information. During and after the pilot phase, the LIFE 2.0 ecosystem will enable the combination of the two typologies. Given the existence of large technological requirements for the service, the living labs are expected to develop innovative services up to the level of a *beta version*, which will be used in local contexts for limited groups.

Local Exchange Trade System (LETS) is a **social networking service** in a diffused form of exchanging individual competences among a community. The LIFE 2.0 platform will support elderly people to offer and receive services from peers and neighbors, such as cooking and shopping for others, carpooling, community teaching (e.g. knitting, language), and receiving and delivering parcels (e.g. medications, library books). The LETS system will allow the elderly user to announce the availability of the services and the older adults who want to utilize this service can visualize the location through their ICT device and geographical positioning data that are searchable and updated in real time. Social assistants, caregivers, and any other service provider that will provide support and services to elderly people in the local Smart City can use the LIFE 2.0 services. When elderly people will authorize it, their service providers will be able to access data on geographical location, monitor activity, and possibly provide prompt

assistance when required. Elderly people using the services will also be able to order or subscribe to products and services offered by local service providers.

Personalized restaurant/shopping services are an example of **local market-based services** the LIFE 2.0 platform can provide through access to local restaurants and cafés. The elderly person could check the menu posted online, the location, and the possibility to pick up the meal or have it delivered by someone. Another example of locally-based services is public event organization. The LIFE 2.0 platform can provide information about training courses, concerts, shows, gatherings, and cultural events that are relevant for older adults.

The platform developed in this project will achieve:

- The introduction of advanced ICT products and infrastructure in elderly people's home without requiring specific learning processes
- A strong visual connection between elderly people's private home and their local communities using advanced technologies in an elderly-friendly way
- A support for services with different levels of complexity, including:
  o Functional level (geographical positioning, monitoring)
  o Social level (open health services, networking services)
  o Market-based services (content provided by external actors)

3. DISTINGUISHING INNOVATIVE ASPECTS

It is worth noticing that in the last few years, several projects have been funded and developed that concern the potential of gerontechnology. Many projects focus on home assistance, thus providing technologies that facilitate senior's control of their home environment or remote monitoring of health status. Other projects, including several projects funded under the Ambient Assisted Living (AAL) program [5], were considering elderly people's social life as an outcome of the effect of the introduction of ICT. The new services we aim to offer will give a new perspective to improve social communication, access to public and private services, healthcare assistance, and QoL of aging people living independently. Prototypes and simulations will be used to understand to what extent these technologies are challenging elderly people's existing knowledge and learning capabilities The new approach, based on an open networked circulation of information, is not new in other scientific areas [6][7], in technological innovation [8][9], and even in public services [10][11]. The early applications of this approach demonstrate its potential to provide solutions that are economically sustainable and highly tailored to individual needs of citizens in local contexts. However, LIFE 2.0 will be the first to consider this approach in conjunction with the use of advanced ICT applications.

3.1 Comparison with Similar Solutions

CogKnow [12] aims to develop and prototype a cognitive prosthetic device to help those struggling with dementia to perform their daily activities. ICTs are linked via a screen to remind users to carry out regular tasks such as making a meal, locking doors, or telephoning friends and relatives. Alarms sound if, for example, windows are left open or other dangers present themselves around the house. The system is flexible and can be tailored to meet the needs of individual users. **ISISEMD** is similar in technology (i.e. reminder via screen, alarms), but does not view services as a prosthetic device, rather as assisting technologies to support independence and self-care.

Elder Games [13] are therapeutic, Information Society Technologies-based games for monitoring and improving the QoL of elderly people. It consists of interactive computer games specifically to improve cognitive skills and to monitor cognitive health and welfare issues for early detection of cognitive diseases or problems related to social integration and well-being. **EASY LIFE LAB** incorporated cognitive stimulation as well as psycho-motor stimulation activities into the prototype. **ISISEMD** is also incorporating Brain Games as an optional service for end users. These consist of puzzles, word finds, and similar logical and visuo-spatial stimulation. Also available to all end users in the project is the cognitive reminiscence service in the form of a photo album displayed on the touch screen GUI.

Hermes [14] proposes an integrated approach to cognitive care through an assistive technology (AT) that combines the functional skills of the older person to reduce age-related decline of cognitive capabilities. Based on intelligent audio and visual processing and reasoning, the project results in a combination of home-based and mobile devices to support the user's present cognitive state and prevent cognitive decline. As mentioned earlier in relevance to Elder Games, both **EASY LIFE LAB** and **ISISEMD** have incorporated cognitive stimulation activities in their design. Hermes is taking a more focused approach in this area of gerontechnology by keeping their concentration on strengthening and maintaining cognitive capabilities.

SHARE-IT [15] means Supported Human Autonomy for Recovery and Enhancement of cognitive and motor abilities using Information Technologies, and this project is developing adaptive 'add-ons' which can allow ATs to be integrated for the home. **ISISEMD** is also working with existing technologies and Plug and Play type services which promote aging people to live independently in their own homes for longer; however, the scope of ISISEMD is larger than for AT integration, as a major objective is also to evaluate technology and services against their intended goals.

Mpower [16], Middleware platform for empowering cognitive disabled elderly people, project aims to devise ways to simplify and speed up the development and use of support services for helping older people and those with cognitive disabilities live full and active lives. In particular, the project will support the use of Smart Home technology and look into ways of making information management systems safe and secure. In a way, one could view **EASY LIFE LAB** and **ISISEMD** as responses to Mpower's aims, by also focusing on Smart Home technologies for home management and ATs for lifestyle management.

Netcarity [17] is a networked multi-sensor system for elderly people and is investigating how new and existing technologies can be integrated, cost-effectively, into people's homes by developing and testing new technology, including systems to enhance communication with friends, family, and carers. Both Netcarity and **ISISEMD** aim to support day-to-day living and promote a sense of social inclusion and both are exploring implications for caregivers; however, ISISEMD is focusing on a disadvantaged user group and is not so interested in integrating multiple technologies per se, but integrating functional services through technology.

AALIANCE [18], the European Ambient Assisted Living Innovation Alliance, is investigating solutions based on advanced ICT technologies for the areas of aging at work, at home, and in society. The aim of the project is to provide a framework for stakeholders to define strategic research and development priorities for AAL and to provide a roadmap to ensure adequate focus of the research funding. It could very well be that the results derived from Alliance impact **ISISEMD** and **LIFE 2.0**, as the motivation for this research is more applicable to policy, funding, and research development.

Persona [19], Perceptive spaces promoting independent aging, aims to harmonize Ambient Assisted Living Technologies in a bid to develop sustainable and affordable services that will support the social inclusion of older people, while allowing them to live independently for longer. In its search for easy-to-use, integrated technologies, Persona's technology platform will harness and assess a range of ICTs, including smart textiles, tele-services, bio-sensors, display devices, and intelligent software tools. Persona and **ISISEMD** have similarities in goals, but ISISEMD is focusing on older adults with cognitive maladies as the target population and, additionally, is not incorporating smart textiles or bio-sensors into the design. **LIFE 2.0** is targeted towards older adults in general, and also addresses social inclusion, but is not integrating textiles or bio-sensors in their aim to increase access to community and social services.

OASIS [20], the Open Architecture for Accessible Services Integration and Standardization project, aims to revolutionize the interoperability, quality, breadth, and usability of services for daily activities of the elderly. While OASIS is exploring the considerable implications of services for daily activities, **ISISEMD** is incorporating specific services directed towards enhancing the aspect of carrying out these activities independently, by empowering the end user with information and support.

Dfa@eInclusion [21], Design for all for e-Inclusion, project fosters the *design for all* approach which encourages engineers and developers to consider the needs of all potential users when they create new ICTs. Similarly, **DIADEM** [22], Delivering Inclusive Access for Disabled or Elderly Members of the Community, aims to develop an adaptable web browser interface for people with reduced cognitive skill to help elderly and disabled internet users to remain active and independent for longer. Likewise, important design considerations are being made in all three AAU projects towards incorporating specific, sensitive user requirements into the engineering of the systems and services.

Vital [23] aims to develop technologies, applications, and platforms that will provide remote assistance products for older people, such as computing on the move, location sensing, natural speech processing, digital TV and video, and mobile telephony. When compared to **LIFE 2.0**, we see that, in Vital, new technologies are being developed, whereas LIFE 2.0 is employing existing technologies; furthermore, the aim is more on remote access rather than remote assistance. However, both projects allow access to assistance, information, education, and entertainment both inside and outside the home environment.

Easy Line+ [24]: Low-cost, advanced white goods (e.g. washing machines, dishwashers, refrigerators) that will help older people live independently longer. The project examines the use of sensors, neural networks, and assistive software to produce control systems for white goods that older people will find easy to use. Relatedly, **i2Home** [25] project aims for intuitive interaction with home appliances based on industry standards by making it easier for older adults to use electronic consumer goods. The project seeks to develop a universal remote console that will allow networked access to everyday appliances in the home. **EASY LIFE LAB** has incorporated similar aspects into the networking design, based on hypothetical situations of monitoring home equipment, energy usage, and appliance use. **ISISEMD** also uses sensing equipment to monitor utilization of home equipment, including stove, electricity, and water use. Both EASY LIFE LAB and ISISEMD developed a type of universal console (touch-screen interface for older adults), which has the potential to monitor a number of activities within and close to the older adults' home as well as to help locate items within the networked area.

ICT for ALL [26] project examines the social impact of ICTs and gauges how they are used by excluded communities with the aim to measure the extent to which these groups find it difficult to access ICTs, and to come up with potential solutions. **LIFE 2.0** will be applying social inclusion (i.e. social networking, multimedia communications, and locating services) solutions and measuring their use and impact on QoL.

As exemplified in the research endeavours described above, several technologies are emerging to support elderly people's independent lifestyle. Furthermore, some initiatives are emerging to integrate such technologies into more complex solutions concerning remote monitoring, communication, and health. Despite differing methodologies and research objectives, all projects are accentuating the need for design considerations involving this increasing consumer group.

3.2 Added Value

ISISEMD and LIFE 2.0 will add value to local communities by generating an ecosystem in which social links and services will be easier and more accessible, thus improving the quality of existing institutional and informal support to

elderly people. LIFE 2.0 further allows elderly people to be able to exchange information with peers and to locate services or any kind of information they may desire in the community. The added value for elderly people will consist in the possibility to visualize their network in an easy way, thus increasing their confidence in independent living and reducing their sense of isolation. For relatives, the service consists of having a discrete, yet effective tool to check that their elderly relatives are in good condition, know that they have access to help services, and could be located in an emergency. The innovative aspects of the LIFE 2.0 project, in comparison with previous projects, is that the social component of elderly people's life is considered as a foundation of the project, and the integration of existing geographical positioning, technologies, and social network applications into a platform that is specifically developed for and in collaboration with elderly people. The aforementioned innovations add value to the services that people receive through relevant domestics solutions:

- User-centric approach for controlling devices and services
- Easily, transparent, and comprehensive interaction with the platform
- Feeling of safety inside and outside their own home
- Feeling of satisfaction from the supported ability to care for themselves
- Ability to live a longer time independently and in their own home
- Enhanced social interaction opportunities through inclusive design
- Particular focus on ICT influences in QoL

3.3 Cooperation with relevant EU projects

The LIFE 2.0 project will directly cooperate with the projects in the Smart Cities working group portfolio [27], as the focus of LIFE 2.0 is on services that use innovative IT applications to improve the quality of urban communities. In discussion with project coordinators, LIFE 2.0 will pay attention to results gained in Persona project [19] as they take AAL technologies and concepts and develop them into sustainable and affordable solutions for the social inclusion and independent living of senior citizens. Soprano [28], Service-oriented programmable smart environments for older Europeans, is committed to designing and developing innovative ICT-based services that have interfaces which older people will feel comfortable using. The aim is to meet the needs not just of older users, but also of their families and care providers. The Soprano system will integrate ATs designed for older people with Smart Home technology and telecare services with 600 older adults testing the system, the results of which could benefit both ISISEMD and LIFE 2.0.

LIFE 2.0 will use some of the deliverables of the Bridging Research in Aging and ICT Development (BRAID) [29] and Self Orchestrated Communities Ambient Intelligent Space (SOCIETES) [30] projects as support in some of the work packages. Another opportunity to which the LIFE 2.0 project will link will be the "eHealth at ePractice," a medium on practices of eGovernment, eInclusion, and eHealth [31]. In this forum, case studies, insights, expert opinions, and lessons learned are shared among eGovernment, eInclusion, and eHealth practitioners. This forum may represent a bridge between the LIFE 2.0 and other eHealth initiatives, also in the medical area and in the area of public services that are not the focus of LIFE 2.0 but are expected to benefit from it.

At the 3rd International Symposium on Applied Sciences in Biomedical and Communication Technologies (ISABEL) [32] in November of 2010, ISISEMD technical and regional partners held a workshop on ATs for older adults. In total, there were over 250 participants registered for the conference. It also gave the opportunity to highlight how the spectrum of disciplines works together towards the same goals. In addition to presentations by ISISEMD consortia, there were presentations from two other PSP projects, SOCIABLE [33] and LongLastingMemories (LLM) [34], as part of the liaison activities undertaken by ISISEMD. The SOCIABLE consortium also consists of technical partners, domain experts, and regional sites for study. The focus of this project is to incorporate cognitive and social stimulation activities for a target population very similar to ISISEMD. SOCIABLE has developed a set of ICT-supported Cognitive Training Sessions that are performed in a care center with appropriate medical or specialized support from employees. One important distinction is that SOCIABLE is measuring cognitive, functional, affective, and social changes and not the interaction or functionality of the technology used. In addition to assessing how the older adult finds the services and technology, ISISEMD is also evaluating the project from the secondary end users' point of view. This includes measuring caregiving stress and QoL in the informal caregivers, as well as satisfaction and acceptance for both formal and informal caregivers, and results in the transfer of caregiving responsibilities.

LLM aimed at integrating services for seniors by combining cognitive and physical training with fall detection. As a goal similar to ours, the idea is to promote older adults living healthy and independently in the community through ICT innovation. LLM offers support to the elderly and their families through daily activities monitoring, promoting independent functionality, increased communication, increasing self-esteem, and alleviating symptoms of early cognitive decline. The goal is to strengthen life skills, force engagement, reward new functions, and decrease loneliness in end users. The project services consist of three components: physical exercise, cognitive exercise, and independent living. Also discussed were successes and barriers in implementation, platform components, next steps, and evaluation and assessment strategies. As new developments give rise to new products and solutions, many telehealth projects are focusing on increased modularity, scalability, and interoperability. For LLM, their technical components are interoperable as long as they "speak" the language of LLMWSDL/XSD. ISISEMD and the Easy Life Lab are also working towards increasing interoperability of our components, so it was fruitful to hear how LLM is handling the issue. Other significant outcomes from the

workshop included taking notice of how formal caregivers are expecting the AT to support their clients, not to cause more interference or stress for them or their family members, and this also influences acceptance and satisfaction, as well as professional work flow and development. By far, the use of AT must cause more benefits than harms, and the professionals having the direct contact with elderly adults and their informal caregivers note that additional stressors caused by installing the system is a very real and important consideration. Also highlighted were examples of promoting independence that the end user reminded us of as the protocol for services had left them out of the chain of command in efforts to have the system as least demanding (i.e. interactive) as possible.

Representatives of all three projects agreed that it would be quite beneficial not only for the people working on such projects, but also for the European Commission, if there could be a gathering of similar research projects to discuss the many barriers that arise as well as newly developed trade knowledge to overcome such obstacles. As of January 2011, ISISEM, SOCIABLE, and LongLastingMemories are the only EC sponsored Policy Support Programme Pilot Type B projects running.

4. DISCUSSION

Gerontechnology has the ability to help older people overcome isolation and loneliness through increase opportunities for keeping in contact with friends, as well as extend social networks. As digitized use of information in business and government administration becomes more wide spread, it is vital that everyone can use technologies to access public and commercial services. However, many older adults are met with arduous barriers in attempting to use ICT products, services, and applications to their full potential.

Social networking online applications aim at building and reflecting social networks or social relations among people who share the same interests, activities, or socio-cultural identity. In the last decades, human beings' capability to create social networks with others in their geographical proximity has been amplified with the use of ICT, which have extended the concept of proximity to cultural or social proximity, thus going beyond issues related to geographical proximity. Although the existence of social networks in general is an important element of elderly people's life, the use of online networking services to support social interaction is not necessarily viewed with enthusiasm by older adults. The lack of personal knowledge about the people contacted online, together with the sense of fragility due to reduced physical capability or lack of skill, understandably make elderly people feel insecure towards a virtual place in which personal information is made largely available.

Tracking technologies have been used in social services and locating systems for dementia patients. Location tracking is not limited to just organizational systems, but also support location-based services, which are able to offer personalized services connected to specific locations. Besides the obvious privacy problems that can arise, the use of this technology can increase a sense of independency, knowing that they can push a button to call for help or to be found by a loved one. The challenge, with respect to existing tracking systems, concerns different issues, including elderly people's familiarity with tracking devices, questions related to privacy, and integration of tracking devices with communication devices in a user-friendly manner. Furthermore, it is essential that any actor in the proposed service can understand the implications of and can choose whether their tracking device can be seen by other people or not, and who has access to their positioning data. The integration of the tracking system with social networking applications is also expected to increase the social interaction of elderly people, thus keeping them more active, and giving them the possibility to make themselves useful for others. This is an essential psychological element to support elderly people's independence.

Although the services will provide indications on how to improve existing technologies for becoming more age-friendly, the most innovative aspects of these projects is not by technological advances, but rather in the integration of existing technologies, applications, and platform and interface development for specific target groups. The knowledge exchange allowed by the introduction of ICT in their life is multidirectional, that includes older adults as a source (as opposed to a target) of information flows. Future requirements for gerontechnology and assistance systems include how to develop tools or enable technologies to be marketable, sustainable, and effective in the long-term, and how to scientifically filter the impact of so many studies in the same field.

5. CONCLUSION

In relation to all of the research efforts described in this paper, whenever identifiable data referring to a person is accumulated, privacy issues arise, and this is a concern for ICT users regardless of their age. In the Information Age, communicating information can be a risk, but at the same time, withholding information can be a disadvantage. The serious issues of risks and benefits can further be confounded when working with vulnerable populations, such as aging adults who may be naïve to Internet scams and those with cognitive impairments that prevent them from fully comprehending their potentially sensitive situations. In ISISEMD and LIFE 2.0, health information, location, and other identifiable data are transferred for the effective functioning of the system. To fully explore privacy, security, and confidentiality issues, both projects benefitted from the input of knowledgeable professionals currently working in these fields. Furthermore, ethical and legal issues were analyzed regarding the target populations, national requirements at the pilot site (regional) end, and from a European Union perspective and applied accordingly.

The European Commission's Information Society offers older people the chance to live independently and continue to enjoy a high Quality of Living. Currently, however, a number of barriers prevent older generations from fully embracing Information and Communication Technologies. This work has described three innovative projects

undertaken in compliance with this EC plan. By making comparisons with related projects, a more complex, yet thorough synopsis of similar gerontechnological research to date is offered.

The potential of ICT to support innovation in this area is immense and several applications and services already exist that can be directly applied to this context; however, services and user interfaces have not been designed for people with low familiarity with computers and decreased functioning capabilities. The major hurdle in this domain is the lack of familiarity of elderly people with such new services and technology, which so far has excluded elderly people from the benefit of an information and communication network. Furthermore, the use of these services and technologies has hardly been considered as a support for public services, even if they are well-known or even popular, thus it is anticipated that better access to ICT in the public sector could broaden innovation chains. The direct participation of the elderly people in the prototype phases of service development is the ground for a user-centric approach. This approach is crucial to capture tacit knowledge (about residual capabilities, creative resources, existing practical knowledge, and social and cultural attitudes) that will increase the possibility that the solution is successful. It is only through the work of multidisciplinary collaboration and incorporating end user corroboration that these and analogous research and development projects can come to fruition.

ACKNOWLEDGEMENT

REFERENCES

[1] Giannakouris, K. "Ageing characterizes the demographic perspectives of the European societies," *Eurostat – Statistics in Focus* (72), 2008, Released 26 August 2008. http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KSSF-08-072/EN/KS-SF-08-072-EN.PDF

[2] Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. *Aging Well in the Information Society – an i2010 Initiative – Action Plan on Information and Communication Technologies and Aging* (SEC, Brussels: Commission of the European Communities, 811, 2007).

[3] ISISEMD Intelligent System for Independent Living and Self-Care of Seniors with Cognitive Problems or Mild Dementia. http://www.isisemd.eu/, 2009-2012.

[4] Data Protection Working Party of Article 29 of Directive 95/46/EC. http://ec.europa.eu/. 11 February 2009.

[5] Ambient Assisted Living. http://www.aal-europe.eu/

[6] Lakhani, K.; von Hippel, E. *How Open Source Software Works: "Free" User-to-User Assistance.* MIT Sloan School of Management Working Paper #4117, 2000.

[7] von Hippel, E. and von Krogh, G. "Open Source Software and the Private-Collective Innovation Model." *Organizational Science 14*(2), 2003; 209-223.

[8] von Hippel, E. *Democratizing Innovation*. (Cambridge, Massachusetts: MIT Press, 2005).

[9] Tapscott, D. and Williams, A.D. *Wikinomics, how mass collaboration changes everything.* (London, England: Atlantic Books, 2006).

[10] United Kingdom Prime Minister's Strategy Unit. *Building on progress: Public services.* (London, United Kingdom: Her Majesty's Government Policy Review, 2007).

[11] Leadbeater, C. and Cottam, H. "The User Generated State: Public Services 2.0" in P. Diamond (ed.) *Public Matters: The renewal of the public realm*. (London: Politicos, pp. 95–116, 2007).

[12] CogKnow. http://www.cogknow.eu/

[13] Elder Games. http://www.eldergames.eu/

[14] Hermes. http://www.fp7-hermes.eu

[15] SHARE-IT: Supported Human Autonomy for Recovery and Enhancement of cognitive and motor abilities using Information Technologies. http://www.ist-shareit.eu

[16] Mpower: Middleware platform for empowering cognitive disabled and elderly people. http://www.sintef.no/mpower

[17] Netcarity: a Networked multi-sensor system for elderly people – health care, safety and security in the home environment. http://www.netcarity.org/

[18] AALIANCE: European Ambient Assisted Living Innovation Alliance. http://www.aaliance.eu

[19] Persona Perceptive spaces promoting independent aging. http://www.aal-persona.org/

[20] OASIS: Open Architecture for Accessible Services Integration and Standardization. http://server-5.iti.gr/joomla

[21] Dfa@eInclusion: Design for all for e-Inclusion. http://www.dfaei.org/index.html

[22] DIADEM: Delivering Inclusive Access for Disabled or Elderly Members of the Community. http://www.project-diadem.eu/

[23] Vital. http://www.ist-vital.org/

[24] Easy Line+. http://www.easylineplus.com

[25] i2Home. http://www.i2home.org

[26] ICT for ALL. http://www.ictforall.info/

[27] European Smart Cities. http://www.smart-cities.eu/

[28] Soprano: Service-oriented programmable smart environments for older Europeans. http://www.soprano-ip.org

[29] BRAID Bridging Research in Aging and ICT Development. http://www.braidproject.eu/

[30] SOCIETIES Self Orchestrated Communities Ambient Intelligent Space. http://www.ict-societies.eu/

[31] eHealth at ePractice. http://www.epractice.eu/ehealth.

[32] ISABEL 3rd International Symposium on Applied Sciences in Biomedical and Communication Technologies. November 7-10, Rome Italy 2010. http://www.isabelconference.com/.

[33] SOCIABLE, Motivation platform for elderly networking, mental reinforcement, and social interaction. http://www.sociable-project.eu/. 19 August 2009.

[34] LongLastingMemories (LLM). http://www.longlastingmemories.eu/