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Short Version of the first AALIANCE2 Roadmap

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1 Introduction

Population in Europe is rapidly ageing due to the increase in life expectancy (eight year increase) and low birth rate [1]. The growth in the number of elderly people means that also the number of “retirees” will get higher, coming to the point in 2060 where there will be almost one person over 65 every two persons in working age in Europe [1]. This increase is causing a wider request for services and more responsibilities for the society both from an economical and a social point of view.

The growth of retirees will affect the public finances, increasing the costs for the society. Moreover during the last years the European Union, as well as other countries worldwide, is facing an economic crisis that is involving all parts of the society. So it is necessary to help people staying healthy and active as much as possible, so to give citizens the possibilities to keep on being involved in the society and working longer.

In order to face with the actual socioeconomic context a new approach is necessary and in this background the Ambient Assisted Living (AAL) model is getting a foothold. In the last years in fact new services, called AAL services, have been developed and their main characteristic is the use of ICT technological solutions. According to this vision, AAL could support elderly people in staying independent and active and help them having more years of healthy life. Technologies could indeed monitor their health, assist them in executing daily life activities and support them in maintaining social contacts and being involved in the community life. The current studies carried out in AAL show the great potentialities and the possible benefits of AAL in the society, however there are still both technological, social and political barriers that slow down and delay the exploitation of AAL in the real communities. For this reason the European Community is financing the AALIANCE2 project aiming at identifying challenges and research priorities in the AAL field for the next decades that could allow and facilitate the AAL exploitation and deployment of the actual services. This document shows the preliminary results of AAL Roadmap developed till now in the context of AALIANCE2 project.

2 AALIANCE2 and methods

AALIANCE2 Project is a coordination action funded by the European Commission's within the ICT Programme of the 7th European Framework Programme. One of the main objectives of AALIANCE2 is the identification of the research priorities in AAL and the development of the AAL Roadmap and Strategic Research Agenda for the upcoming decades. Furthermore the aim of the AALIANCE2 Project is to study and investigate the technological innovations needed in the next years for the real deployment and exploitation of AAL services in the society.

The AAL Roadmap and the Strategic Research Agenda written during the Project will introduce new possible and necessary AAL scenarios and their relative technologies that should be developed for providing these new services for elderly persons and their caregivers, both formal and informal. This last aspect, the necessities of caregivers, is really important and should be evaluated and considered in the same manner as the needs of old persons.

The workflow followed during the elaboration of the roadmap is shown in Figure 1.



Figure 1. Stream used in the development of the Roadmap and the SRA

The first phase was devoted to the identification of actual necessities of senior persons and caregivers. Starting from this information new scenarios of AAL services, effective for satisfying real user needs, were conceived. Finally the innovations and the challenges for the five enabling technologies (acting, reasoning, sensing, communication and interacting), necessary for developing the new AAL service scenarios, were studied and presented. In the following paragraphs the main results of these three work stages, reported in the first preliminary version of the AAL Roadmap, are briefly presented.

2.1 User needs

The AAL Stakeholders were identified and divided in four groups that are:

- Primary Stakeholders: which includes users and caregivers;
- Secondary Stakeholders: which includes organisations offering services;
- Tertiary Stakeholders: which includes organisations supplying goods and services;
- Quaternary Stakeholders that are organisations analysing the economical and legal context of AAL.

The identification of the stakeholder needs was the first step of the work and is necessary in order to conceive new service scenarios that are really implementable and effective in the society. The needs were identified starting from the experience of some partners and from an analysis of the state of the art. Moreover some questionnaire were made to different stakeholders in order to understand the real needs and in this way find suitable solution for all the stakeholders. Interest of the AALIANCE2 Project was also the AAL market that was considered in the analysis of solutions to be provided to the different stakeholders. As a matter of fact it is important to suggest solutions that can be then commercialized, so that new solutions don't remain a pure research product.

Analysing the elderly persons point of view, it emerged that they want to maintain their independency, autonomy and dignity without, however, being excluded and uncared-for from the society. They want to remain at their own place, but at the same time they want to feel safe there, meaning that if something happen to them they can easily get in contact with someone that can help them or receive the help directly from the "environment". Moreover old persons are at high risk to be isolated, due to their health weakening and due also to territorial causes. As a matter of fact, Europe presents a variegated territory made of metropolitan district and wide rural areas. These geographical differences influence the access to services and could then increase the isolation, due to the difficulty in moving for different kilometres.

Furthermore the economic crisis influences elderly population increasing the risk of poverty and social exclusion, as shown in the Eurostat studies [2], which could then worsen their health and quality of life [3].

The AAL approach could help elderly people in staying healthy as long as possible, allowing them to keep on living their own life and helping them to be mainly involved in the society and keep on working when they like to. As a matter of fact elderly subjects feel to be citizens that could be still useful for the society so they would like to be more included and involved in the community life. This need is important not only for them but also for the same society that could still benefit from their experiences and capabilities.

Moreover AAL could help also informal caregivers in managing elderly people, reducing the stress and also the amount of work related to that. AAL devices would allow informal caregivers to monitor elderly and always being in contact with people that could support them in making decisions and in evaluating the best behaviour to adopt. This kind of help could be useful also for formal caregivers. Often formal caregivers spend just a little time with the person they take care of because they have to follow several people. If AAL devices could help them monitoring or doing some of the work they have to, they could spend more time with the elderly people and this would also be a valuable time.

Analysing the needs of all stakeholders, it has to be considered also the fact that the economic crisis is influencing different countries, meaning that some of them are making cuts to services and in particular to healthcare services, reducing the services that are covered by the state or reducing the group of persons covered by the state. New solutions that could reduce the costs for the state should be found, e.g. to reduce hospitalization.

2.2 Service Scenario

The scenarios described in the actual version of AALIANCE2 Roadmap are identified on the base of three main aspects that help to guarantee independent living and active and healthy ageing:

- Prevention that is the action to reduce or eliminate the onset, causes, complications or recurrence of disease;
- Compensation and Support that concerns elderly people with physical or cognitive impairments that need help in their daily activities;
- Independent and Active Ageing that aims to extend healthy life expectancy and Quality of Life for all people as they age, including those who are frail, disabled and in need of care

These macro-areas are at the same time complementary and overlapping, as shown in Figure 2.

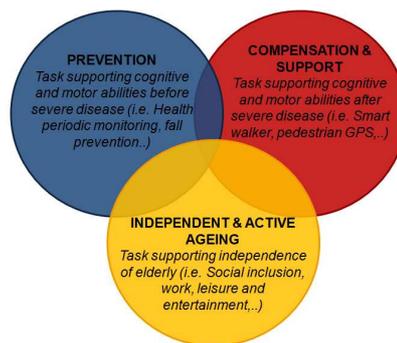


Figure 2. The AALIANCE2 macro-areas: Prevention, Compensation and Support, and Independent and Active Ageing

Moreover these aspects are strongly related to the Quality of Life of senior citizens. Five themes are important for the perceived Quality of Life, i.e. (physical) health, (psychosocial) welfare, social contacts, activities and living environment. The way in which each of them influences the Quality of Life depends on personal experiences and life [4,5]. Based on these considerations, the three AALIANCE2 macro-areas include those innovative services that could positively influence the Quality of Life of elderly people. As a matter of fact, by helping people staying healthier and more independent, their Quality of Life could be improved, allowing them to feel better during their everyday life. Figure 3 shows how the Quality of life of elderly people could be influenced by Prevention, Compensation and Support and Independent and Active Ageing.

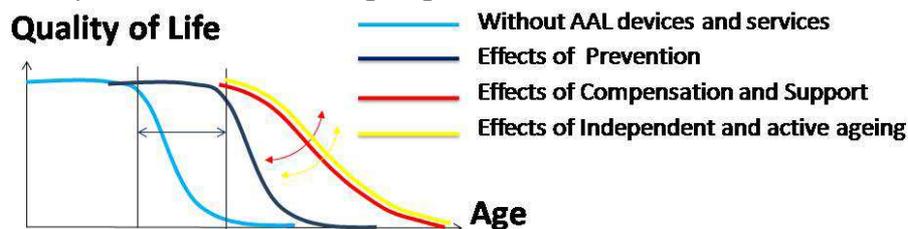


Figure3. Possible effects on Quality of Life

In particular, the light blue line of Figure 3 represents the Quality of Life of a person, that is not provided with any AAL technologies and services. It would decrease after a certain age, due to disabilities and morbidity related to age. This line would decrease later (dark blue curve) if people perform a series of prevention actions that help delaying or managing diseases, in order to reduce or eliminate the morbidity. When, coupled to prevention, compensation and support actions are made, the line could decrease even slower (red curve). As a matter of fact, ICT could help patients doing desired activities, making them perceiving a higher Quality of Life. Eventually, maintaining independency and remaining active, keeping on living their own life, increase the perceived Quality of Life (yellow curve). During different Workshops, several service scenarios were identified, describing possible ICT and robotic solutions that could help elderly people in their daily life.

Some examples of scenarios are briefly listed as follows:

- *Healthy living*: intelligent kitchen suggesting nice recipes for cooking healthy food, also considering what is going to expire soon in the fridge;
- *Falls*: advanced environmental and wearable sensors linked to intelligent systems, could prevent possible falls during daily activities;
- *Prevention for health*: motor and cognitive games carried out with smart tools to maintain elderly active and healthy, to make some rehabilitation and preventing cognitive diseases;
- *Senior citizens at work*: considering the actual socioeconomic context it is important to help people to keep on working longer and this can be done by supporting them in learning new skills and also in doing their daily work thanks to smart tools;
- *Support in driving*: smart car providing more information about the traffic and the street status and helping elderly to drive safely;
- *Sensing the emotion*: by understanding the emotion formal and informal caregivers could better understand how the elderly people feel and how to help them;
- *Assistance at home*: robotic assistant that helps older persons to carry out the most complex and dangerous activities of daily life for caring him/her and the house;
- *Keeping social contacts*: ageing friendly environment that make easier access to services, so to make people more involved in the society. Moreover radio and television can be used to make people interact with others, to create like chat-rooms also with topic channel.

2.3 Enabling Technologies

Starting from the scenarios, some technological components and innovation necessary for the development of these services were identified. AAL systems are typically comprised of sensors, components that process the sensor data and derive conclusions, human-machine interface components and actors that execute all the actions. Finally all these components have to communicate with each other. The enabling technologies were then grouped in:

- Sensing
- Reasoning
- Acting
- Interacting
- Communicating.

Sensors are necessary in AAL systems in order to perceive what is happening. New sensors need to be developed, in order to develop new technologies that could improve elderly people and caregivers' life. New environmental sensors should be developed in order to reduce their impact in people life. Further from vision sensors also acoustic and smell sensors should be developed. These kind of sensors in fact could help informal and formal caregivers to take care of elderly people by adding to the vision system also other devices

that could help them to understand what is going on. Moreover it is important to improve the personal sensors, increasing the acceptability and reducing the invasiveness. That means that new wearable and implantable sensors should be developed and all these new sensors should be developed taking in account the challenge of the power management and energy harvesting.

In order to face the great amount of data coming from the sensors, it is necessary to have good communication networks (both wired and wireless) and communication protocols. It is thus necessary to have communication standards and interoperability between systems and components. Main development has to be made in the field of body area or personal area network, local area or home network and wide area network, in order to make always more systems and components communicate between each others. Cloud computing should be further investigated to manage data and make all the devices collaborating together, coming then to the cloud robotics where different agents are integrated together to improve the collaboration and provide then useful and high quality services to citizens. Into this network of devices that can be useful for elderly people also robots have to be considered. Wearable robots and service robots could support elderly people in their life, helping them feeling more independent and safe.

If all these AAL systems will be part of the everyday life, it is important that people can interact easily with them. Effort have to be made to make this interaction "friendly" and usable to let the users being encouraged in using AAL systems. New interaction system should be then be developed based for example on spatial interfaces, such as 3D movement-tracker or gesture-based interaction, or on sensorial interfaces.

Finally people should feel safe with the new AAL systems, considering them as an advantages not as an additional problem or cause of stress. For this reason systems should be dependable and they should also be able to manage automatically possible system failure, so to prevent damage or help the user to manage it. New challenges in the process systems are also the capability to recognize emergency situations as well as user habits, so to identify uncommon situations. Moreover, the systems could be able to learn from the users' habits, so to change with them and stay updated with the user needs.

Eventually it is important to make people feel comfortable with the technologies. The acceptability is fundamental to make elderly persons really using the new devices and make them feeling the system like part of their home or themselves. In this way the new technologies can also find a place in the market and be really commercialized.

In the end it is important to underline that technology should be an "enabler", that means that technology should be something that helps elderly people feeling better and help formal and informal caregivers in their work, but it is still necessary for older people to have real contact with other persons. AAL systems should thus help to do all the things that can take away time for spending valuable time that familiars and caregivers spend with elderly persons.

3 Conclusion

The AAL Roadmap, developed in the first period of the AALIANCE2 Project, aims therefore at finding new suitable service and technological solutions in the AAL field, starting from the user needs, that will allow old persons to remain healthy and active as much as possible. In this way senior citizens can be involved in the society, keeping on being part of it and working as long as they want. Moreover, one of the objectives of this document is the identification of challenges both for the AAL research and industry for next years.

The Roadmap and the Strategic Research Agenda will be updated during the last months of the Project, in order to refine the contents considering new technologies and also the feedback coming from the different experts and stakeholders.

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