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TOWARDS A HUMAN CENTERED PERSPECTIVE ON AMBIENT ASSISTED LIVING

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Abstract: While reviewing some of the 150 projects that received funding under the AAL-Joint Programme, it becomes obvious that most of them exhibit several major drawbacks. Among these, the most important is the excessive focus on technology. Many of the proposed solutions still follow the design pattern of the feeding machine presented in the famous Charlie Chaplin's movie "Modern Times", by treating the assisted person as an object. The research described in this paper aims to outline a different approach on the implementation of the AAL systems, by focusing on a neglected resource, which is the assisted persons themselves. We explore two possible solutions aimed to facilitate the participation of the assisted persons in the process of caregiving. First, in an "asynchronous" scheme, we consider the possibility that careseekers may act as caregivers at distinct time moments. Second, in a "synchronous" perspective, the assisted persons actually provide some sort of assistance to other people in need, either by sharing information about their activity patterns, or by participating in technology mediated social interactions similar to those established in therapy groups.

Keywords: Ambient Intelligence, Ambient Assisted Living, Smart Environment, Activity recognition

1. INTRODUCTION. CONTEXT OF THE RESEARCH AND PROBLEM FORMULATION

According to the European Commission 2015 Ageing Report (European Commission, 2014), one third of the EU population will be over 65 by 2060. The same report notes that the proportion between working people and "inactive others" will drop from 4 to 1 in 2015 to 2 to 1 in 2060.

Public spending with the ageing population already accounts for 25% of the GDP, and it is expected to grow by 4% of the GDP until 2060 (EUR 26426 EN).

An alarming proportion of these people (40% of the women, and 19% of men in the U.S.) "live alone and do not have anyone in the home to assist with activities of daily living, provide care when they are sick, or to assist with home maintenance" (Jacobsen et al., 2011).

An aggravating factor is that age related impairments are quite common among the elderly: the number of people in need of long term

care (LTC) is expected to raise from 68 million in 2005 to 84 million in 2020. This will create about 2 million job vacancies in health and social services by 2020.

Job creation may seem an opportunity for economic growth (Cutler et al, 1990), but it is unlikely that an increased demand of wheelchairs, crutches, and Altzheimer medication is enough to promote large scale economic growth, and to justify the optimism of the theorists of the "silver economy" (Kohlbacher & Herstatt, 2008).

Along with the demographic decline (Muenz, 2007), the ageing of the population is a major social and economic challenge, which should be addressed from a multidimensional perspective. Simplistic solutions, like encouraging the migration of people from outside Europe, don't seem to work (Herrchen, 2016).

Therefore, new concepts and strategies were proposed. The first document of the European Commission discussing the concept of "active ageing" dates back in 1999 (Commission of the European Communities, 1999). After this date, active ageing has become a common theme of the EU/EC discourse, with policies focusing on lifelong learning, encouraging later retirement, and promoting engagement in health sustaining activities (Commission of the European Communities, 2002).

Under the Seventh Research Framework Programme and its successor, Horizon 2020, the European Commission provided funding for research targeting the development of ICT systems that support independent daily living of people having limited capacity to take care of themselves autonomously. Such systems are called "Ambient Assisted Living (AAL) Systems", and are a particular class of Ambient Intelligence (AmI) systems (Sadri, 2011).

For example, the EU AAL Joint Programme (AAL-JP) funded over 150 projects (AAL-JP, 2015) with over 700 million EUROs in a 5-year period alone.

Since 2011, The Commission created the European Innovation Partnership on Active and Healthy Ageing (http://ec.europa.eu/research/innovation-union/index_en.cfm?section=active-healthy-ageing), with a focus on integrated care, fall prevention and detection, medication adherence, and age friendly home and work environments.

Of course, the interest for AAL is not limited to Europe. Researchers in the U.S.A. and Japan also proposed many interesting contributions in this area. Good surveys of the existing solutions in AAL are available for example in Rashidi & Mihailidis (2013), and Memon et al (2014).

While reviewing some these solutions, it becomes obvious that most of them exhibit at least one of the following important drawbacks:

- they are focused on technology. Many of the proposed solutions still follow the design approach of the feeding machine presented in the famous movie Modern Times of Charlie Chaplin by treating the assisted person as an object;
- they are complex and expensive;
- rather than trying to involve more people in the lives of the assisted persons, they try to replace people with certain specially designed machines;
- they neglect an important resource, which is the assisted persons themselves.
- they neglect the positive, possibly healing, outcomes for assisting persons as a result of their involvement in a greater support scheme.

Therefore, from the scientific perspective, the general objective of the research described in this paper is to outline a solution capable to overcome all of the above listed drawbacks.

2. A POSSIBLE SOLUTION

Basically, the current approach on AAL has the structure presented in figure 1, and may be described by the following "equation":

AAL System = Assisted persons + Assistive technology

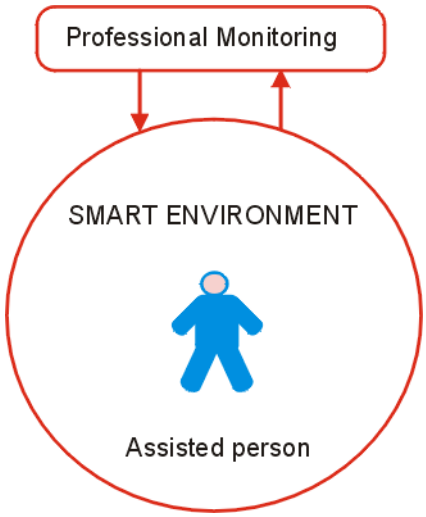

Fig.1. The structure of a "classic" AAL system

The typical functions assigned to the smart environments are (Rashidi & Mihailidis, 2011): cognitive orthotics, health monitoring, and

emergency detection. The actual technical solutions to perform these functions include wearable sensors, PIR motion detectors, RFID and many others (Memon et al, 2014 and Susnea, 2012a).

We propose a system with the structure shown in fihure 2, where:

AAL System = Assisted persons + ICT + Other people

The obvious question is*: "What other people?"*. As the statistics presented above clearly show, caregivers are a scarce resource, so the only feasible solution appears to rely on other assited persons as providers of assistance:

AAL System = Assisted persons + ICT + Other assisted persons

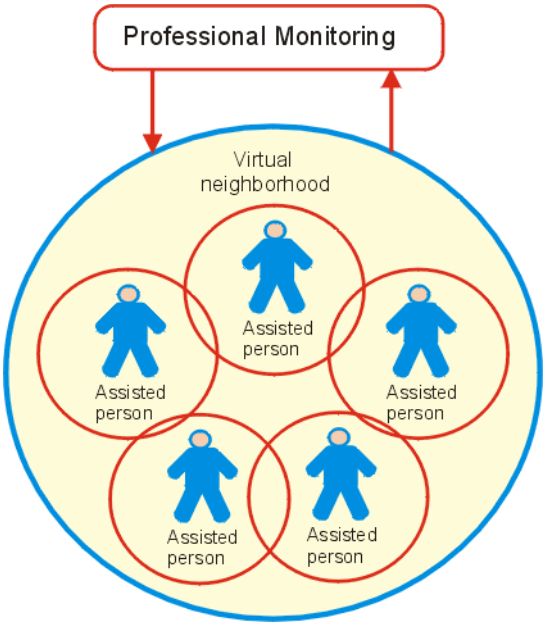

Fig.2. The structure of the proposed human centered AAL system

So, the core research question of our study can be formulated like this: *"Define the structure of the ICT systems capable to allow people in need of assistance to effectively help other similar people."*

In our opinion, there are two possible approaches to solve the above formulated problem:

First, in an "asynchronous" scheme, we consider the possibility that careseekers may act as caregivers at distinct time moments (See Susnea, 2012b). For example, a person suffering from a mild, incipient form of a chronic disease is probably aware of the fact that he will need assistance himself within a certain time horizon. In many cases, it is even possible to predict, based on medical and family records, that a certain person has a higher risk of contracting a debilitating disease.

Knowing that one will be entitled to receive care, free of charge, at a later time, if he dedicates some of his time to helping others, will increase the probability that one will be motivated to join a group established according to these rules.

In a typical application scenario based on this approach, a dedicated web platform would allow direct contact between careseekers and volunteer caregivers, and keep track of the activity of the caregivers, so that only the persons having a record of work as caregivers will be entitled to request assistance at a later time.

Second, in a "synchronous" perspective, the assisted persons actually provide some sort of assistance to other people in need. Basically, this can be done in (at least) two ways:

- by sharing information about their activity patterns. This may serve as input data for a system capable to extract "patterns of spatial behaviour" (e.g. persons repeatedly being in certain places, or using certain devices or appliances, at certain time moments) and to integrate this information at the level of the entire group. Such a system could easily detect deviations from the "average routine", and treat these deviations as "attention requests" to be sent to the other members of the group, or to healthcare professionals. In another application scenario, (as demonstrated in one of our preliminary studies – see Susnea, 2016), by deploying devices capable to record certain data about the notion of a group of "agents" in outdoor environments, it is possible to create a network of distributed "patches of knowledge" about the environment, which can be used for orientation by persons with visual or cognitive impairments.

- by participating in technology mediated social interactions similar to those established in therapy groups. This may offer a valuable psychological support and mitigate the feelings of depression and loneliness, which are quite common for assisted persons and for elderly people in general. Noteworthy, this form of support could emotionally and psychologically benefit both the careseekers as well as the caregivers.

It is very likely that further research will identify several other application scenarios for each of the approaches mentioned above, specify the actors and their roles in each case, and describe the

structure of the ICT systems that implement the desired functions.

It is important to note that the solutions outlined in the above paragraphs do not intend to replace the healthcare professionals by ICT systems. It is likely that a fully operational system based on these ideas, would be a combination of solutions based on various approaches, and the supervisory tasks (e.g. defining the composition of the groups, establishing the nature and the levels of the deviations from the routine that would trigger alarms, etc.) will always be reserved to human professionals.

It is expected that the solutions will be massively multidisciplinary, requiring knowledge from various technical domains: embedded systems, wireless sensor networks, web applications, activity recognition, wearable sensors, pervasive computing, the Internet of Things, etc.

3. CONCLUSION

The proposed approach on AAL is entirely novel. Unlike all other similar solutions, we consider a new "resource" (the other assisted persons), and add a new dimension to the problem, by moving the focus from the interaction between an assisted person and a specially designed "smart environment", to a larger environment that hosts a "virtual neighborhood" of people in need of assistance, but still capable to provide some sort of assistance to their peers. Furthermore, engaging assisted persons in a reciprocal scheme is also novel, and at the same time could turn out to be unavoidable in a machine-dominated future of healthcare.

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