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COOPERATIVE INFOTAINMENT SERVICES PLATFORM FOR AMBIENT ASSISTED LIVING

Markus Hager, Mais Hasan, Karsten Renhak, Maik Debes and Jochen Seitz
Department of Communications Networks, Faculty of Electrical Engineering and Information Technology
Ilmenau University of Technology, Germany

ABSTRACT

According to the senescent society, the current demographic trend has a big challenge for development of new and better services for elderly people. Today, elderly people experience better health and sanity than elderly people some years ago. Therefore, there is a need for healthcare, infotainment, e-learning and other services that can satisfy the desires of this group. But the comparison of different learning platforms and currently developed or deployed architectures in this field identifies the absence of the combination between ambient assisted living and e-learning services. Our proposed solution called CrISP-AAL helps to overcome this weakness. It uses the OpenAAL platform and consolidates services for ambient assisted living and e-learning. These services are optimized by exploiting context information obtained from the users. To gather context information, we utilize a network of sensors, which are disseminated through the environment or worn by users. The following paper describes two practical scenarios for using our CrISP-AAL system. It demonstrates that this system can support a humanly responsible and self-contained life for elderly people in a familiar environment and ensures their integration into society.

KEYWORDS

Ambient assisted living; e-learning; infotainment; health care

1. INTRODUCTION

The term "*Ambient Assisted Living*" (AAL) describes methods, concepts, (electronic) systems, products and services which are tailored to unobtrusively support the daily life of (elderly) people. Most AAL systems basically benefit from additional information about the user and his or her environment, which are usually called context information. The combination and analysis of all present context information can thus be used to improve health or social services and even the user's daily life.

Smart home technologies are often utilized to provide AAL services. They are extensively using sensors and actors to realize home automation services. Based on sensor information and predefined rules, specific actions are performed, like e.g. closing windows automatically when the heating is turned on. For a successful deployment and commercialization of an AAL system, the additional values of the whole system and each single service have to be taken into account. Otherwise, users will not accept such new assistance systems, if there is no direct benefit visible. This user centric approach is used in some AAL projects like *Soprano* (Sixsmith et al. 2009) and *Weitblick* (Lutherdt et al. 2009).

The next section will first give an overview of ongoing AAL projects. Thereafter, section 3 derives the main requirements an AAL system has to fulfill, by comparing the investigated projects. Section 4 presents our approach of an AAL system and highlights two application scenarios. Finally, section 5 summarizes the paper and gives an outlook to the next working steps.

2. RELATED WORK –AAL PROJECTS FOR INFOTAINMENT

Research of AAL-related topics has been intensified in the recent years. Thus, to get a complete overview on all the related projects is really a cumbersome task which cannot be presented in a conference paper. Therefore, the scope of the projects must be limited – according to the requirements of the users of AAL

systems. Inquiries and interviews of these users have produced similar results. Within the *Soprano* project (Sixsmith et al. 2009) typical themes of user needs could be defined and should be addressed by the services of an AAL system: social isolation, safety and security, keeping healthy and active, forgetfulness, community participation, care provision and mobility inside and outside the home.

It is our impression that many of these themes require a cooperative AAL infotainment platform. Therefore, we concentrate on infotainment AAL projects. Infotainment is "information-based media content or programming that also includes entertainment content in an effort to enhance popularity with audiences and consumers" (Demers 2005). Since the 1990's, the issue of infotainment and lifelong learning has become increasingly important, especially for the elderly people who represent a growing percentage of today's society. These people want to learn more about everything new in the world particularly with relation to their work. On the other hand, seniors who do not work anymore need to satisfy their social and personal requirements. The old people also want to decide when, where, what, and why they learn, they prefer to learn freely without the need to follow any curriculum.

Which learning opportunities are currently existing for old people? (Kimpeler et al. 2007) have discovered in their study that only a few e-learning products and services exist for the old learners. There are some Internet portals or platforms which support age-related interests like seniority, rights and habitation. However, specific learning or infotainment software for this target group is still the exception and most of these programs are primarily designed to give older people basic media skills. The few institutional e-learning programs all have project or experimental character.

Current e-learning modules for seniors take their social and personal needs into account, like health knowledge, travel tips, literature, social connections and everything that relates to their hobbies. Here are some practice examples from European countries:

- *Seniorweb* (http://www.seniorweb.ch)

Seniorweb is the trilingual (French, German, Italian) interactive Internet platform for the generation 50plus in Switzerland. This Internet platform has been existing for over 10 years in the market and has many service and edutainment offers for its users. It supports many services like blogs, chat, club calendar, forums etc. The user can inform about health, life, education, work, society, ambience and other categories which the platform supports.

- *Senioren lernen online* (http://www.senioren-lernen-online.de)

This is a project consisting of seniors who volunteer their time to help other seniors to take advantage of lifelong learning using the Internet and various special synchronous and asynchronous platforms. The Internet portal offers courses, workshops, regular's table and also single coaching. The content depends on Web 2.0 and the demand of participants.

- *SeniorLearning* (http://www.seniorlearning.eu)

This senior-learning platform offers courses to learn how to use popular communications tools such as email, chat and forums. It also presents some courses for book lovers to learn how to access online newspapers, e-books, digital libraries, etc. as well as how to purchase books online (e-shopping). The user should be registered by the administrator to participate in these courses.

- *E-learning for Seniors* (http://www.el-se.org)

This is an Internet portal that offers computer courses for seniors who want to learn more about using the Internet and the computer at home, e.g. using an E-Mail client, doing online banking, how to organize a journey via the Internet or how to use the online phone programs. The participation in these courses is not free. The seniors must pay to get a user name and password; they also get an e-learning CD with course content to be able to repeat the course offline too.

These examples show that the need for infotainment applications for senior citizens is obvious. Nevertheless, these approaches do not take context information into account that helps to judge the interests and the abilities of the user. Therefore, we propose a new approach called CrISP-AAL (**C**oope**r**ative **I**nfotainment **S**ervices **P**latform for **A**mbient **A**ssisted **L**iving).

3. OUR SOLUTION: CRISP-AAL

Before detailing our solution, several basic considerations have to be decided. Firstly, an analysis of different AAL projects shows that there is much ongoing research, but there is no generally accepted standard for

AAL services. Table 1 gives a brief overview of a wide selection of AAL related research projects and commercial products. The table compares the presence of typical assistance system functions (columns) with the listed projects (rows). A "+" or a "-" sign indicates that the feature is available by this project or not. A "u" denotes that the authors of this paper have no explicit information about this specific fact.

Each service could be offered by the assistance system itself or by a third party. In general, the assistance system should act as a brokering service for carefully selected services from known companies. This role could be defined as *service brokering*.

Medical and social services could further be offered by a professional nursing service supported through personal indoor and outdoor activity detection or a GPS assisted emergency call device.

The column *miscellaneous and value added services* represents any service which is adding a subjective or objective value comparing to common services. Such a service could be for example a medically trained call center which has access to (medical) information about the calling user or customer. Based on this information and the trained call center staff, further professional help can be arranged if necessary.

Table 1. Survey of AAL projects.

AAL project	Service brokering	Home automation	Presence scanning	Social network	Medical and social services	Video conference	Misc. and value added services	Context sensitive service offers	Memorization service	Entertainment and activities	E-learning
Sophia	*u*	*u*	*u*	*u*	+	+	+	*u*	*u*	*u*	-
Paul	*u*	+	+	*u*	*u*	*u*	*u*	*u*	*u*	*u*	-
Soprano	*u*	+	*u*	*u*	+	*u*	*u*	+	+	*u*	-
SLiM	*u*	*u*	*u*	*u*	*u*	+	*u*	+	*u*	*u*	-
homebutler	*u*	+	+	+	+	*u*	+	+	*u*	*u*	-
Alter leben	*u*	+	+	u	+	+	+	*u*	+	*u*	-
easyCare	+	*u*	*u*	*u*	+	*u*	*u*	*u*	*u*	*u*	-
MIDIS	+	-	*u*	*u*	*u*	*u*	*u*	*u*	*u*	*u*	-
Weitblick	+	-	-	+	+	-	+	+	+	-	-
CrISP-AAL	+	+	+	+	+	+	+	+	+	+	+

While comparing the content of Table 1, it is obvious that *e-learning* and *entertainment and activities* are only served by the system described and proposed in this paper. According to the authors present information e-learning related aspects or services are not covered by any other known AAL projects.

3.1 Sensors in CrISP-AAL

There are several solutions and systems presenting a way how to monitor the indoor environment or how to get the physiological parameters of a person. For example (Zhengzhong et al. 2009) and (Yamagiwa et al. 2010) present a solution based on a wireless sensor network to collect various attributes of the indoor environment like temperature, humidity ratio, intensity of illumination or the existence of a person. (van de Ven et al. 2009) defines a system for health sign sensing based on a waist-worn device supporting a complete electrocardiography and monitoring for the blood oxygen saturation, body temperature and respiratory rate.

In summary, these works demonstrate that there is the possibility to get sufficient information about the environment and the physiological constitution of a person. The further development will make it possible to integrate the necessary sensors in a simple wristlet in such a way that the user will not be impaired or even notice them. The modular structure of the openAAL platform presented in the next section easily facilitates integrating these different sensors into the whole system.

3.2 The openAAL Platform

A promising technical solution to set up and maintain AAL related scenarios represents the *openAAL* middleware (Wolf et al. 2009). This open source project is a result of the SOPRANO Integrated Project and it is based on the OSGi framework. It can be separated into three functional components, see Figure 1.

Figure 1. The openAAL architecture (Wolf et al. 2010).

Data and information management is done by the *Context Manager*. An ontology-based semantic description is used to provide an abstract representation of all present information and the available hardware components. Therefore, an interpretation of low-level information from sensors (as described in the section before) to abstract context information is required. After this semantic uplifting, abstract information, like person X left the building, can be specified. The *Procedural Manager* is basically implementing business logic through a BPEL-based workflow description language. Here, precise events with certain context conditions execute a course of actions defined by the workflow. Procedural templates can further be used to define generic services of certain knowledge domains. The *Composer* is finally executing the abstract workflow. Hence, a mapping of internal semantic services to external OSGi service bundles is done. (Wolf et al. 2009) explains all components of the middleware in detail.

To use or to extend this middleware a context-aware description and an OSGi interface of sensors and actuators have to be available. The DIANE service description language (Klein 2005) is used to define the corresponding ontologies. To develop a service or workflow, only high-level abstract information have to be used. Technical knowledge about implementation is not necessary at this level. Care service providers, users or relatives are able to control predefined properties of the AAL system without any programming skills.

4. SCENARIOS FOR CRISP-AAL

The CrISP-AAL approach can flexibly integrate different applications to assist elderly persons in their daily life. The main criteria these applications have to fulfill are as follows.

Firstly, these applications should take care of physical exercises for the users. Although it might be cumbersome, especially elderly people have to keep practicing their physical abilities. Otherwise, they are in danger of losing their mobility and independence. However, these exercises need to be closely monitored to not overstrain the users. Secondly, not only physical but also mental exercises are important for the well-being of elderly people. They keep the users interested and train their receptiveness.

For both kinds of exercises, the elderly people must always be in total control of the application. They must not feel urged to exercise, the system rather proposes new exercises and tries to motivate the user.

Furthermore, these proposals must consider the current physical or mental state of the user to achieve best results and the users should always be informed about their performance.

Additionally, the application must take into account multi-users exercises, too. Thus, the problem of isolation that elderly people often experience could be handled. The users can meet like-minded people without having to travel far. Finally, relatives and medical care should have the option to access the training results to deduce information about the physical and mental state of the users – of course respecting the privacy of this information. According to the medical point of view, new exercises can be selected and integrated into the training program.

To motivate our framework, we give two exemplary applications that should be of interest to the target audience. We selected one application that deals with training the physics and the other application is concentrating on the mental abilities of the users. Thus, the first application is taking dancing lessons. Assuming that dancing is a kind of sports which is attractive for all ages, we propose a remote dancing class for ballroom dancing. The second application is a remote language course for either refreshing the knowledge of a certain language or for starting a new one. Using a multimedia stream one can listen to the pronunciation of words, can get information about the grammar or learn special phrases. Obviously, this is also an application suited for single users as well as for groups of users.

4.1 CrISP-AAL Application "Dancing Lessons"

An application allowing the user to learn dancing could be one interesting option for such a system. But there are two main problems which have to be solved.

On the one hand it must be possible to show the user the correct way how to dance. This could be done with the help of a virtual reality system or similar solutions but then expensive hardware and a good technical comprehension would be necessary reducing the acceptance of this application. Therefore, it is advisable to use the already present TV screen or a computer screen to show the user the dancing lesson.

But on the other hand, the more interesting question is how to realize the necessary feedback for the learning application. The main problem for all motion capturing solutions is that they need expensive hardware. Some systems detect motion based on the view of several camera pictures or with only two cameras but then the users have to wear tags on the knees or the arms to detect the position of these body parts. However, the evolution of these hardware system, for example the *Kinect* motion control system, used by the Xbox game console, or the Asus *Wavi Xtion* system, shows that they will be cheaper and easy to use in the near future.

If these problems are solved, the application could be trained by a professional dancer to record the comparable data for the feedback system. To make it as simple as possible to start learning a dance, different levels should be recorded, for example "simple basics", "beginner level", "intermediate level" and so on. To guide the user through the process of learning to dance, the progress of the user is stored in a data base to analyze his last results and to provide him with suggestions for the current training session.

Depending on the available data about the environment such as appointments or other persons in the house, the application could suggest to train a special dance together at an appropriate time and level or to suggest an interruption during the practice if the pulse of the person is too high. The assembly of such different facts is the main advantage of our CrISP system.

4.2 CrISP-AAL Application "Foreign Language Course"

To learn a new or to improve skills in foreign languages is still a popular adult education area and the usage of multimedia tools in this area is widely accepted. Most languages learning courses address at least three essential subjects areas: vocabulary, grammar and conversation. The challenges to realize this application are usually not related to hardware issues. A technical language lessons system could be provided by an ordinary laptop computer with a screen, a keyboard, a speaker, a microphone and optionally a video camera included.

Thus, the quality of the application is depending on software related tasks. To adopt this application to the *openAAL* middleware several low-level information have to be analyzed and combined to abstract high-level information. The *low-level information* could for example consist of the microphone input, speaker outp

ut, keyboard input, video camera input or the background noise. On the other hand, the e-learning application relies on abstract *high-level information* to interact with the users. Such information could be for

example the articulation level, learning progress, or the user motivation. Those high-level information are computed from (multiple) low-level information or internally from the language lessons application.

The final learning system should be capable to offer suitable language lessons according to the users' motivation and their learning history. During the language lesson, the application should even react and interact with the user to modify the level of difficulty or to offer a short break. Participation with other users will also be covered by the learning application. Here a (guided) conversation about certain topics via video chat, like a Skype video call, can improve the learning process.

5. CONCLUSION

In this paper, the CrISP-AAL platform has been introduced which is based on the openAAL framework and combines infotainment services and applications for seniors with context-sensitive processing. According to our investigations, this distinguishes CrISP-AAL from all other platforms and portals currently existing in the AAL sector.

Our next working steps will be to refine our implementation and to test their attractiveness with a group of volunteering seniors. Accordingly, we will enrich our portfolio of applications accordingly.

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