WHERE DO WE GO FROM HERE?A PRELIMINARY EVALUATION OF THE EU AMBIENT ASSISTED LIVING PROGRAMME

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1. Introduction

There is a large variety of the innovative AAL systems being developed to support elderly persons in their daily living. However, to tackle the innovation of both existing and new systems, it is necessary for them to undergo the process of evaluation. It is of the utmost importance to assess the usefulness of the systems, to underline their particular advantages and disadvantages, to compare their similarities and differences in order to come to proper recommendations for future system development. In addition, with the increasing rate of the system developments and without thorough evaluation, it might be difficult for the users to find the adequate system that fully addresses their needs.

2. Taxonomy for AAL systems

This paper extends on our earlier explorative work using a grounded theory approach that demonstrated the possibility to arrive at a set of dimensions that can be used as taxonomy to classify existing and new AAL systems. Such a systematic classification of AAL systems is useful both for potential users as well as for researchers and developers. A set of AAL systems from the AAL programme were examined leading to a preliminary taxonomy for AAL systems comprising ten dimensions (e.g., subject type, settings). These dimensions can be selected for a quick scan of a specific system, but they can also be used for new developments and system verification and validation. An important notion of this AAL taxonomy is that it views the human factor as an explicit part of the system. This implies that the AAL taxonomy involves both technical as well as human factors issues. The AAL taxonomy can be used both retrospectively for evaluation purposes as well as prospectively as part of a front end system engineering approach.

In this paper the taxonomy will be used as a tool for exploring the Ambient Assisted Living (AAL) programme of recent years. Accordingly, the necessity of technological innovations out of a user perspective can be discussed and the goals of the programme assessed. We will deal with the ten dimensions of the taxonomy of the AAL systems including its targeted end-users, the settings and contents of AAL use, privacy issues as well as the research methods and tools applied in the evaluation of specific projects.

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All these points reflect contexts crucial for understanding the relative success of AAL projects.

2.1 System subject type

The dimensions under the Subject type refer to the target population group for which the system is primarily designed as most of the AAL systems were designed for a specific target group. More specifically, in the first call 26% of the systems were developed for Dementia problems, 17% for Fall detection and 17% for Specific Motoric & Mobility Issues. Thirteen percent of the systems were developed for supporting medication or other goods supplies while 9% were developed for COPD lung diseases and 4% for chronic heart failures. Moreover, 13% of the system were not developed for a specific sub group of elderly persons but for general group, for example, to support overall physical activity (PA). It is interesting to note that, in some case, the system description does not involve specific target groups so further examination for this type of information is therefore often needed. One question in this context is to what extent future developments should focus on building systems that can be used for a more general population or focus strictly on specific target groups. There are several advantages and disadvantages and different potential solutions in both approaches.

2.2 System settings

The dimension setting in the taxonomy refers to the environment where the system is used. Systems can be designed for a specific setting: elderly peoples' home and its surroundings, or for a more general setting, e.g. clinical and non-clinical settings, urban or rural environment etc. It is sometimes difficult to find the exact description regarding the focus of setting in the existing AAL documentation.

2.3 System function types (causal variables)

This dimension refers to the type of functional content that the system has implemented to achieve its aimed effects. In particular, it refers to the causal functional variables through which the system aims to find increased wellbeing and independence of elderly people. Systems can give support on physical, cognitive and emotional functions. One issue is to what extent systems make sufficient use of existing functional taxonomies as developed and validated by psychologists in the last century, e.g. Fleishman & Quaintance's Taxonomy of human performance. Also within the dimensions function types the AAL documentation is sometimes inadequate.

2.4 System measures (effect variables)

This dimension refers to the measures that the system generates which are used to assess the effect of the causal variables of the system. These measures could either be self-report measures such as interviews, questionnaires, survey approaches; human performance measures or general observation measures such as sensors for behavioural and/or physiological data. The focus on adequate human performance measures for system is stressed.

2.5 System cause-effect relation type

This dimension refers to the existing evidence that using the system will produce desired effect. More specifically, it addresses the reliability and validity of evidence-based relations between the cause and the effect system variables.

Most systems seem to be using small pilots and case-based reviews to validate the effect. However, it is well known that the validity of such approaches is limited. Few systems use relational or quasi experimental approaches, but also these approaches have crucial validity problems. While reviewing the projects of the first AAL call, it appeared that most systems were not validated through experimental procedures like random controlled trials or transfer validation studies. This all leads to the important methodological question of how to verify and validate AAL systems. Several solutions for the AAL domain are given.

2.6 Theoretical basis

This dimension refers to the theoretical basis behind the system's intervention. Based on our review, for many systems the theoretical basis of the intervention can be made more explicit. The theoretical background of the system can refer to micro or macro level issues, since both are important for system development. The first step in the evaluation of the theoretical background should thus focus on the individual user perspective followed by the analysis of its larger impact at the socio-economic level. Bronfenbrenner's socio-ecological model, for instance, represents a promising frame for evaluating AAL programmes in such a way.

2.7 System's ambient intelligence

This dimension refers to the level of intelligence in a system. AAL Systems should be ambient intelligent systems. Ambient systems monitor behaviour to assess and diagnose the subject situation. Next, on the basis of the analyses, optimal support is provided and/or action choice options are given, e.g. the optimal intervention. According to our analysis seems that quite a few AAL systems lack sufficient ambient intelligence, and some are even more comparable to 'advanced webpages'.

2.8 System documentation

This dimension refers to the level and quality of the systems documentation, including functional, technical documentation as well as the manuals. Quite a few AAL systems lack sufficient documentation. In many situations there is insufficient functional or technical design documentation. Often adequate user manuals are lacking. This may be due to the business reasons; however for future development the importance of building earlier well documented work is stressed.

2.9 Usability and ease of system training

This dimension refers to the focus on simple, easy and self-explaining AAL solutions. Some of the systems still can improve on this dimension. This is partly related to dimension 8 and 7 since lack of human performance measures and insufficient documentation may lead to the reduction of system use.

2.10 System safety issues

This dimension refers to what extent the user safety can be adequately managed. One question is to what extent the AAL system uses existing validated techniques for assessing management safety profiles. Such techniques, for example like the TRIPOD have recently, become relatively popular to be used in the health and care domain and are in particular relevant in the context of patient safety. This issue is still somewhat neglected in several AAL systems.

3. Concluding remarks

Based on this examination, it appears that there is low consensus on how to describe an AAL system. This may lead to insecurity about questions like 'What is an AAL system?' and 'What is the difference between an AAL system and an ICT system for assisted care?' Quite a few AAL systems in the EU programme are lacking sufficient ambient intelligence. Cause-effect relations of the system variables are sometimes lacking adequate descriptions. It was sometimes unclear for which specific subgroup(s) the system could be used or for which setting the system was designed and what the theoretical basis is for the intervention used. Two preliminary conclusions were drawn from our review: (I) AAL systems need a sufficient evidence-based foundation, and (II) the field of AAL research needs a theoretical and methodological framework leading the future AAL system development, research and applications.