End User Context Modeling in Ambient Assisted Living

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ABSTRACT

Ambient Assisted Living (AAL) services provide intelligent and context aware assistance for elderly people in their home environment. Following the vision of an open AAL service marketplace, such an approach has to support all lifecycle phases of an AAL service, starting with its specification and development until its operation within the user's smart environment. In AAL the support of a user level context model becomes important. This enables an inhabitant of a smart home to get and give feedback on context without technical expertise and intensive training. At the same time, the context model has to be operational and to support context dependent service adaption and abstraction of the underlying context sensors. This leads to a layered context model for AAL with abstraction levels for different aspects. In this paper we focus on the requirements, the model elements and the concepts of the user interface layer of our approach.

Keywords: Ambient Assisted Living, Context Model, Smart Home, User Interface

INTRODUCTION

Ambient Assisted Living (AAL) aims at extending the time where older people can live in their home environment independently. A smart home environment integrates into the living space of the inhabitant and provides services that help to increase their autonomy and gives assistance in different activities of daily life. Key technologies for AAL services can be found in the research areas of ‘home automation’ and ‘ambient intelligence.’ Examples of such services can be found in (Meyer & Rakotonirainy, 2003).

Home automation is focused on the development of sensors, actuators and smart appliances that can be integrated into a home network. A home automation infrastructure, e.g. OSGi (OSGi Alliance, 2003), can then be used to interconnect these devices and to provide services.

‘Ambient Intelligence’ follows the goals of a vision expressed by Marc Weiser (Weiser, Gold & Brown, 1999). In that vision the computer becomes invisible for the user, enriches his natural environment with additional intelligence and supports her/him in her/his daily goals. Communication with the intelligent environment happens intuitively by interface support for language, movement, gesture and pointing (Coen, 1998). Additionally, context awareness can be used to observe the inhabitant and his environment and to provide services that adapt accordingly without the need for explicit user interaction.

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In the project ‘SmarterWohnen’ (Meis & Draeger, 2007), we have implemented and tested a number of AAL services together with a local housing company. They have been deployed in apartments, which have been equipped with different sensors and actuators, and are now used by a number of selected tenants. These services include intrusion detection, water and gas leakage detection, health related services and other various home automation services. We have developed an AAL service platform which also includes a context subsystem. This subsystem supports the integration of context sensors, the refinement of context information and the provision of a layered context model. From our experience the development and operation of context aware AAL services lead to requirements on context modeling that are not in the focus of current approaches. A consistent context modeling approach is needed to support different context aspects in the lifecycle of an AAL service. Examples are the specification of the context aware capabilities of an AAL service, the dynamic integration of context services into the smart home environment and the provision of service specific context models. One aspect that is of importance in the AAL domain is the communication of context aspects with the inhabitant. All these aspects of context modeling have to be supported by a consistent approach. We will shortly introduce our approach of context modeling in AAL. One part of our modeling approach is a layered context model. The main focus of the paper will be the user interface layer of that context model, which abstracts from technical details and allows for end user communication. The concepts described in this paper are part of the implemented context subsystem.

The rest of the paper is organized as follows. In section 2 we give a short introduction on context awareness and discuss the related work regarding end user interaction. After that we briefly motivate the different context aspects in the lifecycle of an AAL service in section 3 and describe the requirements on context modeling in AAL from an end user perspective. Subsequently, we give an introduction to our three-level context model which we use for building AAL services in section 4. In section 5 we give a detailed description of the application of the user interface layer of the context model. We then end with an evaluation and conclusion in sections 6 and 7.

STATE OF THE ART

We follow Dey’s (2000) definition in which context is “any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and application themselves”. Context aware applications can adapt their behavior directly to a situation in the user’s environment without having to ask for explicit user input. Examples of such context aware behavior can be found in location based services, where information is provided directly dependent on the locality of the user. Additional information on opening hours of restaurants, the time of day, the current activity of the end user and other relevant aspects can be used to realize an even more context aware service, e.g. a situation aware service provision for visitors of the Olympic Games in Beijing (Uszkoreit, Xu, Steffen, Aslan, Liu, Mueller, Holtkamp, Wojciechowski, 2007). Context information can be used to adapt the behavior of an application in many ways. A classification on context adaptivity is given in (Schtit, 1995).

A context model formally describes the relevant aspects of the real world that are used for an application. It abstracts from the technical details of context sensing and allows coupling the real world to the technical view of context adaptive applications (Becker & Nicklas, 2004). Therefore context models play an important role for building applications that can react on real world events. Research in context modeling is not new, and there are already a number of approaches introduced in the context awareness community. An overview on actual approaches is given in (Strang & Linnhoff-Popien, 2004).
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