A Platform for a More Widespread Adoption of AAL

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Abstract. This paper describes an AAL-enabling platform which combines OSGi middleware, interactive TV, RFID and NFC in order to ease the day to day of not only dependant or semi-dependant elderly people (its main focus) but also their care takers and relatives. The end result is an affordable, unobtrusive, evolvable, usable and easily deployable ICT infrastructure which aims to approach the vision of "AAL for All".

Keywords: AAL, OSGi, interactive TV, RFID, NFC, Rule systems.

1 Introduction

Ambient Assisted Living [1] fosters the provision of equipment and services for the independent or more autonomous living of elderly people via the seamless integration of info-communication technologies (ICT) within homes and residences, thus increasing their quality of life and autonomy and reducing the need for being institutionalised or aiding it when it happens.

A common issue in AAL systems is that deployment is limited to premises where an important economic investment and cumbersome ICT deployment can be justified. The main aim of this work is to define an AAL-enabling platform, namely ElderCare, which addresses this limitation.

An important collective not usually targeted by AAL platforms is the people concerned with or interested in the elderly people, e.g. relatives or friends which are not directly involved in caretaking. Hence, this work proposes different access and notification mechanisms to keep them up-to-date.

Another hard issue to solve regarding AAL is adequate and timely care-related data management at residences and homes. In them, big amounts of data must be gathered and reported in real-time to be able to follow the progress and incidents regarding elderly people's daily routine. Thus, this work proposes to combine NFC mobiles and RFID tags to address this issue.

The structure of the paper is as follows. Section 2 gives an overview of related work. Section 3 presents the overall architecture of the ElderCare system. Section 4 offers more details on the three distributed component types conforming ElderCare's modular, extensible and intelligent architecture. Section 5 draws some conclusions and states some future work plans.

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2 Related Work

In [2], Standford describes one of the first AAL solutions: an instrumented elderly home using pervasive computing to help the residence's staff to easily identify where they are needed and to give them support to increase their work efficiency. Information is acquired by the system via locator badges, weight sensors in beds and so on, enabling the staff to better study and react to the problems that arise. The main limitations of the system are the difficulty of integration of new hardware and the residence-centric design.

The GatorTech Smart Home [3] is a remarkable 5 year long project that led to the construction of a very advanced smart house. A modular OSGi-based service architecture is defined that allows easy service creation, context and knowledge intelligent management and the integration of some custom-built hardware. Unfortunately, this solution can only be deployed in residences willing to make a big investment and go through a heavy deployment process.

The combination of NFC technology and RFID tags has been used in several research projects related to medicine and caretaking [4][5][6]. However, none of them stores the most relevant caring information with the residents themselves.

Fig. 1. AAL Kit (left hand side) and Interactive TV interface (right hand side)

3 The ElderCare Platform

This platform is devised to provide universal ICT support for friendly aging either at elderly people's own homes or in residences. In essence, The ElderCare platform aims to *provide a holistic ICT infrastructure for AAL that it is:*

- *Affordable* since it has to be offered at a low cost to ensure anybody can purchase it. In our prototype, the base system amounts to 265 €, a price that could be reduced significantly if such a product was to be produced massively.
- *Unobtrusive* so that it can be seamlessly integrated within a home or residence room, i.e. it should have the form of other common electronic devices.
- *Easily deployable* so that relatives or even elderly people can plug in the system and configure it.
- *Usable and accessible to any user collective*. The system must provide adequate user interfaces for Elderly people, care staff and family and friends.
- *Evolvable.* It should be easily integrated with any existing or emerging home automation devices, notification mechanisms and assistive services.

In summary, ElderCare addresses the aforementioned requirements proposing the following three distributed component type architecture:

1. *A bundle of essential hardware and software components known as* ***AAL Kit*** which can be deployed in any home or residence room to offer support for prolonging personal autonomy. A key part of this AAL Kit is a set-top-box enhanced DVB-T decoder. The set of default assistive services it provides are described in §4.
2. *A central remote management and service provisioning system*, namely ***ElderCare's Central Server***. It remotely manages and collects data from the Local Systems deployed in the rooms of a residence or in different homes, issuing notifications to staff and family alike when needed. It also offers an AAL service repository, something like an "AAL store", which can be accessed from a web browser to select, download and install new services.
3. *A mobile client to assist in care logging, namely* ***Mobile Care Logging System***. It is used by relatives and care staff to record, through NFC mobiles in elderly people's RFID wristbands, events and caring procedures performed over them.

4 ElderCare Internal Architecture

This section details the three distributed component types conforming ElderCare's system architecture.

1. **ElderCare's Local System:** Internally, an ElderCare's Local System is governed by an OSGi server (deployed on Equinox) which manages the following set of embedded default services:

- *TV Tuning and Widget Manager*. It generates the interactive TV main interface offered by a Local System, using a in-house widget system that allows users to control the system using TV remotes and touch screens.
- *Home Automation Manager*. This service allows communication with different widely available building automation standards such as X10, Zigbee or KNX.
- *Alert Manager*. Alerts may be programmed locally or remotely. Generally, alerts will be rendered in the TV screen, although other alternative channels when the TV is off are possible such as TTS through TV's speakers.
- *Elderly Vital Sign Monitor*. Vital sign data collection and analysis from a Zephyr HxM biometric wireless vest has also been integrated. Data is reported to the server, where health alerts are identified and forwarded to relevant people.
- *Service Manager*. This core service provides the extensibility capability of a Local System. It allows to install/un-install services dynamically without system reboot.

2. **ElderCare's Central Server:** The Central Server offers a unique façade from which managers of Local Systems (relatives or staff in a residence) can control ElderCare deployments using an advanced web interface developed with GWT. Another interesting feature of the Central Server is its capability to react autonomously to unexpected or emergency aspects in Local Systems via a rule- based system that supports different rule engines.

3. **ElderCare's Mobile Client:** Recording caring logs *in situ* through an NFC mobile phone and an intuitive mobile logging application on HF RFID tags worn as wristbands or watches by residents is a very feasible approach for suitable care data logging. The most recent and relevant care information remains at all time in the resident's wristband, so that without a network link, any caretaker can quickly review a resident's care status, and all data is synchronised with the server by mobiles where all patient-related data is stored and published in the form of tweets or RSS feeds. A total of 34 and 164 messages could be stored in the 1K wristband and 4K watch RFID tags considered, after applying ElderCare's data encoding format.

5 Conclusions and Further Work

This work has shown a novel AAL infrastructure platform offering three main features: a) it is affordable and easily deployable at both elderly people's own homes or in their residences, b) it does not only primarily target elderly people's assistance but also helps caretakers in their work and properly keeps relatives and friends up-to- date and c) it alleviates data management in care taking by combining NFC mobiles and data storage on RFID tags. Future work will evaluate the ElderCare platform in a real deployment, a residence recently created which will be opened in May 2010.

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