Design Framework for Ambient Assisted Living Platforms

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Abstract. Nowadays the new technological advances offer the possibility to provide a great number of different personalized services that cover the needs of diverse categories of users. The application of the Ambient Intelligence (AmI) paradigm and the Ambient Assisted Living (AAL) concept makes possible the creation of new applications that can significantly improve the quality of life of elderly and dependant people. This paper presents an interaction framework that provides a new generation of user interfaces for AAL services in the context of an AmI-based platform. This solution aims to develop the technological context where elderly and dependant citizens can increase their life independence.

Keywords: Ambient Intelligence, Ambient Assisted Living, wireless sensor networks, adaptative interfaces.

1 Introduction

One of the main applications of Ambient Intelligence (AmI) concept is the development of services aimed at improving citizens' quality of life, providing a better control of the environment through the electronic devices. AmI implies the development of seamless environment of computing and the use of advanced networking technologies. It also embraces specific interfaces that are aware of the particular characteristics of human presence and personalities, take care of users needs, are capable of responding intelligently to spoken or gestured indications of desire, and even being engaged in intelligent dialogues. In AmI applications technology is transparent and invisible for users, who can effortless access to a great number of functionalities while they are immersed in their natural and familiar environments (i.e. at home). In addition, it is guaranteed that all security and privacy requirements are preserved.

AmI paradigm differs from traditional models in two important aspects. First, the user interaction is proactive meaning that actions are the result of a user's presence or behaviour. Second, this new concept is not linked to any specific device or set of

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devices, but associated with technologies located in the environment. This is possible due to the utilization of wireless sensors and actuators networks that control and monitor the environment in which they are embedded. Additionally, it is necessary a middleware platform in which the network components are linked, and a semantic data processing system for analyzing the conditions of user needs and the context environment.

This paper presents the design of a user interface framework, which is part of an AmI platform developed under the scope of the AmIVital project, partially funded by the EU and the Spanish Ministry of Industry, Tourism and Trade [1]. The platform aims to provide Ambient Assisted Living (AAL) services to dependant people and chronic disease patients. It has been based on an architecture that is easily expandable for offering additional services and can also be integrated with other existing healthcare platforms.

2 The Interaction Framework

AmIVital platform has defined a set of technological services in the AAL domain [2]. These services cover several aspects of the daily living activities and health status of chronic patients and dependant people (i.e. virtual calendar, health record, domotic control, personal alarms). Technological services can be combined in different groups or configurations according to the user's preferences. Each of these combinations is called a functional service. The project has defined set of basic predefined functional services attending to the identified users needs (i.e. health and telecare, social interaction, information and learning). However, the global architecture of the platform has been designed for supporting new functional services, defined as any possible combination of existing technological services.

Functional services are provided to the users by means of an adaptative interaction framework that is based on a service-oriented architecture (SOA) [3][4]. This alternative has been selected because it respects the main principles of AmI platforms: it is autonomous, reusable, ubiquitous, low coupling and adaptable. The services on the defined architecture are supported by a middleware that intercommunicate end-users and service providers. This middleware makes possible the adaptation of the user interfaces based on the user's preferences and context data provided by a network of sensors.

The interaction framework is composed by several components: the sensors network, the user profile, the knowledge management module, and the context module (Fig. 1). The first component corresponds with the physical layer of the SOA platform, that is, the set of sensors distributed in the environment for capturing the relevant data. More specifically, the selected sensors are non-invasive, according the AmI paradigm, and are classified in two categories: wearable and environmental sensors. Wearable sensors provide information on the user's physical and physiological status while environmental sensors detect changes in the user's environment and actuate accordingly. Sensors are connected in networks that are further integrated in the general communication platform, using a combination of wireless communication technologies: Wi-Fi, ZigBee and Bluetooth. The sensors network module requires a deep specification of the scenarios in which the sensors are embedded.

The user's profile contains all the information related with the user preferences, capabilities, and health status. It is one of the main input data for the interaction adaptation process. It is first filled in when the user subscribes to any of the services offered by the platform and updated periodically based on the user's actions.

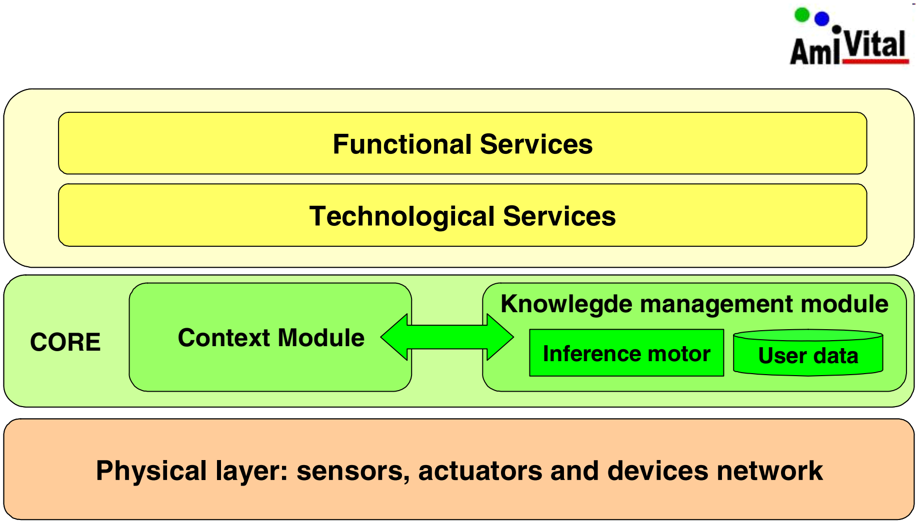

Fig. 1. Interaction framework architecture

The knowledge management module is responsible for the multimodal dynamic interaction adaptation. It incorporates an inference motor that creates a set of rules baased on parameters obtained from the user profile (i.e. user's preferences and services subscription). These rules are used for later adapting the user interfaces and define the type of interaction, the type of device, and the specific technological services to be used.

Finally, the context manager module manages the real presentation of the information provided by the different services to the users. It effectively performs the user interface adaptation by using the data provided by the knowledge management module (defined adaptation rules) and the sensors network (context information). Furthermore, the context manager has the capacity of extracting data from the user's behaviour and service usage and utilizes it for updating the adaptation rules, improving the whole interaction mechanisms. The module is also responsible for adjusting the information to be presented to the specific device that the user is utilizing.

The proposed framework follows several steps for the interaction adaptation. First, there is a collection of user's data that includes user's target groups (i.e. medical staff, elderly people) and the individual and non-transferable user preferences in terms of technological services. Secondly, the user profile is created and it is associated with the content to be provided based on the data type and user category. Then, the real content delivery and presentation is defined, by specifying the different possibilities that the system has for providing relevant information to the user. Additionally, the system collects feedback from the user actions and updates his current profile accordingly.

As a result, the developed framework provides a complete set of AAL functional services that can be totally adapted to different user requirements in terms of interaction, environmental context information and different devices.

3 Conclusions

Ambient Intelligence technologies are playing nowadays a key role in several aspects of the society, offering new solutions and services that cover the needs of an increasingly aging population. The proposed interaction framework is a novel system that facilitates the adoption of these technologies by providing a natural pleasant and easy method for interacting with the environment.

The platform has a clear impact on the specific areas of health care and social assistance, providing a seamless and natural access to different AAL services for dependant citizens, and offering innovative and integrated solution. Elderly users, chronic patients and dependant people are the main benefited from this kind of technological solution, by receiving new services that can significantly improve their quality of life and reduce their level of dependency.

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References

1. AmIVital project. EU and Spanish Ministry of Industry, Tourism and Trade funded, http://amivital.ugr.es
2. Cruz-Martín, E., del Árbol-Pérez, L.P., Fernández González, L.C.: Telefónica Research and Development, Spain, The teleassistance platform: an innovative technological solution to face the ageing population problem (2007)
3. Newcomer, E., Lomow, G.: Understanding SOA with Web Services. Addison Wesley, Reading (2005)
4. Bell, M.: Introduction to Service-Oriented Modeling. In: Service-Oriented Modeling: Service Analysis, Design, and Architecture. Wiley & Sons, Chichester (2008)