

OMNIACARE: A Comprehensive Technological Platform for AAL

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Abstract Technological projects and products developed in the scope of Ambient Assisted Living provide a wide range of solutions for the elderly's and their caregivers' needs, but typically focused to single aspects of care and assistance. There are systems for monitoring of health signs, along with home automation or home assistance request systems. Multiple needs may therefore lead to adopt multiple systems at the user's premises, making it more difficult for the elderly and their circle of support to manage their usage and fully benefit from the advantages of technologies. The OMNIACARE platform brings along an innovative concept of integration and adaptation to users' needs. It comprises different modules, developed in ad-hoc projects, to cover different sides of home care and assistance with one interface in one single system.

1 Introduction

Quality of living is getting better worldwide. Due to improvement in nutrition and in therapies and, due to an increased attention to prevention of diseases, population is rapidly ageing. The number of older people, in good health conditions but still in need of constant, although non-obtrusive, monitoring will grow up in the next years. This may greatly impact on national health systems, for cost increases in assistance and hospitalisation. Technological solutions are a key factor to help people to actively live in their own homes despite aging.

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The OMNIACARE platform, developed by **eResult**, is built with the aim to realise an innovative and integrated system to help improve the quality of life of the elderly, fostering their autonomy to live in their homes, and to provide and manage for themselves in order to keep good health [1]. The system principally addresses the needs of self-sufficient older adults, who have fragilities or chronic conditions typical of ageing that require small or moderate assistance [2]. The proposed technology contributes to keep the elderly autonomous and confident but also prevent degradation of mental, physical and cognitive conditions, with the goal to also detect potential risk situations at their early stage.

2 OMNIACARE: System Overview

OMNIACARE is a software platform that provides modular and flexible functionalities. It supports several devices that can be employed singularly or in multiple combinations: smartphones, tablet PCs, TV set-top boxes, wireless sensors. The system can virtually be interfaced with any device which is capable to detect vital parameters or environment conditions and can continuously and automatically acquire data. Such data are processed by a home server to be later stored into a centralised back-end server. Through access to the back-end cloud server, caregivers can configure the behaviour of client devices, assess the status of local sensors, and view logs of past events or browse along the clinical history of the patient. In the event of critical situations, OMNIACARE can also send alerts to families or caregivers and activate IP cameras to remotely assess and control the situation.

2.1 System Architecture

The architecture of the system is shown in Fig. 1.

Each end-user (patients) is equipped with a device that can consist of:

- a set-top box connected to a TV monitor with Internet connection;
- a smartphone with 3G connection
- a tablet PC with 3G connection

Eventually, sensors and actuators can be located around the users' house to detect parameters or trigger motors or lights. 2D or 3D sensor cameras can also be installed to monitor sensitive areas and even user's behaviour. Wearable devices able of detecting biomedical parameters can be provided.

The set-top box, smartphone or tablet has the task to act as interface to the users for the services provided. It also provides live audio and video conferencing, along with the possibility to act as home server for first data processing and transfer to the cloud server, although a fixed PC is preferred for reliability due to power issues (portable devices are battery powered).

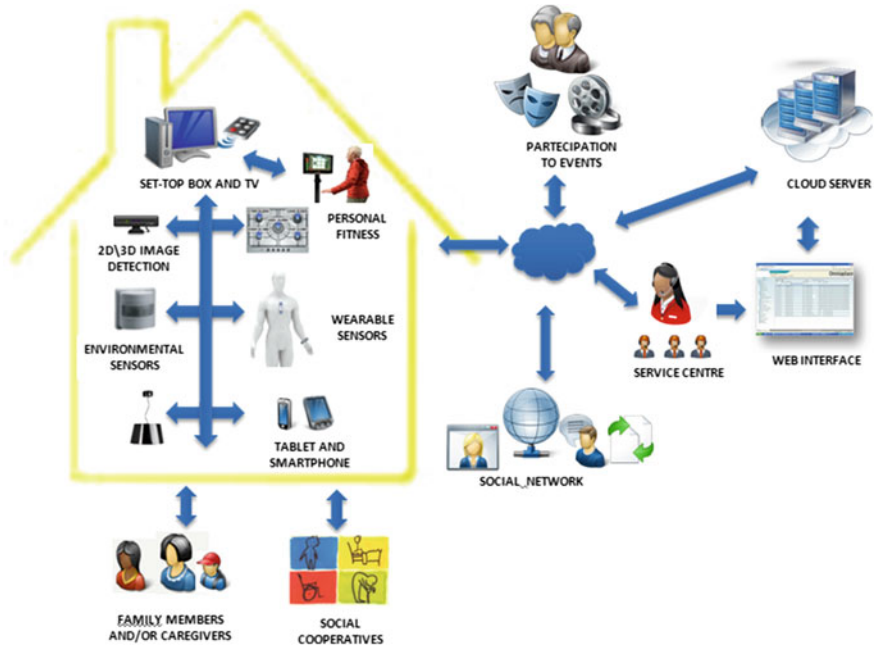


Fig. 1 OMNIACARE. Architecture of the system

The cloud server acts as a repository for data, vital parameters, video streams (if requested) and, through customized web interfaces, is the central point of access for families, caregivers and service centres. The cloud server can also provide services to the final users, which can range from home assistance and house maintenance to promotion and encouraging of leisure activities and access to dedicated social networks.

3 Modules

OMNIACARE’s client-server architecture was developed in a project named *ADA*, in which the platform was devised and realised. A very special eye was kept on features of configurability, scalability and robustness. In the *Aid-Assistant* project, the platform’s Monitoring Module was developed. The project aimed to bring along a product to help frail users to keep living in their own homes by supporting caregivers in their activities [3]. The platform was endowed and interfaced with devices able to:

- detect health status through wearable sensors for vital parameters (heart rate and breath)
- detect fall

- locate the user's position around the house (indoor localisation)
- monitor special events, like lack of response by the user to a reminder or wandering

As extension to the platform, attention has been paid not only to medical and care assistance, but also to social inclusion of the elderly. In the *HOST* project, the issue of providing customized and easy access to several e-Services for older people has been tackled [4]. The project objective is to provide an ICT architecture based on a friendly and well known technology such as the television, tablet PC or smartphone, enabling elderly independence and participation on a free choice basis to the self-serve society. The services are ensured by specialized and dedicated organizations such as social housing operators. The OMNIACARE platform has been consequently enriched with a Service Module to:

- provide sound or voice alerts to remind the user to perform a specific task (take drugs, call the physician, favourite TV programme...) and accept simple feedback in return, in order to record execution of the activities
- access services and better organize the way of life in social housing (request maintenance, browse events calendar, foster social and recreational activities)
- request home drugs delivery, accompaniment for medical appointments
- shop online

In the *HOST* project, a first version of an OMNIACARE's Social Module has also been created. The platform now allows to:

- send and receive messages to and from the people included in the elderly's own circle of support (manager of social housing association, tutors, caregivers or family members) that are registered in the system
- start Skype video calls by simply pushing a button.

OMNIACARE therefore provides the elderly with the opportunity to stay in touch with friends and relatives, close or distant (or even abroad) without call charges and without having to learn a new interface. In forthcoming projects, the creation of simplified social networks of elderly will be evaluated, to enrich older people's social life and offer socialization and human contact with the aim to foster their sense of usefulness, independence and, finally their well-being [5].

The platform is being enriched with extended capabilities for monitoring and assessment of health conditions. In the *AL.TR.U.I.S.M* project, OMNIACARE is being employed to develop a remote system for cognitive home rehabilitation [6] through a customized "Virtual Personal Trainer" that can allow the patients to perform some cognitive rehabilitation process at home [7]. The system architecture is realized by a set-top-box, with Internet connection, a TV monitor for Graphic User Interface visualization, a commercial 3D sensor (Microsoft Kinect) and a t-shirt for biomedical parameters detection.

Along with indoor monitoring and service offer, the platform is being trialled even for outdoor mobility for senior citizens and favour elderly's tourist activities. The *Sweet Mobility* project, now in course, exploits new specifically designed OMNIACARE Modules in order to advise and support the senior to choose and successfully reach a predefined touristic destination. Based on the information on the senior's

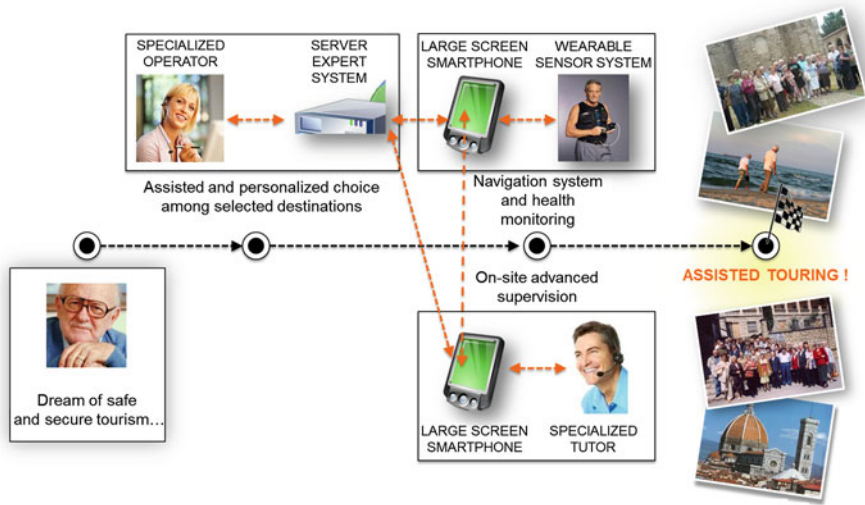


Fig. 2 Sweet Mobility: Architecture of the system

physical and mental history, the system estimates the adequacy of the chosen destination and may propose a more feasible alternative. During the touristic visit, the system continuously and adaptively monitors the senior’s physical and mental state, by means of wearable sensors, and based on the knowledge of the track characteristics, it provides orientation and navigation during the walk, gives information on the available services along the path (toilettes, resting points, bars, etc.) and, when needed, may suggest to take action (have a pause, rest, have refreshments, etc.) in order to keep the older user’s physical state within health parameter limits. The information is provided by means of easy visual communication on large screen mobile devices and acoustic communication via headsets or loudspeaker, thus minimizing the user cognitive workload. The localization and monitoring features provided by the system are also useful tools for caregivers and operators who may accompany or supervise the elderly’s walk. All the necessary information is available to them in real-time via web access to the platform’s cloud server, thus allowing to rapidly and effectively intervene if the person is in need. The service architecture of the system is shown in Fig. 2.

4 Conclusions

The OMNIACARE platform enables new application scenarios of ICT to improve the quality of life of people with special needs such as the elderly and frail persons, by including a wide range of services in modules that are easily integrated in the overall architecture. The work done so far has confirmed that the context of AAL is definitely

a scope and impact of particular relevance where access to effective and reliable service packages selected directly by users and a better quality of communication adhering to the expectations and the ability of older people are able to give them greater autonomy and a stronger social inclusion, preventing improper forms of sanitation or institutionalization.

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