An Ambient Assisted Living Technology Platform for Informal Carers of the Elderly

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Abstract. Family care is the most accepted and preferred care setting for both long-term care patients and their relatives. However, many of these caregivers are elderly people themselves, and often reach the point where they also need support. Care poses a substantial burden, so often it is not the health of the patient but the overload of stress for the caregiver that results in the need for much more expensive professional care and even residential care. An ambient assisted living technology platform is developed to support both older adults and their carers to overcome the challenges of the care. The platform offers informal carers support by means of monitoring Activities of Daily Care as well as their psychological state, and will provide orientation to help them improve the care given. Monitored information will be registered by means of home-installed and personal sensor technologies based on Internet of Things (IoT), which will be as unobtrusive as possible for the house inhabitants.

Keywords: Health care · Ambient Assisted Living · Ambient Intelligence · Elderly · Dementia · Assistive technology · Sensors · Internet of Things

1 Introduction

The world population is currently suffering progressive ageing which can have dramatic effects on health systems due to increasing costs and a higher demand of socio-healthcare services to maintain the elderly's independence and quality of life. The four major themes that are important for older adults to age in their own homes and community are [5]; safety and independence, social interaction, use of technology, and the desire for support. In addition, many older adults prefer to age in their own home rather than in an assisted living facility, even though they require long-term care due to diseases associated with ageing and assistance in their Activities of Daily Living (ADLs) [3]. Therefore, a significant increase in care responsibilities, which is typically performed by family and friends, appears

and implies a need for innovative support approaches for family members and their carers.

This demographic change will lead to significant and interrelated modifications in the health care sector and technologies promoting independence for the elderly. Therefore, an enormous interest is growing in the use of technological solutions and specifically Information and Communication Technologies (ICT) to support elderly people to live independently for longer period in their homes and connect the older adults to geographically dispersed family and friends. In order to deal with this issue, the Ambient Assisted Living (AAL) initiative [4] promotes the creation of products, systems and solutions based on ICT for the support of the elderly's life independence. AAL services can be enclosed in the Ambient Intelligence (AmI) concept which implies a seamless environment of computing, advanced networking technology and specific interfaces providing users with context-aware, personalized, adaptive, ubiquitous and interoperable systems [1]. Additionally, AAL might need to support or collaborate with informal carers, such as relatives and friends, who play important roles in the lives and care of older adults [2].

2   Technological Needs

In order to initially establish the needs and concerns of the elderly and their carers, domain analysis was carried out. In a business context, a system would generally be based purely on pcs and servers, and the end users would probably be the primary stakeholders. They would be interviewed and user stories solicited. However for AAL systems, the sensors and AmI are as necessary as the servers, and the end users include formal care organisations, informal carers and the elderly. It is thus difficult to apply the usual open interview techniques since they may have no ideas of what they want from such systems. To provide an initial perspective on the problems and concerns of the stakeholders, without rejudging what is important to them, an automated method of finding contextual information was applied. Lexical analysis of over 34000 words from different Alzheimers Carers' forum threads has indicated some of the key concerns of the carers and issues for the elderly. Although the terms 'mum', 'mother', 'dad' and 'care' obviously dominate, the terms 'social', 'health', 'friends', 'services', 'people' were used surprisingly frequently, whereas specific care issues were not so dominant. These appeared to indicate that the carers were more concerned about the general well-being of the older adult.

The intelligent care guidance and learning services platform for informal carers of the elderly (iCarer) project has made an attempt to develop a personalized and adaptive platform to offer informal carers support by means of monitoring Activities of Daily Care (ADC) as well as their psychological state, and will provide orientation to help them improve the care given. Monitored information will be registered by means of home-installed and personal sensor technologies based on Internet of Things (IoT), which will be as unobtrusive as possible for the house inhabitants. Registered data will be analysed and fed into the platform
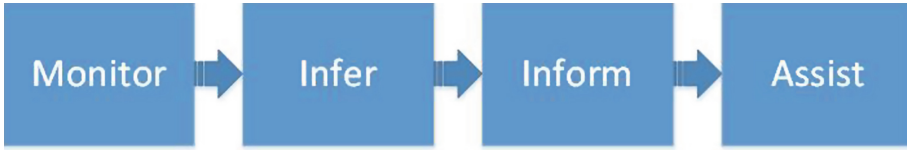
Fig. 1. Stages of iCarer platform.

in order to model the ADC based on behavioural patterns. With this information, and if the informal caregiver is absent at the time, the platform will act as a 'virtual carer', giving support to the older adult and providing information to the carer in case a daily activity is done incorrectly. Additionally, iCarer will provide e-Learning services and an informal carers' learning network. As a result, caregivers will be able to expand their knowledge, supported by the experience provided by expert counsellors and fellow carers. The coordination between formal and informal carers will be improved, offering the informal carers flexibility to organize and combine their assistance and social activities.

3 iCarer Platform

Considering the contextual situation of the elderly and their carers, the iCarer project proposes a personalized and adaptive platform to offer informal carers support by monitoring their ADC and psychological state, as well as providing an orientation to help them and improve the care provided. Monitored information will be registered by means of home-installed and personal sensors. Registered data will be analysed and fed into the platform in order to model the ADC based on behavioural patterns. With this information the platform can infer possible problems in the informal carer's activities or status. Thus, the platform will act as a "virtual carer" providing to the carer with recommendations to solve the issue. If the informal carer is absent at the time from the older adult's home, the platform will give support to the older adult in case a daily activity is done incorrectly. Additionally, iCarer will provide e-Learning services and an informal carers' learning network. As a result, carers will be able to expand their knowledge. The coordination between formal and informal carers will be improved, offering the informal carers flexibility to organize and combine their assistance and social activities. The platform is aimed at informal carers living with elderly adults (co-residents, commonly another elderly adult) who suffer cognitive impairment at any stage (from mild to severe).

The platform comprises four stages of: monitoring, inferring, informing and ultimately assisting the carer of an older adult as shown in Fig. 1. Unobtrusive sensors around the house are used to monitor activities of older adults and send data to the Cloud for analysis. To infer activities from the data, Computational Intelligence techniques are used to determine the activities and whether these are as expected. If the activities change from the usual pattern, fuzzy models are
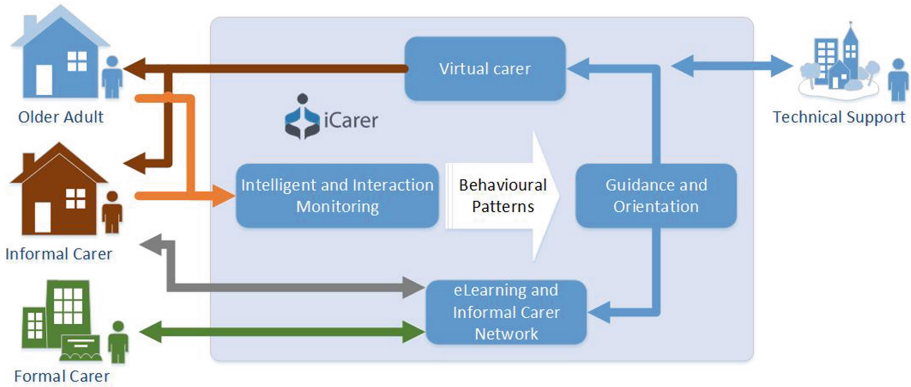
Fig. 2. The iCarer platform architecture.

used to deduce potential problems e.g. with sleep behaviour. Once a problem is identified, the carer is warned about the problem, and offered strategies to solve it, and hence reduce their stress.

In order to achieve the previous goals defined, the iCarer platform will be composed of a suite of modules, which provide the different services to support the informal carer, as shown in Fig. 2 and described briefly below.

– Intelligent and Interaction Monitoring - The iCarer platform provides a monitoring environment where the assistance tasks (ADCs) are monitored to detect early symptoms of carers' burden and stress.
– Guidance and Orientation - After analysing the data monitored, behavioural patterns of both informal carers and older adult will be inferred in this module. In the case of the informal carer, once the behavioural patterns have been inferred, this module is also responsible to determine if a problem is occurred in assistance tasks.
– Virtual Carer - The iCarer platform through this module proposes a service to support the care process reducing the carer's burden. Once the informal carer's problem or mistake is detected in ADC or ADL performance, the "Virtual Carer" will provide them with suitable guidance to improve the care activity or reduce the burden level of the informal carer.
– eLearning and Informal Carer Network - By employing a content management system (CMS) this module will offer to the carer a personalised selection of video based e-Learning contents in order to reduce their workload and improve the effectiveness of the provided care.

4   Conclusions

Informal carers feel thrown into the caring role without receiving enough assistance, lacking education and training for their role as carers. Informal carer's quality of life will be improved by detecting their burden and stress before it

becomes overwhelming, by improving the assistance they provide and by increasing their social interactions and support. The informal carers have individual characteristics which have to be considered when a solution or service is offered to them, and so iCarer ensures that they can coordinate their own personal activities with the care tasks that they have to perform. The unobtrusive nature of IoT sensors allows the carer and the elderly to carry out their normal ADL without additional stress caused by interference from external carers or obvious intrusive camera monitoring.

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