Chapter 8
The Role of Ambient Intelligent Environments for Tracking Functional Decline

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ABSTRACT

We live in a ubiquitous world where we are surrounded by context sensitive information and smart devices that are able to capture information about our surroundings unobtrusively. Making use of such rich information can enable recognition of activities conducted by elderly users, and in turn can allow the possibility of tracking any functional decline. This chapter highlights the current methods for unobtrusively recognising activities of daily living within a home environment for people with physical or cognitive disabilities. A main group for which this is important for are Alzheimer's patients. The chapter also bases the discussion of what makes a successful environment for carrying out accurate activity recognition, which is then followed by a proposed taxonomy of the key characteristics that are required for robust activity recognition within a smart environment, contextualised with real-life scenarios.

INTRODUCTION

In the beginning and closing stages of a person's life they have a high level of dependency on others. In today's working world with its emphasis on the nuclear family there are fewer problems with looking after babies, but there are significant problems in looking after the elderly. In Britain, in common with most western societies and now in Asian societies (particularly China with its single child policy), there has been an increase in the proportion of elderly people and many

find it hard to look after their parents because of life commitments and distance, or just not wanting to look after their parents when needing care. Adversely, many old people want to remain independent for as long as possible. However, the existence of Alzheimer's disease among elderly is also seen as a concern, as this disease gradually destroys the elderly person's memory and their abilities to learn, communicate and carry out everyday activities (Tung, et al., 2013). These elderly patients are usually sent to care homes where other people look them after. In many cases this approach is not completely successful due to issues concerning isolation or even abuse. Therefore the introduction of smart homes is gradually becoming an alternative promising solution, as it aims to provide the ability for elderly people to lead an independent life until the disease reaches a severe stage.

It has been suggested that smart homes contribute to a better future for elderly people who are in their early stages of Alzheimer's disease. It is important for the wellbeing of these elderly people that they can independently perform day-to-day tasks such as dressing, cooking, and toileting. This has been recognised by gerontologists, who developed a detailed list of activities in 1963 (Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963) which should be carried out by the elderly person, known as Activities of Daily Life (ADL). They are also referred to as Activities of Daily Living. Being able to monitor these ADLs is seen as a key approach for tracking functional decline among elderly people (Ogawa, Ochiai, Shoji, Nishihara & Togawa, 2000). Hence, there is a need for techniques and algorithms to be developed which are able to discriminate between different ADLs and determine the intentions of old people as they carry out such everyday tasks. One way to support elderly people who aspire to live an independent life and remain safe in their home is to find out what activities the elderly person is carrying out

at a given time and provide appropriate assistance or institute safeguards (Yin, Yang & Pan, 2008; Mocanu & Florea, 2011).

The aim of this chapter is to enlighten readers about the current methods for unobtrusively recognising ADLs within a home environment for Alzheimer's patients. This chapter makes the following contributions. Firstly, we discuss the adoption of smart environments by the elderly followed by a detailed look at the related literature of ADL recognition. This is then followed by a discussion of what makes a successful environment for carrying out accurate ADL recognition. The chapter then concludes by defining the taxonomy of the key characteristics that are required for robust ADL monitoring within a smart environment.

ELDERLY PEOPLE, SMART HOMES, AND INDEPENDENT LIVING

Elderly people spend most of their time at home. While they are at home they carry out a variety of activities such as brushing teeth, taking a shower, preparing breakfast. The home is also a place where they can rest and relax, as well as socialise with friends and family.

The quality of life for an elderly person can be enhanced significantly by living in a smart home environment as a result of the extra support received from such an intelligent environment (Abascal, 2004).

Smart Homes have a variety of features and goals. A principal goal of Smart Homes is to improve the quality of life by increasing self-control that will allow the person to live an independent life, which in turn will enable self-fulfillment (Harris, 2005). Supporting independent living is also another related goal, as the smart home will make everyday life easier for the elderly. Health and fitness is important for the elderly, so another goal is to monitor the elderly person's health to prevent

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