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Smart Home Research:
Projects and Issues

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ABSTRACT

Smart Homes are environments facilitated with technology that act in a protective and proactive function to assist an inhabitant in managing their daily lives specific to their individual needs. A typical Smart Home implementation would include sensors and actuators to detect changes in status and to initiate beneficial interventions. This paper aims to introduce the diversity of recent Smart Home research and to present the challenges that are faced not only by engineers and potential inhabitants, but also by policy makers and healthcare professionals

Keywords: *Ambient Intelligence, Assisted Living, Smart Homes*

INTRODUCTION

United Nations population demographers predict an increasing number of elderly inhabitants in all societies in the near future, especially in western countries (United Nations, 2008). In Europe, the percentage of the population aged 65 and over in the year 2001 was 17%; it is estimated that by 2035 this figure will have risen to 33% ("Office of Health", 2008). Ní Scanaill et al. (2006) asserts that eventually the 'Care Ratio' will become unbalanced in that taxes paid by those of working age (usually 16 – 64) will not be sufficient to accommodate a distending older population. They also point out that the situation will be made worse by the fact that apart from infants, elders over 65 are the primary users of a countries healthcare system. The *Public Health Agency of Canada* (2008) has estimated that by the year 2021, 6.7 million Canadians will be 65 and over, corresponding to 18% of the population as a whole.

Currently, 16.4% of France's population are 65 and over, a further 8% are over 75 (National Institute, 2006). According to the United Nations Programme on Ageing (United Nations, 2008):

One out of every ten persons is now 60 years or above; by 2050, one out of five will be 60 years or older; and by 2150, one out of three persons will be 60 years or older.

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The UN's statistics go even further and state that:

The older population itself is ageing. The oldest old (80 years or older) is the fastest growing segment of the older population. They currently make up 13 percent of the 60+ age group and will grow to 20 percent by 2050. The number of centenarians (aged 100 years or older) is projected to increase 14-fold from approximately 265,000 in 2005 to 3.7 million by 2050.

People generally wish to remain within their own living environment (the research of which is covered in detail in a later section), and therefore this gives researchers the opportunity to deploy assistive technology that will allow those elders to do so. One inevitable consequence of this so called (Ní Scanaill et al., 2006) 'greying population' is the increased prevalence of the symptoms of Dementia among the older generation. Dementia has been described by the Institute of Psychiatry (Albanese et al., 2008) as:

A collection of symptoms, including a decline in memory, reasoning and communication skills, and a gradual loss of skills needed to carry out daily activities. These symptoms are caused by structural and chemical changes in the [human] brain as a result of physical diseases.

Dementia is considered to be one of the main causes of disability in later life, as it renders suffers unable to look after themselves adequately in the performance of daily tasks such as (Nugent et al., 2007) cooking, grooming, dressing, the management of medication and drink preparation. A higher relative proportion of the population now suffer from dementia than have every done so before and the current figure are set to rise over the coming decades (correlating with the statistics on ageing). More people are simply living longer, and this phenomenon can be attributed to better diet and ever improving healthcare. Recent research commissioned by the Alzheimer's Society (Albanese et al., 2008) revealed some facts about dementia which highlight the disease as a growing problem. In 2007 there were 683,597 people with dementia living in the UK (this included over 15,000 young people living with dementia), and this can be taken to represent one person in every 88 of the UK populous as a whole.

The research estimates there will be over 1,000,000 people with dementia in the UK by the year 2025. One third of the population aged 95 and over lives with dementia and 60,000 deaths a year can be directly attributable to the illness (i.e. to delay inception of the illness may save up to 30,000 of these lives per year). Two thirds of people with dementia live in the community i.e. in their own homes; while one third live in residential care homes. 64% of people living in care homes have some form of dementia and the overall financial cost of the disease to the UK is over £17.03 billion a year. Family carers of people with dementia save the UK over £6 billion per year.

The aforementioned report on current dementia statistics in the UK highlights the relatively few numbers of research papers released devoted to dementia and has stated that since 2002 they accounted for only 1.4% of papers i.e. the number of papers released is not relative to the scale of the problem. The top recommendation of the report indicates that addressing the problems associated with dementia should be made a national priority. With Dementia being such a large problem now, it is easy to see how the problem will become exponentially worse when coupled with aforesaid statistics on ageing from the United Nations (2008). There should now be an urgency to find solutions to a healthcare problem that will be a permanent feature of societies in the Developed World.

This is now a challenge facing those developing assistive technologies and solutions and as such advancements in the area of Smart Homes will be the subject of this review. Smart Homes can be described living spaces facilitated with technology which acts to monitor the patient and intervene in activities of daily living (ADL) usually in a manner which is specific