

## Chapter 35

# An Autonomous Intelligent System for the Private Outdoors Monitoring of People with Mild Cognitive Impairments

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### ABSTRACT

*The aim of this chapter is to describe a system for the private outdoor monitoring of patients with Mild Cognitive Impairments (MCI) and dementia. The system has been designed for patients suffering from early stages of Alzheimer's disease and people suffering from MCI and dementia. Virtually, the system may be applied to any person capable of living autonomously but might get lost whilst doing his/her everyday activities, due to a decrease in their cognitive function. The system uses off-the-shelf smart-phones carried by patients to detect abnormal situations and to raise alarms accordingly. The authors describe the system, detail its features, and discuss its utility and relevance both technically and socially.*

### BACKGROUND

The average age of the world population has increased progressively over the last 50 years as a result of the decrease of fertility and the increase in life expectancy. It is believed that life expectancy

will grow in about 10 years by 2050. The ageing of the population is one of the most important challenges for public healthcare systems since they have to face the rise of an aged and very demanding population and their associated health conditions, namely chronic illnesses, injuries and disabilities.

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According to the Organisation for Economic Co-operation and Development:

*In most OECD countries the population is ageing. Due to higher life expectancy and low fertility rates, the elderly population (those aged 65 years and over), accounts for almost 15% of OECD population in 2010, up from just over 12% 15 years earlier. The proportion of elderly population is remarkably lower in the emerging economies (India, South Africa, Brazil and China) and Mexico, Turkey and Chile. (OECD, 2013)*

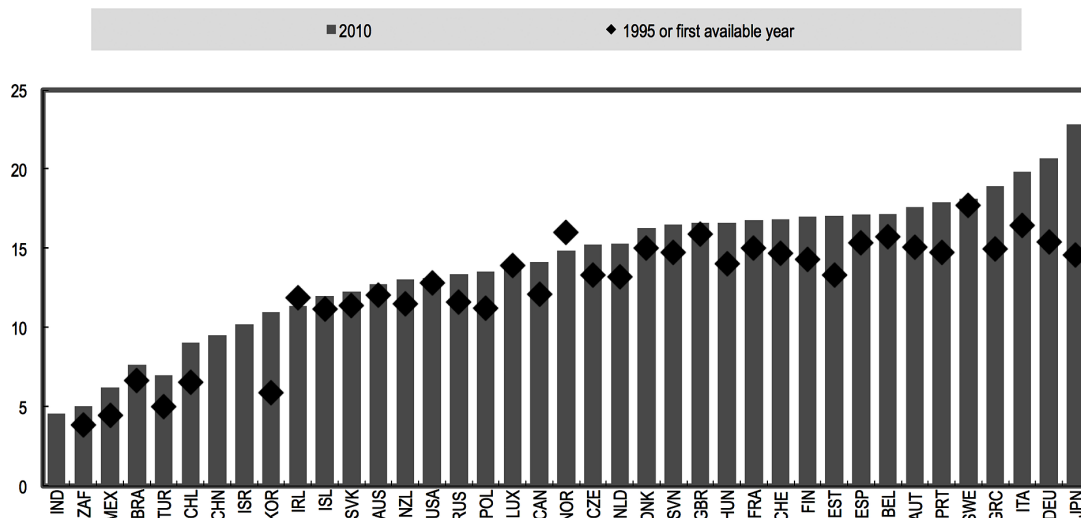
This demographic shift (cf. Figure 1) will result in a huge impact on society and actions have to be taken in the years to come to cope with it. The aforementioned ageing of the population leads to an increase in the cases of cognitive disorders like Mild Cognitive Impairment (MCI), Parkinson's disease (PD) and Alzheimer's disease (AD).

We pay special attention to MCI because it can be seen as a precursor of the early stages of AD and PD and other types of dementia that imply impaired memory function whilst the cognitive function is generally preserved (Petersen, 2001). MCI is a brain function syndrome involving the onset and

evolution of cognitive impairments beyond those expected based on the age and education of the individual, but which are not significant enough to interfere with their daily activities (Petersen, 1999). Annual prevalence estimates for MCI in the United States range from 3% to 4% in the eighth decade (Ganguli, 2004) in the general population. Amongst community-dwelling African Americans, the estimated prevalence is 19.2% for those aged 65-74 years, 27.6% for those aged 75-84 years, and 38% for those aged 85 years and older (Unverzagt, 2001). The prevalence of mild cognitive impairment increases with age. The prevalence is 10% in those aged 70-79 years and 25% in those aged 80-89 years (Roberts, 2008). Many studies indicate that the risk of Alzheimer disease (AD) is significantly higher in women than in men, and it is therefore presumed that the likelihood of developing MCI is greater in women than in men (Anderson, 2013).

People suffering from MCI and early stages of different types of dementia might experience a decrease in their cognitive capabilities that might affect their mobility patterns but they still have considerably high degrees of autonomy (*i.e.* they can live alone, walk, do exercise). The most appar-

**Figure 1. Percentage of elderly population in OECD countries in 2010 and in 1995 (or first available year)**  
Source OECD.



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