

Chapter 13

The Smart Condo Project: Services for Independent Living

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ABSTRACT

Most would agree that older adults want affordable, high-quality healthcare that enables them to live independently longer and in their own homes. To this end, ambient assisted living environments have been developed that are able to non-intrusively monitor the health of people at-home and to provide them with improved care. The authors have designed an environment, the Smart Condo, to support seniors and rehabilitating patients. They have embedded a wireless sensor network into a model living space, which incorporates universal design principles. Information from the sensor network is archived in a server, which supports a range of views via APIs. One such view is a virtual world, which is realistic and intuitive, while remaining non-intrusive. This chapter examines computing technologies for smart healthcare-related environments and the needs of elderly patients. It discusses the Smart Condo architecture, reviews key research challenges, and presents the lessons learned through the project.

DOI: 10.4018/978-1-60960-469-1.ch013

INTRODUCTION AND MOTIVATION

As baby boomers grow older and life expectancies increase, we need advances in health service-delivery models that address an increasing number of chronic conditions in ways that are appropriate for an increasingly informed older population. The healthcare and social implications of aging populations, and the need to enable them to live independently at home longer, is a priority for governments, industry, and researchers to address. Motivated by this need, an increasing number of industrial products and research prototypes today envision *ambient assisted living environments* that are able to non-intrusively monitor the health of people at-home and to guide and support more specialized, timely, and cost-effective care to them. The substantial and increasing wave of new research in this area is a testament to the social importance of the problem and the technical challenges involved. The technical challenges span a range of disciplines.

1. What types of monitoring technologies can be deployed for assisted living purposes? Today, we have a wide variety of technologies at our disposal, ranging from passive and active RFIDs¹, to sensors that can be embedded in the environment or to the patients' clothing and bodies, to wireless devices that are (or can be) integrated with home devices to communicate data on their status and readings.
2. How can data from the various technologies above be fused to infer clinically relevant information about patients? How can the inferred information be communicated to patients and their caregivers (health professionals and family members) in order to be effectively acted upon? And what healthcare disciplines might benefit from information thus obtained?
3. What types of physical, psychological, and cognitive assistance can be possible through

digital technologies? Individual patients may suffer from a variety of ailments, such as limited mobility, diabetes with its variety of implications to stability and food concerns, and forgetfulness.

4. How should care-delivery activities be effectively orchestrated between the patients themselves and their caregivers? Depending on their condition, abilities, and their social environment, patients may be more or less able to manage their own conditions. How can the monitoring infrastructure flexibly support them, while also recognizing exceptional situations and triggering alarms to responsible health professionals?

Hand-in-hand with the above technical challenges (and the functional requirements they imply for an assisted-living infrastructure) come a variety of social requirements. These are distinct yet equally important as the technical requirements, and their fulfillment is a prerequisite for the eventual adoption of any such infrastructure.

1. First is the issue of ethical concerns around privacy, ownership of the collected data, patient access to it, and fair use. Patients, although they may appreciate the increased sense of safety that comes with the monitoring infrastructure, are leery of having their every move monitored. The question then becomes the identification of an acceptable trade-off between data collection and safety.
2. Second is the issue of adaptability. Patients come with different needs, and as their conditions progress, their needs change. This evolution of patient needs implies the need for an extendible assistive infrastructure that can evolve as necessary.
3. Third is the issue of training healthcare professionals. New technologies are only as effective as the people who are using them are knowledgeable; thus, an education program is needed for training health-sciences

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