

Chapter 9

IoT for Ambient Assisted Living: Care4Me – A Healthcare Support System

Fulvio Corno

Politecnico di Torino, Italy

Luigi De Russis

Politecnico di Torino, Italy

Alberto Monge Roffarello

Politecnico di Torino, Italy

ABSTRACT

Research activities on healthcare support systems mainly focus on people in their own homes or nurses and doctors in hospitals. A limited amount of research aims at supporting caregivers that work with people with disabilities in assisted living facilities (ALFs). This chapter explores and applies the Internet of Things to the ALF context. In particular, it presents the design, the implementation, and the experimental evaluation of Care4Me, a system supporting the daily activities of assistants. The requirements for designing and implementing Care4Me derive from a literature analysis and from a user study. The solution combines wearable and mobile technologies. With this healthcare support system, caregivers can be automatically alerted of potentially hazardous situations. Furthermore, inhabitants can require assistance instantly and from any point of the facility. The system was evaluated in two ways. The authors performed a functional test with a group of professional caregivers, and deployed the system in an ALF in Italy, collecting the opinions of caregivers and inhabitants.

INTRODUCTION

One of the challenges that the healthcare sector has been facing in the last decade is how to ensure full coverage of professional care for those who require special attention (e.g., the elderly, people with disabilities, or patients with chronic conditions) containing the associated costs. To address this challenge, Ambient Assisted Living (AAL) systems have been researched extensively (Rashidi & Mihailidis, 2012). AAL is a term used to describe a set of technical systems, infrastructures, and services to support elderly

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people or people with disabilities in their daily routine. It allows an independent and safe lifestyle via the integration of information technologies within homes and residences. Research in the field of healthcare support systems is mainly focused on addressing two problems: improving the quality of life for people in their own homes, especially the elderly, and supporting nurses and physicians in hospitals. However, less research has been done about systems to support caregivers that assist persons with disabilities within nursing homes and on how to design such systems to be effective. To fill this gap, Aced López, Corno, and De Russis (2015) presented a series of guidelines for designing systems that could effectively support caregivers in tasks such as monitoring nursing homes inhabitants and attending to their assistance requests. These design guidelines derive from a literature analysis and from the qualitative analysis of a comprehensive user study carried out in three different Italian Assisted Living Facilities (ALFs) for people with physical and cognitive disabilities. ALFs are health and social care facilities with the aim of providing hospitality, welfare benefits, and recovery to people in mental or physical conditions of dependency. They ensure adequate living conditions for the inhabitants, appropriate for their dignity, by promoting the maintenance or recovery of their residual capacities and the satisfaction of their relational and social needs. Healthcare assistants are the only professional figures employed full time in such houses, typically, so their point of view is central in designing a system that successfully operates in a ALF. The authors of the guidelines conducted three focus groups with a total of 30 caregivers, first focusing on the needs of the healthcare assistants and the overall user acceptance of a new healthcare support system, then on the features and capabilities of the devices used for its implementation. They concluded that a healthcare support system should be designed taking into account issues such as portability, ubiquity, unobtrusiveness, and automatic detection of hazardous situations.

This chapter aims at applying these guidelines and other specific requirements to an effective solution for a healthcare support system. In particular, the authors present the design, the implementation, and the experimental evaluation of an Internet of Things (IoT) system, named Care4Me, capable of supporting the daily activities of healthcare assistants that operate in ALFs and compliant with the guidelines set forth in the work of Aced et al. (2015). The requirements for designing and implementing Care4Me derive from a literature analysis and from a user study conducted with professional caregivers. The authors chose to adopt the IoT technology because this paradigm is being increasingly recognized: the potential of IoT can be used to enhance or at least to enrich healthcare support systems by sensing physiological signals ubiquitously and unobtrusively. As the name suggests, the IoT is the network of physical objects that are supposed to be always connected to the Internet with the aim of sharing services and information with other connected “things”. In addition to connecting people, anytime and everywhere, IoT connects humans to smart objects, and puts these objects at the service of humanity. The system presented here involves mobile and wearable technologies to improve the modalities to provide and require assistance. Through it, caregivers can be automatically alerted of potentially hazardous situations that happen to the inhabitants while these are out of sight. Furthermore, inhabitants can require assistance instantly and from any point of the facility.

The work was divided in several phases. First of all, the authors extracted the requirements from the study of Aced et al. (2015) and from the results of a user study with a group of professional caregivers. In this way, the authors based the design of the system on the needs of real users. Then, the solution was implemented and tested in laboratory. Finally, the system was evaluated in two ways: a) performing a functional test with a small group of professional caregivers, and b) deploying the system in an Italian ALF for 36 hours, collecting objective data as well as the opinions of the involved caregivers and inhabitants.

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