Ambient Intelligence for Monitoring Alzheimer Patients

Walid Bourennane, Laboratory for Analysis and Architecture of Systems, University of Toulouse, Toulouse, France

Yoann Charlon, Laboratory for Analysis and Architecture of Systems, University of Toulouse, Toulouse, France

Fehd Bettahar, Laboratory for Analysis and Architecture of Systems, University of Toulouse, Toulouse, France

Marie Chan, Laboratory for Analysis and Architecture of Systems, University of Toulouse, Toulouse, France

Daniel Esteve, Laboratory for Analysis and Architecture of Systems, University of Toulouse, Toulouse, France

Eric Campo, Laboratory for Analysis and Architecture of Systems, University of Toulouse, Toulouse, France

ABSTRACT

Distributed sensors allow people to be followed in independent living situations. In this paper, the authors present a multisensor system which allows monitoring elderly people in hospital environment. The system is composed of motion infrared sensors installed in the ceiling, presence sensor in bed and ZigBee tags embedded on the person. From data collected on locations and movements of people, the system determines, through learning, the behavior model and lifestyle. Analysis and decision algorithm in integrated systems provide the functionality to choose actions in order to alert surveillance team and help them by providing historical events record. A web application is also set up to display results of data processing allowing caregivers to monitor patient behavior. Here, they present the system architecture, the technology used, and some preliminary results.

Keywords: Activity Data, Data Fusion, Elderly, Health Monitoring System, Wearable Device, Wireless Infrared Sensor, ZigBee Communication

INTRODUCTION

Population ageing and autonomy loss are associated with higher health costs challenges in our modern society. The problem of ageing population in France and worldwide has been extensively studied. In 2010, France has about 65 million inhabitants of which 16.8% are over 65 years (more than 10 million). 17 million are expected in 2020. 6.6% of those over 60 are dependent. The prevalence increases with age, 2 million dependent people requiring support are planned for 2020 (insee). Technologies for health is an important market, dynamic and
high value added, on which France lagging is in international scale, this sector is the first one that creates benefit (percentage of produced value 45%). The overall market is estimated to 185 billion Euros, and its annual growth is 6 to 7% on average (Pammolli et al., 2005). The French market is estimated in 2005 to 6.7 billion euros (snitem). It includes medical devices, technical assistance, medical benefits and social home (ALCIMED, 2006). Market estimates “Autonomy and Homecare” will provide in France a potential of four billion Euros annually, new jobs are advanced to about 50,000 people, it should multiply by three or four (ALCIMED, 2007).

As individuals, families, communities and, authorities, we are facing new technical and social challenges to design the delivery of health care, ensure health service quality and maximize elderly and handicapped autonomy and quality of life. Recent advances in information technology (IT), computation and, miniaturization of sensors allow us nearer to futurist visions of smart devices and technology embedded environments. Many smart homes have been developed throughout the world; most of them are from academia or industrial prototypes (Chan et al., 2008) (Bonhomme et al., 2008). These solutions are based on embedded devices or distributed in the life environment of the individuals. However, activity monitoring systems based on movement detection showed their limitations (Chan et al., 2009); these systems can’t detect the patient when several people were in the same room. To resolve this problem and to extend it to the outdoor monitoring (opened areas inside hospital, garden, park) identifying the patient is necessary with a complementary location and identification equipment (Campo et al., 2010).

In this paper we present a system used to detect and predict indoor and outdoor mobility and activity conditions of the elderly and so to prevent complications before they develop. The experimental platform architecture implemented in a hospital’s unit is described. It is based on a presence sensors network coupled with a wearable device used to locate, to identify and to assess activity status of the patient. It’s obvious that the system could be installed at home for example and not only in dedicated or specialized places. Then, we show how the association of the two solutions allows properly following the patient’s health-status evolution. Finally, we present the database and interfaces developed especially for the medical staff. A conclusion ends the paper.

**EXPERIMENTAL PLATFORM**

1. Alzheimer unit

A monitoring system for following the status change of people has been implemented in confused people unit in Caussade Hospital in France. This unit is a ground-floor service for seniors who suffer from Alzheimer’s disease and have a secure garden promotes walking.

2. General architecture

The general architecture of the system consists of two processing units (local and remote) as shown in Figure 1. Local unit is used to collect displacement data in real time via sensors (Infrared (IR), ZigBee) and to store them in a database. It can also generate emergency messages to prevent medical staff if a risk occurs.

The concept uses a patient behavior model based on learning techniques (Chan et al., 1995). Remote unit recovers files containing the displacement data in order to make the calculations and establishing the behavior model. It receives requests periodically to update the thresholds, these thresholds are the result of merging these data from behavior model, and it will be forwarded to the local unit in order to trigger alerts and warnings. Remote unit can also host the web application that will be accessible by the caregiver to view the results of data processing.
Electronic Medical Records as an Improvement to Comply with Data Protection Rules
[www.igi-global.com/article/electronic-medical-records-improvement-comply/68837?camid=4v1a](www.igi-global.com/article/electronic-medical-records-improvement-comply/68837?camid=4v1a)