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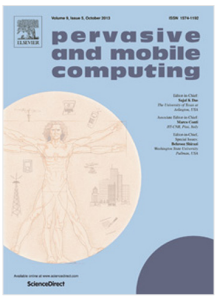

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Haider Mshali, Tayeb Lemlouma, Damien Magoni

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Adaptive Monitoring System for e-Health Smart Homes

Haider Mshali[a], Tayeb Lemlouma[b,*], Damien Magoni[a]

[a] *University of Bordeaux, LaBRI, 351 Cours de la Liberation, 33405 Talence, France*
[b] *University of Rennes 1, IRISA, Rue Edouard Branly, 22302 Lannion, France*

Abstract

Existing e-health monitoring systems mainly operate in isolation from the requirements of modern healthcare institutions. They do not include optimized techniques which learn the patient's behavior for predicting future important changes. We propose a new context-aware e-health monitoring system targeted at the elderly and isolated persons living alone. It monitors daily living activities and evaluates dependency based on geriatric scales used by health professionals. Its adaptive framework collects only relevant contextual data for evaluating health status. By monitoring the achievement of daily activities, the system learns the behavior of the monitored person. It is then able to detect risky behavioral changes by using our novel forecasting approach based on the extension of the Grey model GM(1, 1). In order to evaluate our system, we use a Markovian model built for generating long term realistic scenarios. By simulation, we compare the performances of our system to traditional monitoring approaches with various synthetically generated scenarios and profiles. Results show that with minimal sensing and data collection, our system accurately evaluates a person's dependency, predicts its health condition, and detects abnormal situations while preserving system resources.

Keywords: abnormal behavior detection, adaptive context-aware monitoring, dependency, e-health, health smart home, health state prediction.

1. Introduction

The ratio of aging population has risen significantly in the past few years [1]. The progressive decline in physical and cognitive skills prevents elderly people from living independently and from performing basic instrumental activities of daily living (IADL). A potential solution to this issue is to develop e-health monitoring systems (HMS) implemented at home, leading to the creation of *health smart homes* (HSH). HSH can monitor patients' activities and enable healthcare services at home especially for persons with chronic diseases. They can thus delay their placement in institutions such as nursing homes and hospitals.

Traditional monitoring systems tend to manage all sensed data with unconditional processing. Most of them adopt a continuous monitoring strategy that negatively affect resource usage and relevance of decisions. Such long-term monitoring consumes storage, uses energy for multiple sensors and sinks, increases computational costs required to analyze data, and increases network usage leading to transmission failures. Handling huge amounts of data can also impair the system in triggering relevant and quick decisions. In order to enhance the reliability of data transmission and the availability of high relevant contextual information, there is a need to define efficient data summarizing and filtering mechanisms applied with a conditional scheme.

Context-aware monitoring systems require a global and full visibility of the person's context. This visibility includes recognizing daily activities and detecting abnormalities. The key challenge in such environments

*Corresponding author.
Email addresses: haider-hasan.mshali@u-bordeaux.fr (Haider Mshali), tayeb.lemlouma@irisa.fr (Tayeb Lemlouma), magoni@labri.fr (Damien Magoni)