Affordable Smart Living System Prototype Based on Generic Environmental Sensors

Zarko Popovski, Vladimir Trajkovik

Faculty of Computer Science and Engineering, University "Ss Cyril and Methodious", "Rugjer Boshkovikj" 16, P.O. Box 393, 1000 Skopje, Republic of Macedonia
zarko.popovski@gmail.com, trvlado@finki.ukim.mk

Abstract. This paper presents our approach to create affordable self aware Ambient Assisted Living System (AAL) that has possibilities to follow activities and take care of the humans who live in certain healthcare environment. The developed prototype is applicable to different healthcare environments, but in this paper we focus on nursing homes populated by elderly people or people with disabilities. The system presented in this paper is using environmental sensors and body sensors. Using this kind of AAL system can increase quality of life to its users.

Keywords: Body Sensor Networks, Environmental Sensors, Assisted Living, Health Care, Smart Home, Self Aware Systems

1 Introduction

User aware AAL systems are systems that collect and analyze data from different sensors in real time and can define context of behavior of end users. These systems could be very promising for helping elderly and people with disabilities. They can also provide information needed to decrease economic cost for medical centers. There are many companies that are interested for developing systems that analyze collected patient data and depending on patient Electronic Health Record (EHR) or Electronic Medical Record (EMR) take specific actions. These systems are mostly used in medical institutions because it's important to track patient activities in real-time. Also some variations on these systems could be used individually for making homes more secure and for smart house automation [7].

AAL systems are built by using many different sensors needed for collecting environmental data: temperature, humidity, light detection, sound detection, motion detection and body sensors for reading: heart rate, blood pressure, brain activity, oxygen capacity etc. Collected data from sensors is evaluated and analyzed by the system and different actions are executed according to some predefined rules. These actions can be used to provide help in medical treatments but also for early diagnosis and preventing illness. Social networks are also very good source for tracking patients' real time activities, which creates data that can be used in combi with data collected from the AAL sensors to generate more precise diagnosis. Analyzing social data [5] shared by

S. Loshkovska and S. Koceski (eds.), *ICT Innovations 2015*,
Advances in Intelligent Systems and Computing 399,
DOI: 10.1007/978-3-319-25733-4_12

users with similar health conditions is important because it can help for generating the recommendations [8] for improving patient health. Social networks can be also used for sending notifications to specific user or group of users.

Many medical centers give portable diagnostic devices to the patients allowing automatic generation of notification whenever some parameter from EHR is changed. Depending on the EMR, they can give instructions to the patient what actions to take. This provides possibility for real time monitoring of patient vital data regardless to his/her location. Real time tracking on patient's health status in combination with AAL system can find and notify the closest medical center for sending the ambulance vehicle or calling taxi for transportation in case of emergency. AAL system can inform doctors about patient's condition prior to his/her arrival in the medical institution.

AAL systems are usually implemented in medical centers. Implementation on AAL system for personal usage is expensive. Generic sensors can decrease cost of implementation of AAL systems. Generic sensors can be reconfigured automatically depending on the needs of end users. These sensors can be used for implementation on informative AAL systems where the main role would be notifying or recommending the end user for some actions.

In this paper we'll present prototype AAL system based on general AAL design architecture of generic sensors. [1]. It focuses on cheap, affordable implementation that includes easy reconfiguration, data persistency and availability of offered services. We investigate the total data throughput needed to establish such AAL system.

We use generic portable sensors and analyze collected data from the sensors. The prototype includes: custom developed data collection server that collects all data from the sensors, transforms and encrypts them for easy transferring trough the Internet and post processing, mobile devices for notifying the person for the current status, and cloud based backend where all data are collected, transformed by the data collection server, analyzed and processed.

The rest of the paper is organized in five sections, Section2, Related Work, analyzes similar systems to prototype AAL system developed in this paper, emphasizing their positive and negative features. Section 3 explains operational architecture and implementation of our prototype system for Ambient Assisted Living, based on the custom developed portable sensors. Section 4 presents deployment of prototype system and two simple test use case scenarios. Section 5 concludes the paper.

2 Related work

There are already many developed systems. We'll try to present some of them.

In [1], general architecture for AAL based on mobile, web and broadband technologies is presented. Mobile devices are used for collecting data from environmental and body network sensors, but also for easy accessing the specific person data. Raw data is preprocessed, filtered by noise, and then processed using healthcare algorithms that transforms raw data into relevant information which is distributed and used by different services. This model includes processing of data aggregated from social