Chapter 48
Adoption of Wearable Systems in Modern Patient Telemonitoring Systems

Antoniadou Eleni
University of Central Greece, Greece

Ilias Maglogiannis
University of Central Greece, Greece

ABSTRACT

The adoption of wearable systems in modern patient telemonitoring systems has been considered as a medical challenge towards the established medical practices, aiming at the highest level of quality of life. The current state-of-the-art technologies in wearable computing, wireless telemedical platforms and wireless sensors allow easy and unobtrusive electronic measurement of several vital signals and health conditions regardless the time and the place the patients need a condition monitoring. Certain major milestones to consider in the process of adopting wearable systems, besides the enabling technologies, are the affordability that depends on financial criteria, the adaptability of the overall healthcare sector to the innovative technologies and the conformance of the medical staff to the lifelong learning for vocational training. These aspects are discussed in this chapter, along with the description of the wearable systems capabilities and reference to their latest popular applications and future trends.

1. INTRODUCTION

The area of patient telemonitoring utilizing wearable devices is of particular importance and relevance during the last years. Monitoring of physiological and physical parameters may improve significantly the assessment and management of a patient health status, as it can contribute to the reduction of healthcare cost by avoiding unnecessary hospitalisations and ensuring the direct confrontation of emergency situations. Innovative wearable computer and software technologies are deployed to provide vital patient data monitoring and connect clinicians with patients using wearable computing technology via workstations, wireless devices and the Internet. Having realized the impact of this technology era to the healthcare industry, this chapter focuses on the e-health tools and practices related to wearable computing systems. The chapter investigates the current and

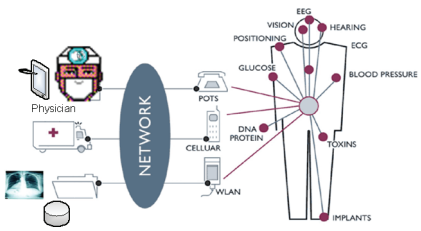
DOI: 10.4018/978-1-61520-670-4.ch048

future trends in this field through the adoption of wearable systems.

Wearable systems bring technology to patient care, ranging from prevention and diagnosis to follow-up, allowing the utilization of modern communication equipment and services. The goal is to link distant healthcare stations and individuals for the provision of healthcare services in real-time, allowing patient mobility. Unlike a laptop or a PDA, a wearable computer follows patients around and merges into the therapeutical processes and the human interactions. These devices not only allow long-term, continuous, and unobstructed monitoring of physiologic information, such as biopotential, photoplethysmogram (PPG), heart rate (HR), blood pressure (BP), blood oxygen saturation (SpO_2), and respiration, but can also provide more realistic indication of the patient's health status, and information that is otherwise inaccessible in clinical settings. By supporting online access to written information, anatomical maps, diagrams, photos, patient databases and allowing consultation with experts and peers through audio, video and text, the wearable computer can provide both doctors and patients with access to knowledge everywhere and in any situation. Enabling remote collaboration between doctor, nurse and other staff members, through wearable computers, should bring to faster, more efficient knowledge sharing and hence faster, more accurate, on-line higher standard performance. A typical architecture of electronic healthcare provision based on wearable systems and sensors is depicted in Figure 1.

As it may be seen in Figure 1 a central node in the patient's body is not prerequisite in every wearable infrastructure. Wireless communication infrastructure may be used for interconnecting the central node. The modern trend towards this direction is the formulation of patient Personal Area Networks, consisting of a wireless infrastructure of medical sensors, attached to patient's body, which lays the path for incessant telemonitoring of the person in mind, without discomforting them.

Figure 1. A typical wearable system architecture



The nature of data that these networks are set to handle, as well as the particular demands that patient telemonitoring services raise, necessitate for a thorough analysis of the design requirements of the networks communication protocols, in order to outflank possible disadvantages appearing in protocols for different types of wireless sensor networks, without putting aside simplicity and feasibility factors.

From the variety of fixed and mobile access techniques, according to assumed selection criteria, one can determine which technology to choose. Looking at both incumbent and emerging solutions, each medical party and patient may obtain as many benefits as necessary. When the scenario requires mobile telemetric of patients' health, GSM or WLAN connections might be chosen. When medical specialists have to perform videoconference or live surgery coverage, they may utilize broadband techniques like POTS, xDSL or IP networks (LAN/WAN). Wireless LANs came to bridge the gap of applications like those that are described above. However, they are not limited to that small sector of science. More information regarding the networking modules of wearable systems are provided in Section 2.

The most popular biosignals incorporated in wearable systems are summarized in the table below (I. Maglogiannis and S. Hadjiefthymiades, 2007).

Wearable systems are applied in wide range of specific targets in the areas of: