

## Chapter 8.2

# Mobile Health Applications and New Home Telecare Systems: Critical Engineering Issues

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### ABSTRACT

This chapter describes the very actual issues on mobile health (M-H) and home care (H-C) telecare systems, reviewing state of the art as well as theoretical and practical engineering issues crucial for designing these applications. The purpose, advantages and overall information and communication technology (ICT) architectures of M-H and H-C telecare systems are firstly presented. There are several engineering fields involved in the design of modern M-H and H-C applications. Making the optimal application-specific choice in each engineering aspect and achieving the right balance between complementary coupled technological requests are of crucial meaning so the main critical engineering issues (weighted at sensing node's design and the wireless communications) are presented in details as well. Systematic theoretical review and accentuation of the design and realization problems given in this chapter can contribute in better understanding of crucial engineering issues and challenges on this topic as well as in giving the proper direction lines

to approaching the practical realization of M-H and H-C telecare systems.

### FROM DESKTOP TELEMEDICINE TO THE NEW WIRELESS SOLUTIONS

For more than 30 years, the achievements in IT, electronics, telecommunications and biomedical engineering have been used to facilitate the quality of health care delivery. This kind of approach has provided great benefits in improving the health of population generally, especially by assuring the timely diagnostics and therapeutic treating of patients. Taking the historical view of the technologies that have been used in classical telemedicine applications, one can notice that these applications mainly were designed for fixed-based infrastructure remote monitoring, professional teleconsultations and in providing medical help to remote patients treatment. These applications were concentrated on transferring biomedical and video signals, as well as the medical images and sounds, with the main aim of providing the remote health care service. But, the main drawbacks of the early health delivery

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systems are contained in the fact that they were not designed to provide the mobility, autonomy of measured subject and health care delivery integrated into patient's everyday life.

Current and emerging developments in microelectronics and wireless communications integrated with developments in pervasive and wearable technologies will have a radical impact on future health care delivery systems (Istepanian, Jovanov, and Zhang, 2004). The results of these developments make possible the realization of the wireless medical sensors with networking capability. Such medical sensor networks greatly enhance the ability of physicians to timely examine and treat complex biological systems at a distance and effectively reduce the infrastructure cost at hospital side and the travel expense at the patient side. The use of new wireless technologies in health delivery systems, offers many advantages, especially in continuous remote monitoring of patient vital signs. The most important improvements are achieved in earlier illness detection enabling timely medical intervention as well as in the treatment of chronic diseases. The integration of emerging wireless technologies in health delivery applications today is separated in two new engineering challenged disciplines – **mobile health** and **home care telecare** systems. Newer concepts represent M-H as a form of e-health evolution from traditional desktop telemedicine to wireless mobile configurations. M-H provides remote medical service delivery (especially the monitoring of biomedical signals) even while patient is in a move and regardless of geographical location of the patient. Home care systems, on the other hand, provide usually more functionality but these systems have the reduced range of mobility. In this case, the mobility range is usually limited to the level of the house, hospital or office. So, the main functional difference between M-H and H-C telecare systems is related to the mobility area. By using small-scale sensing and processing hardware attached to the patient's body or embedded into patient's everyday life ambience, both M-H

and H-C systems make possible: more often or continuous inspection of patient's health condition generally, the monitoring of daily variable medical parameters (ECG, SpO<sub>2</sub>, blood pressure, glucose level, EEG etc.) which variations can point to specific medical conditions and illness etc. The advantages of using the modern m-health and home care applications can be summarized as follows:

- Medical treatment even when the patients are not situated in medical institution,
- Continuous, “real time” or store-and-forward insight into patient's health parameters
- Mobility and comfort of patients while medically treated
- Intelligent monitoring systems with the ability to generate alarms
- Multi-parameter and multi-user health care delivery
- Tele-consultations and flexible access to expert opinion and advice at the point of care without delay
- Easy integration into greater telemedicine systems.

## **M-HEALTH AND HOME CARE APPLICATIONS**

Applications related to the applying of wireless concept in medicine, usually have been realized for portable teletrauma systems (Chu & Gantz, 2004) and in systems designed for remote medical monitoring of mobile or “semi-mobile” patients (Lin et al, 2005, Anliker et al 2004, Fadlee et al 2005, Boquete, 2005). In the case of teletrauma systems, realized applications provide the transmission of medical parameters as: biomedical signals, images, video signals and voice assuring better understanding of the problem by medical professionals residing at remote location and, consequently, better assistance to the medical

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