Chapter 23
Quality of Service and Radio Management in Biomedical Wireless Sensor Networks

Carlos Abreu
Instituto Politécnico de Viana do Castelo, Portugal

Francisco Miranda
Instituto Politécnico de Viana do Castelo and CIDMA of University of Aveiro, Portugal

Paulo M. Mendes
Universidade do Minho, Portugal

ABSTRACT

Biomedical wireless sensor networks enable the development of real time patient monitoring systems, either to monitor chronically ill persons in their homes or to monitor patients in step-down hospital units. However, due to the critical nature of medical data, these networks have to meet demanding quality of service requirements, ensuring high levels of confidence to their users. These goals depend on several factors, such as the characteristics of the network deployment area or the network topology. In such context, this chapter surveys the main applications of biomedical wireless sensor networks, taking into account the key quality of service requirements of each one of them. Finally, it presents an analytic method, and its experimental validation, to help engineers managing the radio power of the network nodes in order to improve the communications and the quality of service provided by the network while minimising the energy consumption and, thus, maximising the network lifetime.

INTRODUCTION

Healthcare providers and professionals broadly use information and communication technologies in their daily practice. Indeed, it is practically impossible to find a healthcare service that does not use any kind of computer-based technology. The information and communication technologies become almost completely pervasive and ubiquitous. The last frontier envisioned by the research community concerns

DOI: 10.4018/978-1-4666-8823-0.ch023

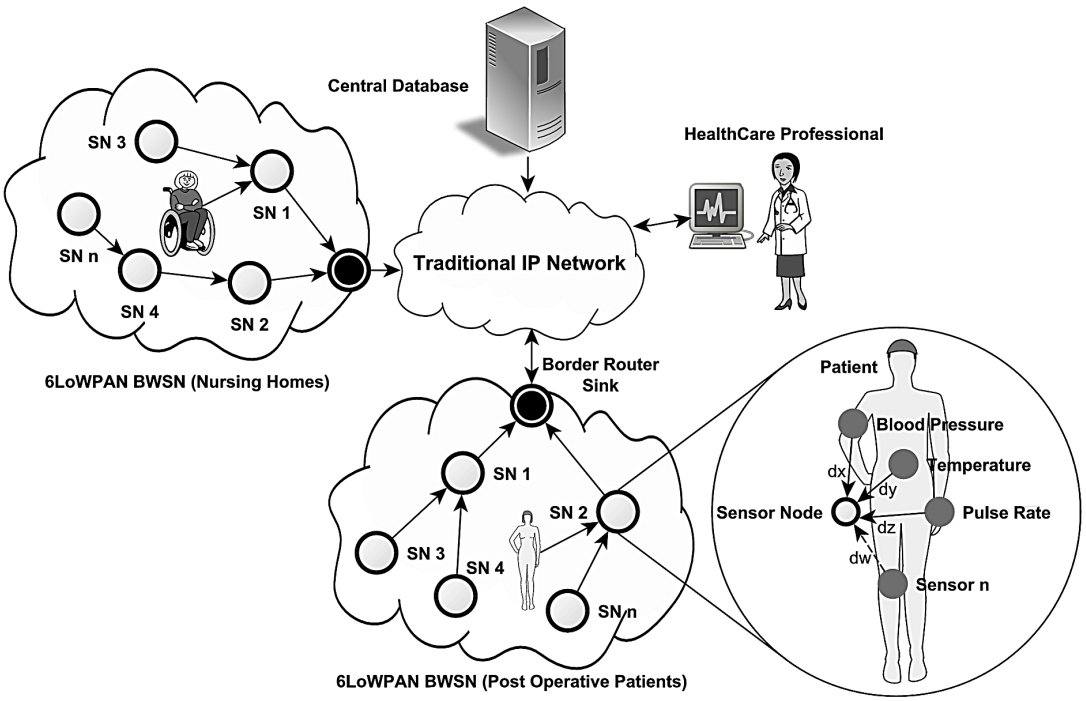
Copyright © 2016, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

closed-loop real-time and continuous monitoring of each person's health in every aspect of its daily life, using non-intrusive and ubiquitous technologies. Although this futuristic vision is still far from reality, some big steps are being taken in that direction. It is expected that pervasive and ubiquitous healthcare (u-health) systems, combined with wireless sensing systems like Biomedical Wireless Sensor Networks (BWSNs) and Body Sensor Networks (BSNs), contribute to change the actual healthcare practice centred in the episodic evaluation of the patients, to the continuous patient assessment, based on real-time and long-term monitoring.

BWSNs are small-sized Wireless Sensor Networks (WSNs) equipped with biomedical sensors, designed for medical applications or healthcare services. Typical applications of BWSNs include catastrophe and emergency response, Ambient Assisted Living (AAL) applications to monitor and assist disabled or elderly people, and patient monitoring systems for chronically ill persons. Among these application fields, this chapter will focus on the aspects related to the Quality of Service (QoS) guarantees requested to BWSNs by patient monitoring systems used to collect vital and physiological signs of patients in step-down hospital units of nursing homes.

Typical patient monitoring applications, supported by BWSNs, are used to collect vital or physiological signs, such as respiratory rate, pulse rate, temperature, blood pressure, and blood oxygen saturation in order to complement the measurements performed manually by nursing professionals a few times a day and thus, enhancing the quality of the health care provided to patients. The sensed data are then sent to a local or remote database to be used to support healthcare professionals in their medical practice. As an abstraction, BWSNs can be seen as a physical layer for Healthcare Information System (HIS), collecting data to support healthcare professionals in their decisions and medical diagnosis, see Figure 1.

Figure 1. Typical applications of biomedical wireless sensor networks and their architecture



20 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:
www.igi-global.com/chapter/quality-of-service-and-radio-management-in-biomedical-wireless-sensor-networks/137460

Related Content

Artificial Intelligence Techniques for Unbalanced Datasets in Real World Classification Tasks
Marco Vannucci, Valentina Colla, Silvia Cateniand Mirko Sgarbi (2011). *Computational Modeling and Simulation of Intellect: Current State and Future Perspectives (pp. 551-565).*
www.irma-international.org/chapter/artificial-intelligence-techniques-unbalanced-datasets/53319

Relay Race Methodology (RRM): An Enhanced Life Cycle for Simulation System Development
Evon M.O. Abu-Taieh, Asim Abdel Rahman El Sheikhand Jeihan Abu Tayeh (2008). *Simulation and Modeling: Current Technologies and Applications (pp. 156-174).*
www.irma-international.org/chapter/relay-race-methodology-rrm/28985

Improving the Operational Efficiency of Healthcare Operations Using Digital Twins
Dipti Chauhanand Pritika Bahad (2025). *AI-Powered Digital Twins for Predictive Healthcare: Creating Virtual Replicas of Humans (pp. 139-168).*
www.irma-international.org/chapter/improving-the-operational-efficiency-of-healthcare-operations-using-digital-twins/373668

Challenges Faced in Enhancing the Performance and Scalability in Parallel Computing Architecture
M. Narayana Moorthiand R. Manjula (2016). *Handbook of Research on Advanced Computational Techniques for Simulation-Based Engineering (pp. 252-269).*
www.irma-international.org/chapter/challenges-faced-in-enhancing-the-performance-and-scalability-in-parallel-computing-architecture/140393

Motivated Learning for Computational Intelligence
Janusz A. Starzyk (2011). *Computational Modeling and Simulation of Intellect: Current State and Future Perspectives (pp. 265-292).*
www.irma-international.org/chapter/motivated-learning-computational-intelligence/53309