Chapter 4.1
Pervasive Healthcare:
Problems and Potentials

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ABSTRACT

Pervasive healthcare is a vision for the future of healthcare. Healthcare provisions can be delivered with high quality at low cost along with higher patient-experienced quality and satisfaction as a service on top of a pervasive computing infrastructure, which can be built by integrating communicating computer-power into industrial products and fixed structures in urban and rural spaces. For pervasive healthcare, integration with on body networks sensors and actuators may also be needed. This chapter discusses the prerequisites of this vision from a point of a healthcare professional. A number of parallel advances in concepts have to take place before pervasive healthcare (PH) is matured into a general method for delivering healthcare provisions. The contemporary, most widespread model of healthcare provisions as industrial products with consumer-goods characteristics has to mature into the concepts of welfare economics. New market models have to be developed for PH to pervade society and add value to the health aspects of an individual's life. Ethical and legal aspects must also be further matured. Maturation of technology is needed. This includes all the components of the "pervasive loop" from sensors to the central intelligence back to the actuators. The "virtual patient/healthy human" as an operational digital representation of the "object/subject of care" also has to be developed. Pervasive healthcare (or the European Union term: ambient assisted living) is a promising field, that has potential to integrate health considerations and health promoting activities for patients and non-patients in their everyday conduct and provide added value to life quality for individuals.

INTRODUCTION

The author of this chapter will discuss, from the point of view of a person seeing patients every day (i.e., a health professional), the prerequisites and needs for successful implementation of a computer-supported, universal healthcare delivery system. The author will also suggest possible concepts for the future maturation of technology

and services for the purpose of creating such a pervasive healthcare system. More specifically human aspects of pervasive healthcare computing are considered.

The topics discussed in this chapter will be more abstract than that of simply describing developed solutions and current research approaches; and it is not a comprehensive overview of "state of the art" in pervasive computing or pervasive computing for health. Future directions will be discussed briefly at the end of the chapter. There are three parts to this book chapter: the human-societal perspective, the clinical perspective on architecture and services, and briefly the future trends in pervasive healthcare.

Pervasive Computing

Pervasive computing is at present a vision for the future of healthcare. The word *pervasive* itself is derived from the Latin word *per vas* meaning to go through. Pervasive computing can be defined as a ubiquitous, computer-based service. Pervasive computing could be used to service both individuals and society as a backdrop for providing with information. Pervasive computing architectures are achieved by integrating, networking, and enabling communication between computers and humans, humans and computers, and between computers themselves. Such interactions could exist among (nearly) every industrial product and more fixed structures in the environment such as buildings, bus shelters, and poster stands used for advertising. Pervasive computing could also include *wearable computing* devices. Wearable computing is a term that describes *body area networks* (BANs) (or *PAN = personal area networks)*. Here, computational power interacts with a pervasive infrastructure, the user, and/or his or her physiologic functions through on-body sensors and actuators. Intelligent textiles are also a part of this interaction network. Other terms, such as *ubiquitous computing* or the European Union's term for pervasive computing, *ambient*

intelligence, have been used more or less synonymously with pervasive computing.

Pervasive Healthcare

"Pervasive healthcare" (PH) refers to the "invisible, omnipresent" networked, interoperable, computational power-structure that is employed for the purpose of adding to the quality of life and health and wellness of every citizen (whether they consider themselves healthy or not). Pervasive healthcare involves individualized interaction between health services layered "on top" of a pervasive computing infrastructure. In the future, pervasive healthcare could have a public health dimension as well, providing more general, invisible social science information via surveys and context sensitive advice and information aimed at prophylaxis and the collective health of groups of individuals. In European Union terms, pervasive healthcare is equivalent to the term "ambient assisted living."

In computer science, "context sensitivity" is a term that describes a computer system as being "aware" of a number of physical circumstances (the current user, the location, the task to be worked on… etc.). In order for pervasive healthcare to become a reality a health-oriented, individual, "intellectual, health context sensitivity" needs to be developed. This health or "clinical context sensitivity" will be discussed in a later chapter in terms of the current research and work in the areas of the object of work—or the object of interest (OOI).

SECTION ONE: THE HUMAN-SOCIETAL PERSPECTIVE

Societal Aspects of Healthcare

One of the main or fundamental pillars of a welfare society is its healthcare services. In welfare societies, healthcare services present as organized, industrial, institutions with a concentration of

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