

## Chapter 3.4

# Utilizing Mobile Phones as Patient Terminal in Managing Chronic Diseases

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### ABSTRACT

Mobile information and communication technologies are advancing rapidly and provide great opportunities for home monitoring applications in particular for outpatients and patients suffering from chronic diseases. Because of the ubiquitous availability of mobile phones, these devices can be considered as patient terminals of choice to provide a telemedical interaction between patients and caregivers. The most challenging part still is the patient terminal, that is, to offer the user a method to enter measured data into a system as well as to receive feedback in a comfortable way. The objective of this chapter is to present and compare solutions for mobile-phone-based

patient terminals as developed by us and other authors.

### INTRODUCTION

“Telemonitoring is defined as the use of audio, video, and other telecommunications and electronic information processing technologies to monitor patient status at a distance” (Field, 1996, p. 271). This concept may be particularly suitable in the management of chronic diseases where a close partnership as well as collaboration between patient and healthcare provider are essential. New paradigms such as prevention and patient empowerment promote the development of novel

care approaches in which outpatient monitoring is a basic aspect.

Rapid advancements of information and communication technologies and the increasing availability of mobile phones open new perspectives in using these devices for tele-monitoring applications to deliver healthcare to people geographically remote from physicians or medical centers. The possibility to use the mobile phone for standard voice communication as well as for the transmission of a variety of multimedia information like text, audio, images, and videos makes it the communication interface of choice for patient-centered tele-monitoring applications.

The basic idea is to track patients' personal health status using the mobile phone as a patient terminal and to send the data to a remote monitoring centre. An automated monitoring process checks the values and gives feedback in order to guide the patient through the self-managing process and to turn the doctor's or other caregiver's attention to the patient when necessary by means of notifications and alerts. The most challenging part in this scenario still is the patient terminal, that is, to offer the user an easy method to enter measured data into a system as well as to get feedback of the current health status in a comfortable way.

This chapter will focus on the usage of mobile phones in the management of chronic diseases and gives an overview of available technologies. Furthermore, it will present and compare already implemented mobile-phone-based home monitoring concepts as developed by us and other authors.

## **BRIEF HISTORICAL OUTLINE**

Basically, tele-monitoring combines topics from the fields of medicine, information and communication technology, and computer science. Particularly, information and communication technologies have undergone rapid advance-

ments over the past decades, driven by the needs of modern information society. Communication devices such as mobile phones or personal digital assistants (PDAs) became smaller and more powerful, and advanced from single-purpose stand-alone devices to multipurpose networked devices that make them usable for tele-monitoring applications indeed.

However, reviewing the literature, the exact date when tele-monitoring was first mentioned in healthcare is still unknown (Brown, 1995). Starting with the first words transmitted by telephone in 1876 by Alexander Graham Bell, communication technology was ready to be used to facilitate healthcare services. For example, William Einthoven, the father of electrocardiography (ECG), transmitted ECG signals over wired telephone lines in 1906 (Barold, 2003).

In the 1930s, when the telephone became standard equipment in households, it also became the mainstay of medical communication and remained a major element until today. Wireless communication technologies were invented at the same time. Around the time of World War I, radio communication was established in a wider area, and, around 1930, it was used in remote areas such as Alaska and Australia to transfer medical information (Zundel, 1996).

Besides pioneering efforts of a few physicians using off-the-shelf commercial equipment to overcome time and distance barriers, current tele-monitoring concepts originated from developments in the manned space-flight program introduced by the National Aeronautics and Space Administration (NASA) in the early 1960s (Brown, 1995). The main intention was to monitor physiological parameters like heart rate, body temperature, ECG, and oxygen and carbon-dioxide concentration of astronauts in space and transmit the data to earth in order to establish an understanding of the health and well-being of the astronauts while they were in orbit.

Nowadays, tele-monitoring is adjudicated an important role in health systems since for a num-

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