

Chapter 3.7

Sensing of Vital Signs and Transmission Using Wireless Networks

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ABSTRACT

People living with chronic medical conditions, or with conditions requiring short term monitoring, need regular and individualized care to maintain their normal lifestyles. Mobile healthcare is a solution for providing patients' mobility while their health is being monitored. Existing studies show that mobile healthcare can bring significant economic savings, improve the quality of care, and consequently the patient's quality of life. However, despite all progresses in advanced information and telecommunication technologies,

there are still very few functioning commercial wireless mobile monitoring devices present on the market, which most work off-line, are not proper for m-health services and there are still many issues to be dealt with. This chapter deals with a comprehensive investigation of feasibility of wireless and cellular telecommunication technologies and services in a real-time m-health system. The chapter bases its investigation, results, discussion and argumentation on an already developed remote patient monitoring system by the author. The implemented m-health system has been evaluated and validated by a number of well defined tests and experiments. The designed and implemented system fulfils the requirements.

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The suggested system is reliable, functions with a clinically acceptable performance, and transfers medical data with a reasonable quality, even though the system was tested under totally uncontrolled circumstances during the patients' daily activities. Both the patients and the involved healthcare personnel expressed their confidence in using it. It is concluded that the system is applicable in clinical setup, and might be generalized in clinical practice. Finally, the chapter suggests improvement approaches for more reliable, more secure, more user-friendly and higher performance of an m-health system in future.

INTRODUCTION

Telemedicine has been defined as "medicine practiced at distance". This encompasses diagnosis and treatment as well as medical education. The European Commission Information Society Directorate-General (2001), defines telemedicine as "the use of remote medical expertise at the point of need, which includes two major areas: Home care, as care at the point of need through connected sensors, hubs, middleware and reference centers, and co-operative working, as a network of medical expertise linked together".

The definition of telemedicine differs depending on the background of the user and the applications aim. From a clinician's point of view, telemedicine can be defined as "practicing healthcare delivery such as consultation, transferring medical data, monitoring, diagnosis, treatment and patient education, using interactive audio/video facilities and a telecommunication network". This definition leads to the creation of "E-health" and "Tele-health" terms.

Tele-health is the use of information and communication technology to deliver health services, expertise and medical information over a distance. Whereas, **e-Health** is broader than either Telemedicine or Tele-health and can be described as an emerging field composing medical informatics,

public health and business, which enables health services and medical information to be delivered or enhanced through the internet or other related communication technologies. So, a telemedicine system encompasses information technology, biomedical engineering and telecommunication technologies, serving healthcare providers and patients at a distance. Thus, the used terminology to describe healthcare services at a distance will probably change as fast as the used technology.

Telemedicine is showing its value in a rapidly increasing number of clinical situations (Agha, Schapira & Maker, 2002; Bai et al. 1999; Freedman, 1999; Kyriacou et al., 2003; Magrabi, Lovell & Celler, 1999; Scalvini et al., 1999). Moreover, telemedicine applications may include but are not limited to, rural healthcare, public healthcare service, humanitarian efforts, school-based health services, disaster medicine, prison healthcare and nursing home care (Berek & Canna, 1994; Perednia & Allen, 1995). There have been many studies around the world which have shown the feasibility and usefulness of telemedicine in remote areas (Jasemian & Arendt-Nielsen, 2005c; Lin, Chiu, Hsiao, Lee & Tsai, 2006; Jasemian, 2006; Jasemian, 2008; Bai et al. 1999; Freedman, 1999; Kyriacou et al., 2003; Magrabi et al., 1999; Gott, 1995; Coyle, Boydell & Brown, 1995; Dansky, Palmer, Shea & Bowles, 2001). Fixed communication networks have been used in different telemedicine setups for some years (Gott, 1995; Coyle et al., 1995; Rezazadeh & Evans 1990; Patel & Babbs 1992), whereas wireless and cellular technologies within telemedicine have been in focus in the latest few years (Freedman, 1999; Kyriacou et al., 2003; Orlov, Drozdov, Doarn & Merrell 2001; Satava, Angood, Harnett, Macedonia & Merrell, 2000; Shimizu, 1999; Uldal, Manankova & Kozlov, 1999; Woodward, Istepanian & Richards, 2001).

Mobile healthcare is a solution for providing patients' mobility while their health is being monitored. It has real benefits which are often significant; this can become evident through clini-

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