# Chapter 1
# Telemedicine and Biotelemetry for E-Health Systems:
## Theory and Applications

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## ABSTRACT

*This chapter develops an integrated view of telemedicine and biotelemetry applications. The objective of the chapter is coherent with the objective of the book, which includes techniques in the biomedical knowledge management. Telemedicine is the use of modern telecommunications and information technologies for the provision of clinical care to individuals at a distance and the transmission of information to provide that care. The medical systems infrastructure underpinning this form of medicine, consisting of the equipment and processes used to acquire and present clinical information and to store and retrieve data are explained in detail. An investigation of telemedicine applications in various fields is presented and the likely enormous impact of telemedicine systems on the future of medicine is discussed. For example, bioelectric and physiological variables could be measured by biotelemetry systems. Developing a biotelemetry system and the principal operation of such a system are presented, and its components and the telemetry types are explained. The author suggests that the content of the chapter will assist the medical sector and the general reader in gaining a better understanding of the techniques in the telemedicine and biotelemetry applications.*

## INTRODUCTION

Literally, telemedicine means medicine at a distance. Telemedicine has been defined as the electronically-transmitted rapid exchange of medical information between sites of clinical practice for the purposes of relief and/or education. Telemedicine is also defined as the use of electronic information and communication technologies to provide and support health care when distance separates the participants. A broader definition is the use of telecommunication technologies to provide medical information and services (Chen et al, 1999; Foster et al, 1998; Güler & Übeyli, 2002a; Moore, 1999). Telemedicine

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includes diagnosis, treatment, monitoring and education of patients using systems that allow ready access to expert advice and patient information no importance where the patient or relevant information is located. The fundamental concepts of telemedicine technology including: Basic principles of telecommunications and internetworking of computer systems, use of communications software, forms of telecommunications. The use of telemedicine systems in hospitals, clinics, long-term care facilities and home care is becoming well established and evolving in effectiveness and efficiency (Garshnek et al, 1997; Stanberry, 2001). Telemedicine can therefore be divided into three areas: Use for decision making; remote sensing; and colloborative arrangements for the real time management of patients at a distance. Each of the three areas are limited to aspects of medical diagnosis, patient care and education (Merrell & Doarn, 2007; Sood et al, 2007).

Biomedical telemetry is a special field of biomedical instrumentation that often permits transmission of biological information from an inaccessible location to a remote monitoring site. When direct observation is impossible, biotelemetry can be used to obtain a wide spectrum of environmental, physiological and behavioural data (Güler & Übeyli, 2002b; Hines, 1996; Jones & Normann, 1997; Ziaie et al, 1997). The purpose of biotelemetry includes the capability for monitoring humans and animals with minimum restraint and to provide reproduction of the transmitted data. If measurements and monitoring techniques are applied to restrained humans and animals, stress of immobilization causes alterations of measured variables. According to this concept, the advantage of biotelemetry is the measurement of physiological variables in conscious, unrestrained humans and animals. The method of biotelemetry is offering wireless, restraint-free, simultaneous, long-term data gathering (Axelsson et al, 2007; Lee et al, 2007; Mussivand et al, 1997). Measurements which have been done in biotelemetry can be determined in two categories:

1. Bioelectrical variables, such as electrocardiogram (ECG), electromyogram (EMG) and electroencephalogram (EEG);
2. Physiological variables that require transducers, such as blood pressure, gastrointestinal pressure, blood flow and temperatures. By using suitable transducers, telemetry can be employed for the measurement of a wide variety of physiological variables (Rocchitta et al, 2007; Welkowitz et al, 1976).

## TELEMEDICINE TECHNOLOGIES

The use of telecommunications and information technology is central in providing health services- regardless of location. The investigation, monitoring and management of patients and the education of patients and staff using systems which allow ready access to expert advice and patient information, no matter where the patient or relevant information is located (Chen et al, 1999; Garshnek et al, 1997). In addition to the aspects covered by these definitions, telemedicine involves a combination of topics from the fields of telecommunication, medicine and informatics. The application of telecommunication technology to health care requires integration of technology, tools and training with medical care practices and problems, although it is not necessary to be an expert in all these components to effectively use a telemedicine system. Telemedicine achieve its potential to improve delivery of health care in rural or remote areas only through cooperation among health professionals, computer system developers, telecommunication providers and educators.

Telemedicine includes transfer of basic patient information over computer networks (medical informatics), diagnosis, treatment, monitoring and education of patients using systems that allow access to expert advice and patient information. During these processes location of patient or relevant information is not important. The fundamental concepts of telemedicine technology, including: