

Chapter 31

A Survey on Health Care Services Using Wireless Sensor Networks

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ABSTRACT

Although the present technology has aided in development of high-technology-based disease detection machines, potential medicines and devices, the well-being of the individual remains a challenge. Human beings are struggling to control diseases such as Parkinson's disease, Alzheimer's disease, asthma, hypertension, insomnia, heart disease, and diabetes due to non-availability of patient's real-time data for comprehensive study and analysis. Smart health centre environments represent the evolutionary developmental step towards intelligent health care. The Wireless Sensor Network (WSN) with pervasive and ubiquitous computing may be a solution for this predicament. WSNs are a key technology for ambient assisted living. The concept of WSN is used to measure the various health parameters like blood pressure, blood clot, allergy, ECG, cholesterol, RBCs, etc. In this chapter, the authors highlight the importance of WSNs with respect to health care services and discuss some of its challenging applications for diseases like Parkinson's, Alzheimer's, asthma, and heart disease. They delineate the challenges that researchers face in this area that may lead to future research.

1. INTRODUCTION

A famous quotation says "A sound mind in a sound body." Comfort and happiness can be experienced only when each individual is blessed with good health. The present style of living and demand-

ing nature of work is creating more health related problems. The people suffering from chronic disease are increasing along with treatment costs (Teng 2006). Hence, health care services are facing enormous challenges. Some of the challenges are with respect to cost effective and responsive way

DOI: 10.4018/978-1-4666-3986-7.ch031

of delivering the health services and quality of life improvement from available resources (Scholtz, 1999). The cultural and socio economic factors influence the disease occurrence and their management. The conventional way of monitoring health condition focuses on monitoring and diagnosis of the patient at the hospital. This trend is shifting its focus towards the individual centered health care systems with emphasis on early detection of disease, diagnosis and treatment (Lymberis, 2003) using an intelligent health care system.

Wireless Sensor Network (WSN) is an emerging and promising technology to meet the demands for intelligent health care services for various diseases. Recent advancements in wireless technology and Micro-Electro-Mechanical Systems (MEMS) allow the development of low cost, low power, large scale, multi-functional, portable devices on a single board also known as motes (Hsuan, 2010) or wireless sensor nodes. An ad hoc network comprising of wireless sensor nodes is called WSN. These nodes are also known by various terms like tiny devices and smart dust particles. Spatially distributed sensing devices communicate with each other through single or multihop. The wireless sensor networks find wider applications in all the domains because of their minimal configuration and ability of rapid deployment.

The wireless sensor network field offers a rich, multi disciplinary area of research. The applications of WSNs include home automation, agriculture, building structure, ecology, environment, health care, ambient intelligence, security, industrial automation etc. The applications in health care are; assisting the aged people, remote monitoring of patients in their routine life for chronic diseases and so on. WSNs can be effectively used in healthcare domain to enhance quality of life provided for the patients and increase the quality of health care services. So far, WSN technology has been adopted in medical field for various disorders such as respiratory disorders, nervous system disorders and so on.

The continuous patient monitoring and collection of physiological data for analysis is a critical issue for health and disease management. Advances in networking, sensors, medical devices and smart phones (Benhaddau, 2008; Virone, 2006) have made it feasible to monitor and provide medical and other assistance to people in a remote fashion.

The Wireless Body Sensor Networks (WB-SNs), an application of WSN makes the task easier for the medical applications; the wearable sensor devices can capture continuous data from the patient in real time and communicate to doctors and medical technical staff over their hand held devices at the remote end. This helps in regular monitoring and storing of the patient's vital information in secured database and can be retrieved as and when required. Doctors can share the stored information with other experts to get better diagnosis. This method saves precious time and energy of patient and doctor. Even the data can be made accessible to the insurance people (so that they can settle the medical claims) and government agency (to make better health policy).

The objective of the chapter is to give an overview of some diseases related to different systems such as nervous system, respiratory system, cardiovascular system and the use of wireless sensor networks for monitoring and diagnosing such diseases. We also present the future works and conclude with summary.

1.1. Wireless Sensor Network Architecture

The general architecture of wireless sensor network applied to healthcare services is as shown in Figure 1. The platform can be described with three sections: (1) patient unit, (2) central system consisting of various communication media and gateways called interface unit, and (3) clinician's hosts or hospital unit. In the following discussion, we shall describe the various services of each section.

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