

Chapter 13

Designing Pervasive Healthcare Applications in the Home

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ABSTRACT

The authors propose a new home health care system for the acquisition and transmission of data from ordinary home health care appliances, such as blood pressure monitors and weight balances. In this chapter, they briefly explain a standard protocol for data collection and a simple interface to accommodate different monitoring systems that make use of different data protocols. The system provides for one-way data transmission, thus saving power and extending to CCITT. Their standardized protocol was verified during a 1-year field test involving 20 households in Japan. Data transmission errors between home health care devices and the home gateway were 4.21/day with their newly developed standard protocol. Over a 1-year period, they collected and analyzed data from 241,000 separate sources associated with both healthy, home-based patients and chronically ill, clinic-based patients, the latter with physician intervention. They evaluated some possible applications for collecting daily health care data and introduce some of their findings, relating primarily to body weight and blood pressure monitoring for elderly subjects in their own homes.

INTRODUCTION

Health promotion is a critical process that enables people to increase control over and to improve their

health and health determinants. Currently, this capability is provided via assistive technology through information communication technology (ICT), which supports medical and health care services such as electronic healthcare and telemedicine. Us-

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ing ICT tools for health informatics can prevent disease and promote optimal health. Furthermore, mobile-health (m-health) applications deliver mobile communication and network technology for health care systems to improve a patient's quality of life. Finally, personalized health care will improve the safety, quality, and effectiveness of health care for individuals. Health care promotion enables people to become more involved in their own wellness, and the interoperability of several monitoring techniques assists in maintaining and improving health conditions for individuals.

New criteria in ISO/IEEE 11073 standards for medical device communication have led to the proposal of new health promotion goals to enable plug-and-play interoperability for personal health devices. These new ISO/IEEE 11073 standards address transport-independent applications and information profiles between personal telehealth devices and monitors. Current research has culminated in several proposals (Brennan et al., 2007; Chadwick, 2007; Galarraga et al., 2007a, b; Laakko et al., 2008; Martinez et al., 2008) although very little work has been conducted on the actual settings (Yao and Warren, 2005; Yao et al., 2005).

Recently, home health care users have been motivated to maintain their health and to avoid metabolic syndrome; in this endeavor, many people buy several home health care devices, such as blood pressure monitors, body scales, and pedometers.

Metabolic syndrome encompasses a wide range of medical disorders often associated with increased weight and obesity, which increase the risk of cardiovascular disease, stroke, and diabetes. The term "metabolic" refers to biochemical processes, some of which are readily monitored, that are involved in the body's normal functioning. Metabolic and behavioral risk factors are conditions that increase the probability of disease, and these risk factors are generally high in the elderly. Thus, we propose a new home health care system

to monitor such risk factors, maintain good health, and reduce disease in the elderly.

Home health care and home-based primary care have been commercialized for reasons of cost and convenience. Patients with chronic conditions are heavy users of the health care system, and ideally, considerable cost savings and improvements in health care can be achieved if patients maintain their health and continue to live in their homes. Home telecare and telemonitoring systems have been demonstrated, but are not yet satisfactory. Inadequate health monitoring has been associated with adverse outcomes, including increased emergency department visits and hospitalization, and decreased caregiver well-being.

Previously, some systems for data acquisition and transmission have been used to reduce disease, and some automated systems have also been developed, but high costs have prevented their general implementation (Tamura et al., 1998, 2007). Established automated systems include ECG monitoring during sleep and bathing, and monitoring for routine health care is generally an underdeveloped area. In this chapter, we propose a new health care system to monitor data from ordinary home health care appliances, such as blood pressure monitors and body weight scales. We also discuss some of the potential applications of this new system for elderly home-based patients.

BACKGROUND

A system for automatic health monitoring in the home has been considered for health management and disease prevention. The onset of lifestyle diseases, such as hypertension, arteriosclerosis, and diabetes, is highly correlated with daily activities, such as physical exercise, sleep, and nutrition. Daily monitoring is important in preventing such diseases and in achieving a healthier quality of life. Although the monitoring of daily activities is not well established in evidence-based health care,

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