Chapter 30

Innovative Architecture to Enhance Quality of Service for Laboratory Management Information Systems

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ABSTRACT

Technological improvements have changed the life style in the modern era, where communication has become easier compared with olden days. Technological solutions have been deployed in every sector including business, education, and health services. Although a number of solutions are proposed for improvements in the healthcare sector, the complexity and growing interest in this sector have created new approaches. This chapter proposes an innovative architecture for the laboratory management information system to enhance the quality and management issues. The proposed architecture integrates two major fields, namely wireless technology and data mining. The wireless technology enables the collection of data easily and wirelessly, and data mining ensures meaningful and novel knowledge discovery from the collected data. In particular, the architecture helps management in three different ways: (1) prevention of risks/errors using technological solutions, (2) an environment to respond rapidly to adverse events, and (3) construction of knowledge base for future guidelines.

INTRODUCTION

The Information Technology (IT) has taken great attention since last few decades, and it has altered the lifestyle. Healthcare agencies are one of the examples that have taken fruits from emerging technological solutions (Kushniruk, 2013; Tongsiri, 2013). For instance, Health Information Technology (HIT) using hardware and software maintains and analyzes information of health data. However, poor design may risk the patient's safety (Jha, 2009; Kushniruk, 2013). Electronic Health Records (EHRs), being part of HIT, are cost effective in comparison with manually and paper-based systems (Wang, 2003). EHRs significantly improve health services for health providers (Jha, 2009; Wu, 2006). Furthermore, health is an essential element in human's life, and it needs to be taken care, because the lack of immediate care can cause a problem for a long time in life. Developed nations draw great attention towards health on priority. For example, by allocating higher percentage of the annual budget on health.

The growing increase in interest and complexity of healthcare has caused new approaches as the center of attention for researchers (Bates, 2003). Every day, hospital management using HIT solutions store a large amount of hospital data having records about patients, disease diagnosis, statistics about medical tests and many more. Information management is a fundamental factor for healthcare providers (Chassin, 1998). The key issue in healthcare domain is the procedure to collect the medical data (i.e., hospital data) and then interpretation of the collected data. Firstly, the collection of data is resolved using computerized solutions e.g., HIT solutions for monitoring the laboratory information system. Regular and continuous human monitoring is inherently boring and unsuitable (Bates, 2003). Instead, wireless technology can be exploited to facilitate hospital management. For example, healthcare data can be collected with the help of wireless sensors for the ease, and computerized applica-

tions can generate reports and other calculations inquired by management. The literature reports that hospital computerized physician order entry (CPOE) caused reduction in medication errors by 81% (Koppel, 2005). To maximize the efficiency of huge electronic data resources available in hospitals, the electronic surveillance system has been suggested (Freeman, 2013). Hence, use of sensors in collecting hospital data would significantly facilitate hospital management. Secondly, the large collections of data can profitability be analyzed using data mining techniques to extract meaningful and important information (Mahoto, 2013). The derived information can help in managing hospital resources, as well as care guidelines. Several techniques and methods are proposed to extract valuable knowledge from healthcare data (Baralis, 2010; Antonelli, 2012; Antonelli, 2013a; Antonelli, 2013b).

The availability of wearable and implantable sensors that are parts of networks known as *wireless body area networks* (WBANs) significantly help to collect the vital signs of the humans, which can be very useful for the laboratory management information system, where data is fed to the system. WBAN is a new dimension of Wireless Sensor Networks (WSNs) and have evolved in recent years due to significant innovation in sensor miniaturization, embedded computing, and wireless technologies. WBAN has received tremendous interest from academia, industry, and consumer device manufacturers due to their novel defense and commercial applications. During the past decade, the drivers for WSN research were applications of surveillance, monitoring, tracking, and automation, but the drivers behind WBAN growth are applications that directly impact on quality of human life, including telemedicine, ubiquitous health care, laboratory management, sports, and entertainment. Furthermore, because of a sedentary lifestyle and lack of exercises, the society is moving toward a disastrous situation, and life-threatening diseases are being diagnosed in almost every family. The traditional healthcare

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