Chapter 3.15
Modeling and Analysis of Surgery Patient Identification Using RFID

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ABSTRACT

This article proposes a workflow and reliability model for surgery patient identification using RFID (Radio Frequency Identification). Certain types of mistakes may be prevented by automatically identifying the patient before surgery. The proposed workflow is designed to ensure that both the correct site and patient are engaged in the surgical process. The reliability model can be used to assess improvements in patients' safety during this process. A proof-of-concept system is developed to understand the information flow and to use information in RFID-based patient identification. Reliability model indicates the occurrences of patient identification error can be reduced from 90 to as low as 0.89 per 10,000 surgeries using the proposed RFID based workflow.

INTRODUCTION

Improvement in patient safety in medical care continues to be a very important issue in the medical care community. According to an Institute of Medicine (IOM) report, 44,000 to 98,000 people die each year as a result of preventable medical errors (Kohn, Corrigan, & Donaldson, 1999). The percentage of hospital inpatient admissions experiencing adverse events has been estimated at 3.7% in the U.S., 16.6% in Australia, and 10% in the UK (MF & JD, 2004). Various types of medical errors occur during the course of healthcare delivery, such as improper transfusions, wrong-site surgery, and mistaken patient identities. High error rates with serious consequences are most likely to occur in intensive care units, such as operating rooms and emergency departments ("What

an unbelievable surgery!-Perform an operation with exchanged charts", 2006). Many of these medical errors are due mainly to avoidable human errors that can be potentially eliminated by proper design and error-proofing of the associated workflow. Surgery generally involves the execution of many complex tasks and each task is composed of multiple steps. The most common human error in the medical process is unintentional omission of one or more steps, especially when there are a large number of steps (Reason, 2002).

Patient identification is one of the necessary processes performed prior to anesthesia and surgery. Errors in this process can lead to unrecoverable medical accidents and there are numerous such accidents reported ("What an unbelievable surgery!-Perform an operation with exchanged charts", 2006). One instance of such an error involved intake nurses and surgery doctors: two patients––one with thyroid cancer and one with stomach cancer––had their identities exchanged in the surgery. As a result, the thyroid of the patient with stomach cancer was removed and the stomach of the patient with thyroid cancer was removed. There are other instances where medical doctors have reported performing invasive procedures on the wrong patients (Mark R. Chassin & Elise C. Becher, 2002).

The IOM report revealed that the majority of medical errors are not caused by individual recklessness or the actions of a particular group (Kohn, Corrigan, & Donaldson, 1999). More commonly, faulty systems, processes, and conditions lead people to make mistakes or fail to prevent them. Therefore there is a need to design and error-proof workflow systems that render human error essentially impossible or at least extremely difficult (Etchells, O'Neill, & Bernstein, 2003). Barcode system such as the Global Service Relation Number (GSRN) from GS1, which is used to identify patients and the services provided to them, may be helpful in addressing some of these needs (http://www.gs1.org/docs/patient_safety). However, use of such a barcode system may impose awkward constraints on the surgery team because a bar code must be within the line of sight of the scanner. Ideally, patient identification technology should be simple and reliable so that the overall activities and associated workflow of the surgical team is smooth and efficient. In this context, RFID technology offers an attractive solution because it does not need a line of sight and its reading range is greater than that involved with a barcode system. RFID technology is one potential solution in resolving occurrences of patient misidentification (Fisher, 2006; MF & JD, 2004).

We suggest a model that applies RFID technology to the patient identification process prior to entry into the operating room, and a prototype system for the application model. Automatic recognition eliminates the possibility of misidentification error by displaying the patient's identification information on the computer monitor of the operating room as s/he is being rolled into the room. A reliability model is used to show that the probability of patient identification error can be reduced by the proposed RFID based workflow. The next section provides a literature review on the RFID application in medicine and an overview of current costs. In the third section a typical workflow process for identifying a surgery patient is described and a process involving the RFID identification system is suggested. The suggested process is evaluated according to workflow process reliability model. Lastly, the prototype system developed to serve as a proof-of-concept of the proposed workflow process is discussed.

RFID TECHNOLOGY IN THE MEDICAL AREA

RFID technology may dramatically improve an organization's capability to obtain real-time information on the location and properties of tagged moving objects, such as people, materials, or equipment. It has been utilized in many areas, such as luggage tracking, security keys, toll