Chapter 8
Enabling Real-Time Management and Visibility with RFID

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ABSTRACT

Radio frequency identification (RFID) and Real Time Location Systems (RTLS) provide a wireless means to identify, locate, monitor, and track assets and people. RFID technology can be used for resource and patient location, to reduce costs, improve inventory accuracy, and improve patient safety. A number of pilot deployments of RFID and RTLS technology have yielded promising results, reduced costs, and improved patient care. However, there are three major issues facing RFID and RTLS systems, privacy, security, and location accuracy. As described in this chapter the privacy and security issues can be easily addressed by employing standard security measures. Location accuracy issues are physics-related and new advances continue to improve this accuracy. However, in hospital applications accuracy to the room level is sufficient.

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INTRODUCTION

While radio frequency identification (RFID) technology has a long history of providing efficiency and savings in the consumer goods and supply chain areas, it is now also moving into a number of other application domains. This chapter will examine how Radio Frequency Identification (RFID) technology can be used to improve resource management and quality of care, and reduce costs in healthcare. The issues of security, privacy, and location accuracy with respect to hospital management and RFID/RTLS will be investigated. Solutions to these issues and future research directions in this area will be presented in this chapter.

BACKGROUND

RFID Background

Radio frequency identification (RFID) systems are composed of three types of components: tags, readers, and application software. Hawrylak, Cain, and Mickle provide a detailed overview of RFID and its history (Hawrylak, Cain, Mickle, 2008). Tags are attached to assets, items, or people that are being tracked or inventoried. RFID tags contain a unique identifier (UID) that links a tag to a particular asset, item, or person in the application software database. Modern tags have varying amounts of memory for data in addition to the simple UID. An expiration date or manufacturer lot number are two examples of the data that are stored in the tag's memory. Readers, sometimes called interrogators, communicate with the RFID tags and provide the link between the tags and the application software. One common use of RFID readers is to read the RFID tags attached to items on a pallet as it is loaded onto a tractor-trailer. Unlike bar codes and other printed labels, RFID does not need a visual line of sight between the reader and tag to be read. RFID tags can be read through cardboard, packaging, water, and even people. RFID tags can typically be read even if they are dirty or wrinkled; currently these cause problems for bar codes. Finally, the application software provides information to the user and allows the user to interact with a larger information system. The application software can perform complex analysis based on the collected data to infer a number of conditions (including maintenance information) beyond simply reading a tag.

An example RFID system with one reader and three tags is illustrated in Figure 1. Such a system could be used for many purposes, including inventory control for a hospital. For example, if the hospital manager is required to take an inventory because a particular batch of medication has been recalled based on a list of lot numbers and manufacture dates provided by the pharmaceutical company. With RFID tags linked to the lot number and date of manufacture in the database attached to the medication containers, this is a simple task. First, the hospital manager would instruct the backend software to take the inventory. The backend software would then issue the inventory command to the RFID reader. The RFID reader would then proceed to collect an inventory of all the tags within range and report the unique identification number of each tag to the backend software. The backend software would then use each tag unique identifier to search the database for that unique identifier to retrieve the lot number and manufacture date. The backend software would provide this information to the hospital manager or could even check the retrieved information for matches against a list if the list was in electronic format. This is one example of how RFID technology can improve hospital management.

RFID tags can be grouped into three general categories, passive, battery assisted passive (BAP), and active. How the tag is powered determines the category it falls into. Passive tags have no on-board power source (e.g. a battery) and must