Chapter 29
Using Radio Frequency Identification Technology to Store Patients' Medical Information

Peter J. Hawrylak
University of Tulsa, USA

Chris Hart
University of Tulsa, USA

ABSTRACT

Radio Frequency Identification (RFID) technology enables wireless communication between a RFID reader and a RFID tag. One type, passive RFID tags, need no battery, being powered from the RFID reader's radio frequency signal. Passive RFID tags can support memories that can be used to store portions of the patient's medical history. One form factor for passive RFID tags is an employee ID (used for wireless access) or credit card form factor. This form factor allows the patient to carry their medical information with them. RFID benefits include providing information to Emergency Medical Technicians (EMTs), maintaining a patient's vaccination history and providing emergency contact information, all in a clear and unmistakable format. This simplifies information exchange during patient transfers, a cause of many preventable medical mistakes and errors. Cheap and simple systems, such as the one presented in this chapter, can reduce stress and prevent possible errors. Such systems with an intuitive human-machine interface can reduce the duration of a patient visit throughput. This system can prevent simple errors such as the administration of the wrong drug, dose, or drug omission, which is a major issue in hospitals. This requires that information be stored in a standardised manner, with limited healthcare provider access and use to protect patient privacy. This chapter explores the use of passive RFID tags to store medical information about a patient, with specific focus on storage of a child's vaccination history and safety.

DOI: 10.4018/978-1-5225-2237-9.ch029

1. INTRODUCTION

Tracking vaccination history is difficult for adults and even more difficult in children, especially young children and infants, because they cannot remember or do not know their vaccination history. This chapter presents a solution to the problem of tracking the vaccination history of children and infants using radio frequency identification (RFID) technology. This technology will help to prevent missed doses or vaccinations, prevent multiple doses being given (extra doses), and will provide a clear transfer of information from patient to healthcare provider to increase the vaccination rate and ensure patients have been provided with the maximum possible immunity. The vaccination history is stored in the RFID tag's memory and the patient, child or their guardian, keeps the RFID tag with them. This comprehensive list of vaccinations will help physicians ensure that the patient is up to date on their vaccinations and prevent unnecessary treatment. They then present the RFID tag to the healthcare provider at the time of treatment and the healthcare provider is able to retrieve the vaccination history. This problem is magnified for rural patients, and those that use health clinics. In a rural setting, the healthcare providers may not be the same at the clinic during each visit. Often children are taken to the clinic by a close relative that may not have this information and it may be a different relative each visit. Without the child's current and complete information, the provider may prescribe unnecessary treatment or vaccination, incomplete care (e.g. missing a dose or vaccination), or incorrect care (e.g. extra dose). This leads to higher cost of care and could have adverse effects on the patient depending on the already administered vaccinations. The system described in this chapter will enable the healthcare provider to obtain a complete and correct vaccination history allowing them to provide needed vaccinations in a correct and timely manner. This will improve overall quality of life and help stop the spread of infectious and serious diseases, which modern medicine can prevent through vaccination and other preventable medical errors. This system is also applicable in pharmacies that provide vaccinations. Patient education about the benefits and risks of vaccination can be customised for each patient, depending on where they are in their vaccination cycle. Previous studies of vaccination rates for the influenza virus (flu) have shown that those reminders that contain education information about the influenza vaccine produced a greater increase in vaccination rates compared to mailings containing only a reminder (Armstrong, Berlin, Schwartz, Propert & Ubel, 1999).

Radio frequency identification (RFID) was developed from several related developments: crystal radio sets, RADAR (radio detection and ranging), and identify friend or foe (IFF) technology (Hawrylak, Cain & Mickle, 2008). Crystal radio set technology provided the means for passive tags to power themselves by harvesting energy from the radio frequency (RF) signals emitted by the RFID reader. RADAR and IFF technology provided the basis for backscatter communication, which enables a RFID tag, communicate with an RFID reader using a simple and very low power mechanism, termed *backscatter*. Initial deployments of RFID were in the animal tracking and toll collection industries, e.g. E-Z Pass (Landt, 2005). Today RFID is integrated into many other aspects of life including the supply chain, retail, and healthcare.

A RFID system is composed of four major components: (i) RFID tags, (ii) RFID reader (sometimes referred to as an interrogator), (iii) middleware, and (iv) back-end software. RFID tags are attached to an object, asset, or person. Tags contain an identifier for that entity and may contain additional information. RFID readers provide the "last-mile" connection between the larger system and the RFID tag. They provide the communication link with the tag and depending on the tag type will also provide the operating power for the tag. Middleware provides the interface between the reader and the computer or controller unit. It is similar to a device driver, but may support additional features such as filtering data