



Real-time location and inpatient care systems based on passive RFID

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ARTICLE INFO

Article history:

Received 7 November 2009
 Received in revised form
 19 March 2010
 Accepted 28 April 2010
 Available online 10 May 2010

Keywords:

Real-time location system
 Medical asset management
 EPC Gen1&2 performance
 Inpatient management
 Hospital information system

ABSTRACT

RFID technology meets identification and tracking requirements in healthcare environments with potential to speed up and increase reliability of involved processes. Due to this, high expectations for this integration have emerged, but hospital and medical centers interested in adoption of RFID technology require prior knowledge on how to squeeze RFID capabilities, real expectations and current challenges. In this paper, we show our lab tested solutions in two specific healthcare scenarios. On the one hand, we analyze the case of a medical equipment tracking system for healthcare facilities enabling both real-time location and theft prevention. Worth-noting aspects such as possible EMI interferences, technology selection and management of RFID data from hospital information system are analyzed. Lab testing of system reliability based on passive UHF RFID is provided for this case. On the other hand, we analyze and provide a solution for care and control of patients in a hospital based on passive HF RFID with the result of a fully functional demonstrator. Our prototype squeezes RFID features in order to provide a backup data source from patient's wristband. It also provides an offline working mode aiming to increase application reliability under network fail down and therefore, improving patient's safety. Considerations regarding lessons learned and challenges faced are exposed.

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1. Introduction

Radio frequency identification (RFID) technology enables a seamless link between any physical tagged entity and the business information infrastructure providing lightweight computational and communication capabilities. Due to this, RFID is receiving considerable attention and is considered to be the quintessential pervasive computing technology (Rieback et al., 2006) and the next wave of the IT revolution (Tzeng et al., 2008). As a consequence of the identification, tracking and tracing nature of RFID, organizations can acquire detailed data on property and location information that increases their ability to monitor the history, location and changing states of mobile wirelessly scanned entities. The adoption of RFID technology is being embraced in a wide range of applications; including retail industry, supply chain management, anti-counterfeiting, security and transit systems.

In recent years, high expectations for the integration of RFID in healthcare scenarios have emerged. By exploiting RFID characteristics and possibilities, this technology is considered to have the potential to enable better service to patients and end customers while underutilization of equipment and mistakes in patients' treatment can be minimized. A proper management of RFID technology may improve the quality of medical processes making

patient care more reliable and consistent, lowering costs and providing the tools to properly manage and trace material and information flows (Kumar et al., 2009). In spite of recent research interest in the healthcare environment, RFID adoption is still in its infancy and a larger number of experiences need to be collected and studied (Tzeng et al., 2008) in order to better understand how to exploit RFID capabilities.

A highly concerning healthcare application is real-time tracking and location of medical assets. Medical centers have to face continuous losses of high-value assets each year (Bacheldor, 2007). Furthermore, equipment whereabouts are frequently unknown. Medical staff needs to sacrifice patient-care to find assets locations. Moreover, unneeded equipment is acquired or rented while the existing one remains underutilized. In this paper, our first case study focuses on this particular scenario. Our solution for real-time tracking of medical devices in a healthcare center is presented which consider anti-theft capabilities and partial automatic inventory. Beyond the presentation of our approach, several worth-noting and commonly overlooked aspects in the development of the solution are discussed such as electromagnetic interferences of RFID in medical equipment, RFID branch technology selection and management of the data generated by the RFID infrastructure from the healthcare information system. The real-time tracking solution is based on passive UHF RFID technology, a field where few previous results are available in literature. We measured the performance and reliability of the system in a laboratory experimental environment and the conclusions of our tests are provided.

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