

# Chapter 13

## Widespread Adoption of RFID Technology

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### ABSTRACT

*In recent years there is an emerging usage of RFID technology in various application scenarios. The authors have classified the applications into three major types: item tracking, where statically placed readers are responsible to track mobile items; item location where mobile readers are able to locate items of interest, and finally, identification applications where RFID tags are used for identification purposes. They have taken a close look at the various applications, the technology driving the RFID systems, and presented a comprehensive picture of requirements and considerations of particular RFID technology behind a class of applications.*

### INTRODUCTION

RFID technology is rapidly gaining attention in various applications that cover many different aspects of modern day lives. It is seen in our daily stores, in our workplace for identification, we encounter it on our way on highway easy passes, there are some used in large scale supply chains, some are in use in critical applications like chip fabrications and hospitals. The widespread adop-

tion of the technology requires some study that takes a look at the various kinds of applications and tries to classify them in a meaningful way and look at the RFID technology that is used in all of these applications. The aim of this chapter is to give a comprehensive view of applications and technology that suit best in various cases.

We first take a close look at the applications using RFID technology. There are reference based applications such as collection tolls without stopping the vehicle, gaining access in the building, automated parking etc.; there are monitoring

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based applications in automobile stores and merchandise stores; there are tracking applications in libraries, airport and retail industries; there are location based applications in search and rescue scenarios (Landt, 2001). There are set of medical applications that links patients with drugs, personnel with patients and links equipment access to the hospital personnel. The RFID technology has been successfully used in sports event to track the athletes and their race time in recent days (Stanford, 2003; Nath, 2006; Activeware, 2010). We address the application scenario that considers deployment of RFID devices. There are a set of applications called *item tracking* that are responsible for tracking mobile objects mainly; *item location* applications focus on locating RFID tagged objects and identification applications uses RFID technology for identification purposes. We discuss the applications in detail in the following subsection.

Item tracking uses statically placed RFID readers to track mobile objects that have RFID tags. Airport baggage handling, supply chain tracking, tracking of books in libraries are examples of item tracking applications. Item location refers to the opposite of item tracking applications where mobile RFID readers are used to track RFID tagged objects. The identification applications use RFID tagged badges that are detected by statically placed readers of entry points. It is interesting to note how the requirements vary for different applications. The tracking applications require large number of RFID tags at the same time must ensure accuracy while the objects are mobile handling various environmental factors (presence of metal or liquid etc.). The identification applications are considered to have closer proximity and certainty compared to tracking applications. The location applications are discussed in many different scenarios with positive possibilities but are not deployed widely compared to the tracking and identification applications. We consider the various RFID technologies based on operational

techniques and other methods and find out which technology is preferred for various applications.

## RFID APPLICATION CATEGORIES

We discuss the various application category and application scenarios under each category in this section. The various groups have been defined based on relative positioning of the RFID reader and tags which correspond to item tracking, item location and identification applications.

### Item Tracking

The item tracking applications consider taking notes on the RFID tagged items using static RFID readers. In the item tracking applications, statically placed readers are in charge of tracking tagged items in motion as shown in Figure 1. The warehouse scenario where objects are tracked as the items arrive and leave and the airport baggage claim system where tagged baggage are tracked through the conveyor belts are examples of tracking applications as can be seen on Figure 2. It is observed that there is a flow of data that creates a path as the tagged items traverse through the system.

The main challenges faced by large scale deployment of item tracking applications are the unreliable RFID readers as they provide false negative and false positive readings. False negative readings refers to the reader's inability to read an existing item and false positive is the reader's reading of an item that is beyond its reading range. Then there is the challenge that a large amount of data is produced as the items traverse through the system in item tracking applications. The system must be able to provide adequate support for large scale expected and unexpected (sudden) data arrival.

There are many large scale item tracking applications using current RFID technology. A warehouse scenario which uses RFID tags to monitor and note real time information as shown

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