Chapter 1.7
Radio Frequency Identification History and Development

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ABSTRACT

This chapter describes the history and development of Radio Frequency Identification (RFID). Key information on RFID such as the ratification of the RFID standards and important regulations on frequency usage is presented. As businesses move towards the convergence of information, RFID technology provides a step closer to the reality of connecting the real world and the digital world seamlessly. This is possible as RFID communication does not require the line of sight as barcodes do. Thus, is the continued existence of the barcodes technology under threat? Before RFID makes its way into the mainstream, there are teething issues to be sorted out. The immediate attention for a global uptake of RFID is the adoption of a frequency standard that is accepted internationally. This chapter provides an understanding of the RFID technology, its background and its origin

INTRODUCTION

Radio Frequency Identification (RFID) is an Automatic Identification and Data Capture (AIDC) technology. Its application can be found in most industries, offices and even homes. The application ranges from electronic article surveillance (EAS) in retails, electronic toll collection in transportations, to building access control in offices. RFID is fundamentally a radio technology and its history can be traced back to the 1930s (Bhuptani & Moradpour, 2005). The underlying principle of RFID is the transmitting and receiving of data in a form of electromagnetic energy. The primary components are tags and readers. Together these components form a coupling relationship where communication becomes possible. This chapter revisits the history of RFID development and looks at other forms of AIDC. This helps to form an epistemology of what RFID is and its origin, so that we could relate to the various aspects of RFID characteristics when planning on a RFID

project. The emergence of RFID has raised the question of barcodes' continued existence (Allen, 1991; Atkinson, 2004). It is therefore inevitable to know the characteristics of RFID and barcodes, and examine their future existence, particularly in the supply chain.

The discussion in this chapter is motivated by the activities of RFID surrounding supply chain management. The suppliers' mandates to use RFID in the supply chains have significant impact on businesses (C. B. Soon & J. A. Gutierrez, 2008). This has created interest in RFID by businesses around the world. It is thus an appropriate topic to introduce RFID. Although this chapter is focused on RFID applications in the supply chains, the technical aspects are common across application areas.

This chapter is arranged as follows. First, the development of RFID is summarised with key events identified from the history of RFID. Second, the various concepts of AIDC are discussed. Third, the RFID system is discussed with particular attention to the tag classification and frequency allocation. Fourth, a comparison between RFID and barcodes is made. The continued existence of barcodes and the future of RFID are discussed in the conclusion.

HISTORY: THE DEVELOPMENT OF RFID

Electromagnetic theory was developed in the 1800s. Michael Faraday discovered that light and radio waves are part of electromagnetic energy and James Clerk Maxwell demonstrated that electric and magnetic energy travel at the speed of light in transverse waves (Landt, 2001). The discovery led to consequential experiments. In 1896, Guglielmo Marconi successfully transmitted radio waves across the Atlantic (Landt, 2001). Marconi's demonstration was followed by more innovations. In 1922, radar was developed. The

transponder (or tag) and interrogator (or reader) were then bulky and heavy. Radar was extensively used by the Allies during World War II to identify friendly military aircraft. Radar was further developed into a commercial air traffic control system in the late 1950s following the invention of integrated circuits (IC), which greatly reduced the size of RFID components. The 1960s marked the start of RFID development as scientists and commercial businesses started to show interest in the technology. The first concept of RFID for commercial use was probably thought of by Mario Cardullo in 1969 when he worked with an IBM engineer on a car tracking system using barcodes for the railroad industry (Shepard, 2005).

Most RFID applications were identified in the 1970s. The use of RFID for EAS began in early 1970s (Bhuptani & Moradpour, 2005). EAS is a simple anti-theft measure for use in retail stores. It is the first and most widely used RFID application commercially (Landt, 2001). Further interest in the adoption of RFID extended to areas such as vehicle tracking, access control, animal tagging, and factory automation. The use of RFID cards for controlling access to office building by Westinghouse (Mullen & Moore, 2005) is an example of access control. Further development improved the reading speed and enabled a longer read range. The advanced RFID systems were utilised to identify railroad cars and track animals in the 1980s, and for electronic toll collection in the 1990s (Bhuptani & Moradpour, 2005).

RFID applications became more widespread in the 1990s. The success of electronic toll collection kicked off large scale deployments throughout the United States, Europe and Asia (Landt, 2001). There are two basic systems employed in road toll collection. One uses a contactless card or proximity card and the other uses a transponder fitted into the vehicle. The latter does not require the vehicle to halt at a barrier unlike the proximity card model where, the driver has to stop and hold the proximity card close to a reader at the bar-

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