Radio Frequency Identification and Its Application in E-Commerce

R

Witold Bahr
Aston University, UK

Brian Price
Aston University, UK

INTRODUCTION

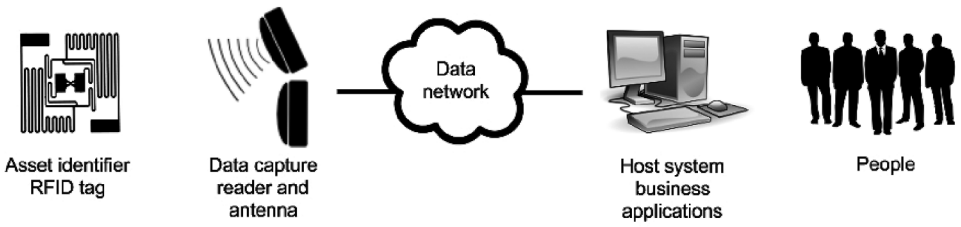
This chapter presents Radio Frequency Identification (RFID), which is one of the Automatic Identification and Data Capture (AIDC) technologies (Wamba and Boeck, 2008) and discusses the application of RFID in E-Commerce. Firstly RFID is defined and the tag and reader components of the RFID system are explained. Then historical context of RFID is briefly discussed. Next, RFID is contrasted with other AIDC technologies, especially the use of barcodes which are commonly applied in E-Commerce. Lastly, RFID applications in E-Commerce are discussed with the focus on achievable benefits and obstacles to successful applications of RFID in E-Commerce, and ways to alleviate them.

RADIO FREQUENCY IDENTIFICATION (RFID)

RFID is an abbreviation for Radio Frequency Identification and as the name implies it is a technology that transmits coded information sets through radio waves. Information is transmitted between RFID tags (also called transponders) and readers (or interrogators) (Hunt et al., 2007). The information flow in a basic RFID system is presented in Figure 1 (based on Dua and Meyers, 2007). The tag receives a radio signal from the reader. The tag is activated and sends back the data to the reader. The collected information is passed on to RFID middleware for processing, for use in business applications. Each tag consists of unique identification information about the item to which it is attached, e.g. item ID, date of production, shipping detail, expiry date, etc. depending on the intended uses (Dua and Meyers, 2007).

An RFID system is defined as an "integrated collection of components that implement an RFID solution" (Lahiri, 2005, p. 7) and is also referenced as RFID infrastructure (Banks, 2007). There is a differ-

Figure 1. Basic components of RFID system and information flow



DOI: 10.4018/978-1-4666-9787-4.ch130

ence of opinion among authors regarding what constitutes the RFID system. Five different propositions of what constitutes the RFID system are presented in Figure 2. It can be deducted from Figure 2 that an RFID system in its most basic form consists of a tag (transponder) and a reader (interrogator), which is the view put forward by Finkenzeller (2010).

RFID TAGS

Elements of RFID Tag

An RFID tag is defined by Lahiri (2005, p. 9) as a "device that can store and transmit data to a reader in a contactless manner using radio waves". Although RFID tags come in different shapes and sizes, as illustrated by Figure 3, they all have in common three essential components (Banks, 2007; Finkenzeller, 2010): antenna (coupling element), integrated circuit (chip), printed circuit board/substrate (housing). Figure 4 illustrates the three core elements of an RFID tag. Additionally, some tags may have their own power source (i.e. battery) and/or sensory elements.

The antenna in an RFID tag transmits and receives radio waves and facilitates the communication with the reader, and when it is used as a coupling element, it draws energy from the reader and energises the tag for communication (Lahiri, 2005). Antenna determines the size of the RFID tag (Banks, 2007).

The integrated circuit or chip is another essential component of the RFID tag and can be described as the tag's "brain" (Banks, 2007). The chip consists of several elements: modulator, power control, clock extractor, logic, and memory (Lahiri, 2005). Logic and memory elements constitute the "brain" part of the chip, as they provide implementation of communication protocol and storage for data, respectively (Lahiri, 2005). Depending on the complexity of the tag the integrated circuit can only send its unique identifier or it may send more data, for example data collected from peripheral components (Banks, 2007).

The printed circuit board, substrate or housing are the structural elements that hold the various components of the RFID tag together (Banks, 2007). The function of the housing is to provide protection to the chip and antenna to allow for optimal performance (Finkenzeller, 2010). Materials used in providing the substrate/housing for RFID tags come in a wide range of options, from adhesive labels, flexible inlays through to hard plastic enclosures. Figures 4 and 5 provide examples of such different types of materials and configurations.

Figure 2. Five views on elements of RFID system