Chapter 1

Item-Level RFID for Retail Business Improvement

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ABSTRACT

This chapter proposes an item-level RFID-enabled store management system to help improve retail business. The system adopts an integral design approach to exploit RFID and the e-pedigree established for anti-counterfeiting and tracking of product items in a supply chain. Various modules, such as back-store inventory, smart shelves, interactive mirrors and fitting, and self-checkout services, can be subsequently implemented for retail operations and management. Features for anti-counterfeiting and individual customer marketing can also be incorporated to enhance brand image and customer experience. Moreover, intelligent algorithms may be integrated to mine useful information, such as the sales history of products and the shopping behaviour of customers from the data captured by the RFID devices to facilitate business decision-making and proactive individual marketing. As such, the efficiency of store operations and the overall retail business can be expected to improve substantially. The chapter presents the design approach of the proposed system and discusses some implementation issues, exemplified by two basic applications: (1) track-and-trace anti-counterfeiting to prevent injection of faked products into the back-store inventory and (2) smart product collocation to promote individual customer marketing and cross selling.

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INTRODUCTION

To survive and thrive in competitive retail business, companies need to promote omni-channel retailing to enhance customer experience and hence improve operation efficiency and profit margins. This may be achieved by innovative adoption and integration of advanced technologies, including cloud computing, mobile devices/payment, and Radio Frequency Identification (RFID) (Ganesan et al., 2009; Tajima, 2007; Violino, 2013).

RFID, as a non-line-of-sight identification technology, has great potential to improve physical process efficiency and overall supply chain visibility (Ngai and Gun 2009; Vlachos, 2013). Vlachos (2013) studied the impact of RFID practices on retail supply chain performance, and reported that RFID could improve the performance of distribution systems, including products dispatched and inventory in transit by 33.8% and stock availability by 45.6%, respectively.

Advancement of RFID and the related technologies in recent years has made real-time identification and tracking of individual product items a realistic possibility (Tajima, 2007), which is not practicable with barcodes. Using barcodes, it is not easy for retailers to achieve identification and tracking of individual product items in supply chain processes, from source to store. It is often time-consuming and impractical in item-level applications to read a barcode attached to a product item, a case, or a pallet, one by one.

Hence, a number of pilot projects have been conducted to adopt RFID to enhance source-to-store supply chain management, including production tracking, pack and ship verification for logistics services, warehouse management, product anti-counterfeiting, and retail business enhancement. Kwok and Wu (2009) proposed an RFID-based intra-supply chain system for textile industry to facilitate coordination and integration of supply chain functions and activities for enhancing the overall performance of a supply chain. It has been demonstrated that RFID offers huge potential to elevate the visibility of product items and the overall efficiency of supply chains to levels not previously practicable.

Furthermore, full visibility of product items, from source to store, facilitates omni-channel retailing and improves in-store inventory accuracy. This is because available inventory from any location, whether in stores or distribution centres, or in transit, or on order from the manufacturer, can be located and allocated in real time. Indeed, adoption of RFID for real-time identification and tracking of individual product items from source to store highlights its benefits for improving inventory accuracy, on-shelf availability, differentiated customer experience, brand image, and store operation efficiency. As such, the efficiency of retail operations and profit margins can be improved accordingly.

The success of item-level RFID application hinges greatly on generating and maintaining a trustworthy electronic pedigree (e-pedigree) that records the movement of products to uphold the integrity of the supply chain. A main implementation issue concerns formulation and real-time tag programming of a unique product identifier (PID) and the related production data of a product item at the manufacturing source, and subsequent updating and synchronization of all the transaction records of each of the product items across various nodes of the supply chain, from the manufacturer’s warehouse to the logistics service providers and wholesale distributors, and finally to the retail stores and the end-customers.

We propose an item-level RFID-enabled store management system to help improve retail business. This system is primarily aimed to achieve better intra-organisational coordination within a retail enterprise through synchronisation and management of information at item-level along the whole supply chain, with a possible extension in future development to facilitate inter-organisation/cross-enterprise coordination. It is integrated with a track-and-trace anti-counterfeiting system to generate product PIDs at manufacturing and
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