Business Case

LPR Global Inc.

RFID Metal Tag
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Introduction

Radio-Frequency Identification (RFID) is a short-range wireless communication technology exchanging data between a reader (known as an interrogator) and an electronic tag attached to an object, for the identification or tracking purpose. It has a baseband processing unit for storing and processing information, an RF unit for modulating and demodulating an RF signal, and an Antenna for receiving and transmitting the signal. Most passive RFID tags without power sources are excited with the external electromagnetic field usually initiated from a reader, whereas active RFID tags with a battery respond and transmit signals when an external interrogator has been successfully identified.

It is used for many applications. We can think of mobile phone payment, transportation payment at the toll roads, public transit payment, asset management at the retail sales, product tracking, casino chip tracking, animal identification, inventory systems, libraries, passport, schools, museums, even for human implants.

The most important consideration in the practical implementation of RFID is the tag detectability. There are several reasons for a reader to fail to detect a tag. The tag position, the tag distance from the reader, the tag direction towards the reader could be solved with the appropriate adjustment, but the type of object material (water content or metal object are worse for readability) and the environments such as electro-magnetic interference (EMI) should be dealt with more sophisticated technology.

The new specially designed antenna utilizing the metal interference and signal reflection for longer read range than similar sized non-metal tags is required with RFID metal tags. The technology is evolved into embedding transponders in metal to deal with metal interference, which allows the usage to extend into weapon tracking, medical device quality control, etc.

The value of entire RFID market will be $5.63 billion in 2010, up from $5.03 billion in 2009, which includes tags, readers, and software/services, according to IDTechEx, a technology market research company. The market value for passive RFID tags is expected to amount up to $5.5 billion in 2013, as seen from Figure 1. It seems that the market is at the stage to start a rapid increase in value in 2011.
Figure 1

This article begins with two real world examples, how the RFID find applications in industry and commercial purposes. All other applications, challenges for RFID to resolve, and conclusions will follow.

Case study 1: RFID management of POSCO Steel Production

The problem: Steel product distribution and warehouse/facility management

It takes a long time to deal with the production process manually, such as a product inspection with barcodes or bare eyes, and a unified database system is required in the supply chain among vendors, original equipment manufacturers (OEM), and customers for acquiring traceability. The product information such as location information of trucks carrying the steel product, product specification, etc should be shared among supply chains in real time.

The production facilities also have similar problems. It is needed to take maintenance of production equipments and to check the maintenance results in and out of the database in real time, which can cope with the situation where a swift action is in need, for example, when the production materials are in shortage and an urgent supplication is needed.
Wireless electronic solutions are difficult to be used for the resolution of the aforementioned issues, because of the large presence of metal and high temperatures at the plant. Read distances are low, and devices also have to withstand the high temperatures.

The solution: RFID system

Figure 2 shows how the RFID systems are applied to those who pile up the steel products. As we see from Figure 2, a serial number per each steel plate is manually typed into a personal digital assistant (PDA), and a worker at the plant checks its warehouse and pile number and writes it onto a steel plate manually in the current pile-up system. This process has been simplified through RFID readers and tags. Each RFID tag with a serial number will be placed onto a steel plate and read through a reader which will confirm its warehouse and pile number automatically, reducing labor efforts and time.

The crane labor has also been processed manually in the current system, as seen from Figure 3. A pile number has been confirmed with bare eyes and a plate has been piled into the corresponding pile. There is no computer terminal or system in the place, and a worker does not maintain the data and should take a safety check by himself at the work place. The new work procedure in the crane labor can be set with the help of RFID systems, as follows. The RFID readers are installed in the cranes and workers check the information of the steel plates through the web pads and set the cranes in position toward the steel piles. A steel plate to be moved is picked up with the crane and moved to the position to accumulate. The information for a steel plate ID, size, weight, and location number to pile up is automatically obtained through the RFID Tag. The corresponding information for a steel plate can be managed at the computer terminal in the crane controller seat.
Figure 4 describes how the RFID systems made the shipping easier. Crane workers used to be informed of which pile of steel plates to move via two-way radios and put each pile on the conveyer belt, so shipping line workers may enter the warehouse and pile number of each pile into a PDA for shipping, whereas new process with RFID systems makes crane workers confirm the work orders through a web pad in the crane and the data processing with the piles on the conveyer belt are automatically done through RFID readers and tags.
<Figure 4: Convenient shipping of steel products through RFID systems>

Hot-Rolled (HR) steel plate manufacturer also take the advantage of RFID system for the simplification of working process. High temperature resistant RFID tags are used in this HR steel plate shop.

**Case study 2: RFID Casino Cashing System**

**The problem: RFID systems improvement and integration**

There have been two separate database (DB) servers and middleware for Casinos in two different locations, the Seoul Hilton Hotel and the Pusan Lotte Hotel, and thus membership management has been handled separately. Since there is one DB system for two DB servers, it takes a long time to recover the DB system from a DB server down. The DB and middleware SW are the Oracle and Java, respectively, which are not optimized to perform under Windows 2003 middleware OS. The Oracle and Java SW are known to be optimized for UNIX OS. There has been a problem for the currency exchange system, too. The SW for the currency exchange is C++, whereas the middleware SW is Java, which makes the system maintenance complicated.

**The solution: RFID chip management under DB server integration**

It has been known that .NET and SQL DB server perform optimally under Windows 2003 middleware OS. Both the SW for the currency exchange and the middleware SW for it had better be written in C# for a relatively easier maintenance and update. The DB server which
used to be in two different locations shall be unified into one place, and a back-up DB server will be clustered for easy recovery from an accident server down.

Figure 5 shows the overall data flow of an RFID Casino Cashing System between two casinos, one in Seoul and the other in Pusan. The RFID chip management system and the currency exchange system access to a separate middleware in each location. The purpose of middleware server in each location is to collect and to take a transaction of data from the desk. The middleware SW deals with the data input, its process, and inquiry check, as well. The main role of PC is the management of currency exchange. One DB server takes care of both casinos cashing system in both locations. There is an extra duplicate DB server to recover quickly from an unexpected system shut-down. The SQL DB server SW is optimally performed with the Windows 2003 OS.

An RFID technology has been applied to raise the stability of the Casino business. The renovated casino cashing system is set up with the familiar Windows OS and .NET framework, which makes the cashing system simple and unified, so it may achieve the fast performance and the system update can become easy. The same SW environment is used for both PDAs and servers, and both wireless and wired communication technology is applied. The C# development programming language has advantages in the fast development and update. We can easily see how the RFID technology be integrated with a new casino cashing system from Figure 5.
Case study 3: RFID for Mold Management

The problem: Difficulty in manual management of mold manufacturing

In the process of manufacturing mold products in industries, it has been difficult to keep track of the in-and-out of manufactured mold products. The manual logging process causes often mistakes and takes a long time to input data. The real-time management of manufacturing flow of mold products has been difficult to be achieved, too. The history of modification, repair, or even demolition of mold products is difficult to be maintained without a real-time management of manufacturing flow. A statistical management of mold manufacturing process becomes also possible with the automation of data-input process for mold products. The status of stocks scattered in various locations or even in different companies can be managed with an automated system.

The solution: RFID HW/SW systems

<Figure 6: RFID HW system for the management of mold production>

Figure 6 shows the structure of RFID HW system for the management of mold production. The high temperature resistant RFID tag is attached as shown in the picture. The fixed or portable RFID reader takes the required signal from the tag attached to the mold for the real time management of production flow. The wireless LAN network or a simple direct sequence spread spectrum system can be enforced between the RFID server and portable RFID readers. The corresponding SW structure is shown in Figure 7.
The HW/SW RFID system is applied in the industry of mold production as shown in Figure 8. The RFID system shown in Figure 6 and 7 is applied in reality for the mold production of Samsung.
Electronics located in Gumi, South Korea. The Samsung Electronics reaped several benefits from adopting an RFID system for the manufacturing process. The inherent high possibility of mistake with the manual data input has been reduced in huge scale, which increased the credibility of data accuracy in the database and enabled the data to be used for the future prediction out of the statistics analysis. The reduction of time consumption in data handling is another benefit. The history of mold products is easily managed with the automated system, which makes it possible to easily locate the right mold product in the rack when it is needed.

Applications

Fashion and Consumables

In order to satisfy the needs of retailers for the success of being able to put the right item in the right style or size in the customers’ hand at the right time, the RFID technology can help fashion retailers address these age-old issues, achieving the real time inventory visibility required to improve the many aspects of inventory management with very little effort.

This field of fashion and consumables has been the frontier of IT applications. Our product has rendered even more possibilities of RFID technology in this industry sector. Special multi-functional tags of different types can satisfy the needs of different styles in this area.

Asset Management

RFID devices can be used to track assembly line components and tools in manufacturing places. The technology provides details of asset location and it can monitor critical information pertaining to each asset, as such, RFID is becoming a valuable integral system for the asset management purpose.

The latest material science technology is applied for the research and development of our RFID Asset Management Tags product. Regardless of whether it is cabinet-type metal carrier or

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precious archive assets of enterprises, our Asset Management Series of metal tags can fully meet the actual application needs with its impact size, high read rate, long identification distance, and other noticeable features.

Food and Drug Administration Series of small-size special tags we provide can effectively improve the monitoring capability during the circulation by leveraging the fundamental technology of unique identification number for RFID chips, thus helping enterprises maintain their values of product.
Industrial Manufacturing

For stringent industrial production process, our Industrial Manufacturing Series of integrated tags boast high quality, high performance and high applicability, enabling RFID implementation in a variety of fields such as production line monitoring, supply chain management, and process flow tracking for the finished products, etc.

Warehousing and Logistics
Our Warehousing and Logistics Series high-strength anti-wear tags can be fixed on skids, metal pallets, feed box, etc. in multiple ways, and can even be designed in embedment mode to integrate with the carrier, so as to address the harsh application environment in logistics.

Government and Public Safety

Our Government and Public Safety Series of high-strength metal tags can help realize the certification, routing inspection, retracing and other supervisory actions by administrative governmental bodies for dangerous articles, public facilities, civil defense assets, etc.
Following are some other applications of our RFID tags.

Firearms Management Tags

RFID tag can help real time monitoring of firearms in-out information, inventory, and history, etc.

Document Management Tags

For the security protection of important documentation or arrangement of large volumes of documentation, RFID tags are extensively used.

Commodity Management Tags

Real time monitoring system including internal assets storage, transfer, lease, or disposal, and capital asset inventory applicable to the metal products such as printers, laptops, desktops, etc.

Logistics Management Tags
Tags are attached to metal surfaces using magnetic. Logistics management attachable to pallet, military IT assets, or ammunition management is the application.

Access Control Tags

Companies, governments, or organizations that require secured access need an automated access control for employees or visitors to enter or exit. RFID tags are extensively applied for this purpose.

Washable Tags

RFID tags are used for the laundry inventory tracking management at the military to prevent the loss or stolen uniforms, blankets, parachutes, etc.

Real-Time Location Systems (RTLS)

Location tracking in limited spaces.
Challenges

Oil and Gas Industry

From pipe-work to refinery QA checks to tracking trucks and mission critical assets, RFID is playing an important role in the oil and gas industry. Although barcode has been and continues to be used for pipe-work joints in the crude oil supply chain, RFID is proving to be a more reliable way of ensuring the right parts and torque pressures are being used during the assembly process. Refineries are also looking for ways to ensure that their processes meet safety and audit requirements. It is also critical to track the movement of trucks to ensure optimum utilization of expensive capital and labor. Key assets need to be maintained throughout the entire oil and gas distribution supply chain.

Our water and chemistry resistant RFID tags provide furnished solutions for this project. RFID should be able to withstand harsh conditions and remain operable long after bar code would have been washed or worn away. RFID could assist refinery operators to identify key inspection points and provide the audit trail. RFID is also well suited for tagging parts that require routine maintenances as well as for tracking truck movement.
Gas cylinder tracking

Strength

Our RFID tags are manufactured in special ceramic substrate for super stable performance. Our tags can be embedded in the use of **metal** or placed on the **metal surface**. It can work under the temperature condition of 230 °C with its **high-temperature resistance characteristics** as well as with its **corrosion-proof encapsulation**. Our tags are extensively applied for the iron and metal industry, and IT asset management and identification.

*Following is our product specifications.*

**UHF Protocol** UHF EPC Global Class 1 Gen 2, ISO 18000-6C, **Memory** EPC 96 bits, **Chip** ImpinJ/ Alien/ NXP, **Operating Frequency** 860 ~ 960 MHz, **Surface Material** Metal, **Weight** 5.2g / .18oz,  
**Dimensions** Case: 24X19X4.4 mm / .95X.75X.17 inch, Tag: 21X17X2 mm / .83X.67X.08 inch,  
**Back Adhesive** 3M 9473 PC, **Casing Material** Thermal resistance engineering plastic, **Reading Range** Reading Range of Handset: above 1 m / above 3.3 ft, Regular reading range: above 2 m / above 6.6 ft, **Application Temp** -30 ~ 85 °C / -22 ~ 185 °F, **Storage Temp** -40 ~ 230 °C / -40 ~ 446 °F, **EEPROM (Permitted reading time)** 100,000 cycles, **ESD Performance** OK (compliant with the IEC 61000-4-2 standards), **Water Resistance (IP Grade)** IP 68, **Salt-mist Performance** OK (compliant with the IEC 60068-2-11 standards), **Drop and topple Resistance** OK (compliant with the IEC 60068-2-31 standards), **Vibration Resistance** OK (compliant with the IEC 60068-2-6 standards).
Clients can choose customization services such as code writing (on EPC code, Access password, User memory), Data visualization, Company Logo printing, Encapsulation, or Extra securing pattern with minimum 5,000 pieces of order.