Introduction

RFID (Radio Frequency Identification) technology is fast replacing ScanCode technology for asset tracking and inventory management. Traditionally, asset tracking and inventory management in retail supply chain or manufacturing/service units depended heavily on manual scanning of bar code printed on each item at every strategic point.

Though manual bar code scanning has been there in the market for quite some time, the focus is shifting fast towards RFID based solutions since they have a number of advantages over traditional bar-code based solutions. RFID tracking is fast, secure and reliable. RFID based tracking solutions can be tailored to the needs of your enterprise. The most compelling advantage is the tremendous gain in ROI (Return on Investment) by replacing all manual components for asset tracking and inventory management. In areas requiring the valuable inventory items to be handled many times during its life-cycle (or transitions from location to location) the ROI is appreciably high. What is more, RFID technology does not require a line-of-sight for detection by the system. So, you can still have valuable inventory stocked up in the racks or wrapped up and yet the system can read the item identification. An asset tracking and inventory management system can be extended to provide you additional functionalities such as automatic reorder of low-stock items, sending email notifications to concerned person when something moves in or out of a section within your enterprise and lot more.

If you are worried about not knowing where your valuable inventory is, or tired of having a lot of people to scan bar-codes at every point within your enterprise, it is time you start thinking to take advantage of RFID based asset tracking and inventory management.

This white paper focuses on details of RFID technology and how you can automate asset tracking and inventory management of your enterprise using it. The white paper takes aid of a case study on how FicusSoft has developed and successfully implemented RFID integrated Asset Tracking and Inventory Management solutions for a reputed manufacturer of ultra-sensitive instruments used in the field of biotechnology and pharmaceutical research.
Background

A reputed company manufactures ultra-sensitive equipment used in biotechnology and pharmaceutical research. Each of the equipment consists of several components and costs several hundred thousand dollars. Every constituent component is identified with a unique serial number. The whole equipment is also given a unique serial number. Each component is manufactured in its own department and then sent to the next department for mounting. When the equipment is ready, it has to pass through multiple quality checks including a decontamination/sterilization section. Finally they are packed in shipping crates and moved to the shipping department.

When a customer experiences a defect or has a complaint about something not working properly, they would call up the service department and lodge a service ticket. Faults can occur in any component, so a Service Engineer for that component needs to be intimated. The components are ultra-sensitive and cannot be generally repaired at the customer's site. So the service engineer carries a replacement while visiting the customer. He replaces the faulty component with the good one and carries it back for repair. When the component is repaired, it is kept ready to be used as a replacement with another equipment which might be with some other customer. In this way, the constituent components not only keep moving from department to department during the manufacturing process, but also from equipment to equipment during service and repairs. As such, the managers, service engineers and sales force of the company need to know exactly what is lying where at any moment. The service engineers need to be notified when a component arrives or moves out of the premises. In addition they need to know the complete history of each component since it was first manufactured.

In such a scenario where a huge number of components are continuously on the move, it is not difficult to imagine the effort required to track the valuable inventory using manual barcode scanning. FicusSoft developed a complete solution for asset tracking and inventory management using RFID technology for the company. As of writing this white paper, the net ROI was calculated to be more than $54,000 in the first three months of operation.

How does RFID tracking work?

In traditional bar-code systems, the unique item identification number is printed on an adhesive sticker and pasted on to the items. At every strategic point where the tracking system needs to be posted with a movement, a person scans the bar-code with an infra-red or laser based bar-code scanner. The data from the bar-code scanner is fed into the system which then processes the information to record the locational information of the items.

In RFID based system, each item is fitted with a RFID tag. The RFID tag is basically an electronic radio transmitter comprising of a micro-chip and an antenna and a tiny battery, everything fabricated on a thin plastic sheet. It can be easily attached to a variety of items directly. They can also be fitted inside identity cards and put on people (such as employees) or animals in a
farm. Each RFID tag has a few bytes of memory built on to it which contains its unique identification number and it periodically sends out a radio signal carrying the same. A receiver device, called the RFID reader detects the signal emitted by each tag as soon as it enters into its radio range and interprets the identification number. The RFID tags that are powered with a tiny battery are known as Active RFID tags and can be read from a distance as high as 100 feet. The detection range of a RFID reader can be adjusted so that it defines an area in the enterprise. Simply put, when a RFID tag is detected by a particular RFID reader, you know that the item that the tag is put on is present in the area where the reader is sitting.

**System Architecture of RFID Subsystem**

The RFID based asset tracking and inventory management solution developed by FicusSoft uses a simple yet scalable architecture for the RFID subsystem to suit the needs of a variety of application domains. It uses a number of individual software components that work collaboratively for smooth processing of the RFID tag information (such as Tag ID, time of detection, area where detected etc.) and feed the information to the inventory management solution.

A number of RFID readers are placed within the enterprise, depending on its shape, size, number of strategic detection points and other factors. Each RFID reader defines an area in the enterprise. Data that is captured by the readers are sent to a software called Concentrator. The concentrator software can receive RFID information from several reader devices. It processes the information and buffers them for a predefined time period. There is another piece of software called Collector which collects buffered data from the Concentrators. For bigger enterprises or higher tag densities, additional Collectors can be added to the system. The Collector software performs additional processing and finally puts the data into an SQL Server database.

The Asset Tracking and Inventory Management (ATIM) solution has its own SQL Server database at the back-end. The ATIM database is designed as per the inventory management functionality required by the customer. The ATIM solution exposes its complete functionality through a web-based front-end that can be deployed on the Intranet server of the enterprise. The users can use the front end using the standard web browser on their computer.
For integrating the RFID information with the ATIM solution, FicusSoft has developed another middle tier software component called RFIDSrvc. This software component is a windows service that starts automatically when the computer is booted up. It runs in the background and coordinates between the ATIM database and the RFID subsystem database. In addition, it also performs specific tasks such as updating movement history of each component in the ATIM database, sending out email notifications to concerned personnel when a component arrives at a location or moves out of the location. The RFIDSrvc service relies on a simple XML based configuration file. Parameters in the configuration file can be changed to alter the way the RFID system functions as per the needs of the enterprise.

In addition to the above software components, FicusSoft has also developed a library of software components that can be quickly integrated to build up the RFID based asset tracking and inventory management solution, making the whole system scalable and configurable by the end-user. In addition, FicusSoft can develop the complete RFID based asset tracking and inventory management solutions right from scratch depending on customer requirements as suitable for the business process of the organization.

Areas of application of RFID technology

The major application area of RFID tracking is in manufacturing, service and retail chains. However it can be applied in many other ways. Theoretically speaking, RFID tracking can be used in any area where some kind of tracking is necessary. Some interesting application areas have been discussed here, but it can be applied to many more.

✔ In Hospitals and Health care, each patient can be tracked by a RFID tag. RFID tags in form of wrist-bands are now available in the market. Doctors and nursing staff can see detailed information of the patient on a hand-held PC or PDA, just by standing near the patient's bed.

✔ In large farms, dairies etc., RFID tags can be used to track live stock. Active RFID tags in form of ear tags have started coming to the market.

✔ RFID tracking can be used in any organization for employee/visitor tracking within its premises.
Access to sensitive areas can be controlled by RFID tags in place of swatch cards.

✔ The same idea can be taken into Hotel industry, where access to a room can be controlled by a RFID tag. Additionally, safes used for storing personal valuables can be RFID enabled providing yet another level of comfort and security for hotel guests.

✔ In prisons, RFID tracking can be used for monitoring activities of the inmates which can be very helpful tool for security personnel.

✔ In Airlines, RFID technology can be used for tracking baggages with 100% accuracy.

✔ In a city transport system, RFID tags can be used on high priority vehicles such as police cars, ambulances, fire trucks etc. so that when they arrive at a crossing, the traffic signaling system can automatically switch on green lights only for that lane and red lights for all other lanes, allowing the vehicles to pass through smoothly saving precious seconds.

✔ RFID tags can be used on cars for hands free authorization at parking lots, gas stations and other such areas.

As it can be seen from above, RFID identification and tracking can be used very imaginatively in many ways, making life much easier and helping businesses run smoothly. RFID technology can be tweaked without much difficulty to suit specific business requirements.

Benefits of RFID based Tracking & Inventory Management

RFID based asset tracking and inventory management can benefit your business a lot. One of the major advantage being complete saving on manual labor for traditional bar-code scanning. In addition, RFID tracking gives you maximum accuracy, without any human intervention and need for line of sight. Using RFID technology offers huge cost savings that can be appreciably high for any business. The table below shows how you can improve your business and also enjoy huge cost savings by using RFID technology.

<table>
<thead>
<tr>
<th>Major Costs</th>
<th>RFID Value</th>
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<tbody>
<tr>
<td>30% Labor cost; mostly in manual bar-code scanning</td>
<td>5% to 45% improvement</td>
</tr>
<tr>
<td>4% Order fill rate (right product, right quantity)</td>
<td>Nearly 5% improvement</td>
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<tr>
<td>1.17% Shrink (lost or misplaced products)</td>
<td>0.06% improvement</td>
</tr>
<tr>
<td>Inventory Error</td>
<td>99% improvement</td>
</tr>
<tr>
<td>61% Transportation (detention, demurage, safety stock)</td>
<td>40% to 60% improvement</td>
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</tbody>
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You can also reap the benefits of using RFID technology for your business. If this sounds interesting, please contact us now. FicusSoft with its extensive background in RFID technology, can help solve your tracking and inventory management needs. We will analyze your business requirements and guide you how to save money by using RFID technology, including developing complete customized solutions for you.

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