

# RFID TECHNOLOGY

*Sanita Baggetta, Siena College*  
*Maria Ehlinger, Siena College*  
*Jenny Falco, Siena College*  
*Nicholas Franck, Siena College*  
*Will Hassett, Siena College*  
*Jenna Millington, Siena College*

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## WHAT IS RFID TECHNOLOGY?

RFID, radio frequency identification tags are used in host of applications to track and identify products, animals and even humans. The tags transmit unique identifiers (8 – 12 bytes or characters) using radio waves. This technology contains two elements, the actual RFID tag and a reader to receive the signal.

Current applications using RFID technology include; proximity cards used for building access, automated toll-payment transponders (EZ-Pass), ignition keys of many millions of automobiles, American Express ExpressPay & MasterCard PayPass, and approximately fifty million house pets around the world have RFID tags implanted in their bodies to track them when lost.

There are two general types of RFID tags. The primary difference is how they are powered. Active RFID tags contain a battery that allows them to transmit the signal autonomously. In contrast, passive RFID tags, which do not have a battery, require the transmitter signal for power. The passive tags are less expensive to the active counterparts. Passive tags cost about twenty cents and active tags can cost upwards to \$2 - \$3 dollars per tag. While passive tags have a long life, they are also limited in the transmission range. Passive tags can transmit up to 12 inches in comparison to active tags, which can transmit up to 1km.

## RFID BENEFITS

With RFID technology there is less human intervention. This technology allows for real-time information flow as an item changes states through the supply chain. RFID technology also allows for machine to machine communication and can prevent lost or stolen inventory.

## RFID & DAIRY FARMS

### Background information

Dairy farms began using computerized record management systems in the 1950's. They progressed and began using smart tags and sensors to manage dairy herds in the early 80's. Dairy farm operators are now using communications technologies such as wired Ethernet, Bluetooth, Wi-Fi, & RFID to improve their business efficiency. Since 1991 the number of dairy farms has declined, however the remaining farms are getting bigger. This has triggered an increase in reliance on IT systems, sensors and wireless technologies to support the growth of farms. With the help of new technology, milk output per cow has increased by 15% (U.S. Dept. of Agriculture).

### Cow tagging

In 2007, 9% of dairy cows were tagged using RFID tags only costing between \$2-\$3. The major tag producer is Flex USA Inc. Several different types of tags are utilized for cow tagging. Ear tags are used to monitor when cows are entering the milking-parlor gate. Mobile wand readers are used by workers to read the RFID tag. Stomach tags are used to monitor heart rate, stomach PH, and body temperature. Rear leg tags allows a person to use a mobile scan wand and perform several tasks at the same time. For example, vaccinations (usually performed at the cow's rear) are performed more efficiently since a tag is located in the rear leg. Having more than one tag allows for

work that is more efficient for monitoring different aspects of dairy production.

An example of RFID implementation at a farm is Thomas Farms of Garland Maine Inc., that uses RFID technology to identify cows, to check food consumption and even as a pedometer. The pedometer can tell if cow is sick or is in heat. An overly active cow may be ready to breed. At Thomas Farms the VAS (Valley Agricultural Software) Dairy-Comp 305 management system is used to process the RFID tag information. This information system measures milk weight, identifies the cow and transfers this information to another computer system to match veterinary information. The system produces reports and to-do lists as output.

### **RFID roundup**

RFID tags are also being used with handheld computers and scanning wands. The tags on the cow's ear are read and then the data, including the ID number is transmitted to the computer via Bluetooth wireless technology. The computer then checks the ID number against a work list and sends an audio message to a Bluetooth headset. This determines what the cow needs, for example vaccinations or pregnancy tests. Data is then uploaded into the dairy management system via a USB or Wi-Fi connection. This system improves accuracy and saves on labor costs.

### **Bovine biometrics**

New technology is allowing dairy farm operators to monitor each cow's heart rate, PH levels and temperature in real-time. TenXsys Inc. is developing a temperature sensor called SmartBolus. This pill-shaped device sits harmlessly in a cow's first stomach and is battery operated, lasting about four years. It takes temperature readings and uses a transponder to transmit that data 96 times a day to a solar-powered repeater in the corral. This repeater relays the readings to a PC in the office and the data is integrated with a DHI dairy management program. Bella Health Systems is in the process of developing a similar device that uses a passive RFID tag. These tags log the cow's temperature when she passes by a reader gate in the pen or milking parlor. They can also detect a cow in heat and help with early detection of pregnancy or illness. Early detection of illness can reduce the time it takes a cow to recover and ultimately return to milk production.

### **Issues**

Temperature sensors have not been proven to increase efficiency (Jim Reynolds, Clinician at School of Veterinary Medicine - University of California). Animal temperatures can fluctuate rapidly. Specifically, cows allow their temperatures to rise and fall with environmental conditions. The temperature in their stomachs also changes quickly when drinking. These new systems must allow for such variation in order to prevent false alarms.

Dairy farms could suffer from information overload. As dairy farms expand, they must add more sensors and systems to their farm. These additional sensors increase the amount of data produced and could overload the system. Creating lists of cows that might have problems based on biometric readings could be considered a distraction.

## **RFID & WAL-MART**

### **How it all started**

In 2003, RFID tagging was mandated for all suppliers by CIO Linda Dillman. RFID tagging started with the top 100 suppliers. The targeted suppliers had to tag all pallets and cases with RFID chips. As of 2007, 600 Suppliers are using RFID. This is  $\frac{3}{4}$  of Wal-Mart's sales volume. Wal-Mart started out wanting to implement RFID in Distribution Centers and at the Store level. As of 2007, Wal-Mart wanted 12 out of 120 distribution centers to be RFID equipped but only 5 have been setup for RFID. As of 2007, 1,000 out of 4,000 stores are equipped with RFID technology. Focus has switched from the distribution centers to the store level.

## **Purpose of using RFID technology for Wal-Mart:**

### **Manage inventory**

If pallets and cases are tagged with RFID chips they are detected by a tag reader antenna when entering the store or distribution center. The information that the tag reader picks up is sent to a computer and is entered into inventory management software. When purchases are made, the RFID tag will be scanned and the inventory system will deduct the item from the inventory count. This alone has reduced out-of-stocks by 8% and has allowed Wal-Mart to resupply 3 times as quickly. This type of management of inventory shows perpetual inventory improving by 20%.

### **Collaboration between suppliers and Wal-Mart**

**Promotional offers;** Helps with product placement in the actual store (End-cap displays). Makes sure promotional items are in-stock without sending a sales manager to check each store. Suppliers can spend time doing more value-added activities instead of "babysitting" the store (Webster 36).

**Helps suppliers manage time sensitive merchandise;** Helps manufacturers work with retailers to put certain products in special locations. An example of this is, Procter and Gamble can collaborate with Wal-Mart to stock and place batteries around Christmas or cleaning supplies in the Spring in locations that are most likely to get customers to purchase them.

### **Benefits to Wal-Mart:**

Through efficiencies gained by using RFID technology, Wal-Mart enjoys increases in revenue, and more products on shelves to sell. Wal-Mart has also experienced faster and more efficient inventory management. The technology eliminates a lot of manual procedures, such as counting inventory. With the implementation of RFID technology Wal-Mart has noticed better communication with suppliers. They have been able to offer better promotions and more effective placement of products in the store.

Another benefit Wal-Mart has experienced is lower out-of-stock merchandise levels. This has directly translated into a growth in sales as their customers are not being forced to go elsewhere to find their desired product because out-of-stock items.

### **Benefits to Wal-Mart suppliers**

Wal-Mart Suppliers have also enjoyed an increase in revenues; RFID technology has aided in communication between them and Wal-Mart. By using RFID technology suppliers maintain a current view of what their product status is in all Wal-Mart stores and distribution centers.

### **Challenges**

While RFID technology offers numerous advantages it is not without challenges. The price of implementing a RFID system can be prohibitive for some suppliers. When RFID tags were first mandated they cost about \$1.25 each. The cost is currently about 7 – 10 cents each. It is argued that "RFID won't really make financial sense for suppliers until the cost of tags drops to 2 cents" (Webster 36). The price of the reader/antennas is currently about \$1000 each. Big companies like Wal-Mart and many of their suppliers require thousands of readers for all their factories, warehouses, and retail stores.

There were no real standards for using RFID technology when it first developed. This meant that there was no assurance that tags and data readers would work together. Since Wal-Mart was on the bleeding edge of RFID technology they helped to create standards.

Another problem is that the accuracy of data collected was only about 60%. The RFID readers were having difficulty picking up the RFID chip when dealing with glass, liquid, or metallic materials. The current accuracy is now at 90% to 99% levels.

## **RFID & Wal-Mart: The future**

Wal-Mart has seen itself on the bleeding edge on the exciting new RFID technology. However, it may have been too hasty to mandate that all of its suppliers to tag pallets and cases with RFID chips. The cost for smaller companies to get the necessary equipment to follow this mandate is \$100,000 - \$300,000, and the cost to a large-scale manufacturer can be as high as \$20 million.

Even though out-of-stocks have decreased by 8% and inventory reliability has improved by 20%, the simple truth is that RFID tags are too expensive for many suppliers. First generation chips were \$1.25; today second generation chips are 7 to 10 cents. However, RFID won't make pure economic sense until the cost of tags drops to 2 cents.

Wal-Mart has recently been reluctant to talk about its RFID project. Some think this is because the RFID revolution is more costly and difficult to implement than before. Another possibility is the penetration of other competitors in the market; Wal-Mart wants to keep competitive advantages secret. This is the more likely scenario, as Wal-Mart is probably keeping its secrets very close to the vest. Regardless, RFID technology is more effective than the old standard of bar codes, but the price of the RFID tags has to be deemed economically feasible by suppliers before it becomes the standard.

Wal-Mart is attempting to extend RFID technology internationally. They are starting in Canada, because their RFID standards are similar to ours. If this initiative is successful, they will extend further into the global market. Wal-Mart is no longer the center of the RFID universe - rather it is now a competitor. With no longer a link to Wal-Mart, RFID now has the potential to grow exponentially ([http://www.scdigest.com/assets/On\\_Target/08-09-15-1.php?cid=1924&ctype=content](http://www.scdigest.com/assets/On_Target/08-09-15-1.php?cid=1924&ctype=content)).

Once return on investment improves (i.e. the technology, so costs are less), we can expect to see a flourishing of RFID activity within many small and large-scale consumer staples. ([http://www.scdigest.com/assets/On\\_Target/08-09-15-1.php?cid=1924&ctype=content](http://www.scdigest.com/assets/On_Target/08-09-15-1.php?cid=1924&ctype=content)).

## **COLLABORATIVE RESEARCH PRESENTED IN CSIS-114**

<http://sites.google.com/a/siena.edu/rfidtechnology/>

## **REFERENCES**

Brewin, Bob and Vijayan, Jakikumar. "Wal-Mart Backs RFID Technology." ComputerWorld. 16 June 2003 <<http://www.computerworld.com>>.

Juels, Ari. "RFID Security and Privacy: A Research Survey." 28 Sept. 2005. RSA Laboratories. 2 Nov. 2008 <[http://www.rsa.com/rsalabs/staff/bios/ajuels/publications/pdfs/rfid\\_survey\\_28\\_09\\_05.pdf](http://www.rsa.com/rsalabs/staff/bios/ajuels/publications/pdfs/rfid_survey_28_09_05.pdf)>.

Mitchell, Robert L. "RFID: Saving The World One Cow at a Time." Computerworld. Sept. 15 2008: 23,26,27.

RFID tag (picture): retrieved from <[http://www.moeller-horcher.de/de/pressezentrum/download/SATO/RFID-Tag\\_philadelphia\\_Quelle-Metro-Group.jpg](http://www.moeller-horcher.de/de/pressezentrum/download/SATO/RFID-Tag_philadelphia_Quelle-Metro-Group.jpg)> on 3 Nov 2008.

RFID Thought Leaders On the Current and Future State of RFID. 15 Sept 2008. SupplyChainDigest. 3 Nov. 2008. <[http://www.scdigest.com/assets/On\\_Target/08-09-15-1.php?cid=1924&ctype=content](http://www.scdigest.com/assets/On_Target/08-09-15-1.php?cid=1924&ctype=content)>.

Robert, Mark. "Wal-Mart Takes RFID International." Chain Store Age v.82 no.9 (2006):46.

Wal-Mart (picture) retrieved from <<http://mwiner.files.wordpress.com/2008/04/walmart.jpeg>> on 3 Nov 2008.

Webster, John S. "Wal-Mart's RFID Revolution a Tough Sell." Networkworld. 15 Sept. 2008

[www.networkworld.com](http://www.networkworld.com).

Weier, Mary Hayes. "Wal-Mart Rethinks RFID." InformationWeek. 26 March 2007.  
<<http://www.informationweek.com/story/showArticle.jhtml?articleID=198700170>>.