

# RFID TECHNOLOGY

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Radio Frequency Identification technology is a system composed of tags, antennae, and data readers that can track and collect data through radio wave signals. Most RFID tags do not have their own power source, but are instead powered by readers that send out a signal that activates them. RFID tags function by utilizing a tiny chip with an antenna that contains whatever necessary data relevant to the task. The antenna can transmit the chip's data when prompted by a reader, normally through the use of specific frequencies that only the chip recognizes and reacts to. RFID tags are primarily used in stores like Wal-Mart to keep track of inventory and, in some cases, to prevent theft of costly items. Additionally, the technology has found a niche in toll collecting and luggage tracking with rising popularity.

## HISTORY

When people think of RFID Technology, they tend to think of it as a new age technology, but in reality the concept has been around since the 1940's. During World War II, the Germans discovered that they could manipulate the radar signal on the radar screen simply by rotating the aircraft, allowing the radar screen to become a 'secret code' by which they could identify each other. The Allies took this concept one step further and developed a device that manipulated the radar signal, causing a steady 'blip' to occur. This system was referred to as *Identification Friend or Foe* (IFF).

During the 50s and 60s the theories and ideas surrounding RFID continued to develop. The first patent was given to Mario Cardullo for an active RFID tag in 1973. That same year Charles Walton received a patent for a passive transponder, used to open a door without a key. At this time, the government began taking an interest in using RFID to keep track of hazardous materials. (RFID Journal, 2005) Since the 1970s, RFID uses have continued to expand, with the only limit being the human imagination.

## DIFFERENT TYPES OF RFIDS

Among the smallest types are *passive tags*, which contain no independent power source and have the smallest data capacity and communication ranges. They are powered by the radio waves transmitted from the reader, which must be close in order for power to be delivered and data to be transmitted. They can be shrunk to fit many uses and are generally the cheapest. *Active chips* contain a battery for power, can hold much more data, and can transmit much further; however, cost and size are factors that can limit their potential uses and buyers. *Semi-active tags* contain an internal battery as well, but only to monitor environmental conditions, requiring a radio signal in order to transmit data. (KST International, Inc. 2004-2008)

## CURRENT USES

Current uses of RFID technology are quickly spreading into multiple venues. Wal-Mart, for example, uses the tags for security measures to prevent theft of products. (Castro and Wamba, 2007) Manufacturers like Ford Motor Company, Chevrolet, and Boeing are using the technology to track parts and components of vehicles at assembly plants, in order to optimize production and reduce costs on lost or faulty materials. (Castro and Wamba, 2007)

Family pets are also being chipped with the intent of helping to return lost pets to their owners or simply to store medical information. Animal shelters have benefitted from this technology as it diminishes resources necessary to shelter the animal while waiting to be claimed. (Schering-Plough, HomeAgain) The same method is used with livestock to identify each animal and their health records, with the goal of reducing the spread of disease. (Castro and Wamba, 2007) There is even a pet door that is activated only by a pet's unique RFID implant. (Pet Porte Ltd. 2009)

Automobiles have improved security by having remote-activated door locks or even cars that will not start without the proper RFID frequency. (Schuyler, 2004) RFID tags can also be used to allow access to certain functions; such as, Barcelona's Baja Beach Club where club members have a personal RFID chip surgically injected into their arms allowing access to the club and the ability to credit their account for purchases within the club. (BBC News, 2004)

Tracking uses have expand to sports, with the Boston Marathon conducting a trial in 2004 for tracking runners with RFID tags in their shoes, thus eliminating the need to slow down at official checkpoints, verifying that runners don't miss checkpoints, and allowing friends and family to check the progress of a runner throughout the race. (PC World, 2004)

## FUTURE USES

Wal-Mart is one of many companies leading the way in new uses of RFID technology. Among the new innovations being tested is the Electronic Product Code, also known as "EPC." It allows shipments and the merchandise contained within to be tracked during deliver and stocking. It will also allow for shelf inventory to be conducted electronically, a more efficient method than physical inventorying by employees. EPCs in development could allow them to be able to check temperature, expiration dates, and other quality control measures, thus insuring that every item stocked is fit for consumer purchase. (Wal-Mart Stores Inc, *Electronic Product Code*)

Pharmaceutical companies plan to use a similar system to keep track of medications as they move through the supply chain. This would ensure medicines are properly manufactured and prevent counterfeiting. Patients can be given RFID-tagged bracelets containing information such as medication history, which operations they are slated for, and may even help keep patients from being directed into the wrong rooms or surgeries. (Castro and Wamba, 2007)

Delta is testing a new baggage tracking system using RFID tags to track luggage as it is moved from airport to airport. (InformationWeek, 2004) Although Delta reports that

only 0.7 percent of luggage is misdirected, given the size of the airline, that equals approximately 800,000 bags. On average, this costs Delta nearly \$100 million annually locating and returning the luggage. (RFID Journal, 2004)

Coca-Cola is rolling out a limited number of RFID-based drink dispensers to gauge interest in different flavors and flavor combinations. The vending machines are called “Freestyle,” and contain multiple different flavor cartridges, all chipped, to be mixed into drinks in any combination a customer desires. The information gained from this will help the company determine the popularity of certain flavors, as well as assist merchants with restocking by notifying them when a particular cartridge is low. (InformationWeek, 2009)

Lastly, one of the most often-talked-about uses for RFID tags is for personal finance. MasterCard has been working on credit cards containing RFID tags “as a kind of virtual signature.” (BBC Online, 2004) Not only would consumers be able to pay for products simply by waving their cards in front of a reader, but radio waves could also be used as a security measure. An “off switch” for the cards may improve security measures and prevent malevolent RFID readers from gaining information by scanning cards from a distance.

## RFID CONCERNS

Privacy issues are the most frequently referenced issue with the use of RFIDs. A recent *HEARING BEFORE THE HOUSE OF REPRESENTATIVES* specifically addressed the many possibilities and concerns raised by the use of RFIDs. Janice Schakowsky stated that, “[RFID chips] can be hidden in products and documents without one’s knowledge. This raises serious privacy concerns.... I believe that we must not turn a blind eye to the potential for the abuse of this technology.” (RFID Technology, 2004)

Many attendees of the hearing expressed their concerns with the potential abuses presented by RFID Technologies. Most opponents of RFID technology are not only concerned with the potential misuse of RFIDs by corrupt government agencies, but also the ability for personal information to be easily harvested by marketers and identity thieves. Some Representatives expressed strong opposition against the use of this technology, while others urged government regulation as a necessary step for the protection of the people. One opponent of RFID technology believed that violation of individual privacy will become unavoidable. “As RFID sensors proliferate, the abundance of data collection points also increases, making it possible to track movements with [a] book.” (RFID Technology, 2004)

Paula Bruening, Staff Counsel of the Center for Democracy and Technology, invoked a call for regulator action when she stated that, “Congress should also explore whether current privacy laws that apply to the government collection of information adequately cover the use of RFID by government agencies.” (RFID Technology, 2004) Supporters of RFID reiterate standard precautions and policies which are already in place to protect individual privacy rights. Linda Dillman stated, “As the Chief Information Officer for Wal-Mart, I spend a great deal of time working to ensure the privacy of our customers. There is definitely an inherent responsibility for companies using RFID to address privacy issues.” (RFID Technology, 2004)

For some individuals, their concerns with RFID technology are more economical, specifically as it related to the cost of integrating the technology into libraries. RFID tags cost approximately \$0.50 a book, while the total security cost for bar codes and electromagnetic strips are approximately \$0.18 a book, making RFID tags more than double the price of the current security devices utilized. When considering the cost of tagging every book in a modern library, it can become a tremendous expense both fiscally and in man-hours to make the transition. Supporters believe that this technology will decrease in cost as its use becomes more widespread.

Another economic concern is the cost of equipment and software. In order to fully utilize the technology items such as tag programming units, hand held readers, and self check-out stations will need to be purchased. Some flexibility with the financing of the new investment can be managed as not all of the listed items are necessary but the cost is still daunting. As a part of a library's transition to RFID technology, modifications would have to be made to the library's layout, since precautions will need to be taken for the placement of RFID readers in proximity of metal and electronic systems. (Haley, Jacobsen, Robkin, 2007)

Another potential barrier to RFID acceptance is public opinion. Some people are extremely concerned with their privacy. Library users will need to be educated about the library's privacy policy and how the RFID system will benefit them. Additionally, Library staff who may feel inadequate handling such an unfamiliar technology, or who feel their job is in jeopardy because of the reduced workload offered by RFID technology may hinder the utilization of the technology. Libraries need to consider these issues when deciding when to commit to the use of RFID technology. (Haley et al., 2007)

## RFID ADVANTAGES FOR LIBRARIES

Although RFID has received intense scrutiny, this technology has much to offer society, specifically libraries, library staff, and patrons. RFIDs can simplify and speed up the process of circulation, inventory, and stacks management. Circulation would be aided by speedier checkouts, and real time check-ins. If a patron is looking for a book that isn't on the shelf, the library will know right away if it is the building, possibly even know what room it is in. This process will simplify library processes and allow them to be done faster. Additionally, it will reduce the physical stress upon library workers, optimally seeing a reduction in cases of stress related injuries (such as Carpel Tunnel Syndrome). Patrons will benefit from the use of RFID technology as library staff will be less occupied by the routine tasks of maintenance and will be better able to assist with their needs. Additionally, they will be able to utilize expedited functions like self check-out and return. Books will be easier to find, since the stacks can be checked more frequently for miss-shelved items.

Library inventory could be conducted by rows, instead of by the individual book. Scanning rows of books at a time gives more visibility of reference numbers and can speed up the process of finding mis-shelved items, making shelf reading obsolete and decreasing cases of lost books. (Haley et al., 2007)

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