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THE BASICS OF RFID

During the past 5 years there has been much interest in the next generation of AutoID technology - *Radio Frequency Identification (RFID).* This technology has emerged as an enabler to supply chain initiatives to drive out cost and increase efficiencies within the process. RFID has a long history dating back to the late 1800's when Guglielmo Marconi demonstrated the successful transmission of radiotelegraphy across the Atlantic. As we know today, radio frequency technology is wide range and touches every part of our daily lives. Without this development, many of today's technologies would not be possible.

Overview of RFID

RFID is a complete system solution that operates in the electromagnetic spectrum to transmit data without contact or line of sight. It is an automatic identification and data collection technology utilizing "electronic" programmable tags for tracking, tracing and identification of objects. The underlying operating principles of RFID are similar to bar code technology and the applications are similar. The drivers for using RFID are in applications and environments where bar codes do not work well. RFID is a system with the following components:

- Transponder (or Tag)
- Reader/Writer (Interrogator)
- Antenna
- Host computer

The *transponder* is at the heart of the system and consists of a small electronic circuit with an attached silicon chip. RFID tags are powered and classified as active or passive. Active tags have an internal battery that allows for long-read ranges. They are typically read/write capable and are often seen in toll collection applications. Passive tags do not have a battery and powered by a separate source typically the interrogator.

A typical *reader* contains an antenna to transmit information to the tag as well as receive it from the tag. The size and form of the antenna will be dependent on the specific application as well as frequency chosen. It typically houses a decoder and RF module as well as the antenna. Readers can be fixed, i.e. mounted, or portable such as a handheld depending on the application.

An RFID system can be stand-alone or interfaced to an IT platform for exchange of information. In either situation, a host system is needed to collect the data to convert into useful information for the end-user. RFID can also be used in conjunction with installed bar code systems to extend their functionality.

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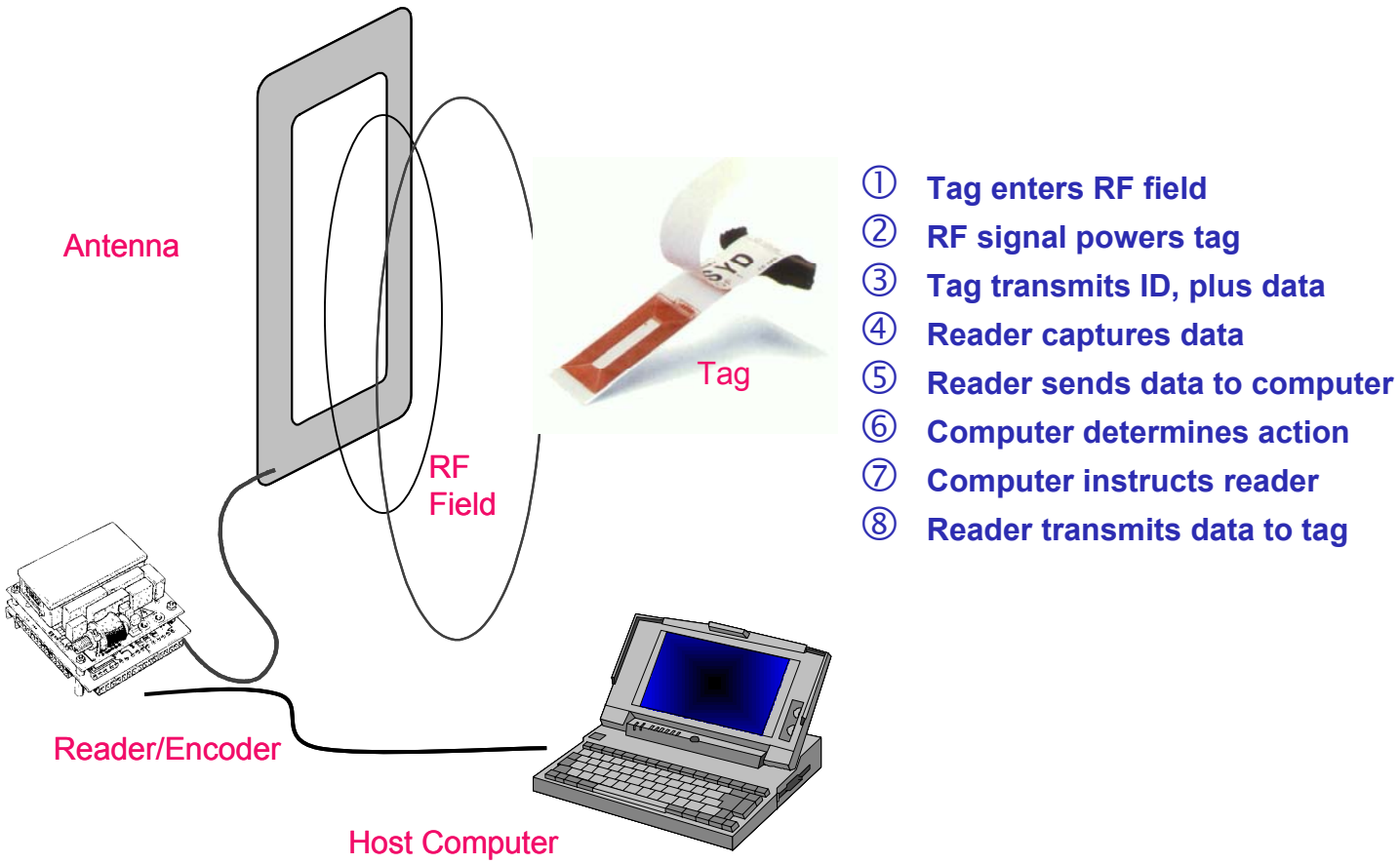
Figure 1: Operation of an RFID System



Types of RFID

There are several types of RFID technology available today with new development in progress to improve functionality and decrease total system costs. The categories of RFID are:

- EAS (Electronic Article Surveillance) systems
- Passive RFID
  - Read Only
  - Write Once, Read Many
  - Read/Write
- Active RFID
  - Local Positioning/RTLS
  - Toll Collection

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Electronic Article Surveillance (EAS) systems are typically a one bit system used to sense the presence/absence of an item. The large use for this technology is in retail stores where each item is tagged and large antenna readers are placed at each exit of the store to detect unauthorized removal of the item (theft). These systems were the first form of RFID to be commercially available and have been in use since the 1960's.

Passive tags are less expensive and can be write once read many (WORM), read only or read/write. These tags typically operate in one of three frequencies: 13.56MHz, 915MH (UHF) or 2.45GHz. Other frequencies are available, however these have been found to have the best functionality for AutoID applications. Read ranges range from 3' to 12' depending on the chosen frequency. Memory capacity ranges from 32 bits to 128 bytes depending on the manufacturer. RFID systems are dependent on their chosen technology as to how well they perform in a specific application.

Active tags transmit information to the receiving antennas by using a battery resulting in read ranges of up to 300ft. The combination of the larger antenna and battery result in a higher cost tag. However, these tags are capable of storing a portable database. Tag life is generally two to five years depending on the battery settings of the tag.

Benefits

Many operational benefits are associated with RFID versus other methods of data collection. RFID systems are application sensitive and it is necessary for a thorough site survey to be completed before solution selection.

RFID does not require line of sight or contact for transmitting or receiving information. Thus, tagged items can be identified within the field without regard to orientation or position of the affixed tag. This allows for many items to be interrogated instanteounsly without manual manipulation of the items. Tags can also be read in harsh environments that are not conducive to bar coded labels such as automotive paint operations, extreme environments exposed to high heat, humidity, condensation, grease and oil. Testing is required in these environments to insure the robustness of the tag.

Due to the dynamic functionality of the tags, information can be added, modified or stored on a tagged item. The advantage of this is exemplified by the adding of information to a part moving down an assembly line and is deemed defective. Rather than continue to manufacture the part it can be removed before more value is added and repaired or destroyed. Another example is the adding of warranty information to a consumer product that can be read a repair technician.

Efficiencies in sortation operations can be realized due to the reduction and possible elimination of manual scanning. For express parcel companies, a scan of one package can occur up to 50 times before it is delivered to its destination. At a cost of $0.02 to $0.05 per scan, this can add significant cost to the process as well as slow it down. RFID would reduce the number of manual scans required resulting in lower processing costs and increased throughput.

RFID SOLUTIONS

When evaluating the need for a new data collection solution, RFID should be taken into consideration with other technologies. Similar to other Auto ID technologies, RFID is a solution

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including hardware, software and installation. The system must be properly configured for the application to yield the most benefit. As global standards become accepted, tags and readers will be interchangeable within a frequency range as protocols will be defined. This will benefit solutions that will be used worldwide. These standards become less of an issue for stand alone systems that will be implemented within an organization.

CONCLUSION

RFID is a viable technology with many applications that are well suited to its functionality. These systems should not be considered an alternative to bar code but as a complement to it. A solution can be a marriage of both bar code and RFID for optimum performance and benefit. The future for RFID is strong as evidenced by its continued growth in the past several years.

Total System Solution

Bar Codes
Labels & Tags
Hardware
Printers
Readers
Software
Installation
Support
Maintenance