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RFID Technology

Neha Gupta
M. Tech Student, Electronics and Communication, Invertis University, INDIA

ABSTRACT

RFID is the only one of the numerous technologies grouped under the term automatic identification (auto id) such as bar code, magnetic risk, optical character recognition, voice recognition, touch memory, smart cards ,biometrics etc. Auto id technologies are a new way of controlling information and material flow, especially suitable for large production networks. Although the foundation of radio frequency identification (RFID) technology was laid by past generations, only recent advances opened an expanding application range to its practical implementation.

Keywords-- RFID Technology, sensors, security and network

I. INTRODUCTION

The RFID technology is means of gathering data about a certain item without the need of touching or seeing the data about certain item without the need of touching or seeing that data carrier through the use of inductive coupling or electromagnetic waves. The data carrier is a microstrip to an antenna the later enabling the chip to transmit information to a reader within a given range which can forward the information to host computer. The middleware and the tag can be enhanced by data encryption for security critical application at an extra cost and anticollision algorithm may be implemented for tags if Several of them are to be read simultaneously.

The microstrip patch antenna is popular printed resonant antenna for narrow band microwave wireless link applications such as radio frequency identification (RFID)system that require semi hemispherical coverage. Wireless technology advancements have given birth to RFID systems, which have generated significant interest and hype among scientists, researchers and industry. RFID technology enables identification, location and information exchange of distant objects via radio waves. It has been commercialized in areas of logistic manufacturing, transportation, health care and mobile communication. Basically RFID systems is a tag or transponder and a trans receiver or reader. The tag consists of an antenna combined with an application –specific integrated circuit (ASIC) chip. In order to activate and detect a tag, a base station (reader) transmit a modulated signal with periods of unmodulated carrier. The microstrip patch antenna is one of the most exicting and fascinating development in antenna and electromagnetic (EM) history. It falls into category of printed antenna such as dipoles, slots and tapered slots. This is due to their distinguised features including ease of integration, good radiation control and low cost of production.

Radio frequency identification (RFID) has been used in a number of practical applications, such as improving supply chain management, tracking household pets, accessing office buildings, and speeding up toll collection on roadways. RFID is used to automatically identify people, objects, and animals using short range radio technology to communicate digital information between a stationary location (reader) and a movable object (tag).

RFID technology can be used to track products in a manner similar to using bar codes for product identification, but RFID also carries additional benefits. RFID does not require line of sight to read the tag, has a longer read range than bar code reader, and tags can store more data than bar codes. Readers can simultaneously communicate with multiple tags. This feature could allow customers to breeze through grocery store checkout counters while a reader identifies all items in a shopping cart at the same time, instead of scanning each bar code individually.

II. RFID SYSTEM CATEGORIES

RFID systems may be roughly grouped into four categories:
1-EAS (Electronic Article Surveillance) systems
2-Portable Data Capture systems
3-Networked systems
4-Positioning systems

Electronic Article Surveillance 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 a large antenna readers are placed at each exit of the store to detect unauthorized removal of the item (theft).

Portable data capture systems are characterized by the use of portable data terminals with integral RFID readers and are used in applications where a high degree of variability in sourcing required data from tagged items may be exhibited. The hand-held readers/portable data terminals capture data which is then either transmitted directly to a host information management system via a radio frequency data communication (RFDC) link or held for delivery by line-linkage to the host on a batch processing basis.

Networked systems applications can generally be characterized by fixed position readers deployed within a given site and connected directly to a networked information management system. The transponders are positioned on moving or moveable items, or people, depending upon application.

Positioning systems use transponders to facilitate automated location and navigation support for guided vehicles. Readers are positioned on the vehicles and linked to an on-board computer and RFDC link to the host information management system. The transponders are embedded in the floor of the operating environment and programmed with appropriate identification and location data. The reader antenna is usually located beneath the vehicle to allow closer proximity to the embedded transponders.

III. RFID STANDARDIZATION

There are several standards related to RFID technology. The standards cover the following topics:

identification, the coding of unique item identifiers, or other data on the RF tag;

1-data and system protocols, effectively the middleware of an RFID system;

2-the air interface, that is, the wireless communication between the reader and the tag;

3-application support, which provides advice about how to implement the technology;

4-testing, compliance, and health and safety, that is, the rules that govern RFID operations; and terminology.

The International Organization for Standards (ISO) has drafted several standards related to RFID. ISO 11784, 11785 and 14223/1 deal with code structure, technical concept and advanced transponders for radio frequency identification of animals. ISO10536, 14443, 15693 relate to contactless integrated circuit, vicinity and proximity cards. ISO 18000 specifies the air interface for various radio frequency identification applications.

EPC global has developed a framework for worldwide RFID standards

The framework is based on the widely accepted Electronic Product Code (EPC) for product identification, as well as the ID System (EPC tags and readers), Object Name Service (ONS), which acts as a directory service for looking up product numbers on the Internet, Physical Markup Language (PML), and Savant, software that manages information in the EPC network.

IEEE-USA has a position paper regarding the use of RFID. Issues addressed include building RFID systems on the concepts of openness and transparency and using appropriate layered levels of protection and security with regard to RFID systems and the information they collect. Such policy is of particular importance as RFID systems are able to collect data "inconspicuously, remotely, and by unknown, unauthorized, or unintended entities."

IV. FREQUENCY RANGES

Three frequency ranges are generally distinguished for RFID systems, low, intermediate (medium) and high. The following table summarizes these three frequency ranges, along with the typical system characteristics and examples of major areas of application.

FREQUENCY BAND AND APPLICATION

frequency	**characteristic**	**typical application**
Low 100-500khz	short to medium read range Inexpensive	access control inventory control .
intermediate 10-15mhz	short to medium read range potentially	access control smart cards.
high 850-950mhz 2.4-5.8ghz	long read range railroad high reading speed line of sight required Expensive toll system.	car monitoring collection

Not all of the countries in the world have access to all of the frequency bands listed above, as some countries have assigned these bands to other users. Within each country and within each frequency range there are specific regulations that govern the use of the frequency. These regulations may apply to power levels and interference as well as frequency tolerances.

V. RFID APPLICATION

Manufacturing and Processing
– Inventory and production process monitoring
– Warehouse order fulfillment
Supply Chain Management
– Inventory tracking systems
– Logistics management
Retail
– Inventory control and customer insight
– Auto checkout with reverse logistics
Security
– Access control
– Counterfeiting and Theft control/prevention
Location Tracking
– Traffic movement control and parking management
–Wildlife/Livestock monitoring and tracking
Smart groceries
-Add an RFID tag to all items in the grocery.
- As the cart leaves the store, it passes through an RFID transceiver.
-The cart is rung up in seconds.
Smart cabinet
Smart fridge
-Recognizes what's been put in it
-Recognizes when things are removed
- Creates automatic shopping lists
- Notifies you when things are past their expiration
- Shows you the recipes that most closely match what is available
"Smart" appliances
– Closets that advice on style depending on clothes available.
– Ovens that know recipes to cook prepackaged food.
"Smart" products
– Clothing, appliances, CDs, etc. tagged for store returns.
"Smart" paper
– Airline tickets that indicate your location in the airport.
"Smart" currency
– Anti counterfeiting and tracking.
Smart groceries enhanced
-Track products through their entire lifetime.

VI. ADVANTAGES AND LIMITATIONS OF THE TECHNOLOGY

Advantages

Though RFID is not likely to entirely replace commonly used barcodes in the near future, the following advantages suggest to additionally apply RFID for added value of identification:

1-Tag detection not requiring human intervention reduces employment costs and eliminates human errors from data collection,
2-As no line-of-sight is required, tag placement is less constrained,
3- RFID tags have a longer read range than, e. g., barcodes,
4-Tags can have read/write memory capability, while barcodes do not,
5- An RFID tag can store large amounts of data additionally to a unique identifier,
6- Unique item identification is easier to implement with RFID than with barcodes,
7- Tags are less sensitive to adverse conditions (dust, chemicals, physical damage etc.),
8- Many tags can be read simultaneously,
9- RFID tags can be combined with sensors,
10- Automatic reading at several places reduces time lags and inaccuracies in an inventory,
11- Tags can locally store additional information; such distributed data storage may increase fault tolerance of the entire system,
12- Reduces inventory control and provisioning costs,
13- Reduces warranty claim processing costs.

LIMITATIONS

Although many RFID implementation cases have been reported, the widespread diffusion of the technology and the maximum exploitation of its potential still requires technical, process and security issues to be solved ahead of time. Today's limitations of the technology are foreseen to be overcome and specialists are already working on several of these issues.

1- Standardization
2- Collision
3- Frequency

The optimal choice of frequency depends on several factors, such as:

A-Transmission mode
B-Behavior of tagged goods and environment
C- International standards in frequency allocation.
4- Faulty manufacture of tags.
5- Faulty or deficient detection of tags
6- Tags may be damaged during usage
7- Adverse conditions of the environment and improper placement may corrupt reading.
8- Registration of data from tags which pass within range of an RFID reader accidentally.
9- Reader malfunction.
10- Security and Privacy Issues
11- Possible virus attacks

One of the common concerns of companies implementing RFID today is the rapid obsolescence of the technology, especially in view of the investment cost. Technology is continuously evolving and new protocol standards, faster and more fault-tolerant readers quickly outdate their predecessors

VII. CONCLUSION

The paper gave an overview of the current state and trends of RFID technology. Even though numerous limitations and unresolved issues still hinder the widespread application of RFID, it can be already seen that especially enterprises in complex supply chains will benefit from RFID, once the application difficulties are overcome.

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