A Survey on RFID Technology

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Abstract:

This paper represents the survey on RFID. Radio Frequency Identification (RFID) makes easier to automatically identify the items by using Radio Waves. Initially RFID tags were succeeded in time to replace the barcodes in supply chains. They can be read without wires (wirelessly), without line of sight (LOS), more robust and comparatively contains more information. Thepaper describes the recent technology which includes the frequency ranges used and standards. The paper outlines possible attacks that can break one's privacy and it also describes counter measures. The RFID technology is not limited at item-level tagging. The paper also presents recent research that focuses on locating and tracking labeled objects that move. The paper reviews some of the current developments in this field.

Keywords: *Radio Frequency Identification; RFID; RFID tags; Electronic Product Cod; EPC; Supply Chain Management; Securit; Location ; Tracking*

I. INTRODUCTION:

RFID tags are simply acts as a transponder which responds by transmitting a serial number, wirelessly, to the corresponding queries from a reader. This technology in used as for locating the lost items, labeling them, tracking moving items and many more.RFID tags are similar to the barcodes;the only difference is that barcodes have to be scanned by physically moving the items against the scanner for data collection with direct line of sight, whereas in RFID the data is transmitted automatically to the reader without a line of sight.

II.EVOLUTION:

IFF (Identification of Friend and Foe) was the first RFID application used by British in World War II.

In seventies ,“ Electronic Article Surveillance” (EAS) was the first commercial RFID application used for theft prevention system in which Tags can store a single bit that was read on lefting the store by customer ,if it founds unset the system would sound alarm.Also, in the end of seventies, this technology has been started use by the agriculture field like for animal tagging. Earlyin eighties, it was used for toll collection on roads in Norway and many US states.Then in following decades this technology made its way in various fields. In 1999, MIT founds the Auto-ID Center for developing a global standard for item-level tagging .And it was closed after completing its work on Electronic Product Code (EPC) in 2003which was then continued by EPC global Inc.Probably, the first paper related to this technology was “Communication by Means of Reflected Power” written by Harry Stockman in Oct 1948.In 1973, the first patent on this technology was issued for a passive radio transponder with memory.

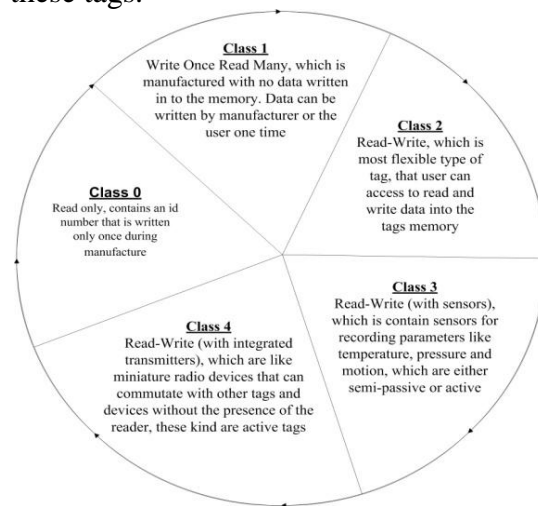# III.CURRENT   RFID TECHNOLOGY:

A. Working:

Most of the RFID tags are attached to the items to be identified. Each tag has its own internal 'RAM/ROM' which depends on the type and application. Memory stores the information related to the product, such as unique ID, manufacturing date, etc.The RFID reader generates magnetic field which allow the RFID system to locate the items (via RFID tags) within the range. The reader trigger's the tags to reply to the query by generating the high frequency electromagnetic energy and query signal, the frequency of query could be up to 50 times per second .From this, a communication is establish between the tags and reader which results in large quantities of data. To control this problemsoftware is used named 'Savant' which acts as a buffer between Information Technology and RFID reader.

RFID tags are consisting ofMicro chip, Antenna Case, Battery (for active tags only).Chip size is depending mostly on Antenna. Also, on frequency the tag is using and its area of use. Many protocols manages the communication process between the reader and tag .when the reader is switched on, the protocols such as ISO 15693 and ISO 18000-3 for HF or ISO 18000-6 and EPC for UHF,starts the identification process. When tags arrives is the switched on readers field, it automatically starts decoding the signal and reply to the reader. If many tags reply at the same time, thereader detects the collision by indicating multiple tags. This situation is resolved by applying anti-collision algorithm which allow the reader to sort tags and select/handle each tag depends on frequency range which is between 50 tags to 200 tags and the protocol used.

B. Tags Classification:

RFID tags are consisting ofMicro chip, Antenna Case, Battery (for active tags only). The microchip is made up of integrated circuit and embedded in a silicon chip. Chip size is depending mostly on Antenna. Also, on frequency the tag is using and its area of use. Many protocols manages the communication process between the reader and tag .when the reader is switched on, the protocols such as ISO 15693 and ISO 18000-3 for HF or ISO 18000-6 and EPC for UHF,starts the identification process. When tags arrives is the switched on readers field, it automatically starts decoding the signal and reply to the reader. If many tags reply at the same time, the reader detects the collision by indicating multiple tags. This situation is resolved by applying anti-collision algorithm which allow the reader to sort tags and select/handle each tag depends on frequency range which is between 50 tags to 200 tags and the protocol used. Several types of materials are integrated on these tags.

Class 1
Write Once Read Many, which is manufactured with no data written in to the memory. Data can be written by manufacturer or the user one time

Class 2
Read-Write, which is most flexible type of tag, that user can access to read and write data into the tags memory

Class 0
Read only, contains an id number that is written only once during manufacture

Class 3
Read-Write (with sensors), which is contain sensors for recording parameters like temperature, pressure and motion, which are either semi-passive or active

Class 4
Read-Write (with integrated transmitters), which are like miniature radio devices that can commutate with other tags and devices without the presence of the reader, these kind are active tags

Different shape and size of RFID tags

Three types of RFID tags in relation to power or energy:

- Passive tags are those tags which do not have their internal power source, therefore their lifespan is unlimited andthey depend on the power induced by the reader. That means the reader has to keep up its field until the transaction has been completed. These tags are smallest and cheapest tags available due to the lack of a battery, however it restricts its reading range to range between 2mm produced by printing.

- Semi-passive tags are those tags which have internal power source that keeps the microchip powered at all time. These tags can respond to the requests faster which increases the number of tags that can be queried per second .Furthermore, since the antenna is not required for receiving power it can be optimized for back scattering which increases the reading range. A semi- passive tag has usually a range larger than a passive tag due to stronger back scattered signal which increases the range even further.

- Active tags also contain an internal power source but they use the energy supplied for powering the microchip and to generate a signal on the antenna, therefore their lifespan is up to 5-10 years. The signals an active tag sends which are not queried are called Beacons. Range for an active tag can be tens of meters which make it ideal for locating items.

C.Tag Frequencies:

RFID range is based on their frequency which determines the resistance to the interference .Different types of RFID tags uses different frequencies. RFID tags fall into four regions in respect to frequency:

- Microwave works at the range of 2.45 GHz. Reader rate is good even faster than UHF tags. At this frequency the reading rates are not similar on wet areas and near metals. This frequency gives better results in applications such as vehicle tracking (in and out with barriers) within the tags read range of 1meter.

- Ultra High Frequency (UHF, 850 - 950MHz, 2.4 - 2.5GHz, 5.8GHz) tags have highest ranges of all tags. Its range for passive tags is from 3-6 meters whereas for active tags is 30+ meters. These tags have high frequency data transfer rate which enables to read a single tag in a very short time period. These tags are comparatively very expensive .Fluids and metals affect these tags .UHF frequencies can be different for different countries and require permits.

- High frequency (10-15MHz) tags have higher data transfer rate but they are inexpensive. They can be used for access control, items or product identification, etc.

- Low frequency (30-500 KHz) tags ranges are approximately half a meter and mostly used for short reading range application. These low frequency tags are least affected when applied on wet and near metal surfaces.

D.Antenna:

Antennas are the medium for tag reading .RFID antennas are used for collecting data. They can be

1. Patch Antenna
2. Gate Antenna
3. Linear Polarized
4. Circular Polarized

5. Di-Pole or Multi-Pole Antenna
6. Stick Antenna
7. Beam-Forming or Phased-Array Element Antenna
8. Adaptive Antenna
9. Omni-Directional Antennas

1. Power supply (for running reader)
2. Communication interfaces
3. Microprocessor
4. Channels
5. Receiver/Transmitter
6. Memory ,and
7. Controller.

Advantages	Disadvantages
High speed	Interference
Multipurpose and many format	Costly
Reduce man-power	Some materials may create signal problem
Accurate	Overloaded reading (fail to read)
Complex duplication	
Multiple reading (tags)	

E. RFID Reader:

Reader is an electronic device which is used to produce and accept the radio signals. It has the central place in the RFID System. It scans (or read) tags through the RFID Antennas at a certain frequency. The antennas consist of an attached reader; the reader passes the radio signals through antenna as per tags capacity. Reader consists of an anti- collision algorithm and one reader can operate on various frequencies. As a result, the readers have to collect the data (or write data on tags) and transfer it to computer systems. For connection to the computers ,reader can be connected using RS-232,RS-485 and USB cable (called serial readers).Also Wi-Fi connection can be made for wireless options(network readers).Readers can be integrated with some devices and some components or hardware into it:

F.Standards of RFID:

Electronic Product Code (EPC) global and International Standards Organization (ISO) are the two major organizations working to develop International RFID Standards in UHF band. But these organizations are not completely compatible with each other. Some Standards are short listed as follows: ISO 11784, ISO 11785, ISO 14223, ISO 10536, ISO 14443, ISO 15693 and ISO 18000.

G.Advantages and disadvantages of RFID:

IV.PRIVACY AND SECURITY:

In this section I am presenting issues of security and privacyand the possible scenarios where the RFID tags can be exploited. Loss of privacy is the main concern for companies where the tags scanned to acquire information about customers and then creates individuals profiles by using data mining techniques. The item level tagging promises more control and large savings in the supply chain management, companies are doing item-level tagging within their production process. Companies need more benefits for which they start labeling the delivered items. Similarly, animal tagging is done for tracking their moving "properties".Anti-RFID activist's shows some possible exploits if no precautions are taken such as

unauthorized scanning of tags for creating user profiles, singling out a person carrying many expensive items, etc.

Privacy is not only the issue for concern, but also Authentication is needed. Also the Kill command which is a mechanism to permanently disable a tag must have protection to unauthorized access. This command is supported by EPC Class 1 and 2 tags. Several approaches exist to protect the privacy of customers. Some of those approaches are as follows:

- Split approach: In this approach the information is distributed over two tags .One of them is removable by customer contains the serial number and the other fixed tag is used to store the information of product. It allows item tracking by its unique identifier and customer to keep track of its own items.

- Proxy approach: All tags are provided by a PIN that a user can set on buying the item. In case, another reader wants to access the stored data on a tag, the reader have to request for it to the guardian who retrieves the information from the tag and forward it if the reader is authorized.

- Distance approach: This approach doesn't require customer's action. Signal to noise ratio is used by tags to provide an estimate of readers distance. These tags are more expensive.

  Tags are usually smaller in size and often embedded due to which most of the peoples are not aware of them at all.

V.APPLICATION:

This paper explores the general RFID application.RFID application has many benefits in hospitality. As we know, object identification can be done by using barcodes, biometric and RFID.RFID is categorized as short range and long range. The short range applications needs closer readers for scanning the tags and the long range applications may not need to be near reader.

A. HealthCare application-:

By using RFID applications in healthcare many resources can be saved which are utilizing further for patients better care. Tagging may reduce the errors of medical objects such as patient's files and medical equipments tracking in timely manner. It helps in integrating the medical objects. RFID based timely information about the objects location would increase the efficiency. Also the RFID sensors used to monitor the heart rate of cardiac patients and the life of dental retainers.

B.Security application-:

These RFID tags can be attached to the objects or any official belongings.RFID application used in secure zones where users grant permissions and also record individual access and duration of their stay.

C.Patrolling applications-:

RFID applications are also good for audit trial. And used for controlling security users themselves. Application provides RFID tags (called checkpoints) which are used for patrolling the security guards needs to scan during their sequential patrol through reader.Reader records the swapping time of the card and the location where the card is used by the security guards. This application improves the patrolling process.

D.Packages application-:

Industries like airline industries that face a lot of loss of money by package and delivery

services. Handling the transfer of packages from several places to several different places is complex. In this field, RFID application provides the industries better resource management, and effective operation in transferring of packages .It also provides identification of packages, their records which helps them for improvements in some areas and provides information to the customers of their packages.

E.Toll application-:

RFID is used in collecting toll which makes the traffic flow smooth such as vehicles cannot pass the toll stations without paying the charge.RFID makes faster transactions by identifying the account holder.

F.Other applications-:

RFID Technology is not only restricted to these areas. It has found applications in construction areas, parking management, transportation and also in traffic control systems.

VI.CONCLUSION AND FUTURE WORK:

This study briefly explained about the nature of RFID technology evolution w.r.t its application. With this application organization, industries or companies become more secure, reliable and accurate. The first part of this paper focuses on RFID technology and its components. In second part has discussed its advantages and disadvantages. Last part of this paper explores the RFID technology application. It provides efficient methods and operations for many applications. This technology requires development in its capabilities to be used with computing devices. This paper also shows that in future this technology will benefits many organization, and companies.

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