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A Peek Into Rfid - Non Technical Perspective

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ABSTRACT

A lot of discussions on Radio frequency identification (RFID) system by Scientists, industrialists, government agencies are going on all around the world. It is said that RFID can be easily used in numerous tasks like managing supply chains, tracking livestock, preventing counterfeiting, controlling building access and supporting automated checkout., animal identification, DNA technologies and so on. A computer can identify objects, record data or control individual object through radio waves. A RFID reader is connected to a terminal of Internet. This enables the users to identify, track and monitor the objects globally, and automatically. Most surprisingly much can be done in real time. The people talking about Human Rights are seeing a red sign. They apprehend that the days are not far off to use this technology on human beings, violating the privacy.

Hence, whether he understands the underlying technology or not, it has become necessary even for a common man at least to have some knowledge about RFID.

This paper gives an introduction to RFID without delving into much of the technical aspects.

KEYWORDS : Radio Frequency Identification, Industry and Maintenance, Logistics and Retail, Security, Tag, Electronic Article Surveillance, EPC

If our browsing habits extend beyond social networking websites, we can't miss the following announcement in the internet. Also we can see announcements in internet about another conference on RFID in May 2016,

We are told that the following are going to be discussed:
- RFID in Industry and Maintenance
- RFID in Logistics and Retail
- RFID in Healthcare
- RFID, NFC and Smart Cards in the application areas of Payment, Security, Access control and Personal ID

We cannot avoid asking "What is all this about? What is this RFID and why so much hue and cry about it among industrialists, Governments and scientists? When we go on delving into this subject, we find that the tentacles of RFID have not ended with this category of people, but people of all the ranks and rungs of society are within the catch of the RFID and it is going to change the life of a common man worldwide.

RFID (Radio frequency identification) is a generic term for technologies using radio waves to automatically identify people or objects.

What are the advantages of automatic identification of items/people? In this age of information, companies want to automatically identify items/people, capture information about them and store it as database in a computer without manually feeding the data. This frees up staff from manually doing value-added functions, reduces data entry errors and thereby increases efficiency of the organization, Bar codes, smart cards, voice recognition, some biometric technologies like retinal/finger print scans are some of the technologies that fall under the auto-ID umbrella and the latest is RFID

The history of RFID started with Sir Robert Watson-Watt's invention, radar. This system used a single transmitter/receiver. The transmitter sent a high power signal, and the aircraft reflected a small amount of the radio energy back and it was received by the receiver. .

But radar could be used only to identify the presence of an object. It did not give any details other than its size. Watson-Watt then developed a system known as IFF - Identification Friend or Foe. A transponder was placed on each plane and when interrogated by a ground station, it responded with a code to identify it. Thus the evolution of RFID started.

The further developments were
- simple electronic surveillance tags used for shop packaging
- Attaching readers and transponders to the vehicles carrying nuclear weapons enabling identification of the truck at various points along its route.
- Injecting a passive transponder under the skin of the cow. This transponder reflected back a "backscatter" signal that was modulated with the cow identification information.

Having its routes in the earliest days of electrical science and then radio, RFID history has come out of developments such as radar and IFF. Now RFID is a technology in its own right which is widely used and showing massive benefits to industry and society as a whole.

Earlier RFIDs were based on a frequency of around 125 kHz. Systems around the 13.56 MHz license free frequencies were developed. UHF frequency spectrum was employed in early 1990s.

The use of higher frequency allowed higher data rates and longer ranges. Broadly, the range of the RFID system are categorised into:

- Close range - within 1 centimetre
- Remote   - between 1 cm and 1 metre
- Long range - more than 1 metre
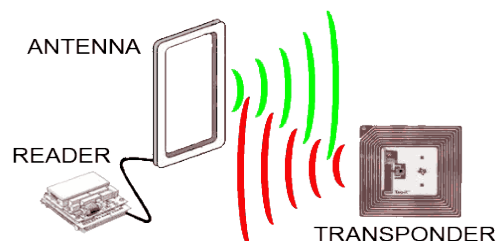
RFID system consists of Transponder and Reader. Identification details and other information are stored on a microchip that is attached to an antenna (the chip and the antenna together are called an RFID transponder or an RFID tag). The antenna enables the chip to transmit the identification information to a reader. The reader converts the radio waves reflected back from the RFID tag into digital information that can then be passed on to computers that can make use of it RFID tags and RFID tagging techniques are essential to the whole operation of the Radio Frequency Identification system. In general the RFID tags are small low cost items that can be attached to items that need tracking or other forms of data collection to be performed. Tags take a variety of forms and RFID tagging can be accomplished in a variety of ways.

RFID, Radio Frequency Identification tags comprise two main elements - Electronics circuitry and Antenna. Care is taken to ensure minimum cost and very low power level.

Some RFID tags do not contain any power and they are called passive tags. Semi-passive RFID tag uses a battery to supply the internal operation of the tag, but relies on the RFID reader to supply the power to transmit the signal to the reader. A***ctive*** RFID tag is one in which battery power is used to supply power to the electronics. Since this type of tag is not dependent upon the received power to provide a reflected signal greater distances could be achieved. This enables more sophisticated control and processing circuits. The requirements decide choice of an active or passive tag,

Depending on function, RFIDs are of two types: Read only radio frequency identification tags are typically programmed either in the factory. Data included will be a unique identifier and other specified data that cannot be changed.

Read-write RFID tags normally contain an area where data cannot be altered - this is often a segregated secure read-only area in the memory. Again this will include a unique identifier, and other data that may be required. The writeable area can then be used to contain data that may be required. For example if the RFID tag is used with a container, it can contain details of the container contents, etc. This area of memory within the RFID tag can be re-written many times.

One important area and function of the RFID tag is the area that handles the information storage and processing. RFID tags range vastly in their capabilities as some do not have their own power, relying on the received signals to provide any power and this limits their abilities. Other RFID tags with their own battery power are able to carry out far more sophisticated tasks.

Although RFID tags may appear to be the more straightforward or simple element within an RFID system, this may not be the case as considerable ingenuity and careful design is required To ensure the RFID tags perform correctly while being capable of being manufactured to a very low cost and within constraints of size, weight, form factor and also reliability. While most RFID tags are very cheap to manufacture, this hides the design behind them

RFID readers, RFID writers and RFID printers are effectively the base connection points used for an RFID system. Often only an RFID read function may be needed and this simplifies the requirements for the item, but at other times both RFID write and read will be needed.

RFID technology allows considerable flexibility in the placement of the RFID readers or RFID transceivers with respect to the RFID tag as line of sight is not a requirement. Barcode systems require a line of sight path to the bar code, and not only do this mean that the items must be visible, but they must also be orientated so that the barcode reader can see and hence read the barcode. RFID readers can be located in a position sufficiently close to the item to allow successful reading. This provides significantly greater flexibility and reliability.

The RFID reader can be broken down into a number of major elements or sub-systems ***Antenna, Controller. Network interface:*** Traditionally RS232 or RS422 interfaces have been used, but now there is much greater use of Ethernet, or wireless systems including Wi-Fi, Bluetooth, or Zigbee.

In addition to these elements there is also software as most items these days have processors which are software driven.

RFID printers are used in conjunction with RFID smart labels.

The RFID reader or reader writer (RFID transceiver) is obviously a key element in any RFID system. It enables the tags to be detected and the data read. While there is not the same level of constraint on the size, they must nevertheless be made relatively compact, and in some circumstances there may be environmental requirements, especially if they are to be operated outside or on vehicles. Accordingly RFID reader design can pose some design challenges.

There are a number of RFID frequencies, or RFID frequency bands that systems may use.

The frequency used by the RFID system determines many of the characteristics about the way in which it will operate. As a result, determining the correct RFID frequency band is an important early decision in the development process.

There is a total of four a different RFID frequency band or RFID frequencies that are used around the globe. These are placed widely different areas within the radio frequency spectrum and this enables RFID to choose frequencies that will enable the right system parameters to be obtained. As the UHF RFID frequencies are not a global allocation, these frequencies cannot be used internationally. Where access is allowed, it may be found that there are different restrictions in different countries.

The broad use and different manufacturers necessitated evolution of RFID standards. Like any other standards they enable manufacturers to make the same products for a variety of markets and in this way gain the economies of scale. RFID standards also enable products from different manufacturers to operate together. One example may be for tags which are used in very large quantities and manufacturers may want to source from two suppliers to provide reliability.

There are two main international RFID standards bodies or standardisation bodies:
- ISO - International Standards Organisation
- EPC global - Electronics Product Code Global Incorporated

Although these two organisations provide the main RFID standards organisations, there is also a plethora of other standards that apply to niche areas of RFID.

In terms of the standardisation organisations ISO is the longest established. In 1996 it set up a joint committee with IEC to look at standardisation for RFID technology. The ISO RFID standards fall into a number of categories according to the aspect of RFID that they are addressing. These include: air interface and associated protocols; data content and the formatting; conformance testing; applications; and various other smaller areas.

In addition to the ISO RFID standards, there are also the standards from EPC Global. In 1999 a number of industrial companies with MIT set an consortium known as the Auto-ID consortium with the aim of researching and standardising RFID technology.

In 2003 this organisation was split with the majority of the standardisation activities coming under a new entity called EPC global. The Auto-ID Centre retained its activities associated with the research into RFID technologies.

Standardization made many manufacturers enter into RFID market RFID systems were introduced in many areas of everyday life. RFID applications are limited only by people's imagination. RFID is used for everything from tracking cows and pets to triggering equipment down oil wells, payment systems, access control, supply chain and asset tracking. Retail, apparel, aerospace, defence, manufacturing, consumer packaged goods and pharmaceutical companies are looking to use RFID to track goods within their supply chains. Health care providers, energy producers and construction companies are using active RFID system to track large equipment, tools and vehicles. It has reduced administrative error, labour costs associated with scanning

bar codes, internal theft, errors in shipping goods and overall inventory levels.

In 1997, Ford Motor Co. Equipped the Mustang with one of the first RFID ignition immobilizers in the U.S. car industry. Theft levels for the Mustang immediately dropped 70 percent from just two years prior. The results were stunning, and pretty much every other carmaker followed suit. Today, the RFID industry claims a 90 percent reduction in theft rates for car models equipped with RFID starters, immobilizers and entry systems

This wide use has brought a question tagged along with it - whether RFID is secure and maintains privacy.

RFID security is an issue from several viewpoints including prevention of the system being hacked, to issues of personal security or privacy and access to personal location information, etc. Both RFID security and RFID privacy go hand in had, issues of one affecting the other.

A major concern over the increase in use of RFID tags is the personal security associated with the illicit tracking of RFID tags.

Private organisations have expressed their concern over this with the increasing use of electronic product code tags being embedded in consumer products. In addition to this the US Department of Defence (DoD) is looking at the problem with their use of tracking assets.

There are a number of ways in which these RFID security issues arise:
- The unique identifiers within RFID tags can be used for profiling and identifying consumer and individual patterns.
- Stealth readers can track people with RFID tags on them - RFID tags will normally remain active after an item has been bought, and when wearing a garment, for example, it is possible to utilise this tag illicitly.
- Hidden tags could be placed within on or within an item to enable stealth tracking to be undertaken.

While these measures are available, personal security can still remain an issue as the possibility of RFID security for individuals is not widely recognized.

There are many other issues associated with RFID security, one of which is RFID tag cloning. RFID security systems need to be able to prevent cloning as this would open the overall system to a variety of forms of security attack. Typically when RFID tag cloning occurs, the responses of RFID tags are received by rogue monitors. Information received can then be used to replicate tags.

To enable RFID security to overcome this vulnerability, cryptographic techniques are used and embedded into the chips used In view of the additional processing required, the tags have a very much higher cost, and they are also far more power hungry. As a result deployment of these RFID secure tags is limited to areas where the cost can be justified.

RFID security and RFID privacy both remain as issues. In many cases the limited range provides the level of security required by many. Also there is often not a direct gain that can be made by criminals, so RFID security is not an issue in the same way as that for credit cards.

RFID, has raised many fears. One major fear is about Human chipping. RFID critics are concerned that human chipping may one day become mandatory. These fears spun out of control when a company chipped two of its employees in 2006, The Company argued that the employees were not forced to be chipped but they volunteered for the microchip implants for easier access to secured vaults where confidential documents are stored. This argument did not hold wetter among critics and common men. They found human chipping has profound religious and civil liberty implications - religiously interpreting the chip as the "Mark of the Beast." and others apprehending control of a Big Brother.

Some novelists and movies have stated visualizing how Major Corporations and Government Plan to Track every move with RFID," They describe how RFID tags could be used to gauge your spending habits and bank account to determine how much you should be charged for the products you buy. This may sound paranoid, but hackers have proven that some RFID tags can be tampered with, including disabling their anti-theft features and changing the price that corresponds to their product. Better encryption is needed to ensure that hackers can't pick up RFID frequencies with super-sensitive antennae.

What's more, some critics say that relying on RFID as the primary means of security could make human security checkpoints lazy and ineffective. If security guards rely solely on the RFID anti-theft devices in merchandise and RFID technology of government-issued identification to screen for criminals or terrorists, they might miss the criminal activity happening right in front of their eyes.

Apprehensions are apprehensions. But nothing can prevent implementation of RFID and the changes it is going to bring in supply chain and retail sales.

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