An Instauration to Radio Frequency Identification

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ABSTRACT
The cognitive content of the paper discuss about the Radio frequency identification (RFID) which is a generic term that is used to delineate a system that transmits the identity (in the form of a unique serial number) of an object or person wirelessly, using radio waves. Lineaments of RFID Tags are hashed out and various vantages are discussed. RFID is an extremely efficient method of identification and finds applications in a wide range of bailiwicks, from chip tracking in casinos to animal identification in ranches and farms. However with this diverse set of uses, there are also several disadvantages and disceptations related to it. The sizes of RFID Tags and the frequency allocations of different type of RFID Tags are discussed concisely. The staple difference between RFID Tags and Bar Code deficiency are hashed out. This paper gives the types of tags, applications, history, potential exercises and demerits of the RFID technology. The paper is diplomatically reasoned out considering vantages and limitations of its applications.

Keywords–EPC, Reader, RFID, Smart Label, Tags.

1. INTRODUCTION
With the growing need of automatic identification procedures, there has been a tremendous revolution in the applications of RFID technology with RFID tags replacing the Bar-code tags in the fastest growing retail industry [1]. The technology really helped in total management of the supply chain as well as the product outlets with least human support and an unbelievable speed. With a predicted $10-billion market over the next decade, RFID (Radio Frequency Identification) is a booming new wireless technology with an eager new audience – retailers. The technology is transforming the way retailers receive, distribute, execute and merchandise good to customers. Retailers today are embracing RFID as an enabling technology that will provide them value beyond the supply chain. The focus has become transportation and logistics, healthcare and medical devices, pharmaceuticals, manufacturing, aviation & automotive sectors and food supply chain. Radio-frequency identification (RFID) is a technology that uses radio waves to transfer data from an electronic tag. This tag is called RFID tag or label which is attached to an object through a reader for the purpose of identifying and tracking the object. Some RFID tags can be read from several meters away, even beyond the line of sight of the reader. There are several applications of RFID, as the RFID tag can be affixed to any object. E.g. Several financial institutions use RFID to track key assets and automate compliance. RFID is more superior and efficient than the traditional manual system or the use of bar code systems. While barcodes can only be read one at a time, parallel reading of RFID tags is possible. A RFID system consists of a hardware system also called as "interrogators" or "readers" and "tags", along with RFID software.

RFID tags can be active or passive or battery- assisted passive, depending on whether a battery is used on board. A basic RFID tag consists of at least two parts- an integrated circuit for storing and processing information, modulating and demodulating radio frequency signals; an antenna for receiving and transmitting the signal.

There are two types of RFID tags based on the mobility of the readers- fixed and mobile. If a tag is read by the readers in a stationary or fixed position, it is called a fixed tag, while if the tag is read by mobile readers it is called a mobile tag.

2. HISTORY
A predecessor to the present RFID technology was invented in 1945, by Léon Theremin. It was an espionage tool for the Soviet Union which re- transmitted incident radio waves with audio information. Even though this device was not an identification tag, instead a listening device, it was passive and was energized and activated by waves from an outside source, similar to RFID tags [2].

Similar technology was used in IFF transponder in World War II, developed in UK to identify if an aircraft was an ally or foe.

In 1973, Mario Cardullo invented a passive radio transponder with memory [2]. This is considered to be the first true ancestor of the present RFID technology. The initial device was passive, and made use of radio frequency light and sound as transmission media.

3. KEY ATTRIBUTES
Passive smart label RFID systems offer unique capabilities as an automatic data capture system in that they:

3.1 Provide real-time, wireless transmission of data without human intervention;

3.2 Do not require line-of-site scanners for operation;

3.3 Allow stored data to be altered during sorting or allow workflow process information to be captured with the data; and

3.4 Work effectively even in harsh environments with excessive dirt, dust, moisture, and extreme temperatures.

4. APPLICATIONS
Use of RFID significantly increased in 2010 due to the following factors- 1) decrease in the cost of the equipment and tags. 2) Increase in reliability of the RFID system to 99.9% 3) the development of a standard around UHF, used in passive RFID.

The applications of RFID in various fields and sectors are listed below:

4.1Electronic Vehicle Registration
RFID technology is being used in Vehicle Registration, for detecting stolen cars and retrieving them [3] [4]. This technology may find its use in India as well, in the future.

4.2Transportation payments
Governments use RFID applications for traffic management, while automotive companies use various RFID tracking solutions for product management. However, the extensive use of this technology is limited due to privacy regulations, even if technological advance is maintained.

4.2.1 Car-sharing

RFID cards can be used for locking and unlocking cars. It can also be used for the identification of a person [5].

4.2.2 Toll roads

In Mexico, RFID technology is being used extensively and is implemented by Neology

In Pakistan, RFID is being used for e–tolling in Motorways, implemented by NADRA.

In India, various toll booths are now in the process of implementing RFID.

1.3 Product tracking

RFID is used by companies and large buyers to track their products.

Casino chip tracking- RFID tags can be placed on high value chips that allow casinos to keep track of counterfeit chips, track the betting habits of the gamblers, and count the chips effectively, eliminating the problem of counting mistakes by dealers [6]. This idea was used in 2005 by the Wynn Casino in Las Vegas, USA.

4.4 Hospital operating rooms

In hospitals the patient safety and O.R efficiency is improved by the use of an RFID based system for use in operating rooms. This system consists of an electronic reader and high frequency RFID tagged disposable gauze, sponges, and towels [7]. The system also provides a reusable wand which may be used to scan the patient, and check for any foreign object that may have been unintentionally retained during the surgery.

4.5 Libraries

Fig1. RFID tags used in libraries

RFIDs can be used in libraries in place of or in addition to the bar codes. The RFID tag is attached to the book or CDs, and a RFID reader is used, which does not require a separate database for identification. This system can also be used as a security measure [8].

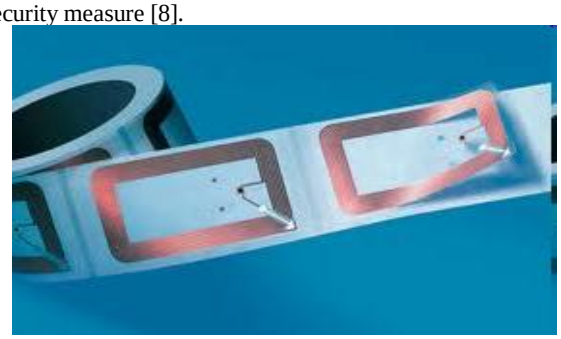

Fig2. RFIDs used in libraries

Schools and universities

Some schools utilize the RFID technology in the student or teacher ID, to prevent any unauthorized entry through the gates [9]. RFID is also used for borrowing books from the school library, for buying items from the school canteen or shops. It is also used for marking the student or teacher's attendance.

5. POTENTIAL USES

RFID can be used in a variety of applications, such as [10] [11]:

Access management

Tracking of goods and RFID in retail

Tracking of persons and animals

Toll collection and contactless payment

Machine readable travel documents

Smart dust (for massively distributed sensor networks)

Tracking sports memorabilia to verify authenticity

Airport baggage tracking logistics [12].

6. DISADVANTAGES

There are several disadvantages and security concerns related to RFID. Some of them are listed below.

6.1 Data flooding

Each tag needs to generate a signal while passing a reader. However, if a lot of tags are passed by a reader at an instant, it may result in data flooding, which does not give a meaningful picture of the moving goods passing a given threshold. For this we need event filtering.

6.2 Global standardization

The frequencies used for RFID in the USA are currently incompatible with those of Europe or Japan. Furthermore, no emerging standard has yet become as universal as the barcode [13]. To address international trade concerns, it is necessary to utilize a tag that is operational within all of the international frequency domains.

6.3Privacy

Most of the privacy issues are due to the fact that, the RFID tags on any item are functional even after the goods have been purchased [14]. This issue is solved by use of Clipped Tags that allow the consumer to tear off a portion of the tag. Now, the tag will work only on a short range of a few centimetres or inches.

6.4 Human implantation

The Food and Drug Administration in the US has approved the use of RFID chips in humans [10]. This system utilizes an identifier that is unique for each individual. This has provoked concerns in to privacy and the security of individuals as they can be tracked wherever they go. This might lead to abuse by the government and restrict the freedom of an individual [11].

Fig3. RFIDs used in animal tagging

7. ANTI-COLLISION ALGORITHM

One of the advantages of RFID tags vis-à-vis bar codes is the ease with which a batch of RFID tagged objects can be simultaneously read. Although this leads to faster read rates, the accuracy of these reads may suffer due to collisions, false reads, among others.

There are two main categories of anti-collision algorithms in RFID systems: tree-based and ALOHA-based protocols. A tree-based algorithm includes a binary search tree and a query tree. For tree-based protocols, the binary search procedure is commonly adopted in several standards, such as ISO/IEC 18000-6 Type B. The tree-based algorithms have been studied extensively to improve the performance of RFID anti-collision in the literature .An ALOHA based algorithm includes pure ALOHA, slotted ALOHA, and framed ALOHA. Of the ALOHA-based protocols, the framed ALOHA is commonly adopted in some standards, such as ISO 14443-3, ISO 18000-6 Type A, and EPCglobal UHF Class 1 Generation 2. There are several techniques for improving the performance of framed

ALOHA anti-collision algorithms. Although the binary search tree and framed ALOHA protocols are commonly adopted for anti-collision in RFID systems, the differences in performance of the two protocols have not been reported in detail according to our knowledge. A majority of tree-based algorithms are based on assigning an n-bit identifier to each tag, and exhaustively considering every bit to distinguish and identify any given tag. However, this can soon become combinatorially explosive depending on the depth of the binary tree[11]as shown in Fig 4.

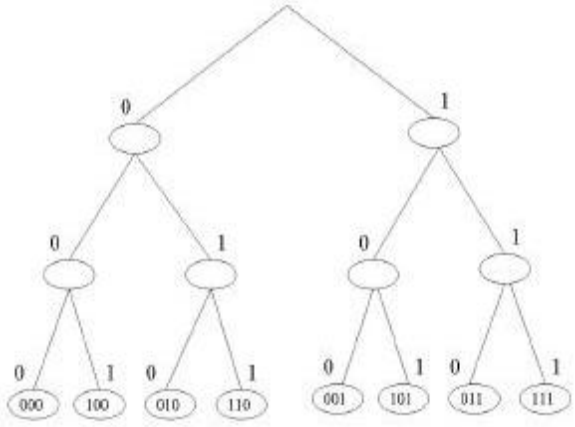

Fig 4: Binary Tree

We start considering from the root of the tree, the earlier attempts are invariably going to be replete with collisions since about half the tags (assuming that the tree is complete and that there is a tag identifier at every leaf node) would respond for the first bit from the top (of either 0 or 1). Similarly, given the symmetry of this representation, the bottom-most level of the tree would have the same consequence since the number of 0s as 1s is the same. This situation clearly necessitates an "intelligent" means to address the issue. The proposed method utilizes the density of entries at any given level, and utilizes this information to reduce the number of iterations that are required to completely determine the identity of every tag in the field of the reader[15].

8. CONCLUSION

RFID is a rapidly developing technology that is already being used in USA, Europe and Japan. However, its use is limited due to several moral, ethical and security issues related to human implanting. Nevertheless, it has applications in a wide range of fields.

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[16]FIG 1,2. RFID tags used in libraries.Developed by 3M specifically for libraries.

[17]http://solutions.3m.com/wps/portal/3M/en_US/3MLibrarySystems/Home/Products/RFIDTags

[18] FIG 3.RFIDs used in animal tagging.Cropped close-up of a Maltese sheep's face (with ear tag).

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