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REVIEW ARTICLE

RFID TECHNOLOGY WORKING IT'S APPLICATIONS AND RESEARCH CHALLENGES

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ARTICLE DETAILS

ABSTRACT

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Radio Frequency Identification is a technology which falls in the category of automatic identification technologies. RFID is used to identify objects using radio waves. This technology is one of the widest used technologies in the world; almost every organization on some stage uses RFID based identification, tracking, etc. RFID basically needs two major devices to work, the reader and the tag. In this paper further detail working of RFID technology its components with real-life application belonging from the field of environment, water, etc. has been discussed. Research issues belonging from technological problems existing in RFID technology also highlighted in this research paper on the basis of which research can be conducted to overcome those key challenges.

KEYWORDS

Radio Frequency Identification, tracking, key challenges, real-life application.

1. INTRODUCTION

Concept of RFID was introduced in 1945 and was invented by Leon Theremin for USSR. Its basic function at that time was to read the incident radio waves with added audio information. Although this was when the RFID was born at that time the components were powered with wired connections or we can say it was a passive communication. In January 1973 Mario Cardullo introduced the modern RFID, although again the tag was passive, it was powered from radio waves instead of a wired connection. The tag is attached to any device or anything that needs to be identified or tracked at some point, the tag is encoded with messages which could include different information related to the product on which it is attached. The reader is a device scaling from hand held to massive size, this device captures the data which is encoded in the RFID tag and sends it to the computer linked with it where the data can be stored for further processing, and RFID readers also come with built-in storage for storing the decoded information from the tag [1]. This whole technology can be summarized by saying that it is a concept where a query is sent using radio waves (What or who are you?) and in response a reply is given like (This is what or who I am). One of the first uses of RFID was to differentiate between British and German aircraft and was integrated into the British radar system. RFID (Radio Frequency Identification) is an automatic data capture technology that uses radiofrequency waves for transfer of data between an RFID reader and an item which contains an RFID tag. This technology is used to identify, categorize and track different items and is vastly used in our daily lives. RFID is fast reliable and does not need to be in direct contact with an item to get its information stored in the tag. RFID was first used in World War II where it was used as a type of radar that was used to capture the info about friendly planes [2].

2. BASIC RFID COMPONENTS

2.1 Tag

These are electronic identification tags integrated with a microchip and a coupling element i.e an antenna. Mostly the tags are on sleep mode which means they are activated when they come in the interrogation range of the reader. There are multiple types of tags such as read-only chips which are programmed once during manufacture, as well there are tags with a read-write option which can be programmed multiple times. These tags are attached to the items which need to be tracked, identified etc. [3].

2.2 Interrogator

Interrogators can also be called as readers, as the name suggests they are the devices of different types which read the tags and show the information of it on some medium. There are different types of RFID readers which include Hand-Held, Fixed and Mobile Interrogators. They also come in different range starting from 3 feet up to 300 feet [3].

2.3 Middleware

It's an interface required between the reader and the company databases and IMS, which after reading information from the tag sends it to the system for further processing [3].

3. WORKING OF RFID SYSTEM

Three parts of RFID are involved for the system to work which includes a Scanning antenna, a Transceiver and a Transponder. The scanning antenna emits radio frequency signals in a specific range. When an RFID tag passes through the field of scanning antenna it detects the activation signal from antenna which activates the RFID chip and transmits information on its microchip to be picked up by the scanning antenna. Later on, the transceiver decodes the data and sends it to the database or computer system or whatever medium it is connected to [4].

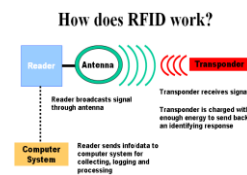


Figure 1: Working of RFID Technology [4]

3.1 Automatic Identification

Automatic identification is a term which is given to a vast number of technologies which are used by machines to identify objects. The combination of Auto ID and Auto Data Capture is used by organizations to identify the item, capture info about them and somehow save that data in a computer system without manually typing it in. Its main aim is to increase the efficiency and reduce errors caused during manual data entry.

Auto ID consists of number of technologies which include Bar Codes, Voice recognition, Smart Cards, OCR and RFID [5].

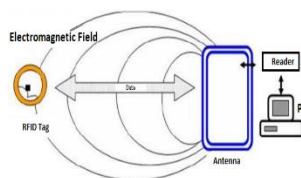


Figure 2: RFID Deployed System Overview [5]

3.2 RFID Tags

An RFID tag is an electronic tag that exchanges data with RFID reader using radio waves. RFID tags are made up of two parts, an antenna and an integrated circuit. The antenna receives and sends radio waves whereas the IC performs different functions such as storing and processing of data, as well as modulation and demodulating the radio waves sent/received from the antenna. There are 3 types of RFID tags [6].

3.2.1 Active Tags

Active tags is equipped with its own battery and its signal availability is up to 100ft, so we can also say that it requires low signal strength from the reader.

3.2.2 Semi-Passive Tags

Semi-passive tags also contains a battery but for communication with a reader it uses a technique called back scatter which is also used by Passive tags, its battery is used to run the circuit on tag hence requiring less energy from the reader and longer range than ordinary passive tags [6].

3.2.3 Passive Tags

Passive tags does not contain a battery instead its power is supplied from the reader through radio wave. Passive tags have low range and require lots of energy from the reader [6].

4. APPLICATIONS OF RFID

RFID is a mainstream technology which is used in most of the organizations. There are a lot of uses of RFID out of which some are as following; In public transport the passengers are provided with the cards which contain an RFID chip, this card is then used to identify the passenger and is also used to charge the ticket from him/her, resulting in less time being consumed at entrance points. Large organizations use RFID tags on their devices or asset to identify them. In developed countries the patients admitted in a hospital are given an RFID wrist band which contains all the information and history of the patient hence the doctors and staff can easily identify the patient or take the required information by just reading the tag. In most offices the employee cards are equipped with RFID chips which are used for access control and identification. Its other uses include Passports, Super-markets etc. [7].

5. RFID VS BARCODES

Barcode technology and RFID were introduced for tracking objects easily although but there exists some key advantages of using RFID over barcode reader technology that are [8].

- Line of Sight communication is not required in RFID technology that was a key limitation of using Barcode Technology [8].
- Barcode can't detect objects from distance whereas RFID technology does this easily [8].
- Fast and Accurate information could be accessed easily using RFID tags rather than barcode readers [8].

6. RFID PROBLEMS

RFID is a cheap technology hence the producers don't pay much attention towards its security just to keep it cheaper and easily available, which indeed causes several security and privacy issues [9].

RFID problems can be divided into two main categories:

- Technical Problems with RFID
- Privacy and Ethics Problems.

6.1 Technical problems with RFID

First technical issue is RFID technology uses electromagnetic waves from the electromagnetic spectrum therefore other similar technologies like (Wi-Fi, GSM etc.) could interfere with this solution or can be jam if the communication occurs between two technologies using same frequency band [10]. Second technical issue in RFID technology is related to reader collision between tags if tags received signals from two different reader or scanner so they would overlap and collision occurs; which leads towards delay or even tags can stop responding [10]. Third technical issue is related to Security, Privacy and Ethics problems associated with RFID: RFID tags are too tinny and hidden inside the objects which are used to be detected by the scanner so any malicious user who could have a tag reader can tune into the frequency and read information related to that object without even knowing; because it does not need to be swapped physically for getting access to that object [10].

Most common attacks over RFID Technology are as follows:

- Reverse Engineering
- Power Analysis
- Eavesdropping
- MITM
- DOS
- Cloning/Spoofing

7. CONCLUSION

RFID technology has a big potential to become universal in the near future. Today it is already successfully used in supply chain management to track pallets of items. Tracking allows better coordination and control in the production cycle. Now the industry is pushing towards item-level tagging to increase the control even further. However, that also creates concerns, most common privacy concern, but also other security related issues.

FUTURE WORK

There is still research direction as highlighted under section 6.1 which are related to security and privacy concern using RFID technology; so a better protocol, mechanism could be introduced to resolve or overcome those technical issues.

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