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Various Network Used Radio Frequency Identification Techniques And Its Frequency Ranges

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Abstract **-** Nowadays, There are various technology used in day-to-day life; such as *Human Computer Interaction*, *Communication Engineering*, various types of architectures of computer system for easy convenience of living life style of human being .However, there are various network utilized for the transmission of signal containing various data like audio, video, data in text format etc.Network utilized for different Purposed based on its application. There are various Network are being utilized such as LAN(local area network),MAN(metro area network),WAN(wide area network),Backbone Network, Public Switch Telephone Network(PSTN), Integrated service Digital Network (ISDN),Broadband Integrated Service Digital Network(BISDN).Depending upon the bandwidth and usage of application by human being ,we are going to utilized this network technologies for transmission of signal to send message in various format. The Purpose of this various network is to use for transmission and receiving message. With the help of this network technology we are going to discuss technology like "Radio Frequency Identification" for tracking, detecting the objects and its working and application..

Keywords **-** *Network, Types of Network, RFID Technique, Working of RFID, Application.*

I. INTRODUCTION

A various organization are using variety of techniques for transmitting digital data and receiving it in various format such as audio, video & data in text format etc. RFID is nothing but radio frequency identification (RFID) which is based on the radio waves to transmit data through electronic tag or barcodes. It is also called as RFID Tag. It is generally used to attach to any object so that it can be able to read and identify the objects at any location. It is generally used for tracking the object. Nowadays (ISO) International Organization For Standardization, (IEC) International Electro technical Commission, etc are utilizing this Radio Frequency Identification Technique. Radio Frequency Identification Technique has information about any object which we want to be observed continuously i.e. for identifying or tracking the object which is present in tag and always being stored in code in electronically format. There are various Application are in Used of this technique; such as tags can be attached to car, computer equipment and its peripheral, smart phones, mobile, books etc.However Radio Frequency Identification can be easily detect or read the tag hundred at a times where barcode is utilized to read the tags only at once .In this paper we are going to discuss the Radio Frequency Identification Techniques, Network required for it and its various types of application we are going to dealt with it.

II.RFID (RADIO FREQUENCY IDENTIFICATION) TECHNIQUE

RFID technology is based on bidirectional radio frequency communication between a base station and an ID tag or badge attached to the person or object to be tracked. The base station consists of a PC or some other microprocessor systems equipped with read/write unit. The tag consists of an antenna, some control circuitry and memory in which ID information is stored. The memory may be read only, i.e. the information stored in that is unalterable, or read/write, i.e. the information can be overwritten or added to the memory by the user [1, 2, and 3].

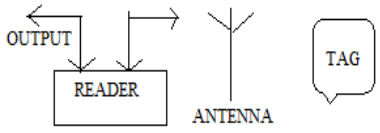

Figure 1.RFID System With Read Tag Only

Radio frequency identification (RFID) is an advanced automatic identification technology used to

identify, track, sort and detect an infinite variety of objects including people, vehicle, garments, containers, totes and pallets. It is widely used in applications such as proximity access control, time and attendance management, supply chain management, vehicle identification, laundry/textile identification, asset tracking, inventory control and factory authentication[5,7,9].

It uses radio frequency waves between a card or tag and a reader in order to make identification. Radio frequency employs non line of sight and, because of the way the transponders or tags are constructed reading can occur despite harsh and dirty environment.

It is particularly applicable where conditions are unsuitable for bar or matrix based coding. It is a "contact less" technology. Hence it neither requires contact with the reader (as in magnetic stripe technology) nor a direct line of sight to a reader (as in barcode technology).RFID is a means of storing and retrieving data through electromagnetic transmission to an RF compatible IC and is now becoming a radical means of enhancing data handling processes.

II. COMPONENTS OF RADIO FREQUENCY IDENTIFICATION TECHNIQUES.

There are main three components used in this RFID technique:

A. An antenna or coil.

B. A transceiver (with decoder).

C. A transponder (commonly called a RF tag) that is electronically programmed with unique information. Often the antenna is packaged with the transceiver and decoder to become a reader.

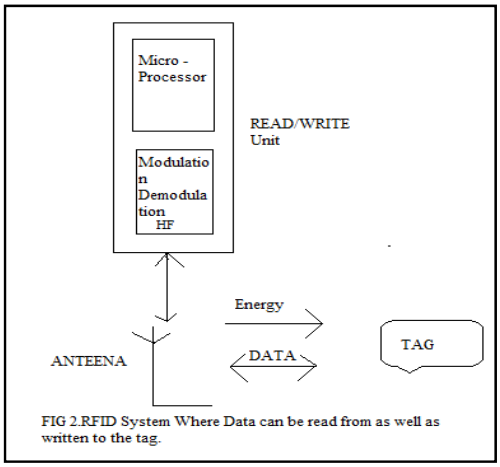

FIG 2.RFID System Where Data can be read from as well as written to the tag.

The Fig.2 shows a RFID system where the data can be read from as well as written to the tag. It consists of a reader which is used to read/write data to RFID tags and a tag is used to transmit data to the reader. The communication between them is made possible by the use of defined radio frequency and protocol to transmit and receive data from tags. The controller is the interface between one or more antenna and the device requesting information from or writing information to the RF tags [1, 3, and 5].

III. TYPES OF RFIDS TAGS

A. Active and passive RFIDS tags

Active RFID and Passive RFID technologies, while often considered and evaluated together, are fundamentally distinct technologies with substantially different capabilities. In most cases, neither technology provides a complete solution for supply chain asset management applications. Rather, the most effective and complete supply chain solutions leverage the advantages of each technology and combine their use in complementary ways. This need for both technologies must be considered by RFID standards initiatives to effectively meet the requirements of the user community [1, 2, 3, and 4].

B. Technical characteristic of active and passive RFIDS tags

- *Tag Power Source:* In Active RFID tags, tag power source is provided internally to the tag where in Passive RFID tags, energy is transferred from the reader via RF.
- *Tag Battery:* In Active RFID there is tag battery present where in Passive RFID there is no tag battery.
- *Availability of Tag Power:* Availability of tag power is continuous where in Passive RFID tag power is available only within the field of reader.
- *Required Signal Strength from Reader to Tag:* Required signal strength from reader to tag is low for Active RFID.In case of Passive RFID required signal strength from reader to tag is very high as compare to Active RFID.
- *Required Signal Strength from Tag to Reader:* Required signal strength from tag to reader is high in active RFID and low in Passive RFID.

C. Functional capabilities of active & passive RFIDS tags

The functional capabilities of Active and Passive RFID are very different and must be considered when selecting a technology for a specific application [1, 2, 3, and 4].

- *Communication Range*:InActive RFID Communicatin range is long 100m or more than that where in Passive RFID Communication range is very small that is 3m or less than that.
- *Data Storage*: In Active RFID Tags, there is large read/write data storage (128kb) with sophisticated data search and access capabilities where in Passive RFID Tags, there is small read/write data Storage (128bytes).
- *Sensor Capabilities*: In Active RFID,ability to continuously monitor and record sensor input; data/time stamp for sensor events; where in Passive RFID, it is available to read and transfer sensor values only when tags is powered by reader; no data/ time stamp.
- *Multi-Tag Collection:* Active RFID collects 1000's of tag over a7 acre region from a single reader. Active RFID collects 20 tags moving at more than 100mph speed. Passive RFID collects hundred of tags within 3metre from single reader. Passive RFID collects 20 tags moving at 3mph or slower speed.

IV.GENERIC TAG ARCHITECHTURE

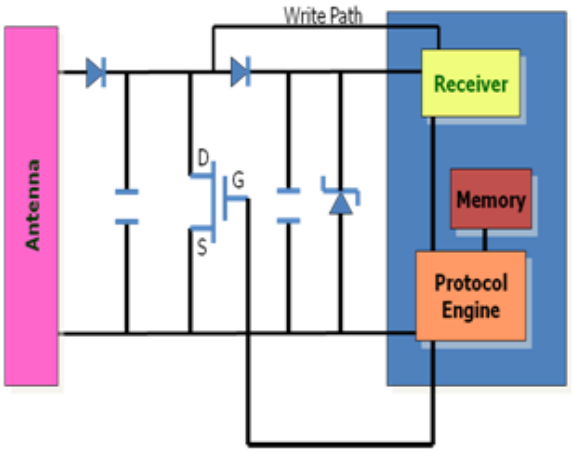

FIG.3: Generic Tag Architecture

Generic Tag Architecture is consist of antenna, receiver, memory are the basic component of generic tag. However antenna is connected to receiver and protocol engine with the help of capacitor, gates, and various types' diodes like zener diodes and simple diodes [6, 7, 9, and 10]. These Electronic device and circuits are used by generic tag as shown in fig.3.Detail of generic tag is as follows:

- *Frequency Range*: Lower Frequency ranges from 125 kHz to 134 kHz.Higher frequencies are 13.56 MHz where ultraviolet high frequency is ranging from 866 MHz to 915 MHz and Microwave Frequency is ranging 2.45 GHz to 5.8GHz.
- *Read Range*: For lower frequencies read range is up to 10cm.Read range for higher frequencies is up to 1m.For ultra high frequencies read range is ranging from 2m to 7m and microwave frequencies read range ranging up to 1m.
- *Coupling:* Magnetic coupling are required for low frequency and high frequencies where electromagnetic coupling are required for ultra high frequencies and microwave frequencies.
- *Market Shares* : There are different tags utilized in day to day life according to application .Percentage of RFID tag used for low frequencies is up to 74%,17% for higher frequencies and 6% for ultra high frequencies and for microwave frequencies is very low only up to 3%.
- *Application*: Smart cards, ticketing, animal tagging, access, laundry are the application of tag having low frequencies. Small item, management, supply chain, Anti-theft, library, transportation, etc .are the application of high frequency tag. Transportation vehicle-Id, access/security, large item management, supply chain are the application of ultra high frequencies and transportation vehicle-id(road toll),access/security, large item management, and supply chain are application of microwave frequencies tags.

IV. VARIOUS NETWORK USED RADIO FREQUENCY IDENTIFICATION TECHNIQUES AND ITS FREQUENCY RANGES

There are various network are in used day-to-day life on the basis of application functionalities. However, RFID (Radio Frequency Identification) Techniques is used for tracing the object on basis of Active and Passive RFID Tags.

These application required network such as LAN (Local Area Network) which help to track the object present in local area, MAN (Metro Area Network) for RFID application is used to trace or track the any object present in metro area, PAN (Personal Area Network) used by RFID application to trace or track object in

personal area such as in shops, hospitals, schools, colleges, etc. Network used by RFID on the basis of area are:

- Local Area Network (LAN)
- Metro Area Network (MAN)
- Personal Area Network(PAN)

These networks are connected to backbone network such as:

- Public Switch Telephone Network (PSTN)
- Broadband Integrated Service Digital Network(BISDN)
- Integrated Service Digital Network(ISDN)

These Networks are used for supporting various network such as LAN, MAN, PAN, etc [11, 12].to provide strong network coverage area. RFID offers a range of data carrying technologies to transfer data carrier to the host via radio frequency link. Systems range from a low frequency of KHz to high frequencies of the order of GHz.

RFID carriers can be either read-only or read/write with data carrying capability determined by the device design and operating characteristics. The most commonly used bandwidths for RFID devices are 125 KHz, 13.56 MHz, 400-900 MHz, 2.45 GHz, and 5.8 GHz. Because RFID uses electromagnetic radio signals to operate, its effective operation is subject to the same physical laws as of any RF operating device. The RF field distance or space between an RFID interrogator antenna and the corresponding RFID tag and the frequency of operation are directly interrelated. Thus different RFID frequencies have different RF effective ranger [11, 12, and 13].

V. WORKING OF RFID TECHNIQUE

A passive (no battery) low-frequency (125 kHz) 'magnetically coupled' RFID system is made up of two parts - a reader and tag. The tags are attached to objects or animals that require a unique identification number. The tags include an electronic circuit (transponder) and tuned antenna-capacitor circuit. The tags are small sophisticated radio transmitters and receivers. The RF field generated by the reader powers them. Upon being 'powered-up' the tag will continuously transmit, by damping the incoming RF power field, its data [2, 5].

By 'pulsing' the incoming RF power field some tags can be written to in the field. The RFID reader has three main functions: energizing, demodulating and decoding. The reader, using a tuned antenna-capacitor circuit, emits a low-frequency radio wave field. This is used to power up the tag. The information sent by the tag must be demodulated (like an AM radio). The encoded information is decoded by the reader's on-board microcontroller. A controlling computer can then use this information.

In both the reader and tag, the antenna can be sized and shaped in different ways. Because of the small size of the tag, it can be formed to fit almost any situation. Since there is no contact or 'viewing' required, the RFID system allows great freedom of movement. Placement of the tag and reader are no longer critical[5,7].

Two methods distinguish and categorize RFID systems, one based upon propagating electromagnetic waves and the other based upon close proximity electromagnetic or inductive coupling. Coupling is via 'antenna' structures forming an integral feature in both tags and readers. While the term 'antenna' is generally considered more appropriate for propagating systems it is also loosely applied to inductive systems.

Fig.4 Shows Working of RFID and its components such as Computer, Tags, and Interrogator.

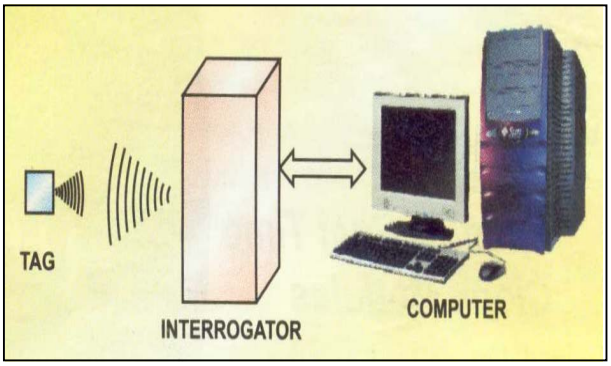

FIG.4: Working of RFID

Transmitting data is subject to the vagaries and influences of the media or channels through which the data has to pass, including the air interface. Noise, interference and distortion are the source of data corruption that arises in practical communication channels that must be guarded against in seeking to achieve error free data recovery. Moreover, the nature of the data communication process, being asynchronous or unsynchronized in nature, requires attention to the form in which the data is communicated. Structuring the bit stream to accommodate these needs is often referred to as channel encoding and although transparent to the user of an RFID system the coding scheme applied appears in system specifications [9, 10].

To transfer data efficiently via the air interface or space that separates the two communicating components requires the data to be superimposed upon a rhythmically varying (sinusoidal) field or carrier wave.

This process of superimposition is referred to as modulation, and various schemes are available for these purposes, each having particular attributes that favor their use.

They are essentially based upon changing the value of one the primary features of an alternating sinusoidal source, its amplitude, frequency or phase in accordance with the data carrying bit stream. On this basis one can distinguish amplitude shift key (ASK), frequency shift key (FSK) and phase shift key (PSK) [4, 6, 12, and 13].

In addition to non-contact data transfer, wireless communication can also allow non-line-of-sight communication. However, with very high frequency systems more directionality is evident and can be tailored to various needs through appropriate antenna design.

VI. RADIO FREQUENCY IDENTIFICATION ADVANTAGES AND DISADVANTAGE AND TECHNICAL ISSUES.

- *Advantages*: Radio frequency identification is an extremely powerful and versatile automatic identification technology that allows a diverse range of objects to be identified, tracked and managed. It does not require contact or line of sight for operation and is based on use of small tags which contain a unique ID no that may be read at a distance up to 6 meters. Tags may also store information relating to the specific item to which that are attached. Reliability of RFID is high and it has the lowest error rate of all technologies including barcodes, magnetic stripe etc [1, 2, 4].

- Inexpensive tags, especially for merchandise.
- RFID as a supplement to GPS tracking.
- RFID for indoor tracking.
- RFID as a trigger in video surveillance.
- RFID to increase the panoptic potential of traffic- count and signal-control systems.
- RFID used as real-time web monitoring.
- Improved efficiency and productivity data collection and identification
- Hands free operation, fully automated identification, counting, tracking, sorting and routing.
- Assists in eliminating errors and consequent waste.
- Improved quality control, profitability, customer's service and responsiveness.
- Reduced operating and production costs, labour costs and inventory.
- Increased information to management and customers.
- RFID speeds up the collection of data and eliminates the need of human operation in the process.
- RFID is ideal for dirty, oily, wet or harsh, commercial as well as industrial environments.
- RFID tags and readers have no moving parts. Hence the systems rarely needs maintenance and can operate flawlessly for extended periods of time.
- RFID tags are virtually impossible to copy. The technology is ideal for confidential identification of people or assets.
- RFID is fast. The tag and reader communicates in milliseconds.
- The tags are resistant to rough temperature. They can work in an interval from –40° C to +200° C.

- *Disadvantages:*

- RFID has Limited range and Position tied to location of the antenna/reader.

- *Technical issues*:

1) It is difficult to increase the range and movement can't be channeled through a minimal number of gates.
2) Reader must deliver enough power from RF field to power the tag.
3) Reader must discriminate backscatter modulation in presence of carrier at same frequency.
4) There is 70db of magnitude difference between transmitted and received signals.
5) Interference between readers may create problem to detect the tag.
6) Hugh volume of tag data so that readers need to filter data before releasing to enterprise network[6].

VII. APPLICATION OF RFID

1. Consumer availability

- It helps to monitors self level usage.
- It calculates replacement to avoid self level out of stock condition.
- It helps in extension of retail solution store business functionality.

2. *Automatic inventory control*
   - Self and rack level scanning for store distribution center and warehouse can be done by using RFID.
   - Real-time accurate inventory of all handling unit quantities can be done by using RFID.
   - Replaces cycle counting can be done by using RFID.
3. *Automatic check out*
   - It helps to detects unit level items gathered for purchase at point of purchase.
   - It helps to the processes payment generates billing documents and clears theft protection.
   - It helps in store functionality.
4. *Asset management*
   - Updates asset records to reflect physical movements can be done by using RFID.
   - Example application: gas cylinders, cargo containers and linens.
5. *Lot trace ability*
   - Locate and quarantine production lots in case of suspect's quality can be done by using RFID.
6. *Security /Access contro*l
   - It helps to validate personal for security clearance, building and system access.
   - It helps to utilize for movement tracking.
   - It helps to notify secure personnel through SCEM of unauthorized activity.
7. Theft protection can be done by using RFID.

VIII.CONCLUSION

The use of this contact less technology reduces the communication channel coast as well enhances the data handling process. It is used as the advanced identification technology in communication field. This identification technology benefits are overcoming limitations and wide application over several fields makes that RFID as an efficient way of identification. However certain factors must be considered to properly implement an RFID system, including the applications, physical environment, and item substrate material and technology cost justification. RFID technology has some unique features, and attributes when compared to conventional ADC technologies.

Development in RFID technology continues to yield larger memory capacities, wider reading ranges and faster processing. It is very likely that the technology will replace bar code provided the integrated circuit in an RF tag becomes comparatively as cost effective as a bar code label.

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