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An Analysis Of The Rfid Technique And Also Its Uses

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ABSTRACT

One of the most interesting technologies is radio frequency identification (RFID). This paper's objective is to review RFID technology and its uses. The concepts of RFID, types of RFID tags and readers, frequencies used, current applications, as well as benefits and drawbacks, are briefly introduced in this paper. This Paper attempts to examine the present state and potential applications of this technology.

KEYWORDS: Radio Frequency Identification , RFID technique, RFID Components, RFID uses

INTRODUCTION

A technology that uses radio waves to automatically identify persons or items from a distance of a few inches to hundreds of feet is known as radio frequency identification, or RFID. This is an automatic identification (Auto-ID) technology [1] that enables the automatic identification of any object. Identification technologies include barcodes, magnetic stripes, IC cards, optical character recognition (OCR), voice recognition, fingerprints, and optical strips, among others. The usage of automatic data collection systems via RFID technology aids in boosting system efficiency. For identifying purposes, a tag and reader combination is utilised. An RFID tag that is affixed to a physical object has a code. The thing is now distinctive and recognisable. Then the object transmits the tag's code. Readers are given information about the thing in this way. Although RFID is not a particularly novel technology, it is used in novel ways [2]. RFID technology is expanding quickly. Compared to traditional identification methods like barcodes, RFID has many advantages. The barcode scanner must be pointed directly at the label in order to read the barcode. It implies that the scanner or items must be manually moved [3]. In contrast, RFID can read data from tags even when there is no direct line of sight. RFID technology also does not require alignment. Singh[4] gives a succinct summary of RFID technology.

RFID can operate in the presence of barriers because of its fast reading speed. When a greater read range, quick scanning, and adaptable data carrying capabilities are needed, this technology performs better. RFID technology is becoming more and more popular in a variety of sectors, including manufacturing firms, agriculture, transportation, and industries [5]. RFID applications employ a number of frequencies, including 125 KHz, 13.56 MHz, and 860-930 MHz for passive RFID and 433 MHz and 2.45 GHz for active RFID. A significant difficulty is the global standardisation of the RFID system. Various manufacturers have used RFID in a variety of ways. There isn't a universal norm that is applicable everywhere. Distinct RFID applications call for different standards or protocols. These specifications cover reader-host command specification, tag-reader air interface specification, and hardware physics specification. The International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), and many global organisations have all established standards for RFID. The following is a list of a few RFID standards [2]: IS0 18000, ISO 10374, ISO 10536, ISO 11784, ISO 14443, ISO 15693, and EPC worldwide. These specifications control the flow of information between RFID tags and readers. These standards operate on certain frequency bands, such as 13.56 MHz for HF and 860-915 MHz for UHF. This essay will discuss several facets of RFID technology. This study includes a review of the RFID literature.

LITERATURE REVIEW

Five sections make up the literature study on RFID: RFID constituents (I) operational frequency (ii), the RFID concept (iii), the RFID benefits and drawbacks (iv), and potential uses (v) are covered.

i. RFID Constituents:

The RFID system, as depicted in figure 1, is a fusion of RFID technique & processing technologies. The following elements make up an RFID system:

a. Label (electronic label).
b. An antenna (medium for tag reading).
c. Receiver (read tag information).
d. Connection architecture, which enables reader/RFID operation via IT architecture
e. User interface, application, and database software.

a) Label: A transponder, or little electrical gadget, is another name for an RFID tag. The tag is made up of an antenna and a basic silicon microchip [6]. The tag may be fastened to a box or other object, usually an item. Chips can wirelessly capture and transfer information. An RFID tag can be either active (using batteries) or passive (not using batteries) (hybrid). The reader can receive an identification code from the tag.

b) An antenna: RFID antennae are used to gather data about any object. There are many different kinds of RFID antennas, including patch, stick, linear polarised, adaptive, gate, and omnidirectional antennas. A RFID antenna should meet the following criteria, according to the researchers [6]: Small size, omnidirectional or hemispheric coverage, a maximum signal output to the microchip, reliability, and low cost are the requirements for it. The best bandwidth is obtained by changing the physical specifications of an antenna after it has been created and tested. The design of circular polarised antennas has been studied by experts during the past few years. You can utilise a dual polarised antenna. The RFID industry can use this antenna for passive 5.8 GHz applications. Due to its compact size and flexibility in changing its polarisation characteristics, the

inverted F antenna has been utilised in numerous RFID applications. Meander line antennas (MLA) are used for ultra high frequency (1GHZ) to reduce antenna size. The construction of tiny meander line antennas for RFID applications was initially presented by Marrocco et al. in 2002. RFID uses micro-strip antennas. These have appealing qualities including light weight, small volume, low profile, and low cost of production.

c) Receiver: The RFID reader is the third part of the RFID system. The reader, also known as an interrogator or scanner, uses antennas to transmit and receive radio frequency (RF) data to and from the tag. There could be several antennas on a reader that are in charge of transmitting and receiving radio waves. Reader alerts data processing system to tagged item's presence. The control section, high frequency interface, and antenna make up its three primary components. A variety of things influence the reader's reading range. The read range is affected by antenna gain, frequency, and direction. There are four different types of readers: read, read/write, fixed, and mobile [7]. The first two are based on technology and design, while the final two are based on device fixation.

ii. operational frequency:

Different RFID system types use various radio frequencies to operate. The read distance, power requirements, and performance vary depending on the radio frequency. The frequency that is used depends on the application. Most frequently, RFID technology uses four different types of frequencies:

a) Low frequency RFID tags operate in the low frequency band (120–140 KHz). For depositing, withdrawing, and regulating assets after, low frequency tags are utilised.
b) High frequency RFID tags function in the high frequency range (13.56 MHz). HF tags are helpful for contactless credit cards, ID badges, and asset tracking applications.
c) The operating range of the ultra-high frequency (UHF) RFID tag is 869 MHz to 928 MHz. Applications for supply chain management use UHF tags. UHF tags are more cost-effective to produce in large quantities and have a greater reading range.
d) Microwave (2.4 GHz–2.5 GHz) – A higher read rate is provided by microwave systems. UHF tags are less expensive than microwave tags. In electronic toll applications, microwave tags are used.

iii. the RFID concept:

The passive tag lacks a power source of its own. Reader input provides power to this tag's chip. Reader antenna sends RF signal in the direction of tag. For LF and HF tags, inductive coupling is used to gather energy from the RF signal, while backscatter coupling is used for UHF tags. To exchange data between the tag and reader, backscattering coupling and inductive coupling use electromagnetic waves and magnetic fields, respectively.

a) Backscatter Coupling: Electromagnetic waves are reflected by objects with dimensions bigger than half the wave's wavelength, as is known from the field of RADAR technology. The reflection cross-section of an object provides information on how effectively it reflects electromagnetic waves. A fraction of the incident RF energy is retransmitted by a tuned receiving antenna. If the retransmission is in the transmitter's direction, it is referred to as backscattering. Another antenna can find this backscattering.

b) Inductive Coupling: An electronic data carrier, typically a single microprocessor, plus a large area coil that serves as an antenna make up an inductively coupled tag. These are always passive in operation. This indicates that it draws its strength from the reader. The reader's antenna coil produces a potent electro-magnetic field for this purpose that permeates the coil area's cross-section as well as the space around the coil. The antenna coil of the transponder is somewhat penetrated by a small portion of the transmitted field. A voltage is produced in the antenna coil of the transponder by induction. This voltage is rectified and serves as the microchip's power source. The primary coil in the reader and the secondary coil in the transponder are connected in a transformer-like fashion in inductively coupled systems. This is accurate if the distance between the coils is less than 0.16 l, placing the transponder in the transmitter antenna's near field.

iv. RFID benefits and drawbacks:

Numerous benefits come with using RFID technology [6]. While this technology offers benefits, it also has certain drawbacks. RFID's benefits and drawbacks are listed in Table 1.

Benefits	**Drawbacks**
elevated pace	Disturbance
multiple uses & formats	Expensive
minimize workforce	Certain elements might cause signaling issues.
Excellent precision	Header message (failing to read)
intricate replication	
Several readings	

v. Potential Uses:

Numerous businesses, including those in production, agribusiness, hospitality, smart parking, and transit, are paying increasing attention to RFID technology. Below are a few of the most common RFID uses:

a) Medical Implications: Applications for RFID in healthcare [6] may be able to conserve valuable resources and improve patient care overall. By accurately labelling medical items in the healthcare system, such as patient files and medical equipment, RFID solutions can lower the amount of errors. Through the integration of medical objects used throughout the course of the patient's treatment, RFID significantly enhances the scenario for patient care. The effectiveness and efficiency of paramedical staff would rise thanks to RFID-based real-time object location information [11, 12]. This would result in better patient care.

b) Applications For Luggage: When luggage or shipments are lost or delivered late, the airline, package, and delivery services all suffer financial losses [6]. It can be quite difficult to manage many parcels going in many different directions on different routes. RFID technology offers the finest resource management, operation, and package transfer in this circumstance. RFID assists in package identification and generates data that can inform the sector of potential areas for improvement. Additionally, it keeps clients updated on their products.

c) Road Applications for Tolls: Since cars and other vehicles cannot proceed through toll booths without stopping to pay, RFID solutions improve toll collecting and charging while enhancing

traffic flow. RFID allows for quicker transactions by instantly identifying the account holder [6]. Using data mining techniques, this application aids in maintaining smooth traffic flow and identifying traffic trends that can benefit decision support systems or the administration. For instance, the data might be used to report on traffic patterns or to expand upon and create new policies [13].

d) Object Identification & Assets Tracking: RFID can be employed to locate or stop the loss of objects. For physical verification, an asset is marked with an RFID chip. The movement of items is monitored by a database.

e) a collection of RFID labels: RFID can be used in libraries to manage their book collection. RFID uses a variety of components for this management, including tags, readers, self-checkout/in, book drop readers, middleware, etc. These elements enable it to control the book borrowing and return processes. When borrowing a book or returning a book, RFID keeps track of the previous borrowings and returns.

f) Animal Identification: One of the early RFID applications is this one. An animal's skin can be implanted with an RFID tag to keep it there [1]. There is no identification mark that may be used to remove or edit tags, making this operation less painful. Because the RFID chip inside the tag is "Read-only," data cannot be changed. Numerous details, including the animal's age, the most recent immunisation, any medical histories, and unique characteristics are stored on this chip.

g) Anti-Theft Device: A sturdy string or plastic band is used to secure the RFID anti-theft tag to the item, which may be used to protect any item. A warning will sound if someone carries this item to the exit because RFID door antennas installed close to the exit will detect the tag's existence.

h) Waste Control: Waste management is another area in which RFID can be employed [1]. Each trash can has an RFID tag attached, and every garbage truck has an RFID reader. The reader reads the tag when the waste bin is emptied into the truck, then wirelessly transfers the information to the driver's cabin. A central server receives data at the conclusion of the path. These details include the amount of waste bins, when they were collected, and who handled the rubbish.

i) Governmental Identification: The major issue for all the countries has been national identification. It is possible to employ RFID technology for identification [1]. Each user only has one card with an RFID chip. Then, this RFID tag number leads to an internet database that other entities can access. For identification, only one ID card needs to be issued. Researchers' attention [14, 15] has also been on employing RFID technology to enhance traffic control systems.

Animals, plants, and especially human bodies can all have RFID tags attached. In the healthcare sector, the technology has the potential to avoid medical accidents. Blood pressure and body temperature can be collected and stored via an RFID tag device. RFID sensors are used in the medical industry. RFID sensors have been used to track the heart rates of cardiac patients [16], identify patients for surgery [17], and keep tabs on the durability of dental retainers [18]. A wireless information management system based on RFID is suggested by Lin et al. [19] for remotely monitoring the missile construction process. The components arriving at a construction site are tracked by Torrent et al. [20] using a mix of GPS and RFID tags. Other uses include enhanced asset management and accountability [22] as well as a productive paper roll management system [21].

Future Scope

Radio waves are used by RFID technology to automatically identify individuals or items. After 60 years of research, RFID is now utilised in a variety of industries. Before RFID becomes widely used worldwide, there are a few issues that must be solved. The exorbitant expenses are one significant obstacle, and privacy concerns are another. The RFID technology will be a huge benefit to humans after preventing issues. The cost of RFID tags is anticipated to drop. RFID tags will only get more affordable and potent as technology and design expertise advance. Some RFID system standards are currently being developed. Additionally, during the past few years, tag durability and life expectancy have improved. The AIDC infrastructure is faced with both new opportunities and challenges as a result of RFID technology. Despite the fact that RFID has several limitations, demand for RFID systems is growing daily. RFID tags can be used in conjunction with several types of sensors. By doing so, the tag would be able to report both current sensor data and identifying information in addition to the same information repeatedly. The percentage of "scan-it-yourself" will rise with time. Barcodes are not displaced by RFID technology. By incorporating features that previous barcode technology is unable to provide, this technology enhances barcode.

CONCLUSIONS

The article provided a summary of the state and future directions of RFID technology. RFID technology will create new opportunities to improve the accuracy, dependability, and security of organisations and businesses. The RFID technology and its components were defined and described in detail in the first section of this essay, and its benefits and drawbacks were covered in the second. The final section examines the uses of RFID technology. The use of RFID technology is discussed in the article as a way to offer new functionalities and effective approaches for a variety of applications.

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