RFID TECHNOLOGY IN LIBRARIES

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Abstract: Today's technological technology presents a wide range of challenges for managing library operations in a genuine and straightforward way. The greatest way to protect the materials in our libraries and manage all of their daily tasks is using RFID technology. RFID stands for Radio Frequency Identification, a technique that automatically identifies individual objects using radio waves. RFID reader and RFID tag collaboration is required by the technology. This technique allows an object, animal, or human to be individually identified using electromagnetic or electrostatic coupling in the radio frequency (RF) region of the electromagnetic spectrum. This technology makes it possible to provide significantly better services to customers, particularly in the area of self-checkout, and it makes better use of professional staff. Additionally, it may help library employees avoid repetitive stress injuries. However, the technology also poses a risk of tracking library users and hot listing them**.**

Keywords - RFID, Security system RFID tags, RFID Technology
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1.0 Introduction
A technology that uses radio waves to automatically identify persons or items at distances ranging from a few inches to hundreds of feet is known as radio frequency identification, or RFID. Any object can be identified using this Automatic identification (Auto-ID) technology. Other technologies used for identification include barcodes, magnetic strips, IC cards, optical character recognition (OCR), voice recognition, fingerprints, and optical strips. The automatic data capturing technique used by RFID technology contributes to increased system efficiency. The reader and tag are combined to serve as identification. An RFID tag is affixed to a tangible object and contains a code. The object is now distinct and unmistakable. Next, the object sends the tag's code. The reader is informed about the object in this way. Though it is used in novel ways, RFID technology is expanding quickly. Compared to more conventional identification methods like barcodes, RFID has many advantages. The barcode scanner and the label must be in line of sight for the barcode to be read. This indicates that the objects or scanner must be moved manually. RFID, however, does not require a direct line of sight to read data from tags. Additionally, RFID technology does not require alignment.

2.0 RFID: An Overview
RFID technology originated in the 1930s as a result of the concept of "mirror-sunlight-reflection". We have known for generations how to send messages via the air by simply reflecting radiated sunlight by flashing the sun's reflection in the direction of the intended recipient. RFID operates on the same fundamental principle as before, but this time it reflects "radio wave."
RFID was first used in combat during World War II, specifically in radar applications. But starting in the 1980s, its commercial application became a reality. The most popular uses are for asset and person tracking, supply chain item identification, reusable containers, high-value tools, and other asset tracking. Security uses include access control to networks and buildings, as well as payment systems. Thus, it is now a common occurrence in daily life.

2.1 History of RFID:

The RFID system is a wireless technology that uses radio frequency identification. For the security system in libraries, this is new technology. However, RFID technology has been used for more than 35 years in other industries. They are widely employed for radio tracking applications, such ticketing public transportation on motorway tollgates, and in many industry and academic organizations in recent years.

Table-1: Timeline of RFID Development and Adoption

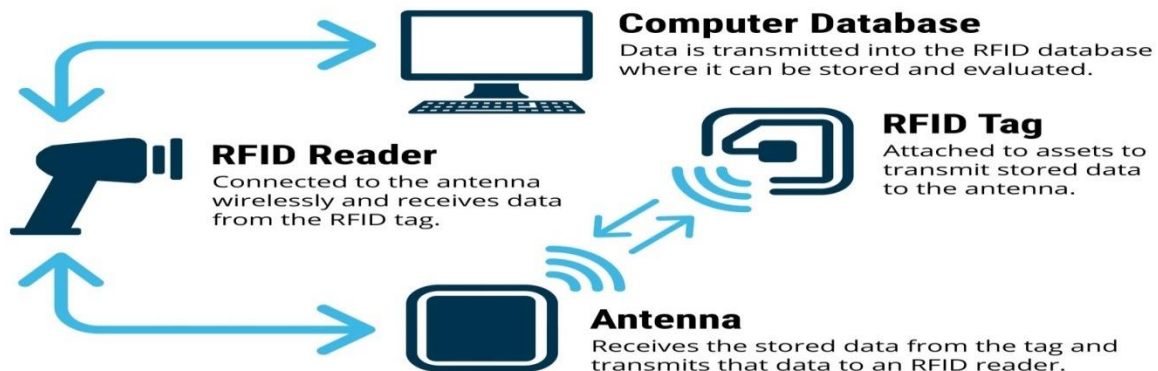| Decade	Event
1941- 1950	Radar refined and used, major World War II Development effort. RFID invented in 1948.
1951- 1960	Early explorations of RFID technology, Laboratory experiment.
1961- 1970	Development of the theory of RFID. Start of applications field trials.
1971- 1980	Explosions of RFID development. Tests of RFID accelerate. Very early adopter implementations of RFID.
1981- 1990	Commercial applications of RFID enter mainstream.
1991- Present	Emergence of standards. RFID widely deployed. RFID becomes a part of everyday life.

3 0 Why Libraries require RFID?

RFID enables library staff to monitor particular items at every point of their circulation duration and can assist prevent theft or accidental loss of library goods. Like most technologies, RFID is significantly less expensive now than it was when it first came out because to its continuous evolution and widespread use. Tags only cost about twelve cents each these days. RFID technology offers a rapid and durable return on investment, and the money saved can be used to fund other library needs.

3.1 How RFID System Works in Library:

The technology is implemented by flexible, paper-thin smart labels, or RFID tags, that can be discreetly placed on the inside cover of every document in a library's collection as well as on other media, such as CDs and DVDs. Each document's complete information is input into the software that is installed on the server or docking station. Now, when a user presents a book for issue or return, the RFID reader from the tag reads the information about the book and transmits the data into the software, allowing the book to be supplied quickly and with the least amount of manual labor possible. The information on the RFID tag is automatically read by the antenna at the exit gate as soon as the user takes the book outside the library, ensuring that it was provided correctly. The antenna detects when a book is being taken from the library or is not being distributed to the user in accordance with library policies, in which case it immediately sounds an alarm. As a result, technology successfully reduces document theft. Technology is also employed in inventory management and stock taking.

Basic RFID System

Computer Database
Data is transmitted into the RFID database where it can be stored and evaluated.

RFID Reader
Connected to the antenna wirelessly and receives data from the RFID tag.

RFID Tag
Attached to assets to transmit stored data to the antenna.

Antenna
Receives the stored data from the tag and transmits that data to an RFID reader.

3.2 Components of an RFID:

RFID is a generic tern for technologies that use radio waves to automatically identify on objects.

1. **Antenna:** An antenna serves as a conduit between the reader and RFID tags. RFID tags become active as they move across the activation field due to radio waves emitted by RFID antennas. A tag that has been enabled can use the reader to send and receive data to and from the PC.
2. **Labels:** The RFID tag, which may be placed directly onto CDs and movies or inside a book's back cover, is the central component of the system. An antenna and a programmable chip are features of this tag.
3. **Reader or Transceiver**: The data on the tag's chip is decoded by the reader and transmitted to the server when the tag goes through the field. These are radio frequency devices that are intended to identify and read tags in order to get the data that is contained on them. An antenna is powered by the reader to produce a radio frequency field. When a tag goes through the field, the reader decodes the data contained on the chip and sends it to the server. The server then checks the circulation database and, if the item is not correctly checked out, triggers an alarm.
4. **Server:** The server, also known as the docking station, serves as the various components' communications gateway. It transfers data with the circulation database after receiving information from one or more readers. The Application Programming Interfaces (APIs) required to interface it with the automated library system are included in its program.

3.3 Optional Components:
Optional RFID system includes the following three components-
1. RFID Label Printer
2. Handheld Reader
3. External Book Return

The labels are printed with a unique barcode, the library logo, etc. using an RFID printer. The data is simultaneously programmed into the chip and printed. Following this procedure, the printer's RFID label is removed and placed on the book.

4. RFID Technology in Libraries:
A library is a well-curated collection of information sources and related materials that are available for loan or reference to members of a certain community. It offers access to content in both physical and digital formats, and it could be a real building or room, a virtual location, or both. Books, magazines, newspapers, manuscripts, films, maps, prints, documents, microform, CDs, cassettes, videotapes, DVDs, Blu-ray Discs, e-books, audio books, databases, and more formats can all be found in a library's collection. RFID has use in theft detection systems and library circulation operations.RFID-based systems advance beyond security to become tracking systems that integrate security with faster and easier charge and discharge, inventorying, and material handling, as well as more effective tracking of materials throughout the library.

4.1 Advantages of RFID:
- self-charging discharging Reliability
- Streamlined Inventory Management
- Longevity of Tag life
- Faster Circulation
- Easy stock verification
- Theft reduction
- Automated issue/return
- Automated sorting of books on return
- Inventory visibility accuracy and efficiency.
- Financial- reduces costs of replacing stock.
- Automated check-in chutes can provide 24-hour check-in.
- Automated 24-hour pickup and checkout units.
- Protects staff from many materials handling-related injuries. (e.g. RSI)
- Staff can exploit their profession skills as opposed to clerical skills.

4.2 Disadvantages of RFID:
- High cost.
- Accessibility to compromise.
- Chances of Removal of exposed tags.
- Exit gate sensor (Reader) problems.
- User Privacy Concerns.
- Reader collision.
- Tag collision.
- Lack of Standard.

5.0 Conclusion:
RFID is now widely used by users of libraries. RFID is viewed as an excellent opportunity since it helps to create services that are both cost-effective and of the highest quality while also saving time and labor. With the use of this technology, workers will be able to better track supplies, deter theft, and expedite the checkout process for customers. By cutting down on wait times at the circulation desk, quickly controlling inventory without handling books, easily identifying lost books, automatically sorting books and preventing theft, and giving library employees more time to assist patrons, it transforms a traditional library into a "Book Smart Library." To sum up, it is imperative that we replace our antiquated system with the newest models in order to lessen labor and give library patrons faster, better services.

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