



RFID Technology-based Stock Verification: A Case Study at Presidency University Library, Bengaluru

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ABSTRACT

Updating the library's collection is necessary to serve the user base better. Libraries purchase books and non-book resources for this purpose; occasionally, they may also accept gifts of books from the public or from within. However, it needs to be examined to see if this collection has been damaged or lost any ground due to natural causes like damage or book theft. So, stock verification needs to be done. Stock verification in the Presidency University Library is done every year. It includes verification through an RFID handheld scanner that stores the data and compares it to the accession register exported from Koha LMS software. The complete process, i.e., stock rectification, initial steps, stock checking, and report verification, is explained.

Received: 29 June 2024

Revised: 30 August 2024

Accepted: 11 September 2024

Copyright: with Author(s)

Keywords: Stock Verification, Stock Rectification, RFID Technology

1. Introduction

A library's primary goal is to spread knowledge by making the appropriate documents available to the appropriate person at the proper time. Modernisation and user requirements enable libraries to provide open access to their readers for the in-time and flexible use of the library holdings, thus leading to book loss, damage, and the misplacement of materials. So taking stock has become an important aspect of the library. The Process of Physically Inspecting and Counting the Documents in the library is referred to as Stock Verification. Stock verification is viewed as a most delicate, as well as important, and continuous process in the library. It improves the collection's quality and makes it more accessible for pertinent information.

The advancement of science and technology leads to new ideas and developments that force libraries to adopt contemporary technologies to operate and maintain their resources and services. In the recent scenario, it's significant to

take up the new modernization aspects that help to improve the accuracy and assistance of the library. RFID stands for radio frequency identification, one of the innovations that keeps library services up to par. When an RFID scanner reads a tag attached to a book and displays the book's accession number on the screen, it verifies the authenticity of the stock. It provides information about the book's physical state, damage status, and loss for rectification.

2. Review of Literature

Shridar M (1991) suggested that explains the sensitive controversial stock verification as one of the occupational hazards and a post-mortem, emphasizes the need for clarity of objectives and procedures regarding stock verification and responsibilities of loss, points out that the cost of stock verification often far exceeds the benefits, highlights norms and procedures of stock verification for Government of India institutions, discusses some advantages and various methods and procedures of physical verification, put forth precautionary measures to be taken against loss and mutilation of library documents, analyses the issue of responsibility of loss and ways of resolving the conflict of responsibility, presents the procedure for the write-off of reasonable loss, finally concludes by stressing the need for rational and updated rules and procedures about stock verification, the responsibility of loss and limits to write-off loss as well as the vital role of professional bodies in this direction.

Selvakamal et al. (2023) say that shelving and stacking play a phenomenal role in any library worldwide. Mainly for new colleges, universities, and organisations. They must know the proper guidelines and principles to set up the new library. The library's beginning period is essential; it needs proper shelving techniques and stack selection for the library, which depends upon the library categories. Any library worldwide can give better services to users in print format only through proper arrangements and good shelving techniques. This research paper deals with various shelving techniques and stack arrangement types in the library.

3. Purpose

In the work, we intend to assess the several techniques involved in stock verification and document their features. A concurrent practice of stock rectification is deployed at many levels, and we monitor them. We codify the Fundamental requirements for implementing RFID further. During the stock verification process and while applying RFID, many issues arise, which we record in this work. Finally, we comprehensively review the practices and stages in the RFID implementation.

RFID Technology

RFID is a wireless, non-contact technology that automatically transfers data from an object's tag for tracking and identification using radio frequency Electromagnetic (EM) waves. The two halves of the RFID system were the transponder and the detector/reader. A transponder is attached to the object to indicate which real data it contains, and a detector or reader is used to determine the object's identity. A control unit, a coupling element to the transponder, and a high-frequency module (transmitter and receiver) are usually found in a reader.

RFID System Components

3.1. RFID Tag

RFID tags are tiny devices that react radio frequency to an RFID reader's query. The majority of RFID tags come with a microchip; however, others do not. These tags can typically store fewer than 2 kilobytes of data. Data can be supplied using the middleware programming software. The reader transmits signals to the tag. These tags expedite the library's circulation transaction process. Two primary categories of RFID tags are seen: Active and Passive.

➤ **Active Tag:** Active RFID tags are battery-powered tags that require a separate power source, which is often more expensive. Its tracking range extends to up to 100m.

➤ **Passive Tag:** Since passive tags don't have a power source, the reader signal transfers the data. Because of its straightforward construction, it is less costly and has a reading range of up to 10 meters. Low-frequency tags on passive tags have a frequency range of 125-148 kHz,

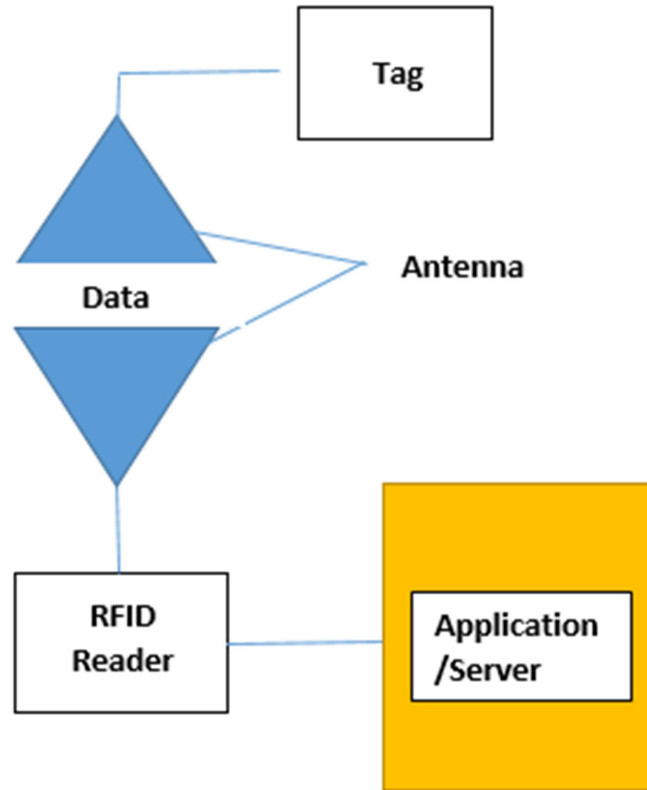


Figure 1. RFID System Components

high-frequency tags have a range of 13-56 MHz, and ultra-high-frequency tags have a range of 860-950 MHz.



Figure 2. RFID Tag

3.2. Antenna

The antenna is within the reader. It generates an electromagnetic field. A tag near an electromagnetic field can generate radio signals that allow it to read and send data to the reader. The antenna serves as a communication channel between the tag and the reader.

3.3. Reader

Data contained on tags is retrieved via RFID readers. It has an antenna for radio signal interrogating electronic tags, a control unit, and a radio frequency module. The reader's internal antenna produces an electromagnetic field. The reader deciphers the data on the tag's chip as it passes through the field and sends it to the server, which then saves or retrieves data on the book's issuance or return.



Figure 3. RFID Reader

3.4. Server

The server acts as a communication gateway between the RFID tag and the reader, facilitating communication between them. When the reader brings the tag close to the reader, it gathers information from the reader. A transaction database is usually installed on the server to enable report generation.

3.5. Handheld Scanner

The RFID technology's handheld reader is used to read tags that are affixed to objects. The portable reader has a UHF frequency range, a camera, and two and one-dimensional barcode readers. Employees utilise portable handheld readers for tasks like asset tracking and inventory management.

Stock Verification

There are several other names for the phrase "stock verification," including "inventory taking," "physical verification or checking," and "stock-taking." Stock verification might be carried out continuously throughout or after the academic year. Planning the stock verification work will help to guarantee that library services are not disrupted as much as possible throughout its completion. Thus, the phrase "stock verification" was coined to refer to libraries. Modern technology makes it possible to automate and integrate the many operations of libraries and information centres to reduce or eliminate the need for human intervention while boosting productivity and speed. it is unavoidable for the library because



Figure 4. Handheld Scanner

1. It reduces theft and dishonest behaviour.
2. It guarantees the papers' correctness and utility.
3. to preserve the library's collection properly

The Proper Stock verification aids in replacing lost or damaged copies of pertinent, practical, and on-demand papers with fresh ones. Stock verification aids in both identifying any shortcomings in the current library maintenance and vigilance system and reviewing the previous preventive steps to prevent loss and mutilation. It facilitates work organisation, shelf organisation, and straightening. There are methods for carrying out stock verification. Libraries use any one of the following conventional techniques to carry out the periodic stock verification,

- Making use of a manual accession register
- Making use of a shelf list or register
- Numerically tallying the books on the shelf
- Verification of stock using an RFID scanner
- Verification through barcode

Stock verification at Presidency University Central Library

4. Methodology

As previously mentioned, RFID integrates radio frequency technology with microchip technology. Radiofrequency technology is used to read the data from the book tags. RFID is libraries' newest and fastest-growing technology for monitoring, access control, and theft detection systems. It can track, manage, and protect library resources. It is not just book tagging; a comprehensive route to enhance all library services is provided.

The Presidency University Library had RFID technology and a completely automated infrastructure. We do stock verification after the semester each year. There are two methods for stock verification, one of which is using a portable RFID scanner. The first method is to enter all the accession numbers from start to end with the most recent collection count. When scanned, matched books with the relevant accession number will be highlighted in green, while missing volumes will be displayed in red. The second approach involves bringing the portable reader close to the book, which will capture the entry in the book and display it.

The central library's stock-checking process took into account the following procedures:

1. Before stock verification, shelf rectification needs to be done.
2. After scanning, we copy the scanned data to the system at the end of each day to keep it safe and up to date.
3. Books that were returned from the users during the stock verification period were also examined before shelving.

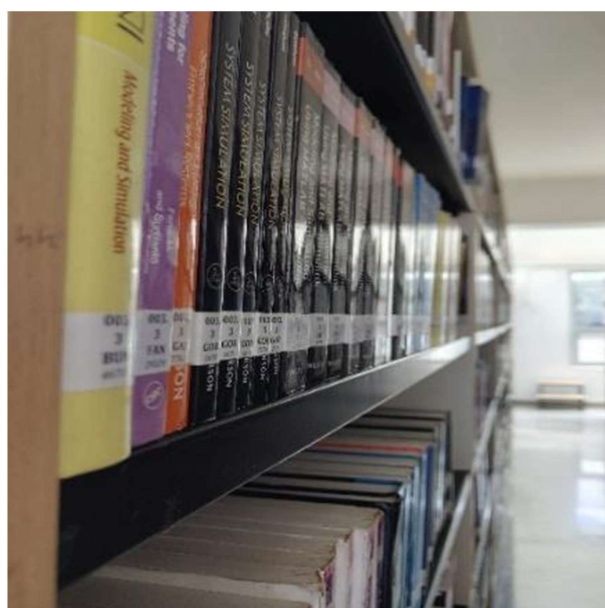


Figure 5. Arrangement of Books

Shelf reading was the first stock rectification technique we used. Our library is home to over 60,000 books and a superb selection of periodicals. The book arrangements are made based on the Dewey decimal classification system. We meticulously inspect every rack to ensure the books are precisely arranged according to their call numbers; if not, we rearrange them properly. This happens when users remove books from the racks and return to the racks themselves after their use. If a book is found to be torn or damaged, we take the necessary action depending on the state of the material; this could involve replacing, rebinding it, or noting in software that the document is not accessible.

Second, we proceeded to every shelf to determine whether it was overflowing with books. This happens because whenever the library acquires new books, we have to arrange the space in the relevant subject area to draw attention to the newly acquired books. Therefore, we used to move the full shelves within the subject area to less full shelves. Also, the spine label portion ought to be positioned at the shelf's edge so our consistency is upheld when attaching the spines to the books; the appearance will be appropriate and consistent.

Problems Faced During Stock Rectification

1. Miss placement of books.

2. Damaged Book.

3. Books tightly packed because of a shortage of Space

Circumstances such as misplaced books, wrongly tagged books, and expired tags are unavoidable, but these can be resolved with proper rectification, preserving the quality and enabling excellent user support.

Stock Verification using RFID Scanner

An RFID scanner has a reader built into it. Thus, the accession number will appear on the display if we place the scanner close to the programmed book. As was previously indicated, there are two ways to scan books: one method involves scanning each book individually and comparing it to the accession register using generation data, or another involves feeding the scanner all accession numbers before scanning the racks. The available books will be indicated in green. Thus, we used the first approach, which involved taking the scanner straight to the shelves. This approach was simpler than entering accession numbers before book scanning. Stock verification functions through

RFID Scanner are mentioned as follows:

1. Start the Stock Verification Process
2. Checking the Stocks
3. Reports' verification

1. Start the Stock Verification Process

Before starting the stock verification, ensure that the scanner is fully charged. If it's not sufficiently charged, then charge it fully. Go to the menu option, then Click the Scanner option on the scanner. It includes three options on the bottom of the display: Start/Stop, Temporary reset, and Clear. The start and stop options are used to Start and Stop the Scanning process. A temporary reset clears data once our shelf or Rack is fully scanned. The top shows the total number of scanned books, but a clear scan is used to clear all the scanned data. After scanning a book at the end of the day, we used to scan the check-in books on the respective days.

2. Checking the Stocks



Figure 6. Checking of Stocks through RFID scanner

While scanning each book, the scanner displays the accession number one by one. We used to check each accession number after scanning each book because while programming, books may get wrongly tagged. So, checking again will provide more Clarity. After scanning, each book produces a beep sound that ensures that it has been scanned.

3. Reports Verification

Reports Verification is considered the most important and final method in stock verification. RFID scanner includes exporting data option in text and CSV file format. We used to generate the data in a CSV file. On the other hand, we created the accession register using Koha software and downloaded it in spreadsheet format. Then, we compare the scanned data file, which includes the book's accession number, with the master accession register. Comparing both reports will provide the details of books that are not scanned, i.e., books not available in the library.

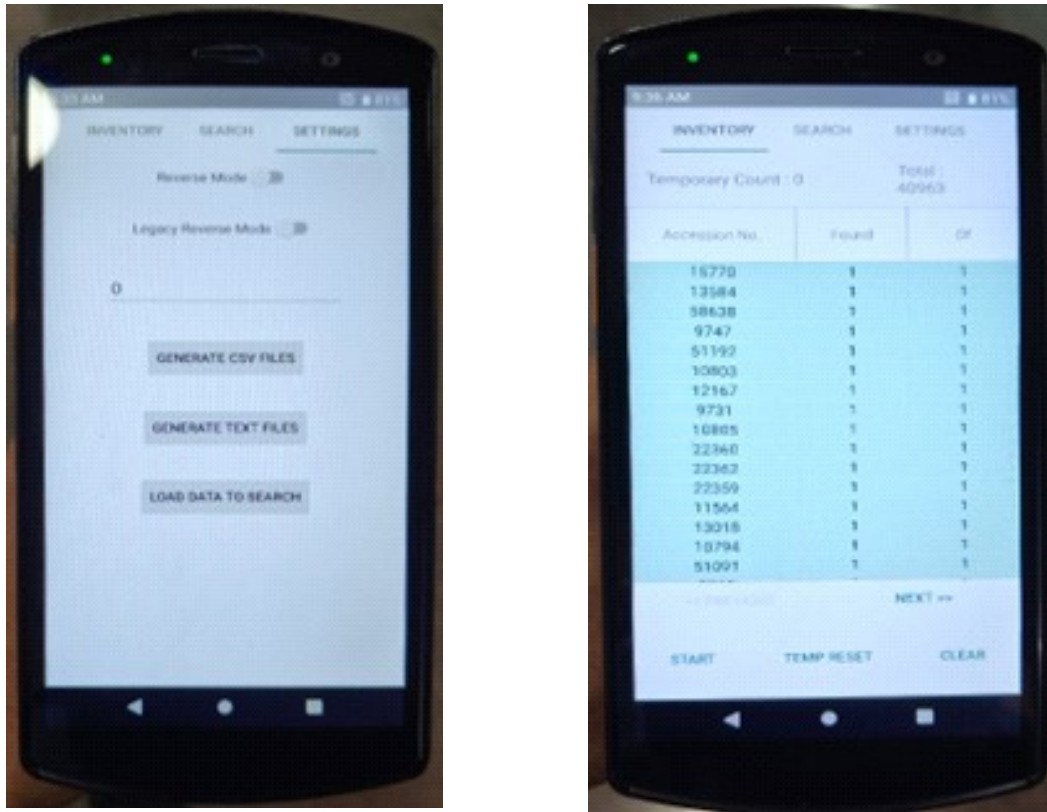


Figure 7. Generating Report

Major Findings of Stock Verification with RFID Handheld Scanner

a) One of the main problems we encountered during stock verification was that some of the tags were unreadable by the scanner, which had been pre-programmed during the procurement process. This could be due to:

- Expiration of Tags.
- Tags might be damaged.
- Loss of data due to long-time use

a) Most of the tags that are not recognizable are from books tagged three to four years ago. So, we conclude that the tags could expire or be damaged internally due to the long use of the tags.

b) The books that are not readable are programmed once again with the middleware software. About 80% of the tags are successfully retagged with the same accession numbers. This is because 80% of tags lose their data due to long usage, and new tags are provided for the remaining books and programmed accordingly.

c) When a book has been tagged for more than three or four years, it is preferable to double-check that the tags are still functioning properly. If not, it is preferable to retag the unreadable multiples; the remaining tags must be replaced with the new ones.

The result of our findings during stock verification can be summarised as RFID tag data is not always preserved; it may be replaced or eventually expire. The quantity of data contained on an RFID tag, its memory technology, and the frequency of tag reading and updating all affect how long the tag's data lasts. RFID tags are frequently designed to automatically update batch numbers, expiration dates, and other dynamic data as products are moved through the supply chain to retain accurate information.

5. Limitation of RFID Handheld Scanner

1. Should be aware of the battery level of the handheld scanner.
2. The verifier should be aware of the scanner's scanning speed. A Handheld scanner can scan multiple books within a few seconds, so he should be aware of the distance between the scanner and the books.
3. These are more expensive and require a whole RFID infrastructure, including a tag, reader, antenna, and programming middleware.
4. If the tag is damaged or worn out, it will not read the book or be verified during verification. So, the verifiers should be conscious about which books are scanned and which are not.
5. If the book is wrongly tagged, it reads the same.

6. Conclusion

RFID technology has updated the library, made it more actively service-oriented, and saved both professionals and users time. Stock verification using an RFID handheld Reader with RFID technology and Library Automation software makes the verification process easy to use, and labour will be reduced. Better Shelving and Stocktaking highlight the library in a unique and disciplined manner. The verifier must properly act towards damaged and lost books during the process. It is one of the key processes that helps to keep the stock up to date and updated with newly released as well as most required collection

References

- [1] Ahmad, S. (2016). Stock verification in automated environment: A case study of Sahitya Akademi Library. *Gyankosh-The Journal of Library and Information Management*, 7(1), 1-3.
- [2] Chaurasia, N. K., Chaurasia, M. P. (2011). Library stock management: A case study of stock verification of Central Library, IIT Delhi. *International Journal of Information Dissemination and Technology*, 1(1), 34-39.
- [3] Kumbhar, K. N., Bidve, H. (2016). Study of stock verification in the college library. *E-Journal of Library and Information Science*, 3(5), 26-35.
- [4] Liu, J., Zhu, F., Wang, Y., Wang, X., Pan, Q., Chen, L. (2017, May). RF-scanner: Shelf scanning with robot-assisted RFID systems. In *IEEE INFOCOM 2017-IEEE Conference on Computer Com-*

munications (pp. 1-9). IEEE. <https://doi.org/10.1109/INFOCOM.2017.8057089>

[5] Makhija, D., Chugan, P. K. (2016). RFID-based library management system: The benefits and challenges. In P. K. Chugan, D. Srivastava, N. Patel, & N. C. Soni (Eds.), *New age ecosystem for empowering trade, industry and society* (pp. 219-231). Excel India Publishers.

[6] Mukhopadhyay, C., Chattopadhyay, M. S. (2019). Stock verification using barcode technology and KOHA LMS: Practical experience at St. Xavier's College Central Library, Kolkata. *Xavier's College Central Library Kolkata*.

[7] Selvakamal, P., Ganesamoorthy, M., C, P., and S, R. (2023). Shelving and stacking in the library: A study. *International Journal of Advanced Research and Review*, 8(7), 31-33. <https://www.ijarr.in>

[8] Sridhar, M. S. (1991). Library stock verification: A ritual and an occupational hazard. *IASLIC Bulletin*, 36(3), 103-110.