



Transactionology of publication under reference and periodical sections using ICT and coding

G V Krishna Sharath^{1,*}, T Sreenivasa Rao²

¹ Dept of Library Science, Indira Gandhi National Open University, New Delhi, India.

² ANGRAU Regional Library, Agricultural College, Bapatla, India.

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Abstract

Purpose. The project intends to use a qualitative approach to investigate the state and procedures of present transaction processes to pinpoint inefficiencies. Integrating ICT and coding solutions will be formulated and examined through prototyping to evaluate their feasibility and effectiveness. By concentrating on user behaviour and section-specific dynamics, the study offers a more analytical and data-driven approach to library management by leveraging Python's analytical capabilities and extracting quantitative data from transaction logs. Future funding can be directed towards required and necessary subjects by using library management's data to research trends and student requirements. This research can potentially transform library operations and ultimately enhance everyone's user experience for all.

Methodology. The approach entails the utilization of ICT and programming to conduct a qualitative examination of data about the transaction aspects of publications.

Results and discussion. By utilising ICT and coding, publication transaction data is consolidated efficiently in the preferred format, paving the way for advanced analytics and strategic insights with minimal human input.

Conclusions. This study contributes to the examination, implementation, and consolidation of automated transaction recording across various sections of a library, with a prospective expansion towards integration with library management systems such as KOHA, Evergreen, Easylib, and Software for University Libraries (SOUL).

1. Introduction

In the library, Transactionology refers to the comprehensive study and management of all transactions involving library materials, with a particular emphasis on books within the various sections. It covers the complete transaction lifetime, from acquisition and circulation to usage trends and data analysis. The primary purpose is to improve library operations, improve user experience, and make data-driven decisions for collection development and service enhancements. In the realm of library management, the recording and analysis of transactions within the reference and periodical sections remain a critical yet often overlooked aspect. While traditional systems may capture some data, significant gaps hinder the comprehensive understanding of these sections' usage patterns and operational efficiency.

First, it is critical to recognise the current limits. Many libraries, particularly those with older systems, struggle to efficiently record transactions in their reference and periodical sections, which remain mostly unreported. Excluding overnight or short-term publications lending under the reference section. As a result, significant insights into user

* Corresponding author.

Email addresses: sharathgkv@gmail.com (G V K. Sharath), sreeni.apj@gmail.com (T S. Rao).



behaviour, resource utilisation, and section performance are lost, preventing informed decision-making and resource allocation. To close this gap, we suggest a novel approach that combines ICT and coding to capture and analyse transactions in these parts. This entails creating a coding application or system that records and logs user interactions with reference and periodical resources. The system would monitor behaviours, including browsing certain areas, accessing individual publications, borrowing resources, and requesting interlibrary loans. The system would automatically generate timestamps and other necessary data points using coding techniques, resulting in a comprehensive record of transactions in the required format for LIS centres with minimal intervention.

The benefits of this method are numerous. By examining the collected data, libraries can get valuable insights about user preferences, resource popularity, and section usage trends. This data can be utilised to optimise resource allocation, improve section structure and accessibility, and tailor user experiences. Furthermore, recorded data can be used to generate reports and statistics, which provide helpful evidence for decision-making and resource justification. To do this, we will provide cutting-edge solutions that promise to transform publication transactions by automating, speeding up, and making them transparent. We will thoroughly assess the benefits and drawbacks of each proposed course of action, ensuring a data-driven and realistic approach. Furthermore, by analysing the acquired statistics and spreadsheets, the expedition may provide a clearer picture of patron preferences, allowing for more exact resource allocation. Ultimately, we will choose the best option, which requires devising a strategy for using ICT and coding to improve library operations and future procurements.

In this current study, we need to address the problem and question of this research. Can we achieve transactional logging in the subject sections by integrating ICT and coding? The subsequent sections of this manuscript will delve further into the specific technical elements of the proposed system, elaborating on its characteristics and strategies for bringing to fruition this innovative concept.

2. Methods

The approach entails the utilisation of ICT and programming to conduct a qualitative examination of data about the transaction aspects of publications. The study will leverage data collection and analysis by examining existing research in transactionology of publication, ICT integration in accounting transactions, and coding applications in scholarly communication; analysing current workflows of transaction processes via observational studies to identify inefficiencies; and developing and testing ICT and coding solutions through prototyping to evaluate their feasibility and effectiveness. The project requires a barcode scanner for streamlined data entry, a LAN-compatible computer for networked access, and custom furniture fabrication for ergonomic workspace optimisation. Access to a publication database integrated with an "Open-Source Integrated Library System and Online Public Access Catalog (OPAC)" like KOHA, ([KOHA, 2024](#)) Evergreen, ([Evergreen ILS, 2024](#)) Easylib, ([EASYLIB, 2023](#)) and Software for University Libraries (SOUL) ([SOUL, 2021](#)) for efficient data management and library operations.

3. Review of Literature

The Bojonegoro Library Service processes written and printed works collections to meet educational, research, information, and recreation needs. From 2021 to 2022, 303 book lending transaction data were analysed using the Association Rule with the Frequent

Pattern Growth (FP-Growth) algorithm. The algorithm extracted frequent item sets from a tree called FP-Tree, resulting in a strong rule of 5 association rules. This research can improve library service quality, provide recommendations for librarians, and help place frequently borrowed classes closer together ([Lestari & Cahyani, 2023](#)).

Python for Information Professionals is an introduction to the Python programming language designed for library and information professionals to develop practical applications for data exploration, data security, and privacy ([Lund et al., 2023](#)). This study examines the evidence-based use patterns of Higher Education Commission (HEC) subscribed e-book databases in Pakistan's higher education institutions. Transaction log analysis found that e-book usage is growing, with male boarding students being more active. The study suggests that HEC should maintain subscriptions and conduct orientations and information literacy programs to enhance usage ([Rafique et al., 2023](#)).

This book is designed for undergraduate and graduate students to understand machine learning from theoretical and practical perspectives. It covers nearest neighbours, linear models, decision trees, ensemble learning, and deep learning and introduces Python packages like NumPy, Pandas, Matplotlib, Scikit-Learn, XGBoost, and Keras ([Zollanvari, 2023](#)). The authors propose a blockchain-powered autonomous transaction system for e-commerce applications, leveraging IoT devices to enhance efficiency and reduce human interaction. Blockchain provides a secure platform for distributed data storage and user privacy protection. The system captures user data, processes it, and delivers a visual representation, ensuring transparency and security in the e-commerce industry. ([Sekar S. et al., 2022](#)).

College library management is an electronic project that stores and manages books according to students' needs ([Sharon et al., 2022](#)). This system helps students and library managers keep track of available books, allowing them to search for desired books. It reduces manual work by tracking information like issue date, return date, and fines, preventing mistakes and ensuring a smooth flow of library activities. This system reduces the chances of errors in detail, allowing for more efficient and effective library management ([Sharon et al., 2022](#)).

Upon examination of prior literature, it is evident that there exists a dearth of research on the transaction aspects of publications in the reference and periodical sections. Previous research has predominantly focused on transactions within the circulation section about physical and digital publications within library settings. According to [Lestari & Cahyani \(2023\)](#), analysing transactions has enhanced service quality and facilitated feedback mechanisms for library staff, thereby addressing issues related to borrowing practices. Additionally, the Python programming language has been identified as playing a crucial role in developing applications for data exploration ([Lund et al., 2023](#)). In conclusion, there is a notable gap in examining publication transactions within the reference and periodical sections, which could be addressed using Information and Communication Technology (ICT) tools and Python.

4. Scope of Study

After understanding the current methods deployed for recording the publication transaction under reference and periodical sections, the author has concluded that there are no means of recording the transaction. The study will explore the use of Information and Communication Technologies ([Schlomann et al., 2020](#)) and coding to streamline the transaction aspects of publications. It aims to analyse the current condition and processes, identify areas for improvement, and propose solutions leveraging ICT and coding for enhanced efficiency, transparency, and accessibility. Examine the current transaction

aspects for publications in the reference and periodical areas. Identify suitable ICT and coding solutions for automating and expediting publication transactions. Create a framework for implementing information technology and coding solutions and recommending the best approach for leveraging ICT and coding in publication transaction aspects. Examine the potential advantages and disadvantages of applying the suggested solutions. Exploring any feasible method to monitor the transaction other than ICT and coding. Predicting the trend and approach of the patrons helps library authorities allocate funds for required books and periodicals.

5. ICT and Coding Requirements

Enhanced library value: Using data-driven evidence to demonstrate the impact of these parts can lead to increased support and financing for libraries, boosting their role in academia. To execute this requirement of this project, we will implement the criteria, namely, the physical and software side; let's elucidate the details.

5.1 ICT Requirement

A study of the transaction aspects of publications was undertaken in the reference and periodical sections. This involved implementing and analysing several ICT requirements, leveraging existing library infrastructure and the LAN network where possible. With Radio Frequency Identification (RFID) tags and International Standard Book Number (ISBN) barcodes readily available in our reference books, adopting an RFID scanner or barcode reader offers an efficient solution for recording publications. However, in the periodic section, due to the quantum books of issues, it's impossible to fit with the RFID tag as every current issue is stored in back volumes after a new one. In this section, we must adopt imaged and barcode-based recording approaches. We can study transactions based on International Standard Serial Number (ISSN) or Optical Character Readers (OCR) with cover page scanning in the periodical section.

We install a network-enabled computer system to retrieve the database, record, process and store data in the required format. Furniture needs some glass, metal, and fabrication to be modified to fit a barcode reader, RFID scanner or Web Camera to trace the traction of the publication while also recording the secondary data regarding patrons. Place this implemented and modified fabrication near the optimised location of reference and periodical section so that the patron has an optimised way to record the transaction without any effort.

5.2 Coding

To automate the transaction recording in different library sections, we must induct or adopt coding to supervise the process. To implement the required operation in our needy way, we must code in simple, easy, and recognised ways to tailor it to fit different library conditions. "Python is a robust programming language that is simple to learn. It features efficient high-level data structures and a straightforward but practical approach to object-oriented programming. Python's beautiful syntax, dynamic typing, and interpreted nature make it an ideal language for scripting and quick application development across" (Python, 2024) various platforms. "The Python interpreter and substantial standard library are available from the Python Web site in source or binary form for all major systems" (Python, 2024). The website also hosts distributions and links to numerous free third-party Python modules, programs, tools, and additional documentation. (Van Rossum, 2022) New

functions and data types written in C or C++ can be added to the Python interpreter. Python is also suitable as an extension language for customizable applications (Van Rossum, 2022) and is broadly taught in different platforms and courses offered by the National Institute of Electronics & Information Technology (NIELIT, 2023)

```
import csv
import datetime
import os
import logging
from pyzbar.pyzbar import decode
import cv2

def log_book_entry(query, log_file, databank_file):
    current_date_time = datetime.datetime.now().strftime("%Y-%m-%d %H:%M:%S")
    book_details = retrieve_book_info(query, databank_file)

    if book_details:
        entry = {
            'Sl. No.': get_next_entry_number(log_file),
            'ISBN': book_details['ISBN'],
            'Book Name': book_details['Book Name'],
            'Date and Time': current_date_time
        }

        with open(log_file, 'a', newline='') as csvfile:
            fieldnames = ['Sl. No.', 'ISBN', 'Book Name', 'Date and Time']
            writer = csv.DictWriter(csvfile, fieldnames=fieldnames)

            if csvfile.tell() == 0:
                writer.writeheader()

            writer.writerow(entry)

        logging.info(f'Book entry logged: {entry}')
    else:
        logging.warning(f'Book with ISBN or Name '{query}' not found in the databank.')

def get_next_entry_number(log_file):
    try:
        with open(log_file, 'r') as csvfile:
            reader = csv.reader(csvfile)
            next(reader, None)
            last_entry = list(reader)[-1]
            return int(last_entry[0]) + 1
    except (FileNotFoundError, IndexError):
        return 1

def retrieve_book_info(query, databank_file):
    try:
        with open(databank_file, 'r') as csvfile:
            reader = csv.DictReader(csvfile)
            for row in reader:
                if query.lower() in row['ISBN'].lower() or query.lower() in row['Book Name'].lower():
                    return row
            return None
    except FileNotFoundError:
        logging.error(f'Databank file not found: {databank_file}')
        return None
    except Exception as e:
        logging.error(f'An error occurred: {e}')
        return None
```

```
def scan_barcode_pyzbar():
    cap = cv2.VideoCapture(0)

    while True:
        _, frame = cap.read()
        barcodes = decode(frame)

        for barcode in barcodes:
            barcode_data = barcode.data.decode('utf-8')
            return barcode_data.strip()

    cv2.imshow('Barcode Scanner', frame)

    if cv2.waitKey(1) & 0xFF == 27:
        break

    cap.release()
    cv2.destroyAllWindows()

def main():
    logging.basicConfig(level=logging.INFO, format='%(levelname)s: %(message)s')

    log_file_path = 'Location for datalogging'
    databank_file_path = 'Location of database'

    os.makedirs(os.path.dirname(log_file_path), exist_ok=True)

    print("Choose input method:")
    print("1. Manual Entry (ISBN or Book Name)")
    print("2. Barcode Scanner (pyzbar)")

    while True:
        choice = input("Enter choice (1 or 2): ")

        if choice == '1':
            query = input("Enter ISBN or Book Name (type 'exit' to finish): ")
            if query.lower() == 'exit':
                break

            log_book_entry(query, log_file_path, databank_file_path)

        elif choice == '2':
            query = scan_barcode_pyzbar().strip()
            log_book_entry(query, log_file_path, databank_file_path)

        else:
            print("Invalid choice. Please enter 1 or 2.")

    logging.info(f"Book entry log saved to {log_file_path}")

if __name__ == "__main__":
    main()
```

Figure 1. Coding Script

6. Result & Discussion

6.1 Result

Coding produces significantly more than just lines on a screen. While the immediate output may be a working program, website, or game, the genuine advantages are felt by both the coder and the world around them. Coding can produce tangible results, such as a working app or website, or intangible results, such as improved logical thinking, increased creativity, and problem-solving abilities. It can bring ideas to life, automate processes, analyse data, and even generate scientific breakthroughs. Finally, coding allows us to express ourselves in a new language by using lines of code to shape the world around us.

After the initial run of the script in Python, an input dialogue box appears on the screen, displaying the choice of 1 or 2, as shown in Fig 3. There is an option to feed data (ISBN) manual entry or barcode scanner in the input dialogue box, respectively. By choosing option '1' and logging the publication transaction using the manual feed of ISBN in the input displayed in Pyscripter is shown in Fig 4. After ISBN data is fed into the programme, the script checks the inputted value from the publication database for the details. If we select option '2', we can scan the ISBN barcode on the books with the help of *pyzbar* and barcode scanner or web camera as per Fig 2. The collected details of the books or journals shown are displayed on the output screen as per Fig 5. with logging transactions in a CSV file "log_file". If the input query is not found in the publication database, then "Book with ISBN or Name (query) not found in the database." will display on the screen. The Python programme successfully generated a well-structured CSV file with clear and organised book data and details along the datstamp. The output file is in CSV format, making it compatible with various spreadsheet and data processing programmes. It methodically organises data into four unique columns: Serial Number, ISBN, Book Name, and Date, allowing for easy sorting, filtering, and analysis of book records, as shown in Table 1. Using this tabular and spreadsheet format, users can easily extract specific facts, detect patterns, and gain essential insights from the dataset and secondary data about the patrons.

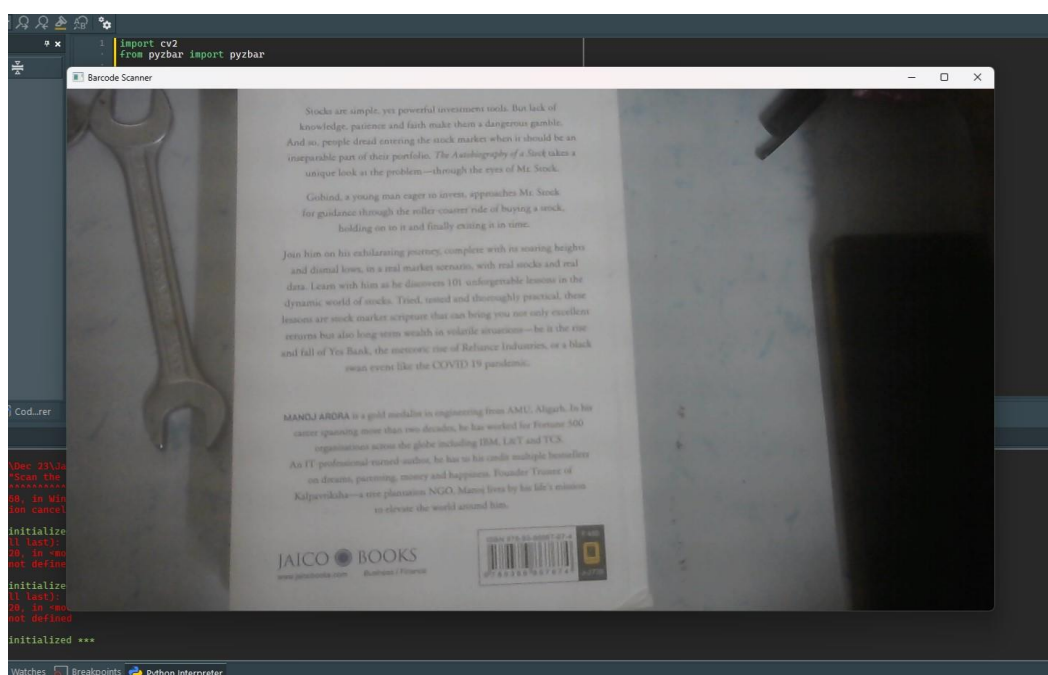


Figure 2. Scanning of ISBN using web camera

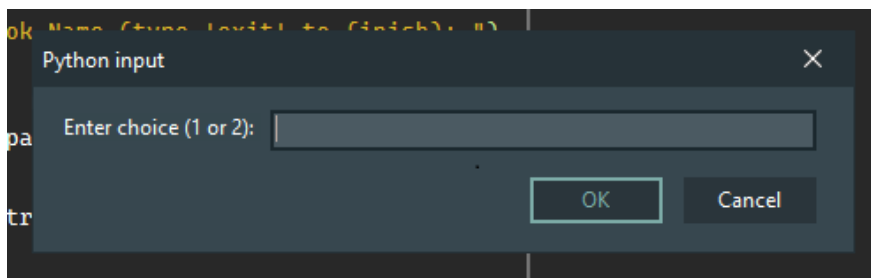


Figure 3. Popup window for choice entry

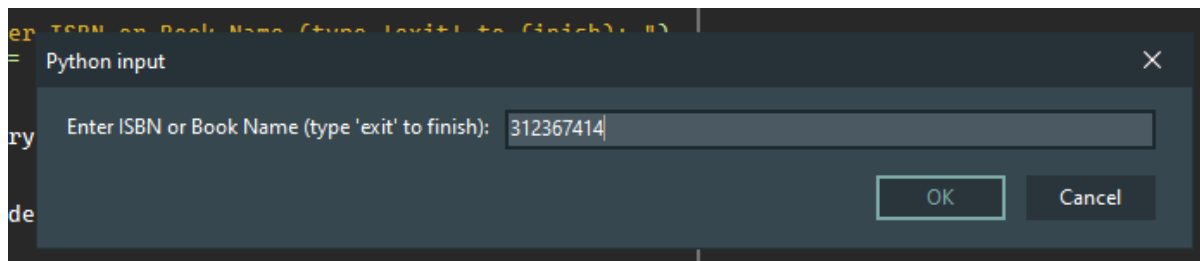


Figure 4. Windows showing for entry of ISBN no

```

Choose input method:
1. Manual Entry (ISBN or Book Name)
2. Barcode Scanner (pyzbar)
Enter choice (1 or 2): 1
Enter ISBN or Book Name (type 'exit' to finish): 9781439169672
INFO: Book entry logged: {'Sl. No.': 27, 'ISBN': '9781439169672', 'Book Name': 'The Midnight Library', 'Date and Time': '2024-01-02 21:44:45'}
Enter choice (1 or 2): 9781439169672
Invalid choice. Please enter 1 or 2.
Enter choice (1 or 2): 1
Enter ISBN or Book Name (type 'exit' to finish): 9781439169672
INFO: Book entry logged: {'Sl. No.': 28, 'ISBN': '9781439169672', 'Book Name': 'The Midnight Library', 'Date and Time': '2024-01-02 21:44:53'}
Enter choice (1 or 2): 1
Enter ISBN or Book Name (type 'exit' to finish):
    
```

Figure 5. Output display after logging of transaction in Python using Pyscripter

Table 1. Transaction logging entry of Publications

| Sl. No. | ISBN | Book Name | Date |
|---------|---------------|---|------------------|
| 1 | 9780552779777 | The Girl on the Train | 16-12-2023 11:02 |
| 2 | 9781784161859 | A Short History of Nearly Everything | 16-12-2023 11:05 |
| 3 | 9788172344504 | Pride and Prejudice | 16-12-2023 12:04 |
| 4 | 0312367414 | Courage Under Fire: Battlefields of the Civil War | 16-12-2023 12:15 |
| 5 | 9780241950425 | The Catcher in the Rye | 16-12-2023 13:18 |
| 6 | 9780740000000 | Nineteen Eighty-Four | 16-12-2023 14:08 |
| 7 | 9780552779777 | The Girl on the Train | 16-12-2023 14:08 |
| 8 | 9781439169672 | The Midnight Library | 02-01-2024 21:23 |
| 9 | 9780312666837 | The Secret Garden | 02-01-2024 21:24 |
| 10 | 9781439169672 | The Midnight Library | 02-01-2024 21:37 |
| 11 | 9781439169672 | The Midnight Library | 02-01-2024 21:38 |
| 12 | 9781439169672 | The Midnight Library | 02-01-2024 21:44 |

Source: Collected from CSV file formed during the execution of Python code

6.2 Discussion

The author got the idea for this transaction study while working as a post-graduation (LIS) intern at an esteemed college library. By the reference section, I've seen that a few

learners read books without making any record, except from lending students and staff overnight. This is used to log in to library management systems like KOHA, etc, using RFID tags. This practice is also seen similarly in the periodical section but without an outing. This spark leads to this idea and approach, which, in turn, helps library management study the transactions in the library to collect primary and secondary data. Planning resources and requirements for the implementation of any project is paramount to achieving the output most shortly and efficiently. For the transaction aspects of publication in the different library sections, we need to record the publication transaction in the most efficient and automated way, with minimum intervention of staff or patrons. To execute this requirement of this project, we will implement the criteria, namely, the physical and software side; let's elucidate the details.

Prospective expected outcomes by effectively implementing this Internet of Things (IoT)-driven approach, we can predict the following positive outcomes. Improved operational efficiency: Streamlined transaction recording, reliable data collecting, and automated analysis minimise manual workload and increase overall efficiency. Data-driven decision-making: Libraries can make educated decisions about resource allocation, staffing levels, section layout, and service offers based on user behaviour data. Improved user experience: Personalised recommendations, efficient resource availability, and user-friendly section design can increase library patron satisfaction and productivity.

In Python coding, The author has used different functions in this study to input data, main functions, functions to read, scan, and video capture of publication and utility functions. The author has only used a small fraction of coding from my study, and there is an enormous scope for improving and automating library services. In my approach to studying the publication transaction, using Python coding to seek information regarding the publication from an already compiled database from library servers using Pyscripter (Embarcadero, 2024). I have input the data into coding by employing barcode scanning and manual feeding of ISBN no of randomly selected books with different names and genres with ISBN 10 and 13 standards. For inputting the data, I have used functions like OpenCV (cv2) and pyzbar to capture video from a webcam and decode barcodes from the pictures, respectively. I have used to collect the information on books from the database by using `retrieve_book_info` with query parameters and `databank_file` to access the data of books from the local database. I have used `input`, `csv` and `logging` to log the transaction recorded by this coding with the `datetime` function to note the time with each entry by creating data structures by the `entry` function. In this current program, I have used `reasoning` and `error-handling` functions if and except to understand and remove any error during the program's execution.

Due to the limited resources, implementing resources like RFID and image scanning using OCR in my study was restricted. To record the transactions in the periodical section, we need to use image scanning or manual entry of the Journal's ISSN no to log the entry in the program, which records the transaction. However, we can implement these functions in a well-established library and information science (LIS) centre. The author used Python coding, as written in section 5.2, which gives an idea of adopting programming in the transaction aspects of books and periodicals. In this program, we can add OCR-based logging by recognising the title of the publications from captured images, for this we need to install a high-resolution web camera.

7. Conclusions

The main aim of this study is to explore the methodologies for integrating ICT and coding for data logging of transactions, which has been effectively achieved. The research

delves into the intricacies of library utilization in reference and Periodic divisions by using Python's analytical capabilities and parsing data from transaction logs. Examining inventory trends and scope offers valuable insights, potentially influencing strategic decisions such as resource distribution, collection enhancement, and service enhancement. This Python-facilitated investigation presents a more analytical and data-focused approach to library management, emphasizing user behaviour and section-specific dynamics. Except for the automated system, alternative systems cannot be implemented as the manual recording process would consume the time of both patrons and staff for monitoring purposes.

This study explores transaction aspects in publications using Python, which has the potential for future growth. The next step could be expanding to LMS like KOHA, Evergreen, Easylib, and SOUL, which can enhance circulation processes. Compiling secondary data on patrons can improve understanding of user behaviour. Real-time data analysis can optimise ordering and resource allocation, automating activities like overdue notices. Limitations exist in all research endeavours, as seen in this study. Challenges include resource constraints affecting research scale and the reluctance of libraries to share databases. The limited sample size hinders the deployment of necessary ICT infrastructure in libraries for the study.

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