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Application of Mobile Technology for Stock Management in Academic Libraries

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ABSTRACT

This paper discusses the role of mobile applications in enhancing library-related tasks. Mobile technology emerges as a valuable resource for saving time and effort. The study demonstrates how mobile applications can simplify tasks like stock-taking and generating other collection-related statistics within a library. The paper takes a distinctive approach by recording book usage statistics and monitoring staff activities, specifically the re-shelving of books. This method carries significant implications for collection development and the efficient management of library staff. It underscores the potential of mobile technology to enhance library services' economic and sustainable operation. Notably, the library's stack area frequently experiences congestion, poor internet connectivity, and insufficient infrastructure for routine operations. Some setbacks, such as inadequate lighting in the stack area, were identified as factors affecting the app's performance.

Keywords: Stack management; Collection management; Academic libraries; Shelf rectification; Mobile application in libraries

1. INTRODUCTION

As various ICT tools existed for the advantage of a few having knowledge and access to digital media, mobile technology facilitated quicker ways to reach out to people, transform our daily lives and helped narrow down the digital divide. The acceptability of any ICT tool has never been so much as it is with mobile phones. The 2010 Horizon Report called mobiles an "indispensable part" of human life. They are described as tools for "study, productivity, task management…that we grab along with car keys and wallet"[1]. People are becoming digitally literate and depend significantly on mobile phones for their day-to-day activities. A study by UNESCO reported that over 6 billion people, out of the world's seven billion estimated human population, have access to a working mobile phone[2]. People increasingly use mobile devices instead of desktops for internet access[3]. A study was conducted to record mobile versus desktop usage to access websites. It was reported that 68.1% of all website visits in 2020 came from mobile devices, in comparison to 28.9 % coming through desktops[4]. In India, the number of smartphone users is increasing owing to various initiatives taken by the Indian Government, such as Digital India. The COVID pandemic has also complimented the increased use of mobile devices. The number of smartphone users is expected to rise above the 1 billion mark in 2026[5].

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With such an enormous smartphone user base, service-based organisations like libraries have ample opportunities to augment their services. Apart from being omnipresent, the device is portable and, hence, offers the convenience of use anytime and anywhere. Also, developing mobile applications does not require much effort and money, which is advantageous for libraries as they constantly struggle for a sufficient budget. These features have led to further penetration of mobile-based applications in offering library services. The trend has emerged, with most library websites being augmented for mobile-based access[6]. Mobile tools can connect patrons and libraries beyond the spatial limitations[7]. Library mobile services help create a ubiquitous learning environment for students to cater to their academic and leisure needs[8]. In a survey conducted by Mansouri and Soleymani[9] regarding mobile-based services at academic and public libraries in Iran, it was found that users of academic and public libraries considered circulation and renewal, search, ask a librarian and information regarding library hours as the most essential services to be included in library mobile applications.

2. APPLICATION OF MOBILE APPS IN LIBRARIES

Mobile phones are much more portable and convenient to handle owing to their size compared to a desktop/ laptop, with features such as built-in cameras, GPS, and biometric scanners offering ample opportunities for libraries to generate new services for their users. Also, they are better alternatives to a desktop or laptop in terms

of the According to Ajab Mohideen, Sheikh and Kaur[10] mobile apps are effective communication and reference tools ensuring the availability of library services 24x7, providing added value to its users and creating customer-centricity. They can be effective tools for establishing genuine and sincere connections with users. Similarly, messaging apps like WhatsApp can deliver effective alerting services[11].

Many studies have enlisted the number of mobile-based library services and applications of mobile technologies in libraries[12-14]. The mobile apps available for libraries are primarily used to support alert services, browsing services, access to e-resources, managing user profiles for circulation-related services, and QR code-based services[15-16]. Lai, Zhong, Chiu and Pu[17] developed a bookcase system to read e-books using mobile devices. Leenaraj[18], *et al.* proposed a mobile application as a new approach for first-year student orientation to create awareness about library services using the gamification concept and found the method very effectively serving the purpose. Bradley[19], *et al.* reported a mobile-based library tour application for library users at Newman Library (Main Branch) of Virginia Tech using iBeacon, a Bluetooth Low Energy (BLE) device. Mullins[20] reported a mobile-based app for information literacy called Research PlusTM to support students' research-related activities.

There are library apps like *Libib,* a library cataloguing app that syncs its database online for cross-platform access through cloud service offered by libib.com[21]. The *Bookshelf* and *My Library* apps help to create a virtual library. *Open Library, Libby, National Digital Library of India* apps provide free and open access to books, with *Libby* offering their users to set a sleep timer. *PocketBook Reader* supports 26 book and audio formats to read e-content. Most publishers, such as Wiley, Elsevier, Sage, Springer Nature, etc., have their presence as mobile apps, and users can access their subscribed content anytime and anywhere. Book clubs can be organised through apps like *BookClubs*, which can automatically schedule meetings and facilitate discussions regarding the recommended reads. The entire Chicago Public Library can be accessed through their app. *Journal Finder*, powered by PhDTalks.org, facilitates researchers to identify journals to publish their research. These are a few of many such apps with varying features in each app. These apps ensure fulfilling all user requirements expected from a library through the single handheld device, i.e., a mobile phone connected to the internet.

Singh and Madhusudhan[22] conducted a systematic literature review on mobile apps based services in libraries and information centers and realised a shift of focus from web-based library service to mobile based library services. Sanjeeva and Gowda[23] presented a study on the computerised stock verification process using *LoMag Barcode Scanner* and *Kutools* for MS Excel. Singh[24] suggested various implementations of QR Codes for the enhancement of library related services. According to Malathy and Kantha[25] mobile technology is reliable, accurate, fast and cost-effective for library stock verification. They are handy, easy to use and can be ported easily. The stock verification process can be done without disturbing the library's routine activities. Boberic Krsticev, Tešendic and Verma[14] reported an inventory management application called *Mobilib* for the Android platform. The application was developed as part of a library management system called *BISIS*, an in-house application developed by the University of Novi Sad, Serbia. Through *Mobilib*, one can search and update the bibliographic records of the BISIS library management system through a specially designed service called *Mobile Service*. Hahn[26] proposed a mobile-based augmented reality (AR) application prototype for increased access to print and digital library collections. In addition, developing apps for educational content in audio and video format and chatbots to supplement library online services are futuristic possibilities for libraries to explore[27].

3. LIBRARY STACK MANAGEMENT

The Libraries that contain large numbers of books require considerable effort to arrange the books in place correctly and quickly, repeatedly during the day. Book stack management remains a continuous concern for libraries. As highlighted by Evans and Sweeney[28] the functions associated with stack management are growing in significance for libraries as they strive to fulfill their responsibilities in maintaining safe working environments and public spaces. This entails the necessity for shelving systems to be both robust enough to support the weight of the books they hold and resilient in the face of regular handling, as well as the occasional mishandling by both staff and library users. The manual arrangement of books results in human errors apart from the requirement of hiring someone.

Shelving or shelf arrangement is an essential library activity to provide quality services to its users[29]. It should be done every day plausibly in shorter periods to save the time of the user as well as staff[30]. Library book rearrangement is a dynamic process that helps libraries maintain order, optimise space, and improve accessibility. It is an essential aspect of library management that requires careful planning, assessment, and ongoing attention. By embracing the art of library book rearrangement, libraries can continue to serve as beacons of knowledge, fostering learning, research, and community engagement. The re-shelved data is an essential inventory for collection development. Studies based on circulation data are available for effective collection management[31-33].

Chinnaiah and Kamarthi[34] presented a model for automating the reshelving operations by applying the concept of an Automated Storage and Retrieval System (AS/RS). They suggested a practical system combining automated and manual operations to place a user-returned book in its appropriate location and carry out the associated data processing work. The experiment demonstrated a drastic reduction of time in the reshelving and improved the performance of the reshelving operations. They concluded

that a fully automated reshelving system is technically feasible but prohibitively expensive. The present study attempts to record the usage statistics of the books by including circulation data and books that are not issued but consulted within the library by library users.

4. INTENT OF THE STUDY

The aim of the study was two-pronged: one is to study a mobile-based application and identify the benefits and issues/challenges that may arise in its implementation for library management. Second, to generate statistics of the books consulted within the library premise. Stack management involves three aspects the library professional has to deal with, i.e. the staff, the users and the collection. The number of books and collection usage determines the workload for staff in the book stack. For a large collection, the distribution of work among staff is generally based on these factors. Thus, it is important to know the strength of the collection in the book stack and its usage statistics. One of the methods to gather usage statistics of library books is circulation data, which can be easily retrieved from library automation software. However, many books are consulted within the library premise which goes unrecorded. Hence, it was decided to record the statistics of the books consulted by users within a library's premises using a mobile-based app.

4.1 Book Stack at Central Library of Government Kaktiya PG College, Jagdalpur

The Book Stack at Central Library, Government Kaktiya PG College, Jagdalpur, houses nearly 70 thousand books and an average daily footfall of 200 to 300 library users. The premise provides a great ambience and suitable infrastructure for convenient study. Mostly, the reading hall is full of library users. The ground floor has open access and houses an active collection of books for circulation to library users. The first floor has restricted access as it houses the books for competitive exams. The stack has 155 iron-made stacks spread across the entire floor area. They are double-faced. Each rack is divided into eight shelves. Each shelf can hold 25 to 30 books. However, due to scarcity of space, the number of books on each shelf may exceed 35 or so, depending upon the book's thickness.

The books on the ground floor are arranged using Dewey Decimal Classification. Each row of shelves has a subject guide indicating the general DDC range covered by the row. The circulation area is near the entrance of the library. The reading hall also compromises reference collection and competitive collection. It has to be noted that the reading hall is separate from the stack area. Students can carry the books from the stack to the reading hall for consultation within the premises or get them issued from the circulation desk.

Collection of books from the reading halls and circulation area, sorting, re-shelving, shelf reading, and providing consultation service to students regarding subject books are some of the routine activities carried out by the library staff working in the stack. It is difficult to record the statistics of the shelf reading done by the staff.

5. BARCODE TO SHEET APP

In an increasingly digital world, libraries continually seek innovative solutions to streamline operations and enhance user experiences. One such solution is the Barcode to Sheet app. This powerful tool combines the simplicity of barcode scanning with the versatility of digital spreadsheets. This app has revolutionised library management by simplifying inventory management, cataloguing, and book tracking tasks.

The app was first introduced in March 2021 by Velocity Software Solutions, an Indian enterprise working under the brand name "Knowband" (www.KnowBand.com). It is highly rated on Google play store (4.6*)[35] and Apple's app store (4.3*)[36]. As per Google play store, it has been downloaded nearly 100K+ downloads.

This app is designed to work on various platforms, including smartphones and tablets. Its primary purpose is to assist librarians and library staff in managing their collections more efficiently. The app allows users to scan a book's barcode or other library materials, instantly capturing relevant information and exporting it to a digital spreadsheet.

5.1 Benefits of the Barcode to Sheet App

5.1.1 Time Efficiency

The app significantly reduces the time required for inventory management, cataloguing, and book-tracking tasks. Manual data entry is eliminated, freeing staff to focus on other essential library services.

5.1.2 Accuracy

Barcode scanning virtually eliminates human error in data entry. This ensures that the library's digital records are accurate and up-to-date.

5.1.3 Accessibility

The digital spreadsheet created by the app can be accessed and edited on multiple devices and shared among library staff, promoting collaboration and data sharing.

5.1.4 Cost Savings

Libraries can reduce the need for dedicated cataloguing equipment and software, as the Barcode to Sheet app provides a cost-effective alternative.

5.1.5 User-Friendly

The app is designed with an intuitive user interface, making it accessible to librarians with varying levels of technical expertise.

5.2 Features of the Barcode to Sheet App

5.2.1 Multilingual

The software supports French, Spanish and Russian languages other than English.

5.2.2 Efficient

The app is easy to handle and offers mobility compared to fixed desktops.

5.2.3 Accuracy

This app can scan the barcode quickly and accurately compared to manually recording the data.

5.2.4 Support to Multiple Code Scanning Systems

It supports scanning, reading or capturing of various major code scanning systems, including Q.R. code scanning, ISBN scanning, EAN-13, EAN-8, etc.

5.2.5 Customisation

It facilitates the creation of of customised sheets/ forms for capturing the data. Rows and columns can be easily added in the same way as in the Excel sheet. One can enter the rows manually or automatically with a button click.

5.2.6 Multiple Format Support

It allows exporting the captured data in CSV, Excel or XML format, supporting data interoperability.

6. METHODOLOGY

The following steps were followed to implement the Barcode to Sheet App in the library for the purpose of capturing the data. The activity of data capturing was initiated in the month of January, 2023 and continued till August, 2023.

6.1 Installation of the App on Mobile Phone

Book collection from reading halls is a routine activity of the book stack. It was decided to scan these books as they will be re-shelved by the staff. These books were scanned daily using a randomly selected mobile app called *Barcode to Sheet App*. The standard version of *Barcode to Sheet App* is provided by Velocity Software Solutions and its features are available on a freemium basis. The app can be easily downloaded from the Google Play Store and installed on any mobile device. The app was very easy to operate for the staff. The landing page of the app is shown in the Figure 1.

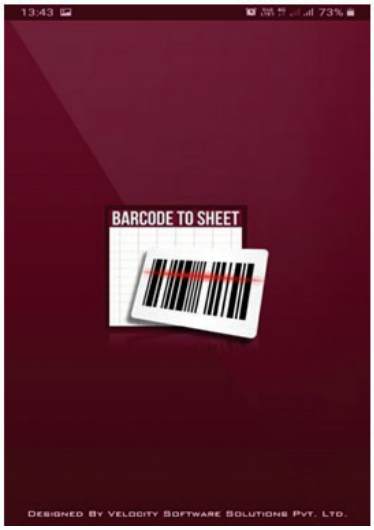

Figure 1. Barcode to sheet app.

6.2 Creating the Sheets

The app's home page allows the creation of sheets, and the free version allows the creation of sheets with 20 columns. Multiple sheets can be created to assign them to multiple staff so that the work can be done simultaneously. The home page has the option to create a new sheet and shows the various sheets created in the apps (Fig. 2). This allows users to create customised forms and save the data in standard formats such as CSV, XML and XLS. Creating a new sheet requires a sheet name and column names (Fig. 3). Effortless capturing of the details of the books (in libraries) can be done through barcode.

Figure 2. Home page.

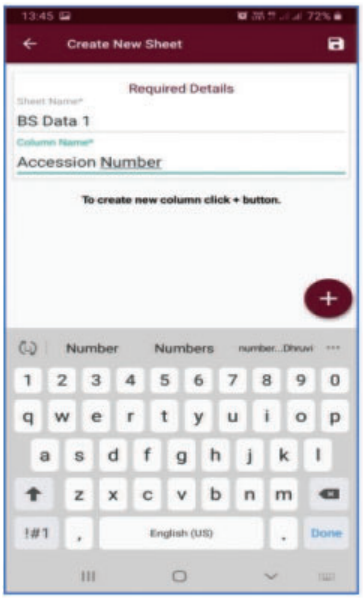

Figure 3. Creating a new sheet.

6.3 Capturing of Data

The app asks for the camera's permission to scan the barcode. It also has a save button to save the records (Fig. 4). During the experiment, the staff captured the accession number of the books using the app. The remark was also added for some books where it was needed (Fig. 5). The app does not require an internet connection; hence, it came off very handy in the stack area, where network connectivity strength is usually very poor.

6.4 Saving the Data

The app allows the export of the captured data, which can be further compiled and used to make records on the computer. The data can be emailed or stored in the device. The app supports different standard format of data like, CSV, XML and XLSX (Fig. 6). The captured data

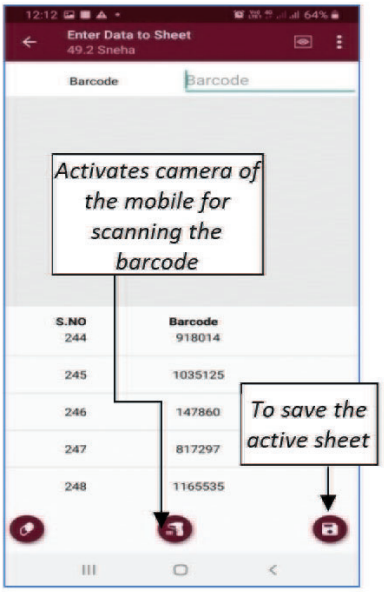

Figure 4. Data capturing.

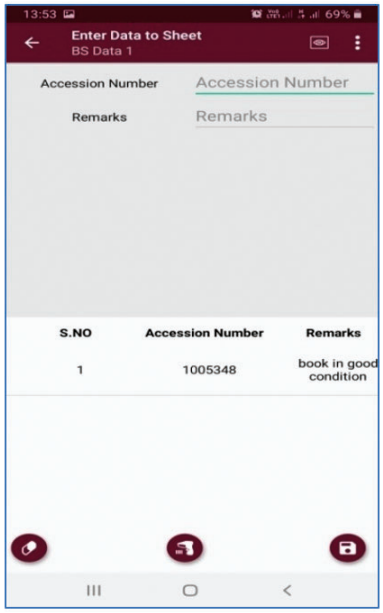

Figure 5. Capturing the data and adding remarks.

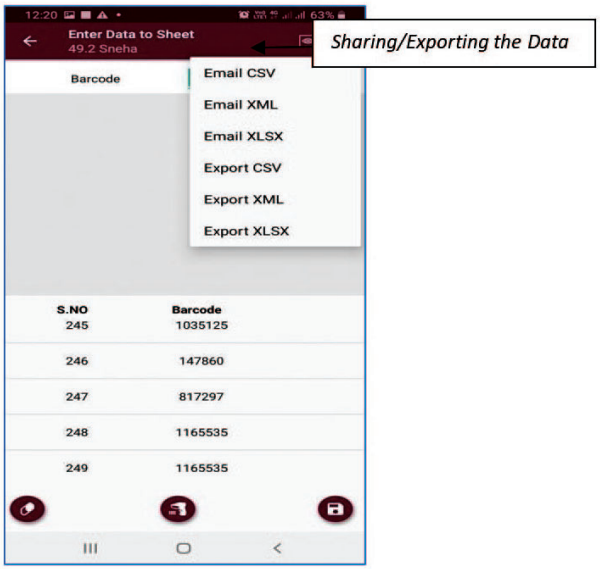

Figure 6. Exporting data.

of the accession numbers in the stack was saved as an Excel file on the mobile device during the experiment by each staff. The standard nomenclature to save the file is *[staffname_date]*. These files were then transferred to a computer in excel format. The data in excel format was then screened for errors and consolidated date-wise to understand the level of workload on each staff.

7. OBSERVATIONS AND IMPLICATIONS OF THE STUDY

The collected data was consolidated month-wise as well as staff-wise as represented in Table 1 and Table 2 respectively. After analysing the data, the following observations were realised:

Table 1. Data collected for re-shelving (month wise)

Month	No. of books re-shelved	No. of books consulted within premise
Jan	2697	329
Feb	3105	432
Mar	2146	543
April	1932	137
May	1396	108
Jun	1294	87

Table 2. Staff-wise re-shelved data

Month	Number of books re-shelved			
	Staff A	Staff B	Staff C	Staff D
Jan	765	516	679	737
Feb	618	752	906	829
Mar	417	454	873	402
April	454	521	545	412
May	367	318	487	224
June	254	310	423	307
Total	**2875**	**2871**	**3913**	**2911**

Table 1 provides insights into the daily average activity of staff regarding the re-shelving of books. It reflects the monthly number of documents re-placed on the shelves by staff. The data shows that staff typically re-shelve an average of 50 to 80 books daily (this excludes the shelf reading and rectification activity performed by the library staff). It also depicts that a good number of books are consulted, which students prefer to read within the library rather than get issued. Users consult nearly 10 % of the book stack collection within the library premises.

Table 2 provides a monthly breakdown of the number of books re-shelved by different staff. Every month, the records were reviewed, and the re-distribution of work was done. The staff were given a minimum target of 500 documents to be re-shelved monthly.

Accession numbers that appear multiple times are deemed more valuable and pertinent for users. Books on literature and history and volumes on notable personalities are frequently consulted within the library's premises.

This study suggests that the most used collection of the library can be identified not only through the circulation record but also from the books consulted within the library premises. The number of books re-shelved is important data to record the usage of the library collection, identify the number of staff required in the book stack and for the purpose of staff appraisal.

A replaced book demonstrates that the users have some interest in the given title. These statistics of the re-shelved books are more comprehensive and effective in realising the strength of the collection and its development.

This method can be very effective in inventory management and stock verification in a library without closing down the library services. However, the app should be connected to the library database, for which good internet connectivity will be a prerequisite for effective inventory management/stock verification.

8. ISSUES/CHALLENGES REGARDING THE PROCESS

Some of the issues reported by the staff during the data capturing process are listed below:

1. Poor Lighting: At some places in the book stack, the mobile app took longer to scan the book because of poor lighting.
2. Issues related to Barcode Label:

• Poor pasting: If the barcodes are not properly pasted and, thus, have a wrinkled surface, the captured information will result in some random absurd numbers rather than the actual accession number.

• Error in Accession Number: Error in accession number due to wrong data entry, improper accessioning, or technical processing of book. The barcode was matched with the manual accession number that is earmarked on the title page of the books at the time of technical processing of the book. Any error was reported to the technical section for further rectification.

• Mistype: During scanning through mobile, a character/ number were added/ deleted automatically or due to an unwanted swap of the finger by the staff while handling mobile phones to capture data. This resulted in absurd digits of the barcode which an alert staff could identify immediately but many times such errors could be identified only at the time of data sorting.

3. The free version does not permit importing the data.
4. Frequent scanning affects the performance of the camera of the phone.

It is to be noted that it will take less time to scan and record the data of re-shelved books if the books returned at the circulation desk can be separated from the books consulted within the premise. The data on the books returned at the circulation counter can be easily collected from the library management software solution.

However, in the present study, the library's policy does not mandate to re-shelve the returned books before making them available for issue; hence, users can often get the books re-issued immediately from the circulation counter. Thus, the returned book in such a scenario is actually not re-shelved by the staff. This is why the detail of the books returned from the library database was not considered in the process. Also, the circulation data will not help calculate the amount of effort put by each staff in the re-shelving of books.

9. BENEFITS OF USING A MOBILE-BASED APP

- The present process was quick and fast to gather the information regarding the number of books re-shelved daily in the book stack.
- The captured data could be saved in standard CSV, Excel, or XML formats. They can be instantly shared through email, WhatsApp and other applications.
- The app works without an internet connection. Also, using a mobile-based app excludes the requirement of a desktop/laptop and infrastructure for power supply during data capturing. This comes off very handy in carrying out the data-capturing task within the often congested aisles of the stack.
- It is much more convenient to carry a mobile phone than a handheld barcode scanner, which requires it to be attached to a computer. Portability is the biggest advantage of using mobile-based apps in carrying out inventory management activities.
- A mobile based app is an economical and environment friendly sustainable option to record the statistics in comparison to using a laptop/desktop with a handheld scanner or capturing the data manually on a register.

10. CONCLUSION

Book stacks are often referred to as step-children of libraries[37] and are considered a non-glamorous entity[38]. Every aspect of the stack remains the furthest thing in comparison to other sections of the library. The

continuous effort of the staff in keeping the book in its right place is considered menial in comparison to those engaged in other technical jobs of the library. Many fail to recognise that a well-arranged stack is crucial for smooth library services and has direct implications for a library's user services.

The present work was instrumental in many ways. First, it facilitated to understand the workload of each staff and redistribute the work accordingly. Second, the statistics for the books consulted within the library premise were also recorded apart from the books that are issued to the patrons/users. Hence, a more comprehensive view of collection development could be undertaken. Third, mobile devices deserve a big "yes" because of the convenience of conducting this study within the narrow and congested lanes/aisles of the book stack. Mobile apps have been playing an increasingly important role in the evolution of libraries, making services more accessible and convenient for library users. Mobile apps would be revolutionary for libraries, especially for time-consuming and labour-intensive tasks like stock verification without disturbing routine services. The future libraries will see embracing mobile technology as a sustainable option for libraries by making services more accessible, embracing digital resources, and fostering a more engaging and user-friendly experience for patrons/users.

During the study, it was realised that though several mobile apps exist for various library services, there is no standardised way to select one for the library. The libraries must have a standard set of guidelines for selecting an app for library services which ensures long-term support with frequent updates to comply with the rapidly changing Android software and provisions for customization. Also, library professionals must acquire relevant skills to understand, operate and modulate mobile apps to improve their library services[39-40].

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