

Research on Intelligent Self-service Borrowing and Returning Service in University Libraries

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Abstract: With the development of mobile Internet, Internet of Things and artificial intelligence technology, university libraries at home and abroad have gradually realized the digitization and management automation of resources. In this paper, the current situation, development trend, technical characteristics and application scenarios of self-service borrowing and returning of books are studied, in order to provide useful reference for improving the service efficiency, security, intelligence and reader experience of university libraries.

Keywords: Smart Library; Internet of Things; RFID; Smart Self-Service Borrowing and Returning

1. Introduction

The importance of the self-service borrowing and returning system of university libraries in China's university libraries cannot be ignored. The self-service borrowing and returning system can improve the service efficiency, security and user satisfaction of the library, which is an important symbol of the modern development of the library. Therefore, the research on the current situation, development trend and importance of the self-service borrowing and returning system of university libraries in China, through the implementation and performance analysis of the intelligent self-service borrowing and returning system of university libraries, the discussion of system architecture, module division, key technologies and other aspects, provides a reference for the subsequent system design and implementation, and is of great significance for the information construction of university libraries.

2. The Importance of Library Self-Service Borrowing and Returning Service to the Development of University Libraries

2.1 The Current Status of Library Self-Service Borrowing and Returning Services

The current digital library technology, the digital library application system in a narrow sense, only contains the effective management method and software platform for digital resources, and for the collection and circulation services of books, it is currently dependent on the traditional manual way to achieve, which is inefficient and the staff labor intensity is high.

With the popularization of computer technology and the advancement of information technology, domestic university libraries have begun to introduce self-service borrowing and returning systems, and gradually promote them. In the early days, the self-service borrowing and returning system mainly used barcode technology, and with the advancement of technology, domestic university libraries gradually introduced advanced technologies such as RFID technology and face recognition technology[1].

2.2 The Development Trend of Library Self-Service Borrowing and Returning Services

2.2.1 Intelligent development

With the continuous development of artificial intelligence technology, the self-service borrowing and returning system of university libraries will be further intelligent in the future. For example, natural language processing technology is introduced to realize the speech recognition function of the self-service borrowing and returning system; machine learning technology is used to analyze readers' borrowing and returning behaviors and provide personalized service suggestions.

2.2.2 Mobile Internet development

The development of mobile Internet technology has brought new development opportunities for the self-service borrowing and returning system of university libraries. For example, the mobile

Internet is used to realize the remote operation of the self-service borrowing and returning system to improve the borrowing and returning efficiency of readers. At the same time, the mobile Internet technology also provides convenience for the data statistics and analysis of the self-service borrowing and returning system of the university library.

2.2.3 Safe development

The security of the self-service borrowing and returning system in university libraries is of paramount importance. In the future, the self-service borrowing and returning system of university libraries will make more efforts to ensure data security and equipment security. For example, encryption technology is used to protect readers' information and improve the security of the self-service borrowing and returning system; at the same time, strengthen the maintenance and management of the self-service borrowing and returning system to ensure the normal operation of the equipment.

2.3 The Importance of Library Self-Service Borrowing and Returning Service to the Development of University Libraries

In the new era, the self-service borrowing and returning system of China's university libraries has developed rapidly. Many libraries have begun to adopt self-service borrowing and returning systems and have added mobile applications and big data applications, so that readers can recommend book selection, borrowing and returning books based on the reading big data graph anytime and anywhere. In addition, some libraries have begun to adopt facial recognition technology, making it easier for patrons to borrow and return books. The importance of the self-service borrowing and returning system of university libraries in China's university libraries is self-evident. First of all, the self-service borrowing and returning system can improve the service efficiency of the library. Through the self-service borrowing and returning system, readers can complete the process of borrowing and returning books independently, without waiting in line, which greatly shortens the waiting time and improves service efficiency[2]. Second, a self-service check-and-return system can improve the security of the library. Through the self-service borrowing and returning system, readers can borrow and return books on their own, reducing the possibility of human error and damaging

books and improving the safety of the library. Finally, a self-service borrowing and returning system can improve reader satisfaction. Through the self-service borrowing and returning system, readers can borrow and return books more easily and quickly, reducing waiting time and queuing time, and improving reader satisfaction.

3. Deficiencies in the Current Self-Service Borrowing and Returning Services of the Library

The library self-service borrowing and returning system is an important innovation in the library field in recent years, providing readers with more convenient and efficient services. However, with the continuous development of technology and the increasing demand of libraries, there are still some problems and challenges in the library self-borrowing and returning system, which need further research and exploration[3]. For example, the ease of use and user-friendly design of the self-service borrowing and returning service in the early stage are not enough; Lack of data statistics and analysis capabilities, no data mining and learning recommendation mechanism, unable to give learning graphs and recommend relevant books and resources according to users' borrowing history and interests; The reliability, stability and security are not high, and in practical applications, the system may crash, suffer data loss and other phenomena, and may face the risk of malicious attacks. Lack of system compatibility and scalability.

4. Intelligent Self-Service Borrowing and Returning Services Promote Digital Libraries To Be More "Smart"

With the development of emerging technologies such as the Internet of Things, big data, and artificial intelligence, the research on library self-service borrowing and returning systems needs to further integrate these emerging information technologies to achieve more efficient and intelligent services and further improve the user experience.

4.1 The Concept of "Smart" Services in Libraries

"Smart library" is a new type of library operation mode that uses a new generation of information technology such as the Internet of Things, cloud computing, and big data to associate various elements such as library buildings, library

equipment, paper collections, digital resources, users, and librarians to achieve comprehensive interconnection, so as to provide humanized, professional and intelligent services and management efficiently and quickly, and finally realize digital management and intelligent services[4]. It is an organism based on book resources, supported by information technology, serving readers as the core, and interacting with each other between business flows, data flows and service flows, it has the dual characteristics of the Internet of Things and digital libraries, with the characteristics of comprehensive perception, co-construction and sharing, ubiquitous services, and interconnection.

4.2 Intelligent Self-Service Borrowing And Returning Service Is an Important Part of the Library's Move Towards Intelligence

With the continuous development of radio frequency technology (hereinafter referred to as RFID technology) and its effective cost control, the perceptual self-service borrowing based on RFID technology will also be more and more in-depth in the application of intelligent construction of the library, and RFID technology has established a scientific and technological application direction for the intelligent library of paper book resources. At the same time, combined with the intelligent recommendation system based on the data mining mechanism, relevant books and resources are recommended according to the user's borrowing history and interests, so as to improve the user's reading experience and satisfaction, and provide an intelligent one-stop service ecosystem of knowledge resource libraries for broadening students' knowledge, enhancing their learning adaptability and improving their innovation ability[5].

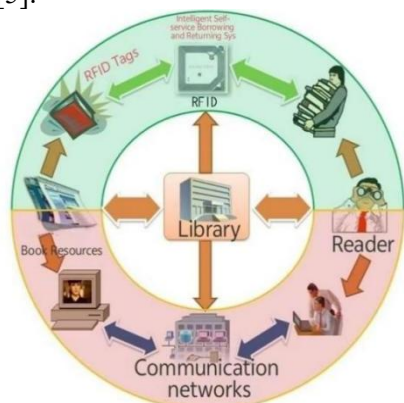


Figure 1. Library's Intelligent Self-Service Borrowing and Returning Service

5. The path of Library Self-Service Borrowing and Returning Service To Improve the Level of "Intelligence"

The intelligent self-service borrowing and returning service of the library is mainly reflected in the efficient, convenient and intelligent self-service borrowing and returning service of the library, which can effectively improve the service efficiency and user experience of the library, reduce the management cost of the library, and improve the transparency and intelligence level of the library.

5.1 Improve the Intelligent Level of the System

5.1.1 Strengthen the ability of systematic self-learning and optimization

The library self-service borrowing and returning system needs to have certain self-learning and optimization capabilities, so as to automatically adjust the system parameters and functions according to the user's usage and feedback, and improve the intelligent level of the system.

5.1.2 Strengthen interconnection with other systems

The library self-service borrowing and returning system needs to be interconnected with other systems, such as the reader's personal information system, the library resource management system, etc., so as to realize the sharing and exchange of data and improve the intelligence level of the system.

5.1.3 Strengthen the application of artificial intelligence technology

The library self-service borrowing and returning system can use artificial intelligence technology, such as machine learning, natural language processing, etc., to achieve more intelligent services. For example, natural language processing technology can be used to realize speech recognition and voice interaction functions to improve the user experience.

5.2 Strengthen the Ease of Use and Humanized Design of the System

5.2.1 Optimize the user interface of the system

The library self-service borrowing and returning system needs to have a user-friendly interface that allows users to quickly complete the borrowing and returning operations and improve the user experience.

5.2.2 Provide personalized service

The library self-service borrowing and returning system can provide personalized services, such

as recommending relevant books and literature according to the user's borrowing history and preferences, so as to improve the user experience.

5.2.3 Strengthen the user feedback mechanism of the system

The library self-service borrowing and returning system needs to establish a user feedback mechanism, collect user feedback in a timely manner, and improve and perfect user feedback to improve the user experience.

6. The Construction Mode of Intelligent Self-Service Borrowing and Returning Service Systems in University Libraries

6.1 Build an Integrated Management Platform for Paper and Electricity and Provide Data Resource Support

The platform should adopt a service-oriented, multi-user, cloud computing environment library management integration system, a unified collection and editing module to manage paper resources, electronic resources and digital resources, support the integrated resource management of paper and electricity, including traditional paper resource management, electronic resource management, and digital resource management, support MARC/Dublin Core and other metadata standards, and provide standard APIs to ensure openness[6]. The overall presentation of a professional and complete electronic resource life cycle management, the management process supports the analysis of resource security, which can not only count the total amount of data of each literature type, but also can be counted separately according to different disciplines or different database providers, so as to better and more efficiently grasp the resources of the library.

6.2 The Application of RFID Tags to Improve the Efficiency of Book Utilization

6.2.1 The combination of RFID technology and library management

Radio Frequency Identification (RFID) is an abbreviation for Radio Frequency Identification. Its principle is that the reader and the tag carry out contactless data communication to achieve the purpose of identifying the target. Taking RFID tags as the identity of books, due to their accessibility (relative), non-directionality, non-contamination and high speed, is the most fundamental factor that distinguishes the RFID

library system from the traditional library application mode[7]. The library that adopts the RFID tag system will greatly simplify the borrowing and returning process of books, so that the borrowing and returning rate of books can be strengthened, so that the number of circulations of books at the same time can be increased, and more readers can be served, which improves the utilization efficiency of library books, and also means that the return on investment of the library is improved, and the self-service of readers can be realized.

6.2.2 RFID book tag positioning is fast and convenient, and the book can be found quickly With the application of RFID tags, each shelf of the library is also encoded and associated with the books placed on the shelf, the rapid and accurate positioning of the book can be realized; through the reading of the RFID tag, the location of the book can be located in a very short time; and further associated with the management system of the library, the borrowing status of the book is queried, the intelligent perception and positioning of the library collection are realized, and the efficiency of book borrowing is improved.

6.3 Self-Service Borrowing and Returning Service Data Resources Are Connected with the Digital Library Platform To Provide Personalized Smart Services

Through the mobile reader comprehensive service system platform, mobile phone borrowing, transfer, renewal, and search can be realized; readers can quickly query the specific location and basic information of the book through the three-dimensional positioning system of the book; and through the SIP2 interface, the data communication between the RFID self-service borrowing and returning intelligent system and the library book management system is realized. The use of big data analysis and mining technology makes all kinds of knowledge data of the library be effectively aggregated, according to the comprehensive score and user portrait of the popular recommendation and personalized recommendation database, books and other information, supporting the library resource guarantee, life cycle, procurement, borrowing, resource utilization, scientific research services, user behavior, operation logs and other statistical analysis, generating analysis reports, and data output. In addition, it provides personalized

intelligent paper reading push and customized services, forms a convenient self-service borrowing and returning service, improves user satisfaction, and makes the library's personalized intelligent service reach the best level.

7. Design and Implementation of an Intelligent Self-Service Borrowing and Returning System for Colleges and Universities

The system includes a unified collection and editing module to manage paper, electronic and digital resources; Support for more metadata standards such as MARC/Dublin Core; With standard APIs to ensure openness, built-in analysis functions and process management functions, it provides a data repository (central knowledge base) for resource management on this basis, and provides data resource support for the operation of smart libraries, including various collection data and operation data.

7.1 Paper-Based Resource Management System

The basic functional modules include: resource interview, resource management, and resource collection module.

7.1.1 Resource interview

The resource interview module needs to include booking management, order management, receiving and post-receipt processing, the journal module, import management, supplier management, etc. Among them, the intelligent selection module can provide the library with a full network of books, and keep the books automatically updated every week. According to the publication time, publishing house, discipline and other conditions, the library can screen the bibliography on the platform, form the result book list, and order or export the book list. In the screening process, based on big data technology, the platform evaluates the selected bibliographies one by one according to the academic influence of the bibliographer and the authority of the publisher, and analyzes each bibliography to generate a resource portrait, which the library can use as reference data to quickly complete the batch intelligent selection of high-quality bibliographies.

7.1.2 Resource management

The resource cataloging module needs to support a variety of international and domestic cataloging standards, such as CNMARC, USMARC, DC, DCTERMS and standard

MARC metadata support. Retrospective cataloging or acceptance cataloging, selecting a system template or setting a custom template, achieve multilingual cataloging.

7.1.3 Resource collection module

The resource collection module should have the functions of new book allocation, inventory allocation, rejection, scrapping, and single volume processing. If there is a record of recommending new books on the shelves, the recommenders will be notified first, so as to ensure that the recommenders know the situation of the books on the shelves as soon as possible.

7.2 Three-Dimensional Positioning System for Books

The three-dimensional positioning system (3D navigation system) provides readers with a specific and visual three-dimensional map to guide readers when consulting books, so that readers can quickly find the corresponding area and the physical bookshelf location where the book is located, query the detailed information of the book, and graphically display and locate the location of the bookshelf. The system can display the shelves of each single layer in detail in the form of 3D technology, associate the book shelf information with the single book information, update the position information of the single volume, and provide the system query display[8].

Quickly locate the bookshelf according to the classification in the picture, and you can quickly locate the bookshelf by the bookshelf number. By retrieving books, identifying the books on the shelves, all the books on each shelf, using the cover display, simple and intuitive, including: popular borrowing, number of books, number of borrowings, new volume, etc.; Each book can also identify the number of collections, clicks, historical borrowings, current borrowings, and copies; Through the circulation index of the collection, the popular books are analyzed, and the company's smart purchase recommendation system is linked to provide the purchase of related books.

7.3 Reader Service System

Reader services include reader management, circulation and lending, reading management, resource requests, etc. It can add, modify, and cancel readers in batches, and realize the management of readers' borrowing aids, including library cards and auxiliary cards.

Provide reservation and entrusted borrowing, document delivery, and support various reservation and entrusted borrowing methods. The use of a multi-purpose integrated service all-in-one machine to provide more convenient self-service for readers in the library. Connected

to the library management system through SIP2 or NCIP protocol, readers can complete library card borrowing, book return, inquiry, withholding, receipt printing, library inquiry, e-book borrowing and other operations on one device.



Figure 2. 3D Positioning of Books



Figure 3. Digital Virtual Bookshelves

7.4 Data Center Systems

In addition to paper book resources and borrowing and returning data, the data center can also integrate other electronic literature resources of the library, give full play to the library's rich resource advantages and information service capabilities, and provide a strong resource guarantee for the school's teaching work. Record and integrate readers' behaviors in detail, and comprehensively analyze readers' usage. Relying on advanced big data prediction technology, through data mining and algorithm design, a smart library service system is comprehensively constructed, combined with intelligent hardware equipment, to establish the connection between users and data, and to provide more convenient and fast personalized services for teachers and students

of the school.

The data center does not generate or consume data, but only stores the data of different business systems in the library for the display of corresponding data analysis dimensions. At the same time, according to the statistics of resource utilization analysis and statistics, the usage data, visits, and other usage data from the aspects of discipline use, search terms, etc., can see the specific resource utilization rate, and according to this conclusion, the resource utilization rate can be improved in a targeted manner, so as to meet the needs of readers for intelligent and personalized services.

7.5 Intelligent Customer Service Applications

The intelligent customer service application is a closed-loop system that continuously collects feedback data with terminal applications

supported by natural language processing (NLP), natural language understanding (NLU), speech recognition, machine translation, image recognition and other technologies in the field of AI. In the service of intelligent customer service, it can not only automatically answer high-frequency frequently asked questions, but also automatically learn new problems according to user behavior and habits, helping colleges and universities to achieve intelligent human-computer interaction, effectively reducing labor costs and improving service quality.

8. Conclusion

To sum up, the library self-service borrowing and returning system needs to continuously improve the level of intelligence, strengthen the security and reliability of the system, and strengthen the ease of use and humanized design of the system, so as to promote the further development of the library self-service borrowing and returning system. At the same time, it is also to put forward enlightenment and suggestions for related fields to promote the innovation and development of information technology in university libraries.

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