

Research on RFID Assisting the Intelligent Construction of University Library Information Resources

Lu Yanxiang

The Library of Jianghan University, Wuhan, 430056, China

Abstract. The application of RFID technology is growing fast in university libraries, mainly reflected in self-help borrowing and return, literature navigation, book inventory. Based on the application practice of RFID in Jianghan University Library, this paper explores the path and method of applying RFID technology in the intelligent construction of literature resources in university libraries, such as readers profile, resources profile, co-construction and sharing. RFID (Radio Frequency Identification) is a kind of non-contact automatic identification technology. It realizes data exchange and automatic identification of targets by non-contact data communication and reading and writing by sending and receiving radio frequency signals and electronic tags. Unlike traditional barcodes based on optoelectronic principles, RFID tags do not require manual operations, but use wireless frequency communication for automatic identification, tracking and management.

1 RFID TECHNOLOGY IS WIDELY USED IN UNIVERSITY LIBRARIES

RFID tags not only have automatic identification function, but also have surveillance function. When books are lent out, the special EAS (electronic article surveillance, also known as electronic commodity surveillance system) or AFI (EPC simulation if RFID Electronic tag does not have special EAS bit, EAS can be simulated with 1 or more data bits in EPC area or user data area.) security bits of RFID electronic tags are modified for security detection.

According to the "2019-2025 China Library RFID Industry Market In-depth Research and Investment Prospect Analysis Report" released by Intelligence Research Group, the size of China's library RFID market in 2017 was 493 million yuan, and the size of China's library RFID market in 2018 was increased to 937 million yuan, and the annual development rate doubled. With the development of RFID technology and the establishment of standards, the cost of RFID tags is further reduced, and the application of RFID technology in libraries is more convenient.

RFID technology has been widely used in university libraries, such as self-service book borrowing and returning, book shelving, self-checking, document navigation, intelligent recommendation, etc., which accelerates the circulation speed, improves work efficiency, increases the security of books, and improves the users' online and offline learning and reading experience. RFID has changed the

traditional lending service and management mode, and effectively improved the operational efficiency of business management.

2 RFID EMPOWERS THE CONSTRUCTION OF LITERATURE RESOURCES IN UNIVERSITY LIBRARIES

The application of digital technology in different smart scenarios continues to be iteratively upgraded, and the application of RFID technology drives library management from automation and intelligence to self-service and intelligence.

2.1 The practice of library application of RFID in the process of resource construction

The five-year practical results of RFID application in Jianghan University Library show that the position of the electronic label, the thickness of the book, the material of the front cover and the back cover all have a certain influence on the reading rate of the label. Electronic tags close to the spine of the book are usually read, but tags close to the places where books are opened or far from the spine are not always read, and the thickness of the book has a negative impact on the read rate of the readers. The metal material of the front cover and back cover will make the electronic label in the book unreadable. The book needs to be opened and placed on the label reader to identify or paste the electronic label on the outside. The anti-signal interference ability of UHF electronic tags is low.

The effective service life of RFID book labels is ≥ 10 years, and the effective number of erasing and writing is $\geq 100,000$ times. However, during the use process, the electronic label will be damaged, and the non-damaged label may need to be replaced after 10 years due to aging. The library of the Max Planck Institute for European Legal History in Germany uses an RFID tag system with a service life of up to 40 years to manage historical documents. If the service life of the RFID tag is long enough, it can cover the complete life cycle from the beginning of book publishing and printing to booksellers, to the libraries, and to the readers. The impact on the construction of library resources can be from procurement to cataloging to readers' use, and there is no need to repeat the compilation of data.

In the RFID system used by the Jianghan University Library, the book reading ability of the librarian workstation is ≥ 5 books/time, and the response speed is ≥ 8 tags/second. During the application process, due to the interface problem with the library's document management system (Huiwen system), the actual conversion speed is slow, the average conversion speed is ≥ 5 seconds/book, and the local RFID storage will lose data, resulting in low efficiency of the connection and conversion of bibliographic data and collection data between the Huiwen system and the RFID system.

2.2 RFID-enhanced literature resource visualization

In the traditional library OPAC system, readers can search for books through OPAC, and the system will display the floor and specific reading room where these books are located, but the exact location of the books cannot be displayed in the system. The collections of Jianghan University Library are

subdivided and arranged by the Chinese library classification system, and readers need to spend a lot of time finding books through static maps. We connect spatial information with data from OPAC and RFID, link bibliographic information with spatial information elements such as reading room layout, bookshelves, shelf labels, etc. The interface visually displays the bookshelf position of each book, and provides accurate positioning and visual display of the position of each book. Readers can obtain the exact bookshelf position of a book through the OPAC system and obtain the route navigation and VR augmented reality, so we provide readers with an immersive reading experience.

2.3 Reader portrait based on RFID data analysis

RFID technology has changed the information environment around the library, and also changed the interaction between library readers and literature information. RFID circulation data can directly drive purchasing decisions. If the circulation times are more than N times of the average circulation number according to the readers' borrowing data, the circulation copies will be automatically recommended to the purchaser. By collecting behaviour data such as readers' borrowing and inquiry, borrowing labels, such as the category of books borrowed, borrowing frequency, renewal times, etc., combined with reader labels, such as gender, age, region, income, educational background, occupation and other information, the reader portrait is carried out. According to the interests of readers, or by referring to the data of similar reader groups, the target construction of literature resource diversification is driven. The RFID smart library data management platform of Jianghan University Library monitors and manages the running status and data of all equipment such as RFID self-service equipment, access control systems, and librarian workstations, and it realizes the seamless connection between the access control system of Jianghan University library and the big data analysis of the reader flow, reading habits and book demands of the smart wall system.

3 INTELLIGENT CONSTRUCTION PATH OF LIBRARY LITERATURE RESOURCES BASED ON RFID APPLICATION

3.1 Strengthen the standardization construction and realize the co-construction and co-sharing of literature resources

With the application of RFID in the library, real-time communication is required between the library's original document management system and the RFID system for information exchange. Frequent links and data calls between the two systems can easily lead to slower running speeds. It is easy to make the dual system run slowly. Effective integration and integration between systems are required.

According to the working frequency of RFID, the RFID system can be divided into low frequency, high frequency, ultrahigh frequency and very high frequency. At present, high frequency is generally used in public libraries in the domestic library circle, and ultrahigh frequency is used in most university libraries. As of 2015, a total of 342 libraries across the country have applied RFID systems, of which 243 are public libraries, and 72.38% of libraries have used high frequency RFID. The main basis for public libraries to select RFID frequency bands is a "radiation effect" of local libraries, or regional

sharing. The ultrahigh frequency system of Jianghan University Library cannot be compatible with the high frequency system of Tanghu Library, and the literature resources of the two libraries cannot be co-constructed and co-shared. The open cooperation based on the high quality cultural resources of the library still needs to be further expanded. Focusing on the construction, maintenance and management of the business, data, services, technologies and products of the smart library, we will establish a relatively complete standard and specification system, mainly including basic standards, resource standards, service standards and relevant business specifications, build a unified, open, collaborative and shared knowledge aggregation, storage, distribution, utilization and operation mechanism, cultivate a collaborative and shared environment for literature and information resources, and establish the new type of sustainable library resources.

3.2 Resource portrait combined with RFID data analysis

Based on the utilization of literature resources collected by the RFID system, according to the dynamic operation data such as book borrowing, browsing, and querying, special analysis is carried out on subjects, topics, responsible persons, publishers, etc., and different weight indicators are assigned to different parameters (Figure 1). This constitutes the basis for scoring resource portraits. Combined with parameters such as collections, funds, disciplines, etc., we used big data mining and machine learning to evaluate the incoming subscription data. And through the resource portrait scores, purchasers can sort the scores and filter out certain score segments, filter out books with low scores, and provide intuitive and clear data support for the construction of literature resources such as procurement analysis and collection allocation. Resource portraits provide accurate and detailed selection basis for literature procurement, reduce the workload of procurement personnel for book selection, and improve the accuracy of book selection. Based on big data analysis, users' purchasing behaviour can be analysed in real time, and the weights and coefficients of various analysis indicators can be adjusted continuously through machine learning, so that the score of resource portraits is more in line with user needs and books collection construction.



Fig. 1. Example diagram of resource profile parameters and weight indicators.

Combining reader portraits and resource portraits, a decision-making model for document resource procurement is constructed. Through in-depth analysis of discipline guarantees and reader behaviour, it provides factual and intelligent data support for the construction of library document resources.

3.3 Improve the efficiency of literature resource management

By scanning and inventorying the books on the shelf in different time periods, comparing the inventory results, analysing the information of the books on the shelf, utilization, and loss, it is regarded as a supplement to the book circulation information, and it provides a reference for the decision-making of books collection adjustment and the formulation of purchasing strategies. With regard to the collecting and recording the data of readers' usage habits, for example, through the RFID book slot of the smart bookshelf, it can sense whether the books on the bookshelf have been moved or not; By dragging and dropping the stream computing component, arranging the flow computing tasks, completing the data analysis and processing, it can intelligently discover the themes and key areas that readers use and pay attention to, as well as the reading characteristics of readers of different disciplines, grades, gender and other groups. We scientifically plan the annual budget for the purchase of literature resources in combination with the business data of readers. We arrange the literature of different disciplines according to the data, carry out the collection layout and spatial planning, so as to achieve multi-dimensional, intuitive and clear decision support.

4 CONCLUSIONS

Library mobile applications are the fastest growing area of library services, and the widespread application of RFID in libraries makes the library a fragment of a "smart city", which can be regarded as a light transition from offline to online. The current application of RFID in Jianghan University Library is still in the stage of "weak artificial intelligence" for self-service book borrowing. The library also needs to apply technical means to further improve the management level and service efficiency, so as to make the construction of document resources more high-quality, fine-grained and intelligent.

5 ACKNOWLEDGMENTS

This work is partially supported by the National Social Science Fund of "Study on the influence of university library", China (18BTQ002).

REFERENCES

- [1] Lu Yahong, Li Jing, Shi Xiaohua. Design and Construction of an Intelligent Collection Management System in the New Technology Environment. *Library Journal*,40(9): 48-53.
- [2] Ma Tianshu. Research on Précise Service of the University Intelligent Library. *Journal of the Library Science Society of Sichuan*, 2021(5):34-38.

- [3] Zhang Jing. Design of Library Bibliography Intelligent Management System based on Internet of Things. *Techniques of Automation and Applications*, 41(3):109-112,127.
- [4] Williams, Carole. Delivering: Automated Materials Handling for Staff and Patrons. *Information Technology & Libraries*, 40 (3):1-3.
- [5] Abcouwer, Kasper; van Loon, Emiel. Library Inventory using a RFID Wand: contribution of tag and book Specific Factors on the Read Rate. *Library Hi Tech*, (39) 2,:368-379.