

Application and Management of RFID System in Libraries

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Abstract—RFID(Radio Frequency Identification)technology plays more and more significant role in library management system. As a core component, how to connect it to Intelligent Library Management System successfully is very important. Using the methodology of case analysis, based on investigations of three libraries and practices of one library, this study concludes some useful points on the application of RFID technologies in libraries, such as what kind of glue is better, where to affix tags, qualifications of managers, how to convert data, how to connect to self-services machines.

Keywords—RFID; intelligent tags; application

I. INTRODUCTION

As one of the ten technologies to impact social development, RFID (Radio Frequency Identification) has broadly been used in many fields globally. The application of RFID technology has brought new challenges to development of libraries. As a non-contact automatic recognition technology, it automatically identifies target objects and obtains relevant data through radio frequency signals. Been a latest kind of electronic label, it has many advantages that barcode does not have, such as relative long reading distance, support for fast reading and writing, multi-target recognition, ability to handle material without exception for video and audio, high-speed inventory and identify items which are out of proper order, and so on. Therefore, once RFID technology is applied to library, it will become a core component of Intelligent Library System. There are many mature and advanced RFID systems used in library in the United States, Singapore, Britain, Germany, Sweden, Switzerland, Japan, South Africa and other countries. In China, the library of Chengyi College of Jimei University in Xiamen, was the first to use RFID system in 2006. Then, Shenzhen City Library, Wuhan City Library, the National Library, Shantou University Library and so on had introduced RFID systems. These libraries got users' positive comments and met their demands through the applications of RFID systems, benefiting local communities a lot. Nowadays, many colleges and universities in Chengdu, Chongqing, Shanghai and other places have also introduced and used RFID systems, most of them getting excellent results.

The library of Yunnan Normal University planed to collect 5 million books. The current collection is more than 1.5 million books. At present, the library of main campus in Chenggong district has opened 8 book rooms, more than 800,000 books in circulation. Those books in urban campus of Kunming city will be gradually relocated to main campus library. So it is necessary to add new technology to improve management system and provide high quality services. The use of RFID in library can realize the functions of user self-service, high-speed inventory, quick lookup, positioning, and so on. What's more, it could open nearly 2000 seats in the library room for college students. Therefore, with an approval from the Yunnan Normal University, and supported by special committee, Yunnan Normal University library decided to build RFID system in stages. In order to address the problems that may arise during construction of RFID system, before the implementation of the project, a work group led by the curator and composed by directors of the digital department, circulation department, editing department and so on was set up, planed investigations to visit the three university libraries in Chengdu city that have already used RFID technology, namely University of Electronic Science and Technology of China, Xihua University, Chengdu Institute of Information Engineering, to lay a solid foundation for the introduction of RFID system and the concrete implementations of the project.

II. RESEARCH QUESTIONS AND ANALYSIS

This study concerns the following issues: (1)How to apply RFID system in library: self-service machines, book searching and positioning, security and anti-theft system, label conversion, smart bookshelves, and other common problems. (2) RFID equipments' installations and adjusting, connecting RFID system to old library management network, as well as other related problems. (3) How to upgrade books by RFID tags, such as pasting of electronic tags, how to dock new books with RFID systems, and other problems related.

Tags are core components of RFID system, which are placed on objects to be identified, composed of coupling elements and chips. Each tag has a unique electrical code, and storing a certain format of data about the object, playing same roles as barcode of scanning technology[1]. RFID electronic tags are very important to the construction of intelligent

libraries, which is the main point of this study. There are some advantages of applications of smart tags.

A. Saving Human and Material Resources, Improving Quality of Services

From bar code and magnetic stripe to RFID self-service system, the introduction of new technologies can not only improve efficiency of library, but also save labor power and reduce economic capital. At present, the library of Yunnan Normal University and other libraries use the "Barcode + Magnetic stripe" methods to improve quality of services. The use of RFID smart tags can realize user self-service functions, and can run more than one processing simultaneously, which is up to nine books, and do not have to degauss books, saving users' time. RFID self-service machines would automatically convert status of borrowed book to "borrowed" state, which would be detected automatically in and out of access control system, and unborrowed books would trigger security system[2]. Users return books by self-service machines, which would save a lot of time compared to traditional manual way. What's more, those books with electronic tags returned successfully will automatically be converted to status of "in library". In short, the applications of RFID smart tags are very convenient for library users, shortening time to borrow books, saving library's human resources.

B. Improve Efficiency and Quality of Management of Books on the Shelves, Convenient for Readers to Search Accurately

Electronic tags contain information of bookshelf number where a book should be located. Before being returned to bookshelves, books could be ordered according to bookshelf number information stored in book tags, and then be classified in groups according to numbers of bookshelves. In daily management, with handheld collector near bookshelves, those books in wrong positions would be detected and easy to be corrected. This error correction function is so powerful, which will greatly reduce workload of circulation department. At the same time, readers can quickly and accurately find the books they need by self-service machines according to specific bookshelf numbers.

C. Cost of Electronic Tags is also Gradually Decreasing, and Security is Constantly been Improved

In previous years, because of high cost of electronic tags, many libraries gave up plans to introduce RFID management system. Nowadays, the cost is gradually declining, at the same time, RFID technologies are more and more matured, electronic tags are thinner and safer. What's more, functional labels can reduce the loss rate of library books. In order to prevent books from being stolen, many libraries use barcodes to identify books, and it is necessary to affix magnetic strips on books for being detected by anti-theft detection system. By contrast, electronic tags not only contain identification information of books, but also can hold security information. Tags of those books being borrowed normally would be automatically marked as normal state, otherwise, when non-borrowing status of books were detected at a specific exit, RFID anti-theft system would automatically alarm[3].

In short, electronic tags have incomparable advantages compared to traditional "barcode and magnetic stripe" management model. As professor Ruoling Wang said, advantages of RFID intelligent tags include several aspects, such as updatable data, strong penetration ability of information reception and dissemination, high convenience for data recognition, large capacity to store information; reproducible, fast scanning for simultaneous reading of several materials, and strong safety and anti-pollution capabilities and durability[4].

III. ENLIGHTENMENT

For achieving successful operations of RFID intelligent system in libraries, the most important step is to do well in the application and management of tags. According to the three university libraries being investigated in this study, and what we get from the practices of YNNU library, we can conclude following enlightenments.

A. About Recruitment and Management of Personnel in Charge of Tag Affixing

In view of loss of books, the three university libraries as cases in this study have one point in common that they are doing their best to hire qualified workers outside campus. Enrolled students of their own campus are not considered. This is in order to keep tags positions unknown as long as possible, which could reduce loss of books. RFID tags are very vulnerable. Folding should be avoided as much as possible in order to protect tags. Clips in RFID tags have functions to store data. One book should be affixed only one tag. Otherwise multi-chips on one book could not be read by system. Those three university libraries have strict requirements of employed staff, and pay a lot of attention on supervision, in order to complete task of affixing tags with high quality and efficiency.

In view of quality of affixing, Xihua University set up a special working position of supervisor in charge of quality inspection and correction for work of personnel. Chengdu Institute of Information Engineering required collecting and editing staff to participate training programs of affixing tags, and to check sample work of tags affixed by employees. These experiences could be used for references by other libraries.

B. What Kind of Latex to Choose for Affixing Tags and Where to Affix on Books

Since acidic latex would cause corrosion, neutral latex is a better choice for tags affixing. The University of Xihua and the Chengdu Institute of Information Engineering are no longer brushing any other adhesives because their RFID tags are with glue.

In the case of University of Electronic Science and Technology of China, they use some strategy to prevent positions of tags being discovered. They brush neutral latex on the top and bottom of posting page to prevent affixed tags exposed. On the front and back pages of the posting page, latex is also brushed to cover up the real tag's real position. The location of RFID tags should be staggered with original affixed magnetic stripes' positions to avoid interference with

each other and leakage occurs. If a book is very thin, interfere may happen between electronic tags and magnetic needles, then original magnetic needle should be removed. The positions of tags differ between Xihua University and Chengdu Institute of Information Engineering. Permanent magnetic strips are retained for the sake of uncontrollable conditions in systems. Positions of permanent magnetic stripes and RFID tags should be staggered. Permanent magnetic stripes are affixed to the front upper end of books, RFID tags are affixed to the back lower end. The distances between tags and magnetic stripes are as big as possible to avoid interference with each other.

C. How to Ensure Libraries Provide Regular Service During Upgrading Period

This mainly includes two issues: the first, how to distinguish between books that have been pasted with electronic tags and those that have not been pasted; the second, how to ensure the management of books in the transition period from the old system to RFID system. The library of University of Electronic Science and Technology of China stamped tagged books to distinguish them from untagged books. During the transition period, it is necessary to affix both magnetic stripe and RFID tags to avoid losses of books. A specific area should be set to store untagged books returned from readers, being prepared to be upgraded.

During the transition period from tradition system to RFID, the practice of Chengdu Institute of Information Engineering is to process district or library room one by one. If one district has been upgraded, those untagged books returned from users would be dealt separately by workers or librarians.

D. Conversion of Data

For data conversion, different universities have different ways. Conversion of data was put on the last phase in University of Electronic Science and Technology of China. Data was converted by workers who were in charge of affixing. In Xihua University, Conversion of data was also in the last phase of processes, and preparatory work was done by outside employees, librarians were in charge to convert whole set of data. The key to assure correction of conversion of data was to arrange another worker to check out.

E. Statistics and Management of Processed Data

Since remuneration of outside personnel of service provider is based on number of tags affixed, it is possible for processing staff to post multiple tags on one same book for overstatement of workload, as well as for possible wear and tear during posting of tags. So salary should not be based on number of tags used. A new temporary fold should be set up for converted data, which is counted for remuneration. It is a bit tedious of the processing of books that cannot be converted due to incomplete data or errors. All rules of book-data recording of a library should be listed in detail when the contractor company is stationed, but it may also be found in the process of conversion of RFID system that data cannot be converted due to incomplete or incorrect data, then they should be sent to editing department immediately.

IV. CONCLUSION

The application of RFID system in libraries is a result of the development trend of library. Implementation of RFID system in library, is not only meaning self-service, high running efficiency, saving manpower and material resources, more importantly, in line with the development of society, it would meet needs of readers. With RFID, library could play more roles than traditional way.

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