

Library marketing with RFID for supporting learning patrons

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Due to rapid progress of ICT, our society is also changing rapidly. A huge amount of information is stored in the Internet servers and shared by all people. It is updated continuously. In such age, we are supposed to keep learning and libraries are supposed to support those people. In order to carry out such missions, libraries are trying to change themselves in order to provide better and up to date services to their patrons. In order to do so effectively they need useful information about which and in what way library materials are used by patrons. Thus marketing is very important for libraries as is for ordinary companies. The aim of this paper is to present the concept of library marketing with RFID (Radio Frequency Identification) technology together with discussing the importance of library marketing in the future libraries, and reporting about our preliminary experiment which intends to automatically collect data about how library materials are used by utilizing the RFID technology.

Keywords library marketing; RFID/IC tag; e-library; digital library; smart/intelligent bookshelf; data mining

1. Introduction

Thanks to the advancement of ICT (Information and Communication Technology), or the Internet, it becomes very easy for us to collect information anytime, anywhere. Now we live in the information society, where huge amount of information is shared by all of us and it is updated continuously and very rapidly. In order to survive in such a society, knowledge and information skill are very important for us. We should keep learning as we live; life-long learning.

As public service organizations, libraries are supposed not only to provide various materials and information to their patrons, but also to strengthen their educational abilities and help their patrons, with life-long education/learning skill. In order to give more advanced services in this respect, libraries provide e-learning materials via network in digital form in addition to the ordinary books. Many libraries are introducing the RFID (Radio Frequency Identification) tag systems for having more advanced physical material management. By applying such AIDC (Automatic Identification and Data Capture) technology, it is easier to manage both types of materials, i.e. physical/analog and data/digital, in a uniform and integrated way.

There are two types of advantages in installing the RFID tag system; efficiency and effectiveness. With such an AIDC technology, the process of checkout and returning of books becomes very efficient. Some libraries have replaced half of the checkout counters with self checkout machines. Inventory process time reduces dramatically; one week to one day, for example.

In this paper we deal with another advantage of RFID tag system for libraries. By installing RFID readers not only at checkout counters and security gates but also at the bookshelves, doors between browsing rooms, booktrucks, and others, we are able to obtain a wide variety of data about how books are used in the library.

By analyzing such data, librarians are able to obtain information about which library materials are used, how they are used, which periods of time they are used, and so on. Such information helps librarians with deciding which materials to collect, how to arrange the materials, etc., so that they have the ideas for better patron services, such as learning, studying environment, and so on. It is a matter of marketing.

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The rest of this paper is organised as follows. In Section 2, we describe briefly about the RFID technology and how they are applied to libraries at the moment. The major aim of introducing the RFID technology at the moment is “efficiency.” In Section 3, we explain the concept of library marketing and show its importance for libraries. RFID technology can be used as a very useful library marketing tool. The aim of introducing the RFID technology in this point of view is “effectiveness.” By analysing the data obtained by the RFID system, librarians will get information and knowledge that are valuable for improving patron services. In Section 4, we show a preliminary experiment for this direction. We use a booktruck that has some RFID antennas in it and collect data about how materials in the booktruck are used. In Section 5, we will summarize our discussion and show a prospect for the future libraries.

2. RFID application to libraries

In this section we learn what RFID system is about. We put special focus on how it is currently used in library applications. First of all we describe what the RFID tag technology is like in Fig.1 a). It consists of two components; tags and reader/writers (R/Ws). Tags can communicate with the reader/writers which are located in near distance of the tags.

In Fig.1 a) the RFID tag at the right-hand side consists of an IC chip and an antenna. It has no batteries and thus cannot run standalone. At the left-hand side is a R/W, which provides energy to the tag. The tag gets energy from the R/W with electro-magnetic induction via the antenna. It waits until sufficient energy is charged. When it is ready, it communicates with R/W and exchange data such as its ID and status data by making use of the same antenna. At the backend of the R/W are applications such as databases.

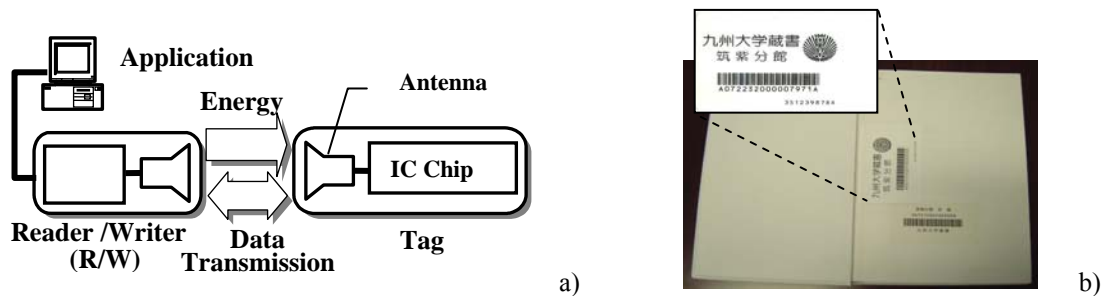


Fig. 1 a) Organization of RFID tag system. b) An RFID tag attached on a book.

The frequencies used in RFID systems range from about 100kHz up to GHz bands, which is in the ISM (Industrial, Scientific and Medical) bands [1]. The most popularly used frequency among them is 13.56MHz. It is mostly appropriate for applications with medium read distance, i.e. from about 1cm to 1m. Currently this frequency is most popularly used also in library applications for book tags and patron cards.

Figure 1 b) is an example that shows how RFID tag is attached on a book (in Chikushi Branch Library of Kyushu University Library[2], Japan). The tag is formed as a label on which the library name is marked together with the university logo. The material ID is also marked in barcode on the label. The barcode is supposed to be used when this material is carried to another library in the ILL (Inter-Library Loan), i.e. for interoperability, and when the tag has going bad and becomes broken; in other words, for insurance.

Comparing to the barcode system which is mostly used now, RFID tag system has an advantage that it is much easier to position materials. As a result self checkout machine is easier to use so that it is easy enough for children and elderly patrons. This is a very important point. So far the dominating reason for the libraries when they introduce the RFID tag system is that it is more efficient; i.e. it is faster to proceed circulation, it is supposed to have less running cost, and thus the number of librarians needed will be smaller, etc., even though its initial cost is very high.

Typical usages of R/Ws in libraries are circulation counter, self checkout desk, security gate and handy R/W for inventory. Some library has reduced the circulation counter in half by adding self check-out/return machines. For inventory, the necessary job terms may reduce from a couple of week to a couple of days.

3. Library Marketing

Marketing is an important concept for ordinary companies in order to get good reputations and increase customer satisfaction. Libraries should give more respect to this concept as public service organizations [3-5]. In order to do so, AIDC (Automatic Identification and Data Capture) technology is very useful. Barcode is one such kind of technologies mostly used in libraries right now. RFID technology is a good candidate that will replace the barcode for physical material management. By using RFID, the process of circulation, i.e. check-out and return of books, magazines and other materials, are much more efficient. Furthermore, it is very suitable as an in-the-library marketing tool.

In addition to the R/Ws mentioned in the previous section, intelligent bookshelf (hereafter IBS in short) or something like it must be most useful tool for library marketing. An IBS is a bookshelf which has one or more R/W antennas in it so that it can read which books are stored in which shelf. By using IBS the library system can detect whenever a book is taken out of the shelf and whenever it is returned on a shelf.

A good candidate usage of IBS is for newly registered books and/or for those just returned by patrons. Such books attract patrons' interest and thus they will be used in high frequencies. By analyzing such data, librarians will be helped by the extracted information with deciding which books to be collect.

Another useful candidate is, specifically in university libraries, for the books that are designated as subtexts by teachers. These books usually appear in the syllabuses. It is a great benefit for students to read such textbooks in the library. By collecting and analyzing these data, the library might be able to decide how many volumes of a title to buy according to the data. If a book has little or no usage history, the library can let the teacher who recommended this book know this information. Then he/she may encourage the students of the class so that they use this textbook more.

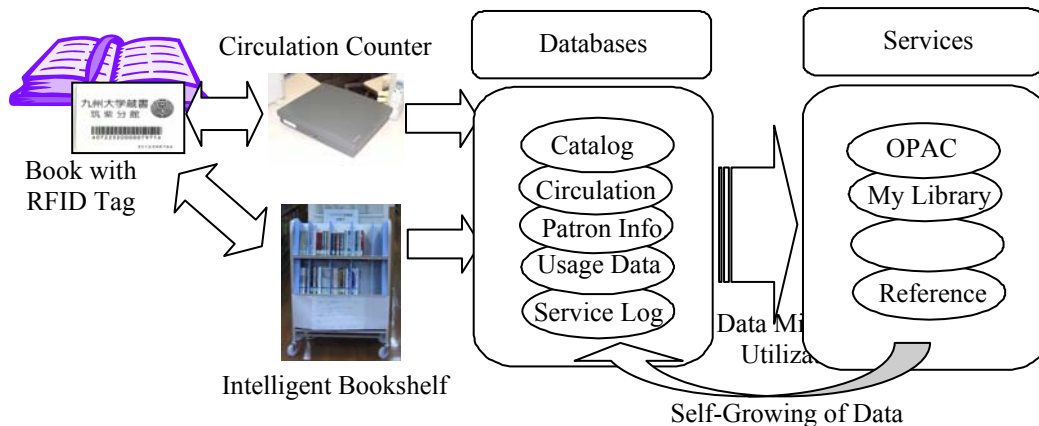


Fig. 2 The mutual depending structure of data and services for library marketing

Figure 2 shows the very important structure for library marketing. It is the mutual depending structure between databases and services. In the right part of the figure are library services provided by the library. OPAC (Online Public Access Catalogue) is a search engine for the library materials. My Library is a new service that provides patrons with individual information such as which books they are borrowing and have borrowed, a list of books the patrons might like to read, and so on. Reference means the online reference service. These are basic and at the same time very useful online library services.

These services depend on the databases that consist of catalogue data, circulation data, patrons' profile data, etc. These data are collected at a circulation counter, at a self checkout machine, at an IBS, and other ways. The log data, which are collected as the system provides services to patrons, are also a data-base component.

The collected data are supposed to be analyzed and the result should be reflected to the services in order to improve the quality of patron services. As the quality of services gets higher, more patrons will use the library and the system so that the system gets more service log data, and they can be used for better services for increasing customer, or patron, satisfaction. IBS is an important component for making such positive feedback mechanism.

4. A preliminary experiment

Intelligent bookshelf is a very useful tool for library marketing. We are now doing a preliminary experiment in Dazaifu campus library of Kyushu Institute of Information Sciences (KIIS). We will describe how it is going on.

Figure 3 is the system organization of the experiment. The most important component is an IBS, intelligent booktruck in this case. It is located in a browsing area of the library. It consists of two bookshelf type RFID antennas as are shown in the figure, and the controlling equipments in the third shelf, which is hidden in the figure. One bookshelf has four antennas and the tags detected in one of the four antennas are recognized to be stored in this shelf. There is a PC beside the circulation counter. The data obtained in these antennas are transmitted to the PC via wireless LAN connection and recorded in the log file.

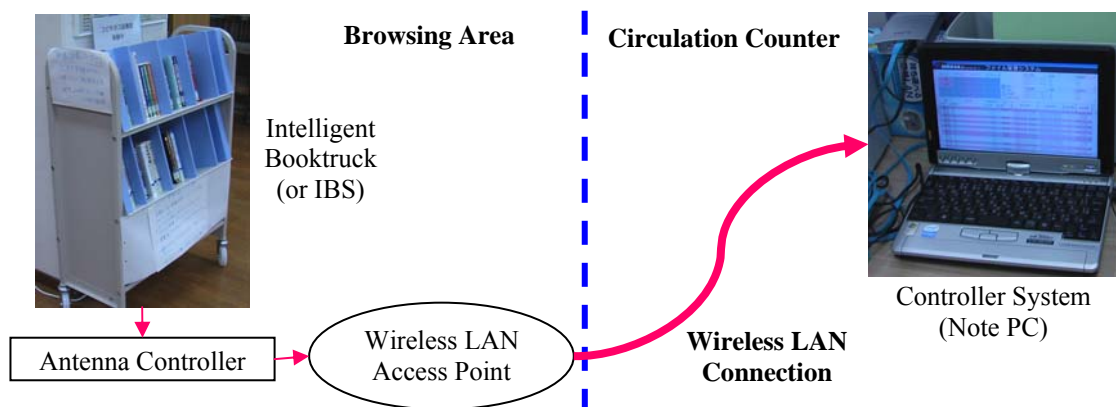


Fig. 3 System organization of the preliminary experiment

The i -th log data collected in the system can be represented as a quadruple in the following format:

$$d_i = (In/Out, Shelf-ID, Tag-ID, Time)$$

where “*In/Out*” specifies book is stored in a bookshelf or removed from a bookshelf, “*Shelf-ID*” and “*Tag-ID*” specify which shelf the book is stored to or removed from and which book is it, respectively. The “*Time*” is the timestamp which specifies date and time of this status change.

The system log file is a list of, or a collection of, such data. Initially it is sorted according to *Time*. If we extract the data by specifying the *Tag-ID*, say TID, we get the following collection of data.

$$D(TID) = \{ (In/Out, Shelf-ID, Time) \mid d_i = (In/Out, Shelf-ID, TID, Time) \text{ for some } In/Out, Shelf-ID, \text{ and } Time \}$$

From this data, we can get the frequency of the usage about book which has the specified tag-id “TID”. We can also get information something like, which time zone of a day, which day of the week it is read most often, etc.

Similarly, by specifying *Shelf-ID* or time zone for *Time*, we can get other information about which bookshelf is more used than others, which time zone is the busiest one according to the usage of books by patrons.

We can get more useful information if we combine the log data with other data. For example, from the *Tag-ID*, we can get the book ID, or material ID of the library, where the tag is attached. We also have the catalogue data of the book from the book ID. The catalogue data consists of book ID, author(s), title, publisher's name, the year of publication, classification data, and others. The most popularly used classification system is the DDC (Dewey Decimal Classification system). Thus from the *Tag-ID* of the log data, we can get its DDC. By specifying a DDC and collecting the log data, we can get the frequency data according to the field of contents; for example, literature, natural science, social science, mathematics, etc.

Some libraries may have their own ways of classification. For example, in the curriculum of KIIS, there are three important fields for students to learn; management, accounting, and information. Students are supposed to learn those courses from all of these three fields. As a result, KIIS library tries to collect materials especially from these fields. These three fields do not correspond to single DDC numbers, unfortunately. So the library specifies a collection of DDC numbers for each field. So by collecting the log data corresponding to a DDC of a field, it can get information how materials are used according to the three important fields.

Furthermore, by combining the circulation data, we can check the interrelationship between the frequencies of usage and of borrowing. We will get information about which books are borrowed more often than others and vice versa. If we know that some books are very often used in the library rather than to be borrowed, we may be able to purchase such books more than one volume. Such fact may not be recognized if we do not have the log data from the IBS.

5. Concluding remarks

In this paper we first point out the importance of libraries that help us with life-long learning in the network age. Then we mentioned that many libraries have been installing the RFID tag systems. Their major aim is to carry out their ordinary jobs more efficiently. We then showed that RFID systems can induce more benefit to libraries if they use for a library marketing tool. Intelligent bookshelf/booktruck is very useful for this purpose. It gives which books are removed from which shelf and are returned which shelf with timestamps. By analyzing the data, librarians are able to know how their materials are used and they can suggest to their patrons based on the knowledge.

Library is a key organization of public service in terms of learning and collecting of information. As Ranganathan claimed [6], libraries should be growing organizations for better patron services. In the near future, RFID technology and other AIDC technologies will become necessary tools in order to achieve this ever lasting goal of libraries.

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