Integrated solutions for libraries: implementation of RFID system

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Abstract

Currently, an innovative technology is implemented in the Romanian libraries, based on radio frequency identification, in other words RFID technology. This technology has been developed into many areas of activity both in our country and abroad. In 2008, Central Library of "Lucian Blaga" University from Sibiu has implemented the system and Central University Library "Carol I" from Bucharest is in the process of RFID implementation. There are presented the components of an RFID library system, what is involving the application of this system, the advantages and disadvantages of RFID technology.

Keywords: RFID, Radio Frequency Identification, Innovative Technology, Electronic Tag, Chip

Have you ever heard of RFID? If not, surely you will hear. We live in a constantly changing world. This change occurs in ways that often exceed the richest imagination. RFID technology or radio frequency

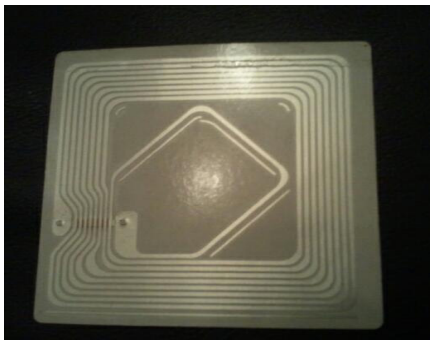
identification has already been developed into many areas of activity even if we are not very familiar with it. In our country, it is at an earlier stage of development.

More recently, RFID system has been implemented in the Romanian libraries. In 2008, Central Library of "Lucian Blaga" University from Sibiu has implemented the system. Central University Library "Carol I" from Bucharest is in the process of RFID implementation.

Many times, RFID system is defined as a modern security system for the documentation units, equipped with smart tags, with software that enables the compatibility with the automatic management system of the library.

The components of RFID system are:

1. The Electronic Tag – is the basic element of the system. This is a self adhesive tag in which there are integrated an aluminium or copper flat antenna, a chip and a memory. Its surface can be printed by the manufacturer or by the user. The tags are characterized by their flexible properties, they are made from thin, but strong materials. They can fit in one of three categories: just read, written once and read many times, read/written. The read/written tags are the most sophisticated. They represent a more effective investment because they can be reused, they aren't dependent on an external database, being itself dynamic databases, they provides a high speed system and they have the ability to contain a larger volume of information. The prices of RFID tags vary between 50 cents and 150 $ depending on the features and performance. Experts estimate that in a few years the price of a tag could reach five cents or even less. Although the cost of an RFID system contains other components in addition to the tags cost, this trend of decreasing tags cost is encouraging. According to estimates made by Forrester Research, the tags represent 80% of the implementation cost. They may have various forms, but generally look like this:



2. The Auto-Check In Station – allows users to manage accounts independently. Navigation with touch screen, easy to use, streamlines the entire process, making it fast and safe. Library users must wait no longer.

They have also ensured discretion in relation to the borrowed materials. The self-serving characteristics "release" the library staff, giving them more time for other tasks, such as services for users. There is also a printer easy to load, for receipts. Thus, the library receives remote monitoring and diagnosis via web. A notification is sent in real time via e-mail if the circulation system becomes off-line or if the printer has no paper.

3. The Self-Return Station – through it, the users can return the borrowed materials. The user must have a library card for identification and for managing his/her account. Only the materials that belong to the library are identified and collected. Automation allows secure return 24 hours, seven days a week. The user account is updated immediately.

4. The Librarian Station has hidden under the desk (integrated into it) a strong antenna. It operates as a circulation station or as a station for programming/reprogramming tags, including software for converting tags from barcodes to RFID.

5. RFID gates – an acoustic and visual signal is triggered as soon as the documents that were not checked correctly pass through the gates.

6. A portable reading device facilitates inventory. Met more often as **Digital Library Assistant (DLA)**, this hand-held device reads instantly RFID tags on materials from the library, transforming the reading rates, arranging to shelf, sorting and finding

exceptions in routine tasks. The memory card from a DLA can store information to over a million articles. The battery lasts between six and eight hours of use.

Application of RFID technology requires:

- placing a smart tag on each book or existing material in the library
- registration of an unique identification code in each tag (the barcode or the number of inventory)
- checking the tags by librarians and users
- reading tags by means of reading devices when receiving and returning books

At the beginning of a new millennium, RFID technology is the subject of experiments in various and military fields, already laying the foundations for the realization of "Internet of the objects". It assumes a world in which billions of objects will reveal where they are, their identity and their history (their past), by means of wireless connections. One of the earliest applications of RFID is represented by the tracking of animals. Another early application is automatic payment for tolls. Perhaps the most widespread use of an RFID system is represented by the tags for electronic articles surveillance (EAS tags).

Compared with the barcode, RFID technology has the following advantages:

1. The speed – allows faster reading and communication of information. A high speed reading results a high rate of transfer within the system.
2. Simultaneous reading – A system can read multiple tags. This advantage is given by passive tags type EPC class 1 (written once and read many times) and EPC class 2 (that allow reading and writing several times). Simultaneous reading is possible as a result of a characteristic named anticollision, that can be read simultaneously about 1000 tags per second, with a degree of accuracy of 98 %. Tags with barcodes enable only individual reading, with the help of the scanner. RFID tags enable you to read unassisted by operator.
3. Possibility of automation – Reading the information stored in the RFID tag do not assume the presence in the eye sight and doesn't

require a specific orientation of the product. If we have the barcode, it is necessary to scan it manually for reading data.

4. The capacity of the storage – Conventional tags, based on the barcode, may maintain a volume of information of only 20 characters long and can't be rewritten. RFID tag offers the advantage of the storage of a larger volume of information, having a spare storage capacity of 16 to 64 kilobits, much higher than that of the barcode tag, only 1–100 bytes.
5. Flexibility – This advantage is represented by tags programmability and information editing. The tags that can be converted are dynamic databases. The information from the tags can be written and read many times. The stored data can be modified in real time. The read/written tags have the possibility to "close" access to sections that contain specific data. The safety checks, added to the tags, prevent unauthorized writing or reading. The fear of disclosure of private information slows down the implementation of many advanced technologies. In the tags and in the RFID readers can be implemented a sophisticated encryption algorithm.
6. The total cost of ownership and property use – The read/written tags are used repeatedly. They are reprogrammed to change the stored data and to enter new data. Compared with them, barcode tags are used only once.
7. Selectivity – RFID technology allows tags to respond selectively to requests from the interrogation device. In this way, can be identified precisely those products of interest. Therefore it is facilitated the activity from the distribution platforms because it is determined the exact location of products required to be delivered to customers.

The combination of RFID technology with sensor technology add value to the applications of an institution. RFID technology is more effective, faster processing, a greater read range, a flexible capacity of data transport and more secure transactions. But now, due to lower costs, the technology based on barcode is used more frequently.

Among the current limits of RFID technology are:

1. Price – RFID systems are more expensive. For products with low price and marginal barcode is preferred. Despite the fact that many potential users consider the price of the tags as the main barrier to widespread adoption and application of this

technology, efficiency analysis should be done with great precision. It doesn't matter only the price tag, but also the results obtained from using them. A bit RFID tag can perform the same functions as a barcode tag. Under these conditions, we don't have a good reason to give up to the applied barcoding. From this perspective, RFID is just a replacement technology for barcoding. Complex RFID tags offer several advantages. The price is a relative comparison criterion. From another perspective, RFID technology is complementary to the barcode.

2. The lack of common standards – for RFID, for now, the market is dominated by systems that belong to certain organizations without being widely accepted and applied. In the field of barcoding, there are standards adopted by several countries.
3. Any security issues – for example, a buyer in a shop, with a PDA equipped with an RFID reader could scan a product with low price tag and replace the information on the tag of a product with high price which would not be notified in the case the point of the payment would be automated. There are arguments against this limit. Given that organizations will exceed the state of performance testing, it will be detected any entry in the store, of a buyer which has an RFID reader. In addition, the tags will be programmed to respond only to specific reading devices. It is also working on encryption systems more powerful than the existing ones.

Specialists consider that the transition to RFID technology will be, in the first step, in the form of hybrid solutions. The name of this solutions comes from the fact that they involve the use of the combination of RFID technology, barcode and location via GPS (Global Positioning System). Gradually, hybrid systems will be replaced by systems based only on RFID technology.

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