Implementationof RFID Technology at the Central Library, Nagaland University

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ABSTRACT

The use of RFID Technology in libraries is not so recent. Technology has its own advantages and disadvantages. While RFID Technology improves library services by making it more efficient and user friendly, there are certain shortcomings that have to be taken into account while implementing this technology.

1. Introduction

A library today as a service organization, aims at providing access to its information resources to the users, an intermediary between the information and the users. While the bulk of information is increasingly available in varied forms and media, satisfying and fulfilling the information needs and requirements of the users in an efficient manner has become the core concern for the libraries today. This has left the libraries without any other options but to imbibe the technological changes and developments.

2. RFID

The usage of intelligent technologies such as wireless networks and Radio- Frequency Identification (RFID) (Kourouthanassis and Giaglis, 2005) has moved during the past decade from labs and niche uses into a broader range of application (Slettemeas, 2009) and derives from the tremendous expansion in computing power and in data captured for decision-making in various domains of retailing, including inventory and supply chain management, category management, dynamic pricing, customer segmentation, market basket analysis, and retail sales forecasting (Rao et al., 2005:127).

RFID technology has been gathering more attention in recent years, but RFID is not a new invention. The history of RFID can be traced back to World War II. It was used by the Allied troops to distinguish enemy aircraft from their own aircraft. The first usage of RFID then was known as IFF (Identify Friend or Foe System), (Piramuthu, 2007). Since then, the range of RFID applications has become increasingly widespread.

RFID has a wide variety of applications ranging from familiar building access control, proximity cards to supply chain tracking, toll collection, parking access control, retail stock management, ski lift access, tracking library books, theft prevention, vehicle immobiliser systems and railway rolling stock identification, and movement tracking (Roberts, 2006:18).

3. What is RFID?

RFID is an abbreviation for Radio Frequency Identification, which is a wireless communication technology that is used to uniquely identify tagged objects (Daniel et al., 2007). According to Wikipedia, radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID (http://en.wikipedia.org/wiki/Radio-frequency_identification). RFID is a wireless system that works in conjunction with an organization's information technology infrastructure to improve business processes such as inventory management and efficiency in supply chain management (Nisha et al., 2006). Radio frequency identification is a system that facilitates the tracking of objects, primarily for inventory tracking, via a three part technology comprised of a reader, a transceiver with decoder and a transponder.

3. Components of an RFID System

A basic RFID system consists of three modules: Tags, Readers and Antennas. RFID Tag is made up of a coupling element and a chip; each tag has a unique electronic code, attached to the object used to identify the target. RFID readers are devices that are used to retrieve and write the information on RFID tags. There are handheld readers and fixed readers. Handheld readers are designed to act like handheld bar code scanners and fixed readers are mounted to read tags automatically as items pass nearby them. The antenna emits radio signals to activate the tag and to read and write data to it. (Wang Guang Hui, 2008, 6)

In practical applications of using RFID technology, a tag is attached to an object used to identify the target, when the target object passes through the area that the reader can read, the tag and the reader builds up the radio signal connections, the tag sends its information to the reader, such as unique code and other data stored, the reader receives those information and decodes them, and then sends it to a host computer so as to complete the whole information processing.

4. Application of RFIDto Libraries

In recent years, libraries have started implementing this technology with positive success. In fact, the first application of radio frequency identification technology was fully deployed in

Bukit Batok Community Library in Singapore in 1995, afterwards e.g. the United States, Australia, the Netherlands, Malaysia (in this order), started using this technology to construct the automated library system (Yu, Dai, 2011).

5. Why do we need RFID in libraries?

Cost, manpower and efficiency are key words in successfully operating a library. RFID makes processing new books and making them ready for circulation much faster. The library process such as check-in and check-out can be automated by use of this technology and increase efficiency. Though self service check-in units RFID readers can recognize several books at once. By installing a separate sorting machine, which will read the tag information from the returned items and sort them into corresponding carts, it is possible to make the check-in unit even smarter. This will save time as the library staff can deliver the books back to their shelves without first spending time on sorting the items. With RFID it is also possible to make it so that the library patrons return their items straight back to the shelves by themselves instead of using the self service check-in unit. Of course this method works best if a patron only has a few items to return. (Pandian, 2010, 50-51)

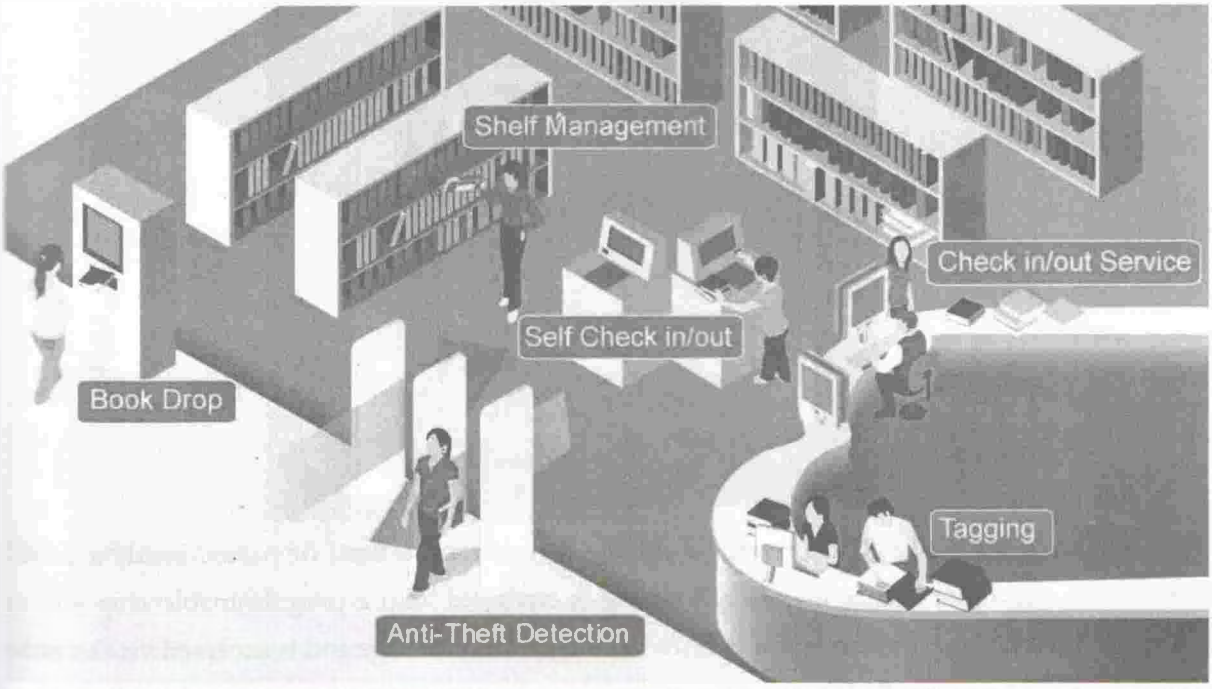
Misplaced and missing items are very common occurrences in libraries. RFID can be used to make things easier. By using handheld readers, a staff can easily check if a shelf has missing or misplaced items, thus making inventory control much quicker. This could also be made so that the shelves themselves contain a RFID reader which will automatically update the information to the staff. This way it becomes possible to quickly check the state of each shelf from a desktop computer without having the need to separately check every shelf. RFID tag can be utilized for both circulation management and for anti-theft purposes.

LIBRARY BACKGROUND

The Central Library, Nagaland University was established in 1997 at Lumami and was shifted to the newly constructed library building in the month of February 2010. With a floor area of 1175 Square Meters, the library is spacious, reader friendly with a collection size of 20,000 books and other documents and staffed by 14 persons. At the time of implementation of RFID in October 2013, the library management software used was SOUL 2.0 (Software for University Library). Besides this, any other library automation software can be used provided it is RFID enabled. Generally, most software, be it open sourced eg. Newgenlib, Koha, E Granthlaya or commercial software like LibSys are already available RFID Enabled

LIBRARY RFID MANAGEMENT SYSTEMS

Illustration-1*



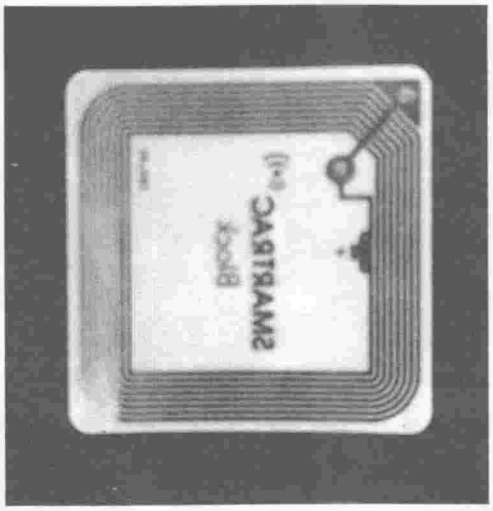
From the figure above, it can be seen that RFID technology is involved in almost all aspects of library management. Tagging station to tag the RFID label to each library material; patrons self check-out station to borrow books using the self service; book drop station is used to return the books; and the anti-theft security gates ensures that items are checked-out before leaving the library by detecting if the RFID label that are attached in the item is activated; and finally for shelf management, for example patrons can track items that were misshelved by using a RFID handheld reader.

*Illustration-1, sourced from http://www.rfid-library.com/ on 12 March 2015

The Central Library adopted RFID technology with the aim of providing self service for patrons and thereby effecting more efficient service with minimum assistance from library staff. Patrons can borrow and return the items using automatic lending machines, which require a library card and a PIN. Besides this, sorting of returned books has been greatly reduced. As RFID label has anti-theft function, there is no need for an extra alarm strip to be attached to the item, which makes the borrowing and tagging tasks a lot easier.

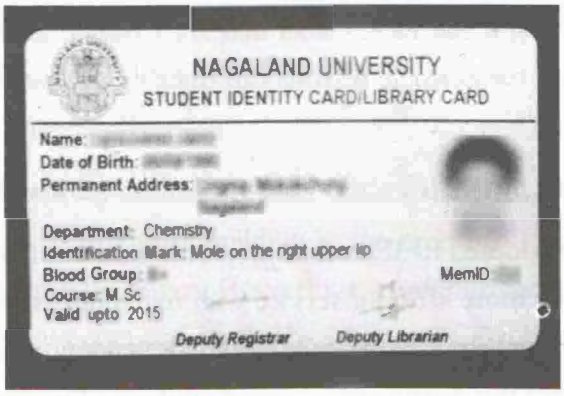
COMPONENTS AND MODULES OF RFID SYSTEM IN LIBRARIES

RFID Tags or Smart Labels



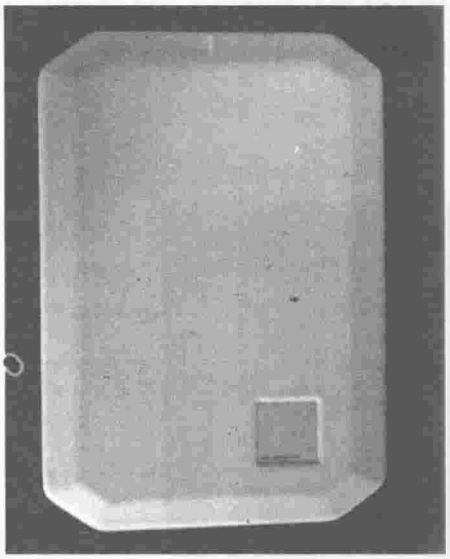
The heart of the RFID system is the tag, which can be fixed or pasted inside a book's back cover and other library materials. This tag is equipped with a programmable chip and an antenna. Specific object information is stored in the memory of tags and is accessed via the radio signal of RFID readers. RFID tags allow materials to be accurately identified and tracked. They have an EAS (Electronic Article Surveillance) function to detect thefts. In the case with Central Library, the tags unique number is linked to the unique accession number of a book or document.

RFID Card



This is primarily a Smart Library Membership Card embedded with an RFID chip. Specific information is stored in the card and the information is accessed through the RFID Card Reader. In the library, the cards unique number is linked to the users' library membership number.

RFID Readers/Writer/Sensors or Pad Antenna



This equipment is used for read/write function of the RFID Tags pasted on the books. It is used for Issue/return of books either by library staff or by users themselves. It is also used during personalisation of tags pasted on books.

Handheld Reader

The hand held reader is a unique device which can scan books on the shelves without the

requirement of the books to be taken out. With a distance of 6 inches away from the books, the device can scan the books rapidly and update the inventory and identify items which are out of proper order or misplaced. With Wi-Fi ability, the scanned data is uploaded simultaneously to the backend server.

Card Reader

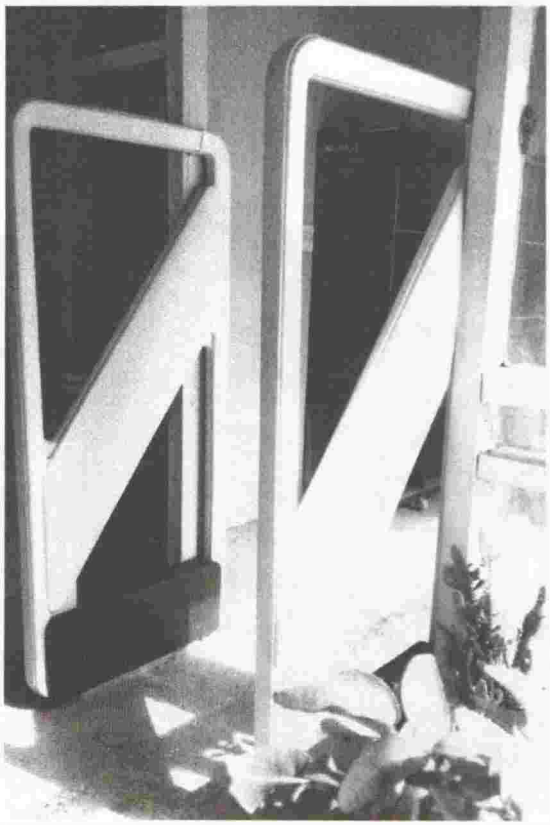
This device is used to access information stored in the Smart Library Membership Card during issue of books.

Kiosk or Self Check-In Check-Out Station

At this station, the books to be checked out or issued are placed on the desk and both user card and books can be read simultaneously, recording the user's identification, the borrowed items and deactivating the antitheft. All these activities are updated to the backend server database automatically.

Books to be checked in or returned are placed on deck station one by one without any intervention by staff. The returned items are instantaneously updated in the integrated library software and the anti-theft device is activated. This automated book return gives enhanced benefits to patrons as well as library staff. For patrons, it offers great flexibility in returning their material when they want and gives immediate status on the availability of books since updating of the library database is done in real time.

Gate Antenna or Electronic Article Surveillance Gate



The gate antenna is a security gate which detects unauthorised passage of books. If a book leaves the premises without an authorized issue, it sounds an alarm with the flashing of light. These are installed at the entry and exit points of the library.

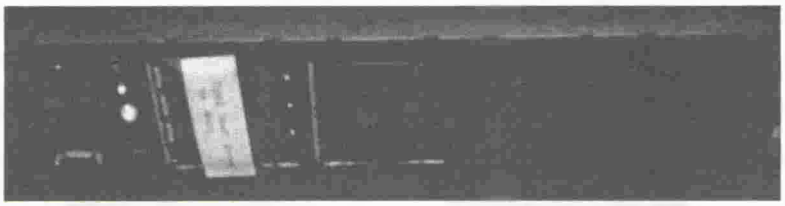
Tagging Station

A tagging station consists of a network PC, reader and antenna. All library materials must be tagged and programmed at the tagging station. This station can also be used for issue and return of books by the library staff if the need arises.

RFID Card Label Printer

RFID Card Label Printer is used to print the labels with individual ID number, members photo, library logo etc.

Server



A high-end server is used for the entire library automation process. This sever is loaded with necessary operating system, library automation software and other application software. Data is backed up at the end of every academic day.

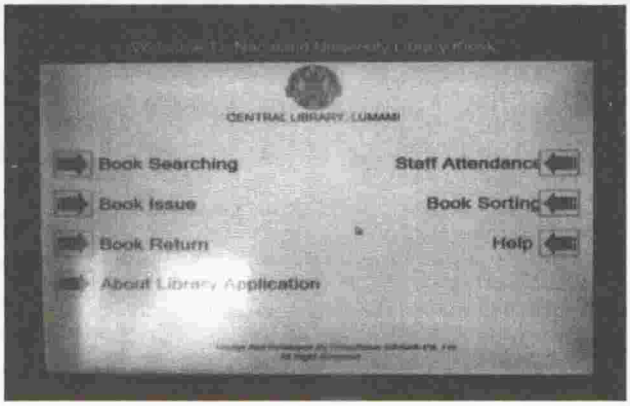
Application Software

For library automation, SOUL 2.0 is used in the library. In addition to this, an interface (application software) specifically developed to associate the RFID equipments and SOUL database is being used.

Power Supply

In instances of unexpected power cuts and failures, two units of 10KVA UPS is installed to power the entire equipments. This has been installed keeping in mind the recurring power fluctuations, whereas the RFID equipments require seamless power supply during all times.

Other Functions



The figure above shows the touch screen interface for self issue/return of books and for book sorting. Along with these functions, an interface for recording of staff attendance has been incorporated. By placing the RFID Card on the Card Reader, attendance of each staff along with time of check in and checkout is recorded and a spreadsheet is printed at the end of each month.

ISSUES AND BARRIERS

Not every application of technology and are perfect in every way. The implementation of RFID technology in libraries has its own shortcomings such as cost, access rate, security etc.

Cost

The cost of the technology is one of the major factors influencing acceptance of RFID, although the production costs of RFID technologies and equipments have been reduced in recent times. All equipments were imported from Germany and thereby the cost of implementation at the Central Library amounted to Rupees Forty Lakhs. However, this might not be possible for many libraries to implement.

Access Rate

Metal objects, coins and distance influence the read/write efficiency of RFID, incorrect positioning of antennas also causes failure even if the tag and the reader are very close together. Close proximity between tags may produce interference between tags or erroneous access. For example, if one patron is in the process of issuing books while another patron is standing too close to the first patron, the reader doing the self check in/out may detect the tags of books which are held by the wrong patron.

Maintenance of Sensors and Other Components

The sensor/reader has to be maintained properly so that they are always in a trim condition and their power supply is always intact. While the short-range readers used for circulation charge and discharge and inventorying appear to read the tags 100% of the time, the performance of the exit gate sensors is more problematic. They always do not read tags at up to twice the distance of the other readers (Butters, 2007).

Lack of Standard

The tags used by library RFID vendors are not compatible even when they conform to the same standards because the current standards only seek electronic compatibility between tags and the information differs from vendor to vendor, therefore, a change from one vendor's system to the other would require retagging all items or modifying the software (Nisha et al., 2006)

Uninterrupted Power Supply

Continued supply of power to the scanners and processors is very essential. Any generator back-up adds to the cost, besides occupying valuable space and generating undesirable noise with power (Shahid, 2007).

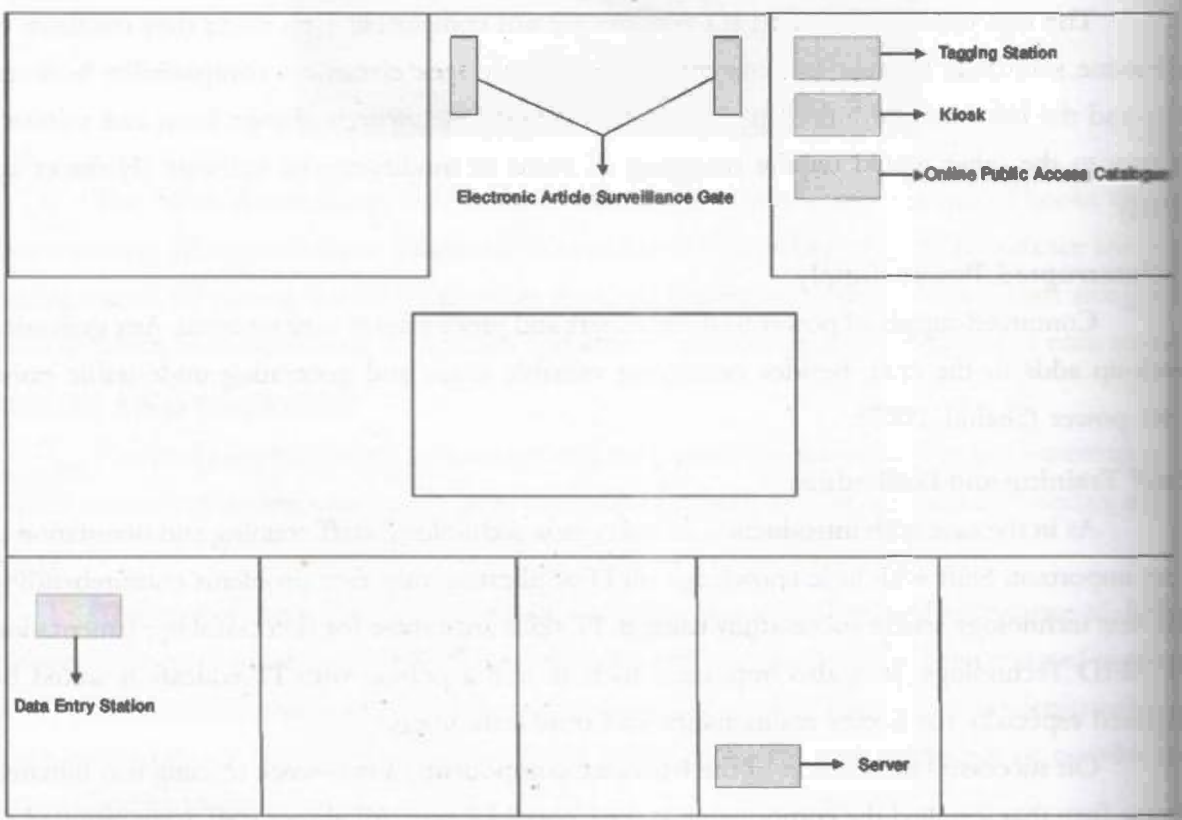
Staff Training and Difficulties

As in the case with introduction of every new technology, staff training and orientation is very important. Staff with little knowledge on IT application may face problems comprehending the new technology and in successfully using it. IT skills are a must for successful implementation of RFID Technology. It is also important to note that a person with IT education would be required especially for Server maintenance and troubleshooting.

On successful installation of the hardware components, a two-week training was initiated by the firm that installed the components at the Central Library. All library staff were required to attend the training. The training was conducted in a phased manner starting from the Data Entry Station. On completion of this phase, tagging and personalisation was initiated. Here, library staffs were taught to tag books, activate the tags using the hardware and software components. The staffs were also taught to use the Kiosk or Self Check-In Check-Out Station. On completion of this phase, the use of Hand Held Reader was taught to perform Stock-Taking operations. In all these operations, the IT person/Information Scientist of the Library was present to take note of the training and also to help with further training of the staff. The responsibility of Server maintenance was left to the Information Scientist.

The main problem faced during the implementation was during the tagging and personalisation of books. While activating the tags and transferring data into the tags, multiple error messages and "faulty tags" messages were revealed. These errors were due to close proximity of multiple tags to the Pad Antenna and thereby creating interference among the tags. However this was solved by instructing the staff to place all other tags a distance away while performing the personalisation.

Illustration–2



Floor Layout illustrating the different RFID Components at the Central Library

CONCLUSION

Though the application of RFID technology in libraries are gathering momentum with further reduction in cost, issues such as standards and perceived privacy issue may be a deterrent to many to successfully implement this technology. One visible advantage of RFID implementation at the Central Library is the reduction in requirement for Library Staff. For example, the Circulation Section which was once manned by 3 persons can now be effectively monitored by one single

staff. While this technology is still improving and evolving, one cannot but just wait and observe what new features this technology would bring about in libraries.

REFERENCES:

1. Daniel H, Puglia A, Puglia M (2007). *RFID: A Guide to Radio Frequency Identification.* New York, John Wiley and Sons, Inc., p. 1.

2. Kourouthanassis, Panos E., Giaglis, George, M.(2005), "Embedding Technology In The Retail Arena", Consumer Driven Elecktronic Transformation, Doukidis G.J., Vrehopoulos A.P. (Ed.), Consumer Driven Electronic Transformation: Applying New Technologies to Enthuse Consumers and Transform the Supply Chain, Berlin, Springer, pp. 227–240.

3. Nisha F, Bakhshi SI, Ali N (2006). RFID System: A Boon for Libraries. In 4th International Convention Caliber-2006. Ahmedabad: Inflibnet, pp.554-555.

4. Piramuthu, S. (2007), "Protocols For RFID Tag/Reader Authentication", Decision Support Systems 43, pp. 897–914.

5. Ravi V., Raman, K., Mantrala, M. K. (2010), "Applications of Intelligent Technologies in Retail Marketing", Krafft M., Mantrala M. K. (Ed.) Retailing in the 21st Century, (pp. 127–141), New York, Springer.

6. Roberts, C.M. (2006), "Radio Frequency Idenfication (RFID)", Computers & Security 25, pp.18–26.

7. Shahid S Md (2005). "Use of RFID Technology in Libraries: a New Approach to Circulation, Tracking, Inventorying, and Security of Library Materials. Library Philosophy and Practice" Vol. 8, No. 1 (Fall 2005)

8. Slettemeas, D.(2009), "RFID—the "Next Step" in Consumer–Product Relations or Orwellian Nightmare? Challenges for Research and Policy", J Consum Policy 32, pp.219–244.

9. Wang Guang Hui, 2008, "The Intelligent Library System Based on RFID Technology Paul Pandian, 2010, RFID for libraries" – A practical guide M. Butters A (2007). RFID Systems, standards and privacy within libraries. Electro. Lib., 25: 430-439.

10. Yu, Dai (2011), Implementation of RFID Technology in Library Systems. Case Study: Turku City Library, Lahti University of Applied Sciences, Faculty of Business Studies, Business Information Technology. Thesis. Available at: http://www.theseus.fi/bitstream/handle/10024/28534/Dai_Yu.pdf. (Accessed on 19-02-2015)