

Effectiveness of RFID and Electromagnetic (EM) Security Gates: an installation experience of a library

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Abstract

Book theft is one of the main problems faced by the libraries since its inception, as far back as pre-Christian era. Generally it is estimated that a library loses 3% of its collection due to theft and the loss is irrecoverable in many instances. Therefore libraries should identify the effective measures to minimise book theft and should take preventive measures to control such incidents. The present study deals with the technological issues relating to the electro magnetic security systems that are installed at many libraries around the world. The main two technologies discussed here are the RFID security gate and the Electro Magnetic (EM) systems. The EM and RFID gates are considered as frontier technologies of the library security system even though these gates seem to have some drawbacks in managing the expected operations depend on different library environments. The study explores the nature of user behaviour in carrying library material through such secured areas and its impact over the performance of the security gate sensors. The paper discusses the pros and cons of the high tech security technology with the trial cases recorded at the Open University of Sri Lanka library when the systems were under the credibility testing undergone through the technical evaluation process.

Keywords: *Library security, Book theft, RFID, Electromagnetic, EM*

Introduction

Security issues relating to circulation control of library materials had become a debating issue in many library and information science fora as the librarians face immense challenge in safe guarding the collections. The librarians treat this duty as one of their prime duties and are responsible for the stock value of the collection. Loss of books due to many reasons like theft, misplacements, hiding, non returning etc. in a library had been happening now and then due to various reasons which are beyond the control of the librarian.

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Still every case of book theft is a questionable issue against the librarian. Therefore library regulations pertaining to check in/ check out mechanisms in libraries are becoming more and more tightening. This paper deals with electro magnetic security systems adopted by libraries as a safe guarding measure.

Safe guarding books have a history as far back as pre-Christian era. The most ancient effort to stop the book theft was writing a letter of curse on hand written manuscripts.

Following curses are two examples found on back side of the front cover of manuscripts.

“ Steal not this book, my worthy friend,
For fear the gallows will be your end;
Up the ladder, and down the rope,
There you'll hang until you choke;
Then I'll come along and say,
"Where's that book you stole away?"

“ He who steals this book, may he die the death
may he be frizzled in a pan...” (Litterascripta, 2010)

These methods were not practically much effective even at that time. Some libraries in old era used to chain the manuscripts. However that method also did not prove effective as many such books/ manuscripts were stolen while the chains remain on its hold. Today various advance technologies were adopted by libraries to stop the book theft. Fixing security cameras, electromagnetic (EM) security gates and Radio Frequency Identification(RFID technology are top of the list, but librarians still complain about book theft of their libraries, despite the large amount of funds and efforts they invested in to install different advance security systems to safeguard the collections.

It is important however to understand preventive measures and strategies adopted for minimising the book theft. In an academic library, with average security measures adopted, it is estimated that the rate of loosing books generally is around 3% from its collection per year (Bregel, 2010). The books stolen were mostly valuable or rare books/ or books on high demand, hence even few losses, would affect libraries seriously as some losses are irrecoverable.

Objectives of the Study

Main objective of the study is to explore the advantages and disadvantages of Radio Frequency Identification (RFID) and Electromagnetic (EM) security systems in relevance to library material circulation (Issuing and returning). The study also hopes to share the knowledge and experiences with librarians those who

are interested in the library security issues as there is no literature or in depth studies performed locally(Sri Lanka) regarding electronic surveillance technology.

Background Issues Identified

As a preamble to the problem it is paramount to find out, why the library books are stolen? There are several reasons brought out by various studies;

- Pressure of the academic work load of the students also a reason for the increasing book theft (Weiss, 1981).
- Boss (1995) suggest that strict policies and procedure may develop anti library behaviour within library users and that would leads to increase rebellion behaviour of users and damage library belonging and steal valuable books.
- Lincon(1984) claims that the perception of potential thieves that library is a safe place for 'good picking' and low potential of getting caught.
- The most recently published literature claims that the new development of Internet based online book auctions like E-bay.com and Amazon.com are the causes for increasing book theft in libraries; The auctions have open a gate to resell used books through online. It creates lot demand to valuable used book through out the world. The trend badly affect the library as the book lifters or thieves purposively steal books from the library for selling it through online.
- SCONUL (2003) claims that there is a fixed market and demand for the stolen books.

Some of these reasons are much applicable to technologically developed countries and has less vulnerability in Sri Lanka, especially the last two points in the above list.

In identifying the effective measures to minimise the book theft, library it self has to explore its own environment, because book theft depend up on many reasons which are specific to a particular library environment. Jayaram (1988) has shown through his study that the library collection are more vulnerable for the potential offenders in extended hours. Ungarelli(1973) argues that high loss of book could be influenced by the physical arrangement of the library; compact shelves, limited space between the aisles, study desks are far from the stack are some of those. Weiss(1995) also identified the existing economical and financial factor of the country also effect book loss of libraries.

Security Measures

Library security measures can be broadly categorised in to as physical and electronic security surveillance systems. Physical security includes inspection bags of library users, secure library windows to avoid pass through books. Regular

visual inspections are few examples most libraries use to perform. In early 1960s libraries were introduced with electronic security systems; among them security camera surveillance are most effective and popular systems which still use with same demand.

With the advancement of the new technologies, libraries also get benefited by introducing new security and anti theft technologies; among those Electro magnetic (EM) anti theft gates and RFID systems are widely accepted by the libraries all round the world. As such electronic theft detection systems is a growing industry due to increasing the book theft in libraries. It was also found that the most common reaction from the librarians, to minimise the book theft in library is fixing electronic security gates (Boss, 1995).

The Technology

Electro-magnetic (EM) Anti-theft Security Gate Technology

Electro-magnetic (EM) Anti theft Security Gate Technology is a technology used by university libraries in common, and is being treated as a proven technology (Bregal, 2010).

The EM was introduced by reputed international company in 1970 (Erwina & Kern, 2004). In EM system, activation and deactivation of magnetic property of a small iron strip which placed inside the spine or inside the book is used to verify the materials passing through gate; In check out, the magnetism of the iron strip is de-activated and in check in the strip it is activated.

EM security gate automatically scans items carried by patrons and identify the status of magnetism of the strip attached to the book. If the iron strip is magnetised, theft means the book is not properly checked-out, and the security gate activates and gives warnings by alarm sound. The main advantages of the technology are the low cost, durability and reliability. The tape can be hidden in the book and hard to notice where it is paste. The system is comparatively cheap and more reliable solution to the libraries (Erwina & Kern, 2004).

Radio Frequency Identification (RFID) Technology

RFID was commercially introduced in 1960s. The RFID developed to increase the productivity and efficiency of many operations such as house keeping activities, inventory control and traffic control.

It is important to understand the basic principle behind the RFID. According Landt (2005) RFID is a term coined for short-range radio technology used to communicate mainly digital information between a stationary location and a movable object or between movable objects; so as the RFID system consists of

two components; Transponder and Reader. The Reader is normally stationed in a door way which is used by the users to enter the library. The transponder is always attached to an object such as a book, CD, Video tapes etc. The transponder is a small chip with an antenna and the chip stores information relevant to the attached item. The transponder passes the data to 'Readers' (the gate sensor) when they are close to each other. The transponder does not have batteries to supply required power to the chip so the chip takes power through the antenna from the Reader and then perform the operation connected.

This very fact makes RFID suitable for libraries in productive manner. Other specific feature of a RFID is the Reader can read more than one transponder signals at the same time which makes it ideally suit to the library transactions. In average 10 inches thick book sack can be read by the reader. The signal also can be sent through non – metallic and the chip can be hidden inside the hard cover of the book. All these RFID features are treated as complementary technology for library automation. Followings are few advantages the libraries could obtain through RFID technology;

- 'self checkout and check in facilities; no lines or greatly reduced lines at the check out counter
- less repetitive work (and repetitive stress injuries) for personnel and an increase in interaction with the patrons;
- reduced material costs and handling (only one label instead of two or three);
- a regular inventory control and update of the data base is possible;
- automation of sorting and conveying
- easy search for misplaced books'

(Erwina & Kern (2004) and Rajendran & Rathinasabapathy(2007)

Practical Experiences Witnessed

A case at Open University of Sri Lanka (OUSL) -the main library

Even though this technology is highly used by large and reputed libraries of the world there are some drawbacks detected in security systems by certain libraries depending on their specific library environment.

In case of the OUSL library, due to several theft detected, the library management decided to go for the electro-magnetic security system as a corrective measure. In 2007, The Open University library installed a RFID system and subsequently an EM security gate. After the technical evaluation process performed the TEC (Technical Evaluation Committee) found both systems have serious drawbacks in one important function that unable to fulfill the minimum requirements of the OUSL library. The function that failed to perform was the 'detection of angle that the materials are carried' by the patrons, within the detection range. These two technologies are discussed below.

RFID System at OUSL

The RFID system was installed in the library and under gone technical evaluation process by the Technical Evaluation Committee (TEC) appointed by the OUSL to evaluate system for it functionality.

According to the evaluation the RFID system at OUSL proved successful in functionalities such as stock control, shelf checking, check-in, check-out, item searching etc. But during the evaluation period, library has observed that the security gate has a high probability of none detecting some of the checked out books carried by the patron in certain angles. This book carrying behaviour is identified as common to most library users as shown in Figure 01, 02 and 03.

Several test cases were done in 'off hours' of the library and verified the observation by mimicking the real users behaviour. Upon these test cases it was found that the system did not fulfill the specifications required by the OUSL library.

The weakness were informed to the supplier Company and requested to adjust the 'non detection range' of the security gate. Despite all the effort made by the technical team of the supplying company the system was not successful in detecting the angles specified the Figures 1, 2 and 3. The university therefore compelled to reject the system.



Fig: 1.0 Close to chest



Fig: 2.0 Close to waist

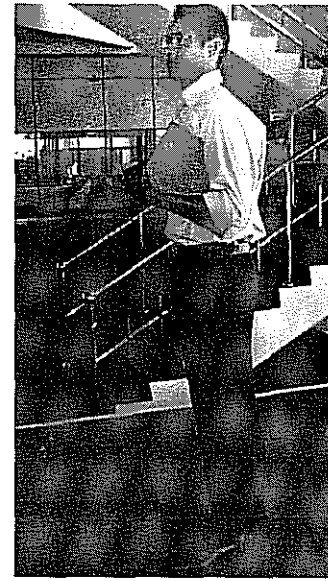


Fig: 3.0 Under arm

EM Security Solution at OUSL

With previous RFID system experience and the increasing number of cases of book theft, library has decide to go for low cost alternative solution security solution and Electromagnetic(EM) gate was proposed and received the approval from the university.

The gate was installed in the library same way as the RFID gate and it was found that same problem exists as observed in the RFID sensor gates.

The library has allowed a month period to fine tune and correct the system but the gate was unable to show reliability expected by the OUSL, finally the EM gate was also rejected by the same reason as RFID. After failure of the two electronic systems, library has strengthened the conventional security control of the library by employing the additional security officer guard the main entrance.

These experiences led the OUSL library to rethink relating to the library security system of the OUSL library. It is hoped these experiences would be useful for decision making in adopting security measures in other libraries.

Observations Made

Upon the observation made through the OUSL experience following facts are brought forward as concerns to be raised when deciding over security systems.

1. RFID tags and EM strips do not have universal standard hence the client should depend up on the particular vendor and less bargaining power available for the clients.
2. Libraries have to spend extra cost for RFID tag or EM strip to implement the system for circulation.
3. In the case of RFID, The book cover must be hard bound hence has to spend extra cost and time to make the paper backs to hard.
4. Annual service/ maintaining charges of the systems are costly and the library has to accept any service maintenance plan offered by the company once installed the system is to be maintained.
5. When the selected system shifts to another version the client has to accept it as they have no other alternative hence in developing countries with many budget constraints they have to face drastic policy related issues.
6. At a power failure –sudden breakdown of all vital functions of the system tend to shut down hence backup power system needs to be installed and the scenario is very common in developing countries. Libraries have to spend additional cost to secure power supply by UPS or generator.
7. Network failure directly affects the RFID system and shutdown of the automated counter operations too affects the security gate functionalities.
8. To maintain the RFID or EM systems, library need additional technical person to take care of the systems operation with care.

9. There is high possibility to disturb or misleading the security functionality. For instance, damage the RFID chip, remove the strip or labels, cover the chip with metal object as a coin, interchange the RFID labels etc. In such cases, additional security measures are needed to be introduced along with the security gate (may be an extra manual gate, security person). These also an extra cost for the libraries.
10. It is seen that the user behaviour and library environment indicate significant differences country to country. But the technologies are designed modular to the county of origin. Therefore adopting these technology models has to be localised accordingly. For instance book carrying behaviour indicating in figure 1, 2 and 3 are common to OUSL library clientele but the gate sensors could not detect the checked out materials.

Conclusion

Elimination of book theft is unachieved task to any library, the fact is strongly supported by the literature (Mansfield, 2009). Most security measures would vulnerable to purposive misleading of the systems, but the theft can be minimised. Hence installing security gate is the most common option selected by libraries since the drawbacks are not known to them.

As investigated at different environments, the effectiveness and reliability of preventing book theft by introducing the electronic security gate such as EM or RFID is a questionable issue (Boss 1995). The fact also proved again in the case witnessed at the OUSL library environment.

Comparison are made by different authors between EM & RFID technology and mention that the EM technology has higher functional reliability and is far ahead than RFID in gate security management (Brehel, 2010). But in this paper it is not attempted to do a comparison again between these two technologies. However, with library automation, with many integrated functionalities in place, RFID is the best solution. This is the reason why some large libraries install both RFID and EM gates at the entrance of the library or in some cases both technologies are embedded in one security.

There are some pros and cons of both the systems; but the weaknesses of the technologies are hidden in the trade literature. As discussed in the paper points brought forward are considerations to be made by the technologist-librarians before planning to purchasing security gates with the new technology.

Suggestions

In the financial point of view, the library is a 'Cost Centre' and justifying the annual budget is a challenge to the library management. Therefore spending on advance high cost electronic security systems a feasibility study is appropriate.

Most literature regarding the EM and RFID are market oriented and target to attract possible clients and do not expose hidden facts behind the technology. The Libraries in turn have very few options to select vendors for purchasing security solution particularly for circulation control as there is a market monopoly. Therefore Proper technical evaluation of the systems should be performed by an expert panel that has competency in the area of electro magnetic applications. This is extremely essential for identifying the suitability and appropriateness of the system to address the institutional requirement.

Sharing experiences with other libraries and further research and explorative studies are needed locally to understand effectiveness of the frontier technologies as discussed above by the technologists and the librarians.

Also the behaviour of students pertaining to each and every library should be observed and surveyed by a special team, most probably the readers service librarians and should propose alternative solutions to guide the readers to make their book carrying postures automatically suitable to the angles detected by the security gates For example some libraries abroad encourage carrying specifically designed bags to carry books or guide the users through another specially designed gate to correct the book carrying angle.

Community effort is also important as individual effort to prevent the library book theft. Any library itself does not have all technical expertise, so regular sharing of knowledge and experience also very important. For example; Leading library associations such as American library association (ALA 2010) and Association of College and Research Libraries (ACRL) have guidelines to their member libraries.

Issues discussed in the paper are hoped to be an eye opener for the librarians as well as the designers of the technology. The security technologies we use are to be commended as a supportive measure to the house keeping functions performed by the librarians. The loop holes in the technology however are to be corrected and further developed by the support of the user community and will become more versatile in use. Therefore these observations should be treated as a positive study to further develop the library security technologies.

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