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COMPARATIVE STUDY OF BARCODE, QR-CODE AND RFID SYSTEM IN LIBRARY ENVIRONMENT

N SIVAKAMI*

ABSTRACT

RFID, Barcodes and QR codes are similar in the fact that they are data collection technologies, meaning they automate the process of collecting data. However they also differ significantly in many areas. Barcodes, QR Codes and RFIDs help to manage and keep track of the inventory. These codes can be used in libraries as paper-free labels, library ID cards, and for acquiring information from a librarian, library instruction, and also for marketing. This article attempts to compare all the three technologies on various grounds like durability, cost, information capacity, read range etc. to determine the best out of it.

KEYWORDS: Barcode, QR Code, RFID, Library Service, Library Automation.

INTRODUCTION

Technology never stands still, it always advances, to overcome the problems faced in inputting data through keyboard in computerized automation systems and achieves maximum efficiency, and there is a need to further improve the automation of library system. This can be done through the automation of data entry. The technology, which can automate the process of data entry and in reach of library profession, is barcode, QR code and RFID.[1] QR Codes, barcodes and RFID (Radio Frequency Identification) are all systems for conveying large amounts of data in a small format. They offer speed, labor savings and cost savings, among other benefits.[2] But there are distinct differences between all three, and differences in the purposes they are best suited for where large numbers of items need to be tracked efficiently. Barcodes, QR codes, and RFID, though fundamentally function similarly-store, manage and track data, are used under different circumstances and with different objectives in mind. These codes can be used in libraries as paper-free labels, library ID cards, and for acquiring information from a librarian, library instruction, and also for security and materials tracking.[3]

LITERATURE REVIEW

Kiran Kumar [4] identified the key case studies from the available literature and shared some of them which can be implemented in Indian Library System and also described in detail the process of creating QR code, QR code accessibility, application of QR code in libraries and highlighted the new ideas to enhance access to library resources. Lotlikar Trupti et al. [5] compared all the three technologies on various grounds like durability, cost, information capacity, read range etc. to determine the best out of it. Walsh [6] aimed at libraries and shows how we can use them to take advantage of the mobile devices in many of our users' pockets.

*Sr. Librarian, Sri Sai Ram Engineering College, Chennai-44, Tamil Nadu, India.
Correspondence E-mail Id: editor@eurekajournals.com

Boss [7] RFID based system moved beyond security to become a tracking system that combines security with more efficient tracking of materials throughout the library, including easier and faster charge and discharge, inventorying and materials handling. In San Diego State University library catalogue, QR Code on that item record gives the title of the book, the call number, floor the book is on, and if the book is available.[8] The power of the library's information combined with the QR Code software's features, make it a pretty useful tool. RFID in library speeds up book borrowing and inventories and frees staff to do more user-service tasks.[3]

COMPARISON OF BARCODE, QR CODE AND RFID DEFINITION

BARCODE

A series of vertical bars of varying widths, in which each of the digits zero through nine, are represented by different pattern of bars that can be read by a laser scanner. The bars are commonly found on consumer products and are used especially for inventory control.

QR CODE

A QR code is a type of barcode that encodes information from left to right as well as up and down. Also known as a matrix barcode or a 2D barcode, they can hold more data and they can also encode varied types of data such as text, URLS, SMA messages, e-mails or a virtual business card.[10] QR codes can be scanned and read by a camera-equipped Smartphone with a scanner app, such as i-nigma for the iPhone. An average person can now de-code or read a QR code, without special equipment.

RFID

RFID or Radio frequency Identification, allows the reading and capture of information stored in tags via radio waves. The system consists of two parts- a tag or transponder, and a reader, that pass signals to one another.

IMAGE

Figure 1.Barcode

Figure 2.QR Code

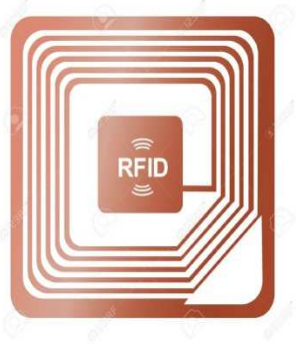

Figure 3.RFID

ADVANTAGES

BARCODE

- Easier to use, since smaller and lighter than RFID tags.
- Barcodes are directly printed on the plastic or paper materials and hence it costs less. Thus they are cost effective.
- Same accuracy is ensured.
- Increases the efficiency and minimizes the errors in the circulation desk.
- The operational cost is reduced, eliminating book pockets and cards.[9]

QR CODE

- Better potential to store information in a smaller space and larger recordable data size.
- A QR code is capable of being read in 360 degrees, from any direction it will eliminate any interference and negative effects from backgrounds. They can be read wherever they are scanned.
- It ensures smart phone compatibility since the codes are readable by and displayable in mobile phones.
- Designed with 2 dimensional codes that ensure error correction capability. Even if the part of encoded area gets dirty or distorted and thus is impossible to read, the total information can still be recognized with error correcting algorithm.
- QR codes allow any information to be stretched out as the information is segmented in up to 16 smaller sized squares.
- It is user friendly as QR code can navigate users exactly to their destination.
- QR codes are eco friendly by replacing magnetic cards with recyclable plain paper.
- The production cost of the use of codes in libraries is low. Thus they are cost efficient.
- It ensures traceable QR code activities with web analytics and other measuring tools.[11]

RFID

- RFID tags can be read from a greater distance than barcodes, ranging up to 300ft.
- They do not need to be positioned in a line of sight with the scanner.
- Approximately 40 RFID tags can be read simultaneously assuring a faster rate than bar codes.
- RFID tag is a read/write device.
- It has a high level security enabling data encryption, password protection or a permanent removal of data by including a ‘kill’ feature.
- It has large programmable data capabilities.
- It can be run with minimal human participation once the settings are done.
- It is reusable and rugged since it is protected by a c cover.
- Flawless read rate data capacity.
- Humidity and temperature resistant.[12]

DISADVANTAGES

BAR CODE

- Labor intensive; requires individual scan through human intervention.
- The reader cannot break the date.
- Less secured than RFID as they are easily forged or reproduced.
- To scan the bar code for extraction of code, a line of sight is mandatory.
- The barcode scanner should be closer around 1.5 ft. in order to be read.
- The printed bar code has to be exposed on the outside of the product as line of sight is required for scanning; hence, barcodes are easily damaged.
- There is no alternative to scan the product if a barcode is ripped or damaged. Wrinkled and smeared tags won’t work.
- They do not contain any added information and have no read/write capabilities.

QR CODES

- Lack of familiarity of the QR code among people is one of the major disadvantages.
- Lacks the automation ability for proximity scanning like RFID. Human input is mandatory.
- To scan the tag input or extract data, a line of sight is necessary.
- Time consuming in designing and producing large number of codes.
- The user needs a smart phone with a QR code app to use it.
- Compatible hardware and software are required to read codes, due to the diversity of smart phones used by students.
- A link to the instruction page of the library is required as QR codes are unfamiliar to most of the library users.
- 30% date of wrinkled tags may be recoverable.
- Two dimensional codes are only readable unlike RFID; it lacks writing ability.

RFID

- RFID is more expensive as it involves assembling and inserting a computerized chip.
- Difficult in picking up information when passing through metal or liquid.
- Results in reader collision when there is overlapping of two signals from different readers and the tag is unable to respond to both.
- Simultaneous responses from numerous tags in the same area can cause tag collision.
- Presence of two separate chips cannot be read by the same machine.

APPLICATION IN LIBRARY

BARCODE

- To automate the data entry process of circulation system.
- It increases efficiency and eliminates human errors.
- Verification of stocks.
- Generating user statistics.
- Transferring stack from reference to lending and vice versa.
- To weed out the collection and to update the records.
- Easy retrieval by providing location codes such as departmental library.

QR CODE

- Users can get the information about resources on their phone by adding QR code to OPACs.
- To link electronic resources within the library.
- Gives step by step guidance for machines like printers and copy machines.
- Provides a list of library guides on the subjects of books on shelves.
- During induction period for new students, QR code is used to great effect to introduce users to the library.
- It connects the user to the information quickly and easily and also plays a pivotal role in education.

RFID

- To increase efficiency and for cost reduction, RFID is adopted in today's libraries.
- Self services automation.
- The provision for security is an added advantage in RFID.
- It improves circulation, easy retrieval and inventory control.

CONCLUSION

RFID, Barcodes and QR codes are similar in the fact that they are data collection technologies, meaning they automate the process of collecting data. However they also differ significantly in many areas. Barcodes offer some advantages over RFID like their low cost. QR code and barcode need to be in the line of sight to be read

by scanner; but it is not at all required in case of RFID. The radio signal can penetrate through objects; it can be used to read bulk of RFID tagged objects at a time and orientation is also not an issue with them. Accessibility range for barcode and QR code varies from few feet to inches whereas for RFID it is up to few meters. The most important benefit with the RFID tag is that it is reusable, also the contents on it can be modified any number of times but it is not possible with barcode and QR code. Also the RFID tags have better durability over barcode and QR code; even damaged ones can read the information written on it. Barcode stores the least information, followed by QR code and RFID can store considerable amount of information. It gives us a clear picture that RFID can deliver more rapid scanning times than barcode QR scanning. QR codes are web oriented, typically used for storing URLs or other information. The conventional resources in library like books, journals, video/ audio materials, company reports, etc., can be supported by QR code which can act as a point of reference to online electronic holdings and additional resources, and can be used as one of the marketing tool in library services. Therefore RFID proves to be a promising technology compared to others in use. RFID system is the comprehensive system that addresses both the security and materials tracking needs of the library.

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