

UTILIZATION OF RADIO FREQUENCY IDENTIFICATION TECHNOLOGY FOR PRIVACY AND SECURITY OF INFORMATION RESOURCES IN UNIVERSITIES IN KATSINA STATE

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Abstract

This research work investigated “Utilization of Radio Frequency Identification Technology for Privacy and Security of Information Resources in Universities in Katsina State, Nigeria.” The investigation was guided by four objectives: which sought to find out the types of RFID technology available for librarians, the procedures for the use of RFID technology by librarian and the barrier faced by librarians in the use of RFID technology for privacy and security of information resources in universities in Katsina State. Quantitative research method was adopted for the study, using descriptive survey design. The target populations for this study consisted all librarians in the two university libraries in Katsina State. The total numbers of librarians in these libraries are one hundred and twenty-nine (129). The entire members of the population were used because the size of the population is small and manageable by the researcher. The instrument for data collection was open and closed ended questionnaires. The data collected from the field was sorted, organized, presented and analyzed using inferential statistics in forms of Mean and Standard Deviation. The study found out that Low Frequency, High Frequency and Passive Frequency RFID technology are the types of RFID technology available for librarians for privacy and security of information resources in the two universities in Katsina State. Furthermore, the study also found among other the barriers faced by librarians in the use of RFID technology for privacy and security of information resources in universities in Katsina State were the high cost of using RFID and the performance of the exit sensors. The research recommends among others that the university libraries and librarians should look for alternative sources to purchase or subscribe RFID technology for privacy and security of information resources though donor agencies such as; IFLA, UNESCO and the rest.

Keywords: Utilization, Information Resources, Radio Frequency Identification Technology, Privacy and Security

Introduction

The need to secure information resources in the libraries cannot be over emphasised. This is because the information resources are acquired in order to be accessed by the users to improve and solve their educational, economic, religious, and social among other problems. Securing information resources in the libraries is done using approaches such as traditional and modern. Modern approach to the security of information resources in the libraries involves the use of electronic technologies. Part of these technologies is radio frequency identification (RFID) technology. However, university libraries are increasingly adopting radio frequency identification (RFID) technology; mainly to improve the efficiency of information services and increase quality services (Makori, 2015). This is in line with the fourth law of library and information science, which states “save the time of the users”. The application and use of RFID solutions in the information environment is slowly changing as more library and information systems adopt the technology.

Radio frequency identification (RFID) is a small tag containing an integrated chip circuit and an antenna that will respond to radio waves transmitted from the RFID reader that is functioning as a sender, processor, and information storage (Wu et al., 2006). Jones et al., 2007, Hsu and Yuan, 2011; Liao et al., 2011; Thorley et al., 2011, Wang, 2011, Suda and Abdul Rani, 2015. According to Liu & Chen, (2009) RFID is an electronic information technology that utilizes wireless radio waves to transmit, identify, trace sequence and confirm various objects. It is a combination of radio frequency based technology and microchip technology by which the information inserted on microchips in the tags affixed to library materials is read via radio frequency technology.

However, Radio Frequency Identification (RFID) Technologies provides a wireless means of communication between objects and readers. RFID involves the use of tags, or transponders, that collect data and manage it in a portable, changeable database.

RFID (Radio Frequency Identification) which is a combination of radio-frequency-based technology and microchip technology is being hailed as one of the most important applications in every field including highway toll payments, automotive, packaging and handling, and retail industries, libraries, etc. (Singh and Mahajan, 2015). Two components in RFID are the tag and reader. RFID tags are used to tag objects or assets, and an RFID reader gathers the tag information. RFID technology is a replacement for barcode technology in terms of non-optical proximity communication, information density and two-way communication. Compared to barcode technology, RFID technology possesses powerful properties which include being waterproof, having a magnetic scratch-resistant protection layer, being heat resistant, being long lasting, transmitting data transmission over long and short distances, data encryption, and relatively large memory capacity (Bi, Cao & Sheng, 2011).

However, RFID technology supports supply chain information sharing by providing unique features in collecting data within and between organizations, which ultimately enhance the performance of the supply chain firms (Zelbst et al., 2010). RFID is a form of technology, which is used to identify physical objects like palettes, industrial containers, or sales units, automatically by using radio waves. Nowadays, RFID technology is gaining interests in businesses, academic environments and the media (Saremi and Taghizadeh, 2013). Even with the growing knowledge about the implementation of RFIDs, there is still not enough information about the elements driving this technology adoption. While there are over 500, 000 RFID systems installed in warehouses and retail establishments worldwide, these are relatively new in libraries. Singapore Public Library claims to be probably the first application of RFID technology fully deployed in a library environment in 1998. The use of RFID by libraries since then has grown dramatically. The adoption of RFID technology by libraries promises a solution that could make it possible to inventory hundreds of thousands of items in their collections in days instead of months. In addition, it allows patrons to check out and return library collection automatically at any time of the day. Besides speeding up checkouts, keeping collections in better order and alleviating repetitive strain injuries among librarians, RFID promises to provide a better control on theft, non-returns and misfiling of a library's assets (Singh, Brar, and Fong, 2016). As modern knowledge hubs and knowledge base nets, university libraries need to manage and handle information and knowledge services effectively and efficiently. Fundamentally, University Libraries are social institutions of knowledge and intellectual development. The main purpose of university libraries is to ensure proper management of Library and information services in meeting the needs and demands of the customers (Makori, 2015)

In modern knowledge and learning environments, libraries have to look for creative solutions in order to be relevant to the needs and demands of customers. RFID technology is rapidly becoming the backbone of quality delivery of information, knowledge, communication, management, education and research services in libraries. The technology provides integration, real-time accessibility and quality delivery of information services.

Statement of the Problem

As technology proliferates, the knowledge economy burgeons, thus, people; especially knowledge workers continue to explore technological innovations for professional and non-professional purposes. Evidences from literature are that studies have been carried out on personal and professional uses of RFID in organisations like the military, business, fashion, government, health, libraries, and so on.

However, based on the interaction with the heads of the University libraries in Katsina State, such as Federal University Dutsin-Ma Library and Umaru Musa Yar'adu University Library concerning their library information resources were diminishing. As such, the heads of libraries procured and installed RFID. Thus, since the installation of the technology, no research was conducted to the best of knowledge of the researcher to find out the situation of the technology in relation to the privacy and security of information resources in the libraries. As a result of this, the researcher intends to carry out this study. The study focuses on Adoption and Utilisation of Radio Frequency Identification Technology for Privacy and Security of Information Resources in Universities in Katsina State.

Research Questions

The following research questions were raised:

1. What are the types of RFID technology available for librarians for privacy and security of information resources in universities in Katsina State?
2. How is the RFID technology being used by librarian for privacy and security of information resources in universities in Katsina State?
3. What are the barriers faced by librarians in the use of RFID technology for privacy and security of information resources in universities in Katsina State?

Literature Review

Types of RFID Technology for Privacy and Security of Information Resources

Radio frequency identification RFID are small tag containing an intergraded chip circuit and an antenna that respond to radio waves transmitted from the RFID reader that is functioning as a sender, processor, and information storage.

Active RFID: Active Frequency system use battery powered tags that continuously broadcast their own signal and tags are commonly used to accurately track the real time location of assets or high speed environment such as tolling. It Provide the ability to completely automate processes in access, location, conducting regular inventory counts and tracking personnel.

Passive RFID: A passive tag is an RFID tags that does not contain a battery, the power is supplied by the reader when radio waves from the reader are encountered by a passive coiled antenna within the tags forms a magnetic field the tags draws power from it, energizing the circuit in the tag.

Battery Assisted Passive BAP: RFID Battery Assisted passive sensor tag target the niche in between both kind of devices and sensor tags include batteries but the communications is kept battery free and continues to be by back scattering.

Procedures through which RFID Technology is Being Used for Privacy and Security of Information Resources

Nowadays, RFID has been more attracting for industry and academic institutes. It has gained wide range of adaptation for low-cost and ubiquitous computing application, such as vehicle tracking, container tracking, object tracking, supply chain management tracking, asset tracking. Radio frequency Identification (RFID) usually is defined as a small tag containing an integrated chip circuit and an antenna that will respond to radio waves transmitted from an RFID reader that is functioning as a sender, processor information storage (Wu et al., 2006). Jones et al., 2007, Hsu and Yuan, 2011; Lia et al., 2011; Thornley et al., 2011; Wang, 2011;). RFID is a form of technology, which is used to identify physical objects like palettes, industrial containers, or sales units, automatically by using radio waves. There are transponders placed inside or on the surface of the particular objects, which allow the objects to be identified without touch (Attaran, 2007). RFID is an electronic information technology that utilizes wireless radio waves to transmit, identify, trace sequence and confirm various objects (Liu & Chen, 2009).

According to OECD 2008, RFID enables wireless data collection by readers from electronic tags attached to or embedded in objects, for identification and other purposes. RFID systems involve software, network and database components that enable information to flow from tags to the organization's information infrastructure where it is processed and store. Systems are application-specific. Some use passive, low cost tags with short read ranges, most data on the network, and ranges, most data on the network, and only small amounts of information on tags.

RFID tags are the chips that are embedded in the product, pallet, or case. They are used to store and transmit information about the specific unit (Attaran, 2007). RFID tags are used to tag objects or assets and an RFID reader gathers the tag information (Bi, Cao & Sheng, 2011). RFID readers are the enterprise application systems (Wang et al., 2010). It is used for reader and device management to provide a common interface to configure, monitor, deploy, and issue commands directly to readers (Cutin et al., 2007; Sweeney, 2005). RFID system is always connected to an enterprise application system for data processing in support of business activities (Wang et al., 2010).

In developing countries, RFID technology is emerging as one of the modern information 2.0 systems increasingly being adopted and implemented in library and information establishments to increase efficiency and quality of the delivery of information services to customers. Radio frequency identification is an exciting and fat growing technology for increasing efficiency and improving profitability, and is an important area of study in today's information environment (Madhusudhan, 2010).

Barriers Faced by Individuals in the Use of RFID Technology for Privacy and Security of Information Resources

RFID adoption in library and information service presents a host of challenges, which includes the following:

Policy Issues: the lack of ICT policies (Makori,2015) to adopt and embrace modern technologies into mainstream information services can impede the adoption and development of RFID applications in university libraries. Often, the policies to guide university libraries with regards to adopting technological solutions are not followed. The standardization of operation also varies across countries (Singh & mahajan, 2014).

Technical Issues: include abnormal signals resulting from environmental differences, higher energy of electromagnetic waves in transient transmission while driving tags by RFID readers, consistency between different suppliers of RFID readers is important along with the lack of standardization of specifications relating of RFID equipment, including chip standards, communication transmission agreements, and programming interface poses further challenges.

Another issue is interference: Accuracy in the transmission process is influenced by real time efficiency of the application. One problem is the direction of signal. This problem occurs because of interference from metal of fog, the distance between the reader and the tag, and the antenna direction (Yu, 2007). A second problem is the possibility of nearby devices interfering with security gates, the transmission of the security gates may also interfere with other nearby devices (Blansit, 2010). Reader collision occurs because the signal from one reader can interfere with the signal from another where coverage overlaps. Once this happens, it is likely that the RFID reader is transmitting incorrect information.

The Lack of Technology Experts: Bansode&Desale (2009), integration with current systems or process (Chellilah, Sood&Scholfield, 2005) and difficulty in integrating with existing library automation system (Bi, Cao & Sheng, 2011) are barriers to RFID technology provides security through its ability to detect whether or not a book is checked-out. However, people with ill intent may exploit the non-line-of-sight operation and other weaknesses in library's RFID system resulting in theft and loss of library material (Butters, 2007). Such threats may be addressed by employing non-tag based security as well.

Economic Issues: The deployment of RFID technology in libraries is costly (Madhusudhan,2010 Bahri& Ibrahim, 2013). The cost have to cover the initial hardware and software purchase, middleware and tag (Mehrjedi, 2011), training and RFID infrastructure maintenance. Libraries with small budgets may find it difficult to start using RFID.

Limited Market Opportunities: traditional approaches of handling and supporting information and services are still used by most of the universities. The limited market opportunities for RFID technologies in information work have left university libraries lagging behind the knowledge society sustainable development goals, and modern information practices based on currently technology.

Privacy Issues: An RFID system can detect all activities or transaction performed by users using an RFID reader. However, this raises users and staff members' privacy (power, 2005). Because of this, some libraries have chosen not to implement RFID system. all user activities in sa library such as reading and browsing can be easily detected by the RFID reader (Mehrjedi, 2011). Some users may object to an RFID related system due to the perceive invasion of privacy. RFID do not feel any motivation to implement RFID.

Lack of Optimal Readability: Accuracy in the case of RFID depends on three factors: signal strength, frequency, and the surrounding environment. Researchers have shown that RFID scanner successfully read tags 85 to 90 percent of the time. Some RFID tags cannot be detected by the antennas if they are shielded in the package or the product itself so the exact location of the tag is not known.

Lack of ICT Policies: Aligning university libraries with RFID system to improve the delivery of quality information services is still one of the biggest challenges facing information professionals. The lack of appropriate ICT policies to adopt and embrace modern technological

solutions into mainstream information services hinder the development of RFID application in university libraries. In reality, more attention is given to policies that favour the acquisition of information resources at the expense of technological systems.

Lack of a business approach in information practices: Information centres have not adopted modern information practices that are business-oriented. A business approach implies the use of modern information practice that helps to provide and deliver quality services to customers through RFID solutions.

Methodology

This study adopted quantitative research method using descriptive survey research design. Quantitative research method was adopted due to the nature of the research problem that try to determine the types of RFID Technology used by librarian for privacy and security of information resources in universities in Katsina State while descriptive survey research design was used in order to give vivid account and description of the RFID Technology used by librarian for privacy and security of information resources as accurate as possible. The target population for this study consisted all librarians in the federal and state owned university libraries in Katsina State. The university libraries are: Federal University Dutsin-Ma Library and Umaru Musa Yar'adu University Library. The total number of librarians in these libraries was one hundred and twenty-nine (129). Table 3.1 presents the population of this study.

Table 1: Population of the Study

S/N	University Libraries	No. of Staff
1.	Federal University Dutsin-Ma Library	65
2.	Umaru Musa Yar'adu University Library	64
Total		129

Source: University Librarians (2019)

For the purpose of this research, the entire members of the population were used because the population is small. Barnard (2012) opined that if the population of the study in research is less than two hundred (200), the entire members of that population can be used. Open and closed ended questionnaire were developed to collect data from the respondents. This is because the respondents can read, understand and respond (write) towards the information content on the questionnaire. The data collected for this study were organized, analysed and presented using the tables in line with the research questions used, such as mean and standard deviation were used to analyse the data collected using Statistical Package for the Social Sciences (SPSS). In addition, 1.50 and above benchmark was used to take decision for the discussion of the analysis. The benchmark was deduced from the average means of the total mean scores of the study.

Result and Discussions

Table 2: Types of RFID Technology for Privacy and Security of Information Resources

S/N	Types of RFID Technology	Types of RFID Technology Available				
		UNIV.	A	N.A	T	M

1	Low Frequency RFID	FUDMA	23	20	43	1.53	0.03
		UMYUK	46	04	50	1.92	0.15
2	High Frequency RFID	FUDMA	15	28	43	1.35	0.07
		UMYUK	37	13	50	1.74	0.02
3	Ultra-High Frequency RFID	FUDMA	10	33	43	1.23	0.12
		UMYUK	03	47	50	1.06	0.46
4	Active Frequency RFID	FUDMA	09	34	43	1.21	0.14
		UMYUK	20	30	50	1.40	0.05
5	Passive Frequency RFID	FUDMA	04	39	43	1.09	0.34
		UMYUK	30	20	50	1.60	0.01
6	Other Specify	FUDMA	01	42	43	1.02	1.40
		UMYUK	01	49	50	1.02	1.40

Source: Field Survey, 2021

Key: Available (A), Not Available (N.A), (U), Total (T), Mean (M), and Standard Deviation (SD)

Table 4.2: Revealed the types of RFID Technology for privacy and Security of information resources at the FUDMA and UMYU. From the table UMYUK with mean value of 1.92(SD=0.15) has the highest type of low frequency RFID followed by FUDMA with mean value of 1.53(SD=0.03) the both have high frequency RFID, Ultra-High frequency and Active frequency RFID. Only UMYUK has appreciable of Passive frequency RFID with mean value of 1.60(SD=0.01). Madhusudhan, (2010) emphasized that Radio frequency identification is an exciting and fast growing technology for increasing efficiency and improving profitability, and is an important area of study in today's information environment

The implication of this finding is that if the RFID technology available for librarians for privacy and security of information resources were not effectively utilized in the university libraries studied, there will be high rate of stealing and loss information resources by library users. As a result, effective adoption and usage of RFID technology available for librarians for privacy and security of information resources will become ways forward for tackling stealing and loss of information resources in the universities.

Table 3: Process for Using RFID Technology for Privacy and Security of Information Resources

S/N	Procedures for Using RFID Technology by Librarians						
		UNIV.	P. A	P.N. A	T	M	SD
1	Self-Checkout Station	FUDMA	12	31	43	1.28	0.10
		UMYUK	01	49	50	1.02	1.40
2	Self-Return System/ Book Drop System	FUDMA	16	27	43	1.37	0.06
		UMYUK	16	34	50	1.32	0.07
3	Security Gates/ EAS(Electronic Article Surveillance)	FUDMA	10	33	43	1.23	0.12
		UMYUK	38	12	50	1.76	0.02
4	Automated Sorting Station	FUDMA	10	33	43	1.23	0.12

	of a Newresource	UMYUK	04	46	50	1.08	0.34
5	Programming/Tagging Library Document	FUDMA	10	33	43	1.23	0.12
		UMYUK	10	40	50	1.20	0.12
6	Shelf Management System	FUDMA	05	38	43	1.12	0.26
		UMYUK	16	34	50	1.32	0.07
7	Circulation	FUDMA	11	32	43	1.26	0.11
		UMYUK	37	13	350	1.743	1.28 0.02 0.10
8	Borrowing/Lending	FUDMA	10	33	43	1.23	0.12
		UMYUK	35	15	50	1.70	0.01
9	Others Specify	FUDMA	01	42	43	1.02	1.40
		UMYUK	01	49	50	1.02	1.40

Source: Field Survey, 2021

Key: Procedure (PA), Not Procedure (PNA), Total (T), Mean (M), and Standard Deviation (SD)

Table 4.3 Show the procedure for using RFID technology for privacy and security of information recourses. UMYUK is the only university in Katsina state which use the RFID more for security Gate/Eas Electronic Article Surveillance with mean value of 1.76(SD=003) followed by Circulation with mean value of 1.74(SD=0.02) the least use of the RFID is for Borrowing/Lending with mean value of 1.70(SD=0.01). Other use of RFID in the two university are for Self-Checkout Station, Self-Return System/ Book Drop System and Automated sorting station of a new resource. It can therefore be deduced that Security Gates/ EAS (Electronic Article Surveillance), Circulation and Borrowing/Lending Materials were the procedures for using RFID technology for privacy and security of information resources universities in Katsina State. This implies that Self-Checkout Station, Self-Return System/ Book Drop System, Automated Sorting Station, Programming/Tagging of a New Library Document, Shelf Management System and Others were not part of the procedures for using RFID technology for privacy and security of information resources universities in Katsina State.

By implication, librarians would be more competent in the procedures for using RFID technology for privacy and security of information resources, if their respective university libraries will fully have dedicated for providing the needed formal of ICTs training. This would go a long way in improving information services with the use of RFID technology for privacy and security of information resources universities in Katsina State.

Table 4: Barriers Faced by Librarians in the Use of RFID Technology for Privacy and Security of Information Resources

S/N	Barriers Faced by Librarians in Using RFID Technology						
		UNIV.	B	N.B	T	M	SD
1	RFID tags can be vulnerable to unauthorized scanners reading the information stored on the tags	FUDMA	09	34	43	1.21	0.14
		UMYUK	02	48	50	1.04	0.69

s2	The cost of using RFID is high	FUDMA	25	18	43	1.58	0.02
		UMYUK	36	14	50	1.72	0.01
3	Vulnerability to compromise	FUDMA	08	35	43	1.19	0.16
		UMYUK	01	49	50	1.02	1.40
4	RFID tags are flexible enough; it cannot be concealed and are exposed for removal	FUDMA	01	42	43	1.02	1.40
		UMYUK	05	45	50	1.10	0.27
5	The performance of the exit sensors is more problematic	FUDMA	02	41	43	1.05	0.69
		UMYUK	40	10	50	1.80	0.04
6	There are no real agreed Standards world-wide for RFID	FUDMA	06	37	43	1.14	0.22
		UMYUK	17	33	50	1.34	0.06
7	Lack of lobbying or negotiating skills among information professionals	FUDMA	05	38	43	1.12	0.26
		UMYUK	10	40	35	1.20	0.12
8	Others specify	FUDMA	01	42	43	1.02	1.40
		UMYUK	01	49	50	1.02	1.40

Source: Field Survey, 2021

Key: Barrier (B), Not Barrier (N.B), (U), Total (T), Mean (M), and Standard Deviation (SD)

Table 4.5 clearly presents the barriers faced by librarians in the use of RFID technology for privacy and security of information resources in UMYUK university in Katsina State for the performance of the exit sensor is more problematic with mean value of 1.80(SD=0.04) followed by the cost of using RFID in high mean value of 1.72(SD=0.01) the least barriers faced in the use of RFID is there are no real agreed standards world-wide for RFID with mean value of 1.34(SD=0.06) others barriers faced using RFID in the two universities RFID tags can be vulnerable to unauthorized scanners reading the information stored on the tags, Vulnerability to compromise, RFID tags are flexible enough; it cannot be concealed and are exposed for removal, Lack of lobbying or negotiating skills among information professionals and others. However, RFID tags can be vulnerable to unauthorized scanners reading the information stored on the tags, Vulnerability to compromise, RFID tags are flexible enough; it cannot be concealed and are exposed for removal, no real agreed Standards world-wide for RFID, Lack of lobbying or negotiating skills among information professionals and others received the responses less than the 1.50 bench mark in the two universities.

Makori, (2015) opined that lack of ICT policies to adopt and embrace modern technologies into mainstream information services can impede the adoption and development of RFID. Based on these responses, the barriers faced by librarians in the use of RFID technology for privacy and security of information resources in universities in Katsina State were the high cost of using RFID and the performance of the exit sensors. The implication of this finding is that it is true that no matter what is being put in place to satisfy needs there must be one problem or the other.

Conclusion and Recommendations

The types of RFID technology available for librarians for privacy and security of information resources in the two universities in Katsina State are; Low Frequency, High Frequency and Passive Frequency RFID technology are the types of RFID technology. Arising from the findings of this study, Security Gates/ EAS (Electronic Article Surveillance), Circulation and Borrowing/Lending Materials were the procedures for using RFID technology for privacy and security of information resources universities in Katsina State. The barriers faced by librarians in the use of RFID technology for privacy and security of information resources in universities in Katsina State were the high cost of using RFID and the performance of the exit sensors. In line with the findings of this study, the following recommendations were made:

1. The management of FUDMA and UMYUK university libraries in Katsina state should adopt and use other types of RFID technology Ultra-High Frequency RFID, Active Frequency RFID, and other types of RFID technology available by librarians for privacy and security of information resources so as to ensure effective and efficient privacy and security of information resources regardless of the format.
2. The librarians in FUDMA and UMYUK should enforce using RFID technology for privacy and security of information resources universities in Katsina State particularly, in the aspects of Self-Checkout Station, Self-Return System/ Book Drop System, Automated Sorting Station, Programming/Tagging of a New Library Document, Shelf Management System and Others.
3. The university libraries of FUDMA and UMYUK should look for alternative sources for purchasing or subscribing RFID technology for privacy and security of information resources via donate agencies such as; IFLA, UNESCO and so.

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