European Journal of Computer Science and Information Technology
Vol.2,No.4, pp.21-28, December 2014
Published by European Centre for Research Training and Development UK (www.eajournals.org)

ADOPTION OF RFID TECHNOLOGY IN KENYA

Jonathan Sangoro* Professor Waweru Mwangi Dr. Michael Kimwele
School of Computing and Information Technology
Jomo Kenyatta University of Agriculture and Technology
P.O. Box 62000 – 00200 Nairobi, Kenya

ABSTRACT: *The objective of this research was to evaluate knowledge of RFID systems in the Kenyan ICT sector. This was in tandem with my Master's thesis titled "Enhancing RFID Application Data Security Using RSA Algorithm". To enhance the current security measures and controls in current RFID applications I propose RSA algorithm as the best suited public cryptosystems in the currently available encryption standards. As I collected my data from the different respondents I issued my questionnaires I found varying responses across the board, some knew of RFID and RSA algorithm while others have never heard of RFID and RSA algorithm. After collection of this data i used SPSS to analyze it and the deductions I attained formed the basis of this publication. This research was focused wholly in the Kenyan ICT sector and evaluated the knowledge of RFID in sector.*

KEYWORDS: RFID, RSA algorithm, encryption.

INTRODUCTION

RFID stands for Radio Frequency Identification. It is a technology that has been around for a while in Europe and America since late 1990's. RFID is a technology that uses radio frequency to transmit and receive information among the different components of the RFID system, but it does not concentrate on authentication and verification of the data communicated.

The different components of an RFID system are tags or transponders, readers, software and antennas.

Tags

Tags are components which store information which can be queried and read by readers and antennas. They also have an inbuilt memory on which to store information about a particular object on to which they are attached. The memory may range from a few kilobytes to megabytes. Tags also have an integrated circuit which enables them to be activated and deactivated.

There are three types of tags; passive, semi-passive and active tags.

Passive tags have no inbuilt power source and depend on the reader to activate and deactivate them. The tags instead convert the radio frequency emitted by the reader to power source using their integrated circuitry and use this power supply to read the information stored in their memory after which they convert this power supply back to radio frequency which is then transmitted back to the reader for the data to be decoded or read.

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

Semi-passive tags have their own internal power source (battery). This makes them not to rely on the radio frequency emitted by the reader as their main power source. The reason why these tags are called semi-passive is that they cannot initiate communication on their own but solely rely to be queried or activated by the reader for them to start communication.

Active tags on the other hand have their own power source and do not rely on radio frequency emitted by the reader or the reader itself to initiate communication. They instead initiate communication on their own and one active tag can also directly communicate with another active tag.

Readers

Readers are the components of the RFID system which as interrogators and emit radio frequency signals to activate and query tags. The readers may be connected to the software database wirelessly or through Ethernet so that they are always in constant communication with the database. There are two types of tags; mobile readers which are handheld portable readers and fixed readers which are mounted on surfaces and only have a certain reading range (scanners).

Software

The RFID software is the core component of the RFID system which ensures that all the other components of the system are visible to each other and are in constant communication. The software ensures that as data is transmitted from one component to another it is also updated with that which is stored in the database. If the software is compromised all the other components will fail to communicate and the entire RFID system will collapse.

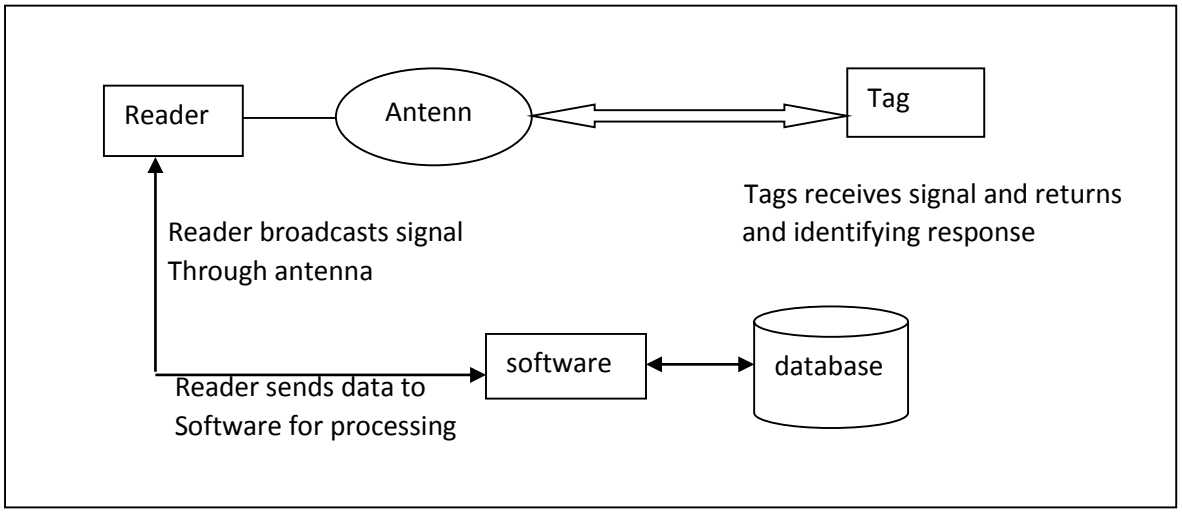

Fig 1. How RFID works

RFID technology has been applied in various fields and industries in the following areas; Supply Chain Management, hospitals, casinos, courier services, vehicle identification, banking and in libraries.

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

RFID Security

The key concern with RFID that makes most companies be hesitant to implement it is it's security and privacy. The data stored in these tags is not secured effectively such that an attacker with a rogue reader can prompt any tag to send the information stored in its memory to that particular reader. This is what makes RFID susceptible to attacks such as man-in-the-middle, eaves dropping, replay attack and jamming. Since the tag does not usually verify the source of reader query but sends data to any rogue reader that the queries data from it.

RSA Algorithm

RSA was developed by Ron Rivest, Adi Shamir and Leonard Aldeman in 1977. Their last names were joined to form RSA from Rivest, Shamir, Aldeman. RSA is asymmetrical public key cryptosystem. This algorithm is used to encrypt data from plaintext to ciphertext and then decrypt the ciphertext back to plaintext.

RSA works on the premise of factoring two large prime numbers which are usually kept secret. These prime numbers and private key are usually retained by the sender of the message who only shares the public key with the recipient who then in-turn uses that public key to decode the ciphertext back to plaintext.

RSA algorithm is one of the most secure public cryptosystems since it is based on factoring very large prime numbers. The primes numbers make it hard for an attacker to guess the private key since it would be very hard to breakdown the two large prime numbers.

Due to its complexity I propose to use RSA as a cryptographic algorithm to secure RFID data during transmission from the tag to the reader and vice-versa. This means that for the reader and tag to exchange data the reader queries a particular tag using its identification number or the username and password assigned to that particular tag. If the password or ID number match with that stored in database communication is verified and authenticated and data is transmitted, if not, data is not transmitted. This effectively locks out other rogue readers used by attackers, since the attacker's reader doesn't have the correct password stored in it's database thus cannot initiate communication with any tag.

RFID in Kenya

In Kenya though RFID is a new technology which has not been adequately explored and implemented ergo has not permeated into the everyday activities of organizations, businesses and everyday life. This means that though RFID would automate, increase productivity, cut costs and increase profit margins subsequently for organizations and businesses, most of these entities are not conversant with the technology, are ignorant or complain that the initial capital would be too expensive to invest. But I usually correct them by advising them that over a period of a year or two RFID would help them recoup their initial investment and after that grow their Return On Investment which would presumably double as their profit margins keep increasing.

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

According to the data I collected for my research most of the respondents I handed my questionnaires most did not comprehend what RFID is. This begs the question what technology are Kenyan organizations and businesses using to perform simple organizational tasks such as asset management. Some respondents intimated that they use barcode technology while others divulged that they have no asset management system in place.

From the questionnaires that I issued for my research on the section of General Knowledge and Exposure to RFID, 5% of the people I asked were not aware of RFID technology, what it is, what it does or how it could benefit their organization. When I analysed this data further using SPSS the highest mean I got when evaluating Knowledge and Exposure to RFID is 1.499 which was a response to the question "Are you conversant with RFID technology?"

My findings also indicated that most respondents' organizations preferred to implement barcode technology to RFID.

ITEM	**FREQUENCY (%)**		**MEAN**	**SD**
	1	2		
Are you conversant with RFID technology?	27 55.1	22 44.9	1.449	0.503
Do you use barcodes in your organization?	30 58.8	21 41.2	1.411	0.497
Have you ever interacted with a barcode scanner/reader and tag?	42 91.3	4 8.7	1.087	0.284
Do you have knowledge of barcode?	49 96.1	2 3.9	1.039	0.196

Table 1. Evaluating knowledge and exposure to barcode and RFID in Kenya

SD = standard deviation

In regards to the question "How long do you think it will take to introduce RFID in your organization?", most of the respondents were not sure when their organization will introduce RFID technology at 73% whereas 18.9% thought the technology would be introduced in 3 to 4 years time.

Variable	**Frequency**	**Percentage (%)**
1- 2 Years	3	8.1
3 – 4 Years	7	18.9
Not in the near future	27	73.0

Table 2. Number of years it would take an organization to implement RFID technology

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

The respondents also identified the following as the 3 best benefits that RFDI would bring to their organization;

- ✓ Access control to the available resources
- ✓ High level of security to mange offices
- ✓ Easy management of organization's resources.

As to the question of importance of RFID technology, "How do you rate the importance of RFID?" Most respondents at 63.7% feel RFID technology is of moderate importance to their organizations. In the figure below 1 represents moderate importance while 2 represents high importance.

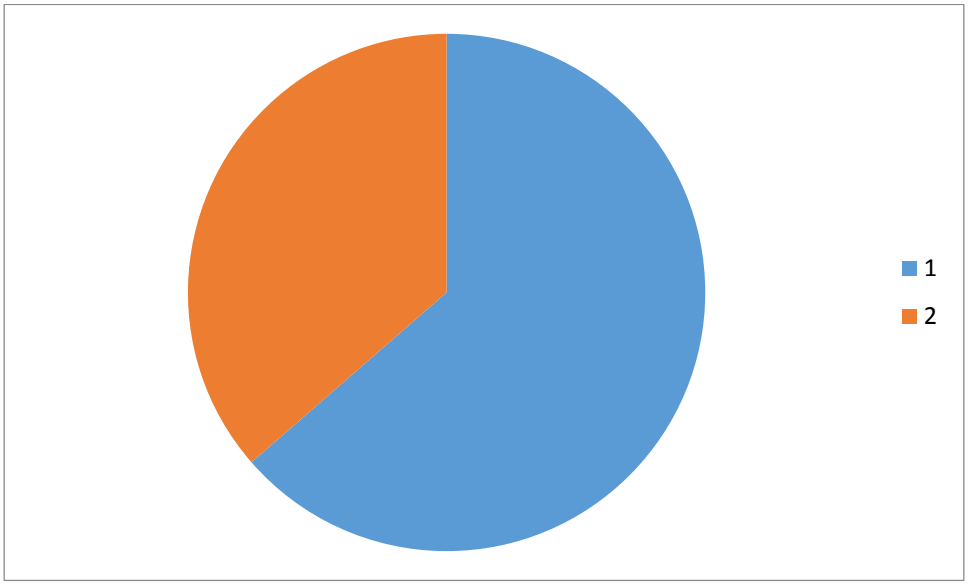

Fig 2. Importance of RFID technology in Kenyan organizations

Also most respondents feel the key challenges of RFID implementation are as follows;

- ✓ Operational costs
- ✓ Malfunctions due power fluctuations
- ✓ Access control and monitoring of RFID

As relates to the last two challenges above, I find that malfunctions due to power fluctuations not a major challenge, since if the organization invests in a good software it should be able to store information locally in-case there is power or internet disruption and on resumption of both amenities the data should be synchronized automatically with that stored in the database.

As for access control and monitoring through RFID, the main reason for implementing the said technology is to help track and monitor organization's assets in real-time and thus reduce theft of organizations assets and help the organizations cut costs. The priority of any organization is to curb theft of organization assets which lead to organization loss, meet their business objectives and maximize profits, this should be their paramount concern and they should not care that

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

employees are uncomfortable having their movements and assets tracked in real-time within the organization.

The last question in this section was pertaining to the level of security of RFID implemented in their organizations, to which majority of the respondents agreed that the security of RFID is moderately secure with a frequency of 5 which corresponds to 62.5% of the respondents. In the figure below 1 represents low importance, 2 represents moderate importance and 3 represents high importance.

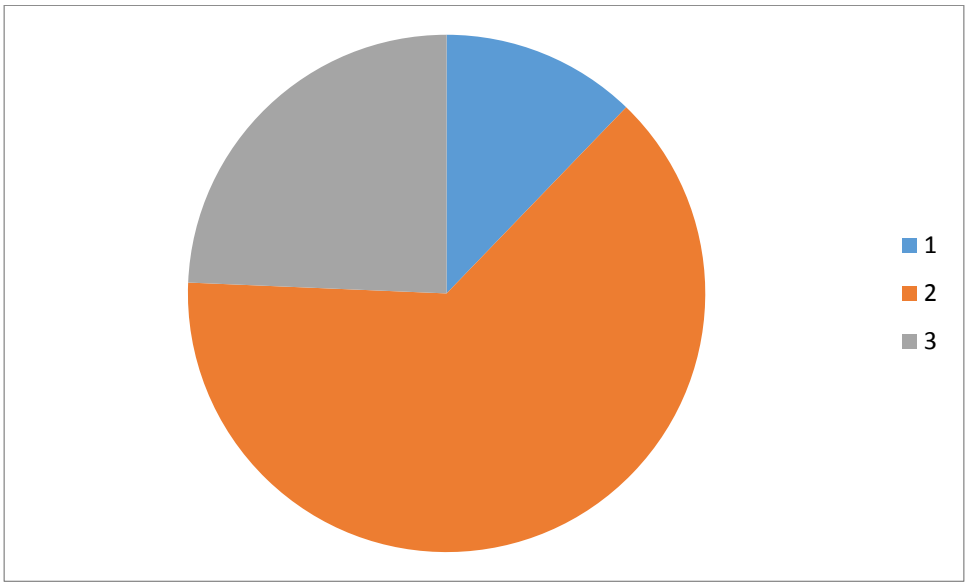

Fig 3. Security level of RFID technology in Kenyan organizations

In the last section of my questionnaire where I queried the respondents on exposure to RSA algorithm, I deduced that some organizations employ encryption standards, and fairly a large number at 48.9% know of RSA as an encryption algorithm.

ITEM	**FREQUENCY (%)**		**MEAN**	**SD**
	1	2		
Does your organization employ encryption standards?	16 34.8	30 65.2	1.652	0.481
Do you know about RSA algorithm?	22 48.9	23 51.1	1.511	0.505
Do you have encryption knowledge?	38 79.2	10 20.8	1.208	0.410

Table 3. Exposure to RSA algorithm in Kenya

From the above table we can extrapolate the data to deduce the conclusion as shown in the bar graph below;

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

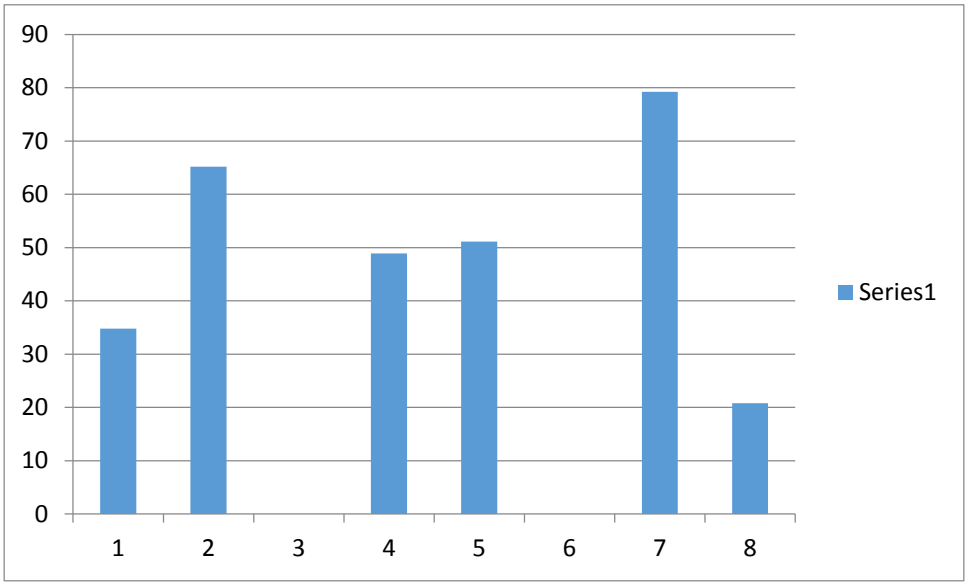

Fig 4. Barcode representing exposure to RSA algorithm in Kenya

From the above bar graph;

column 1 and 2 in the bar graph are answers in relation to the question "Does your organization employ encryption standards?" with one being yes and 2 being no.

Column 4 and 5 in the bar graph are answers in relation to the question "Are you conversant with RSA algorithm?" with 4 being yes and 5 being no.

Column 7 and 8 in the bar graph are answers in relation to the question "Do you have knowledge of encryption?" with 7 being no and 8 being yes.

From my analysis I deduced that not many organizations employ encryption to secure their data but only use encryption to secure their email through password encryption and prefer login to domains through local machines as an alternative to encrypting their computer hard disks.

CONCLUSION

From most respondent's answers i analyzed, i found that most of the organizations in Kenya are not ready to adopt the technology due to ignorance, high costs of technology acquisition and implementation or the complexity of the technology itself.

But I believe with AMBAND as the premier company solely focused on the RFID sector and with a bit more sensitization about RFID technology coupled with its benefits to an organization, I trust that in the next few years most organizations will adopt the said technology. But this being Kenya all that is needed is one key organization or industry player to set precedence and the rest will follow suit.

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)

REFERENCES

Rivest, R.; Shamir, A.; Adleman, L. (1978). "A Method for Obtaining Digital Signatures and Public-Key Cryptosystems

W. Küchlin, "Public key encryption," ACM SIGSAM Bulletin, August 1987, pp. 69-73

Auto-ID Center, (2002), "860MHz-960MHz Class I Radio Frequency Identification Tag Radio Frequency & Logical communication Interface Specification Proposed Recommendation Version 1.0.0", Technical Report MIT-AUTOID-TR-007, November.

ISSN 2054-0957 (Print), ISSN 2054-0965 (Online)