

Effectiveness of AI Security and Library and Information Management in the Internet of Things

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ABSTRACT

With the rapid development of science and technology, culture, education and other fields, people's demand for library and information materials is increasing, and the traditional library and information management can no longer meet this demand. However, at present, the security of library and information management has become an important issue to be solved. Library and information management should also prevent external intrusion to ensure that users and administrators manage within their authority, so as to stop unauthorized operations in time, and timely detect and stop illegally changed documents. This paper aimed to study the effectiveness of artificial intelligence (AI) security and library and information management in the Internet of Things (IoT). This paper proposed RSA (Rivest-Shamir-Adleman, RSA) algorithm to encrypt books and information. However, the algorithm had limitations. Therefore, the Elliptic Curve Cryptography (ECC) algorithm has been adopted again. ECC is currently the most effective and feasible solution for large-scale distributed open networks. The scheme has adopted the characteristics of hierarchical group management, fewer keys stored in nodes, less calculation of key update, and historical group key storage mechanism, which met the needs of file management. The experimental results in this paper showed that when the size of the tested document was 15M, the time for RSA and ECC to encrypt the document was 42ms and 40ms respectively. When the document size was 90M, the time for RSA and ECC to encrypt the document was 502ms and 256ms respectively. It can be seen that the encryption time of the two algorithms is similar when the document is small. However, as the document becomes larger and larger, the encryption time of the two algorithms has been widened.

Keywords: Library and Information Management, Rivest Shamir Adleman, Artificial Intelligence, Internet of Things, Elliptic Curve Cryptography

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1. Introduction

Library information management is an important part of library information construction. Library and information materials are indispensable and important materials in teaching and scientific research in colleges and universities, which must be kept confidential and safe. At the same time, due to the digitalization and electronization of all departments, the library and information management is in a dangerous network environment, which has caused great difficulties to its security management, and also brought new challenges to the work of managers. The management of library and information materials has become increasingly prominent and has been highly concerned by leaders at all levels.

IoT and AI are the two most important technologies in the information age. They can realize the communication between people and things. More security software and systems can be developed by using AI technology to ensure the automation, intelligence and sharing of IoT. High-quality and high-efficiency information technology has changed the way people produce, collect, organize, transmit and use books and information materials. IoT and AI can be applied in the management and service of library and intelligence materials, and the traditional management mode of library and intelligence materials should be changed to commit to creating a development environment with knowledge navigation as the service concept, providing fast and advanced intelligence information for research and development work.

2. Related Work

Library and information management has greatly promoted the development of colleges and universities. In order to ensure the safe and reliable operation of library and information management, a higher standard is put forward for the confidentiality of its management. Smith Mark found the development of library and intelligence materials management at a crossroads. How to keep up with the pace of the times in the network era has always been the subject of his research. Network information technology has successfully replaced the main focus on information in traditional library and information management [1]. By observing the user service in library and information management, Li Shuqing believed that big data must be used to achieve reform and innovation, including data transfer and utilization. This was because the resources of modern digital library and information management not only had the characteristics of big data, but also needed existing services [2]. Alzahrani Ahmed Ibrahim hoped to find out the actual factors affecting the management of library and information materials. He used the information system success model to build a relevant research model, and then interpreted it as empirical research [3]. The above scholars found that with the progress of network technology and information science, the importance of library and information management has become increasingly prominent.

IoT and AI are key drivers of the rapid development of today's information society. In order to attract potential customers and promote library and information management, Jones Michael J created an account on the social media website and found that IoT and AI security had a significant impact on library and information management [4]. The objective of the Mokhtarpour R study was to examine the knowledge structure of international library and information materials management. He used semi-structured interview method. Through qualitative research on library and information management, he found that IoT and AI had created potential for digitization of library and information management [5]. Raja J's research attempted to understand how people viewed IoT and AI, and how they used them to manage library and information materials. Most users in the public were satisfied with these two methods [6]. The above scholars believe that IoT and AI are developing rapidly. They can efficiently and conveniently manage library and information management, and can also open up new options for management mode and content.

Library and information materials are the basis for improving the quality of university teaching and scientific research. Therefore, effective management is very important [7]. With the deepening of

educational reform, teaching methods have changed, and the process of higher education is more dependent on books and information materials. Students pay more attention to the cultivation of ability and the development of intelligence, and are no longer satisfied with the knowledge learned in textbooks. Teachers are eager to use the latest library and information materials to improve their quality [8-9]. The management of books and information materials with IoT as the core is an important link to improve the management efficiency. IoT really realizes the sharing of data, and also solves the problem of fund shortage.

3. Encryption Algorithm Based on AI Security in IoT

3.1. Modernization of Library and Information Management

Today, with the rapid development of science and technology and the sharp increase of the total amount of knowledge, the library and information materials are facing great challenges, and the benefit is the key. The nature, status, role, service content and technology of library and information materials are undergoing a transformation from traditional to modern, and the management of library and information materials is also constantly changing and developing [10]. The key to this transformation lies in the transformation of its traditional concept, which has become the most basic element to realize the modernization of management. The change of traditional concepts has led to the change of management technology. Figure 1 shows the technical scope of library information materials management.

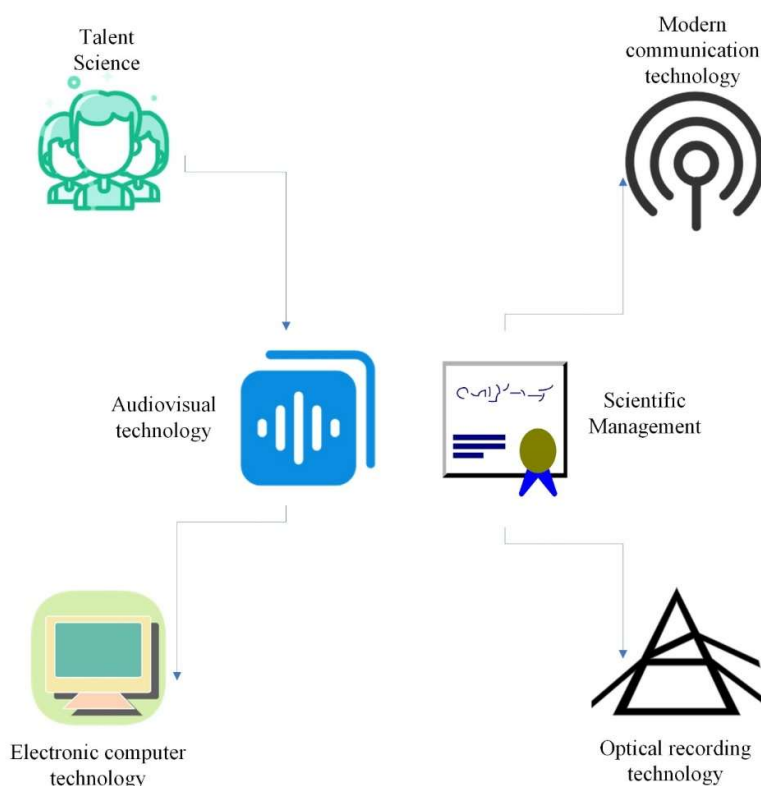


Fig. 1. Technical scope of library and information management

It can be known from Figure 1 that the technical scope of library and information data management is expanding. Electronic computer technology, optical recording technology, audio and video technology, modern communication technology, talent science, scientific management, etc., have been introduced into library and information management, which has gradually modernized library and information management [11-12]. Management modernization is reflected in the following points.

1) The leadership of library and information material management is centralized, which means that library and information material is centrally led and managed, such as the school history database and the establishment of local and Chinese library and information management committees.

2) The management of library and information materials becomes systematic and networked, specifically in the organization of library and information materials management within each university or within each region, and the establishment of a network system with public libraries, databases, computer centers and online searching.

3) The management of books and information materials has realized automation and mechanization. Modern technology has been used to apply electronic computers and other technologies to basic service work, thus realizing management automation.

3.2. Impact of IoT and AI on Library and Information Management

1) Influence of IoT on library and information management. The biggest feature of IoT is perception. IoT technology collects any needed information in real time through a variety of information and data sensors to form a broader network combined with the Internet. The purpose of IoT is to realize the connection between things and things, things and people, and all things and networks, so as to facilitate identification, management and control. The introduction of IoT in the management of library and intelligence materials has enabled automated, digital and intelligent management of library and intelligence materials, greatly improving management efficiency, simplifying the workflow and a range of functions such as security monitoring, thus fundamentally changing the management mode.

With the continuous advancement of informatization and networking, the trend of intelligent library and information management is becoming more and more obvious [13]. At present, most of the library and information management work adopts automatic management mode. Users can quickly query the required information on the computer. At the same time, the work efficiency of the staff has also been greatly improved [14]. IoT realizes the reasonable distribution of books and information materials, and makes the statistical work more convenient and fast through online collaboration and other means. The library and information management equipment under IoT is shown in Figure 2.

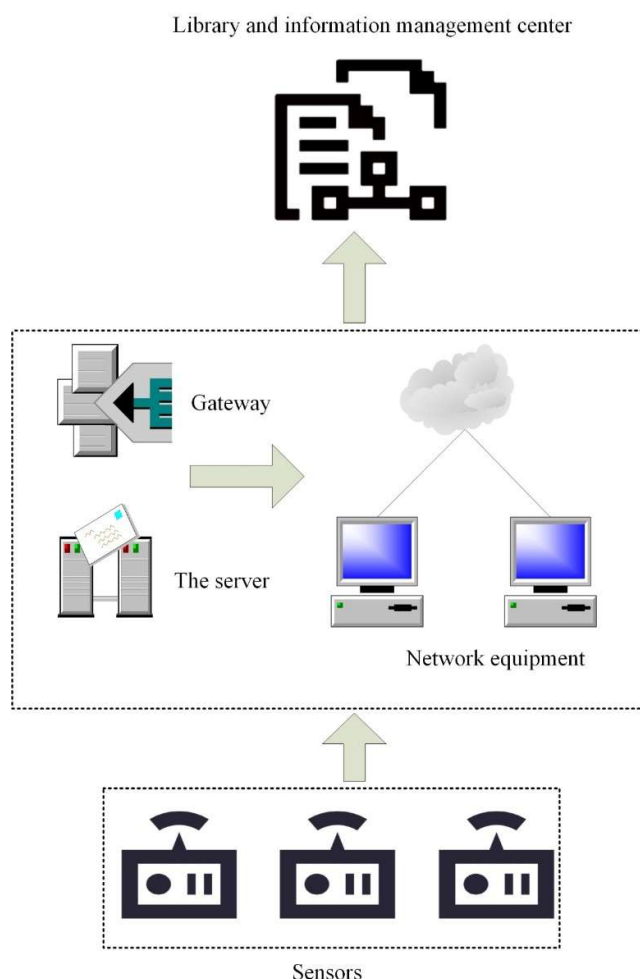


Fig. 2. Library and information management equipment under IoT

As shown in Figure 2, the library and information management equipment under IoT includes gateway, server, library and information management center, sensor and network equipment. With the rapid development of IoT technology and the establishment of digital library and information management mode, IoT can quickly identify and track the data of the data, so as to achieve real humanized management [15-16]. By using IoT, real library and information materials and digital library and information materials are perfectly combined. This can effectively solve the problem that a large number of resources cannot be effectively utilized due to the constraints of time, space, technology and other aspects of traditional management methods, so as to truly realize the sharing of resources across the network.

2) Influence of AI on library and information management. AI is a technology based on machine learning and deep learning. It can train and identify a large number of nonlinear and fuzzy information in the network, so as to predict, detect, identify and prevent security threats in library and information management, and effectively deal with various unknown and unknown risks. Traditional security defence techniques for library and information management are on the basis of feature library-based detection techniques and rely solely on network administrators to set static defence rules on devices, resulting in slow network defences that are unable to detect new attacks in a timely manner and are expensive and costly. AI security principle is shown in Figure 3.

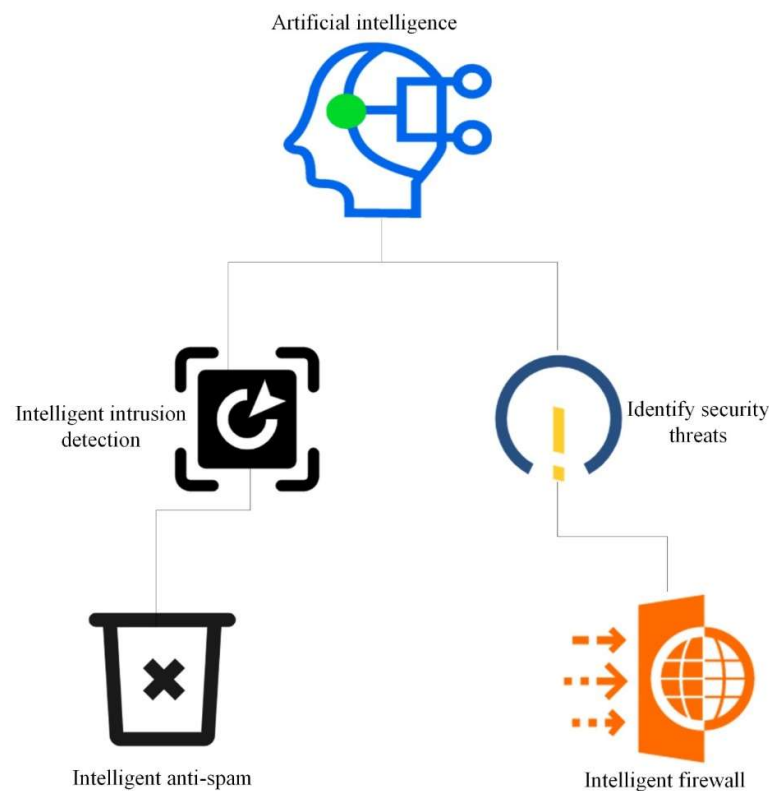


Fig. 3. AI safety principle

As shown in Figure 3, AI security includes identifying security threats, intelligent anti-spam, intelligent firewall, intelligent intrusion detection, etc. Intelligent firewall is a new type of firewall that is different from traditional firewall. It introduces AI technology and has the functions of analysis, learning and automatic response. It can automatically analyze and intercept harmful data in the network, thus effectively preventing the spread and intrusion of malicious service attacks, worms and other viruses. AI is used to analyze and judge the network data obtained by deep detection to discard harmful information and delete information such as new virus attacks.

In recent years, with the rapid development of AI and IoT, the intrusion in library and information management is also increasing. Once a deadly virus or Trojan horse appears, it would cause huge damage. Facing this situation, the existing network security management and defense technology can no longer adapt to the current situation. The comprehensive analysis of the security defense technology of library and information management must be strengthened.

3.3. Encryption Algorithm Based on RSA and ECC

The establishment of a secure and reliable library and information material management system is an inevitable trend in the construction, application and popularization of its information technology. In order to solve its security problem, many scholars have done a lot of research on it, and gradually formed a complete security model. The public key architecture is based on modern public key encryption technology. In this system, the encryption and decryption keys can be different. The sender can use the public key of the user (that is, the receiver) of the received information. Then, the receiver uses his private key to decrypt. This can not only ensure the integrity and privacy of information, but also ensure the undeniability of information. Therefore, the establishment of a security system based on ECC is an inevitable choice to realize the security management of electronic documents. The content of ECC encryption algorithm is shown in Figure 4.

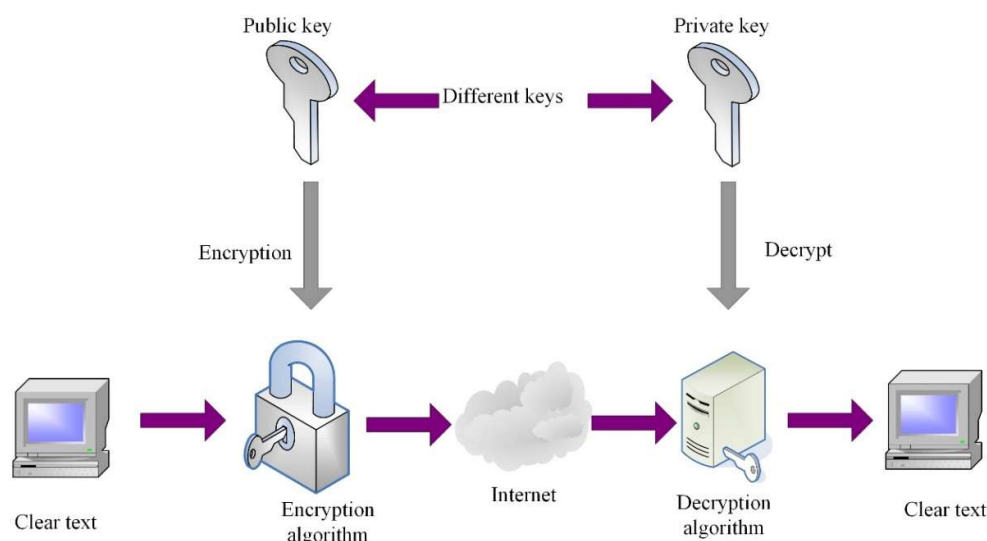


Fig. 4. Content of ECC encryption algorithm

As shown in Figure 4, the ECC encryption algorithm includes the public key encryption algorithm for plaintext encryption, and the private key encryption algorithm for plaintext decryption, all of which are conducted through the Internet.

In the whole library and information management, users only need to interact with the certification center of the certification authority. Because ECC algorithm is based on the principle of encryption protocol, it has strong interoperability, openness, consistency, verifiability, selectivity and high cost performance in practice. Therefore, the management system established by ECC algorithm can not only ensure the safety of books and information, but also ensure the reliability of information.

1) RSA algorithm. In cryptography, the encryption key is different from the decryption key. However, any known key can easily derive another unknown key encryption algorithm, which is called RSA algorithm. Therefore, this key must be maintained during information transmission and management. The encryption and decryption formulas of RSA algorithm are as follows:

$$B = F(A, K) \quad (1)$$

$$A = F'(B, K) \quad (2)$$

Among them, A is clear text and K is key. F' is the inverse operation of F, and B is ciphertext. According to different encryption algorithms, symmetric keys can be divided into group keys and sequence keys.

According to the type of key, data encryption can be divided into symmetric and asymmetric. Among them, RSA algorithm is an efficient, fast and suitable method for large-scale data encryption. However, RSA algorithm has lower encryption speed and higher security, and cannot be used in library and information management.

2) ECC algorithm. ECC algorithm manages the public key by using a certificate, binds the third-party trust mechanism with the public key, and stores it in the network to solve the problem of key management and distribution. In addition, ECC is used to encrypt and sign the transmitted data to ensure the integrity, non-repudiation, confidentiality and authenticity during transmission.

ECC algorithm uses a hierarchical mechanism to divide users into several groups. Each group uses a hierarchical mechanism to generate a key tree to generate user keys. The construction of this method facilitates the generation and management of the key, and can also be used to verify whether the key

belongs to the tree, that is, whether the member's personal key is legally generated. The master key m of the key tree is generated by the seed sequence S . First, I is calculated:

$$I = HMAC - SHA(key = k_{seed}, data = S) \quad (3)$$

I is divided into two 32 byte long sequences, and the master key m is:

$$m = (k_m, c_m) = (I_L, I_R) \quad (4)$$

After the master key m is generated, all key trees can be generated by the master key. The generated parameter is i_r , and the key k_r generation method is:

$$(k_r, c_r) = CDK(m, i_r) \quad (5)$$

Parameter i_{rp} is continuously generated. The generation method of master key c_{rp} is:

$$(k_{rp}, c_{rp}) = CDK(m / i_r, i_{rp}) \quad (6)$$

Assuming the i -th user in the group is U_i , the generation method of the user's personal key c_p is:

$$(k_p, c_p) = CDK((k_{rp}, c_{rp}), U_i) \quad (7)$$

The master key of the system must be strictly confidential. In order to ensure the generation and recovery of member keys between groups, the keys of each team are saved offline. The group key of each group is shared among groups, and the members of the group can calculate the group key through the updated parameters.

In information security, encryption technology is not all the content, but it is the most important foundation. It can be said that if there is no encryption algorithm, there is no information security, and the security of books and information materials cannot be protected. The encryption and decryption technology of information is called cryptography, and its basic process includes encryption and decryption. Encryption technology is an important technology in the field of information security, and ECC algorithm is a good example. The introduction of asymmetric encryption technology into ECC algorithm can effectively solve the integrity, confidentiality, authenticity and non-repudiation of information.

4. Problems Faced by Library and Information Management and the Effectiveness of Encryption Algorithm

4.1. Current Situation and Problems of Library and Information Management

Computer technology is used to informatization the management process of books and information materials to achieve the purpose of information transmission. The use of electronic documents and the rational development and use of books and information materials can help to realize their rational and efficient use. Informatized books and information are often in a very dangerous environment, and its security is particularly important. This paper investigates 250 relevant personnel of library and information management to understand the problems encountered in their development and put forward countermeasures.

1) Security threats. Library and information management staff use modern computer technology to store and manage important data. With the globalization and openness of the Internet, the management of books and information materials has also brought great harm to its security. The security threats faced by library and information management are shown in Table 1.

Table 1. Security threats

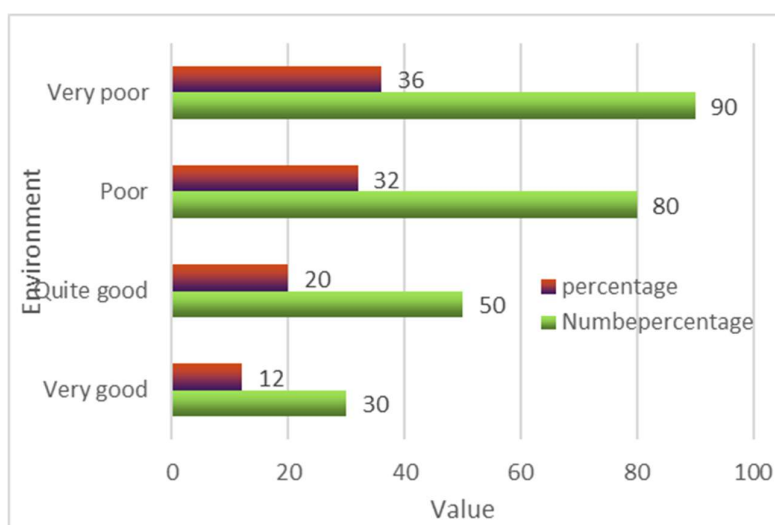
Types	Number of people	Percentage
Computer virus	55	22%
Trojans	60	24%
Malicious software	70	28%
Loophole	30	12%
Human factor	35	14%

As shown in Table 1, 55 people have experienced computer viruses, accounting for 22%. 60 people have encountered Trojan horses, accounting for 24%. 70 people have encountered malware, accounting for 28%. 30 people have experienced vulnerabilities, accounting for 12%. 35 people have experienced human factors, accounting for 14%. The security of electronic archives has been threatened by computer viruses, trojans, malware, vulnerabilities, human factors and other threats.

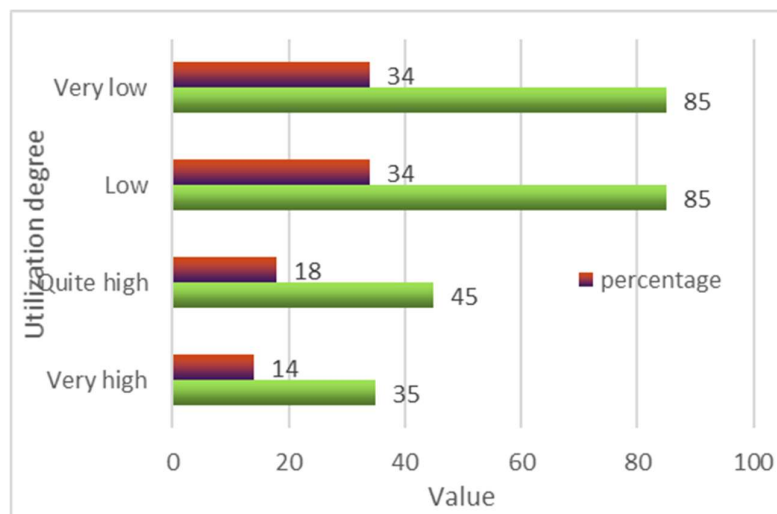
Trojan horse virus is used to steal user information, carry out network intrusion and other illegal acts, so as to obtain library information. The harm of malware is mainly manifested in unauthorized software installation, automatic dialing and automatic pop-up.

These security threats have led to illegal external access, improper use of network equipment and library information, and even unauthorized use. In the case of illegal access to or modification of library and information data, the right of legal users to read and change the data is obtained by means of impersonating legal users, using impostors, cheating and other means. Some lawbreakers spread some viruses, which has caused the paralysis of the library and information management system. The management system is attacked maliciously, and increased the load of the system through repeated attacks. Therefore, in the management of library and information materials, the guarantee of its security is an important part.

2) Better environment and higher utilization of library and information management. With the increasingly rich network resources and the development of online reference services, people's demand for library and information materials is also growing, and the importance of library and information management is also increasingly apparent. In the network environment, the environment of library and information materials has also become better and better, and the utilization rate is not low. The environment and utilization rate of library and information management are shown in Figure 5.



(a) Library and information management environment



(b) Utilization rate of library and information management

Fig. 5. Environment and utilization of library and information management

As shown in Figure 5, it can be seen from Figure 5 (a) that the number of people who think the environment of library and information management is very good is 30, accounting for 12%. The number of people who think the environment is good is 50, accounting for 20%. The number of people who think the environment is poor is 80, accounting for 32%. The number of people who think the environment is very poor is 90, accounting for 36%.

In Figure 5 (b), it can be found that the number of people who show that the utilization rate of library and information management is very high is 35, accounting for 14%. The number of people with high utilization rate is 45, accounting for 18%. The number of people who show very low utilization rate is 85, accounting for 34%.

The increasing demand for library and information materials has formed a benign interactive relationship, further promoting the in-depth mining and service of library and information materials. At present, people have greatly improved the utilization rate of library and information materials in terms of query and utilization.

3) Low professional level of management personnel. With the development of information technology, the service concept of traditional library and information personnel is bound to be affected. These managers should clearly realize that the mission of library and information work is not to replace the traditional library and information management personnel. On the contrary, the role of library and information management personnel as a bridge and navigation becomes more important. Informatization makes the management of library and information materials more convenient and effective to realize the sharing of resources. Only by combining traditional methods with modern information technology can better services be provided to people. Table 2 shows the professional level of library and information management personnel.

Table 2. Professional level of managers

Types	Number of people	Percentage
Very professional	20	8%
Relatively professional	35	14%
Unprofessional	75	30%
Very unprofessional	120	48%

As shown in Table 2, there are 20 people who think that library and information management personnel are very professional, accounting for 8%. Thirty-five people think that managers are more professional, accounting for 14%. There are 75 people who think that today's managers are unprofessional, accounting for 30%. There are 120 people who think that today's managers are very unprofessional, accounting for 48%. It can be found that the professional level of managers is not high today.

It is an important content to carry out the management of library and information materials. The management personnel continuously improve their management skills through refresher courses, lectures, short-term training and other ways, and strive to become high-level, all-round and comprehensive library and information management talents.

4.2. Performance Comparison of Different Encryption Algorithms

The system test environment is a virtual machine under the win10 system with 16GB of memory. In the test, key generation, file encryption and decryption are performed on the client node. In order to test the effectiveness of ECC algorithm in network security protection, the network packet capture tool is used to analyze 600 virus attacks.

1) Accuracy test for identifying virus attacks. This paper tests the security of information. 600 virus attacks are selected, and the identification quantity and accuracy of attack threats are tested under RSA and ECC algorithms respectively, as shown in Figure 6.

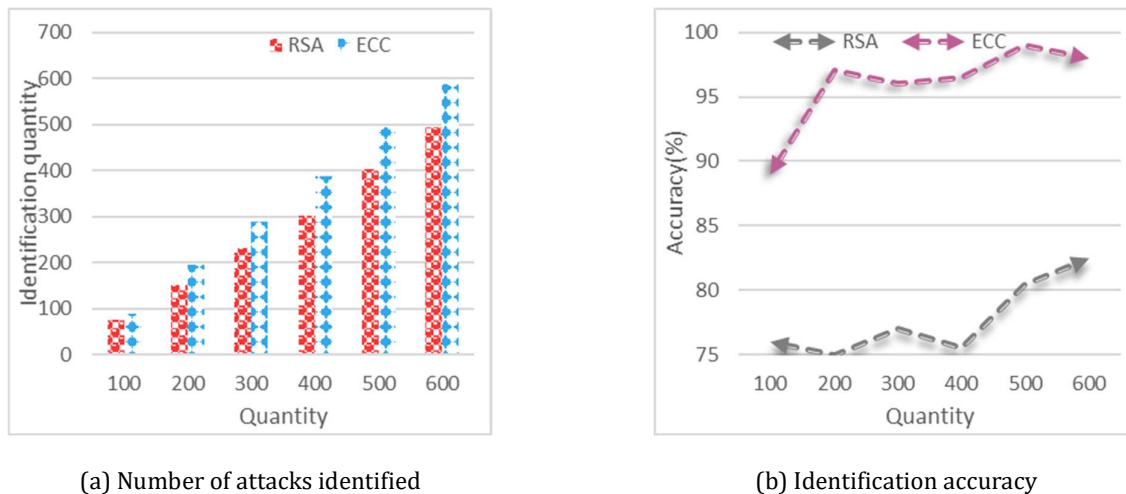


Fig. 6. Number and accuracy of attacks identified by different algorithms

As shown in Figure 6, in Figure 6 (a), when the number of virus attacks is 100, the number of attacks recognized by RSA and ECC is 76 and 89 respectively. When the number of virus attacks is 200, the number of attacks identified by RSA and ECC is 150 and 194 respectively. When the number of virus attacks is 300, the number of attacks identified by RSA and ECC is 231 and 288 respectively. When the number of virus attacks is 600, the number of attacks identified by RSA and ECC is 495 and 588 respectively.

According to Figure 6 (b), when the number of virus attacks is 100, the recognition accuracy of RSA is 76% and that of ECC is 89%. When the number of virus attacks is 200, the recognition accuracy of the two algorithms is 75% and 97% respectively. When the number of virus attacks is 300, the recognition accuracy of the two algorithms is 77% and 96% respectively. When the number of virus attacks is 600, the recognition accuracy of the two algorithms is 82.5% and 98% respectively.

Under the ECC algorithm, users and management personnel must use their own private key for digital signature, and the modified documents or newly added documents must be confirmed by the

system. Aiming at the security requirements of the current library and information management system, this paper puts forward the application of ECC algorithm to realize the security problems in the library and information management.

2) Document encryption and decryption test. In this experiment, RSA and ECC algorithms are used for document encryption and decryption. Both algorithms realize the encryption of documents by public key. RSA and ECC algorithms are tested for the speed of document encryption and decryption. The time taken to test the encryption and decryption of files of different sizes is generated separately, as shown in Figure 7.

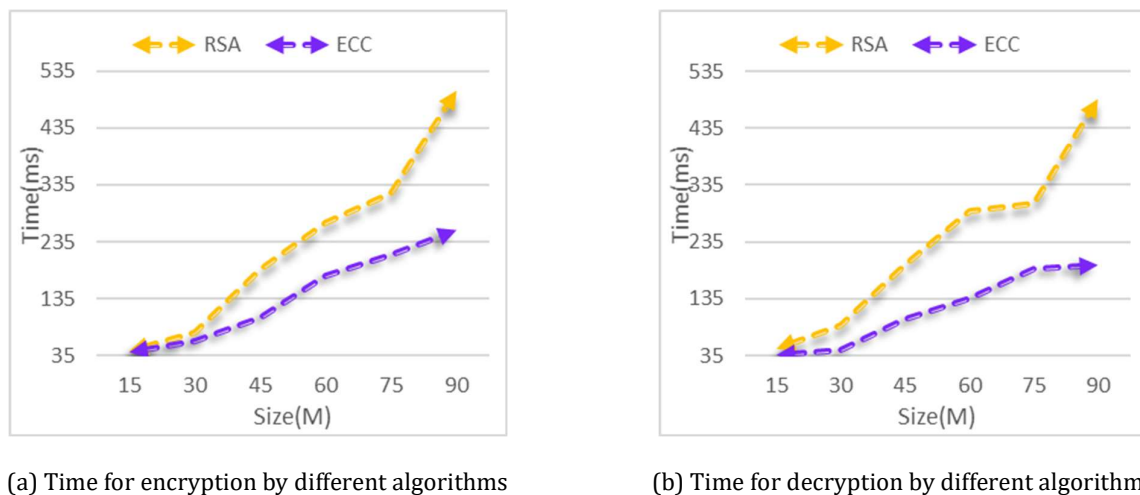


Fig. 7. Time for encryption and decryption by different algorithms

As shown in Figure 7, relevant information is obtained from Figure 7 (a). When the document is 15M, the time for RSA and ECC encryption is 42ms and 40ms respectively. When the document is 30M, the time for RSA and ECC encryption is 75ms and 61ms respectively. When the document is 45M, the time for RSA and ECC encryption is 187ms and 102ms respectively. When the document is 90M, the time for RSA and ECC encryption is 502ms and 256ms respectively.

It can be seen from Figure 7 (b) that when the document is 15M, the time for RSA and ECC decryption is 47ms and 36ms respectively. When the document is 30M, the time for RSA and ECC decryption is 89ms and 45ms respectively. When the document is 45M, the time for RSA and ECC decryption is 195ms and 98ms respectively. When the document is 90M, the time for RSA and ECC decryption is 487ms and 193ms respectively.

The advantage of ECC is that it does not need to encrypt files without storing symmetric keys. It can ensure the integrity of files and effectively verify the correctness of keys. When sharing files, the public key of others is used to encrypt the files. It is not necessary to generate a symmetric key through key negotiation, thus enhancing the security of the files. Experiments show that ECC algorithm has good encryption and decryption performance, and has good application prospects.

4.3. Measures to Promote the Management of Library and Information Materials

1) Attaching importance to the training of the data team. Talents are the key to library and information management. Therefore, reasonable talent training should be targeted. With the continuous development of market economy, managers should not only master certain library and information management technology, but also master corresponding knowledge. The coordination ability cannot be ignored. The key is to have a spirit of dedication. Library and information data management is the basis of science, and the acquisition of any new inventions and achievements cannot be separated from library and information data. Therefore, the technical training of managers must be carried out from

various channels. It is necessary to establish an information inquiry center for library and information management as soon as possible. The library and information industry has shifted from the traditional management mode to the information resource base based on information and modern science and technology, making it truly become the forefront of information work. It is of great significance to realize modernization to realize the regional, Chinese and global information network of books and information materials.

At present, the urgent task is to establish a library and information data center as soon as possible under the overall arrangement, and take all the library and information data as an effective tool for the unified cataloging and distribution of resources. In this way, the center can play the role of overall arrangement and collection. At the same time, it can also give more time for the data collectors to understand the real information function of the center. In addition, a mutual sharing mechanism between centers should also be established to ensure the sharing of books and information.

2) Modernization of library and information management. With the change of traditional concepts, the information construction of books and information materials needs the support of modern science and technology, while the modernization of management needs to be carried out from the management concept. The modernization of its management concept is mainly reflected in paying attention to management, mobilizing enthusiasm and handling management problems with scientific methods. The fundamental goal of improving the level of library and information management is to continuously improve the decision-making ability of managers, pay attention to business efficiency and use modern computer technology to analyze various problems in library and information management to improve the service work, so as to better serve teaching and scientific research.

Because of the increasingly standardized management of library and information materials, the cooperation of management organizations, networking and the popularization of modern science and technology in China, library and information equipment and equipment are developed, produced and sold by professional manufacturers. The scope of cooperation in library, information and data management has been expanded. It is precisely because of the transformation of traditional concepts, the widespread dissemination of the concept of resource sharing, and the continuous development of modern science and technology and communication technology that the cooperation fields of library and information management become more and more extensive and international.

5. Conclusions

Library and information management has played an increasingly important role in society. However, in the case of scattered information resources, the management of books and information materials cannot become the advantage of information resources. The implementation of comprehensive management of library and information materials management is an important means to realize information resources, which can quickly and directly serve the important links of teaching and scientific research. With the rapid development of network technology, the security of library and information management has become increasingly prominent. Traditional security protection measures can no longer meet the requirements of library and information management security. In the current library and information management security management, the introduction of IoT and AI is an important development trend. This paper studied the importance and security of the current library and information management, and gave the ECC algorithm to encrypt and decrypt it according to its existing problems, so as to ensure its defense against network virus attacks on library and information.

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