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Retraction

Retracted: Optimization of University Archives Management under the Application of Blockchain Technology in the Digital Age

Mobile Information Systems

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] H. Li and J. Yin, "Optimization of University Archives Management under the Application of Blockchain Technology in the Digital Age," *Mobile Information Systems*, vol. 2022, Article ID 6256859, 10 pages, 2022.

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Research Article

Optimization of University Archives Management under the Application of Blockchain Technology in the Digital Age

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The centralized database can store a variety of electronic archives. Electronic archives face a variety of network attack vulnerabilities as information technology and network technology continue to advance. Furthermore, these archives will be readily forged and tampered with by internal management or external attackers. Data security and authenticity problems prevail in China's management system for archives. First, this exploration elaborates the blockchain technology, distributed database technology, and distributed database system structure. Secondly, blockchain technology is applied to the authenticity protection of electronic archives. Then, an optimization model of university archives based on blockchain technology is constructed. Finally, this exploration investigates the current use of blockchain technology for college archive management systems. The questionnaire is used to understand the current university personnel's views on the college archive management system under the application of blockchain. The survey results suggest that most people support the digital college archive management system. At present, the operation efficiency of the college archive management system still needs to be improved, and the quality of archives search should be promoted. Therefore, the college archive management system still needs to optimize the archive's efficiency as well as quality. According to the above survey results, this investigation gives suggestions for optimizing the college archive management system using blockchain technology, as well as some suggestions and references for further management.

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1. Introduction

College archives are directly formed in talent training, scientific research, infrastructure construction, enrolment, and teaching. They are various historical records with preservation value for schools, teachers, students, and society [1]. As a crucial part of national archives resources, college archives are also an important foundation for scientific higher education development which have data value [2]. In the new era, China's universities and colleges continue to develop rapidly in the direction of innovation, technology, and compounding. Many electronic documents are continuously generated in teaching, student archives, personnel archives, and financial management. The requirements for archives management have become high [3]. However, present electronic archives management systems and procedures in Chinese universities and colleges are insufficient to fulfill the knowledge economy's current development demands. Therefore, it is imperative to improve the standardization level of electronic college archive management and promote the scientific development of archives management [4]. The present management of electronic archives in most colleges in China has not achieved unified and standardized management. In addition, there is a lack of professional archives management personnel. Irregular management methods and low utilization rate of electronic archives adversely affect the scientific management of archives information and information sharing within universities [5]. Archives management is essentially the process of sorting and keeping the generated archives, information, and materials [6]. Even though China's National Archives Administration has established a management system for electronic archives through the "Measures for Electronic Document Filing and Electronic Archives Administration," it has yet to formulate guidelines for the management of electronic college archives. Managers hone their skills and experience, which leads to a high rate of omissions, errors, and data loss in electronic archives [7]. Also, electronic archives are affected by the environment of the archives management platform which must meet the requirements of fixed-format management. Once the environment of the archives management platform on which they have relied has undergone major changes, the electronic archives must adapt to the changes brought about by information technology. If the existing electronic archives are not compatible, extreme phenomena such as garbled characters, distortion, and even information loss are likely to occur in the content [8]. Therefore, ensuring electronic archives' safety as well as authenticity is a major problem in archives information management.

Digital archives management systems have a wide application in archives management [9]. Traditional paper archives offer intrinsic distinctiveness as well as a high capacity for tamper-proof modification. It is possible to falsify and tamper with digital archives [10]. In the big data era, the emergence of new blockchain technology has led to breakthroughs in solving the problem of electronic archives management [11]. Blockchain technology originates from encrypted digital currency, but the development and use scopes are not only in the field of finance. It has a wide application in aspects like cultural entertainment, social welfare, and data protection [12]. The decentralization, tamper-proof modification, and information traceability of the blockchain can be well applied to the scenario of electronic archives protection. In addition to these advantages, blockchain technology also has some shortcomings. For example, it has a low access efficiency as well as high economic cost. Hence, it cannot replace the current database technology. However, it is usually applied as a supplementary technical method in combination with other technologies [13].

In the past two years, the domestic archives community has explored the feasibility of the combination of the blockchain and electronic archives, the application of blockchain technology in the trust sharing management of electronic archives, and the blockchain technology in the trust and security of archives authenticity. There are few successful cases of the application of blockchain technology in the management of digital archives [14]. The research and application of blockchain technology in digital archive management at home and abroad are still in infancy, especially in college electronic archive applications and innovative research. This study examines the current status quo and blockchain technology in the administration of college electronic archives and suggests an optimization strategy to create a practicable/feasible model for the scientific and efficient management of college electronic archives in China.

2. Methods

The following sections describe undertaken methodology of the current study.

2.1. Analysis of Blockchain Technology. Blockchain is a chain organization composed of blocks connected in a certain time sequence [15]. It is first proposed in bitcoin's white paper. Blockchain is originally a decentralized distributed bookkeeping technology used to record transaction data in bitcoin [16]. Each block's purpose is to store data information. Many server nodes make up the blockchain system. To maintain the blockchain system's secure functioning, these servers store the information structure in the blockchain as a whole [17]. The blockchain system has the strength of transparent as well as credible data, low possibility of tampering, and obvious decentralization which makes the information it stores authentic. The server node in the system not only ensures the security of the blockchain structure but also has the function of storing data. Meanwhile, the ownership of the server node is although not in the hands of the same manager, the consent of more than half of the server nodes must be obtained before the information is modified. This difficult process ensures that the blockchain data is almost impossible to tamper with [18]. The block is the blockchain's basic component. It records all the transaction records in the blockchain during the creation period and records the block address in the block header so that a one-way chain structure is formed, namely, the blockchain [19]. Figures 1 and 2 display the block and block header's structure in the blockchain.

Figures 1 and 2 show the block's header, which includes the front area identity document (ID) and the current ID. Hash value and Merkel tree make up the block. The Merkel tree obtains the Hash value in the block after a sequence of processes and operations. The data transmitted by other nodes is received by the block and stored there. The data is stored in the Merkel tree after a series of checks and verifications. The data is retained for the second time by internal data transportation via the Merkel tree's internal transaction. [20]. The key matching structure inside the blockchain also guarantees the private security of the user's information. The key to constituting the blockchain is the hash field of the former block in the block header. It always points to the upper block. All blocks have the ability of being connected, forming a one-way chain structure, and finally pointing to the creation block [21]. The structure of the blockchain is demonstrated in Figure 3.

In Figure 3, the blockchain structure consists of the block header and the block. Each block has 5 fields, namely, block headers, block size, magic figures, transaction quantity, and transactions. The transaction field records the specific transaction information list. Magic numbers are fixed values. The block header field is an abstraction of all transactions in the block and the key to the blockchain establishment. They jointly preserve the relevant data and information required by the blockchain exchange [22].

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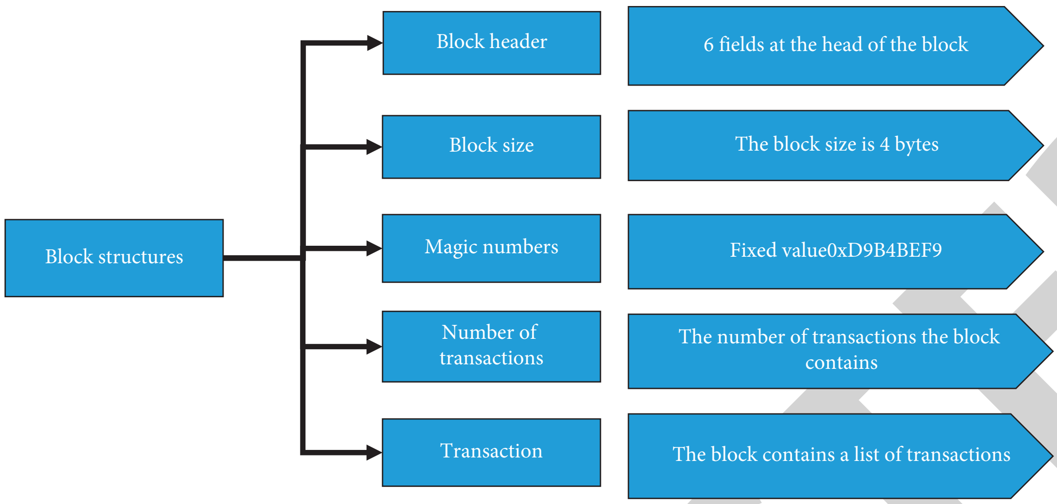

Figure 1: Block diagram.

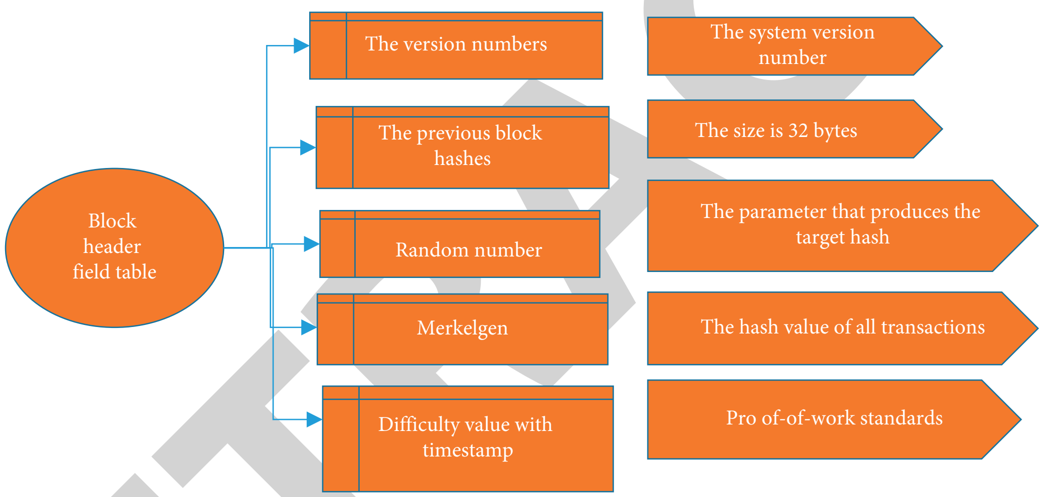

Figure 2: Block header structure diagram.

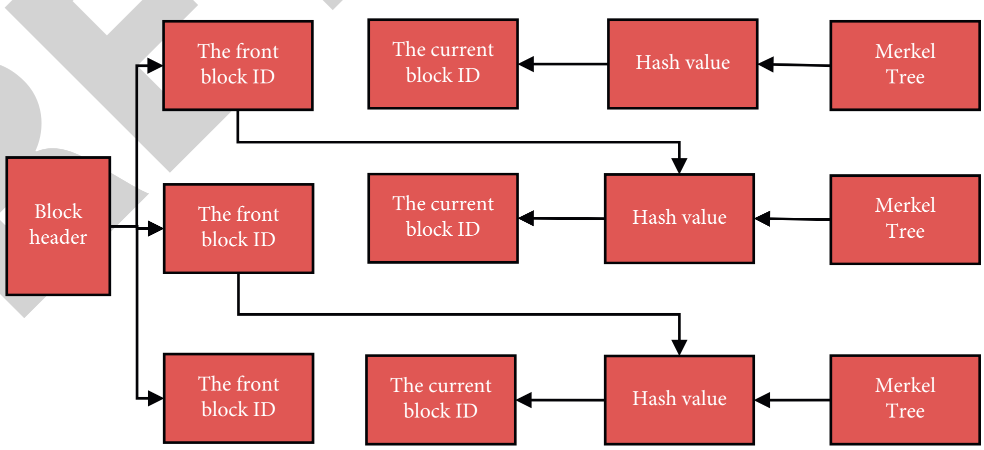

Figure 3: Blockchain structure diagram.

2.2. Analysis of Distributed Database Technology. With the increasingly mature database technology, the computer network technology's rapid progress, and the use scope expansion, people focus more on improving and exploring database systems with distribution as the primary feature. Distributed Database System (DDBS) is a product of database technology and network technology and has formed a branch in the database field [23]. The research on DDBS

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began in the mid of the 1970s. The world's first DDBS Single Shot MultiBox Detector-1 was implemented by American computer companies on Digital Equipment Corporation computer in 1979. Since the 1990s, the DDBS has entered a stage of commercial application. Traditional relationship database products are developed into distributed database products. The core of these products is the computer networks and multitasking operating systems.

There is a step-by-step development of the distributed database into a client/server model [24]. The distributed database systems have two types. One is physical distribution but logically concentrated. This distributed database is only applicable to single as well as small units or departments. Another DDBS is a physical and logically distributed one which is the federal DDBS [25]. Since the subdatabase systems constituting the Federation are relatively "autonomous," this system can accommodate various databases with different aims as well as many differences. It is more suitable for integrating databases in a wide range [26]. The characteristics and classification of the distributed database are shown in Figure 4.

From Figure 4, distributed databases can be divided into three categories. The first is the homogeneous data base system (DBS). Each site adopts the data model in the same type (for example, all of them are relational) and is the same type of database management system (DBMS). The second is isomorphic and heterogeneous DBS. Each site adopts the same type of data model, but the DBMS model is different such as Data Base 2, Oracle, Sybase, and Structured Query Language Server. The third is heterogeneous DBS. The data models of each site are of different models and even different types. Due to the computer network technology's progress, the problem of heterogeneous machine networking has been well resolved. Besides, the data in various heterogeneous local databases in the whole network can be accessed by relying on the heterogeneous DBS.

There are four key properties of distributed databases. The physical distribution is the first. Data is kept on several sites over a computer network, rather than on a single site. The second characteristic is logical consistency. The data is physically dispersed over several sites, yet it is logically organized. They are shared by all users (global users) and maintained by a single database management system. The third factor is site autonomy: each site's data is controlled by a local database management system (DBMS), which has the processing power to complete the site's application autonomously (local application). The fourth is the collaboration among sites. Although the sites have a high degree of autonomy, they cooperate with each other to form a whole.

Distributed databases have the following advantages. (1) It is applicable for distributed management as well as control. The DDBS's structure is applicable for organizations or institutions with geographically distributed features. Various departments, distributed in different regions and levels, can exercise local control over their data. (2) It has a flexible architecture. The local DBMS of the DDBS is autonomous, so most of the local transaction management, as well as control can be solved locally. Distributed DBMS can be designed with varying degrees of autonomy, from having full-site autonomy to almost fully centralized control. (3) The system is economical with high reliability and excellent availability. (4) The response speed is accelerated under certain conditions. (5) It has excellent scalability and is easy to integrate with existing systems and then expand.

However, distributed databases also have some disadvantages. (1) It has a large communication overhead and a high failure rate. When the network communication transmission speed is not high, the system's response speed is slow. (2) It has a complex data access structure. Generally, accessing data in a distributed database is more complex and expensive than in a centralized database. (3) It is difficult to control data security and confidentiality. In the highly autonomous distributed database, the local database managers of different sites can take different security measures, but global data cannot be guaranteed as secure. Security issues are inherent in distributed systems. The distributed system uses the communication network to realize the distributed control, but the communication network is weak in data security as well as confidentiality protection. Data can be easily stolen.

2.3. Analysis of the Structure of Distributed Database System. Horizontal fragmentation, vertical fragmentation, hybrid fragmentation, and induced fragmentation are the most common methods for fragmenting data in distributed databases. Induced fragmentation is when a connection is horizontally fragmented because of the features of another relationship that is connected to it. Relationships between tables in a database involve the concepts of foreign keys and internal keys. The fragmentation result is calculated by the result of the "semijoin" operation. Induced fragmentation is the result of performing a semijoin operation on global relations. The relationship between semijoin and natural join is shown as follows:

$$R \propto S = R \infty \left(\pi_R (S)\right), \tag{1}$$

$$R \propto S = \pi_R (R \infty S). \tag{2}$$

In Eq. (1)–Eq. (2), R and S are the results of the combination of common attributes. $\propto$ is the semiconnected state. ∞ is the natural connection state. π_R represents the mapping from the R table.

The quality of the database's data distribution or fragmentation results can be estimated by the distribution costs and benefits. The horizontal fragmentation is used to estimate database allocation costs and benefits. The number of local visits to *fi* on site j can be calculated according to the following equation:

$$B_{ij} = \sum_k \left(F_{kj} * N_{ki}\right). \tag{3}$$

In Eq. (3), i is the fragment number. J is the site number. k is the application number. F_{kj} is the frequency with which application k is activated on site j. N_{ki} is the total number of accesses to segment i by application k.

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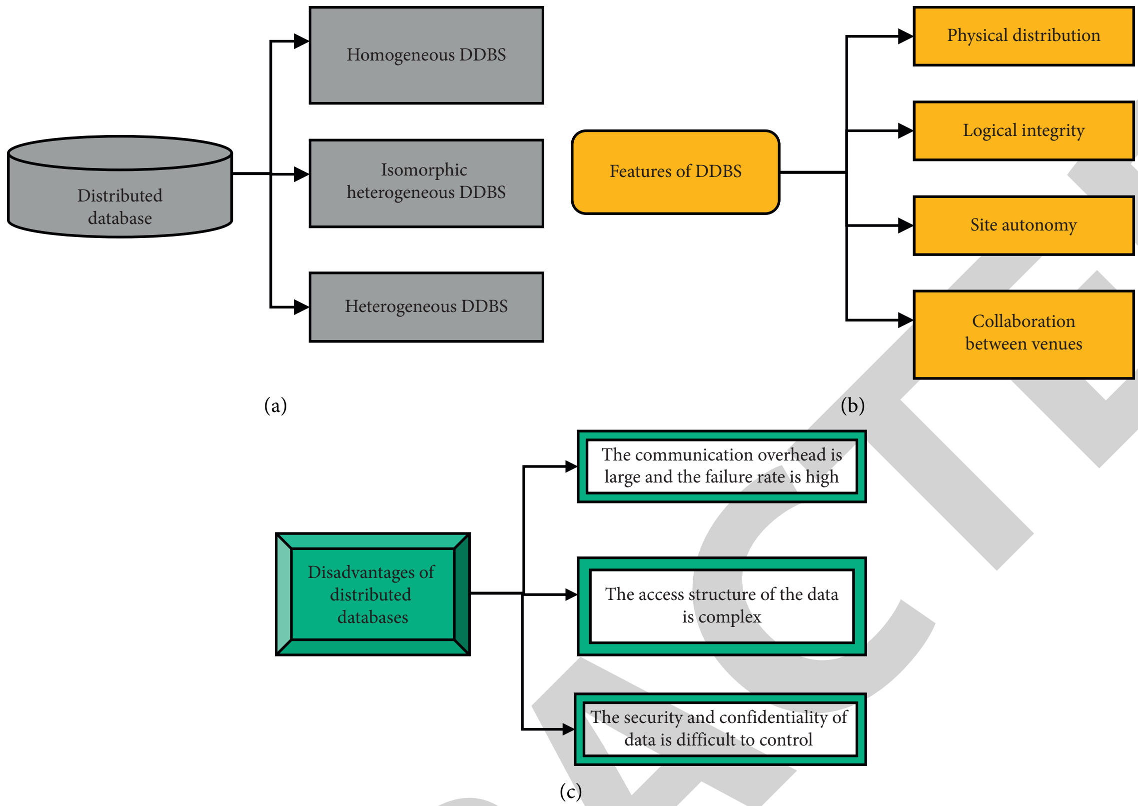

Figure 4: Distributed database classification diagram. (a) Distributed database category diagram; (b) distributed database feature diagram; (c) distributed database disadvantage diagram.

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The local benefits and the costs of other site updates are compared. The local benefits and other site update costs and tradeoffs at this point can be obtained according to the following equations:

$$B_{ij}^{r} = \sum_{k} \left(F_{kj} * R_{ki}\right), \tag{4}$$

$$B_{ij}^{u} = \sum_{k} \sum_{j' \neq j} \left(F_{kj'} * U_{ki}\right), \tag{5}$$

$$B_{ij} = B_{ij}^{r} - c * B_{ij}^{u}. \tag{6}$$

In Eq. (4)–Eq. (6), R_{ki} is the number of times that application k performs retrieval access to segment i. U_{ki} is the number of times that application k performs update access to segment i.

Vertical fragmentation is adopted to fragment the data, and the working situation of the vertical fragmentation is demonstrated in Figure 5.

In Figure 5, the global relationship is vertically divided into R_1 and R_2, and R_1 and R_2 are allocated to Site_1 and Site_2. The benefits are calculated separately according to the application of the fragment.

$$BA_n = \sum_{k} \left(F_{kn} * N_{kn}\right). \tag{7}$$

In Eq. (7), n is one, two, or three.

$$BA_4 = 2 * \sum_{k} \left(F_{k\langle 3\rangle} * N_{ki}\right), \tag{8}$$

$$BA_5 = \sum_{j} \sum_{k} \left(F_{kj} * N_{ki}\right), \tag{9}$$

$$B = BA_1 + BA_2 - BA_3 - BA_4 - BA_5. \tag{10}$$

In Eq. (8)–Eq. (10), B is the benefit value

2.4. Analysis of College Archives Optimization Model Based on Blockchain Technology. A system model for college archives management is constructed based on blockchain technology and distributed database technology. Figure 6 displays the system's main functional modules.

From Figure 6, the functions provided by the university archives information optimization management system include organization management, operator management, authority management, maintenance of various data information items, process management, and system log management. This system mainly deals with some problems of unclear division of college archives. The archives of information belonging to the corresponding different organizations are subdivided. The subdivision is made by dividing the organization. The organization in this system, therefore, represents the unity of different colleges or different institutions in the university. Division and

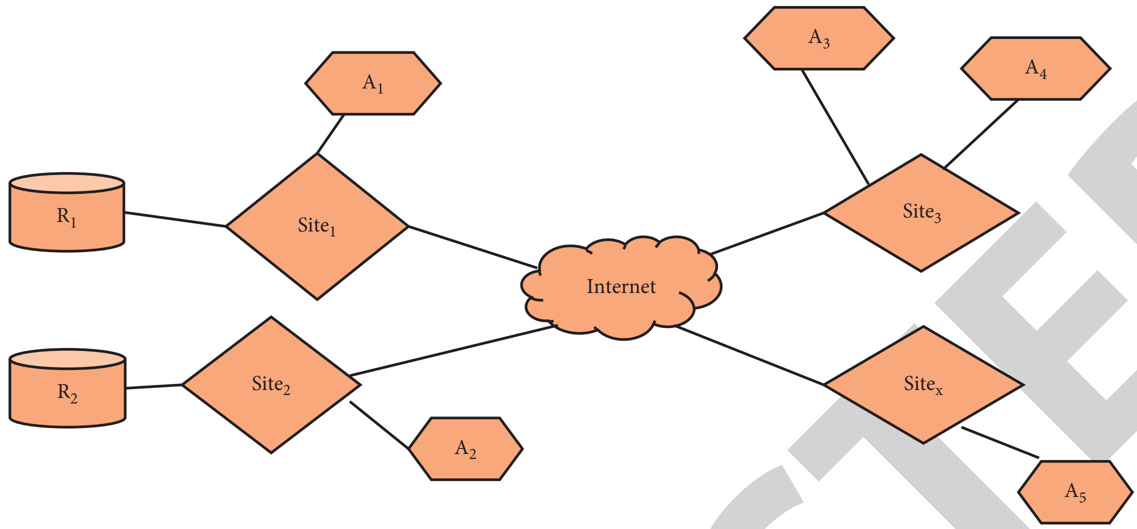

Figure 5: Working diagram of vertical fragmentation.

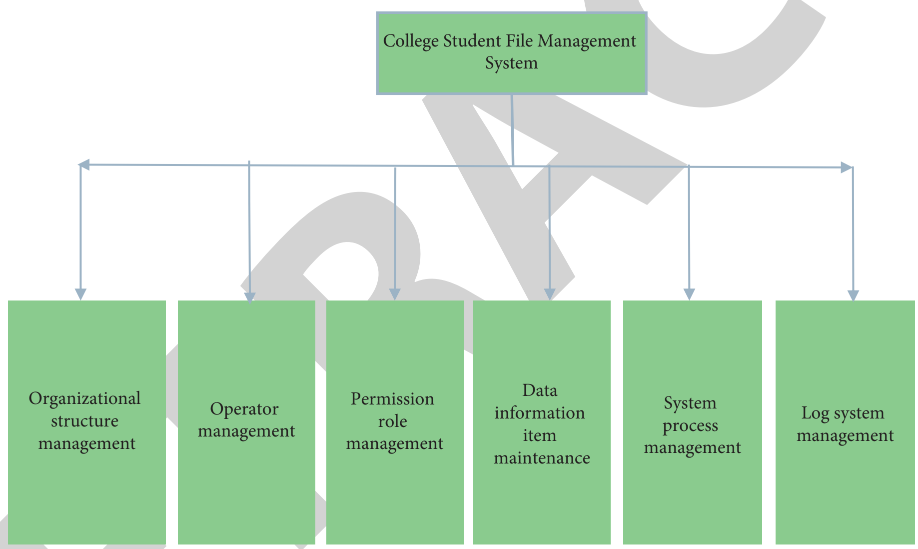

Figure 6: Functional module diagram of university archives management system.

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management coexist. Organizational management is also important in this system. The departments within the unit are managed using this function. The relationship between the superior and the subordinate of the department is displayed in the form of a tree structure. In addition, the related attributes of the department can be maintained. This includes the department name, department leader, and telephone number. The system administrator can add, modify, and delete the department of the organization through this function module. Figure 7 shows the overall architecture of the college archives management system.

Figure 7 reveals that the blockchain-based university archives management system has the archives management subsystem, the blockchain data protection subsystem, and the system monitoring platform. Data interaction through network calls can not only provide archives management functions but also ensure the system's stability and the authenticity of archives data. The entire blockchain-based archives management system enters through the archives management subsystem. This technology allows ordinary users to question, verify, and borrow archives. Users and archives can be managed by archives administrators. The blockchain data protection subsystem's data storage is organized into three categories: blockchain, InterPlanetary File System, and distributed database. The system monitoring platform is adopted for monitoring the running state of the archives management subsystem, the server host, and the application program related to the blockchain data protection subsystem.

This paper randomly surveys the administrators of university archives, the students who use university archives systems, and the faculty members. Two hundred questionnaires are distributed. A total of 196 valid questionnaires are returned. The questionnaire effectiveness rate is, therefore, 98%. Figure 8 displays the basic information of the investigators.

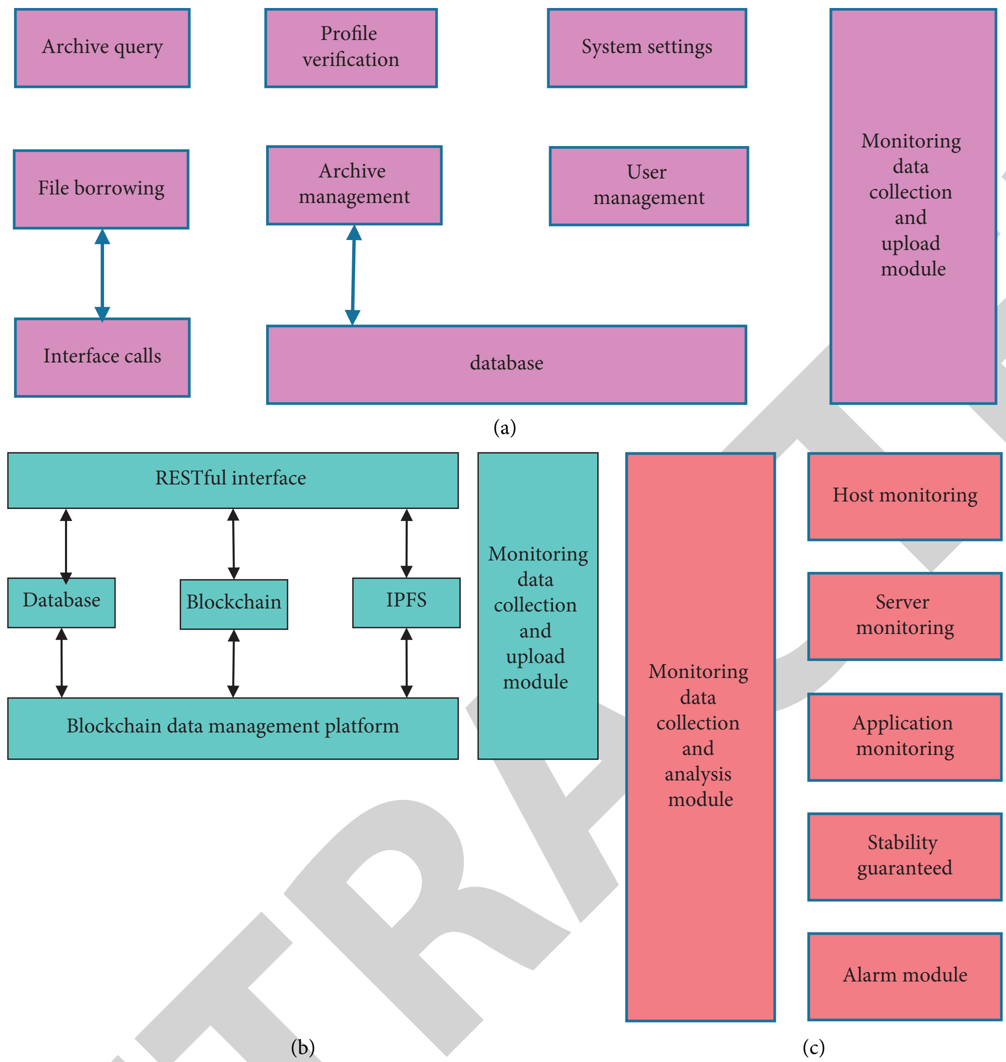

Figure 7: Structure diagram of college archives management system. (a) Diagram of archives management subsystem; (b) diagram of blockchain protection system; (c) diagram of system monitoring platform.

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From Figure 8, there are 43 freshmen, 40 sophomores, 41 juniors, and 44 seniors in this survey. There are 6 university archives system administrators, 10 university teachers, 12 university staff, and 168 university students. Among the investigators, 46 are in liberal arts, 42 are in science, 38 are in medicine, 36 are in art, and 34 are in engineering, with an even distribution.

3. Results

The following section describes the results and analysis of conducted research.

3.1. Analysis of College Archive Management System. A survey is conducted on the archives management personnel in colleges. The current internal archives arrangement method of the archives relationship system is analyzed. The results are revealed in Figure 9.

From Figure 9, 71% of college archives have implemented the unit of archives sorting, and only 28% of college archives still follow the method of using volume as a unit. Moreover, 57% of college archives are organized and archived by each filing unit, 34% of college archives are organized by archives institutions, and 8% of college archives are combined in a unified and self-organized way.

The attitudes of university personnel toward the digitization of the university archives management system and the storage of university archives are investigated. Figure 10 shows the results.

In Figure 10, there are various archives carriers. In addition to the traditional paper archives, about 92% of the archives have electronic archives, and about 88% of the archives have physical archives. Besides, 92% of the archives collect relevant photos, and 80% of the archives collect relevant video recording archives. Also, 64% of the respondents support the digital university archives system, 1.7% of the respondents express general support for the digital university archives system, and only 1.5% do not support the digitalized archives management system. Therefore, the process of digital optimization of the college archives management system should be accelerated.

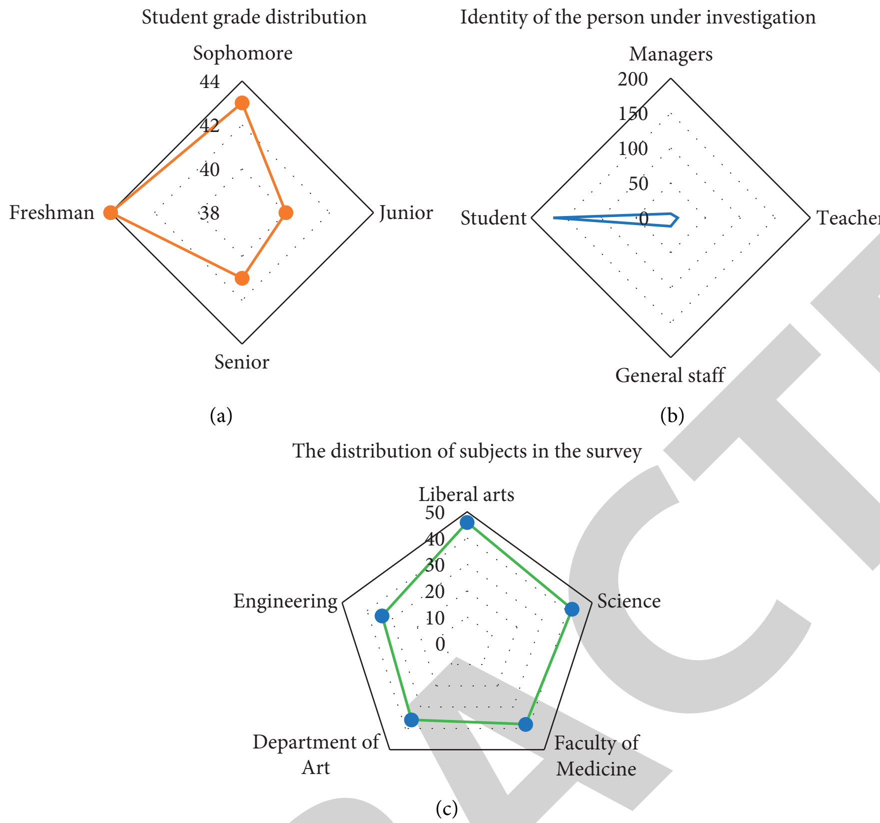

Figure 8: The detailed situation map of the respondents. (a) The distribution map of student grades; (b) the identity map of the respondents; (c) the subject map of the respondents.

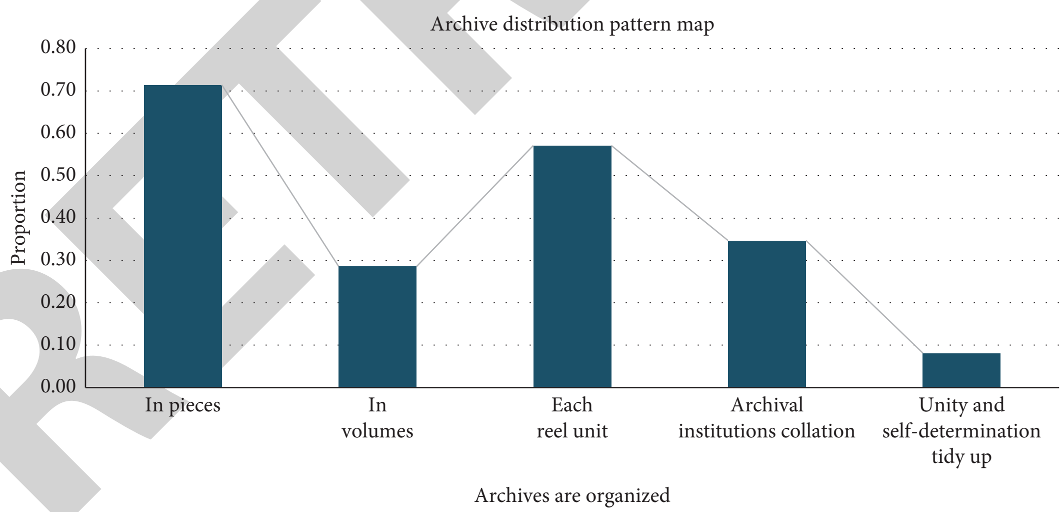

Figure 9: Distribution map of archives organization methods in colleges and universities.

3.2. Application Analysis of Blockchain Technology in the Design of College Archive Management Systems. The opinions of university personnel on the operational efficiency of the archives management system and the quality of archives search results are investigated. Figure 11 demonstrates the survey results.

From Figure 11, about 52% of the respondents believe that the university archives management system is highly efficient and can provide convenience. In addition, 31% of the respondents think that the operating efficiency is average, and 17% of the respondents think that the system is running slowly. Furthermore, 60% of the respondents believe that the university archives management system can well meet the purpose of archives search, 29% of the respondents believe that the quality of the search results is average, and 11% of the respondents believe that the quality

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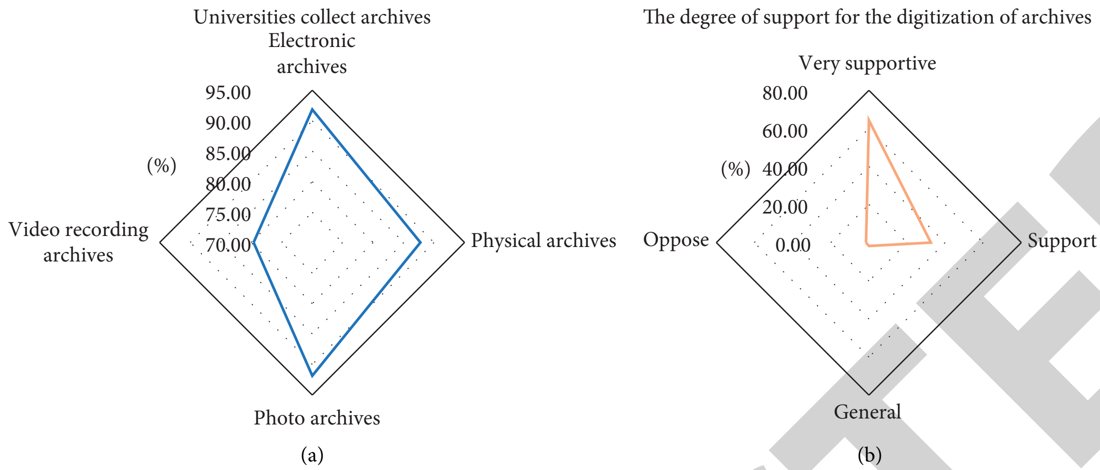

Figure 10: Survey results. (a) Attitude map of archives management digitalization; (b) state of archives collection and storage in colleges and universities.

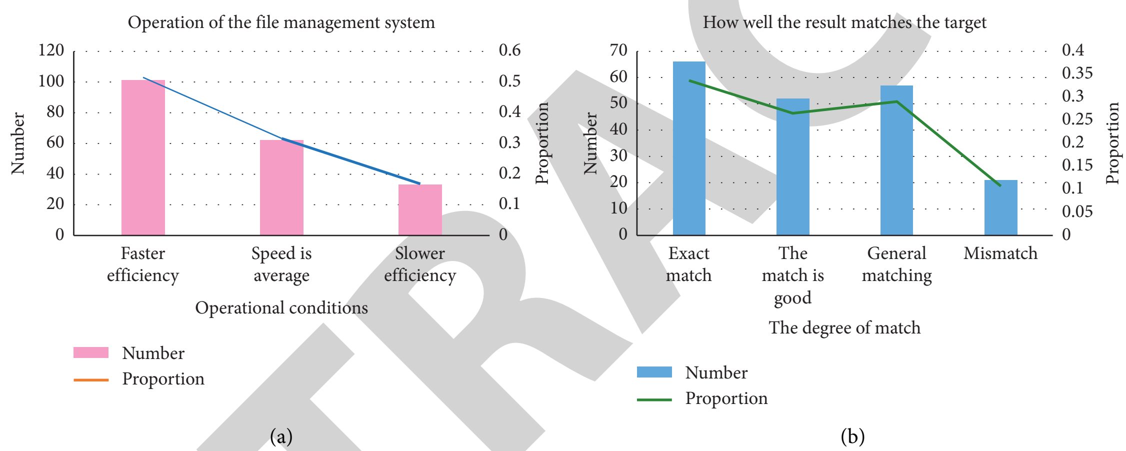

Figure 11: Result graph of respondents' experience of use. (a) Result graph of system operation efficiency; (b) result graph of search archives quality.

of the search results is poor. As a result, the operation efficiency of the archives relationship system in colleges and universities should be improved. It is necessary to accurately meet the needs of users' archives through blockchain technology.

4. Conclusions

With the advancement and progress of information technology, digital archives management systems have begun to popularize and gradually replace paper archives management methods. The current progress of domestic and foreign archives management systems has matured. However, the existing digital archives management systems store electronic archives in centralized databases and disks, which cannot solve the problem of data tampering from inside and outside the system. Therefore, it is needed to ensure the security and stability of the archives management system, so that the electronic archives information is not tampered with. It has become the focus of attention in this field. This exploration uses a questionnaire survey to investigate the views of university personnel on the archives management system based on the university archives management system under the blockchain technology. The survey results are as follows. First, most university archives are classified and stored in units of pieces. Second, most of the respondents support the digitized college archives management system and believe that the digitization process should be accelerated Third, the operation efficiency and search quality of the university archives management system should be improved. The disadvantage is that all the analysis and ideas proposed here are only in the theoretical stage. The question whether they are suitable for practical work needs further verification and research. This paper aims to provide an important theoretical basis for the upgrading and transformation of the college archives management system.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

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Conflicts of Interest

The authors declare no conflicts of interest.

Acknowledgments

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