Hindawi
Journal of Sensors
Volume 2022, Article ID 9675342, 10 pages
https://doi.org/10.1155/2022/9675342

Research Article

Research on Online Education Curriculum Resources Sharing Based on 5G and Internet of Things

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Received 18 September 2021; Accepted 8 December 2021; Published 5 January 2022

Academic Editor: Gengxin Sun

Information technology has brought great changes to China's education. 5G technology provides a better guarantee for the sharing of curriculum resources, facing the extreme shortage of educational resources in China. The contradiction between limited educational resources and unlimited development needs of higher education has become increasingly prominent. How to effectively realize resource sharing among universities has become a problem that must be considered in the talent development of universities. In order to solve this problem, universities must improve the utilization rate of resources, maximize resource sharing, and establish a more perfect resource sharing mechanism under the background of 5G and Internet of Things. This paper analyzes the current situation of research at home and abroad, the current situation of resources development, and the application of online courses under the background of Internet of Things, thus constructing an overall framework of curriculum resource sharing mode. According to effective experiments, the offline curriculum education resource sharing and traditional resource sharing schemes in the background of 5G and Internet are compared, and the necessity and importance of applying 5G Internet of Things are verified.

1. Introduction

With the increasing scale of higher education, whether there is a complete resource sharing mechanism is an important factor to ensure that students can receive high-quality education. Faced with limited teaching resources and unlimited development needs, universities must reasonably improve the utilization rate of resources, make use of the convenience of 5G and Internet of Things technology, maximize resource sharing, and propose solutions to the problems existing in resource sharing. The literature [1] shows that there is an extreme shortage of educational resources in China at present. According to effective investigation, most students cannot get high-quality teaching resources. On the university campus, with the convenience of 5G and the Internet, they have gradually formed a mode of sharing curriculum education resources, which can share teaching resources, teachers' resources, and curriculum resources and advanced teaching facilities. According to the investigation of college students' access to resources in the literature [2], it is concluded that the simplest way for college students to obtain high-quality learning resources is through libraries and online search tools. According to a report, college students tend to share resources among classmates and friends. Instead of directly obtaining resources, on average, students share learning resources twice or more times a week. They will share their handwritten notes and textbooks, purchased extracurricular books, and use some social software that cannot be directly shared, such as sharing learning resources on the Internet. The literature [3] studies the main ways of sharing high-quality resources inside and outside universities. The conclusions are as follows: the first one is through learning textbooks, extracurricular books, online courses, and learning websites. The other is network resources. The characteristics and differences between them are obvious. The literature [4] investigated more than 600 teachers in order to investigate

the influence of shared resources on teaching and practice. Knowing how they use shared resources and how to choose shared resources, the survey results show that shared education can not only reduce costs but also bring greater flexibility to education. The literature [5] is to verify the timeliness of the application of blog and wiki resource sharing mode. Taking "Principles and Methods of Instructional Design," one of the universities awarded by the Ministry of Education of China, as the research object, based on the research and analysis of curriculum resources sharing at home and abroad, this paper establishes a general framework of curriculum resources sharing mode. The literature [6] studies the sharing of massive open online course resources and puts forward a solution to the fragmentation of network resources. The implementation process and application framework of linked data are introduced. The literature [7] puts forward a brand-new way of education, which is called Fujian-Taiwan cooperation in construction and education. How to make full use of their respective educational resources, limited integration and sharing between the two campuses is the key to improve the education quality of talent training programs. Organizational coordination institutions and teaching quality monitoring mechanisms have been established to ensure the substantive sharing of educational resources. With the prevalence of the Internet of Things and the explosive growth of various data flows, the Internet of Things may face the problem of resource shortage. Reference [8] puts forward a scheme to solve the shortage of resources sharing. Considering the different communication requirements of various sensors, a new function is designed to drive the learning process. The results show that this algorithm can achieve good network performance. The literature [9] studies the platform of "Construction and Sharing of Moral Education Curriculum Resources in Shanghai Universities." It is found that they are realized through "1+2" operation mode, cloud storage structure, user classification management, and resource sharing scoring mechanism, which has the characteristics of intelligent resource retrieval and real-time resource evaluation and has become one of the important research achievements of "the construction and sharing of moral education curriculum resources in colleges and universities." The literature [10] describes a knowledge based on a learning development system. Used in e-learning courseware design and e-learning resource management, the distributed e-learning system development environment is developed by building a system model. The literature [11] introduces intelligent algorithms in a distributed manner to coordinate the overall goals of cellular systems with the individual goals of Internet (LOT) devices. The utility function of Internet of Things users is designed, a new incentive mechanism is constructed, and a priority queue is set for continuous actions. The literature [12] proposes a distribution protocol using blockchain technology. In the Online education resources, there are unfair distribution of teaching resources and difficulties in retrieving resources. Facing the emergence of 5G and Internet of Things technology, teaching resources can be shared and utilized in a variety of ways. With the support of 5G technology and Internet of Things technology, this paper realizes the research framework of sharing teaching resources and puts forward the theoretical model of sharing resources. This paper compares the offline curriculum educational resource sharing and traditional resource sharing schemes under the background of 5G and Internet and greatly improves the performance of teaching resources.

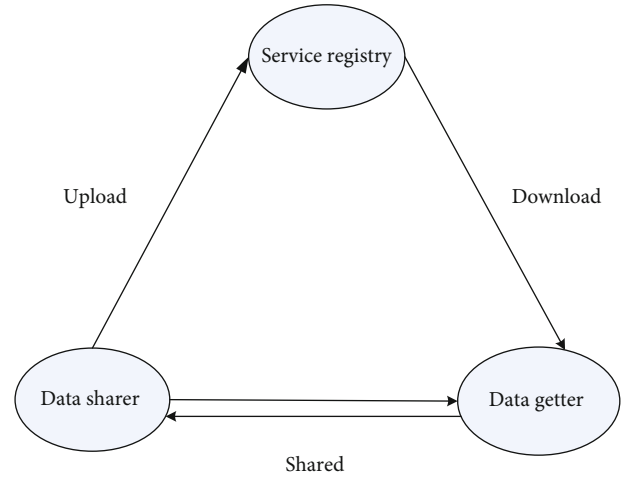

Figure 1: System model.

1.1. Research Background. With the development of science and technology and the prevalence of Internet technology, compared with traditional networks, 5G networks have the advantages of light coverage, low energy consumption, hot spots, and high capacity. It can spread data well. According to the current extremely scarce state of educational resources, some places do not have advanced teaching resources, so it is necessary to make use of the convenience of the Internet to share networks.

1.2. Significance of Research. The rise of the Internet of Things has also promoted the development of the education industry and launched a brand-new education model. The sharing of network resources has broken the traditional teaching concept, so that students are no longer limited by time and place. The sharing of network resources can not only save manpower and material resources but also quickly let more people receive high-quality educational resources.

1.3. Research Status at Home and Abroad. Effective storage and management of data is a problem that information resource sharing parties need to solve. A large number of scholars have done a lot of research on data encryption, storage, and management. Safe and efficient storage of shared data is the basis of safe sharing of resources, which can maximize the use of effective resources, maximize the value of data resources, and promote the development of society and production.

The prevalence of Internet of Things technology leads to the frequent sharing and exchange of data, and more and more people begin to pay attention to security and privacy issues. Access control is an important technology to ensure the data security of the Internet of Things. It is the control

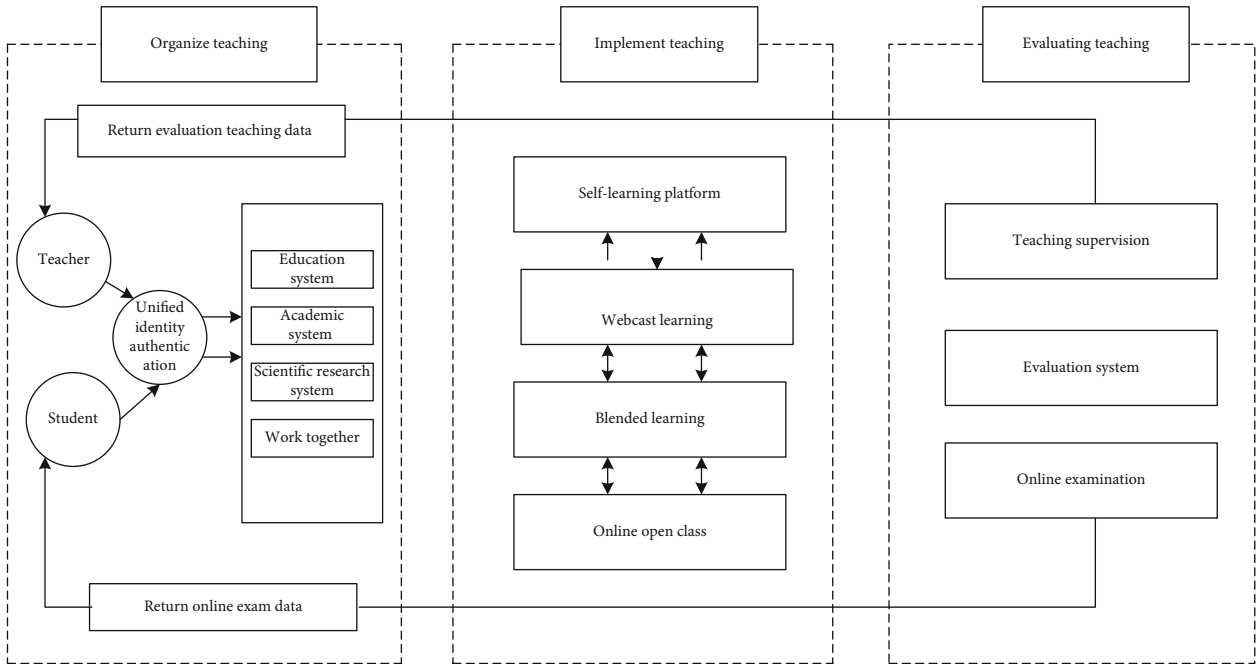

Figure 2: The educational information platform and realize resource.

of terminal access members to access shared data resources, which makes the access more secure, effective, and flexible.

1.4. Problems in Resource Sharing. In the process of resource sharing, there are also many security problems. The data processing ability of data exchange mode is poor, and the sharing security problem cannot be guaranteed. The following are the problems:

(1) Resource interconnection and interoperability in multidomain IoT scenarios. It is difficult to share data across domains. The Internet of Things is independent, and services are massively diversified and decentralized, resulting in difficult data sharing, poor service interaction, and system coordination and linkage

(2) The confidentiality and privacy of data have received a great threat. Therefore, how to ensure that information resources are not leaked and the security of shared resources has become a major challenge for Internet of Things resource sharing

1.5. Implementation Process of Curriculum Resources. We should make full use of the convenience brought by the Internet of Things to our lives. Although network teaching has been popularized, the traditional teaching methods are still deeply rooted, and some teachers do not use information technology very well. Therefore, teachers should fully feel the charm of the integration of information technology and classroom and lead teachers to recognize and utilize information teaching resources and take their essence. For some poor areas, school curriculum resources are extremely scarce. As a result, many students cannot enjoy high-quality educational resources, and then, the sharing of network resources is particularly important for them. Sharing resources is not only conducive to the reform of traditional teaching methods in some poor areas but also conducive to stimulating teachers' "want to teach" and students' "want to learn," which greatly stimulates students' interest in learning and makes the teaching quality reach a higher level.

1.6. Application of Network Sharing Courses under the Background of "Internet of Things"

1.6.1. Network Design and Development. When designing the curriculum content, we should first analyze the learning needs of different scholars and create multitype curriculum files. Before the course is officially used, it is necessary to try it out and modify and improve it according to the feedback and opinions of different auditioners.

1.6.2. Requirements of Online Courses for Teachers. In the multimedia teaching environment, teachers should not only have the basic knowledge and application skills of online courses but also use some advanced equipment. On the traditional basis, some easy-to-understand pictures and videos have been added to the network sharing course, but students cannot master knowledge without a teacher's explanation, so teachers should also have clear language expression ability.

2. Secure Resource Sharing Protocol for Ciphertext Attribute Authentication

2.1. System Model. The service registry is a data sharing platform. The shared data information is encrypted and stored in the server, and the data collector can download the data

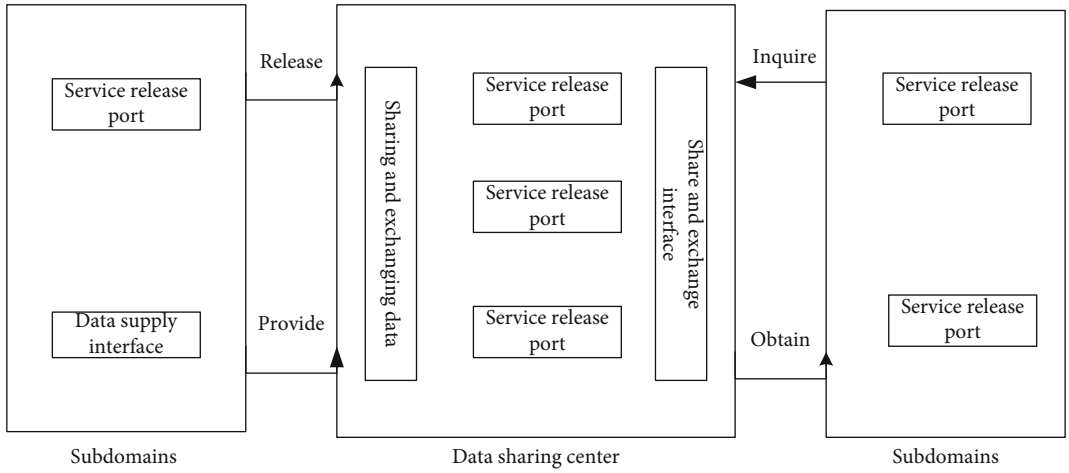

Figure 3: Data exchange framework.

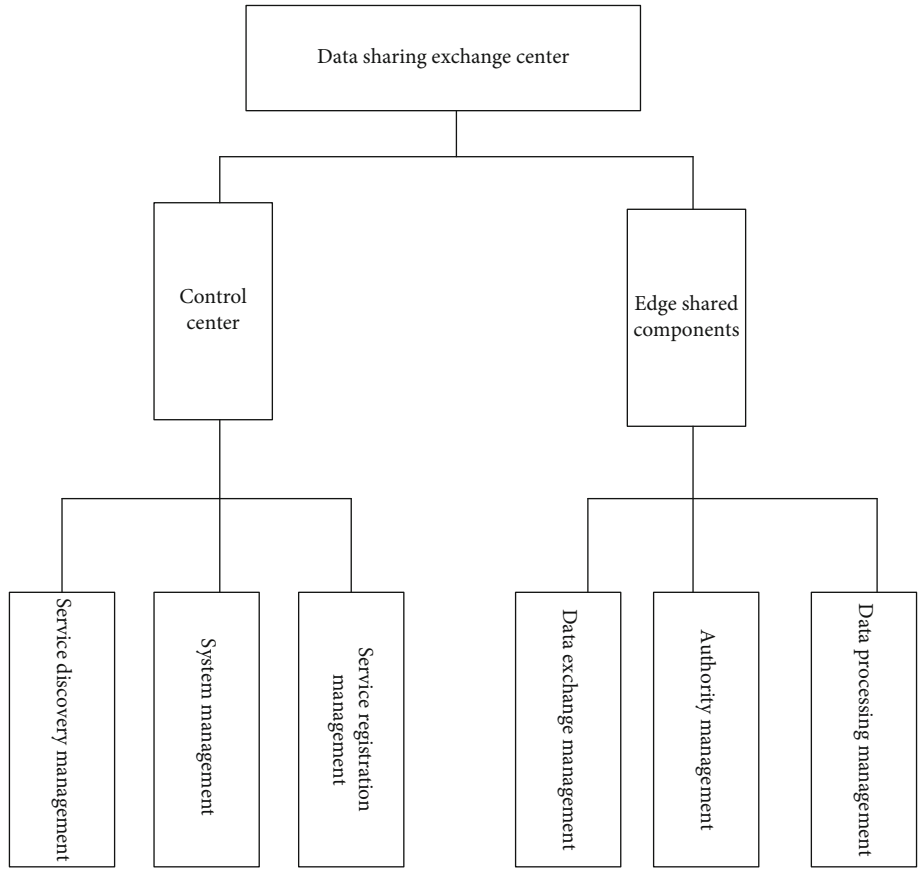

Figure 4: Data exchange center function module.

from the server. Data sharers can exchange identities with data recipients. Data sharers can share data with data collectors on the server, encrypt the provided data, and upload it to the server.

Data acquirers are members who are interested in the data on the server. They can download the corresponding data from the server. If they have data access rights, they can decrypt the ciphertext with the group key. The relationship between the three is shown in Figure 1.

In Figure 1, the data sharer uploads course resources to the Service Registry side, and the data getter downloads resources from the Service Registry side, thus realizing the sharing of teaching resources between the data sharer and the data getter.

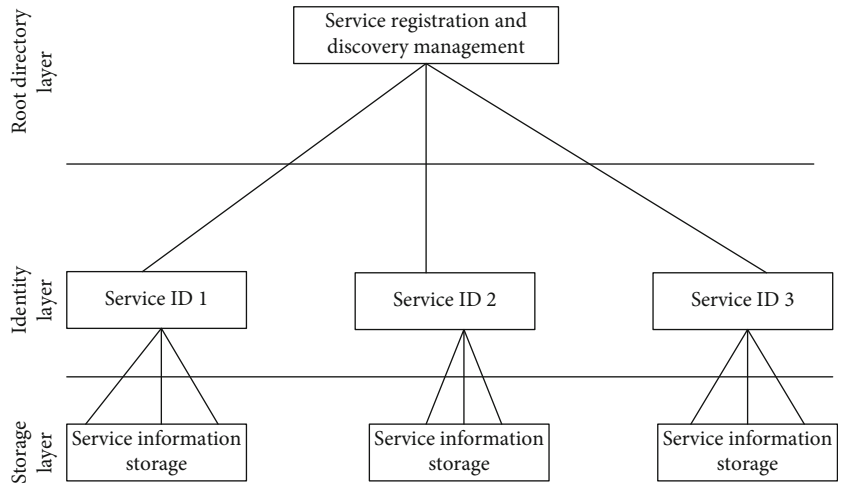

Figure 5: Service information architecture.

2.1.1. Chinese Remainder Theorem

Definition 1. In Chinese remainder theorem, suppose there are k pairwise positive integers $p_1, p_2, \cdots, p_k$ $(K \geq 2)$. Let $P = p_1 p_2, \cdots, p_k = p_1 P_1 = p_2 P_2 = \cdots = p_k P_k$; P_i is shown in

$$P_i = \frac{p}{p_i}(1 \leq i \leq k), \quad p_i > y. \tag{1}$$

The following equations are satisfied:

$$\begin{cases} x \equiv y_1 (\bmod p_1), \\ x \equiv y_2 (\bmod p_2), \\ \cdots, \\ x \equiv y_k (\bmod p_k). \end{cases} \tag{2}$$

There is a unique solution:

$$x \equiv y_1 p_1 p_1^i + y_2 p_2 p_2^i + \cdots + y_k p_k p_k^i (\bmod p) = \left(\sum_{i=1}^{K} y_t \cdot p_t^i \cdot p_t \right) \bmod p, \tag{3}$$

where $p_t^i p_t (\bmod p_t) = 1, \quad i = 1, 2. \cdots, n.$

2.1.2. Key Calculation for Shared Resources. According to the Chinese remainder theorem, the following equations are calculated:

$$\begin{cases} x_i \equiv c_{t,1} (\bmod p_2), \\ x_i \equiv T_{t,2} (\bmod p_2), \\ \cdots, \\ x_i \equiv T_{t,2} (\bmod p_2). \end{cases} \tag{4}$$

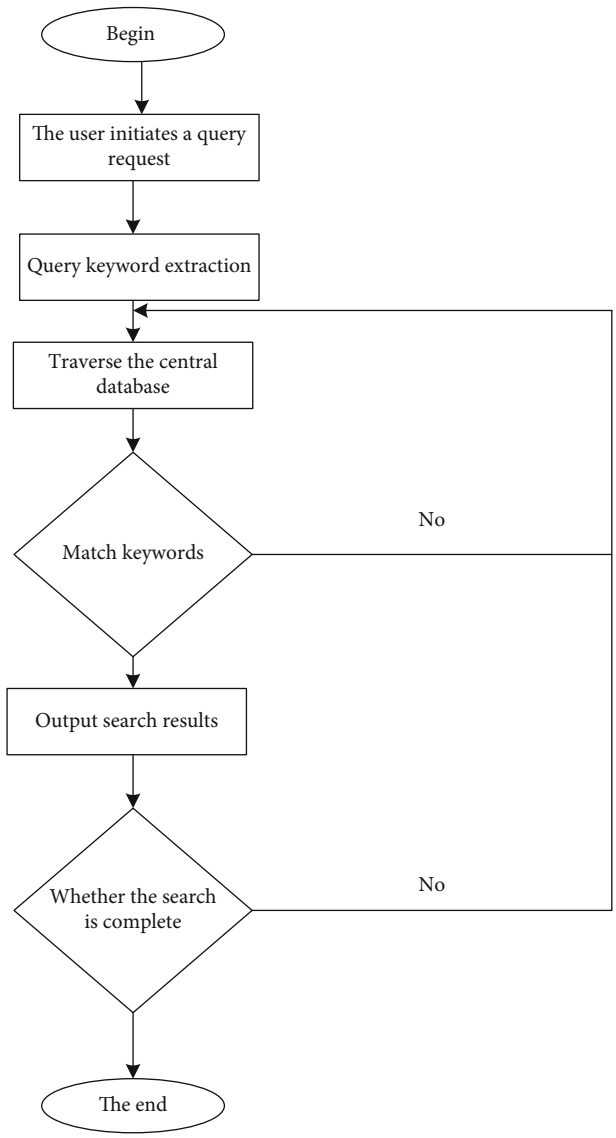

Figure 6: Resource query flow chart.

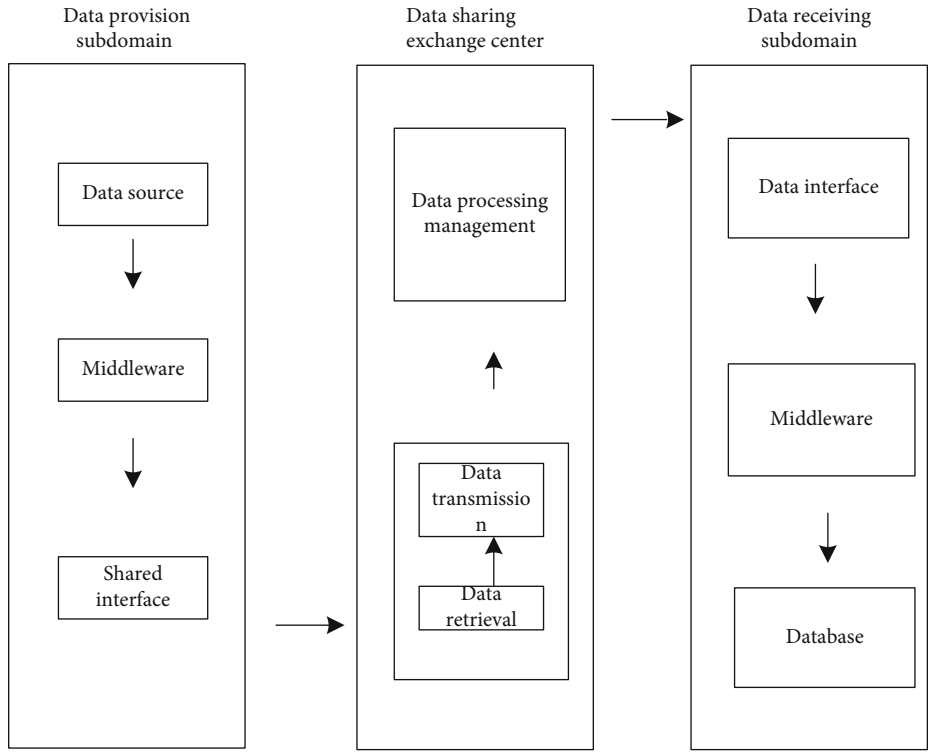

Figure 7: Data security architecture.

And get a unique solution: $x_i = (\sum_{v-1}^{t} \delta_{t,v} \bullet y_v \bullet (p/p_v)) \bmod P$ (in order to facilitate the solution, $T_{t,v} = \delta_{t,v}$, $v = 2, 3, \cdots, t$).

Among them,

$$\mathbf{P} = P_1 \times P_2 \times \cdots \times P_t = \prod_{v-1}^{t} p_v, \quad y_v \bullet \frac{p}{p_v} \bmod P_v = 1. \tag{5}$$

Results obtained

$$\text{Group}_{\text{key}} = x_i = \left(\sum_{v-1}^{t} \delta_{t,v} \bullet y_v \bullet \frac{p}{p_v} \right) \bmod P. \tag{6}$$

It can be used to encrypt the information exchange between shared resources and terminal devices to ensure the security of information exchange.

2.1.3. Encryption and Storage of Shared Resources. After the terminal members in the shared resources complete the successful registration steps, they can selectively encrypt and store the uploaded resources.

2.1.4. Download and Access to Shared Resources. Each user who logs into the system searches for corresponding resources on the platform through keyword search and related description content. If the user needs to access the shared resources, he needs to send information to the platform, download the corresponding ciphertext resources according to the ciphertext link, and then select the corresponding authority to calculate the decryption key:

$$x_i = \left(\sum_{v-1}^{t} \delta_{t,v} \bullet y_v \bullet \frac{p}{p_v} \right) \bmod P = x_i = \text{group}_{\text{key}}.. \tag{7}$$

According $\text{tom} = c_{t,2m} \oplus H_2(x_3) \quad c_{t,2m} \oplus H_2(x_3)$, get the resources of civilization.

2.2. Types of Learning Platform for Curriculum Resources. With the advent of the information age, in order to better organize platform resources, colleges and universities have successively built educational administration management systems, online learning course centers, and so on. The main categories are as follows:

(1) Students' autonomous learning: students can freely answer the discussion questions raised by teachers on the platform, and teachers can also upload exercises. It makes up for the defect that offline teachers have less communication with students and can also test students' autonomous learning ability [13, 14].

(2) Live webcast learning: on the basis of traditional classroom, live webcast learning has more intelligent functions, such as sign-in, answering first, and class inspection. During the epidemic period, live webcasts were held at home. After the outbreak, colleges and universities also maintained a live learning

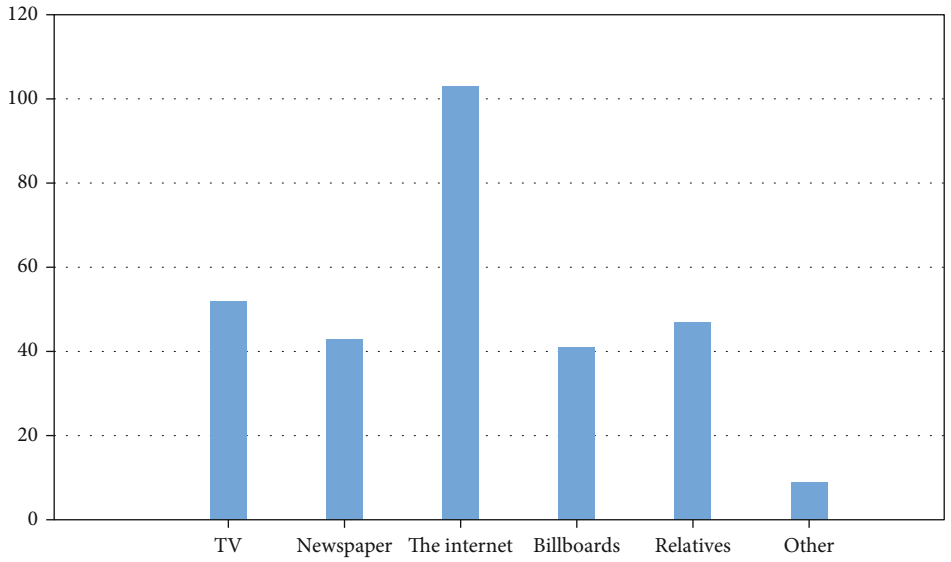

Figure 8: Understanding ways of information resource sharing construction.

platform. This is of great help to students' final review. Students can watch live playback and consolidate their knowledge.

(3) Blended learning: in blended learning platform, representative platforms are "recording and broadcasting classroom" and "smart classroom," which have the functions of recording, playback, interaction, and group discussion. Give the teaching environment intelligent, integrated teaching management and diversified teaching scenes and even introduce the Internet of Things and big data technology to open up all intelligent teaching platforms.

(4) Online open class: students can choose courses according to their own hobbies, which are not limited by time and place. As long as there is a network, they can learn. In some places, the resources of famous teachers are scarce. We can learn the courses of famous teachers through the Internet, so that more people can come into contact with the classrooms of famous teachers and share resources to the maximum extent.

(5) Calculator-assisted instruction: because the platform type has a wide audience and the needs of various universities are similar, it has become the mainstream trend to open up the educational information platform and realize resource sharing. The flowchart is shown in Figure 2.

2.3. Resource Accumulation. Traditional teaching resources basically come from teaching materials, extracurricular books, etc. With the rise of multimedia teaching, more resources come from multimedia courseware. In the information age, network resources have gradually occupied the mainstream trend. According to the learning platform, the

Table 1: Comparison table of results of different schemes.

Statistics	5G and Internet of Things	Traditional method	Other methods
Mean	269 s	304 s	325 s
Median	25.24 s	37.69 s	42.58 s
Mode	23.87 s	39.65 s	43.65 s
Standard deviation	12.65 s	18.73 s	19.65 s
Maximum	13.95 s	17.67 s	19.97 s
Minimum	59.57 s	92.67 s	97.19 s

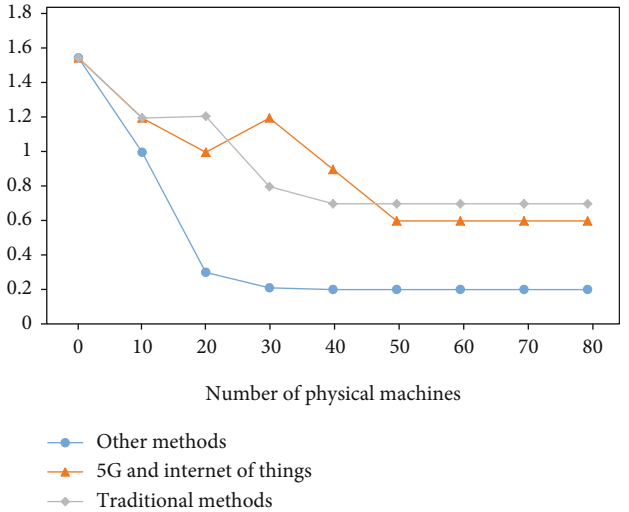

Figure 9: Evolutionary process.

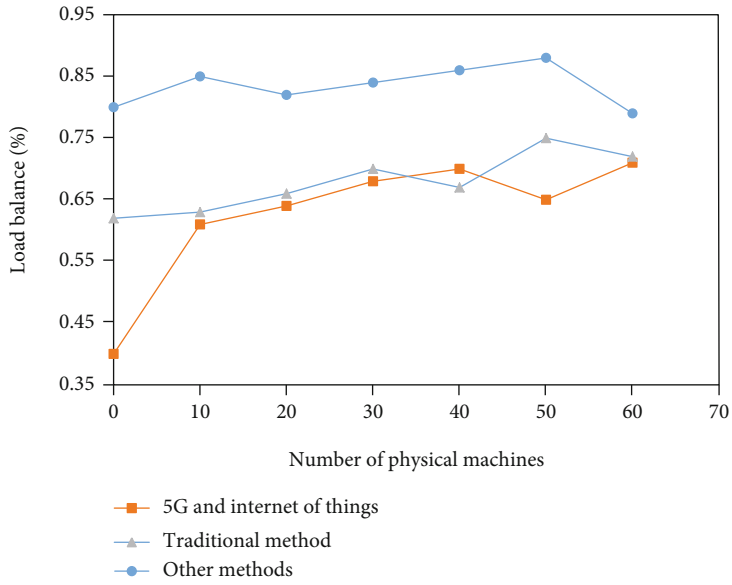

Figure 10: Resource sharing degree of different methods.

accumulated resources mainly include PPT, excellent massive open online course, question bank, and experimental material training.

(1) PPT: it is mainly written around the curriculum and helps students understand by means of some pictures and micro videos, which is beneficial to stimulate students' learning enthusiasm.

(2) Training of experimental teaching materials: it mainly focuses on the construction of experimental centers in schools and obtains medical experimental operation resources based on visual intelligent laboratories.

In the face of numerous platform resources, we should do a good job of sorting out and complete a certain amount of resource reserves according to the advantages of the Internet.

2.4. Architecture Design of Internet of Things Data Exchange System. The data exchange framework is show in Figure 3.

As can be seen from Figure 3, data sharing center is more important among several modules. Subdomains are divided into data providing and data releasing ports. Subdomains can provide teaching resources to the data sharing center and can also obtain resources to exchange data and interface with the data sharing center. Data sharing center is mainly used to provide data service and service interface, and the three modules are used to realize data exchange and sharing.

The core is the data exchange center, which plays the role of service query, service release, and data conversion. It consists of administrative center and edge shared components, as shown in Figure 4.

2.4.1. Management Center. Manage the security management of registering, publishing, and maintaining data exchange services, as shown in Figure 5.

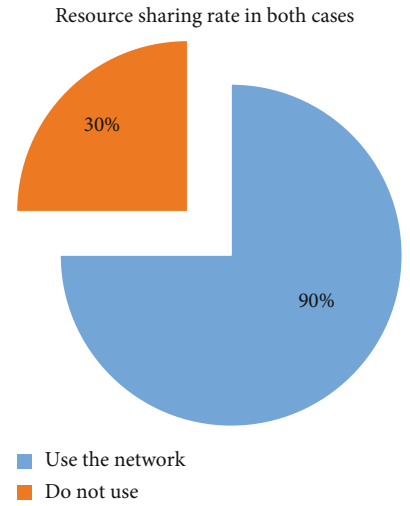

Figure 11: Statistical table of resource sharing rate.

When a user initiates a query request, keywords are usually used to search, and the operation mechanism adopts recursive mode. The flow chart is shown in Figure 6.

2.4.2. Edge Shared Components. Edge sharing component consists of three parts: data exchange management, authority management, and data processing management. Data exchange management has the functions of data retrieval and data transmission, and the data processing management module has the functions of extracting and transforming the data obtained by the management module, so as to realize the sharing and exchange of diversified data. Privilege management module is the core to ensure data security. The architecture diagram is shown in Figure 7.

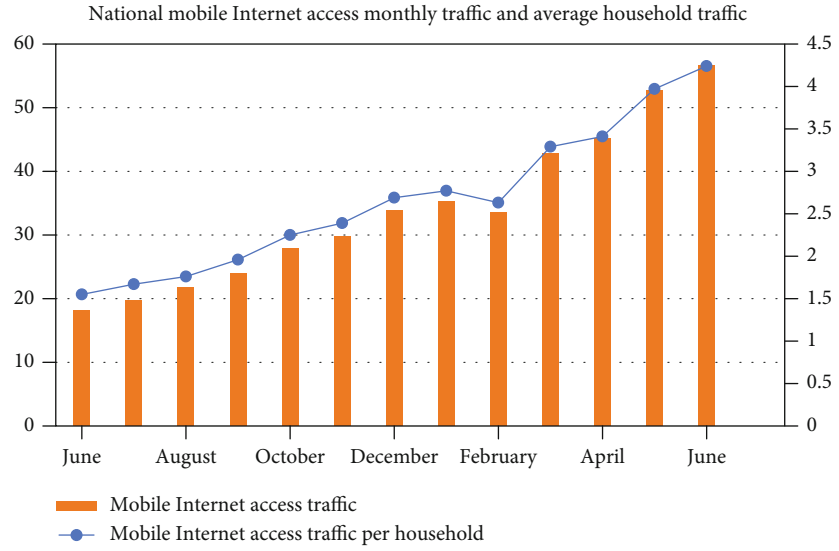

Figure 12: Traffic statistics.

3. Experimental Simulation

3.1. Data Budgeting. In order to understand the use of the Internet of Things, we conducted a questionnaire survey on the members of Hunan Literature Information Resources Co-construction and Sharing Collaboration Network. Experimental results show that compared with traditional methods, most people know new resource information through the Internet of Things. A small number of people learn about it through newspapers, relatives and friends, publicity columns, or other means. The statistics are shown in the following table. Statistics are shown in Figure 8.

3.1.1. Experimental Results and Analysis. We conducted a simulation experiment to compare the speed and universality of resource sharing in the context of 5G and the Internet of Things. The specific comparison results are shown in Table 1.

Compared with other methods, the results are shown in Figures 9 and 10.

3.2. Necessary Experimental Results. Comparing the implementation effect after adopting 5G and Internet of Things with other schemes, we designed an experiment to compare the degree of resource sharing without the background of Internet of Things with the prevalence of resources under the background of 5G and Internet of Things and obtained the following data, as shown in Figures 11 and 12.

3.3. Evaluation Results. According to the survey results, under the background of 5G and Internet of Things, information dissemination is wider, faster, and more accurate. The Internet of Things has become a mainstream trend. Of course, the requirements for 5G network are higher, so we should constantly optimize the network carrier and make sufficient preparations for the service bearing of 5G and Internet of Things.

4. Conclusion

We rationally apply the Internet of Things, which has brought great changes to the information season and maximized the sharing rate of information resources. Finally, on the basis of absorbing the theoretical research results and practical experience of foreign resource sharing, according to China's specific national conditions, proceeding from reality, this paper puts forward some new ideas on the construction of literature resources sharing network in China and especially puts forward some constructive views and suggestions on how to choose the breakthrough point of the construction of resources sharing network in China and how to establish a self-developing network operation mechanism, the guiding ideology of the construction of resources sharing network in China, and the construction of network system.

Data Availability

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

Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.

References

[1] F. Wang, "College Park development and sharing of educational resources exploration mode," *Electronic Test*, vol. 14, pp. 146-147, 2013.

[2] T. Judd and K. Elliott, "Methods and frequency of sharing of learning resources by medical students," *British Journal of Educational Technology*, vol. 48, no. 6, pp. 1345–1356, 2017.

[3] Z. Li and L. Qin, "Comparison and analysis on sharing ways of high-quality curriculum resources based on modern

educational technology," *Experimental Technology and Management*, vol. 32, no. 3, pp. 25–29, 2015.

[4] B. de los Arcos, R. Farrow, R. Pitt, M. Weller, and P. McAndrew, "Adapting the curriculum: how K-12 teachers perceive the role of open educational resources," *Journal of Online Learning Research*, vol. 2, pp. 1–9, 2016.

[5] Y. Xie, J. Bai, G. Li, and R. Yin, "Research and application on Web2.0-based sharing modes of curriculum resources," in *International Conference on Hybrid Learning and Continuing Education*, pp. 30–39, 2014.

[6] X. U. Yan-Dan and Q. J. Zhang, "Research on the linked data in the sharing of MOOC educational resources based on Drupal," *Journal of Xichang College*, vol. 29, no. 4, pp. 46–49, 2015.

[7] J. H. Zheng and L. Huang, "Integration and sharing of high quality educational resources in the colleges running by Fujian and Taiwan," *Higher Education Forum*, vol. 7, pp. 34–36, 2013.

[8] Z. Shi, X. Xie, M. Kadoch, and M. Cheriet, "A spectrum resource sharing algorithm for IoT networks based on reinforcement learning," in *2020 International Wireless Communications and Mobile Computing (IWCMC)*, pp. 1019–1024, Limassol, Cyprus, 2020.

[9] S. Johnson, J. Gao, M. Bian, D. Hsu, J. Yuan, and Y. Zhou, "Informatization construction of moral education curriculum resources in schools and universities," in *2014 IEEE Workshop on Electronics, Computer and Applications*, pp. 594–601, Ottawa, ON, 2014.

[10] T. Tanigawa and T. Fuji, "The methodology for reuse of E-learning resources," *Proceedings of E-learn 2002–world conference on E-learning in corporate, government, healthcare, and higher education. Montreal, Canada: Association for the Advancement of computing in education (AACE)*, 2002, pp. 305–310, San Diego, CA, 2002.

[11] Y. Li, Z. Li, J. Liu, and R. Zhou, "Resources sharing in 5G networks: learning-enabled incentives and coalitional games," *IEEE Systems Journal*, vol. 15, no. 1, pp. 226–237, 2021.

[12] B. Hamdaoui, M. Alkalbani, A. Rayes, and N. Zorba, "IoT-Share: a blockchain-enabled IoT resource sharing on-demand protocol for Smart City situation-awareness applications," *IEEE Internet of Things Journal*, vol. 7, no. 10, pp. 10548–10561, 2020.

[13] S. Bin and G. Sun, "Matrix factorization recommendation algorithm based on multiple social relationships," *Mathematical Problems in Engineering*, vol. 2021, 8 pages, 2021.

[14] G. Sun and S. Bin, "Research on public opinion propagation model in social network based on blockchain," *CMC-Computers, Materials & Continua*, vol. 60, no. 3, pp. 1015–1027, 2019.