Research on Library Construction Driven by Multi-Technology Integration

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ABSTRACT

The deep mining of data and the application of technology integration are the main characteristics of a smart society. This paper is to explore the application of multi-technology integration in library smart construction in a smart society, and study the library construction route driven by multi-technology integration. It promotes the transformation of technology empowerment to service empowerment, and provides a reference for the sustainable development of libraries and the construction of a national smart society. This paper analyzes the connotation and research status of multi-technology integration in a smart society. Based on this, it studies the important role of multi-technology integration in promoting the development of library service innovation, and analyzes the specific application of key technologies, such as 5G, IOT, big data, artificial intelligence, block chain and other technologies. Finally, it proposes the route of smart library construction driven by multi-technology integration.

Keywords: Smart society, Technology integration, Connotation, Trend, Construction route

1. INTRODUCTION

At present, digitization, networking and intelligence have become the general trend of economic and social development. At the 19th National Congress of the Communist Party of China held in October 2017, General Secretary Xi Jinping put forward the development goal of "accelerating the construction of an innovative country" on behalf of the Party Central Committee, and "smart society" was officially included in the report of the 19th National Congress of the Communist Party of China [1] . The construction of a smart society is to make full use of the new generation of information technologies such as the Internet of Things, big data, artificial intelligence, etc. It improves the coverage and equalization level of basic public services in the whole society by means of networking, platformization, and remoteness, and builds a three-dimensional, all-round, and wide-coverage social information service system, The public library is the information resource center, reading and learning center, cultural exchange center, social harmony and symbiosis center and leisure innovation experience center of a city or even a region or a country. It is a necessary element for building a modern city and inheriting human civilization [2]. It is an important institution under the public cultural service system of modern society, carrying the important responsibility of improving public service functions, and playing an important role in promoting the dissemination of advanced culture and improving the overall quality of the people. Therefore, based on the new generation of information technology, exploring the innovative development concept and innovative service model of the library is the key way to build a new generation of public cultural service system, meet the people's growing demand for cultural services, and realize the sustainable development of the library. It is an important part of social construction.

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2. MULTI-TECHNOLOGY INTEGRATION PROMOTES LIBRARY INNOVATION AND DEVELOPMENT

Smart society emerges after "smart city", "smart industry" and "smart people's livelihood". It integrates various smart systems of the former, and it is a new stage in the development of human society. The smart society is based on intelligent infrastructure, takes the deep mining of data as the realization path, and takes the integration and application of technology as the main feature. It promotes the integrated development of digitization, networking and intelligence, and finally realizes five characteristics, one is the ubiquitous information network, the second is the scientific government decision-making, the third is the refinement of social governance, the fourth is the digitalization of industrial development, and the fifth is public services. Universalization. The development of a smart society is no longer driven by a single technology, but is a driving force formed by the integration of many cutting-edge technologies such as 5G, big data, artificial intelligence, blockchain, and the Internet of Things. This driving force promotes the development of innovative applications in various fields. Multi-technology integration in a smart society refers to the integration and innovation of emerging technologies with "intelligence" as the core feature. In the global wave of intelligence, the integration of multiple technologies will break the traditional boundaries of open innovation and collaborative innovation. It provides more space for the application of data in the whole society and promotes social depth through hybrid and collaborative work and joint innovation and integration. Innovation leads all fields of society to move towards intelligent high-end, so as to better serve people's livelihood.

Regarding the connotation and research of technology integration, Zhang Jing analyzed the framework, data set construction, technical field definition and main research methods of technology integration from the perspective of metrology [3]; Tang Wenxian discussed the driving force of technology integration. , technology diffusion process, life cycle and structure and degree investigation, the theories of technology integration are explored, and the essence of technology integration is the diffusion of technology among different industries [4]. Chen Xiaohong discussed the new trends in the development of a variety of key technologies starting from the new features and challenges presented by the digital economy era [5]. From the research status, it can be seen that the current research on multi-technology integration mainly focuses on theoretical exploration, and the specific application research is still relatively rare, and in the field of multi-technology integration under the background of smart society, there are few targeted researches.

The development concept of the library mainly solves what kind of thinking should be used to guide the practice of the library. The advanced development concept should conform to the basic principles of library management and reflect the current spirit of the times. It can fully reflect the service tenet of the library [6]. The current trend of innovation and development is based on extensive technological integration, promoting the transformation of scientific research into actual competitiveness, promoting the combination of various cutting-edge technologies and field needs, and promoting the combination of core technologies and application scenarios. The two jointly promote field innovation and reshape how people live, work, study and play. From front-end perception to data aggregation, from software development to application services, modern technology has endowed the library with more application scenarios and creative elements, making the library a carrier for modern people to pursue the external world and explore the inner spiritual world. At the same time, the expansion of application scenarios and the innovation of service models are inseparable from the support of multi-technology integration. Therefore, taking scientific and technological means as an approach, taking technological integration as a springboard, and incorporating data security into the development strategy at the same time, and accomplishing the following points, is a long-term mechanism for realizing the intelligent construction of public libraries and promoting the sustainable development of libraries. The first is to strengthen information security governance, the second is to advocate green information resources, the third is to focus on intellectual property and personal privacy protection, the fourth is to build long-term preservation and open access to information resources, and the fifth is to provide creative, accurate and secure user services.

3. MULTIPLE TECHNOLOGIES FOR BUILDING SMART LIBRARIES

Under the impact of the technological revolution, the library has developed from an early library building to a digital library that collects electronic publications, and then to today's smart library. Every technological change reshapes the spatial layout of the library, changing its resource storage mode and service mode. The construction of a smart library is a huge systematic project. The integration of 5G, Internet of Things, big data, artificial intelligence, blockchain and other advanced technologies will provide more application space for library construction and create a smart humanities service environment to enhance user experience [7]. For the library field, 5G is the basis for the development of intelligent applications in libraries. It has the characteristics of high speed, low latency, high reliability, and high density, which

provides powerful technologies for big data, Internet of Things, artificial intelligence and other technologies in library construction. With the support of 5G, artificial intelligence and other technologies, the Internet of Things provides the library with information interaction between things and things and between people and things; Big data technology provides data service support for libraries, and provides a data interaction environment for the survival and development of artificial intelligence and other technologies, using its core data collection, sorting and analysis technologies to achieve "data-driven"; artificial intelligence includes Core technologies such as pattern recognition, natural language processing, and machine learning. With the support of artificial intelligence, libraries can realize more intelligent applications that simulate, extend and expand human intelligence; without the protection of blockchain technology, it is impossible to effectively protect user privacy, data security, copyright and other information. The museum cannot truly realize the "people-oriented". The interaction of multiple technologies and the support provided by the integrated environment for the library are shown in Figure 1.

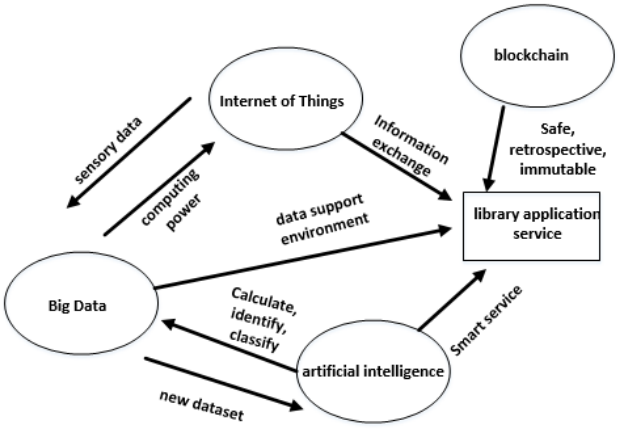

Figure 1. The Interaction of Multiple Technologies and the Supporting Function of Fusion Environment for Libraries

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3.1 5G technology provides basic support for the construction of smart libraries

5G, the fifth generation mobile communication technology, is the latest generation of cellular mobile communication technology. 5G has the characteristics of high transmission rate, low latency, high reliability, and high density, and can provide services for the Internet of Everything. In addition to providing more intelligent applications for libraries, the high transmission rate of 5G can also make users no longer rely on traditional service terminals, and data exchange can be realized through the service cloud platform, which will inevitably lead to library users' Needs and concerns change. In addition, the low latency and high density of 5G make information dissemination no longer limited by time and space, and can provide users with data services anytime, anywhere.

The International Telecommunication Union (ITU) has defined three main application scenarios for 5G. One is Enhanced Mobile Broadband (eMBB), which mainly refers to the application scenarios realized under the support of 5G's high transmission rate; the other is large-scale The machine communication mMTC (massive Machine Type of Communication), also known as the large-scale Internet of Things, is mainly for the technical application of the Internet of Things; the third is the ultra-reliable and low-latency communication uRLLC (Ultra Reliable & Low Latency Communication), mainly Covers business applications that require low-latency, high-reliability connections. The three main application scenarios correspond to the basic characteristics of 5G. Table 1 lists the specific applications that can be realized in the library smart construction under these three application scenarios.

3.2 The Internet of Things technology provides the library with the information interaction between things and things, people and things

The Internet of Things is based on the Internet, and it exchanges and communicates information through sensor perception to realize a network of connected things. The core of the Internet of Things is the information interaction

between things and people and things. The essence of the intelligent construction of the library is the information exchange between things and people and things. The Internet of Things technology can integrate various information into the library with the help of sensing equipment, and realize the interconnection of people, resources, space and equipment. It can be further improved by using the Internet of Things technology, such as Book lending, book search, book inventory, resource query, etc., so that users can obtain a better service experience. The application of Internet of Things technology in the process of library construction is mainly reflected in two aspects: book management and intelligent management of space environment.

Table 1. Specific scenarios of smart library construction supported by 5g technology.

Application scenarios	Related Technology	Application in smart library
Enhanced Mobile Broadband (eMBB)	AR augmented reality, VR virtual reality	VR/AR Innovative Reading Experience Virtual service , Such as virtual book search, virtual retrieval, virtual consultation space, virtual teaching, etc.
	Ultra HD Video	Digital audition resources, cloud classrooms, MOOCs, live events, etc.
	Panoramic broadcast	Ultra-clear panoramic interactive live broadcast
Massive Machine Communication (mMTC)	Internet of Things	Mobile reading, face recognition, crowd management, space reservation, equipment management, equipment maintenance, intelligent bookshelf system, intelligent seating system, access control system, various behavior detection systems
Ultra-reliable and low-latency communication(uRLLC)	Video Surveillance	Smart Security
	Positioning and Navigation	Remote problem location, cross-space, cross-regional remote control, indoor navigation
	artificial intelligence	Robotic Services and Other Smart Services

3.3 Big data technology provides data service support for libraries

The most critical support that big data technology can provide in the field of library construction is to solve the problem of digital resource integration and provide users with more expansion services. Due to the common isolation problems in the construction of library service platforms, a large number of fragmented data exist. These data often have the characteristics of different sources, inconsistent data standards, and diverse storage methods. The compatibility, interoperability and co-construction and sharing of terminals have brought difficulties. At the same time, the fragmentation of data can easily lead to a one-sided understanding of users, which is not conducive to in-depth and complete analysis of users' behaviors and characteristics, thus failing to provide users with more accurate services. For the special subject of the library, the integration of data resources can be understood as the comprehensive integration of platform data, services and technologies [8]. Through the use of big data core technologies such as data collection and preprocessing, data storage, data cleaning, data query analysis and data visualization, structured and unstructured data from various sources can be collected, processed, analyzed and applied.

The specific application scenarios that can be realized in the application of big data technology to provide digital resource integration services and user personalized services for libraries are shown in Table 2.

Table 2.Specific application scenarios of smart library construction under the support of big data technology.

Application scenarios	Related Technology	Application in smart library
Digital resource integration	RFID, data collection and preprocessing, data cleaning, data storage, data fusion, cloud computing, automatic translation, semantic technology, etc.	Digital resource sharing platform construction, institutional database construction, information service, decision-making assistance, etc.
User personalized service	Data analysis, data mining, artificial intelligence, semantic analysis, scenario simulation, intelligent perception,	For user data: Intelligent reading analysis, personalized recommendation, precise push, subject service, knowledge service, user portrait, maker space, etc.
		For business data: Service evaluation, visual analysis, map analysis, etc.

3.4 Artificial intelligence provides smart applications

Artificial intelligence is a new technical science that studies and develops theories, methods, technologies and application systems for simulating, extending and expanding human intelligence. Research in this field involves machine learning, image recognition, natural language processing, cognition and reasoning, language recognition, games and ethics, robotics and expert systems, and more. Artificial intelligence technology has promoted changes in the fields of industry, manufacturing, biology, and medical care, and has also provided favorable conditions for the intelligent construction of libraries. Intelligent terminals such as intelligent robots, intelligent retrieval systems, and wearable devices have brought more human-computer interaction scenarios to the library, triggering a huge change in the human-computer relationship [9]. With the help of artificial intelligence technology, some key technologies such as (1) browsers beyond keyword retrieval, (2) semantic analysis of web page content, (3) integrated speech recognition and machine translation to support real-time multilingual translation, (4) crowdsourced translation and recognition of cloud services for diverse and complex web content, these key technologies will have an important impact on the future development of libraries.

By integrating the advantages of artificial intelligence technology with library services, the innovation of library space, resources, and users can be realized [10]. The specific application scenarios that can be realized are shown in Table 3.

Table 3. Specific application scenarios of smart library construction under the support of artificial intelligence technology

Application scenarios	Related Technology	Application in smart library
Space service	Voice recognition, image recognition (including picture recognition, fingerprint recognition, face recognition, iris recognition, etc.), Internet of Things, etc.	Smart building, smart experience (perception) space, smart learning center, game application center, night reading space, etc.
		Smart desktop, smart touch screen, smart navigation, etc.
		Monitoring and identification, intelligent firewall, intelligent access control system, etc.
Resource service	Machine Learning, Computer Vision, Natural Language Processing, RFID, etc.	Intelligent book inventory, intelligent classification management, intelligent book shelf management, intelligent warehouse management, etc.

		Intelligent retrieval system, intelligent reference information system, etc.
User service	Semantic technology, corpus, natural language processing, speech recognition, glasses-free 3D, GPS, etc.	Intelligent picture book reading, intelligent assisted reading, robot accompanying reading, etc.
		Intelligent consulting librarians, librarians, guide waiters, intelligent chats, intelligent library robots, etc.
		Audio readers, electronic visual aids, intelligent navigation and positioning equipment, etc.
		Domain analysis, industry analysis, thematic analysis, knowledge push, collection structure analysis, resource layout analysis, etc.

3.5 Blockchain technology guarantees user privacy and data security

Blockchain is an innovative application model of computer technologies such as distributed data storage, point-to-point transmission, consensus mechanism, and encryption algorithm in the Internet era. It has the characteristics of decentralization, de-trust, collective maintenance, security, openness, anonymity and autonomy [11]. Blockchain technology uses block chain data structure to verify and store data, uses distributed node consensus algorithm to complete the basic operation of data, uses asymmetric encryption and authorization technology to ensure the security of data transmission and access, uses automatic script code composed of Smart contracts are used to program and operate data, and its technical characteristics can effectively enhance the integrity and security of data information exchange in a distributed environment. While blockchain technology has been initially applied in the fields of finance, industry, energy, medical care, e-government and other fields, it has also brought great changes to the field of libraries. The most critical point is to "decentralize" thinking Introduced into the construction of the library, the library gradually changed from an information disseminator to an organizer and manager.

Blockchain technology is strictly divided into three types, namely public chain, private chain, and alliance chain. The public chain has the characteristics of complete decentralization, which can be understood as a public blockchain, that is, a blockchain that everyone can participate in. In the process of library construction, using the public chain, users can acquire or create resources according to their needs, improve user participation, and promote the diversity of information collection. At the same time, the quality of resources can be guaranteed through background review and effective resource ranking based on clicks and downloads. The private chain has the characteristics of complete centralization, emphasizes privacy, and can only be accessed and exchanged within a certain organization and area. Using a private chain can ensure the integrity and credibility of user behavior data, and provide technical support for user privacy protection. The alliance chain is controlled by multiple centers, and each center node is coordinated and managed according to the consensus mechanism, which has the characteristics of partial decentralization. In the construction of the library, the use of the alliance chain can realize the collection of cross-platform data resources and promote data sharing among institutions.

4. APPLICATION AND REALIZATION OF MULTI-TECHNOLOGY INTEGRATION IN LIBRARY CONSTRUCTION

The library construction driven by multi-technology integration is to form a complex ecosystem in an intelligent library environment, guided by user needs, and use the collaboration of intelligent technologies to provide users with intelligent, accurate, efficient and reliable services. Its specific structure is shown in Figure 2.

Data collection: including perception layer collection, platform collection and network collection. Among them, the acquisition of the perception layer is to use various hardware equipment and tools to collect and perceive various data in the library application environment. The hardware equipment and tools mainly include cameras, sensors, GPS, M2M terminals, RFID tags and card readers, and two-dimensional codes. Tags and readers, sensor gateways. Perception layer

acquisition is a key part of information acquisition and an important link between the physical world and the information world. Platform collection and network collection are the use of automation technology and data mining technology to collect user and social data on the library information resource platform and network platform. The data collection layer mainly uses the Internet of Things technology, big data technology and artificial intelligence technology. The Internet of Things connects terminals and sensors to the network to make data available; big data technology uses its key data mining technology to collect library platform data and network data. Artificial intelligence technology exerts its perception ability and obtains structured information from unstructured data [12].

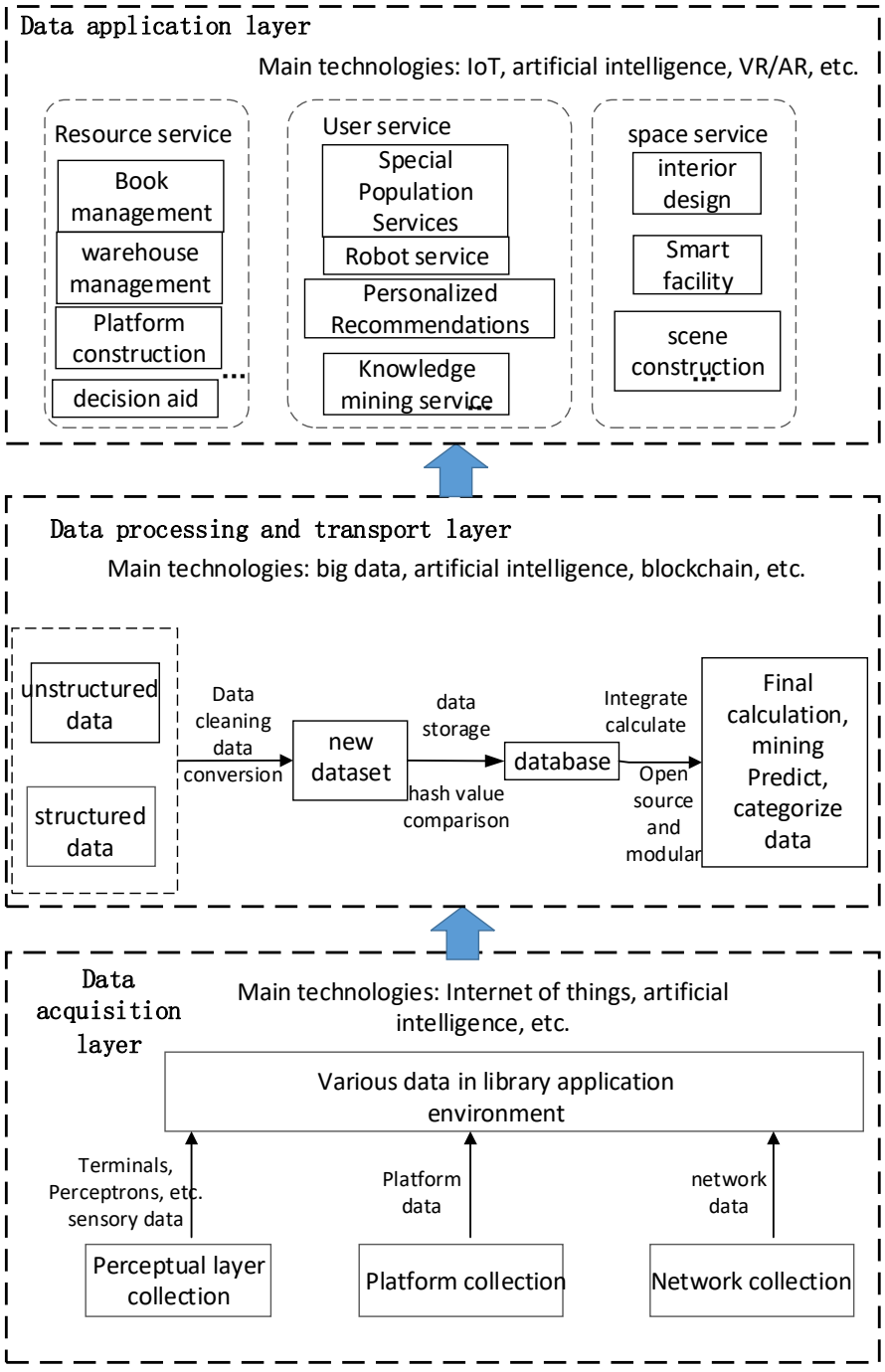

Figure2. The architecture of the smart library system driven by multi-technology integration

Data processing and transmission: Use data mining, data cleaning, data analysis and other technologies to integrate, calculate and process the data collected by the collection layer. Secure, trusted and immutable. Specifically, preprocess the collected data of different datasets in the library, import the data after data cleaning and data conversion into the fusion system, and generate a new dataset. Based on different data types, the data sets are stored in different storage methods. For structured data such as library user data, a decentralized trust mechanism is introduced for data processing; during storage, the hash value on the chain is compared to ensure that the big data is not tampered with; during transmission, a signature mechanism is used to ensure data security.

Data application: apply the final calculation, mining, prediction and classification data of the data processing and transmission layer to scientific decision-making and various scene construction, etc., to assist the library in providing effective data resource services, such as providing diversified space services to support personal learning, team communication, project construction, information consultation, cultural exhibitions and other activities. The second role is to provide "knowledge recommendation" and "knowledge navigation", to realize the transformation of the library from information service to knowledge service, and to match people's learning, scientific research and innovative work methods in the future. The data application layer mainly uses artificial intelligence technology and blockchain technology, artificial intelligence technology provides automated business processing, and blockchain technology provides trusted authorization.

In addition, the entire architecture system is built on the basis of 5G communication technology, providing a network with large bandwidth, low latency, and high reliability, and promoting the implementation and application of technologies such as the Internet of Things and artificial intelligence.

5. CONCLUSION

As a product of the birth of the humanistic trend of thought, the most fundamental purpose of the library is to serve people, and the service is an organic combination of technology, ideas and systems. The user ultimately perceives the service of the library rather than a single technology [13], under the background of smart society, the innovation and development of libraries should not only pay attention to the changes brought about by technology, but also consider the importance of humanistic concepts and management in library services. This paper deeply studies the important role of multi-technology integration in promoting the innovation and development of library services, and makes an in-depth analysis of the specific applications of key technologies such as 5G, Internet of Things, big data, artificial intelligence, and blockchain in the library field. The application of multi-technology integration in the construction of smart library is analyzed and practiced. In the next step, more consideration will be given to the synergy of technology integration and application with humanistic concepts and management innovation, to promote the transformation of technology empowerment to service empowerment, so that technology integration can fully infiltrate all processes and links of library services, and realize technology integration-driven and people-centred "balance".

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