

Analysis on the current situation of Intelligent Library in the environment of Internet of Things

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Abstract—Intelligent library is the future development direction of Digital Library in the environment of Internet of things. Research on the development of Intelligent Library in the environment of Internet of things is the key to ensure that intelligent library can better meet the needs of readers. In order to ensure the effectiveness of this work, this paper first introduces the concept and characteristics of intelligent library, and then analyzes the problems in the development process of Intelligent Library. Furthermore, on the basis of describing the research status and connotation of intelligent library, the paper introduces the concepts of "intelligent society" and "intelligent craftsman spirit", and puts forward the new path of innovative intelligent library from the aspects of the construction concept model of intelligent library, "library + cooperation" model, and the ability cultivation of intelligent librarians, so as to promote the integration of library into the construction of "intelligent society" or "intelligent city" For reference, to create new value for the society and service objects.

Index Terms—Internet of things, intelligent library, innovation path, intelligent craftsman, intelligent service.

I. INTRODUCTION

General secretary **Jinping Xi** put forward the concept of "intelligent society" for the first time in the party's "Nineteen big" report. He stressed that "by promoting the deep integration of Internet, big data, artificial intelligence and real economy, new growth points and new driving forces are provided for social development" [1]. Smart city, smart campus, smart community and Intelligent Library are all organic parts of the social organism. They must be incorporated into the National Smart strategic system and explore new paths for the development of Intelligent Library, so as to promote the sustainable development of "smart city", "Intelligent Library", "smart campus" and "smart community".

Internet of things is the third wave of information technology revolution after computer and Internet. The Intelligent Library in this wave is a problem worthy of discussion [2-13]. With the continuous development of Internet of things related technologies, the application range of Internet related technologies in all walks of life is more and more wide. In the process of the development of intelligent library, the effective application of Internet of things technology is one of the main ways to ensure that the

library can meet the needs of readers at this stage in terms of function, operation efficiency, etc. In this context, it is not difficult to find that the support of Internet of things and network technology can effectively guarantee the realization of the expected functions of the intelligent library on the basis of the original, but at the same time, the problems of standardization, RFID hardware design, software system positioning, software security and so on are all related to intelligence. The development of the library has been hindered. In order to ensure the development of Intelligent Library in the context of continuous improvement of the Internet of things system, it is necessary to study and analyze the future development direction of intelligent library.

II. THE DEFINITION AND CHARACTERISTICS OF INTELLIGENT LIBRARY

A. The definition of Intelligent Library

According to the existing research data, intelligent library can be simply defined as a high-level form of digital library that provides intelligent services and management for users through Internet of things and other technologies. Based on the analysis of this definition, it can be concluded that intelligent library not only has all the characteristics of digital library, but also improves the functions of digital library, and the level of intelligence has increased greatly. In the future, the intelligent library will become the main development mode of the library. Only in this way, under the background of computer technology and network technology in all aspects of life, can the library more effectively meet the needs of readers and avoid being eliminated by the market.

B. Characteristics of Intelligent Library

1) Significant improvement of intelligent level

The improvement of intelligent level of intelligent library is mainly reflected in the following aspects: **First**, the library analyzes the data such as user's reading preference better through RFID electronic tag technology, and then improves the existing management methods of the library combined with user's reading habits; **Secondly**, the library realizes the intelligent management and control of these devices through the combination of RFID electronic tag technology and various devices in the library. In this context, human

resources can be well controlled in the process of library related work.

2) Support personalized customization

Personalized customization is mainly for library readers. In the follow-up development process, in order to further enhance its competitiveness, the library must be able to provide more targeted services for different users. For such a requirement, in the process of library operation, the application of intelligent technology and concept is essential. Based on the effective collection of user information, the intelligent library realizes a more comprehensive and three-dimensional personalized service in virtual and real environment, and the satisfaction of users for the library can be effectively improved.

3) More humanized

On the one hand, with the support of related intelligent technology, users will be able to choose the library service form according to their own wishes, such as the choice between self-service and artificial service, the choice between mail service and mobile service, etc. On the other hand, the user-oriented time limit of the library has been greatly improved. Through the application of RFID and other technologies, the library builds a 24-hour self-service borrowing and returning system according to the user needs. Obviously, after the system is put into use, the convenience and rapidity of users' borrowing and returning books can be better guaranteed.

4) Interconnection

The most remarkable feature of intelligent library is its interconnection. The intelligent library not only collects data anytime and anywhere through the Internet, but also connects the data collection end through the Internet, transmits the collected data information to the library data center, and constructs an intelligent system through the network. In the environment of Internet of things, intelligent library realizes the connection between all objects (including things and things, things and people) and network. Due to the progress and application of Internet of things technology, all parts of modern library are endowed with "wisdom", realizing interaction and multi-party sharing. The interconnection makes resources searching, positioning and other services more convenient.

5) Efficiency

The efficiency of intelligent library mainly refers to that it implements the "intelligence" of information materials, greatly simplifying the original procurement and processing process (such as adding magnetic stripe, cataloging, pasting book labels, bar codes and other collection marks). Inventory, search, positioning, racking and other work can be done through self-service. This makes the work of the library more convenient. Compared with the traditional library, the intelligent library not only greatly improves the efficiency of service management, but also significantly improves the utilization rate of collection resources and realizes efficient management.

6) Convenience

The convenience of intelligent library mainly refers to that Internet technology and Internet of things technology have greatly improved the service efficiency of library. The traditional library relies too much on human services, which makes the demand for information seriously constrained. The intelligent mobile communication technology has greatly changed the service mode of the library. It is no longer limited by time and space. It provides great convenience for the borrower and makes it more convenient to obtain information.

III. ANALYSIS ON THE CURRENT SITUATION OF INTELLIGENT LIBRARY

A. Current situation of Intelligent Library

The term "Intelligent Library" was first coined in 2003 by Markus Aittola of the University of Oulu, Finland. In his opinion, "Intelligent Library" is a perceptible mobile library service, which is not limited by space. According to Hui-Cao Gao, the key elements of intelligent library include intelligent technology, intelligent service and intelligent people. Younghee Noh believes that the new form of Intelligent Library in the future can be described by keywords such as 4.0. The theory and practice of foreign research are closely linked, providing a mirror for research and practice.

Compared with foreign countries, the concept of domestic intelligent library has only appeared in the field of library information for about 10 years. The representative opinions are as follows:

1) In 1999, **Wenrui Lin** explained the concept of Intelligent Library from the perspective of super intelligent building management system;

2) According to **Dong Yan**, "Intelligent Library = library + Internet of things + cloud computing + intelligent equipment, which realizes intelligent service and management through Internet of things";

3) According to **Shiwei Wang**, people-oriented, green development and convenience for readers are the soul and essence of intelligent library. The feature of being is ubiquitous, and the inner feature is people-oriented;

4) In 2018, **Jingli Chu** and others put forward that the number of smart libraries is the core connotation of character library, mobile library and new library is the highest and leading mode of future library.

B. Problems in the development of Intelligent Library

1) Standardization

With the wide application of Internet of things related technologies, international standards have been established for RFID, etc., but for the intelligent library discussed in this paper, the establishment of RFID system in some libraries is completed under the background of no unified standards, and this part of libraries will inevitably need to improve the RFID system in the subsequent development process in combination with the existing standards. This process not

only requires a lot of human and material resources, but also affects the overall operation of the intelligent library.

2) Design of hardware equipment

Take the application of self-service loan and return equipment as an example. On the one hand, although this equipment can save human resources, but at the same time, in the face of a large number of users, some of the equipment can not effectively detect and control the damage and contamination of books, which leads to the continuous increase of the damage rate of books in the collection, but causes the economic loss of the library. On the other hand, for some large-scale books, the existing equipment can not be effectively borrowed and returned under the background of user self-help, and this situation is likely to lead to the reduction of the efficiency of library operation. In the follow-up development process, relevant technical personnel must make further research on such hardware problems to avoid the continuous impact of the above conditions on the operation of the Intelligent Library.

3) Software system fails to achieve accurate positioning

Combined with the current situation, with the support of RFID technology, the existing library system has been able to locate the location of a book on a specific shelf. However, users still need to do further search on the bookshelf. For libraries with large traffic, such a processing method will obviously lead to a reduction in efficiency. On the other hand, a large number of human resources are still needed to support the operation of intelligent library at this stage. Taking the development of manual inventory work as an example, according to the different professional qualities of relevant staff, there will be some differences in the probability of book wrong shelf and off shelf. However, the existing Internet of things technology and intelligent technology can not effectively judge this situation, which eventually hinders the subsequent work of the library.

4) Software safety performance is not up to standard

The continuous development of information technology will inevitably bring security problems. For the problems discussed in this paper, if the relevant software cannot meet the user's requirements in security performance, then the user's privacy is likely to be leaked or embezzled. Taking the application of RFID technology as an example, if the hacker blocks the communication link by transmitting interference signals, then the RFID system cannot process the normal data, and the hacker will intercept the communication data directly in this situation. Combined with this content, most of the intelligent libraries at this stage do not pay attention to information security effectively in the construction process. In the context of the continuous development of Internet of things related technologies, once the whole system is attacked, it is likely to bring a devastating blow to the library, unable to provide normal services to users, or even threaten their own interests.

5) Relatively high construction cost

The library should be able to provide users with services

such as book borrowing and returning, data query, etc., which is relatively weak in profitability. For the construction of intelligent library, the introduction of new equipment and technology, the selection and employment of senior technical personnel, etc. need a lot of financial support. Even if the library can support such capital investment, it is difficult to recover the cost in a short time in the follow-up operation process, which eventually leads to problems in the capital flow of the library. For the university library, the construction of intelligent library is more difficult. At present, some university libraries in China still rely on human resources for management. If we want to fundamentally improve this situation, we must need enough funds and a long construction period, which are difficult for university libraries to achieve.

To sum up, at present, intelligent library has become an important and hot research topic in the field of Library and information. To this day, although scholars have produced a lot of practical and theoretical results on the research of Intelligent Library, leading the new trend of domestic research on Intelligent Library. A complete system has not yet been formed, and this research path is still in its infancy. Therefore, as an information intensive industry, it is necessary and necessary to explore the innovation path of intelligent library, so as to provide users with open, transparent and green precise services and convenient services.

IV. CONNOTATION OF INTELLIGENT LIBRARY

Analyzing the views of relevant scholars, we can see that Intelligent Library is based on cloud computing, artificial intelligence and other new technologies, with intelligent devices as means, through the Internet of things to achieve intelligent services and people-oriented new management. The biggest challenge of intelligent library is the concept. The author believes that the intelligent library must connect people-oriented people and things. It needs to uphold the spirit of "intelligent craftsman" under the support of new technology, gather people's wisdom and knowledge ability, make "things" become more intelligent, make people's wisdom become more flexible, realize the integration, complementation and mutual promotion of people and things, and reflect the characteristics of intelligent, efficient and convenient service of the intelligent library Color.

A. From the perspective of smart society

On the one hand, we should increase the support for the construction of Intelligent Library in terms of funds and policies, on the other hand, we should promote the cooperative operation and management of the whole library service field, which is consistent with the characteristics of Intelligent Library.

- 1) A new type of interconnected library;
- 2) "Perception + efficient intelligence" library;
- 3) Low and convenient library.

In the environment of Internet of things and Internet, Intelligent Library is a combination of wisdom and humanity,



which allows users to share and experience deep perception, ubiquitous, convenient and high-quality knowledge services.

B. In terms of concept

Intelligent service is essentially a kind of modern human wisdom. It can be said that the service of intelligent library is the spirit of keeping improving, dedication, innovation, etc. If the library can make full use of its idea in the intelligent service, it can also be called the new thinking of the intelligent service of the library.

V. THE INNOVATIVE WAY OF INTELLIGENT LIBRARY

The value of the survival and development of the library lies in the intelligent service and its benefits. To improve the service utility, we need to integrate and reconstruct the main elements of "hard intelligence" and "soft intelligence", so as to promote the high-quality development of the intelligent library.

A. The innovative concept model of Intelligent Library

In the context of the construction of smart society, the library should first follow the overall planning, development vision and innovative development concept of smart society construction, make smart cultural services, smart industry and smart business become smart, and actively open to the public and build digital resources with the society. Secondly, we should attach importance to technological innovation and service innovation, so that readers spend less time, manpower and cost in the process of using and enjoying services. Therefore, the Intelligent Library is an important part of providing cultural services. The standards and norms in the process of data and system construction should be consistent with those in the process of smart society. Moreover, the library should also form a new consensus with the institutions of the alliance, build an open and collaborative ecosystem, and provide accurate and intelligent services for the public. In the whole system of a single intelligent library, all elements need to operate efficiently and cooperatively, and finally, form a decentralized intelligent integrated system and intelligent service ecosystem.

B. Innovation of "library + " cooperation system

How to borrow ships to go to sea and reconstruct the new production relationship of library intelligent service? How to stimulate the vitality of library intelligent service? "Library + cooperation" provides a new way to solve these practical problems. For example, the time and space extension of global service forms a new service format of "smart service + n", expanding and improving the service level and coverage. For example, innovate the cooperation mode of "library + bookstore" to realize the seamless connection of library business, readers' borrowing and reading study activities. For example, London in the United Kingdom is closely associated with other relevant functions of the community, forming a new community cultural place integrating libraries,

training institutions, ubiquitous smart services and green and open systems, which provides demonstration functions for the construction of smart libraries.

The library plays a new role in supporting social development and user research. On the one hand, under the guidance of the thought of "activating demand, activating knowledge, integrating into society and serving society", the library should expand the intelligent service to the support of social development, and promote the high-quality development of the Intelligent Library through the cooperation between the library and the government, the library and the business, and the cross-border socialized cooperation. On the other hand, the library should They are good at using the Internet to carry out linkage cooperation, and are good at borrowing ships to go to sea. They can borrow other libraries or institutional platforms, as well as some social resources and external human resources, to promote the organic integration of user needs and intelligent services, to present knowledge and intelligent achievements to the knowledge audience in a more personalized and intelligent way, to meet their growing spiritual and cultural needs.

C. Ability cultivation of smart Librarians

Intelligent Library and smart service bring more new experience and sense of gain to users. According to the research, from the perspective of the evolution and development of the library, the intelligent librarian is the main body to implement the intelligent service. Without the intelligent librarian, it is difficult to realize the rapid development of the intelligent library. Therefore, the library should emphasize the idea of people-oriented, and should not blindly pursue "technology first" to deviate from the core competence of "intelligent person" and "intelligent Librarian". In the future, the construction of Intelligent Library puts forward new requirements for librarians. The library should take advantage of the situation, transform and develop from mainly relying on space and hardware investment to mainly relying on science and technology, intelligent librarians, user literacy improvement and other elements, pay attention to the cultivation of intelligent librarians, strengthen their information literacy, data literacy, technical literacy, and improve their new service ability and innovation ability Efforts should be made to build a people-oriented, interconnected and open access smart service environment, and enhance the recognition and dependence of users on smart libraries.

In a word, the emergence and application of Internet of things technology realize the high efficiency and automation of library management. The Internet of things will certainly become the mainstream of the future society, and the library will also join in this mainstream, so as to give full play to the advantages of intelligent library, provide higher service quality and cultivate more intelligent public. The intelligent library is a revolution of service technology promotion,

service content innovation and management form transformation in the future. The application of Internet of things technology to construct the intelligent library will have a very broad development prospect.

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