The Design of Smart Library Based on 5G

Li Jiahui¹, Wang NingXing², Duan Chao³

¹Communication Engineering, Guangzhou College of Technology and Business, Guangdong Province, 514400, China
²Electronic and Information Engineering, Guangzhou College of Technology and Business, Guangdong Province, 528000, China
³Communication Engineering, Guangzhou College of Technology and Business, Guangdong Province, 528000, China

Corresponding author and e-mail: Li Jiahui,3043540340@qq.com

Abstract. This article takes the "first step" attitude to seize the development opportunities of 5G and its group technology, make full use of the functions of 5G mobile Internet, and promote the application of 5G communication technology in the field of the library. On the basis of designing a three-dimensional real-time book tracking map, etc., the author put forward the concept of a future smart library based on 5G mobile Internet.

1. Introduction

At present, with the rise of the 5G wave, AI, refers to the artificial intelligence, is becoming more and more valued. VR, refers to the virtual reality technology, which is developing rapidly. AR is able to augment the reality technology skillfully and combine virtual information with the real world. At the same time, the application of mobile Internet human-computer interaction technique is gradually mature and extensive[1]. The university library is a platform for college students to obtain digital resources. 5G and its group technologies are gradually embedded in the construction of smart libraries. 5G and human-computer interaction techniques are currently the most advanced communication protocols and mobile Internet development hot spots. The fusion of both of them is bound to collide with different new models of libraries. In recent years, China’s library innovation has ushered in a new model, combined with big data, cloud computing, information communication, etc. which has created a new platform, then, about the future of 5G-based smart library design ideas, will create new heights, create a more intelligent, comfortable and convenient library environment for readers.

2. Current Status of libraries

Many libraries have many bibliographic categories and large collections. Although many domestic libraries have introduced advanced security monitoring systems and automated integrated management systems, there are still incomplete network coverage and slow network speeds. It is inconvenient for teachers and students to find books when borrowing books, and it costs a large amount of manpower to arranging books which also contain other issues. The smart library has broken the limitations of traditional libraries through advanced 5G communication technology[2]. As we all know, the library is a garden for teachers and students to learn and communicate and learn extracurricular knowledge, which has far-reaching significance for the construction of teachers and students. Promote the exchange and sharing of resources within colleges and universities which can improve the teaching
level of colleges and universities, and it also can ensure a high-quality learning environment for college teachers and students.

3. Scheme design of future smart library system based on 5G mobile Internet

The design concept of the 5G-based smart library system solution is mainly to carry out 5G intelligent design from the three major sectors of service management, reader VR and mobile terminal experience, and smart academics, conform to the development trend of the times, and better improve the educational quality of teachers and students of the college[3]. Optimize service management system, introduce wisdom education, and create high-level application-oriented 5G intelligent colleges. The overall system plan of the future smart library based on 5G is shown in Figure 1.

![Figure 1. Vision of future smart library program](image)

3.1. Library Service Management

The quality of library service management is an important factor to measure the level of library management. Today's world has entered a new era of informatization. The traditional service management methods that consume a lot of manpower and resources which can no longer seek development for libraries. Digital service management has become library informatization[4]. The main line of development, the future smart library based on 5G will reform and innovate the service management sector, as follows:

1) The introduction of a smart library control system based on the 5G Internet of things. According to daily weather conditions and scheduled time data, automatically adjust the temperature and humidity in the library (to meet the humidity requirements of books), automatically open and close the curtains and lights, the management staff can remotely observe the situation in the library in real time, and also have an automatic alarm system to help the librarian as soon as possible dealing with unexpected situations not only saves energy, but also saves manpower, material and financial resources, and further improves the quality of library services.

2) Create a 5G+AI intelligent entrance and exit detection system. The intelligent entrance detection system based on 5G+AI is mainly to assist the librarian to effectively judge whether the teachers and students entering the library carry prohibited items into the library or privately carry books out of the library, and realize the intelligent analysis of the teachers and students entering and leaving the library through AI technology. Through visual automatic recognition, it can use the
high-speed, large-capacity, and low-latency communication capabilities of the 5G network to transfer photos of prohibited items to the mobile terminal APP automatically, and send out a voice alarm. So that the administrator can quickly conduct remote monitoring through the 5G network, ensuring the personal safety of teachers and students in the museum further.

(3) Design library intelligent management robot, and control it by 5G+AR/VR unmanned operation. There are a lot of people in the library. If you rely on manpower to sort the books returned by teachers and students, and put the books on and off the shelves, it is very time-consuming and laborious, and this intelligent management robot can avoid it in the process of traveling. Because 5G has ultra-low latency, let the administrator wear VR glasses to control the robot in real-time video and transport the books to the corresponding bookshelves through intelligent information matching and recognition, which greatly reduces the possibility of misplacement of books. The working principle of the intelligent robot is shown in Figure 2.

![Figure 2. How intelligent robots work](image)

(4) Create a three-dimensional real-time tracking map and embed it in the mobile terminal APP. The specific process principle is shown in Figure 3. Readers can open the three-dimensional real-time tracking map function through the self-developed smart library mobile terminal APP, combined with the bibliographic retrieval function in the library. Since the books in the library are magnetic, enter the book name and pass the book. The bookshelf in the library is displayed in three-dimensional, readers can quickly track the specific location of the book, and find out in real time which bookshelf the book is in which row and which number, so as to avoid wasting time because of blindly searching for the book or placing the book incorrectly. This function can also quickly check the free seats in the library, reducing the time for teachers and students to find seats.

![Figure 3. Three-dimensional real-time book tracking design flow chart](image)
3.2. Reader VR and mobile terminal experience
The most fundamental purpose of building a library is to serve readers. The quality of the reader's experience is one of the standards for measuring the quality of the future smart library. The future smart library is based on the "strong sense of experience, technology, and modernity". To create a rich, convenient and diverse learning environment for readers, as follows:

(1) Create a virtual book VR experience hall, design a VR device based on 5G and human-computer interaction technology, and experience the book environment characters in a panoramic way. It can also support interaction with virtual characters in books, breaking the limitations of time and space.

(2) Development of mobile terminal applications for smart libraries. The use of Internet of Things technology to integrate and process all kinds of data. The envisioned functions include borrowing books, booking arrival time and seats, counting the number of visits, subscription number function, push function of competition events in the library, library bibliographic retrieval function, three-dimensional real-time tracking function, cloud integration function. It is also necessary to continuously strengthen digital resource push services and optimize mobile reading services. The specific implementation function of the smart library mobile terminal application is shown in Figure 4.

![Figure 4. Specific implementation functions of smart library mobile terminal application](image)

3.3. Smart Academic Communication
Wisdom academic communicate is an important part of the current development of college education. It aims to use modern information technology to promote the development of education and promote
the reform of education. Although many libraries have academic communication centers and academic lecture halls, compared with the future, the introduction of 5G functions in smart libraries will further enhance the functions of some high-quality academic seminars and academic lecture halls, Smart Library will assemble the following three aspects to create a new academic exchange model in the future:

1. Build a 5G+3D projection academic communication hall to create an environment for multi-division interactive communication. Due to the large volume of 5G traffic, in the future, academic lectures will use the 3D projector to directly project what needs to be displayed in mid-air. You can also connect other speakers for interactive lectures, creating more possibilities for smart academics.

2. Innovation of remote conferences/academic seminars. Cross-regional remote conference breaks the limitations of field-level conferences, uses ultra-high-definition 4K/8K video, uses 5G communication technology to achieve refined conference methods, maximizes the experience of remote conferences/academic seminars, and enhances its sense of presence. Through cloud integration, download, use, manage, and back up meeting content in real time, and transfer meeting information streams to their respective PCs.

3. Initiate 5G+VR/AR virtual simulation learning. Speakers can import course video data into VR/AR glasses, which can satisfy readers to use 5G+VR/AR virtual simulation to learn different knowledge in their spare time. This learning method can also be used in college classrooms in the near future. Further enhancing the reader's learning ability and broadening the reader's knowledge level can also achieve interdisciplinary learning, which is a major upgrade for the education industry.

4. Existing problems and challenges
There are also existing problems and challenges in the smart library, which are mainly manifested in three aspects: Firstly, 5G construction is in its infancy, MMTC and URLLC standards in the five major application scenarios of 5G have not yet been completed, and the application of 5G+ is still have a long way to go; secondly, with 5G mobile Internet as an emerging industry, investment capital is large, colleges and universities need to plan funding sources and investment in advance; thirdly, the application of 5G mobile Internet technology requires continuous optimization of hardware equipment, hardware equipment requirements are higher.

5. Conclusion
In summary, the design of the 5G-based smart library is an innovative design of library service management, reader VR and mobile terminal experience, and smart academic communication combined with new technologies in the information age, and proposed a book location tracking system, VR experience and intelligent mobile terminal services, so that smart libraries can provide readers with better resources and better services, creating a smart learning and working environment.

At present, 5G chips are already on the market, and the country is vigorously building 5G network base stations. Integration of 5G in smart libraries is an inevitable development trend of smart libraries, so the construction of 5G-based smart libraries has great feasibility.

References
[1] Sun,L.B,(2019) Explore the application of artificial intelligence in the construction of smart libraries.J.Jiangsu Science and Technology Information, 36 (13): 20-22.
[2] Li,G.W,(2018) Library reform and development strategies in the 5G era.J. Books and Information, 183 (5): 94-97.
[3] Wang,Q,(2019) Research on smart library innovation service based on blockchain technology.J. Journal of Jiamusi Vocational College, (9): 268 - 269.
[4] Xiang,H.H,(2017) Research on Library Service Innovation under the "Internet +" Thinking.J. Library Work and Research, (4): 5-10.
[5] Yang, N. (2017) Thoughts on the construction of university smart library system based on Internet+. Journal of Hubei Correspondence University, 30(09): 49-50+84.