

# Analysis of Cloud Computing Algorithm based on Smart Campus Message System

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## Abstract

In order to solve the shortcomings of the smart campus message system constructed by the current method in network indicators, data processing, business interface, human-computer interaction, and other technologies, a cloud computing algorithm-based smart campus message system construction method was proposed. In this method, the LAN interconnection, the network multimedia terminal, and the network architecture platform were established by the cloud computing algorithm. This method established the awareness of smart campus development, established the cloud smart campus management norm system, and constrained the network environment based on the cloud smart campus. The overall structure of the smart campus message system was constructed from the technical level, the main layer, and the constraint layer. The functional module analysis of the smart campus message system software was performed, which had two major categories, including basic function modules and extended function modules. It achieved the construction of a smart campus messaging system based on cloud computing algorithms. The experimental results showed that the proposed method had obvious advantages in network indicators, data processing, business interface, human-computer interaction and other technologies which can bring a lot of convenience to the school staff.

**Keywords:** smart campus; message system; cloud computing algorithm

(Submitted on November 2, 2018; Revised on December 3, 2018; Accepted on January 4, 2019)

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## 1. Introduction

At present, cloud computing has received widespread attention as a global issue from a theoretical point of view. The issue of smart campuses in colleges and universities has also become the focus of attention in many subject areas. Since the first vague concept of cloud computing was put forward in the 1980s, the understanding of cloud computing has gone through four stages: power plant mode, utility computing, grid computing, and cloud computing, and it has developed to a more mature stage. Cloud computing has always been a hot issue of social concern [1]. As a technical means, cloud computing, like other technical tools, will have different degrees of influence in its development. The competition in the comprehensive national strength of the world today has intensified, and the structural contradictions in the transformation of domestic society have intensified. Under such circumstances, the use and development of cloud computing have become a brand new factor, and the social effects caused by it are all-round. A core issue is how to make rational use of cloud computing technology as the great performance of new productivity, and provide technical support for the establishment of a smart campus messaging system [2]. With the development of cloud computing technology, the impact of technology has become increasingly prominent. Cloud-based colleges and universities have many problems, wide coverage, and profound influence, which has attracted wide attention from all walks of life. Especially in the context of today's network society, the establishment of a smart campus in colleges and universities has become a systematic project of collective collaboration among various disciplines, countries and departments.

Liu et al. proposed a method for constructing a smart campus message system based on big data and visual analysis [3]. This method was based on the era of big data. The concept of smart earth was used to extend the concept of smart campus. It

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introduced the development background of smart campus and the current development status of smart campus at home and abroad. It summarized the five characteristics of the smart campus, and through the connection between the smart campus and the information visualization design, analysed and studied the specific information visualization design application examples, and realized the construction of the smart campus message system. Kassim et al. proposed a method for constructing a smart campus message system based on expectation-satisfaction assessment [4]. The method analysed the correlation between the expected effect and the actual performance of the use of the university information system by the student user. At the micro level, it revealed the characteristics of the informationization effect of college campuses and build a smart campus message system based on this feature. Shyr et al. proposed a smart campus message system construction method based on embedded and RFID IoT technology [5]. It consisted of a smart RFID sensing module, network fusion module, embedded hardware support module, support station module, business application module, and comprehensive service module. The method designed and implemented these modules separately, and realized the smart management of the campus.

From a practical point of view, the rapid development of cloud computing technology is amazing. With the development of technology, smart life has gradually penetrated our lives. The influence of cloud computing has formed an era demand. The social problems caused by the development of cloud computing technology have gone through a simple to diverse process. In the face of various new changes in the technological age, the above methods cannot adapt to the development of today's society [6]. The smart campus message system constructed has a slow output transmission rate and a large query time cost when the number of users is large, and there is still room for improvement in network indicators, service interfaces, human-computer interaction, and other technologies. In view of this, from the perspective of the impact of cloud computing technology, it reflects the problem of smart campus in colleges and universities, constructs a harmonious campus culture environment that adapts to the development of the times, and proposes a smart campus message system construction method based on cloud computing algorithm. The overall framework of the study is as follows.

(1) Using the cloud computing algorithm to construct the smart campus message system from the technical layer, the main layer, and the constraint layer;

(2) Analysis of software function modules of the smart campus message system;

(3) Experimental results and analysis, from the network index, data processing, business interface, human-computer interaction and other technical aspects, the advantages and disadvantages of method [5] were analyzed, and compared with experimental data, the superiority of the proposed method is proved.

## **2. The Overall Construction of Smart Campus Message System based on Cloud Computing Algorithm**

### *2.1. Technical Level*

#### *2.1.1. Establish a LAN interconnection*

To build a smart campus information system in colleges and universities, it is necessary to realize the construction and implementation of the local area network on campus and to build a suitable campus LAN by combining the specific conditions of the campus, rationally constructing the campus network, and making a reasonable layout [7]. As shown in Figure 1, the overall structure of the smart campus message system in colleges and universities is given.

The overall design of the campus LAN is based on cloud computing algorithms. It includes a core layer design, convergence layer design, and access layer design. The core layer is the aorta for transmitting data and processing data for the LAN. The implementation of the aggregation layer ensures the accuracy of the processed data and the accuracy of the transmitted data. The access layer is the data processed by the fingertip system and transmitted to the user's terminal.

The construction of local area networks is inseparable from routers, switches and Ethernet technologies. To achieve efficient LAN connection, it is necessary to have Gigabit Ethernet technology to protect and escort and to establish good cooperation between routers and switches in order to more effectively realize the construction of smart campus messaging systems in colleges and universities [8]. The high-speed computing performance of cloud computing algorithms also lays a solid foundation for network connectivity in the campus system of colleges and universities.

#### *2.1.2. Building Network Multimedia Terminal*

Multimedia technology is the core technology in the campus system of colleges and universities. Students learn and communicate with teachers through multimedia technology [9].

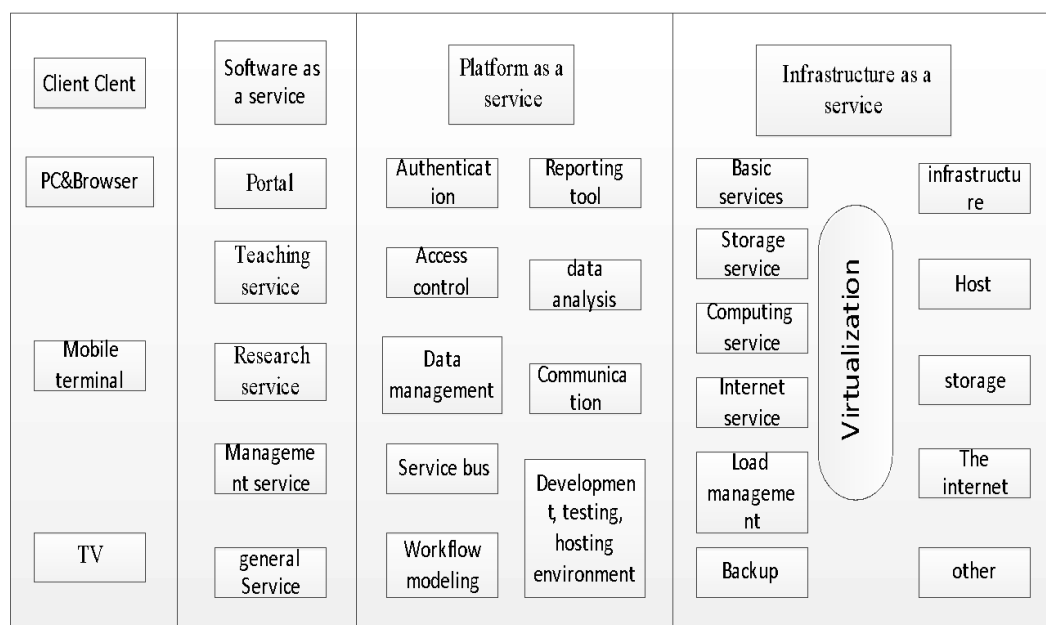


Figure 1. The overall structure of the smart campus message system

The media stream is transmitted on the Internet by means of streaming, and the user can download while watching to ensure the maximum utilization of learning resources. Streaming is a general term for transmitting video, audio, etc. through the network. It uses network technology to transmit video and audio to the client's client.

The multimedia video on demand function is a one-to-one on-demand mode of the network. It requires a separate data stream for each request. The video on demand system includes a server system, a network system, and a client system. To achieve video on demand, it is necessary to ensure that each system is connected to each other. In the smart campus message system of colleges and universities, it is mainly applied to video teaching on demand. Teachers can upload their multimedia courseware to the smart education system. Students can learn and review through the client to effectively improve their interest in learning. The school can also conduct distance education through video on demand.

### 2.1.3. Building a Network Architecture Platform

The network structure platform of the cloud computing smart campus message system is a system section describing the organization, structure and function of the system. This research method is very good for designing and implementing the network system of the smart campus in colleges and universities. It implements a hierarchical network model and a collection of protocols at various levels into a smart campus messaging architecture [10], as shown in Figure 2 for the system network architecture platform.

A complete network platform requires a complex set of protocols, and the organization of each level is divided into model structures, each of which is relatively independent. The way of "dividing complex cloud computing problems" has completed the information transfer function of the entire system. International organizations propose open system interconnection, OSI. OSI divides the system into seven levels, namely the physical layer, data link layer, network layer, transport layer, session layer, presentation layer and application layer.

The network is composed of a plurality of interconnected nodes, and data exchange is continuously carried out between them. To achieve stable operation of the system, each node must follow certain rules. This is the network protocol we use now, referred to as the IP address, to ensure the operation of the network security and to ensure the smooth operation of the smart campus messaging system.

On campus, students and teachers sometimes need massive amounts of information to process, and a large amount of data needs to be analysed and applied. Cloud-based big data may require a lot of data to be licensed, obfuscated, and anonymized. The construction of the smart campus has solved the difficulties faced by some teachers and students to a certain extent. With the development of smart campuses in colleges and universities, these things may be more prominently resolved [11].

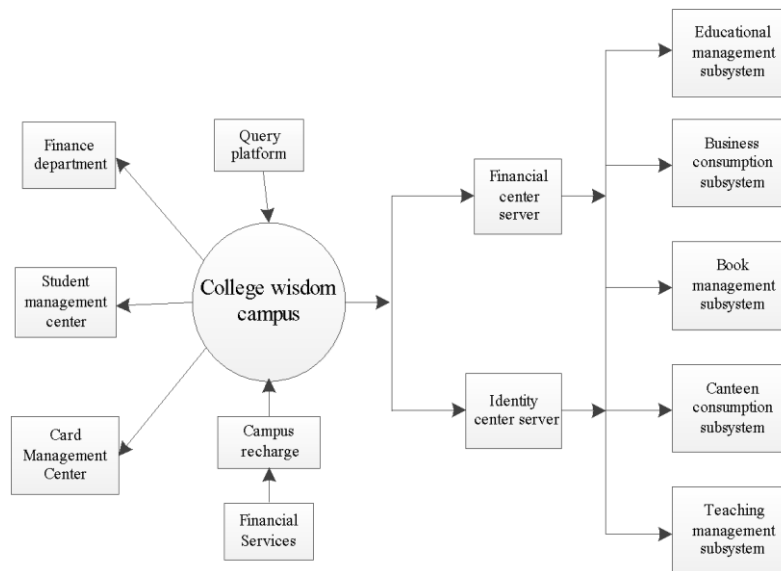


Figure 2. Network architecture platform of college smart campus message system

## 2.2. Main Level

The smart campus of colleges and universities absorbs the participation of teachers and students in development and better adapts to colleges and universities. It is the trend of modern education development. The reason why the research solves the problem from the perspective of teachers and students participating in the development is because the core of the system is to build a modern and efficient education method with teachers and students as the core [12].

### 2.2.1. Establish an Organic Combination of Teachers and Students and Smart Campus

First, we should be independent from the cloud-based campus technology. That is to say, after leaving the teachers and students, is there any need for cloud intelligence campus technology to existing, without teachers and students, it would be impossible to talk about technology because the intelligent campus is human technology. Secondly, it should be realized that cloud smart campus technology is for teachers and students. Building a cloud-based campus is for the better and longer-term development of education in China so that under the influence of teachers and students, it will be more beneficial to the development of smart campus technology. Finally, cloud smart campus technology will dominate our education, but we should also rationally see the development of education. We must not blindly use the psychology of teachers and students to believe in the well-being of technology, but also to reflect on the negative impact of cloud-smart campus technology on education.

### 2.2.2. Establish a Correct Sense of Smart Campus Development

Cloud computing smart campus technology should serve the majority of teachers and students, and the standardization of its technology should also be supervised by teachers and students. The cloud smart campus technology jointly developed by teachers and students has many drawbacks, and we need to jointly manage and supervise. We cannot blindly see the advantages that cloud computing smart campus brings to our education without rethinking and rectifying its shortcomings. We must understand the truth that it is not up to speed. All our teachers and students should carry out research work based on the smart campus of Yun University in an orderly manner with the cooperation of technical staff. At the same time, we have less external supervision force in the development of our teachers and students. Therefore, our teachers and students will do more reflection while developing.

## 2.3. Constraint Level

Based on cloud computing, smart campuses in colleges and universities should protect the educational subsystem resources that have been built and proven to be effective. Our cloud-based smart campus is not a bottomless, unconstrained and smart campus. Under the impact of the wave of the college education, it is not sufficient to standardize the development of cloud-based campuses by teachers and students. Therefore, China's education departments must set up systems, strengthen management to standardize the development of teachers and students, and protect the existing educational resources subsystem of colleges and universities [13].

### 2.3.1. Establish a Cloud Smart Campus Management System

The management control based on the cloud computing smart campus is to find ways to solve the problems that come with the coexistence with the existing education system at the management level during the development of teachers and students and to prevent and avoid the vicious development cycle of developing existing projects and abandoning their own projects.

Let all education systems play their due role and avoid waste. In order to ensure the smart campus system software, application software and data security of colleges and universities, the smart campus system of the university strictly selects the operating system platform and development platform to design anti-virus functions and protect system data. Also, the backup system is established in the system, and the full and incremental backup of the smart campus system of the university is automatically and regularly performed.

The university system is dominated by the Founder Education System. The problem of the education system is that there are many subsystems, the management is not very standardized, and the educational resources are wasted. However, the system is still an important software system for education through years of operation. We must build the cloud smart campus to absorb the advantages of the system, and absorb the strengths of the system into the cloud-based campus system, effectively establishing an organic combination of the old system and the cloud smart campus. In this way, to a certain extent, it supports the development of smart campuses based on cloud colleges.

### 2.3.2. Constraining the Network Environment based on the Cloud Smart Campus

Like the network society, the smart campus of cloud University requires us to restrict network behaviour with law and ethics. At present, the development of society and the development of education require us to seek breakthroughs for the education of our country for generations. The smart campus proposed by Zhejiang University is a breakthrough in our reform education, but it is not an unbridled development without considering the consequences of building a smart campus. He establishment of a relatively smart management system for cloud computing in colleges and universities constrains the development and utilization of smart campuses based on cloud colleges and universities.

We must strengthen the supervision of smart campuses and strike a strong blow to the uncivilized behaviour in the cloud computing smart campus network. To investigate the responsibility of teachers and students who publish false and false educational information, the campus management system is used to restrain the behavior of teachers and students in the intelligent campus system. In this way, we can build a free, sound and civilized smart campus system that benefits teachers and students and benefits our education.

## 3. Smart Campus Message System Software Function Module Analysis

Software requirements analysis has a crucial impact on the success of software development. A correct and reasonable analysis of the software requirements determines whether the software can be successfully launched. The focus of software requirements analysis is analysing user requirements and improving the user experience. As a mobile campus client dedicated to accelerating the process of campus information construction and improving students' access to campus information, a lot of preparations were made in the early stage of software development. The requirements analysis includes feasibility analysis of software implementation, functional module requirements analysis, user experience requirements analysis, software stability requirements analysis, and security requirements analysis. The following is a detailed introduction to each analysis [14].

When the user installs the smart campus mobile client and enters the main interface of the software, it can be seen that it is divided into two major types of modules, including basic functional modules and extended functional modules. The basic function modules include nine announcements: important news, class schedule query, grade query, library, recruitment announcement, personal information, flea market and campus yellow pages. Case diagram is shown in Figure 3.

### (1) Analysis of basic function modules

#### ① Notification announcement module

The notice announcement has always been a very important component of campus information construction. Through the announcement of the notices of various departments of the college, important information can be transmitted to the students to facilitate students' campus life planning.

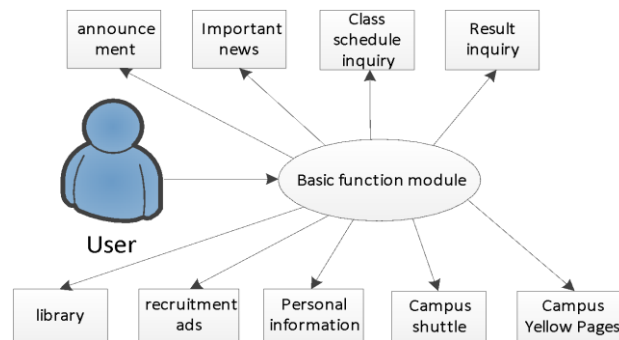


Figure 3. Smart campus message system software function module based on the cloud computing algorithm

## ② University of Science and Technology News

The University of Science and Technology Highlights module provides on-campus news and is the place for the latest news releases on campus work and student life. Students can use this module to learn about the latest campus developments.

③ Class table queries are one of the most important features of a mobile campus client. Students can use the class questionnaire to query the latest class schedule to better plan their study and life.

## ④ Query results

Grades are very important for the student's academic and future work. Through this module, students can check their grades at any time.

## ⑤ Library

The campus library is rich in resources and is a sacred place for students to learn. Through the library, the library books can be better queried.

## ⑥ Recruitment ads

Whenever the graduation season comes, students urgently need to obtain various types of recruitment information. Through the recruitment announcement, students can get all kinds of recruitment information and find suitable jobs.

⑦ The personal information module mainly provides students with the ability to view and manage their student account information.

⑧ The campus shuttle module mainly provides information on the shuttle bus to each campus, so that students can travel between campuses.

## ⑨ Campus Yellow Pages

The campus yellow page module mainly provides contact information for the departments of the campus departments, so that students can contact the various departments of the school.

## (2) Analysis of extended function modules

The Smart Campus Mobile Client Extension Module provides students with some supplementary functions to enrich the application usage scenarios, such as new students viewing campus maps in the application [15]. The extended function is shown in Figure 4.

① The campus map is obtained by obtaining Baidu map API permissions. Students can see the latest campus maps through the software.

② The weather forecast provides local weather conditions, and the data source is China Weather Network.

- ③ The calculator mainly provides simple calculation functions for students' learning.
- ④ The perpetual calendar module mainly provides perpetual calendar browsing.

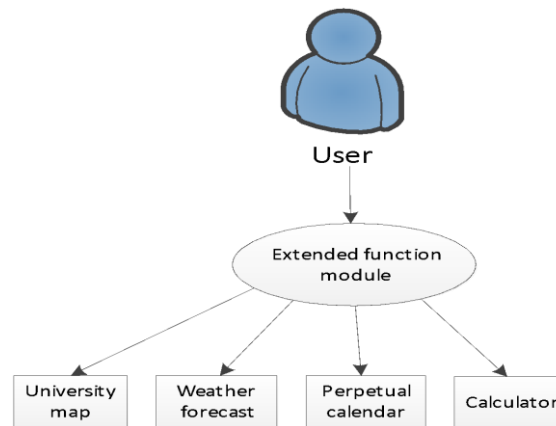


Figure 4. Extended function module

#### 4. Experimental Results and Discussion

In summary, the smart campus message system construction method based on cloud computing algorithm can bring a lot of convenience to the school staff. Compared with the method of [5], the advantages of the proposed method are as follows.

##### (1) Network convergence, real-time unified management and control

The network of the smart campus is interconnected. The device management of the Internet of Things plays a big role in the campus. The local area network accesses the external network through a unified security gateway through an effective security mechanism. The whole process embodies the theory of smart campuses. In the literature [5] method, the application network areas are relatively independent, and access to the external network and internal network access is chaotic, and it is difficult to effectively manage the network in all areas with a unified system. The technical implementation is as shown in Table 1.

Table 1. Comparison of the proposed method with the network index of the literature [5] method.

	Proposed Method	Literature [5] method
Network composition	Network infrastructure convergence and cross-applications such as the Internet, wireless LAN and Internet of Things	Internet-based, partially independent wireless local area network.
Network architecture	Adopting a central network and a peer-to-peer network, different network nodes cooperate with each other	Mainly based on the central network, with the central gateway strictly controlling the nodes
Network application	Network-based applications, including network-based LBS.	The network is mainly used for data transmission.

##### (2) Open and standard business interface

The applications and services in the smart campus messaging system are based on a common, open interface that is guaranteed through independent and mature security mechanisms. In the literature [5] method, each business system is relatively independent. For example, the mailbox system and the student management system basically belong to two different systems, and there is not much connection between business logic and data storage. Relevant technical indicators are shown in Table 2.

Table 2. Comparison of the proposed method with the business interface of the literature [5].

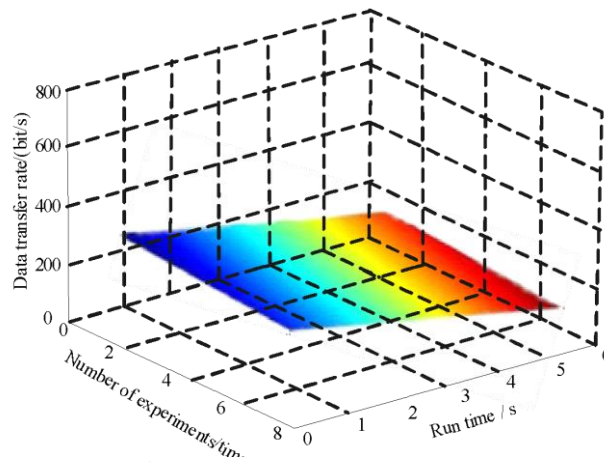
	Proposed method	Literature [5] method
Interface design	The so-called interface is an independent, non-repetitive basic service module. Smart campus services are based on interface secondary packaging to form a high-level interface.	There is no definition of a unified interface. Various service interfaces are vague, scattered and repetitive. Difficult to reuse and secondary packaging.
Interface technology	Both use Web Service. Technical realization. Specification naming.	There is no unified interface technology for each application system.

(3) Realize the integration, storage and discovery of various types of data.

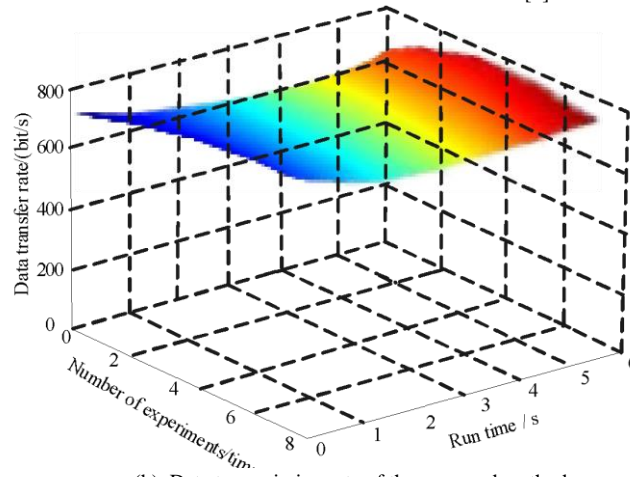
In the smart campus, the context-aware application and service public awareness database are implemented to realize unified sensing data processing business logic and to achieve campus application integration. The various business platforms of the literature [5] method are relatively independent and isolated and are easy to generate data islands, which is difficult to maintain. Relevant technical indicators are shown in Table 3, Figure 5 and Figure 6.

Table 3. Comparison of the proposed method with the data processing of the literature [5] method.

data	Proposed method	Literature [5] method
data maintenance	The smart campus messaging system relies on a unified distributed database.	A single database. Different application database types are different.
Data Sources	In addition to basic business data, it also includes a variety of context-aware data.	It's just business data, and the databases of different applications are mostly incompatible.
data processing	Includes unified data mining and analysis, big data analysis	Various types of system data mining are independent, and its mining data cannot be used by other systems.



(a) Data transmission rate of the method [5].



(b) Data transmission rate of the proposed method.

Figure 5. Comparison of data transmission rates of smart campus message systems constructed by two different methods.

It can be seen from the experimental comparison results of Figure 5 and Figure 6 that the data transmission rate of the smart campus message system constructed by the proposed method is always kept at 600 bit/s. The data transmission rate of the smart campus message system constructed by the method [5] is getting lower and lower with the increase of the system running time and the number of experimental iterations. At the lowest, the number of data characters transmitted per second is only 200 bits. This may be related to the unreasonable design of the LAN platform architecture in the smart campus messaging system. In addition, with the sharp increase in the number of concurrent users in the smart campus messaging system, the query overhead time of the literature [5] method is getting larger and larger. This situation is likely to cause system congestion, which is not conducive to the user to obtain the required information in the first time. The query time of



the proposed method is relatively stable, basically staying at 200ms, and is not affected by the sharp increase in the number of concurrent users, which maintains good query performance.

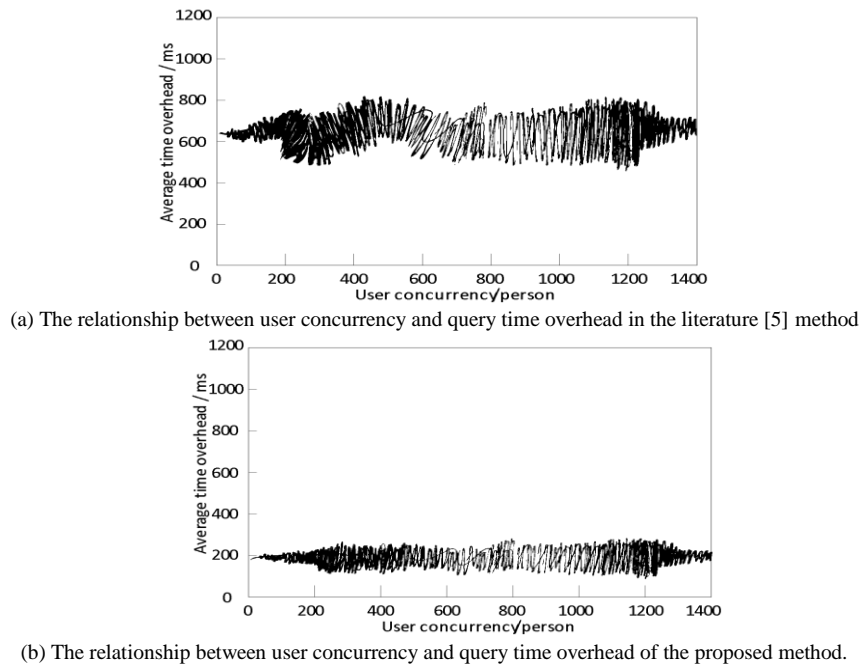


Figure 6. Comparison of user concurrent quantity and query time overhead of smart campus message system constructed by two different methods

(4) Has a unified access portal and business interface, role control, personalized display.

In a human-computer interaction on a smart campus, each page should generally maintain a consistent user experience, that is, to achieve a single login, anytime and anywhere to access the service. The function list of each service is kept the same to reduce the user interaction error rate and improve service efficiency. In the literature [5] method, each access page has various forms, and users switching to different systems need to perform different roles and authority verification, and the efficiency is low. Related technical indicators are shown in Table 4.

Table 4. Comparison of human-computer interaction performance between the proposed method and the literature [5].

Human interaction	Proposed method	Literature [5] method
Interactive page	Unified gateway, unified page layout	Different applications have their own separate UI design
Interactive place	The platform application can realize a unified interactive page in the desktop terminal and the mobile terminal.	Many applications do not take into account the needs of mobile end users.
Interactive place	In addition to basic entry input, it also includes perceptual-based interactions such as voice control, rejuvenation, and more.	Basic information query, delete, update and other operations.

(5) Implement information standardization and strengthen security maintenance system

In the early stage of construction, smart campuses should carry out a large number of researches and planning, using all forms of information standards and a unified security maintenance system. The literature [5] method is gradual in the construction of the smart campus message system, which means that there will be new demands in the period of construction of the system. New subsystems are added to the total system, and the overall design always changes with the actual situation. As a result, various types of information standards are not standardized and not unified, resulting in a decrease in overall efficiency after completion.

## 5. Conclusions

The forward-looking concept of cloud computing has turned computing into a public facility that people have dreamed of, and has undoubtedly had a profound impact on information technology itself and its applications. Cloud computing brought

society the convenience of accessing information resources and the improvement of utilization rate. At present, the application systems of higher education institutions were different because of the established standards or technologies, and the application systems cannot be interconnected. Therefore, information between departments cannot be shared, distributed, and accessed. In response to the above problems, the research proposed to use the cloud computing algorithm as the core to create a public cloud independent of multiple application systems. Building a smart campus message system based on cloud computing algorithms to maximize the use of resources was of great significance for building a harmonious campus culture environment. The effectiveness and superiority of the proposed method were proved by experimental test results.

Studying the smart campus of colleges and universities based on cloud computing algorithms as a research content was only a preliminary rough attempt of education. There were still some shortcomings, and it is necessary to deepen and improve in the future research process. It is also necessary to strengthen cooperation with various related disciplines, deepen and expand the research concept, and improve research methods and means. The popularization of smart campuses in colleges and universities also require the dissemination of technical systems and the ideas of colleges and universities. Only when the research results go deep into all corners of colleges and universities can we better adapt the smart campus of colleges and universities to the development of education, better change the awareness of college education, and promote the standardization of smart campus behaviour in colleges and universities. The research on the construction of a smart campus message system based on cloud computing algorithm required the attention of researchers in various related fields and the effective cooperation of various educational approaches. Therefore, the campus of Smart Campus was a comprehensive education and teaching project.

### Acknowledgements

This research is supported by following grants: Key project of Anhui university excellent young talents support plan in 2016 [gxyqZD2016454]; Natural Science Foundation of Inner Mongolia [No. 2018MS6010]; Foundation Science Research Start-up Fund of Inner Mongolia Agriculture University. [JC2016005]; Scientific Research Foundation for Doctors of Inner Mongolia Agriculture University. [NDYB2016-11].

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