

Research Article

Smart Campus Economy One-Card Management Mode Based on the Integration of Big Data and Cloud Computing

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In order to create an information construction road suitable for its own development faster and better, this paper has established a smart campus through new technologies such as big data. By increasing the application of data, cloud computing, and internet of things technologies, colleges and universities have improved their ability to comprehensively collect and efficiently process information. Combined with big data, cloud computing, and internet of things technology, this paper analyzes the construction of smart campus in colleges and universities. Finally, it summarizes the integration of big data, cloud computing, and internet of things technologies in the construction of smart campus in colleges and universities. The construction of intelligent campus card in colleges and universities can not only give full play to the advantages of campus network, but also use a card instead of various certificates of teachers and students in various consumption places on campus. In the future, with the sustainable development of information technology, smart campus will occupy a higher proportion in school management. The university must constantly improve the application level of big data and cloud computing technology in the smart campus. Therefore, in the new era, major universities should deeply understand the importance of smart campus construction and improve the application efficiency of advanced technology.

1. Introduction

With the rapid development of computer technology and communication technology, information construction will be the only way for the future development of colleges and universities in China. However, information construction is a huge system engineering. It is impossible to complete without technical support, unified guidance, and scientific planning. Through combing the process of the informatization construction of colleges and universities in China, we can find that the informatization construction of colleges and universities in China has been paid attention by leaders at all levels. It has been gradually accepted by the majority of teaching staff and has produced good teaching benefits. With the progress of technology and the broadening of management thinking, the informatization construction of colleges and universities in China has shown the trend of

digitalization, networking, intelligence, flattening, cooperation, and so on. The information construction of colleges and universities has been in the stage of rapid development. The further promotion of internet in colleges and universities has brought convenient conditions for students and teachers to share school resources. In addition, the requirements for network speed and hardware are constantly forcing major universities to invest human and financial resources to improve. After the popularization of intelligent mobile devices among the public and students, the construction of mobile internet and wireless network has gradually occupied a major position in the informatization infrastructure of major universities. By increasing the application of big data, cloud computing, and internet of things technologies, the ability of comprehensive information collection and efficient processing in colleges and universities has been improved. On this basis, the intelligent

campus management platform has achieved the goal of intelligent integration of various businesses [1]. In modern colleges and universities, modern management facilities are one of the important indicators of construction [2]. At present, colleges and universities at home and abroad are committed to building intelligent campuses, so they have made a large number of construction plans and implemented a series of measures, with the aim of creating a faster and better information construction road suitable for their own development. This requires the system to fully consider the security of key, communication, card, terminal, transaction, and operation. During the construction of “smart campus,” the campus one card is not only the earliest implementation project, but also the forefront of the integration of information technology innovation and in-depth reform of education and teaching. Under this architecture, more and more products are made, functions are more and more rich, there are more and more personalized functions, and maintenance is more and more difficult [3].

In recent years, smart campus has become one of the main goals and approaches of college informatization construction. Then, the construction is based on digitization and networking, emphasizing mobile interconnection and the internet of things, and the comprehensive interconnection and interaction between people, people and things, and things and things in the campus organically constitute an intelligent campus management platform and intelligently integrate business applications. The construction of a smart campus card in colleges and universities can not only give full play to the advantages of the campus network, but also replace the various certificates of teachers and students with one card and use it in various consumption places on campus [2]. It can also provide support for the mobile phone card. On the entire campus, places that need identification or cash use can be realized through the mobile phone card, truly realizing the “mobile phone card.” In the era of rapid development of informatization, college teachers and students have more and more extensive application of network, computer, smartphone, and multimedia equipment in their daily teaching and life. The needs of teachers’ teaching activities, students’ study and life, and the management work of administrators make the work of colleges and universities to realize informatization and intelligence [4]. International standard security and encryption algorithms must be adopted to achieve system security. For example, in order to monitor the security camera of the campus gate in real time, it is necessary to dynamically monitor the entrance and exit of personnel at the campus gate to avoid potential security risks. These data need a lot of space to store, and a lot of computing is required if the smart personnel identification system is installed. The most basic large data service is the retrieval service; in addition to the retrieval service, there are data analysis services, data visualization services, and so on [5].

The informatization construction of colleges and universities is developing from digital campus to intelligent campus. In recent years, in fact, understanding the connotation of “Campus Card” is the key. From the common point of view, “Campus Card” is based on cards. It is a complete information system, which combines related

software, hardware, network, and other technologies, and integrates applications such as identity identification, scene consumption, and various campus services. In this process, data information generally has two characteristics. Because of the large amount and variety of data, the difficulty of data collection is inevitable, and the storage and analysis of massive data are relatively difficult. It has laid a foundation for improving the information retrieval, online analysis, and data statistic ability of colleges and universities as a whole [6]. It can not only facilitate the study, life, and work of teachers and students, but also effectively improve the management efficiency of the school and provide a logistical service guarantee. Aiming at the backward situation of informatization and intelligent construction in colleges and universities, this paper puts forward the construction of intelligent campus in colleges and universities by integrating big data and cloud computing. The first goal of high efficiency is security [7]. We start with the development status of big data and cloud resources. The utilization of information resources of smart campus is analyzed. By analyzing the information system model of big data and cloud computer, a service platform model of cloud resource utilization of smart campus is constructed. Big data service is a new service economy based on massive data in the era of big data. It refers to providing various data services derived from big data to users through computers and the internet. The use of big data, cloud computing, and other technologies for data statistics, online analysis and processing, intelligence retrieval, machine learning, pattern recognition, and other new technologies to support smart campuses has become an urgent problem facing the informatization construction of colleges and universities in our country [8].

2. Related Work

Data analysis of college students in foreign countries started early and made rapid progress. Edwin assessed the risk of underground rock engineering by brainstorming, pointing out that experts in risk management, engineering, economics, law, and other fields are suitable for members of brainstorming meetings, and a group of professionals with the ability to analyze and summarize [9]. LV proposed that people generally use the deterministic factor method and the sequential pattern mining method in association rule mining. By mining students' minimum association rules and temporary interest learning patterns, students' behavior can be analyzed [10]. Hong proposed that flipping the classroom requires students to watch the teaching videos prepared by teachers and preview the knowledge they need to learn in advance [11]. Mou et al. set up, through data mining of students' behavior characteristics, and complete the analysis of students' behavior [12]. Tu believes that project management and key managers have a key responsibility for project risk management. Management should be able to timely estimate the existence of risks and the possible factors that cause them, select the possible risk factors, and then analyze [13]. Qiao believes that in the process of project risk management, in order to prevent, deal with, and solve risks, it is necessary to formulate a perfect risk response and control process [14]. Liu et al.

tried to identify and evaluate the risks of information projects in other fields, which provided a decision-making basis for project risk management and ensured project management [15]. Liu put forward that risks are not transferred by people’s will, but this does not mean that risks are inevitable. Risks can be thoroughly managed only by grasping the causality of risks [16]. Li established that the boundary between risk factors is not clear and put forward an improved project risk assessment method, which combines the AHP and the fuzzy evaluation method in risk analysis [6]. According to students’ recent behavior, an e-mail is sent to regularly students to guide their next study plan and life plan. This system can efficiently analyze students’ behavior and timely report it to counselors for processing.

3. Technical Support for the Construction of Smart Campus in Colleges and Universities

3.1. Application of Big Data Technology. Under the background of the information age, college students are inseparable from the application of the internet, smartphones, and computers in their daily campus life. In the process of actual teaching activities, in order to introduce more abundant teaching resources and strengthen the teaching effect, teachers also need to fully apply advanced multimedia equipment [17]. According to the certainty of the queried data results and the degree of matching with the user’s request, the retrieval results are sorted and optimized, and then, the results are assembled and packaged and fed back to the user. In this process, users are generally divided into two categories according to their professional level. It is difficult to adjust the population. Different users will feel different about the same product. The more users can feedback the actual situation of the product to the R&D department. Thus, the product can be continuously improved to give the product more vitality and value. Data processing, that is, filtering, splicing, transformation, and final application of the original data, has two main forms of data processing; one is online real-time analysis, and the other is offline batch processing [18]. With all kinds of application service systems as carriers, campus environment intelligently perceives, network learning can be anytime, anywhere, transparent and efficient school management, innovative scientific research, rich and colorful campus culture, and comprehensive and fast campus life, making colleges and universities develop in an innovative way and making progress in world-class universities. In terms of technical standards, to have standardized interfaces and data models, many enterprises today have the same technical standards as 4G standards. The Data Resource Center function table is shown in Tables 1–3.

However, it is different among enterprises, and it is necessary to introduce corresponding standards from the national level rather than based on the interests of enterprises themselves. Big data technology is used to collect and deeply mine massive data information, and then, the mined effective data are analyzed and processed. At the same time, the combination of hardware and software is used to strengthen network security, in which network segmentation is an important measure to ensure security. With the improvement of campus information infrastructure, a seemingly simple but powerful information

product—campus card—has begun to enter the campus. Due to the limited public IP addresses, many ISPs use the method that multiple intranet users share the internet over the same public IP through proxy and gateway routing. This restricts these users from setting up personal websites on their own computers. In order to set up websites on these clients, it is necessary to map the intranet IP of multiple users with an IP that they only share to access the internet. Clients access resources directly through internet links, and servers provide resources in the “cloud” repository to clients, regardless of complex issues such as system compatibility. As the earliest landing project, and an important component and basic project of digital campus construction, campus card can be said to be favored in schools. The common normalization is zero mean normalization, which is based on the mean and deviation of attributes as follows:

$$\frac{S'}{\sigma_A} = \frac{S - \bar{A}}{\sigma_A}. \tag{1}$$

The main purpose is to evaluate whether certain words have good distinguishing ability from documents. That is,

$$w = \frac{n_{ij}}{\sum n_{kj}} \times \log \frac{|D|}{1 + |\{j: t, \in d_j\}|}, \tag{2}$$

$$\chi^2 = \frac{N(ad - bc)^2}{(a + c)(a + b)(b + d)(c + d)}.$$

The student’s behavior at a point can be formulated as follows:

$$e'_{s,t,p} = \sum_{n=1}^{N_{s,t,p}} e_{s,tp} f_{s,t,p}(t), \tag{3}$$

$$f_{s,t,p}(t) = e^{(1/H)|d=d_0|}.$$

The resulting relationship matrix shows the following:

$$R = \begin{cases} r_{11}r_{12}r_{13}, \\ r_{21}r_{22}r_{23}, \\ \dots\dots\dots, \\ r_{n1}r_{n2}r_{n3}. \end{cases} \tag{4}$$

We fine-tune the weights and calculate the membership values in a continuous experiment as follows:

$$V = W \times R$$

$$= (v1v2v3),$$

$$\begin{cases} : (1.0.5.0), \\ : (0.5.1.0), \\ : (0.1.0). \end{cases} \tag{5}$$

3.2. Application of Cloud Computing Technology. General-purpose software is oriented to the common needs of large-scale enterprises, which cannot meet the personalized application needs of industries and enterprises. There is no

TABLE 1: Standard.

Function type	Subfunction module	Illustrate
Standard	Guideline	Includes viewing and exporting of reference standards
	School standards	Includes viewing and exporting standards
	Executive standard	Contains viewing execution standards, export table definitions, and export table data
	Create a standard	Includes creating school standard tables, creating school standard dictionaries, and creating an execution standard table
	Edit school standards	Contains editing classification information, editing table information, and modifying table fields

TABLE 2: Standard management.

Function type	Subfunction module	Illustrate
System management	User management	Including the functions of adding new users, editing users, deleting users, user authorization, and restoring the initial password
	Role management	Includes adding roles, viewing roles, editing roles, and deleting roles
	Log management	View the user operation log, which can be queried by operator name or code and date

TABLE 3: Docking management.

Function type	Subfunction module	Illustrate
Docking management	Docking system management	Includes system registration, editing system, deleting system, and system authorization
	Database user management	Includes modifying database user passwords and deactivating or enabling database users
	View management	Contains add view, edit view, view view, and delete view functions

product software that meets its own needs, and the software is likely to be the same. There are hidden dangers in software security. In the process of making full use of cloud computing technology, resources can be dynamically allocated, and the information architecture shows strong openness and coordination. These data cannot meet users' needs by traditional technology and common software, so new methods and technologies must be used to store, process, mine, and analyze massive data. User access information can be controlled through authorized secure access, and user rights include card recharge, card use, and system management. When the user's password is too simple or the permissions are improperly set, it is easy to be illegally invaded, and the user's basic information and financial information are illegally obtained. Platform as a service layer can provide users with software development and operation environment such as software operating system and database, which are characterized by unified platform architecture and efficient data processing capabilities. At present, many switches have access control capabilities to physically segment the network. In the process of application, the security control of the network system is usually achieved by combining physical segmentation with logical segmentation and the curve of the average response time of each transaction with different number of users, as shown in Figure 1.

Wisdom campus provides a comprehensive and intelligent information service platform for teachers and students. Through this platform, the interaction between management departments and students, teachers and students, and students and different schools can be realized. Finally, according to the assembly results, the retrieval results obtained from the data service set are assembled and ranked and presented to users. Keyword retrieval is the basic function of big data retrieval service, and users' retrieval satisfaction can be improved by effectively expanding retrieval. At present, a common solution is to closely link electronic payment with the mobile phone. During the transaction, the system will generate a dynamic password and send it to the mobile phone, and the mobile phone number has been bound to the user himself, so a perfect system key system was born. Both CPU and TPS utilization are within the normal range, and the system performs well, as shown in Figure 2.

Overall, distributed computing not only reduces the load on a single computing unit or processing unit, but also enables fast processing of large amounts of data. You just need to use computers, smartphones, and so on. You do not need to have dedicated facilities and software. At this time, you can not only view more shared resources, but also upload your own data or information, to build a richer cloud

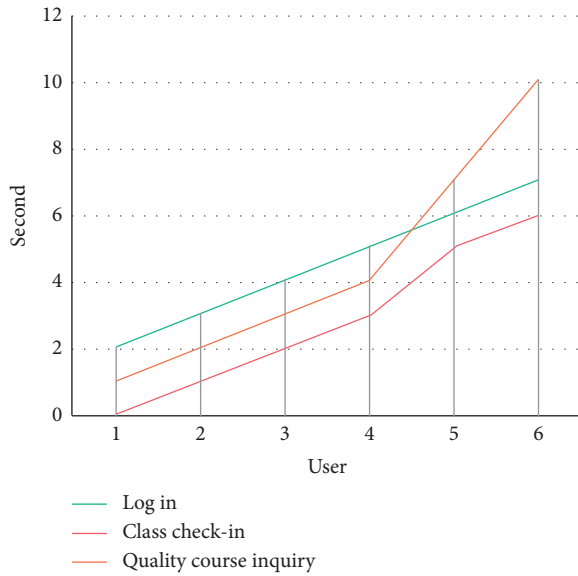


FIGURE 1: Average response time for each transaction.

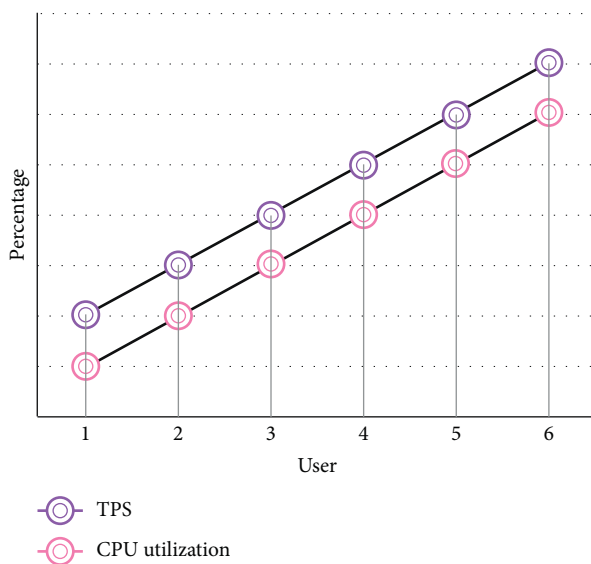


FIGURE 2: Utilization.

space, which can promote universities to produce more learning materials in the long-running process.

4. Analysis on the Combination of Big Data, Cloud Computing, and Internet of Things Technology in the Construction of Smart Campus in Colleges and Universities

4.1. *The Combination of Smart Campus Construction and Big Data Technology.* The generation and application of “Campus Card” is the product of the close combination of smart campus construction and big data technology. Business links such as personnel system, educational system, scientific research system, postgraduate system, dormitory management, one-card platform, archive system, genuine software platform, and self-

service on campus network provided by business direct bus can quickly open these systems and pages, complete business management and query, etc. The accuracy of the HRCCA algorithm is compared with the experimental results as shown in Figure 3. The efficiency comparison experiment of the HRCCA algorithm is shown in Figure 4.

Security problems are common in computer systems, especially when there are a lot of data in many shared databases. Database security can be divided into database system security and data security. Another kind of data collection can use internet web page data collection. The so-called web page collection refers to obtaining the relevant content from the web page, then extracting the content that users need from these contents, and then adding the content and format to this content. Nowadays, big data visualization services are becoming more and more mature, and many open-source visualization programming languages and environments have emerged, which can provide users with common professional visualization templates or graphic libraries. Therefore, the demand for big data is imminent, the demand for big data has led to changes in the system structure, and the increasingly bloated traditional data structure needs to be condensed into the cloud processing mode. By installing a camera above the blackboard to capture the facial expressions and movements of all students, we analyze the students’ listening status in real time and let the teacher know the students’ listening status in real time. Its recognition rate effect is shown in Figure 5.

We make teaching adjustments and use of generative resources based on the data provided by the system to improve the quality of the classroom. The main purpose is to make a horizontal comparison among the four grades. The result is shown in Figure 6.

In the process of applying “Campus Card,” it can effectively connect the school intelligent sensing devices and form a docking relationship with the financial system. Figure 7 shows the financial difficulties of households in consumption.

Therefore, massive amounts of data have been collected in the entire “Campus All-in-One Card” system. By increasing the application of big data technology, we can conduct more targeted and in-depth mining of these data, laying the foundation for improving the rationality of resource allocation and strengthening teaching effects.

4.2. *The Combination of Smart Campus Construction and Cloud Computing Technology.* At this stage, in the process of modernization construction, most colleges and universities in China have built relatively perfect network application systems and network links, which are of great significance to the innovation of teaching modes, the promotion of service, and the improvement of teaching quality. For example, we create a safe campus through the internet of things technology. The school installs cameras and sensors in different areas, and implements access control, identity identification, and location detection to effectively control potential hazards and ensure the safety of the campus environment. First, in the aspect of training, in order to bring the management function of the card service center into full play, it is

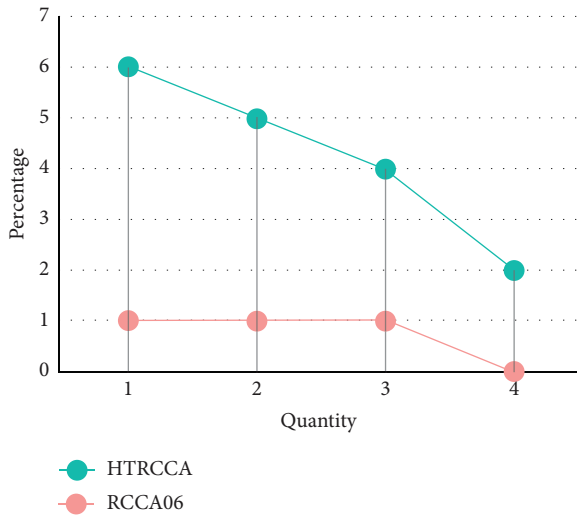


FIGURE 3: The experimental effect of the HRCCA algorithm accuracy comparison.

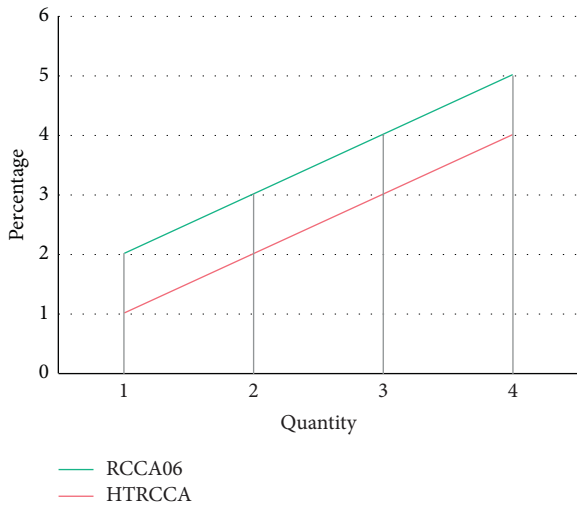


FIGURE 4: The effect of the HRCCA algorithm efficiency comparison experiment.

necessary to systematically train the management and operation personnel, and the training work should run through the whole process during the whole system promotion. You can enter the application page by clicking on “All Applications,” which is divided into office services, teaching services, resource centers, life services, and gadgets according to the service type. Users click on services and applications according to their needs. In addition, there is a strict access policy between and within each subsystem, which prohibits unauthorized users from illegally using the campus one-card system across departments and subsystems. Information collection methods include real-time collection and regular collection. For example, the whole campus monitoring system and campus all-in-one card system can use real-time acquisition. Students’ information management system, staff attendance system, etc. can be

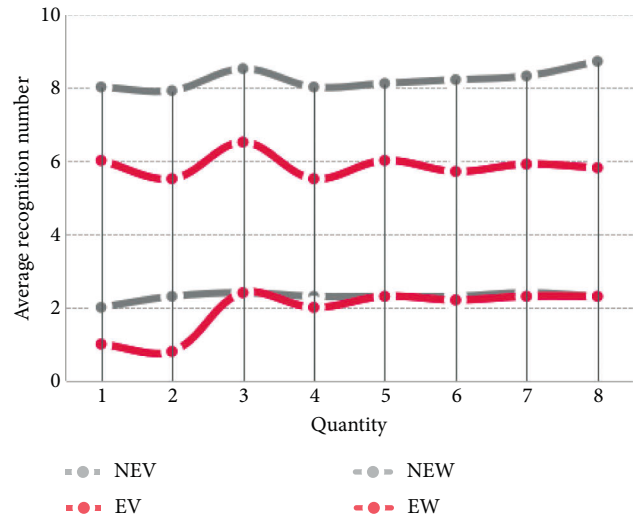


FIGURE 5: Schematic diagram of the comparison results of the four classifiers.

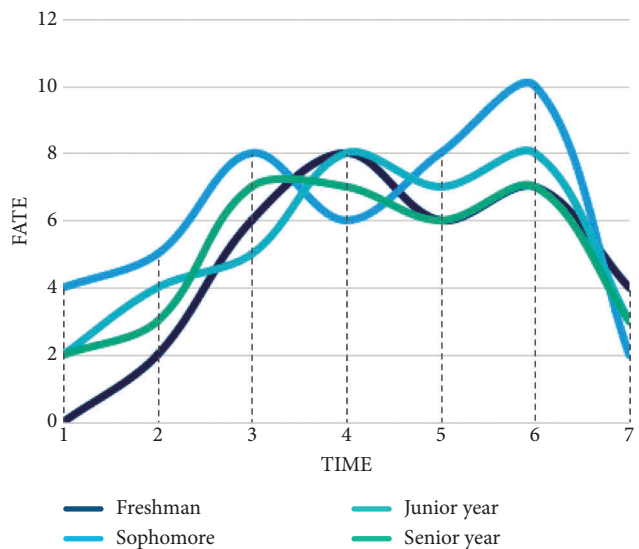


FIGURE 6: Comparing the effective days of students’ consumption in school.

regularly collected. The capability elements of big data service capabilities include time, labor, facilities, equipment and tools, and user participation, the most important of which is user experience. To improve the user experience, we can start from two aspects: improving the efficiency and accuracy of retrieval service. A series of campus applications can be built around the bracelet, and the bracelet can be bound with the campus card, so the future mobile payment market has a broad prospect. Using a dynamic face recognition system for security management, the combination of dynamic face recognition system and gate system is applied at the entrance of campus. It can realize students’ unconscious face attendance, and realize the judgment of black and white list, in which authorized personnel can enter and exit by brushing their faces, while unauthorized

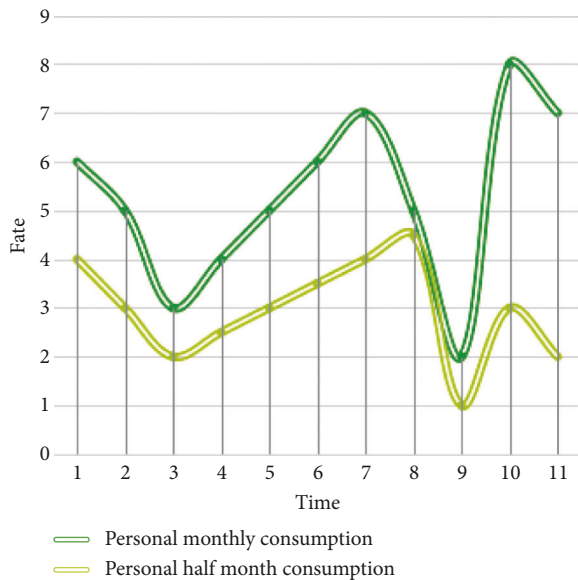


FIGURE 7: Families' financial difficulties in consumption.

personnel need to obtain authorization through visitor registration before entering. The internet of things technology is used to supervise the use of campus energy such as water and electricity, to realize the intelligent management of campus energy consumption, to effectively avoid unnecessary waste and to save resources. It can be seen that in the process of actively building intelligent campus, the network application platform formed by the application of cloud computing not only presents efficient and intelligent functions, but also has the characteristics of high integration.

5. Conclusions

This study promotes the rapid and sustainable development of the school. Campus one card is an important part of intelligent campus. To further improve the functions of the mobile terminal system, it is necessary to establish a more effective management system. It has created a convenient, fast, safe, orderly, and green scientific research, teaching, and intelligent living environment for the school. In the process of modernization, most colleges and universities in China have established relatively perfect network application systems and network links, which are of great significance for innovating teaching models, promoting services, and improving teaching quality. In the new era, colleges and universities should deeply understand the importance of smart campus construction and improve the application efficiency of advanced technology. In the future, with the sustainable development of information technology, smart campus will occupy a higher proportion in school management. The university must constantly improve the application level of big data and cloud computing technology in the smart campus. However, the concept of smart campus is a new concept in China. The experience is not mature and

needs to be gradually improved in the development process.

Data Availability

The data used to support the findings of this study can be obtained from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest or personal relationships that could have appeared to influence the work reported in this paper.

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