



Experience and Thinking on the Construction, Management and Operation of Campus Card System in Colleges and Universities

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Abstract. University campus one-card system is an important part of university management, and its construction, management, and operation and maintenance are directly related to the convenience and security of campus life. This study comprehensively surveyed the construction, management, and operation and maintenance experiences of multiple universities' one-card systems, and reflected on their highlights. Firstly, the study found that reasonable planning and establishment of a one-card system is the basis for realizing campus information management, and the overall effect of the system can be improved by integrating multiple functions, enhancing adaptability and convenience. This paper summarizes several management experiences, including standardizing processes and systems, strengthening technical support and maintenance, and establishing sound security mechanisms to promote the smooth operation and long-term development of the one-card system. This study analyzes in depth the challenges and problems currently faced by the system, and proposes some solutions, such as establishing a cooperative mechanism for sharing social resources and improving user privacy protection. The construction, management, and operation and maintenance of university one-card system is a challenging task, and this study aims to provide experience guidance and problem-solving ideas for universities.

Keywords: Construction of the one card system, Information management experience, Operation and maintenance, Security mechanism.

1 Introduction

With the continuous development of the wave of informatization, the college campus card system, as a comprehensive management system integrating information management, access control, consumer payment and other functions, is gradually becoming an important part of college management. The construction, management and operation and maintenance of the college campus card system are directly related to the convenience and safety of campus life. However, in the process of construction and manage-

ment, we also face a series of troubles and challenges. Therefore, it is of great significance to study the construction, management, operation and maintenance of the campus card system in colleges and universities.^[1]

2 Construction of college card system

2.1 System design and development

In college campuses, the one-card system plays an extremely important role as the core tool for various services on campus. For the construction of the all-in-one card system, the design and development of the system is one of the primary considerations.

In the system design and development phase, first of all, the functions and requirements of the system need to be clarified. According to the different role needs of students, faculty and management personnel, determine the functions that the system needs to provide, such as consumption payment, access control management, book borrowing, etc. Through internal construction demand research and extensive solicitation of opinions, we can deeply understand the needs of teachers and students, and improve the usability and user experience of the system.

Second, the scalability and compatibility of the system need to be fully considered. With the increase in the number of users, the college card system needs to be able to expand and adapt to changes, and also needs to be seamlessly connected with other campus management systems, which can lay a solid foundation for future system upgrades and function expansion.^[2]

Therefore, the design and development of the college card system is an important part of building an efficient and convenient campus card system. Clear system requirements, reasonable system design, and full consideration of system scalability can effectively improve the performance and user experience of the one-card system, and realize the convenience and intelligence of campus management.^[3]

2.2 Equipment purchase and installation

In the construction of the college card system, the purchase and installation of equipment is a very critical step. The selection and installation of equipment has a direct impact on the stability and reliability of the entire system. Therefore, when purchasing and installing equipment, it is necessary to fully consider the actual needs of the system and the future development direction.

First of all, the purchase of equipment needs to be reasonably selected according to the scale and needs of the university. When selecting equipment, factors such as performance, scalability, and compatibility of the equipment should be considered.

Secondly, the installation of equipment is also crucial. The installation of equipment needs to be carried out in accordance with certain specifications and procedures to ensure the stability and safety of the equipment. According to the evaluation analysis or experience, make a plan in advance, pay attention to the wiring and connection of equipment, and ensure the normal communication between various equipment.

In addition, equipment debugging and testing are also important links in the equipment installation process. By debugging and testing the equipment, it is possible to verify whether the function and performance of the equipment meet the requirements, and to discover and solve existing problems in time. In the process of debugging and testing, it is necessary to test by simulating the real use environment to ensure the stability and reliability of the device in actual use. After the equipment is purchased and installed, make a record of the equipment, and check and maintain the equipment regularly in the future to ensure the normal operation of the equipment and extend the service life of the equipment.^{[4] [5]}

To sum up, the purchase and installation of equipment is a link that cannot be ignored in the construction of the college card system. Reasonable purchase of equipment, standard installation of equipment, strict testing and debugging of equipment, and good record and management of equipment can ensure the stable operation of the system and improve the reliability of the system.

2.3 System testing and adjustment

The testing and adjustment of the college card system is a crucial link in the construction process. System testing aims to verify the integrity, stability, and security of the system, ensuring that the system can function properly before it is put into use.

System testing is mainly functional testing. For example, the one-card system needs to support multiple functional modules such as student one-card, access control, and book lending. Therefore, it is necessary to ensure that each functional module can operate normally during the test. Comprehensive and in-depth testing of different modules can help identify potential problems and resolve them in a timely manner.

In addition, performance testing is also one of the important links of system testing. The one-card system needs to process a large number of user requests during use, so the performance stability of the system is very important for the normal operation of the entire system. By simulating high-concurrency scenarios and performing performance tests, the system's throughput, response time and other indicators can be evaluated to provide a reference for the system to go online.

The test results may reveal some problems and deficiencies. Corresponding optimizations are made based on user feedback and test results, and timely adjustments are made to ensure that the system can better meet user needs.^[6]

To sum up, the testing and adjustment of the college card system is a link that cannot be ignored in the construction process. Through full testing and reasonable adjustments, the stability and efficiency of the system can be ensured, and the needs of users can be better met.

3 University card system management

The user management of the college card system is a crucial part of the system construction. In the college campus card system, users are diverse and large in number,

including students, faculty members and off-campus personnel, etc. Therefore, effective management and maintenance of these users' information is crucial to the normal operation of the system.

First of all, the college card system needs to establish a complete user registration and authentication mechanism. On-campus users such as students, faculty and staff should register their identities through departments or personnel departments, and submit relevant certification materials for authentication, or the school data center will open up data through data integration to complete cross-departmental business process integration. The data source of the one-card system Undergraduate School, Graduate School, or Human Resources. At the same time, for non-full-time users such as off-campus personnel, a specific registration process should be set up, and their identities and permissions should be strictly reviewed to ensure the security and reliability of the system.

Secondly, for different types of users, the university card system should establish an effective user rights management mechanism. When different users use the one-card system, they will have different operating permissions and functional requirements. Therefore, system administrators need to divide and control users' rights according to different roles and responsibilities. For example, on-campus teachers and students can perform basic operations such as consumption and book borrowing, while off-campus personnel cannot use the book borrowing function. Different users may have different access rights to functions in the system. Through reasonable authority management, the security and operation standardization of the system can be ensured.^[7]

In addition, authority management should realize the controllability and traceability of authority. For the college card system, the authority adjustment and authority use can be tracked and monitored through log records and other methods. For example, when a user needs to adjust permissions, identity verification is required, and the time of permission change and the information of the operator are recorded for subsequent audit and accountability.

In short, the user management of the college card system is one of the key factors to ensure the normal operation of the system. By establishing a complete user registration and authentication mechanism and setting an effective user authority management mechanism, various users in the system can be effectively managed and maintained, and convenient, safe and efficient one-card services can be provided for colleges and universities.

4 University card system operation and maintenance

4.1 Routine maintenance of the system

The daily maintenance of the college card system is an important link to ensure the normal operation of the system, which involves the stability, security and reliability of the system. The daily maintenance of the system includes the following aspects.

First of all, the stability maintenance of system hardware is the basis of daily maintenance work. The college card system involves a large number of hardware devices, including servers, network devices, card reading devices, etc. These devices require

regular inspections to ensure their normal operation and stability. For example, it is necessary to check the health of the server, the free space of the hard disk and memory, and the connection of the network equipment. If a hardware device is found to be faulty or abnormal, it needs to be checked and repaired in time to ensure the normal operation of the system.

Secondly, the update and maintenance of system software is also one of the important contents of daily maintenance work. College card systems usually use specialized management software, such as database management systems, operating systems, and so on. These softwares need to be regularly updated and maintained to ensure the improvement of its functions and security. Specifically, software versions can be updated by installing the latest patches and update packages to fix known vulnerabilities and problems. At the same time, it is also necessary to back up system data regularly to prevent data loss or damage.

Third, the establishment and maintenance of security protection mechanisms are the key to ensuring system security. The college card system involves a large amount of user information and capital transactions, so it is necessary to establish a complete security protection mechanism. This includes setting up user authentication mechanisms to ensure that only authorized users can access the system, and encrypting the storage and transmission of sensitive information to prevent information leakage. At the same time, it is also necessary to establish a security audit and monitoring mechanism to monitor the operating status of the system in real time, and to discover and deal with security loopholes and threats in a timely manner.

In addition, daily maintenance work also needs to respond to user problems and needs in a timely manner. Users of the college card system may encounter various problems, such as failure to read the card normally, recharge failure, etc. In this case, maintenance personnel need to communicate with users in a timely manner to understand the specific situation of the problem and solve the problem as soon as possible to reduce the impact and inconvenience of users.

To sum up, the daily maintenance of the university card system is the key to ensure the normal operation, safety and reliability of the system. It involves the stability maintenance of hardware equipment, software update and maintenance, the establishment and maintenance of security protection mechanisms, and timely response to user problems and needs. Only by doing these things well can we ensure the smooth operation of the college card system and provide more convenient and safe services for campus life.

4.2 System problem handling

As an important tool for modern university management, the college card system provides convenience for teachers and students. However, various problems will inevitably be encountered in actual operation, so it is particularly important to deal with problems in the college card system. The following is a discussion on how to deal with the problems of the one-card system in colleges and universities from three aspects.

First of all, it is necessary to establish a scientific feedback mechanism to deal with the problems of the college card system. In daily use, there should be a fast and effective

feedback channel for problems encountered by teachers and students. You can set up full-time system maintenance personnel to be responsible for timely handling of user feedback, or build an online service platform so that users can submit questions and opinions at any time. At the same time, establish a complete problem-handling process, clarify the priority and time requirements for problem-handling, and ensure that problems can be resolved in a timely manner.

Secondly, the problem handling of the college card system needs to focus on teamwork and communication. The problem is not only the failure of the system itself, but sometimes it may be caused by improper operation of the user or other environmental factors. Therefore, when dealing with problems, it is necessary to organize collaboration among multiple departments, such as the system development department, equipment maintenance department, and user service department, to locate and solve problems. At the same time, strengthen communication and cooperation with manufacturers, keep abreast of system updates, patches and technical support provided by manufacturers, so as to ensure that problems can be properly resolved.

Finally, the problem handling of the college card system needs to focus on problem prevention and optimization. While dealing with the problem, it is necessary to analyze and summarize the root cause of the problem to avoid similar problems from happening again. Regular system inspection and maintenance can be carried out, system software and equipment can be updated in time, potential loopholes can be patched, and system stability and security can be improved. At the same time, it is also necessary to maintain close communication with users and management departments to understand their needs and feedback, continuously optimize and improve system functions, and enhance user experience.

To sum up, it is necessary to establish a scientific feedback mechanism, focus on teamwork and communication, as well as the prevention and optimization of problems in order to deal with problems in the college card system. Only by comprehensively considering all aspects of the elements can we effectively deal with the problems in the college card system, improve the stability and reliability of the system, and provide better services for teachers and students in campus life.

4.3 System upgrade and optimization

After a period of operation of the college card system, with the continuous advancement of technology and the continuous development of the school, it is gradually necessary to upgrade and optimize the system to meet the growing demand and higher efficiency requirements.

System upgrade is an important and necessary work, which includes both the upgrade of hardware equipment and the upgrade of software system. First of all, in terms of hardware equipment, it is necessary to upgrade the hardware equipment according to the development needs of the campus card system. For example, more advanced magnetic card readers, self-service top-up equipment, etc. can be considered to improve the convenience of card application and use. In addition, it is also possible to consider increasing the number and types of devices to meet the increasing user scale and the

needs of different users. In this way, the experience of using the card for students, faculty and other relevant personnel will be further improved.

Secondly, the software system also needs to be upgraded. With the increase in the use of the college card system, the functional requirements have gradually increased, and the stability and security of the system have become more important. Therefore, in the system upgrade, new functional modules can be considered, such as campus consumption, access control management, attendance management, etc. At the same time, the stability and security of the system should also be strengthened during the upgrade process to ensure that the system can operate normally and is not vulnerable to external attacks. In addition, loopholes and bugs in the system should be repaired in time to improve system performance and user satisfaction.

In addition to system upgrades, system optimization is equally important. Optimization refers to improving the performance, efficiency and user experience of the system based on the actual operation of the college card system and user feedback. After the system is upgraded, the problems and deficiencies in the system can be found by collecting user feedback and needs, and then targeted improvements and optimizations can be made. For example, the user's waiting time can be reduced by optimizing the response speed of the system; the user's convenience can be improved by improving the system interface and operation process. In addition, it can also provide schools with more decision-making basis by adding data analysis and statistical functions.^{[8][9][10]}

In short, the upgrading and optimization of the college card system is a continuous process. By continuously improving hardware equipment and software systems, improving system performance and user experience, we can better meet the needs of schools and users. At the same time, it can also provide more data support and decision-making basis for the management of colleges and universities through system upgrading and optimization, and provide strong support for the development of schools.

5 Prospects for the One Card System in Colleges and Universities

This study aims to explore the construction, management, operation and maintenance experience and thinking of the campus card system in colleges and universities. Through a comprehensive investigation of the cases of multiple universities, we conducted an in-depth analysis of the highlights and problems in the construction, management, operation and maintenance of the one-card system, and put forward some solutions and suggestions.

The campus card system of China Agricultural University was established in 2011. It mainly provides functions such as identity authentication, on-campus consumption, information query, school affairs management, and merchant settlement for teachers and students of the whole school. Including: catering, access control, water control, bathroom, shuttle bus, computer room management, library management, school hospital management, network charges, online payment platform, financial collection fees, self-service printing and copying system, self-service report card printing system, online self-service inquiry, Various modules such as self-service electricity purchase,

self-service laundry, gymnasium venue management, and other systems (undergraduate school, graduate school, human resources and other departments) and other modules, realize "one card with multiple functions, one card for common use, one card in hand, travel everywhere campus". However, only supporting the traditional physical card model can no longer meet the informatization needs of teachers and students for "walking around the campus without a card". Lost reissues, single payment methods, and overdue service of all-in-one card terminals and servers have brought about insufficient equipment performance and high failure rates, large amount of maintenance and other problems, there are operational risks. Therefore, in September 2020, we conducted a thorough investigation of our school's campus card platform to confirm the main terminal equipment and system interfaces. In December, the school collected opinions on the construction needs of the next-generation campus card platform.

We have investigated the construction of campus cards in off campus universities, and the virtual card construction in 985 universities in Beijing is shown in Table 1. Overall, 985 universities in Beijing are in the initial stage of upgrading from physical cards to virtual cards.

Table 1. The construction of virtual cards in 985 universities in Beijing

The construction of virtual cards	985 Universities in Beijing	
	Name of university	Virtual card usage stage
	Tsinghua University	Survey
	Peking University	The Software College has started to implement a virtual card project
	Beijing Normal University	The entire school has started to implement a virtual card project
	Central University for Nationalities	Not Started
	Beihang University	Not Started
	Beijing Institute of Technology	Not Started

We also investigated universities with relatively comprehensive coverage scenarios and rich construction experience using virtual cards, as shown in Table 2. The two traditional campus card manufacturers, NewCapec and Synjones, have both launched and popularized virtual card solutions; The virtual card case of NewCapec at Dalian University of Technology covers the entire scene, and the maturity of the solution is relatively high. The supporting networks of various universities are mainly private networks. When both physical and virtual cards exist, the actual usage rate of virtual cards is not as expected. Through communication, it was found that the reasons are multifaceted: firstly, for users, the card is more convenient to operate than the code, and in dense scenarios such as cafeterias, the card usage rate is higher; Secondly, for those with limited acceptance of mobile payments, such as some retired faculty members, they prefer to use physical cards.

At the same time, we conducted research on the traditional two major card companies, NewCapec and Synjones, and found that the solution is "virtual card+physical

card", while internet solutions represented by Tencent WeXiao are more prominent in "pure virtual card".

Table 2. The use of virtual card in other universities

Name of university	Vendor	Virtual card usage	Network
Zhejiang University	Synjones	50%	Private network
Shandong University	Synjones	10%	Private network
China University of Political Science and Law	Synjones	Less than 50%	Private network+ Campus network
Dalian University of Technology	NewCapecc	Less than 50%	Private network+ Campus network
Beijing Information Technology College	Tencent WeXiao	100%	4G+ campus network

At the same time, research on the construction of campus cards in some colleges and universities outside of Beijing and exchanges with manufacturers found that the consumption mode of mobile payment has become a consumption habit of people. After 2017, some colleges and universities gradually upgraded their campus card platforms to support virtual cards. The potential and goals. Some universities have adopted the "virtual card + physical card" solution, which is compatible with both physical and virtual cards. Some colleges and universities have begun to use "virtual cards", pure virtual card solutions. Virtual campus card has become a new generation of campus card platform construction trend. Combined with the actual situation of our school, the campus card system will be upgraded smoothly and provide non-stop service during the construction and upgrading process. It also fully considers the original usage habits of users, formulates a clear implementation path, and is compatible with the original physical card. It will be released in September 2021. The new "CAU E-Card" invites you to experience the access control and consumption functions of the virtual card. In August 2022, the university and various departments jointly promoted the implementation of a new generation of campus card application platform upgrade project. The virtual card can be used for dining in the cafeteria and saving water in the bathroom. It provides authentication and consumption functions in all application scenarios, such as control, boiling water saving control, book borrowing and returning, access control, computer room access, self-service document printing, on-campus medical treatment, physical exercise, subsidy distribution, online payment, shuttle bus ride, and conference check-in. At present, our school campus card supports physical card and virtual card. The two cards share a set of balances, which can be freely selected when using, which relieves teachers and students from all kinds of troubles caused by having to carry campus cards; commonly used recharge and balance inquiries Businesses, such as checking the account, reporting the loss of the card, modifying the password, modifying the limit, binding bank cards, etc., can all be handled by themselves in the virtual card on the mobile phone, without being limited by time and place; the virtual card not only supports the original balance payment , also added bank card direct payment and WeChat easy payment modes, the latter two modes can also be consumed without recharging. In October 2022, the "China Agricultural University Campus Card Management Measures" will

be revised. In March 2023, the campus card off-campus will be integrated into the "public transportation application" function. In July, the NFC function of the mobile phone and the campus virtual card are in the cafeteria and other scenarios, and the screen of the mobile phone is off, and the campus card consumption can be realized by using the screen of the mobile phone. The platform architecture of China Agricultural University is shown as Figure 1.

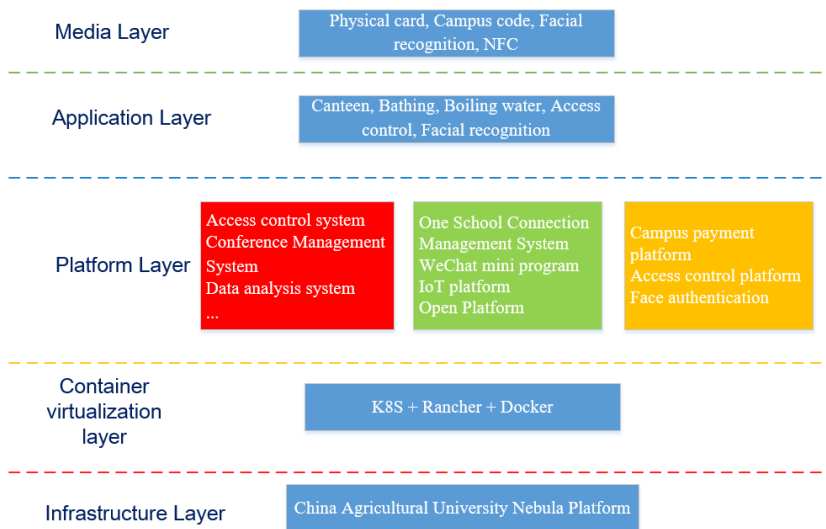


Fig. 1. Platform Architecture of China Agricultural University

6 Conclusion

In the new era, the development of campus card system in colleges and universities is more diversified. In terms of construction goals, relying on the on-campus identity authentication function of the campus card to promote the integration of campus information applications and provides convenient and fast service experience for teachers, students and off-campus personnel. And it continuously expands the full scene coverage of campus cards, bringing more room for development to user experience and digital campus governance. The college card system is a systematic project that needs to respond to user needs and solve problems from the aspects of network, system, database, cloud platform structure, rules and regulations, user services, security mechanisms (user privacy and system security), technical support, and operation and maintenance. to improve user satisfaction. At the same time, establishing a sound security mechanism can effectively protect user privacy and system security. Utilize digital technology to promote university management model innovation and business process reshaping, and build a new smart campus ecology.

There are still some shortcomings in this study. Since the one-card system involves many aspects, this study only discusses some of the key issues, and there are still some

details and issues that need further study. Future research can further expand the sample size and conduct in-depth research on the construction, management, operation and maintenance experience of more colleges and universities to improve the reliability and practicability of the research.

To sum up, the construction, management, operation and maintenance of the college campus card system is a challenging task. Through comprehensive research and analysis, some experience and thinking are summarized, and some suggestions and ideas for solving problems are provided for colleges and universities. We hope that this study can provide some reference and guidance for the improvement and development of the college card system, and promote the further improvement of campus information management.

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