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## Design and research on the campus IC based on Java model

Yanru Dong

Business college of Shanxi University, Taiyuan, 030031, (CHINA)

### ABSTRACT

Since the smart Cards came out in the 70s, it has been widely used throughout the world. But for various reasons, development process of one card system is very long and complicated. The Java Card technology is a good way to deal with the needs of a variety of applications and without interfering each other. Use Java Card technology development system has the advantages of simple programming, short development cycle, and high security, strong scalability and reusability and cross platform ability etc. The current development of the complexity of the campus IC system and use Java Card technology to develop such a system has a unique advantage. Due to the use of Java virtual machine, java Card Applet can perform in different JCAEs (Java Card Application Environment) in Java Card. To achieve cross-platform ability through the mechanism of the Java virtual machine, achieve the function of IC card, which greatly enhances the flexibility of smart Cards<sup>[3]</sup>.

### KEYWORDS

Campus; IC; Java model; Design and research.

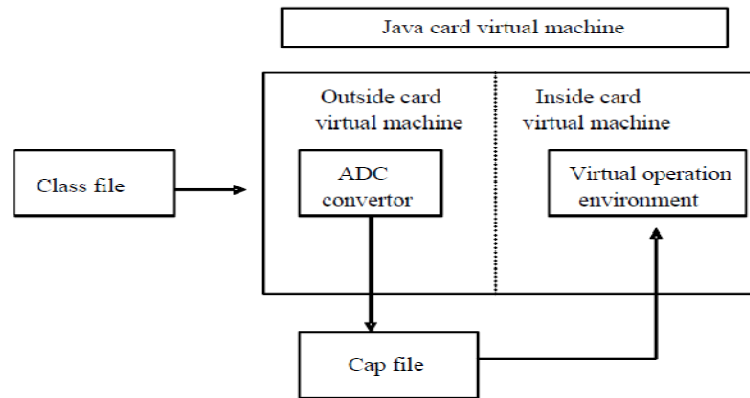


**INTRODUCTION**

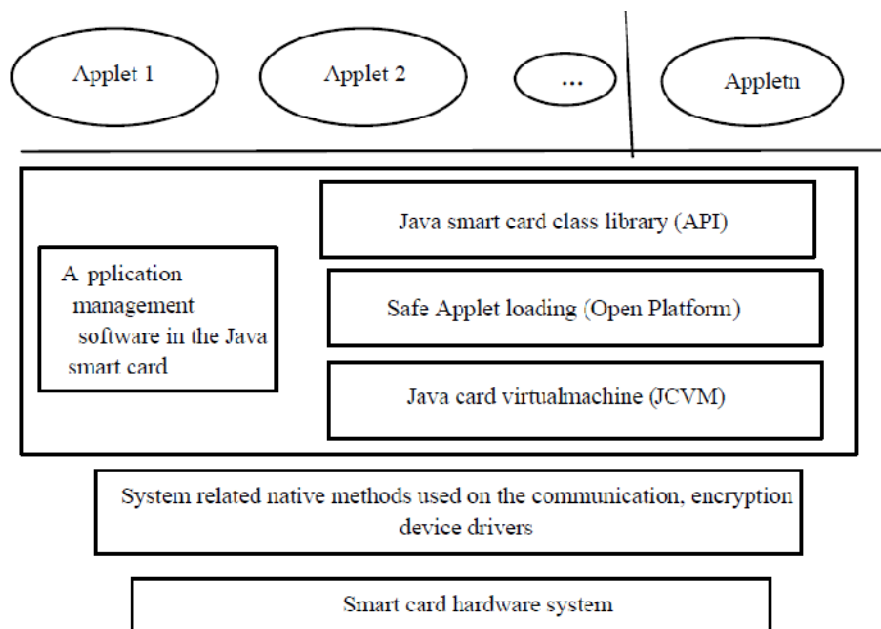
Java smart card technology is a kind of synthesis technology to combine the smart card technology with the technology of development and application of the Java language, it puts software, security and encryption, standalone and network as well as the relevant social management, financial and business professional knowledge and technology of synthesis technology altogether. Java Card makes full use of the ability of write once and performing anywhere of Java, making the Java can be used in such devices that have smart Cards and lacks of storage capacity. Java card is a kind of smart card can run Java language procedure, is a new application of Java embedded in a smart card. It has the advantages of multiple supports of application, good security features, mainstream object-oriented programming environment, application dynamic download online, which further promote the application and development of the smart card technology in the Internet age. At the same time, the development of the Internet and mobile computing technology of Java card technology puts forward higher requirements.

**The system structure of Java card.**

Biggest advantage of Java card is simple programming, short development cycle. Apple in the Java card do not implement directly on the card hardware, but in the virtual machine in the Java card. Java card virtual machine provides a set of standard Java card programming API that developers don't have the need to understand the complex of smart card hardware and some special technologies, and can make the application development of smart card, thus it greatly reduces the development difficulty, reduces development time. The structure of the Java card virtual machine is shown as Figure 1.



**Figure 1: The structure of division Java card**



**Figure 2: The system structure of Java card**

The system structure can be seen in the above Figure 2. The code at the bottom of Java Card ROM is to have access to memory block (including RAM, ROM and EEPROM) and I / O device drivers. According to the needs, it may also have

access to encryption processor driver. These drivers are implemented in C or assembly language, thus greatly improves the Java Card execution efficiency. Java card virtual machine is one of the traditional simplified versions of the JVM which will be responsible for the control of the upper application access to Java Card hardware driver. Java Applet can be dynamically loaded into the card, the developers don't need to know complex technology, smart Cards and smart card hardware dedicate to the development of smart card applications, thereby significantly reducing development time and reduce the development difficulty. Due to the use of Java virtual machine, the Java card Applet can in different card JCAE performed on, namely through the mechanism of the Java virtual machine to achieve cross-platform ability<sup>[8]</sup>.

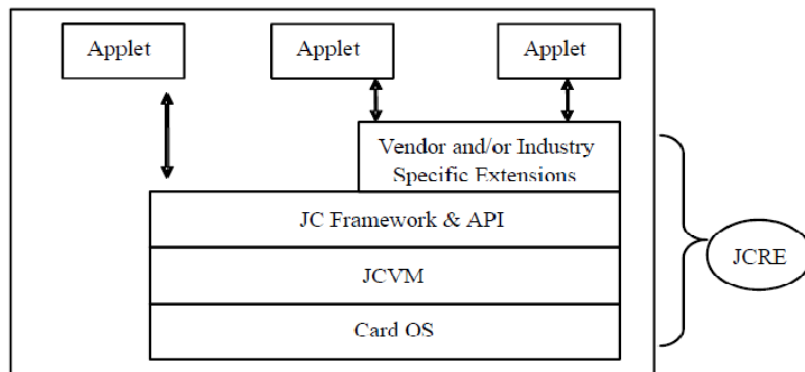
**Technology specifications.**

There are three kinds of technology specifications: JCVM specification, JCRE specification, and the API specification<sup>[6]</sup>.

In the TABLE 1, JCVM only supports a limited subset of a Java programming language, but it retains many familiar features, including object, inheritance, package, dynamic object creation, virtual methods, interface and exceptions. JCVM specification gives up the support of many language elements, because the language elements may use a lot of limited memory of smart card. The operation environment of the Java card is shown as Figure 3. JCRE specification defines the life cycle of Java card virtual machine and little application, and how the little application is chosen and isolated.

**TABLE 1: The information of Java card language restriction.**

Language features	Dynamic loading, security management, threads, object cloning and don't support package access in some aspects
Key words	Don't support native, synchronized, transient, and volatile and strictfp.
Type	Don't support char, double, float and long, as well as multidimensional array.
Class and interface	Only Object and Throwable, and most of which are not fit.
Abnormal	Some subsets of Exception and Error are left out.



**Figure 3: The operation environment of the Java card**

**CAMPUS IC**

The aim of the campus electronic currency is: any occasion needs cash, negotiable instruments or identification all uses smart Cards. The card is available for the cardholder to deal with campus chores, buy food, drinks, books, books, check information, register and pay the fees, etc. Cardholders only need to simply open a bank account and deposit money to open the function of electronic wallet<sup>[8]</sup>.

At present, digital campus construction has entered a stage of comprehensive planning and implementation. The essence of digital campus construction is to implement effective integration of various resources, integration and optimization, to achieve the effective allocation of resources and make full use of school management and logistics service process optimization, coordination and implementation of the teachers and students in the process of teaching, learning, life optimization through informatization of the different sections in the campus and the service section, thus greatly improve the management level and service efficiency, effectiveness and efficiency.

Campus IC system is a very effective management means, it can manage large amount of teachers and students. It represents the development trend of the campus informatization, is an important symbol of the modern management and campus digitalization<sup>[9]</sup>.

**The development of IC card.**

Information construction is an important problem facing in the college construction and development at the beginning. In the process of information construction of colleges and universities, the construction of digital campus is one of

the most important, and as a foundation for digital campus construction project of "campus- IC card" system. It becomes the key of the information construction of colleges and universities<sup>[7]</sup>.

After ten years of development, IC card has experienced three stages in China: the first generation IC card, the second generation IC card, the third generation of IC card. Figure 4 is the third generation of cartoon structure diagram<sup>[2]</sup>.

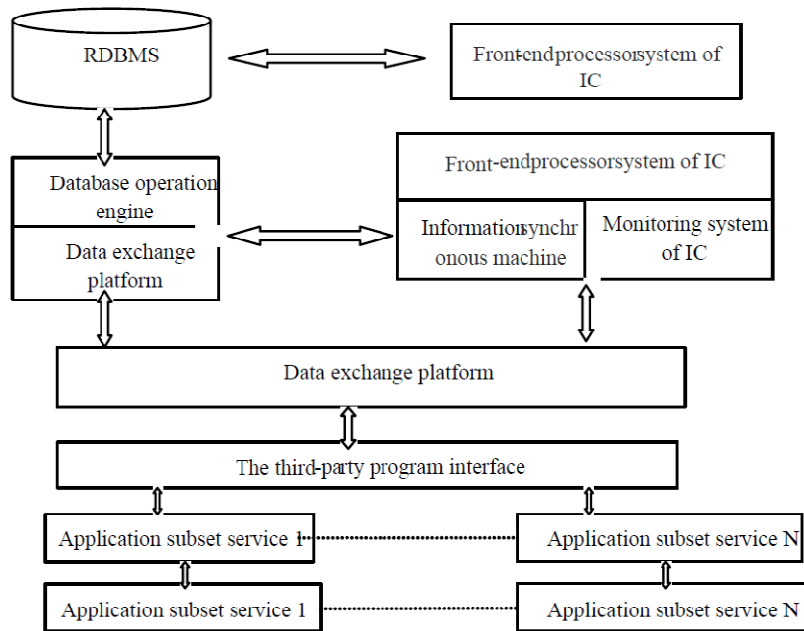


Figure 4: Structure of the third generation IC card

**The technology of IC card**

UML (Unified Modeling Language) has the characteristic of extension. UML extension mechanism for graphics can make it being used for a long period of time, and can adapt to a new programming language and idea. UML provides three extension mechanisms to extend, namely, stereotype, tagged value, and constraint. Chart 5 is the perspective of UML model.

The point of view of UML model mainly depends on which view different users use to examine the results of the system and design considerations of each view. Different graphs express the meaning of the system in different point of view, which are referred as Architectural View. In the structural view provides different graphics, can be more clearly expressed<sup>[1]</sup>. The view of UML is shown as Figure 5.

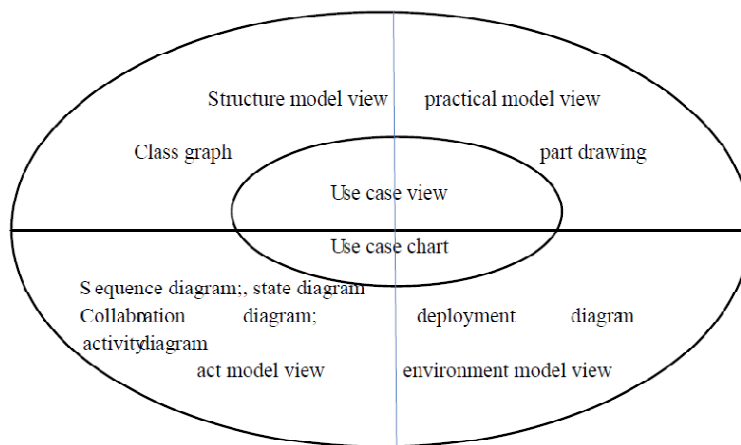


Figure 5: 4+1 View of UML

J2EE (Java 2 Platform Enterprise Edition) is enterprises version with different Java specifications developed by Sun Microsystems in the past few years in order to realize the development of distributed application model execution Platform. Itself is a set of standards, it provides a distributed application model of multilayer structure, this model has the ability to reuse components, data exchange based on XML (Extensible Markup Language), unify security mode and flexible transaction control, which enables developers not only publish new solutions to the market more quickly than before. Its

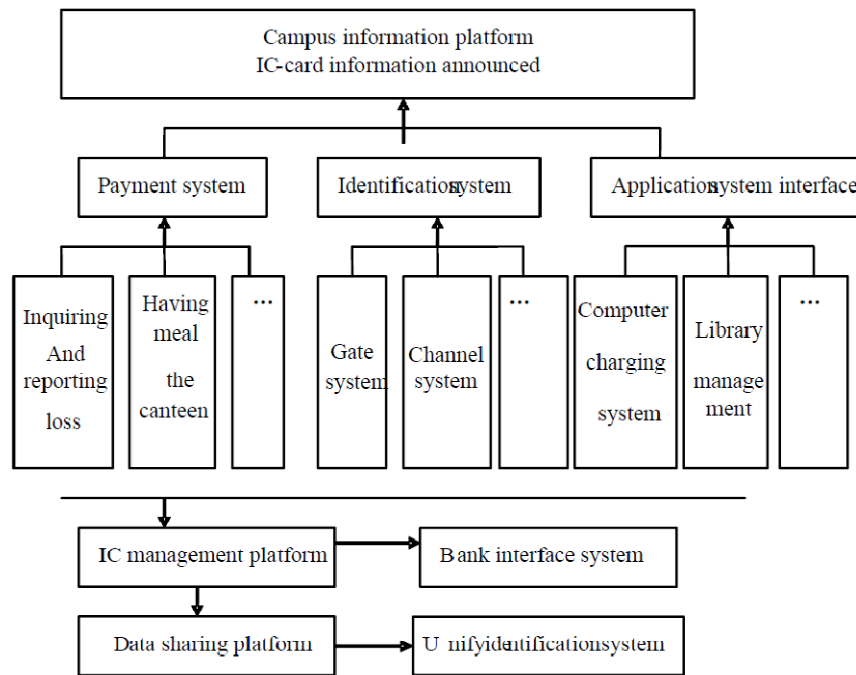
character independent Platform and based on the component makes the J2EE not subject to the conditions of products and application programming interface, but has high productivity, rapid development, high quality and easier to maintain<sup>[10]</sup>.

### THE DESIGN RESEARCH OF THE CAMPUS IC CARD

Campus IC card system is one of the basic program in the digital campus, essentially for digital campus services. And, as it involves in many campus consumption as well as academic affairs management, financial management and other basic engineering, campus IC card should consider the extension in the future from different angles as a whole framework.

**TABLE 2: Information table of the IC card**

Name	Type	Length	Vacant	Key typing	Tips
CARD_ID	Number	20	no	yes	Card no.
CARD_USED_ID	Number	11	no	yes	Holder No.
CARD_PASSWORD	Char	6	no	yes	Password
CARD_TYPE	Number	2	yes	yes	Card type
CARD_MTIME	Date		yes	yes	Time out CO
CARD_RTIME	Date		yes	yes	Time register
CARD_LASTUSE	Date		yes	yes	Last time use
CARD_TOTALUSE	Number	20	yes	yes	All used times
CARD_STATE	Number	1	yes	yes	Condition
CARD_DATE	Date		yes	yes	Issuing time
CARD_OPERA	Char	20	yes	yes	Operator
CARD_INVADATE	Date		yes	yes	Time to hold
CARD_INVAPOERA	Char	20	yes	yes	Cancelling date
CARD_MARK	Varhcar	100	yes	yes	Cancelling operator



**Figure 6: The framework of the IC-card system**

From the technical level, campus IC card system should include the network architecture, protocol selection, hardware equipment, card design, software and safety requirements etc. And it should follow the principle of design of modern and mature stable operation efficiency; in the management view, the campus IC-card system should include the management organization structure, management processes, business process and related system maintenance, etc., follow

the requirements of the specification design and modern management concept. Campus ID system realizes in the target that "one card in hand, go through the campus", in principle that "use IC card, a card holders", fundamental demand "centralized control, information sharing".

Combining school status quo of informatization construction and the development trend of the informationization in university, school constructs the digital campus on the basis of the construction of data center and IC-card platform, integrates campus computer application system. In digital campus, the construction of IC card system is very complicated system engineering. And the Figure 6 is the framework of the IC-card system<sup>[5]</sup>.

### SUMMARY

As part of the digital campus, campus identification system has been gradually showing its intelligence services on campus and the huge advantage of basic service. Not only convenient teachers and students in school life, but also has provided the safeguard for campus management scientific and efficient. Campus ID systems involves a lot of data, its security should not be ignored. At the same time, the accuracy for building on the campus network of other applications provides a good data collection and sharing of space. For how much larger colleges and universities combined with the campus network as well as other related application form of their own digital campus environment, the formation of integrating teaching, life, scientific research, management of the digital space gradually on the agenda, drive the whole information level enhances unceasingly<sup>[4]</sup>.

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