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## **Recent Advances in Information Intelligence: Methods and Applications**

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During the past few years, information intelligence has radically transformed human life style. In the today's competitive and highly dynamic society, to collect and analyze the obtained information is a must to understand in detail how the society is processing the "data" and to reason the outputs and anticipate the trends in information intelligence, has become critical.

This Vol.2016, No. 17B of RISTI - Revista Iberica de Sistemas e Tecnologias de Informacao seeks to contribute new insights on these issues and challenges in order to better address the proposed problems. The 30 extended papers included here stem from the panel discussion on Information Management held in Yichun China in 2014. As we know, the peer review process for journal publication is essentially a quality control mechanism, so we invite 28 experts from China to evaluate the review work with high academic standard, their contributions are greatly appreciated. Lastly, many people worked long and hard to help this issue become a reality. We would sincerely like to gratefully acknowledge and thank all of them.

We hope all the readers will find something interesting in the present issue and would appreciate your feedback on any of the articles.

Enjoy reading this issue.

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# Design and Research of ICAI Based on Cognitive Student Model

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**Abstract:** With the development of computer technology and network technology, Computer Assisted Instruction has been increasingly applied to the field of Education. One of the key features of Intelligence Computer Assisted Instruction is suitable for individual teaching, according to the learner's actual need to choose the appropriate teaching content. Cognitive student model is one of the most important parts in ICAI system. How to use the appropriate teaching strategy according to the students model is the key to realize the intelligent and personalized teaching. Therefore, the design and research of ICAI based on cognitive student model are carried out in this paper. The defects and limitations of the different construction methods of student model in ICAI system are summarized based on the analysis of the different implementation methods of the student mode, the realization process of a student model is described to construct a practical student model based on cognitive theory in theory, the concrete index system of the system evaluation on the basis of the evaluation of cognitive model is put forward. The experiment proves its effectiveness. This model provides a strong basis for the development, design and selection of ICAI system.

**Keywords:** Student model; ICAI; system evaluation; cognitive learning theory.

## 1. Introduction

Intelligent Computer Assisted Instruction (ICAI) system is a kind of Computer Assisted Instruction's application mode based on the theory of artificial intelligence, cognitive science and thinking science. It concentrates the experience and wisdom of the teaching experts. The function of the student model is that it can describe the students as accurately as possible (Xiao, Z. X., 2012), which is one of the most important parts of the ICAI system, and the student model is also the key to really implement "teach students in accordance of the materials" of ICAI. However, there are still some deficiencies and defects in many CAI systems. The one-time investment of the CAI teaching system is high, and the technical requirement of CAI is also very high, which limits a number of experienced subject teachers to prepare courseware in person. CAI courseware production is far from the convenience and freedom of the traditional teaching process, this is currently the most important reason for Computer Assisted Instruction to carry out. In addition, some teachers overly rely on the role of Computer Assisted Instruction,

which makes them can't carry out the design of the courseware according to the teaching requirements. Therefore, in the process of the design of courseware, designers not only should pay attention to the software design skills, but also pay attention to the use of learning theory and teaching design methods, which will help to improve the quality of CAI courseware. Based on this, this paper focuses on the analysis of the different implementation methods of the student model, and the realization process of a student model is described, so as to construct a practical student model based on cognitive theory in theory. And the experimental results show that it is effective. This system makes the positive and good interaction among the elements in the education activities (Galván, J. B., Recarte, L., & Pérez-Ilzarbe, M. J., 2014), so as to improve the enthusiasm of the students and cultivate the students' cognitive ability.

## **2. Research Status**

Nowadays, in some developed countries, such as the United States, Japan, Canada, Britain, France, Australia and so on, CAI has been widely found in schools and families, and is playing an increasingly important role. Research of ICAI is from the beginning of the 70's. A ICAI system SCHOLAR was successfully developed to teach South American geography, its characteristic was to allow students to ask or answer questions in natural language (Mexas, F., Efron, A., Chaisson, R. E., & Conde, M. B., 2012). SCHOLAR could understand the students' questions and was able to answer the questions accurately, the system had organized different levels of teaching materials to meet the different levels of students. The SOPHIE system was developed for the training of students' electronic experimental skills (Wenxiu, X., & Fu, D., 2014). In the late 70's, people began to research more perfect practical system of ICAI. The GUIDON system was developed in the Stanford University (Ellison, M. L., Biebel, K., Huckabee, S., Davis, L., & Golden, L., 2015). The WHY system was developed to improve the efficiency of multimedia teaching in Colleges and Universities (Ashok, K. K., 2014). It can be said that the development of the ICAI has a fruitful results. CAI research in China is from the beginning of the 80's, a small amount of research work is mainly concentrated in a few universities and research institutions, and most of that are the "toy system", after rigorous evaluation of the system is less. The remainder of this paper is organized as follows. Section 3 describes the topological structure and traditional control diagram of the VSC-HVDC power transmission system. Section 4 gave the iMFAC designate using a dynamical linearization method, as well as, the convergence analysis of the proposed algorithm. Section 5 presented a real experiment to evaluate the performance of iMFAC. Conclusions are summarized in Section 6 (Aşık, A., 2016).

## **3. Related Theory and Technology**

### **3.1. Computer Aided Instruction**

With the rapid development of information technology, the application of computer technology has become one of the important signs of the degree of information technology. The continuous development of society has also put forward new requirements FOR the talent training. The combination of the computer technology and education field

promotes the reform and development of various disciplines, breaks the traditional closed education system, reforms the curriculum, enriches the teaching content, so as to create good conditions for the pioneering talent. In the field of education, computer technology is not only a subject, but also gradually becomes a kind of effective teaching media. The wide use of which makes the teaching methods, teaching ways, teaching ideas and teaching forms, classroom teaching structure and so on change a lot. Thus a new comprehensive study of the combination of knowledge and computer technology in the field of research is formed - Computer Assisted Instruction (CAI). Computer assisted instruction is carried out with the aid of computer software in all kinds of teaching activities, it can dialogue with students to discuss the teaching content, and arrange teaching process, which uses computer as the main teaching media for teaching activities.

### **3.1.1. Advantages of Computer Assisted Instruction**

In our traditional teaching mode, teachers often use words, language, action and other means to impart knowledge to students. Sometimes in order to express the views of intuitive knowledge, the teachers will be with the help of some material object, model, teaching instruments and illustrations auxiliary teaching tool to demonstrate and explain the content need to explain, so as to achieve presenting the knowledge to the students. The teaching tools in the teaching of course are indispensable, but they also have limitations in some cases: It can't present the details of knowledge to students, for example, can not reflect the movement of the process of change, such as the wave propagation process, the growth process of the seed. Although sometimes the video is used to express the content, but such a method can't be coordinated to explain the content of the teachers. The computer assisted instruction can use the multimedia way to directly display the image of the teaching content in front of the students, which not only attracts the attention of students, but also deepens the understanding of the knowledge of the students. In view of the current environment of the Computer Assisted Instruction, Computer Assisted Instruction's advantages can be summarized as the following aspects:

Computer assisted instruction uses the way of multimedia to make some abstract, microscopic and complex dynamic process really materialized and focused. In biology class, teachers can use computer software to create a simulation of the division process to explain the division of cells, so that students can grasp the point of view of this knowledge in an intuitive (Huber, T., Baumgart, J., Peterhans, M., Weber, S., Heinrich, S., & Lang, H., 2016).

Computer Assisted Instruction increases the content of classroom teaching capacity, improves the efficiency of classroom teaching, and broadens the students' knowledge. Simply explaining is difficult to attract students. The teaching content can be demonstrated to the students through the computer, so as to make the students have the feeling of the scene.

The storage time of knowledge system is long, the traditional teaching method is just to present the teaching content on the blackboard, if there are more content, it needs to cover the knowledge in front of the blackboard (Feczko, P., Engelmann, L., Arts, J. J., & Campbell, D., 2016).

### 3.2. Cognitive Student Model

The student model is used to represent the students' cognitive status, and through the interpretation of the activities of the students to draw his mastery of teaching resources and skills. In the system, each student has a unique ID identity, which can establish unique learning resource, learning information and feature database. The realization of the intelligent system of the system is how to dynamically and correctly extract the features of the students' subject.

In general. The system can use the teaching resource tree model to represent the students' mastery of the teaching resources. For example, setting the entire teaching resource tree is *dkt*, the knowledge tree that students have learned is *skt*, the knowledge tree that has not learned is *snkt*, the knowledge tree that the student has already mastered is *gkt*, the knowledge tree that the student has not mastered is *gnkt*. Then,  $\{snkt\}=\{dkt\}-\{skt\}$ ,  $\{gnkt\}=\{skt\}-\{gkt\}$ . If both *snkt* and *gnkt* are empty, it means that the student has met the requirements of the study. Among them, if the *gnkt* is not empty, then the students can't enter the next stage of learning, they can only repeat learning and supplementary exercises, until *gnkt* is empty, they can enter the next phase of learning. The deviation model and the coverage student model reflect the student's learning level, but the main function of cognitive ability in the learning process is ignored, which can't reflect the cognitive ability and the stage of the learners, and it is very important for the students and teachers. Cognitive student model can not only reflect the level of knowledge of students, but also reflect the students' cognitive ability and psychological factors.

### 3.3. General Structure of Cognitive Model

#### 3.3.1. Level of Cognitive Ability

The famous American psychologist Bloom divides teaching objectives into 3 areas: the cognitive field, the action skill field and the emotion field. The cognitive ability of the target according to the complexity of the cognitive activities can be divided into six grades: memorizing, understanding, application, analysis, synthesis and evaluation. In the construction of student model, in addition to realize the the data description of the cognitive ability, and the cognitive ability should be carry on the quantitative assessment and measurement. According to Bloom classification, a six element array is used to define the student model:

$$T=(a_1, a_2, a_3, a_4, a_5, a_6) \quad (1)$$

Six element array of the model corresponds to students memorizing, understanding of the curriculum and knowledge layer. First of all, the different weights of the 6 kinds of abilities are given. Setting  $a_1$ =memorizing ability,  $a_2$ =comprehension ability,  $a_3$ =specific application ability,  $a_4$ =analytical application ability,  $a_5$ =comprehensive utilization ability,  $a_6$ =complex integrated applications. When the system is initialized, the corresponding weights are paid. For example, in the computer application basic, the value of the individual teaching system is:

$$a_1=0.11, a_2=0.13, a_3=0.16, a_4=0.19, a_5=0.20, a_6=0.21 \quad (2)$$

Weight matrix is composed of cognitive ability:

$$T=(0.11, 0.13, 0.16, 0.19, 0.20, 0.21) \quad (3)$$

According to the test results, the matrix is concluded, such as the WORD2003 graphics and text mixed, knowledge point of the test result matrix is:

$$S=(90, 80, 80, 90, 85, 90) \quad (4)$$

Calculating:

$$X=T \times S=0.11 \times 90+0.13 \times 80+0.16 \times 80+0.19 \times 90+0.20 \times 90=83.1 \quad (5)$$

Designing five level evaluation index system:

$$A=90 \sim 100, B=80 \sim 89, C=70 \sim 79, D=60 \sim 69, E=0 \sim 59 \quad (6)$$

Compared with X value, the student model is constructed. The score of the knowledge point test is 83.1, belongs to B class.

### ***3.3.2. Composition of the Cognitive Student Model***

The cognitive model is composed of the student model base and the student personality inference engine. The student model base is used to record the current state knowledge of the students. Student individual reasoning machine is mainly responsible for the student's cognitive ability, so as to judge and evaluate the status of students knowledge management, including input, modify, delete and so on.

### ***3.3.3. Characteristics of Cognitive Model of Students***

The cognitive model is constructed based on the theory of cognitive psychology, which not only records the students' knowledge ability, but also records the students' cognitive ability. The dynamic management of students is realized. Students are not subject to time constraints in the exercise or test process, it avoids poor students with poor learning ability to finish all the questions. The system records the total time spent in the exercise test. So that the teacher's model can distinguish the learning situation of different students.

## **3.4. Introduction of the Main Modules of the Cognitive Student Model**

In order to achieve providing different decisions on the basis of different student information, the student model is composed of three units, the evaluation unit, the diagnosis unit and the recording unit. The evaluation unit is used to realize the comprehensive evaluation of students' learning situation and cognitive ability (Bartholomew, A., Test, D. W., Cooke, N. L., & Cease-Cook, J., 2015); and the diagnostic unit is used to find the error and the source of error in the process of learning, so as to correct the error; and the recording unit includes knowledge tracking, information

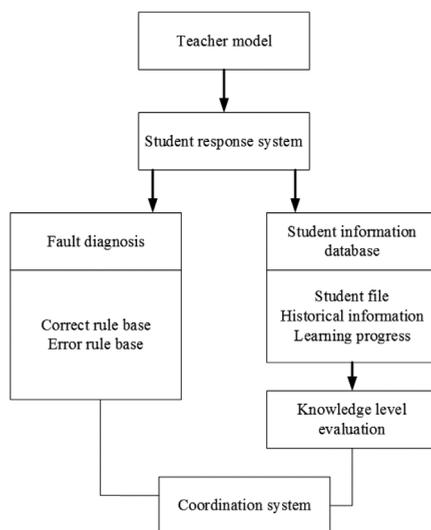


Figure 1 – The General Structure of the Student Model

feedback and record. The function of student model is realized by these three parts. The general structure of the student model is shown in Figure 1:

### 3.5. Establishment Method of Cognitive Student Model

In the last 20 years, several establishment methods of cognitive student model have emerged.

#### 3.5.1. Overlay Model

The overlay model is the earliest student model based on artificial intelligence, it is based on a subset of the knowledge that students master is always the correct professional knowledge (expertise or expert knowledge) (Arron, B. L., & Cooper, R. L., 2015) to construct. If the students' performance in the interaction shows that he has mastered a knowledge point of professional domain knowledge, the overlay model will be recorded. There is no record of the knowledge point is the focus of the need for further study, in order to achieve the coverage of all knowledge points. More complex and accurate overlay model can be used to evaluate that whether the students really have mastered some knowledge points. The overlay model can be represented by Figure 2.

#### 3.5.2. Bug Library

In order to solve the problems of the shortcomings of the overlay model, many researchers have focused on the construction of a student's misunderstanding or bias of the database, called the Library Bug. In the deviation model (Li, W., O'Brien, J. E., Snyder, S. M., & Howard, M. O., 2016), it is needed to construct a bug library by hand in advance through analyzing the mistakes that the students easy to commit. A student model is obtained by comparing the behavior of the students with a kind of errors in the bug library. Deviation model can be expressed by Figure 3.

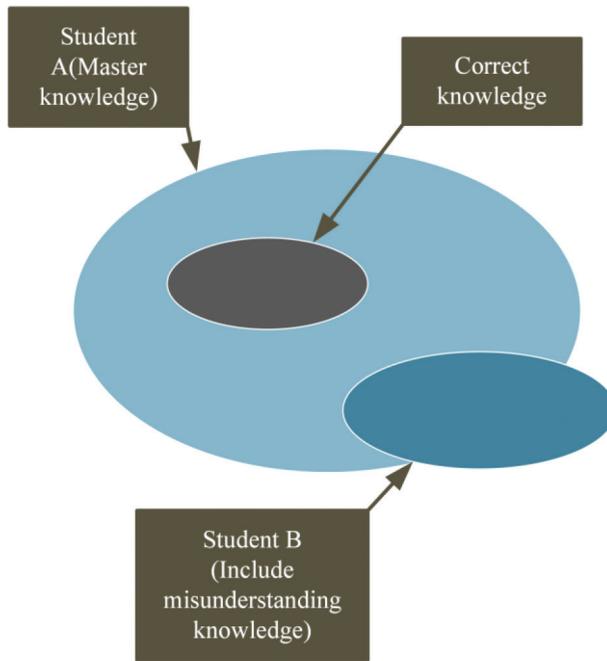


Figure 2 – The Overlay Model

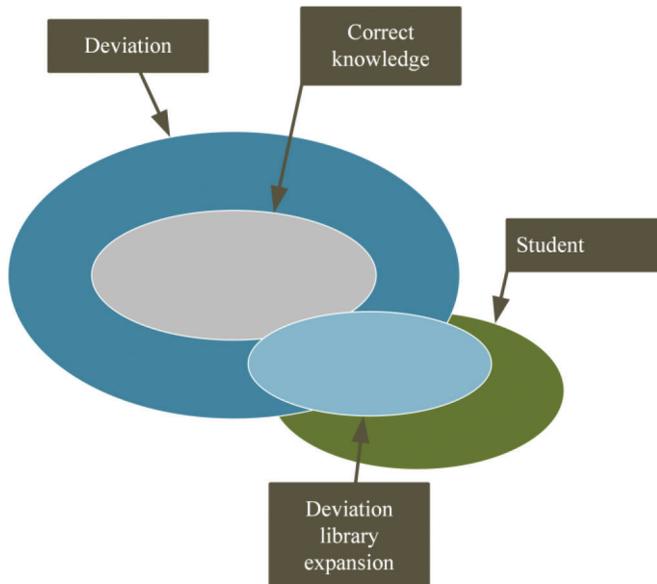


Figure 3 – Deviation Model

## **4. Design of Student Model**

The performance of the student model directly determines the performance of ICAI system. This paper combines the advantages of the construction methods of some classical student models (Schwarz, N., Flacke, J., & Sliuzas, R., 2016), and avoid the shortcomings of the models, and through the delay of computer technology making the complexity of the model greatly simplified.

### **4.1. Student Model**

The function of the student model is to currently reflect the knowledge level and learning ability of the students. It is a systematic method to record, evaluate and predict what the students know, what they can do and what they want, provide the basis for the teacher's model to determine the teaching content and improve the teaching method. Along with the progress of the students learning, the domain knowledge and the structure of the students will be changed, student model will also be changed. But in a period of time, the teaching content, organization form is relatively stable, this paper attempts to derive the structure of the student model in the form of this organization (Noh, J. W., Kwon, Y. D., Jung, J. H., Sim, K. H., Kim, H. S., Choi, M., & Park, J., 2015), and observe the cognitive status of students at this stage and the group knowledge.

### **4.2. Structure of Domain Knowledge**

The domain knowledge is indicated by the logical relationship between knowledge points and knowledge points, a knowledge point corresponding to a concept, a topic or a basic unit. Each knowledge point is accompanied by a set of tests to test the students' mastery of the isolated knowledge; the logical relationships between knowledge points represent a (or a set of) knowledge point relative to another (or a group) knowledge point. Due to the hypermedia technology developing from the introduction of hypertext by the multimedia technology, it takes the node as the unit to organize the information, links the nodes through the chain, which forms the information net to express the specific content, breaks the restriction that the original text system can only be accessed in the order of order. So it is very suitable for us to adopt the way of hypermedia to organize the domain knowledge and their relations of ICAI system.

Knowledge points and their relationships can be represented by a AND/OR graph, as shown in Figure 4. The directed chain represents the logical connection between knowledge points, to master the knowledge of the chain source, it is necessary to have a certain knowledge of the sink chain. The degree of connection between each knowledge point is given by the weight of the chain. There are two types of dependency relationships between knowledge points of chain source and knowledge points of sink chain. AND chain (connected with the arc), indicating that all the knowledge points located in the sink chain are the necessary conditions to master the knowledge points of the chain source; the OR chain indicates that it can adopt many ways (means multiple knowledge point of sink chain.) to grasp the knowledge points located in the chain source.

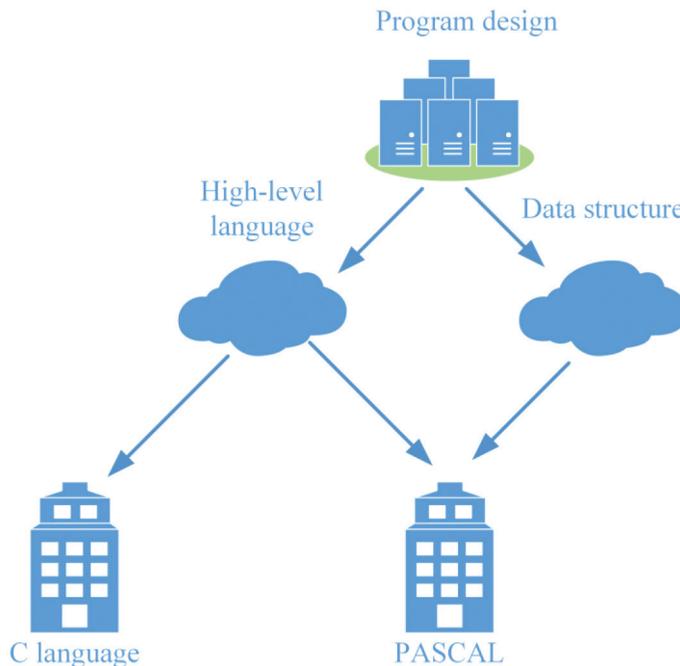


Figure 4 – AND/OR Graph

### 4.3. Practical ICAI Student Model

The student model can be regarded as a kind of approach to the knowledge level of a student in the learning process. On the whole, it is similar to the overlay model, through tracking and monitoring the learning and test situation of the students on a node in the AND/OR chain, to mark the node with fuzzy measure. Equivalent to imitate mastery of knowledge of the students in a single concept, it can adopt performance measure or the method of bug library. With the interaction between the system and the students, the fuzzy measure on the node is transmitted between the nodes of the AND/OR graph, this can evaluate the mastery of the students to the knowledge hierarchy of the teaching target. The evaluation of students' cognitive level in the AND/OR graph is achieved by the fuzzy measure propagation of the two directions, the forward chain (From the current knowledge to prepare knowledge) and the backward chain (From the prepare knowledge to current knowledge).

### 4.4. ICAI Application in Student Model

Overall assessment of students' cognitive status.

The teacher model can adopt the following methods to accurately understand the overall cognitive status of students, and to take the corresponding decisions. First, the AND/OR graph is converted into AND/OR tree at the concept level, the public prepare knowledge node is copied to the two position in "concept", as shown in Figure 4-4 K node and its



Figure 5 – Classroom Teaching

branch T. Then scan the AND/OR tree according to the follow-up method, during the scanning process, the passing of the fuzzy measure is gradually achieved between the nodes. After the whole AND/OR tree scanning, according to the lower, bound U, B that the teacher model given, ( $U, B \in [0,1]$  and  $U > b$ ), then, evaluating the nodes and the obtaining overall cognitive status of the students. Concrete can be expressed as: I of any AND/OR tree node, the node corresponding to the knowledge point is one of the following. From the AND/OR graph to the AND/OR tree is only a “concept” conversion, did not cause the same node multiple redundant, it will not happen the problem that the same node is not the same; because the concept of replication also took away the K nodes of the branch t (As shown above), according to a sequential scan will inevitably get correct results of any one node (Ogle, A. D., Barron, L. G., & Fedotova, A. V., 2016).

Determine the students’ learning desire, recommend learning program.

In the process of learning, students can freely browse any information in the hypermedia network, start the test unit of some knowledge points, and leave some records to the student model. According to the student’s view history and the AND/OR chain can infer the learning desire of the students; through the record and AND/OR graph in the student model, it also be able to find the ignition ability and the ability that will quickly



Figure 6 – Computer Assisted Instruction

have of the node (that is, knowledge points), according to the teaching objectives to sort these nodes, then we can get the learning program that the system recommended.

## 5. Experimental Analysis

In this paper, the teaching mode of the traditional physical education model and the Intelligent Computer Assisted Instruction system based on cognitive student model are experimented and analyzed. The experimental objects are two natural classes that randomly selected from 2014 undergraduate class teaching, Sichuan Normal University. Respectively, the experimental class and the control class, in which the experimental class uses the ICAI system, while the control class uses the traditional teaching. From the two aspects of the effect of teaching and learning performance to compare, as shown in the following figure:

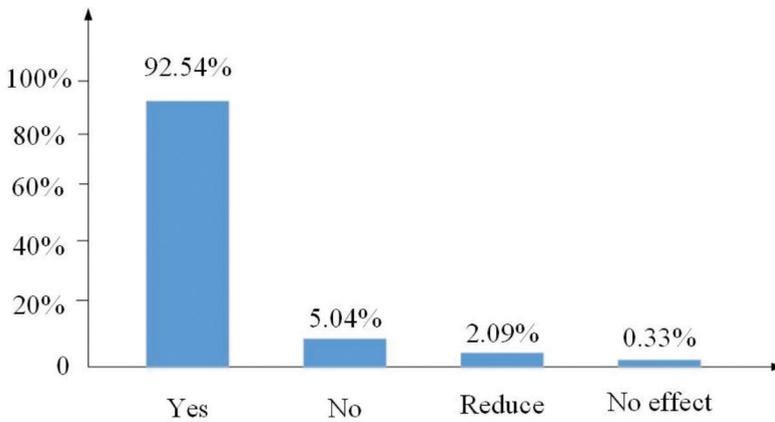


Figure 7 – Whether Reinforcement Learning Interest

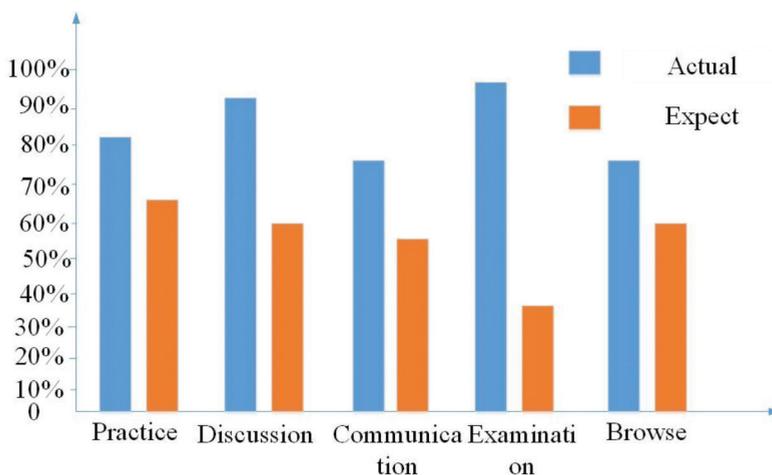


Figure 8 – Expected Usage and Actual Usage

The experimental results show that the effect of classroom learning in the experimental class is better than that of the control class. The teaching mode of the experimental class not only extrudes the teacher's leading role, but also fully embodies the cognitive subject status of college students, which makes the positive and good interaction among the elements in the education activities, so as to improve the enthusiasm of the students and cultivate the students' cognitive ability.

## 6. Conclusion

Intelligent Computer Assisted Instruction system (ICAI) integrated with artificial intelligence, computer technology and educational psychology, and other disciplines, has become a new field of vigorous development at present. This paper mainly analyzes the different realization methods of the cognitive student model in the ICAI. This paper first analyzes the limitations of CAI in the application and the development history and the advantages of ICAI, as well as the research status and hot spots of ICAI. Based on the theory of CAI, this paper expounds the theoretical basis of ICAI - cognitive learning theory, the realization of a student model is systematically expounded, and a practical student model based on cognitive theory is constructed in theory. According to the student model, adopting appropriate teaching strategies is the key to realize the intelligent, personalized teaching of the ICAI system. Choosing the appropriate teaching method is an important part of the teaching strategy. In this paper, on the basis of the evaluation of cognitive student model, the concrete index system of system evaluation is put forward, which provides a strong basis for the development, design and selection of ICAI system.

## Acknowledgment

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# Research on QoS Flow Control Method Based on OpenFlow Technology

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**Abstract:** With the emergence of a large number of multimedia applications on the Internet, the higher requirements for the quality of network services are put forward. At present, most of the existing Quality of Service (QoS) flow control methods have low utilization rate of network resources, poor reliability, coarse grain size, difficult implementation and poor scalability. Therefore, a QoS flow control method based on the OpenFlow technology is proposed in this paper. The separation new ideas of control layer and data layer that proposed by the software defined network (SDN) are referenced on the basis of the brief introduction of QoS, OpenFlow technology and Open vswitch, and the adaptive multi constrained QoS routing technology is used to design the QoS flow control method based on the OpenFlow technology. The experimental results show that this method can improve the flexibility and reliability of QoS control, and realize the efficient utilization of network resources and the fine granularity of traffic flow control. The QoS flow control method based on OpenFlow fully plays the advantage of SDN network, and realizes the reliable transmission and fine granularity control of QoS flow, so as to achieve the efficient utilization of network resources.

**Keywords:** Software defined network; quality of service; traffic control; adaptive.

## 1. Introduction

With the extensive transmission of audio, video and other multimedia resources on the Internet, people put forward higher and higher requirements on the performance of the network. Such as real-time multimedia requires high bit rate throughput, network game requires low delay jitter rate. The current network system is difficult to meet the Quality of Service (QoS) demand for these services. How to effectively use the limited network resources to meet the QoS needs of these businesses has become a key problem in the development of Internet. Although some QoS solutions have been proposed, but there are a lot of problems. For example, the Integrated Services model (IntServ) focuses on the required parameters of each flow, which uses the Resources Reservation Protocol (RSVP) to reserve the network resources. This requires that the routers on the path run the same protocol and cache all streams information. Therefore, it is necessary for the IntServ itself to carry out real-time monitoring of the data flow, which causes the complex realization, poor expansion and other disadvantages. Differentiated Services model (DiffServ) uses the service

level field in the packet to carry out the classification, marking and aggregation of the stream. DiffServ mainly provides the guarantee of differentiated services for the converging flow, which can't achieve the fine-grained control of convection (Zapata, B. C., Niñirola, A. H., Fernández-Alemán, J. L., & Toval, A., 2014), and can't guarantee the QoS of each flow. In addition, Multi-Protocol Label Switching (MPLS) uses its fast exchange capacity to achieve some functions, but it lacks of the real-time configuration and adaptability. MPLS-DiffServ requires static classification of QoS streams, and requires to install special software and hardware. Software defined network (SDN) provides new ideas for solving the existing problems of QoS flow control mechanism in the existing network system, and gradually becomes a hot research topic in the field of network. This paper puts forward the adaptive QoS-guarantee flow control method based on Openflow, which fully plays the advantages of SDN network and realizes the reliable transmission and fine-grained control of QoS flows so as to achieve the effective use of network resources.

## 2. Research Status

OpenFlow is a new kind of network architecture based on the TCP / IP technology, which carries out the revolutionary reform on the basis of traditional network architecture, including new OpenFlow network model and application protocols. OpenFlow is a standard protocol in SDN, which is mainly used to implement communication between control layer and bottom layer equipment. OpenFlow network is mainly composed of OpenFlow controller and OpenFlow switch. OpenFlow switches on the market are mainly divided into two categories: based on hardware and software. In recent years, many scholars have put forward the solution to the QoS flow control in SDN network. Scalable video streaming QoS flow control method (Picher, C., Anguera, J., Bujalance, A., & Andújar, A., 2016) reduces the length of the QoS path as far as possible, at the same time, when the link is congested, the basic layer of the video stream is rerouted to ensure the video quality (Civanla et al. 2010). QoS routing algorithm (Egilmez, H. E., Dane, S. T., Gorkemli, B., & Tekalp, A. M., 2012) applies the CSP problem in the multi constrained routing problems to the SDN network, the link and time delay information obtained by the controller is used to calculate the path of QoS flow, so the better service quality is obtained (Egilmez et al. 2012). Framework of the flexible configuration of QoS strategy under SDN network (Bairwa, S., Memon, S., Wakhet, O., Sambyo, K., & Saha, A. K., 2015) solves the QoS configuration constraints from provide side to server side, and reaches the effective use of network resources, it also allows the network to carry on elastic dynamic configuration on the basis of the service, and avoids excessive Internet configuration (Buen et al. 2013). QoS strategy automation deployment framework (Du, Q., & Zhuang, H., 2015) mainly puts forward whether the QoS strategy can be implemented accurately, and establishes the implementation of policy violation mechanism (Bari et al. 2013). QoS aware algorithm (Colombo-Dougovito, A. M., & Block, M., 2016) mainly achieves the purpose of QoS flow control through the different routing between QoS flow and non QoS flow (Tomovic et al. 2014). However, most of the QoS flow control methods have the problems of low utilization rate of network resources, poor reliability, coarse grain size, difficult implementation and poor scalability. Based on this, this paper uses the virtual OpenFlow switch open vswitch based on the software. OpenFlow controller is the control unit for the whole

network in OpenFlow network, it can control all the behavior of the switch, so as to control the behavior of the whole network traffic. In addition, OpenDaylight (ODL) controller is powerful, extensible, and easy to design and add function modules, it is the controller used in this paper. The remainder of this paper is organized as follows. Section 3 describes the key technologies used in this paper. Section 4 gives the design process of QoS flow control method based on OpenFlow technology. Section 5 presents a real experiment to evaluate the performance of this method. Conclusion is summarized in Section 6.

### **3. Related Technology**

#### **3.1. QoS Technology**

QoS is a network security mechanism, it is also a kind of technology to solve the network delay and congestion and other issues. Specific indicators can be quantified as the transmission delay, jitter, packet loss rate and other indicators. In recent years, IETF has put forward many service models and mechanisms, but they all have some deficiencies. (Zuo Qingyun, Chen Ming, Zhao Guangsong, et al., 2013) In the commonly used QoS models, the RSVP and IntServ have the disadvantages of poor scalability and high routing load. The disadvantage of DiffServ is that it can only provide relative QoS protection. Therefore, at this stage, QoS research generally combines the two, but it still faces the problem of large workload of the router.

#### **3.2. OpenFlow Technology**

OpenFlow technology is an open protocol standard, at the same time, as a sub project of the GENI program, it is mainly used in the new agreement and the new business applications on the existing network. (Li Yingzhuang, Sun Meng, Li Xianyi, et al., 2011) OpenFlow technology uses centralized control method, a (or more) center controller that contains the whole network topology through an open protocol to directly program the flow tables in the different switches and routers, so as to control the flow of each data packet. (Lakshantha, E., & Egerton, S., 2016) The essence of this technology is to centralize the control functions of the router, which is controlled by the controller, and the router only performs the work of data forwarding, so as to reduce the workload of the router. Experiments show that when using a simple desktop to act as the controller, 10000 streams can be handled per second. This also proves that the OpenFlow technology doesn't have a new bottleneck because of the controller. (Tiew, F., Holmes, K., & de Bussy, N., 2015).

#### **3.3. Opendaylight Controller**

OpenDaylight is an open source SDN framework based on the community. It was founded in early 2013 by the Linux Association. Which aims to become a leading software defined network technologies. The goal of OpenDaylight is to make users reduce the complexity of the network operation and extend the life stage of the existing network architecture in hardware as a core component of the SDN architecture, while also can support the innovation of the SDN new business and new capabilities.



Figure 1 – OpenFlow Technology

### 3.4. Open Vswitch Switches

Open vSwitch, that is, open virtual exchange standards, the specific point that Open vSwitch is the multi layer virtual exchange standard for product quality under the open source Apache2.0 license. It aims to make the huge network automation (configuration, management, maintenance) through programming extensions, and also supports the standard management interfaces and protocols.

### 3.5. Lagrange Relaxation Algorithm

Basic principle of lagrange relaxation method is the problem is absorbed into the objective function, and the objective function of the linear is maintained, so that the problem will be easier to solve.( Tao Zhiyong, climax., 2015) The optimization objective of which is to reduce some constraints in the original problem in some combinatorial optimization problems, so that the difficulty of solving the problem is greatly reduced.

Given integer model:

$$\begin{cases} Z_{IP} = \min c^T x \\ Ax \geq b, \\ x \in Z_+^n \end{cases} \quad (1)$$

When the problem RP:

$$RP : Z_R = \min Z_R(x) \quad (2)$$

Meets the following nature, which is known as a relaxation of the original integer programming problem (relaxation):

Feasible solution region compatibility: S is a feasible region for the original integer programming problem.

$$S \subseteq S_R \tag{3}$$

Objective function:

$$c^T x \geq Z_R(x), \forall x \in S \tag{4}$$

## 4. Design of QoS Flow Control Method Based on OpenFlow

### 4.1. QoS Flow Control Framework

Although the proposed method for QoS flow control in SDN network can achieve QoS flow control to a certain extent, there are still some limitations, such as low utilization rate of network resources, poor reliability, coarse grain size, difficult implementation, poor scalability and other problems. In this paper, the QoS-guarantee method is proposed to take full advantage of the SDN flow control capability, and take into account the control granularity, flexibility, scalability and other factors. (Liu, M., Xu, Y., & Mohammed, A. W., 2016) The QoS-guarantee flow control method proposed in this paper is mainly designed and implemented in the SDN controller, and the concrete frame is shown in Figure 2.

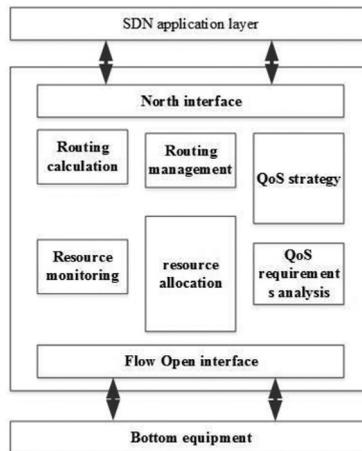


Figure 2 – QoS flow control framework

QoS flow control framework mainly includes network resources monitoring, QoS requirements analysis, QoS strategy library, QoS routing calculation and management, resource allocation, access control module. Each module is described below.

#### 1. Network resource monitoring module

Network resource monitoring module is used to count and monitor the current network link state information, including network link congestion, link usage bandwidth, delay, jitter and packet loss rate information, and based on the OpenFlow protocol. Therefore, assuming that the number of bytes of a port in the unit time T is S, the bandwidth approximation of the link is S/T. Delay of the switch is mainly considered in the link

delay, which is based on the time stamp method, and the average time delay of the data packet is the approximate time delay. Assuming that a packet enqueue time is  $T_1$ , a port forwarding time is  $T_2$ , the forward delay is:

$$\Delta T = T_2 - T_1 \quad (5)$$

Average delay:

$$delay = \sum \Delta T / N \quad (6)$$

$N$  is the number of data packets for cycle statistics. Jitter is obtained as a first order derivative of the delay. Packet loss rate  $loss = \text{lost bytes} / \text{number of bytes sent}$ .

## 2. QoS strategy and requirements analysis module

QoS policy module is used to develop strategies for QoS flows,( Reddy, C. R., Poppa, T., Chen, K. H., Anderson, S. W., Damasio, H., Love, T., & Hickok, G., 2015) including policies for specific applications or for a particular user, and can also be a priority policy, a routing policy, and so on. The business flow is controlled by the strategy of artificial, and the high priority flow table is made for the corresponding data stream in advance. QoS requirements analysis module is carried through the QoS information to carry on the analysis of the data packet, which is used to obtain the bandwidth, delay or packet loss rate and other QoS requirements of the business flow. At present, the controller in SDN network doesn't require parsing mechanism for the service flow QoS. The flow table matching field defined by OpenFlow contains a series of matching domain, which can be very good to support most of the basic protocols the L2-L4 layer. So the QoS message transfer mechanism between the controller and the server can be established. This article achieves developing the corresponding QoS requirements for different ToS field through the analysis of the ToS field.( Ptak, M., 2015).

## 3. QoS routing calculation module

QoS routing calculation module through the routing algorithm that gets from the network host, switch, topology, link information and the specified QoS to calculate the path to meet the requirements of the QoS transmission. The specific process of the routing algorithm is: firstly, the link which doesn't meet the requirements of transmission bandwidth is removed, and then the path that meets the delay, jitter and packet loss rate is found in the remaining network topology. (Ma, C., Wu, L., Jiang, Y., Yu, H., Bi, Z., & Ma, L., 2015) It is consistent with the multi constrained routing problem ideas. When the constraint condition is not less than 2, it is the NP-complete problem, so the problem is reduced to RSP in order to reduce the complexity of the problem. The delay requirements of QoS flow are used as the main constraint conditions, jitter and packet loss rate are used as the cost parameters of QoS flow, QoS routing can be found to satisfy the delay constraint. (Li, T., Yang, G. J., & Deng, F. G., 2016).

Network topology can be represented by a simple directed graph  $G(N, A)$ , where  $N$  represents the set of switches in the network, and  $E$  represents the network link set.  $S$  represents the sending side,  $d$  represents the receiving side.  $(i, j)$  node represents the link

between the  $i$  node and the  $j$  node.  $r_{st}$  represents all routes between the sender and the receiver,  $r$  represents the path. The link that does't meet the requirements of bandwidth is deleted. Any  $r \in r_{st}$  routing can be defined:

$$f_c(r) = \sum_{(i,j) \in r} c_{ij} \quad (7)$$

$$f_d(r) = \sum_{(i,j) \in r} d_{ij}$$

Where  $d_{ij}$  represents the time delay of routing from node  $i$  to  $j$ , and  $c_{ij}$  represents the cost of routing from node  $i$  to  $j$ , which is defined as:

$$c_{ij} = (1 - \beta)g_{ij} + \beta p_{ij}, 0 \leq \beta \leq 1 \quad (8)$$

Where  $g_{ij}$  represents the delay jitter between  $i$  and  $j$ ,  $p_{ij}$  represents the packet loss rate between  $i$  and  $j$ . So the mathematical formula that satisfies the time delay and the lowest cost of the routing can be expressed as:

$$r^* = \arg_r \min \{ f_c(r) | r \in r_{st}, f_d(r) \leq d_{\max} \} \quad (9)$$

Where  $d_{\max}$  represents the delay requirements of the QoS stream. For this multi constrained routing problem, a lot of mathematical algorithms are proposed, such as dynamic programming algorithm, backward forward heuristic algorithm, Lagrange linear combination algorithm and hybrid algorithm. Lagrange relaxation algorithm is adopted in this paper. Lagrangian relaxation algorithm is a classic algorithm to solve the mathematical combination optimization problem. The basic idea is to exchange the optimization problem into the solution problem of the linear function, makes the solution procedure simple through the transformation of the constraint conditions for the parameters of the objective function.

#### 4. QoS Routing management and resource allocation module

QoS routing management module is used for the generation of QoS flow resource allocation flow table and the state of QoS routing, including delay, jitter, packet loss rate and so on. Once the requirements of QoS flow transmission are not met, it is needed to re calculate the route, flow table is the OpenFlow protocol of the switch in the definition of forwarding rules. The instruction set of the metering band type and the flow table defined in the OpenFlow metering table can be used for speed limiting and queue priority services. Therefore the resource allocation module obtains the path and the allocation of resources flow table from the QoS routing management module, passes the table information to the forwarding rule management module to generate a stream table, and sends to the bottom equipment, so as to create a high priority queue for the QoS flow and ensure the transmission bandwidth.

#### 4.2. Implementation Framework of QoS Flow Control Based on OpenDaylight

In this paper, the OpenDaylight controller is used to implement the QoS flow control method. The OpenDaylight control layers mainly includes the service abstraction layer (SAL layer) and the basic network service function. The SAL service layer supports a variety of

South shields, avoids the differences between the protocols, and provides consistent service for the upper module and the application. The services include packet services, topology services, streaming programming services, resource query services, connection services, statistical services, list services and so on. The basic service function modules include the topology management module, the statistical management module, the switch management module, the forwarding rule management module and the host computer tracking module. The block diagram of the module based on OpenDaylight is shown in Figure 3.

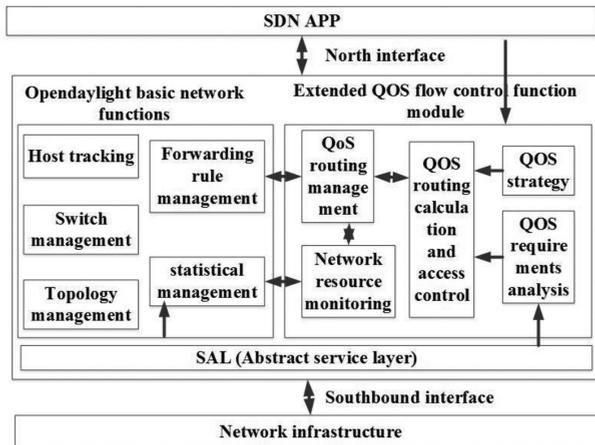


Figure 3 – Block Diagram Based on OpenDaylight

### 4.3. Implementation Process of QoS Flow Control Method

Based on the analysis of the framework and OpenFlow1.3 protocol of OpenDaylight, this paper designs the QoS flow control workflow, as shown in Figure 4. The establishment process of the flow includes: first of all, the first data packet is sent to the controller, the controller data packet can be extracted from the ToS field of the data packet. If the tag belongs to the QoS flow of QoS routing, the ToS field information is further analyzed, so as to get the QoS requirements of the pre established parameters. At the same time, the controller inquires the network link state information every 2 seconds, which is mainly from the view of OpenvSwitch point, in the experiment, the value of the counter from the kernel to the user space is 1seconds.

## 5. Experimental Analysis

### 5.1. Experimental Environment

IPerf is used in the experiment to generate different types of flow. IPerf can generate the specified length, specify the time, and the specify type of data stream. Before the experiment, the bandwidth of the main transmission link is set to 100Mbps. The main test indicators of the experiment are: throughput and packet loss rate. Table 1 indicates the information of the data stream generated in the experiment, including the rate, the transmission protocol, the ToS field, the source host and the generation time.

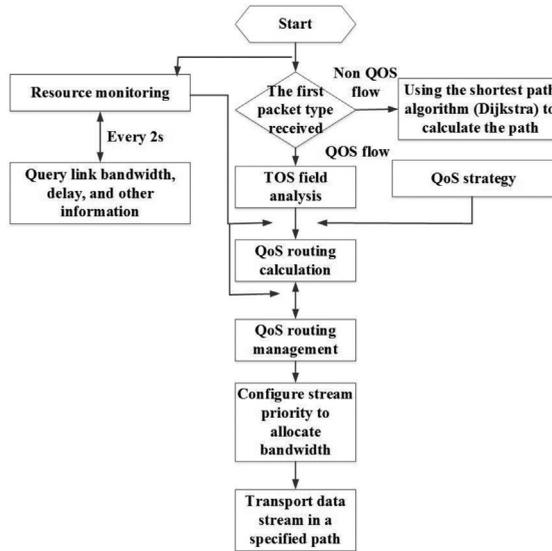


Figure 4 – Implementation Process of QoS Flow Control

Flow number	Source host -destination host	Transport protocol	Rate	TOS field	Generation time
Flow1	h1-h3	UDP	30Mbps	4	0
Flow2	h1-h4	UDP	40Mbps	8	10s
Flow3	h1-h3	UDP	60Mbps	0	30s
Flow4	h2-h4	UDP	60Mbps	0	50s
Flow5	h2-h3	UDP	50Mbps	12	70s
Flow6	h2-h4	UDP	60Mbps	16	90s

Table 1 – Experimental Data Stream

### 5.2. Experimental Results Analysis

Through the comparison of the experimental results of the throughput and the packet loss rate, it can be seen that when the QoS flow control is not taken, each stream competes with each other for bandwidth and randomly assigns to the limited bandwidth. Which leads to the low throughput of each stream, the network resources are not effectively utilized, so as to leads to the serious loss of the packet loss rate. Despite the non QoS flow is rerouted to guarantee the transmission requirements of QoS to realize the load balancing and QoS flow assurance to a certain extent, but the QoS flow is not divided, which leads to part of the high QoS flows can't obtain the throughput that meets the requirements, and affects the reliable transmission of part of QoS flows. So the QoS-guarantee flow control method is put forward in this paper, controller gets the QoS flow bandwidth requirements by analyzing the flow of the TOS field, and distributes the required bandwidth to the corresponding QoS flow, then the throughput reaches the requirements, so as to make the rate of packet loss to the minimum, and the network resources get effective use. Although

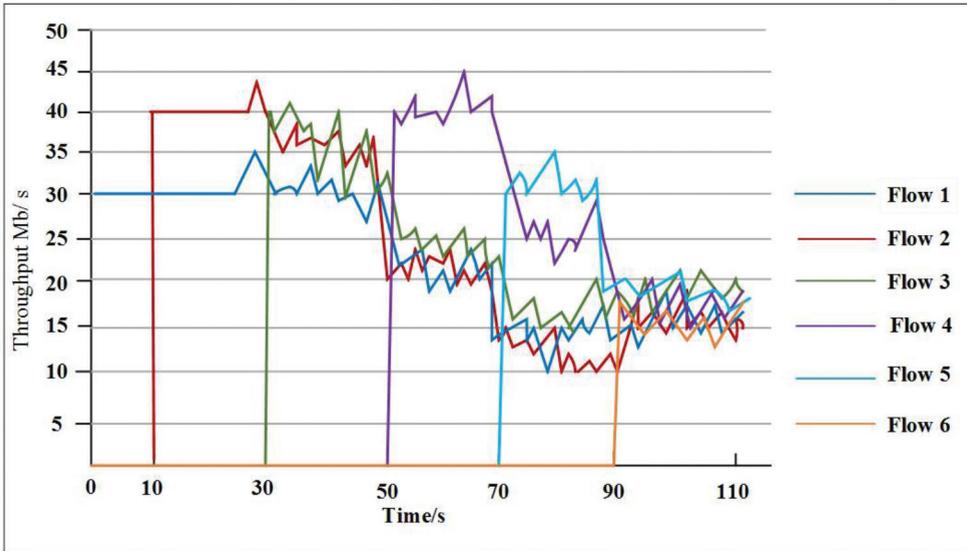


Figure 5 – Throughput Without the Qos Algorithm

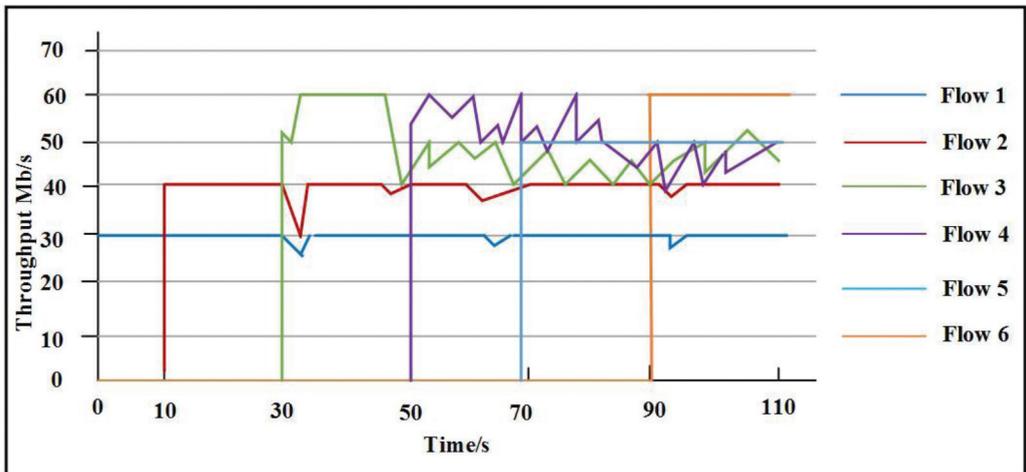


Figure 6 – Throughput With the Qos-Guarantee Algorithm

the transmission of flow3 leads to the throughput of flow1, flow2 reducing and the packet loss rate increasing in 30s, but after 2s, the throughput returns to normal again, the packet loss rate reduces, and the reliable and stable transmission of QoS flow is achieved. To sum up, the QoS flow control method based on OpenFlow realizes the effective utilization of resources, and achieves the reliable transmission control granularity for each QoS flow, and when disturbed, it is able to adjust the route in time to ensure the high reliability and adaptability of QoS transmission.

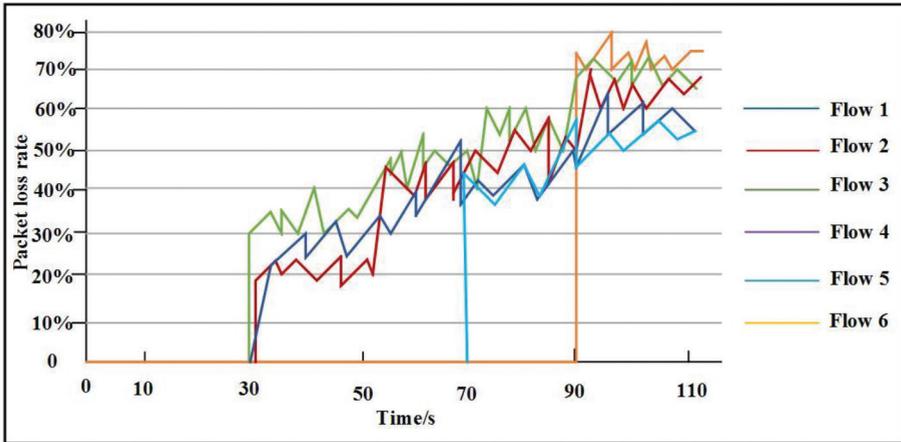


Figure 7 – Packet Loss Rate Without the Qos Algorithm

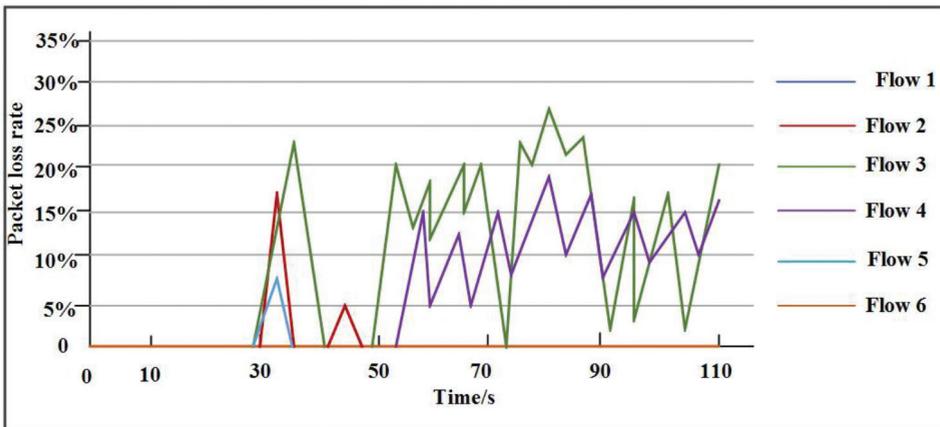


Figure 8 – Packet Loss Rate with Qos-Guarantee Algorithm

## 6. Conclusion

With the extensive transmission of audio, video and other multimedia resources on the Internet, people put forward higher and higher requirements on the performance of the network. At present, most of the existing QoS flow control methods have low utilization rate of network resources, poor reliability, coarse grain size, difficult implementation and poor scalability. In order to solve the above problems and effectively control the flow of QoS, in this paper, the characteristics that the controller can obtain the real-time accurate information of the whole network link and node state are used in OpenFlow network, and the separation new ideas of control layer and data layer that proposed by the software defined network (SDN) are referenced, so as to design the QoS flow control method based on the OpenFlow technology. The experimental results show that this method can improve the flexibility and reliability of QoS control, and realize the efficient

utilization of network resources and the fine granularity of traffic flow control. Compared with other QoS flow control methods under SDN, QoS flow control method based on OpenFlow technology has strong flexibility, reliability, adaptability and scalability.

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# Multi dimension classification method for Incomplete Data Based on Bayesian Network Learning Algorithm

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**Abstract:** In fact, there are a large number of incomplete data, and these data are mostly contained in a serious impact on the classification efficiency and efficiency of the redundant and irrelevant attributes. However, due to the complexity of processing incomplete data, the selective classification algorithm for incomplete data is very rare at present. In addition, with the continuous development of modern information technology, a large number of high dimensional data are emerging. Naive Bayesian is simple and efficient, suitable for processing high dimensional data, but also very sensitive to the choice of attributes. Therefore, it is significant to study the selective Bias classification algorithm for high dimensional data. The redundant or irrelevant attributes of incomplete data can not only reduce the classification efficiency but also can seriously damage the classification effect. Based on the packing method, two selective incomplete data classifiers are proposed. First, the classification effect is more prominent than the incomplete data classifier RBC and search results are good and the relative low complexity of the best pre search method, and a selective incomplete data classifier SRBC was constructed. Through experiments, compared with the efficient RBC and DBCI, SRBC can not only obtain significantly higher classification accuracy, but also significantly reduce the number of redundant and irrelevant attributes.

**Keywords:** SRBC; incomplete; high dimensional data; data classifier.

## 1. Introduction

With the rapid development of information technology and the popularity of computers and the Internet, the ability to generate and collect data from all walks of life is rapidly increasing. How to effectively organize and utilize these data to extract useful information and knowledge has become a major issue in the current information society. Machine learning and data mining is the theory and technology to research and solve this problem. These theories and technologies have been widely used in today's world of science and technology and economy. Classification is to construct a classification function or classification model (also called classifier) based on a predetermined set of data sets, and map the non-categorical data into the process of a given class. Bayesian classification method to establish in Bayesian statistics and Bayesian networks based

on, can effectively deal with the incomplete data, and with the model could explain. Bayesian networks has the advantages of high precision, and is considered to be one of the optimal classification model. Study in-depth study of the naive Bayes can produce good classification effect, found that as long as the class posterior probability estimation values of the order and the true class posterior probability values of the order, you can get the correct classification results, and a posteriori probability of specific estimates regardless of the value (Nava, M., Quhe, R., Palazzesi, F., Tiwary, P., & Parrinello, M., 2015). Semi Naive Bayesian classifier, the attribute variable is divided into several groups, the related attribute variables are divided into a group, the attribute variables in different groups are considered to be conditional independent (De Vries, J. W., Hoogmoed, W. B., Groenestein, C. M., Schröder, J. J., Sukkel, W., De Boer, I. J. M., & Koerkamp, P. G., 2015). K- Dependency Bias classifier, which allows each attribute variable in addition to the class node in addition to the K parent node (Ejarque, M., Mir-Coll, J., Gomis, R., German, M. S., Lynn, F. C., & Gasa, R., 2016). At the same time, tree augmented naive Bayesian classifier, in Tan, class variables no parent node and each attribute variables to class variables and most another attribute variables of the parent node and all variables constitute the whole network structure is tree structure (Sonmez, E., Aydin, E., Turkez, H., Özbek, E., Togar, B., Meral, K., ... & Cacciatore, I., 2016). The BAN and GBN using conditional independence test network learning method is improved, so that the classification effect is improved (Acosta-Cabronero, J., Betts, M. J., Cardenas-Blanco, A., Yang, S., & Nestor, P. J., 2016). At the same time, the super parent Bias classifier is proposed, the model assumes that there is a property variable as the other attributes of the common parent node (called super father) (Hyakusoku, H., Sano, D., Takahashi, H., Hatano, T., Isono, Y., Shimada, S., ... & Oridate, N., 2016). Recently, the qualifying double level Bayesian classification model, attribute set points for the two sub set, the attributes of a subset of attributes as another sub concentrated parent node, and classification effect is better in the Tano (Wang, L., Duan, Q., Yang, F., & Wen, S., 2015). The redundant or irrelevant attributes of incomplete data can not only reduce the classification efficiency but also can seriously damage the classification effect (Mora, A. D., & Fonseca, J. M., 2014). Based on the packing method, two selective incomplete data classifiers are proposed. First, the classification effect is more prominent than the incomplete data classifier RBC and search results are good and the relative low complexity of the best pre search method, constructed a selective incomplete data classifier SRBC. Compared with the efficient RBC and SRBC, DBCI can not only obtain significantly higher classification accuracy, but also significantly reduce the number of redundant and irrelevant attributes.

## 2. Bias Network

Consider a set of  $U = \{X_1, X_2, \dots, X_n\}$ , which is composed of a finite number of discrete random variables, each of which is a finite number of  $X_i$ . Bias network is used to represent the probabilistic dependency graph model of variable  $X_1, X_2, \dots, X_n$ . Formally, a Bayesian network is a two tuple  $B = \langle G, \Theta \rangle$ . Among them, G is a directed acyclic graph, nodes in the graph and the corresponding random variables  $X_1, X_2, \dots, X_n$ . The conditional dependencies between variables are expressed in a graph, which expresses the conditional independence assumption: when a variable of the parent node of a given variable is valued, the variable is independent of its non-successor nodes.  $\Theta$  is

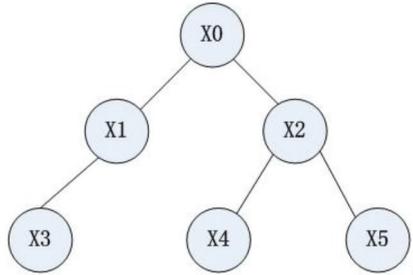


Figure 1 – Sketch Map of Bias Network

about the network of local conditional probability of the parameter set  $\{\theta_{x_i|p\alpha_i}\}$ , where  $\theta_{x_i|p\alpha_i} = P(\theta_{x_i|p\alpha_i})$  is the node  $X_i$  of the parent node set  $p\alpha_i$  configuration for the  $p\alpha_i$ ,  $X_i$  value is the conditional probability of  $x_i$ . (Wang, D., Wright, M., Elumalai, N. K., & Uddin, A., 2016).

From the chain rule of probability, the joint probability distribution of the U determined by the Bayesian network B is (Zhang, Y., Hu, X., Chen, L., Huang, Z., Fu, Q., Liu, Y., ... & Chen, Y., 2016):

$$P(X_1, X_2, \dots, X_n) = \prod_{i=1}^n P(X_i | X_1, X_2, \dots, X_{i-1}) = \prod_{i=1}^n P(x_i | p\alpha_i) \quad (1)$$

For a set of specific values  $\langle X_1, X_2, \dots, X_n \rangle$  of the variable tuple  $\langle x_1, \dots, x_n \rangle$ , the joint probability value  $P(x_1, \dots, x_n)$  can be calculated by the following formula:

$$P(x_1, \dots, x_n) = \prod_{i=1}^n P(x_i | p\alpha_i) = \prod_{i=1}^n \theta_{x_i|p\alpha_i} \quad (2)$$

Usually, the Bayesian network is constructed in 3 steps:

The first step is to determine the variables associated with the problem and determine all possible values of each variable according to the observed values.

The second step, to determine the structure of the Bayesian network: domain knowledge or through learning through the data to determine the dependency relationship between variables, the establishment of a depict variables conditional independence relations of directed acyclic graph (DAG). For each variable  $X_i$ , if there is a subset of  $\Pi_i \subseteq \{X_1, X_2, \dots, X_{i-1}\}$  such that  $X_i$  and  $\{X_1, X_2, \dots, X_{i-1}\} \setminus \Pi_i$  are conditionally independent, that is (Rossi, A., Pederiva, F., Santos, R., Wood, S., & Humphrey, G., 2015):

$$P(X_i | X_1, X_2, \dots, X_{i-1}) = P(X_i | \Pi_i), i = 1, 2, \dots, n \quad (3)$$

From formula (1) and (3),

$$P(X_1, X_2, \dots, X_n) = \prod_{i=1}^n P(X_i | \Pi_i) \quad (4)$$

If  $P\alpha_i$  is used to represent the parent node set of the variable  $X_i$ , then,

$$P(X_1, X_2, \dots, X_n) = \prod_{i=1}^n P(X_i | P\alpha_i) \quad (5)$$

Thus, the  $\Pi_i$  can be used as the parent node set of  $X_i$ . Therefore, in order to determine the structure of the Bayesian network, the need to: (1) the variable  $X_1, X_2, \dots, X_n$  in order to sort the order of a certain order; (2) to meet the formula (3) of variable subset  $\Pi_i (i = 1, 2, \dots, n)$ .

The third step, to determine the parameters of Bayesian networks: the specified or through learning to get the parameters of the local conditional probability set  $(\theta_{x_i | p\alpha_i})$ .

Obviously, second steps and third steps are the key to construct Bayesian networks. These steps may need to be repeated alternately, and a simple sequential execution is often difficult to get accurate Bayesian networks.

### 3. Bayesian Network Learning Under the Condition of Incomplete Data

#### 3.1. Parameter Learning Under the Condition of Complete Data

In general, it is difficult to deal with the problem of parameter learning in incomplete data by means of accurate method, and some approximate methods are usually adopted (Zivadinov, R., Cerza, N., Hagemeyer, J., Carl, E., Badgett, D., Ramasamy, D. P., ... & Ramanathan, M., 2016).

EM algorithm is one of the most commonly used methods of parameter learning in incomplete data. It gets more and more optimized parameters by “seeking” and “taking the maximum” two processes. “Expectation” process calculation of incomplete sample data in each event under the conditions of sufficient statistics expectation value; and the “maximum” using the “expectation” process to obtain the expected sufficient statistics to find the likelihood values (or experimental values) the maximum number of parameters. A likelihood value (or a posteriori) reaches the local maximum, stop iteration. The specific steps of the EM algorithm are as follows:

1. set an initial value for the  $\theta_m$  (which can be set randomly).
2. to calculate the expected full statistics of each event in the incomplete data set.

$$E_{P(x|D, \theta_m, m)}(N_{ijk}) = \sum_{l=1}^N P(x_i^k, P\alpha_i^j | y_l, \theta_m, m) \quad (6)$$

Wherein, N is the number of examples in the data set A,  $y_l$  is the first instance of the data set L, may contain missing values. When all variables in  $X_i$  and  $P\alpha_i$  in the  $y_l$  are not missing value,  $P(x_i^k, P\alpha_i^j | y_l, \theta_m, m)$  or 1 ( $x_i^k, P\alpha_i^j$  configuration in the  $y_l$ ) or ( $x_i^k, P\alpha_i^j$  configuration not in the  $y_l$ ). Otherwise, you can use the current parameters to seek the probability value.

3. using the current expectation sufficient statistics to make the maximum likelihood estimation of the parameters of the likelihood (or posterior):

$$\theta_{ijk} = \frac{E_{P(X|D, \theta_m, m)}(N_{ijk})}{\sum_{t=1}^{r_i} E_{P(X|D, \theta_m, m)}(N_{ijt})} \quad (7)$$

If the maximum a posteriori calculation:

$$\theta_{ijk} = \frac{\alpha_{ijk} + E_{P(X|D, \theta_m, m)}(N_{ijk})}{\sum_{t=1}^{r_i} (\alpha_{ijt} + E_{P(X|D, \theta_m, m)}(N_{ijt}))} \quad (8)$$

Wherein,  $r_i$  is the number of B values,  $\alpha_{ijk}$  is a priori parameters. Iterative second steps and third steps,  $\theta_m$  can converge to the maximum likelihood (or posterior) local maximum.

### 3.2. Structural Learning Under Incomplete Data

In the incomplete data under the condition of the network structure learning to than in the complete data is much more complex. At this time, scoring function cannot generally be decomposed into only with partial structure factor, resulting in the network structure of evaluation as complete data as simple, and the need to perform some of the reasoning process. And when the optimal parameters are given to the network structure, it is necessary to use the EM algorithm or the gradient descent method to optimize the parameters. Therefore, the network structure learning under the condition of incomplete data has a very high computational complexity. In this regard, the most influential research work is the SEM Friedman algorithm. EM algorithm will be the network structure of the greedy search process and the use of EM algorithm to carry out the process of parameter evaluation alternately. The main advantage of this algorithm is that in the search process, only the selected network structure parameters are estimated by EM algorithm, and the EM algorithm is not used in the network which is not selected. After that, the network of the parameters is used to evaluate all the candidate structures. So every evaluation of the current network of the “neighbor set”, only call a EM algorithm, greatly reducing the computational complexity. If the maximum likelihood estimation of a candidate structure is higher than the current network structure, the candidate structure is used to replace the current structure. The process has been carried out until a better network cannot be found (Eldridge, W. J., Sheinfeld, A., Rinehart, M. T., & Wax, A., 2016).

## 4. Packing Method

Packing method is one of the main methods of attribute selection. Figure 2 describes the process of using the wrapper to select the attributes.

The attribute selection algorithm based on the packing method uses the given classification algorithm (such as the Naive Bayesian classifier) to evaluate the attribute subset, and then search the attribute space (set by the attribute subset). For each candidate attribute

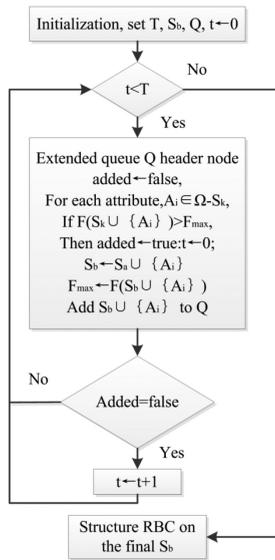


Figure 2 – Process of Feature Selection With Wrappers

subset  $S$ , the classification accuracy rate  $F(S)$  is used as the evaluation value of  $s$  on the  $S$ . In the search for the attribute space, it is necessary to determine the following aspects: the search direction, the initial attribute subset, the initial optimal evaluation, the search mode and the termination condition (Soliman, R., Fouad, E., Belghith, M., & Abdelmageed, T., 2016).

Search direction in general there are three, one is before to search: according to the attributes of some evaluation indicators have been selected to select the best attribute is added to the selected attributes, the selected attribute increasing; second is to search: according to some evaluation indicators constantly from the temporary retention of properties delete attributes, to retain the property will continue to reduce. Three is a two-way search: the current attribute subset of the same time the implementation of the two operations, which is not to add the attributes of the selected and delete temporarily retained properties.

Set the initial attribute subset of common ways: one is set to the empty set, in the former to search generally used in this setting; the second is arranged as a collection of the entire property, in the post to the search often use this setting; the third is randomly assigned to a subset of attributes, in the bidirectional search often with this setup. In order to start the search process to be carried out, the initial optimal evaluation should not be too high, generally set to 0 or the maximum value of the maximum category of training (Li, J., Li, W., Yin, H., Zhang, B., & Zhu, W., 2015).

There are a variety of search methods; in general there are exhaustive search, heuristic search and random search. The exhaustive search to evaluate all subsets of attributes, generally do not need to terminate condition. This search method only applies to a very small number of attributes. Heuristic search is the vast majority of cases the search way,

usually need to be arranged termination conditions to avoid exhaustive search. Random search is a relatively new search method, in which the candidate attribute subset is randomly generated. In order to get a good search results, and sometimes the candidate attribute subset plus some limit parameters. The random search often set a maximum number of cycles, in order to avoid the degradation of the exhaustive search.

## **5. Selective Incomplete Data Classifier Srbc**

To packaging method based on construct selective classifiers for incomplete data. It is necessary to determine such aspects: the incomplete data classifier, search mode, search direction, initial attribute subset, and optimal initial evaluation value and termination conditions.

### **5.1. Selection of Incomplete Data Classifier**

The classification accuracy of the classifier constructed on a subset of attributes is used as an evaluation index of the subset of the attributes. Thus, it is easy to construct a classifier for each attribute subset, so that the computational complexity of the whole process is very high. Therefore, based on the packaging method to build a selective incomplete data classifier, it should be required that the efficiency of the incomplete data classifier to be relatively high. In addition, the classification accuracy rate of course the higher the better (Ciancanelli, M. J., Abel, L., Zhang, S. Y., & Casanova, J. L., 2016).

For existing capable of dealing with incomplete data for the classifier,, such as naive Bayes classifier and C4.5 decision tree, the incomplete data is usually simply discarded contain missing values of data items, or for different variables are respectively provided with a specific value. These two kinds of incomplete data processing methods, it is often difficult to produce an ideal classification results. Therefore, the classifier based on the incomplete data processing method is not an ideal choice for the construction of the selective incomplete data classifier based on packaging method.

In the use of probabilistic parameter optimization method to construct incomplete data classifier, the EM algorithm and Gibbs sampling algorithm are used to approximate the optimization algorithm, and these algorithms require MAR (at Random missing) hypothesis. Unfortunately, there is no way that a particular data set whether to satisfy the Mar assumption, and when this assumption is not met, these approximate optimization algorithm in terms of accuracy will be significantly decreased, so to construct the classifier accuracy will decline. In addition, such as EM algorithm, Gibbs sampling algorithm is to estimate the parameters through the loop iteration; the complexity of the algorithm is generally higher. Therefore, this method is not suitable for constructing a selective incomplete data classifier, regardless of the efficiency of the algorithm and the classification results.

In addition, the RBC classifier proposed by Ramoni and Sebastiani is a Bias classifier constructed directly from the incomplete data set. The classifier does not require the missing data to satisfy the MAR hypothesis, and has high classification efficiency and classification performance. Therefore, RBC is an ideal choice for constructing selective classifiers based on packing method.

## 5.2. Determinations of Other Factors

When selecting the search method, the computational complexity of the packing method is very high, so it is better to choose the heuristic search method. The two main kinds of heuristic search method, mountain climbing method and best first search method, mountain climbing search efficiency to slightly higher, but stability and search results as best first search method, hill climbing method it is easy to fall into local extreme point. As a result, we use the best first search method to construct the classifier with incomplete data.

Packaging method to classifiers built on a subset of attributes classification accuracy as the evaluation index on a subset of the attributes and properties of sub concentrated attribute number less, in the subset construction classifier used in less time. From the point of view of the search direction, before to search general to the empty set as the initial selection of the attribute subset, followed by adding attributes, concentrate was evaluated in terms of the properties of sub attributes the number gradually increased. Thus, the forward search is more efficient than the backward search and the bidirectional search. In this way, we decide to use forward optimal search method. Corresponding, the termination condition is the best first search method is the default termination condition: if continuous  $t$  ( $t$  is given in advance of a parameter) of the previous optimal attributes subset expansion did not further improve the highest classification accuracy, the search process is over.

In order to make the search process more compact, set the initial subset of attributes for a single attribute subset (i.e., a single attribute constitute a subset of), the RBC classifier constructed in this subset of classification accuracy is higher than that in other single attribute subset. At the same time, the corresponding classification accuracy is used as the initial value.

In conclusion, through the above analysis, we choose to use the RBC classifier and SRBC Bayes Classifiers (Robust), which is based on the selective incomplete data classifier, which is based on the packing method.

## 5.3. Srbc Algorithm Description

Given incomplete data set  $D$  as a training set, assuming that  $n$  has a total of  $D$  attributes.  $\Omega = \{A_1, A_2, \dots, A_n\}$  is the entire set of attributes,  $S_b$  represents the current best subset.  $Q$  for a queue, used to store once is the best attribute subset and its corresponding classification accuracy,  $S_h$  is the  $Q$  of the head node corresponding to the attribute subset.  $F(S)$  indicates the classification accuracy of RBC on the attribute subset  $F_{\max}$  is the highest classification accuracy for the current  $S$ . Threshold  $T$  is used to control the search process is stop parameters, namely if continuous  $t$  time of  $Q$  head node expansion did not further improve the highest classification accuracy, the search process is over. Figure 3 describes the construction process of the SRBC.

Algorithm SRBC can be described as follows:

1. Initialization: set the parameter  $T$ ; make the integer  $t \leftarrow 0$ , attribute  $A_s \leftarrow \arg \max_{1 \leq i \leq n} \{F(\{A_i\})\}$ , the current highest classification accuracy  $F_{\max} \leftarrow F(\{A_i\})$ ; the attribute subset  $\{A_s\}$  together with  $F(\{A_i\})$  as a node to join the queue  $Q$ .

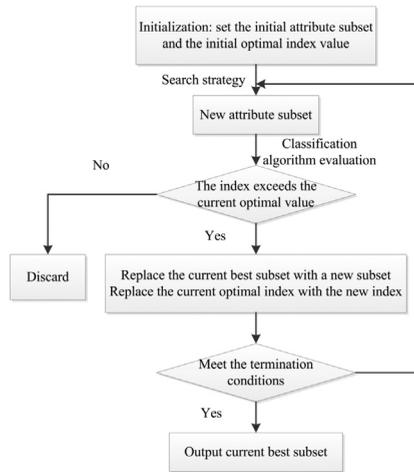


Figure 3 – Process of Establishing A SRBC

2. When the  $t < T$  executes the steps (3), (4) and (5), otherwise, the execution steps (6).
3. Take out the Q header node, remember its corresponding attribute subset for  $S_h$ , so  $added = false$  ( $added$  mark in the extension of the head node of the Q, whether to add a new node to the Q); for each attribute  $A \in \Omega - S_h$ , if the  $S_h \cup \{A\}$  has not been evaluated, and  $F(S_h \cup \{A\}) > F_{max}$ . Then make  $added = true$ ,  $S_b = S_h \cup \{A\}$ ,  $F_{max} = F(S_h \cup \{A\})$  and  $t=0$ ;  $S_b$  together with the  $F(S_b)$  as a new node, and in accordance with the classification accuracy rate from high to low in the order to join the queue Q.
4. If  $added = false$ , then  $t \leftarrow t + 1$ .
5. Go to step (2) to continue.
6. Construct a RBC classifier on the final subset of the attributes of the  $S_b$ .

It should be pointed out that, since the RBC classifier only considers the character type attribute variables, the selective classifier constructed on the basis of SRBC can only deal with the attribute of this type. Discretization of the data set that contains the numeric attributes.

## 6. Comparison Test

This experiment compares the SRBC with the classification efficiency and the efficiency of the incomplete data classifier RBC and DBCI. Compare the classification accuracy of these 12 standard incomplete data sets, and investigate the screening effect of SRBC on redundant attributes and irrelevant attributes, that is, to investigate the attributes set selected on each data set by SRBC.

The test data set is the incomplete data set of the UCI machine learning knowledge base. In the implementation of the algorithm SRBC, the parameters of the Weka T system to take the default value of  $T=5$ . When evaluating the subset of each attribute, the Weka

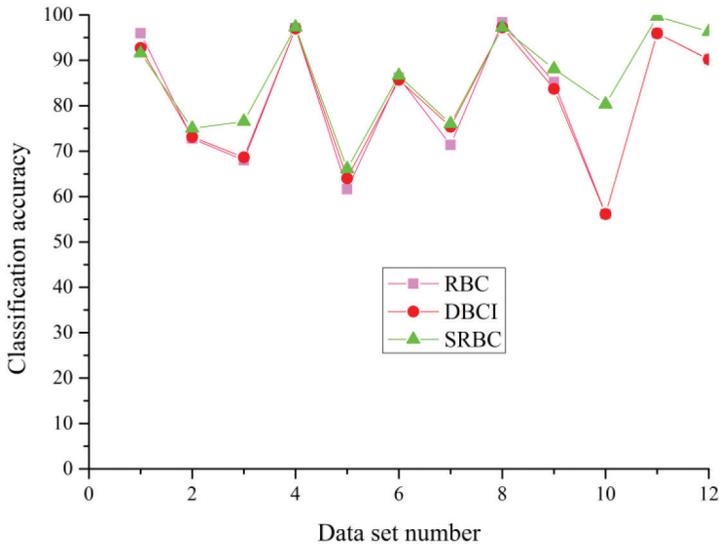


Figure 4 – Comparison of the Accuracy of RBC, DBCI and SRBC

system is used for the 5 - fold cross validation. Numerical attribute, using the Weka system of numerical data discretization of the procedures for discrete. In order to compare the classification accuracy of SRBC, RBC and DBCI, the average classification accuracy of the three classifiers on each data set is compared in the form of a graph.

In addition, RBC, DBCI and SRBC are listed in table 10. The average classification accuracy and the corresponding standard deviation of 10 times of 1 weight cross validation on each data set are also listed. In order to compare the overall situation of the classification results, the total average and standard deviation of the classification accuracy on the 12 data sets are listed at the bottom of the table. In each data set, the higher classification accuracy is in bold. In order to investigate the effect of SRBC on the selection of redundant and irrelevant attributes, table 2 lists the number of attributes selected on each data set by SRBC.

From Figure 4 and table 1 can be seen, SRBC in all experimental data set on the 10 data sets, the classification accuracy rate is significantly higher than the RBC and DBCI classification accuracy. The average accuracy of SRBC on the 12 data sets was 4.34% and 4.25% higher than that of RBC and DBCI, respectively. Especially in the data set Cancer L., SRBC classification accuracy than RBC and DBCI classification accuracy rate is higher than 24.19%.

The reason why the data set Cancer L. classification accuracy will be improved so much, in addition to the role of the algorithm SRBC itself is also related to the characteristics of the data set Cancer L. itself. Cancer L. a total of 32 examples, and the number of attributes but there are 56. In general, when the instance number and the number of

Serial number	Data set	Classification accuracy		
		RBC	DBCI	SRBC
1	Annealing	95.96±0.31	92.74±0.30	91.59±0.12
2	Arrhythmia	72.77±0.89	73.13±0.70	75.01±0.62
3	Audiology	67.99±0.79	68.64±0.89	76.53±0.42
4	B.caneer	97.11±0.11	97.02±0.06	97.31±0.11
5	Bridges	61.62±2.20	64.00±1.61	66.10±1.04
6	Credit	86.18±0.40	85.70±0.37	86.65±0.30
7	Cylinder	71.36±0.46	75.37±1.19	76.02±0.55
8	Echocardiogram	98.36±0.87	97.26±0.02	97.26±0.01
9	Horse-colic	85.20±0.59	83.71±0.54	88.09±0.39
10	L.cancer	56.13±1.60	56.13±1.62	80.32±3.86
11	Mushroom	95.96±0.02	95.93±0.02	99.68±0.04
12	Vote	90.25±0.19	90.18±0.25	96.31±0.00
<i>Total average or sum</i>		81.57±0.72	81.65±0.63	85.91±0.62

Table 1 – Classification Accuracy of RBC, DBCI and SRBC

Data set	Original attribute number	Number of selected attributes	Data set	Original attribute number	Number of selected attributes
<i>Annealing</i>	38	8	Cylinder	39	9
<i>Arrhythmia</i>	279	11	Echocardiogram	12	3
<i>Audiology</i>	70	12	Horse-colic	27	5
<i>B.caneer</i>	10	9	L.cancer	56	5
<i>Bridges</i>	12	6	Mushroom	22	3
<i>Credit</i>	15	10	Vote	16	3

Table 2 – Numbers of Selected Attributes Of SRBC

attributes than is too small, to estimate the class conditional probability of each attribute variables, and the probability of the class variable estimation will become very imprecise and use these estimates to obtain the classification results will be very accurate. When the SRBC delete partial attribute to attribute reduction of several, relatively speaking, is equivalent to the number of instances is increased, so that the probability estimates become more precise, also makes the classification accuracy may be improved. At this time, the superiority of SRBC will be more significant.

Also through the comparison of the three classifiers in each data set of standard deviation can be found, in 12 data from nine data sets SRBC standard deviation less than RBC, is also on nine data sets, the standard from the contrast of DBCI low. The average value of the standard deviation of SRBC on the 12 data sets is also lower than that of RBC and DBCI. This shows that the classification performance of RBC is more stable than SRBC and DBCI.

By investigating the properties of SRBC in Table 2, we can find that SRBC can significantly reduce the number of attributes in almost every data set of 12 data sets. Especially in the data set Arrhythmia contains 279 attributes, SRBC only select the 11 attributes. Overall, the total number of 12 data sets contains 602, and the total number of attributes selected by the SRBC is 83. Therefore, SRBC can simplify the data set to a large extent, which can significantly improve the efficiency of the classifier.

## 7. Conclusions

With the development of modern information technology, especially the Internet technology, a large number of high dimensional data represented by text data are emerging. And naive Bayes is simple and efficient, is suitable for dealing with the high dimensional data, and the attribute selection is very sensitive, so for the study of selective Bayesian classification algorithm for high dimensional data is a very important research topic. In the past, although many researchers have studied the attribute selection of high dimension data, especially the text data, the research work of Bias classifier is very little. The redundant or irrelevant attributes of incomplete data can not only reduce the classification efficiency but also can seriously damage the classification effect. Based on the packing method, two selective incomplete data classifiers are proposed. First, the classification effect is more prominent than the incomplete data classifier RBC and search results are good and the relative low complexity of the best pre search method, constructed a selective incomplete data classifier SRBC. Compared with the efficient RBC and SRBC, DBCI can not only obtain a significantly higher classification accuracy, but also significantly reduce the number of redundant and irrelevant attributes. The incomplete data classifier constructed in this paper is very important for the classification of incomplete high dimensional data SRBC.

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# On the Stereoscopic Multi-Dimension Network Platform of Ideological and Political Work in University

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**Abstract:** Ideological education's biggest feature is the emphasis on the interaction of both or all parties, in the ideological education in the role of interaction in the process of seeking ideological education effect implementation. According to current situation of ideological and political education, ideological and political education to the introduction of the network interactive teaching activity, in the context of multidimensional interactive network, university students to contact with new information, has had an urge to seek new knowledge, this is deiform in impact to the traditional college education mode form, bring certain difficulty. College ideological education under the situation, should take the initiative to change, make good use of the network interactive, develops the education new mode and a more effective path. This article analyses the present situation of the network communication between teachers and students in colleges and universities, the empirical analysis of the multidimensional network communication model, architecture education workers in colleges and universities in the new period, to adapt to the era of the development of three-dimensional multidimensional network communication platform. Introduce the network interactive teaching activities of the ideological and political education, the teaching effect of political education in colleges and universities have improved significantly.

**Keywords:** Network platform; education teaching; BBS; interactive.

## 1. Introduction

The highly integrated derived from the rapid development of Internet, fast delivery and two-way communication network information platform, for teachers and students in colleges and universities provides a convenient and efficient communication platform. And give full play to the network and technology advantage, comprehensive utilization of the network carrier, expanding, digging the breadth and depth of communication with college students' communication, has become a college education workers in particular should be the choice of college students' political education workers to adapt to the era development.

Points out the characteristics of the network ideological and political education in the new period: practical, technical, effectiveness; for nearly a decade of generalizes the

research achievement, and proposes the research of the four patterns. In certain research results at the same time, also points out the shortage and outlook, laid the foundation for future research, Summarizes the characteristics of interactive network ideological and political education: on the basis of information interaction, interaction between subject and object as fundamental, process interaction for security (Velásquez, E., Cardona, A., & Peña, A., 2014); Pointed out that this year to the rising number of studying but quality is declining, and points out the new direction. Must carry on the research object of the profound grasp and repositioning, will deepen and foundation in the field of study.

The remainder of this paper is organized as follows. The second part describes the modern society, the ideological and political lesson the significance of using the Internet to carry out multi-dimensional interactive teaching. The third section describes the now is how to take advantage of network to carry on the thought political lesson teaching in colleges and universities. The fourth part puts forward the various network platform in the teaching of ideological. The fifth part of the advantage of each network platform, make the design and implementation of a new network communication platform. Conclusions are summarized in Section 6.

## **2. The Meaning of the Thought Political Lesson Multi-Dimensional Interactive Teaching**

### **2.1. Multi-Dimensional Interactive Teaching Mode to Adapt to Changing Times**

With the continuous development of network technology and mobile information technology, represented by BBS, stick the bulletin board of the media, represented by qq instant messaging media, represented by blog, space blog media, represented by weibo (de Angelis, F., 2015), We Chat micro media gradually penetrated into every aspect of our lives, have greatly changed our way of life, the study way, way of thinking, communication, entertainment, and even language habits, this marks a new media era has arrived. College students as a young intellectuals, as well as the most active, the cutting edge of new media use groups, youth show self-worth and gain attention of psychological demands, further improve the new media as the spotlight of contemporary society and the absolute position of microphones (Jelenković, D., 2016). New media era, to build college students make true love and life-long benefit of ideological and political theory class, is about to make full use of new media interactive, use all kinds of new media to promote innovation of teaching methods, implement education courses in colleges and universities teaching by “I said you listen to” one-way infusion mode to the multidimensional interaction “you sing and I”, “flowers” to participate in the model (Isaacs, T., & Waghid, Y., 2015).

With the advent of the era of new media, new media and the integration of education problem has caused wide attention, on the one hand, the new media constantly penetrating to the classroom, teachers and books as the center of bring great challenge to the traditional education mode; New media era, on the other hand, the extensive use of information technology and expand the teaching interactive dimensions, because the interactive new media is the unique charm, this makes the multi-dimensional interactive teaching, and it reveals the inevitable trend for the development of modern education mode (Thorpe, C., 2015).



Figure 1 – The Use of Computers for Multi-Dimensional Interactive Teaching

## **2.2. Multi-Dimensional Interactive Teaching Mode Suitable for Ideological and Political Theory Course**

As public required course of ideological and political theory in colleges and universities, often take the way of all the mixed course selection, will eventually form a more professional mixed classes, and this kind of mixed professional class, as a kind of common environmental education courses teaching effect of complex is neglected for a long time. In the long-term teaching practice, we found that, compared with the single professional class, this class form has the following characteristics, first, the number of more. Relative to some around 40 people set the number of professional courses, education courses of class size often around 100, this will give the teacher the classroom organization and management has brought certain difficulties. Second, professional compound. Classes taught by the author generally includes the school in almost all the departments of students, both liberal arts and science majors, has both basic discipline and applied discipline, teachers on the choice of teaching content and interactive way often faced with the plight of divided. Third, the structure is loose. In a class of different specialties will often form specific groups, professional virtually formed between fragmented situation, makes the range of interaction and students' classroom participation, so as to give the teacher a multidimensional interactive teaching method has brought great resistance. I also met such problems in the teaching work, in according to the classification group organization activities of student number, for example, to have students don't know other professional students and couldn't be reached for reasons shuffle, then I realize the importance of this problem and have made some exploration in the teaching, found with modern information technology as a multi-dimensional interactive teaching method, is to improve the effect of mixed class education courses teaching a welcome antidote (Fleischer, F. S., & Garrow, W. G., 2016).

## **3. The Ideological and Political Theory Course Multi-Dimensional Interactive Teaching Practice Exploration**

### **3.1. The Modern Information Technology to Increase Course Appeal.**

Due to the mixed professional class size is more, the traditional teaching model is easy to cause the back of the students can't see the blackboard writing, couldn't hear the teacher

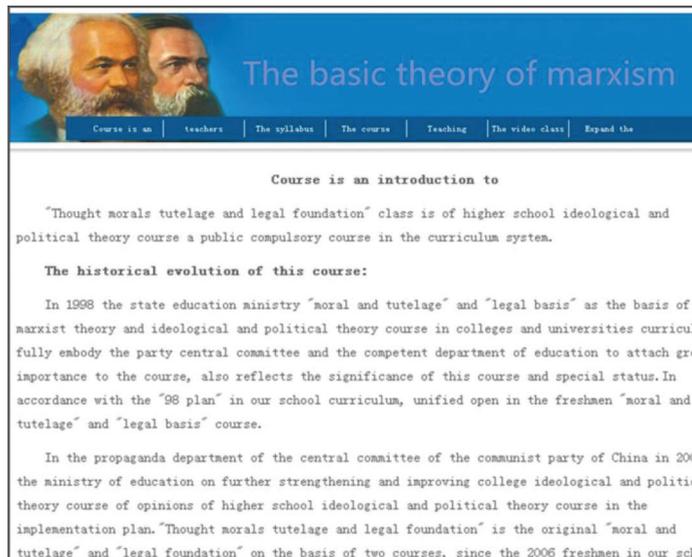


Figure 2 – Marx’s Theory of the Classroom

lectures, so you need to use the form of multimedia teaching demonstration, teachers will course mainly in the form of text, images, video, etc with a computer and projector teaching message to all students, teaching the theory of the originally dull become “colorful” (Soliman, M. M., Al-Swat, K., Alsaif, F., Al-Nassar, S., Bayoumi, N., Leheta, O., ... & Aldrees, A., 2016). It is worth noting that teachers should especially consider when making the courseware to mix professional class’s and grade’s specific situation, such as in the teaching of an introduction to basic principle of Marxism as the author will pay special attention to when choosing case, video, and discussion topics both academic characteristics, so as not to attend.

### 3.2. Using the Network Platform to Enhance the Students’ Participation

At present various universities have established a powerful network teaching platform, to strengthen the connection between the different majors, improve their participation of education courses interaction part. Taught by the author in recent years, an introduction to basic principle of Marxism courses have been established data rich, attractive and interactive network teaching platform. On the upload data quantity and browse the number has been in the school. In addition, the classroom teaching content and the social hot spots, combining students’ own professional characteristics and ideas, set up a weekly topics related to the teaching content for students free discussion, such as: “my happiness feeling”, “life philosophy”, “I in the eyes of the eighteenth big key words”, “hobby and working distance how far”, etc., aroused the enthusiasm of the students’ interest and participation (Bollich, K. L., Hill, P. L., Harms, P. D., & Jackson, J. J., 2016). Different students in the classroom due to the limitation of space and less interaction, but in the virtual network platform, you can break the professional limitation, for they are interested in the topic freely, to acquire knowledge in the mutual exchange and debate and friendship, deepen the understanding of basic theory and thinking to the real problem.

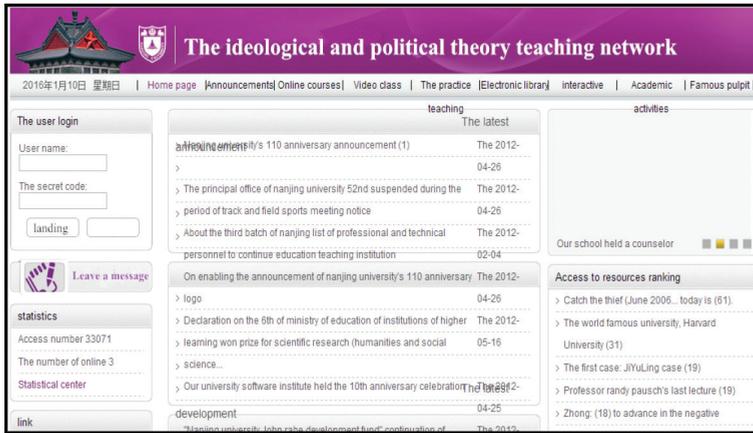


Figure 3 – The Ideological and Political Theory Course Teaching Network

The emergence of the network and popularization, the college students' learning activities more rich content, many people use the Internet as an aid to learning. In the survey, when asked "what is your general network learning activities?", the results shown in the following table. From the point of ratio, using the Internet to browse, obtain and pass the required data and information, complete assignments or tasks the majority of college students (Mushroor, S., Islam, M. Z., Amir, R. A., Ahmed, N., & Amin, M. R., 2016).

Options	Browse information,	Network communication	Network course learning	Other
The percentage	82.3%	10.6%	2.8%	4.3%

Table 1 – College Students' General Network Learning Activities

### 3.3. Use A Variety of Teaching Methods to Improve the Students' Cognitive Level and Development Capacity.

Teachers should according to the different characteristics of various professional guides the student to the correct use of the new media era of comprehensive and competitive, permeability, openness and other features. For example the author on the network platform set up "recommended" weekly column, students can not only according to the teacher's recommendation to have certain thinking orientation of reading, but also can participate in, share reading experience and recommend yourself feel good work, in the debate and communication ability to raise huge amounts of information in the network to identify, broaden the vision and knowledge. In teaching the author also according to the characteristics of the mixture of professional class, take the professional arrangement way of group tasks, pay attention to when arranging task combined with professional in order to improve the students' participation, such as when it comes to consciousness and artificial intelligence problems of computer

professional students, please introduce the latest development of artificial intelligence technology; Please when we talk about the development of political economics school of economics students to introduce the origin and development of economics and political economics. In addition also specially set some tasks to two professional do together, such as philosophy majors of liberal arts and science of biology, please to a professional “animals have consciousness?” The debate, on the same problem of science fierce sparkles between different thinking; Please chemical professional students and law school classmates together looking for two seemingly unrelated professional contact, and make them deeply aware of the importance of the cooperation spirit. This form can play various professional expertise, stimulate students’ participation, and to promote mutual communication between the professional, active classroom atmosphere (Sidelinger, R. J., & Bolen, D. M., 2016). In addition the author also pay attention to guide students to use modern information means to complete the task, so as to improve the students’ way of information processing, promote learners’ divergent thinking ability, received the unexpected effect, a lot of team creation sitcoms, micro video, PPT, eBook design clever, unique design, novel idea, even the teacher also benefit from it quite a lot (Fairlie, A. M., Maggs, J. L., & Lanza, S. T., 2016).

Options	Teach	Case	Discuss	Network	Other
<i>The percentage</i>	95%	73.5%	46.7%	22.6%	3%

Table 2 – Teacher USES the Teaching Method

### 3.4. Using A Variety of New Media to Strengthen the Communication Between Teachers and Students Interact With Multidimensional

As the post bar, BBS, weibo, WeChat, QQ, etc of the advent of the era of new media, students present a diverse contact with the world development trend, so teachers should pay attention to the interaction of classroom and students, our education courses to the “them” and “cramming education” teaching should extend to a more flexible and open space, from the emphasis on the development of individual thinking to attach importance to the social construction of knowledge. In the era of new media, the teacher can use a variety of modern information technology means such as E-mail, QQ, weibo, WeChat, WeChat public platform for answering questions such as, communication, discussion, interaction and strengthen the interaction between teachers and students and teachers individual learning and interactive teaching intermediary, strengthen personal interaction with the environment, to produce teaching resonance, so as to really improve the ideological and political theory course teaching pertinence, timeliness and effectiveness. The average students surf the Internet time shown in the table below:

Options	0<hours<1	1<hours<3	3<hours<5	5<hours<7	>7 hours
<i>The percentage</i>	15.8%	49.2%	24.4%	8.2%	2.4%

Table 3 – The College Students’ Internet Time

## **4. The Advantages and Disadvantages, Each Network Platform in the Teaching of Ideological.**

### **4.1. QQ Private Chat**

As a kind of instant chat tools, use the QQ chat the biggest advantages of communication information real-time transmission. Live it in the form of lively, use QQ powerful features, cartoonish expression and mood images, such as easy to narrow the distance of the heart, Online, offline messages for the time arrangement provides a convenient and full of elasticity. College students can through QQ chat with teachers one-on-one separate, content not limited, and have certain illicit close sex, can eliminate the scruples, speak freely, realize the equal communication between teachers and students. But also because of QQ private chat immediacy, synchronicity is strong, need teachers one-on-one, personalized communication like face to face, in some cases appears unavoidably replies too slow and too brief or forget to reply and the like, easy to cause the students have not taken seriously by teachers (Bogg, T., Lasecki, L., & Vo, P. T., 2016).

### **4.2. The Blog**

On the blog, teachers can with students discuss hot topics of mutual concern to produce consistent, or people with students. Life experience, professional knowledge communication and exchanges, and even extended to the life, study, employment, etc is closely related to college students all aspects of the event. On the one hand, college students can through the teacher's blog to absorb nutrition, to earn profits, on the other hand, teachers can effectively extend the teaching way, in a blog post repost articles and publish some professional knowledge, stimulate students interest in learning, have good. Semi-public but blogs and message boards, communication between teachers and students care about their public influence, leave room in the speech, to a certain extent has alienated the distance of the mind, each other or polite compliments and deal with, and reach the purpose and effect of deep communication.

### **4.3. QQ Group Chat**

As a point product of instant messaging, QQ group is the biggest advantage of people live chat, can achieve more than synchronous communication (Semenchuk, Y., 2016).

The effect of the group of range can be either a class can also be a professional or even a grade. A good, positive QQ group communication, a one-liner in chat can make the emotional connection between teachers and students closer quickly, achieved with one-to-many, resource sharing, fast and vivid communication effect. Or professional class QQ group, however, if the lack of management personnel daily elaborate maintenance, not timely communication issues, take the initiative to adjust chat atmosphere, thus stimulate interest in communication, easy to become a "group of death", the group was largely invisible, teachers in the QQ group in the position of the embarrassing adverse instead. Besides, if there is opposite in the QQ group, not harmonious sound, easy to cause vibrations to the entire group bring bad negative influence, may even become a breeding ground for negative information and a hotbed of bad mood.

#### 4.4. QQ Space

QQ space for teachers and students provides a real-time communication network platform, can avoid the teachers and classmates in my spare time Mismatch between the contradictions, can effectively solve some students complete, for a positive exchange of tension clearly expressed defects. Also required to provide teachers can give students enough time to think about questions, make a thorough, efficient and high quality communication response. Shortcoming of this approach is that some teachers do not often use QQ space of the individual, and the number of students in general teachers face the audience is more, if only is the way with QQ message, teacher is difficult to distinguish the student identity, causing difficulties. In addition, the illicit close sex of the QQ space message is lack, also make some college students don't want to will the in the mind real ideas and teachers to communicate.

#### 4.5. Weibo

Weibo for college students provides a platform to express themselves, emotions, at the same time, college students are also very eager to be "attention" and comment on their own. Education courses teachers can understand students' learning through weibo, emotion, the problem in the work, especially for learning education courses in learning, be agitated, resistance, even teachers according to students' personality and characteristics of the use of weibo "comment" and "private" functions such as guidance, in time for mental health education and psychological consultation, popularize knowledge of mental health, prevention of psychological barriers, get rid of bad factors of influencing the students' healthy growth, to promote the healthy growth of college students' personality (Wynn, C. T., Mosholder, R. S., & Larsen, C. A., 2016).

#### 4.6. BBS

BBS is an effective tool for school teachers and students access to information, the teachers and students in different time, different place to get to the Internet can be a direct dialogue and exchanges through it. According to students' interests, hobbies, focus, and inside the school teachers and students communicate information needs, such as BBS BBS on various topics, registered by the user ID to comment here, access to information, each person's hobby, special skill and talent can get full display in different BBS, and through his long-term struggle to obtain other net friend's attention and respect. Here also easier to form a kind of mutual environment, students in the real life, learning, emotional difficulties, often the first to think of go here to ask for help or psychological relief. Out of common real identity, students here tend to more closely combine together, communicate with each other, enthusiastically participate in school affairs to discuss, boldly to the national government giving their views, dynamic provide the convenience for teachers to learn the student thought, promote the close relations between teachers and students. In addition, BBS magnify environment, the students have for each other between teachers and students together to participate in the discussion for a topic of common concern and conditions. So from the ideological and political education work, anyone can organize a political discussion, can also organize a political BBS, it is not restricted by time and space conditions, has great flexibility and convenience, expand the object of ideological and political education work.

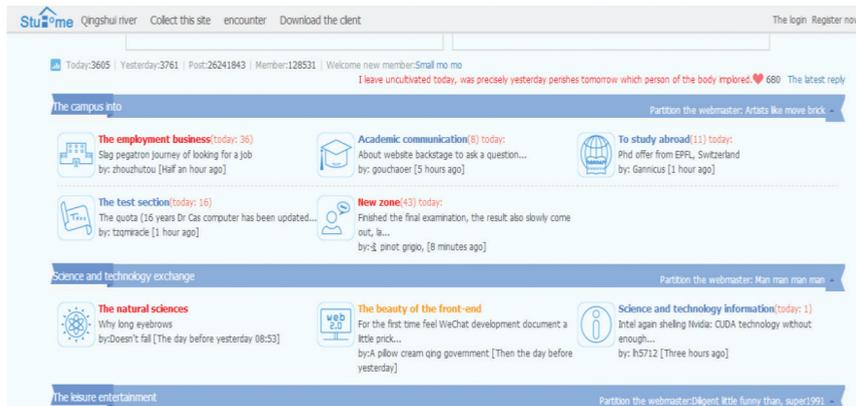


Figure 4 – University of Electronic Science and Technology Campus BBS

Through BBS to carry out the ideological and political work, and the traditional ideological and political education work is different: interactive mode education activities'. Students and teachers' interactions .BBS is a medium, a platform, the interaction between students and teachers is the equal communication or teachers using the BBS on the subject of ideological and political education carry out various discussions or to evaluate the related issues of the BBS, guidance.



Figure 5 – Beijing University Campus BBS

## 5. The Design and Implementation of Network Communication Platform

Urgency and importance of college teachers and students after class communication needs, the maturity and popularity of the network communication conditions, etc., and jointly contribute to the teachers and students after class the generation and development of network communication, with which a both traditional culture essence, cultural connotation and modern relationship between teachers and students, has

become an important focus in the current college education work and the difficult problem (Cetin, B., 2016). And network communication based on the consideration of the characteristics of different students, different nature of the problem, adopt different methods, pay attention to strategy, pay attention to the occasion, seize the moment and node, the architecture design of network communication platform, in order to achieve good communication effect (Nadelson, L. S., Sias, C. M., Matyi, J., Morris, S. R., Cain, R., Cromwell, M., ... & Seegmiller, J., 2016).

### 5.1. With the Internet: Three-Dimensional Multidimensional Network Communication Platform Construction

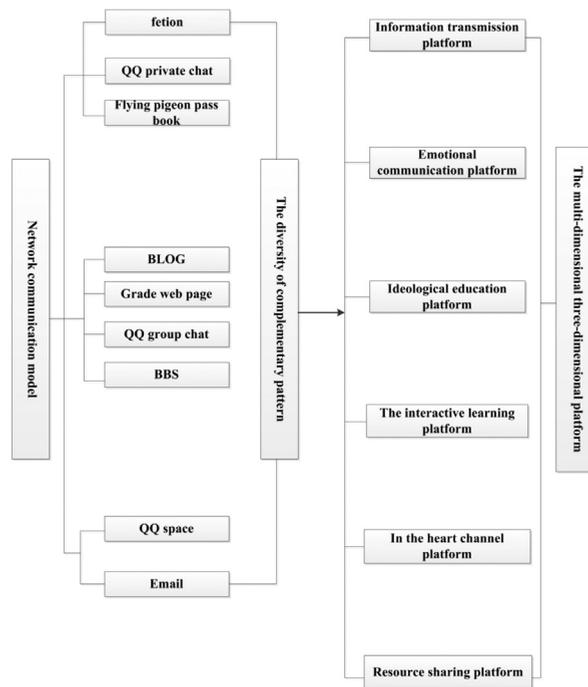


Figure 6 – The Multi-Dimensional Three-Dimensional Network Platform Construction

Network communication itself as a kind of auxiliary way of communication, at this time we need to treat different students, different hobbies Things, different scenarios to take different ways of network communication, the last is “where” where need. Research results show that if the teachers and students online communication way to form a single, rigid, can make the students gradually lost interest in network communication with teachers. Workers and students need to comprehensive utilization of the network carrier and the actual situation based on the characteristics of students, to use different network communication, build complementary advantages of diversified network communication mode, give full play to the depth of network communication, collaboration, communication, and timely communication of many advantages, set up information transmission, the emotional communication, ideological education,

interactive learning, psychological counseling, resources sharing platform, to further forming three-dimensional multi-dimensional network communication mode.

**5.2. Together with the Time: A Good Construction of Network Communication Ability**

With mainstream network times, familiar with network communication language style “if you want to talk to the fish, don’t stand on the land, and should learn how to breathe like a fish in the water”. Contemporary college students open, understanding and learning new things quickly, have strong trend, it is correspondingly requires students to workers in pay attention to choose agree with college students’ Internet communication network tools at the same time, also need to keep up with the trend of The Times, understand fashion information, timely to change the old ideas and thoughts, clear what fashion in popular, make the content of the communication more close to the students. Want to proper use network cartoon expression, at the same time the campus network buzzwords, careful formulaic language lecturing, strive to build an easily accessible online communication environment.

Through sampling survey, middle school students in many existing network communication way more like and agree with the way: QQ private chat, email and QQ group chat, etc. see figure.

Look from these students like communication, convenient, quick and economical factors of college students pay attention to. These have a certain distance of written communication, can add an unknown and mysterious color, long-distance chat at the same time, can need not sense motive, to some extent, can reduce the sensitivity of the language, college students are more likely to express the real inner thoughts and feelings.

Options	E-mail	QQ private chat	Blog	QQ group chat	QQ space	Fetion	Weibo	Bbs	Other
<i>vote</i>	50	88	22	45	33	12	5	69	5

Table 4 – College Students Like Network Communication Research

**5.3. With the Real Space**

Students in the network can be made for any questions related to their study life, student workers can communicate with students

Process, a comprehensive, accurate, and dynamically grasp to the majority of students thought tendency and the concerned hot issues, the full range of communication between teachers and students is “comprehensive interactive”;This move will be daily communication in real work to a virtual network communication, involves students’ learning life, interpersonal communication, diathesis developing all aspects, such as technical to improve the working efficiency, also can timely understand the students’ opinions and ideas, implement personalized guidance for students, realize the organic combination of the reality space and virtual space, to further expand the space of

ideological and political education work, optimize the improvement work, improve the management level.

## 6. Conclusions

Network greatly changed the traditional pattern of information dissemination, interpersonal communication, and also on college students' way of thinking and values formation caused great impact, the increasing popularity of traditional ideological and political work in the network today has lagged behind and inefficient. In this study, on the basis of traditional ideological and political education, puts forward the multi-dimensional three-dimensional interactive teaching, and through the network for real-time interaction, the application of ideological and political education based on network platform to carry out the strategy are studied, pointed out that the current network platform in the use of the advantage and disadvantage of the process, and put forward the corresponding countermeasures in the system, to perfect the system of the network ideological and political education application has a certain practical guiding significance. Research on surface, three-dimensional multi-dimensional education mode based on network platform, education teaching in colleges and universities has a great role in promoting.

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# Research on the Interactive Platform of Network Ideological and Political Education in Colleges and Universities

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**Abstract:** With the advent of the Internet age, information technology has infiltrated into many fields such as politics, economy, culture and so on. The way of human production, life style and learning style have changed a lot. Through a series of exploration, it is found that the teaching mode of network teaching is the new mode that meets the requirements of the times. Ideological and political lesson network teaching platform as a new network teaching is more and more attention. The network ideological and political education teachers and students interactive platform were investigated, and the mechanism of the network teaching platform of Ideological and political course was analyzed. Through the questionnaire survey and expert interview method, qualitative and quantitative analysis of the influence factors, the ideological and political lesson network teaching platform of the perfect has important significance for reference.

**Keywords:** Ideological and political theory course, network teaching platform, influencing.

## 1. Introduction

With the social change and development, the traditional ideological and political theory course teaching mode has been unable to meet the needs of the development of today's college students, many college students of Ideological and political theory course learning tired, (Cho H., 2016; GALLEGO, M., 2015) College Ideological and political theory course teaching is for students of Ideological and political education main channel, to change the traditional thinking and political theory course teaching mode, using the Internet to build the harmonious ideological and political theory course of teacher-student interaction in classroom teaching mode, to mobilize the enthusiasm of students, improve the teaching effectiveness of Ideological and political course of the, put forward a kind of based on the Internet, the network of colleges and universities thought political education interactive platform, on the ideological and political education has a positive role and significance (Cadavid, J. M., & Gómez, L. F. M., 2015).

The On Ideological and political course network teaching platform construction that ideological and political course network teaching platform on network as the basis, the network teaching platform should have online learning, communication, online exam and system management and maintenance, such as plate (Ozga J., 2016). With the construction of Ideological and political course network teaching platform that thought political course network teaching platform it by services, campus network, under the guidance of teachers, teacher-student interaction is composed of three modules, to achieve the classroom teaching and practice, teaching platform of Trinity (Hoyng R., 2016). To improve the specific measures of the network teaching platform is to enrich the teaching resources library, improve the quality curriculum, develop the network teaching function in line with the teaching requirements (Martinsons M G., 2016). Through the investigation and study that from increasing the function modules of the platform development and application, cultivation of talents management of network teaching platform, improve the students themselves to the using rate of the network teaching platform to proceed, enhance the thought political education network teaching platform effectiveness (Catalina, C., & Anca, B., 2015).

The remainder of this paper is organized as follows. (Untong, A., Mir, V. R., Kaosa-Ard, M., & Palmer, J. R. M., 2015) Section 2 introduces the ideological and political course network teaching platform connotation. Section 3 analyzes the operation mechanism of the network teaching interaction platform. Section 4 puts forward the first class index weights to evaluate the influence factors of the network ideological and political education platform. Conclusions are summarized in Section 5.

## **2. Ideological and Political Network Teaching Content**

### **2.1. The Meaning of Network Teaching Platform**

At present, many colleges and universities have the use of Ideological and political courses network teaching platform, such as Blackboard online teaching management platform, Moodle platform, Tsinghua Education online, Nanjing easy to learn the sky room, etc. (Rottler-Hoermann, A. M., Schulz, S., & Ayasse, M., 2016) Blackboard online teaching management platform called Academic Suite TM Blackboard educational software.( Adamska-Chudzińska, M., 2016) Dynamic Learning Environment Moodle referred to as Modular Object-Oriented platform, it is a learning management system, also known as virtual learning environment, is a tool for students to build online dynamic web site. Tsinghua Education Online is a network of Tsinghua University Institute of educational technology research and development support for higher education and teaching support platform, it to meet the needs of actual teaching as a starting point, suitable for in various levels, a variety of objects and a variety of network environments of an interactive teaching support platform. (Young, D. S., 2015; Abdullahi, M. M., Hassan, S. B., & Bakar, N. A. B. A., 2016) Integrated with the original results based on the thought political course network teaching platform is defined for: according to educators and educates demand based, design make up for the traditional ideological and political course defects as a carrier, it information technology and ideology and political course fusion together, the educator and the educated are connected in a virtual environment, to promote education and the educated in the virtual space learning and communication

to training college students to establish a scientific world view, life outlook and values of an education service system.

## **2.2. Characteristics of Network Teaching Platform**

Everything has its own characteristics, the new thing has its own advantages, ideological and political course network teaching platform is different from the traditional ideological and political course, has its own characteristics. The traditional classroom teaching is restricted by time and space, and the communication between teachers and students can only be carried out in a specific time space. (Setyowati, R. R. N., & Imron, M. A., 2016) Ideological and political course network teaching platform is based on Internet, so it has the characteristics of time and space, which overcomes the traditional ideological and political class by the defects of the limits of time and space 11 students must be in a certain time and place to listen to the teacher carefully. Interactivity: Ideological and political course network teaching platform to break the traditional ideological and political education in the one-way communication situation. Network resource sharing, making the vast resources on the network, network compared with traditional media, it is not subject to the paper, time and space constraints, network in real-time information, richness and get easily has obvious advantages. People can understand the information around the world through the Internet, not only to break the restrictions caused by the regional restrictions, but also strengthen the ability of people to deal with information, broaden people's horizons. Ideological and political course network teaching platform to rely on the network, will be useful for the integration of resources, forming a wealth of teaching resources. In addition, the timeliness of network information, update speed, for the contemporary college students to grasp the situation in the world and the world, to grasp the pulse of the times laid the foundation. The network teaching platform of Ideological and political education provides rich instant resources for teachers and students, (Littlewood, J. R., & Smallwood, I., 2015) and overcomes the shortcomings of traditional ideological and political education resources, lack of medical resources, backward and obsolete. Ideological and political course network teaching platform is not only text, image, video and other integrated platform, but also a multifunctional platform, it with the traditional thinking and political education didactic methods compared, its educational method is more flexible. Ideological and political course network teaching platform has a plurality of modules: learning module, communication module, test module, everyone according to their own needs, flexible access module. (Basin, M. B., Haidov, S., Cherkasova, S., & Shalaginova, K., 2015) It not only meet the needs of The Students, And Improve The Effect Of Ideological And Political Education.

## **3. Operating Mechanism of Interactive Platform for Network Teaching**

### **3.1. Network Teaching Platform Architecture**

Ideological and political course network teaching platform is an important part of the network teaching platform in Colleges and universities, ideological and political course network teaching platform and the operation mechanism of the public course network teaching platform is basically the same. (Ozyurt, G., Bayram, E., Karaoglu, P., Kurul, S.

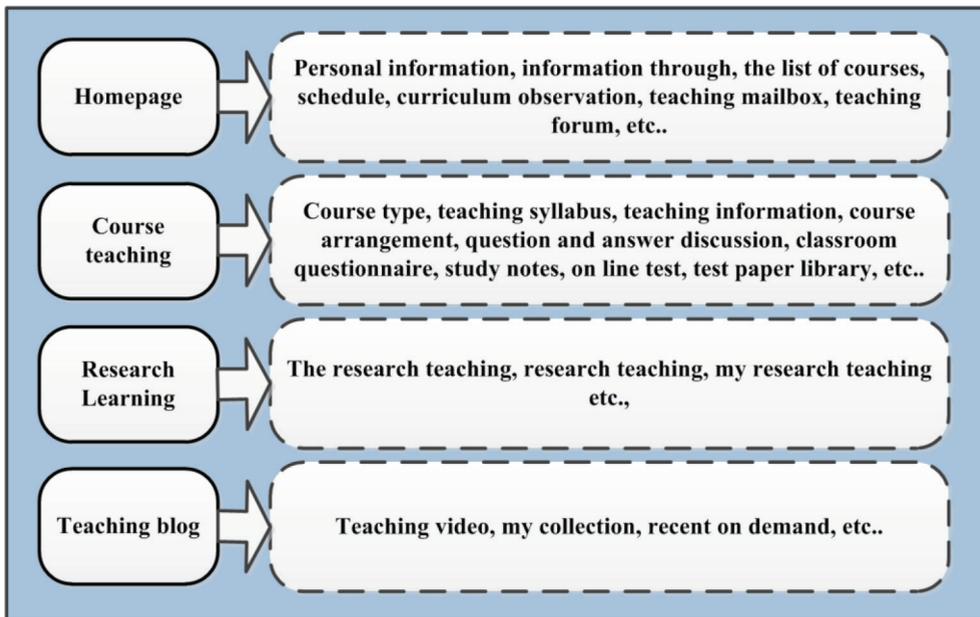


Figure 1 – Main Architecture of Network Teaching Platform for Ideological and Political Course

H., & Yis, U., 2015) In Jiangnan University of Tsinghua University online, for example, thought political course network teaching platform architecture is mainly composed of the homepage, course teaching, research teaching, teaching blog plate, different universities vary, but the core idea of consistent: adapt to the network information age new requirements, convenient college students to learn from the exchange.

Ideological and political class network teaching platform mainly includes personal basic information, information notice, curriculum list, oral course arrangement, curriculum observation, teaching mailbox, teaching forum and other information. Teaching plate mainly includes curriculum categories, curriculum, teaching outline, teaching calendar, teacher information, teaching materials, curriculum notice, answering discussion, curriculum questionnaire, learning notes, course work, online testing, test papers in libraries and other information. The research teaching mainly includes the research teaching information of university study teaching, research teaching. The teaching blog mainly includes the teaching video, my collection, the near future and so on.

### 3.2. Operation Mechanism of Network Teaching Platform

Ideological and political course network teaching platform of the operational mechanism of the complex, each module have the operation mechanism, now in Ideological and political course network teaching platform in teaching, for example, thought political lesson teaching including course introduction, teaching outline, teaching calendar, teaching materials and online testing information. This information is based on information, in a fixed period of time can not be changed, it does not have a short-term improvement of the feedback mechanism, through a semester of student learning

feedback appropriate adjustments. Teaching material is the focus of network teaching platform, the content and form of teaching materials determines the students learning enthusiasm, participation and learning; teaching materials of feedback mechanism is complex, long-term, and with students preference, teachers innovation is closely linked.

Teachers can use in curriculum questionnaire, course work and research teaching, answering discussion, question bank and the online test with short-term timely feedback and communication system, to understand and to control the enthusiasm of students and participate in the information. According to the information feedback from the students, improve the relevant information. The communication between teachers and students can be through the Internet, the network under the dual channels, online through the plate has some feedback mechanism and teaching mailbox, the network can be in the classroom teaching process feedback. Ideological and political course network teaching platform is a dynamic development process, it is not possible to jump on, need to go through repeated exchanges, feedback, analysis, research.

### **3.3. Problems and Analysis of Network Teaching Platform**

Ideological and political course network teaching platform is built on the Internet, for ideological and political education to provide a more comprehensive support and services. Ideological and political course network teaching platform after years of construction and development, and gradually improve the mouth, has made some achievements, but there are still a lot of problems in the application of the letter to be resolved. Figure 3-3 for college students of Ideological and political course network teaching platform satisfaction distribution, 56.44% of students of Ideological and political course network teaching platform basic satisfaction, 21.17% of the students are satisfactory, very satisfied with the students accounted for only 4.60%, and are not satisfied with the students accounted for 17.79%. Show that the Jiangnan University Thought political course network teaching platform is still in the initial stage of development, the application of network teaching platform in a certain extent facilitate the learning of college students, but due to the lack of teaching resource platform, content manifestations of a single, the different needs of students and colleges and universities have greater access and other reasons, so the students of their very satisfied, satisfied compared with the proportion of low. This objective shows that the network teaching platform of Ideological and political course in Jiangnan University needs to be improved.

## **4. Results Analysis**

### **4.1. The Influence of the Four Major Factors**

Teaching resources of colleges and universities and the construction of the platform and the teachers and students is the qualitative factors, qualitative analysis is mainly researchers to objective things and subjective, qualitative analysis of professional quality requirements are very high. In addition, due to the complexity and dynamic development of the teaching platform, it is difficult to comprehensively, objectively and systematically reflect the state of the various factors. So the comprehensive index analysis method, the qualitative and quantitative issues, through expert scoring method to determine the weight of indicators of each factor, calculated the value of the influence of four factors,

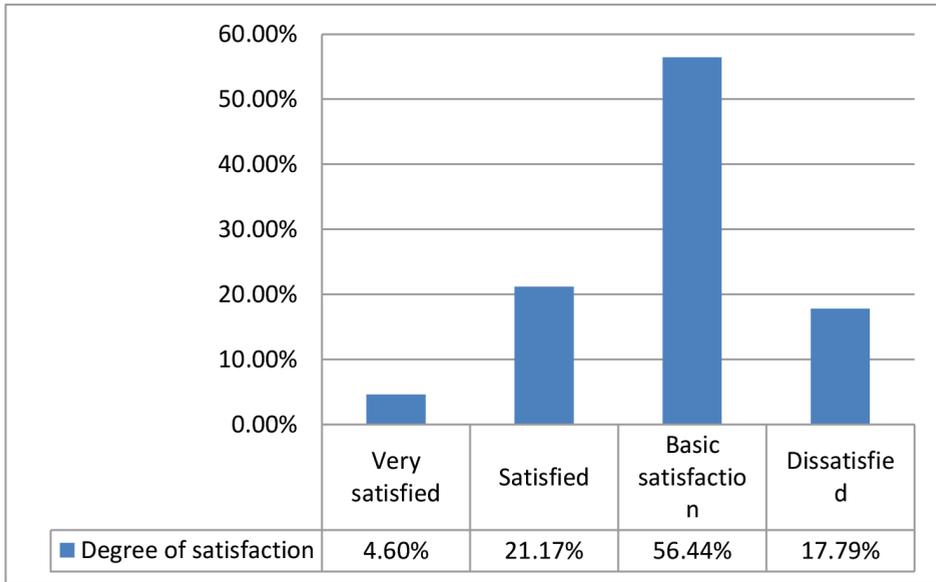


Figure 2 – Ideological and Political Network Teaching Evaluation

to observe the effect of Ideological and political course network teaching platform of the primary and secondary factors, provide the basis of Ideological and Political Course network teaching platform perfect. Index comprehensive analysis method can be more comprehensive and accurate reflection of the influence of various factors of Ideological and political course network teaching platform application.

**4.2.Index Evaluation Result Analysis**

Marx principle of philosophy of the primary and secondary principles that, because there are major and minor points, only to distinguish between primary and secondary, in order to seize the key factors, better analysis, to solve the problem. One class index for the four dominant factors, but the important degree of each factor vary. In order to make the research results with intuitive contrast effect and shows differences of each factor, using the scoring method to give the weight of indicators. In order to make the score of each factor more authoritative, using expert scoring method for many years, Professor, associate professor, and other 20 scholars for the score.

The calculation formula of the first order index is as follows:

$$W_g = \frac{\sum_{i=1}^N W_{gi}}{N} \quad (i=1,2,3...N) \tag{1}$$

$$W_p = \frac{\sum_{i=1}^N W_{pi}}{N} \quad (i=1,2,3...N) \tag{2}$$

$$W_j = \frac{\sum_{i=1}^N W_{ji}}{N} \quad (i=1,2,3...N) \quad (3)$$

$$W_x = \frac{\sum_{i=1}^N W_{xi}}{N} \quad (i=1,2,3...N) \quad (4)$$

$W_{gi}$ —The evaluation of the support of the University by the I.

$W_g$ —Support weight.

The function direction of the setting of the first order index weight is positive, and the direction of the function of the two level indicators of each level index is positive, and the influence degree of the 4 factors of the first grade index is positive, that is, the greater the value, the greater the impact value is.

The impact of the 4 main factors of the first level indicators are as follows:

$$Y_g = W_g * (\frac{1}{2} * X_{ga} + \frac{1}{2} * X_{gb}) \quad (5)$$

$$Y_p = W_p * (\frac{1}{4} * X_{pa} + \frac{1}{4} * X_{pb} + \frac{1}{4} * X_{pc} + \frac{1}{4} * X_{pd}) \quad (6)$$

$$Y_j = W_j * (\frac{1}{3} * X_{ja} + \frac{1}{3} * X_{jb} + \frac{1}{3} * X_{jc}) \quad (7)$$

$$Y_x = W_x * (\frac{1}{3} * X_{xa} + \frac{1}{3} * X_{xb} + \frac{1}{3} * X_{xc}) \quad (8)$$

According to the relevant score of the expert grading method, combined with the above formula, the weight of the 4 leading factors is obtained:

Target layer	First order index	Weight
<i>Influence factors of network teaching platform of Ideological and Political Course</i>	Colleges and universities support( $W_g$ )	0.767
	Network teaching platform ( $W_p$ )	0.788
	Teacher team( $W_j$ )	0.75
	Student ( $W_x$ )	0.73

Table 1 – First Level Index Weight

Through the expert scoring method, we can know that the score of the 4 leading factors is more uniform, basically maintained at about 0.75, but there are differences. The factors from the point of view, the construction of network teaching platform is the dominant

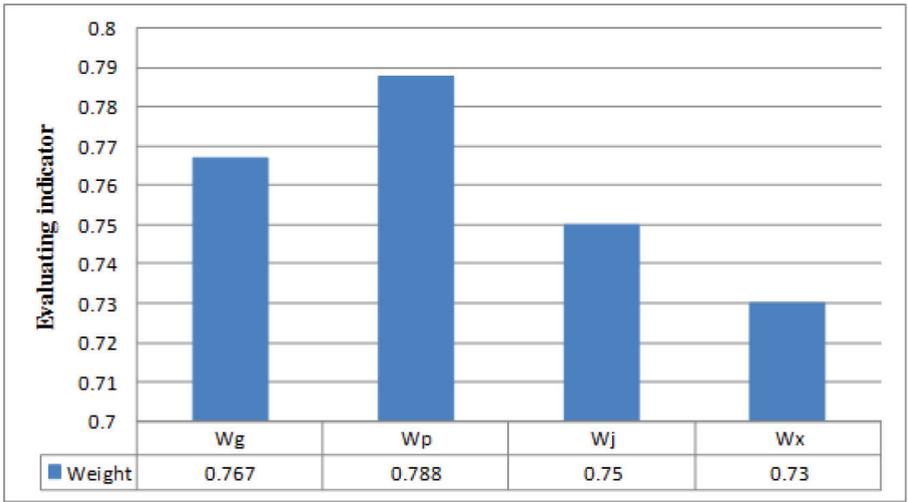


Figure 3 – Comparison of Index Weights

factors of the present operation situation of the influence, its weight is 0.788, which and above students thought political course network teaching platform operation exist cognitive deficiencies of consistent that network teaching platform construction lag is the main problem.

Target layer	First order index	Influence degree
<i>Influence factors of network teaching platform of Ideological and Political Course</i>	Colleges and universities support( $Y_g$ )	1.8
	Network teaching platform ( $Y_p$ )	2.1
	Teacher team( $Y_j$ )	1.7
	Student ( $Y_x$ )	1.5

Table 2 – Impact Degree of First Order Index

According to the results of the first level indicators, the construction of network teaching platform of Ideological and political course is the leading factor affecting the operation status and development of network teaching platform. The influence degree is 2.1, which is much higher than that of the other 3 factors. For ideological and political course network teaching platform construction is the dominant factor, experts and students have a common understanding, and with the college students of Ideological and political course network teaching platform deficiencies about network teaching platform construction is lagging behind the same evaluation. The construction of network teaching platform of Ideological and political course is the main factor that affects the efficiency of the current network teaching platform. It also reflects that it is a major problem to be solved in the course of the network teaching platform of Ideological and political education in the future.

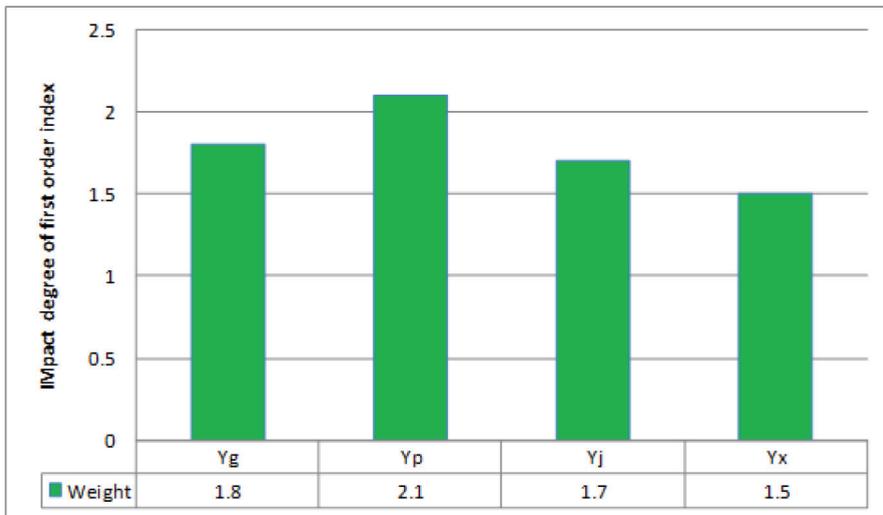


Figure 4 – IMpact Degree of First Order Index

## 5. Conclusions

With the advent of the Internet age, information technology has infiltrated into many fields such as politics, economy, culture and so on. The way of human production, life style and learning style have changed a lot. The traditional mode of education has, it is difficult to meet the diverse needs of students, our country's education reform and development facing unprecedented challenges, is the breakthrough point of the reform of education and the education information to promote the modernization of education. Ideological and political lesson network teaching platform as a new network teaching emerged as the times require. In the part of basic theory, discusses the development stage of the network teaching platform at home and abroad, and analyzes the Chinese universities thought political course network teaching platform main function, the analysis of the general thinking of the operational mechanism of political course network teaching platform, and combining with the channels of communication between the teachers and students of the inquiry. Based on the comprehensive evaluation method of the expert scoring method and the college students' score method, the influence factors of the network teaching platform of Ideological and political course in Colleges and universities are analyzed. From the first level indicators to the weight perspective one by one to explore the 4 leading factors of the index factors on the ideological and political course network teaching platform. The study found that the impact of the various factors on the overall ideological and political course network teaching platform is not a separate role, but intertwined, interaction, is a dynamic development of the system, a common role in the teaching platform. According to the influencing factors, the quantitative analysis of multi angle and qualitative problems, and puts forward the countermeasures to improve the ideological and political course network teaching platform system. The research results of this paper hope to provide help for more experts and scholars, using quantitative and qualitative methods to study the problems of Ideological and political course network teaching platform and its influencing factors.

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# Research of Computer-Assisted English Teaching System Design Based on Constructivism

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**Abstract:** Currently, computer-assisted instruction is developing toward the directions of virtualization, multimedia and networking, and has become a modernized teaching method. Particularly, with the advance of constructivism learning theory, computer-assisted instruction grows more mature. Currently although massive CAI software exists, they are not universal enough. In this case, this paper brings about a computer-assisted English teaching system based on the theory of constructivism. On the foundation of the constructivism theory, it employs the dominant integrable ware idea on the framework of Java language to construct an integrable ware platform tailored to basic teaching contents in English classes. The system can not only expand new content in the form of knowledge points and generate new courseware, but also make students intuitively feel the algorithm realization process and results. Moreover, through the integrable ware platform, teachers can independently develop their teaching software to cater to their teaching needs.

**Keywords:** Computer-Assisted instruction; constructivism; integrable ware idea; java.

## 1. Introduction

Nowadays, computer-assisted instruction is becoming a modern teaching method. Especially the proposal of constructivism learning theory has injected new vitality to computer-assisted instruction, (Shimomura K., Horie H., Sugiyama M., et al., 2016) so that computer-assisted instruction can grow more mature. Research on computer-assisted instruction first sprung up in the United States: the first computer system especially for general educational use was designed by IBM's Waston in 1958, (Sylvester O., Bibobra L., Ogbon O N., 2015) followed by PLATO a teaching system developed by the University of Illinois in 1960; in 1963 the IBM 1500 instructional system was designed and built by Stanford University and IBM in collaboration and functioned in university education; in 1968 the Ontario Institute for Studies in Education jointly developed CAI for individual education and quizzes; China began CAI research in the 1980s, and achievements have been made successively including the computer-assisted instruction system by East China Normal University, and the Fortran language teaching system by Xi'an Jiaotong University,

to name just a few. Overall (Kikot, T., Fernandes, S., & Costa, G., 2015), CAI studies in all countries have made great progress. However, despite that a lot of CAI software is present on the market, it is not universal enough, and it is often time-consuming for teachers to make courseware, thus limiting the widespread applications of CAI courseware. Based on this, this paper develops a computer-assisted English teaching system grounded upon the constructivism theory. This system employs the dominant integrable ware idea on Java, (Yunus M M., Salehi H., Amini M., 2015) a new generation of high-level programming language, to construct an integrable ware platform tailored to English teaching content. In this way, it can not only expand new content in the form of knowledge points and generate new courseware, but also make students intuitively feel the algorithm realization process and results. Moreover, through the integrable ware platform, teachers can independently develop their teaching software to cater to their teaching needs, marking that people's awareness of computer-assisted instruction has entered a new stage, and that it will become the development trend of future computer-assisted instruction.

## **2. Theoretical Basis**

### **2.1. Constructivism Theory**

The constructivism theory is composed of the constructivism learning theory and constructivist teaching theories. According to basic views of the constructivism learning theory, knowledge is not obtained by teachers' instruction; instead, knowledge is acquired by learners in a specific social and cultural context, relying on the help of others, taking advantage of necessary learning materials and through the construction of meaning. Help students construct meaning in the learning process, which is to help students to have a more profound understanding of the nature and laws of things reflected, as well as intrinsic links between different things (Cook F R., Geier E T., Asadi A K., et al., 2015; Ferguson J S., Sonetti D A., 2016). The long-term storage form of this phenomenon in the brain is the cognitive structure of the current learning content. Since learners actively construct the meaning of knowledge through interpersonal activities, the constructivism learning theory is student-centered. The constructivism teaching theory requires teachers to change from imparting and instilling knowledge to helping and promoting students to take the initiative to construct meaning, while it can be reached by education means brought about by the emergence and development of modern information technologies (Sineglazov V M., Godny A P., 2015).

### **2.2. Integrable Ware Idea**

Integrable ware is the basic teaching element of courseware. It is based on micro teaching modules, teaching materials or micro teaching strategies of a knowledge point. People can schedule, combine and use it as per teaching needs to generate multimedia teaching programs with some teaching functions. Integrable ware library composed of integrable ware and the software environment which develops, manages, assembles, generates, uses and processes integrable ware are collectively referred to as the "integrable ware system". Integrable ware aims to break through the isolated, narrow line of sight of instructional design based on class hours, to look in the long term and create an overall curriculum design, so that teachers can give full play to their initiative, activity and

creativity without the worries behind about making outstanding software by themselves. It provides a new guiding idea to design multi-media computer assisted instruction (MCAI) teaching software (Zhang Q., Zhang J., Wang M., et al., 2015).

### **2.3. Object-Oriented Thinking**

Object-oriented method (OO) is a systematic approach that applies object-oriented thinking to the software development process to guide development activities, and is a methodology built on the concept of objects. Objects are packaging bodies consisting of data and allowable operations and have a direct correspondence relationship with objective entities. An object class is defined as a group of objects with similar properties. (Zahra S B., 2016) The so-called object-oriented concept is to recognize, understand, characterize the objective world and to design, build the appropriate software systems based on the object concept following the class-based and object-centered construction mechanism of classes and inheritance (Lim S N., Chai J H., Song J K., et al., 2015).

## **3. Relevant Technology of the System**

### **3.1. Technical Architecture of the System**

The basis for the system to complete integrable ware combinations is that the integrable ware library should have a large number of integrable ware for use. The integrable ware can be prepared by developers in the product development process or added independently by teachers when preparing lessons, and the integrable ware are organized in some formal structure and stored in the computer, thus constituting an integrable ware library. Therefore, according to the above characteristics, the C/S structure is taken as the system infrastructure in platform design. Servers typically use a high-performance PC, workstation or minicomputer, and a large-scale database system such as ORACLE, SYBASE, informix or SQL Server. This system uses a two-tier C/S structure for development, which enables to put modules closely related with users like new courseware creation and courseware presentation to run in the foreground client, while let system administrators to unify the management of integrable ware in the background server. The client connects to the server via a LAN and interacts with the server. When a client needs to access the database, the server first contacts with the database via JDBC, and then returns the data processing results to the client.

### **3.2. System Development Environment**

This system is based on a Java two-tier C/S architecture. Below are the basic requirements of the development environment to run this platform. Hardware Environment: CPU processor: PentiumIV 1.5G processor; PentimuIV 1.7G or above is recommended. Memory: 256M, 512M or more memory is recommended. Hard disk: it is suggested that 500M is retained. CD-ROM drive: CD-ROM or DVD-ROM drive. Display: both CRT monitor and LCD monitor are suitable; screen resolution of 1024 x 768 pixels is recommended. Software Environment: operating system: due to Java cross-platform feature, the system can run in other operating systems such as Unix and Linux in addition to Windows. Given that currently Windows XP system is still preferred by most users, it is recommended that users use Windows XP as the operating system

of the system. JDK: Java Development Kit (JDK) is an applet that writes Java and an application development environment. It consists of a runtime environment on top of the operating system layer as well as developer compiling, debugging, and running tools for applet and applications written in the Java language (Bhusnure O G., Gholve V S., Sugave B K., et al., 2016; Kunz L., Nicoletto G., 2015).

## 4. System Design and Implementation

### 4.1. System Model

Research of the computer-aided English teaching system module in the present paper is based on the constructivist ideologies. To begin with (Perveen S., Chaudhary H S., 2015), by studying the computer-assisted instruction model, some comments on computer-assisted instruction are proposed as well as the three-tier computer-assisted instruction model based on constructivism. (Potočnik M., Klemenc B., Solina F., et al., 2015; Halász A., Halmai Á., 2015) The system model is mainly in the form of a mathematical model, and expands reciprocal links of various elements in the computer-assisted instruction and the model MX is defined as follows:

$$MX = (X t(1,2,3,4 \dots n), JA, XTK, CF, ZP, L) \tag{1}$$

where JA is the local multimedia courseware of this curriculum; XTK is local database of exercises for interactive learning; ZP is students' assessment system, CF is link event sets for triggering events, X t is network link event set for the reference pages of teaching resources, and L is the mapping of relevant items to the multimedia courseware, then:

$$(JA, XTK, ZP) \times (CF X t(1,2,3,4 \dots n)) = JA' \tag{2}$$

JA' is the new multimedia courseware formed by local or network resources. Below is a link relation diagram of computer-assisted instruction system model:

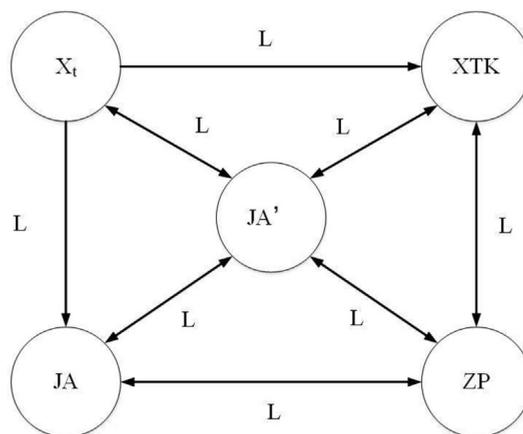


Figure 1 – Relation Diagram of System Model

**Courseware-level model**

The courseware-level model is the second level of the computer-assisted instruction system model. It describes the mutual link relations between courseware pages. The courseware level model is displayed in a mathematical model to expand mutual link relations between courseware pages. The model YM is defined as:

$$YM=( Y, CF, Q, L) \tag{3}$$

where Y is this course page, CF is link event sets for triggering events, Q is the course home page, and L is the mapping of relevant items to the multimedia courseware, then:

$$Y \times CF= Y' \tag{4}$$

Y' represents a new page for curriculum links. Below is a model link relation diagram of the courseware:

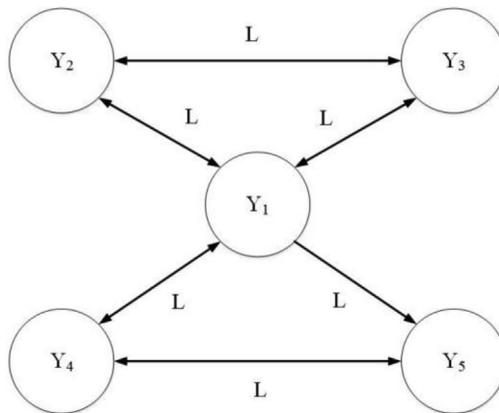


Figure 2 – Model Link Diagram of Courseware

In the figure above, Y1, Y2 and Y3 represent a link relation of coherent sequence between knowledge points in the courseware; Y1 and Y4 indicate the relation links of interaction between knowledge points, while Y1 and Y5 or Y4 and Y5 indicate the relation links of background knowledge between knowledge points.

**Page-level model**

The page-level model is a further description of the courseware-level model. It is the third layer of the computer-assisted instruction model being studied and mainly depicts link relations between internal sets of media. The courseware level model is displayed in a mathematical model to expand mutual link relations between courseware pages. The model Pr is defined as:

$$Pr=( Mp, CFp, Lp, Kp, Jp) \tag{5}$$

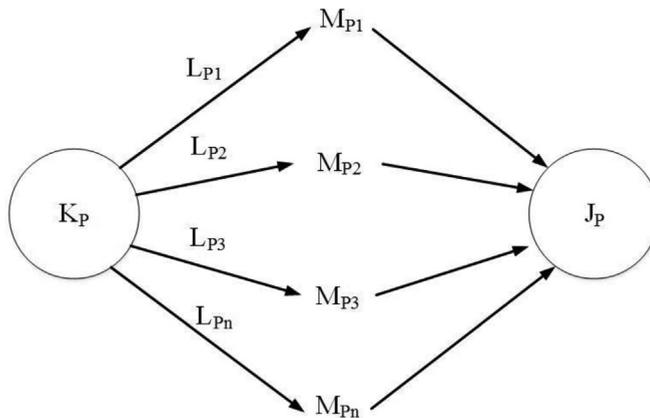


Figure 3 – Page Level Model Link Diagram

where  $M_p$  is a collection of a variety of media,  $CF_p$  is a link event set that triggers events inside pages,  $K_p$  is the home page,  $J_p$  is the end of the page, while  $L_p$  is a mapping of a multimedia event set of  $M_p \times CF_p$  related items inside of pages. Below is a model link relation diagram of the page:

#### 4.2. System Architecture

The computer-assisted English teaching system based on the constructivism theory is mainly for teachers that teach computer graphics, with the purpose of providing teaching and students a teaching-centered environment, and a permission mechanism oriented at teaching content and based on user role. The system architecture is shown in Figure 4.

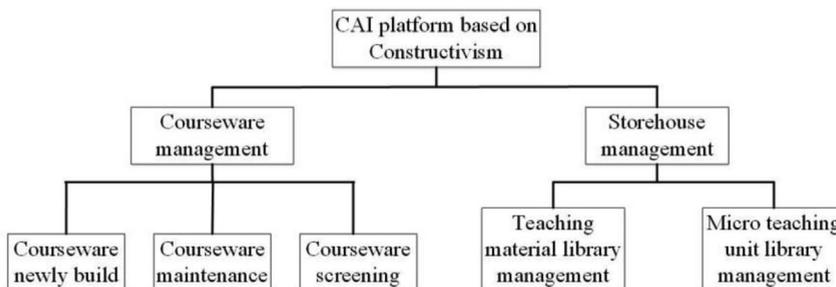


Figure 4 – Architecture of the System

##### 4.2.1. Courseware Management Module

The courseware management module mainly completes organic combinations of various types of integrable ware, to form an integrated whole, provide teachers with a convenient and efficient courseware making platform, and conduct unified management of the courseware generated, which encompass new courseware creation, courseware presentation and courseware maintenance. Flow chart of courseware presentation is shown in Figure 5.

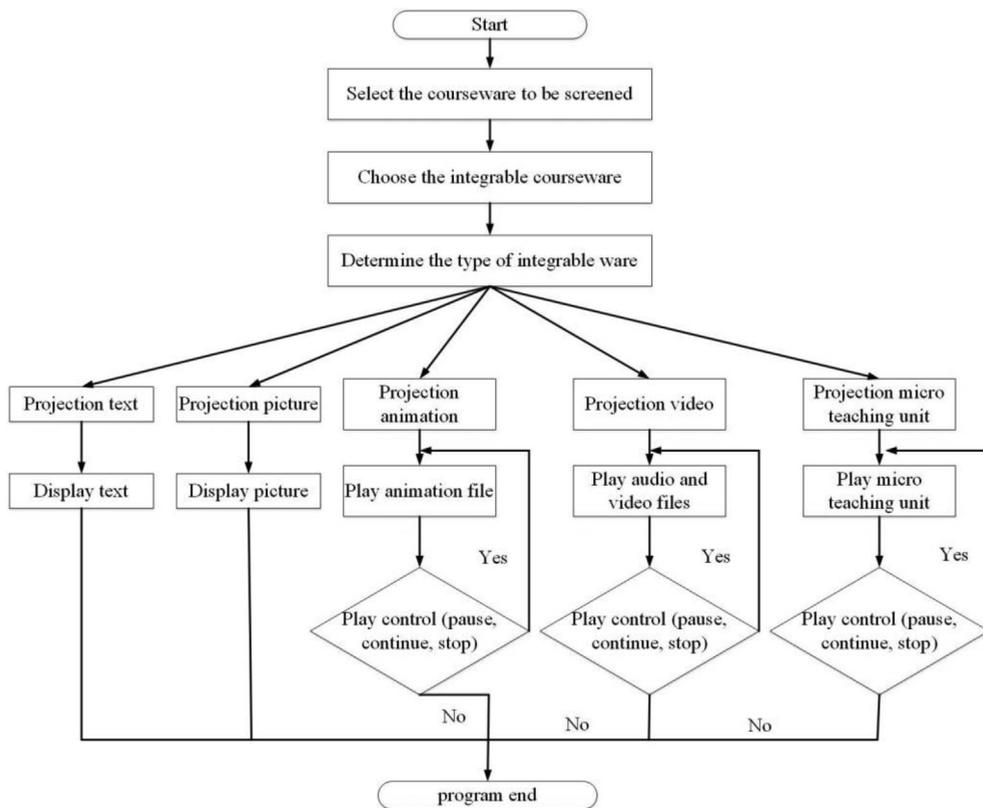


Figure 5 – Flow Chart of Courseware

#### 4.2.2. Integrable Ware Management

Integrable ware management completes unified management of teaching material library and micro teaching unit library in the five major integrable ware library, which facilitates users' retrieval and use of the integrable ware library, including: (1) teaching material library management: teaching materials are managed in both the foreground and background, and in the foreground client, teachers can use the search engine to use materials retrieved. Nevertheless, the main teaching material maintenance work is handed to the background. System administrators update or maintain materials in the teaching material library at any time through the background database management system. (2) Micro teaching unit library management: micro teaching unit (MTU) is small courseware designed to help teachers teach a difficult point or to help students learn a knowledge point or skill. It is resources prepared for teachers and students to use in teaching restructure. The micro teaching unit library in this system is mainly developed for basic graphics generation, a key point in computer graphics teaching. Graphics in computer graphics design is generated into an algorithm and small micro-teaching modules are designed for teachers to use directly in teaching, which enables students to feel immersive and more intuitively view the course of the algorithm execution.

### 4.3. Database Design and Implementation

Database is an indispensable part in the whole system design process. The implementation of computer graphics aided teaching platform requires the participation of database, and the quality of database structure design will directly affect the system efficiency and achievement results. A reasonable database structure design can improve the data storage efficiency and ensure integrity and consistency of the data. This system decides to use Microsoft SQL Server 2000 as the back-end database; SQL Server 2000 is located as a database application in the Internet, which provides a comprehensive data management and analysis solution for Web applications of users. The database can well support text and non-text information and is easy to use. Moreover, it has very high level of data security function.

#### Data table design

After analyzing the database functions above, the database structure is elaborated below: the database is named cgcai and has five user tables. These tables are structured as follows: (1) Courseware information table (CourseInfo) mainly records data regarding basic courseware information and its logical structure is shown in Table 1.

Serial number	Data name	Data code	Type	Width	Remarks
1	Courseware number	cID	int	4	Primary key, automatic plus 1
2	Courseware name	cName	nvarchar	100	Not null
3	Making time	cTime	nvarchar	50	
4	Producer	cMan	nvarchar	50	
5	Knowledge point	cTopic	nvarchar	50	
6	The chapter	cChapter	nvarchar	50	
7	The festival	cSection	nvarchar	50	
8	Courseware description	cDescription	nvarchar	200	

Table 1 – Courseware Information Table

Serial number	Data name	Data code	Type	Width	Remarks
1	Storeware number	iID	int	4	Primary key, automatic plus 1
2	Storeware name	iName	nvarchar	50	Not null
3	Storeware type	iType	nvarchar	50	Media material
4	Storeware theme	iTopic	nvarchar	50	
5	Route	iPath	nvarchar	50	
6	Size	iSize	nvarchar	50	
7	Introduction	iSummary	nvarchar	200	

Table 2 – Integral Information Table

Integrable information table (IntegrableInfo) mainly records data regarding basic integrable information, including the basic information of teaching materials and micro-teaching unit. Its logical structure is shown in Table 2.

Member information table (Member) mainly records users' basic information and its logical structure is shown in Table 3.

User list (yonghu) mainly records users name and password, as well as authority information about the user. Its logical structure is shown in Table 4.

Serial number	Data name	Data code	Type	Width	Remarks
1	Membership number	mID	int	4	Primary key, automatic plus 1
2	Member role	mRole	nvarchar	20	Administrators, teachers, students
3	Member name	mName	nvarchar	50	Not null
4	Company	mUnit	nvarchar	100	
5	E-mail	mEmail	nvarchar	50	
6	Home phone	mPhoneH	nvarchar	20	
7	Mobile phone	mPhoneM	nvarchar	20	

Table 3 – Member Information Table

Serial number	Data name	Data code	Type	Width	Remarks
1	User number	uID	int	4	Primary key, automatic plus 1
2	Membership number	mID	int	4	Not null
3	User names	uName	nvarchar	50	Not null
4	Password	uPwd	nvarchar	10	
5	User role	uRole	nvarchar	20	Administrators, teachers, students

Table 4 – User List

#### 4.4. Design and Implementation of Major Interfaces

##### 4.4.1. Design and Implementation of Login Interface

In order to protect the system safety, any user should first log in before entering the client because the platform is targeted for users of different authorities and can realize different functions. Users with teachers' permission can make all operations of the client in the platform whilst users with students' permission can only query, browse and perform other operations, but not create new courseware, etc. Interface of the client login is shown in Figure 6.



Figure 6 – Interface of the Client Login

#### 4.4.2. Design and Implementation of the Courseware Management Module

Courseware management is divided into three parts: new courseware creation, courseware presentation and courseware retrieval. New courseware creation is mainly presented to teachers in a guiding way so that teachers can easily and quickly create new courseware through interface prompts, including input of basic courseware information and selection of integrable ware. Therein, basic courseware information includes courseware number (the number is automatically generated by the system without user input), courseware name, producers, knowledge points involved and chapters, sections, etc. The information will be all saved to the server database and also used as keywords for courseware retrieval. The input interface of basic courseware information is shown in Figure 7.

### 5. Experimental Analysis

8 natural classes are randomly selected from freshmen enrolled in 2014 for testing (experimental group). In addition, 12 natural classes form the control group. Both the control group and experimental group use the same New Version of New Concept English. This study chose 6 of the natural classes (183 students), in which two classes from the experimental group (61 students) participate in the assisted instruction project (two classroom teaching, two computer-assisted instructions per week) and four classes (122 students) for the control group according to traditional classroom teaching (two intensive reading and two listening classes per week). In order to ensure that the research subjects' English proficiency before experiment participation does not affect the study, we set a significance level to 0.05 and carry out an ANOVA (analysis of variance) test of English entrance examination scores of two groups of students. Results  $F(1,151)=0.174$ ,  $P(\text{Sig.}=0.667>.5)$ , showing there are no significant differences of the English proficiency



Figure 7 – Interface of the Basic Information of Courseware

between the experimental group and the control group. Throughout the semester, six classes are taught by the same teacher with the exactly same books, homework, quizzes and examinations. Before analyzing the test scores of the experimental and control groups, a development testing is conducted of the mid-term and final-term results of our team, and the result (Sig. = .733/ .2.2/ .999/ .543) >0.05, demonstrating results of the study objects are normally distributed. We used SPSS to analyze results from two groups, as shown in Table 5, in order to determine whether there are differences in academic performance between the experimental and control groups after studying for a period of time.

		Midterm grade	Final grade
<i>Control group</i>	Average	67.3535	68.0606
	Standard deviation	7.99498	9.74765
<i>Experience group</i>	Average score	67.4352	73.6852
	Standard deviation	6.51634	7.98542
<i>ANOVA analysi</i>	Significant level	0.949	0.000

Table 5 – Comparison Between Experimental Group and Control Group

$P^* > 0.05$ ,  $P^{**} < 0.05$

The analysis shows that there are consistent differences of the average and standard deviation between the control group and the experimental group; the average of two exams in the experimental group is higher than that of the control group, while the standard deviation is always lower. Through the above investigations and analyses, a

major result is found that computer-assisted instruction system as a supplement to English teaching can improve students' academic achievement in the long term.

## 6. Conclusion

In recent years, with the continuous development of computer technology, research of computer-assisted instruction systems has also encountered many new opportunities and challenges. This paper develops a computer-assisted English teaching system grounded upon the constructivism theory. This system employs the dominant integrable ware idea on the framework programming language of Java to construct an integrable ware platform tailored to English teaching content. In this way, it can not only expand new content in the form of knowledge points and generate new courseware, but also make students intuitively feel the algorithm realization process and results. Moreover, through the integrable ware platform, teachers can independently develop their teaching software to cater to their teaching needs, marking that people's awareness of computer-assisted instruction has entered a new stage. In addition, this system needs to be further perfected. It has been running for a very short while in the LAN with inadequate testing, so some problems may also occur, and more considerable attention should be paid to the actual teaching effects of this platform.

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# Research on an Improved Pedestrian Detection Method based on Deep Belief Network (DBN) Classification Algorithm

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**Abstract:** The wide application of pedestrian detection method makes it an important part in the computer field, which provides significant support in multiple domains as video monitoring, driver assistance system and intelligent robots, etc. Based on full investigation of related technologies as pedestrian detection and deep learning, this paper summarized the main difficulties of pedestrian detection and problems of the current method, specifically studied the pedestrian detection method based on deep learning, and proposed an improved pedestrian detection method with DBN classification algorithm on account of the problems existed in current shallow classification method as over amount of training samples and weak fitting ability of complicated functions, etc. First, the research improved the DBN input mode by establishing T-distribution-included function outermost layer nodes RBM (Restricted Boltzmann Machine) input terminal, and converted the extracted pedestrian feature information into the classifier recognizable Bernoulli distribution through the outmost layer structure of the input terminal. Then, BP neural network is used to establish the output terminal of the classification structure to realize the revert transmitting of the classification error message, tune the parameters of classification structure and optimize the structure of the classifier continuously. The experiment shows that the improved DBN pedestrian detection method has better performance than that of the classic shallow-layer classification algorithm. The detection speed of the improved algorithm can satisfy the use requirement.

**Keywords:** ITS (Intelligent Transportation System); DBN (Deep Belief Network); RBM (Restricted Boltzmann Machine); deep learning.

## 1. Introduction

Video-based pedestrian detection has been a research hotspot in the computer visual and intellectual traffic fields. The research is dedicated to obtaining the real-time pedestrian information accurately and automatically within the monitoring scope to provide a strong information support for the subsequent researches of analysis of pedestrian behaviors, pedestrian safety protection as well as pedestrian quantity statistics. The research on pedestrian detection has been developed for several decades and made impressive progresses in both detection accuracy and detection speed.

However, compared with human's recognition ability, pedestrian detection still faces a lot of problems in solving practical issues and has a long way to go. With the increasing demands of pedestrian detection technology in recently years, a number of researchers focused on the improvement of pedestrian detection performances. To solve the problems, researchers put forward various algorithms, which promoted the development of pedestrian detection. In 2001, Viola et al. (Enzweiler, M., & Gavrila, D. M., 2009) raised the face detection algorithm based on "AdaBoost + Haar". The algorithm uses the AdaBoost method to select the high discriminative features from abundant simple Haar features for classification. It has achieved good results and is a breakthrough in the target detection domain, which is successfully applied in pedestrian detection (Zhao, L., & Thorpe, C. E., 2000). In 2005, Dalal et al. proposed the HOG (Histogram of Oriented Gradient) feature. Taking simple linear SVM (Support Vector Machine) as the classifier, HOG feature is very effective and has achieved preferable effects. The detection rate can reach 100% in the pedestrian data base MIT test set. For this purpose, Dalai established a pedestrian data base INR1A based on a daily life scene, which greatly reduced the difficult of pedestrian detection. The appearance of HOG feature tremendously promoted the development of pedestrian detection, which has a profound influence for subsequent researches. Most of the subsequent pedestrian articles are extended on this basis. In order to improve the speed of pedestrian detection, Zhu et al. (Dollar, P., Wojek, C., Schiele, B., & Perona, P., 2012) used integral histogram technology to rapidly calculate HOG feature. It selects the high discriminative sections through AdaBoost algorithm and constructs a classifier. The speed of this method increased nearly 70 times than (Tuzel, O., Porikli, F., & Meer, P., 2008). Except HOG feature, researchers also proposed some new features to improve the pedestrian detection performances by combing with HOG feature. Tuzel (Xu, F., Liu, X., & Fujimura, K., 2005) et al. raised the covariance descriptor and trained LogitBoost classier on Riemannian Manifold to improve the detection performance. Based on the characteristics of pedestrians and traditional LBP (Local Binary Pattern) (Geronimo, D., Lopez, A. M., Sappa, A. D., & Graf, T., 2010), Mu (Gavrila, D. M., & Munder, S., 2007) et al. proposed two variants of LBP, Semantie-LBP and Fourier-LBP. Wang et al. (Hinton, G. E., Osindero, S., & Teh, Y. W., 2006) also achieved good effects in pedestrian detection by combining HOG feature and LBP histogram feature. In 2011, Wu et al. put forward CENTRIST feature (Chin, C., & Brown, D. E., 2000) (CENSusTRansformhiSTogram), which can represent the overall information of the scene and apply to the scene classification. Then Wu et al. used integrogram to calculate CENTRIST (Barrett, H., 2001) with cascade classifier and applied to pedestrian detection. Although the pedestrian detection effect of current deep learning is still not as good as the best pedestrian detection algorithm, deep learning will also become the mainstream of detection algorithm or even become the best method of all the target detection tasks(Carvalho, A. A., Araújo, I., & Fonseca, A., 2015). By taking advantage of the deep learning idea to construct the pedestrian detection system, this paper proposed an improved DBN pedestrian feature classification algorithm. This algorithm first establishes the T-distribution-included function outermost layer nodes RBM input terminal to realize the data information conversion between the pedestrian feature data distribution and the classifier; then uses the multiple hidden RBM structure to realize the layer-by-layer conversion of the feature information and maintains the key information; at last, it tunes the whole classification system through the revert

transmitting performance of BP network and continually optimizes the classification structure to realize the preferable pedestrian detection result.

## 2. Improved DBN Classification Algorithm

Different from shallow learning classification algorithm, deep learning classification algorithm has better ability of approximating complicated functions. This kind of algorithm usually contains a multi-layer structure to realize the gradual transformation of feature algorithm and retains the most effective information part (Erhan, D., Bengio, Y., Courville, A., Manzagol, P. A., Vincent, P., & Bengio, S., 2010). In 2006, scholars represented by Hinton put forward a deep learning algorithm based on DBN. This method constructs the learning model with a multi-layer RBM, and realizes the overall optimization of training through the adjustment of iterative network weight value and change of optimal deep structure and escape from the local minimum value. Being able to solve the long-existed local minimum value problem, DBN algorithm has been more and more concerned by related scholars and is being applied in many image and speech recognition fields (Warburton, K., 2003). When using DBN to realize feature classification, as the input value is normally binary vector information and the value property of the pedestrian feature value information is a consecutive integer or real value in the pedestrian detection field, the direct use of DBN algorithm to realize feature classification may cause the loss of information data and affect the classification effect. (Beattie IV, V., Collins, B., & McInnes, B., 1997) This paper aims to improve the DBM deep learning algorithm by introducing the input layer of T-distribution-included function outermost layer nodes to better treat pedestrian feature information and realize information classification and pedestrian recognition through network pre-training and network tuning.

### 2.1. RBM With T-Distribution-Included Function Outermost Layer Nodes

As a key part of DBN algorithm, a single RBM is usually consisted by two tiered structures: outermost layer and hidden layer. Outermost layer unit and hidden layer unit are connected with each other. But the units themselves are not connected. The structure diagram is shown as Figure 1.

As shown in Figure 1, outermost layer structure  $v$  and hidden layer structure  $h$  constructed a RBM structure. The weights of each unit can be adjusted by comparing the relevance and difference between outermost layer structure unit and hidden layer structure unit. As the pedestrian feature adopted in this paper is approximately subordinate to

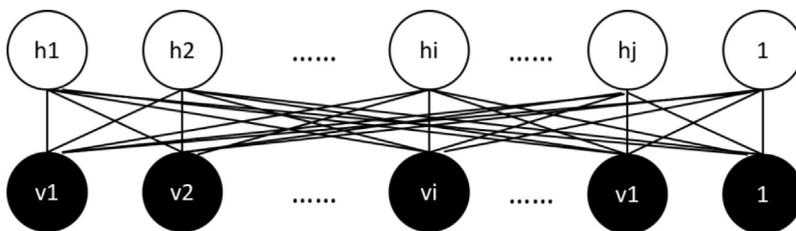


Figure 1 – RBM Structure Sketch Map

T-distribution function, this paper constructed a new-type RBM with T-distribution function outermost layer nodes, and realized the function of transforming T-distribution function to Bernoulli distribution between the outermost structure and hidden structure. In the RBM with T-distribution function outermost layer nodes, the outermost structure subordinates the T-distribution, and the hidden structure subordinates Bernoulli distribution. The energy function is shown as below:

$$E(v, h; \theta) = \frac{1}{2} \sum_{i=1}^I \frac{[(u-2)(v_i - b_i)]^2}{u^2} - \sum_{i=1}^I \sum_{j=1}^J \omega_{ij} v_i h_j - \sum_{j=1}^J \alpha_j h_j \tag{1}$$

where,  $\theta$  represents the given model parameter;  $\omega_{ij}$ ,  $\alpha_j$  represents the relevant weight between outermost layer node  $v_i$ ,  $v_i$  and hidden layer node  $h_j$ ,  $h_j$ ;  $b_i$ ,  $b_i$  stands for the offset of outermost layer node;  $\alpha_j$ ,  $\alpha_j$  represents the offset of hidden layer node;  $u$  is the freedom degree of T-distribution function which is used to control the change of distribution form;  $u/(u-2)$  is the variance yields of T-distribution function.  $I$  refers to the number of nodes of the outermost layer structure;  $J$  refers to the number of nodes of the hidden layer structure.

Similar to traditional RBM, the relational expression of joint distribution and energy function of the RBM with T-distribution function is:

$$p(v, h, \theta) = \frac{\exp(-E(v, h; \theta))}{Z} \tag{2}$$

where,  $Z = \int \sum_h \exp(-E(v, h; \theta)) dv$

In the RBN with T-distribution function outermost layer nodes, the corresponding conditional probability of outermost layer nodes and hidden layer nodes can be represented as:

$$p(v_i = 1 | h; \theta) = \frac{1}{\sqrt{2\pi}\sigma_i} \exp\left[-\frac{(1 - b_i - \sigma_i \sum_{j=1}^J h_j \omega_{ij})^2}{2\sigma_i^2}\right] \tag{3}$$

$$p(h_i = 1 | v; \theta) = \delta\left(\sum_{i=1}^I \omega_{ij} v_i + \alpha_j\right) \tag{4}$$

where,  $\delta(x) = \frac{1}{1 + e^{-x}}$

### 2.2. Construction and Pre-training of DBN

The DBN constructed in this paper is consisted by a 1-layer RBM with T-distribution function outermost nodes, multi-layer traditional hidden RBM and 1-layer BP network. The RBM with T-distribution function outermost nodes is the data input layer, which transforms the pedestrian feature information to Bernoulli data that can be recognized by DBN. After transformation, the data will be extracted and abstracted in multi-layer RBM. Key information will be retained and redundant information will be eliminated. The last 1-layer BP network is the output layer of the system. The information transformed

by multi-layer RBM enters BP layer, supervises the output structure through the back propagation ability of BP network, and reversely tunes the overall DBN model parameter to achieve the goal of optimizing model classification effect. The diagram of the DBN model constructed in this paper is shown as Figure 2. The diagram is consisted by a 1-layer RBM with T-distribution function outermost nodes, 2-layer hidden RBM and 1-layer BP network. The data is input by the RBM with T-distribution function outermost nodes at the bottom and output by the BP network at the top. The top BP network has the ability of back propagation and tuning the whole DBN model, which can optimize the model structure.

In the model pre-training, the calculation method of the joint distribution of data and the conditional distribution of the outmost and hidden layers at the input layer is stated as 1.1°.The mid-layer is the traditional RBM information transformation that is the data transformation from the (outmost layer) Bernoulli to the (hidden layer) Bernoulli. The energy function is defined as:

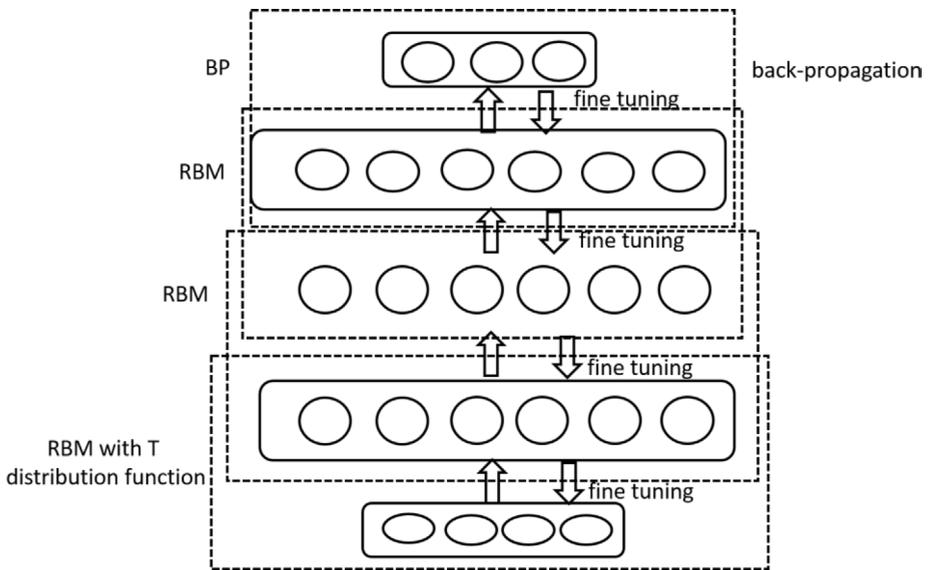


Figure 2 – Deep Belief Network Model

$$E(v, h; \theta) = - \sum_{i=1}^I \sum_{j=1}^J \omega_{ij} v_i h_j - \sum_{i=1}^I b_i v_i - \sum_{j=1}^J \alpha_j h_j \quad (5)$$

where,  $\theta$  still stands for the given model parameter,  $\omega_{ij}$  represents the associated weights between the outmost layer node  $v_i$  and the hidden layer node  $h_j$ ;  $b_i$  is the outmost layer node deviation;  $\alpha_j$  stands for the hidden layer node deviation;  $I$  refers to the node number of the outmost layer structure;  $J$  refers to the node number of the hidden layer structure. The corresponding condition probability of traditional RBM outmost layer and hidden layer nodes is defined as:

$$p(h_i = 1 | v; \theta) = \delta \left( \sum_{i=1}^I \omega_{ij} v_i + \alpha_j \right) \tag{6}$$

$$p(v_i = 1 | v; \theta) = \delta \left( \sum_{i=1}^I \omega_{ij} h_i + b_i \right) \tag{7}$$

Where,  $\delta(x) = \frac{1}{1 + e^{-x}}$ .

Based on the gradient of the log-likelihood ratio  $\log p(v; \theta)$ , the expression of RBM weight is updated as:

$$\Delta \omega_{ij} = E_{data}(v_i h_j) - E_{model}(v_i h_j) \tag{8}$$

Where,  $E_{data}(v_i h_j)$  represents the expectation of the training data set;  $E_{model}(v_i h_j)$  is the expectation of the definition in the model. As it is not easy to calculate the model expectations directly, this paper will calculate the approximate value with the contrast difference algorithm of the approximation gradient proposed by the documents.

### 2.3. Tuning Phase of DBN

In order to optimize the classification result and further improve DBN structure, a comparison between the output result and the real result should be conducted. The comparison result will be used for the tuning of DBN structure and parameter to achieve the goal of further optimizing the classifier. This paper takes advantage of BP network for the supervision and feedback of the output value, reversely propagates the classification difference to the DBN model input terminal and tunes the whole classification model accordingly. The realization of the DBN tuning phase includes two steps. In the first step, the forward propagation properties of BP network is used to further treat the BP network connected and RBM processed information, and outputs the classification results. The second step is the reverse propagation. After comparing the output result and real result of BP network, the difference between the results can be obtained and then reversely propagated to the input terminal to optimize the classification model parameters with the conjugate gradient method.

## 3. Realization of Pedestrian Detection Algorithm

In the pedestrian detection algorithm proposed in this paper, the detection process is realized through the extraction and classification of features. First, there are some preliminary tasks, such as the pre-processing and shadow elimination of images. Then, the pedestrian feature extraction and training should be carried out. Last, enter the collected data into the classifier for feature classification and pedestrian recognition.

### 3.1. Pedestrian Feature Extraction

GSRLBP algorithm with gradient information presented in the first section is applied to extract pedestrian features. The pedestrian sample base is treated as following steps:

Step1: To obtain the accumulated gradient information of the image and to find out the possible interested area that may contain pedestrian objects.

Step 2: To extract the texture features of pedestrians with the improved GSRLBP algorithm.

Step 3: To calculate and input the weight allocation value of classifier's outmost layer based on the distribution range of pedestrians' texture features.

### 3.2. Deep Learning Classifier

In the establishment of deep learning classifier, the RBM with outmost layer nodes discussed in the second section is used to build the input terminal of the classifier, realizing the numerical transformation from the input data into the classification data; then, the data is transferred layer by layer equivalently using the energy function hidden layer structure; in the end, RBM will be connected to BP network to form the output terminal. Detailed steps are as following:

Step1: Initialization

1. Input the training sample set  $E = \{(x_1, y_1), (x_2, y_2), \dots, (x_n, y_n)\}$ ,  $x_i \in X$ ,  $y_i \in \{-1, 1\}$ ,  $X$  is the sample space,  $y_i$  is the sample type.
2. Initiate unit number of RBM's outmost layer that has outmost layer nodes; initiate the unit number of RMB's outmost and hidden layer.
3. Initiate the weight of the sample.

Step 2 Training of Classifier

1. Select the classifier's layers which have hidden layer structure.
2. Use equation (2)~(4) to get the pedestrian feature data, and input the data into the outmost layer terminal of the classifier.
3. Use equation (5) and (6) to achieve the layer-by-layer transformation of the feature data in the hidden structure.
4. Update the weight using equation (7).
5. Calculate the error rate of sample classification by  $h_i : \varepsilon_{asym} = N_{FN} + N_{FP}$ . In this formula,  $N_{FN}$  is the number of incorrectly classified pedestrian samples;  $N_{FP}$  is the number of incorrectly classified non-pedestrian samples.
6. Based on the calculations of incorrect classification, use BP network to reversely tune the classifier's structure, until the structure is in optimal arrangement.
7. Output the final classification results.

## 4. Experimental Results and Analysis

The performance of this new pedestrian detection algorithm based on texture features and deep learning is verified through the following experiments. The first step is to select

the sample set; in this step, the training and testing samples are chosen from the open-source pedestrian sample set library. Then, compare the pedestrian feature extraction algorithm proposed in this paper and the DBN pedestrian sample classification algorithm with other classical feature extraction and classification algorithms under the same pedestrian detection system and environment, thus verifying the feasibility and excellence of this new algorithm. At last, analyze and conclude the experimental results.

#### 4.1. Selection and Distribution of the Experimental Samples

Most of the experimental samples are chosen from the open-source pedestrian sample set Daimler. Some samples are collected or shot by the researchers, and are well-processed to present an identical image format as the samples from Daimler. In order to train the classifier and to test the classification performance, the sample set is divided into training samples and testing samples. The experiment is conducted on OpenCV platform. Totally, there are 8346 images as training samples, which are applied to train the classifier of deep belief network pedestrian. Meanwhile, 3256 images are chosen as the testing samples from the experimental sample set, which are used to verify the classification recognition results of the classifier.

#### 4.2. Influence of Feature Extraction Algorithm on Pedestrian Detection Performance

In this experiment, the performance of the pedestrian detection method presented in this study is evaluated and analyzed. In order to objectively evaluate the classification and detection performance of this new method, the indexes (e.g. detection rate and false alarm rate) that can best visually reflect the detection results are adopted to analyze and evaluate the testing results:

$$\text{Detection rate} = \frac{TP}{TP + FP} \times 100\%$$

$$\text{False alarm rate} = \frac{FN}{TP + FN} \times 100\%$$

TP is the number of positive samples that correctly classified; FP is the number of positive samples that wrongly classified; FN is the number of negative samples that are wrongly classified as positive samples.

In the same detection environment, the GSRLBP texture feature extraction algorithm that has gradient information is compared with the three classical pedestrian feature extraction algorithms discussed in document (Arel, I., Rose, D. C., & Karnowski, T. P., 2010) and (Rushton, A., 2005); the deep learning classifier proposed in this paper is applied to this experiment. Detailed testing results are listed in Table 1.

It can be concluded from Table 1 that the pedestrian feature extraction algorithm is better than the classical pedestrian feature extraction algorithms from the perspective of comprehensive performance. This new algorithm has high detection rate and low false alarm rate. From the aspect of real-time capacity and scalar pedestrian features,

Feature algorithm name	Detection accuracy		Detection speed
	Detection rate	False alarm rate	Average processing a frame picture
	/%	/%	/s
GSRLBP with gradient information	92.6	8.7	0.112
Extended Haar	79.8	22.3	0.095
HOG-LBP	87.1	10.7	0.273
Radon-SOFT	88.7	13.1	1.715

Table 1 – Comparison Pedestrian Feature Detection Index

there is still room for improvement, but this new algorithm can satisfy system’s basic requirements on real-time capacity.

### 4.3. Influence of Classification Algorithm on Pedestrian Detection Performance

In the same detection conditions, the deep learning classification algorithm is compared with the three outstanding pedestrian classification algorithms (CPSOSVM, SVM-AdaBoost and CS-SVM-AdaBoost). The GSRLBP algorithm with gradient information is selected as the pedestrian feature extraction algorithm, and its performance is evaluated through the testing indexes. In this experiment, the layer of deep belief network is set to be 4 layers, in which the number of neural nodes of the three hidden layers is 60, 80 and 150, respectively. The iteration times is set to be 1500. Detailed detection indexes are listed in Table 2.

Feature algorithm name	Detection accuracy		Detection speed
	Detection rate	False alarm rate	Average processing a frame picture
	/%	/%	/s
Deep belief network	92.6	8.7	0.112
CPSO-SVM	88.2	13.2	0.311
SVM-Adaboost	87.3	11.5	0.117
CS-SVM-Adaboost	89.8	10.6	0.136

Table 2 – Comparison of Different Algorithms Detection Index

As shown in Table 2, the deep learning classification algorithm presented in this paper is superior to the other three classical classification algorithms. Therefore, the pedestrian classifier established based on deep learning has better classification performance than the classification algorithm built on shallow layer learning.

## 5. Conclusion

On account of the high requirements of current shallow layer pedestrian classification methods on training sample quantity and pedestrian feature description, this paper proposed a pedestrian test algorithm based on deep learning idea. First, the method improved the traditional DPN algorithm by introducing a T-distribution-included function outermost layer RBM to realize the Bernoulli conversion of pedestrian feature data. Secondly, it established a RBM structure, realized the mutual conversion of feature data in the hidden structure and maintained key recognition information. At last, the method used BP neural network to establish the DBN output terminal, reversely transmitted the recognition errors through the reverse transmitting property of BP network, which were kept as the important evidence for the tuning and continual optimization of the classification structure. According to the experiment, the training samples needed in the proposed pedestrian classification algorithm are less than that of the traditional shallow learning algorithm. In addition, the classification performance of the improved algorithm is better than that of the classic shallow layer classification algorithm, and the detection speed can also satisfy the use requirement.

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# Design of Automobile Internet Marketing Management Platform Based on B/S Three Layer Structure

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**Abstract:** In the domestic and foreign automobile market competition is extremely fierce, the modernization and information of automobile enterprises will also become the new point and breakthrough point of enterprise profit. Automobile enterprises are constantly adapting to the development of the market economy, to change the marketing mode, so that the automobile enterprise marketing management to information management forward. According to the actual demand of automobile marketing management, the sales process and function of the automobile marketing are studied, and the structure of B/S three layer structure based on Web is put forward. Through the Internet browser, the client can be very convenient to complete the data entry, information browsing, query and other work. According to the theory of the three layer B/S software structure model, the overall framework of the marketing management information system is designed, which is suitable for the development of automobile enterprises. Combined with the automobile marketing business situation and features, abstract automobile marketing system. The general requirements, the automobile enterprise marketing management information system were system structure design, function and structure design, the backstage database design technology. Through the test, you can get the next quarter of the car sales forecast. At the same time, the system also improves the overall efficiency of the company. The design of the automobile mobile internet marketing management platform based on B/S three layer structure has a great promoting effect on the automobile marketing management industry.

**Keywords:** B/S three tier structure; automobile mobile marketing management platform.

## 1. Introduction

With the control of the national macro policy, the concept of life of Chinese residents, consumption structure is constantly changing. China's automobile marketing information management started in twentieth Century 90 years, by the management system, the traditional concept of constraints, the status quo is still in an embarrassing position. Most of the enterprises or by the way of artificial statements, the enterprise information management; or only use the computer statistics report, wage payment.

Market information serious failure, product forecasting data deviation, enterprise and enterprise, between the enterprise various departments, business processing and information exchange is not smooth; long cycle, low efficiency, high error rate (Oh, J., Koh, B., & Raghunathan, S., 2015). Although has established all over the country and even around the world sales and after-sales service network system; but the whole network system utilization rate is not high, efficiency promotion is slow, the feedback information is not timely, lack of modern information technology support system, to customers as the center of management thought to comprehensive strikes root in the hearts of the people (Mattson, D. C., 2015). According to the problems existing currently in the process of automobile enterprise marketing management, in the master automobile marketing mode of management of the whole process under the premise, fully integrated car on the basis of knowledge, knowledge and information management, marketing theory, information science theory and various aspects of knowledge. Through the organic combination of personnel, machine and program (software), to develop a suitable for the current market needs, simple and easy to use, scientific and standardized automotive marketing information management platform (Hu, Y., Zhang, X., Feng, B., Xie, K., & Liu, M., 2015). The platform can be accurately and in a timely manner to the automobile marketing management information collection, sorting, classification, storage, analysis, evaluation and distribution, automobile marketing decision makers can get the most real, the most cutting-edge automotive marketing management information in the first time and can therefore formulated and revised for enterprise development and expansion of the automobile marketing plan, and ensure the smooth and effective implementation and control. Establish a set of marketing information management system to meet the needs of the development of the automobile market, which can provide the basic guarantee for the small and medium enterprises to win the market. Automobile enterprise marketing management platform in the full understanding of the consumer market demand and understanding based on the business needs of the design in line with sales of enterprise marketing management function modules, for marketing management of automobile enterprises provide quality and efficient service, to provide more comprehensive and efficient information resources for marketing decision makers, greatly enhance the market competition ability of the enterprise. It has very important practical significance (Mira-Giménez, M. J., 2015).

## 2. B/S Architecture System

B/S structure is a kind of structure in the process of rapid development of network distribution technology, which improves the structure of C/S. The structure of the system is divided into three parts, that is, the representation, functional applications, data three blocks, these three blocks are placed on different or the same hardware platform. Application system logic through the presentation layer, application layer, functional layer three levels to achieve technological progress and the transformation of business norms. The user interface part of the transaction logic is realized through the WWW browser at the front end, the main business logic is realized through the browser on the server side. B / S structure, by WWW browser technology, combined with the client browser, through various script language (VBScript, JavaScript), HTMLJavaApplets and ActiveX control technology, the realization of the complex special software to realize the user interface and control Qiang Dagong, save the development costs, ensure the

openness of the system is a kind of walking in the forefront of the times and the software structure technology. It can be found that the application of B/S structure is more prominent than the traditional C/S structure application program. (Tai, Y. N., 2015; Reeves, M., 2015).

B/S three layer structure of the three levels, respectively, the presentation layer, application layer and data layer. The schematic diagram of the B/S three layer structure is shown in Figure 1.



Figure 1 – Three Schematic Diagram of B/S 1 Layer Structure

The presentation layer is the interface between the user and the system information, which is part of the user interface. Mainly to the user input data to check the output of the data display. Said layer is to the end user as the core, in the web server to verify the identity of the user, through the HTTP protocol, file transfer data to the client, client acceptance file data, and displayed on the web server. The modification and inspection of the presentation layer only need to be performed on the presentation layer, without affecting the application layer and data layer. Simply rewrite the display control, data validation procedures, data formats and values can be, do not need to deal with the logic of the business itself.

Application layer (feature layer) is the processing logic that includes all the business processes in the application system. Is an interface that sends messages to the presentation layer and the data layer. The functions of statistics, analysis, printing and updating of the system are also stored in the application layer.

Database management system (DBMS), mainly responsible for the management of database data read and write. Exist in the database server data layer, through the WEB server to accept the request, the realization of the query, update, modify, and other functions, and then the results are transmitted to the WEB server (Gangadhar, R., Venugopal, P., & Kumar, P. V., 2015).

### 3. Marketing Management Platform Design

In recent years, our country with the growth of GDP, the car retains the quantity also increases with the increase. (Figure 2).

#### 3.1. Master Plan Design

Automobile marketing management platform based on the B/S model of the three tier architecture. In the data storage layer, all the operations of the database are encapsulated, which fully reflects the new idea of the object oriented programming. And all of the functions of the business process are concentrated in the business logic layer, fully demonstrate the advantages of development tools, reduce the design requirements of the client, for the user to provide a platform for the two development. B / S mode of

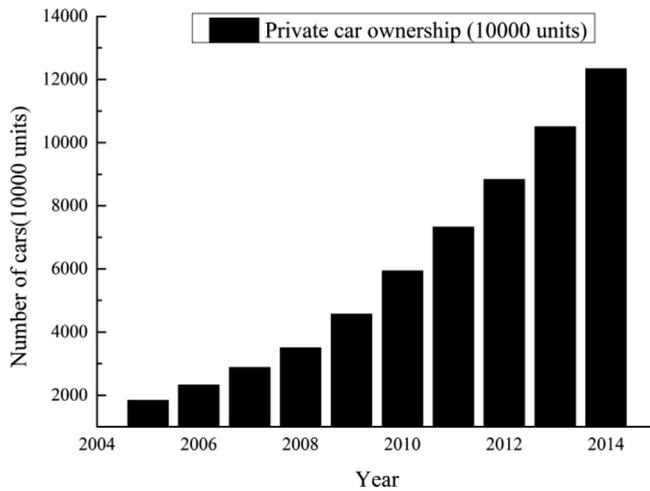


Figure 2 – Car Ownership Plan

three layer architecture using components and modular design, the part of the common module integrated, avoid repetition code, easy to modify and update, greatly reduces the workload, and effectively improve the work efficiency (Sandlin, J. A., & Letts, W., 2015).

The overall framework of the automobile marketing management platform is divided into the following three parts, namely, the database, data processing layer, business logic layer. Its overall architecture design as shown in figure 2:

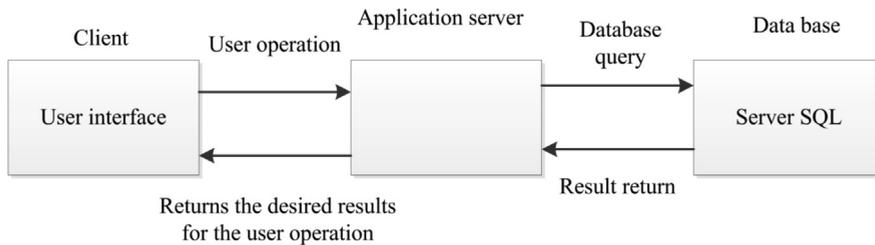


Figure 3 – The General Framework of the Automobile Marketing Management Platform

As shown in Figure 3, the marketing management platform software system architecture from left to right is the client, application server and database.

The database is at the bottom of the system. In the design of the automobile marketing management platform, the database used is Server2005 SQL. It stores all the business logic and system function program information of the automobile marketing management platform. The data processing layer is in the middle of the system. It connects to the database, and provides the interface service for the business logic layer. A variety of database operations, such as selection, add, delete, and so on, through the establishment of a data model for a complete description of the data, is the key layer of the entire system. The business logic layer provides the user interface to the corresponding position, which is more convenient and effective for the user to interact with the server. The operation of

the user is driven by the operation of the user, the operation of the database to the data processing layer, and data processing layer back to the user's data presented to the user.

Through the integration, construction, deployment framework of the main line, according to the business logic, the various components and services to string together, it forms the various business modules.

In addition, according to the demand analysis of the automobile enterprise marketing management platform, the comprehensive customer to the software system of some special requirements, the module function of the software system design as shown in figure 4.

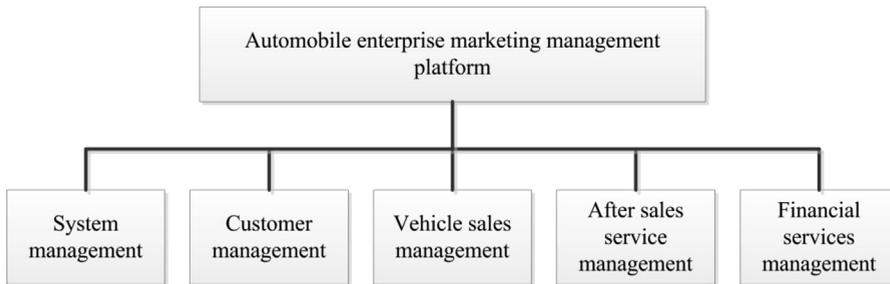


Figure 4 – Module Function Design of the System

System management module, mainly to achieve the registration of software users, permissions settings, as well as the operation of the user login authentication (Bellini, S., & Cardinali, M. G., 2015).

Customer management module: the main completion of the registration and change the customer information, for the company in the future operations can be more clear, effective and customer interaction.

Vehicle sales management: according to the demand analysis, this part need completed many functions, such as the generation and change of ordinary and special order management, order review, contract, report query and other business functions, so the further such as the module design, as shown in Figure 5.

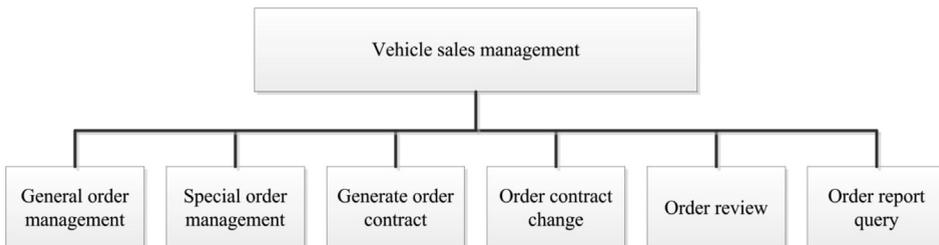


Figure 5 – Vehicle Sales Management Module Design

After sales service management: according to the demand analysis results, this part needs to complete the function more, such as the maintenance of warranty business, second-hand car rental business, to its further do as shown in Figure 6 module design.

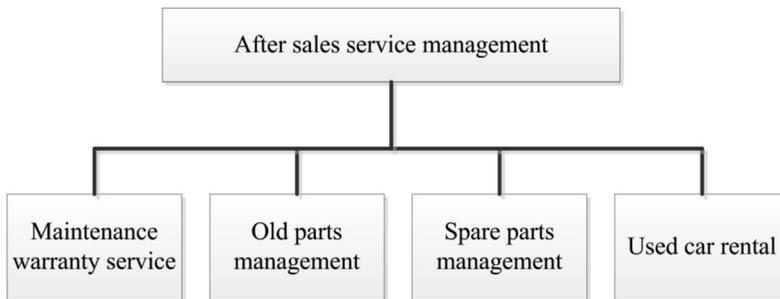


Figure 6 – After Sale Service Management Module Design

Financial services management: this part of the module is mainly completed including car loans, transaction settlement, insurance consulting, new car insurance, family investment financial advisory services, these functions. Further modules are shown in figure 7.

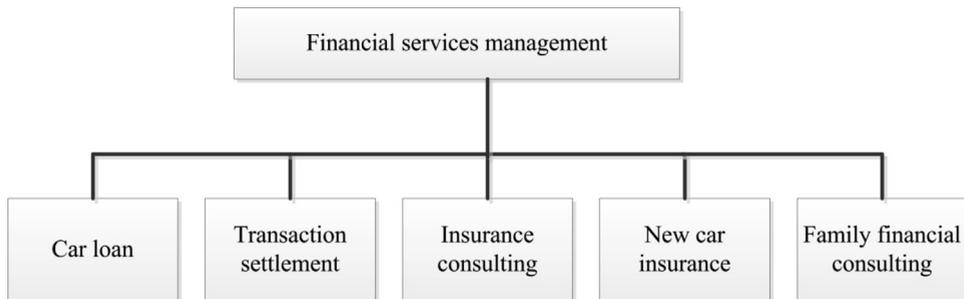


Figure 7 – Module Division of Financial Services Management

### 3.2. Database Design

The database is located at the lowest level of the whole system, and the database stores all the data in the system. Database structure design is good or bad, is directly related to the overall performance of the application system and development efficiency. Good database design can not only improve the efficiency of database storage, but also can ensure the integrity and consistency of the data stored in the database. And not good database design, in addition to the data storage effect is poor, modification of the database is time-consuming and laborious, not only to modify the database design also modifies the data processing layer, affecting the development effect of the system, even lead to bad consequences.

Database is created by the application, so in the design of automobile enterprise marketing management platform database must first, comprehensive analysis of the functional requirements of the system, fully collecting the data system, clarify the logical relationship among data, excluding database application of unfavorable factors and risks etc.. According to the standard steps to complete the design of the database, in the design process, not to forget the user needs (Dodds, M. A., 2015).

The database design should be based on the format, type, length, and organization of the data required by the application. The database application system needs to process the data is very big, therefore the database design must be an independent development activity.

According to the characteristic and demand of the automobile marketing management, automobile marketing management platform database is divided into: business data sharing common database, each subsystem sharing private data and data sources in the central database of the public database of each subsystem.

### **3.3. Module Algorithm Flow Design**

After full investigation of the automobile market, take the automobile sales process as an example, the following steps are described as follows (Zghidi, A. B. Y., Mida, F., & Zaiem, I., 2015):

Step 1, the dealer by the customer to purchase a car induced, to store reception, introduce goods, try to take a test drive, negotiate and a series of sales activities in and customers of the vehicle color, model, chassis number, engine number and other identified. Determine the purchase intention after the transaction, the advance deposit, signed pre orders, the system to determine whether there is a car. If you have a car is to generate a single; according to the car to generate a single car purchase contract, customers in the delivery of the money after the car handling procedures. If there is no car, then automatically generated without mentioning the car.

Step 2, after the system to determine the car, according to the car did not mention a single case to increase warehousing procedures; vehicle storage after confirmation, the car did not mention the single vehicle has been raised, according to the car to generate a single car purchase contract.

Step 3, according to the car to generate a car purchase contract, and then according to the purchase contract to generate a database, each out of the library and the corresponding contract corresponds to the system according to the generation of inventory, and a single inventory inventory.

Step 4, the user to obtain a single, according to the actual car purchase contract to determine whether a one-time payment, if it is a one-time payment, financial management. If not, then choose the types of loans and repayment methods, according to the repayment of the repayment schedule, the financial management procedures, the system according to the repayment, automatic generation of car payment details. The flow chart of vehicle sales is shown in figure 8.

## **4. Implementation and Operation of Marketing Management Platform**

In the core function module, the main need to complete five modules: vehicle sales subsystem module, vehicle loan management subsystem, service management subsystem, interface management subsystem, authority management subsystem. This article will take the vehicle sales subsystem module as an example to analyze (Afifi, F. R., & Ngatno, N., 2016).

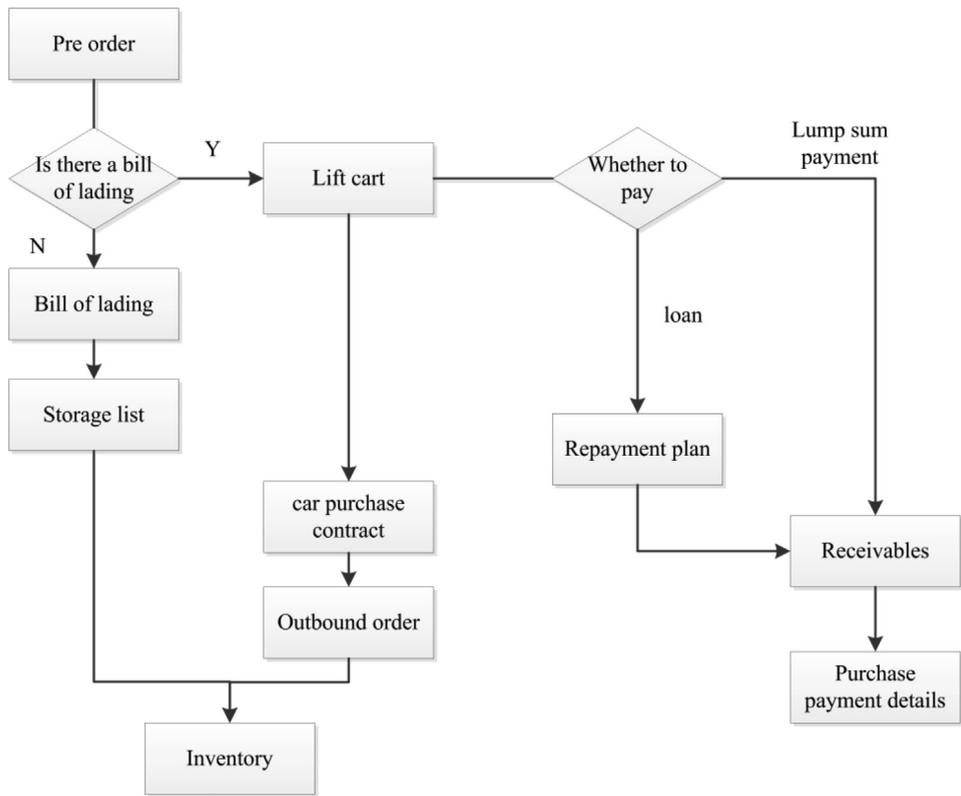


Figure 8 – The Flow Chart of Vehicle Sales

Vehicle sales subsystem module, the vehicle sales system is mainly completed the mention of a single, not to mention the single car, car purchase contracts, vehicle storage, a library of single increase, query, generation and vehicle allocation. Add vehicle storage, a library information, you must put in storage, a library of information to confirm, in order to update the inventory information as well as information to mention the car. After the confirmation of entry, a library, can not be modified, only after the cancellation of confirmation before re modification. More important is that the system can provide immediate all related single car, not to mention cars, single, single storage, storehouse and vehicle information query, report print, to supply chain management to timely understanding of inventory, timely make reasonable purchasing, inventory processing plan. According to the number of statistics, the amount, the models can be carried out, such as the end of the year, the end of the inventory statistics, can be timely understanding of the area and marketing team sales situation (Smith, D. J., 2015).

Vehicle sales subsystem function module includes: storage management, a database management, inventory management, vehicle management, vehicle management, query print six parts, as shown in Figure 9.

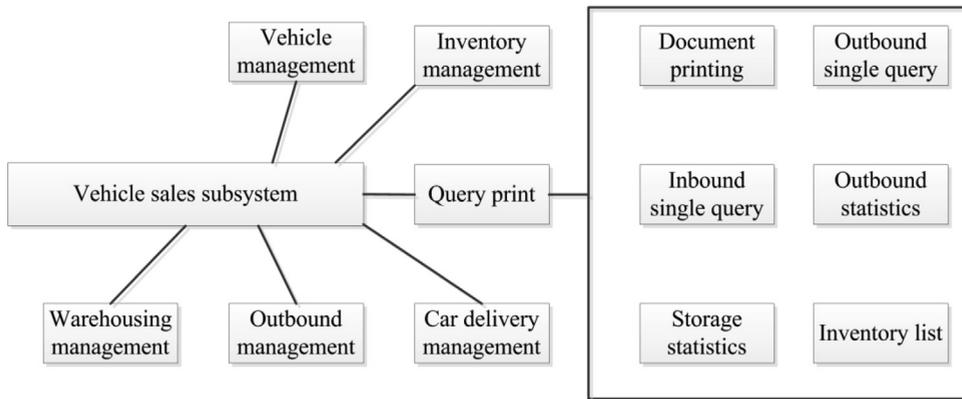


Figure 9 – Vehicle Sales Subsystem Function Chart

Storage management module is mainly based on the vehicle inventory, order information base, the daily production schedule, after checking the vehicle configuration, to generate the vehicle storage information table. And its management, the system needs to generate the statistics, query, print and other functions. At the same time with an additional storage function, to provide a daily refresh of the vehicle storage situation function, can create, print “vehicle bar code - vehicle transfer” and other documents. Its main function: because the car marketing funds is larger, automobile enterprises in marketing management to improve sales profit is to reduce inventory, not the hundreds of thousands or millions of cars on the library in long-term storage, therefore, need to often according to the actual needs of the automotive sales and stock to suppliers. In order to record to suppliers for the goods after the storage of information, specially designed for the storage of the addition of single, according to add automobile storage batches (PZ), supply unit (gydw), cheque number (zph), payment (fkqk), order No. (DDH), car (TCR), to buy the vehicle information, the rebate situation generated a single storage (t T\_rkd) (Albarq, A. N., 2015).

Library management function module by calling the inventory information in the vehicle information database, create, print “vehicle inventory application form”, “pick up the car”, “vehicle transfer orders” and other documents required by the library. Provide the vehicle forward, additional warehousing functions; system according to library information dynamic update outbound vehicle information library and add “Library of time” and other items. To compare the number of Companies in the distribution company, and put forward the corresponding warning when necessary. Its main function: the addition of a library is to record the record through the vehicle sales or because of the vehicle allocation and the design of the shift out of the library (Hatziminaoglou, E., Zwaan, M., Andreani, P., Barta, M., Bertoldi, F., Brand, J., ... & Muehle, S., 2015).

Send car management function module mainly includes send car registration management, contains of sending a company car management. By tracking the send company car shuttle vehicles, corresponding timely rate, quality of service evaluation, and keep relevant information existing in the vehicle information database.

Vehicle management: prototype module can according to the distribution, classification, in vehicle information database form distribution details of its prototype, according

to the data of CarMoveRecord table records transferred to transfer information, and will be based on the distribution company vehicle deployment information records, management, and dynamic update vehicle information database. In addition, prototype module can implementation on each car vehicle tracking management, generation of vehicles flow diagram, and presents the current state of the vehicle.

In automobile marketing management platform for inventory management module by of car storage information, vehicle information from the tracking management, inventory information table is created, to provide reliable data for automobile enterprises of production and marketing decisions. In inventory management, the automobile marketing enterprises, can be through query inventory distribution, according to the sales of the number of vehicles for the deployment, by querying the vehicle inventory information, adjust the direction of sales, and modify the sales plan and make the correct marketing decisions. Its main function: according to the storage table incoming time rksj t T\_rkd statistics situation of storage for a period of time storage vehicle quantity SL, vehicle coding cxbm, model code cxzjm, models CX, and print preview. According to a database table database t CKD the storage time of the cksj statistics within a period of time outbound vehicle quantity SL, vehicle coding cxbm, model code cxzjm, models CX and, through storage, computing and printing form inventory information table, for enterprises to provide inventory information.

Query print: main function is according to various queries (such as: Order No. DDH, TCR vehicles, storage date rksj, model Cx) to query the storage table t T\_rkd, and storage table for preview, print and export to excel. The same query a database table t CKD, according to sales Dan Hao xsdh conditions on the situation of the library of preview, print or export (Forga, J. M. P., & Cànoves, G., 2015).

## 5. System Testing



Figure 10 – Car Sales Management Platform

### 5.1. System Feasibility Determination Method

Automobile marketing management system is established to improve the overall efficiency and sales performance. This paper will carry out the test of the two blocks.

Sales performance testing, this article will be 12 months of testing time, while the use of these 12 months of sales to predict sales performance in the next quarter. Seasonal index forecast method can be divided into two categories: the first category is obtained by fitting the trend equation first, then with the actual average worth out of the seasonal index, the second kind of seasonal index is obtained by the ratio of average method. In this paper, the annual ratio average method is used.

Ratio to annual average method is first obtained by every year value of each month (quarter) and then monthly (quarterly) average ratio of, and then obtain the calendar year (season) ratio in the same month the average number, so as to calculate the seasonal index and prediction method. The calculation formula is as follows:

Average number of monthly (seasonal) months of the same year,

$$\bar{Y}_{ij} = \frac{Q_i}{n} \tag{1}$$

Wherein,  $Q_i$  is the total number of years;  $n$  is the number of seasons or months.

Seasonal factor for each year  $C_{ij}$ ,

$$C_{ij} = \frac{Y_{ij}}{\bar{Y}_{ij}} \tag{2}$$

Wherein,  $Y_{ij}$  is the actual quarter sales;  $\bar{Y}_{ij}$  on behalf of the average quarter sales.

The seasonal index is the mean seasonal coefficient,

$$F_j = \frac{\sum_{i=1}^m C_{ij}}{m} \tag{3}$$

Using the average seasonal coefficient  $F_j$ , according to the forecast of the annual forecast of the annual total value of  $Q_i$  forecast annual forecast of the season (monthly) forecast of  $Y_{ij}$ .

$$Y_{ij} = \frac{Q_i}{n} \times F_j \tag{4}$$

Wherein,  $I$  indicates the annual sequence;  $J$  represents the seasonal or monthly series;  $m$  indicates the number of years; the  $N$  season or the number of months.

In the determination of work efficiency, it is mainly to consider whether the cost of the whole system is reduced during the operation of the auto marketing management system.

$$E = \frac{W_i}{W_{i-1}} \tag{5}$$

Wherein,  $E$  represents the ratio of one quarter and one quarter of the previous quarter. When  $E < 1$ , the cost is reduced. If  $E > 1$ , then the cost increases.  $W_i$  represents the cost of the quarter,  $W_{i-1}$  represents the cost of the previous quarter.

## 5.2. System Feasibility Determination

Sales performance test.

Using the full year ratio average method, according to the January 2015 to December auto sales management system statistics, you can predict the industry's 3 months of sales in 2016. As shown in table:

Quarter	Project	First month	Second month	Third month	Season total	Monthly average
<i>First quarter</i>	Monthly sales	63	57	58	178	59
	Monthly coefficient	105.1%	96.6%	98.3%		100%
<i>Second quarter</i>	Monthly sales	70	63	59	192	64
	Monthly coefficient	109.4%	98.4%	92.2%		100%
<i>Third quarter</i>	Monthly sales	65	62	73	200	66.7
	Monthly coefficient	97.5%	93%	109.5%		100%
<i>Fourth quarter</i>	Monthly sales	63	66	69	198	66
	Monthly coefficient	95.5%	100%	104.5%		100%
<i>2016 First quarter</i>	Monthly index	101.875%	97%	101.125%	223	100%
	Pre measurement	72	67	74		

Table 1 – Car Sale Forecast

Month	E	Month	E
<i>First month</i>	0.99	Seventh month	0.99
<i>Second month</i>	0.97	Eighth month	0.99
<i>Third month</i>	0.99	Ninth month	0.98
<i>Fourth month</i>	0.97	Tenth month	0.97
<i>Fifth month</i>	0.98	Eleventh month	0.99
<i>Sixth month</i>	0.97	Twelfth month	0.97

Table 2 – Work Efficiency Test

## 6. Conclusions

With the rapid development of science and technology, the world economy continues to flourish, people's living standards are also increasing, personal and business to the application of computing technology have higher requirements. In the Internet technology change rapidly, it is not connected with the quiet time. The data service as the core, the network for the radiation of a variety of management information systems are constantly

advancing the development of enterprises, improve the level of enterprise management and decision-making. In the domestic and international automobile market competition is extremely fierce, the modernization of automobile enterprises and information technology will also become a new point of profit and a breakthrough in the enterprise. Automobile enterprises are constantly adapting to the development of the market economy, to change the marketing mode, so that the automobile enterprise marketing management to information management forward. According to the actual business needs of the automobile marketing management of automobile marketing sales process and business function, is proposed in this paper based on Web B / S three-tier structure, through the Internet browser function, the client can be very convenient to complete the data input, information browse, query and so on. Using B/S structure system terminal, greatly improving the flexibility of information collection and remote browsing speed. According to the theory of three layer B / s software architecture model technology, the design of the automobile enterprise marketing management information system for overall framework, architecture, and combined with the automobile marketing business status and characteristics of abstracts automobile marketing system of the universal demand. The system structure design, function structure design, background database design technology of the automobile enterprise marketing management information system are carried out. Through the test, you can get the next quarter of the car sales forecast. At the same time, the system also improves the overall efficiency of the company. In this paper, based on the B/S three layer structure of the automobile mobile internet marketing management platform design for the automobile marketing management industry has a great role in promoting.

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# Design and Implementation of College Students' entrepreneurship Management System Based on B/S Structure

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**Abstract:** Objective: The rapid economic development of our country, enrollment expansion of colleges and universities, college graduates employment difficult. Develop a set of college students' venture management system, can better solve the problem of university graduates employment. Methods: To describe the college students' innovative entrepreneurial management system development present situation, characteristics and requirements, through the relevant technology, the computer information technology applied to college students' entrepreneurial management, to implement the dynamic management of entrepreneurship students. Process: the college students' entrepreneurial management system adopts B/S structure. This paper used C++ and ASP .NET to develop the system. Application of Oracle database on the system of data storage, combined with this .NET to develop this system, and combining the data sharing and Internet technology to carry on the design implementation. Conclusion: This system has realized the college students' innovative entrepreneurial management system's main function modules. Research and development of this project to project management play a positive role.

**Keywords:** Entrepreneurship, graduates, the management system, B/S.

## 1. Introduction

In the rapid development of economy of our country, enrollment expansion of colleges and universities, the number of college graduates and the number of recruitment market demand contradiction, that makes the market competition is increasingly fierce. With the rapid development of computer technology and network technology (Wang W, Lu W, Millington J K., 2011).the widespread use of computer had improved work efficiency. And "based on B/S college students venture management system" is in order to solve the disadvantages of traditional paper-based office way, is also the addition to the digital campus information system, to improve college students' entrepreneurial ability plays an important role (Zhou M, Xu H., 2012).

Setting up the science and technology business incubator, creates the first-class platform for college students. The enterprise operation pattern, provides the college

students' entrepreneurial project resources and adequate financial support, Created a superior business environment, promoting the transformation of the intellectual property rights of college students Actively carry out business activities, and make full use of the government and social resources, to help college students entrepreneurship For entrepreneurial university students to provide quality business resources and professional consulting services, forming a set of perfect system of entrepreneurship education(Lindo-Salado-Echeverría, C., Sanz-Angulo, P., De-Benito-Martín, J. J., & Galindo-Melero, J., 2015).

The remainder of this paper is organized as follows. Section 2 describes the entrepreneurial university students at present. Section 3 describes the relevant technology of the information management system used for carving. Fourth and fifth part of the design and realization of the system are put forward. Conclusions are summarized in Section 6.

## **2. Entrepreneurial University Students At Present**

### **2.1. The Entrepreneurial University Students At Present in Our Country**

Entrepreneurship in China starts late, until the early 1980s was developed gradually with the reform and opening. Entrepreneurship in nearly 20 years of development in our country The communist party of China in three main waves: one is at the beginning of the reform, represented by farmers individual business entrepreneurship's it is in the early 1990s with comrade ding Xiaoping "southern talk", the south investment climax; Is the last time at the turn of the century, with IT, the Internet as the core of the high-tech entrepreneurial boom for the university students' entrepreneurship, Tsinghai's first business plan competition 1998 had a history of enlightenment. College students entrepreneurship is no longer a veiled trail from now on Smell, just be the highlight of campus attention. In 1999 continued to heat up, Chinese college students business began to enter the first peak. In 2000 suspension for the rise of entrepreneurship, pushed the students' entrepreneurship to the top (Keat O Y, Selvarajah C, Meyer D., 2011). In 2002, when employment phenomena caused by rapid enrollment expansion of colleges and universities, and trigger a self-employed warms up again, the ministry of education began to attach importance to this problem. in 2003 the ministry of education of the entrepreneurship education in Beijing university of aeronautics and astronautics backbone teachers training and will promote the college students' education of colleges and universities into a new stage. Although college students will encounter problems in the process of entrepreneurship, after the first hot cold, change from cold to hot. But the students will not weaken their entrepreneurial zeal (Haddad, F. S., & Leopold, S. S., 2015). Because these some venture capital investment company of college students never speaking out of turn to give up, the competent department of education is to set up special college students of science and technology venture fund, encouraging part of the entrepreneurship of college students, the business through to the end. Can say, the level of university students' entrepreneurship and level is rising, from the initial blind eye entrepreneurship to the present scientific entrepreneurship, rational entrepreneurship, entrepreneurship theory is in constant practice and summarizes the development and maturity (Tran, K., & Thomas, I., 2015).

## 2.2. Entrepreneurial University Students At Present Abroad

Entrepreneurship education in foreign countries have nearly 90 years of history, especially for nearly 30 years made a vigorous development, has formed comparatively perfect system of entrepreneurship education. At present, the United States the entrepreneurial guidance and education into the national education system, entrepreneurial guidance and education from primary school, junior high school, high school, until the cultivation of graduate students to conduct a comprehensive university. Britain, France, Japan and other countries of entrepreneurship education, guidance and practice is basic to junior high school; there have been some promotion to the elementary school. In the western developed countries, entrepreneurship has become a national important engine of economic growth (Shields, G. F., 2015).

Entrepreneurship education in colleges and universities in the United States can be traced back to the 1940 s, it has been more than 60 years of history. Turned to entrepreneurship education in some colleges and universities in the United States, mainly develop entrepreneurial skills, many colleges and universities opened entrepreneurship and entrepreneurial studies majors. The United States attaches great importance to the college students' entrepreneurship, make the economic development has played a very important role (Raman, S., 2016).

Germany's pioneering work education using simulated training, make the simulation company one of the most influential teaching practice.

In Japan, as early as in 1998, the Japanese elementary school pupils often work-study programs, training them to enrich their knowledge.

## 3. The Relevant Technology of the System

In order to achieve the business information management system, college students to choose the appropriate system structure, development language and development tools. Here, this system development need related technology is discussed and analyzed (Hancock A M, Jorgensen B L, Swanson M S., 2013).

### 3.1. C # Profile

In June 2000, Microsoft released a new programming language c #, it is the first component oriented programming language, mainly by Anders Hejlsberg (Anders Hejlsberg) development, source code will be compiled to msil Added many features and grammar, and c # is Microsoft. NET Windows network framework protagonist.

C # is a simple, elegant, has the security, stability, C # is a programming language that is object oriented, C ++ is in c. derived on the basis of C+ +. C ++ not only with C and C + + powerful functions, and optimize the function, in addition to the C and C + + part of the complex features. Also has a simple visual C++ operation and high efficiency of function, is to learn c+ and C++ has powerful operation ability, and language features of innovation, the grammar of the elegant style, convenient component-oriented programming support, it has become. NET development preferred language.

### 3.2. Introduction to the .NET Technology Platform

.NET is Microsoft XML Web services platform (Microsoft .NET platform to create XML Web services) of services composition together. Either the operating system and programming language, or equipment, XML Web services allow applications over the Internet to communicate and share data. For the benefits of individual users are seamless, attractive. Microsoft. .NET as of a new generation of technology platform can for agile business building interconnectivity.

### 3.3. B/S Mode is Introduced

B/S structure, namely the Browser/Server (Browser/Server) structure, is the Web after rise, the C/S (Client/Server) structure of a kind of change and improvement B/S structure of the main use of the current development of quite mature Web browser technology, combined with a variety of scripting languages (such as VBScript, JavaScript, etc.) and ActiveX technology, with a general browser to implement various Web application functions, and these functions if in the original C/S mode implementation requires

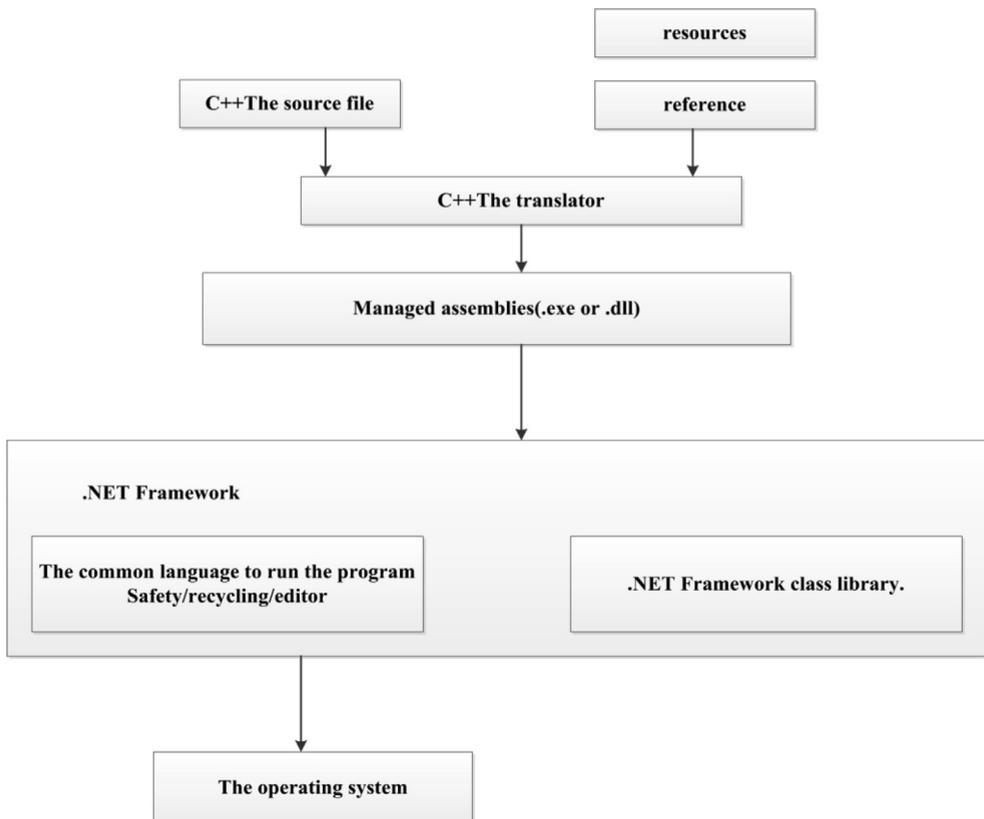


Figure 1 – .Net Integrated Operation Principle

complex special-purpose software, upgrade and not easy to maintain. Therefore, B/S structure is a kind of high efficiency and low cost of software system structure technology. In this structure mode, the user interface through a Web browser to realize completely, part of the business logic in the front-end, and most of the transaction logic is on the server side implementation, form the three layer architecture technology. The B/S three-tier architecture has become the first selection of the current Web application (Heras Saizarbitoria I, Boiral O., 2013).

## 4. System Design

### 4.1. System Design Principles

With the rapid development of economy, college students' entrepreneurship is becoming more and more common, college students' innovative entrepreneurial management system based on B/S to the evaluation experts and teachers to help college students under the supervision of positioning to have considerable prospect gains good projects (Lucas, M., & Moreira, A., 2015). College students' innovative entrepreneurial management system based on B/S was divided into eleven modules, from setting up the project start and to declare the deadline, the student to carry on the project of the declaration, teachers and school level and field experts team project and project progress report of the audit, concluding and data summary, to the vital backup, etc., throughout the college students' innovative undertaking all project management processes, among them (Shah, P., 2016).

### 4.2. System Architecture Design

College students' innovative entrepreneurial management system mainly USES the c # language and Studio.NET integrated development platform for system development and application of Oracle database on the system of data storage, combined with the .NET Framework technology to develop this system, and adopts B/S architecture design

Attribute properties	Detailed requirements
<i>availability</i>	When an operation may perform a long time, should use asynchronous processing, cannot allow the user to wait after completion of the operation can perform other operations.
<i>Ease of use</i>	When users perform each function, operation steps shall not be more than three steps.
<i>security</i>	Should have complete authority management mechanism, can realize the function of a user limit and access restricted
<i>maintainability</i>	Design documents complete, complete, consistent with the actual code without divided;
<i>scalability</i>	Design and implementation of the system shall be interface, modular, have very strong scalability, and expanded its function in future, removable plug-in functionality.
<i>compatibility</i>	Requirements can be compatible with the mainstream operating system, application server, database, and no obvious difference and functional performance limit.

Table 1 – The Overall Design of the System Standards

and implementation. College students' innovative entrepreneurial management system is divided into time, parameter setting module, (review) module, the expert group of project application, review project module, project release module, project specification submitted (review) module, project progress record module, the interim progress report (review) module, project post-project report (review) module, project concluding module, data aggregation query process statistics module, data backup archive 11 big function module (Richards, G., 2015).

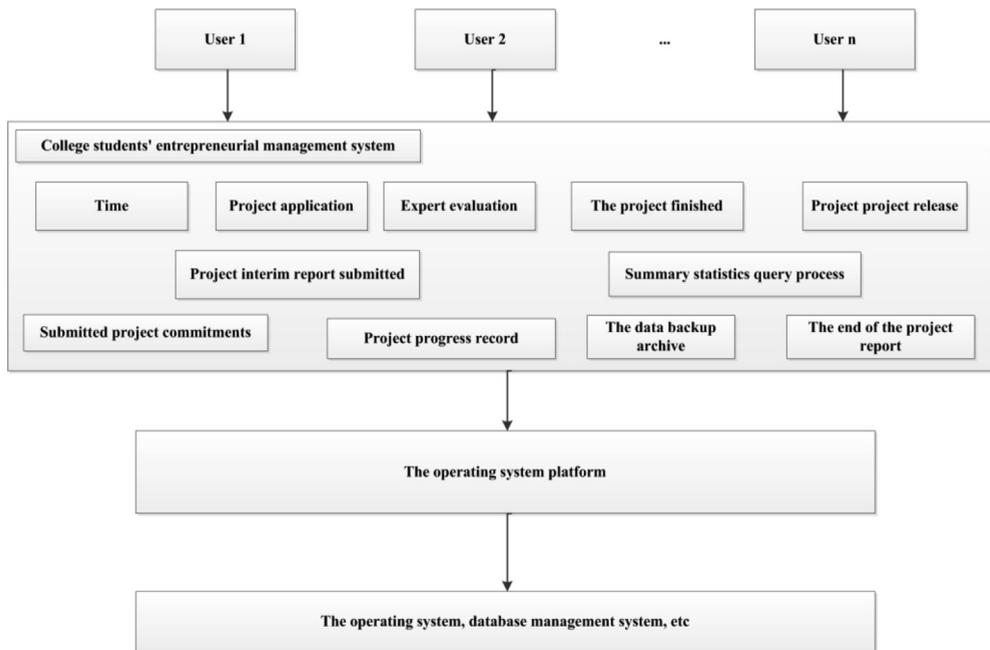


Figure 2 – The System Level Structure

Among them, the first Software infrastructure mainly includes: the construction of a “communications operations platform software system, such as database, operating system, middleware, and short message service, etc., and provide basic support for system running .NET development platform used. On the basis of .NET Framework integrated development structure and B/S architecture The third floor, in the use of fully considering the system requirement and the practice, on the basis of both the business application system planning for 11 big function module, and the corresponding modules will be subdivided into various modules; The fourth floor is the office environment to each application system, data resources, Internet resources, integrated into the information management platform, and based on facts, characteristics, role, form the application of personalized interface.

### 4.3. Database Design

Database design is to point to according to the needs of users, in a particular database management system, design of database structure and the process of establishing the database. Database design process generally is divided into six steps: requirement

analysis, concept structure design, logic structure design, physical design, validation, design and implementation, operation and maintenance (Yeager, V. A., & Bertrand, J., 2016). Conceptual data model is a problem oriented data model, and modeling data and information, according to the user's point of view, the user's requirements, can be clearly and accurately express. The concept of entity relationship data model is a commonly used method, its use e-r diagram describe the entities in the real world, and not to the implementation of these entities in the real world. We know that the college students' innovative entrepreneurial management system based on B/S entity involving students, teachers and college experts, such as project basic information, project specification.

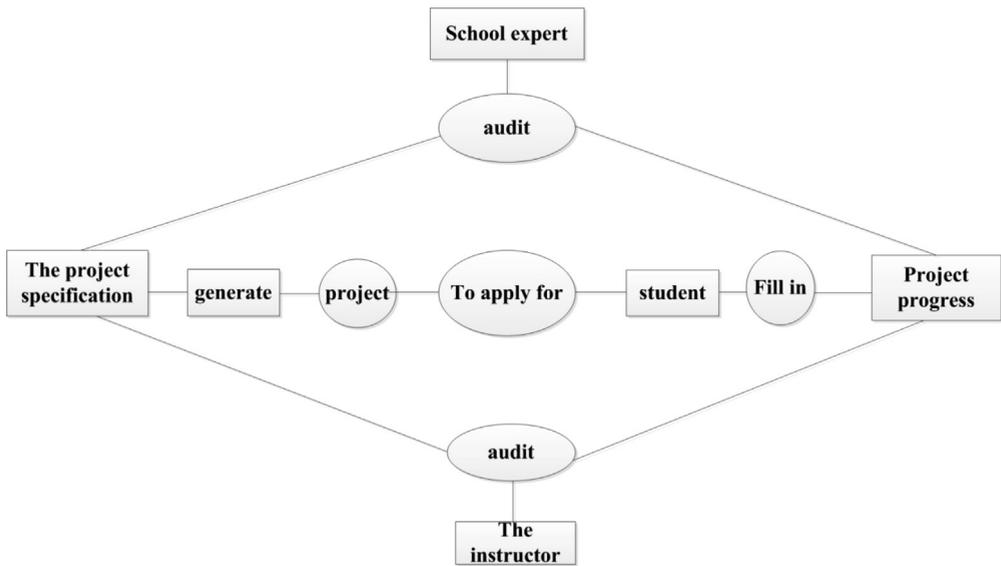


Figure 3 – College Students' Entrepreneurial Management System E-Rdiagram

**4.4. Data Table Design**

1. The project is based on B/S of college students' innovative entrepreneurial management system is a very important table that is used to record some details of the project.
2. Student table is college students' innovative entrepreneurial management system based on B/S in a very important table, used to record some of the details of college students.

**5. The Realization of the System Each Function Module**

**5.1. The Main Interface**

Homepage is not only a normal user access to information platform, is also a pioneer park office users and business studio user login window. And, the system the need of realization of each function module and the background database connection.

The field names	The data type	Describe	Can is empty
<i>g_ id</i>	Int(8)	Serial number	cannot
<i>g_ xmid</i>	Int(8)	Item no.	cannot
<i>g_ xmname</i>	Varchar(20)	The project name	cannot
<i>g_ student</i>	vvarchar(30)	students	cannot
<i>g_ profess</i>	vvarchar(30)	professional	cannot
<i>G_ teacher</i>	vvarchar(30)	tutor	cannot
<i>g_ date</i>	date	The date of	cannot
<i>g_ content</i>	vvarchar(80)	The content description	cannot
<i>g_ money</i>	double	To apply for funding	cannot
<i>g_ remark</i>	vvarchar(100)	note	can

Table 2 – The Project Table

The field names	The data type	Describe	Can is empty
<i>s_ id</i>	Int(8)	Serial number	cannot
<i>s_ xuehao</i>	Int(8)	Student id	cannot
<i>s_ name</i>	Varchar(30)	The name	cannot
<i>s_ age</i>	Int(8)	age	cannot
<i>s_ gender</i>	vvarchar(11)	gender	cannot
<i>s_ yuanxi</i>	vvarchar(40)	departments	cannot
<i>s_ zhuanye</i>	vvarchar(30)	professional	cannot
<i>s_ phone</i>	vvarchar(10)	The phone	cannot

Table 3 – Students Table

## 5.2. The Realization of Time Parameter Setting Module

Time, parameter setting is the most basic function of college students' innovative undertaking management system, time, parameter setting module contains the declaration date is set, the initial set up and account management, and other three child function module (Ariapour, A., 2015).

## 5.3. The Realization of the Project Application Module

Project application module is one of the functions of college students' innovative entrepreneurial management system is necessary, the auditing of project application, including project application, project review, return to modify three child function module. Due to the module content is more, only declare sub function of the project (Šipoš, M., Primorac, M., & Klaić, Z., 2015). In college students' innovative entrepreneurial management interface, select the left side of the exhibition of project application, review of project application, module of function menu, included in the project application, project audit and return to modify three child functions. Can according to need to choose the left side of the expansion of the declaration (review) module function of the three sub menu

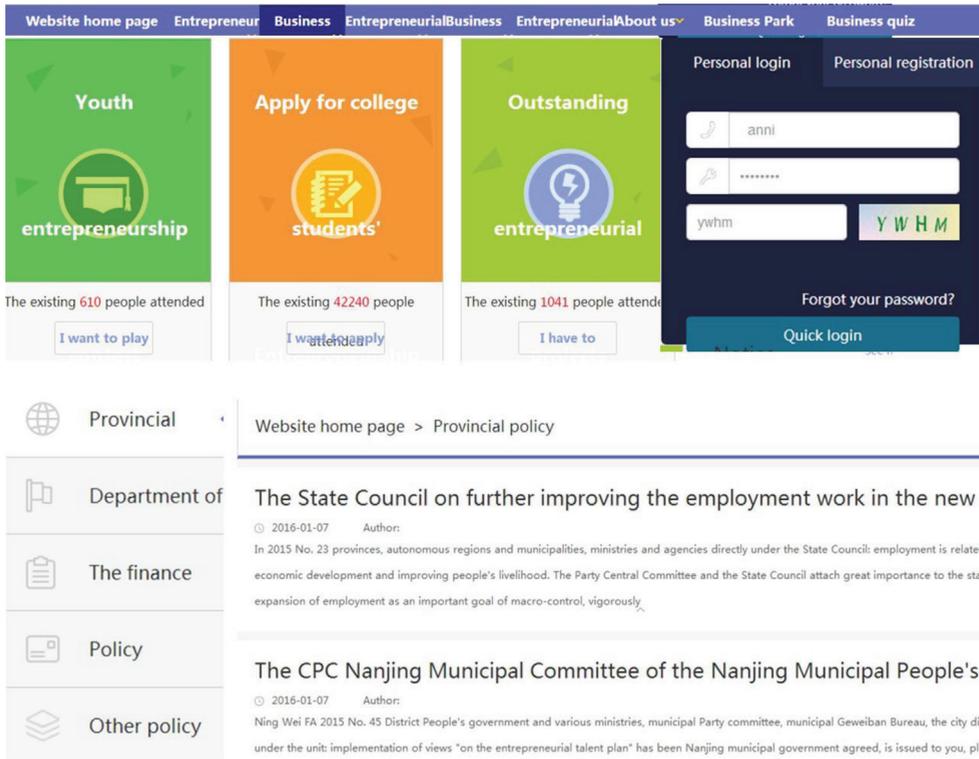


Figure 4 – Entrepreneurial System Main Interface

button, the selected one, went into the management of the corresponding page, according to the corresponding page information operation, after operation if you want to save is selected to save button, if you want to return to the higher, just click the back button.

#### 5.4. Project Release Module Implementation

Project launch function is the core of the college students' innovative entrepreneurial management system function, only the project to carry on the project after the release, the project will be launched, on the back of the link of the implementation of the play a crucial role. In college students' innovative entrepreneurial management interface, select the left side of the project of module will open the module subroutine menu item project release function. Release the selected project, went into the management of the corresponding page, according to the corresponding operation page information.

#### 5.5. The Realization of the Project Progress Record Module

Project progress record module is the important complement part of the college students' innovative undertaking management system; it can help students to know the progress of project in time, to be prepared for the project follow-up progress. This module includes fill in project progress record and fill in the project log two child guidance functions. Due to the module content is more, only introduction to fill in project progress record function.

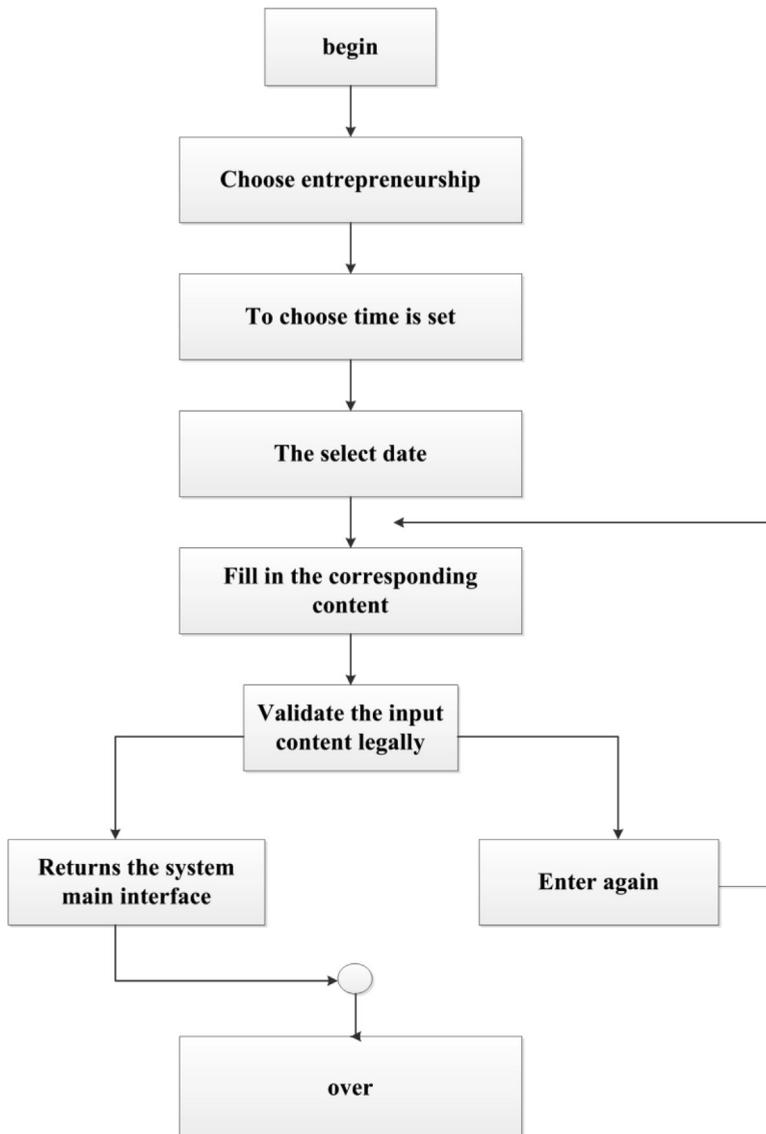


Figure 5 – Set the Flow Chart of Filing Date

### 5.6. Project Report (Review) the Realization of the Module

Project submission (review) and two child function module is divided into report and audit reports. Due to the module content is more, only to introduce audit report function.

In college students' innovative entrepreneurial management interface, select the left end of the project report (review) module will report and audit report two child function menu. Choose one of them, went into the management of the corresponding page, can be operated in accordance with the corresponding page information (Đukić-Petromanjanc, L., 2015).

When making project report review, select the audit report of sub menu, as shown in the above, according to the project specification number and query conditions for the query, the query result display in a web page, and then choose according to the specific information need audit project report, if the audit, submit it.If choose wrong, you can cancel to return to the home page, to project report for review.

## 6. Conclusions

As a result of college expansion, the current severe employment situation, college students have no work experience, low starting point, in the current environment, employment, there is a big problem. In order to solve the above problems, this paper According to the characteristics of college students' entrepreneurship, using currently popular. Advanced technology such as.net platform, ASP.NET, set up their career management system based on B/S. Combined with the present development of employment situation, characteristics and requirements, the comprehensive nature of the employment work in colleges and universities and the process, a detailed analysis of the design. College students' innovative entrepreneurial management system adopts B/S structure, to achieve the client's zero maintenance, and connecting with the Internet technology to carry on the design and implementation. The experimental results show that this system of college students entrepreneurship plays a big help, to the question of college students' employment, has played a great relief.

## Acknowledgment

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# Research on the Construction of College Students' e-Commerce Business Based on MMC

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**Abstract:** with the rapid development of the network, the advantage of e-commerce business is becoming more and more obvious, and it has become a popular choice for college students. E-commerce provides a practical platform and development space for college students' Entrepreneurship under the influence of modern economic values. On the basis of the composition elements analysis of the campus business platform, the service model of the entrepreneurial platform was built based on the theory of adaptive structure, and the new model of campus e-commerce business platform service was established. Design and implementation of each layer of the system platform based on MVC mode was carried out. Construction of the three layer of the realization of the strategy was put forward, and which is a reasonable solution to the security of system data storage and transmission. The campus e-commerce business platform which is special and in line with the campus environment was put forward and make students realize the business practice of the platform has a real feasibility. The college students e-commerce business platform has a great role in promoting for college students to build e-commerce business platform.

**Keywords:** Electronic commerce; business platform; MVC model.

## 1. Introduction

With the reform of higher education system in China, the difficult employment of college students is not a fresh topic, and the 2008 financial crisis lead to economic unrest that college students' employment problem once again become a hot social issues (Vlachos, I. P., & Gutnik, S., 2016). Along with the tide of electronic commerce, with the Internet, e-commerce ventures in the world has achieved unprecedented development, knowledge economy for highly educated people provides the advantages of resources, the popularity of the Internet for college students entrepreneurship provides information superiority. As the elite crowd, contemporary college students should become a force in this full of youthful spirit business boom. At the same time, the gradual increase in the way out of the high school graduates in the way to choose the way to avoid the fierce competition in the job market. At present, the research on campus e-commerce business platform focused on the technical level, on the other hand, more common in the news reports. From the point of view of entrepreneurship education and management, the academic articles on the phenomenon of e-commerce business platform in campus environment

are not many. The article “electronic commerce to lead the university student to start a business” points out: the online business is no doubt that the college students facing employment problems have a choice (Chaharsooghi, S., Beigzadeh, N., & Sajedinejad, A., 2016). “The use of network marketing promote entrepreneurship for college graduates “pointed out: starting from the network marketing to their own businesses, lower cost, less risk, and the prospects for the development of the electronic commerce good, so the network marketing is one of the ideal way to high school graduates to start their own businesses (Delina, R., & Tkáč, M., 2015). “on online shop strategy” that the set up shop on the net is at present electronic commerce a new bright spot, many entrepreneurs, especially the college students venture way of choice (Jain, R., 2016).: “On the campus e-commerce”, she thought: build a employment and entrepreneurial base through the campus electronic commerce, can open up a new channels of employment and entrepreneurial opportunities for college students (Choi, S. N., 2015).: “Chongqing University Students in e-commerce entrepreneurial practice and university entrepreneurship education research” she thought based on campus environment conditions, for school students provide characteristics of e-commerce business platform, is a form of practice in Enterprise Education in Higher School of good feasibility, it is a good way to ease the employment pressure (Chung, P., Yeh, R. C., & Chen, Y. C., 2015). “E-commerce for college students to provide business platform” is mainly about the electronic commerce based on the advantages of e-commerce environment to analyze how to create conditions for the realization of College students (Eberle, L. S., 2015). On the basis of the composition elements analysis of the campus business platform, the service model of the entrepreneurial platform was built based on the theory of adaptive structure, and the new model of campus e-commerce business platform service was established. Design and implementation of each layer of the system platform based on MVC mode was carried out. Construction of the three layer of the realization of the strategy was put forward, and which is a reasonable solution to the security of system data storage and transmission. The campus e-commerce business platform which is special and in line with the campus environment was put forward and make students realize the business practice of the platform has a real feasibility.

## **2. Campus E-Commerce Business Platform Service New Model**

### **2.1. Campus E-Commerce Business Platform Model Elements Analysis**

According to the analysis of the structural model of adaptability, combined with the practice of the campus and the demand of the group using the service model of the entrepreneurial platform, the analysis of its components.

Campus e-commerce business platform as a student practice, independent entrepreneurial campus network platform, it has a great difference with the general e-commerce service system from the purpose or service model. From the overall point of view, the impact of campus e-commerce business platform elements are mainly reflected in the following aspects, as shown in figure 1 (Mahmood, A. S., Rahim, M. S. M., & Othman, N. Z. S., 2016):

From the system composed of the working group, the group of campus e-commerce business platform system is campus college students, they are responsible for

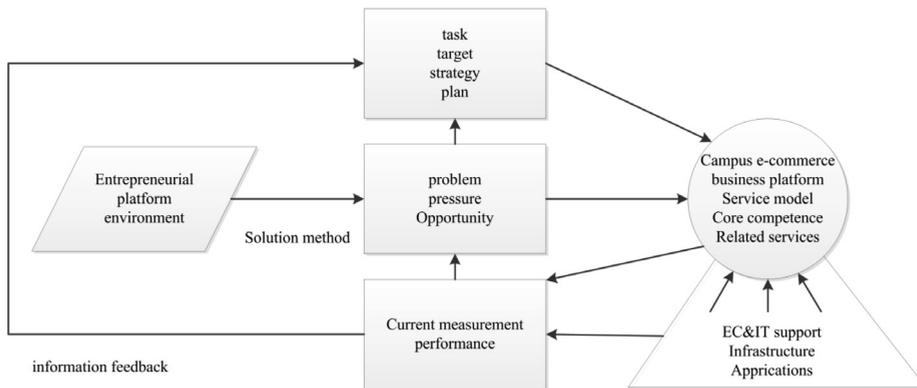


Figure 1 – Components of E-Commerce Business Platform Model

e-commerce platform for entrepreneurs in the mode of organization and operation, from shop practice to entity shop real implementation and operation, which relates to the mission, objectives, marketing strategy and future plans of the enterprise are student teams work together. Speaking from the Adaptive Structuration Theory, user self efficacy, possess professional knowledge representing the system characteristics of the group, on the other hand, in experience strategy, philosophy, mission, goals and, it represents is system, “the use of process.

From the point of view of the campus e-commerce venture platform environment. It also is the need to address the problem, environment pressure. Also the existence of opportunities, on their way to solve directly determines the campus e-commerce business platform of the core competitiveness(Gasca-Hurtado, G. P., Peña, A., Gómez-Álvarez, M. C., Plascencia-Osuna, Ó. A., & Calvo-Manzano, J. A., 2015).

From the point of view of the support e-commerce venture platform of technical factors, network infrastructure construction and application, system development model and its stability and openness, is one of the key factors in the implementation of the impact of e-commerce platform for entrepreneurs. How to ensure students in their open network platform to complete the experimental simulation and the entrepreneurial link, improve the efficiency of the system, is the key issue to be considered in the implementation of the entrepreneurial platform.

## 2.2. Campus E-Commerce Business Platform New Model

Based on Adaptive Structuration Theory of campus e-commerce platform for business model analysis, according to the characteristics and current situation of the talent demand, coupled with the special environment of campus, put forward the new service mode of the “e-commerce venture platform + diligent student delivery center. Entrepreneurial groups in business platform created his shop, the user can according to their own needs, the relevant search, order and confirm, entrepreneurial team can directly inform the part-time distribution center, take the self run logistics service mode. This is due to the specific area of the campus environment, its distribution scope is small, business is more concentrated, in the delivery mode is relatively simple, if the use of

logistics and distribution is not reasonable. After analysis, in the campus environment, to take the school to organize the distribution of student team. This part of the students from the work study students, both exercise their practical ability, but also give them the opportunity to work. Whether from the school level or from the family level, it has reduced the corresponding burden (Sucheran, R. E. S. H. M. A., 2015).

In the mode of payment, considering the small living scope of teachers and students, we should choose a simple, safe and efficient way to pay. According to the characteristics of the campus, the campus e-commerce business platform, the payment method does not require financial institutions to participate, you can choose to meet payment methods and campus card payment methods. There is work study students direct delivery and the receipt of receivables. Its specific model of service transactions as shown in Figure 2 below:

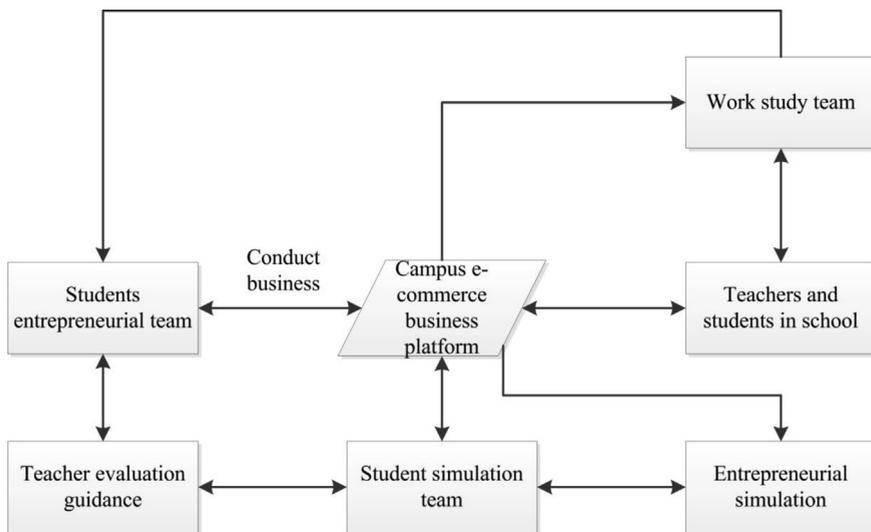


Figure 2 – New Model of Entrepreneurial Platform Services

In view of the above the new mode of architecture. It can not only meet the requirements of teachers and students, and can provide the opportunity of student frequently to the poor students in the school, the entrepreneurial student team and work student distribution team combination. On the one hand, the students not only in their own entrepreneurial quality, business planning and operation ability and comprehensive practical ability to get exercise, but also for entrepreneurship and employment, provides a practical platform. On the other hand, it is of great practical significance to ease the pressure of the society to cultivate students' ability of independent entrepreneurship, business integration and comprehensive application of information technology (Rahati Belabad, A., Iranpour, E., & Sharifian, S., 2015).

### 2.3. System Platform Architecture Design

In order to improve the security of the system and the user's operability, the system adopts the design mode based on MVC, and the view shows the data to the user through the.aspx file. Page controller through the.net page of the background to achieve encoding

aspx.cs file, front controller is mainly used to respond to the user's access. And according to the requirements of the Web.config file configuration to respond to the action and the logic of the implementation of the program to make decisions. Model uses the .Net components to achieve, mainly containing user info user management, AccessBase basic access, practical info and practical operation, analog info business simulation, open funInfo public function and the getinfo to obtain information related to the component class. Which Info User component classes can be completed on the user's inspection, audit and other related operations. AccessBase component to complete the data access and update the basic database operation, practical info, analog info component class were used to achieve system in practical operation, simulation of the operation of the relevant functional operation, such as opening a store, product release. Fun Info Open to achieve some of the public functions of the system, such as landing function. Online learning, online communication function, etc. Its specific application system in MVC to achieve ASP.net as shown in Figure 3 below:

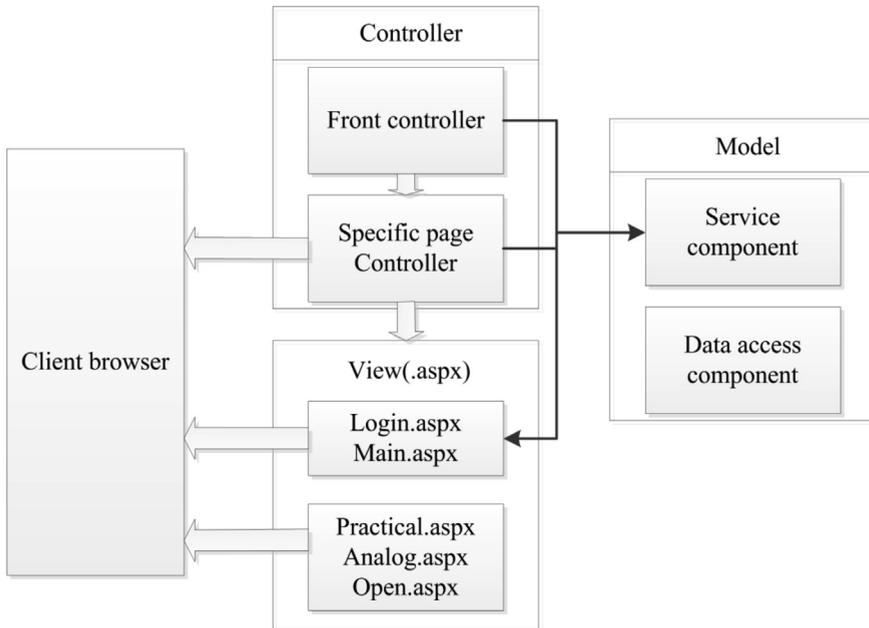


Figure 3 – The System Architecture Diagram Based on MVC

### 3. Database Design and Implementation

#### 3.1. Database Design Process

Database design includes two parts: a part is the logical database design, content that contains the corresponding concept model from the conceptual level, namely the system to deal with global database logic structure, also includes the user level outside the model. The other part is the physical design of the database, which is the storage structure of the database (corresponding to the internal model of the physical level) under the premise of the logical structure (Busetto, L., Luijckx, K. G., Elissen, A. M. J.,

& Vrijhoef, H. J. M., 2016). At the same time, the database design is the application of computer software and hardware technology, management technology and application of the relevant knowledge of the system engineering technology. In fact, need to follow certain rules, methods and the necessary steps, it is not a personal experience or skills to achieve and complete the things. Generally speaking, we divide the design steps of the database into four steps: requirement analysis, conceptual design, logical design and physical design. Its specific processes are shown below in figure 4:

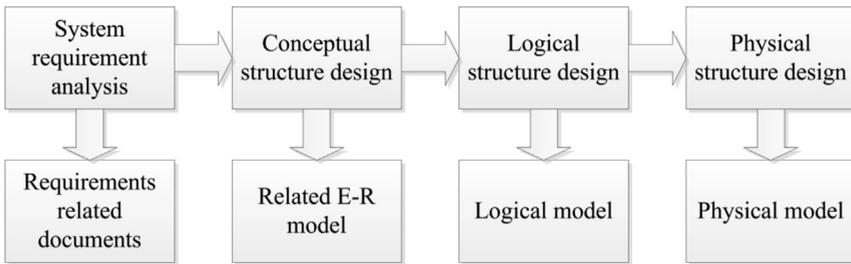


Figure 4 – Flow Chart of Database Design

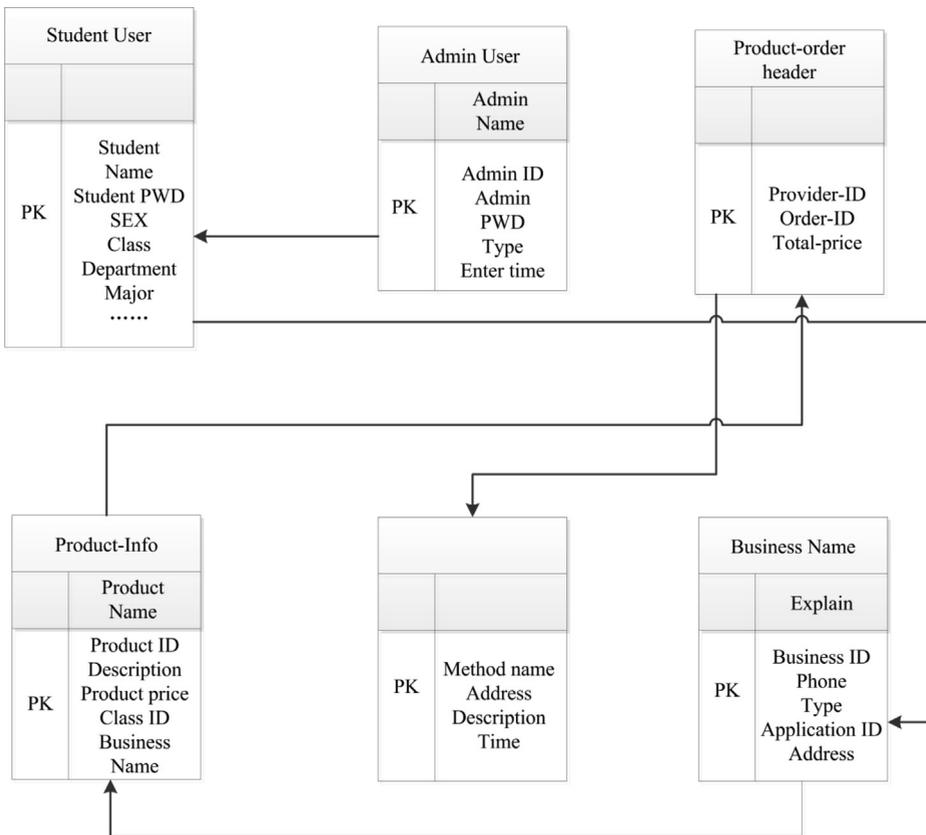


Figure 5 – Database Table Logical Relation Diagram

### 3.2. Logical Structure of the Database

Campus e-commerce business platform using Server SQL relational database, the reality of the system as a entity (Entity) and contact (Relationship) constitute. We put all the data into the table, the table is composed of rows and columns, rows represent the data records, the list shows the records in the field, the table reflects the real system entities and values. All the tables in the 1D field is the main key word, the whole table unified number, database program to create, the database contains the table relationship is mainly shown in figure 5:

### 3.3. Data Dictionary

In the campus e-commerce business platform system is mainly involved in the following table:

Administrator user table (Admain). Storage manager of the relevant information, which is divided into three types of administrators: Super administrator users, the system can be related to all the information. Project manager users can only update and modify the information related to the project. Company data entry clerk, you can modify the company's relevant information. Specific design as shown in table 1 (Ektem, I. S., 2016):

Key	Field name	Data type	Explain
PK	Admin ID	Automatic numbering	Administrator number
	Admin PWD	Varchar	Administrator password
	Admin Name	Varchar	Administrator name
	Type	Int	Administrator type (0: super administrator, 1: project manager, 2: data entry clerk)
	Last Enter Time	Date/Time	Last landing time

Table 1 – Administrator User Table

Student user list. Student user table is used to save the user's ID will not change the basic information, and there will be related to the type of field ID Student to serve as the unique identity of each student users, in order to facilitate the association with other tables. Using ID Application to distinguish the user is belonging to the user of which system module. The user table is shown in table 2:

Company information table. Storage company's related information, including company name, company profile, student user's founder and other related information. The company information table is shown in Table 3:

Commodity information table (Product\_info). Storage of goods related information. As shown in table 4:

Delivery mode table as shown in table 5:

Key	Field name	Data type	Explain
	Student ID	Int	Student number
	Student PWD	Varchar	Password
	Student Name	Varchar	Student name
	Sex	Varchar	Gender
<i>PK</i>	Class	Varchar	Class
	College Department	Varchar	Department
	Major	Varchar	Major
	Business ID	Varchar	Enterprise project number
	Application ID	Varchar	Enterprise type number

Table 2 – Student User List

Key	Field name	Data type	Explain
	Business Name	Varchar	Company name
	Explain	Varchar	Company profile
	Business ID	Int	Company ID
	phone	Varchar	Telephone
<i>PK</i>	Type	Varchar	Company type
	Is Open	Varchar	Whether the company opened
	Application ID	Varchar	Enterprise type number
	Address	Varchar	Company address
	Verify Admain Name	Varchar	Name of auditor

Table 3 – Company Information Table

Key	Field name	Data type	Explain
	Product Name	Varchar	Commodity name
	Product ID	Int	Commodity serial number
	Description	Varchar	Commodity Description
<i>PK</i>	Product_Price	decimal	Commodity price
	Product_Amount	Int	Commodity quantity
	Class ID	Int	Commodity classification number
	Picture_ref	Varchar	Enterprise type number
	Business Name	Varchar	Name of auditor

Table 4 – Commodity Information Table

Key	Field name	Data type	Explain
PK	Ship Method Name	Varchar	Delivery method name
	ShipMethod Address	Int	Delivery address
	Description	decimal	Describe
	Ship Method time	Date/Time	Delivery time

Table 5 – Delivery Mode Table

#### 4. Design and Implementation of Each Layer Based on Mvc

System uses B/S mode, in the system development platform of Microsoft. Net+SQLServer2000 by ASP. Net framework technology combined with the MVC design pattern, to achieve the business logic, control logic and front-end data display logic classification, so that the system has good expansibility and maintainability (Tehrani, F. M., 2016).



Figure 8 – Campus E-Commerce Business Platform

##### 4.1. View Design and Implementation

This system mainly includes mainly containing view page login.aspx, Main.aspx, Save.aspx, Practical.aspx, Analog.aspx, Certify.aspx etc. and based on asp.net framework, view is easy to be realized, the system in each page use the form of composite view, a page containing a plurality of sub view. The so-called child view it is not only a simple Html control, but also the server or a number of control nested Web custom control.

The layout of the page, and the number of tags and numbers of the user components, are defined by the template. Platform according to the template definition of information to create the page, for different state of the template content, the use of different template content configuration. Such as the contents of some dynamic template, according to different request of users, display parts of the user selection filter, portfolio page components from the user according to the template content related configuration to achieve, in enhanced code reusability, and enhance the prototype for the layout of the site.

A partial view of the process is roughly as follows: firstly defined the page layout template page; configuration page file user defined components (tab view details); secondly, page strategy for page initialization and loading page; user part according to the configuration initialization and loading verifier and events entrusted to the. Finally, submitted by checking, transferred to business entity model. From the view of the realization process of view, in order to realize the flexibility of the application of Web, also used the template configuration, page configuration, verify the configuration and other related to many configuration files. The process is roughly as shown in Figure 6 below:

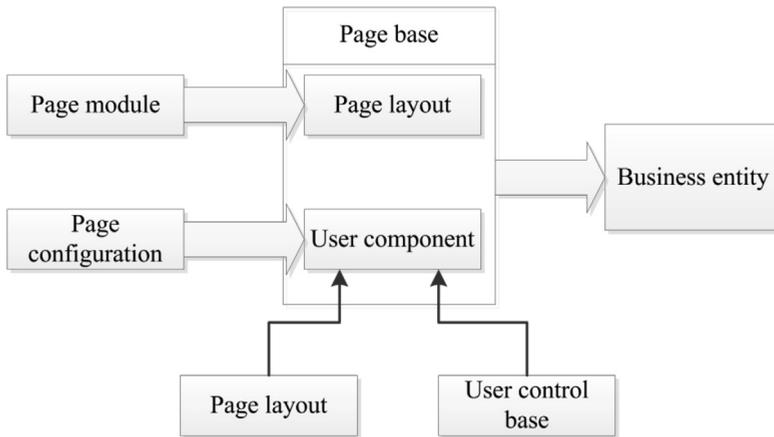


Figure 6 – View Processing Flow Chart

#### 4.2. Model Design and Implementation

Based on the model of MVC design pattern system, it does not contain any code related to the view, only related to the database. It consists of two types: the internal state of the system and the change of the system state. According to the requirement of the system, this paper provides two kinds of objects, which are business entity and business process:

Business entity object: it is mainly responsible for package of specific processing logic and invoke business logic model, and submit the related with the corresponding view components to produce the corresponding request; it belongs to the ProcessBase derived classes, it can also define attributes to describe the client about the form of the data information. To define the public property as an example:

Business process object: the business process object to encapsulate all the information needed in the system, including the display information, data information and so on. It can direct the business entity to read write operation, support for interaction between view and model, achieve the “what to do” (business) and “how to do” (the business entities) separation, which can realize the reuse of business logic.

Campus e-commerce business platform system, define the database operating as a public database of basic classes, is responsible for the implementation and database connection and interaction of some common operating, the definition UserLogin DBUser this two kind of to complete the specific operation of the relevant business logic.

UserLogin is mainly used to complete the record of the operation of the log, the user is about to complete the login success of the user name and password to the specified log file. DBUser class is mainly responsible for the database related business logic operation of the package, its specific implementation and database connection method.

### 4.3. Controller Design and Implementation

Control mechanism to use centralized management application, so that it can control and coordination of each user can be a plurality of processing a request, the business platform system, the front controller to realize the operation of the main interface, the specific page-Controller to achieve system related user requests the page operation.

Generally speaking, client requests by the application of the controller to receive, according to the request of the decided to adopt the implementation of logic function, the next user interface task passed to the view components with the requirements. In this part of the definition of the HttpRequestDispatcher (distributor class), HttpCapture (request capture class), Controller (controller class) and other related control categories, they cooperate with each other to complete the function of the controller. Where the request of capture class capture HTTP request and forwarded to the controller class, controller class as well as handling all requests of the initial entry point, after the completion of the necessary processing the request is delegated to the distribution class; distribution like the distributor is responsible for the management and navigation of the view, manage it will choose which view is provided to the user, and provide distributed resource control.

In calls to achieve, to the user request is to capture classes in HttpCapture (request) to automatically capture, ASP. Net framework technology provides the low level request / response application programming interface (API), for the. Net platform frame capable enough to pass into the HTTP request the services is provided to create HttpCapture (request capture classes), can use it to support the system page implementation related interfaces, and to realize the process request () method, and the class was added in the page of the configuration file < httphandlers > section. Achieve HttpHandler class specific examples to deal with ASP. Net received each incoming HTTP request was eventually, HttpHandlerFactory provide HttpHandler example URL request of real analytic structure, the HTTP handler procedure and factory in the ASP. Net configuration statement as part of the web.config file.

ASP.NET defines a "httphandlers" configuration section where you can add and remove handlers and factories. Sub directories inherit the settings for HttpHandlerFactory and HttpHandler. HTTP processing procedures and factories are the main body of the ASP.NET page framework. Each request is assigned to a processing program that handles the request.

### 4.4. System Implementation Strategy

Under the framework of ASP.net technology, according to the three layer Web structure system, is divided into three layers, that is, presentation layer, business layer and data layer. Web structure system, the use of HITS algorithm. HITS algorithm is as follows: the query Q submitted to the common similarity based search engine, search engines return a lot of pages, from which to take the first N pages as a root set (set Root), with s said. By adding the page referenced to s by s and the page referenced by s, the S is

expanded into a larger set of T, as the base set (set Base). First of all, for the basic focus of each page to give a non negative weight  $a_p$  and non negative Hub weight  $h_p$  and all the A and H value of the initial value of the same constant. Hub and the authority of the weights can be calculated according to the following formula:

$$a_p = \sum h_q \quad (1)$$

$$h_p = \sum a_q \quad (2)$$

After each iteration, the  $a_p$  and  $h_p$  are used to standardize processing to ensure invariance.

$$a_p = \frac{a_p}{\sum_{q \in T} [a_q]^2} \quad (3)$$

$$h_p = \frac{h_p}{\sum_{q \in T} [h_q]^2} \quad (4)$$

The last HITS algorithm outputs a group of pages with a larger Hub weights and a page with a larger RI ty Autho weight. In order to improve the relationship between the two hosts, the following algorithm can be used to eliminate the mutual enhancement between the two hosts:

$$a_p = \sum h_q / k \quad (5)$$

$$h_p = (\sum a_q / m) / n \quad (6)$$

Wherein, K indicates that the Q is the same as the host and points to the number of pages in the P. M said with the Q and the host computer is p to point to the number of pages,. Formula (5) said that if the host 1 has a K page to host 2 of the same page P, then the K pages each of the Autho P rity Hub weight contribution to its K weight of. Formula (6) said that if the host 1 of the same page P at the same time point to the host 2 of the K pages, the K pages each of the page Hub P weight of the contribution to the K weight of Authority.

The presentation layer to realize the function of the view and the controller, business entities and business logic components belonging to the business layer and the relevant components in a data object and data access model for data layer, generally speaking, model to achieve the function of a business layer and data layer together to complete. Its application model is shown in Figure 7:

From the implementation of the data layer, it is required to ensure that the changes in the database layer does not affect the rest of the layers, that is, the change in the database of the rest of the opacity of the layer. Through ADO.NET to achieve the business object data access, so that the system of business logic and data layer of the persistence of logic separation.

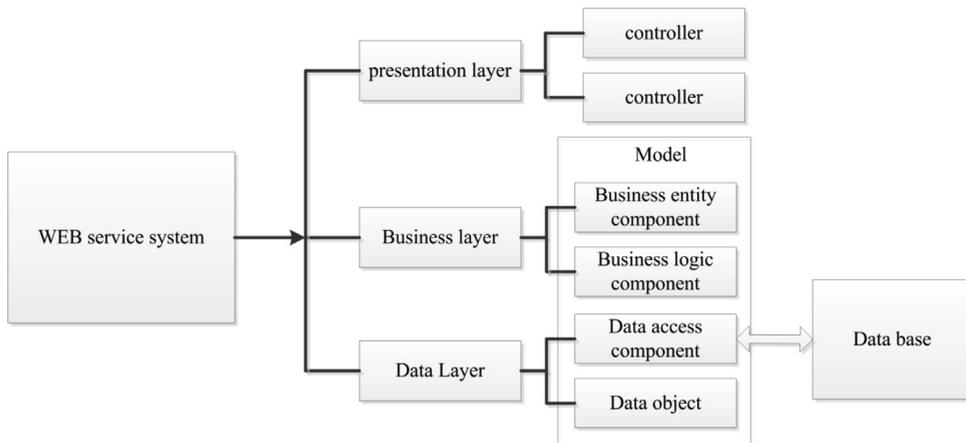


Figure 7 – Three Layer Application Model

Layer covering the interface design, event response, encapsulation of the data related to the contents of the said and from interface to achieve the speaking, due to the different needs of the user, interface of mutability is stronger, therefore in the realization of said layer, the variable factors control are very important in the local small range. Also ensure that any changes in the interface design does not involve modifying the contents of other layers, so the display logic and control flow in the call to be separated from the business object, to ensure that the clear principles of design.

From the point of view of the business layer to achieve, it is not data layer and representation layer and in determining the scope of the, to ensure that reaches a maximum at a time is not affected by changes in the database or interface, but if the class does not belong to the needs of business rules, does not belong in the business layer.

## 5. Conclusions

Campus e-commerce business platform, as the entrepreneurial environment of Cultivating College Students' practical ability, it is the demand of the social needs and the training of talents in Colleges and universities. Realization of three layer architecture development system based on MVC design pattern and hierarchical code to achieve clear separation, with higher development efficiency, data access is through the business layer to achieve, which makes building connected to the database server greatly reduced the number of, improve the operation efficiency of the system. Coupled with the system has a good scalability, so that users in the campus e-commerce business platform system, which can be easily implemented with the business module to achieve the connection of shops and other business. The campus e-commerce business platform system model is constructed, and on this basis, build a set of teaching, simulation and practice in one of the suitable for the characteristics of the electronic commerce business platform, which has great role in promoting students e-commerce venture platform construction.

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# Research on the Construction of Engineering Cost Estimation System Based on Fuzzy Prediction Technology

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**Abstract:** With the development of market economy in our country, the project cost budget has been more and more complicated, and it's an important link to establish a real and reliable factor market price and cost index database, choose feasible forecast method, and improve the accuracy of project cost prediction. For such engineering problems, this paper introduces the general situation of the engineering cost and the function of the construction cost, and establishes the fuzzy exponential smoothing forecasting model, combining with the fuzzy forecast technology, at the same time, the engineering cost management information system is constructed. And finally the fuzzy forecast technology of engineering cost is verified from the aspect of highway infrastructure construction, through the analysis of experimental data it's found that fuzzy prediction technique can effectively evaluate the engineering construction.

**Keywords:** Market economy; project cost budget; cost index database; fuzzy forecast technology.

## 1. Introduction

Under the condition of market economy, project owner and project construction contractor, for the project cost prediction, in fact, it is not consciously to give a certain degree of attention, if we can grasp the fluctuation of the project cost and the change trend, to the owner, we can control the design phase of the project cost control in a reasonable range to reduce investment risk; For the contractor, it can reduce operational risk; for the government departments concerned, according to the relevant regulation and control policy formulation. Therefore, the research project cost movement rule has the important realistic significance to the cost control and the cost management (Pizzo, F., Lombardo, A., Brandt, M., Manganaro, A., & Benfenati, E., 2016). Datu Xu enlarges the content of project cost information, the cost of information use and analysis method, and cost management information system to establish the ideas that can make beneficial exploration, but for cost information storage system, the analysis system is without detailed analysis; "Support Vector Machines" the book put forward optimal boundary classifier algorithm, which supports the vector machine algorithm in the original model (PRAKASH, K. S., KANAGARAJ, A., & GOPAL, P., 2015)."Support vector machine soft

margin classifiers: error analysis” further explores the nonlinear case of the optimal boundary classification (Tangri, N., Grams, M. E., Levey, A. S., Coresh, J., Appel, L. J., Astor, B. C., ... & Evans, M., 2016). Then, “the Nature of Statistical Learning Theory “is full of support vector machine learning algorithm based on statistical learning theory (Kai, F. E. N. G., HE, D. F., XU, A. J., & WANG, H. B., 2015).”Support vector machines for classification and regression” the text is based on the support vector machine method of regression estimation method and signal processing method (Kinjo, T., Masamoto, H., Mekaru, K., Taira, Y., Chinen, Y., Nitta, H., & Aoki, Y., 2016). It can be described as a prediction result of optimal prediction trajectory Cluster Fuzzy prediction, which can objectively reflect the complexity of the evolution process of product requirements. In this paper, the fuzzy prediction technology is used to predict the cost of the project. Project cost prediction can be carried out through two ways, Firstly, the market price of the elements of the project make factor price forecast based on market information, and then calculate the expected cost of the project; The two is based on the cost data and information of the construction project has been built over the years, combined with the subjective experience and judgment ability, the use of mathematical methods, the future trend of changes in the construction of various cost indicators to make calculations, then convert the cost index into engineering cost. Therefore, no matter which way, establish a real and reliable factor market price and cost index database(Martins, J., Gonçalves, R., Santos, V., Cota, M. P., Oliveira, T., & Branco, F., 2015), choose feasible forecasting methods, it is an important link to improve the accuracy of project cost prediction (Olawejaju, O. O., Bertling, I., & Magwaza, L. S., 2016).

## **2. Related Technology Theory**

### **2.1. General Situation of Project Cost**

In a simple way, the cost is the monetary expression of living labor and materialized labor in the production of goods. Ensure that simple reproduction can be carried out smoothly, is the theoretical basis for the division of costs from the value of money. So the transfer of value in economics and the value of their own to create a form of currency, consumption of material consumption and labor remuneration, from the commodity value of money in the form of division, as a special economic category, called cost. Project cost is refers to construction enterprises in the construction and installation engineering construction process in all of the actual cost of the sum, including materialized labor cost and live labor necessary labor cost, the former is refers to the value of consumption of engineering a variety of means of production. The latter refers to the remuneration paid to the workers. Engineering cost is an important part of project cost, should be borne by the project itself, the level of engineering costs, directly reflects the cost of the project to be used in the production of the cost of compensation for the production cost of the project, the higher the cost, enterprise’s profit is less on the contrary, the profit of the enterprise will increase with the decrease of the cost. Therefore, the engineering cost is a comprehensive index to assess the effect of the construction enterprise management. The classification of engineering cost: according to the engineering cost can be points refers to construction companies and owners signed the construction contract as determined by engineering contract price minus the profits and taxes from the balance budget cost, plan cost and actual cost budget cost contract cost. It’s based on the construction drawing budget, according to the cost of a

certain budget price. It is the basis of enterprise economic accounting, which is to control the cost of expenditure, inspection cost savings or cost overrun standard, is an important reference for the arrangement of the construction plan, the supply of materials. Project cost refers to the enterprise in order to clear and ensure the completion of tasks to reduce costs, on the basis of engineering budget cost, the construction condition of each project is considered, develop positive and feasible technical and organizational measures, fully tap the internal potential and efforts to increase savings economic effect after the preparation cost of the scheme. The plan cost reflects the cost level of the enterprise, and it is the basis of economic control and the economic effect of the construction enterprise. The difference between the planned cost and the budget cost is the enterprise's plan to reduce the cost and the actual cost, so it can examine the implementation of the enterprise cost plan. Actual cost refers to the total cost of construction and installation works in the construction. It is a comprehensive index reflecting the operating activities of construction enterprises. Comparing with the project budget cost, it can reflect the profit and loss situation of the project. Compared with the planned cost, it can be used as the basis of the internal evaluation of the preface, which can reflect the construction technology management level, and the implementation of the technical organization measure plan and so on (Jung, W. S., Lee, K. J., & Lee, B. W., 2015). Firstly, the concept of fixed cost and variable cost should be defined, as shown in Figure 1 and Figure 2.

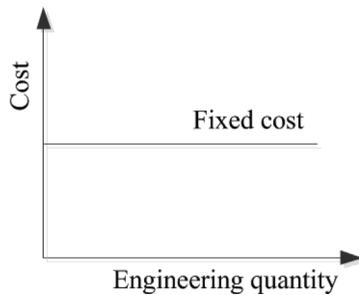


Figure 1 – Schematic Diagram of Fixed Cost

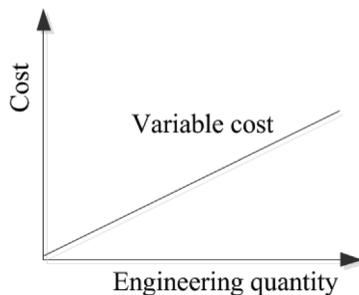


Figure 2 – Sketch Map of Variable Cost

Fixed costs are defined within a certain period of time and within a certain amount of engineering, its cost is not affected by changes in the amount of works and the relative fixed cost.

Such as depreciation charges, overhaul costs, management staff salaries, office expenses, lighting, etc.. This cost is in order to maintain a certain production and operating conditions of the enterprise. In general, the fixed cost of the enterprise is basically the same every year, but when the project is over a certain range, it will need to increase the mechanical equipment and management personnel, at this time, the fixed cost will be changed. In addition, the so-called fixed is relative to its total amount, on the allocation to each the fixed cost of project unit project quantity is changed. Variable cost is refers to the amount with engineering changes and positive change in the proportion of the cost, such as direct engineering cost of raw materials, the implementation of piecework wage system of labor costs and so on (Guedes, M. B. O. G., Lopes, J. M., Andrade, A. D. S., Guedes, T. S. R., Ribeiro, J. M., & Cortez, L. C. D. A., 2015). The so-called change, but also in terms of its total, changes in the unit project cost is often the same.

**2.2. Overview of Fuzzy Prediction Techniques**

Definition of fuzzy sets: Definition 1: given a distinct set of X, an element of X belong to the X or does not belong to the X two will be one of the. If  $x \in X$ , we consider the extent to which it belongs, we believe that the degree of X belonging to X is 0. In this way, for each subset of A X, we get a function  $X_A : X \rightarrow \{0,1\}$ ,

$$X_A(x) = \begin{cases} 1, & x \in A \\ 0, & x \notin A \end{cases} \tag{1}$$

The characteristic function of  $X_A$  for A. A is completely determined by its characteristic function. In fact, A can be expressed as:

$$A = \{x \in X : X_A(x) = 1\} \tag{2}$$

Known n has finished a typical project, set  $C_i(i=1,2,\dots,n)$ . Using T to represent the engineering feature set, the determination of this set of elements, in order to describe the characteristics of the project, the problem is fully explained. Often take: structural characteristics, foundation, layer height, inside and outside wall, decorate, building floor, roof.

Remember as:

$$T = \{t_1, t_2, t_3, \dots\} \quad j = 1, 2, 3, \dots, m \tag{3}$$

The T fuzzy sub set is denoted by Chad:

$$T_i = t_{i1} / t_1 + t_{i2} / t_2 + \dots + t_{ij} / t_j \tag{4}$$

The name of the element in the formula,  $t_j$ ;  $T_i$  represents a fuzzy subset of the known I engineering features to the set T;  $t_{ij}$  represents the value of the membership function corresponding to the known engineering characteristic element. In this way, the fuzzy subsets of the corresponding engineering features are estimated:

$$T_o^* = t_1^* / t_1 + t_2^* / t_2 + \dots + t_j^* / t_j \quad (5)$$

The value of membership function of  $t_j^*$  in the formula of predicting the engineering characteristic elements (Jeffrey, O. O., & Falode, O. A., 2015).

### 3. Construction Cost Prediction Model

#### 3.1. Product Demand Fuzzy Exponential Smoothing Forecast

The exponential smoothing forecasting is one of the most commonly used forecasting methods in the enterprise organization, which is simple and easy to operate, which can eliminate the influence of the accidental factors, and has the characteristics of less data storage. Product demand index smooth forecast process as shown in Figure 3:

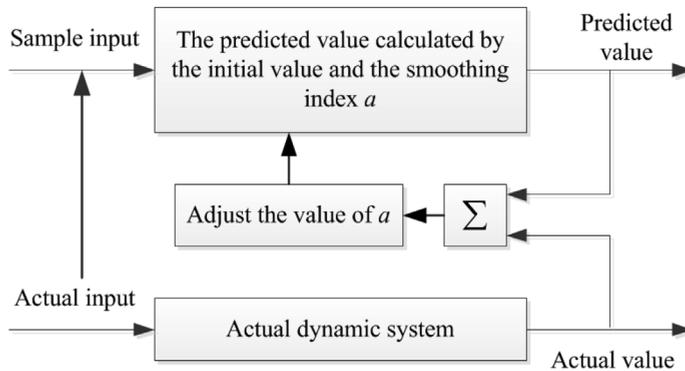


Figure 3 – Product Demand Exponential Smoothing Prediction Process

General product demand index smoothing forecasting model for:

$$S_{t+1} = \alpha X_t + (1 - \alpha) S_t \quad (6)$$

Among them,  $X_t$  said the T phase of product demand for the observation value;  $S_t$  expressed t product demand forecast value;  $S_{t+1}$  indicates the demand forecast value of t + 1 period, and  $\alpha$  is smooth index;  $\alpha \in [0,1]$ . The exponential smoothing predicts the most recently observed value with the greatest weight, and the previous observation is given a smaller weight, which is consistent with the recent observation of the future value of the observation of a greater impact. Because the product demand is affected by various factors, it can be better to reflect the actual situation that the exponential smoothing forecasting model is changed into the fuzzy forecast model. The model is as follows:

$$S_{t+1} = \alpha X_t + (1 - \alpha) S_t = (\alpha_1, \alpha_2) X_t + (1 - (\alpha_1 - \alpha_2)) (S_{t1}, S_{t2}) \quad (7)$$

Among them,  $X_t$  said the T phase of product demand for the observation value;  $S_t = (S_{t1}, S_{t2})$  is the triangular fuzzy number of the forecast value of T period product demand;

$\alpha = (\alpha_1, \alpha_2)$  is a triangular fuzzy number with exponential smoothing index,  $\alpha_1, \alpha_2 \in [0, 1]$ . The initial value of  $S_t$  can be obtained by triangulation of the observed value of the original product requirement, and can be obtained by the linear programming method with the minimum of Delphi Fa or trend regression.

Thus the triangular fuzzy number of the forecast value of the product demand in  $t + 1$  period is obtained:

$$S_{t+1} = (\alpha_1 X_t + (1 - \alpha_1) S_{t1}, \alpha_2 X_t + (1 - \alpha_2) S_{t2}) \tag{8}$$

After obtaining the triangular fuzzy number of the predicted value of these products, we can further solve the flexible production organization plan to adapt to the market changes (Kaur, P., & Kumar, R., 2015). The forecast is generally carried out in Figure 4.

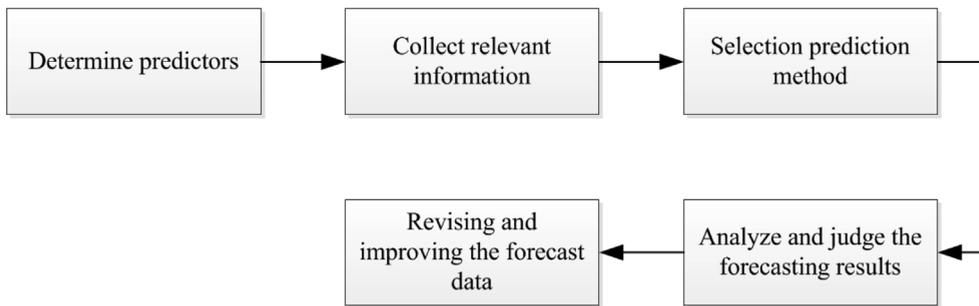


Figure 4 – Prediction Program

### 3.2. Construction Cost Management Information System

Project cost relates to the various departments of the national economy, the industry, related to the various aspects of social reproduction, directly related to the people’s living conditions and the living conditions of urban residents. Its function and influence, mainly has the following several points: Engineering evaluation is the basis of investment decision making: the importance of project decision making is determined by the characteristics of large investment, long production and long service cycle. Project cost determines the cost of an investment project. Do investors have enough financial ability to pay the cost, do you think it is worth paying for the cost.

This is the main problem to be considered in the project decision. Financial ability is an independent investment subject must first be resolved. If the price of construction projects over the investor’s ability to pay, will force him to abandon the proposed project. If the effect of the project investment is not expected to achieve the desired goal, he will also automatically give up the proposed project. So in the project decision-making stage, engineering valuation is an important basis for financial analysis and economic evaluation of the project. Engineering evaluation is an effective tool to make investment plan and control investment. Investment plan is established in accordance with the construction period, the project schedule and the construction price and so on.

Proper investment plan helps to use funds reasonably and effectively. Engineering evaluation in the control of investment is very obvious. Engineering cost is through a number of estimates, ultimately determined by the final accounts. Each estimate of the process is the cost of the control process. And every estimate of the next estimate is strictly controlled. Specifically, the latter estimate must not exceed a certain margin of the previous estimate. This kind of control is necessary to obtain the investment benefit in the limit of investor's financial ability.

Engineering evaluation is the basis for raising funds for construction. The reform of investment system and the establishment of market economy, Investors must have a strong ability to raise funds for the project, to ensure adequate funding for the project. Engineering evaluation basically determines the need of construction funds, so as to raise funds to provide a more accurate basis. When the construction fund comes from the loan of the financial institution.

Financial institutions on the basis of the assessment of the project's ability to repay loans.

Also need to determine the amount of loans given to investors based on the engineering valuation (PourAli, M., Hashemian, H., Heidarzadeh, A., Amini, M. R., Sartavi, M., & Fallah Karkan, M., 2016).

### **3.3. Engineering Cost Management Information System**

Construction cost management information system (CCMIS) is a management information system in the project cost management of the specific application. Engineering cost management information system is a person based, using computer hardware, software, network communication equipment and other office equipment, engineering cost information collection, transmission, processing, storage, update, maintenance and use, can fully accumulation and analysis of the project cost management data, and can effectively use past data to predict the future price changes and development trend, in order to achieve the project cost realize reasonable determine and effectively control the integrated human-machine system. Engineering cost management information system, to project management as the content, based on the project cost management main business. Engineering cost management is the management of the whole process of engineering construction, it runs through each stage of the engineering construction, its core content is the reasonable determination and effective control of the engineering cost. Project cost management is along with the course of engineering construction and gradually deepening, and the function of engineering cost management information system is with the process of engineering construction of information system, the main functions include: query information query, state enterprises, information prediction, information analysis, application software, engineering quantity calculation, cost control, cost evaluation, cost control and so on. Project cost management of information interaction platform based on the content of the information engineering is different, can be roughly divided into quota information, price information, enterprise information, index information index, the cost of regulatory information, project information, construction standards and specifications, the cost of paper publications, such as, the effective combination of these information constitutes the project cost information. Engineering construction we need

to quickly and accurately grasp the information, the application of Internet technology in the field of engineering cost was born engineering cost information network and information network for further integration and development will build national and global engineering cost management information interactive platform. This technology has a wide range of distribution, strong technical consistency and easy to use, rich and colorful performance characteristics greatly promote the speed of the flow of information, thus promoting the development of social economy. In the construction industry, through information network material manufacturers can more timely and more acquisition and release of material price, the owners can publish tender notices, query construction enterprises of the basic situation, the construction enterprises can obtain the bidding information, material price information, the accumulation of finished engineering data, standard, and more extensive use of all kinds of information, sharing of resources to expand range.

At present, the project cost information mainly in the domestic site has Shanghai, Chongqing, Hunan and other places of the project cost information network, due to geographical factors, sources of information, investment and technical level of difference has its own characteristics. Network information content usually have price information, information index, cost index, policies and regulations, standards, unit survey, comprehensive information, announcements and news, engineering Jianhe bidding and so on, in fact, now divided into two types such as text and standardization of data, the former documents, laws and regulations and other descriptive information, the latter after sorting out the data, such as material price, index, quotas and other; the former is generally to web page in the form of storage and maintenance, which is usually used database technology to input, processing, production and distribution. The information source of the information network is derived from the internal information of the cost management department and the external information from other relevant departments two categories. External information such as information acquisition of material price, market news, after manual sorting, entry into the system; internal information can through the establishment of the internal network and the corresponding management information system to support the daily work, by the management information system and information network interface automatic selection to produce information system transmits the data to the information network formation information, formed, integration integrated cost information network (Lacoste, M., & Powles, S., 2016).

#### **4. Experimental Data**

In this paper, the fuzzy prediction technique is used to evaluate the highway mileage and investment in China, and the experimental results are shown in Table 1. From the table, we can see that since the “Ninth Five Year Plan” in China increasing the highway infrastructure construction, according to the Ministry of communications data estimates, the traffic capacity with an average annual growth rate of 11.4%, tension of highway resources preliminary eased, but because of too many historical debts, coupled with in recent years, China’s GDP and its growth rate has been in high stage, as shown in Figure 5. And is directly related to the highway turnover amount of passenger and freight transport also demand, during the period from 1997 to 2008, highway passenger and freight turnover of an average annual growth rate of China reached more than 7%. From

the experimental results, we can see that the fuzzy prediction technology can effectively evaluate the engineering construction (Pourmoghaddam, A., Kreuzer, S., Freedhand, A., & Dettmer, M., 2016).

Period	Average growth rate of total highway mileage	Average growth rate of total super highway mileage	Highway's fixed assets investment (one billion yuan)	Compound growth rate of fixed assets investment of highway
<i>Ninth Five-year</i>	1.29%	47.97%	897.4	24.57%
<i>Tenth Five-year</i>	6.6%	20.26%	1903	16.22%
<i>Eleventh Five-year</i>	3.56%	9.65%	3300	11.64%

Table 1 – Chinese Highway Mileage and Investment

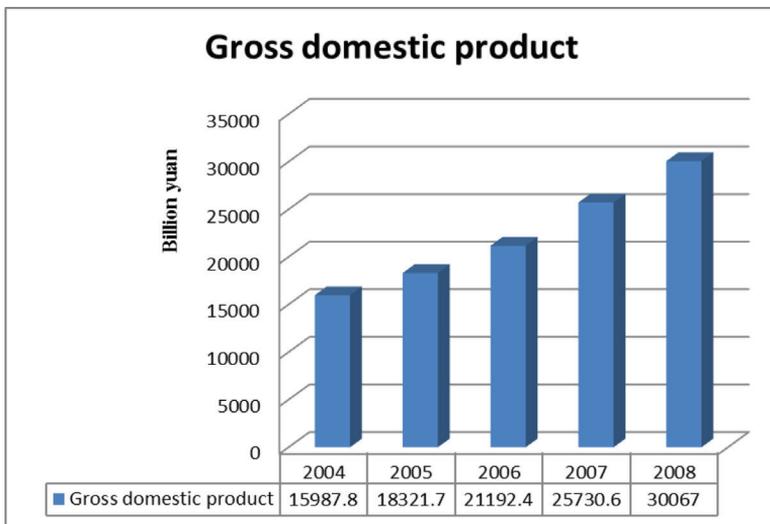


Figure 5 – Gross Domestic Product and Its Growth Rate From 2004 to 2008

## 5. Conclusions

In project engineering, cost prediction is a very important link. In this paper, the concept of engineering cost is analyzed, and the project cost forecasting model is established based on the fuzzy forecasting technique. The cost of the project refers to construction enterprises in the construction and installation engineering construction process in all of the actual cost of the sum, including materialized labor cost and live labor necessary labor cost, the former one refers to the value of consumption of engineering. And the latter one is paid to workers compensation. In this paper, the fuzzy prediction technique is used to evaluate the highway mileage and investment in China, and the result shows that the fuzzy prediction technique can be used to evaluate the engineering construction effectively.

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# Research on College Sports Assistant Educational Administration Model in Combination with Computer

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**Abstract:** College sports educational administration system based on computer makes the administrative work more informative, standardized and normalized. The information storage and processing based on cloud computing make it convenient for universities to read mass data. Due to the characteristics of complexity and mass data of temporary university's academic affairs on sports, assistant management system of sports education in universities structuring with browser/server can be designed with the characteristics of extension, generality, unique stability, virtualization, safety and low costs of cloud computing. This system based on the four cloud architectures of computing, storing, back-up and network schemes out five main modules: teaching and research management, teaching basic resource management, teaching affairs management, teaching quality management and practice teaching management through taking advantage of cloud computing to improve the quality and efficiency of college sports teaching management. The system passes the tests of online population, service process, and exchange of data, querying data, statistics and stability and proves to have practical use.

**Keywords:** College sports educational administration system; cloud computing; cloud structuring; browser/server structure.

## 1. Introduction

Academic management on sports means planning, implementing and checking the academic works on sports by obeying the fundamental rule of school and sports and using labor, material and financial resources as little as possible in a best way or method. It is the key part of academic management on sports to assure the students' balanced development on moral, intellectual, physical aesthetics. It is also the work hinge of the sports teaching system which helps every aspect of school to cooperate harmoniously and minimize the energy consumption. With the rapid development and popularity of the computer and network, the idea of traditional sports management approach must be improved accordingly. School sports manager should pay attention to the modern instrument and equipment and keep pace with the scientific and efficient management idea. Thus the modernization of the sports management in school especially the assistant management of computer and network is the efficient way and method to increase

efficiency of work and quality of management which is crucial to achieve the school sports goal. In the high-efficient sports management, people should deal with mass information data like tests of various sports items, assessment of test results, statistics of teachers' personal files and workload. However users can capture and upload data quickly on the internet through service platform of cloud technology without installing software and purchasing equipment. In 2009, Chen Q et al. elaborated the cloud computing theory and related theory (Malleesh, J., Babu, M. D., & Someswar, G. M., 2016); Bingsi H X F et al. put forward the academic model of library management system based on cloud computing at the same year (Krishna, P. J., Babu, M. D., & Someswar, G. M., 2016); Armbrust M et al. analyzed cloud computing in detail and prospects of its application in 2010 (Ramesh, S., Rao, B. M., & Someswar, G. M., 2016); Sultan N et al. analyze the model of applying the could computing in universities in 2010 (Rakesh, G., Babu, M. D., & Someswar, G. M., 2016); Mell P et al. gave it a relatively standard NIST definition (Oelmann, M., Pittmann, T., & Steinmetz, H., 2015). Based on the characteristics of extension, generality, unique stability, virtualization, safety and low costs of could computing, assistant management software on sport teaching is designed structuring with browser/server system including five modules: teaching and research management, teaching basic resource management, teaching affairs management, teaching quality management and practice teaching management to make the academic sports management more efficient and convenient.

## **2. The Theory Introduction of Cloud Computing**

### **2.1. The Introduction of Cloud Computing**

The formation of the basic cloud computing theories are based on the following aspects: various useful resources like network storage and network computing have been fully explored after a long-term development which have important effects on education and technology development; to realize the sharing and transmission of data increases the work efficiency and lowers the cost on network computing and so forms the theories like core technology in distributed computing, utility computing, interconnected computing and on-demand service. The most dominant features are strong management, wide range and convenient use. This model occupying a rather high position has been the research focus of current network service industry. Cloud computing is much different from other network model and has its own unique character. For example, pay according to actual application; centralize various resources without limitation of network; realize the personalization of services and expansion of functions combined with need to divide it into different layers of service like data service, infrastructure service, software and platform service (Vaismoradi, M., Jones, J., Turunen, H., & Snelgrove, S., 2016).

### **2.2. The Features of Cloud Computing**

#### **1. Expansibility**

Expansibility is one of the features of cloud computing. Regarded as resource pool it can realize the comprehensive use of resources and provide multiple services to optimize allocation. The introduction of cloud computing which becomes key model

of information technology in the future promotes the transmission and interaction between information on the internet and achieves the goal of sharing information. Cloud platform can largely improve the work efficiency to create more profits and lower the cost and workload of workers. No matter from the perspective of data information or from computer resources, single computer resource will be further integrated and through optimizing allocation in the cloud platform, the noticeable results can be seen on increasing the construction costs and making full use of the resources (Van Cauwenberg, J., De Bourdeaudhuij, I., Clarys, P., Nasar, J., Salmon, J., Goubert, L., & Deforche, B., 2016).

## 2. Generality

In the practical use of cloud computing, it has the characteristic of general use and no limitation. It can provide users with multiple services and applications with the help of related cloud computing technology and equipment. Software developers and designers are the key of the establishment of cloud computing platform and also the base to ensure the full play of open source software to open up to the users.

## 3. Unique Stability

It can process data by using virtualization technology in the system and also ensure the reliability of information and store the data in the cloud computing platform. Many measures are taken to sustain the utility of data and ensure the stability of network.

## 4. Virtualization Technology

The resources such as data and physics in the system can be processed and stored normatively by cloud computing in which the key is virtualization technology. As long as the user terminal is connected with data center in the teaching affairs management system, people can obtain the related information and realize the personalized service.

## 5. Safety and reliability

Based on the management system in cloud computing, the reliability of data information can be improved by using its high safety feature. In the past, the user's computer was easily hacked when using computer which leads to greater security risk of personal information. However, by using the cloud computing, the personal data information will be protected by special group organized by relevant service providers and thus improve the safety greatly (Dichev, I., Graham, J., Harvey, C. R., & Rajgopal, S., 2016).

## 6. Low Operating Cost

Because of the specificity of cloud computing, cloud system can be constructed by inputting low cost node under the multiple protection measures. Cloud computing can also promote management benefit on reducing workers' labor. To further reduce the cost of operating the system, the related facilities can be built in the area full of power resources because of the low demands on infrastructure. Besides, it has strong applicability and also provides reassurance to the reduction of resource waste. In conclusion, applying cloud computing to the program can increase revenue while reducing the cost.

### **2.3. Architecture of Cloud Computing**

From the aspect of architecture, it should be defined as the integration of different services which should obey the relevant requirements and condition and meet the demand with resources in flexible space. Due to the current situation of our domestic technology on cloud computing and related technologies, we can come to the conclusion as follows: teaching affairs management interface, data service management and information service based on cloud computing platform make up the key parts of architecture of cloud computing in research system. The key link in the process of providing service is the abstraction of service aiming at system's several applications, operational conditions and related facilities (Abreu, A., Rocha, Á., Cota, M. P., & Carvalho, J. V., 2015). The service layer has advantage on safety and Expansibility and can meet the requirements of users with its personalized service. Service management layer has the ability to ensure safety; avoid losses of data; improve the liability and usability of information service and at the same time provide a solid guarantee to the service provided.

### **3. Analysis of the Demand on Assistant Management System on Sports Teaching**

To analyze the actual college sports teaching in China on its systematic function, the research procedures are as follows:

1. Teaching research management. It is regarded to be the crucial beginning of running the teaching affairs in the university smoothly. This module often contains many management contents including training program, teaching plan setting and curriculum setting.
2. Teaching basic resource management. It is often related to curriculum resources, specific information, class information, teacher allocation and so on. To some extent, it is the basis to realize the function of education administration system. Resource construction plays a very important role in realization of system's function.
3. Academic activities management. It mainly includes teaching tasks, course arrangement, starting class, exam management, score management and school role management. These are the cores of system and also the key part of this research.
4. Teaching quality management. The major contents of this module are teaching assessment and subject competition. This module does research on the teaching quality by arranging and calculating the data of each module and handing it to superior department.
5. Practice teaching management. This module based on teaching plan and theory curriculum is divided into graduation project, experimental teaching SIT project and second major four parts. Practice is often related to arrangement of teachers and students, project grouping and score assessment.

According to the foregoing demand of system function, this system is divided into five subsystems: teaching research management, teaching quality management, teaching affairs, practical teaching and assistant teaching. The general structure of this system is depicted in picture 1.

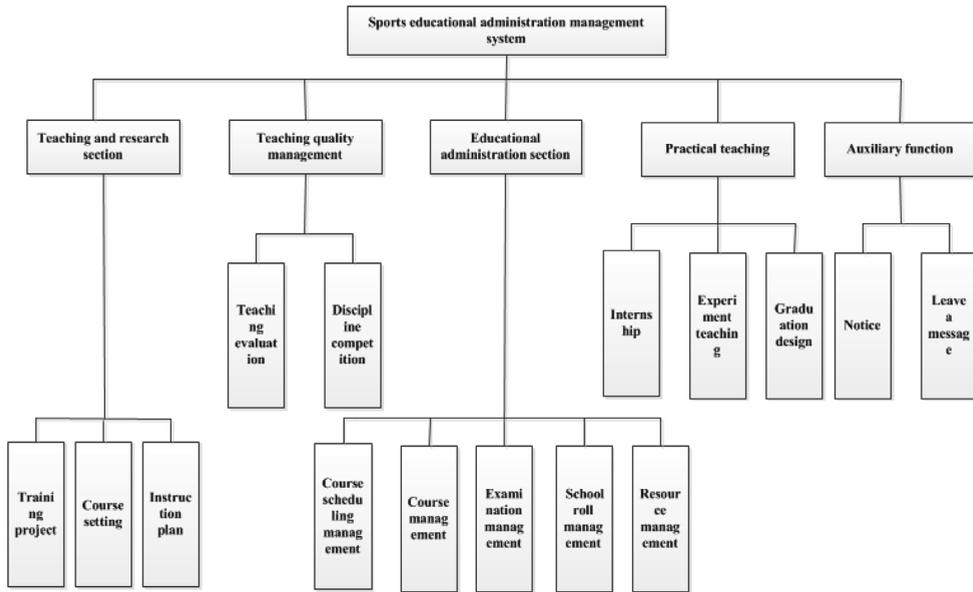


Figure 1 – Functional Structure Diagram of the Educational Administration System of Colleges

## 4. The Design of Sports Teaching Assistant Management System

### 4.1. College Sports Educational Information Management Cloud Architecture

#### 1. Computing Resource

From the perspective of college sports information management’s demand, cloud service platform mainly relies on the two servers: application and data. It is made up of six servers of which four for data storage and protection function and the rest of it are the extra backups of main database. The cloud platform used in this system is IBM System x3950 M2, Scale X-pander Option Kit series product allocated to users’ and other four System x3950 M2 which efficiently widen the original server of management system so as to adjust the investment of information technology energy all round and bring cloud computing into full play (David, J. S., Levrat, A., & Bouzat, P., 2016).

#### 2. Resources Storage

The equipment applied to storage in this cloud platform is Oceanspace S5000 storage system. This product has dominant advantage on computing, data safety and redundancy and plays a very important role in storage research. It can process mass data efficiently and design more flexible interface with service of data migration and data backups. It is essential to improve teaching quality and plays the decisive role in the efficiency of system. The specific function of disk restore and protection in storage can ensure the usability of the data stored in the disk and avoid the abnormal conditions and thus make it more reliable. In addition, under the intelligent hard disk delay and power technology,

it can reduce the energy consumption of central processing unit (CPU) and assure the facilities to cool itself normally and reduce the energy wastes brought by fan operating and consumption of alternating current (Bubel, D., 2015).

### 3. Backup Resources

In this research, backup device chosen in the cloud platform of college sports education administration system is Ocean Space HDP3500, an integrated machine with storage and backup which is produced by HUAWEI Symantec Technology Corporation. The device with high security can encrypt relevant information and lower the cost of constructing management system. The backup device in cloud platform has a relatively large capacity and can realize storage of data backup without occupying large area (Murphy, S. P., Yates, A. A., Atkinson, S. A., Barr, S. I., & Dwyer, J., 2016).

### 4. Network System

Compatible with existing network systems, the network system based on the college sports education administration system should carefully check and analyze the hardware device to be used in the process of designing and ensure that the quality meet the demand. Besides, it should also guarantee the reliability of data information to help management staff to work efficiently and satisfy the users' demand, realize the personalization and best application efficiency (Ferrer, M. M., Gouveia, A. F., Gracia, L., Longo, E., & Andrés, J., 2016).

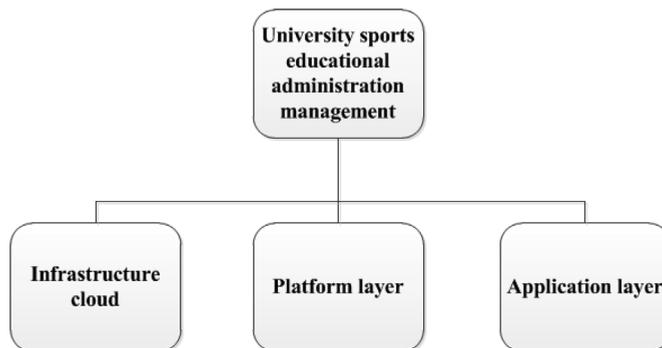


Figure 2 – Information Management Cloud Architecture

## 4.2. The Design of College Education Administration System

### 1. The Layout of System Interface

System interface is the input and output interface applied by the users when they are communicating with each other. It also involves the functions and service contents needed by users. Generally, the requirements of interface by system are as follows: simple, clear and easy to operate. The login interface of education administration system is shown below.

For any academic management module, login is the unified entrance. Similar to other login system, user name and a password are necessary and then click to enter. After click the logging option, system will immediately analyze the user name and reconfirm the



Figure 3 – Login Interface

user’s identity. However, the verification code is to further ensure the system’s safety and to prevent brute force effectively. The following passages mainly introduce the realization process of the main modules of academic affairs management system. User login process is shown below.

## 2. Course Elective Management System

The course elective management system can manage the students’ grades or the course elective situation. It can be achieved as follows: users only need to type in relevant user names and passwords and then enter the management system to check their information about scores and courses or to modify, add or delete the information. In addition, users can also modify their passwords and ensure their information’s safety. In this research, the system has dominant advantage on data checking and ensures users to get information more conveniently and thus improves the quality of service.

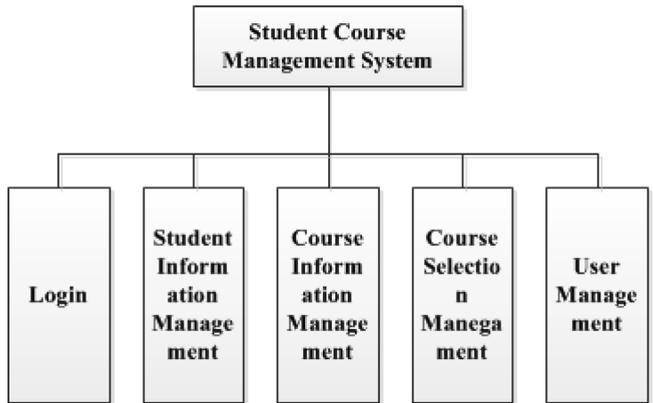


Figure 4 – Overall Structure Diagram of the Elective System

### 3. Examination Management System

Exam management often contains exam course management, exam schedule arrangement, makeup exam management, course-retaken management, invigilator management, invigilation schedule arrangement, invigilation workload management and grade exam management. Exam management design is shown below.

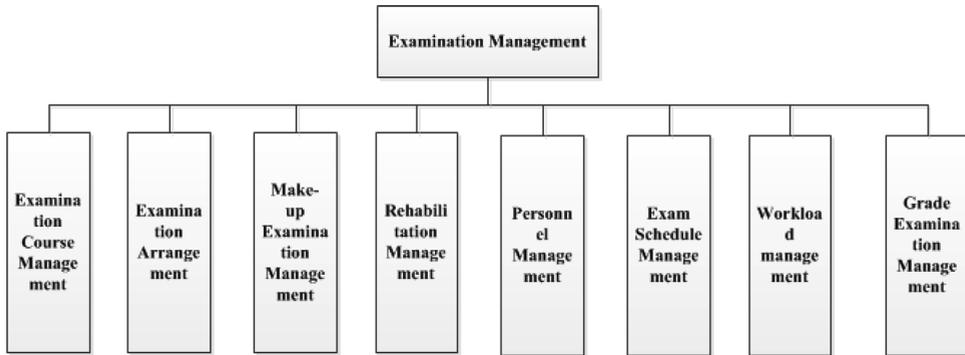


Figure 5 – College Sports Management Structure

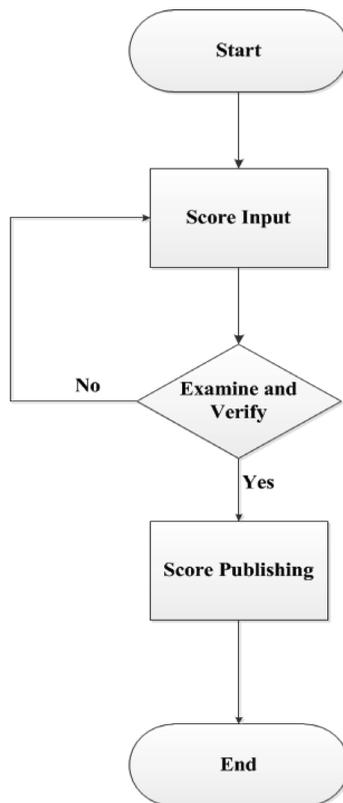


Figure 6 – The Process of College Students' Performance Record

#### 4. Grade Management System

After the final exam, teachers should type students' regular grades and exam grades into the system. The system will produce the final grades by a proportion of 4 to 6. The process of inputting the scores is shown below.

Grade query management contains two parts: grade query and makeup exam query. After the teacher input the grades, it will be sent to the second class institute and at last the grades will be announced by academic administration office. Then, the users can check their grades by inputting key words. The grade query interface is as follow and the detailed procedures of querying the grades in this system is shown below.

[Existing grade list]				Search by student ID [Advanced search]			
Student ID	Name	Course	Whether early examination	Performance results	homework grade	examination performance	Final grade
10050401	Qiang Li	Basketball	No	0	0	0	0
10050402	Yi Zhang	Basketball	No	0	0	0	0
10050403	Ting Wang	Basketball	No	0	0	0	0
10050404	Fei Xu	Basketball	No	0	0	0	0
10050405	Lihong Wu	Basketball	No	0	0	0	0
10050406	Na Wang	Basketball	No	0	0	0	0
10050407	Xuwen Zhang	Basketball	No	0	0	0	0
10050408	Celi Sun	Basketball	No	0	0	0	0
10050409	Si jie QI	Basketball	No	0	0	0	0
10050410	Donghao Liu	Basketball	No	0	0	0	0
10050411	Shuijin Zhu	Basketball	No	0	0	0	0
10050412	Cangsong Pan	Basketball	No	0	0	0	0
10050413	Qin Jian	Basketball	No	0	0	0	0
10050414	Ge HU	Basketball	No	0	0	0	0
10050415	Cheng Luo	Basketball	No	0	0	0	0

First page    Total 266 pages    Next page    Last Page

Figure 7 – Grade Query System

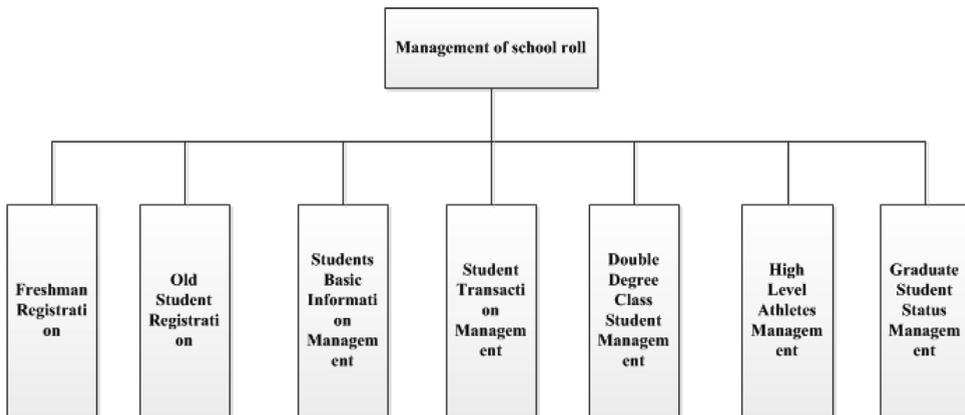


Figure 8 – Student Status Management Framework

## 5. Student Status Management System

This module is often related to freshman status enrollment, undergraduate student enrollment, student basic information management, student status removal management, double major class management, high-level athlete's class management and graduates' status management. It is shown below.

The contents of managing students' basic information include information of students' family, nationality, age, comprehensive practical records and other information. To input the school year, grade, class number and student's name, one can check comprehensive information or modify, delete students' information.

Server	IP	Processor	Internal memory	Storage	Operating system	Application software
<i>Web server</i>	172.16.11.117	Quad-Core AMD Opteron™ Processor	4GB	140GB	Windows Server 2003 SP2	Tomcat 6.0
<i>Database server</i>	172.16.11.117	Quad-Core AMD Opteron™ Processor 2375 2.4GHz	4GB	140GB	Windows Server 2003 SP2	Oracle 10g
<i>Application server</i>	172.16.11.117	Quad-Core AMD Opteron™ Processor 2375 2.4GHz	4GB	140GB	Windows Server 2003 SP2	JDK 1.6
<i>Test machine</i>	172.16.14.175	Intel® Pentium® Dual CPU E2200 @2.20GHz,2.20Ghz	1GB	70GB	Windows Server 2003 SP2	Load Runner 8.0 Oracle Home 9i

Table 1 – Test Environment

## 5. System Test and Analysis

### 5.1. Test Environment

When testing the management system, people should construct the simulation environment the same as the real environment so as to master the real performance of system. The testing environment analysis is shown in diagram 1.

### 5.2. Test Strategy

#### 1. Test Requirements

The testing of the academic affairs management system can be achieved by several steps. When the parts being tested are blocked, we can get the test results. The conditions for testing are as follows: (1) The system should remain certain physical space with vacancy rates of at least 20%; (2) The use efficiency of the CPU applied to the system should be under %. (3) The time for carrying out each operation and response should be within 15minutes.

## 2. Testing Approach

When doing the stress test on the system, we can adopt simulation environment test to make the results more accurate and reliable. The testing approach used in the system based on cloud platform is relatively advanced. The testing approach can be achieved by a testing tool known as Load Runner which is widely used recently. This tool can carry out an all-round detection of the capability of whole system and accomplish the load test by constructing the model under a series of limitations created by the tool. It can also conclude and arrange the concrete results of the test which plays an important role on ensuring system's reliability. (1) Set up business model. This system will meet the challenges from different aspects after being put into use which asks for higher requirements for the efficiency of the system's operation. The stress proportion of different system capability can be reflected on the storage and records of the data. (2) Set up testing model. The construction of testing model has a great influence on the accuracy of testing results. There are three continuous testing steps during this process. After the test of account management system, it can find out and analyze the deficiencies for developers to deal with and thus improve and optimize system's ability of dealing with business. (3) Set up the implementation model. The testing works of this system are related to various contents. Thus we must guarantee the effective connection of links and coordinate each working staff to improve the efficiency of testing work. Hence, to carry out the performance testing work efficiently and orderly, we should set up more reasonable, scientific and standard testing procedure and make clear each user's role and responsibility.

### 5.3. Test Results

The contents of system test include student's course elective management, grade query management, user's authorization and login management, course and teaching arrangement and so on. These testing contents can reflect system's operating efficiency and capability in an overall view. The final performance test is arranged and analyzed in detail in diagram 2.

It can be seen from the diagram above that it passes all the 9 tests and appears to be in good condition.

## 6. Conclusion

The traditional management system can no longer meet the need of the college sports teaching with its increasing complexity and data volume. With the unceasing development of cloud computing, it makes the system management more convenient due to its characteristics of extension, generality, unique stability, virtualization, safety and low costs. In order to resolve the problems of complexity and large data volume in managing system, this research based on cloud computing designed a college sports educational administration management system with browser/server structure. This system mainly includes 5 major system modules: teaching research management, teaching basic resources management, academic activities management, teaching quality management and practice teaching management. In addition, this system optimized common teaching affairs managements like course elective management,

Test items	Performance index	Execution	Actual result	Test results	Test personnel
<i>Online number</i>	3000 people online at the same time	Completed	40000-70000	Pass	Qiang Li
<i>Business management</i>	Input / modify response time $\leq 1s$	Completed	<1s	Pass	Qiang Li
	Others $\leq 3s$	Completed	2s	Pass	Qiang Li
	1800 per minute at peak value	Completed	1790-2400	Pass	Qiang Li
<i>Batch data exchange</i>	Non concurrent data exchange $\leq 20000$ /million	Completed	<6240	Pass	Qiang Li
<i>Query</i>	Million local query response time $\leq 3s$	Completed	$\leq 2s$	Pass	Qiang Li
<i>Statistics</i>	Simple statistical report query response time $\leq 10s$	Completed	$\leq 9s$	Pass	Qiang Li
	With summary statistics of the response time $\leq 1200s$	Completed	900s	Pass	Qiang Li
<i>System stability</i>	Failure time no more than 1/1000	Completed	Continuous high-speed operation for 24 hours, not found abnormal	Pass	Qiang Li

Table 2 – System Final Performance Test

exam management, grade management and student’s status management which improved the efficiency of the managing system. Finally, through the online population, business handling, exchanging large volume of data, query, statistics and stability tests, it is obvious that the system has a realistic meaning and meet the demand of college administration management.

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# Badminton Training Auxiliary Teaching System Performance Analysis Based on Artificial Intelligence

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**Abstract:** With the widespread use of computer technology in the field of education as well as the rapid rise of the artificial intelligence, intelligent computer auxiliary teaching system has come into being. The badminton training mode for Chinese athlete shifts from traditional on-site teaching to the teaching combined artificial intelligence with computer-aided instruction. ICAI system sets education science, psychological science and cognitive science etc. as the theoretical basis, adopts the artificial intelligence and many other computer-related technologies and has strong comprehensiveness. Targeted on the demand for badminton athletes' training mode change, the practical ICAI student model has been established based on the badminton basic skills training principles and setting the computer-aided instruction system as the theory platform. This mode has a high intelligence, including the general characteristics of CAI, having the natural language ability, being able to identify different student models and provide relevant teaching environment for them. It has been known from the experimental analysis that the ICAI system established in this article has a good effect for the special training and physical fitness of the badminton athletes.

**Keywords:** Artificial intelligence; computer aided instruction; badminton; special training; fitness training.

## 1. Introduction

With the popularization and development of China's badminton, more and more colleges and clubs open the badminton courses and badminton training institutions. Most of the badminton courts are indoor and they won't be influenced by the weather changes. Its feature of entertaining and having a wide participating group makes the number of the people who participates in badminton increase day by day. Tracy Morgan (Handel Liao Y C., 2007) thinks that the core is in the central region of the body. This area includes abdominal muscles, hip muscles, and back muscles. These muscles play a very important role in the human body's movement. They can not only provide the needed energy for the body sports to keep the body in balance under special circumstances, but also enhance the coordination of the body to complete the technical action. Travis Brown (Pilkington R M., Hartley J R., Hintze D., et al., 1992) thinks that the body's core muscles are the rectus abdominis, external oblique, internal oblique, transversus abdominis around the abdomen and the erector spinae around the spine, as well as the

muscle groups connected with it. (Paul Li K F., Takano K., Johnson M G., 2011) thinks that the muscles of the core region are composed of 29 muscles, mainly including the rectus abdominis, external oblique, internal oblique, gluteus medius, gluteus maximus, tensor fascia lata, iliocostalis, biceps femoris, psoas iliac, and erector spinae. Generally summarizing, the core muscles refer to the generic terms for the muscles to effectively control the body's center of gravity and support the body's balance. Its beginning and ending range is from the middle of the thigh to the center of the chest. In the early 1970s, SCHOLAR system of JRCarbonell (Li K F., Takano K., Johnson M G., 2011) to teach South America came out, creating this new direction of ICAI. Subsequently, the WHY system of Stevents (Papastergiou M., Gerodimos V., 2013) .etc. to teach rainfall factors analysis , the WEST systems of Burton (Hsu H H., Lee C N., Hung J C., et al., 2013) to teach arithmetic operations, and BIP system of Barr (Mokhtar I A., 2005) to teach BASIC language and other ICAI systems have come out successively. The early research of ICAI focused on the representation of the professional knowledge. In the late 1970s, AI techniques are used to construct the student model which represents the students' status and the teacher model to reflect the teachers' teaching methods and styles. In the 1980s, people began to continue to further study ICAI design principles from the perspective of cognitive psychology, and at the same time, the application of AI technology is more specific in-depth to make the education system have a higher level of response sensitivity and overall concept. This paper introduces computer-aided teaching system and its characteristics, and establishes the intelligent computer aided teaching system combining the basic theory of Badminton training, and analyzes the structure and characteristics of ICAI system, to provide a more convenient system of badminton training.

## **2. Relevant Theoretical Basis Introduction**

### **2.1. Principles for Badminton Basic Skills Training**

The basic technique should be correctly mastered and being familiar with on the move. The badminton technology has the characteristics to complete the action on the move. In actual combat, the techniques and footwork are complementary and closely linked. The actual combat requirement will be deviated if the techniques are exercised without exercising the footwork. As a coach, during the teaching training of technique basic skills, the factor "hitting the ball" should be considered and appropriate training should be designed and organized so that the athletes can correctly master and be familiar with the action technique on the move. Continuously creating difficulty and mastering the basic skills training familiarly in the confronting situation is an adaptation to the new stimulus itself and the technical training is no exception. Badminton technology is complex and changeful, having very high demand for the human body's nervous system. Increasing the training difficulty continuously, especially in the case of confrontation, can not only improve the coordination of central nervous system and the flexibility of the body regulating function, but also make the technical movements to gradually achieve coordination and correctness. So during the technical training, the coach should pay more efforts in terms of the difficulty of suiting the remedy to the case and arrange in the appropriate time to enable the athletes to master the technology in the case of confrontation (Runa, A. I. D. N. F., & Miranda, G. L., 2015).

On the basis of developing the comprehensive technology, for the currently training to outstand advantage technique or the main technique, the world badminton technology is developing fast and comprehensively. The so-called “comprehensiveness” means that each attack and defend tactic should be mastered. Such as the high, lob, smash and chop for overhead technique, the receiving smashing, receiving lob, lift, drive of underarm technique and chop, hook, push and save on the net position and other technologies should all be mastered comprehensively, and strive to have no apparent weakness, which must be owned by a high-level athlete. So during the process the coach trains the athletes, they should pay attention to the athletes’ comprehensive technical shape, especially the juvenile athletes from the amateur sports schools. They should pay more attention on technical training. The training method for arrested development only for one-sided pursuit of achievement should be forbidden. However, as a high-level athlete, it’s not enough to only have the comprehensive technology alone, they must also possess certain advantage technology or unique skill. It means that in the crucial moment in the game, the skill can give the opponent a serious threat, or even the fatal blow. It’s particularly important for the top class athletes.

Mastering and developing of the advantage technology must work closely with the personal play and tactics. Mastering and developing advantage technique must be in accordance with the personal play characteristics and tactics. The formation of the athlete personal play characteristics is affected by many factors, including physical conditions, such as height, shape, quality and so on. That technical conditions mean the mastering and applying degree for various techniques, mental condition and the guidance from the coach in training and competition and the gained experience by himself and so on. It needs a development process itself. Therefore, mastering and developing the advantage technology must cooperate closely with this process. For example, in regards to the formation of rapid attack play, in addition to having the relevant strength and speed, the athlete should also have the advantage technique to assault from backfield, and that means the consistency of high, lob, smash, chop technical movements should be strong and the smash should be fierce and sharp while the front court should master the unique skill of chopping, pushing and hooking. Then, in the process of forming rapid attack, the exercise for these advantage techniques should be strengthened. They should develop the advantage technique per personal play characteristics and tactics.

## **2.2. Definition and Status of Computer-aided Instruction System**

Computer Assisted Instruction (CAI) means to make use of computer to teach instead of teachers. The teaching content can’t be compiled into various “courseware”. The learners can choose different content to learn according to their level so that the teaching content can be diversified and visualized, which is easy to teach the students in accordance with their aptitude, such as a variety of educational software, test database and expert systems etc. CAI has played an important role whether in the general education, higher education or in continuing education. Overseas, CAI courseware has been widely used in schools and at home and has received good results. In China, although CAI research started late, but it developed rapidly. Since the 1980s, there have been a number of powerful institutions of higher education listing the development of CAI as the key research subject. The realization of CAI requires to apply AI technology and compile complex procedures, such as natural language understanding, knowledge representation and the inference

methods etc. Some special application results of AI techniques, such as the algebraic description, sign synthesis, medical diagnostics and theoretical proof etc. were all applied into the CAI system to improve its intelligence and practicality. A majority of the early CAI courseware mostly use decision theory and random learning model, which greatly simplifies the expression of the learning process, such as the early geological teaching system (SCHOCAR) and the like. Later, with the development of the artificial intelligence technology, the students' learning behavior and training strategy have been added to the CAI systems, and at the same time, AI technology is used to establish learning consultant module (storage the issues and skills for the taught courses). This method can control the training strategy and give the learning content suitable for the students. Currently, to obtain the flexibility and modularity of representation and control of curriculum knowledge, some CAI systems also use AI techniques to express training programs and strategies, for example, many programming languages CAI all belongs to this case. So far, the whole education information of the vast majority of the traditional CAI being used is preset in the way of programming. Once this kind of CAI courseware is finished, any big teaching change will bring great inconvenience for the maintaining work. Therefore, the existing CAI system faces many challenges, which mainly exist in the following areas:

1. lack of openness: lack of openness is the biggest shortcoming of the current CAI courseware. Users can not make any modifications to the courseware and they can only use the existing resources for teaching according to the setting route. Its shortcoming is that: the limitations of the fixed content make the applications of the courseware so narrow; the setting running route makes teaching lack of autonomy; the pertinence of the teaching isn't strong; the secondary development can't be made on a higher starting point by using the emerging resources.
2. lack of human-computer interaction capability: most of the existing CAI sets light disc as a carrier of information and show up the content of textbooks to in the form of multimedia. The teaching information is provided to the learner according to the preset teaching process mechanically. The learners who use CAI courseware are entirely passive. In the classroom teaching, it can only be operated per the preset courseware by teachers. Both students and teachers can't be well involved in the teaching and learning process, so the human-computer interaction can't be realized well.
3. ignoring the characteristics of the course itself: there are different requirements for each course in teaching, but the existing courseware totally ignores these different requirements. For example, many programs will all involve a large number of curves or surfaces. For some courses, it will be enough to give a simple show for these curves or surfaces, while for some courses, this show can't meet requirements for teaching purposes. For example: when teaching the generating algorithm of various curve or surface in the computer graphics, if the generating process of these graphs can be displayed directly and dynamically in the courseware and the advantages of computer-assisted instruction have been brought into full play, and the teaching for computer graphics will undoubtedly be more attractive, thus to greatly improve the teaching efficiency.
4. lack of interaction between teacher and student : as for the existing CAI courseware in students' self-study and operating to use, how to study is their own

business. Teachers can't fully understand the situation of learners. The students can't ask for help from teachers when they encounter problems. The students and teachers are closed to each other, not to mention the interaction between the teacher and the student, and therefore the effect playing by the courseware is greatly reduced. At the same time, due to lack of network support, the vast majority of existing CAI courseware is running in stand-alone environment and they can't take advantage of the network to make knowledge updated quickly, of course, they can't provide a convenient space for study and discussion, teachers and students exchanging ways anywhere, anytime and the realizing conditions for distance teaching.

5. lack of teaching strategies: in the development process of courseware, the teaching strategy design can't be departed actually, but the producer of the courseware often do not realize this. For example: the vast majority of existing courseware is the single type broadcasting. Such courseware is made "finely," but it is not reversible and can't interact. Actually it's only a means and not a purpose to apply the courseware to teach. It should be under the guidance of teaching design theory, the courseware effectiveness should be stressed, and the emphasis should be put on helping students to learn new knowledge, acquire new technology, and train various capabilities rather than the "fine" surface production.
6. lack of intelligence: the existing CAI courseware system can't give the targeted education to different levels of students. Students' learning are passive, and the system can't provide the help to learn information for the students automatically to make the students learn selectively. For the teachers, their teaching can't be actively involved and they're unable to prepare the most suitable learning content based on the information provided by the system in accordance with students' cognitive model and can't give teaching mode and method in different ways. So it does not have the intelligence. In summary, there are many problems for the existing CAI. With the continual emergence of new technologies, these problems will make CAI increasingly unable to meet the new requirements. Therefore, the new computer-aided teaching system represented by intelligent CAI will become the development direction to continue to explore on education technology and strive to achieve (Tenenbaum G, Bar-Eli M., 1993).

### **2.3. The Definition of ICAI**

Computer Assisted Instruction (Computer Assisted Instruction, CAI), is a form of computer in education. It's a modern teaching system to make the computer as a teaching media to complete the teaching process and process and delivery for teaching information, and the organic integrity is formed by teacher - computer - students. The application for computer aided instruction mainly lies in two aspects: aid classroom instruction and support individual learning. People often call the demonstrating software to aid classroom instruction the CAI courseware, while they call the software which is suitable for students' individual learning the CAI learningware or system. The CAI can be classified as : CAI courseware which aids the classroom and CAI system based on individualized learning. The CAI mentioned in this paper refers to the CAI system. The ICAI system discussed in the paper is the further development of the CAI system.

Since the early 1980s, the educational researchers around the world and computer education experts have done a lot of research for CAI impact on students' learning process. Under the influence and push of cognitivism, CAI has gradually began to enhance its adaptability to different learners, namely, to strengthen its intelligence orientation. The pursuit of the perfect artificial intelligence CAI has become a hot topic for CAI research. ICAI (Intelligent Computer Assisted Instruction) sets the cognitive science as the theoretical basis and brought the artificial intelligence (Artificial Intelligence, AI) technology into the CAI system and its intelligent CAI. It is by studying the characteristics of human learning and thinking process, seeking to learn the cognitive model, it is an educational expert system based on knowledge. It is given to mankind advanced machine intelligence system is intelligent CAI. Because the most important feature of ICAI is tutorial, it's often be called ITS (Intelligent Tutoring System) abroad, ie, intelligent tutoring system. The study for ICAI system in this paper not only includes theoretical support but also includes technological realization of ICAI system components module, and put emphasis on the discussing of the student model (Goodyear V A., Casey A., Kirk D., 2014).

### 3. System Model Construction

#### 3.1. Practical ICAI Student Model

Student model can be seen as an approach for the knowledge level of certain students to the above knowledge structure in learning progress. Overall, it is similar with the cover model, by tracking and monitoring students' learn and test conditions on certain node in AND / OR diagram and mark the node with the fuzzy measure. It's equivalent to model student's mastery degree of knowledge on single concept and the performance measures or deviation model can be used. With the interaction activity carrying on between the system and the students, the fuzzy measures on node spread between the joints on the ND / OR graphs, and this can evaluate the students' mastering degree of the knowledge system of a teaching target. This evaluation for students' cognitive level on the AND / OR graph is realized by the fuzzy measure of chain forward (from the current knowledge to preliminary knowledge) and the chain reverse (from preliminary knowledge to current knowledge). Therefore, in addition to conventional information recording, each node  $i$  needs addon domains:

$s_f^i$ : For any chain  $\bar{ij}$  issued by  $\bar{i}$  in AND/OR graphs, because the negative deviation of chain source node  $i$  of chain  $\bar{ij}$ , then there is doubt for mastering degree for chain host node  $j$ . The realization of propagation algorithm in both directions all adapts delay computing technology. Only one node  $i$  is evaluated, the contribution of the chain lodge knowledge  $j$  of all chains  $\bar{ij}$  connected with it to it will be considered. When the node  $i$  has the negative bias, it then deliver this negative bias to the chain lodge  $j$  along each chain  $\bar{ij}$ . This pass can only happen between the adjacent layers at any moment and it will not affect the entire network and the knowledge points having nothing to do with  $i$ .

The behavior for student model on knowledge systems: the mastering degree of a knowledge point will impact to the knowledge point learning associated with it. As described above, the correlation between knowledge points can be represented with AND / OR diagram clearly. This section will use the spread of calculating fuzzy measure on AND / OR diagram to describe this correlation between the knowledge points.

From the point of view of knowledge understanding, there exists two semantic association between knowledge points:

Mastering preliminary knowledge will bring help to the understanding of the subsequent knowledge. It shows that in the AND / OR figures of student model, the mastering of chain lodge node will be helpful to understand the chain resource knowledge.

The showing difference for the mastering of the same knowledge point, especially the difference the student shows comparing with the historical record to some extent reflects the defects in their understanding on the preliminary knowledge. For example, students has forgotten the past.

In order to show the student’s cognitive status completely and correctly, the effect the above-mentioned two correlations causes should be portrayed in the model.

The relationship between Some knowledge point  $i$  in AND / OR figure and the knowledge point related with it can be shown in Figure 1. It has a series of preliminary knowledge nodes (lower layer) and several subsequent node (upper layer) which sets  $i$  as the preliminary knowledge. We can depict the impact of the preliminary knowledge on the subsequent knowledge from two aspects:

1. The influence for the mastering condition of lower layer node to the understanding of node  $i$ ;
2. The influence for node  $i$  to upper layer node;

According to the delay computing technology, only when knowledge point  $i$  is considered, the influence for its preliminary knowledge then will be considered. So, (2) can be reduced to the calculation of  $s^i$ , and only (1) is considered.

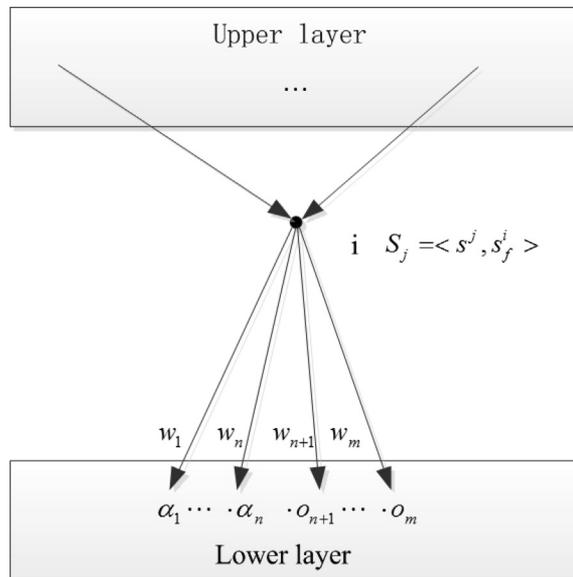


Figure 1 – Node  $i$  and Its Correlation in AND / OR Graph

In the preliminary knowledge of node  $i$ , some are connected with AND chain (such as  $\alpha_1, \dots, \alpha_n$ ), some are connected with OR chain (such as  $o_{n+1}, \dots, o_m$ ). They have different contributions to understand  $i$ . The entire  $\alpha_j (j=1, \dots, n)$  has influence to  $i$  and any understanding of  $o_k (k=n+1, \dots, m)$  will be helpful to  $i$ . S when discussing the contribution, the two types of nodes should be handled differently. According to the disjunctive normal form in the mathematical logic, use one transformation to classify the preliminary knowledge point in the lower layer and get a series of (such as  $p$ ) node cluster (Feng Y., Lapata M., 2013). They construct OR chain relationships each other and inside the cluster, there is AND chain relationship. The transform intuitive schematic diagram is shown in Figure 2.

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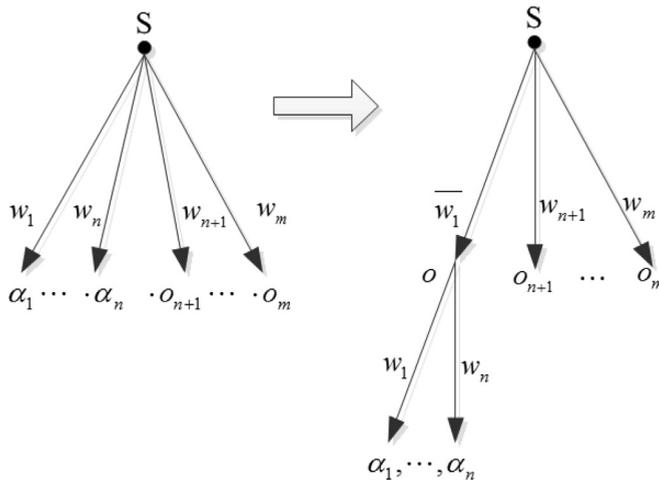


Figure 2 – The Visual Diagram Transform

$O$  in the figure is the virtual node and  $\bar{so}$  is the virtual OR chain.

For certain cluster of  $K, k \in (1, \dots, p)$ , if there are  $n$  nodes totally and the effect is:

$$C_k = \sum_{j=1}^n S^j \cdot w_j \tag{1}$$

For p clusters, the combined effect is:

$$C = \max_k C_k \quad (2)$$

The contribution for the preliminary knowledge to understand the current knowledge point can be represented by a monotonous non decreasing function  $f: R \rightarrow [0,1]$ , it can be:

$$f(x) = \frac{1}{1 + e^{-x}} \quad (3)$$

And order:

$$\sigma = f(c) \quad (4)$$

Algorithm 2: Reverse delay calculation for Fuzzy measure.

Input: node i.

Output:  $\sigma$ .

Working variables: c,  $c_k$ , l.

steps:

1.  $c \leftarrow 0$
2. for all the chain  $\bar{ij}$  circulation issued by node i, set the control variable to j

$$c_k \leftarrow 0$$

IF chain  $\bar{ij}$  is chain AND, THEN

Circulate for this cluster AND chain, set the control variable to l

$$c_k \leftarrow c_k + s^l \cdot w_l$$

ELSE  $c_k \leftarrow w_j$

IF  $c_k > c$  THEN  $c \leftarrow c_k$ ;

3.  $\sigma \leftarrow 1 / (1 + EXP(-c))$ ;

In the learning process, the phenomenon to recognize that there is defect for the past recognition and then need to restudy often happens. Forgetting of the Knowledge is an example. The forgetting of the preliminary knowledge will be shown in the test of its subsequent knowledge point. The student model should be able to track the defect of the preliminary knowledge from the poor performance of the subsequent knowledge. This track performs that the non-zero elements  $S_f^i (S_f^i < 0)$  of the node i opposite transmit this defect according to the AND/OR chain of their lower layer preliminary knowledge point. It manifests as the following:

The responsibility that the cluster K acted as the preliminary knowledge of i should take to cause  $S_f^i < 0$  is:

$$p_k = S_f^i \cdot \frac{\overline{w}_k}{L} \quad (k = 1, \dots, p) \tag{5}$$

$$\overline{w}_k = \left[ \frac{\sum_{l=1}^n w_l}{n} \right] \tag{6}$$

Where: The integer parameter L should be determined by the domain model, and all the weight w on AND / OR chain must be taken from;

$\overline{W}$  represents the average contribution intensity for chain lodge node  $l$  ( $l=1, \dots, n$ ) of n AND chain  $\overline{ij}$  within a cluster k to the node i. If the chain  $\overline{ik}$  is OR chain,  $\overline{W} = w_k, n = 1$ .

4. The responsibility that the node j should share for n AND node within cluster k is that:

$$p_j = p_k \cdot \frac{w_j}{\sum_{l=1}^n w_l} \quad (j = 1, \dots, n) \tag{7}$$

For any chain  $\overline{im}$ ,

$$s^m = s^m \cdot (1 + \delta) \quad (\delta < 0) \tag{8}$$

Where:  $\delta = \begin{cases} p_k & \text{when k is the end point of link OR} \\ p_j & \text{when k is the end point of link AND} \end{cases}$

### 3.2. The Features of ICAIM

In addition to have general CAI features, ICAI system also has the natural language ability and can identify different student models and provide the relevant teaching environment for them and has the function to diagnose students' mistake and can give the diagnosis prescription. It should understand the teaching materials, organize them reasonably and inference according to a certain way. Its biggest feature is it has certain intelligence and can guide the students individualized. It has changed the traditional teaching model and it can more bring the enthusiasm of students, and is helpful for students' intelligence development and ability training and it's the new method to realize the modernization of the teaching method. In order to achieve this, the computer must accomplish three W, that is to know or understand the course content, to understand the object of education and to know the teaching methods ( ie, WHAT, WHO, HOW). Therefore, the general ICAI system should have the following features:

It can automatically generate into a variety of questions and exercises;

It can select and adjust learning content and progress according to students' learning level and learning condition;

It can automatically solve the problem and generate the answers based on the understanding of teaching content;

It has the natural language generation and understanding ability in order to realize the relatively free teaching quiz systems and improve the initiative for human-computer interaction;

It has the explanation and advisory ability for teaching content;

It can diagnose the Students' mistakes, analyze the causes and then take corrective action;

It can assess students' learning behavior;

It can continue to improve teaching strategies in teaching.

As far as the existing scientific and technological level, the ICAI system to have all of the above functions can't be achieved in short term. It's generally believed that we can call it ICAI system if it has one or several CAI characteristics.

The guiding ideology for ICAI system is to make the education process based on computer scientific and personal. The scientific means that the system should incorporate the understanding of modern people on the education and should incorporate scientific research fruits of the modern education. Personalization means that the system should better meet the different needs of different students and can identify the learning status (the mastering status of knowledge and skills)the students currently have so that it can decide what information should be provided to the students in what way. Therefore, ICAI system is a dynamic system and the students are no longer limited to the preset procedure. In ICAI system, the machine solving the problem is not carried out in pre-determined step, but under the guidance of the control strategy, it looks for the answers by exploring and reasoning. it's achieved by knowledge-based exploration and reasoning and using student module to dynamically generate content and strategies suitable for individual teaching. It can judge students' level of knowledge, diagnose their mistakes, judge the reason causing the mistake and then generate relevant correction strategy to make ICAI always be able to meet the needs of different students thus to achieve a high level education (Feng Y., Lapata M., 2013).

### **3.3. Classification of Cognitive Learning Theory**

Cognitive learning theory includes various learning theories setting cognitive processes as the main research object, such as Gestalt learning theory, Tolman's sign learning theory, Bruner's cognitive structure learning theory, Ausubel's recognition structures assimilation learning theory, Gagne's information processing cognitive learning theory and constructivist learning theory and so on. Depending on the difference of person's internal information processing hypothesis, cognitive learning theory can be divided into two schools: information processing theory and constructivist theory.

Information processing theory of learning: since the modern learning theory has the impact of information processing theory, more and more people accept the idea of the computer simulation and they analogy the learning process to the computer's information processing. The basic concepts of learning information processing theory is that by means of information science and computer science, combine the human cognitive process and the information processing by the computer to study human's study. The theory states that the computer's information processing and the treating

process have similarities with human’s cognition process. The human brain can be explained by the computer processing information thus to get the model for the people to process the information. Cognitive learning theory suggests that external stimuli acts on the student’s senses to make the nervous system to produce the corresponding activities. According to the multi-store model for memory raised by Atkinson (JWAtkinson) and Shifrin in 1968, the memory is divided into three interrelated systems, namely the sensory memory, short-term memory and long-term memory. Sensory memory effects as sensory selection passing one or two felt information to short-term memory. Short-term memory capacity, stored information items and the time that one item can be saved are limited. After many times use of the information stored in short-term memory, through semantic encoding conversion, the information can be transferred from short-term memory to long-term memory. In the human brain, the information is stored based on the significance of the information. When asking students to produce behavior, we must search for long-term memory, and extract the searched information and skills from long-term memory to short-term memory, and combine new incoming information to form the new learning ability, or through the reactor to convert the information into action. In 1974, Gagne (RMGagne) based on modern information processing theory put forward the basic model of the learning process. This model shows the information flow (Khot T., Natarajan S., Kersting K., et al, 2013; Walklate B M., O’Brien B J., Paton C D., et al, 2009; Majumdar P., Khanna G L., Malik V., et al, 1997) in the learning process as shown below:

### 3.4. ICAI System Components

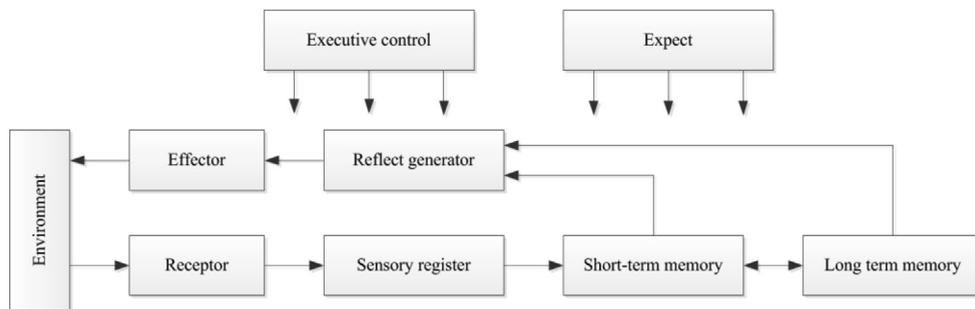


Figure 3 – Gagne’s Learning Model

The initial motivation for ICAI was to create "intelligent tutor" which can be comparable with the excellent teachers. So it must give the machine advanced intelligent – namely to understand the learning ability, learning situation and the current level of knowledge of different students and it should be able to select the best teaching strategies for the students according to different characteristics and allow man-machine conversation to use natural language to convey communication information. Thus, although the forms of ICAI system vary, but it mainly consists of four parts: Expert Knowledge, Student Model, Tutorial Model and Interface. This system architecture has become the mainstream of the international ICAI.

“Student model,” records students’ level of knowledge and historical knowledge; “teacher model” makes intelligent teaching strategies; “natural language interface” communicates the message passing between learners and teaching system; “Expert Knowledge” Stores the course professional knowledge to teach the students and is able to generate questions and provide the correct answer to the question and the problem solving process. ICAI system model is shown in Figure 4:

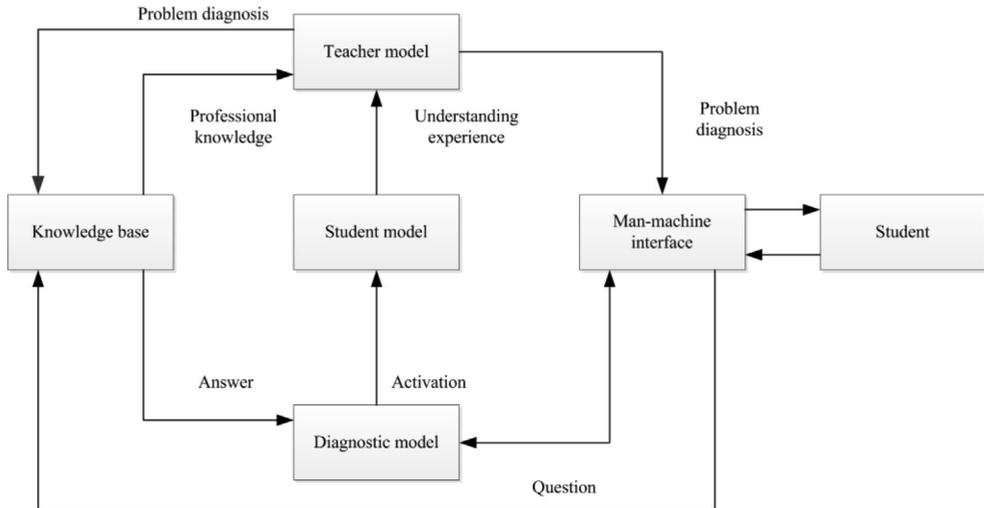


Figure 4 – ICAI System Structure

Expert Knowledge is constituted by the field knowledge, which includes two aspects of knowledge: one is teaching materials, question information, teaching materials emphasis, difficult and evaluation and other related courses; the second is about the application of this knowledge to generate questions and solve the questions. Its mission is to compose of teaching materials, generate questions and evaluate the correctness of students’ answers to questions. This part is equivalent to the expert part - based on facts to obtain answers by deductive reasoning. Expert Knowledge does not only contain the knowledge itself but also include the ability to use that knowledge. In other words, the expert knowledge can understand the students’ knowledge level in this area based on the obtained students’ information, The Objective of student model unit is to be able to dynamically represent the students’ knowledge and skills being formed. To achieve this purpose, in the student model unit, it must have the diagnostic capabilities to infer students’ level of knowledge based on students’ performance in the teaching activities. The objective of teachers model unit is to design teaching ways, arrange teaching content and manage students’ learning reaction. In order to “intelligently” distinguish individual differences between students, student model unit and teacher model unit are inseparable. Teachers model unit determines the teaching activities to be used according to the students’ level of knowledge, the system teaching objectives, individual student learning variable and other factors and whether to give tips, advice, interpretation, new teaching materials and different exercises activities, and can use tests to confirm or revise the student model. People-machine interface unit is the part to be used to render

the teaching content, and communicate with the students face to face and it's ICAI appearance and also the only part that the students can see with their naked eyes (LIU Y., LI X., 2012).

#### 4. Experimental Results and Analysis

In order to understand the physical quality of the experimental group and the comparison group before and after the test, the paired sample T-test has been done for the physical quality before and after the test of the experimental group and the comparison group. Please see table 1 and table 2 for the test results.

Item (unit)	Data type	Average	Standard deviation	T value	P value
<i>30-meter running (S)</i>	Before the experiment	4.65	0.19	4.13	<0.01
	After the experiment	4.53	0.19		
<i>100-meter running (S)</i>	Before the experiment	13.74	0.59	5.47	<0.01
	After the experiment	13.61	0.59		
<i>Standing lateral shot (m)</i>	Before the experiment	10.27	0.99	-9.81	<0.01
	After the experiment	14.05	0.98		
<i>Back throwing solid ball (m)</i>	Before the experiment	14.05	2.15	-4.36	<0.01
	After the experiment	15.86	2.14		
<i>Standing long jump (m)</i>	Before the experiment	2.49	0.15	-8.65	<0.01
	After the experiment	2.59	0.15		
<i>1000-meter running (min)</i>	Before the experiment	4.08	0.04	8.14	<0.01
	After the experiment	4.05	0.04		

Table 1 – Test Data of The Experience Group Before and After The Test

We can see from the test data of table 1 that after a semester of badminton special training of the experimental group, each data of their physical quality has very significant difference. The improved of shot, throwing solid ball backwards, standing jump scores means that the muscle explosive power of upper and lower extremities has been enhanced. The improvement of 30 meters and 100 meters means that the speed quality has been enhanced. The improvement of 1000 meters then indicates that the

badminton special training has a very positive impact on the improvement of endurance. It can be seen from this that the muscle power, speed and endurance qualities of the students in the experimental group after quality has been significantly improved after the badminton special training.

Item (unit)	Data type	Average	Standard deviation	T value	P value
<i>30-meter running (S)</i>	Before the experiment	4.66	0.19	2.46	>0.05
	After the experiment	4.66	0.19		
<i>100-meter running (S)</i>	Before the experiment	13.77	0.58	2.37	>0.05
	After the experiment	13.77	0.58		
<i>Standing lateral shot (m)</i>	Before the experiment	10.27	0.99	-3.91	<0.01
	After the experiment	10.72	0.97		
<i>Back throwing solid ball (m)</i>	Before the experiment	14.04	2.13	-5.55	<0.01
	After the experiment	14.95	2.13		
<i>Standing long jump (m)</i>	Before the experiment	2.49	0.14	-2.75	>0.05
	After the experiment	2.49	0.13		
<i>1000-meter running (min)</i>	Before the experiment	4.07	0.04	2.58	>0.05
	After the experiment	4.07	0.03		

Table 2 – Test Data of the Control Group Before and After the Test

As it can be seen from Table 2 that after one semester of badminton study, except for the significant differences of the data for the side pushing shot in place and throwing solid balls backwards, other testing data of the physical quality all has no significant differences. The reason why there is a significant difference in side pushing shot in place is that the strength of upper extremity, wrist and finger and the action speed have been enhanced during the process of playing badminton. The score of throwing solid ball backwards has also been improved significantly. One reason is that when hitting the badminton on top of the head and smash the badminton, the waist and back muscles get exercised and the strength has been enhanced. Another reason is that when test before the experiment, there are some students throwing the solid ball for the first time and their consistency of technical action is very poor. While in the second test, they have mastered the throwing ball skills, and their technical movements are more reasonable (Xing D.,2013).

## 5. Conclusion

With the rapid development of modern science and technology, the multimedia computer has been widely used in the education field and has exerted a profound influence to education and the teaching process. The use of computer-aided teaching system can provide the ideal teaching environment, can easily stimulate the learners' enthusiasm and initiative to study, thus to significantly improve the teaching effectiveness. The article firstly introduces the basic theory and the status of computer-aided teaching system, builds a practical ICAI student model by combining badminton technique basis in accordance with ICAI's characteristics, and uses two groups of students as the experimental group and the comparison group to carry out the physical quality experiments. It's concluded by analyzing the test data that the test data of the experimental students who have gone through the badminton special training has been improved significantly and their body quality has been strengthened significantly and especially their muscle fast explosive power, speed and endurance qualities are enhanced. The ICAI system targeted at the badminton training has very good using effect.

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# An Analysis of Entrepreneurial Management System Architecture for University students

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**Abstract:** Based on the current development status, characteristics and requirements of innovative and entrepreneurial management systems for university students, combining the nature and process for university employment, this paper performs a detailed design analysis in order to propose complete and reasonable solutions to address such issues as low efficiency of decentralized management by using traditional spreadsheets. The innovative and entrepreneurial management system for university students employs a B/S structure so that the client can achieve a zero-maintenance result; C# language and ASP. NET technology are made use of for system development, and Oracle database is applied for system data storage. This design is realized by making system development combined with the .NET framework, as well as data sharing and Internet technologies. This system first analyzes the research background and status of innovative and entrepreneurial management system for university students, and presents the research content, related technologies, overall design, needs analysis, implementation, and finally system testing. The system has realized the main function modules of the innovative and entrepreneurial management system for university students, including 11 major functional modules like time, parameter setting and project declaration (audit), thus exerting a positive role in entrepreneurial project management for university students.

**Keywords:** University students; entrepreneurship; management system.

## 1. Introduction

At present as university students suffer from increasing employment pressure, our country has accelerated the implementation of entrepreneurship education policies. The 17th CPC National Congress has been proposed “to implement a development strategy that promotes job creation and encourage entrepreneurship to create more employment opportunities”. This provision has to some extent stimulated and encouraged entrepreneurship while at the same time reflecting that entrepreneurship has become an effective way to solve our employment problems, while fresh force that starts their own businesses are students who just graduate from universities and are uncertain on finding a job or an entrepreneurial start-up. Entrepreneurship education is to let university students ideologically understand and accept an entrepreneurial start-up during the process of improving entrepreneurial education, so that they can grasp more basic theoretical knowledge regarding

entrepreneurship. In the meantime, entrepreneurial education can help university students to establish correct concepts of employment and entrepreneurship and cultivate their own entrepreneurial spirit in order to fully improve the overall quality of university students and give full play to their active role in carrying out entrepreneurial activities. In 2007 Mu Zhirong *et al.* made an exploration into the model of entrepreneurship education for university students (Hatten T S, Ruhland S K., 1995); in 2005 Xia Chunyu *et al.* investigated the practice and thoughts of entrepreneurship education for university students (Vesper K H, Gartner W B., 1997); in 2006 Luo Meiping *et al.* put forward some suggestions and countermeasures tailored to the status quo of university students' entrepreneurship education (Wang W, Lu W, Millington J K., 2011); in the same year, He Yunjing *et al.* drew on foreign experience and construct an entrepreneurial support system for Chinese university students (Hisrich R D, Brush C., 1984), whilst in 2006 Zhang Yuli and Li Qianwen *et al.* conducted a study of new entrepreneurial management concepts (Gorman G, Hanlon D, King W., 1997) and designed and developed an entrepreneurial information management system based on the characteristics of university students' entrepreneurship management. Therein, computer technologies mainly involve computer networks, databases, ASP, data mining and analysis, and the like (Prata, P., Fazendeiro, P., Augusto, C., Azevedo, S., & Machado, V. C., 2013).

## **2. Fundamental Issues of University Students' Entrepreneurship**

University students' entrepreneurial activities are not only an important part of university employment, but also receive widespread concern in society. However, there are a lot of subjective and objective conditions plaguing entrepreneurial activities of university students in reality. Therefore, by researching entrepreneurial promotion systems for university students, this paper aims to make an in-depth analysis of defects in our current entrepreneurial environments, such as loss of subjects, unclear functions and ineffective mechanisms, explore and construct entrepreneurial promotion systems for university students, perfect the functioning mechanism, optimize business promotion systems, among others, thus trying to play a more active role in supporting university students to start their own businesses (Ward T B., 2004).

### **2.1. Existing Problems in Independent Entrepreneurship of University Students**

#### **1. The limit of knowledge**

Entrepreneurship entails a wealth of knowledge regarding enterprise registration, management, marketing and financing. When having inadequate knowledge of the target market or competitors, or in the case of lacking appropriate knowledge reserves, entrepreneurship is not only difficult to find the necessary funds but also in a disadvantageous position in brutal market competitions. Nevertheless, the vast majorities of entrepreneurs cannot organically blend their business expertise with their undertakings in practice, so they cannot make good use of all the knowledge.

#### **2. The lack of experience**

Due to the limits of age and appropriate knowledge level, many people only engage in idle theorizing when they start their own businesses. They are lack of experience and knowledge

in specific market development, so it is difficult for them to obtain first-hand market information and cannot analyze the future direction of the market. In addition, despite the high educational attainment of entrepreneurial team members, most of them are very good classmates and friends, which have increased the difficulty of management. Due to a lack of practical work experience, they cannot be effectively managed in a short time.

### 3. The mentality problem

Having a good mentality, especially a clear understanding of entrepreneurial risks, and adequate mental preparations for risks is a necessary condition for entrepreneurial success, but because of age and experience restrictions, university students do not necessarily have clear entrepreneurial awareness; they may be lack of necessary preparations for risks and failures. Also there should be a sense of responsibility: they should be responsible for the company, employees, and investors.

### 4. Financial difficulties

It is difficult for university students to get enough venture capital, and it is an inevitable choice to get fundraising or gain interest-free and subsidized loans from the community. However, university students are eager to obtain funds at the expense of cheap technology selling; on the other hand, they cherish technology too much and refuse to make appropriate concessions. For early entrepreneurs, they should get some investors who have real strength, can provide value-added services and share unified entrepreneurship concepts, even at the cost of temporarily giving up some of the immediate benefits.

### 5. Weak technological innovation capabilities

Due to knowledge limitations, only a small portion of undergraduate science students have entrepreneurship technologies, while those liberal arts undergraduates would find it extremely difficult to have entrepreneurial technologies. Further, their technical innovation ability is quite weak, which will directly lead to a weak status in the marketplace and hardness to gain business success (Levin J S., 2005).

## **2.2. Problems Existing in Independent Entrepreneurship of University Students**

In addition to the inner cause of inadequate entrepreneurship of university students themselves, there are some problems in the existing university entrepreneurship policies. The existing entrepreneurial training, entrepreneurial support, policy support and incentives that the government introduces should still be implemented and further improved and perfected.

### 1. The policy is not complete

Entrepreneurship of university students is a systematic project. It cannot be deemed as a matter of universities, but entail all sectors of society to give support, especially the government at all levels to shoulder the primary responsibilities. In addition to the current education system, labor and social security system, personnel system and public security system, other systems such as banking, insurance, industry and commerce, justice, taxation and investment funds still do not have appropriate policies that support university students to start their own business. After university graduates enter the market, if there are too high market access standards or unimproved

undertaking environments, the market competition rules will be unfair or standardized; if entrepreneurial achievements and property rights are not properly protected, entrepreneurial passion of university students will be vulnerable (Fayolle A., 2000).

## 2. Policy implementation is not strong

Although the state has repeatedly stressed the need to vigorously support and encourage university graduates to engage in entrepreneurial activities and appropriate policies have been enacted, some local governments and relevant units as well as universities do not actively implement these policies.

## 3. Policy palliatives

Currently, entrepreneurial policies for university students are mainly preferential terms that they can enjoy in the process of handling business licenses. However, as university students are lack of entrepreneurial management abilities, the problem cannot be easily solved in the short term. One can imagine the results in the case of not knowing team management, financial management and financing even if there is venture capital (McMullan W E, Long W A., 1987).

## **3. Status of Independent Entrepreneurship of University Students in our Country**

From the perspective of actual development of entrepreneurial education for university students in our country, on the basis of drawing on foreign successful research and combining the actual development status in our country, the government, relevant departments and the community have paid more attention to entrepreneurial education for university students, so that our entrepreneurial education has made further progress. So far, China has developed a variety of modes of undergraduate entrepreneurship education, and most have set up a variety of entrepreneurship education governing bodies which are responsible for the implementation, management and supervision of school entrepreneurship education. For example, the Professional Management Venture Training College and the Science and Technology Park created by Beihang University have partly made great contributions to the comprehensive development of entrepreneurship education in Beihang University. At the same time, these models will combine a variety of quality education so that entrepreneurship education for university students can train more versatile university students, so that university students can better respond to and deal with some problems arising in startups.

Moreover, since China's implementation of entrepreneurship education, governments and relevant departments have attached particular importance to the target, requirements and connotations of entrepreneurship education development, etc. Although it fails to do a good job in many ways, in a short term our entrepreneurial education development has achieved unprecedented progress, such as entrepreneurship education being taken seriously, and students' entrepreneurship awareness is gradually strengthened. Since the pilot action of entrepreneurship education, entrepreneurship education has largely alleviated the employment problem of current university students. This development is attracting the attention of more and more colleges and universities, and is aware of the importance of entrepreneurship education, thus actively carrying out since entrepreneurship education.

## 4. Information Management System Design

### 4.1. Overall System Design

Technical architecture design of the system uses the B/S architecture, combined with the HTML language, VBScript, JavaScript scripting language, ASP, IIS, ODBC and other technologies (Kuratko D F., 2003). Background database uses SQL Server 2008. B/S architecture belongs to a three-tier thin client infrastructure. The first layer is a presentation layer, which is the client browser layer (such as IE) and is the user interface of an application, which bears a dialogue feature between users and applications; the second layer is the logic layer, namely the intermediate Web server layer that is responsible for centralized management of client applications; the third layer is the data service layer, namely the backstage server layer that is primarily responsible for data storage and organization, distributed management of database, database backup and synchronization, etc. This B/S three-tier architecture is shown below:

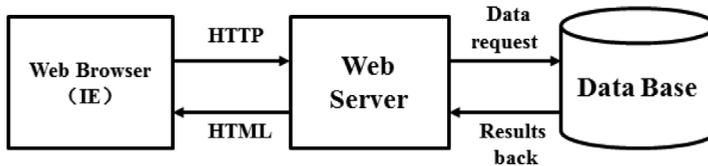


Figure 1 –Three Layer System Structure

Its working principle is: the user makes a request to the web server on the network through a browser; the web server (Microsoft IIS) and middleware process the browser requests and access the database; the database server returns the running results back to the web server and then the web server generates dynamic web result pages and return to the user. The Web server, middleware, and database server in this system can be integrated on a single server.

### 4.2. System Database Design

Database is the core of the information management system of a pioneer park. Whether information stored in the database can meet the needs of different users, timely and accurately provide the required data for each program interface are closely related to the system performance. The design approach for the system database is: first create a conceptual model based on needs analysis, convert the conceptual model in the database into the logical model, and finally conduct a normalized treatment.

#### 1. Design of a database concept model

The design of a database conceptual model is a process of abstracting user demand obtained by analyzing system needs into information structure. In the conceptual model design phase, E-R diagrams are usually taken as a description tool for conceptual design. E-R diagram, also known as entity relationship diagram, provides methods indicating the types of entities, attributes, and their connections (Peterman N E, Kennedy J., 2003).

According to users' data needs, the system plans major entities as: pioneer park administrator, studio, studio executives, ordinary users, institutional dynamics, performance, problems, funds, programs, competitions, files, etc.

## 2. Structural design of the database table

The server back-end database for university students undertaking information management system uses Microsoft SQL Server 2008. Grounded upon the previous database design concept model and logic model design, combined with the database table structure designed by Microsoft SQL Server 2008, this system has a total of 26 data tables, and each table structure of the database is designed as follows:

Field names	Data type	Length	Allow empty
<i>gzs_id</i>	int	4	N
<i>mc</i>	varchar	50	Y
<i>mph</i>	char	5	Y
<i>ywjs</i>	varchar	max	Y
<i>yw_id</i>	int	4	Y
<i>jzsj</i>	date		N
<i>gzsb</i>	varchar	10	N
<i>ty</i>	varchar	50	Y
<i>tyrq</i>	varchar	50	Y
<i>tyyy</i>	varchar	50	Y

Table 1 – Gzs Studio Table

Field names	Data type	length	Allow empty
<i>gzs_id</i>	int	4	N
<i>cy_id</i>	int	5	Y
<i>fzr</i>	int		Y

Table 2 – Members of the Studio Table

## 5. System Coding and Implementation of University Students' Undertaking Information Management

Grounded upon the previous needs analysis and system design, various functional modules designed are achieved one by one. Furthermore, this paper elaborates the key codes of the system core functions and analyzes the program flow to implement section modules (Twenge J M, Konrath S, Foster J D, et al., 2008).

### 5.1. Coding and Implementation of Ordinary User Module

The needs of ordinary users determine the functions of the system foreground website. The implementation of ordinary user needs is dependent on the realization of system front-end features. This site is adopted with ASP+SQL Server dynamic webpage development technology and DIV+CSS webpage layout techniques to basically realize a user-friendly interface, clear structure and highlights outstanding contents.

The overall structural layout for the website homepage is: the top is the pioneer park logo, navigation bar and banner advertising area; the middle is the major categories of the pioneer park site and a core part of the site content; the right side is set with a user login form and venture project declaration, venture capital application, park views and other navigation; the bottom is the site’s footer information (Zhou M, Xu H., 2012).

In fact, the homepage is not just a platform for ordinary users to obtain information, but also a window for pioneer park office users and entrepreneurship studio users to login in. Besides, the realization of each system module should be connected with the back-end database, so pre-create a database connection file named “conn.asp”, and later when operating the database in the program, it is all right to directly use `<!--#include file=“conn.asp”-->` (Shariff M N M, Saud M B., 2009). The codes are as follows:

```
<%
Dim connstr,conn
connstr=“provider=SQLOLEDB; Data Source=127.0.0.1; Initial Catalog=cyy; User
ID=sa;Password=123”
set conn=Server.createobject(“ADODB.Connection”)
conn.Open connstr
%>
```

If pioneer park office administrators enter into the system management interface, they must first log in at the front-end homepage. The login interface is shown below:

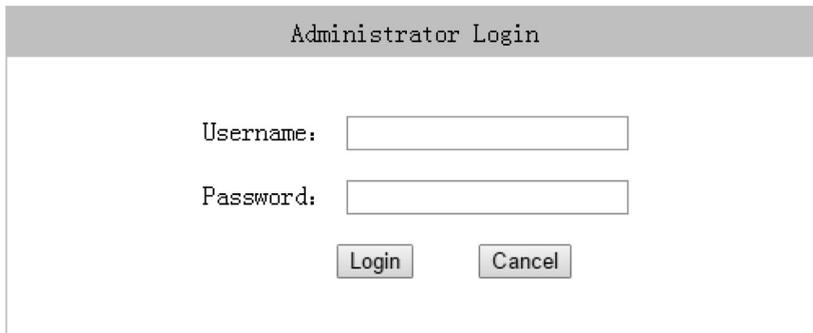


Figure 2 – The User Login Interface

When users log in, the system will verify the user name, password and the selected role (Qian-zhan F U, Yong-jun C., 2010).

After successful login, one can enter the system management interface. In order to ensure the security of data operations, set a login timeout limit for office users in the pioneer park. After logging into the system, if there is no operation to the current system, then this user will be cancelled after some time, and one should log in it again. Thus, pre-create a session file named “session.asp”, and later directly call the program code files for the module `<!--#include file=“session.asp”-->`.

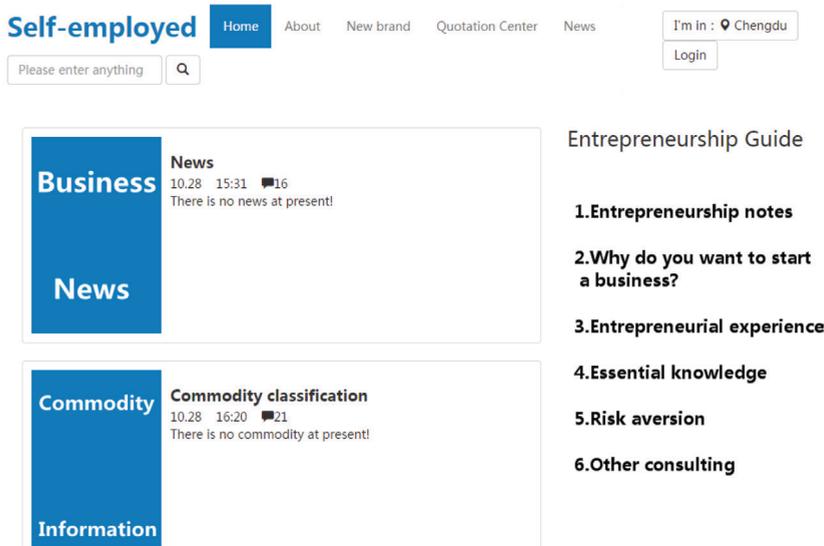


Figure 3 – Entrepreneurial System Main Interface

## 5.2. Entrepreneurship Studio Management

Pioneer studio management includes sub-modules such as adding studio, in-park studio management, management of withdrawn studios, studio department list, studio distribution statistics and business management.

1. Adding studio: the function of adding studio allows administrator to add basic information of the studio for entrepreneur teams that newly enter the pioneer park. The information consists of the studio name, house number, type of business, entry time, department and business presentation.
2. In-park studio management: in-park studio mainly manages the information of various venture studios in the park, including information views, modification and deletion of studio in the park.
3. Management of withdrawn studios: management of withdrawn studios is to aggregate and manage studios withdrawn from the pioneer park; the pioneer park office can understand the back studio house number, studio name, department that it belongs to, withdrawal time, service type and withdrawal reason and other information through management of withdrawn studios, and can export word documents and print online documents.
4. Studio department list: Studio department list is to aggregate and classify various venture studios in accordance with the department and summarize the name, the number of entrepreneurs and business scope of each department of each studio.
5. Studio distribution statistics: According to the statistics of each studio department, generate a studio-based pie chart to graphically present it in visual image and help the pioneer park to quickly grasp the venture situation of each department.
6. Business type management: Business type management includes adding, modifying, and deleting operations of business types in order to provide suitable business segments for entrepreneurial studios.

Label	#Smples	Average	Median	90%Line	Min	Max	Error%	Throughput	KB/sec
HTTP	200	13	12	21	8	44	0.00%	153	584.7
Total	200	13	12	21	8	44	0.00%	153	584.7

Table 3 – 200 Users Concurrent Access to the System Test Results Report

Label	#Smples	Average	Median	90%Line	Min	Max	Error%	Throughput	KB/sec
HTTP	500	19	16	29	8	139	0.00%	202	773.9
Total	500	19	16	29	8	139	0.00%	202	773.9

Table 4 – 500 Users Concurrent Access to the System Test Results Report

Label	#Smples	Average	Median	90%Line	Min	Max	Error%	Throughput	KB/sec
HTTP	1000	69	18	233	8	510	0.00%	210	806
Total	1000	69	18	233	8	510	0.00%	210	806

Table 5 – 1000 Users Concurrent Access to the System Test Results Report

## 6. Conclusion

By analyzing entrepreneurial management of university students, relying on the prevalent .NET platform, ASP.NET and other advanced technologies, based on the current development status, characteristics and requirements of innovative and entrepreneurial systems for university students, combining the nature and process for university employment, this paper performs a detailed design analysis in order to propose complete and reasonable solutions to address such issues as low efficiency of decentralized management by using traditional spreadsheets. The innovative and entrepreneurial management system for university students employs a B/S structure so that the client can achieve a zero-maintenance result; C# language and ASP. NET technology are made use of for system development, and Oracle database is applied for system data storage. This design is realized by making system development combined with the .NET framework, as well as data sharing and Internet technologies. It realizes the main functions of the innovative and entrepreneurial system for university students, encompassing 11 major functional modules like time, parameter setting and project declaration (audit), thus exerting a positive role in entrepreneurial project management.

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# Analysis Focusing on Intrusion Detection Technology When an Outside Party Breaks into Computer Database

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**Abstract:** With the rapid development of computer networks, the application of network data sharing grows increasingly common, which, at the same time, makes the security management of data system more and more difficult. By computer intrusion system, several barriers will be set up in the network or computer database. In this way, when there is something wrong with the computer or when an outside party tries to break into the database, the barrier will protect the computer database automatically. This paper, with its focus on the research status of computer database security as well as the current threats facing database, discusses the important role of intrusion detection in the security maintenance of database and also analyzes the problems that exists in computer intrusion detection technology. What's more, it compares the commonest intrusion technology types and builds a system of database intrusion detection based on association rules improved algorithm and also experiments on intrusion detection. Through the actual measurement analysis, the computer database intrusion detection system (IDS) based on data mining (DM) can overcome the lack of intelligent analysis in the present detection system. The intrusion detection of computer database is of vital significance.

**Keywords:** Intrusion detection; computer; database; association rules; improved algorithm.

## 1. Introduction

Today, computer technology is used widely in all walks of life. It greatly promotes people's work and life efficiency. However, its security problem also becomes more and more severe. Because virus as well as all sorts of hacker behaviors impose great threats on computer users' information safety. Therefore, more efforts should be exerted to intensify the protection work of computer database safety, which will need the application of computer database intrusion detection technology. The application study of DM technology in the field of intrusion detection starts from Wenke Lee (Khorasani M., Amigo J M., Sonnergaard J., et al., 2015) and so on, who expand association rules as well as frequent segment algorithm and also put forward the algorithm of constructing characteristics automatically from intrusion-only mode. Their discovery, verified by DARPA(Defense Advanced Research Project Agency, has achieved relatively good

experiment results. Since 1993, researchers including Agrawal R. (Kiranmayi T D S., Ravi Kumar K., 2015) and so on in the IBM research center in Almaden, Spain has studied association rules as well as sequence analysis technology in DM and proposed the classical Apriori algorithm (Satam P, Alipour H., Al-Nashif Y., et al., 2015), which has been improved many times for efficiency in the following researches. Two improved algorithms of Apriori All and Apriori Some (SAIT S Y., BHANDARI A., KHARE S., et al., 2015) are put forward in the sequence analysis. In 1996, they proposed the idea of parallel mining (Liu A., Chen J X., Wechsler H., 2015) and realized association rules algorithm through database system. In 1997, someone including J.S. Park (Murty C S., Mownika B., 2015), etc. proposed to cut down the spending of the traversing database of Apriori algorithm with the use of hash table nullity filtration rule. And others like Ke Wang (Lakshmi A A., Valluvan K R., 2015) pointed out that when the minimal support differed, since the traditional Apriori algorithm would choose the fixed value as the judgment threshold, some efficient matters might be lost. Moreover, they also offered an improved algorithm of Adaptive Apriori through research. This paper introduces the definition as well as the functions of data intrusion detection and also puts forward the problems existing in computer intrusion detection technology, with the introduction of the common DM ways and technology. In this way, the database IDS based on association rule improved algorithm is achieved. In addition, the experiment results of intrusion detection are analyzed and the prototype of database abnormal IDS based on association rule improved algorithm is accomplished (Vargas, A. V., & Osma, J. I. P., 2013).

## **2. The Key Technology of the Computer Database Intrusion Detection Technologies**

### **2.1. Intrusion Detection and Its Functions**

Intrusion detection refers to the setting up of barriers in the computer database or the network. If there are something wrong while the computer is running, or when an outside party tries to break into the computer database, the barriers will take effect to protect the computer database automatically. Intrusion detection technology is a kind of active protection technology applied in the operation process of computers. Even compared with firewall, it is safer. As many computer operations can be made without going through the firewall, the protection functions of firewall are not complete. Besides, from the perspective of firewall's protection features, its major protection comes from the rule-breaking operation outside the computer, which makes it unable to protect the abnormal behaviors inside the computer. Most importantly, firewall's protection is positive, which cannot trace some violations actively. At present, the main threats facing computer database are hacker attack and virus. Throughout the world, the loss of computer data caused by virus or hacker attack is enormous. As a result, intrusion detection technology becomes extremely important. From the perspective of defense, the functions of computer intrusion detection technology are as follows: firstly, it can examine the weak links of the entire computer system; secondly, it can monitor all the operations in the computer in real time; thirdly, it can analyzed all kinds of abnormal behaviors deeply and react correspondingly; fourthly, it can record every abnormal behavior, which will offer a basis for the following detection, thereby enforces the safety protection of the computer (Oliker N., Ohar Z., Ostfeld A., 2016).

## 2.2. The Common Computer Intrusion Detection Technology

Misuse detection technology mainly defends against the known virus, attack action and intrusion. It will at first analyzes the intrusion action or abnormal activity already known and then summarized their characteristic to construct a certain mode. When there are something abnormal appearing in the operation process of the computer, the IDS will compare the abnormal action with the abnormality mode it has constructed. If there are matching features between them, then the system will identify the action to be illegal intrusion. Otherwise, it will not be identified to be illegal. Through the operation mode of misuse detection technology, it is clear that its application range is limited. Because it just detects the virus or abnormality already known and thus cannot find out those unknown. Nevertheless, in a world where computer network technology develops rapidly, all kinds of technologies are growing increasingly mature. New types of virus and attack behaviors appear everyday. Lots of illegal intrusion activities cannot be found out if misuse detection technology is used while the computer is running, which will put the computer database in great danger. Of course, misuse detection technology has its own advantages. With its comprehensive understanding, it can guarantee a relatively high degree of accuracy when detecting the virus and intrusion already known (Castela, N., Dias, P., Zacarias, M., & Tribolet, J., 2013).

Anomaly detection means the computer's analysis of its users' habits during the long term of using and summarizes his or her behavior characteristics, which will be stored within the database as patterns. When they happen while the computer is running, the system will compare them with the users' daily action. If there is relatively difference between them, then the present operation in the computer is intrusive and the computer will defend. Compared to misuse detection technology, anomaly detection requires no mode. The computer will form a law during the users' daily use. So when faced with behavior operation data, it can master the acting law of the users, through which it detect. What's more, it can detect not only the virus and attack behavior already known but also those unknown. And the results are relatively accurate. Therefore, the safety protection of the computer database is promoted (Muthukumar B., Sindhu S S S., Geetha S., et al., 2015).

## 2.3. The Problems Existing in the Computer Intrusion Detection Technology

The problems are shown as in figure 1.

The importance of information stands out gradually in the development of all walks of society. In particular, for some enterprise information, once it is leaked out, the enterprise growth will be affected severely and it may even go bankrupt. This phenomenon makes the research staff of computer intrusion detection technology require much. In order to completely eradicate the occurrence of information leakage, they always stick to the principle of "eradicating all without missing one". They set a relatively high standard for the key point in intrusion detection, nearly defending any suspicious action. However, this kind of strict demand increases the task load of defense and also detects some non-virus and then defend them automatically, which increases the load of the entire system and affects the normal running of the computer database.

For the running of the computer, some virus and intrusion may destroy the whole database. Therefore, it is required that the intrusion detection technology can find them

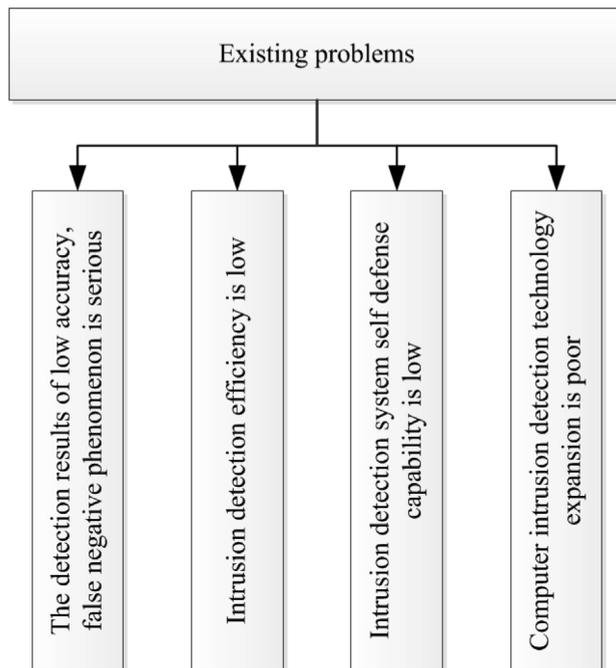


Figure 1 – Problems in Computer Intrusion Detection Technology

out in time and take certain defensive measures. But as the binary coding is the most basic in computer running, the IDS should firstly trans-code all the behaviors in binary code to detect them and then identify whether they are intrusive through algorithm and analysis. In this procedure, the workload of algorithm is quite heavy. For example, in misuse detection technology, the users' behaviors should be firstly collected to build up the mode, which contains an extremely heavy workload of algorithm and also high cost of operation. And in anomaly detection technology, the behavior characteristics in need of analysis are even more and thus bring heavier workload, which often decreases the efficiency of detection, which fails to meet the demands of the users, especially in the times when network grows rapidly.

Since computer has not been used for a very long time in our country, there are many flaws in the training of computer professional talents. During the process of researching and designing the computer IDS, the lack of consideration or technological measures of the research and development staff will often lead to loopholes in the IDS itself, which make its self-defense ability weak. So once the system itself is attacked by virus of hackers, it will fail to detect and defend the abnormality and the entire system will be paralyzed. Without the defense of the intrusion detection technology, the virus as well as illegal attack will become more and more rampant, putting the computer database in great danger, such as stealing the users' information, harming the computer system and even altering the IDS unable to record the overall intrusion process of the illegal action.

According to the present computer intrusion technology, once the computer is equipped with intrusion detection technology, then it will not change in a certain period. Because all the key points in the technology have been set up well. However, with the development of the network technology, new virus as well as attack means will come up. If the computer detection technology cannot getting updated or optimized correspondingly, then its efficiency will be reduced, which will make virus and hacker attack more and more frequent and at last endanger the computer database. So the study of intrusion technology expansibility should be intensified in the future computer intrusion detection technology research. In this way, the intrusion detection technology can be continuously updated and optimized (Brahma A., Panigrahi S., 2015; Mani M., Uludag S., Zolinski C., 2015).

**2.4. The Common DM Means and Technologies**

The common DM means and technologies are as follows:

1. Classification: Classification is to finding out a group of patterns (or functions) able to describe the typical characteristics of data set, so as to classify and identify the unknown data. The commonly used typical modes of classification are linear regression mode, decision-making tree mode, rule-based mode, neural network mode and so on. In the means of classification, since most issues in the real world are blurring, the fuzzy logic is usually adopted to estimate the adjustment between rules and membership functions. Suppose that  $x$  and  $y$  are fuzzy logic proposition, and  $mem(x)$  defines the membership function value. Then the following equations are used to calculate:

$$mem(-x) = 1 - mem(x) \tag{1}$$

$$mem(x \wedge y) = \min(mem(x), mem(y)) \tag{2}$$

$$mem(x \vee y) = \max(mem(x), mem(y)) \tag{3}$$

2. Regression: it is used to evaluate the strength between the two variables. By the means of matching a set of points through a curve, the future value is predicted based on the past one. A standard value used to measure linear dependence is the correlation coefficient  $r$ . Two variables  $x$  and  $y$  are offered and the correlation coefficient is an actual value  $r \in [-1,1]$ . The smaller the degree of correlation, the closer  $r$  to 0. Negative correlation indicates that the value of one variable is increased while that of the other one is decreased. The definition equation is:

$$r = \frac{\sum(x_i - \bar{X})(y_i - \bar{Y})}{\sqrt{\sum(x_i - \bar{X})^2 \sum(y_i - \bar{Y})^2}} \tag{4}$$

3. Time order analysis: similar to association analysis, aiming at digging out the relation among data too. But it focuses more on the cause and effect relation of data in the time order. Every record has an associated interval  $[t_s, t_e]$ , of which refers to the beginning

time while  $t_e$  refers to the ending time. The quests of time order query  $q$  concern an effective time range:

$$V^q = [t_s^q, t_e^q] \quad (5)$$

$V^q = [t_s^q, t_e^q]$  is the effective time range of tuple. Time order query can concern all combinations of the following two time ranges:

1. Cross analysis: only when the intersection of the effective time range of the tuple and the query time range is not vacant, namely  $V^d \cap V^q = \emptyset$ , can the tuple be searched.
  2. Content query: only when the effective time range of the tuple is totally within that of query, namely  $t_s^q \leq t_s^d \leq t_e^d \leq t_e^q$ , can the tuple be searched.
  3. Containment query: only when the effective time range of the tuple contains that of query, namely  $t_s^d \leq t_s^q \leq t_e^q \leq t_e^d$ , can the tuple be searched.
  4. 4 Point query: only when the tuple is effective at a particular moment, namely  $t_s^d = t_s^q = t_e^q = t_e^d$ , can it be searched.
4. Prediction: with the use of the history data, rules can be found and the model can be build, which can be utilized to predict the categories, features and so on of the future data.
5. Cluster; data is classified into a series of meaningful parts according to certain rules. In the same cluster, the difference among the individuals is relatively smaller while that in the different one is larger. Unlike classification, the groups of the cluster are not defined in advance. Instead, they are defined on the basis of the characteristics of the actual data and the similarity among data. The cluster algorithm can only deal with numeric data. Therefore, the data points are often supposed to be measurable. Groups in the cluster are also called as clusters, which are defied as:

The gathering of some similar members. The members in different clusters differ.

The distance between two points in a cluster is smaller than that between one point in the cluster and any one outside it.

A cluster  $K_m = \{t_{m1}, t_{m2}, \dots, t_{mN}\}$  containing  $N$  points is provided:

$$\text{Center of mass} = C_m = \frac{\sum_{i=1}^N (t_{mi})}{N} \quad (6)$$

$$\text{Radius} = R_m = \sqrt{\frac{\sum_{i=1}^N (t_{mi} - C_m)^2}{N}} \quad (7)$$

$$\text{Diameter} = D_m = \sqrt{\frac{\sum_{i=1}^N \sum_{j=1}^N (t_{mi} - C_m)^2}{N(N-1)}} \quad (8)$$

6. Summarization: map data into the subset with simple description. Summarization extracts or obtains representative information from the database, which can be fulfilled through searching part of the data. It can also obtain some summarizing information from the data. Summarization characterizes the content of database in a simple way.

7. Association rules: association analysis refers to the DM task of revealing the correlation among data, which is not directly indicated in data. The task can be best demonstrated by determining association rules, which is able to identify the model of data association of special type. For instance, customers purchasing computers will buy some kind of software at the same time. Association rules are not cause and effect relations. It cannot guarantee that the association will also exist in the future (Sengupta A., 2015; Mabu S., Li W., Hirasawa K., 2015).

## **2.5. Complete the Computer Intrusion Detection Technology**

Computer database is the place where the users' information is restored. Intrusion detection technology often analyzes the characteristics of all kinds of abnormal behaviors in the process of protecting computer database, which concerns numerous binary trans-coding. The workload of calculation is enormous, thus decreasing the efficiency of intrusion detection. As a result, when completing the computer intrusion detection technology, the workload of calculation should firstly be reduced. At present, the commonest manner when facing complicated data is Apriori algorithm. When used in intrusion detection, Apriori algorithm should be optimized. At first, when forming a candidate set in the center of Apriori algorithm, it should be compared with the support degree. If the item set is smaller than the support degree, then the item set should be simplified so as to make the entire candidate item set have the best amount. Secondly, scanning the database and improve it till Apriori algorithm can be achieved on encoding, which should be implemented according to the database. If an item appears, then it should be set as "1". Otherwise, it should be set as "0". After such encoding scanning, DM technology can be improved effectively. In the process of computer intrusion detection, the improvement of Apriori algorithm can promote the using efficiency inside the database.

The most critical link in the computer intrusion detection technology is to master and analyzed the behavior characteristics of the intrusion action, which is also the prerequisite for the overall intrusion detection work. During the process of DM, the commonly used means is association analysis. Stipulating a record and a group of items, and then integrate them effectively to identify the correlation among them, which can be utilized to analyze the potential problems afterwards. Generally speaking, this means contains two aspects. On the one hand, when detecting complicated item sets, the iteration technology is employed to scan the database randomly. On the other hand, transform the complicated item sets into another stipulation, based on which the system is running so as to reduce the workload of algorithm and discover all sorts of potential intrusive action (Le Vaillant M., Barnes S J., Fiorentini M L., et al., 2016).

### **3. The Realization of the Computer IDS**

#### **3.1. Protection of the Management System**

Formulate and complete relevant management systems of network information security, such as network computer operation and maintenance management system, network administrator management system, file management system, machine room safety management system, etc., and execute them strictly so as to guarantee the safety of the network and the computer. Following the systems and rules can guarantee the security of the network and the computer. Operators must abide by the rules and regulations consciously. Only in this way can the functions of the security management systems be reflected. (Rahman A., Islam M M., Chakraborty A., 2015) The systems should be reviewed and modified regularly for continuous improvement, which helps them play a better role. As for the implementation of the systems, a monitoring and controlling mechanism should be constructed to check the effect of the systems and supervise their implementation.

In terms of the organization's personnel allocation, an information safety leadership team and a work team should be formed, with a full-time information safety administrator who takes charge of information security management. The allocation of the key posts will be under the management of several people, restricting the authority limits of one another and thus minimizing their authority limits. Greater efforts should be exerted to manage the approving of the significant matters like important operations, system variation, system access, physical visit and so on, and form the summarization of the approving records for regular review.

In the level of the company, the management should be intensified with all rules and regulations being executed strictly and network safety training to increase the users' security awareness. It is of vital importance to avoid security risks inside the enterprise. There should be training as well as education of information security awareness and information security behavior habits, which clarifies the importance and urgency of information security. Have the employees grasp the correct information safety knowledge and develop good information security behavior habits, enforce the security management of the intranet terminal users. In this way, the staff will protect the enterprise information and resources consciously in their daily life and work.

#### **3.2. The Realization of the Database IDS Based on Association Rule Improved Algorithm**

This paper, with the use of the improved association rule technology, constructs an IDS based on the association rule improved algorithm and conducts a simulation experiment. Adopting the four parameters of detection rate, false alarm rate, missing report rate and detection accuracy rate, it analyzes the detection effect of the IDS for attack behaviors.

The major components of the system are as shown in figure 2:

#### **3.3. The Common Database Intrusion Detection Technology**

The existing database intrusion detection technologies are as shown in figure 3:

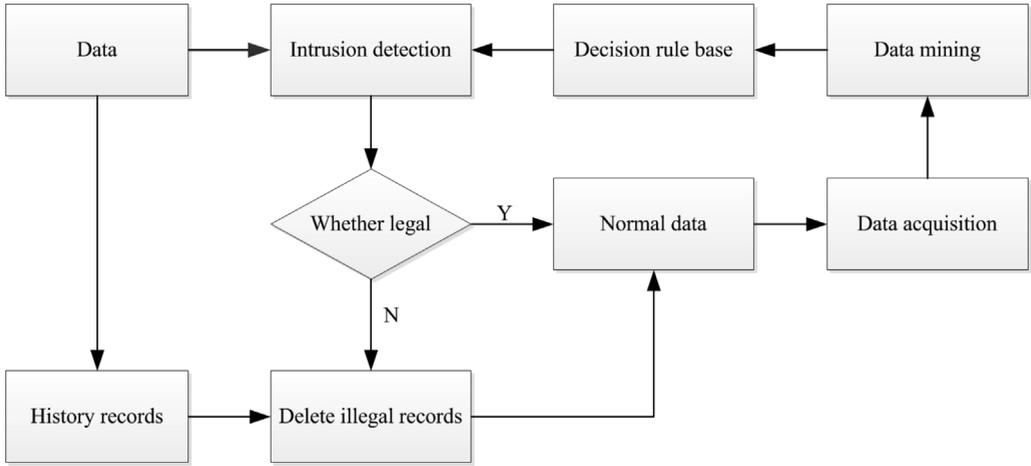


Figure 2 – Flowchart of Intrusion Detection System

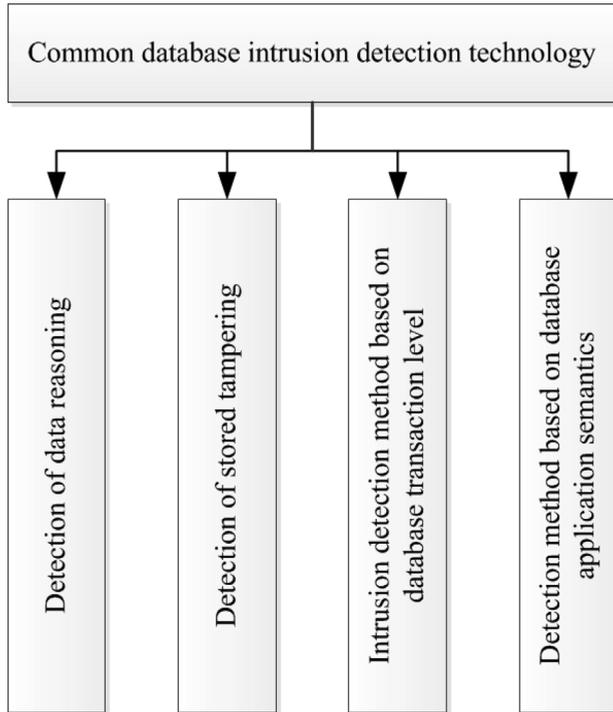


Figure 3 – Common Database Intrusion Detection Technology

1. Detection of data inference: it can be deemed as a database misuse detection at an earlier time. Data inference means that the users can infer the data without restoring some them. Those who employ the inference attack are always the inner misusers who own the legal authority. For example, the employment of base connection or inaccurate and fuzzy relation belong to the detection methods at the designing phase of the database.
2. Detection of the storage jamming: it is a behavior of maliciously changing the stored data within the database to decrease the data quality, aimed at misconducting and obstructing the opponents with wrong or low-quality data. Storage jamming is a kind of internal misuse behavior, for instance, adopting the way of detection object to detect the storage jamming. Detection object is usually not used by normal users. However, the tamperer cannot tell the detection object and the normal data apart. If the detection object is found to be under normal or predictable status, it means that data jamming behavior perhaps have happened.
3. The intrusion detection method based on database transaction level: the database owns its own unique transaction dealing mechanism as well as SQL language query. It is the important content of the database intrusion detection to detect the users' mode using SQL statements. Fingerprint technology is an intrusion detection way based on SQL statement.
4. The detection manner based on database application semantics: in many cases, the independent detection of the database transaction or users based on applied semantics fail to identify the abnormal behaviors of the users. For example, the doctor's recipe is just within his profession ability.

The detection ways mentioned above mainly match the characteristics of the audit matters with those of the feature library. As the present feature library is formed through static manner and has simple rules, the missing report rate as well as false report rate are relatively high. Therefore, it is hard to detect the complicated attack means, such as dispersed, cooperative attack and so on. What's more, the alarm ability is greatly limited by the attack feature library, lacking in an ability of warning unknown intrusion. As a result, the functions of such intrusion detection ways are restricted (Melinder A., Augusti E M., Matre M., et al., 2015).

#### **4. The Results and Analysis of Intrusion Detection Experiment**

The three types of attack behavior should be detected respectively.

##### **1. Penetration of legal users**

By bypassing or avoiding the security control, the authorized user can visit the database or database objects which are not allowed by the security mechanism or get the authority of visting the them. However, an unauthorized operation is conducted in this way.

##### **2. Masquerading**

Through legal process of logging in, the users enter the database system(with correct accounts and passwords, which may be stolen or copied), while the system is operated in a different way from the normal one.

### 3. Intrusion Attempt

Many intrusion attempts often try to use several passwords under the same account or log in different accounts with the same password. Or several users use the same password under different accounts. Another kind of intrusion attempt leads to failure because of unauthorized operation. This detection effects of the three types of intrusion of this experiment are shown as in table 1.

Number	Normal event	Anomalous event	Detected abnormal events	False negative events	False alarm event	Detection rate	Rate of missing report	False alarm rate	Normal rate of detection
1	50	50	42	8	2	86.00%	7.00%	2.00%	90.00%
2	50	50	45	5	0	90.00%	5.00%	0.00%	95.00%
3	50	50	44	6	1	88.00%	6.00%	1.00%	93.00%

Table 1 – Detection Results of Intrusion Events

On the foundation of the results, the IDS realized in this chapter achieves the prototype of the database abnormal intrusion detection system based on association rule improved algorithm: experiment is conducted on the key algorithm and procedure in the present popular relation database management system SQL Server. The prototype of the detection system is developed. In addition, small-scale test and detection analysis have been conducted too, further verifying the relevant theories. The experiments show that the database anomaly IDS, which is based on DM, can overcome the intelligent analyzing function that the present IDS lacks in, and thus is likely to realize the activeness of the intrusion detection (Saumur B M., Cruden A R., 2016).

### 5. Conclusion

With the wide spread and application of computer technology, its safety issue grows increasingly severe. All sorts of hackers and virus endanger the information security of the computer users. Hence, to improve the protection work of the computer database, the intrusion detection technology must be employed. This paper discusses the research status of computer database security as well as the threats facing the database. In addition, it builds up a database IDS based on association rule improved algorithm for the problems in the present computer intrusion detection technology. The most important link of computer intrusion technology is to master and analyze the characteristics of intrusion behaviors, which is also prerequisite of the overall intrusion detection work. Through actual detection analysis, the computer database IDS described in this paper possesses relatively high intelligent analyzing and detecting functions.

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# Study on LAN-based Computer-aided English Teaching System Framework

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**Abstract:** computer network has been developing rapidly and LAN, Campus Network and Internet have applied in educating, providing a personalized teaching environment. In this thesis, BBS, SQL and Serv-U FTP are integrated to build an autonomous learning and discussing platform featuring teacher-student interaction and resources sharing. The design of teaching, audience of teaching, environment, and methods, etc are discussed in detail and steps of LAN-based education are introduced. This thesis has assessed the effectiveness of LAN-based education from results of students' academic examination and final oral examination and the results have proved that LAN-aided English teaching platform has reached expected aims.

**Keywords:** LAN; english teaching platform

## 1. Introduction

With the rapid development of information and modern technology, many universities has built their own Campus Network and online reading and learning have come into reality. But how to use Campus Network to create a good English learning environment for students has been a research focus in recent years (Moller L M., 2015). In 2004, Ma Junbo studied on LAN-based computer-aided foreign languages teaching model design (Healy N., 2016); In 2010, Wei Xi studied on the effects of multimedia in computer-aided English teaching (Oluwaniyi N O., Afeni B O., Lawal O O., 2015); In 2001, Wei Gang and other researchers explored in LAN-based computer-aided teaching models (Joan D R R., 2015); In 2009, Zhao Shali studied on LAN-based English teaching models in vocational high school (Shockey T., Pindiprolu S., 2015); In 2007, Lin Zhi studied on the development and reality of ICAI in LAN (Abdelraheem A Y., Abdelrahman M A., 2015); In 1997, Jin Zuoli studied on the design and reality of language teaching system in LAN (Lin C, Ma J., Kuo K Y., et al., 2015). From the present situation of teaching, some of the major problems have not been solved such as: the main content of classroom teaching is language knowledge impartment; the main model of classroom teaching is impartment-centered; interactive activities in classroom teaching are of small number and poor quality; the skills of listening and speaking and writing have not attached enough importance by teachers. Based on these above, this thesis has studied how to make use of FTP transmission protocol on the Internet to integrate BBS, SQL and Serv-U FTP to build an autonomous learning and discussing platform featuring teacher-

student interaction and resources sharing and to design and implement LAN-based teaching models while conducting effectiveness assessment (Jiménez, D. L., Redchuk, A., Dittmar, E. C., & Vargas, J. P., 2013).



Figure 1 – Campus Local Area Network

## 2. LAN-based Teaching Platform Design

Teachers make use of existing Campus Network to open a FTP service and BBS service and link those services to student account of college English autonomous learning system, which effectively solves a series of problems such as uploading and downloading of resources, (Maasum T N R T M., Mustafa R., Stapa S H., 2015) assigning and collecting of learning tasks, interaction between teachers and students, online storage and so on.

### 2.1. BBS

BBS is a kind of code program. It only requires a server with IIS and an individual IP address to publish. Besides its strong function and numerous plug-ins, it can also well integrate with FTP management software, Serv-U FTP and SQL to make linkage between BBS account and FTP account, which is easy to manage (Lavrova A V., Zabolotnyi V F., 2016).

### 2.2. Building of a FTP Service

FTP is the short form of File Transfer Protocol which controls tow-way transmission of files on the Internet. It is also an application. Users can link their own PC to all the servers running FTP protocol all over the world to visit mass applications and information in those servers. Likewise, it is based on IIS service and surely, other FTP service applications provide similar services. For example, in this thesis, the FTP server that we need is Serv-U FTP (Nadtoka O F., Martyniuk T S., 2016).

Serv-U FTP is now one of the strongest in function and easiest in usage FTP servers in Windows. It has almost all the functions of other FTP servers and it also has such

functions as RESUME, limitation on broadband and the speed of uploading and downloading, remote control, virtual machine and so on. Moreover, it can restrict user rights, logging-in catalog and the size of the server storage. Especially, the most powerful function is that it can link to SQL database by BBS plug-ins to directly manage FTP accounts using the BBS account.

### **2.3. Using SQL Database and ODBC Data Source to Store Account Information**

In Serv-U 5th edition and newer, domain account information can be stored in .ini, LR list or ODBC database. Students using college English autonomous learning system are mainly freshmen and sophomores and they are in huge number and high in flexibility. Thus, it is better to store their account information in a database. Because ACCESS database management system is one unit in OFFICE and it is easy to operate and has powerful functions, I suggest that ACCESS database be used to store account information. (Shipka J., 2016).

In ODBC database, to store account information needs to choose while open a new domain. Serv-U cannot automatically generate a blank database, so administrators need to open database by themselves. Serv-U is very quick in handling account information in a database which contains all the information of account and its group and at least one piece of account information table which should at least include account name, home directory, password, directory access rule. Since Serv-U the 8th edition, database can be generated automatically, which solves problems in self-built database. I give the example of Serv-U the 6th edition (Nikolaev A I., Parfenov E A., Artemiev I T., 2015).

Detailed steps in using SQL database and ODBC data source to store account information are:

1. Install SQL Server database and build a database (database name: FTP, login account: FTPname, password: 123456, and relative rights of this account are set.
2. Build a table named after "FTP-users" in this database and fields of this table include: FTPUserName, FTPPassword, FTPPasswordType changePassword, accessRule, dirHome, login MsgFile, sessionEncryption, dirHomeLock, alwaysAllowLogin, hideHidden, maxUsers Concurrent, speedLimitUp, speedLimitDown, maxUsersLoginPerIP, time OutIdle, timeOutSession and so on. According to the actual needs of the BBS to build other tables and the main table names include: FTP\_groupAccess, FTP\_groupIPs, FTP\_group, FTP\_log, FTP\_manage, FTP\_set, FTP\_user\_group, FTP\_useraccess, FTP\_userIPs, FTP\_users and detailed fields are omitted.
3. Build system ODBC data source: Enter "start/control panel/management tools/ODBC data source/system DSN" and add a system DSN. Steps are as followed:
  - a. Add system DSN, choose SQL Server and enter name as followed: FTP, server: local.
  - b. Enter visitor name of the pre-built database: FTPname, password: 123456.
  - c. Change default database with pre-built database "FTP" and click "next" to complete ODBC setting.
  - d. Run Serv-U 6th edition, open domain, click ODBC and set ODBC link.
  - e. Enter ODBC source name, ODBC account name and ODBC password

respectively in "ODBC database link setting". I choose FTP, FTPname and 123456 respectively. Click "apply" and the domain can be visited (setting succeeded). If there is an online user in ODBC database, the user name can be directly read. If it cannot be visited (the domain is offline all the time as shown in the figure), please check the "session log" in "active". If the log shows that there is an error in ODBC, check the reasons why error occurs in ODBC.

4. After setting relative virtual path and visiting rights of the FTP, ODBC-based FTP server is all set up.

## **2.4. Integration of BBS Account and Serv-U FTP Account**

When building an BBS, we can make use of students information in college English autonomous learning system to build accounts, password and other information of students in BBS in bulk and by using self-programmed ASP software open several FTP management pages and one FTP application page, which contains (Wood M., Russell A., Verrall T., et al., 2015):

1. FTP application page.
2. User management.
3. User group management.
4. System settings--flow, speed and thread.
5. Uploading path management.
6. FTP log management.

These pages enable students to self-apply FTP service (including downloading and uploading of resources and so on). Teachers can control FTP accounts and FTP resources of students and administrators can control FTP account and relative user group rights (such as downloading flow, speed and thread), uploading path, rights to visit FTP log, logs of FTP and so on.

## **3. LAN-based Teaching Design**

### **3.1. Teaching Aims**

Teachers make use of multimedia to personalize teaching methods to develop students' ability to independently search for information and communicate in English, especially the oral and written English skills. The two aspects all meet the requirements of the teaching outline. Teaching time has been reduced by a fifth, but teaching effectiveness remains the same.

### **3.2. The Audience of Teaching**

The audience of teaching is 85 college students whose majors include chemical industry, law, ship making, and math and so on. They are from joint class after an entrance placement test (according to the entrance examinations of each major including math, physics, chemistry and English) and their English levels are slightly lower than A-rated students and higher than B- and C-rated students.

### 3.3. Teaching Environment

There is a multimedia classroom which can accommodate 45 students. Specific hardware includes: one server managing LAN and connecting to the Internet, one teacher computer with Pentium III processor, 256M memory, 20GB hard disk, audio card and 15-color display, and Win 2000 operating system with MSPowerPoint and Sword software, 45 student computers with Pentium III processor, 128M memory, 10GB hard disk audio card and 15-color display and the same operating system and software as teacher computer. The structure of this Internet classroom is shown in Figure 2.

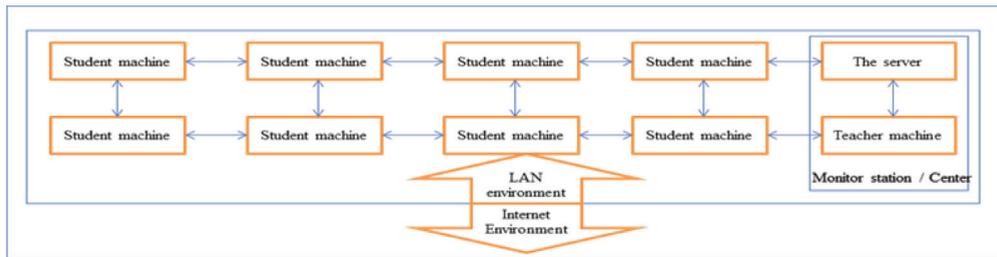


Figure 2 – Local Area Network Teaching Environment

In Figure 1, there is an LAN-based teaching environment. It also can visit the Internet through server but the running of teaching PPT and other online teaching activities such as information issuing, online tutoring and so on are LAN-based considering the safety of information and the clearance of the Internet. In LAN, teachers can connect to student computers through teaching network in control platform/center to realize teacher-student interaction and they can also visit the Internet through LAN, which builds an interactive teaching environment.

### 3.4. Teaching Methods

We applied "learners-centered" teaching method. One major difference between this teaching method and the traditional one is that the former sees "to learn a language as a process to gain communication skills other than pure grasp of language knowledge" of the latter (Nunan, 2001:21) (Pulcini V., 2015). One task can be divided into 6 parts according to teaching analysis, including Goals, Input, Activities, Teacher role, Learner role and Settings, which is shown in Figure 3.

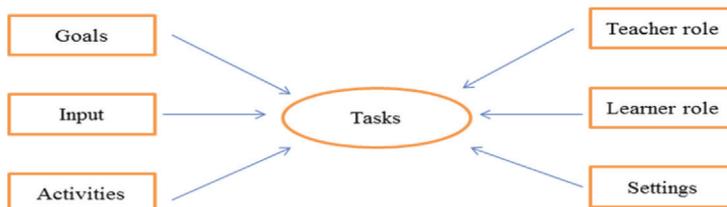


Figure 3 – Analysis of The Teaching of Communicative Task

In the 6 parts of communication process, the first step is to set communication goals and the second is to input, be it text or multimedia such as picture, sound, movie and so on. Next is to design student-centered communication activities according to goals and input. Finally is the role of teachers and students and the places of communication activities.

1. Teachers give task example

In this example, teachers make clear factors of each task and quality, content, relationship between factors and so on of each factor. Students design specific task according to example and complete it.

2. Students design tasks according to example

Three students as a group design this task. For example, in Table 1, the task aim is "to understand this unit from paragraphs" such as general meaning and structure. Input is online teaching materials and relative multimedia resources. Task should include relative knowledge such as views of family education, forms of media and advertisements, customs of gift exchanging in English spoken countries and so on, which helps understand the whole text. Besides, there should be vocabulary and sentence patterns input and such resources. Table 2 is specific tasks designed by students according to the example (Table 1) that teachers give (Bigdeli R A., Rahimi A., 2015).

Communicative task sample		
1	Goal	Understanding an article from a textual point of view
2	Output	A. online multimedia teaching material itself
		B. online related culture materials, can also use the Internet
		C. vocabulary, sentence patterns and other language materials
3	Activity	A. personalized browsing learning multimedia courseware
		B. Duo or group discussion of global comprehension questions (requires the use of this lesson vocabulary)
		C. one person to summarize the content of the discussion
		D. The group discussed the question of the article
4	Teacher role	The task sample provider, activity director and helper, process monitoring, evaluation.
5	Student role	The contents of the task designer, active participants, cooperation effect assessment
6	Environment	The multimedia classroom network support; electronic reading room

Table 1 – A Learning Discourse Communicative Task Teaching Example

<b>The design of students' communicative tasks</b>		
1	<i>Goal</i>	The understanding of "easy money" from the perspective of discourse.
2	<i>Input</i>	<p>A. Browse the "easy money" the content of the text and answer online:                      -How does the father educate his son to be independent?                      -What ist he sons' response to their father's suggestion at the beginning?                      -How does the story conclude?</p> <hr/> <p>B. Red hypertext Reading Courseware and the "Reference" section to understand the occurrence and development of the cultural background, and answer:                      -What are the different views about Youth in the U.S.?                      -What are most people's views about self-dependence?                      -How do most business men advertise their products?</p> <hr/> <p>C. Consult, understanding and memory of vocabulary, idioms are as follows                      Vocabulary :cash,competitive,deadline,deliver                      Idioms :a piece of cake,pull up,settle for,have no business with, etc.                      Sentence pattern :Idon'tcare...;I was comfortably settled in...; Just tell sb. To do sth.                      ; Her voice kept rising as if...; there is no eating or sleeping until...; in addition,the parties agreed on...;I assume that...</p>
3	<i>Activity</i>	<p>A. each independently browse courseware, and complete the input A, B, C, ready to discuss in pairs or groups</p> <hr/> <p>B. pair work: this lesson vocabulary is discussed for "enter a" (presenting their views, listen to others talk, and to discuss the difference) work in pairs: one interpretation of lexical meaning, another person with examples illustrate its usage</p> <hr/> <p>C. each elect a person to speak on behalf of the group as, on the understanding of the problem</p> <hr/> <p>D. re-assembled into the new group of three people, and discussed the lessons for people's inspiration</p>

Table 2 – The Design of Students' Communicative Tasks

From table 1 and table 2, teachers only have to set task framework and the task itself is designed and completed by students. Undoubtedly, it enhances students' learning interest and trains their ability to analyze and solve problems. This teaching method is totally different from the one that teacher does all the jobs. In the whole teaching process, students continuously and voluntarily participate in heated discussion instead of passively listening and note-taking. Of course, teachers should play the role of an organizer, an instructor, a helper, an assessor and so on.

#### 4. Implementation of LAN-based Teaching

Based on the design of table 1 and table 2, we have following steps:

1. Teachers upload task example to "Teaching Park" in the server for students to download;
2. Students visit task example online and design their own tasks according to task example (entering A, B, C in table 2);
3. Two students as a group participate in activities (activity B in table 2);
4. Students make a speech after discussion (activity C in table 2);
5. Students discuss the deeper meaning of the text after discussion (activity D in table 2).

From activity A to E, students not only have an overall grasp of the meaning of the text and language points and usage but also learn to pose a question, answer a question, make a conversation, keep conversation going and other basic communication skills. At the same time, teachers can conduct person-to-person tutoring according to different levels of students and their problems during learning, especially guiding students to overcome psychological barriers appearing in the learning process such as fear of making mistakes and being laughed at and to encourage them to actively play their part in activities and tell them that practice makes perfect.

As the instructors, teachers' role in class hour distribution and control is of great importance. Otherwise, it is difficult to finish tasks due to enthusiasm of students and their heated discussion. The distribution of class hour is different according the length and difficulty of each activity, but each activity should be set under a basic time unit to make students aware of which activity in which period to ensure high quality of every activity. Take the example of "Big Bucks the Easy Way" again to specify class hour of each activity (2 hours as a unit, 100 minutes as an example) shown in table 3.

<b>Student communication task class arrangement</b>		
<b>Project</b>	<b>Content</b>	<b>Class time (100 points)</b>
1 <i>Goal</i>	The understanding of "easy money" course from the perspective of discourse	5
2 <i>Input</i>	A. online browsing "easy money" the content of the text and answer	10
	B. reading hypertext courseware in the red part and the "Reference" section to understand the occurrence and development of the cultural background	10
	C. read, understand and memorize vocabulary and idioms	15
3 <i>Activity</i>	A. each independently browse courseware, and complete the input A, B, C, ready to discuss in pairs or groups	20
	B. pairs: Discussion of "input A" problem with the lessons learned vocabulary; Double action: One interpretation of lexical meaning, one example usage	20
	C. each elect a representative of the group on the understanding of the problem	10
	D. re-assembled into the group of three people, to discuss the lessons for people's inspiration	10

Table 3 – Student Communication Task Class Arrangement

In table 3, "goals" accounts for 5m--5% of the total class hour. Although, teachers have already uploaded the task example to server for students to visit and download, it takes a little time to emphasis on some goals requiring students' cooperation. "Input" 35m--35% of the total class hour. In this section, whether students do well directly influences the following output. So this section is given about one third of the total class hour. "Activities" 60m--60% of the total class hour. Activity A is students' self-output, that is to say, imitation or conversation practice between students and computers. B, C, D are cooperative output. Students learn from each other, add for each other and make

progress together under teachers' appropriate instruction. From the distribution of class hour, the time spent in practicing is far more than that in passive note-taking. As for Previewing and Reviewing, their time is flexible because the classroom is open to students after class.



Figure 5 – Computer Assisted English Teaching Platform

## 5. Effectiveness of LAN-based Teaching

### 5.1. Assessment of Students' Academic Examination

From table 4, we can see that 85 students in experiment class take the exam and 83 of them have passed. Passing rate is 97.7%, good rate 68.3% and excellent rate 17.6%. This shows that about 98% students have the ability to use written English.

Class	Reference number	Not pass	Pass	60~69	70~84	85~100
<i>Experimental class</i>		%	%	%	%	%
	85	2	83	10	58	15
		2.3%	97.7%	11.8%	68.3%	17.6%

Table 4 – Test Results of the Experimental Class N=85

## 5.2. Comparison of Final Oral Examination

The results: oral examination in IELTS is classified into 9 levels or it is called 9 grades system. 6 grades mean pass and 5.5 grades or under mean failure. If we see 6-6.5 as "passable", 7-7.5 as "good" and 8-9 as "excellent", "passable" means that one has English communication skill with some grammatical mistakes and misuse of some words; "good" means that one has English communication skill with a few grammatical mistakes and few misuse of words; "excellent" means that one has English communication skills and he can independently and completely express himself. From table 5, we can see that 69 students of all the 85 students are "passable" accounting for 81.2%, which shows that most students can conduct daily speech in English with others after two-year study. 6 (7%) of the 69 are "good" and "excellent", which shows that they can express themselves in English fluently.

Class	Reference number	Not Pass	Pass	6~6.5	7~7.5	8~9
		%	%	%	%	%
<i>Experimental class</i>	85	16	68	65	5	0
		18.8	81.2	11.8	5.9%	0

Table 5 – Oral performance result of experimental class

From the results of written test and oral test, we can conclude that this study has reached our overall expectations. When graduate, students can use English as a tool to conduct daily speech and they have developed the ability to self-study English.

## 6. Conclusion

College English teaching reform now faces teachers' inexperience in computer Internet skills, inconvenient application of teaching resources to students' self-study, disparity of the effectiveness between students' self-study and expectations and other problems. This thesis has integrated BBS, SQL and Serv-U FTP to build an autonomous learning and discussing platform featuring teacher-student interaction and resources sharing. It also discusses teaching design, teaching audience, environment, methods and so on of this teaching platform and introduces steps to carry out LAN-based teaching. At the end of this thesis, from the assessment of the results of written test and oral test, we can conclude that this study has reached our overall expectations. When graduate, students can use English as a tool to conduct daily speech and they have developed the ability to self-study English. LAN-based computer-aided English teaching platform can meet the requirements of English teaching in most colleges and it has excellent effects.

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# Research and Application of School Computer-assisted Sports Management System

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**Abstract:** As one of the key compulsory projects in higher education, especially with the current change of China's state sports system, the sports in college asks for a higher requirement of management. How to design and develop an effective management system has been an urgent issue to be solved by sports administrative of higher schools. In order to improve the efficiency of sports management, this paper designed and developed a set of sports management system especially for colleges and universities. Under the goal of scientific management and in order to improve the teaching quality, this paper analyzed the functions and demands of the sports management system software, adopted JAVA technology and SQL Server2008 data base technology as the basic tool of system development and application after a deep analysis on sports management, and improved the scalability and maintainability functions of the system. The system can conduct the scientific and systematic management on the specific sports management work so that to provide support in assuring the high-efficient management work.

**Keywords:** Sports management; management system; system realization; software structure

## 1. Introduction

Sports industry is one of the core industries of China's culture and technology. With the continuous reformation of sports mechanism and improvement of management levels, the sports management methods are also required to keep the pace with the time and technology (Oferkin I V., Sulimov A V., Katkova E V., et al., 2015). However, sports management is becoming tedious and some problems also came up in the management process. For example, the using and allocation of sports fields became limited to satisfy the increasing demands, and the development resources were distributed unequally or seriously wasted, etc. Design and development of effective management information system may solve the above problems. The purpose of this paper is to improve the efficiency of the sports management of colleges and universities by designing and developing sports management system to provide a high-efficient and normalized management operation procedure for school sports staff to accomplish all the functions

and targets of sports management (Wieczorek M V., Bakanov N., Stang C., et al., 2016). After the appearance of computer, scholars in and abroad started to combine management and computer, and conducted different levels of research on management system from different aspects, aiming to improve the efficiency of management system in modern management. In 1980, American scholar Sprague first put forward the Three-level Model Theory of management system, which divided management system into three levels as management tool, management generator and specialized management system (Bellia L., Spada G., Pedace A., et al., 2015). In 1987, CtDeSanctis and R.B.Gallupe proposed the mode management system consisted of the sub-system, user interface sub-system, group-supporting or converting sub-system and user generator sub-system. In 2001, Peter Meso and Robert Smith developed the mode management system consisted of knowledge, technology, organization, human resources and culture (YASAR D., CELIK N., SHARIT J., 2016). In 2002, Xie Ying studied management system from the technical perspective and discovered that the technology used in management system mainly includes network communication technology, knowledge warehouse technology and neural network technology, etc. (Baborska-Narozny M., Stevenson F., 2015). In 2004, Jeffrey L from UK conducted a further study on management system technology and found out that management system technology is a constantly emerging and updating process (Chorney E., Rosen A., Lewis S., et al., 2016). After a deeper analysis on the sports management of colleges and universities, this paper takes JAVA technology and SQL Server2008 data base technology as the basic tool of system development and application, and improved the scalability and maintainability functions of the system. Compared with traditional software development technology, the JAVA technology and SQL Server2008 database adopted by this paper possess the properties of complexity and variability that can effectively control the system, and have the advantages as flexibility and security, etc. Besides, with the development of network, JAVA technology and B/S multi-level structure mode will be widely used. The management system developed in this paper can conduct a scientific and systematic management on the specific sports management work, and provide supports in the high-efficient operation of the management work (Pigeot I., Baranowski T., De Henauw S., 2015).

## **2. Introduction of Related Technologies**

### **2.1. JAVA Technology**

JAVA language is a new generation of program design language, which is designed by Sun Company and mainly used in target program design. Based on JAVA platform, the application of JAVA technology is to conduct certain program compilation through JAVA language and keep them in a computer environment that JAVA operated. It is a software that can run the programing at a highly interactive, dynamic and maximum safe level on the computer under network environment. (Belo, A., Castela, G., & Fernandes, S., 2013).The platform mainly consists of two parts. The first part is JAVA VM (JAVA Virtual Machine). The second part is JAVA API (JAVA Application Programming Interface). JAVAVM is the core of JAVA platform, which can be realized by software or use hardware part as JAVA chip to realize u11. JAVA API is the standard interface for JAVA small applications and application software. It is the basic frame of application development, which can be extended to a certain degree. Through a series of basic interfaces to each key domain, JAVA API can visit various data base

with the interfaces in a unified way (Wahab A., Hod R., Ismail N H., et al., 2016). Similar to ODBC, the JAVA technology developer is always separated from personal data base. Established on JAVA platform, JAVA can also provide the access for the data base unrelated to the platform so that to facilitate the programmer to conduct related development and application. JAVA API mainly contains two parts: JAVA basic API and JAVA standard extension API. The JAVA structure diagram is shown as Figure 1. JAVA language is popular because of its ability of compiling Applet that can be embedded into HEML file and its object-oriented, simple, platform-independent, safe and multi-thread characteristics (Chitale V D V., Alabi G., Gramin P., et al., 2015).

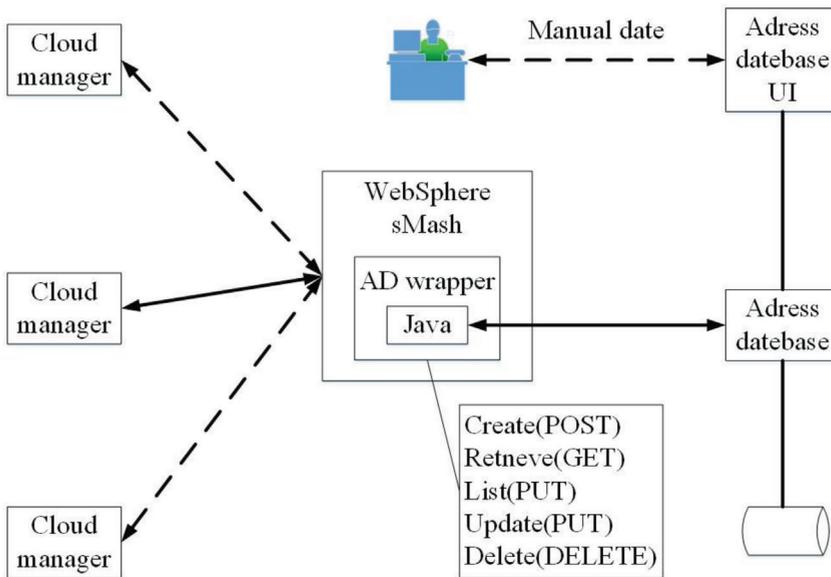


Figure 1 – Technology Structure Diagram of JAVA

## 2.2. SQL Server 2008 Data Base

In a broad sense, data base refers to a warehouse to organize, store and manage data according to the data structure. In a narrow sense, data base is a data set organized according to a certain data model and stored in a secondary storage. The basic structure of data base can be divided into three hierarchies, which reflect the three different perspectives on the data base. (Freixo, J., & Rocha, Á., 2014) The data base consisted by the frame of internal schema is known as the physical database; the data base consisted by the frame of conceptual schema is known as the conceptual data base; the data base consisted by the external schema is known as the user data base. Data base possesses the features of realizing data share, reducing data surplus, independent data, integrated control of data and failure recovery, etc. SQL is the structured Query Language. In the design and realization of sports management system in colleges and universities, the main function of SQL language is to connect and communicate with various data bases. SQL Server 2008 data base a SQL Server data base management system promoted by Microsoft. This version has advantages as higher integrated degree with related software, good running effects on

multiple platforms from laptops with Microsoft Windows XP to large processor servers with Windows Server 2008, etc. The application of SQL Server 2008 in the Microsoft data platform helps companies operate their most important applications and reduce the costs of basic data facility management and delivery of observing information to users (Yang X L., Tong Y A., Lu Y L., et al., 2015).

### 2.3. B/S Structure

B/S (Browser/Server) structure is also known as browser/server mode, which is a network structure mode after WEB. WEB browser is the most primary application software at the Client. This mode unified the Clients and integrated the core part realized by the system function to the server, which simplified the development, maintenance and application of the system. The user's computer only needs to install a browser such as Netscape Navigator or Internet Explorer, and the server only needs to install data bases as Oracle, Sybase, Informix or SQL Server, etc. The browser interacts with the data base through Web Server, which can greatly simplify the Client load, alleviate the cost and work load of system maintenance and upgrading, and reduce the overall cost of the user. The system diagram is shown as 2-2. The biggest advantage of B/S structure is that it can be operated on any computer with network and anywhere without any requirement of special software, which makes the Client in a zero maintenance status.

## 3. Related Tests of the System

### 3.1. Performance Test of Webservice

Use SPECweb99 to test a fixed Webservice, gradually increase the setup concurrent connections, and observe the tested actual maximum concurrent connections that meet the requirements of the speed range. The result is shown in Figure 2.

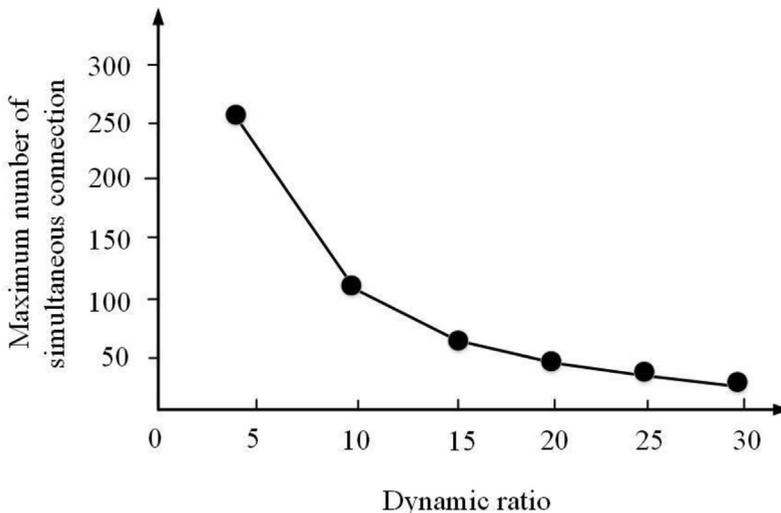


Figure 2 – Changes of Actual Performance With Load

The result shows that the response of WebService on the request changes with the system load. Under the permitting range of service ability, the request from the Client can be treated and responded in time when the arrival frequency of request is strengthened and the load is increased. But when the load is increased to a certain degree, the system performance would decrease apparently, which is called the critical point of WebService.

Besides, the way of server software dealing with dynamic requests also has a considerable impact on the performance. First, screen out the intensively tested dynamic part, conduct pure static test on the Web Server, introduce the dynamic test, gradually increase the proportion of the dynamic content, and observe the real maximum simultaneous connections. The test result is shown as Figure 3 :

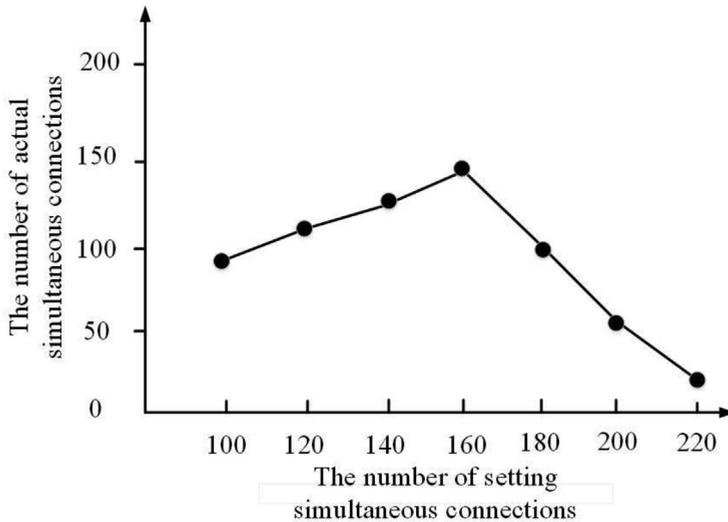


Figure 3 – Relationship Between Actual Performance And Dynamic Content Ratio

As shown, the greater the proportion of dynamic test, the less the Server-supported maximum simultaneous connections.

### 3.2. Loadrunner

As a load test tool of predicting system behaviors and performances, LoadRunner confirms and searches problems by simulating millions of users to conduct simultaneous load and real-time performance monitoring, which can test the overall structure of a company. It is very necessary to create virtual user execute scripts, and LoadRunner provides Virtual User Generator to record or edit virtual user scripts. When using Vugen to create virtual user execute scripts: click the menu and run Virtual User Generator; create a single protocol script, and select the “Tuxedo” protocol type; input an executable file name (SimpApp.exe) in the pop-up window, and select “Record into Action” as the Action; click “OK” to record the script; then Vugen will activate “Simpapp.exe”, as shown in the following figure; input WSNADDR and string of “Tuxedo is powerful!”, and click TOUPPER; after accomplishing the request, TUXEDO server will output the string of “Tuxedo is powerful” and write into

“Output string”; click to stop recording and edit the Vuser script. All the operations in C will be recorded in a script file. The content is shown as below. Store the file as “simpapp”.

## 4. Establishment of the System

### 4.1. Design of Software Structure

Specific constraint conditions should be taken into consideration when a management system is designed. In the design of college and university’s sports management system, the specific design process of software development should be followed, and the operation quality should be carefully controlled in the entire design process. In respect to the overall particularity of this system, JAVA technology and B/S multi-hierarchy structure are adopted to realize centralized management and unified maintenance of the management information (You J J., Zhang W H., Deng L., 2015). The overall structure is shown as Figure 4 based on the requirements of Hezhou University’s sports management system.

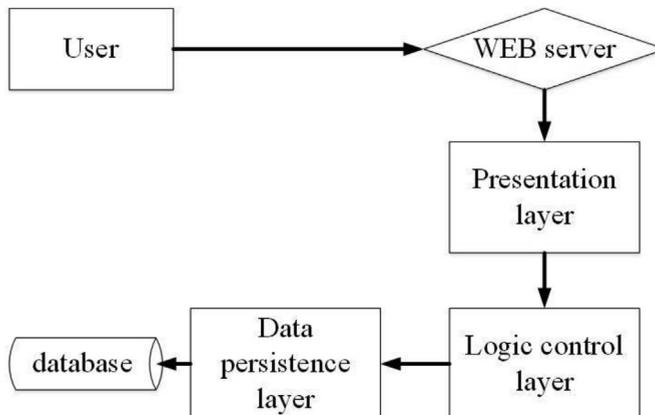


Figure 4 – Software Architecture Diagram of Sports Management System

### 4.2. Application of JAVA Technology

In this study, JAVA is chosen as the main programming language. It has close similarity to C language. Therefore, it can be easily mastered and used by the developers of system software. Although there are some similarities between JAVA and C++, JAVA has more advantages than C++. For example, JAVA is convenient to program, and it is also reusable. Furthermore, JAVA is also popular for the outstanding compatibility of its cross platform; which can switch JAVA source code into the class file of byte code. This class file is portable to any kind of hardware platform equipped with JAVA operating environment, which is also a great convenience to the user (McMurran M., Bruford S., 2016).

### 4.3. Application of B/S Structure

In this study, the design and realization of the sports management system include three hierarchies, which are the client hierarchy, application hierarchy, and the data storage

hierarchy. The client hierarchy is in charge of the display of data and interactive browse. Application server is a kind of serve equipped with the extended functions of applications based on the client server; its main function is to connect the corresponding extended application with the data base, using specific data base statements to submit data base server's data processing structure to the Web server, and then to the client. Data base is responsible for receiving the Web server's request of data processing; realize the inquiry, modification and update of the data base, and then submit the final results to the Web server. Excellent real-time performance is the main advantage of B/S structure. Users only need to install common browser rather than special client software. Besides, B/S structure has low requirements on clients' hardware, which can reduce some cost for its clients (Guo H., Chen S., Bao A., et al., 2015).

#### 4.4. Design of the Overall Function Module

Based on the analysis of the requirements of Hezhou University's sports management system, the function structure diagram of this sports management system is established (see Figure 5).

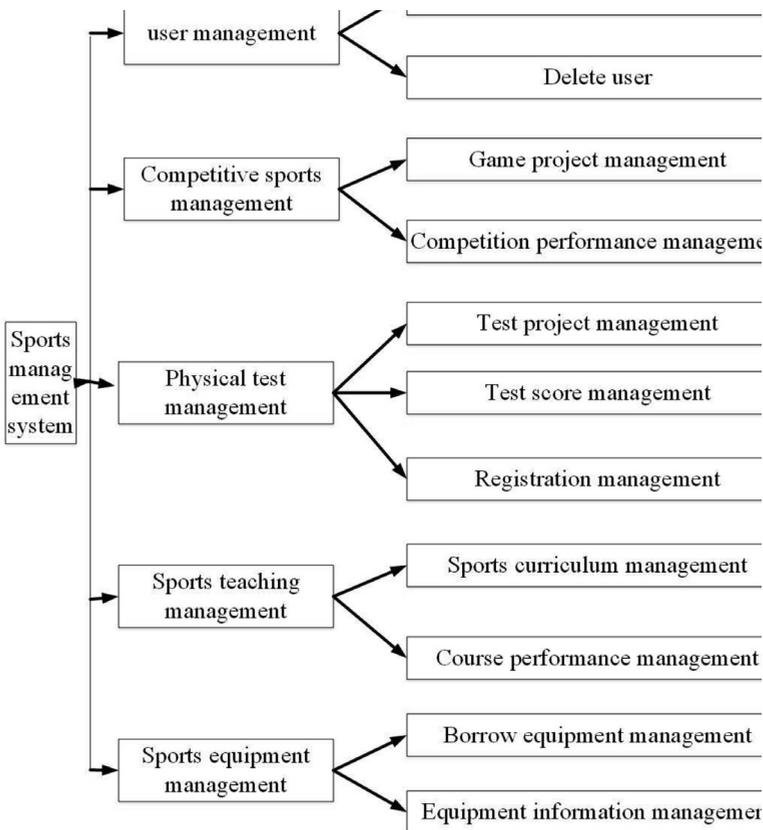


Figure 5 – Function Structure Diagram of Sports Management System

This system is divided into five modules, which are user management, competitive sports management, physical fitness test management, physical education management, and sports equipment management. Each module contains 2 or 3 sub-modules to realize relevant functions, ensuring normal operation of the entire sports management system.

#### 4.5. Design of Data Base

The design of data base is to establish a data base in a given application environment by building a certain pattern to effectively store data and satisfy users' requirements, including the storage and processing of data. Data base design is the foundation for the establishment of the required data base and the application system. And it is also the core of the establishment of a system. Based on the actual sports management conditions of Hezhou University, SQLServer2008 is selected as the tool of data base. According to the in-depth analysis of the system requirements and the practical application situation of Hezhou University's sports management, the following data base tables are needed by this system. In order to describe the conceptual model of the real world, it is necessary to make the drawing of E. R Diagram, which is also called the Entity-Relationship diagram. E. R Diagram is an effective approach to illustrate the conceptual model of the real world; as a method to describe conceptual model, it uses rectangle to represent entity, and put the entity name on the rectangle box; the property of the entity is written in oval, which is connected to its corresponding entity by undirected edge; rhombus is used to describe the relations between entities, and the type of the relation is written in the rhombus box; the rhombus is connected to the corresponding entities by undirected edge, and the relation type is also written down beside the undirected edge (Kuklinski M R., 2015).

Field name	Type	Remarks
<i>ID</i>	nchar(32)	User number
<i>Name</i>	nchar(10)	User name
<i>Name</i>	nuhar(10)	Login name
<i>Password</i>	nuhar(32)	Login password

Table 1 – User Table

Field name	Type	Remarks
<i>ID</i>	nchar(32)	User number
<i>Name</i>	nchar(10)	User name
<i>Time</i>	date	Match time
<i>Address</i>	nuhar(32)	Competition site

Table 2 – Competitive Sports Event Table

Field name	Type	Remarks
<i>ID</i>	nchar(32)	User number
<i>Name</i>	nchar(10)	User name
<i>Time</i>	date	Test time
<i>Address</i>	nuhar(32)	Test site

Table 3 – Physical Fitness Test Item Table

Field name	Type	Remarks
<i>ID</i>	nchar(32)	User number
<i>Sid</i>	nchar(10)	User name
<i>Item</i>	nuhar(10)	Test items
<i>Score</i>	nuhar(32)	Test score

Table 4 – Physical Test Results Table

Field name	Type	Remarks
<i>ID</i>	nchar(32)	User number
<i>Sid</i>	nchar(10)	User name
<i>Sub</i>	nuhar(10)	Course
<i>Score</i>	nuhar(32)	Course score

Table 5 – Teaching Achievement Project Of Sports Table

Field name	Type	Remarks
<i>ID</i>	nchar(32)	User number
<i>Sid</i>	nchar(10)	User name
<i>Equip</i>	nuhar(10)	Equipment name
<i>Borrowdare</i>	data	Borrow date
<i>Due</i>	data	Return date

Table 6 – Sports Equipment Borrowed From The Table

#### 4.7. Realization of Operational Module

After the overall running conditions of Hezhou University’s sports management system are presented, the operational modules of the sports management system will be introduced one by one, (Schindel N., 2015) aiming at achieving a comprehensive understanding of the system’s operational process through several key components. Before entering the specific operational module, the administrator should first log in the system (see Figure 6).



Figure 6 – Login Interface

The login interface is presented in Figure 4; enter this interface by running the executable file. There are two input boxes; one is for the user name, and the other is for password. Type in correct user name and password; then, click “Login” to enter the main interface. When the user name or password is wrongly entered, user can click the “reset” button to quickly erase the input words. The source code of the Login interface is as following:

```
void CDlgLogin::OnOK()
{
    BOOL bLogOn=FALSE;
    CString sUserPassWord, sPurview,sUserName, slnputPassWord;
    LRunSql m_runsql;
    CString sql;
    --variant--t value;
    CString sError;
    this->m_editPassWord. GetWindowText(slnputPassWord); this->m_editUserName.
    GetW
    indowText(sUserName);//update the data variable
    CApp*App=(CApp*)AfxGetApp();//app is the object pointer of the application
    Sql. Format("select admi_password, admi_purview from tabpurview where
    admi__name='%s, sUserName);
    if(m_runsql. CheckSQLResult(sql))
    {
        value--m_runsql. mrecordset->GetCollect("admi_password");
```

```
if(value.vt!=VT_NULL)
sPurvie, IV=(char*)(_bstr_t)value;
if(sUserPassWord=-----CCrypt::Encrypt(sInputPassWord))
{
App->m_sUserName=sUserName;
App->m_sPurview=sPurview;
bLogOn=TRUE;
}
else
{
sError="please re-enter your password.\n pay attention to capitalization!","incorrect
password";
this->m_editPassWor. SetFocuso();
}
else
{
sError=" please confirm whether the capitalization of the user name is correct or not!",
"the user does not exist";
this->m_editUserName. SetFocus(); .
}
}
```



Figure 7 – Student Information Management Platform

The student information management platform is shown in Figure 7. The administrator can inquire the data by entering the numbers or names of the item. Besides, the administrator can check the information of students (e.g. student number, gender, class, and major) by clicking the “inquire” button. Wrong information can be revised via the “revise” button. In this platform, administrators can also input the scores of students, enabling the students to timely inquire their performance. If students find some mistakes about the student number or scores, they can report the mistake to the administrator. Then, the administrator can use the “revise” function to correct the wrong data. The source code of the student information management program is as following:

```
#include<iostream>
#include<string>
#include<fstream>
#include<cstdlib>
#include<iomanip>
using namespace std;
class student
{private:
char name[20];//name
double cpro, english, math, sport, law,hbpro, computer;//course
int order, number;//ranking, student ID
public:
student(){
student(char n[20], int nu, double CC, double eng, double ma, double
sp, double l, double hb, double com)
{strcpy(name, n);
number=nu;
cpro=cc;
english=eng; math=ma; sport=sp; law=l; hbpro=hb; computer=com;
}
friend void main();
}
void main()
}
cout<<"welcome to **score management system**!"<<endl;
cout<<"*****"<<endl;
cout<<"**** score management system ****"<<endl;
cout<<"*****"<<endl;
cout<<"*****"<<endl;
cout<<"*****"<<endl;
cout<<"**0, input data**"<<endl;
cout<<"**1, add data**"<<endl;
cout<<"**2, revise data**"<<endl;
```

```

cout<<"**3, inquire in order of name**"<<endl;
cout<<"**4, inquire in order of student number**"<<endl;
cout<<"**5, output the score of each student输出所有学生的成绩**"<<endl;
cout<<"**6, Log off**"<<endl;
cout<<"*****"<<endl;
cout<<" select the number from 0 to 6 to operate"<<endl;
Char p; char w;
Student*s[1000];//pointer object, the maximum storage capacity of 1000 students' data
Ofstream*file[1000];//insert documents
int i=0;
int j=0;
int flag=0;
do //flag verify the validity of the input data
{
cin>>p;
if((p>='0'&p<='6'))
flag=1;
else
cout<<"false command! Please re-enter:"<<endl;
}while(flag==0);
do{
switch(p) //option of receiving function
{
case'o'://input data
{
Harc;
char name[20];int number;double
cpro, English, math, sport, law,hbpro, computer;
do{
cout<<"please enter the name.";
cin>>name;
cout<<endl<<"please enter the student number:";
cin>>number;
tout<<"please enter the score of the test item.";
cin>>cpro;
cout<<endl;
file[j]=new ofstream("D:\document",ios::ate);
*file[j]<<"name" <<"student number"<<number<<"score of the test item
"<<cpro
tout<<" data input is completed, do you want to continue (ym).";

```

```
cin>>c;
cout<<endl;
do
{
If[c!="Y&&cI_“n)
{
cout<<” false command! Please re-enter!”<<endl “ ””;
cin>>c;
}
else
flag=1;
}while(flag=0);
}while(c=="Y);
Break;
}
case'1': //increase data
{
char name[20];
int number; double cpro, English, math, sport, law, hbpro, computer;
charc;
do
{
cout<<”please enter the student’s name you want to modify.”;
cout<<endl<<”please enter student number.”;
cin>>number;
cout<<endl<<”please enter the score of test item.”;
{
char name[20]; int nu; double CC, eng, ma, sp, l, hb, com; flag=0;
char c;
if(i=0)
{
cout<<” No data is entered into the management system!”<<endl; break;
)
do
{
cout<<” please enter the student’s name you want to modify.”;
cin>>name;
cout<<endl;
```

```

for(int h=0; h<I; h++) //h record the position of the student to be revised
{
if(strcmp(name, s[h]>name)==0)
{
flag=1;
cout<<"please enter new student number.";
cin>>nu;
cout<<endl<<" please enter the score of test item.";
cout<<endl;
cout<<"data modification is completed!"<<endl;
}
}
if(flag=0)
{
cout<<"the student you want to modify does not exist! Please check and re-enter!"<<endl;
}
cout<<"do you want to continue the revision (y/n):";
cin>>c;
cout<<endl;
if(c!='Y'&&c!='n')
{
cout<<" False Command! Please re-enter!"<<endl<<" ";
cin>>c;
}
}while(c=='Y');
Break;
}
{
char n[20]; int j=0;char c;
if(i==0)
{
cout<<"No data is entered into the management system!"<<endl; break;
}
do{
int flag=0;
tout<<"Please enter the name of the student you want to inquire:";
cin>>n;
cout<<endl;

```

## 5. Experimental Analysis

### 5.1. Experimental Tests

In this study, LoadRunner is selected to test the system on two different servers. The blue one stands for the server with 2.83GHz as its dominant frequency; the red one is the server with dominant frequency of 3GHz. In the experiments, LoadRunner is used to simulate different numbers of client users' access to the server; concurrent access to the server is simulated to test the number of requests that the server can process in a second.

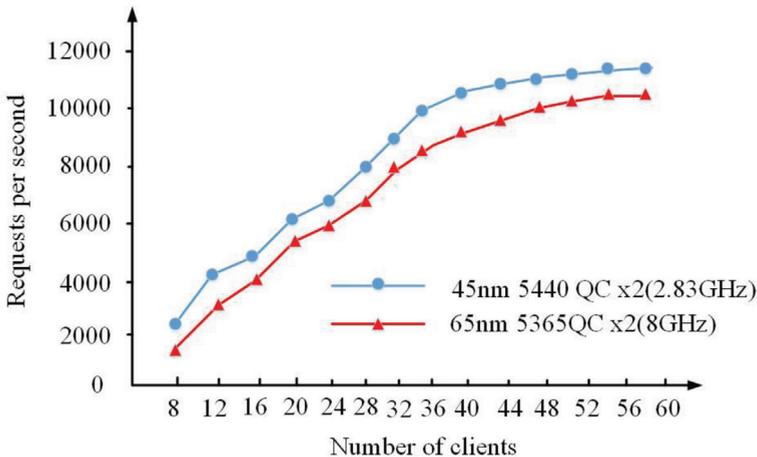


Figure 8 – Results of Web Performance Test

As shown in Figure 8, the processing capacity of the server program is basically in a linear relation when the number of clients is relatively small. The number of unsuccessful requests may rise if the number of clients increases.

### 5.2. System Evaluation

This sports management system is designed according to special technology. This system focuses on the specific work of sports management, providing it with scientific and systematic management as well as high efficient operation. However, some of the functions are not perfectly designed and realized. There is still room for improve and perfection in the software.

As for the software, the system should be further deeply analyzed to form a comprehensive sports management system. Besides, further and detailed study should also be conducted on the following four main sections: competitive sports management, physical fitness test management, physical education management, and sports equipment management. This way, a comprehensive data basis can be established to ensure the versatility of the system and the safety of the management work. In addition, the coupling degree of all the modules should be adjusted according to the actual conditions, which can reduce the dependence between different modules and enhance their independence. Consequently, the system can be well operated and maintained.

## 6. Conclusion

The sports industry is becoming more and more important in China. In order to reinforce the management of sports and enhance its efficiency, the functions and requirements of sports management system software are analyzed through the brief induction of JAVA technology, SQL Server 2008 data base technology, and B/S framework, hoping to realize scientific management and improve the quality of education. In this in-depth research into sports management, JAVA technology and SQL Server 2008 data base technology are applied as the essential development and application tools to enhance the system's expansibility and maintainability. Consequently, a reasonable sports management system for colleges and universities is designed and tested. With this system, the sports management work can be operated under scientific and systematic management, providing support for the highly-efficient operations of management work. In addition, the management of sports education enables the sports teaching module to scientifically integrate with the entire educational administration system of the school, offering students and teachers efficient and quality social services.

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# Art Modular Education Research Based on Computer Platform

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**Abstract:** With rapid development of modern communication technology, traditional C/S backstage management system is replaced by B/S little by little, and the education has changed significantly under strong impact of information technology. Teaching assistance system of art drawing course plays significant role in art education field. Based on teaching theories and methods adopted during teaching researching and analyzing process of art drawing course, I adopt fundamental principles of software engineering to analyze needs of system, and use UML modeling technology to divide the system into registration management function module, user management module, notice management module, famous oil paintings management module, photography works management module, teachers' works management module, works pictures' presentation page and forum for teachers and students to discuss and communicate. The system adopts JAVA EE high-layer language to program, and adopts Oracle database to be program database. The actual measurement result shows that this system can collect and present all information of art course related to several courses and bring classroom teaching into brand-new state.

**Keywords:** Computer; Art; teaching assistance system; JAVA EE; oracle.

## 1. Introduction

Computer science and technology is one of information technologies that is with great power and develops rapidly, since computer technology has been applied into all fields of scientific researches and human life, it has provided convenience for various researches continuously based on self owned rapid development. The classroom teaching adopting computer as main means has been accepted by the public, we can see that there are many people from domestic universities even middle and primary schools starting to research and develop various teaching assistance systems. The teaching assistance system of art is one support software instrument which truly carries out modern internet education based on Internet. It provides learners and teachers of information teaching, remote education and online education with support instruments for teaching, learning, mentoring, discussing, homework handling and other education processes. It adopts the standard that supports share, owns interoperability, provides quality assurance and conforms to unified openness that is necessary teaching support environment to carry out internet education. Seen from existing teaching assistance systems, the technological realization styles can be

divided into following four kinds: 1. The main realization method is remote network: it really realizes to place excellent education resource on internet server via computer net, in order to share resource (Cutting D., Noppen J., 2015). 2. The main realization method is P2P: the streaming media technology can't realize to transmit user information effectively due to influence of bandwidth, thus the internet teaching assistance system adopts P2P network docking technology to design and develop based on P2P framework (Ahlquist S., Erb D., Menges A., 2015). 3. The main realization method is campus network: the online teaching platform which is researched and developed based on realization of generally applied modern educational technology, generally adopted multimedia teaching and computer aided instruction and other means internal the school (Fuqiang W., Qingzhi L., Huaizhi H., et al., 2016). 4. The main realization method is existing computer lab local area network: realize transmission of teaching contents and interaction between teachers and students via server/client. In addition, some researches of teaching assistance system focus on certain single one realization means or development tool, such as development mode based on WEB, development mode based on B/S, development mode based on VFP and so on (Shin H., Lee S., 2016; Morotti F., Santos G M G., Júnior C K., et al., 2015; Hallin M., Šiman M., 2016). This paper is based on researches and discussions of teaching characteristics and traditional teaching methods of specialized courses such as art and painting courses, combines with physical truth and actual demand of teaching courses, puts forward one solution for one set of teaching assistance system of art painting course. This paper selectively analyzes business process of the system and business process and authority management mode of database information management that significantly improves efficiency and layer of teaching links (Felizardo, V., Sousa, P., Oliveira, D., Alexandre, C., Garcia, N. C., & Garcia, N. M., 2014).

## **2. System Requirement Analysis**

The system has complex flow and involves many people; however its operation needs to be simplified as far as possible, thus strict requirement analysis is needed to divide its functions, the functions of every section and its specific realization possibility should be clarified. Finally, internet all function to form complete teaching assistance system of art painting course. Based on basic information management and information browsing, the system users are divided into: managers, teachers, students and general users, different users correspond to different function permissions. The main requirements of managers are to add database information and user management. The teachers can add specific database information based on self demands during teaching process, and participate in forum discussion. The students can enter the system and guide by the teachers to browse page information related to selected course and communicate with the teachers in the forum. The general users can browse incomplete page without need to log in, but can't participate in forum discussion.

## **3. Technological Difficulty and Feasibility Analysis**

### **3.1. Technological Difficulty**

The functions of the system is not complex, the main technological difficulty is how to store mass multimedia information. Usually, there are two solutions: the one is to store

pictures and other multimedia information in external storage device in document form, then turn storage routine into data storage, finally complete document call in operating system via retrieval routine when search data (Mehmetoglu M S., Akyol E., Rose K., 2015); the other is to realize BLOB (Binary Large Object) function adopting BLOB class provided by Java database, that means to realize picture information storage adopting "Large Object" method (Mafusalov A., Uryasev S., 2016).

### **3.2. Feasibility Analysis**

**Technical Feasibility:** This system adopts JAVA EE to develop, which is able to search many successful cases that adopting similar technologies (Luo C., Hu Z., Zhang S L., et al., 2015), thus provides reference for design and development. Taking efficient Oracle with mature technology as database (Köhler<sup>12</sup> T., Jordan J., Maier<sup>12</sup> A., et al., 2015) is sufficient for completing demands of the system. The system adopts Tomcat server which is popular in current light class WEB applications (Fernandes N M S., Bastos M G., de Oliveira N A C., et al., 2015). In summary, professional and convenient development tools and abundant professional knowledge guarantee technical feasibility of the system

**Economic Feasibility:** The economic feasibility means to analyze cost consumption and possible earnings, in order to if the project will result in a lot of overhead or won't bring in earnings. Based on current computer development layer, one simple personal computer can complete design and realization of the system, the cost is low, no great cost, which guarantees economic feasibility of the system.

**Operation Feasibility:** The system mainly faces to teachers and students of fine art colleges, the interfaces are directive and easy to understand, it owns error prompt messages, that the users will have no problem to operate this system.

## **4. System Design**

### **4.1. Overall Function Design**

This paper will state all design links of the system according to requirements of UML (Unified Modeling Language) (Mazumder D., Saintilan N., Alderson B., et al., 2015). This system is mainly divided into registration management function module, user management module, course management module, notice management module, famous oil paintings management module, photography works management module, teachers' works management module, works pictures' presentation page and forum for teachers and students to discuss and communicate. The system users are divided into: managers, teachers, students and general users, different users correspond to different function permissions.

### **4.2. System Technical Framework**

The teaching assistance system of art drawing course adopts B/S/S (browser/application server/database server) three-layer technical framework management system, this framework owns many characteristics including zero installation of client, cross-platform, maintainability, high expandability, high security and high resource

reusability, it selects Oracle as database to realize management of information system data (pirnău m., beteringhe A., 2015; Vuckovic M., Kiesel K., Mahdavi A., 2015).

The first layer is client layer (browser and client workstation), which is mainly responsible for man-machine exchange and visits via client of B/S mode. The second layer is WEB layer, which operates in WEB server, accepts requests from users of client layer, and transmits service required by the users to business logical layer to conduct corresponding analysis and process. The third layer is database server layer, which mainly stores various data of storage system, and conducts data exchange and data query via certain orders with business logical layer.

The advantages of B/S/S framework: (1) The maintenance and upgrading method of B/S/S framework are simple. (2) The development cost and maintenance cost of B/S/S framework are low. (3) The operating data of application server is light. The disadvantages of B/S/S framework: the HTML language adopted by B/S/S framework owns poor interaction (Shu X., Wang H., Yang X., et al., 2016). The user interfaces which adopt INTERNE technical standards HTML/HTTP to solve input and output can't be used normally. Therefore, it is considerable to adopt XHTML as page standard specification.

### 4.3. System Module Division

Based on thoughts of overall function design of teaching assistance system of art drawing course, this system is mainly divided into registration management function

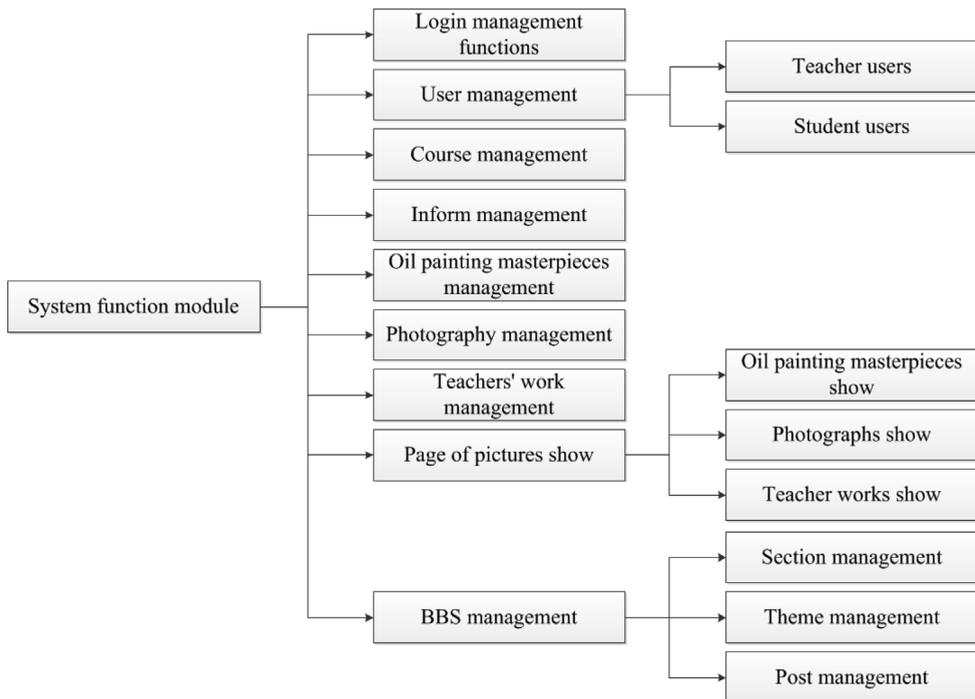


Figure 1 – The Function of Each Module Structure.

module, user management module, course management module, notice management module, famous oil paintings management module, photography works management module, teachers' works management module, works pictures' presentation page and forum for teachers and students to discuss and communicate. In addition, the registration management function module has the ability to identify types of user and confirm contents that can be shown to the user; the permission of user management module, course management module and notice management module belong to managers; famous oil paintings management module, photography works management module, and teachers' works management module can be operated by the teachers and managers; forum management function is charged by the managers. The function structure chart of each module of teaching assistance system of art drawing course is as shown in Figure 1.

#### 4.4. Database Design

The database design is important in software design process, one well-designed database can improve efficiency of data search, reduce redundant data thus save storage space.

##### *Basic Flow of Database*

The completion of database concept design is the work to conduct theoretical modeling on researchful actual problem. The database concept design is one abstract of real world entities, which can reflect relationships among different entity objects of real world and doesn't rely on any database system. It is better to design overall data flow structure before designing E-R figure of this system. The data flow structure of teaching assistance system of art drawing course is as shown in Figure 2.

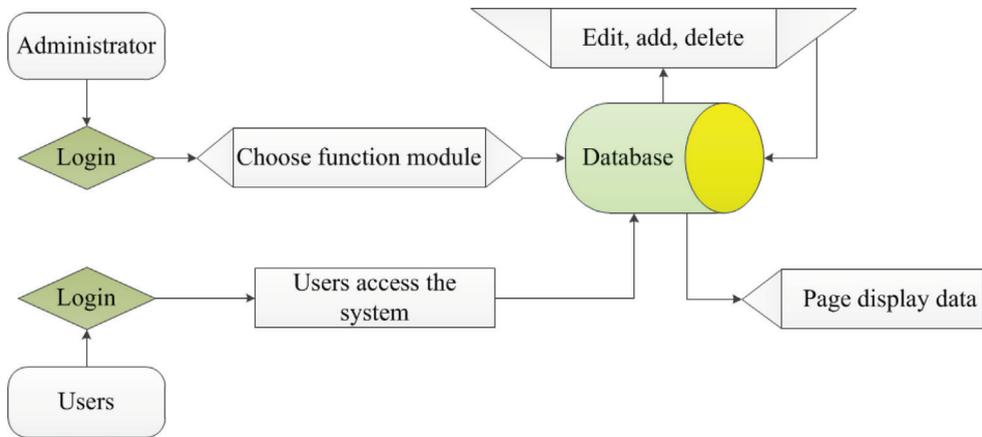


Figure 2 – The Data Flow Diagram

##### *Database E-R Diagram*

Design E-R diagram based on researches on entity objects of the system and mutual relationships, we can see relationships of all data entities from E-R diagram. Figure 3A is E-R diagram for the students; Figure 3B is E-R diagram for the teachers.

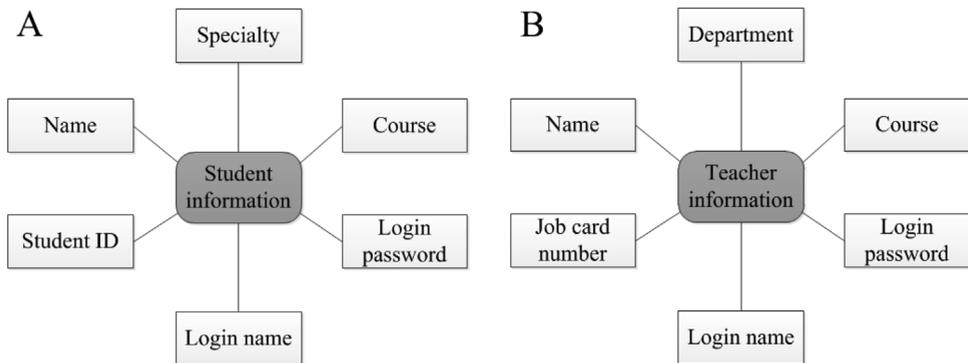


Figure 3 – Database E-R Diagram. A, the E-R Diagram of Student Information. B, the E-R Diagram of Teacher Information.

## 5. Implementation and Test of System

The system is based on requirements of specific design, it realizes code of various function modules, designs to complete all pages, and deploys various codes according to requirements of JAVA EE, completes realization of teaching assistance system of art drawing course.

### 5.1. The Development Tools

Operating System: Windows XP /Windows 7

Development Tool: Eclipse 3.0

Server: Tomcat 6.0

Development Language: JAVA EE

Database System: Oracle 10

### 5.2. Operating Environment Requirements for Hardware

The server: The server is required to have at least 200G disk space, 2.0GHz CPU, 2GB internal storage, corresponding network card supporting TCP/IP protocol and other necessary peripherals.

The client: The server is required to have at least 100G disk space, 2.0GHz CPU, 2GB internal storage, corresponding network card supporting TCP/IP protocol and other necessary peripherals.

The network requirement: Cisco 2960.

### 5.3. Realization of Registration Page and Four Different Identity Pages

The registration page is the home page and the gateway of the system, it should include module for the user to input user name and password in order to register, in addition,

one verification function for safe registration can be added, in order to increase safety and avoid illegal registration. The registration page of the system is as shown in Figure 4.

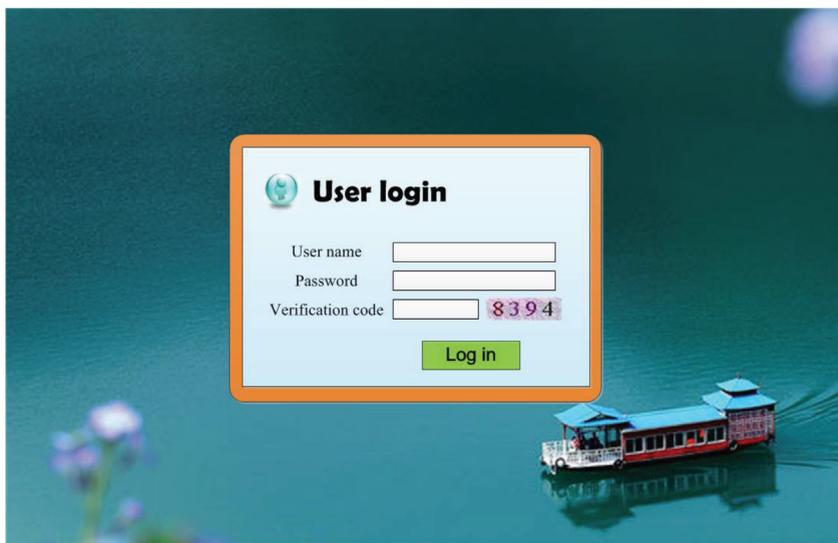


Figure 4 – The Login Page Screenshot of This System.

After the user completes registration operation, there may be 2 situations: the one is the user is one of three identifications acknowledged and confirmed by the system, which will display different pages according to different identifications; the other isn't confirmed by the system and defined by the system as general user, which will display general user page. Therefore, the system selects one page from four pages of registration results – manager page, teacher page, student page and general user page – to present to the user.

The manager page has many links including “user management”, “course management”, “notice management”, “famous oil paintings”, “photography works management”, “teachers’ works management”, “forum management”, “works presentation” and “enter forum”.

The teacher page has many links including “famous oil paintings”, “photography works management”, “teachers’ works management”, “works presentation” and “enter forum”, also the “alter my registration information” button to enter the page for altering personal registration information.

The student page has “works presentation” and “enter forum” links, also the “alter my registration information” button to enter the page for altering personal registration information.

The general user page includes “browse works” and “browse forum” links.

#### 5.4. System Test

Operate the teaching assistance system of art drawing course on deployed machine, test the system, especially some function points, business processes and scheduled

operations, and the findings show that the function points are realized basically, the business processes are right, and all operations reach design requirements. When complete test, we adopt following test steps:

### ***Unit Test***

Login the website as manager level, the management options will show, however the general registration user will not see. After entering into the background, the manager can check and modify information of other users, or even delete the user. Every registration user namely student user and teacher user can modify his/her password after registration. We separately test user management module, course management module, notice management module, famous oil paintings management module, photography works management module and teachers' works management module, the findings show that all modules can correctly complete to add, delete, modify and check data sheet. We test the forum management module alone, it is shown that the module management, subject management, post management and other functions comply with the design requirements.

### ***System Test***

The two profession software engineers test the system according to their understandings, select several groups of unreasonable data to examine the system, including to login the system with inexistent user name and password and leak and mistake to record the data, and the system displays data as expected way; querying with error query methods and fields is also without exception.

### ***Integration Test***

After the system is deployed on the machine completely, a middle school student with little understandings about software engineering is invited to operate the system for nearly one hour, the physical truth is that the system operates well, the real contents of all pages of the system conform to design expectations which means that the function codes are credible.

### ***Performance Test***

We conduct subjective feeling test on performance of the teaching assistance system of art drawing course, the operator doesn't feel any stuck and idling, however this is directly related to system operating environment and user number, that can't prove that the system has good performance. How the performance and effect of the system is on earth, it should be reflected under using environment. The system can only be completed via finding problems and solve problems during actual use period.

## **6. Conclusion**

Modern computer technology is permeating in all fields of human life, with rapid development of modern communication technology and continuously mature front-end technology, the traditional C/S backstage management system is gradually replaced by

B/S. On this occasion, the educations changes significantly under intense impacts of information technology. Based on the situation that current art education field is lack of use of computer technology, the teaching assistance system of art drawing course is designed and completed by adopting fundamentals of software engineering, conducting demand analysis on system, using UML modeling technology, and introducing JAVA EE high-level language and Oracle database, this is one online teaching platform for teaching assistance system which can collect and present information of art course related to several courses. The measured results show that the system can highlight the function of “active learning” for students, establish one new self-learning mode which breaks out traditional teaching mode, territory limit and time limit, and bring the classroom teaching into one brand-new state.

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# The Training Mode of Performance Specialty Research Based on Computer Platform

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**Abstract:** Objective: The problem of training mode is an important problem in performance specialty. As an important research area, it is getting more and more attention. With the continuous development of the cultural industry, the performance specialty needs a more effectively training mode to training professional talents. This paper analyzes and researches training mode of performance specialty by using computer platform. Methods: in this paper, training mode of performance specialty is analyzed by using computer platform. Process: through research of the training mode of performance specialty, we can use computer platform to input student information. Then, by using expert system, we can analysis the status of every student. By using this computer platform, education resources can be reasonably allocated, and every student can get better training. Conclusion: this method can optimize the training mode of performance specialty.

**Keywords:** Performing specialty, computer platform, training mode, expert system.

## 1. Introduction

Under the background of new media various media fusion, the required performance talent is also increasingly complex multivariate. The performance of professional talents in the new period is no longer a single "can a single" film and TV show, but on the basis of master professional, can take the initiative to adapt to the development of modern social cultural and arts enterprises need to cultivate specialized personnel performance class. Not only have higher professional knowledge, good professional quality, good performance, can make an accurate expression on the film and television works, but also in the national professional art groups, culture, and radio and television agencies at all levels and other enterprises and institutions, and other fields, to cultivate specialized personnel engaged in the performance and the related work. Talent quality requirements change as shown in figure 1:

Traditional performance professional training mode by time, space and the number of the limitation of objective conditions, the teacher is more like a "performer", students are more like the "audience" passive accept knowledge, students' active learning consciousness is not strong. Traditional training mode has been difficult to adapt to the needs of the development of the current cultural undertakings, must be to create a more

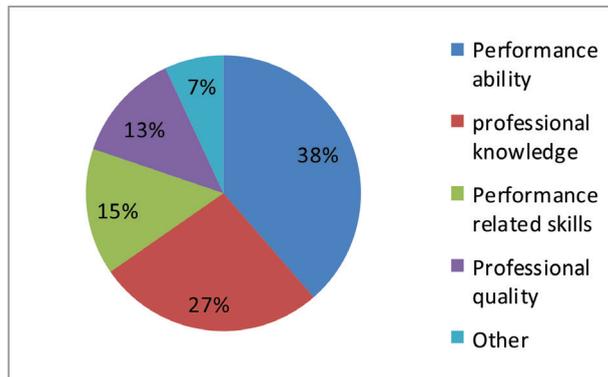


Figure 1 – Personnel Quality Structure

advanced new model instead. Is now a highly developed information age, how to make use of network resources and through the computer platform to learn and benefit from it is performing professional training mode and future research directions. The teacher from the front desk "show" to "director" background, more is guides the student to find their own role, active participation in learning, greatly improving the student active learning the enthusiasm. Based on the computer platform, build information condition show the new model of talent cultivation, can not only ensure the resource sharing, interactive communication, expand the scope of communication and the exchange frequency, the study provides a great convenience for the students. And on the computer platform of network teaching, the teacher directed by front desk performers into the background, no longer as a leader, the role of the dominator, but into the role of supporters and participants, undertaking the preparation, design, lead and participate in the study the role of supporter, through establishment, create a relaxed learning environment for students, indirectly, a subtle impact on them. Because the teacher role transformation, in the process of the network teaching, give full play to the student's main body role, the real achieve the goal of the students according to their aptitude and personality development (Cruz-Cunha, M. M., Simões, R., Varajão, J., & Miranda, I., 2014).

The film performance education is a kind of special talent training mode which is different from the general education, which is different from the general education. As a practical subject, perform teaching has always stressed the teaching method of "the oral teaching that inspires true understanding within the" elite education "and" educational philosophy. After several decades of development, performance education has been a large number of outstanding film actors for the Chinese film industry. However, pay attention to practice at the same time, film performing education but often neglect academic norms of promotion and summary. At the same time, the gradual popularization of the film show between education and change of the times, there is a gradual emergence of crack (Vijayvargy, L., 2015). With the development of society, the development of film technology, the continuous improvement of students' quality, performance art teaching and the creation of the internal and external environment is also constantly changing. The teaching method of film performance must adapt to the changes and make corresponding adjustment in time. The computer platform is an effective way to implement the new training mode.

## 2. Method Principles

### 2.1. Training Mode of Performance Specialty

This study professional talent training scheme content the performance index of the communist party of China set up three level indicators: training specifications, curriculum structure; Secondary indicators have eleven, tertiary indicators, 110:1. The master professional theory, consists of four three-level index; 2. Have the ability, there are 6 tertiary index; 3. Employment index 2; 4, the types of talents, consists of a three-level index; 5. General requirements, there are three tertiary index; 6. Ability, knowledge structure, consists of four three-level index; 7. General performance course, consists of seven tertiary index; Education course consists of three indicators - 11; 9. The professional courses, there are 35 tertiary index; Professional course consists of three indicators, 25; 11. The practice, there are five tertiary indicators.

<b>Score by expert</b>	<b>9.3</b>	<b>9</b>	<b>8.9</b>	<b>8.5</b>	<b>8.3</b>	<b>Average number</b>	<b>8.85</b>
<i>Number of experts</i>	3	1	3	2	1	Number of experts	10

Table 1 – Questionnaire Content Validity Score

### 2.2. Expert System

The preliminary study on the content of the primary index is made into a questionnaire survey on the training program of the professional training program of the performance ". The validity of the questionnaire was assessed by 10 experts. The questionnaire results were processed by means of the mean value of the questionnaire (a). N was used to calculate the weight of each index. Finally, the results were evaluated by using Kendall's coefficient formula:

$$W = 12S / \{K2(N3 - N)\} \tag{1}$$

Note: the number of K is the number of experts, W is the harmonious coefficient, N is the evaluation index number, S is the sum of the squares of the difference.

$$(S = \sum Ri^2 - (\sum Ri)^2 / N) \tag{2}$$

N as the sub index. The statistical results show that the W value is more than 0.8, the chi square test, using the chi square formula.

$$X^2 = K(N - 1)W \tag{3}$$

A significant test was performed to calculate the X2 value.

$$X^2 - XZ(\text{Significant level } 0.01) < 0 \tag{4}$$

Experts have different views on the evaluation of the questionnaire at all levels, setting targets is not reliable.

$$X^2 - XZ(\text{Significant level } 0.01) > 0 \tag{5}$$

W value reached a significant level of experts on the questionnaire at all levels of the evaluation of the indicators have a higher consistency, setting targets, thus determining the sports art talent training program of all content system (Maffulli, N., 2016).

### 2.3. Computer Platform of Training Mode of Performance Specialty

Almost without being limited by the capacity of the network information. Using the method of network teaching, students not only can access to the contents of books, but also can be widely used in the teaching of learning resources. Network media type many, mainly including text, voice, picture, animation, and video and other multimedia elements. Multimedia form, also make the teaching content more vividly, promote the improvement of students' learning interest. So the resources of the network education teaching method has obvious advantages, not only the capacity is rich, but also rich in the form of learning resources. Resources of another expression is also reflected in each of the network may become the students learning, teachers it is a kind of particular rich human resources. The professional knowledge learning system for the performance of the professional staff is shown in Figure 2 (Davies, C., Knuiman, M., & Rosenberg, M., 2016):

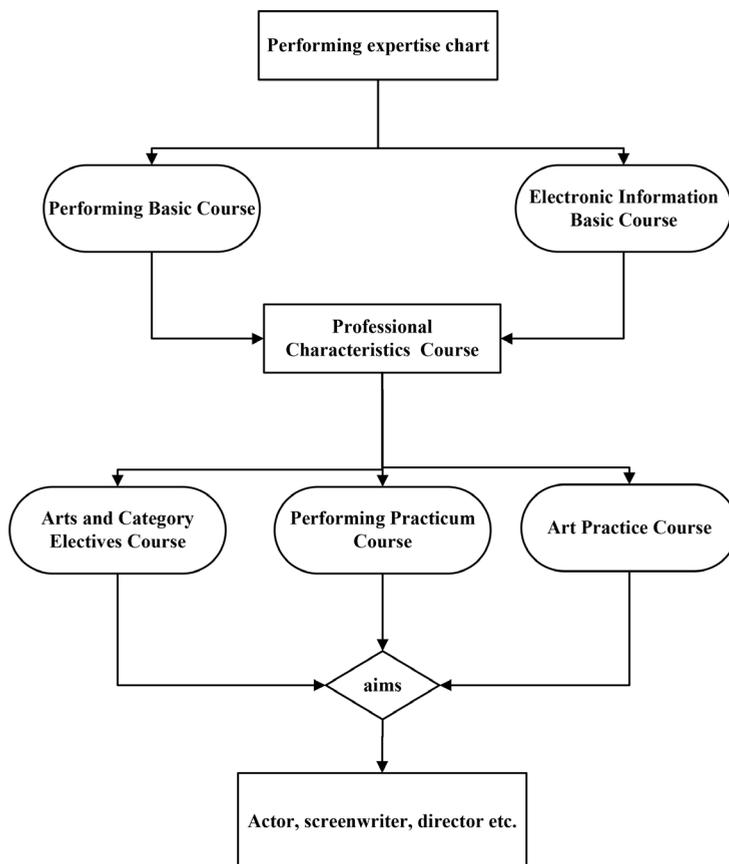


Figure 2 – Professional Knowledge Learning Process

Multimedia has a very strong simulation and show advantages, can put the real teaching contents or real or model show come out, to break through the difficult point of teaching effect is prominent. Such as the teaching of geography, the use of the network media to provide the true situation of volcanic eruptions, the teaching effect is not the same. On this basis, we can carry out theoretical teaching, and can be a good breakthrough in the teaching of difficulty. Therefore, the network teaching method to a large extent can overcome the traditional teaching method in the dead of the lecture activities and rigid text expression, to achieve the students to show the image, intuitive and specific network media environment (ÖZDİL, S. Ö., & KINAY, E., 2015). Let the students in the future performance is from set out actually, not in performance for performance, but in the real scene.

Using computer platform, the performance of the performers can be carried out regularly. For the same work, the performers can weigh to raise their performance level, can also be performed by different comments on people review found that the different points and faults. Will individual performances on display on the computer platform, by or between classmates is review between teachers and students, and help to improve the level of performance. At the same time can target a subject term for communication, discussion, and even cooperation. Fully implement information communication, thinking collisions, free and flexible cooperation, make the whole performance system resources optimization, efficiency maximization of talent cultivation.

To perform professional study in campus, performance of specific training professionals less activity, causes the following figure 3:

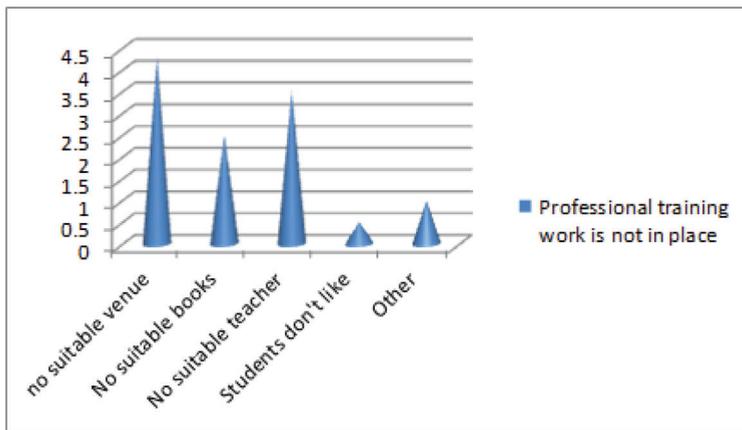


Figure 3 –Professional Training Work is not in Place

Through the computer platform to perform real-time release all kinds of professional training activities of notices, announcements and news, such as tracking report major training activities, through the study of computer platform training video, the teacher not to lecture, good time to master, and online learning resources are rich, many training books, organize regular performance based on computer platform competition, performance discussion, performance expert rostrum, such as training activities, stimulate the participation enthusiasm, create a strong academic atmosphere formed with one, the situation of schools of thought contend (Bica, M. D., & Grigore, D., 2015).

By means of computer platform, can be more convenient and efficient to carry out the performance ratio level certification assessment, performance skills, show professional knowledge contests and other large-scale activities, promote the training and examination of normalized, timely, visually reflect the performance of professional personnel training schedule, results, and existing problems, and to speed up the innovation and development of professional personnel training work.Competition mode has the following:

Assessment types	Performing skills contest	Professional knowledge contest	Performance level certification assessment	Related style
Percentage of	60%	20%	10%	10%

Table 2 – Competition Mode

The implementation of the traditional education teaching methods are generally based on the classroom form, have the characteristics of strong binding time and space limit. The classroom is a place for teachers and students in teaching activities, to leave the classroom can't continue to organize teaching. We use the education teaching method, based on computer platform can provide flexible learning time and a wide range of learning space. Students use the Internet in their spare time to study.It is a beneficial supplement of traditional education teaching method is an extension of network education classroom teaching. For the strong learning ability of students to learn and learning ability almost students supplement provides conditions and opportunities.

The traditional education, the same teacher, using the same teaching patterns, teaching plans, teaching content, teaching methods and teaching schedule, while students exist differences in knowledge base and ability to learn, can' not fully meet the demand of each student's learning.A survey of teachers' teaching satisfaction is shown in Figure 4:

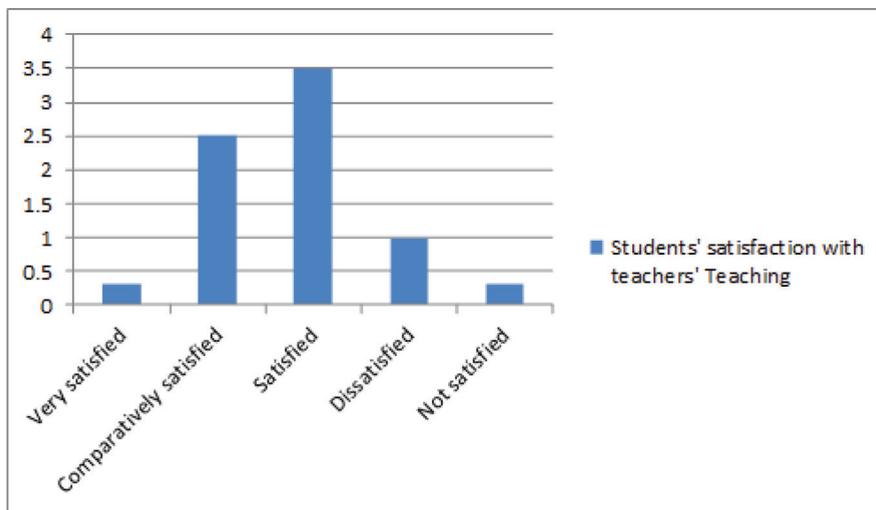


Figure 4 – Students' Satisfaction with Teachers' Teaching

Very pleased and very unhappy to students or less proportion of opinions, most students still in satisfaction phase, the same teacher teaching, different feedback, layered teaching is necessary. But our education several years ago vigorously advocate and try hierarchical teaching reform, but it is difficult to operate. Network education teaching method broke a fixed pattern and the limitations of learning content, through the teaching design and network design, can provide more series of methods for learning and learning methods, so as to meet the needs of the hierarchical teaching (Karl, T. R., & Galletti, L., 2015).

Utilizes the network education teaching method, we create network teaching situation, under the teacher inspired by induction (Mellette, J., 2015), on the premise of students independent learning and cooperative discussion, in the current teaching material as the basic exploring content, to students around the world and life practice as reference object, provide students with full freedom of expression, question, explore and discuss the problem of opportunity (Rollins, M., 2015). Students through the personal, group, collective and various dispel suspicion experiment, applying their knowledge to solve practical problems of a form of teaching (Lee, J. H., Kim, H. S., & Joo, S. H., 2015), realize the exploratory learning. Relative to the traditional education, teachers' use of network teaching platform and teaching method, easier for students to learn to set to explore the situation, to establish inquiry atmosphere (Vincent, P., Nizan, M. S. M., & Julinamary, P., 2015). The student to obtain knowledge, you can found the problem, ask questions, analyze and solve problems (Knox, E., 2015). Using network teaching method, are more likely to promote exploration, grasps the depth to explore, to explore the content of the communication (İlçe, A., & Yüzden, G. E., 2015).

### 3. Actual Data Validation

Through the use of computer platform, information resources can be fully by performing professional personnel for use. But on July 23, the China Internet network information center released today "36 times China Internet network development statereport. 2014.12 2015.6 Chinese Internet users, the report suggests, utilization of all kinds of network application, as shown in Tab.3:

Utilization analysis of the network, network video to the utilization rate of 69.1% in 2015, six months rose 6.5%. Through the data we found that the Internet is becoming more and more common in the use of the public. Let professionals in computer platforms make full use of the advantage of network to improve their own quality, we have reason to hope.

As a professional strong film performing professional should pay more attention to general education or special education? The United States "performing arts journal" editor BonnieMonica pointed out: "the curriculum be set according to the subject requirements, should be combined with the teaching of performing drama, TV, film, dance, visual etc.. In addition to continue to emphasize this, that is, the whole world at all times to perform." Here the author argues that the current performance of teaching based on consistent focus on specialist training, should strengthen the general education of students. Here the so-called general education actually can be discussed from two aspects. From the micro perspective, the general education can be seen as the entire film industry knowledge and skills in teaching and training (Wang, B., 2015). Because of the film shows the professional students, from the entire film industry system. An actor must

be able to be familiar with all aspects of the film production and industry development as an actor is to be accomplished in his performance. So the writers, directors, photography, photography, art, recording, clothing, makeup, props, publicity, marketing and other aspects should be familiar with and master some basic knowledge and skills, to better engage in the professional learning practice. From a macro perspective, the general education contains a variety of humanities, social science and natural science knowledge; for many universities, the film and television drama performance professional, general education is supposed to be its advantages. Nihon University professor Toda Munehiro pointed out: "the drama subject only mastered extensive knowledge but also has a certain degree of conservation at the same time, in order to in-depth to explore the professional knowledge in the field of [14]." For the professional college graduates, lack of culture is soft to help many actors often make fun of him. Mr. JiXianlin had pointed out that the request of a wide range of knowledge, probably no objection. Because no matter how narrow the scope of your research, what a special, only in a wide range of knowledge, based on your vision to be far, your research to further." A good grasp of the general education and special education "of the scale, standardization of" education "and" personality education "; " professional performance "and" social performance "and others literary idea careful thought. Broaden the channels of employment of graduates, undoubtedly should become the important factors to consider teaching [15].

Application	2015.06		2014.12		
	Userscale (million)	Internet users Use rate	Userscale (million)	Internet users use rate	Half year Growth rate
<i>instant messaging</i>	60626	90.8%	58776	90.6%	3.1%
<i>network news</i>	55467	83.1%	51894	80.0%	6.9%
<i>Search Engines</i>	53615	80.3%	52223	80.5%	2.7%
<i>Network music</i>	48046	72.0%	47807	73.7%	0.5%
<i>Blog / personal space</i>	47457	71.1%	46679	72.0%	1.7%
<i>Network video</i>	46121	69.1%	43298	66.7%	6.5%
<i>network game</i>	38021	56.9%	36585	56.4%	3.9%
<i>shopping online</i>	37391	56.0%	36142	55.7%	3.5%
<i>Tumblr</i>	20432	30.6%	24884	38.4%	-17.9%
<i>net literature</i>	28467	42.6%	29385	45.3%	-3.1%
<i>Online payment</i>	35886	53.7%	30431	46.9%	17.9%
<i>e-mails</i>	24511	36.7%	25178	38.8%	-2.6%
<i>Online bank</i>	30696	46.0%	28214	43.5%	8.8%
<i>Travel reservation 4</i>	22903	34.3%	22173	34.2%	3.3%
<i>group purchase</i>	17639	26.4%	17267	26.6%	2.2%
<i>Forum /bbs</i>	12007	18.0%	12908	19.9%	-7.0%
<i>Online stocks</i>	5628	8.4%	3819	5.9%	47.4%
<i>Internet Banking</i>	7849	11.8%			

Table 3 – Application Statistics of Various Network Applications

## 4. Conclusions

In this paper, we start from classical training mode of performance specialty, extend it to an new area by using computer platform which includes more modes of training. We analyzed the contribution of different factors to the total effect of training mode by using expert system. The main conclusions are as follows:

1. Computer platform can increase the communication between students;
2. Computer platform can optimize assessment mode;
3. Computer platform can improve flexibility of training.

By using computer platform, the training mode of performance specialty can be optimized effectively, educational resources can be allocated properly; students can be trained more scientifically. With the expert system, various index of training mode can be clear to decision maker to formulate a more reasonable training mode. Training mode of performance specialty can be improved more by keep using computer platform.

## Acknowledgment

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# Biomechanical Analysis on Turnaround Dribble in Basketball

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**Abstract:** With the development of basketball, the competition has become fiercer and more rival, the defense against attack is used more effectively, the close defense is more fiercer and the attack of offensive players is restrained, requiring the basketball player to boast comprehensive attack skills, be quick to switch between attack and defense and link skills. To adapt to this change, the offensive player must get rid of the defense under the press defense of the defensive player to find out favorable follow-up attacking routes. This paper utilizes advanced experimental apparatus (Qualisys infrared tracking test system and two Kistler force platforms), and principles and means of sports biomechanics to test and analyze the front turns of a group of basketball players and reveal the kinematical features and principles of this action skill. This paper provides reasonable assessment for the action of subjects and theoretical reference for the assessment and training of basketball skills to understand the basic skills accurately, increase the enthusiasm for skills training, develop the basketball skills, and contribute to the enhancement of basketball level.

**Keywords:** Basketball; sports biomechanics; holding; turnaround.

## 1. Introduction

Basketball is both a comprehensive game-like sport and a modern competitive sport. As a game, its meanings lie in that it is a popular nationwide fitness program with functions of keeping body and mind active and fit; as a competitive sport, its meanings lie in that it is an important sports item to implement the Program of Striving for Olympic Glory and it shows the enthusiasm for life, encourage people to establish strong mind, brave style, collective spirit, and will to overcome difficulties, constantly strive to become stronger, win honor for the country, and strive for victory through competition among strong ones. In basketball, every attack skill is used to get rid of the defense and achieve the attack and meanwhile every attack skill has a corresponding defensive skill. The final goal of the skills performance of every player, and tactics changes and strategic actions of the whole team is to score the basket. Whether a team can win mainly depends on the shot times and the shooting rate. The turnaround is an important part of many basketball skills applied in attack, passing, dribbling, and shooting, such as turnaround dribble, turnaround breakthrough, and turnaround shoot. Lin Xiaojun et al. studied on the turning skills and actions of basketball turnaround dribble in 2013 (Fourie, L.,

2015). Li Jun et al. practice investigated the teaching of the turning skills and actions of basketball turnaround dribble in 2013 (Schwartz, M., Travesa, A., Martell, S. W., & Forbes, D. J., 2015). Zou Yuduo et al. analyzed and studied the brief introduction and teaching of the turning of the turning skills and actions of basketball turnaround dribble (Zarei, M., Alambeigi, A., Karimi, P., & Zarei, B., 2015). Wang Zhencheng et al. analyzed the mechanical state of the basic skills of the turnaround dribble in 1999. Zhong Xuejun et al. studied on the turnaround, withdrawing step, and shooting skills in basketball actions in 2002 (Atici, G., & Gursoy, G., 2015). Rong Cheng analyzed the kinematics in backward turn actions in basketball dribbles in 2012 (O'Sullivan, J. R., 2016). Basketball technical action is the action of human body or the action of the combination of human body and basketball. It is the displacement or specific attack or defense through the interaction between human body and the outside world. Therefore, this paper analyzes the human body's kinematical forms and characteristics in terms of time and space according to the principles of biomechanics and analyzes the origin of various forces causing the human actions and their features of mutual interaction, including the action characteristics of basketball in air under the force of human and the floor and so on. By doing so, good technical action model will be established and improved to be developed towards the more scientific direction (Prieto, Á. E., & Lozano-Tello, A., 2014).

## 2. Overview

The basketball turning and moving technical actions almost include all functional activities of human lower body. It is very complicated in terms of action structures. Nevertheless, all complicated matters have their inner rules, including turning skills. The turning technical actions can be divided into warm-up actions, functional actions, and conclusion actions according to their mechanical characteristics. The turnaround dribble is an efficient breakthrough skill in basketball (mainly because non-standard turning actions and high center of gravity). It is popular in teaching and training for students because it is an efficient way to break through the opposite side, break through the shooting and get rid of the defense and can be applied well in practical competition (Singh, D., & Jackson, L. A., 2015).



Figure 1 – The Turnaround Dribble

The turnaround dribble mainly includes three phases: warm-up phase before turnaround dribble; how to turn around; speed-up and mechanics after turnaround. When the player is turning around, he mainly depends on his own power of waist and legs so the waist, hip, and tiptoe are the subjects of great investigation (centers on the right foot).

1. The warm-up phase before turnaround dribble is composed by three parts. First, make sure the best position where you will turn. Then make defensive players have wrong judgment by swaying, feint actions, and position of the basketball. Finally attack from the side: face the opponent sideways, take the active attack to get close to the opponent, the front sole of the foot touches the floor at first by centering on the right foot with a proper tiptoe facing yourself (suppose that the defensive player is in the direction of 12 o'clock, the position of tiptoe in the direction from 8 to 9 o'clock is proper) and stand in the direction of the center's projection between the feet of the defensive player, then prepare well when moving the front sole of the foot in the inner side of the foot (Arrigoitia, M. F., Beetham, G., Jones, C. E., & Nzinga-Johnson, S., 2016).

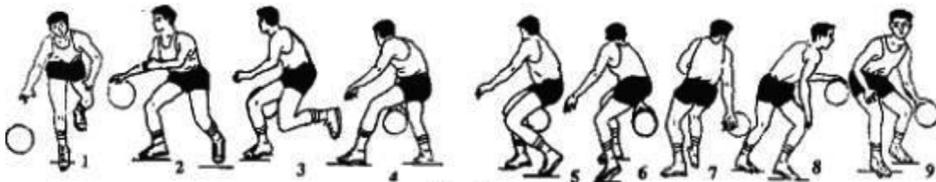


Figure 2 – Basketball A Reversal

2. How to turn around  
 During the period of turnaround, highly complicated professional skills and highly difficult actions are required. The textbooks of sports specialty describe the turnaround and breakthrough skills after dribble very simple and vaguely. *Modern Basketball Advanced Training* describes basketball turnaround and dribble skills like this: when turning around and dribbling, the player rotates centering on the sole of the foot before getting close to the offensive player slowly and then turns around after pushing off with his heel on the floor. During the running, the player must slow down, with his fulcrum foot on the floor powerfully, and the speed must be high when turning around and dribbling due to the influence of inertial resistance. Getting hold of the core of gravity and controlling the acting force balancing the body (Adsit, J., Doe, S., Allison, M., Maggio, P., & Maisto, M., 2016) demand the parts of the whole body to complete the efforts of power generation to make perfect turnaround. The actions of various links of the body are the results of combination of perfections.
3. The speed-up after the turnaround and getting rid of the turnaround dribble is the most important technical link of the breakthrough link on the spot. When the player parallels or exceeds the defensive player at the first step to break through with the basketball, he must exceed the opponent or put the opponent in a dangerous position. The breakthrough link holding the basketball is the means according to the unsteady core of gravity and sudden movement of the opponent. When the player does not speed up at the first step to break through holding the ball, the opponent will get back at a high speed and make up for the mistake by taking favorable position.

### 3. Technical Principle Analysis

When turning around, striding and turning is usually combined to be used. The effects of such kind of action are mainly shown in terms of the speed of turnaround and the scope of the striding. When turning around, the player's core of gravity switches to the fulcrum foot and the front sole of another foot touch on the floor. At the same time, the player's fulcrum foot thrusts on the floor hardly by pivoting the front sole of the foot, the upper body moves with the moving foot, and changes the body direction front and back through the drive of shoulders to waist. When the player's body is moving, the core of gravity must maintain steady. After the turnaround, the core of the gravity should be switched to the position between the feet. When turning around, the front sole of the foot is fixed, the body is rotating around the vertical axis of the line connected by the core of the gravity and the supporting sole of the foot. In the movements with fixed axis, dynamic effects which cause the turnaround are determined by the force ( $F$ ) and the distance from the axis, which is:  $M=Fh$ . Therefore, during the rotating phrase, the force of thrusting on the floor when turning around and the distance between the thrusting foot and the fulcrum foot can both be increased. However, during the rotating phase, the leg should sway to get close to the axis according to the flexibility of the human body's rotational inertia, and to decrease the rotational inertia so as to increase the rotational speed. When the turnaround is to finish, sway the legs to stride the supposed scope towards the effective position. Therefore, the action of turning and striding is the action supported by the swaying legs, the thrusting on the floor, adjustment of the rotational inertia and striding scope. It is an action coordinated by the internal power and the external power of the rotation centered on the sole of the foot of the supporting leg. The turnaround is an important part in many basketball technical actions applied in attack, passing, dribbling, and shooting, such as backward turnaround dribble, turnaround breakthrough, and turnaround shooting.

#### 1. The biochemical analysis on the functions of turning speed

Firstly, the direction of the tiptoe towards you when turning around should be proper. During the period of turnaround dribble, the player usually turns centering on the front sole of the foot. When human beings do this action, according to the formula  $t = 2\pi/W$ , the turnaround should be very quick, the perimeter of the fulcrum foot thrusting on the floor will be decreased correspondingly, and the player will be in favorable position if the direction of the fulcrum foot is towards himself. Secondly, the moving foot must get close to the fulcrum foot at a very high speed during the phase of turnaround dribble. When the player is turning around and dribbling, his perimeter will stay in a constant position. According to the formulas  $t = 2\pi/W$ ,  $W = V/R$ , with the greater angular velocity, the speed per hour of the turnaround will be brought forward more. The player increases of the turnaround efficiency, tries to decrease the radius  $R$ , and tries to contract the joints to make the body close to the arms and legs so that the radius  $R$  will decrease, the efficiency of the turnaround will increase. The specific means are: the arms-when the player is dragging back the basketball, elbow joints adduct slowly and the player should put another arm right ahead of the chest; legs- when the moving foot is thrusting on the floor hardly, the player should get close to the fulcrum foot quickly. Thirdly, the

player should increase the force and flexibility of turnaround when turning around. Under the condition that rotating radius  $R$  and rotating perimeter is balanced, the player should increase the speed of turning around by increasing  $V$  according to the formulas  $t = 2\pi/W$ ,  $W = V/R$ . The flexibility and efficiency of the hip joint must be increased if the rotating speed  $V$  should be increased. Fourthly, the probing of the force thrusting on the floor of the inner side of the front sole of the moving foot must be increased when turning around.

## 2. Biomechanics produced by the physical confrontation of athletes

Currently, the basketball playing has been developing towards the direction of fiercer attack, enhancing the individual ability to defend, the individual resistance capability, and flat-footing defensive capability. Gradually the fixed prohibition of body contact is changed into permission of body contact. First, it is easy to result in the factors causing offensive foul. In basketball competitions, when the basketball is a live ball, the body contact between the offensive player and the opponent is the offensive foul. When stepping forward sideways, the player knocks the opponent down with the basketball because his fulcrum foot uses small force or the moving foot thrusts on the floor too hard when he is unable to turn around, or because he does not control his core of gravity well, or because he passes the ball or muff a catch then the ball touches the opponent. Secondly, it will cause the factors of achieving the best attack effects. As is written in *Master Sun's Art of War*, know the enemy and yourself, and you can fight a hundred battles with no danger of defeat; know yourself but know nothing about the enemy, the opportunity for victory is half; know nothing about yourself and the enemy, you will lose absolutely. Therefore, the defense is significant. It not only depends on the speed but also on the force to make the body stay at a flexible condition. The player should defeat the opponent by force, control the fulcrum foot well, and ensure the braking force to meet the need of resistance when applying stress to defend; when doing the feint action and withdrawing the force, the player will brake to avoid charging foul or dribbling. Defeat your opponent through speed, using cutting speed of speed-up to hide the real actions to make the opponent get the false information or defeat the self-control of the opponent so as to make yourself in the favorable position to break through. The player should increase resultant force  $F$ , increase the thrusting force of the moving foot to shorten the rotating perimeter, and then the radius will decrease correspondingly. The moving foot will rotate and contract towards the fulcrum foot quickly to increase its rotating speed and flexibility (Bashore, K., Berg, H., Bliss, J., Cauley, K., Christopher-Byrd, E., Engelhart, A., ... & Sullivan, M., 2016).

## 4. Object and Means of the Study

The object of the study is ten high level basketball players who have specific training of more than ten years so they have solid technical actions, much practice of the front turning shooting skills, and high shooting rate and they are familiar with turnaround shooting before catching the basketball. Ten basketball players use right hands to shoot. The detailed conditions of those players are shown in table 1.

NO.	Age	Height(cm)	Weight(kg)	Fixed number of year
1	26	188	87	10
2	27	179	90	12
3	23	202	90	9
4	25	188	83	10
5	22	190	88	8
6	30	183	81	15
7	29	204	92	12
8	31	187	85	15
9	27	193	81	14
10	22	186	79	8

Table 1 – Specific Situation Table

#### 4.1. Equipment and Apparatus

Two Sony HCIE cameras, two tripods, one German original three-dimensional framework, one simultaneous light of Zhejiang Nanzhou Technology Co., LTD, one set of German SIMI MOTION sports analysis software, and one basketball.

#### 4.2. The Extraction and Analysis of the Sports Data

This paper uses Video Studio 9 to cut and classify the videos in various phases of ten players, uses German SIMI°MOTION to analyze the data of ten players in 0°,3m; 0°,5m; 45°, 3m; 45°, 5m; 90°, 3m; 90°,5m, totaling 60 sets of data and extract the sports data.

#### 4.3. Definition of the Sports Data

In SIMI MOTION, the degree needs to be defined. Link angle is a two-point angle, which means the intersection angle formed by the line constituted by two points and the horizon line. The joint angle is a three-point angle, the peak of which is the middle angle and the two lines formed by the two points with the peak form the angle (Carbonell, V., 2015).

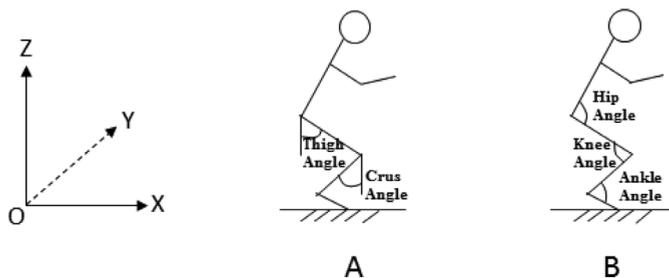


Figure 3 – The Relationship Between Link Angle and Joint Angle

$$F = F_w \times \tan(\lambda + \varphi_v) \quad (1)$$

$$\lambda = \arctan \frac{s}{\prod d_2} \quad (2)$$

$$\varphi_V = \arctan \frac{f}{\cos \beta} \quad (3)$$

$$\tan \beta = \tan \gamma = \frac{mZ_1}{d_1} \quad (4)$$

The joint angles needed to be defined in this paper are as follows: 6 arms angles, 2 body angles, and 4 legs angles.

Left wrist angle: the left wrist joint is the peak, the left hand and the left elbow joint respectively forms two lines with the left wrist joint;

Left shoulder angle: the left shoulder joint is the peak, the left elbow joint and the left hip joint respectively forms two lines with the left shoulder joint;

Left elbow angle: the left elbow joint is the peak, the left wrist joint and the left shoulder joint respectively forms two lines with the left elbow joint;

Right wrist angle: the right wrist joint is the peak, the right hand and the right elbow joint respectively forms two lines with the right wrist joint;

Right shoulder angle: the right shoulder joint is the peak, the right elbow joint and the right hip joint respectively forms two lines with the right shoulder joint;

Right elbow angle: the right elbow joint is the peak, the right wrist joint and right shoulder joint respectively forms two lines with the right elbow joint;

Left hip angle: the left hip joint is the peak, the left shoulder joint and the left knee joint respectively forms two lines with the left hip joint;

Right hip angle: the right hip joint is the peak, the right shoulder joint and the right knee joint respectively forms two lines with the right hip joint;

Left knee angle: the left knee angle joint is the peak; the left ankle joint and left hip joint respectively forms two lines with the left hip joint;

Right knee angle: the right knee angle joint is the peak; the right ankle joint and right hip joint respectively forms two lines with the right hip joint;

Left ankle angle: the left ankle joint is the peak, the heel of the left foot and left knee joint respectively forms two lines with the left ankle joint;

Right ankle angle: the right ankle joint is the peak, the heel of the right foot and right knee joint respectively forms two lines with the right ankle joint.

#### 4.4. Kinematics Data Analysis

SPSS16, EXCEL2007 and WORD2007 are used to extract and analyze the kinematics data. The methods of data testing that are usually taken are: first, paired sample t test of t test. The paired sample t comes from two total samples which interact and pair with each other. Also, they have the same amount of samples and relatively strong relativity

with sample. After being paired, the samples underline the influence of study factors and avoid the hindering of other factors. When  $P > 0.05$ , it indicates that it does not have significance; when  $P < 0.05$ , it indicates that it has significant difference; when  $P < 0.01$ , it indicates that it has super significant difference (George, D. R., Edris, W., Hanson, R., & Gilman, F., 2016). Secondly, the correlation analysis is a popular way to analyze the correlation among variables. When two variables have real mutual influence and restrictive relations, which means that the change of one variable will influence or cause another variable to have change of certain degrees, but this influence cannot calculate the certain number of another variable from a known variable (Upadhyay, N., 2015).

## 5. Turnaround Technical Analysis

Turnaround stage(stage1) means the player catches the ball and crouches back to the basket, the core of gravity comes down a little, hands put the ball ahead of stomach, and the left foot is the moving foot; when the left foot leaves the floor, the left leg begins to rotate clockwise towards the direction of the tiptoe of the left foot centering on the right foot driven by the left foot, and then the body maintains relatively stable; when the left foot leads the whole body to turn around the position right ahead of the basket of the position favorable for shooting, the tiptoe of the left foot begins to touch the floor. During the whole moving stage, the moving forms of the body remain the same, always under a rotating process. Therefore, the beginning of the turnaround stage is “the left foot leaves the floor” and the end of the turnaround stage is “the left foot begins to touch the floor”. Thus the beginning and end of the turnaround stage are the rotating foot begins to leave the floor and touch the floor. At the same time of the turnaround beginning to leave the floor, the core of gravity lies on the supporting foot so the body enters into a short period of single supporting. Nevertheless, when the rotating foot begins to touch the floor, the core of gravity returns to the one at the instant of catching the basketball and the body returns to the period of double supporting. The core of gravity is close to have no change during the turnaround (Jayashree, S., Malarvizhi, C. A., Mayel, S., & Rasti, A., 2015).

The braking stage (stage 2) is a linking stage after completion of the turnaround and before jumping and completing the shooting. It is a stage between the turnaround stage and the stage of thrusting on the floor and jumping. With the ending of the turnaround stage, the body gets a relatively big horizontal rotate speed and the body maintains the existing rotate speed. Thus the body has the trend to continue to rotate. To overcome this inertia, the body must complete the braking consciously. The touch of the moving foot on the floor means the beginning of the braking stage. At that time the body will have inertia toward. To overcome the inertia (Fujimori, D. L., Odo, B. M., & Smith, L. E., 2015), the moving foot should switch from landing on the tiptoe to land on the full foot, the body support should spread on both feet balanced, and meanwhile both knees should bend a little, and lower the core of gravity. Compared with the decline of the core of the gravity in turnaround stage, that in braking stage is greater. First, it is to overcome the inertia. Secondly it is to prepare for the following stage. Therefore the beginning and the end of the braking stage is the moving foot beginning to touch the floor and the feet completing the double support and remaining unchanged (Fujimori, D. L., Odo, B. M., & Smith, L. E., 2015).

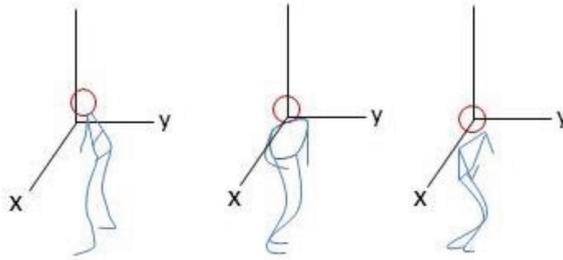


Figure 4 – Phase Diagram

$$T = d_2 / 2 \times F = L \times F \tag{5}$$

$$\eta = \frac{\tan \lambda}{\tan(\lambda + \phi_v)} \tag{6}$$

To analyze the technical actions of ten players more carefully, we add up the time in various stages they spent in terms of turnaround stage, braking stage, thrusting on the floor and jumping, catching in the air stage, and falling buffering stage.

No.	Swivel	Brake	Ground jump	Empty hand
1	0.3	0.2	0.2	0.28
2	0.28	0.12	0.34	0.34
3	0.38	0.08	0.22	0.33
4	0.32	0.1	0.19	0.4
5	0.36	0.12	0.31	0.23
6	0.29	0.08	0.24	0.51
7	0.4	0.08	0.31	0.29
8	0.31	0.1	0.28	0.22

Table 2 – Stage Time Table

From the table, we can see that the falling buffering stage cost the longest time, accounting 27 percent of the total front turning shooting; then is the 24 percent of the turnaround stage and catching in the air stage; then is the 18 percent of the thrusting on the floor and jumping, at last is the 7 percent of the braking stage.

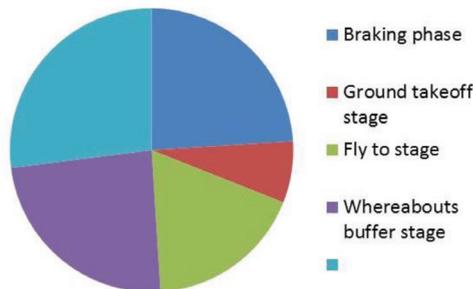


Figure 5 – Turnarounds Phase Time Structure

Kinematics analysis of the turnaround stage is shown as the following. During the turnaround stage, the heel of the moving foot is the first to leave the floor, then the front sole of the foot begins to leave the floor, and the tiptoe is moving towards the direction. The body switches from the stage of being supported by both feet to the stage of being supported by the fulcrum foot. With the movement of the moving leg, the hip joint extends, and the body move towards the direction of the tiptoe. The beginning and the end of the stage is till the moving foot touches on the floor. During the stage, the turnaround needs certain horizontal forces, which are the result of the thrusting on the floor of the supporting foot, the drive of the moving leg, and the generation of the waist and the stomach. The quality of the turnaround is the reasonable combination of the acting force on horizon and the moving speed. Somebody thinks turnaround is the rotation of the body (Levermore, R., 2015), and various turnarounds are the rotation and turning of the body.

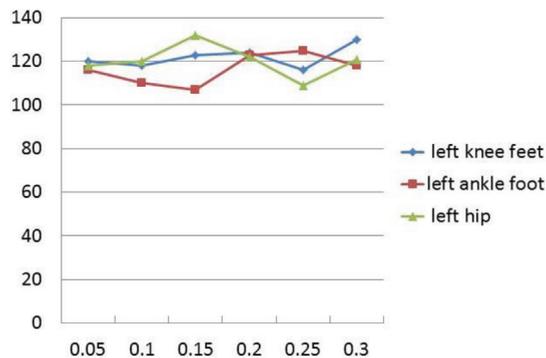


Figure 6 – Diagram of Phase Change

Therefore, the variation of the angle of the knee joint in the turnaround stage reflects that the different angles which are kept when the moving leg leaves the floor during the turnaround stage have reference to the body shapes in the period of turnaround. The angle variation of the ankle joint is a process where the player’s ankle joint angle decreases from the thrusting on the floor to the moving driven by the knee joint. The angle of the ankle joint is the result of thrusting on the floor. The hip joint switches from driving the whole body by the former active power generation to the inertia of the turnaround. The angles of the ankle joint and the hip joint reflect the muscular strength of the player’s ankle joint and hip joint, playing a determining role in the turnaround stage, and is an organic combination of the quick turnaround and stable turnaround.

Angle	0°	45°
Mean	0.268±0.096	0.244±0.098
T		1.395
P		0.235

Table 3 – In the Same Distance, the Comparison and the Analysis of the Time Features of 0° and 45° are Shown as the Following

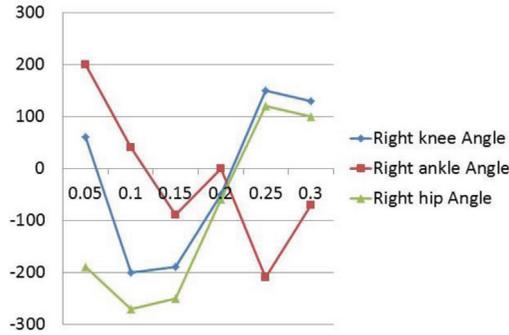


Figure 7 – The Curves of Angular Velocity of Each Joint

Support Angle (left)			
Angle	Knee Angle	Ankle Angle	Hip Angle
0°	107.859±33.616	131.572±38.965	137.852±40.612
45°	134.189±39.336	111.241±32.464	139.921±41.240
t	-1.62	-2.218	-1.263
p	0.112	0.031	0.213
Support Angle (right)			
Angle	Knee Angle	Ankle Angle	Hip Angle
0°	122.665±37.035	113.999±35.721	137.452±34.665
45°	128.965±39.787	112.648±29.452	143.564±34.893
T	-3.518	0.467	-3.848
P	0.001	0.642	0

Table 4 – In the Same Distance, the Comparison and the Analysis of the Angle Features of 0° and 45° are Shown as the Following

### 6. Conclusion

Through the analysis for the research objects, the main technical points of the turnaround dribble are found out. The force used to support the feet in the directions front and back of the turnaround in the same position is much smaller than the force to support the feet in the directions left and right of the turnaround in the same position. With the front turn and breakthrough in the same position, the front turn and jump and shoot in the same position, and the turnaround combined with the various following action, the force of the supporting foot has great change in the directions of left and right. The average angle of the knee joint of the supporting leg when turn around in the same position is 140.9°±12.9°, when front turn and breakthrough in the same position is 143.4°±6.4°, and when the turnaround and jump and shoot in the same position is 169.3°±7.8°. The front

turn and jump and shoot in the same position of the right hip angle of the moving leg are greater than the other two actions. The front turn in the same position does not have great difference with the front turn breakthrough in the same position. The front turn and jump and shoot in the same position of the left hip angle of the supporting leg are greater than the other two actions. The front turn in the same position does not have great difference with the front turn and breakthrough in the same position. The force in the vertical direction when the moving foot turns is the greatest force, then is the force in left and right directions, and the force in the directions of front and backward is the least. The speed of the joint marking point of the moving leg is greater than the speed of other two actions when front turn and jump and shoot in the same position, then is the front turn and breakthrough in the same position, the front turn in the same position is the slowest one. The angular velocity of the knee joint of the moving leg is smaller than the velocity of the other two actions when front turn and breakthrough in the same position; the front turn and jump and shoot in the same position is the fastest action; the front turn in the same position is between the two parties. Through those analyses of data, better data and reference can be provided for the development and improvement of basketball playing.

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# A Study on the Design of Computer-Assisted Learning System of English Vocabulary Based on Associative Memory Method

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**Abstract:** Education informatization is a new teaching conception, which has a close contact and inheritance with traditional teaching method, but simultaneously it also has relative independence. With the development of information technology including computer technology, multimedia technology and network technology, education informatization obtains strong technical support. Computer-assisted learning system of English vocabulary based on associative memory method is a new attempt that combines English vocabulary learning and education informatization. It is a learning method that can bring a new perspective of teaching and learning. For computer-assisted learning model, the design of computer-assisted learning system of English vocabulary based on associative memory method combines the characteristics of computer course teaching for English majors and associative memory learning. In order to achieve computer course teaching based on associative memory method in the network platform, the system is divided into user registration module, user login module, project management module, resource management module and each module is made outline design. The web server and platform components, Net framework, database technology and SQL server are used to implement the system. Computer-assisted system based on associative memory method can improve the learning efficiency and interests of English vocabulary learners.

**Keywords:** Associative memory method; english vocabulary computer system.

## 1. Introduction

Vocabulary is the basis of language. English proficiency and the ability of application depend largely on the vocabulary. Only by remembering a large vocabulary and grasping accurately the meaning of the words can we digest in full to practical application and achieve effective listening, speaking, reading and writing. English vocabulary is large and active, so the study on English vocabulary memory method becomes an eternal topic. At present, according to the principle of psychology memory, associative memory method is considered to be one of the effective methods. Association is a thinking activity which involves an experience or event reminding of another experience or event, or memory of an experience or event reminding of another experience or event. In the process of English

vocabulary memory, to start with familiar words, association links across and expands reasonably so as to form a language and knowledge chain of memories and to improve the effect of vocabulary memory. Mastering association in skills is one of the effective ways to improve vocabulary memory. In the view of psychology, the psychological function of human activity has certain regularity. In the process of association, there are three principal laws to follow: close association contrary association and similar association (Reynares, E., Caliusco, M. L., & Galli, M. R., 2014).

In 2010, Feng Naiqin et al proposed the morphological associative memory framework and made a deep research on the method of memorizing English vocabulary (Zhuge H., Sun Y., 2010). In 2010, Liu Lin et al analyzed the wide usage of computer-assisted system in college English teaching in the electronic portfolio assessment practice (Vesper K H., Gartner W B., 1997). Zhang Jielan and others in 2010 made a deep analysis on the advantages of computer- assisted system in English teaching (Sussner P., Esmi E L., 2011). In 2012, Wang Daoping et al analyzed how to use associative memory method to expand English vocabulary (Rashid I M A., Abdullah M F S., Yusuf B N M., et al., 2016). Xie Yinbao et al in 2012, discussed the design and realization of computer-assisted learning system of English vocabulary based on associative memory method (Sahoo M K., Gomkale M., 2015). In 2015 Lu Aifanget aldid research on how Vocabulary Peculiar Associative Memory Method improve English vocabulary learning by using the schema theory [J]. In this paper, the Microsoft Visual Studio 2010 is used as the program compiling platform. The C# and ACCESS database are chosen to achieve the design and realization of computer-assisted English vocabulary memory system based on associative memory method. Learners can learn with fun through this system, which is good for improving memory and English learning.

## 2. Associative Memory Method and Skills

### 2.1. Making Links

Although the capacity of short term memory is only 7 units, these are isolated, meaningless link of the unit. If we can make connections between these meaningful units, the capacity increases. All of the memory method are based on associations, and most of the associations are artificial.

For example: one is a bun, two is a shoe, three is a tree, four is a door, five is a hive, six are sticks, seven is heaven, is eight gate, nine is a line, ten is a hen. This is the use of rhyme in a notional word to establish a vocabulary to express order:

For example, if we want to remember a sequence of words: *submarine*, *bread*, *duck*, *shoe*, *crocodile*, *tree*. We can artificially establish connections like "submarine crushed a floating bread", "ducksquack in the shoes ", "a tree grew in a crocodile" to remember the word order.

Associative memory refers to a process in which learners make links between the original language system and the phonological, morphological and semantic features of the new words, in which the new words are adopted into the new system to combine with the

old system, so as to remember new words (Sulkowski L., Kaczorowska-Spychalska D., 2015). Therefore, the association can also be divided into the following categories:

1. **Phonological association.** There are a large number of phonetic similar words in English vocabulary. The phonetic features of new words make English learner associate the learned words in their brain. Phonological association is to find the same or similar word in the mental lexicon network schema for the purpose of memory. For example, if we encounter the word *here*, we would think of *hear*, and we would associate *pair* when we encounter *pear*, so as to further consolidate the memory of new words.
2. **Morphological association.** Morphological association involves derivative words and compound words, which occupy a large proportion in English vocabulary. The derivation, synthesis and conversion of words are achieved by means of word formation-derivation, compounding, blending, etc. For example, the similar words association. In English, there are many similar words, which have similar pronunciation and formation, but their meanings are different. This is a difficult point for us to learn the word, such as *vacation* and *vocation*. Another is the polysemy association. Due to the influence of historical, social and psychological factors, the meaning of words are constantly changing in the long history, so polysemic words are not uncommon. For example, degree (level; prescription; qualification), sharp (incisive; sensitive; pungent; sudden, etc.) In addition, morphological association also includes the synonym association and near synonym association. Of all the languages, English has the most synonyms. The action *look* can be express differently in many ways, such as: see, look, watch, glance, glare, stare, peer, etc.
3. **Semantic association.** Among the words in English vocabulary, as long as the meaningful semantic relations are established, a word will help learners associate a series of related vocabulary to achieve associative memory. For example, when we refer to the theme *wedding*, we immediately think of *bride*, *bridegroom*, *engage*, *gown*, *bouquet*, etc. Then we would also think of *church*, *priest*, and next *attend*, *gather*, *together*, *party*, *gift*, *wishes*, and *happiness*, *travel*, *game* etc.

## 2.2. Activating Schema

To say it informally, "schema" means the original knowledge and experience. The word first appeared in the works of the German philosopher Immanuel Kant. Then German psychologist Bartlett put forward "schema theory". In the 1970s, American artificial intelligence expert Rumelhart improved the theory. The main point of schema theory is that when people try to understand new things, they need to connect new things with the original concept of past experiences. Understanding and explaining the new things rely in the schemas which already exist in mind, and the input information must be consistent with these schemas.

### 1. Contextual schema

Context can be a discourse, situation and cultural context. Learners can combine the learning and using of the vocabulary in a context, which is currently recognized

as the best way to learn vocabulary. Teachers should create a context to let students contact the new and the old words and other knowledge. Learning vocabulary by context schema also includes reproduce the new words in specific context. The basic method is to make sentences with new words and to use the new words as teachers' classroom language; secondly the words can be placed in reading comprehension; moreover, students can be required to use the new words in writing or speaking.

2. Semantic and the event schema: by means of semantic schema, to guide the students to associate the synonym, near synonym and antonym of old words; by means of semantic schema and metaphorical thinking, to guide the students to guess the extended or figurative meaning of the word, and to take this opportunity to understand and memorize fixed collocation; by means of event schema, to guide the students to think divergently, and to add relevant vocabulary related to the event or topic; by means of root, affix schema, to enlarge vocabulary; by means of cultural semantic schema, to increase the interestingness of vocabulary and to promote the understanding and memory. In the teaching process, the teacher can input certain cultural background knowledge so as to activate the corresponding schema of students in order to improve the efficiency of memory. Students face difficulty when they study *as cool as a cucumber* (which means *very cool*), but if the teachers can start from the cultural background knowledge, students would not be difficult to memory this word.

### **3. Computer-Assisted System for Teaching Method Design**

Instructional design is a planning process and operation procedures to analyze and to research teaching problems and teaching requirement by means of systematic and scientific method, to identify and address teaching strategies, teaching methods and teaching steps and to evaluate the teaching results (Uzunboylu H., Cumhuri M., 2015). Combined with teaching technology and classroom instruction design method, instructional design of the project learning system mainly involves gathering related knowledge in terms of the project requirements and reasonably selecting information resources according to the characteristics of learners, and setting up system resources library and to provide communication tools for project learning, to achieve on-line communication between learners and to create the situation of project, to provide evaluation system for self-evaluation by learners and evaluation by teachers. The design method of project teaching learning system is shown in figure 1:

#### **3.1. Demand Analysis and Function Positioning of the System**

The demand analysis of English vocabulary of computer-assisted learning system is designed based on associative memory method. Through extensive investigation and research, to fully understand the English vocabulary associative memory method and the development process of computer-assisted system. The system analyzes the advantages and disadvantages of teaching in the current secondary school learning system and then determine the feasibility and necessity of computer-assisted learning system of English vocabulary based on associative memory method (Dursa E K., Barth S K., Schneiderman A I., et al., 2016). In addition, the function of the system mainly is:

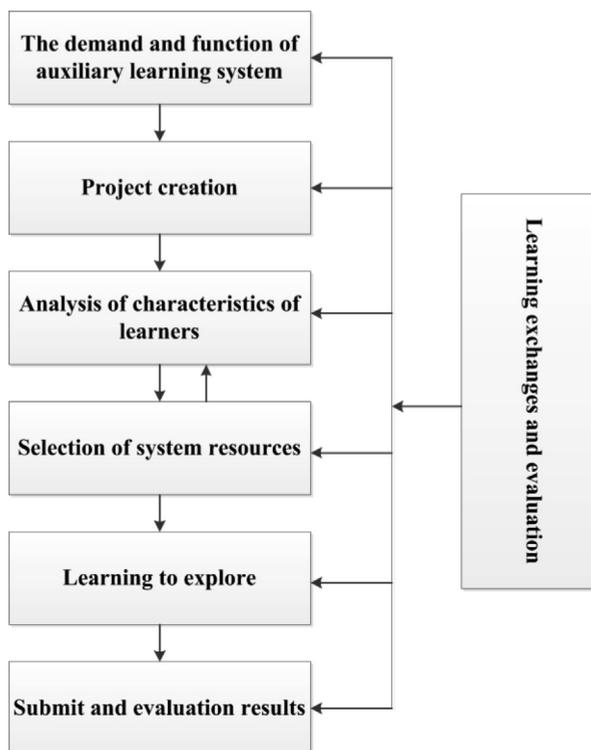


Figure 1 – Project Teaching Learning System Design Method

creating associative memory method of English vocabulary assisted learning project to study the features of learners so as to create resource system repository. Learners can collaborate, communicate and self-inquiry in the project. The results of project would be submitted and evaluated automatically.

### 3.2. Create Vocabulary Association Computer-Assisted Learning System

English vocabulary associative memory method teaching is achieved by the following modules: vocabulary filing, filing of typical examples, wrong words query, score query, memory test, data backup and data recovery, error handling, options, and help menu.

1. Vocabulary filing: vocabulary collection includes operations like adding, editing, deleting, browsing vocabulary. It is one of the core functions of the AM.CALS. It is the principle part of the implementation of associative memory, that is, the contexts of memory.
2. Filing of typical examples: collection of the typical examples includes operations like adding, editing, deleting, browsing typical examples to expand the usage of vocabulary learning.
3. Wrong words query: to record the wrong words according to the user name query, so as to realize the memory of repeated words.

4. Score query: to inquire results one or multiple according to the user name and automatic calculation of average scores which objectively reflects memory effect within a period of time.
5. Memory test: for polysemy, according to the "options" function to determine the difficulty coefficient and random selected vocabulary, learners can implement vocabulary associative memory. Within the specified range of word order or random memory test, learners can choose to translate Chinese into English or English into Chinese. After they submit, the score appear automatically. The mistakes that learners made are automatically saved to the mistake words data sheet, so as to inquire and repeat memory. Repeated memory is necessary when learners use associative memory method.
6. (6) Data backup and data recovery: disk fault tolerance technology prevents file insecurity caused by partial disk failures. For the security of the data, the system provides data backup and data recovery function. Data can be backed up to the mobile storage devices and can be backed up to the other partitions. Once the system data is destroyed, the data can be recovered from the specified backup storage devices.
7. Error handling: the backup system prevents non-secure errors caused by natural factors of. That is, the storage medium data may overflow or gradually disappear as time goes on. The system provides automatic repairing function when sudden power failure occurs.
8. Options: the system default setting, such as a memory test difficulty coefficient 1.0 - 5.0 and random memory selected 1 - 99 words.
9. Help menu: to provide help to the user. Users can enter the problem, and the system automatically retrieves help information.

### **3.3. The Selection and Design of Information Resources**

Information resources in English vocabulary learning system are all the resources that learners use in the associative memory learning process. Different associative memory methods require different learning resource. Due to the different starting point and learning interest of learners, the demands of resources are also different. In the selection and design of the system resources, the targets must be specified. On the basis of the media choicetheory, the resources library should be created according to the characteristics of learners and the demand of associative memory.

### **3.4. The Design of Independent Study**

Independent study is self-learning and self-exploration by learners. The common methods include scaffolding instruction and anchored instruction (Chung C, Han D., Gustavson S M., et al., 2015). In English vocabulary computer-assisted learning system, the learners use information resources to study and discuss independently for certain purposes, promoting the learners to construct the meaning of knowledge. In English vocabulary computer-assisted learning system, independent learning and collaborative learning constitute the complementary ways of learning in associative memory, which can help student master English vocabulary learning methods and strategies.

## **4. Development Techniques of Learning System Based on Associative Memory**

Through the investigation, it is found that there is a certain gap between the actual computer courses teaching and demand. As a supplementary means, the computer network technology design and implement the computer-assisted learning system of English vocabulary based on associative memory method. The design and development of project learning system mainly relate to server technology, net framework technology, database access technology, database technology and main algorithms of technology.

### **4.1. Web Server**

Server software is mode which is adopted in the C / S and B / S. according to the framework, it can be divided into two camps: web server that supports J 2EE and web server that supports .NET. Of course, some web servers support both J2EE and.NET. The following is a brief introduction to the common Web server.

#### **1. IBM Web Sphere**

IBM Web Sphere is based on Web Sphere Application Server. It is software platform for IBM and it supports J2EE. It contains web applications for preparation, operation and monitoring and middleware techniques for cross platform solution, such as servers, services and tools. Based on Java, it provides the foundation of application program which has service oriented application (SOA) and supports the application of business rules to drive t business process applications. WebSphere can be run on many platforms, including Intel, Linux, and z/OSA.

#### **2. BEA Web Logic**

Weblogic is an application service produced by American BEA. It is a middleware based on J2EE framework. The BEA Weblogic is Java application server for the development, integration, deployment and management of large-scale distributed web application, web applications and database applications. The Java dynamic function and security of Java enterprise standard are introduced to the application, development, integration, deployment and management of large-scale network. At the same time, it occupies a large share of the market because it has the performance, scalability and high availability which was needed to deal with the problems of key web application system. Like database and mail server, WebLogic server is not visible to customers and it serves for customers who connect to it. WebLogic servers for Internet or Web on the internet services to provide secure, data driven applications. Currently the latest version is Server WebLogic 10.3.

#### **3. Apache Tomcat**

Apache ranks the first in web server software currently with around 60% market share. It supports J2EE applications. Because of its open source code, support for cross platform applications such as UNIX, windows, Linux, transplantation and open development

team and other functions, it is one of the most popular web server software. Tomcat is a core project in Jakarta project of the Apache Software Foundation. It is developed by the Apache, Sun and some other companies and individuals. Tomcat is mainly used for small systems and servers that the concurrent users are not large-scale. It is the first choice for development and debugging JSP program. Because Tomcat is advanced, stable and free, it is welcome by the Java enthusiasts and recognized by some software developers. It has become a popular web application server. At present the latest version is 7. 0, which achieves the supports for servlet 3.0, JSP 2 and El 2 and other characteristics. In addition, it adds functions such as the detection and prevention of web memory leak, the management of program security and CSRF protection.

#### 4.2. NET Framework

Because the system adopts the Windows system as a server operation system and the .NET framework, this section introduces the.NET technology. The .NET technology was based on the Internet for the construction of a new operating system extends the design of Internet and operating system to enable programmers to create independent applications. It is easier to implement Internet connection. To meet the various needs to the devices of users is the ultimate goal of .NET, it is also the value of.NET. .NET platform contains three basic components: CLR, .net development tools, .Net class library. The versions of .NET have been from.NET1. 0 to .NET 4, as shown in table 1.

Version	Full version	Date of issue	Visual studio	Default installation
1.0	1.0.3705.0	2002-02-13	Visual Studio .NET	
1.1	1.1.4322.573	2003-04-24	Visual Studio .NET2003	Windows Server2003
2.0	2.0.50727.42	2005-11-07	Visual Studio2005	
3.5	3.5.4506.30	2007-11-06	Visual Studio2008	Windows Server2008
4.0	4.0.30319.1	2010-04-12	Visual Studio2010	

Table 1 – Version Development

#### 4.3. Database Access Technology

ADO. Net is a generic interfaces provided by Microsoft company. It experienced several major improvements over the years: ODBC—>OLE DB—>ADO—>ADO. Net. ADO. Net data model was developed from ADO, but it is not just the improvement of ADO but using a new technology. It is mainly expressed in the following aspects:

1. ADO. NET is the product of the close combination with the.NET framework.
2. ADO.NET includes full support for the X'VIL standard which is of great significance to the cross platform data exchange.
3. ADO.NET can work in the environment whatever it is connected with the data source.

#### 4.4. Database Technology

A database is a repository for organizing, storing, and managing data in accordance with the data structure". Common database includes: DB2 (IBM), Oracle, FoxPro, database,

Access database, My SQL, PostgreSQL, SQL server. The combination of data and resources becomes network database which is widely used today. Network database has three meanings: database on the network, database that contains other user address; database in which data record can be connected in a variety of ways in information management.

#### 4.5. Primary Algorithm Design

##### 1. User Password Encryption Algorithm

The technical safety measures that AM-CALS is employed are the establishment of a dedicated user registration and access control list. It can prevent undelegated personnel from intruding the system by the validation and verification of user's legal identity. It can not only share system resources but also prevent the undelegated operation through access control permissions, functioning as effective protection for resources. The delegation to user is realized by defining the type of operation. That is to say, it is achieved by defining the system resources read (Read), Write, Execute. Delegated users are divided into three categories, see Table 2.

The legitimate user name	Password	Access control permissions	Note
<i>Supervisor</i>	The system administrator Settings to use	RWX (all permissions)	The system administrator
<i>Guest</i>	password-less	X (enforcement)	Customer does not save the Settings of the password
<i>General user name</i>	Modify the system administrator	By the system administrator	change

Table 2 – Classification of the User

If a user wants to use system resources, he should first put forward an application. The system administrator then adds and registers user name, and defines access control permissions. He then notifies the user to register, and set his own password (Sagaran J V., Indla R., Roy R., et al., 2015). If the user registration and access control list in the data is easy to be read, the password becomes meaningless and therefore password is employed encryption storage technology. The principle and the encryption algorithm show as follows: password (< = 10Byte) - > coding (encryption), the ciphertext 30Byte, decoding (decode), password (< = 10Byte).

Encryption algorithm: ciphertext = str (ASC + A + B\* (password) mod (recno), (C), 3) A, B, C is a prime number.

##### 2. Memory test algorithm

English vocabulary associative memory tree is shown in Figure 2. An English word can associate to  $n_1$  meanings,  $n_2$  synonyms,  $n_3$  antonyms,  $n_4$  phrases,  $n_5$  sentences.

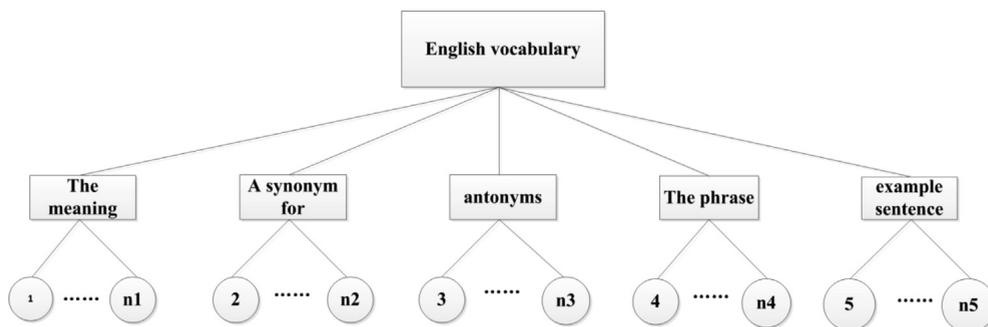


Figure 2 – Lenovo tree English vocabulary association memory method

## 5. Function Module Realization of Computer-Assisted Learning System

### 5.1. Design and Realization of User Register Module

Learners in project learning system are playing different roles: teacher, headman, members. Teachers are allocated when the database is designed. Headman and members of the project must register to become users of the system and then to learn in project system (Zhang W H., Jiang H Y., 2015).

#### Account information

The user name:

The name:

Gender:

The phone:

E-mail:

Password:

Confirm password:

Create a user:

Figure 3 – The User Registration Screen Display

The system adopts .Net member management program technology and role management program technology to create system users and manage the user membership and user roles. If the user membership is created successfully, it will trigger user creation event, in which other user information is collected again such as name, student number, etc. Its initial role is set as student. If the information is collected unsuccessfully, the event rolls back, that is to say, user membership will be deleted (Peñaloza-Salazar C., Gutiérrez-Maldonado J., Ferrer-García M., et al., 2015).

## 5.2. Realization of User Login Module

The login module is the basic module of the project learning system and the only entrance to enter the system for learners, teachers or administrator. Based on the network learning system, the user enters the project learning system through the login module (Zaiceanu A M., Hlaciuc E., Lucan A N C., 2015). Because the project learning system is developed for assisting teachers in computer courses teaching, learners must log in the system first. Users belong to different roles: teachers and learners in the login system. The teachers do not need to log in because they are collated when the database is established.

For users who do not register, the system will prompt the user that the login is unsuccessful and they need to register or try again.

## 5.3. Design and Realization of Project Management Module

Learners in project learning system achieve to study the relevant knowledge in project. Learners join the project team with a certain identity, and play different roles to complete tasks in the project. Therefore, the project learning system of project management is particularly important.

Project learning tasks of project management system are undertaken by the administrator / teachers, including the creation of new project tasks, the management of project status, and management of project team members, as shown in Figure 4.

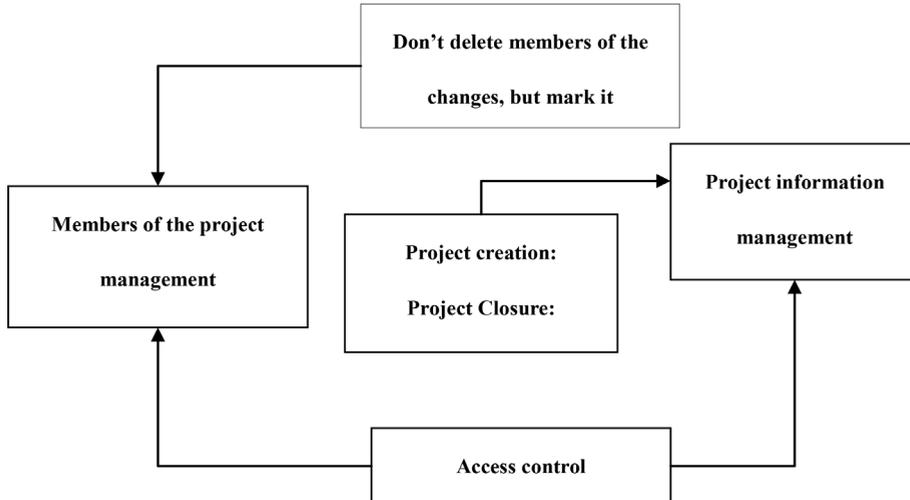


Figure 4 – Project Management Profile Design

## 5.4. The Design and Realization of Resource Management Module

Learning resources refers to all the resources that can be used by learners to complete the learning in the process of learning, including specially designed learning resources and nonspecifically designed learning resources, such as text, system environment.

In traditional teaching environment, individualized and personalized learning is an ideal pursuit, which has rare effect. The project learning system resources for network learning makes it possible to teach students in accordance with their aptitude. Learning has become a large-scale process in which everyone can obtain what he need and personalized learning can become reality. In project learning system, the network learning resources of project team members are added by the project group headman from the project resource system. Thus it can avoid that the project members go wild learning in the massive learning resources and make learning more targeted. Learners may choose their own learning resources according to their own learning style. In project learning process, teachers can add project learning resources that are useful and valuable.

Resource management module is to achieve the learning resources management. The project learning resource database system is divided into resource repository system, project resource library and resources library for learners.

#### 1. Realization of resource system management module

The system resources in the project learning system are stored according to the knowledge module in "basic requirements". Resource Add event is triggered by teachers when they update the resource repository system resources of resources type, size, and resource name are judged by this module. When the system resource is deleted, it triggers the Delete Resource event (Peñaloza-Salazar C., Gutiérrez-Maldonado J., Ferrer-García M., et al., 2015).

#### 2. Realization of project resource management module

Project resource management module provides the related learning resources to meet the needs of members. Headmen update the system resource database to complete the project resource database. It triggers Resource Allocation event when the project resource database is updated.

#### 3. Realization of examination resource management module

Project members obtain the current project learning resources through examination resource management module.

## 6. Conclusion

Associative memory method is an important part in English learning. It makes a good use of the principle of associative memory method. This system can provide a platform for English vocabulary memory. It is easy to operate and with good commonality (Daniel M J., Pazhani A., 2015). The learning system based on associative memory method is a combination of associative memory method and modern computer system. Based on pedagogy, psychology theory and researches, it adopts information technology, multimedia technology and network technology to operate in the network of media to assist English vocabulary learning. This paper describes the design method of the application system, development techniques, realization of the system module and so on. The system is divided into user registration module, user login module, project management module,

resource management module and each module is made outline design. The web server and platform components, Net framework, database technology and SQL server are used to implement the system. Computer-assisted system based on associative memory method can improve the learning efficiency and interests of English vocabulary learners.

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# Research on the Education Salary Resources Based on Computer Incentive Mechanism Mathematical Model

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**Abstract:** Researchers and scholars from the computer application research field always emphasize the importance of computer incentive mechanism. In this article, a computer incentive mechanism mathematical model of the education salary resources is presented focusing on the current salary incentive pattern of education industry and its deficiencies. Based on the features of education industry, this mathematical model of incentive mechanism adopted by the users of education salary resources is designed and realized by applying the theoretical knowledge to the practical operations in way of computer mathematical modeling. Furthermore, computer stochastic simulation is adopted to verify the model's feasibility. The establishment of teacher salary incentive optimization model indicates the emphasis on both safety and effectiveness. In this research, a new incentive mechanism is proposed based on the incentive idea of relative performance and the advantages of "education salary voucher"; it encourages the user "to use with vouchers; to accumulate credits; to settle accounts regularly; to receive awards" The field research reveals that the computer incentive mechanism is an important measure to stimulate users to actively use the salary resources, and it also provides solid basis for the scientific allocation of education salary resource's funds.

**Keywords:** Education salary resources, mathematical model, incentive mechanism.

## 1. Introduction

The application of incentive in education involves two aspects. One is student incentive, which means how teachers use incentive theories to arouse students' enthusiasm of studying; the other is teacher incentive, which means how to use incentive theories to arouse teachers' enthusiasm of teaching. Incentive theory plays an important role in the working enthusiasm of teachers. Based on different teaching periods of teachers, the research on teacher incentive can be divided into college teacher incentive, middle school teacher incentive and primary school teacher incentive. There are a lot of essays regarding "teacher incentive" on CNKI (China National Knowledge Infrastructure). When typing "college teacher incentive", there are 9089 essays. When typing "middle

school teacher incentive”, there are only 2455 essays. When typing “primary school teacher incentive”, there are only 2313 essays. It shows that the researches on college teacher incentive are much more than that of middle school teacher incentive and primary school teacher incentive (Ualikhanova, B. S., Rumbeshta, E. A., Baizak, U. A., Turmambekov, T. A., Sarybaeva, A. H., & Kurbanbekov, B. A., 2015).

Specifically, the research is about the discussion of incentive theory, and the incentive measures taken on teachers and students based on western incentive theories. Involved with what incentive should be used and how to use the incentive, incentive theory consists of two aspects. The first one is the content-based incentive, which focuses on what incentive is used, including Maslow’s Hierarchy of Needs, Frederick Herzberg’s Two-Factor Theory (Hygiene-motivational Factors) and McClelland’s Achievement Need Theory; the second one is the process-oriented incentive, which focuses on the method that the incentive used, including Vroom’s Expectancy Theory, Adams’ Equity Theory and the famous American managerialist Drucker’s Management by Objective, etc. To effectively promote the working enthusiasm of the teachers, the most important is to eliminate the unfair perceptions of them. Adams’ Equity Theory can be conducted to assure the incentives on college teachers are just and equitable (Chaabia, R., Bounouala, M., & Boukelloul, M. L., 2015). The research on teacher incentive mechanism mainly include the incentive measures of incenting teachers and how to innovate based on current incentive mechanism (Galván, J. B., Recarte, L., & Pérez-Izarbe, M. J., 2014).

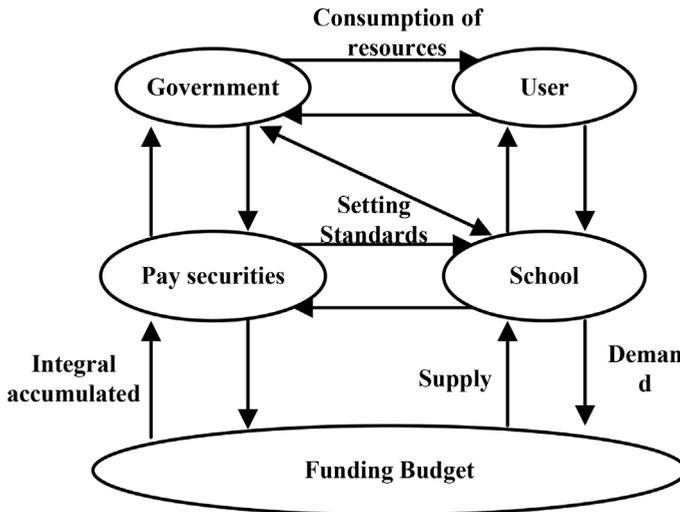


Figure 1 – Incentive Process of Education Salary Resource Utilization

This paper mainly discussed the strategy of promoting the overall utilization of regional education salary resources from the perspective of user incentive. Based on consumer psychology, the study started from the analysis of the features of education salary resource and the process of users employing education salary resources, and proposed to use regional education salary resources with “Education salary vouchers” (Bondarenko, O. I., 2015); then applied the accumulative credit method for the information resource utilization of the users, settled regularly (one year or one term) according to the

accumulative credit exchange rate and allocated related funds to the school; it studied and made full use of mathematical model's bridge advantage of bringing the theoretical perception to practice, preliminarily constructed the mathematical model of school's obtaining incentive funds through education salary resources. Meanwhile, the paper verified the feasibility and operability of the mathematical model by conducting computer stochastic simulation so that to provide certain referential value for the improvement of education salary resource utilization performance (Lal'Arya, M., 2015).

## **2. Researches on Education Incentive Theories**

The sharing of education salary resources is very important in promoting the application of them. It is one of the important ways of realizing the fairness of education salary resources and narrowing the digital gap of them. The urgency of the sharing of education salary resources is being more and more concerned. Some places such as Wu Xi already attempted to share the education salary resources (Benneaser, J. O. H. N., Thavavel, V., JAYARAJ, J., Muthukumar, A., & JEEVANANDAM, P. K., 2016). However, the construction and sharing of education salary resources are also influenced by multiple factors. First, the idea factor is one of the core factors. Idea plays an important role in the sharing of resources because real actions are based on the change of idea. The idea factor mainly refers that the sharing consciousness of education salary resources is weak and people are used to the self-sufficient way; the narrow-minded egalitarianism idea makes people not willing to share resources; people have weak consciousness who pay more attention to the construction of resources but seldom make full use of them, and the owners with abundant resources are not willing to share their resources with others. Secondly, management factor is also a significant factor. For example, the management mechanism needs to be improved to further promote the sharing mechanism, and the policies on resource sharing are also needed to lead the sharing with detailed execution strategies (Stavnås, C. C. M., & Nielsen, L. M., 2015). Besides, problems as imperfect sharing mode and lack of principal functions of sharing parties also existed in the sharing of resources. Hence, it is important to construct a reasonable sharing mechanism of education salary resources. The construction of a perfect resource sharing mechanism is a systematic and complicated process. (Oliveira, J. A., Ferreira, J., Figueiredo, M., Dias, L., & Pereira, G., 2014) The completeness and reasonableness of the system planning is crucial. The sub-mechanisms include funds protection mechanism, standard mechanism, incentive reward mechanism, resource access mechanism, evaluation feedback mechanism, management mechanism and innovation mechanism, etc. With these sub-mechanisms, the effective and reasonable operation of the sharing mechanism can be assured. Based on the information ecological ideas, the education salary resource sharing model can be constructed from the resource, user and service perspectives, through which to discover the relationship between each other and lay the basis for the resource sharing practice. The education salary resource sharing mode is to construct regional education salary source base (Lunga, W., & Musarurwa, C., 2016). One region (a county or a city) shares one central resource base. All the teachers and students in the region have the change to enjoy the high-quality education salary resources. It is recommended for multiple parties as the government, schools, enterprises and experts to attend the construction of source base. As the executor of the education salary resource sharing, the government is responsible for the plans of the construction and utilization of the

education salary resources in the region, asks enterprises to development high-quality education salary resources and encourages schools to use the resources. The enterprises develop high-quality education salary resources according to the demands of the users. Schools become the simple users instead of both the users and the constructors. They bring up feedback and evaluations to resource constructors when using the resources, and make the developers constantly improve the quality of education salary resources. As a result, a government-oriented, enterprise-developed and school-used sharing mode is created (Xiong Caiping), which maximized the effect of the resource allocation and the fairness of education, and accelerated the information pace, with the original education investments keeping unchanged (Quintana, M. G. B., & Zelaya, D. S., 2015).

### **3. Construction of User Education Salary Resource Incentive Mechanism Mathematical Model**

#### **3.1. The Idea of Construction of Incentive Mechanism Mathematical Model**

The construction idea of education salary resource user incentive mechanism mathematical model is: to use with vouchers; to accumulate credits; to settle accounts regularly, credits exchange and incentive basis. The forms of user accumulated credits mainly refer to the use frequency, including the visit frequency and use duration. When the user is extremely interested in a certain resource or think it is necessary to learn more about the part, he/she can choose to download the source for use (Lima, P. C., & Piacentini, V. D. Q., 2015). Download for use is considered as the saturation use of a certain resource. One download can obtain the maximum credit value of the resource. "Visit" is a browsing way adopted when the user wants to know about the quality of a certain resource or whether the resource is important or not, or when the user's browsing duration has not reached the time limit (e.g. 1 minute) due to his/her misoperation or other reasons. It will be counted as one visit with the default value (e.g. 1 credit) to accumulate credits; use duration refers to the online study of the user. When the user chooses to study online, usually the credits are accumulated by the ratio of the real time used and the total time of finishing the study of the resource in one time. "To settle accounts regularly" setup a certain settlement period (a quarter, half a year, or yearly) according to the real education or study. The resources in the information resource base are designed and developed according to a unified standard. Different resources have different functions and purposes. The users in the region are also from different grades or subjects with different demands and preferences of the resources. In a certain period, the users may obtain different accumulated credits. "To receive rewards" means the incentive funds that the school obtained. Usually in a statistic settlement cycle, the funds are obtained by the credits exchange rate of incentive funds. The exchange rate is the ratio between the total incentive funds that the authorities allocated the school and the total accumulated credits of the user (Youn, M., 2015). Different schools are given different incentive funds. The more the education funds resources, the more the incentive funds and the higher the expenses used for improving teacher salary level and training of users. The higher the education level of the school is, the higher the "consuming" potential in the school education salary resources will be, which will be a virtuous circle (Schilder, J. D., Brusselaers, M. B., & Bogaerts, S., 2015).

### 3.2. Establishment of Incentive Mechanism Mathematical Model

The utilization of education salary resources is a complex dynamic process. In order to highlight the conciseness and accuracy of mathematical model and to fully illustrate the user incentive mechanism of the regional education salary resources, the following assumptions are made during the establishment of the mathematical model: (1) In the administrative region of this study, different schools have different numbers of users (teachers and students); the total users number within a certain region will not have significant variations in a given settlement cycle, and it is set as a constant (Cebotari, V., & Mazzucato, V., 2015). (2) During the co-constructive and shared resource design development process, new education salary resources will be developed and utilized in batches; both the quality and quantity of the resources invested in this region have no significant changes within a school year. It is also assumed that in the settlement cycle, the quality and quantity of the resources in the education salary resource base of this administrative region have no big changes. And generally, it has no influence on users' utilization frequency of the education salary resources. (3) To spend the funds, schools should actively improve their information network environment and carry out various incentive measures to encourage users to frequently utilize their education salary resources; the incentive measures include spiritual encouragement, emotional concern, and financial rewards and so on (Buyse, V., Peisner-Feinberg, E., Soukakou, E., Fettig, A., Schaaf, J., & Burchinal, M., 2016). (4) Users can be affected by both internal and external factors when using the education salary resources. In a certain time period, users' utilization of education salary resources is a dynamic and randomized process, which is reflected in variable accumulated credits obtained by the users; for this reason, it is set as the random variable (Botha, J., & Kourkoutas, E., 2015). The basic symbols used in the establishment of the model are listed in Table 1.

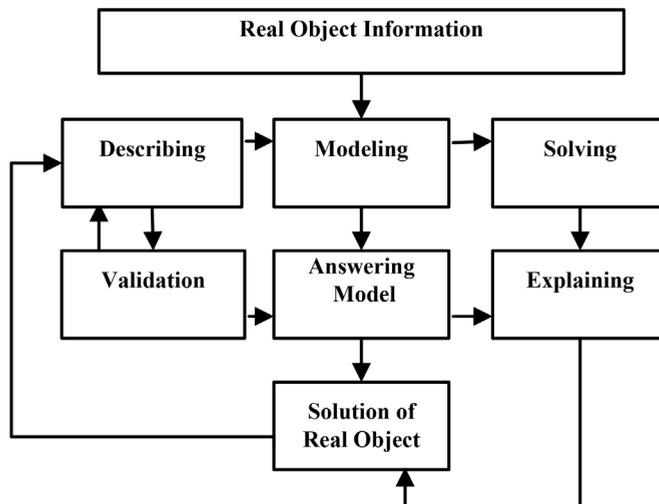


Figure 2 – Mathematical Modeling Process

In the administrative region, the incentive funds a school receives are determined by the number of users, the accumulated credits of the resources and its exchange rate:

$$F = f(Q, E, C) \tag{1}$$

In this equation, E is the exchange rate of user accumulated credits; it is the ratio of P (the total allocation the government invests in education salary resources) to  $I_u$  (the total accumulated credits of all the users):

$$E = P / I_u = P / \sum_{k=1}^U C_k \tag{2}$$

Where, C stands for the accumulated credits of a single user within a settlement cycle, namely, a school year. All the resources in the resource base are divided according to the same technical standard. The user will be able to acquire the maximum accumulative value M as long as he (or she) can make the best use of the resources no matter which kind of resources he (or she) is using. The accumulated credits of a single user are composed of three parts: credits accumulated by downloading the resources (CD); credits accumulated by using the resources online (CT); credits accumulated via the access to the resources (CV). It can be expressed as following:

$$C = C_D + C_T + C_V \tag{3}$$

Put Equation (2) and (3) into Equation (1) to form Equation (4) to calculate the incentive allocation of each school obtained through the utilization of education salary resources can be calculated:

$$F = I * E = \sum_{j=1}^Q C_j * (P / \sum_{k=1}^U C_k) \tag{4}$$

According to Equation (4), under the condition of the same exchange rate of accumulated credits, the incentive funds a school receives are closely related to its total accumulated credits. The total accumulated credits are determined by the number of education salary resource users as well as their utilization frequency and duration of the resources (Greco, P. M., 2015).

The optimized annual salary model is made up of three parts: annual salary income model  $C(t)$ , variable annual salary deferring mechanism  $D(t)$ ; annual salary payment model  $C(t)$ . In this model, the annual salary income model  $C(t)$  is not equivalent to the annual salary payment model  $C(t)$ . Generally,  $C(t) < C(t)$ .

The optimized annual salary model is:

$$C(t) = B(t) + P(t) + E(t) + S(t) \tag{5}$$

It is the annual salary income model, including the relatively fixed income and the variable part.

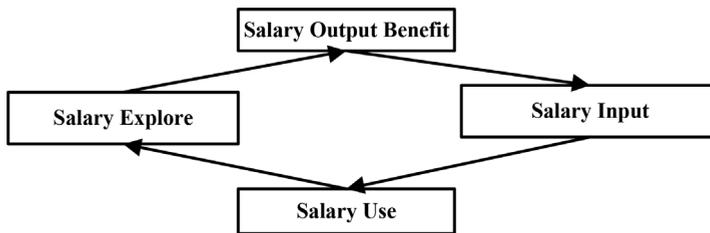


Figure 3 – Flowchart of Education Salary Resource’s Allocations

#### 4. Data Analysis and Simulation of the Mathematical Model of Education Salary Resource Incentive Mechanism Adopted by the School

School number	Users	Education pay securities	Accumulated integral	The exchange rate	Funding
<i>S1</i>	1838	73.52	402.79	0.06	24.16
<i>S2</i>	1692	67.58	18.08	0.06	1.08
<i>S3</i>	1981	79.24	306.74	0.06	18.41
...	...	...	...	...	...
<i>S257</i>	1457	58.28	11.74	0.06	0.70
<i>S258</i>	968	38.72	211.54	0.06	12.69
<i>S259</i>	1054	42.16	69.30	0.06	4.15

Table 1 – Simulation of School Accumulated Credits and Incentive Funds’ Variations

The simulation diagram of school accumulated credits and incentive funds’ change can be obtained by analyzing the above data (see Figure 4).

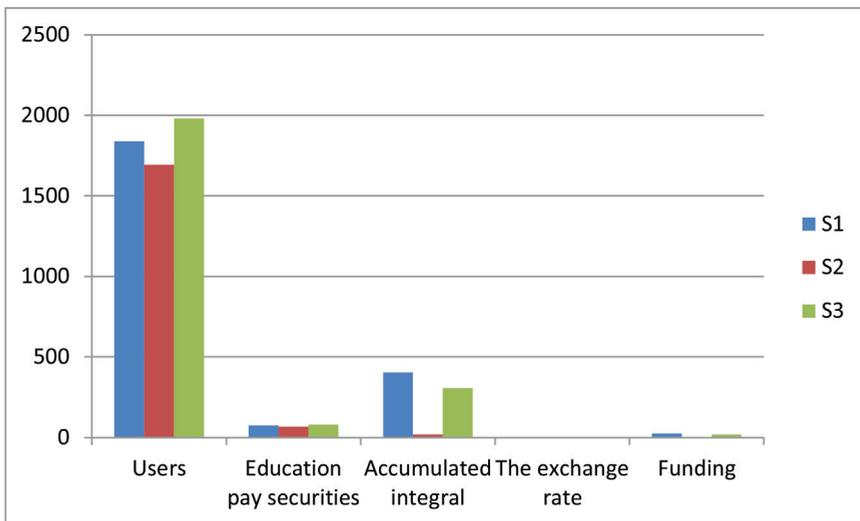


Figure 4 – Simulation Diagram of School Accumulated Credits and Incentive Funds’ Variations

According to the above incentive mechanism, it can be assumed that the limit of each user’s education salary voucher issued by the government is 400 yuan, and the user can get 1 credit when he (or she) “spends” 1 yuan of his (or her) education salary voucher. As shown in Table 2, the number of users in school S2 is 1838, and its pre-obtained education salary voucher is 735,200 yuan; the number of users in school S2 is 1692, and its pre-obtained education salary voucher is 675,800 yuan. However, the number of education information voucher of a school does not mean its “consumption” capacity. The usage of the resources can only be reflected by the total accumulated credits the users get after using their education salary resources. In the end of the school year, school S2 accumulated 180,800 credits in total; the pre-obtained education salary voucher of school S259 is 421,600 yuan, but S259 accumulated 693,000 credits. It indicates that the resource utilization frequency of S259 is much higher than that of S2.

Users	Integral range	Average
5000	10472-13130	11698
5500	11422-14131	12773
6000	12388-15216	13959
6500	13817-16156	15171
7000	14825-17750	16276
7500	16169-18778	17576
8000	17467-19872	18628

Table 2 – Variation Range of a Single Resource’s Accumulated Credits

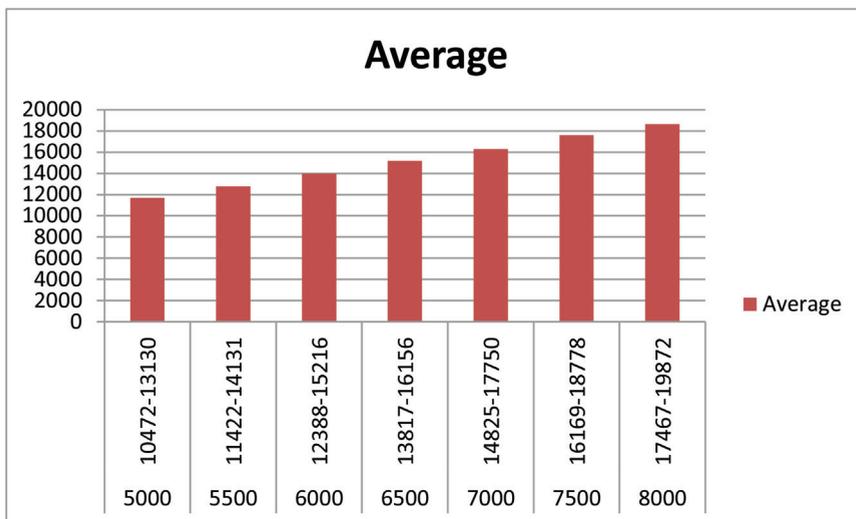


Figure 5 – Diagram of the Variation Range of a Single Resource’s Accumulated Credits

According to the mathematical model of incentive mechanism, the actual amount of incentive funds a school receives equals to the product of the total accumulated credits

that a school obtains by spending its education salary resources and the exchange rate of the accumulated credits. The intra-regional average credits stand for the average credits every user obtains by spending education salary resources within a settlement cycle; the intra-regional average credits is calculated by dividing the total accumulated credits of the region by the total number of users in this region. If other conditions are the same, theoretically, the amount of incentive funds a school receives is closely related to the number of its users. In other words, a school can receive more incentive funds if its number of users increases. Based on the above simulations, the total accumulated credits the school gathers and its exchange rate can be finally obtained; then, the actual incentive funds that the school will receive can be calculated. In Figure 5, the variations of these 5 schools' actual incentive funds and theoretical funds are illustrated.

Year Project	2012		2013		2014	
	Amount	Amount	The growth rate	Amount	The growth rate	
<i>Education funds</i>	56,332	55,573	-1.35%	61,254	10.22%	
<i>Scientific research funds</i>	6,000	8,740	45.67%	11,800	35.01%	
<i>Education business income</i>	31,650	43,858	38.57%	52,474	19.65%	
<i>Scientific enterprise income</i>	10,000	11,500	15%	14,700	27.83	
<i>Subordinate unit payment</i>	3,000	3,500	16.67%	3,350	-4.29%	
<i>Operating income</i>	12,000	20,000	66.67%	25,817	29.09%	
<i>Other income</i>	4,900	6,450	31.63%	8,650	34.11%	
<i>Totals</i>	123,882	149,621	20.78%	178,045	19%	

Table 3 – Statistical Table of a School's Funds Resources and Funds Income from 2012 to 2014

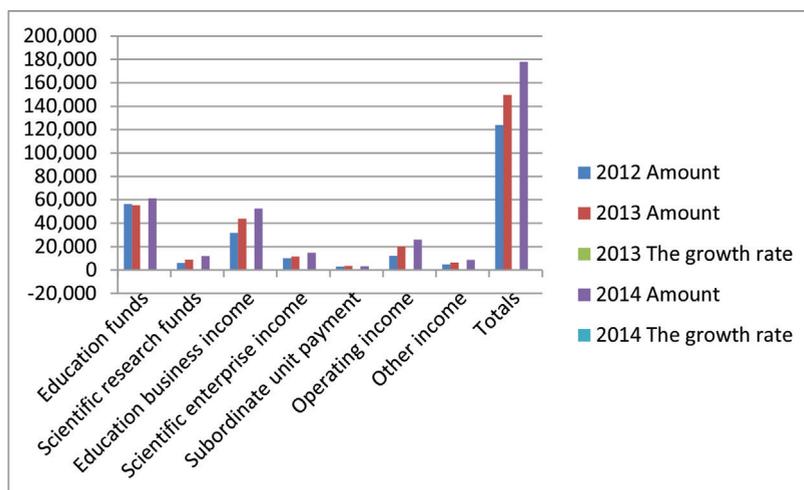


Figure 6 – Input of a College's Education Salary Resources

It can be concluded from the above figure that different schools receive different amount of incentive funds. The more the education salary resources a school uses, the more incentive funds the school will receive. In this case, the school will have more money to spend on teacher's salary and users' training. Hence, the education level of this school will be improved, and the "consumption" potentiality of this school's education salary resources will be higher, thus forming a positive cycle.

## 5. Conclusion

As an important part of education industry's incentive mechanism, the allocation of education salary resources should be given great attention. The computer incentive mechanism has been widely applied to many industries; its merits of being safe and fair have been well presented. In this study, an education salary resource model is designed based on the analysis of the education salary resources by using the computer incentive mechanism. And the validity of this model is has been verified through computer simulations, in which the salary resources of education industry is simulated based on the fairness and reliability of computer incentive mechanism. The analysis of a college's input in its education salary resources revealed that the education incentive funds vary from school to school. The more the education salary resources are, the more incentive funds will be. In this case, the school will receive more funds on teacher's salary and users' training funds. Hence, the education level of this school will be improved, and the "consumption" potentiality of this school's education salary resources will be higher, thus forming a positive cycle. This way, the feasibility and operability of the model in practical application are proved, providing a reliable strategy to improve the utilization efficiency of education salary resources and offering corresponding reference for the adjustment of the traditional education funds' allocation approach.

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# Exploration of E-commerce Platform Development Based on Web Usage Mining

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**Abstract:** Cloud computing is the mainstream technology of the modern Internet in the information age. With the continuous development of computer and network technologies, cloud computing will be penetrated into e-commerce sites, which will bring about major transformations to e-commerce and usher in a new age of e-commerce. Through establishing an intelligent model for e-commerce, this paper notes to support e-commerce intelligence by digging and exploring laws, patterns and knowledge through the web. A refined algorithm for maximal forward references is proposed for processing web logs, obtaining user transaction sequence, and comparing with the algorithm for maximal forward reference model, showing that a refined algorithm can better reflect users' browsing habits. These user transaction sequences are converted into binary vectors; combined with an improved ant colony clustering algorithm, cluster operations are performed to realize user clustering. Finally, an intelligent e-commerce system prototype for online automatic clustering is established and applied into the actually running web system. In comparison, the IP traffic and page views of the applied web systems have been significantly improved. This e-commerce platform based on web usage mining can be applied to major e-commerce sites and will yield good results.

**Keywords:** Intelligent E-commerce; web usage mining

## 1. Introduction

So far, e-commerce has developed into traditional e-commerce, electronic data interchange (EDI), modern e-commerce and dynamic e-commerce, and has begun to enter an era of intelligent e-commerce (IEC). IEC is a new stage of e-commerce development. In 2000, the artificial intelligence Australian working group convened an international conference with the main objectives of guiding practitioners, researchers and developers to explore rapidly growing e-commerce intelligence solutions (Ayan K., Kılıç U., 2016). IEC does not have a clear definition. It is commonly believed that IEC is employs information technology, management ideas, computer technologies and artificial intelligence to achieve automated and intelligent processing of business information (Shao X., Han D., 2016). Domestic and foreign scholars have conducted a lot of research to support e-commerce intelligence by digging and exploring laws, patterns and knowledge through the Web. Literature (Pei Y., Zhu D., 2016) proposes using data

mining technology in web server log files by Web usage mining based on transactions, and brings about the concept of maximal forward reference model (MFRM), while ignoring direct content page jumping and simply considering access paths, which are somewhat different from the actual situation. Literature (Vandana K., Bharathi Y D., 2015) adopts transaction-based methods to study the Web access information mining pretreatment and sequential access pattern mining techniques, and presents an approach of Web access information mining for identifying users' browser mode based on the extended directed tree model, but the study is a preliminary attempt and is lack of practical applications. Literature (Ali J A., Hannan M A., Mohamed A., et al., 2016) applies Web logs to compute page correlation matrices through web coding and conversation extract; by combining CARD (competitive agglomeration for relational data) and RCFC (relational competitive fuzzy clustering) analyses, all probability vectors for various users' webpage access are obtained, but conversation extract would be too simple. Literature puts forward that Web mining objects include not only logs and Web pages, but also market data, and gives the overall Web mining framework in an e-commerce environment but not any specific, practical, application oriented solutions (Yang J., Aldemir T., 2016). Literature (Qian X., Tan H., Zhang J., et al., 2015) presents a Web usage mining model under the e-commerce environment, which considers two conditions: patterns on users' browsing path and association rule mining, thus overcoming the shortcomings of simply considering one situation; however, the algorithm corresponding to the model is unideal. The main objectives of IEC based on Web usage mining are to improve the intelligence level of e-commerce, provide recommendations and personalized services, improve customer satisfaction and enhance the ability to use e-commerce to obtain orders (de Sá A O., Nedjah N., de Macedo Mourelle L., 2016). In fact, Web logs are one of the main targets for Web usage mining. While the two of most important steps for Web log mining are: 1 log preprocessing, namely identification and extraction of user transaction sequences; 2 processing of data extracted by using an algorithm. Grounded upon the maximal forward reference algorithm, this paper brings about a refined algorithm for maximal forward references, and uses the improved extended ant colony clustering (EACC) algorithm to process the data extracted, thereby achieving good results (Zapata, B. C., Niñirola, A. H., Fernández-Alemán, J. L., & Toval, A., 2014).

## **2. Intelligent E-Commerce**

### **2.1. Connotation of Intelligent E-Commerce**

Definition 1 IEC applies management ideas, information technologies, computer technologies and artificial intelligence to e-commerce processing, to realize automation and intelligence of business process.

IEC software system generally consists of e-commerce platform, data warehousing, online analytical processing, Web data mining, data backup and recovery. Wherein, Web data mining is the core to achieve IEC and is mainly responsible for extraction, transformation, analysis and modeling process of large amounts of data from e-commerce system operations, thus deriving critical data, models and knowledge to support e-commerce decisions (Gupta A K., Shukla A V., 2015).

Definition 2 Web mining (WM) is a process to discover model  $P$  from a large number of unstructured, semi-structured and structured Web dataset  $WDS$ . This process can be seen as mapping  $WM : WDS \rightarrow P$ : it has the following properties:

1. Data in  $WDS$  are massive and can be represented by positive infinity (Thiyagaraj V., 2015).
2. Any dataset  $wds$  on the Web is a subset of  $WDS$ , namely  $wds \in WDS$ .
3. WM is complete. For any one subset  $wds$  in  $WDS$ , there is a model  $P$  that satisfies  $WM : WDS \rightarrow P$ .
4. WM is many-to-one.  $WM : WDS \rightarrow P_1$  and  $WM : WDS \rightarrow P_2$ , then  $P_1 = P_2$ , which is a plurality of inputs can be mapped to one output.

There is a wide range of Web mining, which is divided into Web usage mining, Web content mining and Web structure mining.

Definition 3 Web usage mining is a process of analyzing information left by user access to the Web server and finding user access patterns (Huml J., Čerkasov J., Margarisová K., et al., 2015).

By Web usage mining, hidden laws related to user access behavior can be detected, such as frequent access paths, similar user groups and similar Web pages, etc. These have important value in IEC and Web-based decision support systems (DSS).

## 2.2. Architecture of Intelligent E-Commerce

One common e-commerce structure model is shown in Figure 1. It does not introduce services related to Web mining. The client sends a request to the Web application server via the Internet, and the application server exchanges information with the back-end database server. The application server is where e-commerce platform deploys. At present, typical representatives of application servers include Microsoft IIS and standard servers that are line with Sun's Java Enterprise Edition (Java EE) and so on (Kavak B., Tunçel N., Özyörük H E., 2015).

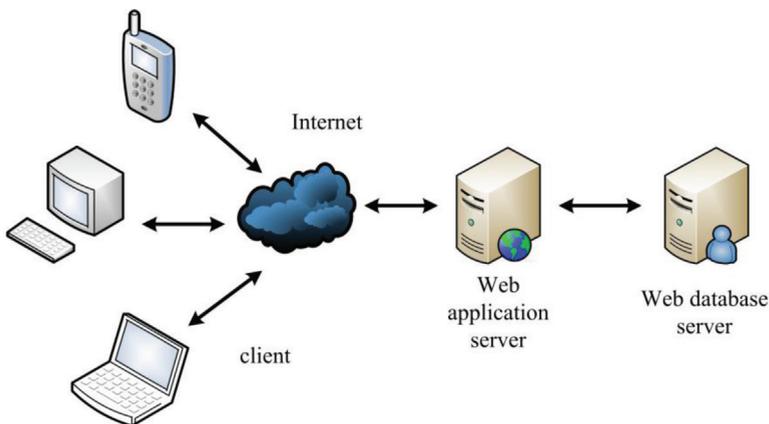


Figure 1 – Common E-Commerce Model

The IEC model that introduces data mining is shown in Figure 2. In addition to components of traditional models, it has added a middleware server and Web repository server. The application server can not only interact through the middleware server and Web server database, but also exchange information with the repository server. The middleware server has not only improved system security but also enhanced the concurrent speed of the system. When the Web application server makes a data mining request to the repository, the repository server processes some information in the database server through Web data mining engine, and returns the results to the application server via the middleware server. Knowledge in the Web repository server comes from laws and patterns such as frequent access paths, similar user groups and similar Web pages and the like obtained by analyzing and processing data in the Web application server, middleware server and Web database server (Fairfield M., 2015).

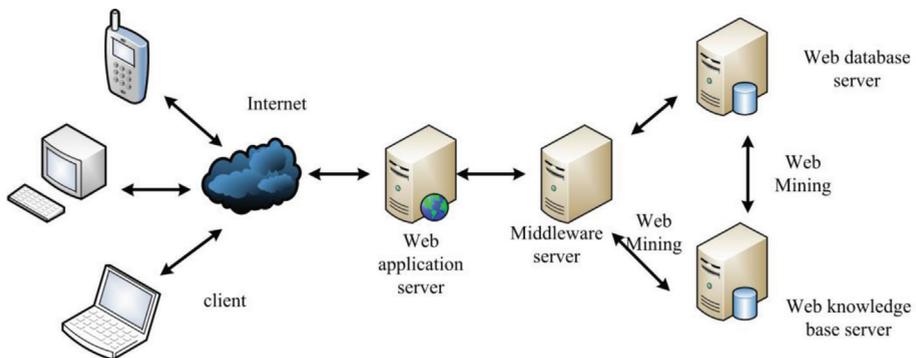


Figure 2 – Intelligent E-Commerce Model

### 3. Web Usage Mining Object--Web Logs

A Web server log is one of the major data sources of Web usage mining. A web server log is some information left on the server side by user access to a Web page. It clearly records the browsing behavior of visitors to a website and reflects their browsing habits. Effective mining and process of information can obtain users' browsing habits. Cluster users with the same or similar browsing habits and form a cluster, deliver personalized service, and dynamically update cluster information with the passage of time and change in the interests of browsers, so that e-commerce can show intelligence (Pandey S., Devasagayam R., 2015).

Definition 4 Web logs are footprints left when Web browsers visit the server. By quintuple, it is denoted as Web.

$\text{log}=\{\text{time, remote host, method, page, request status}\}$ , where:

Time refers to the moment when the server responds to the client request and returns the requested resource to the client.

Remote host represents the hostname or IP address of the client when accessing the Web server. Because there may be a proxy server between the client and the Web server, it may record the last proxy server IP address of the client.

Method indicates the client request methods, including GET, POST, HEADER, OPTIONS and PUT. GET and POST are more usually used.

Page indicates that the client's requested page. Pages are divided into navigation pages and content pages from the use. Navigation pages guide the user while content pages take the user a lot of time to browse the pages, so users typically spend more time in content pages than in navigation pages.

Request status indicates the status code for the request response to return to the server. Status codes have three digits, indicating the return codes that the server responds to the browser request.

Different application servers may have slightly different log formats, but the above are essential elements. By log formats, how long a user stays on a Web page can be drawn. Assume that  $\log_i$  and  $\log_j$  are two Web pages that users consecutively visit, then  $\log_i$  and  $\log_j$  can be expressed as:

Web  $\log_i = \{\text{time, remotehost, method, page, requeststatus}\}$

Web  $\log_j = \{\text{time, remotehost, method, page, requeststatus}\}$  (1)

The time for users to stay on a Web page  $i$  is  $\Delta t = \log_j \cdot \text{time} - \log_i \cdot \text{time}$ , but the time  $j$  to browse cannot be obtained relying on these two datasets alone.

#### 4. Identification and Extraction of User Transaction Sequences based on Refining the Maximal Forward Reference Model

A user transaction is a clickstream formed to complete a particular requirement within a user session. It is a subset of the user session, meaning that a session can have multiple user transactions. (Hytner R., 2015) Suppose that only by changing the access theme by the previously visited pages jump to another page when the user accesses the Web, it is certain that the user access to the transaction is that a user has forward access until returns visit and this is considered beginning a new access transaction. The so-called forward refers to the current page is not concentrated in the current access transaction page, while backward refers to the current page is concentrated in the current access transaction page. The maximal forward reference sequence MFRM is the path constituted on the first page in the user session to the previous page. For example, page sequences requested in a user session are P1-P2-P3-P1-P4-P5, and the corresponding user transactions are P1-P2-P3 and P1-P4-P5. This approach assumes that the last page of access is the content pages, but the preceding pages are navigation pages. The MFRM algorithm flow is shown in Figure 3 (San-Martín S., López-Catalán B., Ramón-Jerónimo M A., 2015).

Step 1 Define the relevant variables to represent and store log information that users are currently accessing. Specifically,  $i$  is used to represent the current traversal pages, with the initial value of 1;  $F$  is used to represent the current traversal direction,  $F=1$  indicates a forward traversal direction currently,  $F=0$  indicates a backward traversal direction currently;  $X$  represents the user access paths to be traversed;  $Y$  is used to store the current user sequence;  $\text{Temp} []$  is a set used to store the user sequence.

Step 2 Remove the  $i$ -th page from  $X$ . Determine whether  $Y$  exists in the page. If not, then add to  $Y$ ; if the page is present in  $Y$ , and  $F=1$ , output  $Y$  to  $Temp []$  array. At the same time make  $F=0$ , delete pages that appear after this page from  $Y$ .

Step 3 If  $F=0$ , set  $F=1$ . Determine whether  $X$  has been traversed; if not, increment  $i$  and go to Step 2.

Step 4 End.

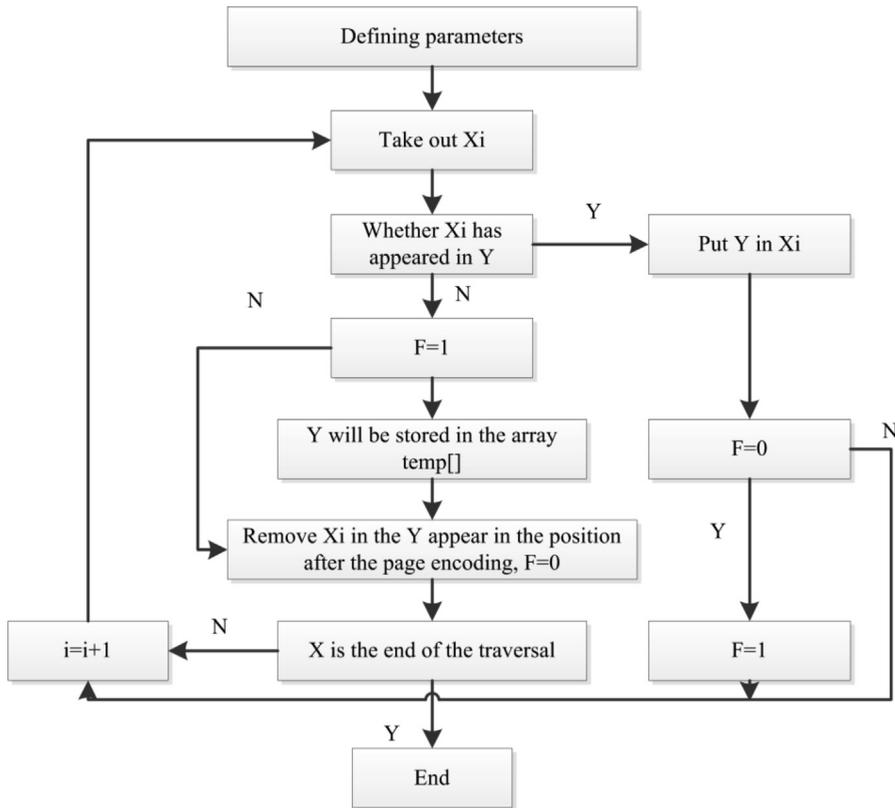


Figure 3 – The Maximal Forward Reference Model Algorithm

According to the browsing habits, after MFRM processing ends, the user transaction sequences acquired will go through secondary fission, and refined user transaction sequence is obtained. This is the refining maximal forward reference model (RMFRM) algorithm, and the process is shown in Figure 3. Specific steps are as follows:

Step 1 Define and initialize variables.  $i$  represents elements in the current traversal  $Temp []$  array; the nature of  $Temp$  is a two-dimensional array, so  $Temp[i]$  is a one-dimensional array;  $i$  is known as one-dimensional traversal variable and is initialized to 0;  $j$  represents the final page of user transaction sequences in  $Temp[i]$ , because  $j$  is used to represent the elements in  $Temp [i]$ , so it is also known as two-dimensional traverse variable and is initialized to 0;  $k$  represents the initial page of user transaction sequence

in Temp[i] and is used to track j, called a tracking variable; Result[] represents the final user transaction sequence; T represents the average time from the first access page to the last two access page in Temp[i]. As per the log format, time to browse the last page is impossible to acquire. N represents the time statistical parameter, T represents statistical time, and t represents time to access a page.

Step 2 Judge whether Temp [] array is traversed. If yes, go to Step 8, otherwise go to step 3.

Step 3 Determine the average time for removing the last page in sequence Temp [i], and then multiply by the statistical time parameter N to obtain statistical time T.

Step 4 Set the iconic variable F to 0, indicating that the current traversal page has not been added to Result [] array. Empty j and k and set 0.

Step 5 Give the two-dimensional variable object j a tracking variable k. Determine whether Temp [i] is traversed; if yes, go to Step 8.

Step 6 Get browsing time for the current page, and compare with the statistical time T. If it is greater than T, the current page is the content page and put from k to current traversal pages in the Result [] array, and set F=1, representing the current variable object has been added in the Result [] array.

Step 7 Determine whether Temp [i] is traversed. If no, go to Step 5; otherwise, if F=0, add the tracking variable k to the current traversal object j to Result []. The one-dimensional traversal variable i is incremented, go to Step 2.

Step 8 End.

## 5. Binary Vector Conversion of User Transaction Sequences

By RMFRM the user transaction sequence is obtained and should be converted to the binary vectors, as follows:

1. Encode effective Web pages

The so-called effective pages refer to pages available for users to access and browse; effective pages exclude those that users cannot access, which can effectively reduce the size of solving data.  $P=\{1,2,3,,k,,N\}$  represents page encoding.

2. User transaction sequences obtained by RMFRM are subjected to a binary calibration

$t_i$  represents the i-th user transaction sequence, and set  $t_i = \{t_1^i, t_2^i, t_3^i, \dots, t_k^i, \dots, t_N^i\}$

$$t_k^i = \begin{cases} 1 & \text{User transaction i to access the page k} \\ 0 & \text{User transaction i did not access the page k} \end{cases} \quad (2)$$

User transaction clustering is a process of mining sets of users with the same or similar access interests through mining processing of Web logs. It can be used to accurately predict the user browsing behavior, understand and influence the buying patterns and

realize personalized services. The user transaction is considered as an ant, and the process of clustering user transactions is a process of gathering ants into a nest of ants.

## 6. The Improved Ant Colony Clustering Algorithm and its Applications in User Transaction Clustering

The traditional ant colony clustering (ACC) algorithm is to use the chemical identification system in ant epidermis to achieve clustering. The algorithm has good robustness and adaptability, but clustering results are random and have a relatively large impact on the data and parameters. Often the clustering quality is poor simply because of its six arithmetic rules. In this paper, these six rules are improved and the EACC algorithm is proposed [16].

Definition 5 Nest Mates Center (NMC) is the arithmetic mean of chemical substances T on ant epidermis in the nest. If there are N ants inside NMC<sub>i</sub>, then

$$NMC_i = \frac{\sum_{j=1}^N T_j^i}{N} \quad (3)$$

Definition 6 The distance D between ants and the ant nest central symbolizes the relative position of ants in the nest, and its value is the sum of absolute difference between the chemical substances on ant epidermis and the nest center.

$$D_i = \left| T_j^i - \frac{\sum_{j=1}^N T_j^i}{N} \right| = \frac{\left| N \times T_j^i - \sum_{j=1}^N T_j^i \right|}{N} \quad (4)$$

The greater the value is, the farther away ants are from the nest center; otherwise the closer ants are to the nest center. Based on the above definition and combined with the ACC algorithm, the following five algorithm rules are presented:

1. Two non-nested ants meet to create a new nest, and calculate the nest center by Formula (3).
2. Non-nested ants and nested ants meet; Non-nested ants join the nest and update the nest center by Formula (3).
3. Two ants from the same nest meet; if they are not mutually received, calculate the distance between them and the nest center by Formula (4), kick out the one with a greater distance from the nest, and update the nest center by Formula (3).
4. If two ants from different nests meet and receive each other, then merge the two nests and update the nest center by Formula (3).
5. Do nothing if the above four situations do not appear.

The EACC algorithm is as follows:

Step 1 Initialize relevant parameters.  $M_i$  is an assessment reference of the nest size and is initialized to 0;  $M_i^+$  assesses similarity of each intelligent ant object in the cluster and by default initialized to 0. n represents the number of ants;  $NB_{Iter}$  is the total number of

any two randomly selected intelligent ants meets in a cluster  $NB_{Iter}$ ,  $NB_{Iter} = 75 \times n$ . The loop variable parameter  $k=1$ ; delete probability  $p$ ,  $p \ll 1$ .

Step 2 randomly select a certain number of intelligent ants to meet with Anti. By Formula (5), initialize  $T_i$  of  $n$  ants.

$$T_i = \frac{\overline{Sim(i,.)} + \max(Sim(i,.))}{2} \tag{5}$$

Step 3 Determine whether or not  $k$  is smaller than  $NB_{Iter}$ . If yes, randomly select two from  $n$  ants to judge by the above five rules.

Step 4 Determine whether or not  $k$  is greater than  $NB_{Iter}$ . If yes, go to Step 5; otherwise increment  $k$  and go to Step 3.

Step 5 Check the number of ants existing in the nest. If the number is smaller than  $n \times p$ , delete the nest.

Step 6 Check whether all ants return to the nests. If yes, go to Step 7; otherwise, restore  $k$  to 1 and go to Step 3.

Step 7 End.

## 7. Typical Applications of Intelligent E-commerce based on Web Usage Mining

### 7.1. Intelligent E-Commerce Prototype System

Based on the above theory, build a self-clustering site prototype system which is divided into two parts: offline and online processing. The framework is shown in Figure 4. Offline processing module consists of data preprocessing and clustering. The task of data preprocessing module is to preprocess log files and site files on the server at set intervals and generate the user transaction model. The main steps of pretreatment include data cleaning, user identification, path perfection and user transaction identification RMFRM, etc. After post-processing, the system generates user transaction sequence files. Given the server log format is usually in txt format, user transaction sequences are also in text file format. Combined with effective access page coding, it is converted to the database tabular form, and the structure is shown in Table 1.

Field	Data type	Remarks
<i>sequence_id</i>	Unique identifier	Sequence number
<i>user_id</i>	varchar(100)	Uses id
<i>user_IP</i>	varchar(100)	The user access to the IP
<i>visit_date</i>	datetime	The user visits the site of the time
<i>sequence_date</i>	datetime	The user generates the sequence of time
<i>sequence_description</i>	varchar(500)	The specific content of user sequence

Table 1 – User Transaction List Structure

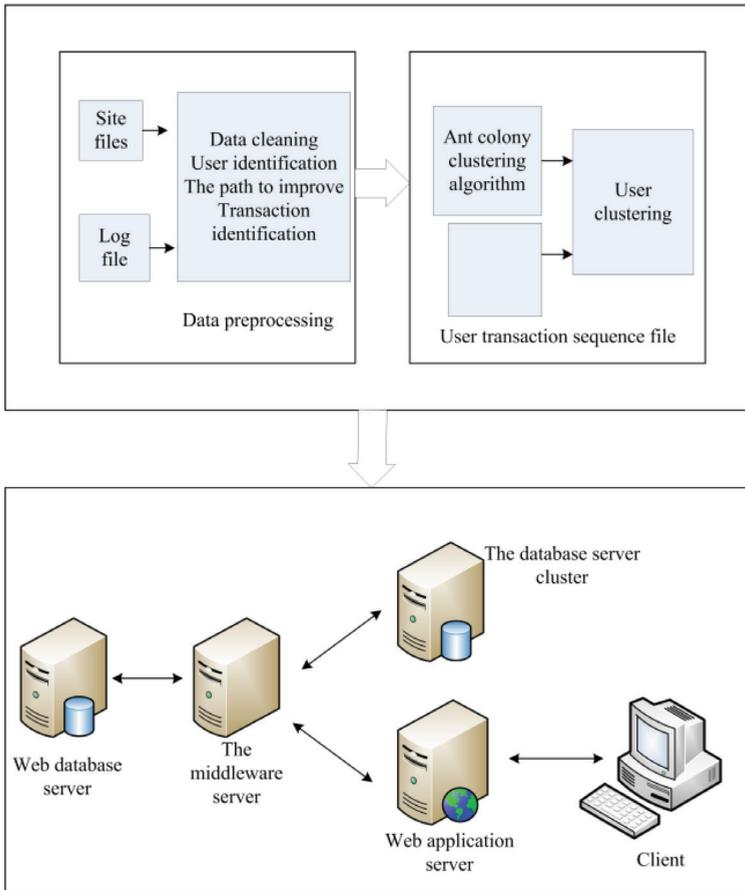


Figure 4 – Self Clustering Site Prototype System Framework

The user transaction clustering module is responsible for using the EACC algorithm to process data in Table 1, generate a user cluster and store it in the cluster database table. The relationship between users and user clustering table structure is shown in Figure 5.

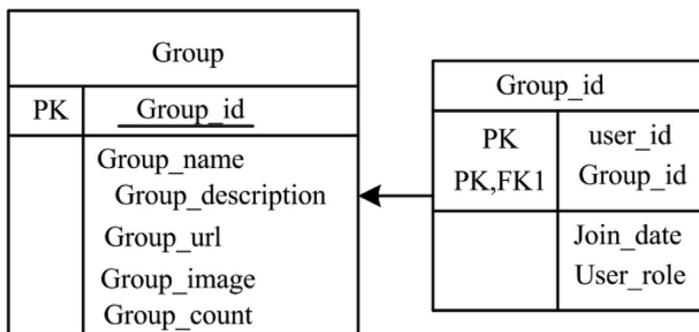


Figure 5 – The cluster structure of the relationship between users

Online processing mainly encompasses the cluster database server, Web application server, middleware server, and Web database server. Among them, the cluster database server is used to store clustering results. Here, the Web database and cluster database are adopted with MySQL510; the Web server is adopted with Tomcat610, and the middleware server is adopted with JBoss410.

### 7.2. Application Cases of the Prototype System

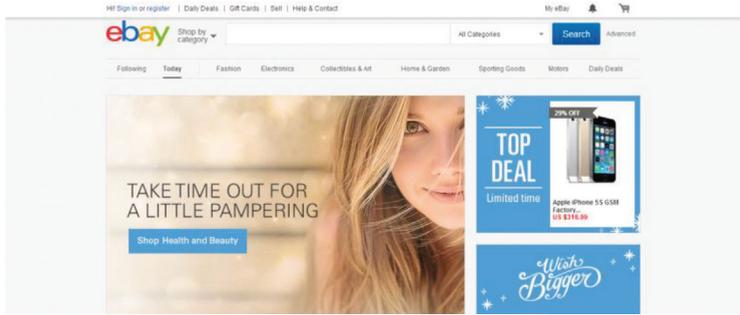


Figure 6 – A Foreign E-Commerce Website

Currently, the prototype system has been applied to a foreign e-commerce site. The site is a comprehensive e-commerce platform that includes online second-hand commodity trading, online games, merchant discount information publishing, virtual currency trading, friend making and so on. Now, the system has been able to achieve automatic aggregation of users, and present to users in the form of Groups. The concrete realization is as follows:

Considering the richness of site navigation pages and content pages, set the time statistical parameter in RMFRM to be 20, and then the statistical time T is 20 times the average time spent; set the effective access page N=80, i.e. P={1,2,3,,80}. Given the relatively large N, update Groups information fortnightly. Combine user log information with page effective codes and import into Table 3. sequence\_description stores refined user transaction sequences in a structure of binary vectors. The vectors are 80-dimensional in elements 0 or 1. The dimensions are relatively large, but the elements are very simple, so it is relatively simple to solve. Substitute N=80 into Formula (3)

$$Sim(i,j) = \frac{\sum_{k=1}^{80} t_k^i \times t_k^j}{\sqrt{\sum_{k=1}^{80} t_k^i} \times \sqrt{\sum_{k=1}^{80} t_k^j}} \tag{6}$$

Solving Formulas (2)-(4) adopts a storage process, which can reduce network traffic and improve the system response speed. For the EACC algorithm, delete probability p=0.1005; the number of ants n takes the number of records generated in Table 2 in two weeks.

Evaluation index	Performance %
registered Number	Increase approximately 15
IP traffic	Increase approximately 20
Page access	Increase approximately 20

Table 2 – Change IP Visits Registrations, and Content Pages

## 8. Conclusion

In recent years, with the rapid development trend of e-commerce, intelligent e-commerce research has become a hot spot today. This paper puts forward the connotation of IEC and compares common e-commerce models with the IEC model. Since Web logs are one of the main sources for Web usage mining, the RMFRM algorithm is advocated for processing Web logs to obtain user transaction sequences. Combined with the actual case, RMFRM and MFRM are compared, which illustrate that RMFRM can better reflect user browsing habits. Meanwhile, the EACC algorithm is proposed for clustering operations of user transaction sequences. Also, a prototype system is established and applied to actual e-commerce platforms, and has achieved good business results. The intelligent e-commerce system established in this paper can reduce network traffic and improve the system response speed, thus exerting markedly great effects in promoting intelligent e-commerce systems.

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# Study on Multimedia Teaching Platform of “Principles of Management” Based on Cloud Computing

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**Abstract:** “Principles of Management” is a theoretical professional basic course whose teaching demands can not be met by traditional teaching methods. This essay illustrates a multimedia teaching platform of “Principles of Management” based on cloud computing. In this essay, the author will analyze functional demands, overall designs, and key technologies of the multimedia teaching platform in colleges and universities, and establish a general design framework under practical conditions so as to achieve basic functions of every part of the multimedia teaching platform. The multimedia teaching platform of “Principles of Management” based on cloud computing raised in this essay can meet needs of multimedia teaching in colleges and universities; therefore, it has practical application values.

**Keywords:** “Principles of Management”; multimedia teaching platform, cloud computing.

## 1. Introduction

Currently, teaching “*Principles of Management*” is a process of interpreting its contents and a teacher’s values and experience. During the class, teachers do not exchange ideas with students; instead, students are forced to accept, remember and repeat contents of the textbook, lacking abilities of creativity and reform. Therefore, it is practically significant to introduce cloud computing into multimedia teaching management system, improve hardware and software equipments of current colleges and universities as well as optimize teaching management, service and cooperation to create a multimedia teaching management systematic platform with strong capability, reliable operation and large amount of work (Nair, S., Tarey, S. D., Barathi, B., Mary, T. R., Mathew, L., & Daniel, S. P., 2016). In 2000, Chenchao studied the operation of CAI focused on “*Principles of Management*” teaching (STOLL, L., BROWN, C., SPENCE-THOMAS, K. A. R. E. N., & TAYLOR, C., 2015). Zeng Fangfang studied online teaching resource construction based on “*Principles of Management*” in 2012 (Cardin, F., Minicuci, N., Andreotti, A., Granziera, E., & Militello, C., 2016). Hu Haibo studied the application of online teaching platform of “*Principles of Management*” (Bajohr, F., 2016). During the exploration of teaching “*Principles of Management*”, Zhouyan raised participative

teaching (Cheng-lin, H., & Jian-wei, C., 2016), Zhang Wenhua illustrated case teaching (Ambarka, A. E., & Dagez, H. E., 2015), and Wangfen proposed a teaching method of sequent projects (Endzinas, A., 2016). This essay will introduce a multimedia teaching platform of “*Principles of Management*” based on cloud computing. In this essay, the author will analyze functional demands, overall designs, and key technologies of the multimedia teaching platform in colleges and universities, and establish a general design framework under practical conditions so as to achieve base functions of each part of the multimedia teaching platform (Mora, A. D., & Fonseca, J. M., 2014).

## **2. Introduction of the Multimedia Teaching Platform of “*Principles of Management*” Based on Cloud Computing**

Cloud computing is a compute mode based on the Internet as well as a service providing dynamic, easily-extensible, and virtualized computing resources to users. Cloud computing equips traditional distributed computing, parallel computing and utility computing supported by computer and network technologies as well as new functions such as network storage, virtualization and load balancing. It can also integrate computer entities and form strong computing ability through cluster effects. Cloud computing is a product combining computer technology and network technology (Velásquez, E., Cardona, A., & Peña, A., 2014).

The multimedia teaching platform of “*Principles of Management*” based on cloud computing is established based on high speed network, multi-media classroom and other hardware. It is focused on knowledge management and the construction of teaching resources under the framework of technology “cloud”. The multimedia teaching platform of “*Principles of Management*” applies and integrates management resources to build a integrative teaching environment and a cloud computing platform composed by complex compute, analysis and storage under the purpose of providing services from multi-angles and multi-layers to teaching. It is set to realize the joint developing and sharing of teaching resources and support teachers and students on their studies, so as to promote the development of “*Principles of Management*”.

## **3. Analysis of Multimedia Teaching Platform Based on Cloud Computing On Demands**

### **3.1. Functional Requirement**

As is shown in fig 1, the online multimedia teaching system can be divided into two sub-systems, that is, remote teaching system and remote tutoring system. In remote teaching system, students send messages to teachers for help, and teachers offer response. In remote tutoring system, teachers send resources to students, and students respond to teachers according to their own learning conditions (Etus, C., 2015; Liu, D., Valdiviezo-Díaz, P., Riofrio, G., Sun, Y. M., & Barba, R., 2015).

In multimedia teaching sub-system, teachers can play videos while students can learn knowledge through watching videos. In multimedia tutoring sub-system, students can watch how teachers operate computers and learn relative information materials through messages that teachers send to them.

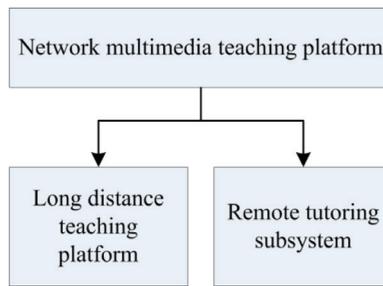


Figure 1 – Analysis of the Functions of the Multimedia System

### 1. Multimedia teaching sub-system

In multimedia teaching system, teachers can organize their classes through multimedia teaching systematic tools. The author divides this system into two sub-systems, that is, teaching and tutor, according to two different communication modes during teaching process. Fig 2 shows the teaching process of multimedia teaching system:

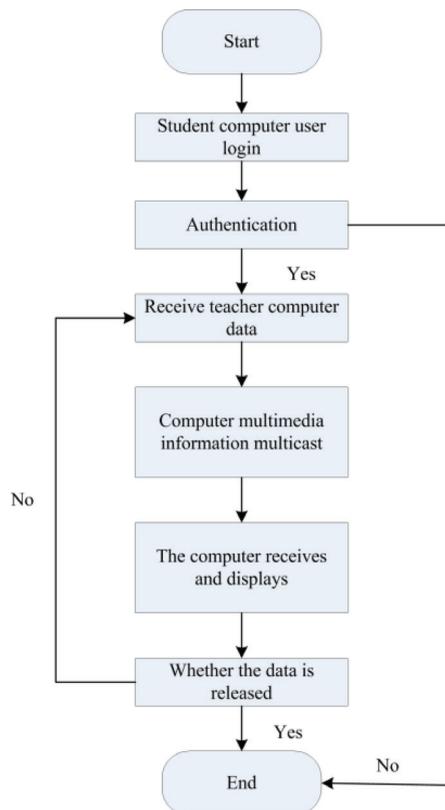


Figure 2 – The Teaching Subsystem Flow Chart

Fig 3 illustrates main functions of teaching sub-system:

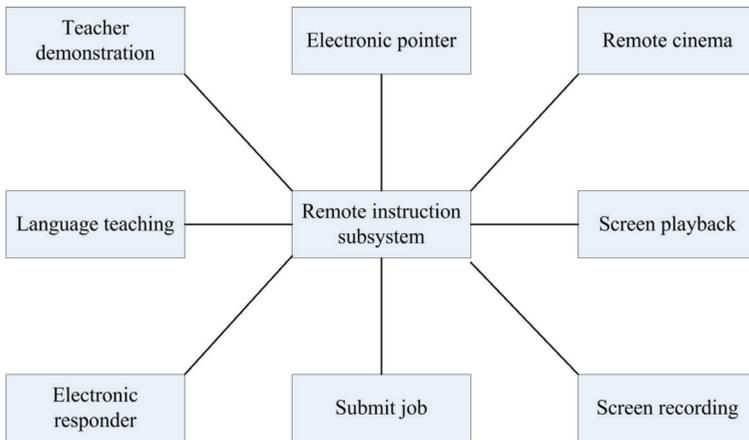


Figure 3 – Teaching Subsystem Function Diagram

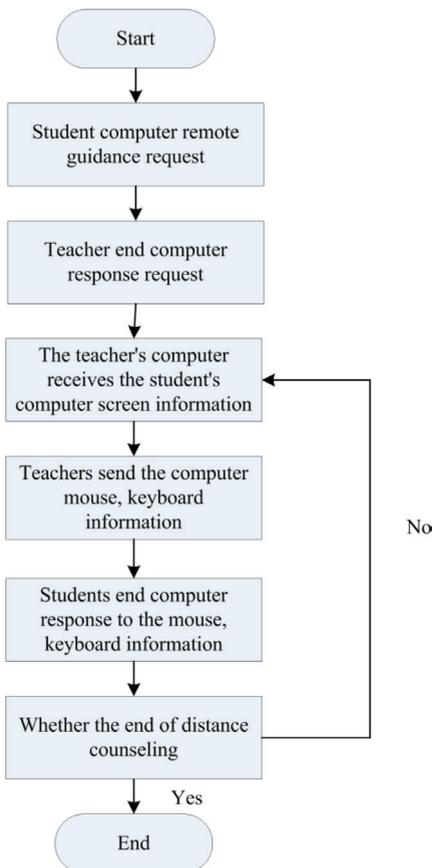


Figure 4 – The Multimedia Tutoring Subsystem Flow Chart

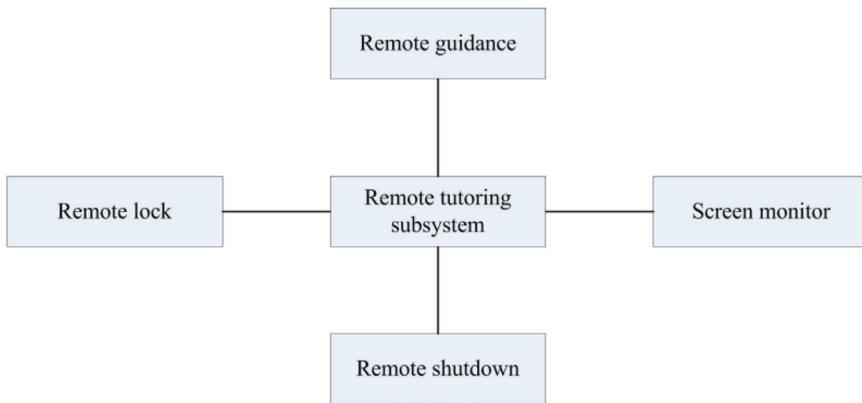


Figure 5 – Multimedia Tutoring System Function Diagram

The teaching sub-system includes functions such as teaching demonstration, homework submitting, answer, class replay, electronics ferule, remote cinema and voice function (Magazzeni, L., 2016).

## 2. Multimedia tutoring sub-system

In multimedia tutoring sub-systems, students can ask teachers for help using online system. Teachers can help students to solve problems by controlling or operating student-ends computers. The multimedia tutoring sub-system has strong functions; for example, teacher-ends computers can monitor, lock or shut down student-end computers, which is similar to remote tutoring system. The multimedia tutoring sub-system is as follows:

Fig 5 shows main functions of a multimedia tutoring sub-system:

Main functions of the multimedia tutoring sub-system include remote tutor, monitor, remote lock, remote power off and other functions.

### 3.2. Performance Requirement

A multimedia teaching platform should meet following requirements: teaching contents are clearly shown in students' computers, the time delay of pictures and voices should be less than 10 milliseconds, blurred screen should not be showed and chattering phenomena should not occur. Also, the interaction should work well (Yaghoubi-Notash, M., & Nouri, Z., 2015).

### 3.3. Problem Analysis

The online multimedia teaching system of colleges and universities have common problems such as time delayed, blurred screen, and photo and videotape out of sync, which will lead to the result students cannot obtain teachers' information in time.

The author finds out that those problems are caused by blocked online transmission, which will lead to unstable transmission, and transmission delay or loss (Kriachko, I. P.,

2016). Because audio and video data use different channel to deliver, trans-formation is large and networks are unstable, out of sync problems may occur. The multimedia teaching platform of colleges and universities need cloud computing, which is of high expandability and has the feature of providing services according to needs, to meet teaching requirements. Cloud computing can help to release unnecessary space and solve problems such as time delayed with huge resources that can burden dynamic flexibility.

## 4. Platform Design

### 4.1. Multimedia Teaching Cloud Platform Design

Multimedia teaching cloud platform is established based on current teaching platforms and school networks. It needs a cloud computing center, and can improve software and hardware environments through centralized management of teaching resources from both new and old platforms. Cloud computing center can provide platforms with data encryption and storage services. Teachers and students can apply terminal equipments to visit teaching resources through school network or obtain services from uniform interface of cloud platform so as to achieve data sharing between old and new platforms. The platform design is as follows (Polge, C., Rowson, L., & Trounson, A., 2016):

The cloud environment of multimedia teaching platform applies SaaS mode, which can help to maintain platform data and shield permission from sub-platforms so as

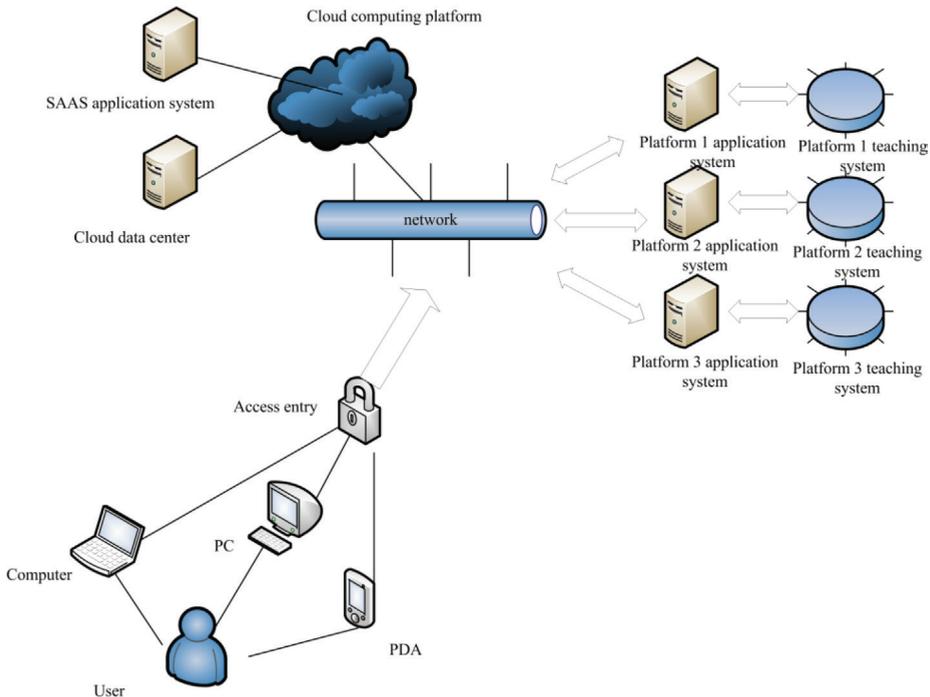


Figure 6 – The Planning of Multimedia Teaching Platform for University

to achieve the mutual establishing and sharing of abundant teaching resources. The cloud environment reflects advantages of a data-intensive system and solves problems of disunited teaching platform data standards, potential data safety hazard and low efficiency caused by incomplete systems.

#### 4.2. General Design of the Teaching System

The multimedia teaching sub-system delivers video and audio information from teacher-ends computers to student-ends computers. Students apply this system to watch teachers' operations and listen to teachers' interpretation. The multimedia teaching sub-system includes processes of collecting, compressing, transmitting and applying multimedia information data (Kanwar, N., Gupta, N., Niazi, K. R., Swarnkar, A., & Bansal, R. C., 2015).

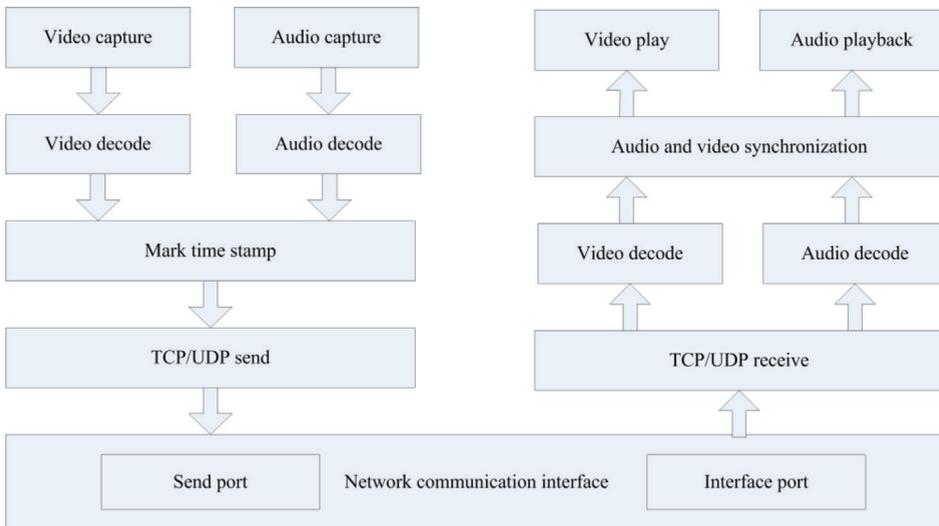


Figure 7 – The Teaching Subsystem Sending and Receiving Diagram

Fig 7 illustrates audios and pictures are main transmission objects. The author finds out that in multimedia teaching sub-system, a large scale of online data transmission is the main problem. Therefore, in designing multimedia teaching system, information of teacher-ends computers should be condensed into blocks. Transmitting information in blocks can help to reduce multimedia data transmission pressure.

#### 4.3. Function Module Design

According to demand analysis, the network teaching platform this essay studies can be divided into three parts: student sub-system, teacher sub-system, and manager sub-system. Each sub-system is in charge of separate works and all three systems work together to accomplish a teaching process. Details are as follows:

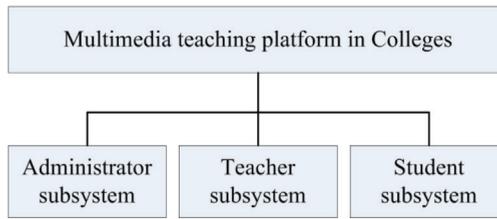


Figure 8 – The Network Teaching Platform System Structure Diagram

Through results of systematic functional requirements analysis, it can be seen that functions of sub-systems are as follows:

Student sub-system: online learning, testing and communication between students and teachers.

Teacher sub-system: issuing teaching resources and information, guiding students to finish learning tasks, delivering information about and organizing tests, correcting homework and answering questions on line.

Manager sub-system: maintaining and managing network teaching platform, distributing permissions, as well as collecting, analyzing and storing data.

Different function modules, for instance, sub-systems, are different as sub-systems take charge of varied works. Detailed functions are shown in fig 9, 10 and 11.

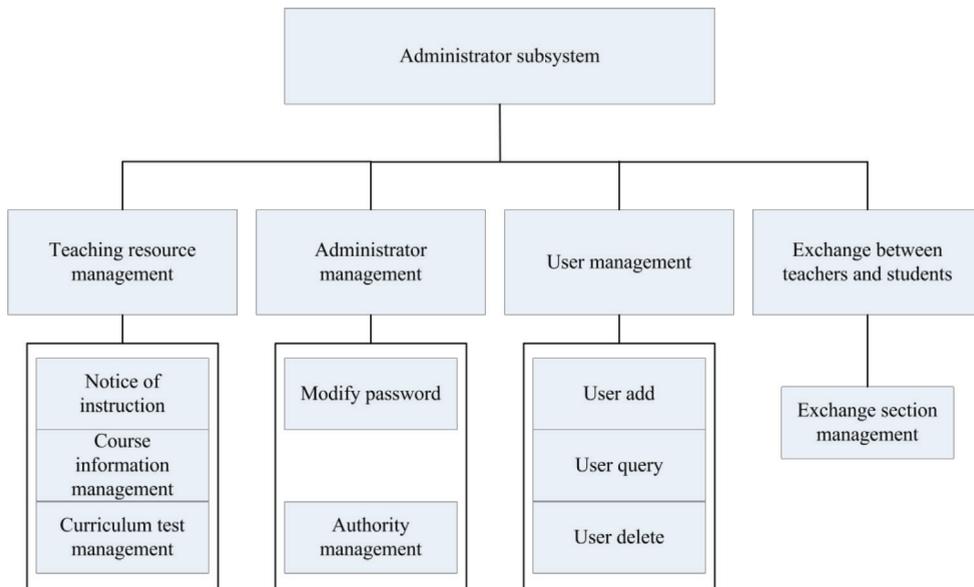


Figure 9 – The Network Teaching Platform Administrator Subsystem Function Module Diagram

Manager sub-system is the most important among three sub-systems as it is the most complicated and is in charge of maintaining and managing basic data of other function modules, for example, managing interaction information module, systematic users, teaching resources, and user permissions, in order to maintain the common performance of network teaching platform and support the regular running of the other two sub-systems.

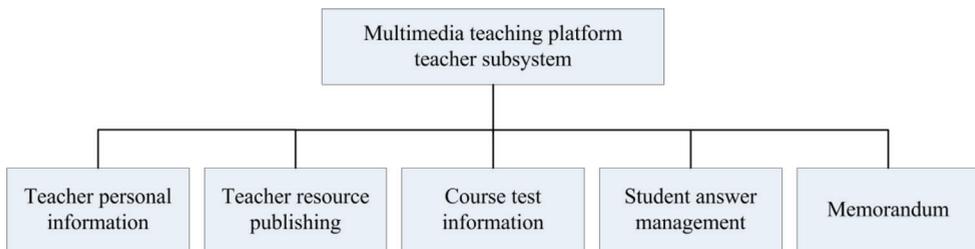


Figure 10 – The Network Teaching Platform Teaching Subsystem Function Module Diagram

Teachers are operators of teacher sub-systems, who can deliver learning resources such as PPT and audio through teacher sub-systems, illustrating information about classes and examinations, correcting homework, communicating with students and answering questions.

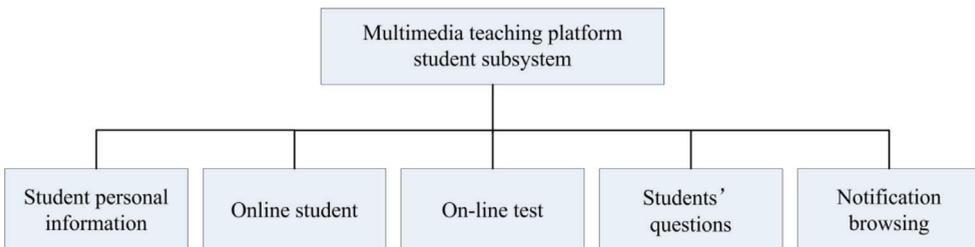


Figure 11 – The Network Teaching Platform Student Subsystem Function Module Diagram

Different from teacher sub-systems, student sub-systems are used to help students accomplish online learning, which conclude function modules such as student information, grade, question and test.

## 5. Realization of Multimedia Teaching Platform Functions

### 5.1. Realization of Collecting and Transmitting Video Data

In order to raise transmission efficiency of network data, images from teacher-ends computers should be cut into blocks. Only transmitting changed blocks can ensure video quality as well as improve data transmission utilization ratio. The image data transmission flow of a remote teaching sub-system is as follows:

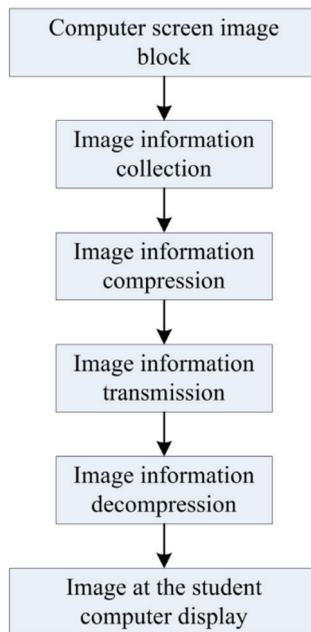


Figure 12 – Image Data Transmission Flow Chart

1. Video image capture

In order to achieve online multimedia remote teaching, it is needed to dynamically capture screen information from teacher-ends computers to ensure contents shown in student computers are as same as in teacher computers.

This platform applies memcmpO function of C programming language. It cuts an image captured from teacher-ends computers into 4x4 blocks, transmits and compares images at fixed 200 milliseconds, and transmits changed image blocks only after judging 16 image blocks. If teachers and students interact well, the capability of the system will improve. Otherwise, it is convenient to access bitmap information from screens. Therefore, when designing the network multimedia teaching system, the author designs to obtain bitmap information directly from DC in order to optimize the system.

When designing network multimedia teaching systems, the author chooses Dffi bitmap to store image information under the consideration of compatibility and general usage. The stored procedure is as follows: first, create a blank bitmap file in accordance with DC and generate a conformable memory space; second, copy information materials from computer screen to DC memory space through WindowsAPI function; Third, release information from the DC memory space and capture screen images. The code is as follows:

```

CRect rect;
GetClientRect (&rect);
CDC* pDC= GetDC();
CBitmap bitmap;
    
```

```
CDC dcMemory;  
dcMemory.CreateCompatibleEK(pDC);  
bitmap. CreateCompatibleBitmap (pDC, rect. widthO, rect.heightQ);  
dcMemory. SelectObject (bitmap);  
::BitBlt(dcMemory. GetSafeHDC(), o,o,rectWidthQ, rect.height(), pDC->ni_hDC, o, o,  
SRC,  
COPY);  
Release DC (pDC);
```

As network multimedia teaching system requires high screen definition, but does not have much requirements about screen color, this system applies 256 colors and screen images with low pixels, to reduce data transmission scale so as to improve its overall capability.

## 2. Video and image transmission

The author applies blocking technology to capture screen images and obtain changed screen information blocks. According to region segmentation theory, only blocks changed are transmitted. The transmission will work well when reducing network data transmission scale as well as compressing image information. Compression algorithms of bitmap images are different with different compression ratios and information losses. As a multimedia teaching platform does not have strict demands on image quality, algorithms can all be used as if the transmission is smooth and images are not distorted.

## 3. Screen image information uncompress

The screen image information uncompress is an inverse process of image compress. This system applies the uncompress function of VC system. The code is as follows:

```
DWORD dwHandle= MAKEFOURCE ('m'. 's'. 'v'. 'c');  
WC= ICOpen(FASTDECOMPRESS, dwHandle. video);  
BITMAPINFO bitmapInfo;  
bitmapInfo =(LPBITMAPINFO)buffer;  
LPVOIDtmp= bufFer+sizeof:BITMAPINFOHEADER);  
HANDLE memory;  
memory=: ICImageDecompress(hIc, bitmap, tmp, o,NULL);  
ICClose(hIc);  
LPVOID 1p=GlobalLock(Memory);  
1p=(LPVOID)(sizeof(BITMAPINFOHEADER)+1p);
```

## 4. Image display

Student-ends computers can store uncompressed information blocks in buffering queue, delete stale data, read new information and display such information at corresponding positions on computer screens.

The multimedia teaching platform will enter the teaching system automatically after students logging in. The platform can provide image qualities at different levels from fluent to high definition. For classes such as video appreciation, it is needed to cut image information into blocks and compress blocks in order to guarantee information transmission, as screen blocks have changed greatly and transmission data scale is relatively large.

## 5.2. Audio Data Collection and Transmission

During the transmission, audio data has less requirements than image data; therefore, the system deals with image data more than audio data. Audio data processing is as follows:

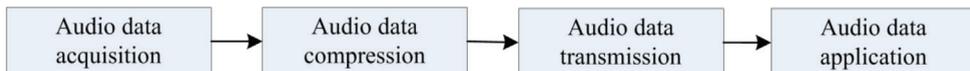


Figure 13 – Audio Data Processing

### 1. Audio data collection

An online teaching platform applies microphone to obtain audio data. When collecting audio data, the author uses VFW (Video for Windows), which can capture audio data from assigned ports, and Cap Create Capture Window function to obtain window handle.

```

LRESULT CALLBACK Set Callback On Wave Stream (HWND hwnd, LPVOID,
callbackWaveStream) ; // Window registration;
  
```

```

BOOL capCaptureSequenceNoFile(hwnd); // Callback function activation.
  
```

In this function, WAVEHEADE pointer points to call back Wave Stream parameters. Hwnd is a window handle in application process. This structure contains too much information, which should be divided into timestamp, audio data, data length and other information in order to facilitate data collecting and processing.

### 2. Audio data compress

In multimedia teaching platform, requirements of audio and video processing and transmission are not strict. Therefore, audio data compress should apply high compression ratio to make the system works efficiently and conveniently. This system uses ADPCM audio data compression standard to deal with audio data. In order to improve the efficiency of acquisition and transmission, the system applies multi-threading technology, deals with audio data in collection, compression and transmission, sets circle buffer regions and put processed audio data into those buffer regions, as well as send audio data packages to user ends.

### 3. Audio data transmission

Student-ends computers have strict requirements of the instantaneity of audio and video data and have less requirements of connecting reliability compared with teacher-ends computers, because multimedia data have inherent corresponding relations. Therefore,

problems such as disorder, data frame losses and transmission failures will have great impact on video and audio quality. Although the system has certain fault-tolerant ability, transmission delay will have negative influence on systematic clients. The author sets time limitation during the transmission and delayed data packages will be deleted automatically.

### 5.3. Synchronous Multimedia Information

There are three methods which can solve problems of information synchronization: multiplexing synchronic technology, synchronic communication technology, and timestamp technology. This system applies timestamp technology. The timestamp technology is similar to multiplexing synchronic technology, which distributes data through separate channels; however, different from the later, the timestamp technology does not add synchronizing channels; instead, it takes clock information as timestamp when servers send data, which will neither waste transmit data nor transmission channels. Multimedia data flows can be played synchronically if clients contrast data in accordance with the timestamp.

## 6. Conclusion

“*Principles of Management*” is a theoretical professional basic course aiming at training students’ management thinking and practical ability. Traditional teaching of “*Principles of Management*” focuses on interpreting contents which can help students to understand methods and principles at limited periods of time; however, it can not help students to develop creativity. In this essay, the author analyzes functional demands, overall designs, and key technologies of the multimedia teaching platform in colleges and universities, and establishes a general design framework under practical conditions so as to achieve basic functions of each part of the multimedia teaching platform. This essay proposes a multimedia teaching platform of “*Principles of Management*”, which can help to solve problems such as time delayed, out of synchrony between voices and images and other problems. The multimedia teaching platform of “*Principles of Management*” based on cloud computing raised in this essay can meet needs of multimedia teaching in colleges and universities; therefore, it has practical application values.

## Acknowledgment

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# Based on Double Two out of Two Interlocking System Design of Full-Electronic Computer Railway Station

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**Abstract:** In recent years, railway construction has achieved remarkable development in our country, at the same time, the reliability and safety of railway signal equipment began to be high-profile. Computer interlocking system is controlled by the signal light, switch and track circuits to achieve the interlocking relationship between them, it's a core part of railway signal equipment. Aiming at the problem of security and reliability of the computer interlocking system, using high-reliability and high-security of double two out of two structure, research and design of a interlocking system design of full-electronic computer railway station. Interlocking system design of full-electronic computer railway station mainly includes the overall structure of design, hardware and software system design, and the structure and hardware design of full electronic execution unit. Making use of MATLAB, Based on double two out of two interlocking system design of full-electronic computer railway station with dual machine thermal structure of railway station interlocking system and TMR structure of railway station interlocking system, reliability, security, and MTBF are tested and analyzed, validation take double two out of two interlocking system design of full-electronic computer railway station 's superior.

**Keywords:** Double two out of two; interlocking system; railway station; matlab.

## 1. Introduction

Computer interlocking system realizes the interlock function system with the main content of access control by using technology, put into many used in computer interlocking control system implementation is the use of computer interlocking relationship at present, in the safe state of relay control and collection infrastructure system, actually, it's a kind of computer interlocking plus a relay system of execution, did not realize implemented completely in the sense of fully electronic safety interlock control system for fault tolerance (Ridgely, D. B., & McFarland, M. B., 1999).

With the need of development of railway transportation and progress of electronic information technology, the functions of interlocking system, architecture, technology applications, operating methods and other aspects are constantly improving (Kwiat, K., Debany, W., & Hariri, S., 1995). Meanwhile, with the rapid development of integrated electronic technology, various 16/32-bit even 64-bit microprocessors have been put

into use in succession, a variety of embedded real-time operating systems with different characteristics have been rolled out in succession, which has applied into control fields increasingly, has improved the performance and processing speed of control systems, thus reducing the size and cost of systems (Millsaps, K. T., & Martinez-Sanchez, M., 1994). This paper studies and designs a preliminary computer interlocking systems with double two out of two redundant structures, and adopts 32-bit microcontrollers ARM as their core CPU, finally designs the full-electronic computer inter-locking systems by architecture and technology application (Panda, P. R., Dutt, N. D., & Nicolau, A., 2000).

## **2. The Structural Design of Double Two out of Two Full-Electronic Computer Interlocking System**

The structures designed by double two out of two full-electronic computer inter-locking systems can be divided into three-tier structures: man-machine conversation layer (also known as operating presentation layer), interlocking layer, interface layer of outdoor equipments. Man-machine conversation layer mainly includes upper computer, you can consider joining the electrical servicing machines. Interlocking control layer includes A interlocking subsystem and B interlocking subsystem (Pozzi, L., Atasu, K., & Ienne, P., 2006). The interface circuit sections of outdoor equipments include switch controlling circuit, controlling circuit of annunciator and acquisition circuit of track circuit. Among them, hardware implementation in interlocking focuses on hardware research.

The design of whole double two out of two full-electronic computer interlocking system (Laureano, R., Caetano, N., & Cortez, P., 2014).

### **2.1. The Functions of Each Layer**

Realize the man-machine conversation layer functionality is available to the operator interface, by operating personnel to the interlocking machine input operation information and receive interlock mechanism reflects the output equipment working status and the operation situation of driving the representation of the information. The man-machine conversation layer by using the computer realize accelerate the response speed of the man-machine conversation, to preprocess command of the operation of the work station.

Interlocked operations layer is the core of interlocking system, it's necessary to have a fail-safe function. Interlocking layers in addition to receiving operational information from realize multi-mouse layer, also receives the reflected signal from the field device control layer power switch machine and the state of the track circuit information. The function of interlocking layer is based on interlocking conditions, operation on the input information and status information, and internal information about the current process of interlocking institutions, change the internal information, produce the corresponding output information, the signal control commands and control command Yu, and delivered control circuit of field device control layer been put in work.

The main function of field device control layer was: received control commands from the interlocking layer, after the signal control circuit, changed the signal display; received from control command Yu of the interlocking layer, after the switch control circuit, dried

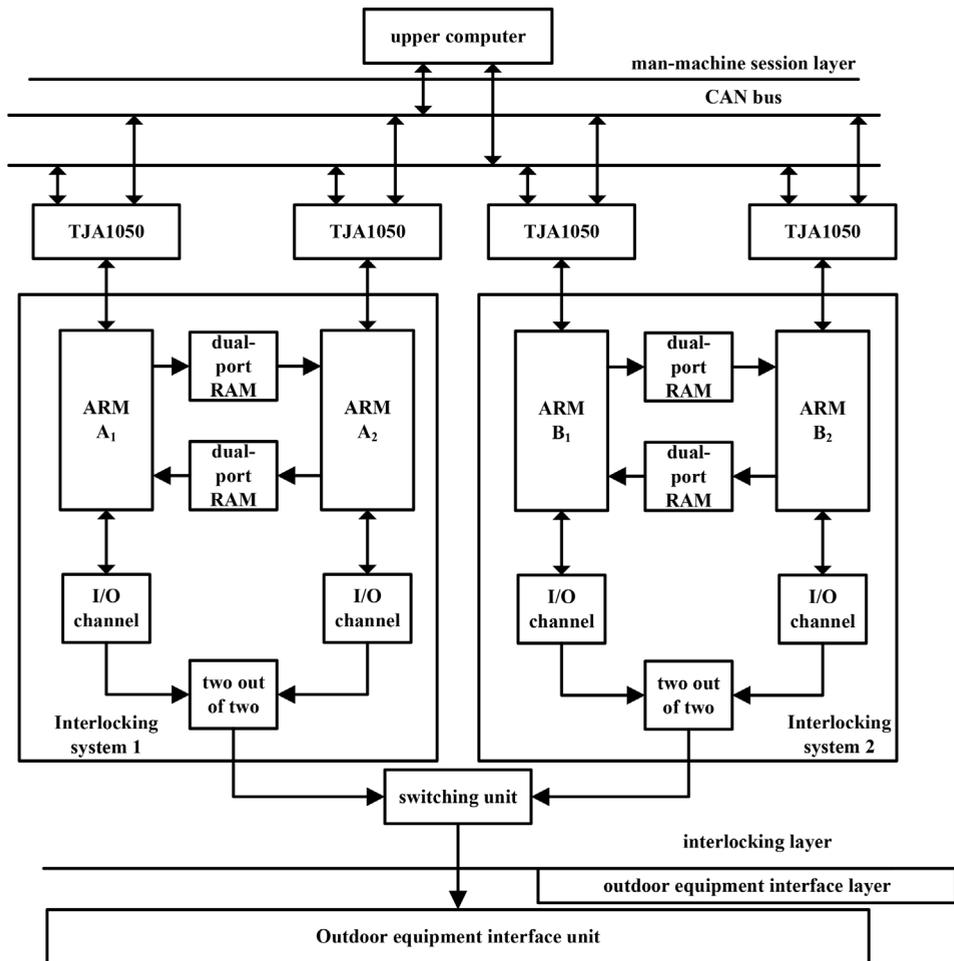


Figure 1 – Double Two out of Two Interlocking System Architecture Diagram

signal conversion; transmitted signal status information, switch status information and track circuit state information to the interlocking layer.

## 2.2. Communication Design in System

The communication between man-machine interview and interlocking layers, i.e., the communication between upper computer and interlocking machine. Generally consider the communications between monitoring machine and electricity maintenance, its characteristic is far transmission distance, high reliability requirements, transmission rate is high relatively. In a practical application, mainly refers to Ethernet network communication technology and the ARCNET network communication technology(Sridhara, S. R., DiRenzo, M., Lingam, S., Lee, S. J., Blazquez, R., Maxey, J., ... & Goel, M., 2011).

Interlocking internal communication is usually between two hot standbys or through synchronization and communication among three interlocking machine’s comparison, that part of the transmission rate should be higher communication requirement, but transmission distances without high requirements, in a practical application, mainly refers to the RS - 485 interface communication technology and CAN bus communication technology(Panda, P. R., Dutt, N. D., & Nicolau, A., 1997) .

In the research and development of interlocking system, I/O control layer tend to consider the decentralized control and regional expansion, and because the IO control layer through the relay control field device directly, so communication of between interlock and I/O control layer, besides the requirement of high speed transmission, it should be also have strong anti-interference ability, and the transmission distance is longer, in a practical application, mainly refers to Genius bus communication technology and light communication technology .

This article using CAN bus technique to achieve the interlock machine with communications between the host computer and interlock machines, between interlocking layer and T / o layer using this room interlocking system adopts interlocking bus, this interlocking bus including 16 data cables, 8 state cables, 5 control cables and 8 address cables. CAN controller input and output pins as shown in table 1.

Pin name	Pattern	Description
<i>RX2, RX1</i>	input	serial input from CAN transceiver
<i>TX2, TX1</i>	output	serial output to CAN transceiver

Table 1 – Description of CAN Pin

CAN controllers and the acceptance filter occupy part of VPB slot space, as shown in table 2.

Address range	Application
<i>E003 8000-87FF</i>	acceptance filter RAM(2048 byte)
<i>E003 C000-C017</i>	register of acceptance filter
<i>E004 0000-000B</i>	register of central CAN
<i>E004 4000-405F</i>	register of CAN controller 2
<i>E004 8000-805F</i>	register of CAN controller 2

Table 2 – Memory Map of CAN Module

As for double two out of two interlocking system of computer, Within each interlocking systems in order to achieve two out of two votes, two interlocking CPU has to communicate and exchange data information in real time. In consideration of within one interlocking system taking into account the need for fast and accurate data exchange between two CPU communication characteristics, in this scenario using dual port RAM CY7Co24A as two CPU communication medium.

### 2.3. Design of Switch System and Synchronous Design

Double switch is divided into autonomous switch and manual switch in two ways. Autonomous switch diagnosis programs by interlocking, if you find that the main system failure, take the initiative to stop working, and the original system upgrade to become mainly system go on with mainly system work. Manual switch is active to cut off the main power supply or forced to reset and make for the main system upgrade system to work. Double system switching sequence as shown in Figure 2.

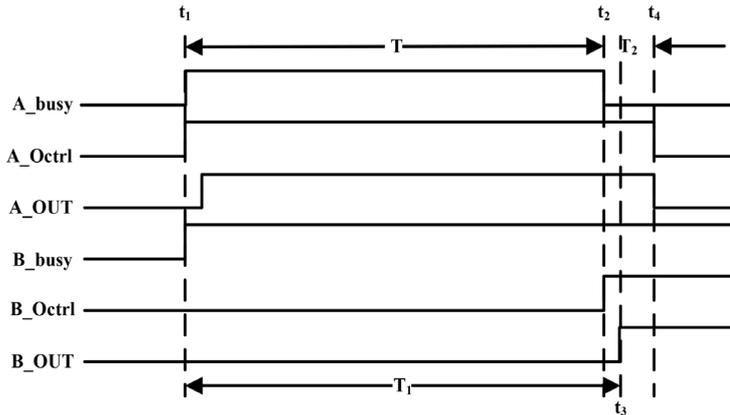


Figure 2 – Double System Switching Sequence Diagram

On the first startup of electric, A, B system is in a state of competition main system, it is assumed that A system of competition is the first time. A\_busy showed that A system is working, high level showed that working condition, A\_Octrl output for A system control signal, when A\_Octrl of high level indicates A system can control the output of a command. A\_OUT is the output signal, There is expressed in high level output, dynamic pulse output is used in the actual control. And B that corresponds to A system of control signals, as can be seen from figure T period of a system as the main system control command output. A system failure at the T2 momentB, system will take the place of a system to continue output. Then A busy change from high to low, indicates that A system downtime, B Octrl changed from low to high. When B is converted into the mainly system to work, but B's output has not been fully effective. Therefore A\_Octrl and A\_OUT the retention time must be greater than T3, starting from the t3 moment B output become effective. The output of A system to stop in times of t4. The relationship between the host and the standby and control information for machine as shown in table 3.

Control Signal	A Main B Standby	A Switch To B	B Main A Stop	B Main A Standby	B Switch To A	A Main B Stop
A_busy	high	low	low	high	high	high
A_Octrl	high	high	low	low	high	high
B_busy	high	high	high	high	low	low
B_Octrl	low	high	high	high	high	low

Table 3 – Main Standby Switching Table

### 3. The Full-Electronic Executes Design of the Hardware in the System

#### 3.1. Double CPU Achieves Two-Out-Of-Two Vote

This design takes the performance of all aspects of embedded processor and functional requirement of interlocking CPU into account, adopts the ARM chip to achieve two-out-of-two as the interlocking CPU of system. The interlocking machines run the core software program of system, including interlocking operation program, especially for this project to be achieved two-out-of-two is required frequent exchange of data between two CPU systems to achieve real-time two-out-of-two comparison, take the second, which can ensure the safety and accuracy of the information, and operating speed, security and stability of CPU are more important measurement indexes (Ghosh, A., & Givargis, T., 2004). In addition, double two out of two computer interlocking system wants to achieve communicating between the lower computer and upper computer , communicating between two line in the lower computer and double PC communication in lines, so a certain amount of the communication interface is also a reference index for CPU selection (Arakawa, F., Ozawa, M., Nishii, O., Hattori, T., Yoshinaga, T., Hayashi, T., ... & Kamei, T., 2004). This article selects LPC2292 produced by PHILIPHS company , whose ARM chip acts as interlocking processing CPU of this computer interlocking system after considering the achievement of functions of interlocking machine ,the features of processing interlocking system and the requirements of this computer interlocking system. From the hardware aspect, the interlocking CPU is the very heart of whole interlocking system, so achieving interlocking CPU of two-out-of-two circuit is the core of achieving the whole system, and designing a reliable and stable CPU of two-out-of-two plays a decisive role for achieving whole two-out-of-two system reliably. The implementing principles of dual CPU of two-out-of-two circuit are shown as Figure 3, and two-out-of-two voting will be achieved between two CPU by inputting and outputting data thought two dual-port RAM (Corporaal, H., & Arnold, M., 1998).

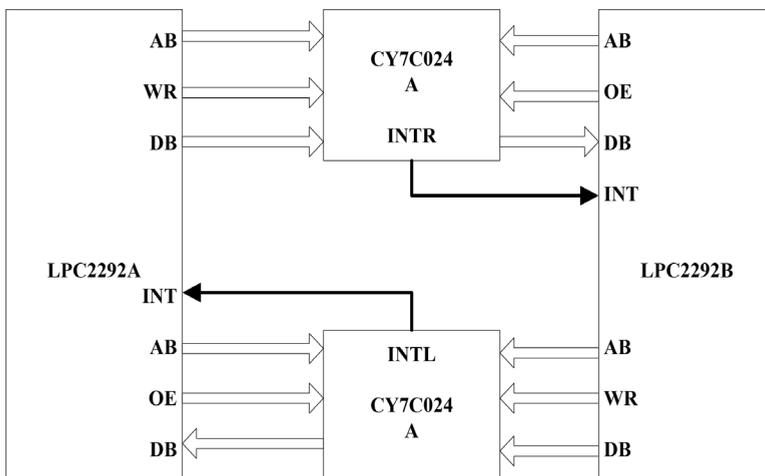


Figure 3 – Interlocking CPU Two Take Two Principles

### 3.2. Input Channel Two Take Two Circuit Design

The realization principle of the input channel two take two circuit is shown in Figure 4. The collected signal is processed respectively by two input circuits, the two interlocking CPU of the system carries on the software two take two comparison, and the fault detection carries out through the intra plate dynamic. The input signal collected from the field equipment is first transmitted to the four input circuits of the two lines. The input signal two take two is achieved in every two input circuits of every system. The input channel of the interlocking system uses dynamic circuit (Dally, W. J., Balfour, J., Black-Shaffer, D., Chen, J., Harting, R. C., Parikh, V., ... & Sheffield, D., 2008). The information expressing the field device status is transformed to the digital information that interlocking CPU can recognize and send to the corresponding interlocking system. After the CPU interlocking receives the initial data that the acquisition circuit transmits, there is the two take two comparison in the system through the dual port RAM. After the comparison is consistent, the data is processed, the processed data is compared through dual port RAM. After the final comparison is consistent, the data is uploaded to PC refresh station field data for display graphics or for the interlocking computing (Chen, L., Bai, X., & Dey, S., 2002).

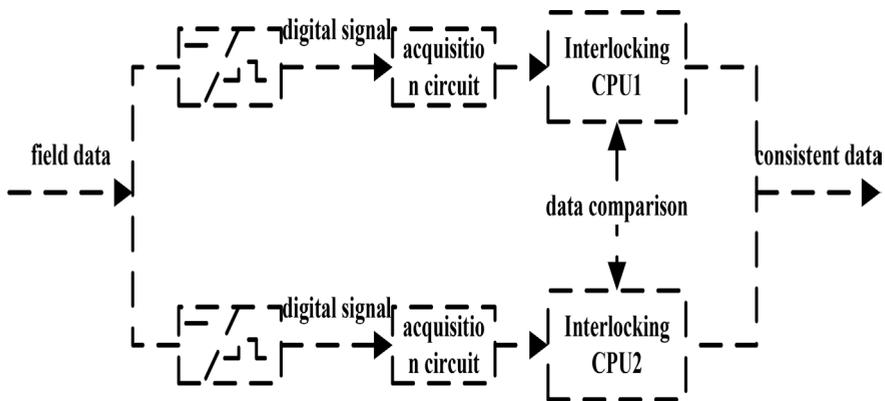


Figure 4 – Input Two Take Two Realize Diagram

### 3.3. Output Channel Two Take Two Circuit Design

The realization principle of the output two take two is shown in Figure 5. The hardware and software both use two take two voting technology, uses the dynamic output and carry on the fault detection through the data reading. The two interlocking CPU of an interlock system has the real-time receiving of the host machine operator's instruction. Firstly, the received information is compared through dual port RAM data, and when the comparison is consistent respectively, there will be the interlocking computing, and the computed data is compared again by dual port RAM. After it is confirmed consistent, they are sent to their corresponding driving circuits, which will carry on the two take two vote. After a unanimous vote, the field devices are driven via a switch unit. Meanwhile, the data reading circuit is added to detect the signal output. It not only achieves the two take two voting of the output signal but also monitors each driving voltage. When the driving voltage is not sufficient to drive the relay suck, it will alarm.

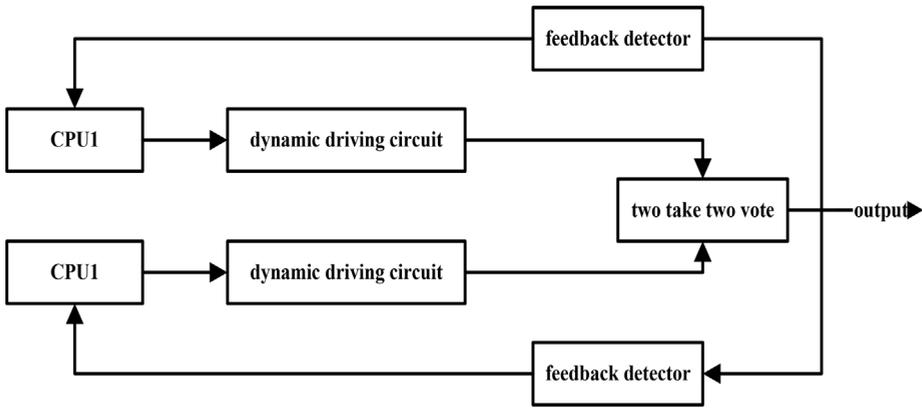
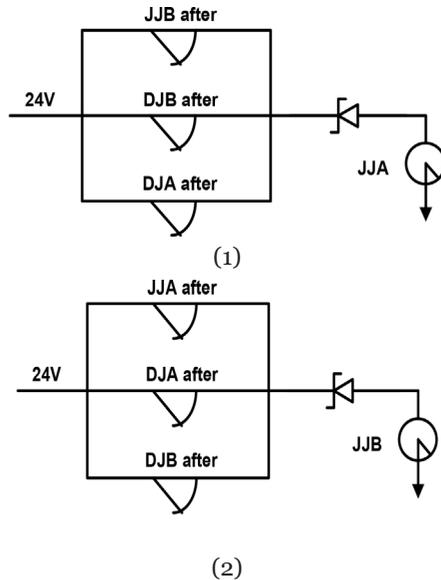
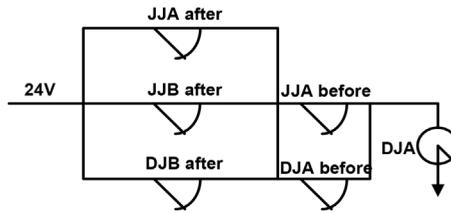


Figure 5 – Output Two Take Two Realize Diagram

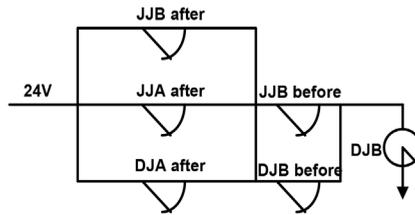
### 3.4. The Two-Line Switch Design of Interlocking Machine

The two-line switch interlocking machine mainly refers to the switch of the driving output, which is implemented by hardware and software. Hardware switching circuit is not only to ensure the work of the main and standby systems, but also to ensure the continuity of the output signal in the process of switching. As can be seen from Figure 3.2, the state of the main system is determined by the A\_busy and A\_Octrl, and in the normal working state, only one output of the interlocking system is valid. The output control signal A\_Octrl and B\_Octrl have a common working time in the double machine switching process. According to the above analysis, the designed switching circuit principle diagram is shown in Figure 6. JJA, JJB represent the the relay of the main state machine, and DJA, DJB represent the two-line control switch.





(3)



(4)

Figure 6 – Two Lines Of Relay Switch Control Circuit Diagram

After the power is on, the two lines also drive the sucking of DJ and JJ relay, but because of the relay control circuit logic constraints, only the interlocking machine with the electricity firstly can drive the drive the sucking of DJ and JJ, and the electric interlocking machine later can only drive the sucking of JJ relay. Through collecting the state of four relays, the relationship of the two interlocking can be determined. After the two lines determines the status of the line, they are communicated with the host computer, so that the host computer can determine the communication address and communication direction.

#### 4. Reliability and Safety Analysis

This paper carries on the reliability and safety test analysis of the two structure of computer interlocking system and the traditional double machine hot standby structure and three take two structure by MATLAB. Through the analysis and calculation of the Markov state transition diagram of the three structure systems, the reliability of dual computer hot standby system can be obtained:

$$R_{2MR}(t) = p_0(t) + p_1(t) + p_2(t) \tag{1}$$

The system security is:

$$S_{2MR}(t) = 1 - [p_3(t) + p_4(t) + p_5(t)] \tag{2}$$

The mean time to failure is:

$$MTBF_{2MR} = \int_0^{+\infty} R_{2MR}(t) \quad (3)$$

The reliability of three take two system is:

$$R_{TMR}(t) = p_0(t) + p_1(t) + p_3(t) \quad (4)$$

The system security is:

$$S_{TMR}(t) = 1 - p_5(t) \quad (5)$$

The mean time to failure is:

$$MTBF_{TMR} = \int_0^{+\infty} R_{TMR}(t) \quad (6)$$

The reliability of two take two system is:

$$R_{2 \times 2}(t) = p_0(t) + p_1(t) + p_2(t) + p_{S_0}(t) + p_{S_1}(t) \quad (7)$$

The system security is:

$$S_{2 \times 2}(t) = 1 - [p_{FU}(t)] \quad (8)$$

The mean time to failure is:

$$MTBF_{2 \times 2} = \int_0^{+\infty} R_{2 \times 2}(t) \quad (9)$$

#### 4.1. Reliability Comparison

Suppose the failure rate of each unit is the constant  $\lambda=0.0001/h$ , the maintenance rate is the constant  $u=0$ , the fault coverage rate is  $c=0.95$  and the simulation time is  $T=10000h$ , through simulation the three kinds of structure reliability curve are shown in figure 7. Suppose the failure rate of each unit is constant  $=0.0001/h$ , the maintenance rate is constant  $u=0.9$ , the fault coverage rate is  $c=0.95$  and the simulation time is  $T=10000h$ , through simulation the three kinds of structure reliability curve are shown in figure 7. (The dotted line of the figure represents the data of hot standby structure of the dual machine, and the line segment represents three take two structure data and the solid lines represent two by two take two data structure. It is the same below).

#### 4.2. The Security Comparison

Suppose the failure rate of each unit is  $\lambda=0.0001 / h$ , the maintenance rate is the constant  $P_0$  and  $0.9$ , the fault coverage rate for  $c=0.95$  and the simulation time is  $T=10000h$ . Through THE simulation respectively for three times, the structure reliability curve are shown in Figure 8 and Figure 9.

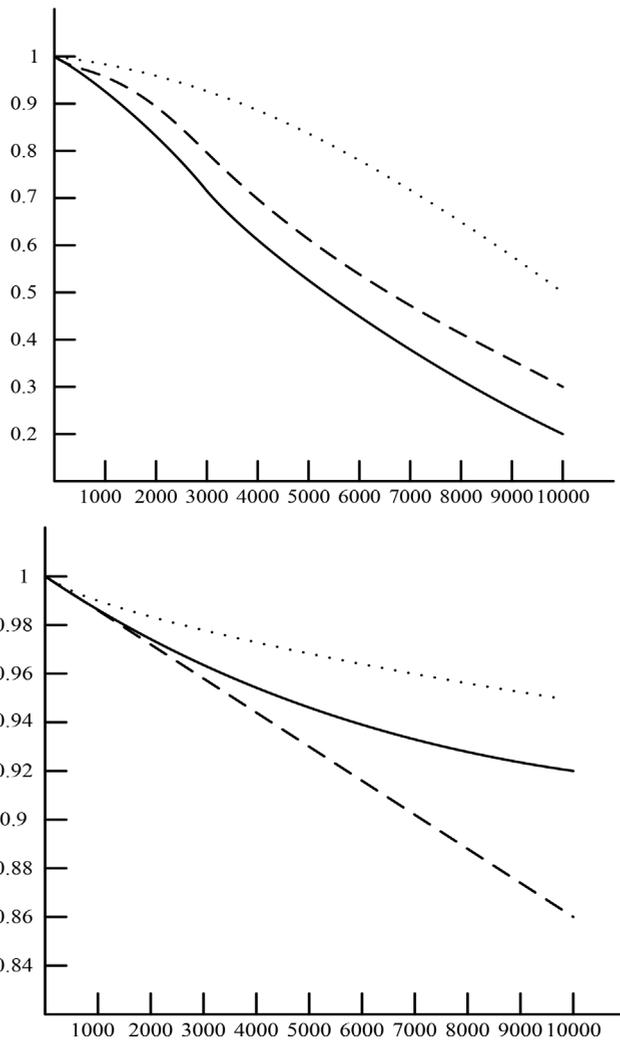


Figure 7 – u=0, reliability comparison & u=0.9, reliability comparison

### 4.3. The Mean Time to Failure:

According to the formula (3), formula (6) and formula (9), the mean time to failure of the three structures can be calculated respectively:

$$MTBF_{2MR} = 9.1728 \times 10^5 h;$$

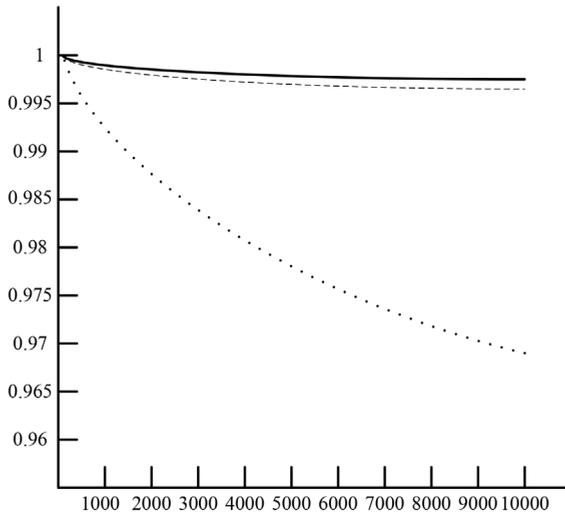


Figure 8 – u=0, Safety Comparison

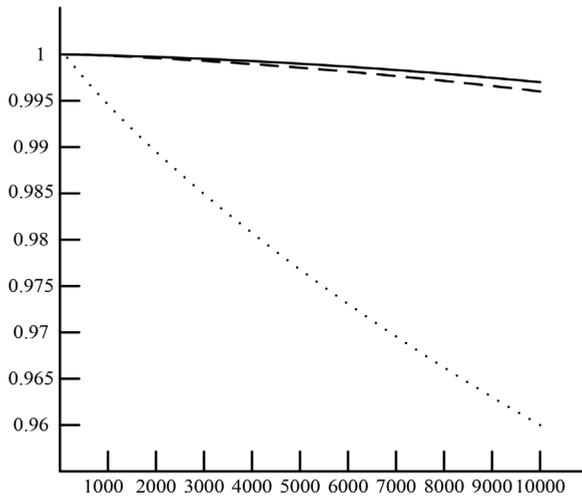


Figure 9 – u=0.9, Safety Comparison

$$MTBF_{TMR} = 6.6429 \times 10^4 h ;$$

$$MTBF_{2 \times 2} = 2.8536 \times 10^5 h.$$

#### 4.4. Data Analysis

The above analyzes the existing computer interlocking system architecture and carries on the simulation analysis and comparison of the system reliability, safety and MTTF

(mean time to failure) and other parameters. As the computer interlocking system is the repairable system, this paper focuses more on the system's reliability index with the maintenance workers. From the above analysis, the two by two take two structure system is slightly inferior to the hot standby structure of the system in terms of reliability and life expectancy, but better than three take two structure. In terms of security, it is far more than the hot standby structure, and it ensures the safety of the system is not reduced greatly in a longer period of time. Compared to three take two structure, it is slightly better than the three take two structure, this is because the hot standby system mainly depends on the structure of single machine to ensure the safety of the system, while two by two take two structure is based on hot standby. The two by two compared dual machine takes place of the single machine, which ensures the safety of the system in two aspects of hardware and software. According to the requirement of the interlocking system, considering the reliability and safety index, it can be proved that the computer interlocking system with two by two take two structure is a kind of redundant structure with excellent comprehensive performance.

## 5. Conclusion

For railway station interlocking system, this paper designs the full electronic railway computer interlocking system based on two by two take two structure. Firstly, it designs the overall structure of full electronic station computer interlocking system of two by two take two, then it carries on the hardware design of the system, two by two take two design and two-line driven design. And the reliability, safety and MTTF of the interlocking system of the two structures are compared by the experimental results of the hot standby structure, the three take two and two by two take two. Finally, by analyzing the experimental data of three structures, it is proved that the interlocking system of the whole electronic computer with two by two take two structure has the advantages of high reliability, high safety and long life. Through the comprehensive evaluation of the data of three aspects, the full electronic computer railway station interlocking system based on the two by two take two is better than the dual hot standby structure and three take two structure of the railway station interlocking system.

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# Design and Application of Computer-Aided English Learning System

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**Abstract:** Associative memory is a highly effective mnemonics, hence it was soon applied by vocabulary learning software. This paper examines the design and application of an English vocabulary learning computer system based on associative memory (AM-ELS). This system uses Sybase's latest database model designer CASE toolkit named Sybase Power Designer 12.0, and creates 7 data tables including user registration table (Flog.dbf), useful sample sentence table (Enms-dto.dbf), English vocabulary table (Wpmsdto.dbf), memory test results table (Wpmsdtsc.dbf), table of wrong words in memory tests (Wpmsdtrr.dbf), memory test score table (Wpmsdtsc.dbf 7), and option data table (Wpmsdtva.dbf). AM-ELS is a multi-user, practical, easy to learn, visualized and object-oriented computer-aided learning system developed under VFP9.0. Experiments show that this system can improve users' associative capacity and foster their ability to use associative memory to consolidate memory.

**Keywords:** Associative memory; computer-aided system; AM-ELS.

## 1. Introduction

It is commonly known that vocabulary is the basics of English language and thus a defining factor of English proficiency and application capability. Only by memorizing large amounts of words and accurately grasping their meaning can English learners be proficient in listening, speaking, reading and writing. Considering that English vocabulary is large in its quantity and active in its nature, research on English vocabulary memory methods is ever-developing (Dasgupta R., Pandey A., Jain A K., 2015; Balducci L., Dolan D., Hoffe S A., 2015).

According to a survey made by Ministry of education, 86.3% students feel it hard to memorize English words, 91% students agree that vocabulary is the key to learn English well, and 96.3% students have no clue of good methods to memorize English words. Therefore, we conclude that the main cause of failure in English learning lies in that learners are unable to master English vocabulary because they follow wrong ways. The current method mostly used by high school students or other Chinese English learners is mechanical mnemonics, a boring, tiring but inefficient memory meethod. As the mechanical mnemonics can't help learnersr establish effective association between spelling and meaning, learners have short memories of the words despite the great

efforts they take to memorize them. Failure in vocabulary learning decreases many students' confidence. They are very eager for a scientific method which can help them solve their problems in vocabulary in the shortest time and can hence facilitate their English learning (Wood S H., van Dam S., Craig T., 2015).

The so-called memory failure means that people are unable to recall or correctly recall newly learnt knowledge with the passage of time. Hermann Ebbinghaus (1850-1909), a famous German psychologist, is the first to find the law of forgetting. The figure 1 is a well-known curve which reflects the law of forgetting: the curve of Ebbinghaus (Mihai D., Mocanu M., 2015). The vertical axis represents the quantity of newly learnt knowledge, while the horizontal axis indicates time remembered (days) and the curve shows the decline of memory retention (Cadavid, J. M., & Gómez, L. F. M., 2015).

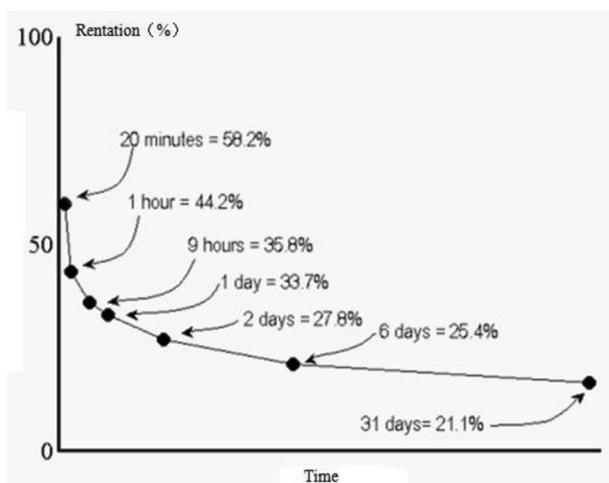


Figure 1 – Forgetting Curve of Hermann-Ebbinghaus

This curve reveals that the forgetting speed is quick but ever decreasing. Association is a mental activity where one object or concept is recalled with the clue of another. Its essence is the renewal of temporary neutral connection, reflection of connection and relationship between objects. As a sort of thinking and mnemonics, association plays importance role in the process of memory. Associative memory utilizes the connections between remembered object and objective reality, between the known and the unknown, and between all parts of the learnt material. Due to its positive role in mastering knowledge, broadening horizon, enhancing comprehension and improve memory, it is widely regarded as an effective English learning approach (Kikot, T., Fernandes, S., & Costa, G., 2015).

According to the psychological principles of memory, associative memory is practical. Association is a creative human thinking and a cognitive means to process the unknown with the known. When learning vocabulary of foreign languages, learners conduct cognitive process to all a sorts of information, such as connecting the learnt words with any knowledge owned by the learner. The connection is built up by learners' subjective and objective association. This effective memory method was soon introduced into

the design of vocabulary learning software. So far, most software focus on associative functions related to meaning and context.( Huang P Y., Chen C M., Tsao N L., 2015) Someone once put forward a phonetic associative memory which links the phonetics with certain contexts by all meaning, and the contexts shed light on the meaning of the words. (Talan J., 2015; Akkerman S., Blokland A., Prickaerts J., 2016) Therefore the phonetic associative memory is context association integrated with phonetics. Most associative memory applications are concentrated on meaning, with little attention to other aspects. If the vocabulary learning applications merely focus on meaning or contexts, learners can only get very familiar with the word senses but ignore the spelling. It is true that knowing word meaning is sufficient for reading, but problems are that learners will be unable to read out or write down the word. The process of completely mastering a word includes four aspects, phonetics, morphology, meaning and usage. That's why an all-round associative vocabulary learning system must attach enough attention to spelling and morphology association. Education experts once proposed a vocabulary memorizing method applying the phonetics association of homophones. This method originates from some teachers who teach their children new words together with learnt words in the same or similar phonetic rules. In this way, students can observe the connection between the words and deduce phonetic rules, thereby associating one word with other words and enhancing memory. When memorizing English vocabulary (Luo R., Wu J., Dinh N D., 2015), association is to make an interwoven language and knowledge memory web with a hub of familiar words. An effective approach to enhance vocabulary memory is to proficiently apply the associative memory. (Kumar K., Sachdeva A., 2015) Psychologists believe that human's psychological functional activities follow certain rules. There are three principal laws of association to follow: close association, contrary association and similar association. Given that there is few professional computer-aided learning system for English vocabulary based on associative memory at present, this paper designs and implements AM-ELS (Associative Memory English Learning System). Experiments show that this system can improve users' capability to properly use associative approach, thereby prolonging their memories (Butler B., Jennings B., 2015).

## **2. Design of AM-ELS**

Although there are all sorts of English learning applications in the market, it is not easy for learners to select a suitable one. To adapt to new learning environment and requirements, the author takes into consideration the reality and the specific requirements of some learners when exploring and developing "English learning aid system based on associative memory". The system mainly integrates autonomic learning, reading and vocabulary recitation to increase the efficiency of memory. With the operating system platform of Windows XP, this system creates database WPMSD.dbc (Du X., Zhao M., Chen G., 2015) based on conceptual data model CDM.

### **2.1. System Function**

The system mainly comprises the following modules: user registration, vocabulary profiling, (Durand T., Jacob S., Lebouil L., 2015) sample sentences profiling, test results examining, associative memory tests and report forms design, as seen in figure 2. The main function descriptions are as follows:

**User registration:** Apply access-control mechanism to prevent danger to profiles caused by human factors. To secure the system and facilitate multiple users, this system is available to registered users. System administrator can give users various permission, mainly to read, write and execute. After associative memory tests, the wrong words and test results of different users are stored separately in order that standard or advanced users can search or compare, for example, memory test results within a certain time period.

**Vocabulary profiling:** The compilation of vocabulary, including operations like adding, editing and deleting words, is a core function of AM-ELS. It is the subject which implements associative memory, namely the materials to memorize.

**Sample sentence profiling:** The complication of vocabulary, including operations like adding, editing, deleting and reviewing, expands the usage of learnt vocabulary.

**Wrong words inquiry:** Users can use their registered names to search for the wrong words in their memory tests so as to memorize them repeatedly.

**Test results inquiry:** Users can use their registered name to search for their test results once or many times. The average score can be automatically counted, reflecting the users' progress within a certain time range.

**Memory tests:** Designed specifically for synonym and polysemy. Coordinated with the degree of difficulty set by "option" and the volume of words used for random memorization, users can apply associative memory to memorize the profiled words. The tests constitute a fixed range of words which line up orderly or randomly. The users can choose to translate English into Chinese or Chinese into English. After they finish the test, the system will automatically give a mark and save the wrong words into a data table for the convenience of inquiring or reviewing. Repeated memory is also necessary in the process of associative memory (Labbé Grünberg H., Rispens J., 2015).

**Data backup and recovery:** Apply the fault tolerance of disk to prevent the danger to profile posed by malfunction of the disk. The system has the function of data backup and recovery. Users can choose to copy their data and save the backup into mobile storage device or other sectors of hard disk. They can thus restore the data if it is destroyed.

**Fault-handling:** Use "back-up system" to prevent threat of natural factors, such as the overflow or gradual disappearance of data with the passage of time. The system can also automatically repair the data damaged out of sudden power-off.

**Option:** Set some default options. For example, the difficulty degree of memory tests ranges from 1.0-5.0; the volume of words used in random memorization can be set from 1 to 99.

**Help:** Offer assistance to users' operation. The system automatically searches for answers to the questions entered by users.

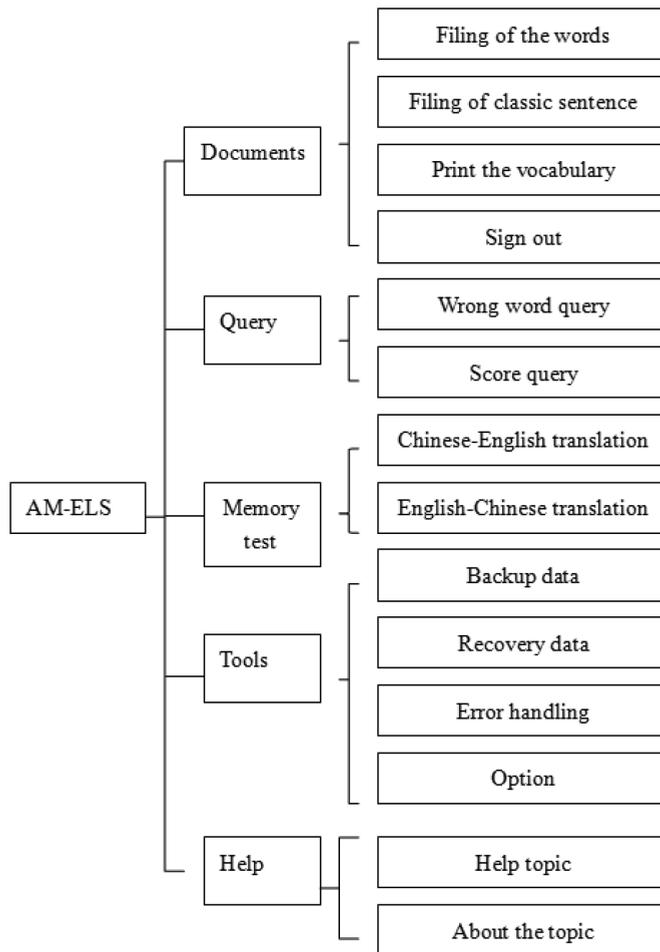


Figure 2 – The Structure Diagram of System Module

## 2.2. Design of Database

Given that the design of AM-ELS database must synthesize not only the theoretical foundation of associative memory, but also the versatility and normalization of the system, this paper uses Sybase's latest database model designer CASE toolkit Sybase Power Designer 12.0 (Leveroy D., 2015), whose conceptual data model is shown in figure 3.

In accordance with the CDM, a database (Wpmsd.dbc) is created, including 7 data table: user registration table (Flog.dbf), useful sample sentence table (Enms-dto.dbf), English vocabulary table (Wpmsdto.dbf), memory test results table (Wpmsdtsc .dbf), table of wrong words in memory tests (Wpmsdtrr.dbf), memory test score table (Wpmsdtsc.dbf 7), and option data table (Wpmsdtva.dbf). Tables 1-3 are descriptions of the main structure of data table.

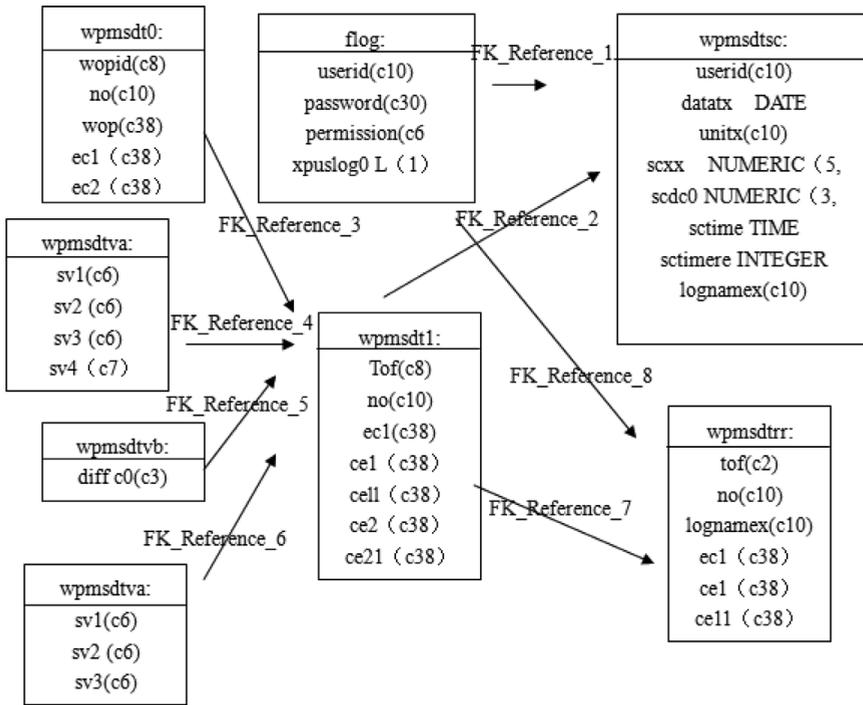


Figure 3 – Conceptual Data Model of AM-ELS

ID	Fields Name	Type	Width	Decimal	Caption
1	wopid	C	8		Lexical identity
2	no	C	10		Code
3	wop	VarC	38		Words
4	ec1	VarC	38		Chinese-EnglishTranslation1
5	ec2	VarC	38		Chinese-EnglishTranslation2
6	ec3	VarC	38		Chinese-EnglishTranslation3
7	ec4	VarC	38		Chinese-EnglishTranslation4
8	ec5	VarC	38		Chinese-EnglishTranslation5
9	ec6	VarC	38		Chinese-EnglishTranslation6
10	ec7	VarC	38		Chinese-EnglishTranslation7
11	ec8	VarC	38		Chinese-EnglishTranslation8
12	th1	VarC	38		Synonym1
13	th2	VarC	38		Synonym2
14	th3	VarC	38		Synonym3
15	th4	VarC	38		Synonym4
16	an1	VarC	38		Antonym1

ID	Fields Name	Type	Width	Decimal	Caption
17	an2	VarC	38		Antonym2
18	an3	VarC	38		Antonym3
19	an4	VarC	38		Antonym4
20	ph1	VarC	38		Phrase1
21	ph2	VarC	38		Phrase2
22	ph3	VarC	38		Phrase3
23	ph4	VarC	38		Phrase4
24	ph5	VarC	38		Phrase5
25	ph6	VarC	38		Phrase6
26	se1	VarC	188		Example sentence1
27	se2	VarC	188		Example sentence2
28	se3	VarC	188		Translation1
29	se4	VarC	188		Translation2

Table 1 – The Structure of the English Vocabulary Data (Wpmsdto.dbf)

ID	Fields Name	Type	Width	Decimal	Caption
1	Userid	C	10		User name
2	Password	C	30		Password
3	permission	C	6		Authority(Read, Write, Execute)

Table2 – The Structure of User Registration Data Table (Flog. dbf)

ID	Fields Name	Type	Width	Decimal	Caption
1	A0	1	4		Code10000+RECNO()
2	A1	VarC	94		Chinese example sentences
3	A2	VarC	120		Corresponded English sentences
4	A3	c	1		Degree of difficulty(0-9)

Table 3 – The Structure of Classic Example Sentences Data Table (Enms-dto.dbf)

## 2.3. Design of Main Algorithm

### 2.3.1. Encryption Algorithm of User's Password

The technical security measure taken by AM-ELS is to establish separate control table for user registration and access. Validating and verifying user's authorized identity can prevent the intrusion of visitors without permission. Therefore, the access control table enables both resources sharing and protection. To authorize users is to define the

operation types accessible to them, namely the authority to read, write and execute system resources. There are three categories of valid users. Details are shown in table 4.

Legal user name	Password	Access control	Remarks
Supervisor	System administrator settings	Read Write Execute	System administrator
Guest	No password	Execute	Password not saved by guest
General user name	Modified by user	System administrator settings	Set by administrator

Table 4 – User Classification Table

The users who want to use the system resources must first send applications to system administrators who can add username and define access control authority. Then the administrators will inform the users to register and set their own passwords. If the data of users’ registration and access control able is accessible, it will be meaningless to set passwords. Therefore, the passwords are encrypted. The following is the principle and algorithm of encryption.

Password ( $\leq 10$ Byte) -- encoding(encryption) -- code(30Byte) -- decoding (decryption) -- password( $\leq 10$ Byte).

Encryption algorithm: cipher text=  $\text{str}(\text{asc}(\text{password}) + A + B * \text{mod}(\text{recno}(\text{ }, C), 3)$  in which A, B, C are prime numbers.

**2.3.2. Algorithm of Memory Tests**

Figure 4 is the tree of English associative memory method. One word is associated with  $n_1$  senses,  $n_2$  synonyms,  $n_3$  antonyms,  $n_4$  phrases and  $n_5$  sample sentences.

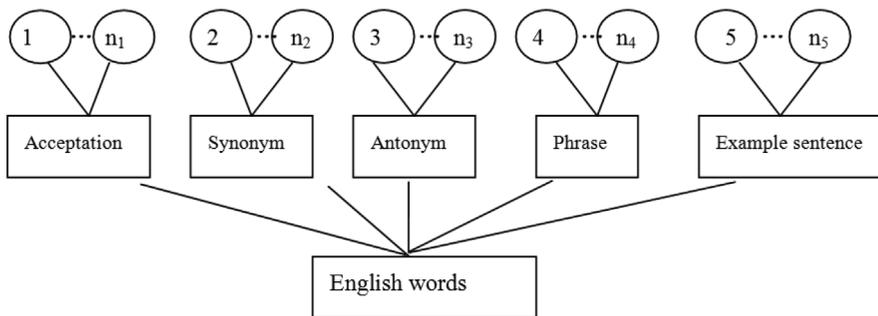


Figure 4 – The Tree of English Associative Memory Method

In the process of implementation, one word has merely 8 senses, 4 synonyms, 4 antonyms, 6 phrases and 2 sample sentences.

The descriptions of memory test algorithm are as follows:

Step1 Encode the vocabulary to be memorized in a unitary form. For example, the vocabulary of the first unit of the first book of Junior High School will be automatically encoded as JHS-1-1-XX.

Step2 Implement the functional module of vocabulary profiling and add vocabulary encoded in the same form into the English vocabulary table (wpmsdto.dbf).

Step3 Conduct memory tests of vocabulary in a given range randomly. The tests are mainly in the form of translation between English and Chinese. If the test content is to produce all the English words in a given sense, the system must present the total number of the words but not the word class. Only the users who produce all the words score. Translation from English to Chinese will follow the similar rule. Figure 5 is the flow chart of memory test algorithm.

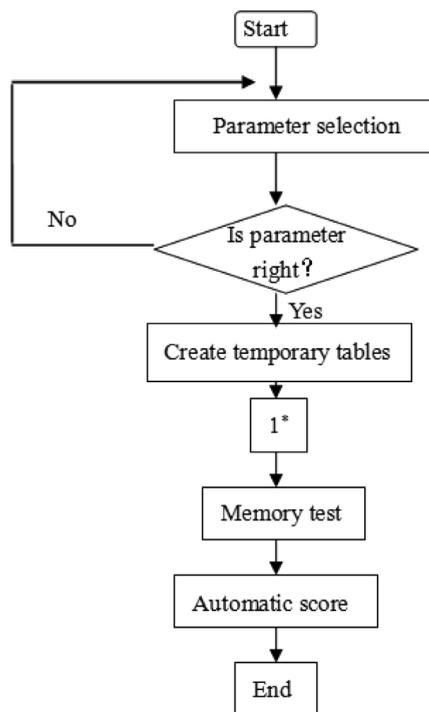


Figure 5 – The Flowchart of Memory Test Algorithm

1\*: Enter the word of wpmsdt() that accords with the parameters into the temporary table

### 3. Implementation

Visual Fox Pro 9.0, a latest release of Microsoft, is a database application system with its own development language. Compared to the previous versions, it is greatly improved, with more powerful functions. It provides design method of visual interface, support object-oriented program design technology and have more new Internet functions. The system can be used as a front-end development tool of both large-scale and small-scale database. It is widely used as a tool to develop database application system, such as English vocabulary profiling, memory test interface (Malve H O., 2015).

### 4. Analyses and Discussion

Association is the extension of memory. In psychology, association is defined as the process of an advanced activity of central nervous system. Using the organic links between objects, man can associate scattered concepts. The entire knowledge is composed by scattered, simple and individual experience. Human save knowledge into two categories of memory: surface memory and deep memory. The former is actively recalled and thus impressive; while the latter is rarely recollected and hence forgetful. In consequence, man's memory has profound connotation and great potential to improve. The process of associating scattered concepts in a certain relationship by using surface memory to stimulate and induce deep memory is called association.

The principles of association can thus be applied to promote vocabulary memorization. The AM-ELS provides a good platform for memorizing English vocabulary. It has simple operation and adequate versatility. By carrying out comparative experiments on 10 students from junior and senior high school, and university, this paper finds that the system cannot only enable students to quickly master associative memory but also proficiently apply it. The average English test scores of the three groups of students increased respectively by 12.6, 8.5, and 5.8. It is thus logical to conclude that students in lower grade make better progress by using the system. In addition, AM-ELS can also be used to assist teachers in their teaching.

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# A Test System for Airborne Computers based on PCI Data Acquisition Cards and Virtual Instruments

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**Abstract:** With the rapid development of aviation electronics technology and mature applications of computer technology, high-end computer products combined with digital electronic technology and virtual instrument technology have become a major characteristic research direction in the field of aerospace. An airborne computer is the core equipment in the avionics system that provides a hardware platform for data processing and transmission and interface software and application software for subsystems. Test systems can automatically collect, analyze data and generate test reports, which can reduce the workload of testers and improve test speed and accuracy. In order to improve integration testing performance of airborne computers and improve the portability of test equipment, a test system for airborne computers based on PCI data acquisition cards and virtual instruments is developed. According to the test functions of an airborne computer testing system, hardware configuration of the testing system is analyzed and given to test the reliability of the system. An actual testing analysis shows that the system has low failure rates, more than 2000 mean time between failures and pretty high reliability.

**Keywords:** Airborne computer; testing system; PCI data acquisition cards; virtual Instruments

## 1. Introduction

The currently prevailing condition monitoring systems are mostly based on virtual instruments. Literature (Alin A., 2015; Capasso L., Branchini P., Budano A., 2015; Rjabov A., Sklyarov V., Skliarova I., 2015) introduces the applications of virtual instrument technology in the field of engineering data collection. Because of its graphical programming language, intuitive and vivid interface, easy dynamic curve display, and short development cycle, virtual instruments have made considerable progress in the testing field. Literature (Kostenetskii P S., Besedin K Y., 2014; Dumitru-Ionuț M., Ciprian-Florin G., 2015; Mohammad H., Fayyumi A., Rashideh W., 2015) proposes the LabVIEW-based monitoring model for motor operations and uses it in different research of the motor model. Literature (Tychkov A Y., Abrosimova O V., Kuz'min A V., 2015)] describes a hardware and software way that combines NI-DAQ cards with LabVIEW. However, in terms of processing control algorithms, compared to the VC

platform, LabView has too many deficiencies. VC software is also adopted with visual programming, but since its control features flexibility, variability and fast execution speeds, its advantages are particularly prominent when using relatively complex control algorithms. In contrast, LabVIEW faces too many difficulties in processing and implementing complex algorithms, and is inconvenient to debug software, so it is not conducive to function expansion or platform migration of the system. Comprehensive testing of airborne computers plays a very important role in its development. Virtual instrument technology uses software to replace part of the hardware capabilities, which is to use software to implement data access, processing and display, thus simplifying the hardware module, reducing the volume of the entire system, and improving system portability and reliability. In this case, it has been widely applied in automated testing and measuring fields. Compared with manufacturer custom instruments, it has greater flexibility and scalability. In this paper, PCI data acquisition card technology is combined with virtual instrument theory to establish and develop an integrated testing system that is highly flexible, efficient and easy to operate, in order to improve the integration performance of airborne computers (Carvalho, A. A., Araújo, I., & Fonseca, A., 2015).

## 2. Key Techniques of Testing System

### 2.1. PCI Data Acquisition Cards

Data acquisition refers to sending analog and digital signals collected automatically from sensors and other equipment during testing out to the host computer (PC, embedded controller, etc.) for analysis and disposal. The data acquisition system is to achieve a flexible, user-defined monitoring system in combination with measurement hardware and software products based on computer or other dedicated testing platforms. Famous professional data acquisition equipment companies abroad include the U.S. NI (National Instruments); there are many domestic enterprises developing and producing acquisition cards, encompassing ART, Tuopu, and Zhongtai Innovation and Research in the Chinese mainland; Adlink and Advantech in Taiwan Province; these companies are excellent professional data acquisition manufacturers. Computers are widely used today, and the importance of data acquisition is very significant. It is a bridge between computers and the external physical world. The difficulty of acquiring various types of signals varies greatly. During actual collections, noise may also bring some trouble. Suppose an analog signal  $x(t)$  is sampled every  $\Delta t$ , the time interval between adjacent samples  $\Delta t$  is known as the sampling interval or the sampling cycle. Its reciprocal  $1/\Delta t$  is called the sampling frequency in units of samples/sec.  $\Delta t, 2\Delta t, 3\Delta t, \dots$ .  $x(t)$  will be known as sampling values. All  $x(0), x(\Delta t), x(2\Delta t)$  are sampling values. In this way, signal  $x(t)$  can be denoted by a group of dispersed sampling values  $\{x(0), x(\Delta t), x(2\Delta t), x(3\Delta t), \dots, x(k\Delta t), \dots\}$ . The sampling interval is  $\Delta t$ , and sampling points are dispersed in the time domain. If the signal  $x(t)$  acquires  $N$  sampling points, then  $x(t)$  can be denoted  $X = \{x[0], x[1], x[2], x[3], \dots, x[N-1], \dots\}$ . This series is called the digital display or sampling display of  $x(t)$ . The series only use subscript variables for indexing without containing any information about the sample rate (or  $\Delta t$ ). So if only knowing the sampling value of the signal but not its sampling rate, as the time scale is lacking, it is impossible to know the frequency of  $x(t)$ . Conforming to the sampling theorem, the sampling frequency must be at least twice the signal frequency. Conversely,

if a sampling frequency is given, the maximum frequency that can display the signal correctly without distortion is called Enqvist frequency, which is half of the sampling frequency. A data acquisition card consists of:

1. Multi-way switching:

Time-sharing acquisition of multi-parameter multi-way signals is completed by controlling multi-way switches, and multi-channel signals are in turn switched to the input of the amplifier by multi-way switches. Analog multi-way switches are divided into three categories: mechanical, electromagnetic and electronic. Modern data acquisition systems mainly use electronic multi-way switches.

2. Amplifiers:

The primary multi-way switches put before amplifiers switch the collected signals and amplifies (or attenuates) it within the range ability of sampling link. Usually in practical systems, an amplifier will have adjustable gain, and designers can choose different gain multiples depending on different amplitudes of the input signals.

3. Sample holders

A sample holder is to take the value of the measured signal at a time (i.e. discretizing time of the signal) and hold the signal constant at A/D conversion process. If the measured signal changes very slowly, sample holder may not be used. Sample holders are sample and hold circuits in the input logic level control. In a sample circuit, an output signal tracks an input analog signal, while in a hold circuit, an output signal holds an instantaneous input analog signal of the former sampling end time for data processing (quantization) or analog control.

4. Converters:

An A/D converter translates input analog quantities into digital output, and quantizes signal amplitudes. With the development of electronic technology, now people generally integrate a sample holder and an A/D converter on a single chip. These four parts are in the PC forward path and the main links that composite data acquisition cards. Together with other related circuits such as timer and bus interface circuit, these are integrated in a printed circuit board to compose a data acquisition card and complete tasks such as signal data acquisition, amplification and A/D conversion. The printed circuit board of a lot of data acquisition cards is also equipped with D/A converters, which are located in the PC backward path as the output channel to translate digital quantities output from the computer into analog quantities, thereby achieving the control function (Silva E C., Taleb C., Costa N M S C., 2015; Möhlhenrich S C., Heussen N., Peters F., 2015; Tawfik M., Monteso S., Garcia-Loro F., 2015).

Common functions of data acquisition cards encompass analog input, analog output, digital I/O, timer/counter, etc. These functions are realized by their corresponding circuits.

1. Analog Inputs: An analog input is the most basic function of acquisition cards. It converts an analog signal into a digital signal typically by a multi-way switch, an amplifier, a sample-and-hold circuit and an A/D converter. The performance and parameters of A/D converters directly affect the quality of analog inputs,

- and an appropriate A/D converter should be selected depending on the actual needs.
2. Analog outputs: An analog output typically provides incentives for the acquisition system. Output signals are influenced by the settling time, conversion rate and resolution of D/A converters. Parameter building time and conversion rate determine the changing speed of the output signal amplitude; newly designed D/A converters with high conversion rates can provide high-frequency signals, and parameter indexes of D/A converters should be chosen based on the actual needs.
  3. Digital I/O: Digital I/O is usually used to control the process, generate testing signals, and communicate with peripherals. The main parameters include digital port line, receive and transmit frequencies, and drive capability. If outputs are used to drive the motor, it does not require high data transfer rates. Line should work with the control object, and the current required shall be less than the drive current provided by acquisition cards. However, adding the appropriate digital signal and conditioning devices, low-current TTL level signals output by acquisition cards can still be used to monitor high-voltage, high-current devices.
  4. Count and timing: the counting function should be used in many occasions, such as timing and producing square waves. A counter comprises three important signals: threshold signals, counting signals and output signals. Threshold signals are actually trigger signals; counting signals are the signal source that provides time standards for counter operations; output signals generate pulses or square waves on the output line. The most important parameters of counters are resolution and clock frequency; higher resolution means that a counter can count more numbers, while clock frequency determines the speed of technology; the higher the frequency, the faster the count.

A data acquisition card has the following performance indicators:

1. Analog input channel: This parameter indicates the maximum signal channels that a data acquisition card can acquire.
2. Input modes of signals: the general input modes of signals to be acquired consist of a single-ended input, which is one of the grounding terminals of a signal; a differential input, meaning both sides of the input are floating; unipolarity, which is the range of signal amplitudes[0~A], is the maximum amplitude of the signal; double polarity, which is the range of signal amplitudes [-A~A].
3. Signal input range: depending on the general characteristics of signal inputs (unipolar or bipolar inputs), there are different input ranges. For example, a typical value for unipolar inputs is 0~10v, and that for bipolar inputs is -5~+5v.
4. Amplifier gain: signal magnification times by a data acquisition card.
5. Analog input impedance: an intrinsic parameter in data acquisition cards, and generally it does not require setting by users.
6. Sampling rate: refers to the number of analog signal samples acquired by a data acquisition card in unit time. It is an important indicator of the data acquisition card. As per the sampling theorem, in order to make a discrete time-series signal sampled reproduce the original input signal without distortion, the sampling frequency must be at least twice the highest frequency of the input signal; otherwise frequencies will be confusing or wrong.

7. Digit b: refers to the binary digit output by an A/D converter.
8. Resolution: refers to the smallest change in the input signal that can be distinguished by data acquisition cards. Resolution is generally denoted by binary codes or BCD codes output by an A/D converter.
9. Accuracy: Usually expressed as the quantization error.
10. Nominal full scale: an analog output quantity equivalent to the nominal value of digital quantification  $2^b$ .
11. Response time: refers to the time interval between outputting an analog quantity to stabilizing it to an appropriate range after changes in the digital quantity (Medina-Flores R., Morales-Gamboa R., 2015; McMeekin P., Flynn D., Ford G A., 2015; Lucas Consiglieri L., Ferri G., Sabag N., 2015).

## 2.2. PCI Bus Technology

A data acquisition card is a computer expansion card that enables data acquisition (DAQ) functions. The majority of board cards at present have access to a personal computer via buses like USB, PXI, PCI, PCI Express, Compact PCI, PC104, PC104 +, VXI, FireWire (1394), PCMCIA and ISA, of which ISA buses are gradually being replaced by PCI and other buses.

After years of rapid development, the PCI bus standards have gradually replaced ISA, MAC and other buses to become the main bus standards for PCs. In a certain sense, it can be considered that the PCI bus standards have solved the contradiction between high-performance CPU processing power and inefficient system structures. In the high-speed data acquisition and transmission applications, high-speed data exchange between the host and external devices can be achieved by realizing DMA data transfer using the PCI bridge chip.

Compared to other commonly used bus standards, the PCI bus has the following main features:

1. Independent of the CPU. Devices for the local PCI bus is designed for PCI but not for CPU, and therefore, the device design is independent of the processor upgrade.
2. Low power consumption. The major design objective of PCI specifications is to get the current as small as possible.
3. A burst transfer can be achieved by read and write transfers. The PCI bus structure allows for a peak data transfer rate of 132 MB/sec in 32-bit, 33MHz PCI local bus read/write transfers; 264MB/S in a 64-bit, 33MHz local bus and 528MB/S in a 64-bit, 66MHz local bus.
4. Bus speed: version 2.0 of the PCI local bus supports speeds of up to 33MHz; version 2.1 and above add support for bus operations.
5. Fast access: when the master that docks on the PCI local bus writes a PCI target, at the bus speed of 33MHz, access time is only 60ns.
6. Under parallel bus operations, the bridge entirely supports buss parallel operations, and use with the processor bus, PCI local bus and expansion bus in synchronization.
7. Automatic configuration.

### 2.3. Acquisition Mode of Structural Testing Data

Data sampling is a technology that uses indirect methods to obtain the state of things. Because almost all test equipment works by using electrical energy, in normal circumstances we convert signals to be measured such as temperature, pressure and flow to electric signals (voltage signals or charge signals, etc.) via certain conversion techniques and then convert electric signals into digitized data. Functions of traditional structural testing laboratory data acquisition systems are completed by hardware equipment. Hardware systems generally consist of a sensor, front-end signal amplifying device, interface, cables, computer and other components. The digitized data that have gone through filtering, amplification and A/D conversion by the front-end instrument are transmitted to the computer and then further processed and archived by a computer. Here, the computer just passively stores the data collected but has no control over the entire system, whereas the virtual instrument system based on computer acquires data in a different way. In the virtual instrument system, the sensor for receiving signals is still necessary, but the front-end equipment for amplifying signals may not be necessary, because the data acquisition equipment installed in the computer case (or mounted in a separate case but controlled by the computer) can amplify the signals. The A/D signal conversion is even accomplished using the A/D converter chip in the device. In the data acquisition system of virtual instruments, the computer has absolute control; signal acquisition, amplification, A/D conversion, data archiving, and a series of other functions are achieved by computer instructions. Since computers perform tasks conforming to software instructions, and software systems that owns entire control are much richer and have more improved functions than traditional hardware instruments. Therefore, the computer-based data acquisition system can achieve very high levels of automation degree (Reza M S., Al Mamun S M M., Al-Mamun A., 2015; Zhang T., Collins J., Arbuckle-Keil G A., 2015).

The functional block diagram of a typical PC data acquisition system is shown in Figure 1:

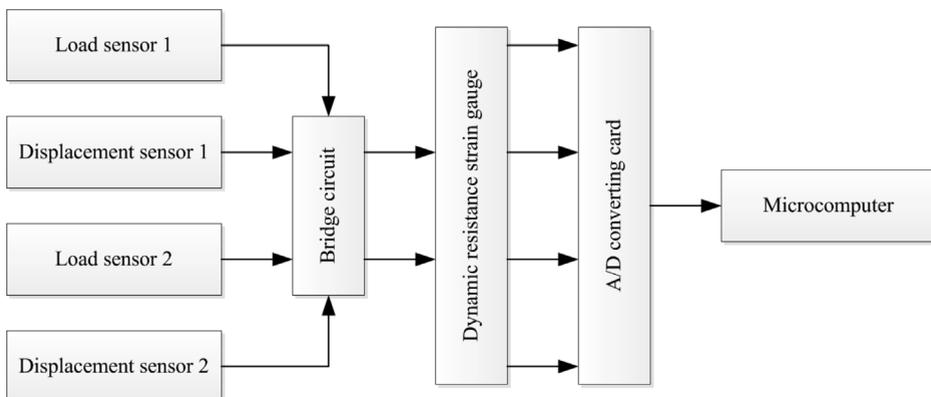


Figure 1 – The Theory of Data Acquisition System in Computer

In the testing, when the concrete member deforms, sensors installed on various parts output signals; since the output electric signals are generally millivolt signals and very weak, resistance strain gauge are required to amplify the signals (the strain gauge is not

necessary if a good programmable gain amplifier is equipped in the data acquisition equipment in the computer, and there is a card providing a stable power supply for the bridge circuit). The amplified voltage signals are transmitted to the A/D interface card on the computer and the analog quantities are converted to digital quantities and sent to the computer bus. After the computer reads the digital quantities, it converts the necessary non-electric data (such as load, displacement and strain) according to the conversion relation and relevant data calibrated, and it is displayed on the computer screen and recorded on computer disks if necessary, which is also convenient for remote data transmission over the network.

### 3. Construction of the Testing System

#### 3.1. Features of Virtual Instruments

A virtual instrument is a computer-based instrument. The close integration of computer and instruments is an important current instrument development direction. Roughly speaking, this combination has two ways. One is to install a computer into an instrument, and a typical example is the so-called intelligent instrument. With the increasingly powerful computer functions and increasingly reducing volume, this kind of instruments has more powerful functions, and there have been system-embedded instruments. However, such instruments have declining flexibility due to its cured hardware, and scalability limits the upgrade space also because of its external hardware limitations. The other way is to install an instrument into a computer and achieve various instrumental functions relying on the usual computer hardware and operating system. Virtual Instruments mainly refer to this approach. Figure 2 reflects a common virtual instrument setup program.

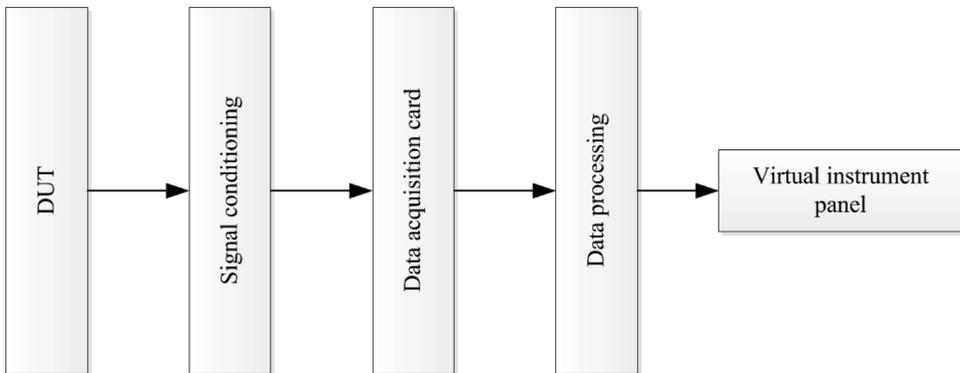


Figure 2 – The Theory of Data Acquisition System in Computer

The main features of virtual instruments are:

1. Use common hardware as much as possible, and the main difference of various instruments lies in software.
2. Can take advantage of computer abilities and strong data processing capabilities and can create a powerful instrument.

3. Users can define and manufacture a variety of instruments as per their own needs.

The most basic part of a virtual instrument is actually to achieve an organization's data acquisition system functions in accordance with needs, which involves basic research theories of data acquisition and digital signal processing; virtual instruments further extend functions to use analog output signals or digital output signals on the data acquisition equipment (such as PCI data acquisition cards) to perform feedback control of automated equipment or production lines so as to achieve the purpose of automatic control. On the basis of computers, virtual instruments have markedly broken through traditional instruments' limitations in terms of data processing, display, transmission, storage, speed, accuracy, and the environment, and have great flexibility. When all kinds of new technologies associated with mainstream PC emerge, just changing related components can keep up the pace of PC innovation and enjoy great convenience. Given the continuous improvement of cost performance of computers, virtual instruments are more accepted by the public due to the prices.

### 3.2. Third Digital Filtering Algorithm

First difference filtering assumes that there should be slight differences between several consecutive sample intervals within a small enough period of time. Such an interval itself should also meet certain limits, which are to meet Formulas (2) and (3). Otherwise it will be regarded as a drifting point. As shown in Figure 4.1,  $y(i-1) - y(i-2) \approx y(i) - y(i-1)$ , then  $y_g(i+1)$ , the discrete value of  $y(i+1)$ , can be obtained by Formula (1).

$y(i)$ ,  $y(i-1)$ ,  $y(i-2)$  are points that meet Formulas (2) and (3) in the sampling sequence  $[y(1), \dots, y(i), \dots, y(n)]$  and are considered as truth-value points.

$$y_g(i+1) = y(i) + y(i) - y(i-1) \tag{1}$$

where,

$$|[y(i) - y(i-1)] - [y(i-1) - y(i-2)]| \leq e \tag{2}$$

$$\begin{cases} |[y(i-1) - y(i-2)]| \leq m * e \\ |[y(i) - y(i-1)]| \leq m * e \end{cases} \tag{3}$$

where  $e$  is the deviation limit and will be talked about below;  $m$  is the amplification factor of the deviation limits.

Determination of initial iteration points: first of all, the initial iteration points can be searched from the first data point  $y(1)$  in the sample sequence or a data point  $y(i+1)$  after a certain sample truth-value  $y(1)$  (the sequence number of a sample truth-value point in the initial sample sequence) until three consecutive points  $y(t)$ ,  $y(i-1)$  and  $y(i-2)$  are found that can meet Formulas (2) and (3), and the three points are set as the initial iteration points. At the same time, consider each sample points  $y(i-3), \dots, y(1)$

or  $y(i-3), \dots, y(j+1)$ , ( $j < i-4$ ) before the initial iteration points  $y(i)$ ,  $y(i-1)$  and  $y(i-2)$  as drifting points. It is necessary to remove and correct them. When corrected, if the search starts from the first point  $y(1)$ , by using a linear interpolation, we only need to replace the drifting points  $y(1), \dots, y(i-3)$  with 0 to  $y(i-2)$  as per the number of drifting points; if the search starts from the data point  $y(i+1)$  right after the sample truth-value  $y(j)$ , by carrying out a linear interpolation, we only need to replace the drifting points  $y(j+1), \dots, y(i-3)$  with  $y(j)$  to  $y(i-2)$  as per the number of drifting points. Meanwhile, in order to approximate the original sampling curve in maximum truth degree, for the linear interpolation sequence  $[y(k), \dots, y(m)]$  (where  $k$  and  $m$  are initial serial number and terminating serial number of the interpolated sequence, respectively), and the original segment sampling sequence  $[y(k), \dots, y(m)]$  corresponding to the interpolated sequence, sequentially judge each point  $y'(j)$  in the sequence  $[y'(k), \dots, y'(m)]$ , as shown below:

$$|y(j) - y'(j)| \tag{4}$$

When  $y'(j)$  satisfies (4), there is no need to replace the original sample values by carrying out interpolation, and directly retain the original samples.

The filtering process of sample data:

After determining the initial iteration point, calculate the estimate value  $y_g(i+1)$  of the sampling point to be filtered  $y(i+1)$  according to (1), and determine the authenticity of  $y(i+1)$  depending on (5) or (6). As long as one of the conditions is met, it is the truth-value, and continue to test the next sampling point.

$$|[y_g(i+1) - y(i+1)]| \leq m * e \tag{5}$$

$$|[y(i+1) - y(i)]| \leq m * e \tag{6}$$

If (5) or (6) is not satisfied,  $y(i+1)$  is considered as a drifting point, and replace  $y(i+1)$  with  $y_g(i+1)$ .

Continue to perform iteration until the following occurs:

1. If two consecutive truth-values are detected right after a drifting point, re-search an initial iteration point;
2. If five drifting points are replaced consecutively without interruption, in order to maintain the curve trends and reduce errors brought about by differential iteration, take the sixth drifting value equal to the former truth-value, and re-search an initial iteration point from the subsequent sampling point.

Determination of the deviation limit  $e$ :

In the above filtering process, if  $e$  is too large, it may not reach good results, and the improved first difference may have reduced anti-jamming capability; if  $e$  is too small, there will be greater possibility to mistake the true sampling point as the drifting point. So the value of  $e$  is essential.

Subtract the former and later of the sample sequence  $[y(1), \dots, y(i), \dots, y(n)]$  and take the absolute value to get a new sequence  $[z(1), \dots, z(i), \dots, z(n-1)]$ .

Define the sampling step size  $ds$  of the structural testing data as: When the variation of any acquired signal exceeds  $ds$ , the system will collect all the data signals at that moment and respectively summarize the numbers  $n_1, n_2, n_3$  of sequence  $z$  falling within the scope  $[0, 1]$ ,  $[1, ds]$  and  $[ds, 1.5ds]$  as well as the sums  $s_1, s_2, s_3$  of all data falling within the scope. Take a weighted average of the new sequence  $z$  in the interval  $[0, 1.5 ds]$  to determine the deviation limit  $e$  (at this time if the absolute value of the default adjacent sampling data differences is greater than  $1.5ds$ , it is abnormal and should not be considered):

$$e = \frac{s_1 p_1 + s_2 p_2 + s_3 p_3}{n_1 p_1 + n_2 p_2 + n_3 p_3} \quad (7)$$

Where

$$p_1 = \frac{n_1}{n_1 + n_2 + n_3}, \quad p_2 = \frac{n_2}{n_1 + n_2 + n_3}, \quad p_3 = \frac{n_3}{n_1 + n_2 + n_3}$$

### 3.3. Hardware Components of the Portable Airborne Computer Testing System

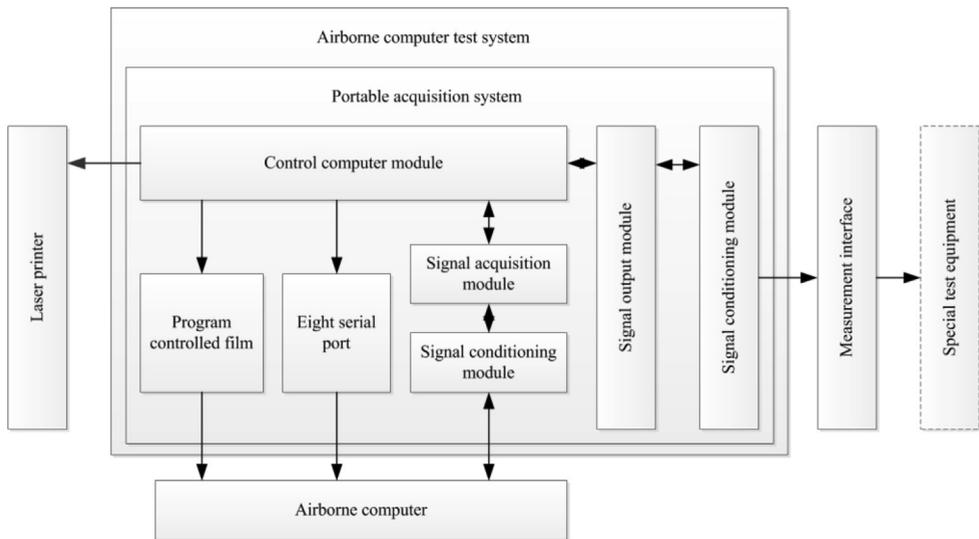


Figure 3 – Block Diagram of Hardware System

The integrated testing system consists of a control computer module, programmable power supply module, signal conditioning module, signal acquisition analog output module, signal acquisition module, measurement and testing interfaces, LCD, portable case, laser printer, etc. The block diagram of the hardware system is shown in Figure 3.

An output signal acquisition module for airborne computers: The NI PCI-6259 is a high-speed multifunction M Series DAQ board optimized for superior accuracy at fast

sampling rates. The board card has an analog triggering function, so no software is needed to continuously monitor the input signal, which can save programmers a large amount of time to engage in data processing. Airborne computers collected by the NI PCI-6259 output two-way operating power, eight serial ports, TB1, TB2 and other signals, while connecting TB1 and TB2 in the circuit design to counter GATE end of the board card. When TB1 and TB2 signals arrive, the counter can directly calculate the cycle or frequency of the signals without processing by software algorithms and can make measurements more accurate. Other modules: the switch control signal module uses the NI M Series multifunction data acquisition card PCI-6229 for the testing system to provide control signals to airborne computers; an analog signal modules uses the NI PCI-6722 to simulate avionics output. The board card provides 8 analog output channels with speeds of 182 MS/S per channel, 13-bit resolution, and digital triggering. It can be set by software and generate any shape and frequency wave, with bipolar output -10~+10V, relative accuracy of 0.035%, maximum offset of 7mV, and absolute accuracy of 10.78mV. While A/D conversion precision testing also uses this module to output DC level, and the system requires an accuracy of 40mV to meet A/D precision measurement requirements; the serial communication port module RS422 uses NI port series card NI PCI-8431/8 to provide 8 channels of port signals to airborne computers; NI PCI-8431/8 is capable of data transmission at the variable baud rates from 57bit/s to 3Mbit/s; for non-standard baud rates, it can reach up to 1% accuracy and 0.01% accuracy under the standard baud rates.

#### 4. Analysis of the Systematic Performance Test

The reliability model mainly includes a programmable power supply module, A/D converter module, D/A converter module, control computer, signal conditioning, etc. To ensure the reliability of the entire testing system in the above models, we must guarantee that each component is highly reliable. Most modules, interfaces and boards in the system design are adopted with mainstream devices provided by foreign equipment manufacturers, so there is reliable quality assurance and technical support. The software is designed on a highly reliable virtual instrument development platform abroad in order to ensure that the entire system is highly reliable. Below is a preliminary prediction of the system's mean time between failures (MTBF). The MTBF value of each component in accordance with the related information system is exhibited in Table 1.

<b>Modular</b>	<b>MTBF<sub>i</sub> (h)</b>	<b>λ<sub>i</sub></b>	<b>Number</b>
<i>A/D Transformation</i>	40000	2.5×10 <sup>-5</sup>	1
<i>D/A Transformation</i>	40000	2.5×10 <sup>-5</sup>	1
<i>Serial card</i>	40000	2.5×10 <sup>-5</sup>	1
<i>Programmable power supply</i>	8000	1.25×10 <sup>-4</sup>	1
<i>Control computer</i>	10000	1×10 <sup>-4</sup>	1
<i>Conditioning and other</i>	12000	8.3×10 <sup>-5</sup>	1

Table 1 – The Average Time Without Failure of System Components

The failure rate of the system is:

$$\lambda_s = 2.5 \times 10^{-5} + 2.5 \times 10^{-5} + 1 \\ 25 \times 10^{-4} + 1 \times 10^{-4} + 8.3 \times 10^{-5} = 3.83 \times 10^{-4}$$

The MTBF of the system is:

$$MTBF = 1/\lambda_s = 2611h$$

It can be seen from the experimental data that the system failure rate is  $10^{-4}$  order; the MTBF is more than two thousand hours, indicating that the system has very high reliability.

## 5. Conclusion

With the development of electronic technology and computer technology, the technical level of the airborne testing system has been significantly improved. When designing the testing system, using a board card based on the PCI bus enables to achieve system miniaturization. The paper begins with introducing the related technologies and virtual instrument technology of PCI data acquisition cards and analyzes the characteristics of virtual instruments, on the basis of which it creates an airborne computer testing system grounded upon PCI data acquisition cards and virtual instruments. The system design process adheres to the test automation philosophy, gives full consideration to the system reliability, and carries out an experimental analysis of the system reliability. The reliability model mainly includes a programmable power supply module, A/D converter module, D/A converter module, control computer, signal conditioning, etc. Practical applications have showed that the testing system has extremely high reliability and broad application prospects in the field of aerospace engineering.

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# Research on hierarchical tree structure of Multi Dimension Data Index in Centralized Environment

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**Abstract:** With the rapid development of computer technology, network technology and database technology, how to storage and management in the network of massive data is an important issue in the field of computer, thus establishing a one-dimensional index has been unable to solve the problem, resulting in multidimensional indexing. The multi-dimensional index structure can be divided into two kinds, one kind is the hash structure, and one is the tree structure. How to effectively support multi-dimensional range query is one of the hot research field of traditional data management. VBI-tree is a peer-to-peer computing environment based on balanced tree index structure, hierarchical tree structure, the architecture can achieve a variety of centralized environment to support multi-dimensional data such as R-tree, X-tree and M-tree for N a node of the network, the index method can ensure the query efficiency is  $O(\log N.VBI-tree)$  proposed AVL-tree network reconfiguration rotating load balancing strategy can effectively balance the load on. In addition, in the case of frequent data operation, in order to improve the performance of the index, establish a special ancestral descendants linked to form the VBI\*-tree structure in VBI-tree by using the ancestor. Descendants of the link, can guarantee for exploration of the query region as simulation experiments to verify the proposed between the nodes in the same layer the effectiveness of the method.

**Keywords:** Multi-Dimensional; data, range query; frame work; distribute system; peer-to-peer computing.

## 1. Introduction

Many different types of mapping heuristics have been developed in recent years. However, selecting the best heuristic to use in any given scenario remains a difficult problem). This work is motivated by the general trend that embedded systems design has high tolerance to longer compilation time. Based on this added flexibility in compilation, this work proposes a multilevel graph partitioning framework for solving the mapping and scheduling problem for distributed heterogeneous embedded systems. Multiple applications are typically sharing the system, running in parallel in different combinations, starting and stopping their individual execution at different moments in time. The different combinations of applications are forming system execution

scenarios. (Xu, Y., Chen, B., & Hu, Z., 2016) The key design automation challenges are designing systems for these use-cases and fast exploration of software and hardware implementation alternatives with accurate performance evaluation of these use-cases. These challenges cannot be overcome by current design methodologies which are semi-automated, time consuming and error prone. A portion of local indexes is selected from each compute node as a global index and published based on the overlay routing protocol. The global index with low maintenance cost can dramatically enhance the performance of query processing in cloud computing systems.

## 2. Method Principle

### 2.1. Node Abstract Data Structure

In this paper, the definition of VBI tree is a tree abstract tree structure. Each node in the tree has the same function module or interface (see Figure 1). In P2P network, each node is VBI tree structure of a functional part comprises two parts: data and network operations. Any space partition based hierarchical tree index structure can be mapped to the distributed indexing architecture, for example the m-tree, R\* - tree and. Each interface will be achieved in the following detailed description. (Soltani, M., & Chaari, A., 2015).

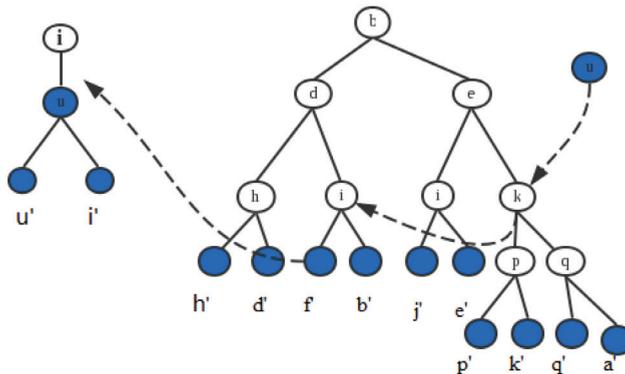


Figure 1 – Node U Joins Network

### 2.2. Node Join and Exit

When a node joins the VBI-tree, it needs to contact a node in the system. The existing node joining process consists of two stages: (1) node join. Find a balance appropriate position of the node adding and does not damage the tree. Node joining algorithm (see algorithm 1) but the same as BATON. Join the process, just consider the routing node. The whole process requires a number of  $\log N$  jump (hop), where  $N$  is the total number of nodes (Kafshdooz, M. M., Taram, M., Assadi, S., & Ejlali, A., 2016). (2) System of data distribution and routing table updates. Nodes join the system, the need for the relevant node data re distribute and update the routing table after the new node. New node added, accept the node  $n$  to join the data node space it is divided into 2 parts, a new routing node and 2 node data of new generation. 2 new data as a new node Routing nodes of

two child nodes, and news's Ode to maintain new routing node and the left child data node. Node n maintenance right child data node (Karpinski, I., Schuler, J., & Müller, K., 2015). Maintenance new ode routing node index management area is the N original corresponding data nodes in space (Mira-Giménez, M. J., 2015).

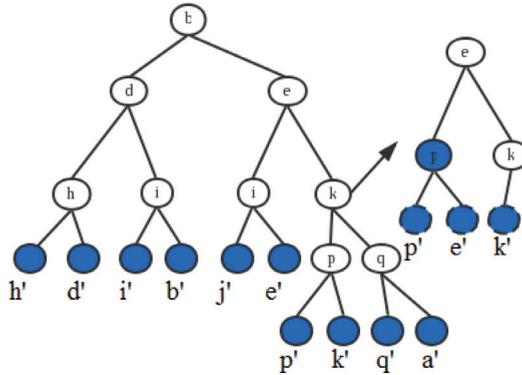


Figure 2 – Node J Leaves Network

As Figure 2 shows the node is added to the sample node notifies the node K to join the network, and K is the routing table neighbors and children is full. The k neighbor nodes, and the neighbor nodes of the child node is not full. So the node K to join request is sent to the neighbor node I. because I routing table is full, but the child node dissatisfaction, so I can accept u to join (Karpinski, I., Schuler, J., & Müller, K., 2015). I corresponds to the data node IC their data space is divided into two parts, and the original data space by the newly added node u maintenance. At the same time, the position of the node corresponds to a routing node, UC as u left children, IC u right child.

Nodes join tree index update cost is  $6\log N$  a hop count and the  $2\log n$  a hop number is used to update the neighbor nodes of the parent node of the routing table, the  $2\log n$  a hop count for update routing tables in the new node's neighbor nodes, as well as  $2\log n$  a hop count for building its own routing table. When a new node joins and may lead to a sub tree. The height change, update the subtree height price for  $\log N$  hop, which is the height of the tree. Similar nodes join the process, when the node leaves the index tree, only need to consider the routing nodes for a routing node as if it leaves, the routing table without any neighbor node has child nodes routing so, it will be free to leave, and the balance will not damage the tree. In this case, the routing node corresponds to the number of turns left by brothers according to the node, node management data node corresponding to it, it is to have all the data nodes to manage their data to the brothers Festival Management (Shokri, B. J., Ardejani, F. D., & Moradzadeh, A., 2016). Therefore, the brother node routing node management data space is to leave the space. The total cost of leaving the index structure of the node is  $4\log N$  hop, which  $2\log N$  hop number for more new leave The routing table of the node's neighbor nodes, as well as the  $N$  hop number used to update the neighbor nodes of the neighbor nodes of the parent node leaving the node from the table.

If the left node is the intermediate routing nodes or leaf routing nodes, a routing node and the neighbor leaves with child routing node, then the node from the need to find a replacement node. Algorithm 2 gives the algorithm of finding alternative nodes.

To find such a node is the price of  $\log N$  hop the number of nodes. For such leave, updating routing table total cost is  $8\log N$  hop  $4\log N$  hop, which is the number of nodes leaving alternative routing table updates the total cost, and the  $4\log N$  hop is the number of alternative nodes into the new location updating routing table total cost. In this case, upside path data structure without changing the content, because it only records the ancestor node index of regional information, rather than their links.

In Figure 3, node j left leads to a child node of the node K with the dissatisfaction of the routing table, as the tree is not balanced, so J must find an alternative node. Due to the node P can leave and does not affect the tree balance. Therefore, P can as a substitute node away from the insert to j position. When leaving the node P, PC to their data to his brother data node KC, and then the node KC's location, the management of the entire routing node P data space. P re inserted into the j, the management of the previous J routing node and data node location.

**2.3. Network Maintenance**

VBI tree error recovery and bat on the method exactly the same. When a node is found to be unreachable, node failure will be sent to the node's parent node failure. Then, the parent node will be initiated a search for alternative nodes request, and through the parent node adjacent home node and neighbor node child nodes for node replacement failure to establish a link between. Various after requesting node failure can be through the neighbor link, parent-child link or adjacency link transferring to send out.

**2.4. Definition and Calculation Formula**

Definition 1: Assuming (Or, nor) and (Ld., ND) respectively the same node maintains the routing node and data node, then the relationship between the two nodes is:  $N_d = (N_r - 1) \times 2^{id-ir} + 2^{id-ir} - 1$ .

Definition 2: The height difference of any one node in the tree or subtree is not greater than 1, so that the tree is a balanced tree.

Definition 3: Node x, hierarchy (level) is  $L_x$ , the size of the number for the  $N_x$ . routing table are:  $\log_2 N_x$  and  $\log_2 (2^{L_x} - N_x + 1)$  to get the upper bound. When the location of the left and right routing table has a neighbor node, called the routing table is full (full).

Theorem 1: If the routing table with a child's node is full, then the tree is a balanced tree.

Proof. Assuming that the node y the left sub tree with the highest level of the leaf node is x, x, y number of layers respectively  $L_x, L_y$ , ( $L_x - L_y \geq 2$ ), number respectively is  $N_x, N_y$ . y the left sub tree height is  $h_y$ . The parent of x. in the  $L_x - 1$ , is  $p_x$  number range is:

$$((2N_y - 1) \times 2^{L_x - L_y - 1} + 1) \leq N_{p_x} \leq (2N_y - 1) \times 2^{L_x - L_y - 1} \tag{1}$$

That is:

$$((2N_y - 1) \times 2^{L_x - L_y - 1} + 1 - 2^{L_x - L_y - 1}) \leq N_{p_x} \leq 2N_y \times 2^{L_x - L_y - 1} - 2^{L_x - L_y - 1} \tag{2}$$

Y in the right subtree ( $L_x - 1$ ) node number range of R layer is:

$$\left( (2N_y - 1) \times 2^{l_x - 1 - l_y - 1} + 1 \right) \leq R \leq 2N_y \times 2^{l_x - 1 - l_y - 1} - 2^{l_x - 1 - l_y - 1} \quad (3)$$

Because the  $p_x$  routing table is full, so there must be a neighbor nodes in R (i.e. node number difference  $2^i$ ). Then y right subtree of height  $h_r$  at least  $h_l - 1$  so the  $h_l - h_r \leq 1$ . Similarly  $h_r - h_l \leq 1$ . Any y subtree must be balanced tree.

Theorem 2: If the nodes x and y are neighbors, their father node relationships are: neighbors or the same node.

Proof. Assuming that the node y is a neighbor of node x, x, y the parent node are u, v,  $N_x, N_y$  are x and y number. Suppose x is the right child of u, then:

$$N_v = \frac{N_x}{2} \quad (4)$$

If y is the right child of v, then  $N_v = N_y \div 2$ , if y is v left child,

$$N_v = \frac{N_y}{2} \quad (5)$$

Because y is the neighbor of x, so:

$$|N_y - N_x| = 2^i \quad (0 \leq i) \quad (6)$$

1. If  $I = 0$  and x, y is a sibling, then they have the same parent node.
2. If  $I = 0$  but x, y is not a brother node. Because x is the right child node, then x must be the right neighbor of y,

$$N_y = N_x + 1$$

Then:

$$N_v = \frac{(N_y + 1)}{2} = \frac{N_x}{2} + 1 = N_x + 2^0 \quad (7)$$

then u, v is a neighbor.

3. If  $I > 0$ , then:

$$|N_y - N_x| = 2^i \quad (8)$$

Because  $N_x$  is an even number, then  $N_y$  must be an even number.

$$|N_y - N_x| = 2^{i-1} \quad (9)$$

So u, v is a neighbor.

### 3. State of the Art

#### 3.1. Build Index

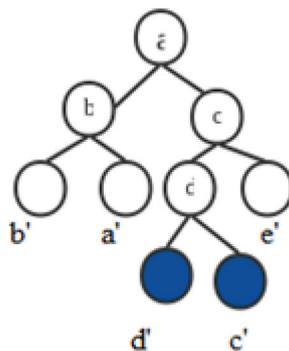
A logical network abstraction data structures discussed earlier, will now introduce how to establish such a general multidimensional indexing architecture. Basic idea is assigned for

each node a is determined by the properties of multidimensional data space. Each intermediate node management data zone can contain the child node of the data region. Therefore the whole tree from top to bottom are an inclusion relation. Centralized data management design many multidimensional data index method based on the level of space division. So, based on the framework of Virtue it can establish the VBI -M-tree, VBI - R - tree are evenly distributed index tree, query processing in a distributed network of multidimensional data.

In the initial state, the entire tree structure only a root node, the only one data point, there is no any routing node. Root node in the management of the whole data area. When a new node is added to the index tree. The root node accept new nodes join and the data area is divided into 2 parts (see Section 1). By section 1 describes the nodes join and exit the method, the index system formed a network of virtual tree structure consisting of a large number of nodes.

### 3.2. Data Operation

The insertion and deletion of data is similar to the centralized index, and the difference is that, in order to reduce the cost of the index update, each routing node is defined as another data structure, called the discrete data area (discrete).When insert data does not belong to any child nodes, the traditional method is to expand the area index a child node to accommodate the number of positions. However, in a distributed network, if such a situation occurs frequently, so will the update cost index becomes very large. To solve this problem in this paper. Using the method of discrete data objects temporarily stored in the parent node, that only when the number of discrete data object management of the parent node exceeds a certain threshold value DS, the index of child nodes to expand domain, and update the routing table. In order to reduce the frequency of the new index system, this paper adopts lazy update strategy: when the heavy load network, news will not index area updates are immediately sent out, and when the network load is light, only released updates (Yuan, Y., Ma, L., He, K., Yao, W., Nie, A., Bi, X. & Shahbazian-Yassar, R., 2016). Regional index is shown in Figure 4 based on M-tree, -tree R two kinds of data structures of the 2 dimensional distributed index of the establishment of an example from Figure 5 can be seen, there are 2 discrete data nodes were a and C management.



VBI-tree

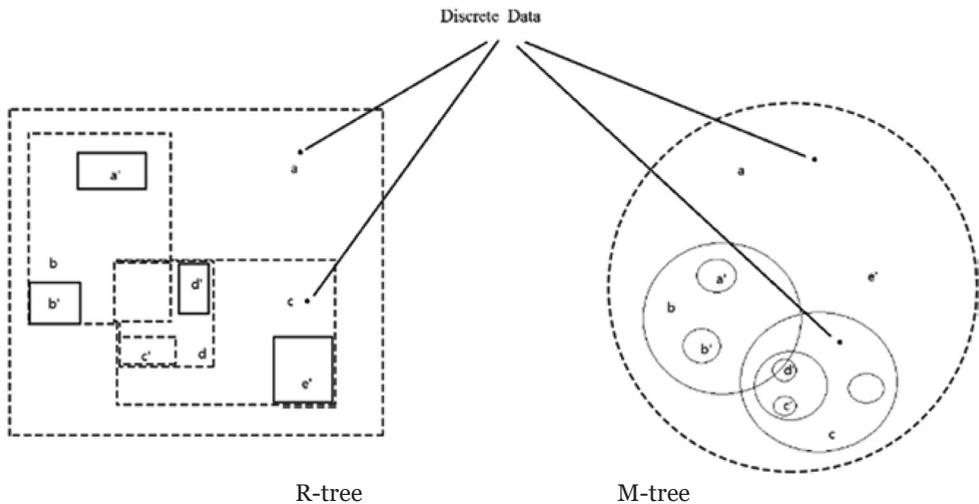


Figure 3 – Two Dimension Indexing Tree Building

## 4. Methodology

### 4.1. Range Query Processing

This section will introduce the range query processing algorithms as (see algorithm 3). In the process of query execution, VBI tree will detect all nodes and query region  $R$  intersecting, not only test contains the query region. Due to the existence of many nodes may and query region intersects, the query will be concurrently transmitted to multiple nodes. Note, query and send will greatly reduce the response time of the query (Iosifescu Enescu, I., Panchaud, N. H., Heitzler, M., Iosifescu Enescu, C. M., & Hurni, L., 2015).

If a node  $x$  sends a range query command  $r$ , if  $r$  and  $y$  node management area intersect. If  $y$  is the descendants of  $x$ , then the query will send down until  $y$ . if  $y$  is the ancestor node  $x$ ,  $x$  first found  $z$  neighbor nodes in the routing table, and the other is in  $z$  while rooted at the  $y$  subtrees, if  $z$  exists, then  $x$  directly to the query is sent to the  $z$ , otherwise the query is sent to the  $x$  parent, then the parent node is forwarded to the other side of the  $y$  tree. If node  $z$  found that the branch had no node management area and index  $R$  intersection, the query is sent to the  $y$  through the parent link discrete data object search (Beardsley, R. L., & Jang, M., 2015). If not is the ancestor node  $y$  is neither  $x$  descendants, then  $y$  will fall in another branch of an ancestor node  $z$  on  $x$  and  $z$  query and must intersect. In this way, the query will be forwarded to the  $z$  is another branch of the subtree rooted at the node of  $t$ . This process has been repeated execution, until you find a  $a$  is  $x$  ancestors or child nodes of the node  $y$ . Pay attention to, through to ensure any node in the network would not accept to repeat the query request parameters nearest -checked -ancestor.

In Figure 4, assuming that node  $h$  sends a query  $R$  (shaded parts).  $H$  first performs local query, because of its management index area and  $R$  disjoint. By querying the upside path to find the ancestor node and  $R$  intersection  $a$   $h$ , then the queries sent to the subtree rooted at the  $a$  the other side of the neighbor node  $j$ . Because  $J$  and  $R$  intersect and in the



## 5. Result Analysis

### 5.1. Experimental Result Analysis

Simulation system is used java sdk1. 5 prepared. 1 gives the experimental parameters and default values. Based on VBI architecture, this paper realizes the M-tree (Kabir, A. S. H., Sanjari, M., Su, J., Jung, I. H., & Yue, S., 2016). Therefore, following experimental results are based on comparison of VBI m-tree and ca n. At the same time, this paper also compares the performance of VBI\*M - tree and the VBI M - tree. Of query efficiency index used to jump to turn the number (hop) to measure, that is, find the results for each number of jumps. Discrete data object in each node to store the default maximum number is 5.

Name	Data range	Default value
Network Size	$10^3 \sim 10^4$	$10^4$
Ziff Parameter		1.0
Data Dimension	4~20	5
Point Query Number	$10^3$	$10^3$
Range Query Number	$10^3$	$10^3$
Insert Data Number		$10^9$

Table 1 – Experimental Parameters Setting

### 5.2. Query Cost

Figures 5 and 6 show the distributed index processing precise check query, range query (search radius of 0.01, 0.05 and 0.1) query efficiency. From the experimental results, it can be seen, is not affected by the influence of the dimensions of the data query efficiency of VBI tree and VBI\*-tree, but can only have in data of high dimension in order to obtain good performance. This is because as in ca n and the number of neighbors of each node will increase with the dimensionality of growth, so the efficiency of query will with dimensions of growth and increased gradually (Saab, S. A., Saab, F., Kayssi, A., Chehab, A., & Elhadj, I. H., 2015). However, the query efficiency decreased with the increase of the network size.

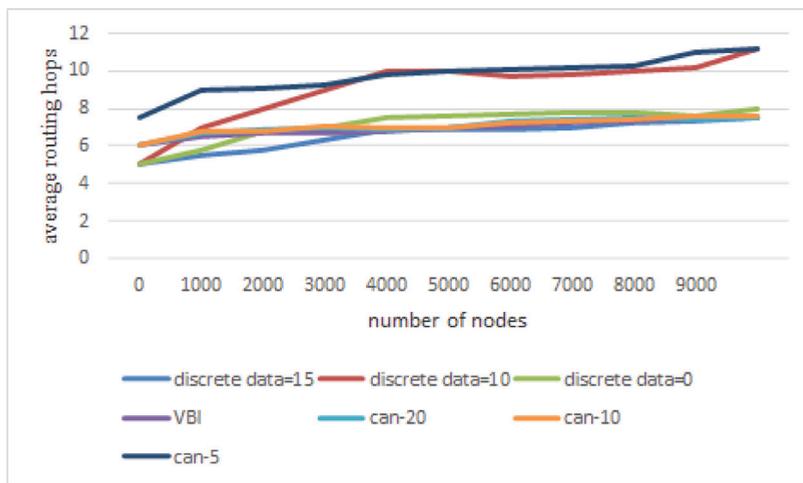


Figure 5 – Point Query Cost

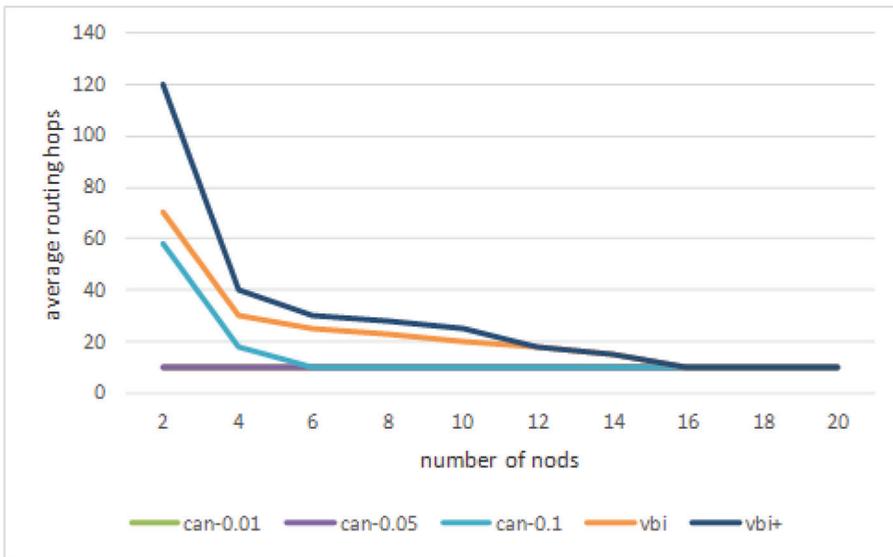


Figure 6 – Range Query Cost

In addition, from Figure 6 can see each node maintains a discrete data object more (here discrete data object of the maximum value is 0, 10 and 15), query efficiency is low. Comparing figures 13 and 14 can found VBI tree query efficiency than VBI\*-tree high because the query efficiency of the former is  $n \log a$  hop count, and the latter is  $2 \log n$  a hop count. But the two methods are very stable, not subject to data dimension, query radius.

### 4.3. Balanced Load Cost

When inserting the data distribution is skewed, the need for load balancing. Figure7 shows the VBI-tree load balanced price adjustment. We can see that the index structure for load balancing and network reconfiguration when the message is not much, about every 1000 data insertion, a load balancing an extra message. The reason of load balancing the price is relatively small: the number of nodes involved in the reconstruction of network under some situation is relatively small, or that the network reconfiguration in a small number of branches (Chiappelli, J., Shi, Q., Kodi, P., Savransky, A., Kochunov, P., Rowland, L. M. & Hong, L. E., 2016). Figure 8 shows the load balance of the number of nodes involved and the same size of the network reconfiguration. From the experimental results can be seen in the network reconfiguration in the process of the index needs to be adjusted more than 50 nodes is rarely the case.

### 5.4. The Relationship Between the Update Cost and the Discrete Data Area

Discrete data object is VBI tree introduced a new concept. Figure 10 shows different network scale, the distributed index update cost and discrete data objects maximum value between the relationships. From the experimental results it is found that, discrete data objects is the maximum value is high and update cost is small.

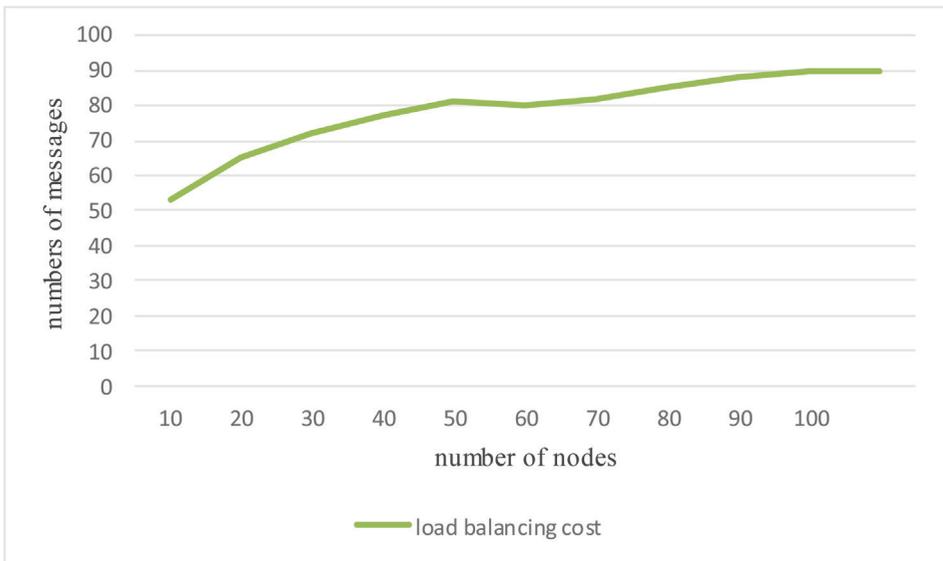


Figure 7 – Load Balancing Cost

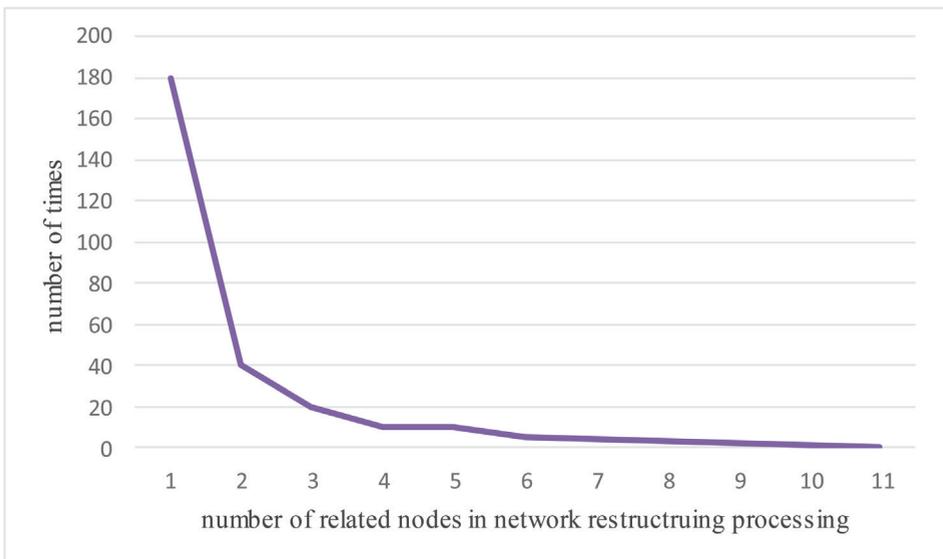


Figure 8 – Size of Node Balancing Process

### 5.5. Load Distribution

Simulation experiments were tested in the data insertion and query an access load. In data insertion phase, the nodes with high level load some big, main if because update is path, that is, the higher the level, about routing table of each node entry is greater, then update costs will be rapid growth. In the query phase, access to the load distribution is more balanced (Slaby, I., Holmes, A., Moran, J. M., Eddy, M. D., Mahoney, C. R., Taylor, H. A., & Bruny , T. T., 2015). Can see VBI tree and VBI\*-tree not kept in the performance bottleneck problem.

### 5.6. The Cost of Updating the Ancestor Link Index

A final set of experiments compared the VBI tree and VBI\*-tree insert data in the index update cost. Under different network size, two indexes are respectively inserted into 10000 five dimensional data object. From the figure 13 can see VBI\*-tree of the system updating cost reduces a lot. Thus, when the data into the frequent operation, suitable for the structure of VBI\*-tree.

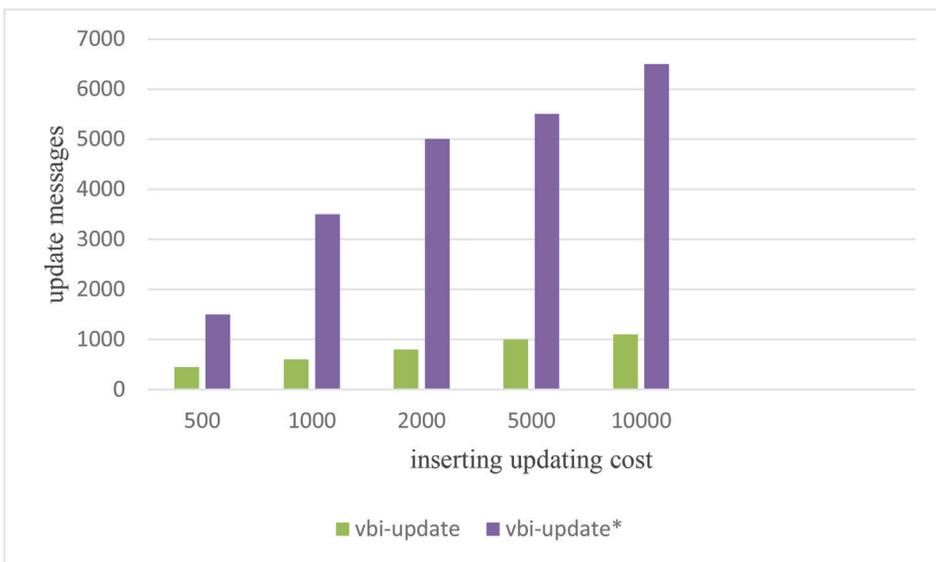


Figure 9 – Insuring Updating Cost

## 6. Conclusions

VBI tree realized a virtual base on space partitioning in hierarchical trees. All the centralized environment based on the hierarchical tree structure of division of space can be easily mapped to the VBI tree. Index schema definition query algorithm can effectively handle multidimensional data precise queries, range queries, and it can avoid the root node with the bottle neck problem. At the same time Indexing Schema defined

load balancing algorithm and network reconfiguration plan, ensure the availability of distributed index. Finally, the paper puts forward the method to improve the performance of. Simulation results verify the correctness and effectiveness of the design of index system, and the modified scheme is proved reasonable.

The remainder of this paper is organized as follows. Section 1 describes the structure of multi dimension index framework in centralized environment. Section 2 gave the range query processing algorithm. Section 3 presented Index improvement program. Section 4 analysis the experimental result .Conclusions are summarized in Section 5.

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# Research of Hierarchical Random Graph Model Based on Maximum Likelihood Estimation

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**Abstract:** With the extensive application of the network structure, the complexity of the network becomes higher and higher. According to the features of the complex network's structure, the Hierarchical Random Graph Model (HRGM) based on Hierarchical clustering method, establishes and expresses the hierarchical structure of the network, and uses the cumulative number of weights to evaluate the organizational structure of the network and to measure the importance of nodes. The principle of maximum likelihood estimation is applied in this model, which can obtain a sample set of relevant probability density functions of the parameters, and suits the HRGM absolutely. Moreover, practical researches agree well with its fine accuracy when maximum likelihood algorithm of the HRGM deals with the networks with hierarchical structure. In this paper, this new method of applying the HRGM to the brain network link prediction has achieved good results, and may have certain reference value to the exploration of the brain network link research.

**Keywords:** Hierarchical random graph; network structure; binary tree; cumulative number of weights; maximum likelihood estimation algorithm

## 1. Introduction

The explosive development of complex networks in recent decade has provided us with a lot of available theories and methods, one of which is the Hierarchical Random Graph Model (HRGM) based on hierarchical clustering method. Maximum Likelihood Estimation (MLE), as a nonlinear spectrum estimation method, was developed in the late 1960s due to the need of the Maximum Likelihood Principle of the seismic wave and the acoustic signal. When combined with the HRGM, the MLE is perfectly suitable for use in networks with composite structure. In 1984, Pierson proposed a basic idea of using the MLE in the wind field retrieval. Since then, the MLE was no longer limited by the positive and negative values of the back scattering measurement. (Gasca-Hurtado, G. P., Peña, A., Gómez-Álvarez, M. C., Plascencia-Osuna, Ó. A., & Calvo-Manzano, J. A., 2015) In 1999, Barabasi and Albert reported the scale-free concept in the Science magazine for the first time. They pointed out that the degree of nodes in the network is the total number of nodes connected directly with it. In order to solve the problem of path analysis and link in the network, Markov Chain, (a probabilistic model) was first

applied by Sarukkai et al. In 2008, Clautet et al. proposed that we could establish the HRGM by using the network with distinctive hierarchical structure. Simultaneously, Karrer et al classified the node in the network to build the random block model to predict the error margin and the missing edge. The key idea of this paper is to find the binary tree model for the best description of the network topology through establishing HRGM (based on the Principle of MLE), which possesses higher accuracy in dealing with hierarchies of complex network structure (Lindo-Salado-Echeverría, C., Sanz-Angulo, P., De-Benito-Martín, J. J., & Galindo-Melero, J., 2015).

## 2. Key Principle of Maximum Likelihood Estimation

### 2.1. Principle of Maximum Likelihood Estimation

Given a probability distribution  $D$ ; assume the probability aggregation function (discrete distribution) or the probability aggregation function (continuous distribution) of  $D$  is  $f_D$ ; a sampling  $X_1, X_2, \dots, X_n$  with  $n$  values is extracted from this distribution; provided the distribution parameter  $\theta$ . Then the probability of the probability distribution can be calculated from function  $f_D$ :

$$P(x_1, x_2, \dots, x_n) = f_D(x_1, x_2, \dots, x_n | \theta) \tag{1}$$

Although the distribution  $D$  contains the sampling data with  $n$  values, the  $\theta$  value remains unknown. Normally the sampling data with  $n$  values is used to estimate the  $\theta$  value. The sampling  $X_1, X_2, \dots, X_n$  with  $n$  values is extracted from the probability distribution. As soon as the  $X_1, X_2, \dots, X_n$  is obtained, the estimation of  $\theta$  can be found. The maximum likelihood estimation is different from other estimation methods. For example, non-biased estimation of  $\theta$  may output neither an overestimated value nor an underestimated value. It may not output the most probable value. The maximum likelihood estimation would seek the most probable value of  $\theta$  (that is to seek a  $\theta$  value from all the possible values, which can maximize the “probability”). To realize the maximum likelihood method on mathematics, first the likelihood function is should be defined as follow:

$$lik(\theta) = f_D(x_1, x_2, \dots, x_n | \theta) \tag{2}$$

Maximize the function with all the possible values of  $\theta$ . The  $\theta$  value that can maximize the function is the maximum likelihood estimation value of  $\theta$ . It is important to note, however, that the maximum likelihood estimation function may not be the only one or even doesn't exist. The likelihood function here means a function about  $\theta$ , when  $X_1, X_2, \dots, X_n$  is constant (Guindon S., Gascuel O., 2003).

### 2.2. The Property of Maximum Likelihood Estimation

1. Functional invariance: if  $\hat{\theta}$  is a maximum likelihood estimation of  $\theta$ , the maximum likelihood estimation of  $\alpha = g(\theta)$  will be  $\hat{\alpha} = g(\hat{\theta})$ , and function  $g$  no need to be a mapping.
2. Asymptote behaviors: as proved by Cramer-Rao lower bound, when the maximum likelihood estimation function reaches the minimum variance, the

total sampling quantity towards to infinity. Under independent observation, the maximum likelihood estimation function usually tends to normal distribution. In the extreme case, the maximum likelihood estimation has the minimum mean square error, which is equivalent to the condition when the maximum likelihood estimation is biased.

3. Bias: the bias of the maximum likelihood estimation is very important. For example,  $n$  tickets (numbered from 1 to  $n$ ) were put in a box. If  $n$  is an unknown number, the ticket with  $n$  which was selected randomly from the box is the maximum likelihood estimation value of  $n$ . In order to estimate the highest  $n$ , although the estimation value is only  $(n+1)/2$ , the only thing can be confirmed is that the value of the selected ticket is less than  $n$  (Meng X L., Rubin D B., 1993).

### 2.3. Theory Basis of Likelihood Probability Channel Model

The likelihood probability channel model is the theory basis of probability density function algorithm. Set the sent digital sequence  $x = \{x_1, x_2, x_3, \dots, x_n\}$ . If there are  $M$  probabilities for  $x_i (i=1 \dots n)$ ,  $x$  will have  $M^n$  probabilities. The interfered signal  $y = \{y_1, y_2, y_3, \dots, y_k\}$  is obtained after passing the ISI channel. The determination principle based on afterwards probability is  $p(x_i | y)$ . This principle will get the  $p(x_i | y)$  output evenly to the maximum with  $M$  probabilities in  $x_i$ . With this principle, the determination probability reaches the maximum and the error probability reaches the minimum, which is the maximum afterwards probability principle (MAP principle). However, in the real system, the afterwards probability required by MAP principle is not easy to obtain.

According to Bayes Formula,

$$p(x_i|y) = \frac{p(y|x_i)p(x_i)}{p(y)} \quad (3)$$

Where,  $p(y|x_i)$  refers to the likelihood probability,  $p(x_i)$  is the forward probability sent by the  $i$ th symbol of  $x$ . Besides, it noted that,

$$p(y) = \sum_{i=1}^n p(x_i)p(y|x_i) \quad (4)$$

Rewrite Formula (3):

$$p(x_i|y) = \frac{p(y|x_i)p(x_i)}{\sum_{i=1}^n p(x_i)p(y|x_i)} \quad (5)$$

When there are  $n$   $x_i$  probabilities,  $p(x_i) = 1/n$ . Besides, Formula (4) can show which  $x_i$  has no correlation with  $p(y)$ . Hence, when there are  $n$   $x_i$  probabilities,  $p(x_i|y)$  is equivalent to  $p(y|x_i)$ . The principle that takes likelihood probability  $p(y|x_i)$  as the determination is called likelihood principle or ML principle. It is the theory basis of maximum likelihood estimation. According to ML principle, the channel likelihood probability channel model is shown as following Figure:

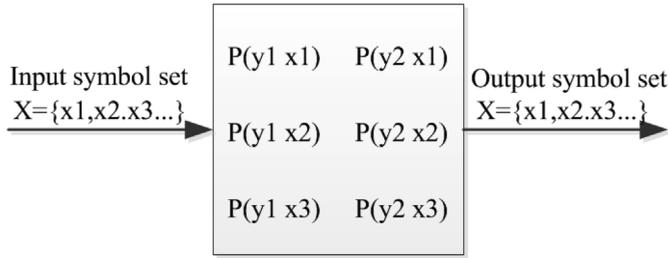


Figure 1 – Likelihood Probability Channel Model

The likelihood probability method is used to describe the process of input symbol set changing to output symbol set (Guindon S., Dufayard J F., Lefort V., 2010). When a symbol  $y_i(i=1,2,\dots)$  is received at the output terminal and if the input symbol at the sending terminal needs to be restored according to the output symbol at the receiving terminal, the likelihood probability with the larger value in the likelihood probability density function table can be taken as the input symbol at the sending terminal. If output by sequence, the likelihood probability of all the symbols in the sequence need to be concerned rather than the likelihood probability of only one symbol. Suppose the intersymbol interference (ISI) covers  $L+1$  symbols, which means there are  $L$  interfering components, and  $L$  means the dispersion length. The maximum likelihood estimation is also equivalent with an estimation of a FSM (finite-state machine) with discrete time so that it can be solved with Viterbi algorithm. If input  $\{x_1,x_2,x_3,\dots,x_{L+1}\}$ , set the state  $s = \{x_2,x_3,\dots,x_{L+1}\}$ , and the information symbol is  $M$ -dimension, then  $s$  has  $M^L$  probabilities. Started with the sampling value  $y = \{y_{L+1},y_L,\dots,y_1\}$ , the maximum likelihood probability will be  $p(\{y_{L+1},y_L,\dots,y_1\}|\{x_{L+1},x_L,\dots,x_1\})$ , which can be expressed as:

$$p(\{y_{L+1},y_L,\dots,y_1\}|\{x_{L+1},x_L,\dots,x_1\})= p(y_1|x_1)p(y_2|x_1x_2)\dots p(y_{L+1}|x_1x_2x_3\dots x_{L+1}) \tag{6}$$

Take the logarithm of Formula (6), and define it as measurement MET:

$$MET = \sum_{k=1}^{L+1} \ln p(y_k|x_k,\dots,x_{k-L}) \tag{7}$$

Where,  $k=1,2,\dots,L+1$ , if  $k \leq 0, x_k=0$ . When the channel is AWGN channel, MET is only related with Euclidean distance  $f(z_1,z_2)$ . Hence, in AWGN system, Euclidean distance is the basis of calculating the measurement. But Euclidean distance cannot be simply used in optical fiber system. Specific application will be discussed later in the paper (Excoffier L., Slatkin M., 1995).

### 3. Hierarchical Random Graph Model Construction

#### 3.1. Complex Network

Complex network originates from the real world, yet it can describe the complex system vividly in real society (such as the social network, protein network, etc.) In the

complex network, the node represents the elements in the system, and the network edge represents the internal correlation among each element. The complex network, whose generality is a set of unique attributes, whose complexity distinguishes different networks, is an approximate abstraction of the real system. Based on its unique attributes, complex network is divided into small-world network and scale-free network. These two networks possess the small-world effect and the scale-free property respectively. In 1967, Stanley .M started the study of social network and proposed the concept of small-world attributes for the first time. Later, Watts et al established the small-world feature model in 1998. They first defined a regular ring network with  $N$  nodes and  $M$  edges, and then set the degree of each node to  $K$ , and assigned a probability value  $P(0 < P <= 1)$  to each side. Focusing on the study of  $0 < P < 1$  of the network feature, they assumed that when  $P=0$ , they called it a regular network; when  $P=1$ , a random network. The experimental results showed that the average shortest path and the aggregation coefficient, these two kinds of attributes are larger in the regular network, but smaller in the random network.

### 3.2. The Brain Network

The brain, with the most fine structure and the most complicated function, is a kind of intelligent processing system. How does the brain regulate and control the individual, how does it continuously repair and adjust itself on the function, and how does it methodically and dynamically work? These problems are worth our pondering and exploring. Furthermore, the research and cognition of the network provides a new approach and perspective for understanding the brain and the direction for the scholars as well. In 1998, *Essay* (Hyvärinen A., 1999) on *Nature* conducted a research on neural network of *C. elegans* and found that the network has the small-world property. After that a lot of researches on brain neural structural network and functional network all proved the small-work property of brain neural network. Based on different brain structure and functions, brain network can be divided into brain structural network and brain functional network, in other works, functional segregation (neurons with small space distances connect with each other and form a certain function unit, the features of which can be reflected by clustering coefficient) and functional integration (neurons with larger space distances interact dynamically and integrate with each other and accomplish a certain function, the features of which can be reflected by characteristic path length) (Johnson D L., Thompson R., 1995). On the one hand, brain structure network explores the connection rules of network and fully depicts human brain structure network map from each micro hierarchy to each macro hierarchy. On the other hand, based on brain structure and due to external stimuli, unconnected neurons produce excitement or inhibit behaviors, and transmit the spontaneous behaviors to other neurons through synapse. In this way, each neuron would cooperate and coordinate with other and accomplish a certain function together. Hence, the research on human brain extended from structural brain network to functional brain network. The structure connection affects the functional connection, and the functional restricts the structural connection. The two parties affect and interact with each other. At present, research on complex brain neural network becomes an important part of complex network theory (Leroux B G., 1992; Kim H Y., Kim J H., 2001; Hobert J P., Geyer C J., 1998) and a hotspot of neural science research. Current brain imaging technologies as Diffusion Tensor Imaging (DTI), functional Magnetic Resonance Imaging (fMRI), Electroencephalogram

(EEG) and Magnetoencephalogram (MEG) are useful tools for the research of structural brain network and functional brain network, and can reveal the brain working, operating mechanism and related characteristic attributes that former analysis tools cannot realize.

### 3.3. Hierarchical Random Graph Model

Complex network has hierarchical structure. In 2008, Clautet et al. established a hierarchical random graph model to study the link prediction of various networks that have hierarchical structures, such as the food chain network, terrorist attack network and treponema pallidum’s metabolic network. This hierarchical structure model is still widely applied to explore the topological features of complex network. In this paper, the hierarchical random graph model is adopted to build the hierarchical structure of brain network. The optimum hierarchical random graph can best describe the hierarchical structure of brain network, and the core of this idea is to find the optimal binary tree of the best description network (Cranmer S J., Desmarais B A., 2011).

The basic concept of hierarchical random graph model is “network hierarchical random graph is the hierarchical organization model”. It can be explained as bellow: (1) network G is a simple undirected graph with n nodes; (2) tree map D is a binary tree, and it has n leaves corresponding to the n nodes of G; it also has n-1 internal nodes corresponding to the node pairs formed in D; (3) Node i and Node j are two nodes of network G, and the probability that these two nodes will be linked with the edge is given as  $p_{ij}$ ; r is the nearest common ancestor of Node i and j in tree map D.

$p_r \in [0,1]$  is the probability of each internal node r, and each of the internal node r is independent of  $p_r$ . Hence, the link strength of the edge can be written as  $p_{ij} = p_r$ . In other words, the link probability of two nodes equals to the probability given by their nearest common ancestor node. Consequently, the hierarchical random graph  $(D, \{p_r\})$  is jointly by tree map D and the probability set  $\{p_r\}$  (Hu R., Fahmy M M., 1992).

The general concept of optimal hierarchical random graph is as following.

As shown in Figure 2, the simple undirected graph G includes 7 nodes and 9 edges. Therefore, the process to find the needed hierarchical random graph that best conforms to the observed real network G is to find out the optimal hierarchical random graph.

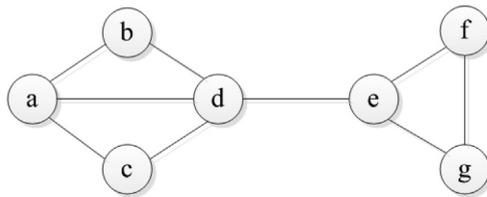


Figure 2 – A Simple Network G

First, all the hierarchical random graphs are assumed to be a priori and equiprobable. Next, the probability of the model  $(D, \{p_r\})$  that can correctly explain the data is assumed to be in proportion to the likelihood estimator L that produces the observable network according to Bayes Theorem. Then, the likelihood estimator formula of the hierarchical

random graph to network G can be written as Formula (8). In this formula, r is the nearest common ancestor of the nodes in the tree map D; Lr and Rr represent the number of the leaf nodes on the left and right subtree taking the internal node r as their roots; Er refers to the number of node pairs that take r as their nearest common ancestor and have already formed linked edges in G (Arkin J M., Alsdorf R., Bigornia S., et al., 2008). As the tree map D is determined, the optimal probability formula producing the maximum likelihood estimator can be expressed as  $pr = Er / LrRr$ . Put this probability formula into Formula (8) to create Formula (9) for the maximum likelihood estimator L(D). Consequently, the optimal hierarchical random graph can be obtained through Formula (9).

$$L(D, \{pr\}) = \prod_{r \in D} pr^{Er} (1 - pr)^{LrRr - Er} \tag{8}$$

$$L(D) = \left[ \prod_{r \in D} \overline{pr}^{\overline{pr}} (1 - \overline{pr})^{1 - \overline{pr}} \right]^{LrRr} \tag{9}$$

According to Formula (9), Figure 3 shows two possible descriptions of the binary tree that can describe simple network G. The likelihood value of the binary tree on the left is  $(1/12)(11/12)^{11} = 0.3840$ ; the likelihood value for the right one is  $(1/2)(1/2) * (1/3)(2/3)2 * (1/4)3(3/4)9 = 0.00004$ . The likelihood value of the left tree map is greater than that of the right binary tree. In other words, it can better illustrate the topological structure of the network (Martinez G E., Koch R M., Cundiff L V., 2004).

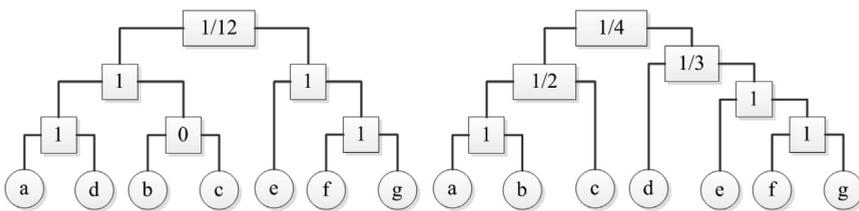


Figure 3 – Two Descriptions of the G Binary Tree

Hierarchical structure is the most essential topological feature of complex network. Researchers have paid much attention to the hierarchical structure of complex network and proposed varied hierarchical structure model for complex network. Hierarchical random graph is a hierarchical clustering model established by Clauset et al. in 2008 based on binary tree. This model has been widely applied to many different areas to explore the topological features of complex network, such as community mining, establishment of hierarchies, measurements of hierarchies, detection of core nodes and so on. Additionally, it is also applied to other scientific areas for semantic induction, path optimization, network feedback, classification sensing, etc. In this study, hierarchical random graph model is used to build the hierarchical structure of road network. The core idea of hierarchical random graph is to find the binary tree model that can best describe the network's topological structure (Koch R M., Cundiff L V., Gregory K E., 1994).

### 4. Algorithm Implementation and Results Analysis

1. Likelihood value statistics in optimal model: lead the brain network data for the experiment; then, the Markor link will start a series of binary tree exchanges to make the likelihood value reaches equilibrium. In this case, the time will be  $n^2$  ( $n$  is the number of 90 brain nodes) and the distribution will tend to be steady. As shown in Figure 4, X axis stands for sparsity, while Y axis refers to the likelihood value. According to this figure, the algorithm collects likelihood values according to the requirements of the optimal seed model in 8 different kinds of network sparsity scales and when the Markor link tends to be steady. The detailed data are presented in Table 1.

When the Markor link reaches equilibrium, MCMC algorithm can be adopted to collect the optimal seed model, and Matlab can be used for visualization. As shown in Figure 5, the seed model is collected in the given 40% of network edges; there are 90 brain nodes in the brain network, and each of the brain regions has specific serial number. In Figure 5, the numbers stands for node NO.; the square stands for the brain network node; the circle refers to the internal node; the link line indicates that edge exists between nodes.

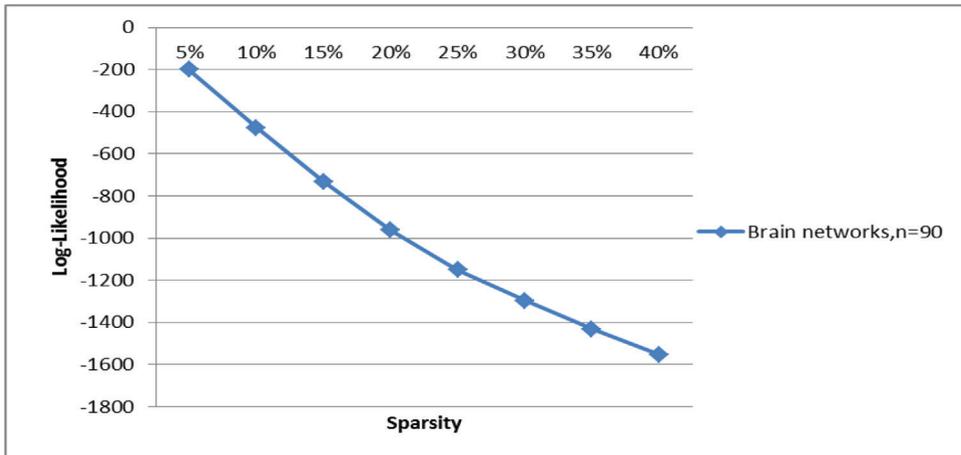


Figure 4 – Maximum Likelihood Values for Different Sparse Degrees

Sparsity	5%	10%	15%	20%	25%	30%	35%	40%
Log-Likelihood	-200.1	-475.2	-731.9	-962.6	-1152	-1296.6	-1431.8	-1552.9

Table 1 – Maximum Likelihood Values of Different Sparse Degrees (The Number of Nodes of the Brain Region Is 90)

Comparisons of the hierarchical random graph model in different networks: use the hierarchical random graph algorithm to conduct link prediction comparisons (see Figure 6) between the brain network (Brain) in 30% sparsity and the 3 networks presented by Clouston et al. These three networks are Treponema pallidum metabolic network (T.pallidum), terrorists relationship network (Terrorists), and the grassland species food network (Grassland). For each of the above networks, remove part of the edges randomly and evenly; then, try to predict the network link edge probability in line with

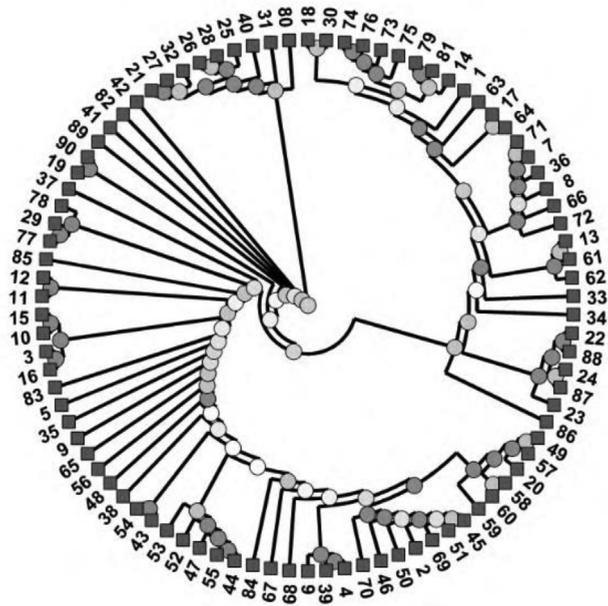


Figure 5 – Matlab Visualization of the Optimal Hierarchical Graph Model

the rest edges. Next, conduct the AUC grading, and the detailed data are presented in Table 2. The X axis in the figure stands for the proportion of the training set to edge set in the experiment, and Y axis represents the assessment index AUC. According to the link prediction results of the above networks through the hierarchical random graph algorithm, Brain network has presented obvious advantages over T. pallidum and Grassland network. The performances of the latter two networks are quite poor. Besides, the AUC values of the Brain network changes from increasing to steady as the scale of the network enlarges.

Train	AUC				
	Pure Chance	T.pallidum	Grassland	Terrorists	Brain
0.1	0.5	0.515	0.53	0.6	0.664
0.3	0.5	0.53	0.57	0.675	0.809
0.5	0.5	0.6	0.646	0.769	0.84
0.7	0.5	0.64	0.71	0.82	0.863
0.9	0.5	0.66	0.755	0.84	0.864
0.95	0.5	0.675	0.775	0.85	0.864
1	0.5	0.725	0.79	0.855	0.847

Table 2 – Comparison Results of Hierarchical Random Graph Models in Different Networks

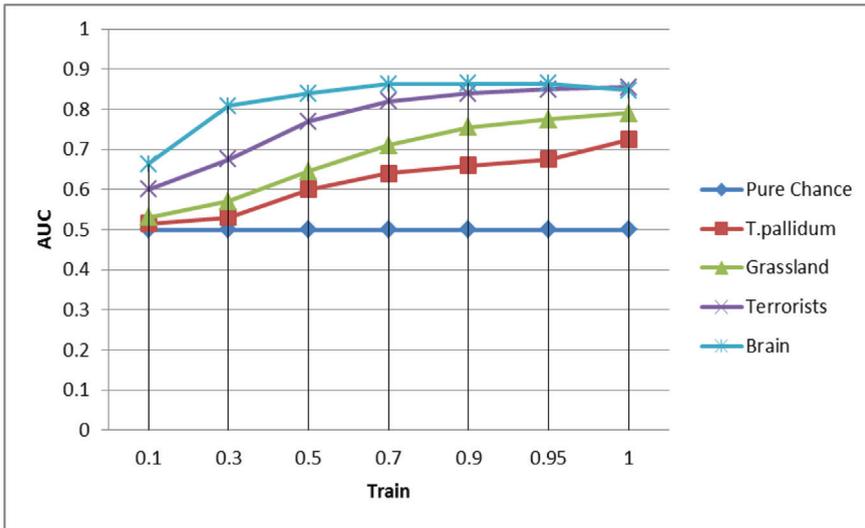


Figure 6 – Comparison of Hierarchical Random Graph Models in Different Networks

## 5. Conclusion

Maximum likelihood estimation algorithm is mainly used for the networks with composite structure. The algorithm, which collected the optimal Hierarchical Random Graph Model as a seed to generate sample network space and calculate the mean value of the connection probability eventually, is a reflection of a certain inner hierarchical structure. The method that the Hierarchical Random Graph Model based on the Maximum Likelihood Estimation algorithm, described in this paper, set up the brain networks with the Hierarchical Random Graph Model to collect statistics of the Maximum Likelihood Estimation when it reaches equilibrium, and visualize the optimal model. It turns out that doing with networks with composite structure, this method provides obvious effect and possesses better time complexity and higher accuracy when compared in different algorithm of brain networks.

## Acknowledgment

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# Explorations of Computer Database Intrusion Detection Technology targeting at External Forced Entry

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**Abstract:** With the rapid expansion of network information, accompanying network information security has been penetrated to commercial, military and personal fields, among others. protective measures for critical data storage has been very important at present. This paper studies the database management system from the intrusion detection technology of computer databases. To begin with, two common methods for detection are introduced: misuse detection and anomaly detection. Then this paper proposes a Trie-based improved Apriori algorithm on the basis of the Apriori algorithm to elaborate the intrusion detection technologies for data paths and then designs an intrusion detection system grounded upon the improved algorithm of Apriori. The results show that misuse detection can well detect attack attempts, but in the misuse detection rule base, there are no intrusion rules for impersonation attacks or legitimate user attacks, these two attacks or more cannot be detected. On the other hand, anomaly detection works by modeling the normal behavior of users. During detection, only records that have successfully logged in will be analyzed, so there is a low detection rate for any types of attacks.

**Keywords:** Database management system; Misuse detection; Anomaly detection; Intrusion detection technology.

## 1. Introduction

In an information society, whether a country, a small business or an individual will store massive important information on a computer system, and security of the computer information system has become an important issue for national sovereignty, trade secrets and personal privacy. Especially with the popularity of database management system (DBMS) (Zuech R., Khoshgoftaar T M., Wald R., 2015), all kinds of important information are stored in a more centralized manner; once an information leakage occurs, the consequences would be disastrous. The database intrusion detection technology is a currently widely used technology and management tool. It is a proactive security protection technology that provides real-time protection to internal attacks, external attacks and incorrect operations; it will give an alarm promptly when detecting intrusions, notify the system administrator to take preparedness measures, intercept

and respond to invasions before the network system is endangered and adjust security policies and protective measures according to security events, while improving the effectiveness of real-time response and recovery afterwards, thus providing a basis for regular security assessments and analyses and improving the overall level of network security. The intrusion detection technology (Patel A., Taghavi M., Bakhtiyari K., et al., 2013) is a dynamic security protection technology. Different from the traditional database static security technology, it as security protective layer on top of the database management system layer strengthens the database system safety. Intrusion detection research can be traced back to the work by James Aderson (Liao H J., Lin C H R., Lin Y C., et al., 2013) in 1980. He first coined the concept of intrusion detection, and in the paper (Modi C., Patel D., Borisaniya B., et al., 2013) put forward using audit trail to monitor the threat of an invasion. The significance of this idea was not being understood at that time. In 1988, the Morris Internet Worm (Hanguang L., Yu N., 2012) caused the Internet to stop working for five days. This event posed urgent needs for computer security, which led to the research and development of many IDS systems. With changes in the detection environment, a number of research institutions have conducted fruitful research of distributed intrusion detection. Typical systems include the 1991 NADI (Ashoor A S., Gore S., 2011) (Network Anomaly Detection and Intrusion Reporter) and DIDS (Distributed Intrusion Detection System). These systems proposed collecting and consolidating audit information from multiple hosts to detect a series of coordinated attacks to the host. In 1994, the COAST Laboratory at Purdue University in the U.S. designed an AAFID (Autonomous Agents for Intrusion Detection) (Shanmugavadivu R., Nagarajan N., 2011) prototype. The system prototype performs testing by using autonomous entities (agents) (Uddin M., Rahman A A., Uddin N., et al., 2013), which has improved the IDS scalability, serviceability, efficiency and fault tolerance. In 2000, the Institute of Software Chinese Academy of Sciences proposed an Agent-based distributed intrusion detection system model which is an open system model with good scalability, easy intrusion detection of Agent, and also easy expansion of the new intrusion detection mode. Despite the intrusion detection research based on data mining has made numerous theoretical achievements and some systems have been applied in practice to a certain degree, this field of study still has many problems to be solved; for example, data mining in intrusion detection places little emphasis on discovering new knowledge (Abreu, A., Rocha, Á., Cota, M. P., & Carvalho, J. V., 2015).

## 2. Database Intrusion Detection Technology

Intrusion Detection System (IDS) is a combination of software and hardware for intrusion detection (see Figure 1). The main functions of the IDS include:

1. Monitor and analyze user and system activities, search for unauthorized operations by illegitimate and legitimate users;
2. Detect the correctness and security vulnerabilities of system configuration, and prompt the administrator to fix vulnerabilities;
3. Make a statistical analysis of non-normal activities of users, and find the law of intrusions;
4. Check the consistency and correctness of system programs and data;
5. Capable of responding to real-time intrusion detection;

6. Audit trail management of the operating system.

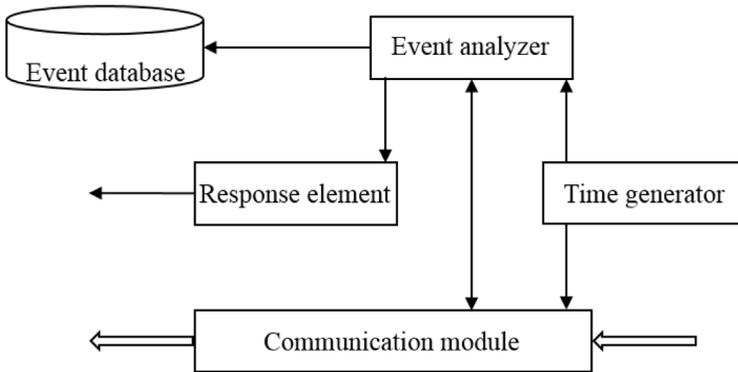


Figure 1 – Frame Structure Diagram of IDS

**2.1. Common Methods of Intrusion Detection**

1. Misuse detection

Misuse detection (Liao S H., Chu P H., Hsiao P Y., 2012), also known as detection based on knowledge, makes detection by using known attack methods based on the defined intrusion patterns to determine whether these intrusion patterns occur. Analyzing the characteristics, conditions, arrangement, and relations between events of the intrusion process can describe specific signs of intrusion. The advantage of this method is high detection accuracy as judgments are made based on a specific feature library, and because a clear reference to the test results makes it convenient for system administrators to take appropriate measures. The main drawbacks are over dependence on a specific system, poor system migration and heavy maintenance workload. Applications of misuse detection contain expert systems, feature analysis, model-based reasoning, state transition, and Petri nets.

2. Anomaly detection

Anomaly detection (Lu M., Qian Z., Hong-mei Y A N., 2015), also known as behavior-based intrusion detection, makes intrusion detection according to user behavior or normal degree of resource use rather than by a specific behavior, which is the current main research direction of the IDS. Anomaly detection is based on a hypothesis that there is a close correlation between program execution and user behavior in terms of system characteristics. There are two keys of anomaly detection. The first is to establish normal usage profile, and the second is to compare the model with the current system or user behavior to determine the degree of deviation from normal mode.

**2.2. Database Intrusion Detection**

1. Relational database intrusion detection system

Yip Chung, Michael Gertz and Karl Levitt presented the Detection of Misuse in Database Systems (DEMIDS) (Chen R M., Hsieh K T., 2012), which is tailored to detect misuse behavior, especially insider abuse by legitimate users. Among the relations in a database

schema, the authors suggested detecting abnormalities by determining the relationship between attributes used in a query through primary and foreign key functional dependencies. To this end, the paper proposes the following concepts:

**Working scopes:** the behavior outline of users, which includes tables, attributes and attribute values that users frequently operate; these attributes are often cited simultaneously in a SQL statement. Working scopes are described with frequent itemsets.

**Frequent itemsets:** sets  $\{F_1 = f_1, \dots, F_m = f_m\}$  that are greater than the minimum support level and smaller than the maximum distance attributes and their values; represented by [sup, appe], where sup is support and appe is affinity.

**support:** support itemset  $\{F_1 = f_1, \dots, F_m = f_m\}$  is the probability that it appears in the audit record.

**affinity degree:** affinity of itemset  $\{F_1 = f_1, \dots, F_m = f_m\}$  refers to the distance measure between the attribute sets.

In frequent user mining itemset algorithms, DEMIDS uses the concept of distance to measure the attribute tightness between frequent itemsets. If the two attributes belong to the same relationship or linked by a series of foreign keys, they are considered as similar.

## 2. Fingerprint technology

Fingerprint technology (Paulauskas N., Garsva E., 2015) is particularly suitable for typical client/server database applications, because these applications often do not allow users to write their own queries, but offers several standard query formats through the interface. It is easy to generate fingerprints, with relatively low false alarm probability. In order to further improve the accuracy of fingerprint technology, two Boolean variables  $F_{begin}$  and  $F_{end}$  are used to mark the execution location of each fingerprint in the transaction, as shown in Fig. 2. If a transaction contains two SQL statements  $r_1$  and  $r_2$ , its execution order would be  $r_1 - r_2$  or the transaction only executes  $r_1$  but not  $r_2$ , which means the execution of  $r_2$  is based on the premise of the execution of  $r_1$ . Then fingerprints formed by  $r_1$  are  $F_{begin} = 1, F_{end} = 1$ ; fingerprints formed by  $r_2$  are  $F_{begin} = 0, F_{end} = 1$ .

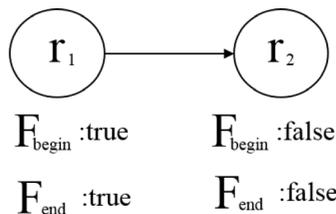


Figure 2 – Fingerprint Technology Model

## 3. Database Intrusion Detection Based on Data Mining

### 3.1. Correlation Analysis Method

Correlation analysis method is a data mining method that is the most frequently studied and used by people. It mainly finds certain relation between a group of objects in the

database. Correlation analysis method can be divided into two categories: association rules and sequential patterns. Among them, association rules are to analyze a set of records and derive the relationship between projects in a given collection of items and some sets of records. Similar to association rules, sequential patterns also aim to dig out the relation between data, but sequential patterns analyze the causality between data and the sequential analysis algorithm can get the relationship between database records in the time window. Such algorithms can find some event sequential patterns that frequently appear as per some laws in audit data. These frequently occurring event sequential patterns can help select valid statistical characteristics in constructing the intrusion detection model. Association rules and sequential patterns are methods commonly used in the intrusion detection systems of network and operating systems. Association rules are to analyze a set of records and derive the implicative relationship between projects in a given collection of items and some sets of records.

Given a set  $I = \{i_1, i_2, \dots, i_m\}$  of all items that are all fields in the database;  $D$  is a set of all transactions, namely the transaction database; each transaction  $T$  is a itemset.  $T \subseteq I$ . Assume an itemset  $A$ , if and only if  $A \subseteq T$ , the transaction  $T$  contains  $A$ .

Definition 4.1 association rule is similar to the implication expression  $A \rightarrow B$ , where  $A \subset I$ ,  $B \subset I$  and  $A \cap B = \Phi$ .

Definition 4.2 Rule  $A \rightarrow B$  establishes in the transaction set  $D$ , with the support degree of  $S$ .  $S$  indicates the percentage of containing  $A \cup B$  in transactions of  $D$ , which is the probability  $P(A \cup B)$ :

$$S(A \rightarrow B) = P(A \cup B) = \frac{|A \cup B|}{|D|} \quad (1)$$

Where  $|D|$  represents the number of transactions in the database  $D$ .

Definition 4.3 Rule  $A \rightarrow B$  has confidence  $C$  in  $D$ ;  $C$  is the percentage that  $D$  transactions contain both  $A$  and  $B$ , which is the conditional probability  $P(B | A)$ , namely:

$$C(A \rightarrow B) = P(B | A) = \frac{|A \cap B|}{|A|} \quad (2)$$

where  $|A|$  is the number of transactions that contain itemset  $A$  in the database.

Definition 4.4 threshold. To find useful association rules from the transaction databases, we need to have users to determine two threshold values: minimum support threshold (mlll\_sup) and minimum confidence threshold (min\_conf) while rules that meet the minimum support and minimum confidence are called association rules.

Definition 4.5 A collection of sets is called itemset. An itemset that contains  $k$  items are called a  $k$  itemset. If the itemset meets minimum support, it is called frequent itemset.

### 3.2. The Apriori Algorithm

The commonly used data mining method in database intrusion detection are association rule mining and sequential rule mining, and generating frequent itemsets is a key step

of these two data mining tasks. In recent years, people have carried out a lot of in-depth research concerning mining algorithms for frequent itemsets. In many algorithms, the Apriori algorithm proposed by Agrawal is the most famous.

The Apriori algorithm uses a hierarchical order cycle method to complete the excavation work of searching frequent itemsets. This cyclic process uses  $k$ -itemsets to generate  $(k+1)$ -itemsets. The specific description is shown below:

```
BEGIN
L1= find_frequent_1-itemset (D);
for (k=2;  $L_{k-1} \neq \Phi$ ; k++){
 $C_k$  =apriori_gen( $L_{k-1}$ );
for each transaction  $t \in D$  {
 $C_t$  == subset ( $C_k$ , t)
for each candidate  $c \in C_t$ 
c.count++;
}
 $L_k$  ={ $c \in C_k$  |c.count $\geq$ min_sup};
}
return L =  $\bigcup_k L_k$  ;
END
```

Subroutine

```
has_infrequent_subset(c,  $L_{k-1}$ )
BEGIN
for each(k-1)-subset s of c
if  $s \notin L_{k-1}$ 
return TRUE;
return FALSE;
```

The Apriori algorithm generates frequent itemsets as per the following three steps:

1. Connection step

Use the property 1 to generate the set of candidate  $k$ -itemsets by self-joining frequent  $(k-1)$ -itemsets via  $L_{k-1}$ . The candidate  $k$ -itemsets is denoted as  $C_k$ .

Assume  $p, q \in L_{k-1}$ , if

$$(p[1] = q[1] \wedge p[2] = q[2] \wedge \dots \wedge p[k-1] = q[k-1]) \quad (3)$$

Then the link of p and q is  $p[1], p[2], \dots, p[k-1], q[k-1]$ .

2. Pruning step

$C_k$  generated by connections is a superset of  $L_k$ . According to property 2 of the Apriori algorithm, if the (k-1) subset in a candidate k-itemset is not in  $L_{k-1}$ , then the candidate set cannot be frequent and may be deleted from  $C_k$ .

3. Scan the database

Scan the database and add up the times when each item of  $C_k$  appears. If a record includes the candidate set, then the support count of the candidate set adds one, and finally by comparing the support degree and the minimum support degree prescribed by the user to determine whether the candidate set is a frequent itemset.

**3.3. The Improved Apriori Algorithm**

Trie is a tree structure down to the roots. The trie structure was first coined by Briandais and Fredkin for efficient storage and retrieval of dictionary structures. The Trie root depth is set as 0; the d layer node of Trie points to the d+1 layer nodes, and this pointer is called the Trie edge, with each edge representing a letter. If node u points to node v, node u is the parent of node v, and node v is the child of node u.

The Trie structure can not only effectively store English words but also suit for storing various finite sequence sets. By simply changing Trie edge to storing one item of the finite sequence set, each path of Trie stands for a sequence.

When frequently mining itemsets, letters can be used to show ordered itemsets. Thus, the candidate k-itemset  $C_k = \{i_1, i_2, \dots, i_k\}$  can be represented by words  $i_1, i_2, \dots, i_k$  constituted by letters in the entry.

Figure 3 is a Trie tree that stores the candidate set  $\{C, D\}, \{A, E, G\}, \{A, E, L\}, \{A, E, M\}, \{K, M, N\}$ . The node number is a symbol and will be used in algorithm realization.

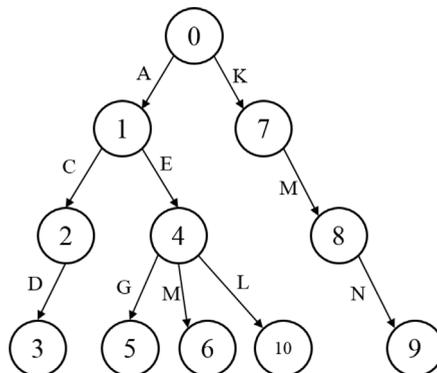


Figure 3 – 5 Candidate Itemsets of Trie

**4. Design and Realization of Intrusion Detection System**

In this paper, misuse detection and anomaly detection features are combined to design and realize a new self-adaptive intrusion detection system. The Trie-based Apriori

algorithm described in the second section will be applied to the database intrusion detection system in order to improve the efficiency of generating rule bases.

#### 4.1. Anomaly Intrusion Detection Module

##### 1. Data preprocessing

First, the audit records are grouped in accordance with the user ID. The association rule mining algorithm is used, which is to first divide UserID in records by several disjoint logical blocks, and each separately considers a block. This can be highly parallel and assigns records corresponding to each user to a processor for generating frequent itemsets and generating the corresponding rules and eventually merging all the rules. By classification, when generating frequent itemsets, user data are non-interfering, thus reducing the number of candidate sets to be analyzed, further improving the efficiency of the algorithm in practice and accelerating the processing speed of massive data .

In our system implementation, two enumeration types are defined; ActStatus indicates the operating status ID set while UserActivity indicates that the operating ID set, namely:

```
enum ActStatus{Fail=0, Suc, Disallow};
```

```
enum UserActivity{Login=3, Select, Update, Insert, Delete,
```

```
DropTable,AlterTable, CreateDB, DropDB, CreateTable,
```

```
PrivManage, AddUser, UpdateUser, DelUser, CreateRule, MapId};
```

Therefore, 0~2 is an operating status ID set; 3~20 is an operating status set and two operating IDs are reserved for DBMS extension; and the resource ID set starts from 21 until the computing performance shows the largest positive integer.

##### 2. Produce association rules

The Apriori algorithm is used for data mining after pretreatment, and association rules produced are stored in a table named AssociationRule.

According to Apriori nature: all non-empty subsets in a frequent itemset must be frequent. Therefore, a frequent itemset and its subsets stand for the same user workspace in a relational database, then only by using the largest frequent itemset to represent user behavior pattern can we reduce redundancy.

Set  $\text{min\_supp}=0.2$ ,  $\text{min\_conf}=0.8$ . Use the Apriori algorithm based on Trie tree put forward in the fourth chapter to facilitate the program to mine audit data after pretreatment and generate the following rules:

#### 4.2. Detection Results

##### 1. Misuse detection results

Misuse detection relies on the construction of a misuse detection rule base. If the misuse rules are not well constructed, then the intrusion detection system cannot effectively detect intrusions. In this system, misuse detection can well detect attack attempts, but since the misuse detection rule base does not have intrusion rules tailored for

Rule	Confidence level	Support
$Rui \wedge User \Rightarrow AddUser$	0.94	0.30
$Rui \wedge User \Rightarrow DeleteUser$	0.83	0.24
$Rui \wedge Xuanke \Rightarrow CreateTable$	1	0.32
.....	.....	.....

Table 1 – Association Rules

impersonation attacks or legitimate user attacks, it cannot detect the two attacks. The results are shown in Table 2.

Id	Resources	Analysis	Invasion time	Detection time
001	DBMS	Landing failed three times in a minute	2014-5-25 09:16:03	2014-5-25 09:20:00
002	officematerial	Operation failed ten times in two minutes	2013-4-21 09:37:18	2013-4-21 09:40:12
.....	.....	.....	.....	.....

Table 2 – Misuse Detection Results

## 2. Anomaly detection results based on data mining

Anomaly detection based on data mining is to mainly find behavior contrary to the normal behavior, so for attacks of legitimate users, anomaly detection has a high detection rate of up to 80%~90%, and the correct detection rate is about 90%; for impersonation attacks, the detection rate is about 70%, but the correct detection rate is 90%. But for password guessing attacks (a large number of login failures in a short time), since anomaly detection of data mining is to model normal user operating behavior, only successful login records are analyzed during detection, so there is a low detection rate of attacking attempt types.

## 5. Conclusions

Due to the complexity of the database structure, with respect to intrusion detection of the network and operating systems, the database intrusion detection technology faces more research difficulties. Research of this paper realizes some features of the database intrusion detection system, but is far from perfection. The following main conclusions are drawn: composite intrusion detection engines combine the advantages of both misuse detection and anomaly detection, thus improving the intrusion detection rate; however, since the misuse detection results depend on rule bases, a rule base should be developed according to the actual situation to cover previously known attacks. Only in this way can it quickly and accurately detect intrusions; for anomaly detection based on data mining, association rules can be employed to achieve the anomaly detection module of database intrusion detection; besides, the trie-based Apriori algorithm proposed in this paper is adopted to quickly raise normal user behavior rules.

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