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Recent Development and Application of Computer Model and Information Technologies in the Real World

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This issue (Vol.2015, No. 16B), presents actual papers on main topics of Journal specialization, namely the application of Information and Computer Technologies in the real world.

In recent years, information and computer technologies, have been applied not only in traditional engineering areas, but also in many multidisciplinary sciences such as education, finance, management, social sciences, plays an important role in scientific research as a key factor. So there has been a considerable increase in research activities from this perspective to analyze and solve the existed problems in the last two decades. Considering this situation, original research and review articles on exploring the recent developments of computer model and information technologies in the real world would be of major interests.

All the 30 extended articles are selected from the panel discussion on Information Technology and Software Engineering held in Chengdu China in June 2014, which reflects the particular scientific problems in the field of information and computer technologies aiming to provide an advanced theory and application reference for relevant researchers and practitioners.

This edition is the continuation of our publishing activities, we would like to thank all those who kindly contributed to this issue: the authors who submitted their papers, the reviewers for their kind comments and cooperation, and the director, Prof. Dr. Álvaro Rocha, for the continued support, and the thanks are given to the publishing and production team of RISTI - Revista Iberica de Sistemas e Tecnologias de Informacao. We hope this issue of the journal will be interesting for research community.

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Research on Digital Adaptive Testing of Foreign Language Based on Computer Information Technology

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Abstract: Objective: In recent years, with the rapid development of computer information technology and modern measurement technology, computerized adaptive language testing, is a hot issue in foreign language testing research in recent years. English language tests and English language teaching complement each other, tests as an important part in the process of teaching, for teaching provides a means of information feedback, provides learners with achievements inspection method. How to make a fair evaluation for English teaching, the English learners' actual language ability to make accurate measurements are English language test to answer the question. Methods: Computer adaptive testing to the character of accurate, efficient and confidentiality is hailed as the 21st century at the forefront of a study to test theory and practice. Process: In this paper, through the computer adaptive test and based on the classical test theory of the contrast experiments of conventional test of two kinds of test model for a comparison between the reliability and predictive validity. Conclusion: Adaptive testing, predictive validity of the reliability test is superior to conventional test based on the classical test theory.

Keywords: Wisdom education; Cloud storage; Data model; Virtual system.

1. Introduction

Since the adaptability test can be traced back to the earliest Binet test. Presented to subjects in Binet test under a test project is based on his reaction to a project before. Early adaptability test mainly has the following several kinds: second stage test (Jin J, Jing R., 2015); Variable test difficulty; Test of branch. These early adaptability tests have their own difficult to overcome shortcomings, but one of the biggest problems is the implementation of the trouble, with the wide use of computer this problem has been solved. In the adaptive test theory development faster. In 1946, Tucker put forward "the project characteristic curve", in 1952, Lord normal ovoid model is put forward, Chinese logistic model is constructed in 1957, 1960 Rasch rush model (García A M V, Duque E J C., 2015), in 1969, made available secondary Samejima, multistage continuous grading test mode, and so on. In China, ETS hua-hua zhang experts have put forward "stratified multi-stage strategy"(Joan D R R., 2015).

Adaptive testing of every stage is very cumbersome, every stage of the selected topic and the ability to estimate complex calculation, if without the help of computer implementation is very difficult, and this is what reason to computerized adaptive testing needs. The new test form computerized adaptive test, is applied to computer adaptive test, implement the update of the test strategy thought, provides a new perspective for education measurement, opened up a new field (Fox K., 2015).

2. Method Principle

2.1. Computer Adaptive Test

CAT is constructed in the 1950 s developed the Theory of modern test Theory, Item (Item Response going (IRT), on the basis of the base construction, the choice of parameter estimation, questions to the final score, are based on IRT as guidance, to say the IRT is the core of the CAT, and even some people say that computer plus IRT is a CAT. IRT is a newly developed a kind of advanced test theory, test model based on the theory called the IRT model (Jiménez, D. L., Redchuk, A., Dittmar, E. C., & Vargas, J. P., 2013). IRT model is a mathematical model, defines the examinee to the question of response (response) and its potential qualities (latent traits). More than 20 kinds of IRT model can choose the proper model according to the actual situation. Project reflect the theory established the examinee reaction and the test parameters and ability level, the nonlinear model between the invariance of parameter, the ability to estimate value does not rely on sample testing subject characteristic, can according to the topic of information at the same time (Da Silveira Paro Pedro H, Nardi S M T, Pereira M I F, et al. 2015), choose to match the subjects ability of title, until you reach a predetermined test accuracy.

With Classical test Theory (Classical Testing found (CTT) compared to the item response Theory is the examinee answer this question, the calculation of the feature functions of the title, speculated that the candidate's ability, according to different parameters, the characteristic function can be divided into the three parameters of single, double and three parameters model, formula is as follows (Ogel K, Karadag F, Satgan D, et al., 2015):

Single parameter model:

$$p(\theta) = \frac{1}{1 + e^{-D(\theta-b)}} \quad (1)$$

Double parameter model:

$$p(\theta) = \frac{1}{1 + e^{-Da(\theta-b)}} \quad (2)$$

Three parameter model (Logistic model):

$$p(\theta) = c + (1 - c) \frac{1}{1 + e^{-Da(\theta-b)}} \quad (3)$$

Among them: $D = 1.702$, is a constant

Theta: the examinee ability to estimate

A: the topic of differentiation (discrimination)

B: the difficulty of the subject factor (difficulty)

C: the subject of speculation coefficient (guessing)

P (theta): ability to theta, the probability that the answer to this question, which correctly reflect the probability

Can be seen from the formula of three models: when take $0 < c$, neither consider speculation, three parameter model is transformed into double parameters model; When a 1, Degree of differentiation, both when subject to achieve the highest ideal state, double parameter model can be converted into a single parameter model again (Andersen G, Tangen S., 2015).

It is not difficult to speculate that in terms of three parameters Logistic model, for any given test questions, ability to value the correct response to the examinee of low probability and low (close to the guess value c), the ability to value the correct response to the examinee of high probability high (close to determine the value of 1). IRT model than CTT model for parameter estimation is more accurate, more comprehensive can solve the problem of test equivalence, By defining the comprehensive quality index information function, provides more scientific challenge subject standard. Three parameters of IRT model covers noodles wide, closer to reality. With the right of IRT model, then can around it to design the adaptive test (Zinzi M, Battistini G, Ragazzini V., 2015).

2.2. The Basic Process of Computer Adaptive Test

To ensure that the computer adaptive test questions difficulty for each examinee ability level, must meet the following two basic conditions. Question (1) the large capacity, namely, to establish a capacity bigger question bank, and according to the item response theory for each question and the number of feet. In addition, the test system must cooperate with good exam exposure control method, in order to ensure to test the question of security. (2) the ability of real-time estimation and choice strategy. The examinee answers every question, test system can real-time estimate the examinee's ability to score, and quickly according to topic selection strategy to choose the most suitable for the examinee ability level of questions to test (Hachem C., 2015).

Computer adaptive test for measuring is a complex technology, including the following eight basic flow: test starting point, the examinee answer, real-time ability of estimation, topic selection, termination criteria, final estimate, the change of scores and grades report, analysis and evaluation.

Process of measurement, choose the most suitable candidates ability level of test questions is the key of computer adaptive test. At present, the computer adaptive test topic strategy mainly have three. (1) the largest project information method, that is, according to the examinee to estimate real-time ability, can choose the candidates ability to estimate the biggest project information of test questions. The biggest project information methods have different variants. Such as a layered biggest project information method, the largest b layered project information (that is, according to the item difficulty layered),

hierarchical biggest project information method (that is, according to the test question content hierarchical), etc. Some other variants (Kalogiannakis M., 2015). (2) using the Bayesian item selection method, assigning the examinee ability as a prior distribution, calculating the right or wrong not to use the test after test variance, and then choose to make the students ability of the posterior distribution variance as the smallest item, as measured by the test. (3) the selected item difficulty closest to the examinee ability to estimate the current exam and right choice somewhat difficult questions, answer questions wrong choice a little easier. During the process of topic selection, testing system must also consider questions exposure (item exposure rates). Try exposure refers to the call number and each item has the proportion of the total number of tests, the calculation formula is: $P_i(S) = X_i/NE$, $P_i(S)$ of said the problem I exposure level; X_i for the problem, according to the number of cumulative call I NE to the total number of the test. A test call, the more observation exposure, the higher the greater the likelihood of the leak. Exposure control level, it is to point to by experts according to the results of simulation study question bank call test questions and expected exposure levels to determine maximum exposure levels. Control of exposure, is to ask control questions observed exposure level below the predetermined control exposure levels, namely(Lima P C, Piacentini V Q., 2015): $P_i(S) = X_i / NE < r_i$. By far the most common exposure control method is Sympson and Hetter SH conditional probability method is put forward. It is a conditional probability is used to analyses the exposure control method, the basic idea is in the project's preliminary selection and final between calls, adding a "filter". So you can ensure that each item of exposure are controlled in a predetermined control exposure levels. SH conditional probability method is then derived from the various variants, such as SH - DP method, SH - SL, SH - SLC, SH - RT method. Recently there are many researchers will SH conditional probability control method and a hierarchical topic selection strategy, common control exposure levels. (Andersen G, Tangen S., 2015) in addition, recently some researchers further puts forward a new exposure control methods, such as project qualified method, multiple exposure method (Alenteva E I, Vedenkina M V, Ryabova E V, et al., 2015).

After the examinee answer complete question, test system to estimate the ability first, then according to the examinee ability estimate instant choice questions, but also to try exposure rate control algorithm Raduka J, Churchill J, Dombrosky E, et al., 2015), thus in the "subject" in this link, the test system will experience more complex operations, need some time to complete this step. However, after completion of test system and to the examinee answer, under the present question immediately. So, how to deal with subject for a long time and the contradiction between questions need immediate present? It can be used to anticipate the examinee ability, advance topic selection method to deal with (Zinzi M, Battistini G, Ragazzini V., 2015) : in the test, the problem is presented to the examinee answer, I think and answer in the examinee of at the same time, the test system in the background in advance according to students "right" and "wrong" two situations, respectively the ability to estimate in advance, ability to get two estimates θ_1 , θ_2 (θ_1 he ability to estimate corresponding examinee answer correctly; θ_2 Ability to estimate for the examinee answer wrong), And advance estimate, based on the two ability as the starting point of topics, from the question bank according to the requirement of the topic selection strategy and exposure control choice question T_1 , T_2 , T_1 corresponding need

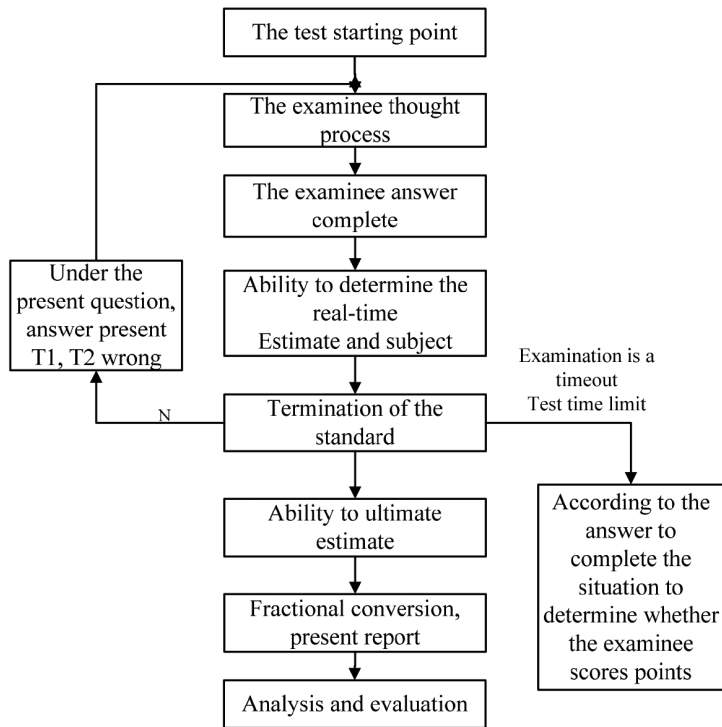


Figure 1 – The Basic Process Computer Adaptive Test

to present the question when examinee answer; T2 corresponding examinee answer mistake need to present the question). Finish the examinee answer the question, I test system will be according to the examinee answer the topic presented under the condition of a topic, I is the itch topic right are T1, the first question I wrong in T2. Thus, we can get as shown in figure 2 computer adaptive test detail of testing process (Nelson L D, LaRoche A A, Pfaller A Y, et al., 2015).

The CAT is a principle of methods: for the high ability of students, give them simple questions is of no effect. Similarly, for the low level of ability of students, give them the hard questions, is of no significance. Therefore, through the selection and management in accordance with each participant ability level project, can avoid the use of valuable information to participants in the first exam and improve the students' learning motivation. So, in the case of the validity and reliability of nondestructive testing, compared with the linear CBT, test length can reduce more than 50%. In recent years, adaptive testing has been applied to the evaluation of E - Learning, in the two aspects of evaluation and teaching shows strong potential. The simple idea of adaptive test is illustrated below (Wilson C R, Wharton D., 2015).

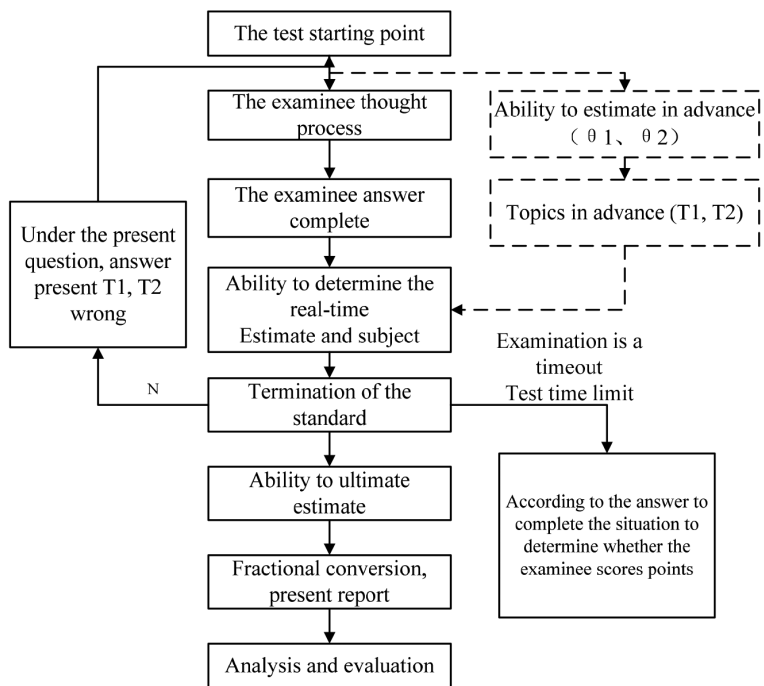


Figure 2 – The Computer Adaptive Test in Detail

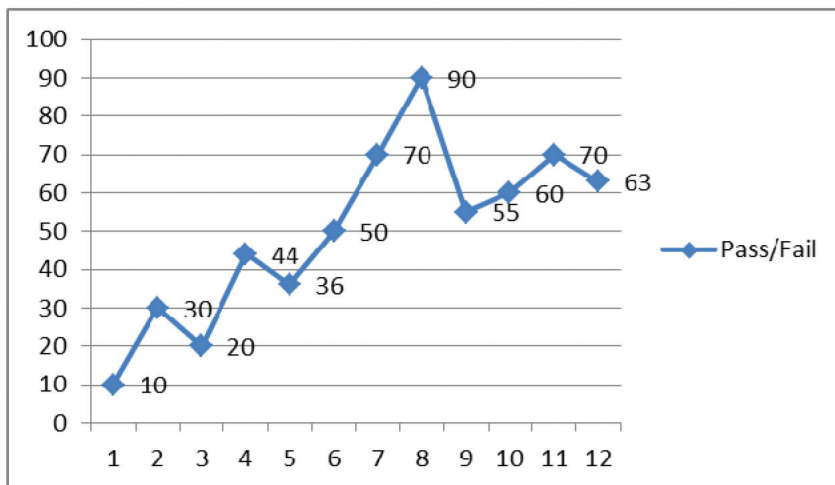


Figure 3 – Simple Idea of Adaptive Test

3. Actual Data Validation

3.1. The Research Object

To participate in this experiment object to a university in Chengdu a grade of non-English major college students, the number of 41 people, including boy of 14, girls for 27 people, average age was 18.3 years. Shall be borne by the same teacher, teaching outline, teaching material, teaching schedule is the same. Teaching of textbook for the 21st century university English”.

3.2. The Experimental System

Adaptive test every stage of the selected topic and the ability to estimate need through complex calculations, auxiliary relies heavily on computer systems. At the same time, in order to try to eliminate the differences of control experiment, routine test and adaptive test adopts the author presided over the design of the same set of college English intelligent network online testing system. The system was published in the “Korean teacher intelligent test system based on (Shao-Jiehan, 1998), in turn, to, system allows to select the

test mode.

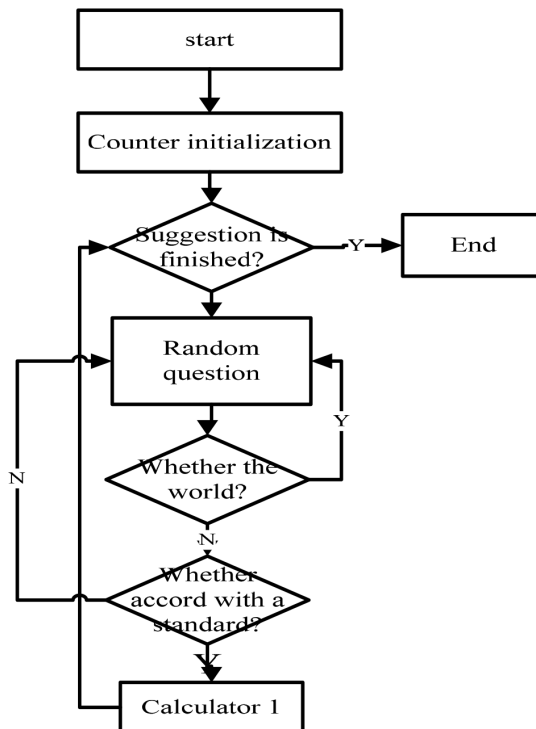


Figure 4 – Regular Test Topic Filtering Algorithm

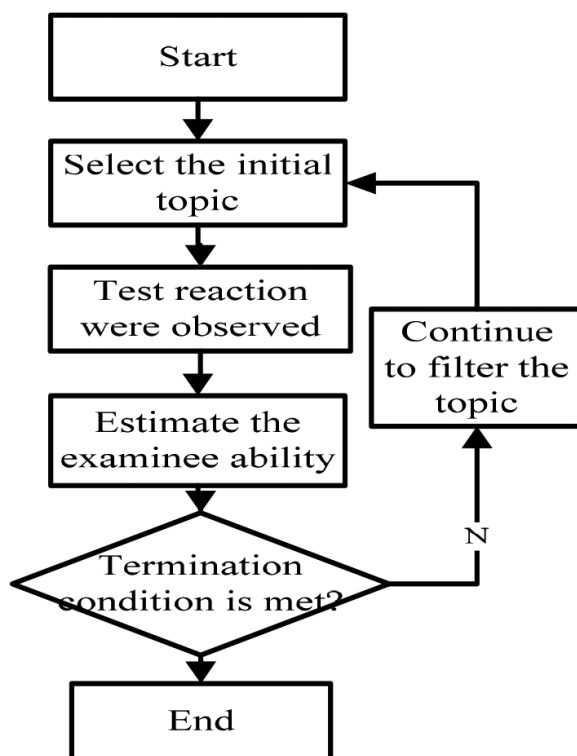


Figure 5 – Adaptive Testing Process

Routine testing and adaptive test used in this experiment the same question, the question bank set up to follow the following requirements: 1) all questions must be after a large sample test: because as the routine test in based on the classical test theory and adaptive testing, based on the theory of the title reaction paper topic quality parameters (the difficulty of the questions and the degree of differentiation) has very important influence. Question, therefore, all questions must be after a large sample test. 2) in various subject quality parameters levels on the distribution of the number should be enough: not a sufficient number of uniform distribution of question bank, intelligent the volume after the test reliability and validity to sell at a discount greatly.

Computer adaptive test based on the theory of the title reaction must be able to choose the right initial difficult projects, can be selected through the analysis of the title reactions of the participants were follow-up questions, according to the topic response theory to estimate the ability level, of the participants were able to terminate under appropriate conditions test, as shown in figure 4 for the basic testing process (zhong-qin bi, guang-xi Chen, an-nong xu, 2004).

This experiment topic filtering algorithm (maximum information) by the largest amount of information method, the algorithm using maximum Likelihood estimation (maximum

Likelihood) calculation ability of adapting themselves to the theta. Whenever after winning candidates new ability, to each of the test subject to calculate the corresponding information (using information function $I(\theta)$ said), then select the corresponding title will be so much as the next test of the participants were the questions. For comparison, this experiment adopts the conditions for the termination of the test to test the length of the fixed, e. after the test time to terminate the test.

3.3. The Experiment Design

This experiment by a semester to review cycle, each test for regular testing first, adaptive test again in 2 days. Tests were conducted 5 times, one is when the students held a baseline test (the routine testing of the final paper is a teacher according to the experience of volume), the second is entrance after a month at the monthly exam (the test to reduce the difficulty of the conventional test), the third was held the mid-term examination in the middle of the semester, the fourth is the mid-term examination held a month after month after test (the examination intends to increase the difficulty of the conventional test), is the fifth time in the final exam at the end of the semester. Each test using the topic, Includes listening comprehension, reading comprehension, vocabulary, grammar, gestalt fills up, composition, composition does not participate in the control experiment, in addition to the composition of conventional test topic quantity for 80, including 20 listening 20 questions, reading comprehension questions 15 questions, vocabulary, grammar, 15 problem, the gestalt fills up the ten questions (in addition to the composition of each questions right 1 points, 0 points wrong); Adaptive test topic type and quantity as routine test. Tests are timed for 90 minutes. Using the maximum likelihood estimation method to calculate the ability of the participants were, according to the principle of equivalent score comparison, it through linear transformation $X=A\theta+B$ (A, B is constant, θ is the ability of the participants were estimated) into 0 points in order to understand.

3.4. The Results and Discussion

With the help of powerful data acquisition and analysis ability of network test system, the experiment to record all the test sample capacity estimation result data (adaptive testing also recorded the process of individual test data for research) and allows for a variety of commonly used teaching later data analysis.

	No	Routine test	Adaptive test	The correlation coefficient	T value	P value
Ability to estimate value	No.1	69	73	0.76	-3.525	$P<0.05$
	No.2	84	74	0.68	7.612	$P<0.05$
	No.3	76	78	0.83	-1.652	$P>0.05$
	No.4	67	71	0.78	-2.713	$P<0.05$
	No.5	71	73	0.85	-1.762	$P>0.05$
Ability to estimate the standard deviation	No.1	10.2	10.5	—	—	—
	No.2	8.3	11.3	—	—	—
	No.3	12.6	13.5	—	—	—
	No.4	14.9	11.5	—	—	—
	No.5	13.4	12.7	—	—	—

Table 1 – Experimental Classes in Two Grades Table Test Mode

In order to compare two kinds of test mode of the reliability test, we the Pearson correlation coefficient was calculated, and the results of the experimental correlations are calculated by t test, $p < 0.05$ level. Through checking the t distribution table get freedom $Df = 40.00$, the significant level of 0.05 double tail critical value of 2.021. The experimental results show that the intention to increase or decrease the routine test, the difficulty of 2, 4 times of two kinds of test mode test scores show significant difference (there was a significant difference in essence is to test the reliability); And elaborate the midterm and final exam, two kinds of test mode test result basically no statistically significant difference (no significant differences in essence is to test the reliability). The above data combined with the mean and variance of the comparison results, we believe that the basic can be concluded that the adaptive testing is better than that of the conventional test of the reliability test. Experimental results also show that test scores are larger fluctuations of the mean, standard deviation, and adaptive test are relatively more stable, Itself, which relies heavily on the examination paper quality is closely related to the subject quality parameters. for example, in the second regular tests to reduce the difficulty of the examination paper, average scores have larger growth, but it has the obvious decreases, and the standard deviation shows that the group scores more concentrated, the essence of which is the subject of the degree of differentiation down). In addition, we noticed that for the first time in the baseline test results of two classes of test patterns also have significant difference, this is because most likely baseline test, the teacher according to the experience of the group with a certain subjectivity and arbitrariness, caused by this kind of situation is quite common in conventional test volume.

		Routine test	Adaptive testing
No.1	validity	0.95	0.95
No.2	validity	0.86	0.98
No.3	validity	0.87	0.97
No.4	validity	0.93	0.97
No.5	validity	0.91	0.94
Validity of the mean		0.904	0.962
Validity of the standard deviation		0.038	0.016

Table 2 – Routine Test and Adaptive Test Validity

Studies have pointed out that the reliability quality indexes such as calculated on the basis of the classical theory, the method of there are heavily dependent on the test sample. But in this contrast experiment, the classical test theory of the validity is still can use the contrast of indicators, because we are not concerned about the validity of the specific values, which is mainly to study in the student under the condition of constant stability of two kinds of test model validity. System USES two types of tests each semester total average score as criterion scores to calculate predictive validity (i.e., calculate each test scores and criterion score criterion correlation). Because the term total average score as criterion score, so the calculated generally validity coefficient is higher, but is still visible routine test the validity of volatility relative to the adaptive testing is more apparent. On the surface it is because this experiment two conventional test consciously increases and reduces the difficulty as a result, but also once again confirmed that essentially classical

test itself, rely heavily on the examination paper quality is closely related to the subject quality parameters. In other words, this can be as adaptive testing proof of predictive validity is superior to the conventional test.



Figure 6 – Digital Adaptive Testing of Foreign Language

4. Conclusion

Education the rapid development of information technology makes the test into a in cognitive linguistics, behavioral science, psychometrics, human cultural science, information technology based on the test information period, the means of production, testing, testing, test research is in the process of digitalization. In order to better adapt to the current test information trend and improve the accuracy of the English test, impartiality, personalization, apply the latest topic reaction test theory in English network testing system design makes sense. Adaptive testing, predictive validity of the reliability test is superior to conventional test based on the classical test theory.

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Research on the Construction of Low-carbon Ecological Planning Green Building Index System Based on Computer Platform

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Abstract: Along with the rapid and healthy development of eco-community, China's green building has entered a scale-up development era, and the low-carbon ecological planning idea based on computer technology platform has be the highlight of modern green building index system. Green building is an ecological and sustainable building, including low-carbon building, energy conservation building and sustainable building, etc. This paper conducted a research on the construction of green building index system, analyzed the security of embedded system in secure computer platform, dissected the basic theory relationship between eco-city and low-carbon building, established an economic evaluation model based on the green building technology of eco-community, and analyzed the evaluation index system and adjustment strategy low-carbon building. In the whole lifecycle of low-carbon building, the use and maintenance stage has the largest energy consumption and carbon-emitting ratio with the longest duration. According to the analysis of the statistic data, the low-carbon ecological planning green building index system based on computer platform is a high-efficient low-carbon building evaluation index system.

Keywords: Eco-community; carbon-emitting; computer platform; lifecycle

1. Introduction

With the coming of low-carbon era, low-carbon development has become the key topic of the world's urban development. China's "The 12th Five-year Plan" clearly put forward to "Sort out green and low-carbon development theory, focus on energy conservation and emission reduction, improve incentive and constraint mechanism, speed up the construction of resource-conserving and eco-friendly production mode and consumption pattern." Low-carbon ecological planning and green building became more and more important. The report of the 18th National Congress of the CPC also pointed out to "focus on promoting green development, cyclic development and low-carbon development; establish resource-conserving and environment-protecting spatial pattern, industrial structure, production mode and life style; turn the ecological environment deteriorating trend at the source; create better production and living environment for people; make

contributions to the global ecological security.”In 2003, Lu Ming, Guo Rong et al. (Arunya R, Ranjith S, Umarani P., 2015) summarized the essential features of ecological city as harmony, efficiency, persistence, integrity and globalization. In 2004, Wang Xiangrong, Wang Pingjian (Seethal K, Menon D M, Radhika N., 2015) et al. discussed the eco-city planning from the perspective of city planning. They deemed that the planning and construction of eco-city is focused on the whole and comprehensive management process on the ecological factors of city, including the management target, procedure, content, method, result and implement solution. It is also an efficient method to realize the dynamic equilibrium of city ecological system and regulate the relationship between human beings and the environment. In 2006, Hou Aimin (Rghioui A, Aziza L, Elouaai F., 2015) pointed that the success of eco-city construction owes to specific and practical target system, specific projects, outstanding key domains, recommended integration of ecological construction and city construction, detailed implementation system of labor division and wide public participation, with supporting conditions of recommending and implementing organizations with specific legal identity and role definition, sophisticated legal regulations, as well as market-oriented management system, etc. In 2008, Wang Ailan (Muthukumaran K, Chitra K., 2015) expressed that the eco-city construction modes abroad mainly include science and technology oriented, government oriented, traffic directed, organization driven, and urban and rural interactive modes. She suggested to learn from international eco-city construction mode and development experience and adopt following measures to accelerate eco-city construction, including making full use of governmental functions, strengthening the basic functions of technological innovation, implementing key breakthrough strategies, constructing eco-city traffic system, encouraging public participation and strengthening construction idea of urban-rural integration. In 2008, Chen Tianpeng (Pratt T G, Chen J, Talebi F., 2015) stated in his doctoral dissertation that the essence of eco-city is “Harmonious and pleasant living environment.” In 2009, Fu Mingxian (Sánchez L, Ranilla J, Cocaña-Fernández A., 2015) suggested that eco-city construction should make efforts in the maintenance and renovation of old towns except in the construction of new towns. In 2010, Li Xun and Cao Guangzhong et al. (Костик К О., 2015) defined “low-carbon” and “ecology” in city, discussed the target and implementation steps as well as policy guidance, technological support and mechanism innovation of low-carbon eco-city development, talking about the constructability of low-carbon eco-city from the aspect of feasibility. Based on computer technology platform and from the perspectives of planning, designing and management, this paper combines green building with the target of urban low-carbon ecological development, extends green building to a broader level with low-carbon ecological planning, establishes green building index system based on specific low-carbon ecological plan, and explores a practical and feasible development way.

2. Related Basic Theory

2.1. Basic Connotation of Green Building and Eco-community

As the name implies, green building means ecological and sustainable buildings. The concept originally comes from the “Eco-building” concept put forward by an Italian-American architect (Freixo, J., & Rocha, Á., 2014). However, the architect didn’t

give a specific definition. As a result, different countries hold different definitions. Thereafter, green building brings in new contents as low-carbon building, energy-conservative building and sustainable building, etc. The Building Services Research and Information Association's definition focuses on the efficient use of resources and ecological benefits; California Environmental Protection Agency (Cal/EPA) focuses on the value of recycling, deeming that green building should possess the previous values in the design, construction, decoration or ecological and resource aspects. According to China's *Evaluation Standard for Green Building*, Chinese version of "green building" refers to the buildings that can save resources (including energy, earth, water and material) to the maximum, protect the environment, reduce pollution, provide healthy, appropriate and efficient functional space and co-exist with the nature harmoniously in the their whole lifespans. Possessed with advantages of UK and US definitions of green building, China's definition focuses on resource conservation and environmental protection, emphasizes land conservation, water conservation, energy conservation, material conservation and pointed out that the essence of green building is to serve the human beings. It summarized the features of green building in the round. Qiu Baoxing, a former vice minister of China's Ministry of Construction, pointed out that green building development is an important strategy to solve the issues of our resources and energy; green building is an overall solution to the improvement of the comfort of buildings and land conservation, water conservation, energy conservation, material conservation; it is the most comprehensive and conservative solution; a single green building may have limited energy-saving effect. But if the buildings are connected and closed matched with the sustainable development of communities and cities, a low-carbon and reduced emission project with multiple effects will be created; green building is the basis of constructing eco-city, which is unavoidable for any eco-city; green building should be considered with the whole community system. Green building can be divided into different levels or types according to the "green" level. In China, there are three grades of green building: one-star, two-star and three-star. Green building is evaluated according to the scores of 7 categories as building and environment, energy-conservation and utilization, water-conservation and utilization of water resources, material conservation and utilization of material resources, indoor environment quality, construction management and operation management, total 100 evaluation indicators. Then under the condition of satisfying controls, the green building will be graded according to the multiplication and addition of the evaluation indicator weights. At present, most of the green buildings act as sample buildings, such as science and technology buildings, business buildings in science and technology area or green office buildings in urban area. Eco-community is a complicated system. Each element inside the system interacts with each other and has single or collaborative impact on outdoor environment and human beings. The construction of eco-community may change the surrounding landforms, hydrological environment, natural or artificial scenery, a certain range of general atmospheric circulation, and even affect the natural environment of other regions in a wider range. When using, the produced waste may influence outdoor environment, or produce remarkable demonstration effect due to appropriate recycling. Internally, the environment of eco-community has impact on the behaviors of people who live there. The designing level also decided some of the behaviors of the residents, which may influence other natural and cultural environment outside the community.

So human behaviors are very important, which not only decide the construction level and operation level of community, but also influence the outdoor environment which will in turn influence human behaviors. In this process, each element is changing. A single change may cause “Butterfly Effect” and lead to larger changes of other elements. Hence, eco-community study and green building evaluation in eco-community should evaluate from multiple directions, and screen out critical and decisive evaluation indicators for better evaluation effect (Zhang J, Yang T, Zhao C., 2015; Bagula A, Abidoye A P, Zodi G A L., 2015; Bindra A., 2015).

2.2. Hierarchical Structure of Secure Computer Platform System

When analyzing the security of embedded system, it is hard to separate software and hardware. The hardware, operating system and applications are usually interdependent and interact with each other. Meanwhile, software designers should specify the operation environment of the softer and available hardware resources. Hence, it is important to abstract and analyze the hierarchical structure of the whole system when designing platform software.

The general hierarchical structure of secure computer system is shown as Figure 1.

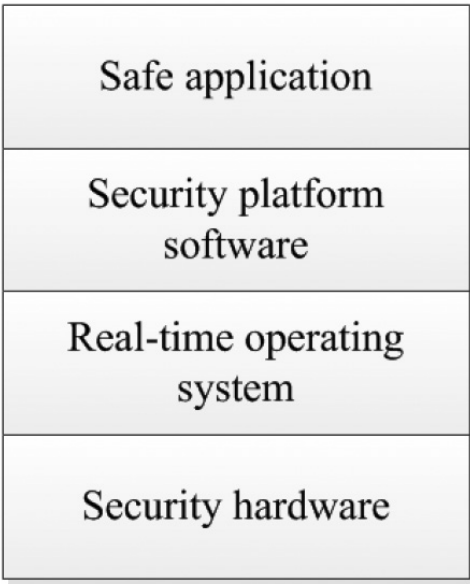


Figure 1 – Hierarchical Structure of Secure Computer Systems

Generally, the system can be divided into four hierarchies: secure hardware hierarchy, real-time operation system hierarchy, secure platform software hierarchy and secure application hierarchy. The overall hierarchical structure of secure computer system is similar to those of other embedded systems, only with different details.

First, the underlying hardware of secure computer system is more safe and reliable. Technologies as dynamic acquisition, dynamic output and seamless switch are often used in the designing process of hardware. These technologies can greatly reduce the possibility of the system collecting wrong signals due to the hardware failure, which can improve the security and reliability of the system. Meanwhile, underlying hardware is also required to observe the “Fail Safe” principle. Secondly, the operation system of secure computer system should satisfy the characteristics of high reliability and high real-time performance. In the application domains of secure computer as rail transit and aerospace, etc., any failure in any part of the system would threaten the safety of human lives. In the secure computer system, the operation system works directly with secure hardware, which is responsible for key functions that directly influence the secure status of the whole system, including the management of task scheduling and control of input and output, etc. As a result, secure computer has a higher requirement on the reliability, security and real-time performance of the operation system.

Thirdly, secure computer system should establish a working platform for applications. Secure applications as rail transit possess following characteristics:

1. Insensitive to system structure. It is not necessary for applications to know what structure the system operates. No matter Two out of Three structure or Two Multiple Two out of Two structure, the logic of applications processing data is the same;
2. Insensitive to communication modes. There is no need for applications to know the acquisition ways of data to be processed including sensor data, external communication message data, etc., neither to transmit the data through certain ways;
3. Insensitive to data status. The logic functions of applications don't need to judge the accuracy and real-time of the data.

Based on these characteristics, it is necessary to establish platform software on the operation system to provide secure data for secure applications and assure the real-time and reliability of the data. In the end, secure computer system needs the secure applications to process related business logics. In the following part, the paper would separately introduce the structure, operation system and platform software of secure computer for urban rail transit signal system (Hiramatsu A, Kurisu K, Hanaki K., 2015).

3. Construction of Low-carbon Ecological Planning Green Building Index System

3.1. Theoretical Basis of the Relationship between Eco-city and Low-carbon Building

The word “Symbiosis” originates from Greece. It is a basic concept of ecology put forward by De Bary, a German mycologist (1879), who defined symbiosis as: “Different creatures live together closely.” After De Bary, many more biologists conducted deeper researches on the symbiosis of creatures. Gaullery (1952) and Lewells (1973) clearly defined the concepts of symbiosis, reciprocal symbiosis, cohabitation, parasitism and relationship between different species of creatures, which enriched the symbiosis study and brought

symbiosis theory into biology and other domains with profound social and historical significances. Since the 1950s and 1960s, the concept of symbiosis is not just about biology, many experts and scholars specialized in anthropology, economics, sociology, management or even politics started to introduce symbiosis concept into corresponding research domains. To better understand the symbiosis theory, the following three concepts should be noticed:

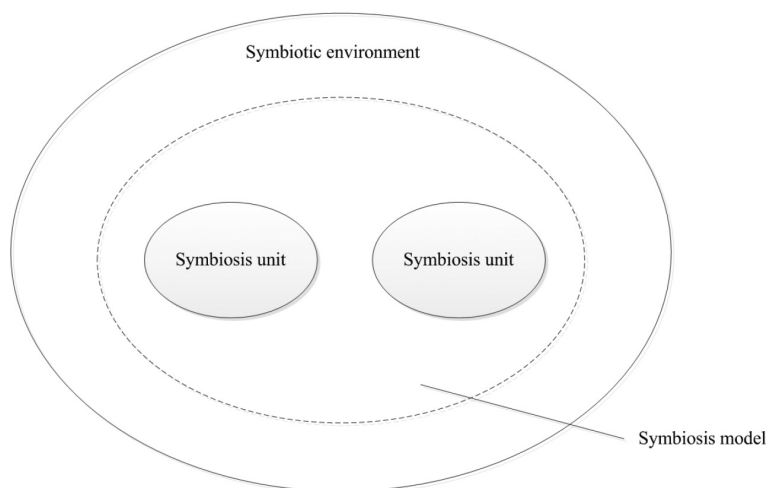


Figure 2 – Schematic Diagram of the Symbiotic System

1. Symbiosis unit. Symbiosis unit is the most basic concept of symbiosis theory.

Symbiosis relationship consists of some basic energy, and the production and exchange units of the energies are known as the symbiosis unit. It is the basic material condition to form up symbiosis relationship. The properties and characteristics of symbiosis units are different in different symbiosis relationship or symbiosis relationship in different hierarchies. To distinguish them, quality parameter and appearance parameter are usually used to feature the internal features of symbiosis units. Quality parameter reflects the internal property and change inside the symbiosis unit. In most cases, a group of quality parameters determine the internal property of symbiosis unit. However, only one of them plays the dominant role, which is called the dominant quality parameter. Appearance parameter reflects the appearing features of symbiosis unit. There is a group of appearance parameters from different angles that reflect the appearing features of symbiosis unit.

2. Symbiosis mode. Symbiosis mode is a reflection of symbiosis units, which refers to the interaction ways or combination forms between the symbiosis units. It reflects not only the interaction way and intensity between the symbiosis units, but also the interactive relations of material, energy and information

between them. Symbiosis mode can be divided into two types. The first type is the symbiosis organizational mode, which reflects the symbiosis organizational level and consists of four states as point symbiosis, intermittent symbiosis, continuous symbiosis and integrated symbiosis. The other type is the symbiosis behavior mode, which reflects the symbiosis behaviors and consists of four states as parasitic symbiosis, commensalism, asymmetric mutualism and symmetric mutualism. Any type of complete symbiosis relationship is a specific combination of behavior mode and organizational mode. Symbiosis relationship changes with the properties of symbiosis units or the symbiosis environment. In the behavior mode, asymmetric mutualism mode may evolve into symmetric mutualism mode or degenerate to commensalism due to the changes of various factors. Same changes may occur in the organizational mode. The evaluation of symbiosis mode can be expressed by symbiosis degree, symbiosis coefficient and correlation degree, etc.

Symbiosis degree: Symbiosis degree indicates the degree of the energy interaction between two quality parameters. Assume symbiosis i and j have the respective appearance parameters X_i and X_j , and quality parameters Z_i and Z_j , then the symbiosis degree δ_{ij} of i and j is defined as:

$$\delta_{ij} = \frac{dZ_i / Z_i}{dZ_j / Z_j} = \frac{Z_j}{Z_i} \frac{dZ_i}{dZ_j} (dZ_j \neq 0) \quad (1)$$

Where, δ_{ij} stands for the impact degree of the changing rate of quality parameter Z_j of symbiosis unit j on that of the quality parameter Z_i of symbiosis unit i . The dominant quality parameters Z_{mi} and Z_{mj} of i and j are often used to describe their symbiosis degree, and $\delta_{ij}^m = \delta_{ij}$ is known as the feature symbiosis degree of i and j .

$$\delta_{ij}^m = \frac{dZ_{mi} / Z_{mi}}{dZ_{mj} / Z_{mj}} \quad (2)$$

Symbiosis coefficient: the symbiosis coefficients of symbiosis unit i and j are respectively expressed by θ_i^m and θ_j^m .

$$\theta_i^m = \frac{|\delta_{ij}^m|}{|\delta_{ij}^m| + |\delta_{ji}^m|} \quad (3)$$

$$\theta_j^m = \frac{|\delta_{ji}^m|}{|\delta_{ij}^m| + |\delta_{ji}^m|} \quad (4)$$

According to the above formula, $\theta_i^m + \theta_j^m = 1$. In the cases of positive symbiosis or negative symbiosis, only if it is a symmetric symbiosis, the symbiosis coefficient will be:

$$\theta_i^m + \theta_j^m = 1 / 2 \quad (5)$$

Based on above formula, following conclusions can be drawn:

If $\theta_i^m = 0$ then i has no effect on j;

If $\theta_i^m = 1$ then i has some effect on j, but j has no effect on i;

If $0 < \theta_i^m < 1/2$ then the effect of j on i is larger than that of i on j;

If $\theta_i^m = 1/2$ then the effect of i on j is the same as that of j on i;

If $1/2 < \theta_i^m < 1$ then the effect of i on j is larger than that of j on i.

Correlation degree: correlation degree indicates the relationship between quality parameters of different species of symbiosis units. If expressed by dominant quality parameter, then the correlation degree ξ^m of the dominant parameters of different symbiosis units can be expressed as:

$$\xi^m = \frac{Z_i^m}{Z_j^m} (Z_j^m \neq 0) \quad (6)$$

Where, the higher the ξ^m , the larger the correlation between i and j.

3. Symbiosis environment: Any symbiosis relationship relies on a certain external factor. The sum of these factors is noted as the symbiosis environment. Generally, the symbiosis relationship exists in not only one single environment but multi-hierarchical environment. Different symbiosis environment will result in different symbiosis relationship. According to different impact levels, symbiosis environment can be divided into primary environment and secondary environment. But the division of primary environment and secondary environment is not absolute. As the time changes, the primary environment may turn into secondary environment, and vice versa. According to different impact ways, symbiosis environment can be divided into direct environment and indirect environment. According to different effects of symbiosis environment on symbiosis modes, symbiosis environment can be divided into positive symbiosis environment, neutral symbiosis environment and negative symbiosis environment. Besides, the symbiosis mode also has a certain feedback effect on the symbiosis environment. The feedback effect contains three cases including positive effect, neutral effect and negative effect (Elshahat I, Wheatley C, Elshahat A., 2015; Dorzhieva E V, Dugina E L., 2015; Pismennaja E V, Loshakov A V, Shevchenko D A., 2015).

3.2. Main Components of Eco-community System

Eco-community can be explained from two dimensions as “Ecological” and “Community”. First, the structure of eco-city must comply with the ecological concept, which means that the community is an “Ecological system”. In this system, all the activities or changes of human beings, other creatures and the environment they live in interact with each other. Meanwhile, as a whole, the system also influences other ecological elements outside the community. Hence, the community should be ecological and friendly, which not only can save resources and energy, protect the environment, live harmoniously with the natural environment not matter in the construction stage or use stage, take full advantage of the

original form, but also can reduce the waste discharge to the surrounding environment, abate the impact on surrounding residents and space. In addition, the main external traffic should be low-carbon ways as public transport, which means the externality of eco-community on the surrounding is positive and will reduce the negative externality to the minimum. Secondly, eco-community exists as a community. The most important elements are the people who live in it and the relationship between them. So the components of eco-community contain not only the lifeless plants, gardens, facilities and buildings, but also the structure, relationship and management of the residents (Li C F, Cao Y Y, Yang J C., 2015).

The above content can be expressed by a simple figure as following:

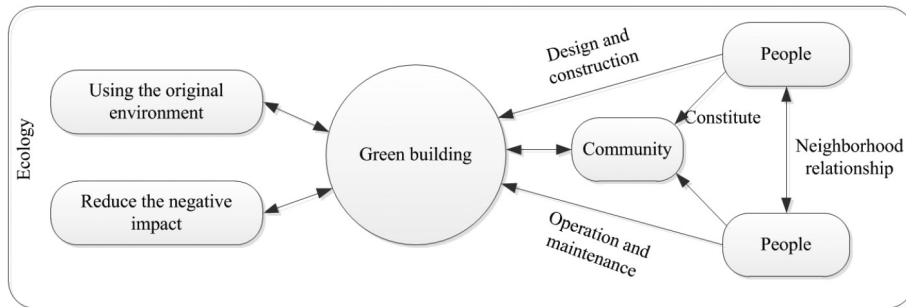


Figure 3 – An Understanding of Eco-Community

3.3. Technological and Economic Evaluation Model of Green Buildings based on Eco-community

Current multi-factor evaluation index systems mainly adopt two methods: additive sub-index and weighted & standardized sub-index. Both of the methods have their own characteristics. Additive sub-index is relatively simple. It only needs to set the value range of each index, add the evaluation results of each index to obtain a total score and evaluate according to this score; if the index number is different when evaluating, increase or decrease the index number accordingly in proportion for normalization. The result of weighted and standardized sub-index is simple, which is better for the normalization of the data. But the preliminary work such as the determination of index weights is complicated. Typical evaluation systems of additive sub-index include LEED, and green building evaluation standard, etc. Typical weighted & standardized sub-index include BREEAM, BREEAM Communities, etc. As there are too much evaluation indexes and additive sub-index has a high requirement of experience observations in determining each index, this paper adopts the weighted & standardized sub-index method, aiming to improve the adaptability of the indexes in different regions. Specifically, as Delphi method requires a high expert score, analytic hierarchy process (AHP) is adopted to determine the weights of each item; in the actual evaluation scoring, Delphi method can be used according to the characteristic of each index.

First, a two-two evaluation matrix is established according to the difference of the first class index and the second class index, including one first class index evaluation matrix and eight second class index evaluation matrix. Take the first class evaluation matrix as the example, the established two-two judgment matrix is:

$$A = \frac{\lambda_{\max} - n}{n - 1} \begin{pmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{m1} & \cdots & a_{mn} \end{pmatrix} \quad (7)$$

Where, the a_{ij} complies with the following characteristics: $a_{ij} > 0$, $a_{ij} = 1 / a_{ji}$, $a_{ii} = 1$.

Then, evaluate the importance between each index. If index i is absolutely important compared with index j, the value of a_{ij} is 5; if the indexes are of the same importance, the value is 1.

After establishing the judgment matrix, ranking vector method will be used to calculate the characteristic root. Normally in the case of undemanding accuracy, root-finding method is used for simple calculation. This paper also adopted the same method:

First multiple each line of elements in the judgment matrix A and get $M_i (i = 1, 2, 3, 4, \dots, n)$,

Then extract an n root for M_i and get a_i , standardize the root vector $\alpha = (a_1, a_2, \dots, a_n)^T$; when w_i is the ratio of the sum of w_i and a_i item, get the sequencing weight vector $W = (w_1, w_2, \dots, w_n)^T$.

At last, the maximum eigenvalue will be:

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^n \frac{AW}{W_i} \quad (8)$$

However, it's worth mentioning that, as the relative importance of judgment in the AHP method is subjective, and A requires the consistency, a consistency check should be conducted. The check indicator is:

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (9)$$

n	2	3	4	5	6	7	8	9	10
RI	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.19

Table 1 – Empirical Values

Where, n represents the orders of judging the matrix. Then calculate the Random Conformance Rate $CR = CI / RI$, where RI is the averaged random conformance index, which usually takes the following empirical values:

If $CI \leq 0.10$ the above calculating results are consistent. Otherwise, the judgment matrix values need to be revised (Baute Álvarez L M, Iglesias León M, Suárez Suárez G., 2015).

3.4. Analysis and Adjustment Strategies of Evaluation Index System

Each index in the evaluation index system is closely related and makes up a same system. As our country has a wide land area with multiple climate divisions, and it is the coldest region in winter and the hottest region in summer compared with other regions in the same latitude in the world, we cannot directly use the evaluation systems of western countries. Take the southern area for example, although the temperature in winter is higher than the northern part, people still feel cold due to the high humidity. So the building should consider the demands of warmth and heating. While the summer is hot and rainy, designers should consider heat dissipation and rapid ventilation, which conflicts with the warming design. In the evaluation index system, it means to cancel the index of "Warmth and heating design". According to the index setup and evaluation standard shown in the previous part, the secondary index selected internally from the primary index is closed related with the primary index. It is a specific embodiment of the content of the primary index. As for the primary index, on one hand, it reflects the core concept of green building of land conservation, water conservation, energy conservation, material conservation and environment protection; on the other hand, it reflects the core concept of eco-community of reasonable location, harmonious with the surrounding ecological environment, less impact on the traffic, and resident-oriented autonomy. Besides, former studies and evaluation systems usually ignore the evaluation of the whole life-cycle, which makes the constructions of green building and eco-community already stay at the designing and project stage. They didn't care about the future operation, only if they can accomplish the green design and pass the green inspection. As a result, the construction party of green building only concerns the immediate interests, and develops the green building and eco-community into "noble architecture" or "high-end residence" rather than consider how to keep the "green" in future operation; and the ordinary people will only notice the high price of green building rather than the advantages of energy conservation and water conservation that would bring to them. The evaluation index system established in this paper takes the whole life-cycle cost evaluation as a primary index, the secondary indexes of which are all basic items, aiming to put the whole life-cycle cost evaluation as an integral part of green building evaluation system. As analyzed above, this evaluation index system has a good systematicness, in which each primary index is closely related and each secondary index basically reflects the content of the primary index (Ribeiro I, Peças P, Henriques E., 2015).

4. Analysis of Experimental Data

The use and maintenance stage of low-carbon building is the largest energy consumption stage with largest carbon discharge and longest duration in the whole lifecycle of the building. Many experts and scholars invested a lot of energy to study and analyze this stage so that to obtain accurate evaluation modes. However, due to the restriction of geographical and climate conditions, their results were quite different. Table 1 and Table 2 mainly showed

	Residential building energy consumption (GJ)	Teaching experimental building energy consumption (GJ)
Building materials preparation	18825.72	81775.76
Building operations	10192.86	27901.54
Construction use	217767.5	1151818.32
Building demolition	7932.88	20382.73
Used building materials department	427.76	1774.63
Total	255146.8	1283652.98
Unit area energy consumption	35.11	68.74

Table 1 – Energy Consumption of Two Buildings' Lifecycle

	Residential building energy consumption (t)	Teaching experimental building energy consumption (t)
Building materials preparation	2099.58	7229.05
Building operations	925.8	3660.56
Construction use	20772.19	101267.82
Building demolition	733.2	1883.88
Used building materials department	32.49	134.92
Total	24563.26	114176.23
Unit area energy consumption	3.38	6.11

Table 2 – CO₂ Emissions of Two Buildings' Lifecycle

the data of energy consumption and discharge of two buildings in their whole lifecycles. The energy during the use stage mainly includes electricity, gas and heating.

As shown in the tables, although the buildings are different in designing, it is obvious that the energy consumption and CO₂ discharge occupy a high proportion in the use stage of the building. Hence, to reduce the carbon discharge of the use stage of building, the energy consumption should be reduced and the use efficiency of energy should be promoted. The scoring points in the use stage include: the use of energy-conservative lightings and high-efficient appliances to save energy; adoption of centralized heating as the dominant way, combining with multiple heating supply ways; full use of natural energies such as geothermal power, wind power and solar power, etc.; implementation of proper measures and technologies to improve the service life of the buildings. As the service life of building becomes longer, the new buildings will be less, which not only can save a lot of resources

and energies, but also can reduce the discharge of solid wastes; use of high-efficient air conditioners, heating and ventilation equipment, lighting and hot water supply equipment to keep the energy consumption of the building at a low level so that to achieve the goal of energy conservation and emission reduction; energy conservation project should take full consideration of the real climate, natural condition, resources, economy and culture of each area, and take corresponding measures according to the local conditions (e.g. The use of solar power and geothermal power, direction of the building, and design of heat preservation and insulation system, etc.) to make the energy conservation project practical and feasible.

5. Conclusion

Based on computer platform theory and low-carbon building concept, this paper compared green building, energy-conservative building and ecological building, and better presented the content of low-carbon building by combing with the development status of low-carbon building in and abroad. According to the existing documents, this study explored an effective index system and evaluation method to evaluate low-carbon building and preliminarily provided the calculation formulas for quantitative indexes. Aiming at the complicated and multi-directional low-carbon building evaluation, the paper established the low-carbon building evaluation system based on whole lifecycle of the building, which can comprehensively evaluate low-carbon building and provide evaluation methods. The evaluation stages mainly include design, material selection, construction, use and dismantling, etc. The study shows that low-carbon energy-conservative project should take scientific organization, management and supervision measures to keep the low-carbon in a good functional state, give full play of the energy-conservative advantages, and conduct timely updating and renovation of the building and equipment to maintain the energy-conservative effect in a relatively stable state.

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Design and Implementation of Interior Decoration Based on VRP

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Abstract: This paper first describes the combination of construction techniques and virtual reality based on VRML and network technologies including JAVASCRIPT, JAVA language and MATLAB/SIMULINK. Afterwards, the basic format and characteristics of Virtual Reality Modeling Language (VRML) are discussed, as well as commonly used technologies to build a virtual indoor environment modeled in VRML. Then 3ds max that supports VRML is employed to realize three-dimensional modeling of complex objects. Through Java/JavaScript, the dynamic interactive system between users and the indoor virtual environment is built. Last but not least, evaluation of the system shows that the model has basically realized user interaction with the virtual environment. VPR interior decoration platform can enrich expression ways of interior decoration and quickly exhibit interior space layout structure, thereby allowing users to feel immersive in this virtual scene.

Keywords: Interaction; virtual reality; JAVA; interior design

1. Introduction

With the development of computer and network technology, virtual reality technology has been increasingly used in social life. It is hailed as an important technology that has changed the future world right after the Internet (Burdea G, Coiffet P., 2003). By using virtual reality technology, we can interact with a three-dimensional space simulated by computer, and get the most authentic experience in a simulated environment. The immersive feeling and natural and friendly human-machine interaction are unmatched by traditional information technologies (Jayaram S, Connacher H I, Lyons K W., 1997).

Traditional interior decoration presents a designer's design concept in working sketches, and can merely provide customers with static visual experience, while non-professional customers are unable to form an intuitive understanding of the design scheme or to fully understand the design pattern or style (Opdyke D, Williford J S, North M., 1995). At the same time, a plane graph cannot comprehensively expand three-dimensional thinking of designers, thus significantly affecting their grasp of the functionality and artistry of the entire design scheme and limiting their ability to make innovations. The application of virtual reality technology in interior decoration has opened up a new interior design and display mode. Through the virtual reality technology, the design concept

can be displayed in a realistic three-dimensional virtual space, so that customers can dynamically interact to examine the work comprehensively, take a close look at interior scenes from multiple angles, real-time switch between different design schemes, and fully experience the functionality, comfort and artistry of the design (Li H., 2015). This paper intends to make an attempt in this area by designing and actualizing a virtual interior decoration platform based on VRML.

2. The Construction Techniques Based on VRML Virtual Environments

2.1. Construction of Virtual Environments by VRML

VRML is a language that describes three-dimensional scenes. It is the basis for all three-dimensional modeling software to construct a virtual environment. VRML as a language can also directly construct a virtual environment (Plasencia D M., 2015). Three-dimensional objects directly constructed by VRML have such advantages as simple code and fast execution, and so on. Also a VRML file can be directly edited in WordPad or some editors that support VRML (such as VtmlPad). For simple objects VRML is generally used for direct modeling; here simple objects typically refer to objects composed by regular geometry, such as a regular table. However, VRML language programming tends to be complicated. When using VRML to construct a three-dimensional object (Felizardo, V., Sousa, P., Oliveira, D., Alexandre, C., Garcia, N. C., & Garcia, N. M., 2014), we can see only lines of codes, rather than the three-dimensional graphics corresponding to the codes, which add difficulty to code editing. Only after editing codes can we observe the edited three-dimensional object by using a corresponding browser. (Hu H, Ma Q, Zhang T., 2015)

2.2. Construction of Virtual Environments by Using Development Tools That Support VRML

It is complicated to use VRML to write complex scenes, and we can take advantage of currently internationally popular tools that can provide good visualization for VRML for modelling of complex three-dimensional objects, thus enormously enhancing the development efficiency. At present there are many tools that support VRML, and most of them provide visual operations, so through using development tools we can get rid of boring language and improve the development effectiveness and efficiency (Merazi A, Malki M., 2015). Currently prevalent development tools include 3ds Max, Maya and LightScape, which can export *.wrl files. 3ds Max is development software that is adapted to run for the typical PC platform, and its powerful features make it easy to draw complex three-dimensional graphics. Maya and LightScape were 3D graphics environments running on SGI and other workstations; they now have been transplanted to the PC and have shown powerful features. Other visualization tools dedicated to the development of VRML, such as a series of VRML authoring tools like ISA (Internet Scene Assembler), ISB (Internet Space Builder) and ICA (Internet Character Animator) launched by ParallelGraphics Company, are the first for professional VRML production. Their functions have different emphases. For instance, ISA highlights creating interactive and dynamic 3D scenes and allows scene interactions with users; guide paths that produce scenes enable to trigger objects under users' behavior and establish relations between events to create

complex objects' behavior. ICA focuses on the production of dynamic three-dimensional characters; through ICA key frames, a variety of character facial expressions, movements and so on can be produced. Any animation parameter operations are displayed in a three-dimensional window, so programming is unnecessary (Borriello E M, Allidi F, Bellesi I., 2015). ISB provides a large library of objects, shapes and textures, but ISB does not support complex animation, or behavioral or event operations. V-Realm Builder from the MATLAB, as another visualization tool of VRML, is a comprehensive integrated development environment that provides an intuitive interface to the virtual world modeling. While it does not yet support Boolean operations, it provides good support to ordinary shape, ElevationGrid nodes, Extrusion nodes and animation editing, etc. V-Realm Builder also provides tools to minimize file storage capacity to facilitate transmission over the Internet. Although V-Realm Builder is integrated within MATLAB6.x virtual reality toolbox, the virtual environment it generates is relatively independent, which can be viewed directly via browsers that support VRML, but not necessarily open in MATLAB (Harpham-Lockyer L, Laskaratos F M, Berlingieri P., 2015).

A format conversion interface between these visualization tools and VRML makes it possible to combine using several tools. However, just in terms of VRML file itself, because of the format language development and coding regulations, the file is relatively large, so it is also unavoidable to optimize and compress VRML. In this regard the most professional VRML editor VRMLPad can provide us with a good optimization and compression feature. Of course, special compression software on the network can be chosen as well, such as wingz, Gzip, IMO (Internet Model Optimizer) and the like (de Queiroz R B, Dutra T, Vidal C., 2015). These tools are essential to create a good webpage. Due to the current network bandwidth limitations, we cannot send a large data packet to the client, or the screen will be lack of a sense of continuity. This phenomenon is undesirable to the author, so data must be properly compressed before sending.

3. The Combination of Virtual Reality and Other Technologies

3.1. The Combination of Virtual Reality and Grid Technology

Grid computing is a technology that interconnects various computing resources widely distributed geographically by using the Internet or a private network. Currently grid can be combined with virtual reality technology in regard to telemedicine and tele-immersion and other applications. Because telemedicine grid plays a role of combining various technologies, blending various platforms and shielding various differences, while virtual reality technology is a major telemedicine technology, so the two can be combined in telemedicine.

Tele-immersion is a special networked virtual reality environment that can be fictional or realistic reflection of reality or history, and can visualize high-performance computing results or data (Angulo A, de Velasco G V., 2015). Tele-immersion sharing is primarily not computing or data storage capacity, but a centralized virtual environment, so it is a typical grid problem itself (Baum C, Ojeda F M, Wild P S, et al., 2015).

3.2 Combination of Virtual Reality and JAVASCRIPT, JAVA Languages

When actualizing a virtual reality environment, there is often JAVA language support, since VRML does not have the multi-user feature. However, VRML is open via Script

node, which provides the possibility for the author to use other tools. JAVA language provides three packages: `vrml`, `vrml. node` and `vrml. field` to support interaction between scene entities and JAVA realm, so by using the JAVA socket communications and multi-channel broadcasting and its platform independence, we can build up a complete cross-platform distributed interactive virtual reality environment (Ramakrishnan S., 2015). Figure 1 is a connection among the three-dimensional model of VRML, Java programming and the Internet. When implementing complex animation and interactivity, simply writing VRML may also be inadequate. At this time we can carry out data communication through SCRIPT nodes provided by VRML and JAVASCRIPT, JAVA. With JAVASCRIPT and JAVA languages, we can design and implement complex animation and interaction (Pederzoli F, Ruozi B, Pracucci E., 2015).

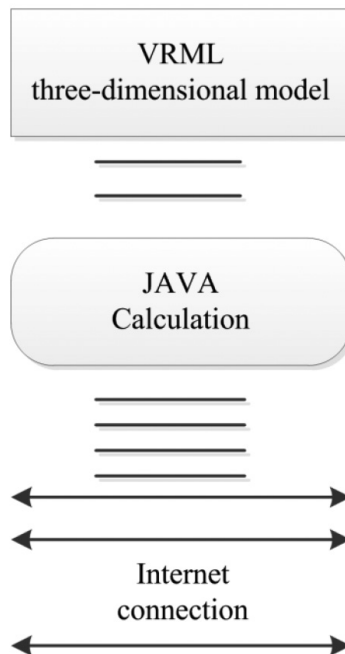


Figure 1 – Communication Model of 3D Scene

3.3. Combination of Virtual Reality and MATLAB/SIMULINK

Virtual Reality Toolbox is a newly added toolbox of MATLAB6.x version. It can provide an effective solution to perform visualized operations and interact with dynamic systems in a three-dimensional virtual reality environment. Virtual Reality Toolbox extends the ability of MATLAB to process virtual reality images. Three-dimensional scenes can be generated by using V-Realm Builder, a VRML scene editor contained in the Virtual Reality Toolbox itself. MATLAB interface functions contained in Virtual Reality Toolbox encompass `vrinstall`, `vrclear`, `vrgetpref`, `vrsetpref`, `vrlib`, `vrview`, `vrwho` and `vrwhos`.

There are three categories of Virtual Reality Toolbox modules in Simulink, which are core module, dedicated input devices and signal module.

By using these interface functions and modules, we can easily use powerful functions provided by MATLAB/SIMULINK to control objects in the virtual environment when realizing the network virtual environments. Virtual Reality Toolbox Server is the core to realize Virtual Reality Toolbox functions. Its working model is shown in Figure 2: The server reads a virtual scene from VRML files and the scene can be identified by MATLAB, SIMULINK and client-side.

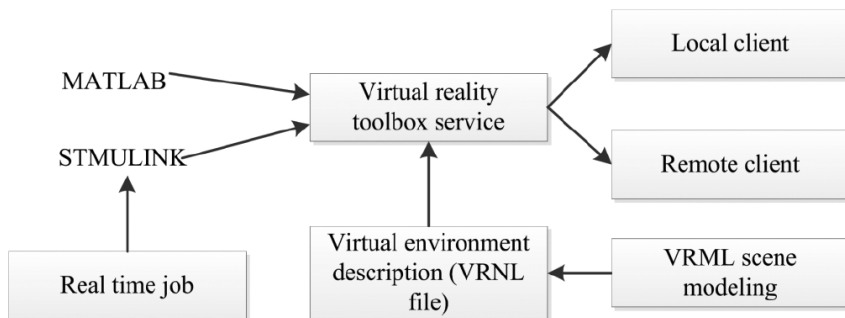


Figure 2 – Virtual Reality Toolbox Service Model

ROUTE provided by VRML can achieve virtual scene animation, but this process is very complicated for complex animation, as dynamic connections are staggered and complex. MATLAB/SIMULINK provides a good way to control objects in the virtual scene, while the strong function of MATLAB/SIMULINK in terms of simulation can be used in simulation tests in the virtual environment. When generating a virtual world and a SIMULINK model, Virtual Reality Toolbox can be used to connect them.

4. VRML-based Indoor Virtual Environment Construction Technology

4.1. Direct Construction of Indoor Virtual Environment by Using VRML

VRML is a language that describes three-dimensional scenes. It is the basis for all three-dimensional modeling software to construct a virtual environment. VRML as a language can also directly construct a virtual environment. Three-dimensional objects created by VRML have such advantages as simple code and fast execution, and so on. Also a VRML file can be directly edited in WordPad or some editors that support VRML (such as VrmIpad). For simple objects such as a regular table, VRML is generally used for direct modeling. However, VRML language programming tends to be complicated, hard to implement and have large workload. When using VRML to construct a three-dimensional object, users can see only lines of codes, rather than the three-dimensional graphics corresponding to the codes. We can observe the edited three-dimensional object only by using a corresponding browser, which adds difficulty to programming.

4.2. Construction of Indoor Virtual Environment by Development Tools that Support VRML

At present, internationally prevalent visualization development tools that support VRML include 3ds Max and Maya, which can export *.wrl files. Using these software for complex three-dimensional object modeling can markedly improve the defects of VRML language, greatly improve development efficiency and achieve good three-dimensional visual effects. 3ds Max is a typical PC-based software development tool. As the world's most popular software for 3D modeling, animation and rendering, its powerful features render it simple and practicable to draw complex three-dimensional graphics, thus fully meeting the three-dimensional object modeling needs. Concrete steps that use 3ds Max to build a three-dimensional model are as follows:

Use 3ds Max for three-dimensional modeling on a plane, and process details of this model, reduce the number of segments, delete and hide unwanted surfaces. To take removal as an example: remove unreasonable designs or dissatisfactory household products from the design scenes and its implementation mechanism is to transfer id that needs to remove nodes to the overall scene, to obtain the corresponding node testNode via id and to use the routing statement ROUTE sc.testNode TO model. removeChildren to complete the removal. The main codes are as follows:

For architectural entities, merely build the geometric framework of entities, while the details and realistic feeling can be done by texture mapping. Use a simple shape or transparency map to model details of houses, stairs and a large number of complex shapes. The above measures have significantly reduced the complexity of the model and ensured good browsing speed and scene effects. If objects in the virtual environment have the ability to walk, stay, observe surface features and other independent interactive sports, there is no need to use two-dimensional maps, and three-dimensional model of independent movement should be used. Then the plug module VRMLOUT of 3ds Max can be employed to output the single model by VRML format, and finally the model is imported into the virtual environment. The entire process is shown in Figure 3.

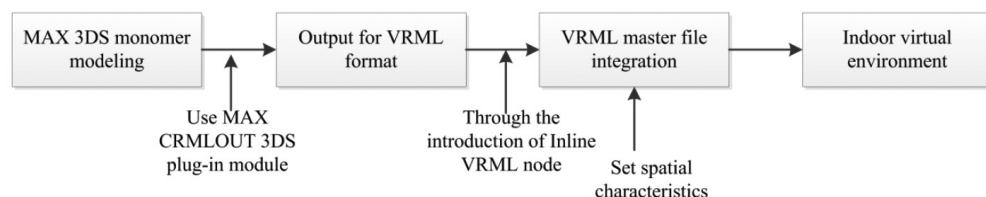


Figure 3 – The use of MAX 3DS to Generate the Indoor Virtual Environment Flow Chart

5. Realization of Indoor Virtual Environments Based on VRML and its Development Tool 3ds Max

5.1. 3ds Max-based Complex Object Modeling

3ds Max is the world's most popular software for 3D modeling, animation and rendering and can fully meet the needs of making high-quality animation. Since its launch, 3ds Max

has won praise with its powerful 3D graphing capabilities. Although *.wrl files derived from 3ds Max are large, using 3ds Max for modeling complex objects can dramatically reduce the development time and improve efficiency. Directly using VRML language would be tedious and difficult to achieve, but it manages simple objects. Computer modeling will become very cumbersome if used without the aid of visualization tools, and using 3ds Max can conveniently get the desired model. Figure 4 is the computer model exported after 3ds Max construction, which shows using visualization tools can not only reduce the workload, and the model constructed will have a good three-dimensional effect. However, 3ds Max is not designed for VRML, so VRML files generated by 3ds Max data are often huge, and there will be data loss. For example, when using the map effect in 3ds Max, map paths of the exported file *.wrl will be lost. However, VRMLPad editor can be used to open the exported file and change the map path in the URL corresponding to the map, so as to reproduce the map.



Figure 4 – The Three-dimensional Model of 3ds Max Structure

5.2. Positioning Assembly of Three-Dimensional Scenes

It is very common and simple to assemble using VRML Inline nodes, but the disadvantage is poor positioning. ISA focuses on the assembly of scenes, so visualization makes positioning easy. But it has a disadvantage of only equidistant zooming in only XYZ3 direction. ISB can also be used for assembly and can assemble complex scenes as objects, but it has poor compatibility with 3ds Max. Therefore, we combine Inline nodes and 3ds Max for assembly, namely positioning in 3ds Max and assembly with Inline. First, construct a single three-dimensional object model in 3ds Max, and then use the three-dimensional house model for positioning reference. Combine the constructed three-dimensional object model one by one into the corresponding positions in the overall scene and export its corresponding VRML format. Finally, use Inline node to assemble exported three-dimensional model (VRML files). Figure 5 is an assembled living room virtual scene graph.



Figure 5 – living Room Virtual Scene Graph

5.3. Dynamic Interaction through JAVA, JAVASCRIPT

If the indoor virtual environment is just a static scene, users can have an immersive feeling when viewing decor and layout of the room, and can also carefully observe an object from different angles. At this time users are equivalent to observers in the virtual environment, but these are far from enough to users, because when they are dissatisfied with a piece of furniture, they cannot respond and make feedback. This is mainly because there is no dynamic interaction in the scenes he observes, there is little commercial value and cannot meet the needs of users. Using VRML SCRIPT nodes to communicate with JAVA, JAVASCRIPT can achieve interaction to a certain degree. As shown in Figure 6, if one is dissatisfied with a piece of furniture (like the bed in the bedroom), he/she can click on the bed three-dimensional model in the virtual scene, and two-dimensional images of bed will pop up. Select the corresponding two-dimensional image to transform the model in 3D scene. By the Script node, the script class compiled by JAVA is cited and the above function can be realized in script class.

Using Javascript can achieve a certain degree of interactivity. Observers may be satisfied with the three-dimensional model shape but not with its color or appearance. Via Javascript, we can change different materials of the same object. Of course, Java also has this feature, but in some cases it is simpler to use Javascript than Java. Besides, Javascript can be directly embedded in VRML. For example, one is very satisfied with the sofa style in the living room, but thinks its appearance is slightly disproportionate to the overall design, and he/she can click sofa in Figure 6 (A) to change its appearance material, as shown in Figure 6 (B).



(A)



(B)

Figure 6 – The Interaction of 3D Scene Based on JAVASCRIPT

6. Conclusion

The emergence of virtual reality modeling language has promote the commercial applications of virtual reality, and now it has wide application prospects in e-commerce. Relying on a variety of three-dimensional development tools that support VRML, we can initially feel the business value brought about by virtual reality. Nevertheless virtual reality technology is still a new technology and its value has not yet been fully developed. In this paper, VRML is employed to construct a desktop virtual environment, and development package provided by JAVA that supports VRML is applied to achieve user interaction

with the virtual environment, which has basically met some business needs. But this is not complete interaction, because users can only choose but not modify the scenes. In future research we can attempt to come up with complete interaction that allows users to make some modifications of the virtual scene in the browser. I am convinced that with the development of virtual reality technology, VRML is bound to exhibit greater value.

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Study on Entrepreneurship Platform in the Context of Informationization

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Abstract: Based on the current employment situation, economic and social demand for talents cultivated in universities and colleges, this paper establishes an entrepreneurship platform system on the basis of B/S design pattern. The platform can help entrepreneurs get familiar with the process of starting business, improve their entrepreneurial ability and independent learning ability, and assist them in finding an appropriate position or job. Through analyzing the characteristics of MVC design pattern, JSP platform technology, Web services architecture, ASP.NET technology, this paper discusses the advantages of the platform based on MVC model, the thinking of UML modeling analysis and the methods to apply MVC model under the framework of ASP.NET technology. This paper proves that the entrepreneurship model in the context of informationization can facilitate college graduates' entrepreneurship. The model enables graduates to achieve their self-development and find a new path for China's entrepreneurship, thereby generating benefits to the whole society.

Keywords: Informationization; Entrepreneurship

1. Introduction

Since the 1980s, China's economic system reform effectively promoted sustained and rapid economic growth. Despite remarkable achievements, reform brought about many problems, such as the employment issue. Recent years, the pressure of employment in China continues to increase. Employment and reemployment problem concerns the vital interests of the masses, the overall balance situation of reform, development and stability, and the realization of the goal of constructing comprehensively well-off society. In 2004, Xu Huaping et al. primarily discussed entrepreneurship education in Chinese colleges and universities (Zahra S A, Covin J G., 1995). Zhang Fan, Zhang Wei et al. published in 2003 the implications of American university entrepreneurship education development (Shane S, Venkataraman S., 2000), Qian Qiang et al. studied the existing problems of entrepreneurship education in colleges and universities and corresponding solutions (2006) (Zahra S A., 1993), Xia Chunyu et al. studied the practice of the college students' entrepreneurship education in our country in 2005 (Baumol W J., 1996). Tang Dehai, Chang Xiaoyong et al. made deep research into the process from employment education to entrepreneurship education in 2001 (Skedelj V. Vidiki eticnega poslovanja.,

2015). Guo Li-jun, Liu Qiang, Lu Xiangyang et al. made comparison between Chinese and foreign college entrepreneurship education policies in 2008(Sloan C W, Caudill S B, Mixon F G., 2016). We make more exploration and research to strongly support and promote entrepreneurship and solve the problem of employment in our country. Taking e-commerce platform as an example, this paper briefly illustrates some technical problems and methods of entrepreneurship and offers some entrepreneurial method samples in the context of informationization.

2. Significance of Studying and Developing Entrepreneurship

Our country has the world's largest population and workforce. How to fully develop and utilize labor resources and how to alleviate the huge pressure of employment concerns basic livelihood. Therefore, our government is forced to solve the employment problem of large quantities of idle people and widen employment channels (Octaviany V, Shiddiq M A., 2016).

2.1. Promote entrepreneurship to increase employment

Recent years, China's total population has been rising; but the increasing rate of "social position" has been falling. The total workforce will be more than the social demand for labor for a long time, causing a continuous employment pressure. Therefore, promoting entrepreneurship will bring more jobs for the society and reverse the decreasing tendency of "total social posts", thereby helping the unemployed find a job. In addition, China is still in high-speed economic development period, with huge demand for labor. But once the economic growth becomes a bit slower, the demand for labor will reduce. The employment issue in our country will become more serious. By studying entrepreneurship, this paper provides the government with feasible entrepreneurship support policy and urges the public and the academic community to attach more importance to entrepreneurship, thereby giving rise to greater private-sector economy and more small companies, etc., creating more jobs to the society and alleviating employment pressure (Zahra S A, Covin J G., 1995).

2.2. Improving entrepreneurship pushes forward the development of new and high technology enterprise

In the 1980s, the United States began its economic restructuring, giving vigorous support to entrepreneurial industries like the information industry, environmental protection industry (Cruz-Cunha, M. M., Simões, R., Varajão, J., & Miranda, I., 2014), and biological engineering industry. The amount of jobs increased rapidly as a result, effectively solving the problem of unemployment. In our country, the growth of new and high technology companies also boosted economic development. According to statistics, China's high-tech entrepreneurial rate rose to 16.2% from 13.7% in 2006. At the same time, during the three years of 2005-2007, China's GDP rapidly rose at an average rate of 9%. Economic development and entrepreneurship are absolutely connected. On average, 4.8 jobs are created by every entrepreneurial opportunity. The employees include college students, laid-off workers, migrant workers, returned students and so on. Entrepreneurship pushes forward China's social and economic development (Shane S, Venkataraman S., 2000).

3. Implications and Characteristics of Entrepreneurship in the Context of Informationization

3.1. Implications of Entrepreneurship

Generally, entrepreneurship refers to an activity in which an entrepreneur starts his or her own business. In limited environment, entrepreneurial individuals or organizations use their knowledge, talent, technology, and a variety of abilities to run different kinds of production and business operations like opening a store, establishing an enterprise, building up a factory or investing a business with methods of self-raised funds, technology investment, seeking cooperation (Zahra S A., 1993). The information-based entrepreneurship makes better use of “innovation”. Internet mode is a general trend of our time. It is a great trend to seek the help of Internet platform startup, also a very good approach. Certainly, informationized Internet startup process is also faced with economic risk, social risk, psychological risk, and so on. Entrepreneurs create novel products or services and achieve their potential value via market operation, so as to obtain financial return and personal satisfaction (Baumol W J., 1996).



Figure 1 – Entrepreneurship Option

3.2. Advantages of Entrepreneurship

Today, Internet develops rapidly development of Internet. In the context of informatization, e-commerce is the best entrepreneurial model. Its advantage lies in its nature (Bhandola P., 2015). E-commerce can enable independent entrepreneurs sell commodities to people all over the world through online e-commerce sales, and make it possible for consumers to buy goods around the world at home. It can make e-commerce entrepreneurs effectively and economically enter new markets around the world. E-commerce’s transmission medium is multi-media equipment, which can generate comprehensive and vivid image, efficient interaction, and timely feedback etc.

E-commerce greatly improves the efficiency of the spread of e-commerce entrepreneurs' information and reduces the publicity cost of e-commerce entrepreneurs' information, and upgrades entrepreneurs' image and strength (Farooq O F., 2015).

In addition, e-commerce can be used to create operation-related application model and to establish new type of procurement relationship. Its online customer service leads to the realization of online sales, online shopping and online payment, thereby enabling independent entrepreneurs to track customers' shopping preference in a timely manner. Besides, e-commerce server can build directory between specific customer group and purchasing group. Consumers can find a number of stores with related products and services via e-commerce. Furthermore, e-commerce provides customers with quality electronic business services and ensures that entrepreneurs have low income at early stage. As customers' basic income grows, e-commerce will be upgraded. E-commerce entrepreneurship requires no rent, greatly reducing the cost and making e-commerce marketing mode more reliable and more executable. Entrepreneurs thus have lower pressure because e-commerce can achieve direct sales and reduce transportation expense freight, the cost of comprehensive index, and inventory, etc. After the world trade organization (WTO) abandoned the network trade tariffs, e-commerce became independent entrepreneurs' green channel of internationalization (Sloan C W, Caudill S B, Mixon F G., 2016).

4. Entrepreneurship Methods and Relative Supporting Policies At Home and Abroad

Currently, the study of entrepreneurship methods is at the starting point and has varied contents: some scholars consider such study should be based on frameworks, while others think we should study entrepreneurship policies under different subjects' methods, and try different ways to solve problems. All these will disorder entrepreneurship-policy studies. On the contrary, scholars have made consensus on the study topic of "entrepreneurship", for example, "entrepreneurial subject" and "entrepreneurial environment". This article will guide policy-making to support policies of entrepreneurship through introducing and combining entrepreneurship methods at home and abroad, as well as taking advantage of entrepreneurship education and related supporting policies.

4.1. Relative Methods At Home and Abroad

There are different frameworks on entrepreneurship methods: the theory frame delivered by Gartner (1995) considers factors such as person, organization, environment and entrepreneurship process. Lund Strom and Stevenson (2001) propose frameworks and types of entrepreneurship policies after researching and studying ten countries, in which situations of population, GDP, population growth, and entrepreneurship activeness are different, that entrepreneurial action is the combination of motive, skill and opportunity, so that people can apply these factors to structure theory frames of entrepreneurship-driven policies. Moreover, scholars propose their views on the basis of varied subjects. Currently, the study of entrepreneurship methods are mainly from three aspects: economy, social psychology, and management.

Lund Strom and Stevenson have studied “entrepreneurship” policies and consider that people should take the following three aspects into consideration when making policies: firstly, boost entrepreneurship at private level; secondly, let entrepreneurs gain necessary knowledge and skill; thirdly, support potential entrepreneurs on resource and environment. In Picture(1), “individual entrepreneurship”, “corporate entrepreneurship”, and “social entrepreneurship” are entrepreneurship subjects. Picture (1) also reflects the study of “entrepreneurial activity”, “entrepreneurial environment” and “entrepreneurial performance”. In addition, we should also consider the relation among different factors, as if there are no particular ideas and inspirations of creators, there will be no success. Therefore, the studying framework of “entrepreneurship” policies targets at the study of “entrepreneurship subject” and “entrepreneurship environment”.

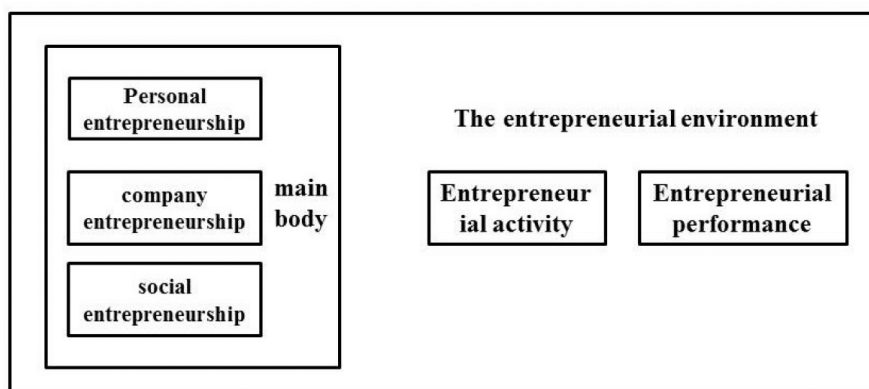


Figure 2 – The Basic Framework of Entrepreneurship Research

4.2. Policies Supporting “Entrepreneurship” At Home and Abroad

What we can learn from entrepreneurship supporting and risk investment pattern of the United States:

In current years, China’s economy has grown rapidly and China has made achievements in government management. As the global rank of governmental executive ability reflects, Chinese government has strong executive ability, and contains powerful management style. However, we should also realize the huge gap on economic power between China and US. Causes for the gap is varied, but there is one important point that the way US government manages economy is different from China, that is, delegating government power and stimulating private management. The government will not intervene in detailed enterprise operation and management, but will try to establish a just competitive environment, and lead private forces to establish a series of effective motivation systems in order to stimulate the economic growth. The US government encourages individual entrepreneurship by setting up entrepreneurship-supporting and risk investment patterns focused on U.S.A. Small Business Administration (SBA), through which we can learn how to build an innovative and entrepreneurial society.

1 US entrepreneurship-supporting model on the core of SBA

The US government formulated “Small Enterprise Law” at 1953, and established SBA to help small enterprises establish their companies. The US government also set up “The White House Committee of Small Enterprise” and “The Congress Committee of Small Enterprise” working together with SBA. Currently, SBA has 90 regional and branch offices in America. The general office is at Washington, and there are many cooperative financing institutions and resource partners in America. SBA shares four basic responsibilities, including financing channel (commercial financing), enterprise management support (on education, information, technology and training), governmental project contract (federal government procurement), advertisement, and legal rights safeguard (voice of small enterprise). These four responsibilities form a motivation system in order to promote the development of small enterprise entrepreneurship. Currently, the US institutional system of government-supporting development is the most completed. It has two parts: one is policy promotion at the core of “Small Enterprise Law”, and the other is entrepreneurship-safeguarding institution formed by scholars and members of congress. The framework is as follows:

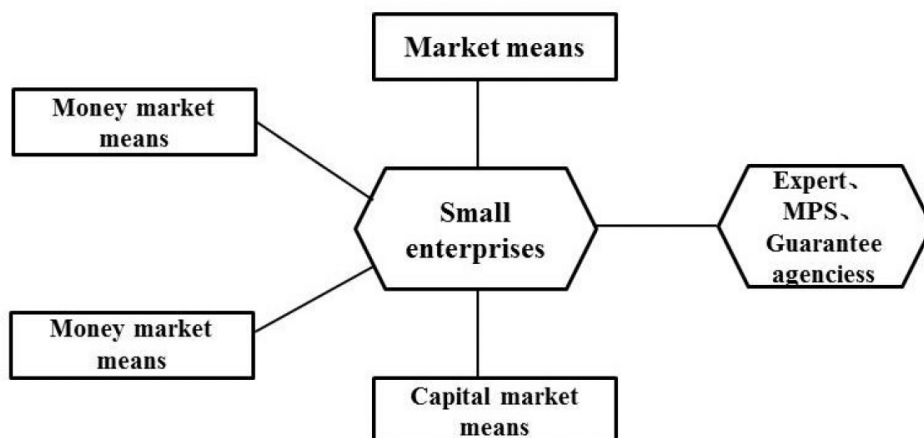


Figure 3 – A Support System in the United States

2 US indirect regulation and control pattern supporting risk investment

Entrepreneurs can attract venture capitals or private angel investments if they have a completed and workable business plan. The global risk investment development under government support can be divided into three patterns: Japanese model with governmental direct participation, American model with governmental indirect participation and Western Europe model which is the combination of both. The US government encourages small enterprises to use indirect adjusting and controlling patterns in order to finance; that is, applying SBA to guide commercial institutions and private investments to lend to or invest in small enterprises. First, the US government uses SBA to provide financing channels on risk investment for small enterprises in order to let entrepreneurs obtain more opportunities for investment, and create good investment environment for risk

investment companies. It is the government that takes charge of leverage financing. SBA is the largest investment organization in America with certain investment ability. At the same time, the government will inject capitals, raised from the bond market, in investment companies. Therefore, private investors can run an investment company with 13% of the total capital. All these stimulate private capital to take part in risk investment, and lead a large amount of private capital to participate in the risk investment industry. At present, there are 446 private risk investment companies in America.

5. Analysis of Entrepreneurship Platform Implementation in the Informationization

5.1. B/S

1. With the rapid development of Internet, the user interface is completely implemented by Web browser. Some part of the business logic is implemented in the front-end, while the main transaction logic is implemented in the server's side. B/S structure mainly uses the WWW browser technology, combining the browser vBScript, JavaScript, and ActiveX technology. A general browser can implement the powerful function of the complex specialized software, thereby saving the cost of development. B/S is a brand new software system construction technology.
2. The structure chart of B/S

B/S (Browser/Server) model decomposes the server part of the C/S model into a data Server and several application servers (Web Server), forming a three-layer structure of customer service system. B/S mode is essentially a special C/S model. But its client application is simplified into a client software which speaks only one single HTML language, namely a general browser. The browser is responsible for user interface processing and communication function. The function of web server is business processing. As for data processing and database administration, they are functions of data server, which dynamically manages a variety of information distributed on the web server.

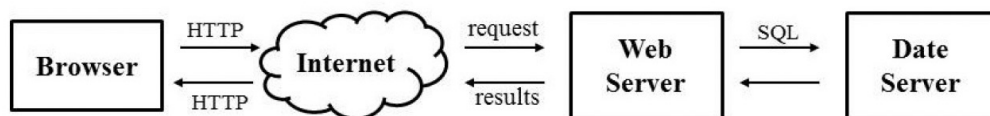


Figure 1 – B/S Model Instructions

3. Working principles of B/S model

In B/S model, the client runs browser software. The Web browser sends request to visit database in the form of hypertext to Web server. After accepting the client's request, the server converts it to SQL syntax, and transfers the syntax to the database server. After database server gets request, it verifies the request's legitimacy, carries on data processing, and then processes results back to the Web server. Once again,

the Web server converts all obtained results into a HTML document, and forwards the document to the client browser in the form of a friendly Web page.

5.2. JSP

JSP(JavaServerPages) is a dynamic website technology standard advocated by SunMicrosystemS and jointly established by many enterprises. The web applications developed via JSP are adaptable to Liunx and other operating systems.

JSP technology uses the Java programming language XML tags and sCriptlets to encapsulate the processing logic of generating dynamic web pages. Page also can get access to application logic of the resources saved in the server via tags and Scriptlets. JSP seperates page logic and web page design and display. It supports reusable component-based design and make the development of a web-based application quick and easy.

Like JavaServlet, JSP is executed on the server's side. It usually returns to the client an HTML text, which be read by browers in the client.

5.3. ASP.NET

5.3.1. Working principles of ASP.NET

Under many circumstances, ASP.NET pages can be simply regarded as general HTML pages including some code segements labeled with special process mode. When installing, the local 15 web server automatically configures into profiles whose extended name are ASPx, and applies the ASP.NET module (named ASPnet_1Sapi.dn) to process these profiles.

5.3.2. Built-in objects of ASP.NET

ASP.NET provides built-in objects including Page, Request, Response, AppliCation, Session, Server, CookieS, Mail and Caehe. These objects make it easy for users to collect the requests send via browser, respond to the browser and the information of saving user to deliver some specific condition management and page information.

1. Response object
2. Request object
3. Page object
4. SeSSion object
5. AppliCation object
6. Server object
7. Mail object
8. Cookie object
9. Caehe object

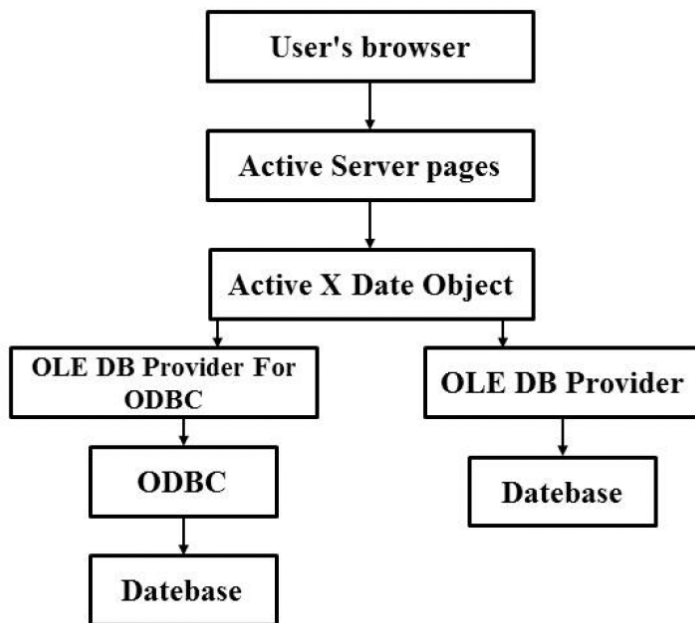


Figure 5 – Hierarchy Between ASP and Database

5.3.3. ASP.NET is customized and extensible

ASP.NET allows developers to define their own module of plugin program in their code, which has been considered at the beginning of the design of ASP.NET, making it possible for users to add any components defined by themselves according to their own needs.

5.3.4. Program structure is clear and highly safe

ASP.NET development approach is based time driving and data binding, implementing the separation between program code and user interface. It has clear design structure. Besides, it is authentication technology and application configuration based on Windows, thereby ensuring the safety of the source program.

5.3.5. scalability, availability and reliability of the multiprocessor environment

ASP.NET considers scalability in its design and adds the function dedicated to improve performance in devoted environment and multiprocessor environment (Moreno J R V, Galvis L V V., 2015). Although the present ASP.NET application software is developed for a single processor, its function can be improved without any changes to multiprocessor.

Basic datasection	Name	Explain	Purpose	Location
Infinite page section	pv	page view	open test number	each drop point
	uv	unique vistor	detection of visitors	each drop point
	pv-uv Conversion rate	pv/uv	relations between the pv and uv	formula for conversion
	users	number of registered members	Statistical membership	each drop point
	uv-uu Conversion rate	uv/uu	relations between the uu and uv	each drop point
The user part	Purchase rate per capita	average sales	new user consumer behavior analysis	For the first time to buy
	unit price	total sales/total	new user consumer behavior analysis	For the first time to buy
	new user sell-through rate	new user/ total	old user consumer behavior analysis	old customers to buy
	old user sell-through rate	old user/ total	old user consumer behavior analysis	old customers to buy

Table 1 – E-Commerce Platform is Analyzed

At present, the background of most sites is dynamic program, its foreground is static page technology. The foreground is in the form of HTML, which can be modified via the background. HTML static page can be easily searched by search engines and get good rankings. It can also save server resources for it doesn't need to call database. As a result, the browser runs very fast.

6. Conclusion

In response to the present employment situation and economic and social demand for talents, this paper takes college students as an example to introduce in detail the establishment and study of college students entrepreneurship platform in the context of informatization. Based on advanced design idea, this paper uses UML modeling technology to make detailed design and analysis on the campus entrepreneurial platform, which has functions like online learning, intern shop, business shop, shop business evaluation etc. The platform offers people the opportunity to experience the specific business operation and better practice and experience. In the example of campus e-commerce, through analyzing the factors of the entrepreneurial platform, this paper puts forward new entrepreneurial platform service model. It applies independent logistics model. Users can pay by cash and campus card. As the platform utilizes design model based on MVC, it can flexibly achieve the seperation among data layer, presentation layer and business layer, for convenience of code development and management. It can not only improve the work efficiency, but also enhance code reusability and the maintainability of the system.

Through establishing and studying entrepreneurship platform, this paper hopes to provide favorable methods to people who intend to start their own business, and also to relieve the pressure of employment in our country.

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The Reliability Model of Computer Economic Information Systems and Its Application based on Bayesian Networks

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Abstract: The computer economic information system reliability model has good performance in the development and application stages, which has solved some life and work problems for a large number of users. However, currently users have raised new demands for the computer economic information system reliability model, such as higher accuracy, more complex relationship management, and higher reliability. An economic model system based on the Bayesian network can compensate for these defects. This paper studies a reliability model constituted by components and connectors as well as its applications tailoring to the computer economic information system. Since the modern Bayesian networks are characterized by accurate, intuitive and intelligible inference and strong operability, a case study of the economic information system has obtained the analytical results regarding probability to calculate system reliability and system diagnosis. It has shown that the model can be easily used to calculate reliability of the economic information system and diagnose system reliability and can make a reliability analysis in third-party components and heterogeneous environments.

Keywords: Bayesian networks; Computer economic information system; Reliability model

1. Introduction

Reliability is an important indicator of quality. With the development and application of computer information systems, there are growing problems concerning reliability, which has directly contributed to the reliability research and quantitative analysis of information systems. The economic information system design and development process and its engineering practices have proved that there will always be more or less some reliability problems in the entire life cycle of economic information system development, no matter how preeminent development and programming talents are, how excellent architecture and construction process is and how effective management has been, and the sooner the problem is detected, the easier it is to fix and the smaller the impact.

From the perspective of the reliability of computer information systems, people have established a number of reliability models of computer information systems and

provided some effective methods for evaluating computer information system reliability. Research on the reliability of computer information systems can be traced back to the 1960s, when Hudson first proposed a reliability analysis in 1967 starting from error generation and ending with error correction. In 1973, Wolverton assumed the hazard rate proportional to the number of remaining errors and the debugging time, put forward using the hazard rate as a random variable, and its distribution function contains a parameter changing with the number of failures, and built a new reliability model of computer information systems (Huelsenbeck J P, Ronquist F., 2001). In 1975, Musa presented a reliable execution time model on the basis of summarizing previous relative works (Ronquist F, Huelsenbeck J P., 2003). After the 1980s, comparisons and selective studies have been performed regarding reliability models of computer information systems (Geman S, Geman D. (1984). Although some progress has been made, there is still a great distance between theory and applications, and the applications are not satisfactory mainly because of imprecise reliability models of computer information systems, poor adaptability, fixed assumptions made on the information system failure, and combined effects of various random factors on computer information systems (Arulampalam M S, Maskell S, Gordon N, et al., 2002). Through making a comparative analysis, the author finds that models estimating the reliability of computer information systems are mostly concentrated on the reliability growth models in the information system testing phase without paying any attention to their internal structure, which is similar to a black box model. However, with the object-oriented system design and extensive applications of Web-based computer information system development approaches, particularly with growing component-based development models for computer information systems, economic information system components may be third-party components, independently researched and developed components or contract components of research and development; the entire application development is in a heterogeneous environment. Therefore, it is unsuitable for applying existing reliability evaluation models and corresponding research and analytical methods for computer information systems to analyze the reliability of modern computer information systems; this is particularly the case with estimation and application analyses of the reliability of component-based information systems (Doucet A, Godsill S, Andrieu C., 2000).

To this end, this paper constructs a new reliability model for economic information systems based on Bayesian networks by using the reliability assessment methods of components and connectors. According to the reliability probability of components and connectors, as well as the conditional probability of the whole computer economic information system, reliability of information systems is derived, which features accurate, intuitive and intelligible inference and strong operability. In addition, this model also applies to reliability testing of computer economic information systems in heterogeneous environments.

2. Bayesian networks

2.1. Introduction to Bayesian Networks

Bayesian statistics come from a paper *An Essay Towards Solving a problem in the Doctrine of Chance* by British mathematician RT Bayes (Drummond A J, Rambaut A.,

2007). This paper gives the famous Bayes' formula and an inductive inference method, which was later developed by scholars into a set of principles and methods of statistical inference. To the 1930s a Bayesian school was formed, and it was developed into a very influential statistic school in the 1950–60s.

Bayesian Networks, also known as Belief Networks and Probabilistic Networks, are first proposed by professor J. Pearl at the University of California in 1986 (Spiegelhalter D J, Best N G, Carlin B P, et al., 2002). In literature (Green P J., 1995), Pearl formally defines the concepts of Bayesian networks, knowledge representation schemes and distributed computing models based on message passing. He believes that when inferring with Bayesian networks, it is not represented in form of a joint probability (Freixo, J., & Rocha, Á., 2014), but interdependence among variables and conditional independence in Bayesian networks; using conditional independence among variables can effectively reduce the number of condition probability tables required for computing joint probabilities. Based on the analysis, Professor Pearl presents a graphical structure to represent condition dependencies among these random variables, and this graphical structure defines a new model of knowledge representation--Bayesian networks (Cooper G F., 1990). The proposal of conditional independence and use of graph models has laid a solid foundation for the high-efficient Bayesian inference algorithm and provided a new approach to process uncertain knowledge in artificial intelligence. Bayesian networks have thus become a very active field of artificial intelligence research, and Professor Pearl has also been awarded the 1999 Outstanding Research Achievement Award by the JCAI (International Artificial Intelligence Association) (Tipping M E., 2001).

2.2. Theoretical Basis of Bayesian Networks

Probability theory lays a theoretical basis of Bayesian Networks, so here its basic concepts and related laws are briefly introduced.

1 Conditional probability

Definition: Given two events A and B with $P(B) > 0$, $P(A|B) = P(AB) / P(B)$ the conditional probability of A given that B is assumed to have occurred.

$P(A|B)$ is shortly defined as the conditional probability of A given B. The concept of conditional probability is based on an idea of narrowing down the sample space: B is known and only consider those sample points belonging to B, and this is visualized as $P(B|B) = 1$ and when $AB = \Phi$, $P(A|B) = 0$. On the other hand, when B has occurred and A has also occurred, it means that A and B occur simultaneously, and $P(A|B)$ is therefore proportional to $P(AB)$ and the scale factor is $1 / P(B)$.

2 Law of total probability

Definition: Assume the sample control of test E is, Ω the event group $B_1, B_2, \dots, B_n$ is mutually disjoint, $\sum_{i=1}^n B_i = \Omega$, and $P(B_i) > 0$ ($i=1, \dots, n$), then for any event A there is:

$$P(A) = \sum_{i=1}^n P(B_i)P(A|B_i) \quad (1)$$

Assume $A, B_1, B_2, \dots, B_n$ as some of the events, $B_1, B_2, \dots, B_n$ are mutually disjoint and $P(B_i) > 0 (i = 1, \dots, n)$, and $\sum_{i=1}^n P(B_i) = 1$. Then for any event $A, P(A) > 0$. As conditional probability defines:

$$P(B_i | A) = \frac{P(B_i, A)}{P(A)} = \frac{P(A | B_i)P(B_i)}{P(A)} \quad (2)$$

As per law of total probability $P(A) = \sum_{i=1}^n P(B_i)P(A | B_i)$

$$P(B_i | A) = \frac{P(A | B_i)P(B_i)}{\sum_{i=1}^n P(B_i)P(A | B_i)} \quad (3)$$

Formula 3 is called Bayes' formula. In Bayes' formula, $P(B_i), i = 1, \dots, n$ is called a priori probability, and $P(B_i | A), i = 1, \dots, n$ is called a posterior probability. Bayes' formula can be interpreted as follows: $B_1, B_2, \dots, B_n$ are n incompatible causes, and A is a "result"; in practical problems, the probability of causes $P(B_i)$ and the probability that some known causes will produce results $P(A | B_i)$ can be estimated in advance, so we can use Bayes' formula to in turn compute the conditional probability $P(B_i | A)$ that one of the "causes" produces given a known "result". When $P(B_i | A)$ is large, observe whether A is caused by B_i on the one hand; on the other hand, even if $P(B_i | A)$ is small, it has greatly increased compared with $P(B_i)$, indicating that B_i and A have very close ties and considerable attention should be paid.

2.3 Basic principles of Bayesian Networks

Bayesian Networks, also known as Belief Networks, is a directed acyclic graph (DAG), where nodes are random variables and there exists an effect probability between directed edges and nodes. Each parent node has a conditional probability table that quantitatively expresses the dependence between the parent node and the node. For example, $P(B | A_1, \dots, A_n)$ is the conditional probability of variable A_i given B , where B is a parent and A_i is a child. Each non-parent node has a priori probability. A simple Bayesian network is shown in Figure 1, where four node variables are C (Cloudy), S (Sprinkler), R (Rain), W (Wet Grass); the variable value takes on the value 1 or 0 when the event is true or false. For example, node variable C is true and its probability is 0.5, i.e., the probability for a cloudy sky is 0.5, and we show $P(C=1)=0.5$. Conditional probability indicates the effect size between nodes, as shown in Fig. 1 where $P(W=1|S=1, R=0)=0.9$, indicating the probability of seeing wet grass for a rainy day with sprinkler on is 0.9.

Thus, a Bayesian network can formally defined as follows: a Bayesian network B consisting of N nodes $\{X_1, X_2, \dots, X_n\}$ can be expressed as a tuple: $B \langle S, P \rangle$, where

S : a directed acyclic graph structure (DAG) with N nodes. Nodes in the figure represent random variables; state of nodes corresponds to the value of random variables; directed edges show the effect probability of nodes.

P : a set of conditional probability tables for each node in the figure $P(X_i | Pa_i)$.

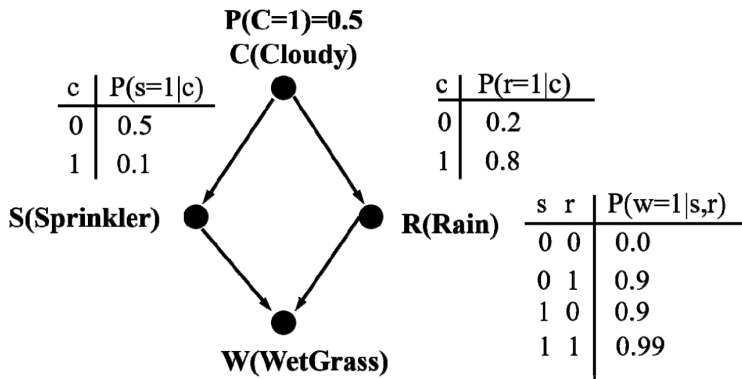


Figure 1 – A simple Bayesian Network

Strong conditional independence is contained in Bayesian networks. This conditional independence can all be read using Pearl's D-Separation criterion.

2.4 Singly Connected and Multiply Connected Bayesian Networks

Bayesian network topology can be divided into two categories: simply connected and multiply connected. Its D-Separation criterion is as follows:

Singly connected Bayesian networks: only one directed path between any two nodes in the network.

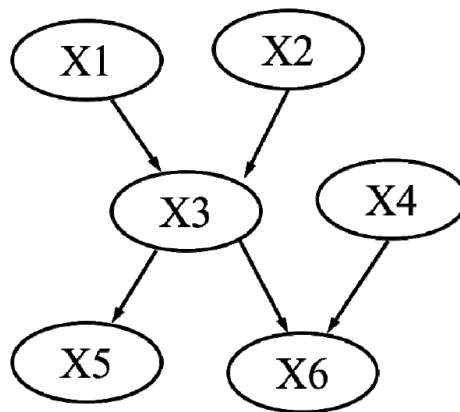


Figure 2 – A singly Connected Bayesian Networks

Multiply connected Bayesian networks: two or more directed paths between any two nodes in the network.

In singly connected Bayesian networks, the time complexity for inference is only $O(d)$, where d is the diameter of Bayesian Networks. In multiply connected Bayesian networks inference is an NP problem.

3. Reliability Model of Economic Information System based on Bayesian Networks

In computer economic information systems, components are a major part of computer information systems, and a complete computer information system is formed via connectors between components. All components can be viewed as a subsystem, and assume these components are independent of each other; connectors are equally regarded as a subsystem and assume these connectors are independent of each other. In this case, the entire computer information system can be viewed as an integrated system consisting of component subsystems and connector subsystems. Use reliability of various components and connectors to estimate system reliability probability of component subsystems and connector subsystems under conditions of components and connectors, and use the Bayesian network model to accurately infer the reliability of the entire computer information system. For example, when an economic information system consists of n components and m connectors, the Bayesian network model is shown in Figure 3.

Reliability of component c_i is Pro_{ci} ; reliability of connector l_j is Pro_{lj} , system reliability is:

$$\text{Pro}_s = \text{Pro}(s | c, l) \text{Pro}(c, l) = \text{Pro}(s | s, l) \text{Pro}(c) \text{Pro}(l) \quad (4)$$

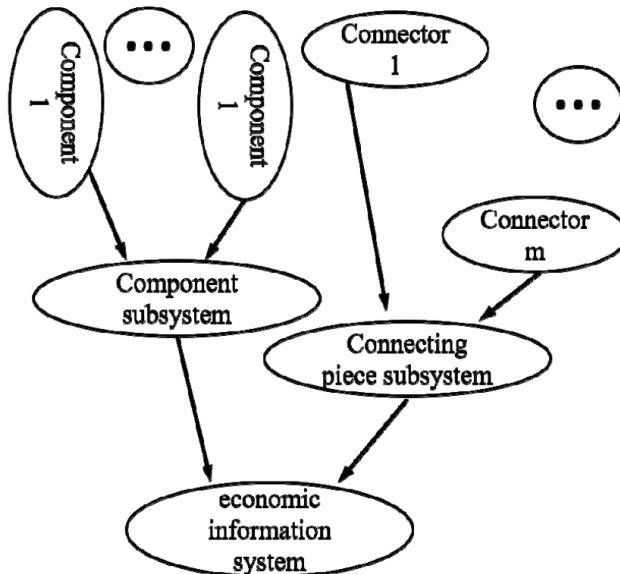


Figure 3- Component Subsystem and Subsystem

Because the connector subsystem and component subsystem meet the conditional independence in Bayesian networks, $\text{Pro}(c, l) = \text{Pro}(c)\text{Pro}(l)$. This also applies to the connector subsystem and component subsystem.

$$\begin{aligned}\text{Pro}(c) &= \text{Pro}(c | c_1, \dots, c_i, \dots, c_n) \text{Pro}(c_1, \dots, c_i, \dots, c_n) \\ \text{Pro}(c) &= \text{Pro}(c_1, \dots, c_i, \dots, c_n) \prod_{i=1}^n \text{Pro}(c_i)\end{aligned}\quad (5)$$

$$\begin{aligned}\text{Pro}(l) &= \text{Pro}(l | l_1, \dots, l_j, \dots, l_m) \text{Pro}(l_1, \dots, l_j, \dots, l_m) = \\ &\text{Pro}(l | l_1, \dots, l_j, \dots, l_m) \prod_{j=1}^n \text{Pro}(l_j)\end{aligned}\quad (6)$$

Hence, substitute Formulas (2)(3) into (1), and the entire computer information reliability can be obtained:

$$\begin{aligned}\text{Pro}_s &= \text{Pro}(s | c, l) \text{Pro}(c | c_1, \dots, c_i, \dots, c_n) \\ &\prod_{i=1}^n \text{Pro}(c_i) \text{Pro}(l | l_1, \dots, l_j, \dots, l_m) \prod_{i=1}^n \text{Pro}(l_j)\end{aligned}\quad (7)$$

where $\text{Pro}(c_i)$ represents the i -th component reliability in the computer information system; $\text{Pro}(l_j)$ represents the j -th connector reliability in the computer information system; $\text{Pro}(c | c_1, \dots, c_i, \dots, c_n)$ is component subsystem reliability under conditions of various components; $\text{Pro}(l | l_1, \dots, l_j, \dots, l_m)$ is connector subsystem reliability under conditions of various connectors; $\text{Pro}(s | c, l)$ is the reliability of the computer information system under component and connector subsystems.

4. Case Studies

Construction of Bayesian networks is a complex process. Bayesian network information required for a computer system reliability analysis is from various components assembled from multiple channels and the corresponding connector information, such as equipment manuals, computer information system design and development process, testing, maintenance and expert experience, etc. To reduce complexity, when analyzing reliability of information systems, the first step is to divide reliability analyses of computer information systems into interdependent and all-inclusive categories (there should be at least boundary to distinguish each category) and then separately build a Bayesian network model for each category. It should be noted that the reliability model for computer information systems starts only when a failure occurs, so modeling is not necessary when the device runs normally. Usually reliability of computer information systems is caused by one or some different reasons, while these reasons may be caused by one or several lower-level causes. After establishing the node relationships of the network, the probabilities must be estimated as well. The specific method is to assume that a certain reason occurs and estimate the conditional probability of each node for the reason; this local probability estimation can greatly improve efficiency. The Bayesian

network model for reliability of economic information systems has two main functions: calculate overall system reliability and diagnose system.

The Bayesian network model for reliability of economic information systems has two main functions: calculate overall system reliability and diagnose systems.

1. Calculate overall system reliability. Without loss of generality, the Bayesian network model is applied in this paper into an instance that has four components and three connectors. The reliability model of computer information systems based on Bayesian networks is shown in Figure 4.

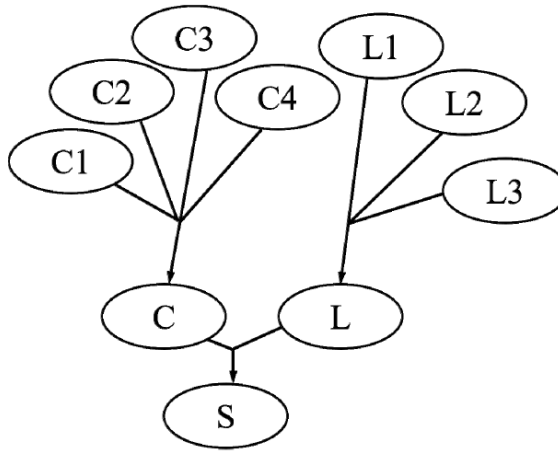


Figure 4- Bayesian Networks

The reliability of each component of the component subsystem is $\text{Pro}(C1)=0.933$, $\text{Pro}(C2)=0.983$ and $\text{Pro}(C3)=0.908$; The reliability of each connector of the connector subsystem is $\text{Pro}(l1)=0.92$, $\text{Pro}(l2)=0.967$ and $\text{Pro}(l3)=0.95$. The reliability of the component subsystem C in conditions of components C1, C2, C3, C4 is the conditional probability of the node C, as shown in Table 1.

The reliability of the connector subsystem L in conditions of connectors L1, L2, L3 is the conditional probability of the node L, as shown in Table 2.

Finally the system reliability in conditions of the component and connector subsystems is shown in Table 3.

Through the principle of Bayesian network inference, the component system reliability is $\text{Pro}(c)=0.9525$; the connector system reliability is $\text{Pro}(l)=0.9717$; the overall system reliability is $\text{Pro}(s)=0.9550$.

2. System diagnosis. The diagnosis function assumes that when the computer information system fails, the cause of failure must be diagnosed and thus amended. From the above, if the system has abnormal conditions, which is

C1	C2	C3	C4	C	
				Yes	No
Yes	Yes	Yes	Yes	1.0	0.0
		No	No	0.681	0.319
		Yes	Yes	0.706	0.294
		No	No	0.48079	0.51921
	No	Yes	Yes	0.765	0.235
		No	No	0.52096	0.47903
		Yes	Yes	0.54009	0.45991
		No	No	0.3678	0.6322
No	Yes	Yes	Yes	0.782	0.218
		No	No	0.53254	0.46746
		Yes	Yes	0.55209	0.44791
		No	No	0.37598	0.62402
	No	Yes	Yes	0.59823	0.40177
		No	No	0.4074	0.5926
		Yes	Yes	0.42235	0.57765
		No	No	0.28762	0.71238

Table 1 – C1, C2, C3, C4 Conditions of Reliability Conditions

L1	L2	L3	L	
			Yes	No
Yes	Yes	Yes	1.0	0.0
		No	0.815	0.185
	No	Yes	0.739	0.261
		No	0.60229	0.39772
No	Yes	Yes	0.866	0.134
		No	0.70579	0.29421
	No	Yes	0.63997	0.36003
		No	0.52158	0.47842

Table 2 – L1, L2, L3, Reliability Conditions

C	L	S	
		Yes	No
Yes	Yes	1.0	0.0
	No	0.815	0.185
	Yes	0.739	0.261
No	No	0.60229	0.39772

Table 3 – Reliability Probability of Component Subsystem and Connecting Parts

Mode name	State 1(Yes)	State 0(No)
C	0.1763	0.8237
C1	0.7071	0.2929
C2	0.9186	0.0814
C3	0.4958	0.5042
C4	0.9505	0.0495
L	0.7938	0.2062
L1	0.8574	0.1426
L2	0.9142	0.0858
L3	0.8943	0.1057
L4	0.0000	1.0000

Table 4 – Bias Network Algorithm Reliability Probability

unreliability caused by failure, inference in Bayesian Networks can be taken advantage of to derive reliability probability (Table 4).

When the system S is abnormal, conforming to inference in Bayesian Networks, it can be known that the probability of component subsystem unreliability is $\text{Pro}(c=\text{No})=0.8237$, while the probability of connector subsystem unreliability is $\text{Pro}(l=\text{No})=0.2062$. Visibly the most likely reason for exception is in the component system. And the probabilities of components C1, C2 C3, are:

$\text{Pro}(C1=\text{No})=0.2929$, $\text{Pro}(C2=\text{No})=0.0814$

$\text{Pro}(C3=\text{No})=0.5042$, $\text{Pro}(C4=\text{No})=0.0495$

Visibly, the problem is most likely to occur in component C3, demonstrating that the reliability model of computer information systems based on Bayesian networks has good diagnostic capabilities and can help economic information system managers to identify reasons for exception.

5. Conclusion

Bayesian networks organically combine directed acyclic graphs with probability theories, which can not only naturally, visually represent human causality knowledge with directed graphs, but also integrate statistical data into the model in form of conditional probability. As thus, Bayesian networks can overcome shortcomings that the frameworks, semantic networks and other models can only express and process weakness of quantitative information and non-intuitive neural networks. Compared to other computer information systems, the reliability model proposed in this paper has the following advantages in terms of reliability analysis and assessment methods: 1 the previous system reliability analysis focuses only on internal testing, while the reliability model based on Bayesian networks has made up for the defect that other models give little consideration to connectors; 2. the model has good operability in practice; 3. Bayesian networks have good diagnostic capabilities. Once the system is found to be unstable, it can find out causes for unreliable economic Information systems through the diagnostic inference

algorithm, thus facilitating handling and solving problems; 4. The model can be applied to reliability testing in large-scale computer information systems, such as heterogeneous environments of third-party components, computer information systems outsourcing, etc. Further, it is able to identify responsibilities for large system instability. Thus, the model has broadened the application scope of information system reliability analysis.

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Simulation of Education Information Resources via Mathematical Model of Computer Incentive Mechanism

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Abstract: Computer simulation has been a focus of computer application research. Improvement on the mathematical model of computer-based incentive mechanism facilitates the simulation research of education information resources. To increase the utilization rate and users' external incentive of utilizing education information resources, this paper builds up a mathematical model of incentive mechanism, proposes an incentive methodology of "utilizing via voucher, accumulating points, settling accounts regularly, getting awards". By using computer random simulation, this paper conducts simulation research on the changes of users' total points, schools' total points and schools' incentive funds. Empirical studies prove that the mathematical model in this paper can indeed optimize the distribution of education information resources and encourage users to actively utilize education information resources.

Keywords: Education information resources; education information voucher; incentive mechanism; mathematical model

1. Introduction

"Ten-year Development Plan of Educational Informationization (2011-2020)" proposed the following principles: promote education modernization by education informationization; give full play to the advantages of modern information technology; realize the all-round and deep integration of information technology and education; uphold education equality and share high quality education resources. However, the general education information resources utilization rate is not high at present. A lot of high quality education information resources fail to facilitate education and teaching, causing a waste of resources. From a psychological point of view, incentive refers to the process of motivating people's behavior, namely inducing or enhancing the intrinsic motivation of people's behavior via the stimulation of various objective factors and maintaining people's state of bliss. Cahir's research found that those people with incentive can give full play to 80% - 90% of their capacity, and that the rest can only exert 20% - 30% (Lorenz J., 2015). Some previous studies (Prihutami N D, Hubeis M, Puspitawati H., 2015; Shin S Y, Seo D K, Kim S Y, et al., 2015) established intra-regional application model to jointly

construct, share and develop education information resources. Specifically, it applies an operation mechanism of “government leading, enterprise developing and school using”. This paper, from the view of user incentive, explores strategies to improve the overall regional education information resources utilization rate. By analyzing the characteristics of education information resources and the process of using education information resources, the author applies consumer psychology and puts forward a proposal: users utilize education information vouchers to use regional education information resources (Dylewski J., 2016); give accumulative points to users of education information resources; distribute funds to schools according to the integral points of one academic year or a semester. Since mathematical modeling has an advantage of turning theoretical knowledge into practice (Sinha A K., 2015), this paper first builds up mathematical model of incentive mechanism of education information resources utilization (Bleichrodt R, Hoffenaar J., 2015). At the same time, by using computer stochastic simulation, this paper verifies the feasibility and maneuverability of this model in application, so as to offer some suggestions to increase education information resource utilization rate.

2. Analysis of Education Information Resources Utilization Incentive Mechanism

2.1. Characteristics of Education Information Resources

Having been digitally processed, education information resources are run in an informatization environment and facilitate education and teaching. Compared with the traditional paper-based teaching resources, it has its unique features: participatory utilization (McLaughlin T, Blow O, Herrick J, et al., 2015), efficient transmission, diverse performance and convenient access.

2.2. The Procedure of Using Education Information Resources

From the aspect of consumer psychology, the utilization of education information resources is in essence a process of consuming the resources. When teaching or learning, users use education information resources to get better effect general. Driven by the incentive to use the resources, users seek the help of library, special education resource website and academic journals (Reynares, E., Caliusco, M. L., & Galli, M. R., 2014), or collect all kinds of resources. And then through comparison, they screen related resources to satisfy their needs. Users' satisfaction level with the resources will decide whether they will continue to use these resources. Due to users' complex psychology users to use resources, they should also be given related incentives in the process of using the resources to stimulate and maintain their inner demands to make better use of the resources, exploit their potential and meet their demand of realizing their self-value (Ghaouar N., 2015).

2.3. Analysis of the Process to Encourage Users to Apply Education Information Resources

In the process of using education information resources, education information voucher is introduced as a currency in order to stimulate users' feeling of “consumption”. There are two purposes of setting up accumulative score mechanism: to decide schools' deserved

quantities of incentive funds; and to produce a sense of achievement to users. Education voucher is a kind of education coupon first put forward by Milton Freeman in 1955. The U.S. government changed the investment to schools into vouchers issued to students at a certain rate. Students were free to choose schools approved by government. Then schools used the vouchers which they obtained from students to exchange for according education funds (Dylewski J., 2016).

Accumulative points is a quantitative measure of education information resources utilization. It mainly has the following functions: first, users having more points in a settlement cycle utilize more education information resources; second, in order to obtain more points, schools will compete with each other for education information resources; third, the total score of a school is an important evaluation criterion of incentive funds distribution. Schools should give more incentives to users to promote the utilization of education information resources (Prihutami N D, Hubeis M, Puspitawati H., 2015).

3. Construction of Mathematical Model of Education Information Resources Incentive Mechanism

3.1. Construction Methodology

The construction methodology of mathematical model of education information resources incentive mechanism is “utilizing via voucher, accumulating points, settling accounts regularly, getting awards”.

“Utilizing via voucher”: education authorities of jurisdictions issue digital education information vouchers to users in their jurisdictions according to certain standards. These vouchers are users’ credential to utilize education resources. They use the free “currency” to buy and obtain the resources they need.

“Accumulating points”: when using information resources, users can get their own accumulative points according to a set of integral form. The total score decides the distribution of incentive funds (Neymotin S A, Suter B A, Migliore M, et al., 2015).

“Settling accounts regularly”: a certain settlement cycle (a quarter, six months or a year) is set according to practical teaching and learning. All the resources are designed and developed under a unitary standard. Each kind of resources has different functions and purposes; users are different in grades, disciplines, demand and preference for resources. Within a certain period of time, users can obtain different amounts of total points (Sopher R., 2015).

“Getting awards”: At the end of a settlement cycle, schools can get their own incentive funds from government authorities in a certain exchange rate of their total points. (Tundisi J G, Matsumura-Tundisi T, Tundisi J E M., 2015).

3.2. Construction Process

The utilization of education information resources is a complex and dynamic process. In order to highlight the briefness and accuracy of mathematical model and to better present the incentive mechanism, the construction of mathematical model makes the following assumptions: (1) the total number of users in a particular area within

a settlement period is a constant value; (2) generally, the quantity and quality of education information resources remain unchanged within a settlement period, causing no influence to the users' utilization frequency. (3) government's budget on education information resources utilization remains the same. The amount of incentive funds schools can receive depends on their total points. In order to get more incentive funds, schools have to improve their information network environment and encourage users to apply education information resources. (4) users are affected by both internal and external factors. Within a time range, the process of using education information resources is a dynamic and random value, thus being set as a random variable. The basic symbols used in the process of building model are shown in table 1.

Symbol	Unit	Brief description
P	ten thousand yuan	The incentive funds used into the education information resources by government
N	number	The total number of rolls education information resources
I	point	The obtained total points of users in school for using education information resources
M	point	The accumulated maximum points of downloading or online saturation using for one time
C	point	The cumulative points obtained by single user in a school year
T	minute	The lowest learning time for obtaining the M value
F	ten thousand yuan	The funds of using education information resources for single school in a region
E	ten thousand yuan per point	The exchange rate of user's points in a region
U	person	The total number of users using education information resources in a region
Q	person	The total number of users using education information resources in single school in a region

Table 1 – Basic Symbol and Description of the Mathematic Model of Incentive Mechanism for Users.

The incentive fund obtained by every school in jurisdictions is decided by users' total points, resources' total points and exchange rate:

$$F = f(Q, E, C) \quad (1)$$

E represents exchange rate. It is the ratio of government's total spending on education information resources (P) and all users' total points (I_u):

$$E = P / I_u = P / \sum_{k=1}^U C_k \quad (2)$$

C signifies the total point of an individual user within a settlement cycle (a semester). All resources are separated under the same technical standard. Users who fully apply any kinds of resources can get maximum point M . The total points of a user consist of three parts: points for resources download C_D ; points for online utilization C_T and points for online visit:

$$C = C_D + C_T + C_V \quad (3)$$

Put equations (2) and (3) into (1), incentive funds of every school can be solved:

$$F = I * E = \sum_{j=1}^Q C_j * (P / \sum_{k=1}^U C_k) \quad (4)$$

Formula (4) shows that when exchange rate is constant, the incentive fund received by schools is closely related to their total points, which is jointly decided by the amount of users and the frequency and duration of utilization. If all users make best use of the resources, schools can get high total points; If users have great enthusiasm on the resources and use them many times every week or every day, schools will get higher final points and more incentive funds. If schools' potential users don't actively use the resources, schools will get low points and fewer funds (Vdovenko N, Palamar I, Fedyshko M., 2015).

3.3. Analysis of the Mathematical Model

With a fixed total amount of funding, if users “consume” more vouchers (Ho H C, Shiu S J, Nguyen D H P P T, et al., 2015), schools will get higher points and more incentive funds, reflecting the principle of “the more utilization, the more funds” (Sopher R., 2015). As shown in figure 1, education information resources distribution has the advantage of “two-way feedback, user-centered”. By introducing market competition mechanism, funds distribution will be fairer. It has obvious differences from traditional method: First, it is innovative. Government does not allocate funds according to the number of users but the accumulative total points of resources utilization. Second, it is user-centered. Between the government and users, a good feedback mechanism has been established via resources utilization rate. The government by means of incentive mechanism of integral can not only understand each user use of dynamic, and can according to the characteristics of preferences and use resources, flexible adjustment of resources allocation strategy.

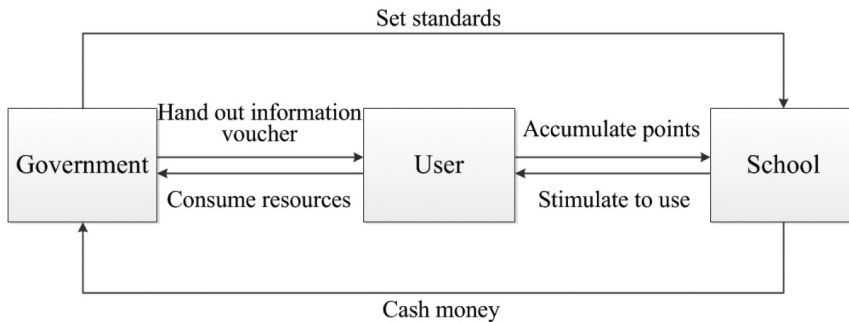


Figure 1 – The Incentive Process of Using Education Information Resources.

4. Model Simulation

4.1. Simulation of Users' Cumulative Points Change

In order to reflect that the process in which users apply the education information of their jurisdictions is random and complex, this study uses computer stochastic simulation technology simulates the changes of users' cumulative points and of the incentive funds received by schools. Simulated data is from X County of the city of Mianyang, Sichuan province. According to the actual statistics, the county has a total of 259 primary and middle schools (4 high schools, 230 primary schools, 25 junior high schools). The number of students and teachers in each school ranges from 1000 to 2000. Scoring rules are as follows: 10 points for fully utilization, 1 ~ 10 points for online access; 1 point for a single visit, 10 points for download. X County has 1000 education information resources for all grades. The results of repeated random simulation of 20000 users' cumulative scores of resources utilization can be seen as the results of the dynamic simulation of actual education information resource utilization. Figure 2 shows a random sample of 20 users' change of cumulative points within an academic year.

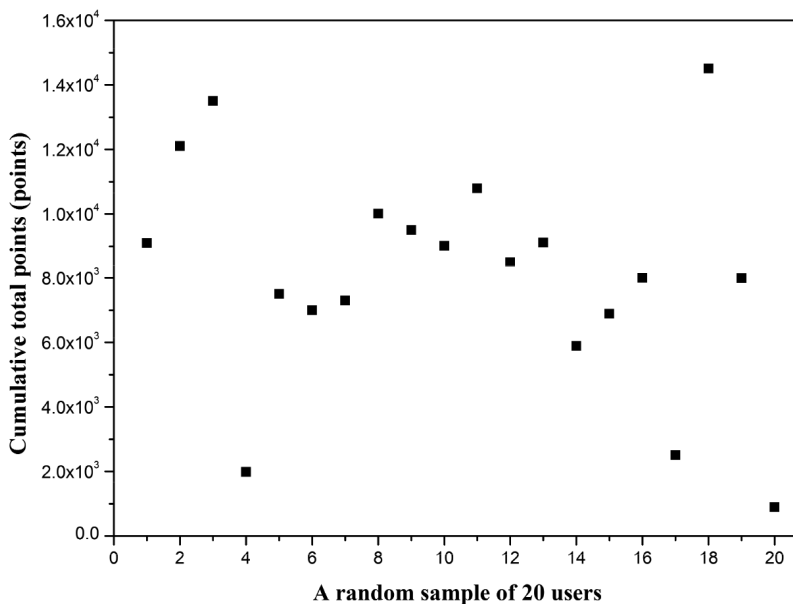


Figure 2 – Random Simulation of the Difference of Cumulative Points for Single User.

As what can be seen from the figure 2, users apply education information resources differently. Some users get 14846 points, while some only have 1887 points. This may be caused by differences between users on purpose, habit and behavior. Young teachers' willingness to accept new things is strong. They dare to try new ideas and new method, lead students to keep pace with The Times, and constantly improve their ability to use education information resources. But some teachers think that education information

resources are not very helpful to their teaching. They are more inclined to use the traditional teaching resources and methods. Towards the latter group of teachers, schools need to adopt incentive measures.

4.2.Simulation of School’S Cumulative Points Change

According to the above design of incentive mechanism, suppose that the government issues education information voucher of 400 yuan to each user. Regulation is that users’ “consumption” of 1 yuan coupon equals 1 accumulated point. As what is shown in table 2, S1 have a total of 1838 people and obtains education information voucher of 735200 yuan in advance. S2 has 1692 users and obtains 675800 yuan vouchers in advance. But the amount of vouchers which schools obtain in advance cannot reflect their ability in organizing the utilization of resources. Only their accumulative points obtained after using education information resources can do so. For example, S2, at the end of the year, obtains cumulative scores of 18.08, and that number of S259 is 69.30, indicating that S259 utilizes resources use far more often than S2.

School number	Number of users	Education information voucher (ten thousand yuan)	Cumulative points (ten thousand points)	Exchange rate (yuan per point)	Obtained funds (ten thousand yuan)
S1	1838	73.52	402.79	0.06	24.16
S2	1692	67.58	18.08	0.06	1.08
S3	1981	79.24	306.74	0.06	18.41
...	...	...	...	...	...
S257	1457	58.28	11.74	0.06	0.70
S258	968	38.72	211.54	0.06	12.69
S259	1054	42.16	69.30	0.06	4.15

Table 2 – Simulation of the Difference of School Cumulative Points and Incentive Funds.

Exchange rate refers to the amount of fund per point. It changes as the government’s spending on education information resources and all schools’ accumulative integral points. On the context of stable spending, the greater total points are, the smaller the exchange rate will be, showing that the utilization rate of resources is higher in this region. Suppose X county allocates 10 million yuan for school funding. If the government pays in advance education information vouchers of 32 million, the total points will be 32 million; and the exchange rate will be 0.31 yuan/min. In table, the exchange rate of one school year is 0.06 yuan/min, far smaller than 0.31 yuan/min, indicating that the user “consumption” of education information voucher is far more than the government payment in advance. The county’s education information resources utilization rate is quite high.

4.3.Simulation of Schools’ Incentive Funds Change

It can be known from the mathematical model of incentive mechanism that the incentive fund obtained by schools is the product of the total points and exchange rate. The average cumulative points of an area reflect the average points of each user within a settlement period,

namely the ratio of total points and total number of users in this area. With other conditions unchanged, the theoretical obtained incentive funds are closely related to the number of users. Theoretically, more users mean that the school can receive more funds (Sopher R., 2015). By using the cumulative score and exchange rate obtained from simulation (see chart 2), the actual incentive funds can be worked out. Figure 3 shows the differences between the actual obtained incentive funds and the theoretical obtained funds of 5 schools.

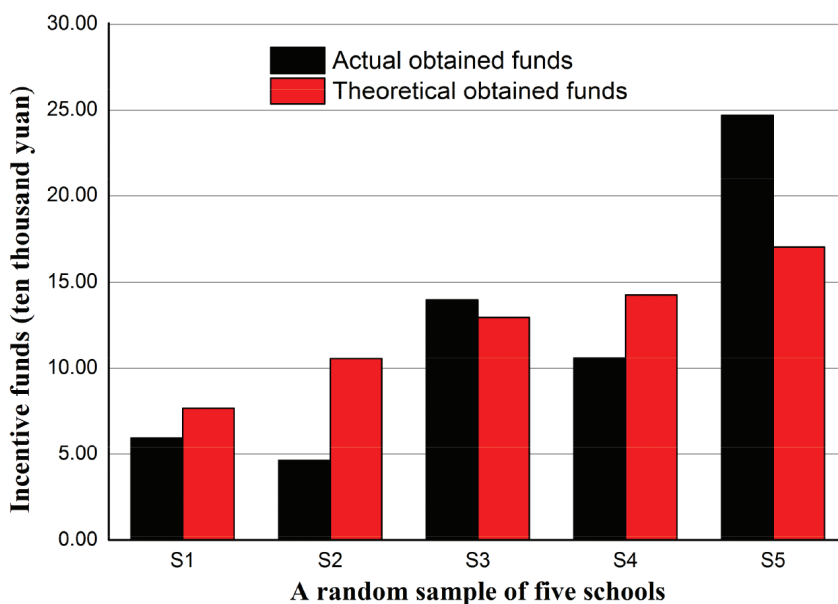


Figure 3 – The Difference between the Actual Obtained Incentive Funds and the Theoretical Obtained Funds of Schools.

Combining the data in table 2, it can be concluded that the S3 (1421) has similar amount of users to S4 (1555). Theoretically, their incentive funds should be similar. But in fact, the S3 obtains actual incentive funds of 140000 yuan; S4 obtained 106400 yuan. S4 gets less money than S3, indicating their accumulative points are different. With other conditions unchanged, the higher scores a school gets, the higher the utilization frequency of education information resources. To some extent, it also shows that the school's informationization level is higher. Within a settlement cycle, S3 has more scores than S4 accumulated points, reflecting the S3 users use education information resources more often and have higher level of information education. S4 needs to take necessary incentive measures to encourage users to actively use education information resources, and improve the ability of the "consume" information resources, so as to get more incentive funds.

5. Conclusion

The importance of jointly developing and sharing quality education has been realized by everyone. Increasing education information resources utilization rate is urgency at present.

Incentive mechanism mathematical model based on computer makes the simulation study of education information resources more feasible. To increase education information resources utilization rate and users' motivation to use the resources, the author builds up a mathematical model of incentive mechanism, proposes an incentive methodology of "utilizing via voucher, accumulating points, settling accounts regularly, getting awards". By using computer random simulation, this paper conducts simulation research on the changes of users' total points, schools' total points and schools' incentive funds. The incentive mechanism constructed in this paper is verified in simulation. The feasibility and operability of theoretical model in practical application has been proved. The incentive mechanism provides a new strategy of increasing education information resources utilization rate and transforming traditional education funds distribution methods.

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A Routing Assignment Algorithm in Wireless Sensor Networks Based on an Improved Ant Colony Algorithm

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Abstract: The rapid development of semiconductor technology, microsystems technology, computer technology and wireless communications among others has led to a dramatic surge in applications of low-power multi-function sensors. A wireless sensor network is a new research area of computer science and technology, has very broad application prospects and is attracting growing attention. The paper begins with introducing the idea, characteristics and several improved algorithms of ant colony algorithms. It then proceeds to propose an ant colony algorithm based on location and resistin strategies, draw on their excellent ideas and design a plane wireless sensor network routing protocol grounded upon the improved ant colony algorithm. Finally, a simulation analysis is made of the proposed algorithm, and the simulation results show that the algorithm relatively balances the energy consumption, thus extending the entire network lifecycle.

Keywords: Wireless sensor networks; Ant colony algorithms; Routing protocol; Pheromone; Resource utilization rate

1. Introduction

Wireless sensor networks (WSN) are to spread a large number of micro sensor nodes over the detection area (usually in a very bad environment or where people cannot reach). These sensor nodes have no fixed ID, but compose a sensor network through self-organization. WSNs have very bright application prospects. Network nodes feature huge numbers, very limited energy that is very difficult to complement, and usually a one-time charge. As network topology is easy to change and even the network nodes do not possess a fixed ID, so it is indispensable to consider designing unique routing protocols tailored to wireless sensor networks (Sun Yan, Ma Huadong, Liu Liang., 2007).

In recent years, people have proposed many routing protocols based on different application goals, and conducted classification research and compared diverse application routes. Braginsky *et al.* introduced Rumor Routing (Li Jianbing, Wei Zheng., 2009) and introduced the unicast random forwarding of query messages, which has solved the problem that Rumor Routing is not suitable for multiple sink nodes, but there is a drawback of great expenses in the case of massive events. Moreover, because Rumor

Routing protocol uses random ways to create paths, the data transmission path is not optimal or even there exists a problem of routing loops. Through setting two thresholds, TEEN (Threshold sensitive Energy Efficient sensor Network protocol) advocated by Manjeshwar (Li Jianbing, Wei Zheng., 2009) can monitor a number of unexpected events and hot spots and reduce network traffic. In a TTDD (Two-Tier Data Dissemination) routing protocol brought about by YeF *et al.* (Xiao C a o, Chuan R W, Huang h, et al., 2012), dissemination nodes gather data in transmission, thereby reducing the transmission overhead of data. Also, XuY *et al.* (Zhang Junyan, Zhu Yongli, Li Lifen, 2010) designed a GAF (Geographical Adaptive Fidelity) protocol mainly for mobile ad-hoc networks also sensor networks; Yu *et al.* proposed the use of a GEAR (Geographic and energy aware routing) protocol (Liu Yongguang, Ye Wu, Feng Suili., 2009) while limited information dissemination in appropriate network regions, thus reducing the number of intermediate nodes, conserve more energy for route establishment and data transmission, and more effectively improving the network lifecycle. HeT *et al.* brought about a real-time routing protocol SPEED (Xiao Hua Yu, tsan Hwei Huang., 2012), which has to a certain extent achieved end-to-end transmission rate guarantees, network congestion control, and load-balancing mechanism. Hedetniemi S *et al.* proposed a gossip algorithm (Minhua, Li Li, Hu Na., 2014) that requires forwarding message packets to only one node from neighbor nodes. This algorithm can effectively avoid consuming extensive network resources from forwarding a large number of data packets in flooding algorithms, but still cannot resolve message implosion effect and some overlap. AntNet (Wu dysprosium, Wen Tao, Guo q.h., 2012) as a routing algorithm based on ant colony algorithms is first applied to wireless sensor network routing. The AntNet algorithm applies two ants, with forward ants collecting node information and return ants using this information update routing table. After this, Camilo T *et al.* proposed the IABR and EEABR algorithms (Estrin D, Govindan R, Heidemann J, et al., 1999); Chen Yanjun proposed a wireless sensor routing algorithm based on ant colony algorithm and genetic algorithm (Saleem M, Di Caro G A, Farooq M., 2011). Based on the current amount of energy and probabilistic heuristic information of the candidate nodes, the next hop is selected, which has improved the global search ability while improving the convergence rate through information feedback.

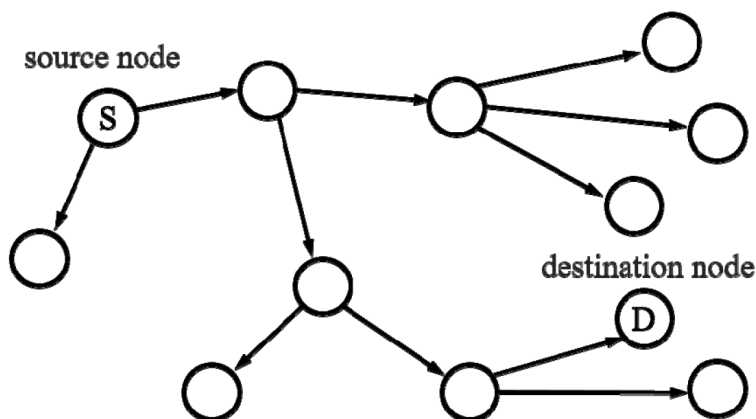


Figure 1 – Flooding Protocol

2. An Overview of Ant Colony Algorithms

Ant colony algorithms are bionic algorithms that simulate real-life ants that find the shortest paths between food sources and their nest. Ant algorithms were first proposed by Dorigo M (Cobo L, Quintero A, Pierre S., 2010) in 1992. It is called Ant System (AS). At the beginning it was to solve TSP (traveling salesman problem). A brief description of TSP is: given a list of n cities, a traveling salesman starts from a city, visits each and every one of the remaining cities just once, and returns to the original starting point. The requirement is to find the shortest path to meet the above requirements (Castela, N., Dias, P., Zacarias, M., & Tribolet, J., 2013).

Dorigo M uses the ant colony algorithm to solve TSP problems and the roadmap is as follows: Let n be the number of cities, m is the total number of ants, d_{ij} is the path length between city i and city j , τ_{ij} is the amount of pheromone at time t on the path from city i and city j , $\Gamma = \{\tau_{ij}(t) | i, j \in V\}$ is the total collection of pheromone on all paths at time t , and the initial time when the algorithm just runs is set to be a constant C . In the search process, after ant k reaches city i , the transition probability will be calculated according to the amount of pheromone and path inspiration information on paths that connect to city i to determine the direction of forwarding. $P_{ij}^k(t)$ is denoted as the probability of ant k moving from city i to city j at time t and the transition formula is:

$$P_{ij}^k(t) = \begin{cases} \frac{[\tau_{ij}(t)]^\alpha [\eta_{ij}(t)]^\beta}{\sum_{j \in allowed_k} [\tau_{ij}(t)]^\alpha [\eta_{ij}(t)]^\beta} & \text{if } j \in allowed_k \\ 0, & \text{otherwise} \end{cases} \quad (1)$$

where $allowed_k$ is the set of cities that have not been visited yet. Forward ants maintain a taboo list of nodes already visited to avoid visiting cities that they have gone to. α is an information heuristic factor, reflecting the relative importance of pheromone accumulated in the moving process. β is an expectation heuristic factor, reflecting the relative importance of heuristic information in the guidance process of searching. $\eta_{ij}(t)$ is heuristic information of ants from city i to city j at time t and is related to distance between city i and city j in TSP problems. The calculating formula is as follows:

$$\eta_{ij}(t) = \frac{1}{d_{ij}} \quad (2)$$

In real life when ants are moving, pheromone will decline constantly as time goes by, while pheromone in ant colony algorithms will be updated over time. Pheromone update formula is:

$$\tau_{ij}(t+1) = (1-\rho)\tau_{ij}(t) + \Delta\tau_{ij}(t, t+1) \quad (3)$$

$$\Delta\tau_{ij}(t, t+1) = \sum_{k=1}^m \Delta\tau_{ij}^k(t, t+1) \quad (4)$$

In the formula $\Delta\tau_{ij}^k(t, t+1)$ represents the change amount of pheromone of ant k between city i and city j .

3. Improvements of Ant Colony Algorithms

Since the proposal, ant colony algorithms have gained widespread attention in academia. Focusing on the inadequacies of algorithms and further mining efficacy of ant colony algorithms, many scholars have optimized the ant colony algorithms from many aspects.

3.1 The Elite Ant System Algorithm

The elite ant system is the first improved algorithm of ant systems and was put forward by Dorigo *et al.* (Kulkarni R V, Förster A, Venayagamoorthy G K., 2011). It mainly improved the pheromone update mechanism. In EAS, the shortest Hamiltonian circuit length is denoted as L_{Best} . For pheromone update, for the edge of the shortest Hamiltonian path, artificially released additional pheromone can enhance the positive feedback effect of ant colony algorithms. The calculation formula of the amount change of pheromone from any node i to node j is:

$$\Delta\tau_{ij}(t, t+1) = \sum_{k=1}^m \Delta\tau_{ij}^k(t, t+1) + \varepsilon \Delta\tau_{ij}^{Best}(t, t+1) \quad (5)$$

where ε is the effect weight of adjusting L_{Best} and the formula of $\Delta\tau_{ij}^{Best}(t, t+1)$ is shown in equation (6).

$$\Delta\tau_{ij}^{Best}(t, t+1) = \begin{cases} \frac{1}{L_{Best}} & \text{if } e_{ij} \in L_{Best} \\ 0, & \text{Otherwise} \end{cases} \quad (6)$$

Experiments show that by setting a reasonable parameter ε , the solution of running the elite ant system is superior to the basic ant system.

3.2 Ant Queuing System

The ant queuing system is put forward by Bullnheimer B, Hartl R.F. and Strauss C *et al.* (Zungeru A M, Ang L M, Seng K P., 2012) The ant queuing system is similar to the ant elite system, and they differ in that the former has changed number and effect weights of ants that release additional pheromone artificially. The original one ant (ant that generates the shortest Hamiltonian circuit) is increased to w , while each ant is endowed with different weights. The system ranks the Hamiltonian circuit generated by ants according to the path length from small to large, and take the former w paths and multiply the amount of additional pheromone that n paths release by the coefficient $w-n$.

$$\Delta\tau_{ij}(t, t+1) = \sum_{k=1}^m \Delta\tau_{ij}^k(t, t+1) + \Delta\sigma_{ij}(t, t+1) \quad (7)$$

$$\Delta\sigma_{ij}(t, t+1) = \begin{cases} \sum_{k=1}^w \left[(w-k+1) \frac{1}{L_K} \right] & \text{if } e_{ij} \in L_K \\ 0, & \text{otherwise} \end{cases} \quad (8)$$

Studies have shown that the ant queuing system has better performance than the elite ant system, and it has significantly improved compared with the basic ant system.

3.3 Ant colony Algorithm with Self-Adaptive Pheromone Evaporation Coefficient

Through the study of ant colony algorithm parameter settings, it can be found that a pheromone evaporation rate ρ has a direct impact on the convergence rate and random search of ant colony algorithms. If ρ is too large, for some large-scale systems, some paths will have 0 pheromone due to lack of ant visits, thus reducing the chances of paths being searched while improving chances of paths that have been searched to be searched again. This will weaken the global search abilities of ant colony algorithms. If ρ is too small, global search ability of ants can be improved, but at the expense of reducing the convergence rate.

Wang Ying *et al.* studied an improved ant colony algorithm based on the self-adaptive pheromone evaporation coefficient ρ . The basic idea is that when the value of the ant colony algorithm does not change within a certain number of loop iterations, the evaporation rate ρ will be adjusted according to the following formula:

$$\rho(t+1) = \begin{cases} \frac{\rho(t)}{0.95} & \text{if } \rho(t) < 0.95\rho_{\max} \\ \rho_{\max} & \text{Otherwise} \end{cases} \quad (9)$$

where $\rho_{\max}$ is the maximum pheromone evaporation coefficient. ρ should not be too large to avoid affecting the randomness and global search capabilities of ant colony algorithms.

4. Applications of Improved Ant Colony Algorithm in Routing Protocols in Wireless Sensor Networks

Sensor nodes in wireless sensor networks consist of both software and hardware systems. Software system includes embedded systems and communication protocols that have a direct impact on the network effective time. Hardware system structure is shown in Figure 2, which generally contains four parts: the sensor module, processor module, wireless communication module and power supply module (Dressler F, Akan O B., 2010).

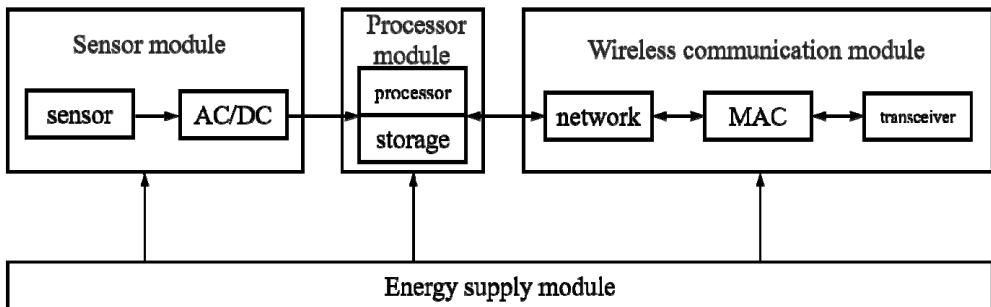


Figure 2- Schematic Diagram of Hardware System Structure of Wireless Sensor Node

The sensor module consists of the sensor unit and data conversion unit. The sensor unit collects information from the monitoring region, while the data conversion unit converts the analog signals collected into the digital signals. The energy consumption of the sensor unit is related to each acquisition energy consumption and the number of acquisitions, and therefore energy consumption can be reduced by using low-power components and lowering the number of acquisitions. The processor module consists of a microprocessor unit and a memory unit which controls operations of all sensor nodes. The data are responsible for storing and processing nodes acquired and implementation communication protocols forward data from other nodes. Choosing a low-power CPU as a microprocessor can reduce energy consumption of nodes. The wireless communication module is responsible for wireless communications with other sensor nodes as well as sending and receiving control information and data collected.

As a wireless sensor network is a distributed self-organizing network and each sensor node forwards data with other nodes, the data forward algorithm in which the sensor nodes forward data to other nodes should also be a distributed topology algorithm. Combining the existing research results, the author proposes a wireless sensor routing protocol based on the PRACA improved ant colony algorithm and uses different types of ants to find a path from the sensor node to the sink node.

Targeting at limited node energy and low storage characteristics of wireless sensor networks, this algorithm takes into account the energy consumption of ants' path and focuses on improving the pheromone distribution ways of the basic ant colony algorithm. The formula computing the amount of pheromone release by return ants is:

$$\Delta T_k = \frac{1}{C - (Avg(E_k) - 1 / Min(E_k))} \quad (10)$$

where C is the initial energy level of the sensor nodes; E_k is a vector carried by forward ant k with the energy levels of the nodes of its path; and $Avg(E_k)$ and $Min(E_k)$ are the average of the vector values $Avg(E_k)$ and $Min(E_k)$ the minimum value of the vector, respectively. Use the ant colony algorithm to obtain a plurality of candidate paths as the gene sequence input of the genetic algorithm between the source node of sending messages and sink node, and then use selection, crossover, compiling and other operations to obtain the optimal path, and timely maintain the path. The PRACA algorithm based on AntNet algorithm uses the fast convergence characteristic of genetic algorithms to constantly update the routing table established. Experimental results show that the algorithm can effectively save energy, prolong the effective time of the network, and improve network reliability and adaptability.

5. Simulation Results and Analysis

In order to verify the performance of the algorithm, we made a simulation comparison between this algorithm and the LEACH algorithm. In the range of 200×200 , we selected 50 nodes randomly distributed, and achieved data fusion in each transmission. Here assume that each node is transmitting and receiving 4000bit data; the base station is located in (100, 200) with the initial energy $Q=0.5$. In our simulation software selection box, we first set the range of 200×200 , selected the number of nodes is 50,

set $\beta = 2$, $\rho = 0.5$ and selected α from (1, 2, 10) in turn. We recorded the cycle number that a node experiences in its first death as (First Dead) in the information bar below the software. The operation repeated 50 times and the results were averaged, and we obtained the relationship between α and first death (see Figure 3).

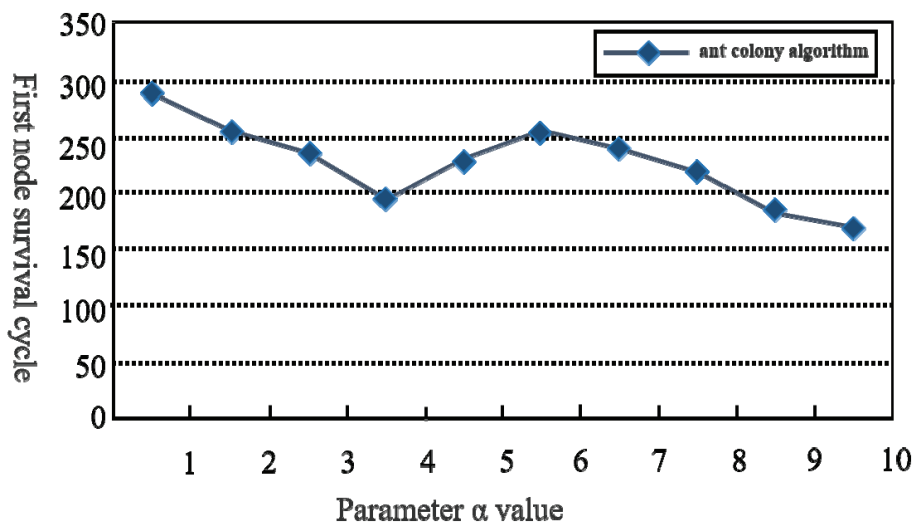


Figure - 3 Relationship Between Value α and the First Node Survival Cycle

Visibly, when α is small, node lifecycle is long. There are two reasons. First, because the proportion of the energy factor is relatively large, and when α is small, ants' previous information is not used enough, so the path selection is largely random and the lifecycle is extended at the expense of convergence time. However, if α is too high, it can speed up the convergence, but the search randomness weakens, which may converge prematurely to a local optimum. Therefore, α should not be too large or too small.

Similarly, in the range of 200×200 , we first set the range of 200×200 , selected the number of nodes as 50, and selected β from (1, 2,...8) in turn. We recorded the cycle number that a node experiences in its first death as (First Dead) in the information bar below the software. The operation repeated 50 times and the results were averaged, and we obtained the relationship between β and the first node death time (see Figure 4).

As can be seen, expectation heuristic factor β reflects the relative importance of heuristic information in the guidance process of searching, and its size mirrors the apriority in the ant colony optimization process and effect strength of uncertainties. When β is small, it will cause a large chance of ants' randomly choosing the path, so it is not good for finding the optimal path and the first node lifetime is short. When the β value becomes large, ants converge to a good solution, but the algorithm convergence becomes poor.

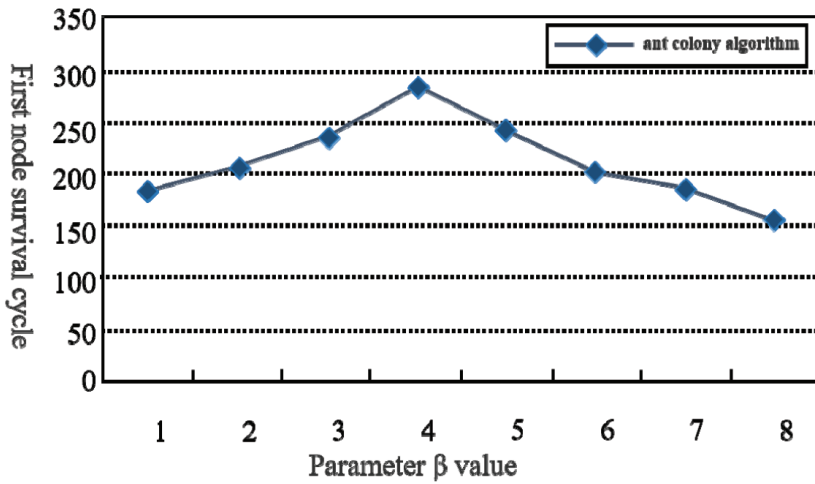


Figure 4- Relationship Between Value β and the First Node Death Time

Finally, we observe the relationship between value β and the first node death time (Figure 5):

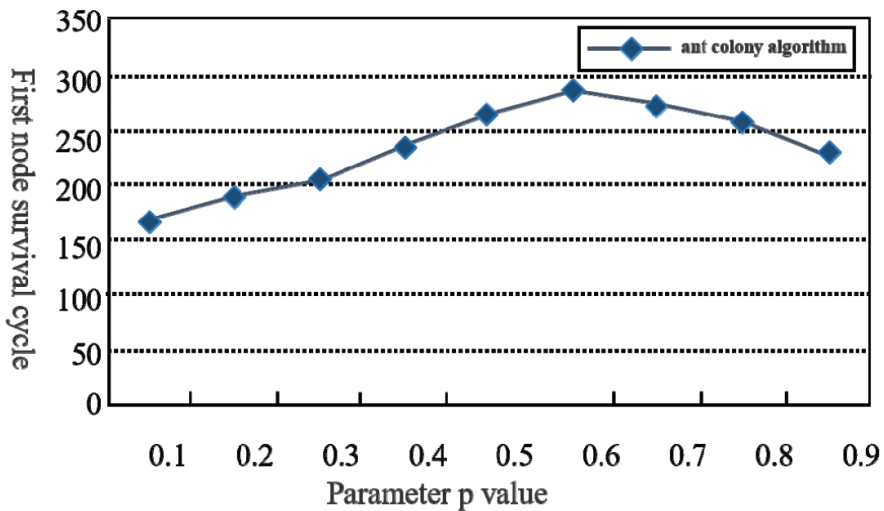


Figure 5 – Relationship between Value ρ and the First Node Death Time

As can be seen, when the ρ value is small, pheromone is volatile slowly, and incorrect pheromone left by previous ants cannot be quickly volatile. Ants find it difficult to find new and better solutions, leading to a relatively short lifecycle of the first node. When the ρ value is increased, the pheromone evaporates more quickly, and incorrect pheromone

left by previous ants can quickly be volatile, so ants can more easily find the optimal solution to extend the lifecycle of nodes, but when ρ grows to a certain value, ants cannot make good use of previously left pheromone, so ants would find it difficult to find the optimal solution, thus reducing the lifecycle of nodes.

Figure 6 shows in the range of 200×200 and with the initial energy of $0.5J$, by comparing the number of death cycles at nodes 1,5,10,15,20,25,30,35,40,45,50, it can be seen that within the first 45 nodes, the lifecycle of the improved ant colony algorithm is better than LEACH, but for the later nodes, as LEACH energy consumption is not as even as the improved ant colony algorithm, many nodes have a small amount of residual energy and relatively long lifecycle, but because of relatively few remaining nodes, it does not make much sense in practical applications.

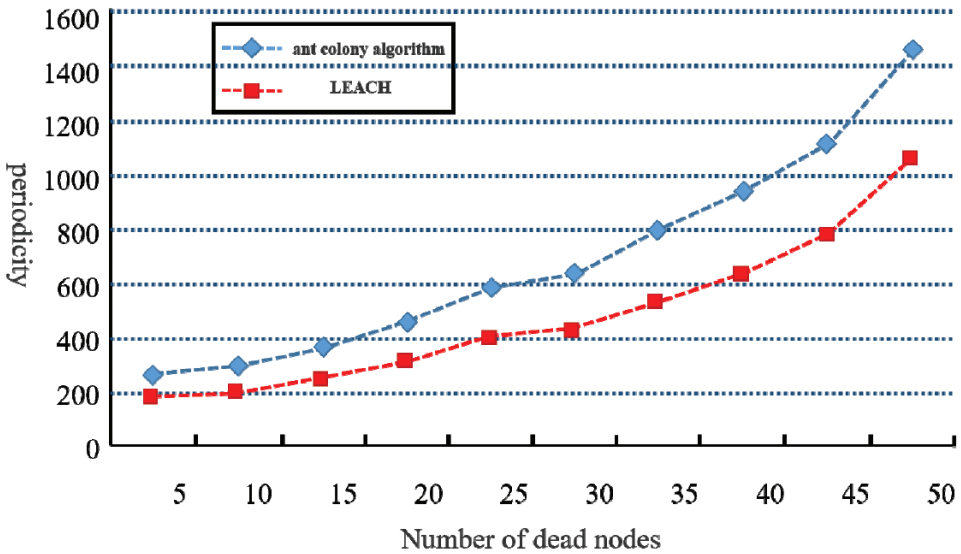


Figure 6 – Comparison of Node Survival Periods

This advantage will be obvious as the network size enlarges. In order to verify this, we set a time t and the time is 1200 seconds, and then select different networks (50, 100, 200). Under the same conditions we run the LEACH algorithm and our PRACA algorithm, respectively, and the results are shown in Figure 7.

When sending the packet back to sink stage, our improved ant colony routing algorithm uses a self-adaptive routing algorithm. According to the residual energy, we take the dynamic routing strategies to better protect nodes that nearly deplete energy, thereby maintaining the integrity of the network functions.

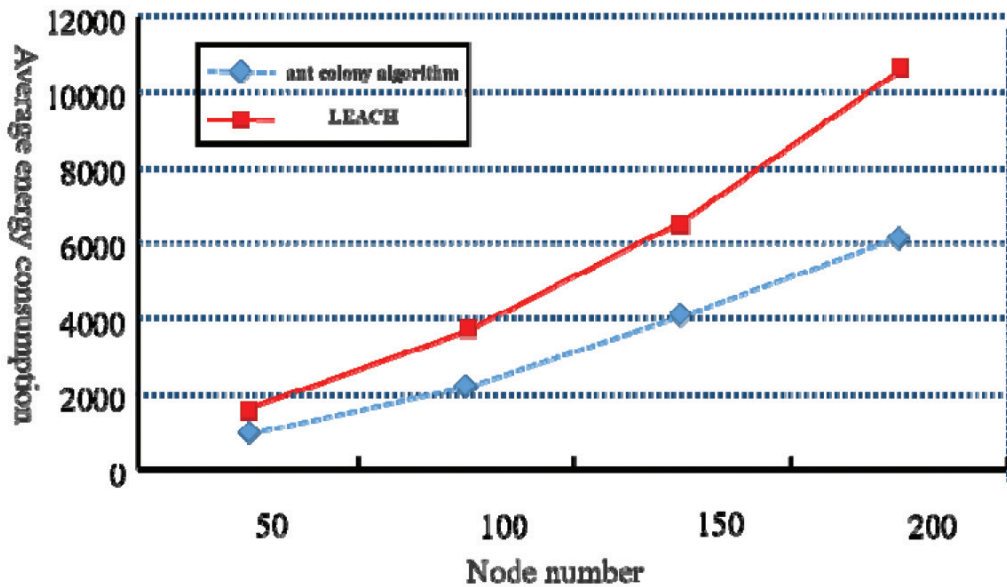


Figure 7 – Energy Consumption Comparison of Different Networks

6. Conclusion

Routing protocols used for guiding data transmission play a critical role in applying wireless sensor networks. However, node energy storage capacity and computing power are very limited due to the low cost and small size of sensor nodes themselves, so the design of wireless sensor network routing protocols should meet the requirements of reducing energy, balancing network energy and extending the network effective time.

By conducting research and analyses of routing protocols and ant colony algorithms in wireless sensor networks, and following the design requirements regarding performance evaluation of wireless sensor networks and routing protocols, this paper proposes a plane wireless sensor network routing protocol grounded upon the improved PRACA, thus reducing unnecessary energy consumption incurred by blindly searching for paths, spreading node energy consumption in the routing process to different nodes, and avoiding premature failures when a path has large energy reserves but too fast energy consumption. Finally, simulation experiments are designed to evaluate the performance of routing protocols based on the PRACA improved ant colony algorithm and experimental results have shown that the wireless network routing protocol based on the improved PRACA is on the whole superior to other routing protocols in regard to balancing network energy, improving energy efficiency and network effective time, so it is effective.

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The Exploration into Computer Network Virus Defense Technology Based on Data Mining

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Abstract: With the development and popularization of network technology and computer science, network virus can transmit through the network's vulnerabilities and the correlative advantages of the global Internet. It has become the major threat to the security of network system. Computer network virus defense Technology based on data mining can fully resist the generation and transmission of virus. In this study, focusing on the transmission patterns of computer virus, a computer network virus defense system is designed with five analytical methods of data mining technology, which are association rule analysis, cluster analysis, classification analysis, heterogeneous analysis, and sequence analysis. This computer network virus defense system is composed of the preprocessing module, decision module, data collection module, data mining module, and rule base module. Field research reveals that this system achieves significant effects gain when defending against the transmission of computer virus.

Keywords: Data mining; Computer network; Virus; Defense.

1. Introduction

During the popularization of the Internet in China, computer virus derives from the network development, and this virus is the representation of worm virus. In 1988, the first worm virus is discovered and named as the Morris Worm; in 2003, the Worm Blaster and Dvldr 32 worm virus emerged; in 2004, the Worm Sasser broke out. For computer users, the above worm viruses have led to tremendous losses. The so-called worm virus is the network virus. The higher the informational level is, the stronger the worm virus will be. The traditional defense technology cannot fully resist the current powerful virus (Belo, A., Castela, G., & Fernandes, S., 2013). Therefore, data mining technology will be applied to replace the hysteretic traditional defense technology to effectively and sufficiently resist the transmission of viruses. Hill et al. established a self-adaptation system and method to defend against virus when the computer is attacked by network virus (Bhuyan L N, Agrawal D P., 1984). Rui presented an active defense technology based on the detection algorithm of computer network virus (Rui G., 2015). Wang applied the data mingle technology to ensure the network security of computers (Perona P, Malik J., 1990). According to the research into the popular computer network viruses, Li suggested using the correlation analysis method of data mining to protect the computer from network

virus (Sterbenz J P G, Hutchison D, Çetinkaya E K., 2010). In this study, the transmission patterns of computer virus are analyzed for the research into the preprocessing module, decision module, data collection module, data mining module, and rule base module in accordance with the common analysis methods of data mining. The aim of this study is to identify and explore the underlying relations between data from the perspective of brand-new data analysis, thus allowing the data to run in a relatively safe environment and facilitating the enhancement of computer network's security level.

2. Basic Transmission Patterns of Computer Network Virus

2.1. Active Scan Transmission

The transmission pattern of active scan achieves the control over the computer by scanning and using the vulnerabilities of the remote host via the Internet. Besides, a small part of viruses transmission though the scan of writable folders, and put virus copies onto the writable folders. Active Scan transmission pattern and Email transmission pattern are very similar in their methods of obtaining the control over the computer. But Active Scan still has its own features (Chen H, Xu J., 2006).

2.2. Email Transmission

Email is the most common route of network virus transmission. During the transmission of emails, the number of infected emails will largely increase. According to the survey of 2 billion emails in 2002, 100 million viruses were found; in other words, for every 300 Emails, there was 1 virus-infected Email. However, in 2000, this proportion was only every 400 Emails containing 1 virus-infected Email (Yang L X, Yang X, Wen L, Liu J., 2012). It can be concluded that the transmission speed of virus-infected Emails is quite fast and frequent, which surely causes troubles to the information exchange of daily life.

3. Introduction and Main Methods of Data Mining

Data mining technology focuses on the analysis, clustering and classification of data, aiming at finding out related data rules. Data mining is composed of three steps: (1) preparation of data; (2) exploration of data rules; (3) expression of data rules. The application structure of data mining is shown in Figure 1.

When a data mining pattern is selected, the relevant mining engine will start to analyze and classify the collected data in line with the requirement of the knowledge base, and to explore the hidden rules to provide reference for the following data analysis. The operation procedures of data mining vary with the application direction. A complete data mining procedure belongs to an extremely tedious and complicated system; it is made up of tremendous accurate and planning work (Hall M, Frank E, Holmes G., 2009). The most important procedure of data mining technology is the preprocessing of data, including data purification, format conversion, variables integration, and the link of data sheet. As the essential part of data mining, data preprocessing provides good conditions for data analysis of the following procedures. The comprehensive structure of data mining technology is presented in Figure 2.

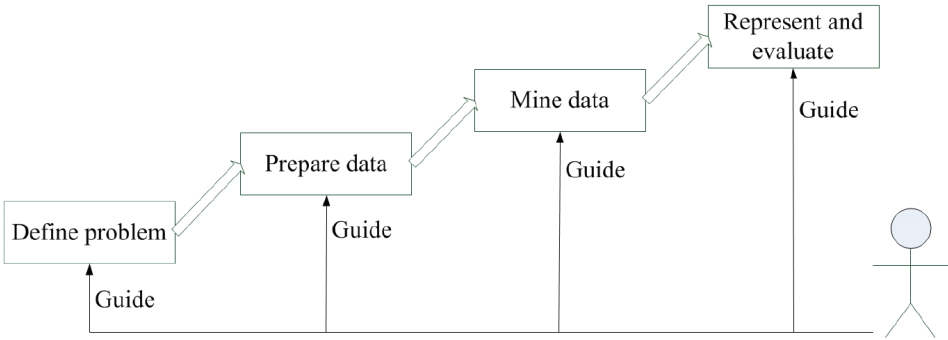


Figure 1 – The Application Structure of Data Mining Technology.

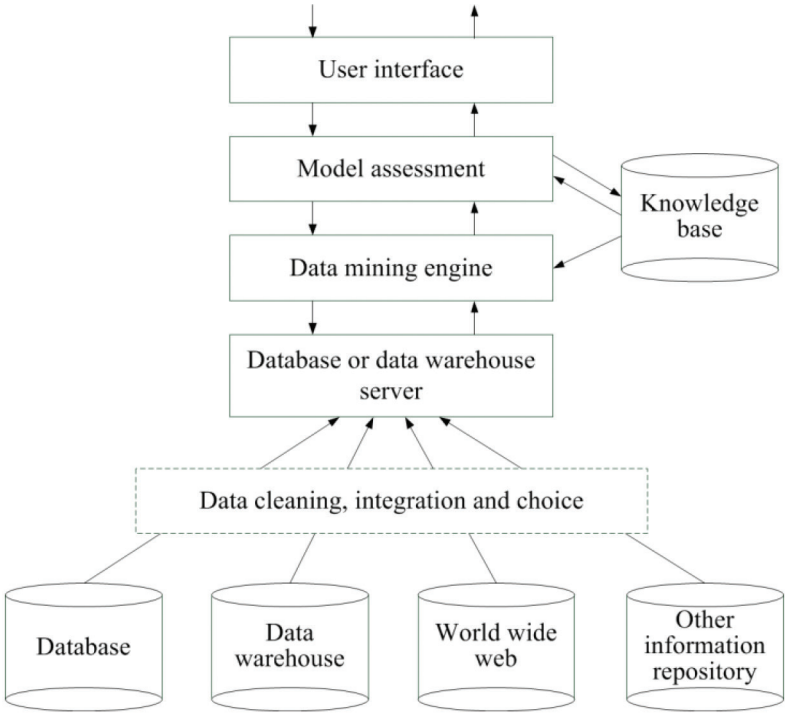


Figure 2 – The Structure of Data Mining.

3.1.Statistical Method

The relationship between fields in data base can be described as incidence relation and functional relation. The main statistical analysis methods are principal component analysis (PCA), correlation analysis, and regression analysis and so on (Pahl C, Donnellan D., 2002).

3.2. Decision Tree

Decision tree is used to classify the data into detailed categories. First, enterprises build the decision tree with the known data; then, this mutual decision tree can be applied to predict data. The establishment process of decision tree can be regarded as the process of data rules generation. In other words, the establishment of decision tree can satisfies the visual data rules, facilitating the understanding of the output result (Jacinto T., 2015). In the same information conditions, decision tree has relatively high accuracy, helping the researchers to easily and better understand the analysis results. It also brings in high efficiency and is regarded as one of the most popular data mining method.

3.3. Association Rules Mining

Association rules refer to the rules of correlation between the items in the data base. For example, it can be used to deduce an unknown item form the emerging item; meanwhile, it can also infer the rules relating to this kind of item emergence. The mining of association rules aims at finding out the hidden correlations via association analysis, using the obtained association rules to predict the unknown problem through the known conditions (Riley C M., 2015).

4. Structure of the Computer Network Virus Defensive System Based on Data Mining Technology

During the transmission of computer network viruses, the relevant data (the data of network users and the system data) needs to be scanned in order to provide related data proof for data mining technology. The application process of data mining technology in the defense of computer network virus is quite complicated and of many various procedures. To suit the convenience of users' daily operations and to master the essential features of each procedure, the preprocessing module, decision module, data collection module, data mining module, and rule base module should be analyzed. The computer network virus defensive process based on data mining technology is presented in Figure 3.

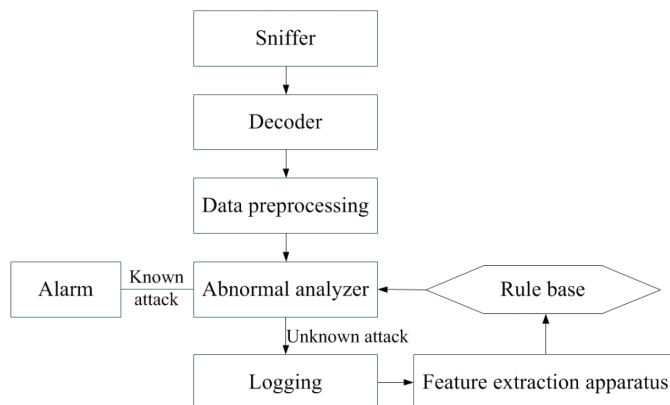


Figure 3 – The Computer Network Virus Defensive Process Based on Data Mining Technology.

4.1. Data Preprocessing Module Analysis

In data mining technology, the simplification of the operations between data mining and data analysis can be achieved via the data preprocessing module. The overall data mining effects as well as the differentiation degree and accuracy for the data can be significantly improved with this preprocessing module (Pahl C, Donnellan D., 2002). The first step is to collect data. Then, the data should be lead into the preprocessing module for analytical classification and data conversion. This way, the data can be transformed into the identifiable and processable data of the system. The data preprocessing module can be used to gather data, conclude data, and process data based on all the information content included in the data package (e.g. the target IP address, source IP address, and port information) (Capi G, Kaneko S, Hua B., 2015).

4.2. Decision Module Analysis

The decision module of data mining technology is applied to build the data base and to match the obtained data. Besides, the data base should be closely linked with the rule base. If there is information indicating that high-level link exists between the data base and the rule base, it can be concluded that there are virus features in the decision module and computers may be infected by network viruses (Chen H, Xu J., 2006). If the data information of the data base cannot match the data in the rule base, it can be deduced that there are virus zones with new features in this data package. In other words, new-type rules have appeared. In this case, the new-type virus should be led into the rule base, thus bringing the rule base a new-type rule.

4.3. Data Collection Module Analysis

The basic requirement for the realization of data mining is to offer sufficient data information. The functions of data collection module can only be realized by gathering data. The data collection module gathers data by capturing and collecting the data package in the computer network. When the data information is gathered, there will be some certain data structures and important functional information (Wainer G A., 2015).

4.4. Data Mining Module Analysis

The key component of data mining technology is the data mining module. And the critical parts of this module are the event base and the data mining algorithm. In data mining, the collection of relevant data constitutes the event base; a relatively accurate data structure can be acquired through the classification and management of the data in the event base.

4.5. Rule Base Module Analysis

The rule base module is also an important part of the data mining technology. It can help to optimize the data mining information base, providing the system with the required data for virus analysis. If network virus emerges in the computer system, the rule base module can be applied to analyze and identify the data, as well as realizing the data mining (Deepa A J, Kavitha V., 2015). During the data mining process, the properties of network virus will change or adjust the obtained rules, and use this record in the

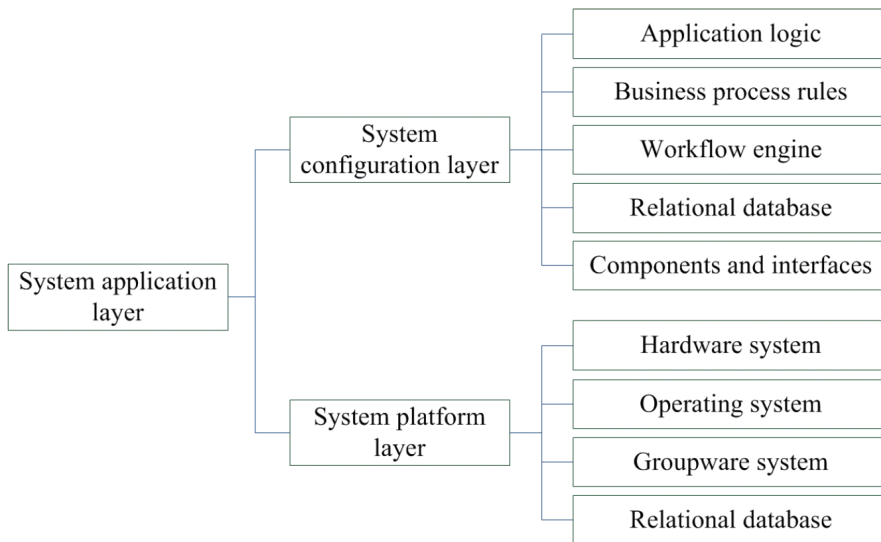


Figure 4 – The Application Layer of Data Mining System.

data mining. This record can help the computer system to analyze the potential network viruses, thus playing an important role in the defense of virus.

5. Applied Analysis of Data Mining Technology in Computer Network Virus Defense

5.1. Association Rule Analysis

The association rules of data mining technology indicate that findable knowledge exists in the data of the same category. In the association rule analysis, the values of two or more than two variables will be taken. If these values present certain rules, specific association exists between these data. Causal association, time sequence association, and simple association are the main associations in data mining technology (Arcand J, Almuhtadi W., 2016). To find out the association net in the data base, association analysis needs to be conducted. Then, data mining can be carried out based on the correlations between the data to acquire the association rules existing between different data.

The mining way of the association rule can be explained via the following example:

If $I = \{x, y, z\}$, $U = \{T_1, T_2, T_3, T_4\}$, $T_1 = \{X, Y\}$, $T_2 = \{x, y\}$, $T_3 = \{x, z\}$, and $T_4 = \{x, y, z\}$, then, $\min \sup = 50\%$ and $\min \text{conf} = 90\%$. Calculate all the non-empty item sets, and compute the support degree (see Table 1 for detailed results).

As shown in Table 1, the support degree of all the frequent item sets are larger than or equal to 50% of the item sets. In the end, calculate and derive the confidence rule of the frequent item sets which are more than two dimensions. Hence, the corresponding rules can be built in $\{x, z\}$ and $\{x, y\}$:

Itemset	Support	Itemset	Support
{x, z}	50%	{x}	100%
{y, z}	25%	{y}	75%
{x, y, z}	25%	{z}	50%
{x, y}	75%		

Table 1 – Support Degree of Non-empty Item Sets

$$\begin{aligned}
\{x\} \rightarrow \{y\} \text{conf}(\{x\} \rightarrow \{y\}) &= \sup(\{x, y\}) / \sup(\{x\}) = 75\% / 100\% = 75\% \\
\{y\} \rightarrow \{x\} \text{conf}(\{y\} \rightarrow \{x\}) &= \sup(\{x, y\}) / \sup(\{y\}) = 75\% / 75\% = 100\% \\
\{x\} \rightarrow \{z\} \text{conf}(\{x\} \rightarrow \{z\}) &= \sup(\{x, z\}) / \sup(\{x\}) = 50\% / 100\% = 50\% \\
\{z\} \rightarrow \{x\} \text{conf}(\{z\} \rightarrow \{x\}) &= \sup(\{x, z\}) / \sup(\{z\}) = 50\% / 50\% = 100\%
\end{aligned} \tag{1}$$

According to the above 4 rules, rules larger than 90% confidence degree are valid rules, namely, $\{z\} \rightarrow \{x\}$ and $\{y\} \rightarrow \{x\}$.

5.2. Cluster Analysis

Decompose the obtained data in line with different features and classifications, and then put the decomposed data into different groups. There are some similar features between the data of different groups; the data of each group also have their own distinctive features. When all the data are clustered by the system, the distribution density of the data in the whole system can be found and recognized. In this way, the correlation between different groups can be revealed, and the global distribution pattern can be presented (Lipoff S., 2016).

5.3. Classification Analysis

Classification analysis is designed to classify the objects into the pre-set categories. The aim of classification is to establish a data classification model through various machine learning methods and statistical approaches. Then, all the existing data of the data base will be classified into several categories according to regular patterns. Next, the other data will be analyzed and classified in line with the above classification results.

5.4. Heterogeneous Analysis

Heterogeneous analysis is also called outlier analysis; it is used to analyze the date which are apparently deviating from other data and the general pattern. Heterogeneous analysis is composed of the discovery and analysis of the outlier. The discovery of outliers will always result in abnormal results, and the analysis of outliers may find some valuable data.

5.5. Sequence Analysis.

Sequence analysis is a statistical method used to process dynamic data; it can be applied to search virus data's sequence hiding in the event base by analyzing the sequence rules

of the random data. In data mining process, the main target of sequence analysis is to establish a model for sequence patterns, and to find out the time sequence that happens frequently among the events (Ali M Q, Al-Shaer E., 2015). Detailed sequence analysis algorithm of data mining can be explained as following: first, it is assumed that the event base D and trade T correlate with timestamp; the trade is located in section (t1, t2); X, Y, and Z are the item sets in D. Then, the sequence rule can be expressed as $X, Y \rightarrow Z$ (confidence, Support, Window); the rule supporting degree is Support ($X \cup Y \cup Z$); the confidence coefficient is $\text{Support}(X \cup Y \cup Z) / \text{Support}(X \cup Y)$.

6. Strategy for the Construction of Computer Network Virus Defense System based on Data Mining Technology

Theoretical research is the premise of data mining technology; software enterprises are the motivation for popularizing data mining technology; the establishment of a standard system is the key to a steady-running environment. Above all, the applied talents are the critical factor stimulating all the relevant work of data mining. All these points are trying to build the computer network virus defense system from the perspective of technology. However, in fact, the following aspects should be emphasized if we want to make full use of the data mining technology in computer network virus defense.

6.1. Attach Great Importance to the Theoretical Research of Data Mining Technology

Theoretical research is the foundation and premise of practical application. In order to better make use of data mining technology, the following job should be nicely carried out: firstly, put emphasis on the theoretical research of data mining research, and encourage scholars and experts to conduct in-depth researches into data mining technology by extensively using advanced western theories for reference and continuously perfecting the theoretical system. Secondly, pay attention to the communication and exchange between the academic circle and the industrial field; combine theory with practice to stimulate a beneficial cycle of data mining theory; in this way, the comprehensive development of data mining technology's theoretical system can finally be realized. Thirdly, actively explore the relationship between data mining technology and the computer network virus defense; design and develop a reliable computer network virus defense system based on this foundation (Ling N, Feng F G, Jing M., 2015).

6.2. Encourage Healthy Development of the Domestic Software Manufactures

Generally, the overseas software enterprises are equipped with mature research system of data mining technology, and they know how to actively apply it to their practical productions. However, this kind of enterprises is very rare in China. The research and development of data mining technology in China is still in the primary stage. For this reason, the government should positively encourage the expansion and promotion of the domestic software manufacturers, providing them a relatively healthy market environment. Moreover, for these manufacturers, they should continuously learn from the advanced data mining experiences from the overseas enterprises, guiding the applications of data mining technology in the defense of computer network virus. In addition, the domestic software manufacturers should try to create a good industrial

communication system, focusing on the exchange of the application experience of data mining technology in computer network virus defense. Consequently, the entire data mining industry will achieve significant development and progress.

6.3. Establish a Sound Standard System of Data Mining Technology

Similar to the formalization and standardization of SQL language, data mining technology is also developing toward standardization (Sexton J, Storlie C, Neil J., 2015). If it is applied to the existing data language system and the knowledge, the quality of data mining can be greatly enhanced, thus allowing clients get a clearer understanding of others, and enabling higher efficiency of man-machine interaction results. When the relationship between the data mining server and the data base server is well handled, the efficiency of data mining in the process of unstructured data can be realized. During the process of building a standard system of data mining technology, market requirements should be taken as the guide, and different problems should be analyzed with different methods to meet market's demands on data mining technology.

6.4. Develop and Train Professional Network Management Personnel

The ultimate aim of applying data base technology to computer network virus defense system is to ensure a safe and stable network, and to achieve better business transactions in network environment. Professional technical personnel are needed whether for the establishment of a reliable computer network virus defense system based on data mining technology or for the practical applications of this system. Hence, great emphasis should be placed on the training of professional talents. From the perspective of higher education, data mining technology should be introduced to the courses, training professional network security management talents to ensure practical applications of data mining technology. For the enterprises, they should provide their personnel with professional trainings to promote employees' skills and abilities, which can then ensure the formation of computer network virus defense system.

7. Conclusion

During the development and application of network technology, people's life and work are affected by computer virus constantly, which leads to certain degrees of damage and loss. Based on data mining technology, the computer network virus defense technology can fully resist the generation and transmission of viruses before they break out. In this study, a computer network virus defense system is designed based on data mining technology focusing on the transmission pattern of computer virus. Besides, association rule analysis, cluster analysis, classification analysis, heterogeneous analysis, and sequence analysis are applied in this study. The virus defense system proposed in this study is composed of five modules, which are preprocessing module, decision module, data collection module, data mining module, and rule base module. Brand-new data are collected for analysis and reflections to identify the underlying relations between the data. In this way, the data can run in a relatively safe environment, facilitating the enhancement of computer network's security level.

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Analysis on the Establishment of Project Cost Database Based on Computer Aided Bid Evaluation

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Abstract: Objective: Construction project cost management system is to analyze and evaluate the cost of each link, so as to provide assistant decision-making for the leadership, and to carry out the computer control system of engineering information, equipment and material information for transmission, storage, maintenance and scientific call, which can simplify the construction engineering in the measurement of the complicated work and optimize the efficiency. Methods: Based on the system theory, this paper used the method of software engineering. Process: Based on the detailed analysis of the construction project cost management system, this paper used the network and database technology to link the information of multiple departments to achieve data sharing, mutual constraints and describes and analyzes the computer in the construction cost of a series of help. Conclusion: The development and application of engineering cost database greatly improves the working efficiency and quality. At the same time, it plays an active role in reducing project cost and improving project cost management.

Keywords: Project cost; Database; Computer control system; Software engineering

1. Introduction

The application of computer aided system has brought new development space and transformation space for various industries. In the field of architectural engineering, computer aided design (CAD) has improved the efficiency of engineering design. Computer aided management system improves the project management ability of construction enterprises. But in the project bidding, many units of the application of computer technology is still in the release of information and text processing. In front of the new changes, how to improve the fairness and scientific nature of the evaluation work is an urgent need to solve the problem. The application of computer aided bid evaluation system provides a powerful technical support for the realization of these two objectives (Khanna D, Nagaraja V, Tseng C., 2015).

1. To realize the automatic extraction of expert judges and improve the position of the judges of the judges is to ensure the fairness of the evaluation work, the important part of scientific. The establishment of the bid evaluation committee

and the selection of the experts of the evaluation of the bid evaluation committee shall be specified in the bid invitation and bid evaluation committee of the People's Republic of China.

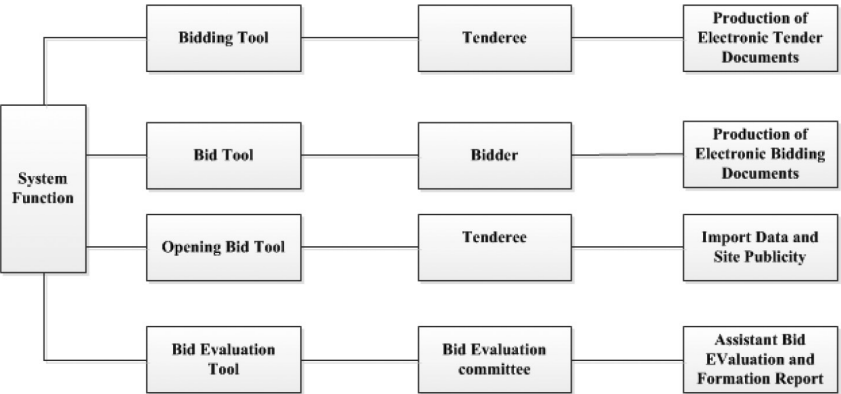


Figure 1 – System Function Module Diagram

2. Improve the accuracy of the data analysis, to ensure that the implementation of the work of the commercial bid evaluation of the scientific nature of the bill of quantities, so that the evaluation of the work has changed a lot, manual evaluation has been unable to adapt (Jiménez, D. L., Redchuk, A., Dittmar, E. C., & Vargas, J. P., 2013). The construction contract in the form of bill of quantities is usually a unit price contract, and the evaluation of the bid evaluation method shall be carried out with the arithmetic check. After the implementation of the list of specifications, the evaluation of the work requirements more detailed, if we complete the evaluation of the tender evaluation in a short period of time, it is difficult to ensure the accuracy of the review. While the judges are not full-time staff, such as spending more time than one day, will increase the cost of the tender, the judges and the evaluation of the confidentiality of the work has brought a lot of inconvenience (Nikolova L V, Kuporov J J, Rodionov D G., 2015).

2. Composition of Project Cost Database

From adapting to the actual needs of the network bidding and bid evaluation, according to China's national conditions, engineering cost information archives include enterprise credit archives, local material price database, engineering project cost index file information database and evaluation expert database, etc.

2.1. Enterprise Credit Archives

In order to further standardize the construction market order and improve the credibility of the system, the construction industry to improve the industry's moral level and strengthen industry self-regulation, improve the overall quality and comprehensive strength, and promote the healthy development of the industry, the company has established a construction

enterprise credit file, the credibility of the company through the local construction site to be publicized. Any units and individuals can search through the web site. The contents of the archives include the main contents of the subject, the contents of the credit record, the document and the number of the credit record, the record time. Credit record points of fine and bad records. According to these records, the evaluation of the credibility of the construction units in the rankings, as the basis for the evaluation of the credibility of the project tender, the credibility of the construction unit will affect the enterprise to participate in the bid and the probability of winning (Yang G, Zhang Y, Chang Q., 2015).

2.2. The Local Price Database of Project Cost Management

The implementation of the bill of quantities, the project cost quantity price, management fees and profit fully liberalized. The implementation of enterprise independent offer to the list of integrated unit price, the main material unit price and other requirements of the project evaluation more standardized, more stringent, the need to make full use of the market to guide the evaluation work. At present, the country has established more than 300 tangible construction market, the project cost factor prices, database, especially the construction material price information release and computer network management integration. Engineering cost management department through the issue of the use of the project integrated pricing system, and continuously collect engineering cost guidance data, while the collection of statistical information, engineering services, materials and equipment, price information and management information through the website to the relevant agencies and professional personnel, to provide paid information services to the community. From the network evaluation of the functional requirements of the database, the site is not enough to provide price. On the one hand, these sites will be a wider range of networking, on the other hand, the evaluation system and the evaluation system has been implemented to establish a dedicated batch query interface, which can help to analyze the evaluation index of the experts (Xia Y, Tan F, Wang L., 2015).

2.3. Project Cost Index File Information Database

The evaluation of project bid evaluation under the condition of list valuation shall be conducted for the evaluation of the cost of the sub item of the project. According to the requirements of project cost management and network evaluation, the database should include the project feasibility study report and approval, project evaluation research materials, design documents, tender documents, engineering quantity list, engineering construction contract documents, bidding documents, project information, intermediate settlement data, final accounts and audit data. These data should be able to analyze the relationship between the cost of each item and the cost of each component in the course of the project. These indicators and data can be used for the evaluation of the process (Il'in A V, Perelman J M, Prikhodko A G., 2015).

2.4. Project Evaluation Expert Database

Project evaluation requires the participation of the experts, the end of 2002, the Ministry of construction is required to establish a unified architectural engineering evaluation expert. From the requirements of the work to meet the requirements of the bidding, the future of these experts in accordance with the expertise and professional classification.

According to the evaluation of the performance and experience of experts, Party A in accordance with the characteristics of the tender and the size of the sample from a random sample of appropriate evaluation experts. In the future, we will choose the large and special projects to be selected by the experts. It is necessary to select and provide services for the bid evaluation expert database, and provide technical conditions for the evaluation of the local area (Viana I, Orteu J J, Cornille N., 2015).

3. Project Cost Information Platform Based On Computer

3.1. Query Module Design

Cost information query module is to facilitate all kinds of users to query the relevant information and set up. According to the needs of all kinds of users, we set up the module as the price of production factors, the project cost data query, construction standards, policies and regulations, cost consulting agencies / cost management practices for the inquiry of six sub modules, as shown in figure 2.

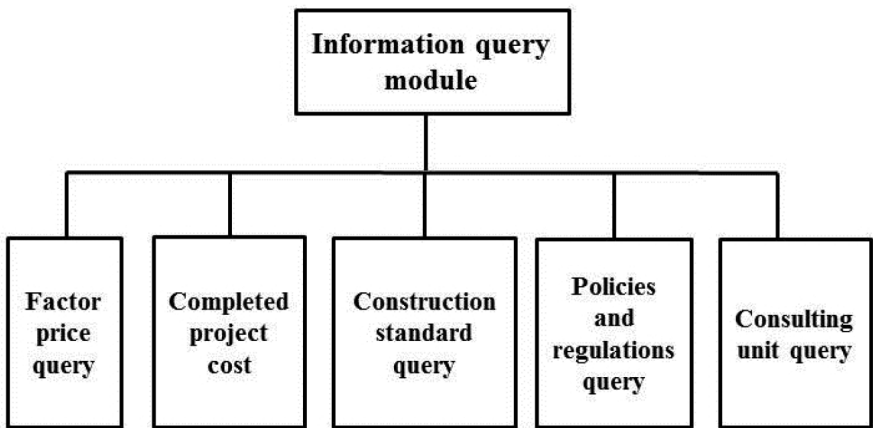


Figure 2 – Framework of Cost Information Inquiring Module

1 Production factor price query

The user can enter into the element name and area to the current and historical price information in a certain area. The user input combination material name and time, it can be found in the elements in the query period across the market price information etc.

2 Completed project cost information query

The user can directly input after the finished project name can browse the project overview of the project, cost of economic indicators, cost, quantity index etc. The user can select the appropriate type of project in the project type column and query the type of all the project survey, the cost of economic indicators, cost, quantity index

information, user program selection, to determine the design scheme of the economy. Project overview information platform will also study as input options, so that the user can according to the main features of the project query to the projects with the same or similar characteristics related to the cost of economic indicators, quantity index, cost information, can easily estimate the project cost and quantity of information (Imai Y, Kim S, Hiraoka H., 2015).

Systematic name: Construction project cost management system		Designer:
Module name: Progress payment approval		Date:2015.12.10
Upper call module: Cost management function		Call module: None
Input	Manage	Output
Item information	Management Content	Approval opinion

Table 1 – Progress Approval Module

3 Construction standards and policies and regulations query

This two part of the query is mainly based on the file name, file number, document department, issued a document time and so on as the query terms, standard documents, policies and regulations of the text as input content (CONSOLO D A, FURTOSO V B., 2015).

4 Cost consulting agencies and practitioners query

Users in the cost of consulting institutions / practitioners query module, you can directly enter the name of the cost advisory body can be a detailed understanding of the company's qualification level, company address, contact information, service content, past project experience and so on. Enter the name of the professional staff, you will be available to get his degree, professional experience, title, business expertise and other relevant information (Akala E O, Adesina S, Ogunwuyi O., 2015).

3.2. Design of Functional Module of Information Release

In the preparation of project proposal and feasibility study report stage, the evaluation index is the important basis for the selection of multi scheme, optimizing the design scheme, the correct establishment of investment estimation, and reasonable determination of the amount of project investment. In the construction project evaluation and decision-making stage, the evaluation index is the main economic indicators of the evaluation of the investment feasibility, the analysis of the investment benefit, and the economic evaluation for the construction projects, the preparation of the fixed investment plan, the financing of construction funds and control the use of funds. In the engineering design stage, the estimation index is the main basis of the quota design. Through the design of the quota, the scheme is chosen, the layout is reasonable, the technology is advanced and the investment is saved (Wang J, Nishikawa R M, Yang Y., 2016).

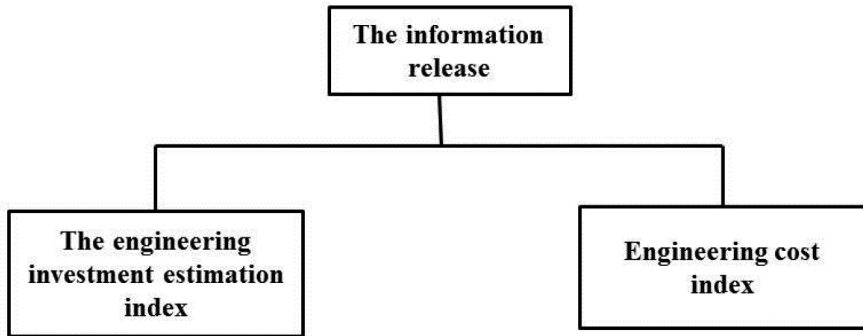


Figure 3 – Framework of Information Promulgating Module

3.3.Calculation of Engineering Estimation Index

The engineering investment estimation index is based on the independent construction project, the individual project or the unit project as the specific object, and the quantity standard of the artificial, material and machinery that the qualified product can be consumed. Due to the construction project proposal, design tasks, the preparation of different depth, in order to facilitate the use of the evaluation index should be combined with professional characteristics according to their comprehensive level of different appropriate classification. Engineering investment indicators can be generally divided into: the construction of the project, the individual project indicators and unit engineering index (Cortes-Mestizo I E, Briones E, Briones J., 2015).

Construction project indicators: general also known as the project total investment targets, to the production capacity of the unit’s comprehensive investment indicators. Indicators include: in accordance with the relevant provisions of the State shall be included in the total investment of the construction project, from the construction to the completion of the construction of all the required construction and installation engineering, equipment and equipment purchase costs and other expenses. Individual engineering index: the general index of the construction project of the individual projects to the production capacity of the unit of investment. The contents include: the construction and installation cost of a single project, the purchase of equipment and other expenses for the investment of individual projects. Unit engineering index: generally refers to the buildings, structures to square meters, cubic meters, the extension of meters, block, and so on for the calculation of the unit of construction installation engineering cost index. The following will focus on the calculation method of the project cost information platform engineering estimation index (Dalmış M U, Gubern-Mérida A, Vreemann S., 2016).

First, the platform management staff in the operating interface select the input will be measured by the index category, area (construction site), and start time. And then in the main parameters of the dialog box, enter the structure form, number, basic form, exterior wall decoration, interior wall decoration, door and window type, floor decoration, roof type, unilateral cost and other factors that affect the project cost, the system will retrieve the project cost information, and randomly selected 6 projects as a typical project. Then, according to the project cost of the project, the parameters of the typical engineering

characteristic parameters are not less than 0.5. Then, calculate the correlation degree of each typical project. 6 typical engineering $A_1, A_2, A_3, \dots, A_6$, each typical project has 9 parameters $T = \{\text{structure form, number of layers, basic form, exterior wall decoration, interior wall decoration, door and window type, floor decoration, roof type, single cost}\}$, typical engineering parameter coefficient series $X_i = \{X_i(1), X_i(2), X_i(3), \dots, X_i(9)\}$, where $i = 1, 2, \dots, 6$. The gray correlation degree is calculated with the parameters of the typical engineering parameters (Larsen K, Buliung R N, Faulkner G E J., 2015). Computational methods are as follows:

1. The absolute difference between the system characteristic and other typical engineering parameter coefficients is;

$$\Delta_{oi} = \{|X_o(1) - X_i(1)|, |X_o(2) - X_i(2)|, \dots, |X_o(9) - X_i(9)|\} \quad (1)$$

2. Find out the maximum difference and the minimum difference.
3. Calculate correlation coefficient.

$$r_{oi}(k) = \frac{\Delta_{\min} + 0.5\Delta_{\max}}{\Delta_{oj} + 0.5\Delta_{\max}} \quad k = 1, 2, \dots, 9 \quad (2)$$

4. Calculate gray correlation degree.

$$r_{oi} = \frac{1}{n} \sum_{k=1}^9 r_{oi}(k) \quad (3)$$

If the correlation degree is less than 0.5, it is discarded. According to the engineering characteristic parameters, the typical engineering is selected and repeated operation is repeated until the appropriate typical engineering is selected.

Finally, using the arithmetic average method to estimate the average of all the selected items, then get the evaluation index of this kind of engineering. Taking into account the characteristics of the construction period of the construction project, and the difficulty of data collection, the cost information platform is updated and published in one year.

3.4. Calculation of Project Cost Index

To determine the type of project cost index, the following two important principles should be followed: Practical: all the needs of users as the guide, according to the information platform for all kinds of users, especially the relevant government departments and professional consulting institutions and professional consulting institutions and the application of cost professionals to determine the type of cost index, built after the index module has practical value. Feasibility. In determining the index type, not blindly perfection, everything, to meet the needs of users at the same time, they should analyze the degree of difficulty of research on all kinds of index and the related data collected. If there is no enough basic data as a support, the accuracy of the information platform is difficult to be guaranteed. Then the establishment of all kinds of cost index of the information platform is determined (O'Farrell R., 2015).

1 Price index of major labor

The index using the classical index theory, namely the base period and report the main types of artificial price ratio. The price of main manual work in the current market price, in order to reflect the main types of the main types of artificial price fluctuations. The model is as follows:

$$L_i = \frac{P_{lin}}{P_{lio}} \quad (4)$$

In the formula: is the artificial price index of i type. is the price of the i type of manual reporting period (phase n). is artificial base price of i type.

2 Synthetic artificial price index

Synthetic artificial price index is a comprehensive, which reflects the average level of artificial price. The price index is the main types of the artificial engineering weighted average, and then compared with the base model, as follows:

$$L = \frac{\sum_{i=1}^m \partial_{lin} P_{lin}}{\sum_{i=1}^m \partial_{lio} P_{lio}} \quad (5)$$

In the formula: L is synthetic artificial price index. M is number of main manual work.

The weight and the weight of each job in the model of the artificial composite price index is related to the engineering type, the location of the project, the time and so on. If the basic data of various types of construction labor consumption, then the weight of each type of work can be adjusted every year to get a weighted index of live weight.

3 Partial project cost index

The project cost index refers to the reporting period the project cost and project cost base ratio. The establishment of sub item of the project cost index can be used as an important reference index to estimate the cost of similar projects in the early stage of the construction project. In the construction project as an example, the scope of the project cost index including earthworks, foundation, structure, interior wall, exterior wall, floor, ceiling, doors and windows, interior and exterior decoration. In the bill of quantities, the cost and the unilateral cost of the branch sub item are easy to get, so the calculation model of the sub item cost index can be directly derived from the definition:

$$S_i = \frac{S_{in}}{S_{io}} \quad (6)$$

In the formula: is project cost index of I partial. is unit size cost of I partial. is the base unit cost scale of I partial.

User table is used to store the basic information of employees of various departments, including user number, user name, password, the Department, work units, contact

information, address, job, authority, etc. Departments include the budget department, procurement department, etc. Work unit include construction unit, design unit, construction unit, etc.

Number	Name	Fields	Type	Length	Primary Key	Remark
1	User ID	User_ID	int	4	YES	Increment
2	User Name	User_name	varchar	20		
3	Password	User_psd	varchar	20		Default values
4	Department	User_apart	varchar	20		
5	Unit	User_unit	varchar	20		
6	Telephone	User_phone	varchar	20		
7	Address	User_address	varchar	50		
8	Duty	User_role	varchar	20		
9	Limits	User_autho	varchar	50		

Table 2 – User Table

Engineering Scale is used to store quantities of information, including automatic numbering, owned projects, artificial volume, the amount of material, amount of equipment, and other amount.

Number	Name	Fields	Type	Length	Primary Key	Remark
1	Automatic Number	ProNum_ID	int	4	Yes	Increment
2	View project	Pro_ID	varchar	20		Foreign key
3	Artificial amount	Worker_num	varchar	50		
4	Amount of material	Material_num	datetime	20		
5	Amount of equipment	Device_num	varchar	16		
6	Other	Other_num	varchar	16		

Table 3 – Engineering Scale Table

According to the data analysis, the system provides information about the statistics, tables, print reading and other functions, which can be related summary table as an Excel file. Users simply select the table you want to print.

4. Database Design

In the design of the project cost information platform, the main reason is that: first, the data warehouse has a powerful data capacity, can save the historical data for a long time; second, data warehouse can provide data base for the analysis of the cost of multi angle (Fichtner F, Baldi G, Bremus F., 2015).

4.1. Data warehouse subject

Because in our project cost information platform, the decision support module in the same kind of engineering cost change rule analysis, the engineering cost structure analysis, the engineering characteristic to the cost analysis all depend on the already completed project cost information to carry on the multi-dimensional analysis. At the same time, the completed project cost information implicit in the rules and knowledge rich. Through the multi-dimensional analysis of these information, we may also find out some important knowledge and rules which are still unknown. Therefore, in the construction process of the construction cost information platform, we will have finished the project as a data warehouse subject to research.

4.2. Data warehouse model design

Data warehouses usually use star and snowflake to provide the fastest response, and the aggregation is based on the OLAP tool management. Star model is the most popular, but also a very simple data warehouse concept model. It can reflect the logical relationship among the entities, and the relationship is demonstrated by the important degree of the entity. It is the most concerned about the data warehouse users as the center, the data warehouse connection into a whole. Because each dimension table is using keywords, the foreign key constraint fact table in fact a row of a table, so the query work can start from the data analysis in the dimension table, with dimensions of keywords, easily linked to the star model center of the fact table, which ensures that the star model with the retrieval efficiency is very considerable. It can be used for providing the end user query, reporting, analysis and other services. Therefore, this system chooses the star model to carry on the conceptual model design.

4.3. Data warehouse metadata design

Metadata is the data about data, it describes the various data in the data warehouse, and explains the relationship between each of the data, so that each data has a realistic meaning. In the data warehouse system, the main function of metadata is to describe which data is in the data warehouse. Define the data in the data warehouse and the data from the data warehouse; Record the time schedule for data extraction based on business event.

5. Conclusion

This paper, from the perspective of the construction of the project cost information as a social resource, develop the construction of the information platform and make an exploratory study. The main results and conclusions include the following aspects:

1. It points out some problems and shortcomings in the construction of engineering cost information management, and establishes the information resources of the existing cost information network in various regions. It provides different levels of cost information service and decision service based on the whole country.
2. It analyzes the information needs of various potential users to the information platform of project cost information, and establishes the four main functions of

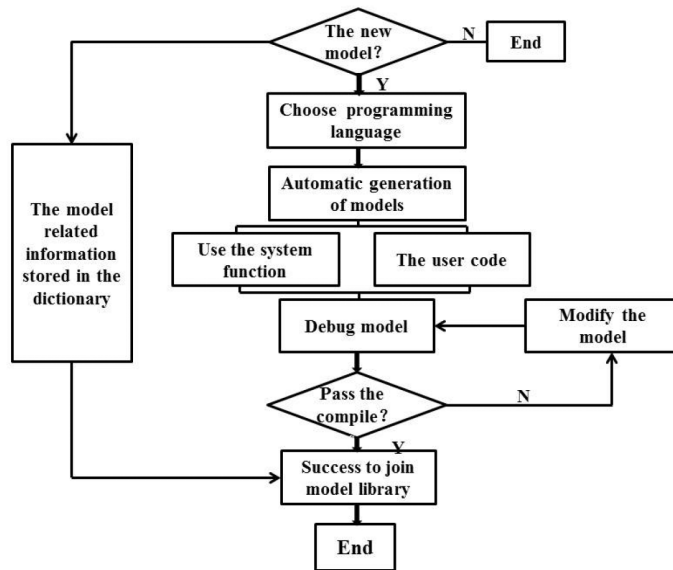


Figure 4 – Flow Chart of the New Model

the information platform for the construction cost information, the information of the construction platform cost, the decision support service, and the information platform management.

3. This paper designs the project cost of the original information collection form. And combined with the present situation of our country, it puts forward the feasible suggestion on the management and maintenance of the information platform of project cost from a management point of view.
4. Due to the limitation of time and space, this paper only takes the construction project as an example to study and explain the construction cost information platform, which is not related to the decoration engineering, installation engineering, landscape engineering, and municipal engineering.

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Analysis on Multidisciplinary Teaching Platform and Its Role in Computer Professional Education - A Case Study from Computer Experiment Center in Universities of China

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Abstract: Objective: To clarify multidisciplinary research and teaching platform and their role in computer professional education. Methods: Construction of the teaching system meets the different needs of students. Process: to establish an experimental teaching system that combines course teaching and scientific practice, so as to nurture students' basic skills and foster innovation and comprehensive capabilities in scientific practice; to use competitions to drive experimental teaching reforms, use independently developed online evaluation system to reform the traditional experimental teaching model; two laboratories have provided students with flexible experimental environments. Results: By conducting a questionnaire survey, students were found to be highly satisfied with the laboratories. Conclusion: The teaching platform actively promotes reforms in terms of experimental curriculum system, teaching content, teaching model and teaching methods, among others, and good results have been achieved.

Keywords: Computer science; Computer experiment teaching center; Multidisciplinary

1. Introduction

Undergraduate education is one of the most basic and most important works in long-term development of university education, while experimental teaching is an essential part of undergraduate education, especially some basic subject education. It is an important indicator to measure the quality of school education, an important process to cultivate the operational ability, practical ability and innovative spirit of students, an important means of training high-level innovative talents, and also an urgent demand for higher education under the new situation, so it plays an irreplaceable role (Miranda-Diaz C, Betancourt E, Ruiz-Candelaria Y., 2015; Jeong W K, Lee E H, Jung S E., 2015).

In order to better train undergraduate students' creativity and create conditions for talents to stand out, the Computer Experiment Teaching Center has conducted in-depth

explorations and practices in reforming the computer experimental teaching curriculum and improving its soft environment (Yaffe M J, Mittmann N, Lee P., 2015).



Figure 1 – Computer Experimental Teaching Center

2. Process

2.1. Construction of an Experimental Course Teaching System

Relying on the scientific research strengths of the School of Information to promote experimental teaching, the experimental teaching center established an experimental teaching system that combines course teaching and scientific research practice.

The experimental teaching center offers computer curriculum of different modules to school students in three levels, which are undergraduates majoring in arts, science, engineering, and medicine, undergraduates in School of Information Science and Technology, and undergraduates in Department of Computer Science and Technology of School of Information. The same audiences are taught in different classes and different levels. Students with a good foundation and strong apprehensiveness are taught in experimental classes, while the vast majority of students are taught in regular classes, and students having a poor foundation receive individual coaching in tutorial classes. For the teaching content at the same teaching level, the cultivating mode taken integrates basic training, integrated practice and innovative training (Mittmann N M, Stout N K, Lee P., 2015).

The experimental teaching center is mainly responsible for three levels of experimental curriculum. The first is Practice of Computer Basic Courses, the main required course for freshmen, including “Computer Basis for arts students” (first and second semesters), “Computing Generality B” for science students (first semester), “Data Structures and Algorithms B” for science students (second semester). The second is computer course software practice for undergraduates in the School of Information Science and Technology. The third is software practice of computer minor, double degree (Freixo, J., & Rocha, Á., 2014), school elective course, and public elective course of computer.

Therein, the experimental curriculum system construction of the School of Information Science and Technology matches with the curriculum system construction of the School of Information (Dehkordy S F, Hall K S, Roach A L., 2016).

There are four undergraduate majors in this school, which are computer science and technology, electronics, microelectronics and intelligent science (Li Y, Gong J, Song Y., 2015). On the one hand, students in each major have a narrow knowledge scope, which is not conducive to the needs of students to adapt to rapidly developing society; on the other hand, some of the courses are also set in different majors, which waste the teaching resources. After foundation in 2002, the school developed a new undergraduate teaching program, let four majors in the freshmen year to receive the same main basic courses, established the basic teaching platform courses of the School of Information, and on this basis built core courses for various majors. Besides, this program was revised twice in 2005 and 2007. A phased, multi-level modular teaching program that places an emphasis on foundation is put forward, and the curriculum is divided into three phases (freshmen, sophomore and higher grades). In addition to required public courses, the curriculum is divided into four levels: school public required courses, professional foundation required courses, professional core elective courses, and electives. In order to strengthen the foundation and weaken majors, the freshmen accept unified arrangements of foundation courses in mathematics, physics, computer and circuit, so that different majors can strengthen their hardware and software aspects (Arisa A A, Pi R M F., 2015).

To match with the curriculum system of the School of Information, the experimental teaching center adjusts its experiment teaching system and rationally allocates the laboratory and experimental facilities. Software practices of computer-related courses in all of the school majors are carried out in the software laboratory, which can on the one hand reduce the pressure of the original specialized laboratory, while on the other hand make full use of the equipment and management advantages of the software laboratory, integrate multidisciplinary curriculum experiment platform, realize resource sharing and improve equipment utilization, thereby effectively protecting the ordered computer experimental teaching for four majors (Arisa A A, Pi R M F., 2015; Navarro P., 2015). Part of the experiment courses related to computer in the experimental teaching center are shown in Table 1 below.

In the construction of experimental courses, we adopt a “three-based” construction mode. 1) Rely on the advanced teaching aids system to strengthen the basic programming skills of undergraduates; use the “100 practice” online evaluation system independently researched and developed by Peking University; implement the One-vote Negation System for Online examination in a series of courses like “Introduction to computing”, “Programming Design practice”, “Data structures and algorithms” “Algorithm Design and Analysis”, etc.; 2) base on the research team and build series of professional courses; the research team of diverse directions is responsible for building series courses related to the research directions, to synchronize the development of teaching content and subjects; 3) rely on research projects and train innovation and practical abilities of students. Undergraduates in the School of Information entered into the research group from the freshman year, 70% from the junior year and 90% from the senior year. Develop a unified corresponding undergraduate research internship management approach, and each institute has developed rules for the undergraduate research internship training

Course orientation	Course group	Course name
College platform	Program design basis	Computational introduction A
		Programming practice
		Data structure and algorithm A
		Data structure and algorithm B
		Data structure and algorithm
Professional basic course	Theoretical basis	Algorithm design and analysis
	Hardware foundation	Electronic circuit experiment A
		Digital logic design
		Microcomputer principle A
		Microcomputer principle B
		Computer organization and architecture / experiment
	Intelligent Foundation	Signal and system
		Artificial intelligence foundation
	Software base	Compiling practice
		Operating system practice
Professional course	Software engineering	Software engineering
		Introduction to object oriented technology
		Introduction to open source middleware technology
	Data management	Introduction to database
	Computer network	Computer network
		Web software technology
		Network and Web Technology
		Introduction to information security
	Computer architecture	Assembly language programming
	Computational intelligence and knowledge discovery	Intelligent information system experiment
		Introduction to machine learning
	Intelligent perception	Introduction to pattern recognition
		Biological information processing
		Digital signal processing
		Digital image processing
	Digital media and human computer interaction	Computer graphics
		Human computer interaction
		Digital media technology foundation
	Program design	Problem solving and program design
		Windows programming
		Linux programming
		Java programming
	Natural language processing	Statistical analysis of language
	Signal processing	Signal and system
	Circuit and system	Computer aided design of electronic circuits

Table 1 – Experimental Course of Computer Related Part of the Experimental Teaching Center

program (Adam M, Young-Wolff K C, Konar E., 2015). The specific operation methods and means of implementation include:

2.2. Basic Skills Training

Use the program to design the basic curriculum and strengthen basic programming capabilities; both system software and hardware courses focus on theory and practice. With reference to training basic skills of programming, “Introduction to computing”, “Programming Design practice”, “Data structures and algorithms” “Algorithm Design and Analysis” are constructed as a basic skills training platform, and a set of phrased multi-level problem sets regarding computer practices are compiled (Garcia D, Harvey B, Barnes T., 2015).

In regard to hardware basic capability training, “Digital Logic”, “Principles of Microcomputer”, “Computer Organization and Architecture”, “Computer Network” are constructed as a basic skills training platform, and a well-structured teaching system is built with gradual connection and transition, and forefront depth and breadth that can match international research. Theory and practice courses are separated to strengthen culturing students’ practical ability, comprehensive ability, and creativity. As the system software theory and practice are attached with equal importance, theory and practice courses of “Fundamentals of Compiling”, “Compiling Practice”, “Operating System” and “Operating System Practice” are separated. In the practice part, the MIT experimental curriculum module is adopted. As per the way that student teams respectively finish big practice projects, improve students’ ability to understand and practical applications of theories, and develop their cooperation skills and creativity in the project.

2.3. Foster Innovation and Comprehensive Capabilities in Scientific Research Practice

Establish a set of undergraduate scientific research practice systems. Undergraduates fully participate in research practice, and scientific research practice and undergraduate course training are listed as two components of undergraduate training. Some freshmen and sophomores with a good foundation are selected to enter into project groups through scholarships, “the Ministry of Education Science Research Practice Plan”, and teachers’ self-financing. In the junior year, each institute and laboratory is institutionalized to enroll undergraduate students for practice, including the organization of registration, assessment, admission, basic training, regulatory framework training, cutting-edge presentations, discussions with students to determine topics, and the training mode similar to graduate cultivation. In the senior year, all students who do not engage in lab practice can enter the laboratory to complete their undergraduate thesis through two-way selection (Malytska I D., 2015).

2.4. Teaching Features of the Experimental Teaching Center

While insisting on the experimental teaching system that combines course teaching and scientific research, the experimental teaching center takes advantage of competitions to drive experimental teaching reforms, and uses independently developed online evaluation system to reform the traditional experimental teaching model. Since 2010, the experimental teaching center has held a programming contest and team qualification

trials facing students all over the university every year, which provides students with a platform to exhibit their programming level and ability and improve their learning enthusiasm. Organize a school team to participate in national programming contest and train a group of outstanding computer talents. When training the team, accumulate a large number of excellent exam questions, which are from outstanding teachers from around the world for many years. The questions are interesting and contain knowledge, covering most of the contents of computer professional foundation courses, and reflecting width and depth. We appropriately select these questions and blend them in normal course teaching such as “Computing Introduction”, “Programming practice”, “Data Structures and Algorithms”, “Algorithm Analysis and Design”, and good teaching effects have been achieved (XU L, TONG L., 2015).

2.5. Management Features of the Experimental Teaching Center

In the six experimental laboratories of the experimental teaching center, each laboratory can be opened in a fixed time period, multiple time periods and all time periods as per the experimental teaching needs, and can make appropriate deployment. The large basic laboratory is open to all students; the software laboratory faces students in the School of Information; two laboratories have their own characteristics in the management methods, and both adhere to the principles of technology and management independent innovation.

The large basic laboratory has over 600 microcomputers in eight rooms. “Computer Basis for arts students” (first and second semesters), “Computing Generality” and “Data Structures and Algorithms B” for science students, and “College English” courses are taken by the lab. When constructing a networking, first-class laboratory environment, the large basic laboratory is people-oriented, innovative and gives full play to the comprehensive technical advantages over the years in regard to hardware and software, network, etc. The Center has pioneered the development of three versions of computer laboratory management systems, which are LAN account billing management system based on Windows NT; cross-segment account billing management system based on Windows NT and cross-segment account billing management system based on Windows 2000. They have achieved cross-segment, cross-domain, multi-room centralized and secure integrated efficient management, while at the same time realizing room no-card account billing management, one account multifunction (large-scale basic laboratory computer practice, schools gateway, sending and receiving Email), no-card (room entry/exit card, protection writing card), no bottlenecks, no time/no room/no dormitory restrictions, easy to use and convenient. The overall layout of large-scale basic laboratory machine room and self-designed terminal desk technology enable wireless connection on desktop and ground without anti-static floor, which have not only saved money but also facilitated use, maintenance and repair, and sanitation cleaning (Stafford N., 2015).

The software laboratory assumes full responsibility for software practice course of students in the School of Information and provides a flexible experiment environment. The software laboratory uses self-developed “Computer Open Laboratory Machine-Hour Management System” for automated management, and is comprehensively open from 9:00 a.m. to 22:00 p.m. Users at any time in the opening hours can have free access to any machine in any room of the laboratory, and can exit the system at any time. If there are not enough machines, the machine-hour can be increased at any time

in the opening hours of the laboratory. Users can use all resources in the laboratory on board and on the LAN, and backup information needed through their own proprietary account. If users have doubts about their machine-hour using, they can apply to print a machine-hour using list. Software laboratory staff can remotely shut down any computer at any time within the laboratory. Also, they can control whether the laboratory machine is connected to the external network through software, thus providing teachers with a flexible teaching environment. As for course arrangement, in addition to free computer practice, the software laboratory provides the computer platform course of the School of Information with fixed time periods, fixed seats (account number are bonded to seats) to fully guarantee that the students in this school can lay a solid foundation of programming. It helps teacher assistants to learn students' condition and prevent student from not participating in the experiment course. For computer professional courses, mainly high-grade students enroll, so there is a relatively small number of students who are mainly concentrated on free computer practice. Meanwhile, they can fix the experimental teaching time according to teacher requirements. In addition, the software laboratory also uses a small machine room to open local administrator rights within a fixed period of time in a number of characteristic small classes, which facilitates students' computer practice while at the same time delivering more services in a limited space.

3. Questionnaire Results

A questionnaire survey was conducted among 40 students who studied the course, concerning questions like whether the experimental teaching center could satisfy their learning, scientific research and other requirements. The specific results are as follows (Table 2):

Degree of satisfaction	Student number
Very satisfied	28
Satisfied	9
General	3
Dissatisfied	0

Table 2 – The Students' Satisfaction Degree in the experimental Teaching Center

The questionnaire results indicate that students have a high satisfaction level with the course arrangement, which will help the experimental teaching center to further arrange work.

4. Conclusion

Experimental teaching is both a means to impart knowledge and a process to unity knowing and doing from theory to practice, and to develop qualities and abilities. In order to nurture students from knowledge learners into knowledge creators, computer experimental teaching aims not only to help students understand and master knowledge taught in class and from books, but also to undertake the vital responsibilities to impart scientific research methods and skills, cultivate scientific spirit, scientific style

and scientific experiment habits. Based on the above understandings and the reform policies of “strengthening the foundation, weakening the major, educating students in accordance with their aptitude, and tributary cultivation”, the experimental teaching center proposes the experimental teaching reform guiding ideologies of “integration, multi-level, open, emphasis on the foundation, and innovation,” takes “Students’ Ability and Quality Training” as a core pursuit, actively promotes reforms in terms of experiment course system, teaching content, teaching models and teaching methods and so on, and good results have been achieved.

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Study on System Construction of Wisdom Education Platform Combining Cloud Technology

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Abstract: Wisdom Education is leading the national education information development direction and has become the main theme of education development in the era when technologies revolutionizes education. The Wisdom Education Cloud Platform is the key to driving national or regional education information to leap forward. Construction of the Wisdom Education Cloud Platform is based on deep integration of data resources related to a large number of teaching activities. The data resources feature large amounts of storage, diversification of file types, and frequent reading by extensive users. The common cloud storage system in the market cannot meet the data storage needs of the Wisdom Education Cloud Platform. Aiming at Wisdom Education, this paper builds a cloud storage system grounded upon computer resource public utility. The system uses 30 sets of data storage servers that run the 64-bit Windows Server 2008 R2 operating system, thus realizing storage and management of text, images, audio and video data resources regarding Wisdom Education, and supporting users to take advantage of private data resources to quickly build the Wisdom Education Cloud Platform. The system has reduced the building cost of the Wisdom Education Cloud Platform, and its high-quality data storage services have not only met the massive data storage needs of the Wisdom Education Cloud Platform, but also stimulated the Platform's post-storage needs and ensured that the Platform platforms efficiently.

Keywords: Wisdom education; Cloud storage; Data model; Virtual system.

1. Introduction

Wisdom Education is a brand new cloud service model. It uses cloud computing, big data, virtualization, augmented reality and other technologies to establish a unified smart open cloud computing platform (Nagesh V S., 2016). The platform deeply integrates a variety of education-related data resources and applications, provides free or paid services to users as required and helps users complete such teaching activities as releasing educational information, accessing teaching resources, carrying out teaching interaction, summarizing data on education, making scientific decisions, executing educational evaluations and conducting collaborative research. Wisdom Education can effectively address existing problems in the current education system, like information isolated island and solidified teaching system. Construction of the Wisdom Education

Cloud Platform is based on storage and management of data resources related to a large number of teaching activities (Wilhelm M., 2015). Although the number of cloud storage service providers in the market are rising, there are a limited number of data resources supported by most cloud storage platforms, and a minority of cloud storage platforms that target at developers fail to optimize storage of data resources concerning Wisdom Education (Liu S H, Lu Y J, Deng C P., 2015). Therefore, as per the storage characteristics of data resources in relation to Wisdom Education, great commercial prospects are offered by building a cloud storage system dedicated for Wisdom Education in order to efficiently store underlying data resources of Wisdom Education.

2. Research Status of Wisdom Education

In terms of Wisdom Education theories, domestic scholars make interpretations from different perspectives and build a basic pattern to understand Wisdom Education (Abreu, A., Rocha, Á., Cota, M. P., & Carvalho, J. V., 2015). Asian Education Network has developed the Wisdom Education Cloud Platform that supports the integration of three networks among the telecom, cable, and Internet sectors. The platform is based on public server clusters and provides three layers of services encompassing Iaas, Paas and Saas to meet the needs for resource openness and sharing in the education sector while at the same time supporting cross-platforms access of mobile phones, computers and television (Giamminuti S, Tye M, Buckley A., 2015). At present, international research on Wisdom Education is mainly centered on Korean scholars. In addition, the system development of Wisdom Education has also made some progress. Some foreign companies (such as IBM, Oracle, Amazon, etc.) have made Wisdom Education solutions. Overall, these studies have played foundation roles in popularizing Wisdom Education philosophy and promoting construction of the Wisdom Education Cloud Platform (Mabey C, Egri C P, Parry K., 2015). However, the current development of Wisdom Education in China has drawbacks as low utilization of hardware and software, great difficulty to integrate all levels of application systems, scarce original and innovative high-quality resources; short of network teaching innovation and poor office automation management (Mabey C, Egri C P, Parry K., 2015). The continuous innovation of information technology has a revolutionary impact on education development; in recent years, people are increasingly concerned about the construction of our education information application systems. Our education information technology development at the provincial level is shown in the following table:

3. Wisdom Education and Its Technologies

3.1. Wisdom Education

Wisdom education is a brand new service model based on the existing cloud computing technology. Its main features include intelligent service scene recognition and can intelligently recognize service scenes like users' terminal equipment, user mode, environment information, basic needs, and use disorders, among others. (Trank C Q., 2015) By a large number of built-in data models, the Wisdom Education Cloud Platform is able to simulate and extract educational information involved in users' participation in

Province Present situation	Annual target of Educational Informationization								
	Broadband network (Reach the required ratio)			Quality resources (Reach the required ratio)			Network learning space (Reach the required ratio)		
	2013	2014	2015	2013	2014	2015	2013	2014	2015
Hubei	60%	85%	100%	60%	70%	100%	30%	60%	80%
Hunan	50%	70%	100%	45%	60%	90%	45%	65%	90%
Guangdong	100%	-	100%	20%	60%	80%	20%	40%	80%
Guangxi	40%	60%	-	50%	70%	80%	25%	-	80%
Hainan	50%	80%	100%	55%	60%	-	35%	-	90%
Chongqing	60%	90%	100%	40%	70%	85%	40%	50%	90%
Sichuan	80%	100%	100%	60%	75%	85%	35%	60%	90%
Guizhou	50%	80%	-	10%	60%	80%	45%	70%	85%
Yunnan	50%	70%	100%	30%	60%	75%	50%	60%	90%
Xizang	30%	100%	100%	30%	65%	80%	40%	65%	90%

Table 1 – Development of Education Information in Various Provinces

educational activities, status information, and education activity information, continue to improve the data models and deliver better education services (Garber Z., 2015).

3.2.Cloud Computing

Cloud computing is a business model. It distributes computing tasks through multiple servers, so as to achieve the time-sharing of computing resources and storage resources (Liu S H, Lu Y J, Deng C P., 2015). Cloud computing is in fact to further develop and expand grid computing, distributed processing and parallel processing. It is the mutually coordinated process that runs on a virtual network service equipment group. By obtaining support of the Internet, distributed computer and network equipment can efficiently complete computing tasks (Salcido R., 2016).

3.3.Cloud Storage Concept and Architecture Hierarchy

Cloud storage is a cloud computing system with the core businesses of data storage and management, with the purpose of reducing input costs of users to store data resources. Cloud storage architecture hierarchy structure is as follows:

4. Wisdom Education System

4.1. Logical Architecture Model

Logical architecture model that builds data storage is as follows: (Liu S H, Lu Y J, Deng C P., 2015)

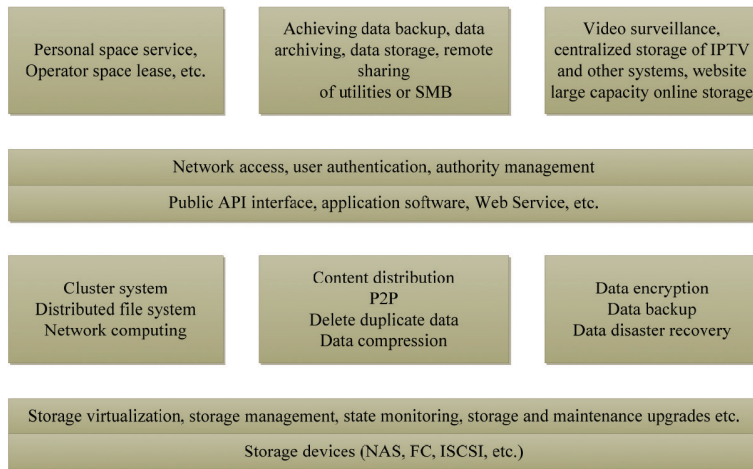


Figure 1 – Cloud Storage Hierarchy

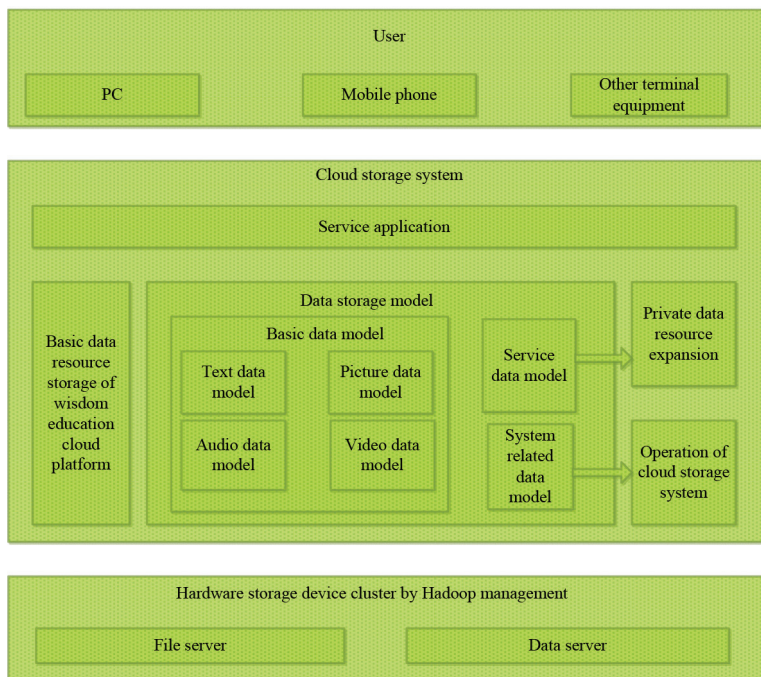


Figure 2 – Logical Architecture of Data Storage

4.2. Physical Architecture Model

Physical architecture model of the cloud storage system is as follows (see figure 3) (Hamilton-Ekeke J T, Dorgu E T., 2015).

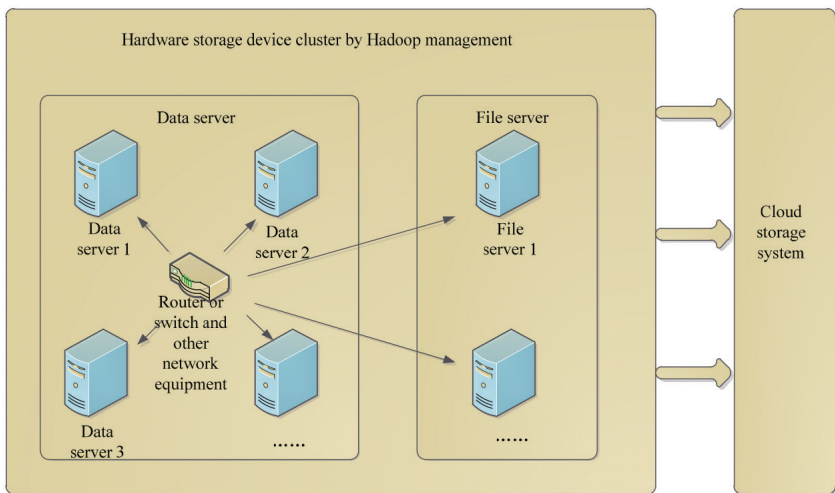


Figure 3 – The Physical Architecture of Data Storage

5. Construction of the Data Model

5.1. Establishment of the Basic Data Model

The cloud storage system that targets at Wisdom Education builds a basic data model in accordance with the attribute characteristics of Wisdom Educational underlying data resources (see figure 4) (Ayal D Y, Desta S, Gebru G., 2015)

	BaseInfo	Document ExtendInfo	Picture ExtendInfo	Audio ExtendInfo	Video ExtendInfo
FileID	Size; Content; Summary; Author; CreateDate; UpdateDate	Title; Font; FontColor; WordCount; PageCount; RowCount; Column Count; Picture Count	Pixel; Special Effect; Alpha; IsCompress; Compress Rate; StyleLabel	Audio Coding; BitRate; Sound Channel; Duration; Sampling Rate ; Mp3 Version; ApeVersion; OggVersion	Video Coding; 3DEffect; Synchroniz ation; Audio Track Count; Chroma ; Duration; Language; ActorList; Legal Notice

Figure 4 – Foundation Date Model

5.2. Establishment of User Data Model

In this paper, the cloud storage system users consist of general users and system administrator (Richardson R., 2015). Details of the user data model are as follows (see figure 5).

	BaseInfo	AddressInfo	BankInfo	ConsumeRecord Info
UserID	PassWD; Name; Age; Sex; Tel Number; Registration Time; Authority Type; Identity Card Number	Country; City; County; StreetName; HouseName; HouseNumber; Zip	BankName; BankCard Number; Account Name	TotalAmount; MaxSingle Consume; MinSingle Consume; FirstDate; LastDate

Figure5 – User Data Model

5.3. Establishment of User Authority Data Model

Details of the Wisdom Education cloud storage system user authority data model are as follows (see figure 6).

	SpaceAuthority	AccountAuthority	ServiceAuthority
AuthorityID	TotalSpaceSize; UsedSpaceSize; FreeSpaceSize; MaxSpaceSize; MinSpaceSize	AccountIDList; AccountCount	ServiceList; ServiceCount

Figure 6 – User Authority Data Model

5.4. Establishment of the virtual file system data model

Details of the Wisdom Education cloud storage system virtual file system data model are as follows (see figure 7).

SpaceID	ResourceInfo	FileInfo
	DocumentSize; PictureSize; AudioSize; VideoSize; DocumentCount; PictureCount; AudioCount; VideoCount	FatherDocumentName; FileType; FileName

Figure 7 –Virtual File System Data Model

5.5. Establishment of Wisdom Education Service Data Model

Details of the Wisdom Education Cloud Platform service data model are as follows (see figure 8) (Che Rodi R, Musa H., 2014)

ServiceID	BaseInfo	ServiceInfo	ResourceInfo
	Type; CreateDate; UpdateDate; Islocked; IsAnonymous	Title; Topic; Writer; Principal; ContentCount; Reward; TargetUser	FileName; FileType; FileCount

Figure 8 – Service Date Model

6. Overall Design of Cloud Storage System

6.1. System Architecture Hierarchy

Architecture hierarchy of the cloud storage system is shown below (see figure 9).

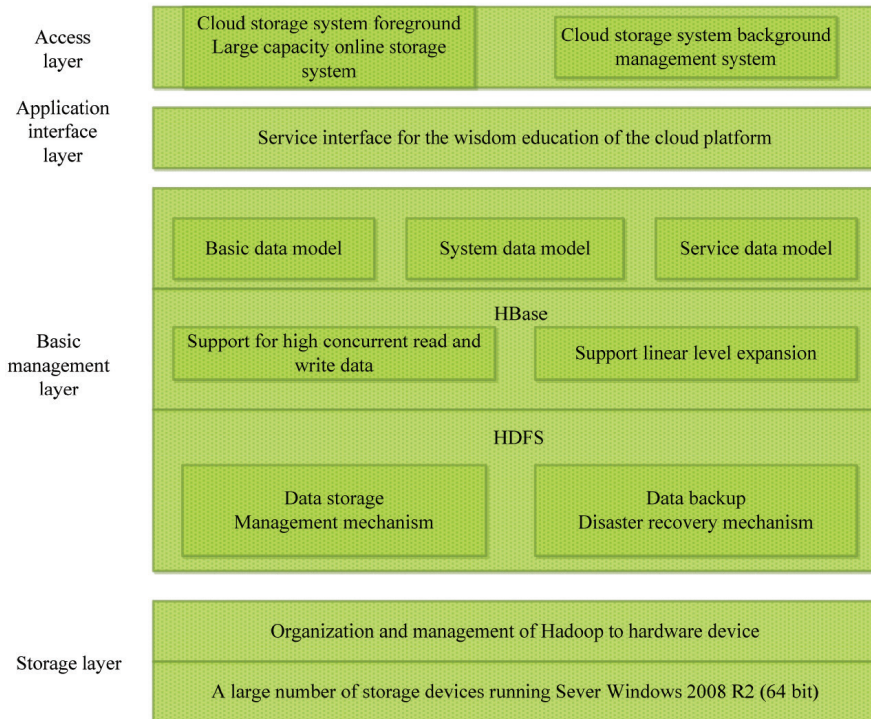


Figure 9 – System Architecture Diagram

6.2. Physical Architecture Design

Physical architecture design of the cloud storage system is shown below (see figure 10).

6.3. Main Functional Design of the Front

The core functional modules of private storage space operation of front high-capacity online storage system are as follows (see figure 11) (Kumar A, Mitra M, Adhikari B S., 2015).

6.4. Expansion of Data Resources

The service expansion module of the front high-capacity online storage system is shown below (see figure 12).

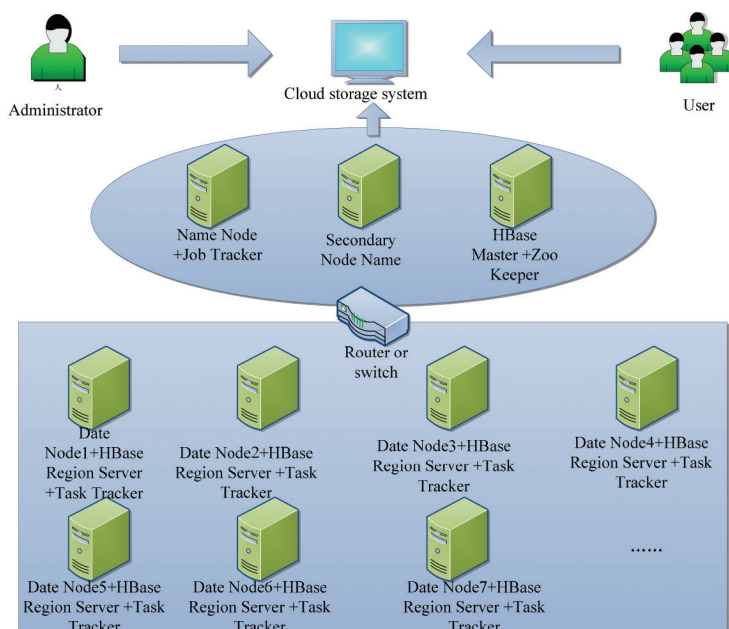


Figure 10 – Physical Architecture Diagram

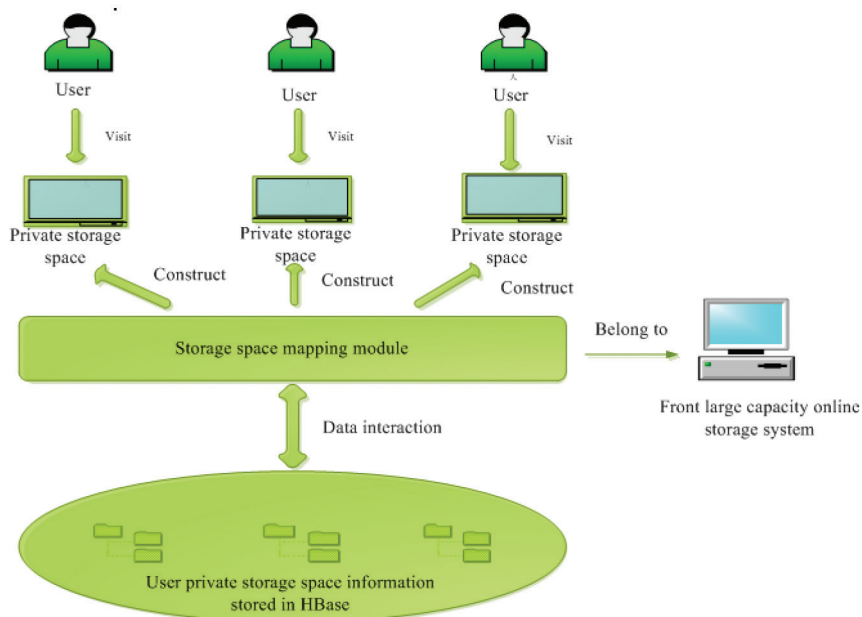


Figure 11 – Storage Space Mapping Model

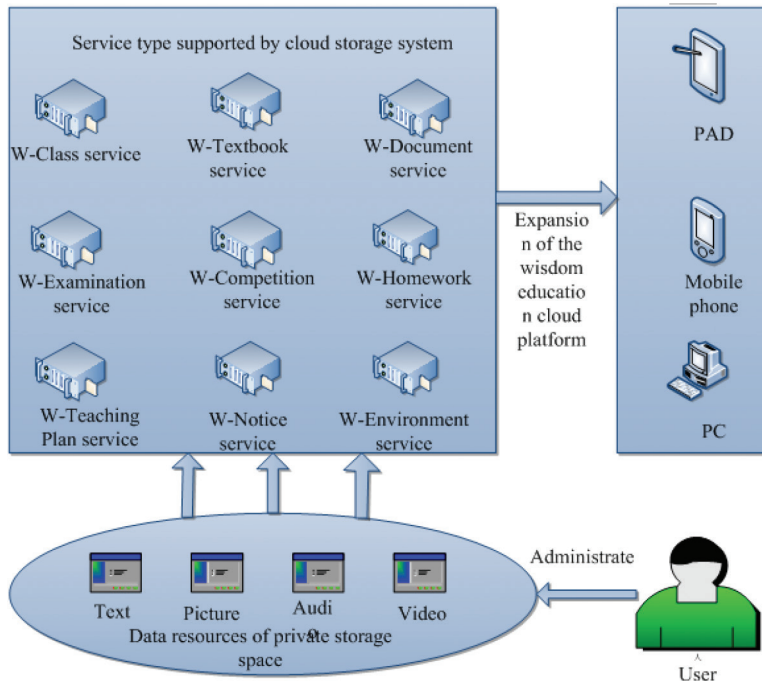


Figure 12 – Service Expand Model

7. Design of System Back-stage

7.1. Information Resources Management

The resource management architecture model of the back-stage management system is as follows (see figure 13) (Muzakki M, Fauziah P Y., 2015).

After storing data in the test environment, the data statistics interface renderings of the back-stage management system are as follows (see figure 14).

7.2. Front Support

The support functions of back-stage management system to front system are as follows (see figure 15) (Carless D, Douglas K., 2015, Watagodakumbura C., 2015).

7.3. Performance Testing

By testing part of the Wisdom Education Cloud Platform in the big data environment, respectively use 1-15 terminals to log in platforms for wisdom learning and wisdom teaching. Each terminal reads 600M teaching resources and learning resources from the server, and makes comparisons with the traditional pattern. The results are shown in Figure 16.

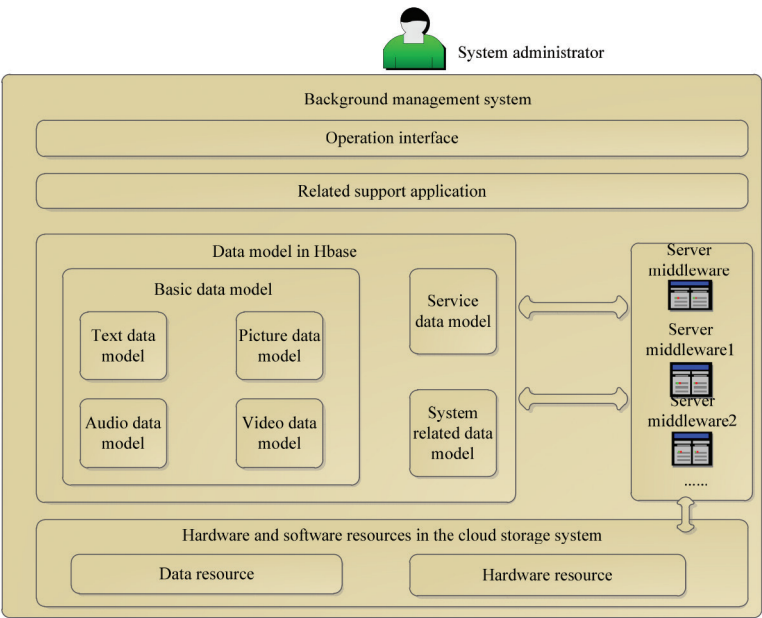


Figure 13 – Framework Model Of Resource Management

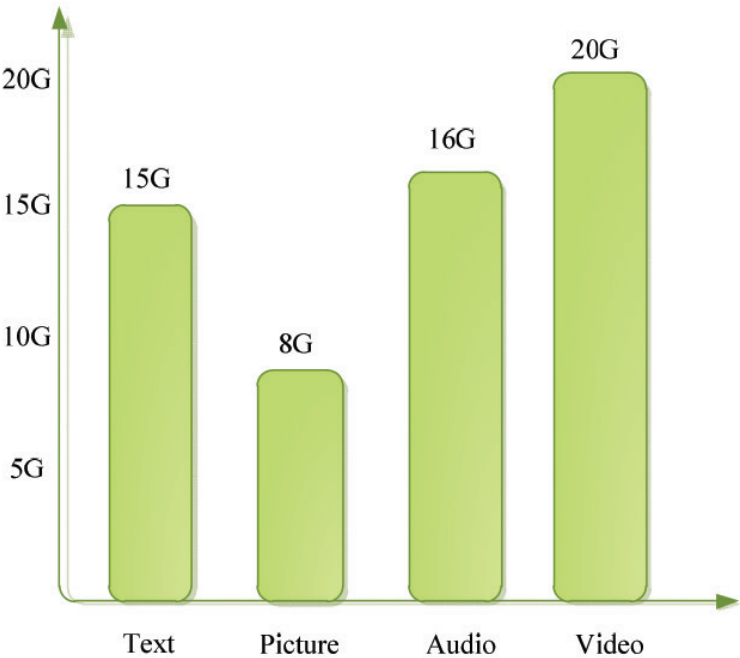


Figure 14 – Results of Data Statistics

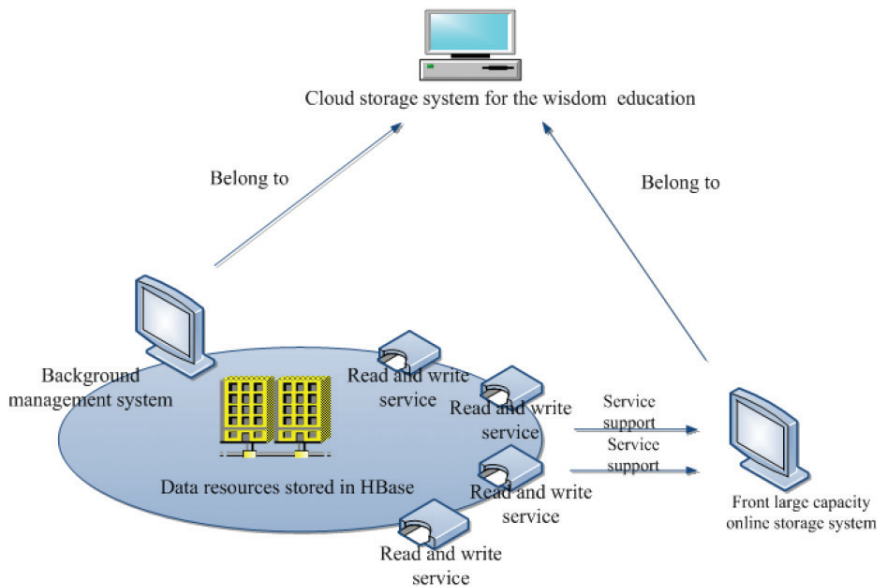


Figure 15 – Front Support Model

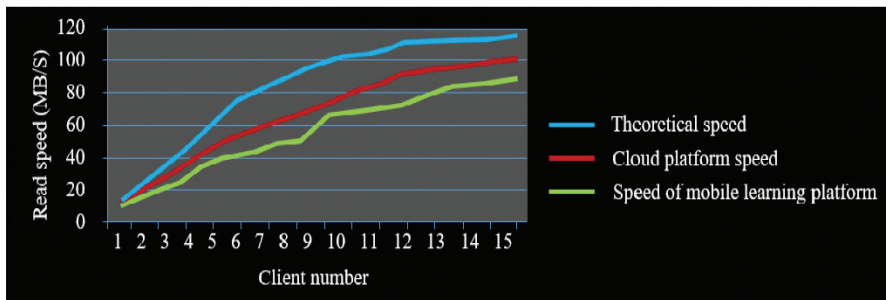


Figure 16 – Test Results of Two Different Modes

8. Conclusion

Under the support of cloud computing and the Internet of Things, new educational technological forms such as virtualization, intelligence, and the Internet of things have occurred, which both provides a new solution for intelligent education and digital campus and points out a new direction for modern educational technologies. Aiming at Wisdom Education, this paper builds a cloud storage system grounded upon computer resource public utility. A mass of data resources related to Wisdom Education can be efficiently organized and stored in the cloud storage system proposed in this paper, and users can quickly build the Wisdom Education Cloud Platform. This system will run a mass of distributed storage devices of the 64-bit Windows Server 2008 R2 operating system

and organize it into a scalable internal storage network. Hadoop's internal transparent data management mechanism is employed to protect the security and reliability of data resources within a cluster. Inside the system a scalable data model is established to realize high-efficient organization and storage of text, images, audio and video data resources regarding Wisdom Education. Further, the cloud storage system supports users to bind private data resources into the built-in service data model and reading of the service data model is published as a service through the network, to achieve an open data storage platform. Builders of the Wisdom Education Cloud Platform have shielded complexity of massive storage device management and reduced the building cost of the Wisdom Education Cloud Platform, so that users do not have to consider about the type, interfaces, transmission protocols, capacity and other information of the storage device. They can acquire high-quality data storage services only by connecting the terminal equipment to the network, thus realizing high-efficient storage and management of extensive data resources regarding Wisdom Education. The main purpose of this cloud storage system is to store data resources in relation to Wisdom Education and supplement the building of the Wisdom Education Cloud Platform, but with its quality data storage services it can also support a majority of network applications that have data storage needs.

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Research on Improving the Accuracy of Big Data Retrieval Service

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Abstract: Objective: In order to carry out the research on improving the accuracy of big data retrieval service, two kinds of large data retrieval service were introduced. Methods: Theoretical analysis and simulation analysis. Process: A kind of large data retrieval service was introduced and its characteristics were analysed. Then its effective search service was improved in order to improve the accuracy of the search. When the query request arrived, the analysis of the user's query intention is analyzed, which provides the key words for the user to choose. After the determine, the final use of keywords, the words were segmented and key words and auxiliary words were extracted. Finally, the simulation test was carried out. Result& Analysis: Simulation results show that the improved method can improve the matching probability the accuracy of the search. Result: The proposed big data retrieval service has a good search accuracy and is worth promoting.

Keywords: Big data retrieval service; accuracy

1. Introduction

IBM research shows that only in the past two years, human beings have created 90% of the world's data; IDC research shows that the next ten years of data storage will grow 50 times (Bagnoli V., 2015). With the advent of the era of big data (McAfee A, Brynjolfsson E, Davenport T H, et al., 2012), to better deal with the big data, many researchers have improved the computing efficiency of big data by cloud computing technology to achieve the parallel processing of big data, from different angles to improve the processing capacity of big data, the main Google parallel programming frame MapReduce (Majhi S K, Shial G. (2015) Google, Haloop (Jacobs A., 2009) and Twister (Howe D, Costanzo M, Fey P, et al., 2008) improved iterative computing, Clustera, and Dryad(Provost F, Fawcett T., 2013), Spark, Pregel (Boyd D, Crawford K., 2012), etc.

Although there have been many new technologies or methods for big data processing, but how to remove the big data from the PB level to meet the needs of users to query a record or a suitable web page, still need to spend a lot of time, which is still a huge challenge for interactive query, especially real-time query. Although there have been a variety of search methods, but it is still difficult to meet the needs of big data search. Especially to QS (Pais J, Ray D M., 2015) for the problem of low efficiency of big data

query, the sharing will history query results to match, if can realize matching, part of a diachronic query results as a new query request results directly to the matching part of the, reducing the large number of of history query repeated computation. In this paper, based on this method, the paper analyzes the user's query request intention and provides the key words to the user's choice (Runa, A. I. D. N. F., & Miranda, G. L., 2015). The topic words and historical queries are classified and matched, and the results of the query results and the new dates are combined. If there are auxiliary words, then the historical results as intermediate results set, on this basis to continue to query. If there is no auxiliary word, directly will be combined as a result of the query. Improved search method can save the search time and improve the query efficiency.

2. The Original Big Data Search

2.1 The Original Big Data Search Framework (Pais J, Ray D M., 2015)

Figure 1 shows a basic framework for big data search. The framework is based on a new query request from the user. To determine whether there is a historical record for the query or part of the query. If it does, it can share the results of historical queries, to reduce the time consumed by all queries for the collection of big data.

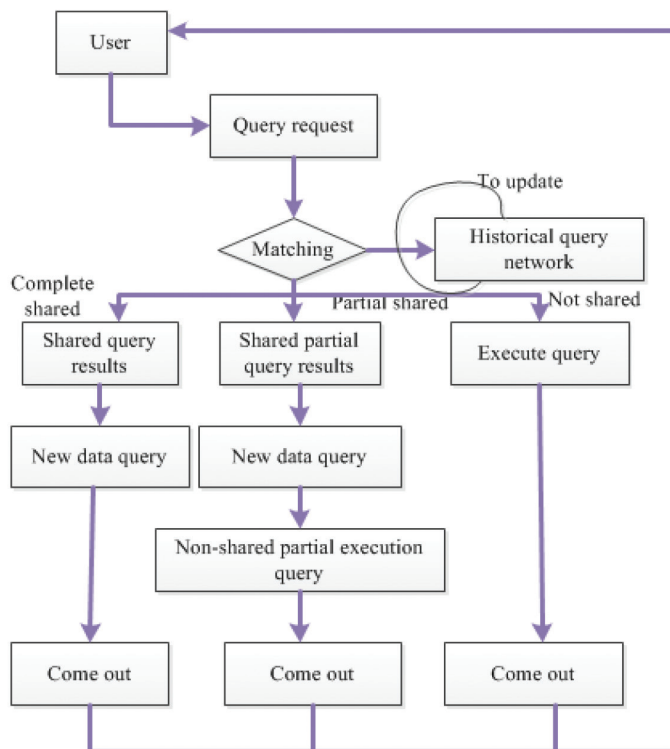


Figure 1 – The Original Big Data Search Framework

The framework consists of the following parts:

Step 1 the user first proposed the query request.

Step 2 to match the query request from the user and the historical query network. There are 3 cases in the matching:

- a. fully shared. If it is fully shared, it indicates that the query request of the new user has also occurred before, so that the query results obtained by the same query can be directly used by the query. The following process is required:
 1. shared history query results.
 2. because the historical query is a query to the data of a certain period of time, it is possible to have a new data record in the history.
 3. the results for the 3 and 2 are combined to get the final result for the user.
- b. partial sharing. If it is shared, it indicates that the new query request of the user has occurred before, so that the query results obtained by the same query results can be directly used by the query. The following process is required:
 1. shared historical query results for the same query results.
 2. because the historical query is a query to the data of a certain period of time, it is possible to have a new data record in the history.
 3. 1) and 2) just get the shared results of the same part of the query, the query is not the same as the query, and the corresponding results are obtained.
 4. to merge the results of the results of 4, 2, and 3, to get the final result for the user.
- c. not shared. If it is totally non - shared, it indicates that a new query request from the user is not shared by any historical query, and needs to be re executed. The following process is required:
 1. execute all of the queries and get the corresponding results.
 2. the results obtained are the final results for the user.

2.2. The Original Big Data Query Implementation Method

Assuming a cloud database table is used to store all of the micro blog records (Big-Table, Hbase, or other cloud database). In January, there were 70 million users on the top of the record; in February, there were 120 million records of users in the top one hundred million. In March, there were 80 million records of users in it. In April, the users posted 30 million records.

If there is a user need to query the site this year, the site contains a “bike” of all the records, but also the history of the same people have had the same query, but the query is in April this year, including the “bike” all the records. As a result of the new micro blog record in, so we can only share the history of the time to query all the historical records of the back of the new data need to re query.

An important feature of the cloud database is that when a new record comes in, all the records are added to the way, so all the new micro blog records will be added in the back of the time sequence, not like a relational database, the data may be inserted into the

historical data in front or in the middle. This provides the convenience for the acquisition of the record, that is, only to find the last record of the historical query can be, the new increase in the part of the micro blog recorded in accordance with the order of the additional in the back of it. Therefore, it can be easy to get a new increase in the number of records that is April to today, there are users in the above 30000000 records released.

Before assuming the three months all 270 million (microblogging records containing “bicycle” microblogging records a number of 50 thousand, then from the three months to record all 270 million microblogging search contains “bicycle” microblogging records for 50 thousand all the time can be saved, only need from April to today have posted by users in the above 30 million records find meet containing “bicycle” microblogging record number (assuming 8500 records), thereby greatly reducing the search range and can share a history of previous query results. Finally, the conditions of the 58500 meet the conditions of the record of the final feedback to the user.

2.3. The Characteristics of the Original Big Data Frame

This big data search method for large data query efficiency is low, and put forward an effective search method. Our main design idea is to share the historical query results as intermediate results set, in the new query request to arrive, the first and the historical query to match, if it can achieve matching, the matching part of the historical results as a result of the new query. This reduces the number of repeated calculation of the historical query, save the search time, improve the query efficiency.

3. Modified Big Data Frame

The framework is based on a new query request from the user to analyze the user’s query request intention, to provide users with the choice to determine the end use of keywords to the user after the word segmentation, extraction of subject words and auxiliary word. And then according to the key words in the theme of the word to determine whether there is a historical record for the query or part of the query, if there is a result of historical queries can be shared in order to reduce the time consumed for the collection of big data.

This framework mainly consists of the following parts:

- a. the user requests.
- b. to analyze the query intent of the query request, provide the query keywords for the user to choose, and get the final query keywords. To extract keywords and auxiliary words.
- c. to match the query subject words and historical query network, and the following three cases are appeared:
 1. complete matching. If it is perfectly matched, it indicates that the new query request is subject to the topic word, and the topic words have been used before, so that the query results obtained by previous queries can be directly used by the query. At the same time, due to historical queries only for a certain period of time before the data query, there may be a new data record in the history, so the new data is still required to perform the query and get a new query results. The historical results and the new query results are merged to get the final result of the user.

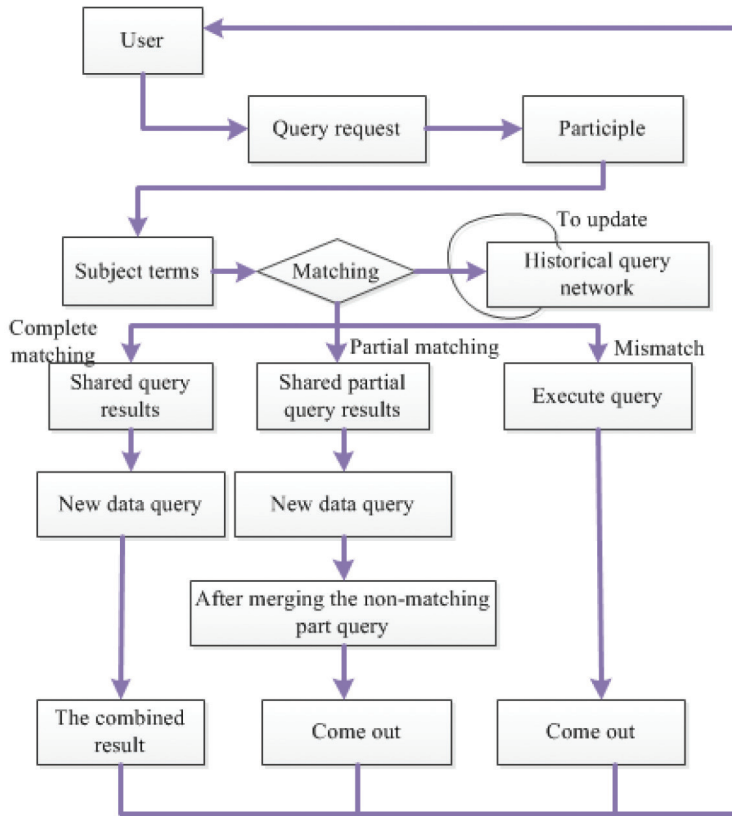


Figure 2 – Modified Big Data Query Framework

2. partial matching. If it is a part of the matching, the key words of the user's query request are extracted from the key words. The topic words have been used before, so that the query results obtained by the same query can be directly obtained.

This query is used, you can share the same query results of the same query results. At the same time, due to historical queries only for a certain period of time before the data query, there may be a new data record in the history, so the new data is still need to perform the query to get a new query results. The historical results and the new query results are merged to obtain the results of the query matching section. Then, in the result of the query matching part, continue to perform the auxiliary word query, get the final result of the user.

3. does not match. If you do not match, it indicates that the user's query request is not shared with any historical query records, and all the queries need to be executed.

- d. feedback to the user by the results of the user's query.
- e. implementation of the update of historical inquiry network.

4. Key Techniques for Searching Big Data After Modification

This chapter mainly introduces the key techniques of query, query keywords and the matching technology, the new data query method and the update method.

4.1. The Method of Extracting Key Words According to the Query Intention

User query requests are essentially a series of independent short texts. After the system receives the user's query, the query intent of the query is analyzed, and the key words are provided to the user. And then the key words (Sabareesan M, Raj A D, Leena C, et al., 2015) are obtained. After word segmentation, a word vector is obtained, each of which has a part of speech tagging, such as a noun, verb, adjective, word, etc.. Different parts of speech of words to express the theme with varying degrees, of which the theme expression and identification of the role of the largest verbs and nouns, so in the word frequency statistics can focus on the part of speech and other parts of speech of words can ignore the user queries to extract the main inscription and auxiliary word.

Chinese word segmentation has a variety of algorithms and tools. The existing segmentation algorithms can be divided into the segmentation method based on string matching. Three categories based on understanding of the word segmentation and statistical based segmentation method. Commonly used Fu-danNLP, SCWS, Ik, etc..

4.2. New Query Requests And Historical Query Network Matching

The following diagram is a schematic diagram of the new query request and historical one.

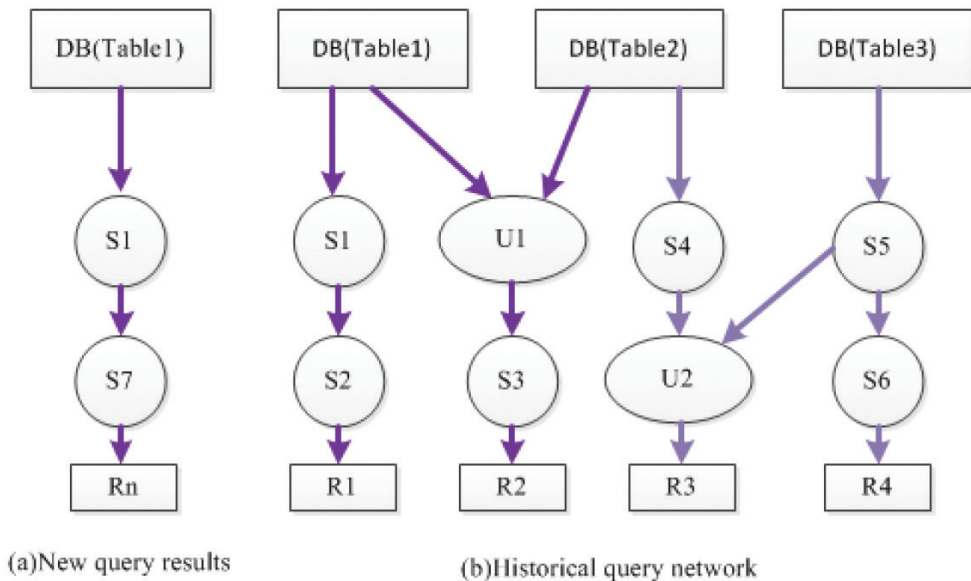


Figure 3 – A New Query Request and Historical Query Network Matching

Big data applications generally use the cloud database to store data records, such as Google's BigTable, Hbase's Apache cloud database, etc.

S1, S2, S3, S4, S5, S6, U1 and U2 are all the query conditions in the historical query network. At the same time, the historical query network in the corresponding query terms of nodes S1, S2, S3, S4, S5, S6, U1 and U2 to save all of the historical records. Which is S1, S2, S3, S4, S5, S6 as a single query results node, U1 and R1 as the joint query results nodes, U2, R2, R3, R4 and R5 as the final results of the query node. In Figure 3 (a), the query request is extracted from the S1, the auxiliary word is S7, which belongs to the matching result. The theme of the word S1 in the history of the query network to find the matching results. It can be concluded that the query node of S1 can share the results of historical query data. If there is a new data record in the history, the new data will be executed. The historical results and the new query results are merged to obtain the results of the query matching section. Then the query results of the auxiliary word S7 are continued in the result of the query matching part, and the results of Rn are obtained. The query uses the collection of historical query results to reduce the query time and improve the accuracy of the query.

4.3. New Data Query Implementation Method

Assuming a cloud database table is used to store all of the records. An important feature of the cloud database is that when a new record comes in, all of the records are added in an additional way, so all the new records will be added in the back of the time sequence. This can be easily obtained by the additional records, only to find the last record of the history of the query. Therefore, it is easy to get a new increase in the number of records.

If there is a user need to query a site this year's Micro blog records contain the "car" of all the records, but also in the history of the people have had the same query, but the query is in July this year, including the "car" all the records.

As a result of continuous new micro blog record is added, it can only be shared in the history of all historical records, and in July after the new data need to be re inquiry.

Hypothesis before 7 months all the hundreds of millions of microblogging record contains "car" microblogging record number is 9 million, so before 7 months all the hundreds of millions of microblogging records in search contains "car" microblogging record number for 9 million all the time can be saved, only need to search from. In today, the user in the above release tens of millions of records to find meet contain "automobile" microblogging record number can. Assuming the condition of the 30000 records, this greatly reduces the scope of the search, you can share the previous historical query results. Finally, the 90000 records of the conditions of the final feedback to the user.

To query the number of micro blog records automatically stop the car, then to meet the car condition of the 90000 continue to query the automatic block conditions can get the final results.

4.4. Updating Method of Historical Query Network

In Figure 3, an analysis of the new query requests and the historical query network matching. The analysis (Wu X, Zhu X, Wu G Q, et al., 2014) shows that there are some

queries can share the results, but there are still new query conditions S7 is not in the history of the query network, so you need to figure 3 (a) and (b) merge, get updated query network, as shown in figure 4.

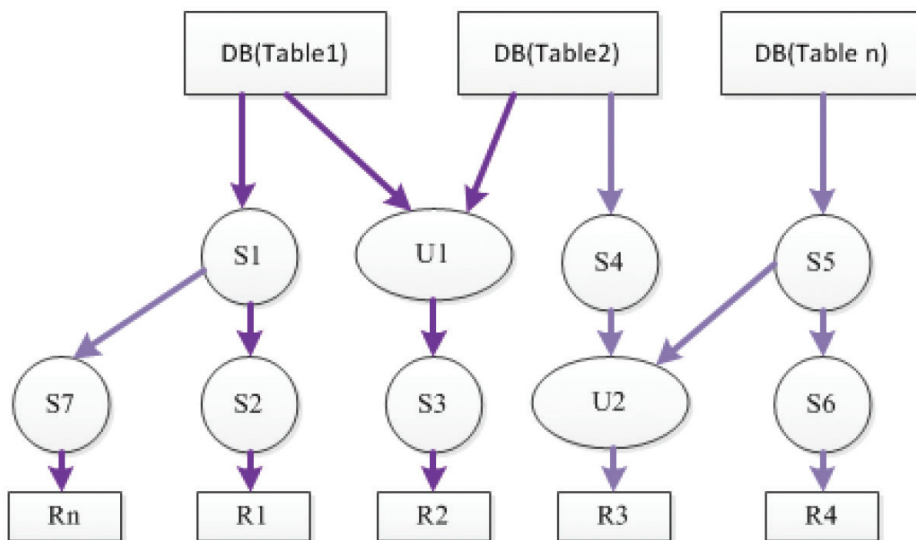


Figure 4 – Update Query Network

A brief description of the new matching algorithm for query requests and historical query network is as follows.

Algorithm 1 : new query requests and historical query network

Input: new query requests, historical query network

Output: the new query request and the matching of the historical query network, which is the node that matches the success, and the node with the unsuccessful node is the new query.

Algorithm basic idea:

Step 1: find the same cloud database table with the same data source as the new query request.

Step 2: find the S1 node in the cloud database, find a tag, and jump to step 3; if you don't find it, exit the program.

Step 3: continue to look for the node S7 in step 2. Find a tag, and jump to step 3; if you don't find it, exit the program.

Step 4: repeat step 3 until you exit the program.

Step 5: end of the algorithm.

Algorithm 2 : historical query network update

Input: new query requests, historical query network

Output: updated query network

Algorithm basic idea:

Step 1: find the same cloud database table with the same data source as the new query request

Step 2: find the S1 node in the cloud database, find a tag, and skip to step 3; if you do not find, connect the new query node to the cloud database.

Step 3: repeat step 2 until all new nodes have been updated.

Step 4: the algorithm ends.

5. Simulation Experiment

5.1. Experiment Environment Construction

Using Hadoop(Lepri B, Antonelli F, Pianesi F, et al., 2015) as the experimental environment, a master node is used as the four machine, a shadow node for the master node, two for the slave node. Four machines installed Linux operating system and various components related to Hadoop.

5.2. Experiment Method

In this experiment, the improved data query method and the improved method are compared.

1. simple query search comparison. The comparison of big data query is realized by using the method of big data based on big data and the effective search method based on big data.
2. complex query search comparison. Jion connection between two data sets is realized by using the improved method and the effective search method based on big data. Because of the most representative of the complex query is the join connection query, which involves the computation of big data between multiple data sets, the efficiency of the query can be directly related to the real time query.

5.3. Simulation Experiment

1. A simple query search simulation experiment (Marx V., 2013) was processing. Mainly to verify the search key words (such as “car”) and the key words (such as “auto”) in the improvement of the former and the improved method in the time comparison.

The improved search method in the implementation of the search should be the first word, subject word for “car”, auxiliary word for “automatic block”. The theme of the word “car” and the history of the query network matching, as a result of the previous history of containing the “car” search, so only need to direct the new part of the record to perform a new search. The search results

of the history and the new query part of the combined records based on the “automatic block” search, the results are obtained. The improved search method and the improved search method of the search method of a comparison, it can be clearly seen that the improved search method only need to search for fewer records, so greatly reduce the search time, improve the query efficiency.

2. comparison of complex query search simulation experiments (Win N W, Thein T., 2015)

Simulation Experiment 2 is mainly to verify the join connection of two data sets. This simulation experiment directly from the data set of two tables for the join connection complex query. Simulation Experiment 2 shows that the improved search method and the improved search method in time consuming(Frankel F, Reid R., 2008), from the comparison, we can see that the search method in this paper only need to search less records, reduce the search time, improve the query efficiency.

6. Conclusions

In this paper, an effective search method is modified for the problem of big data query efficiency. The main improvement point is that the user’s query request intention was analyzed in the arrival of the new query request, and the key words was provided to the user to choose the key words, and then the key words and auxiliary words were extracted. The probability of matching success can be increased by word segmentation, which could be used to speed up the query results. Simulation results show that the improved method can improve the matching probability the accuracy of the search, and reduce the number of repeated calculation of the historical query, and save the search time, improve the query efficiency. The proposed big data retrieval service has a good search accuracy and is worth promoting.

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Research on Sports Technology Based on Computer Aided Tracking System

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Abstract: With the increase of computer speed and the introduction of the new theory, the application of computer technology to the training of physical training will gradually move towards maturity. Because of the importance of the movement of athletes, it is very early to study the movement tracking technology, computer aided athlete training has become a training method, the method can accurately determine whether the athletes' action standards. Computer cooperation can effectively help athletes to enhance the sports technical action, be able to provide reference for the study and master of sports technology, so as to improve the quality of the sports technology. In this paper, we use a variety of computer technology to track the overall technical action of athletes, and to compare the original image and the image, calculate whether the standard, and then analyze movement joint curve, and finally achieve the effect of correcting the action.

Keywords: Computer technology; Tracking technology; Sports technology; Data analysis

1. Introduction

In recent years, with the popularity of low-cost digital video camera and high performance computer, the computer based on the process of capturing the athletes' action has gradually become a hot research. The method can meet the need of monitoring applications, because it does not require action details. In motion capture and motion analysis, computer based methods are still in the laboratory stage, but from the development trend, the method will be applied to a more extensive sports. In the traditional sports techniques, it is often through the coach to explain the relevant action points, and then through their own demonstration to complete the teaching, but in the process of the coach to explain this process, many cases can't accurately describe the entire technical process (Bai X, Yang X, Yu D, et al., 2008; Papagiannakis G, Magnenat-Thalmann N., 2007). At the same time, in the process of athletes' exercise, often can't directly see the defects of their own technology, in such a condition, will inevitably have a negative impact on the results of the exercise. With the development of computer technology, tracking technology is used to track the whole process of the athletes. It can make the athletes and coaches clearly see the complete quality of the movement technology, and then analyze the whole data (Zhou H, Hu H., 2008).

Different from the film production, sports analysis of the field of sports to capture a number of new requirements:

1. The process of training and competition of athletes requires the best possible reduction of external interference, preferably in non - contact and non - obstruction.
2. The timeliness requirements of training can give instant results and feedback in field training.
3. The coach also asked to make a further analysis of the results of motion capture, combined with the specific sports field knowledge, clearly pointed out the shortcomings of the technology, and the reasons for the improvement, given the direction of improvement, so as to help the training of sports technology. One of the first two points is to measure the technical aspects of human movement, while the third involved in the field of sports knowledge, sports scientific research experts and coaches need to make a judgment based on their knowledge and experience. In our research, we focus on video processing and tracking algorithms (Li X R, Jilkov V P., 2010; Wilson J, Patwari N., 2011).

Sports teaching and sports training can't be separated from the sports action, the action standardization is the key to improve the level of sports. In order to improve the movement level, it is necessary to analyze and compare the technical movements, and to understand the difference between the action and the standard. The traditional technology action analysis is to use high-speed photography and video for qualitative analysis, can't accurately determine the movement of athletes in the completion of technical movements of the athletes (including joint point position, displacement and other parameters), and therefore can't meet the needs of quantitative analysis and morphological analysis (Li Y, Xu Q., 2010). With the development of computer technology, especially multimedia database technology, information can be expressed in various forms, such as digital, text, image, sound and animation, and can be saved, managed, processed and transmitted. In this paper, the computer image processing and multimedia database technology for quantitative analysis of sports technical action, and the establishment of technical action feature model, for the sports discipline teaching and training to provide a scientific basis and action examples. In the article, the number of articles was found in the study of sports skill learning. The theory research of computer aided sports is still in the stage of development, and the relevant theoretical technology is still in the research stage. In 1984, Salmoni et al put forward the guiding hypothesis (Hypothesis Guidance), made clear the action mode, and improved the performance of the exercise. Then Schmidt et al established many training models. In 1996, Swinnen used a computer to check the accuracy of motor skills. In the part of the sports, the computer can achieve and meet the needs of the sports movement (Tao Y, Hu H, Zhou H., 2007; Yun X, Bachmann E R, McGhee R B., 2008).

2. Calculation Principle and Application Range

2.1. Application Range and Technical Difficulties

The main goal of computer vision is to make the computer have the ability to have a human eye. A sophisticated computer vision system needs to have the ability to model the image signal and the texture color. Human motion analysis refers to the process of tracking (Martins, J., Gonçalves, R., Santos, V., Cota, M. P., Oliveira, T., & Branco,

F., 2015), detection, description and understanding of the human body in the video, which is involved in digital image processing, computer vision, pattern recognition, artificial intelligence, and so on. Human motion analysis is a cross subject and field, and the computer vision field is not completely mature(Zhang Z Q, Meng X L, Wu J K., 2012). The detection, tracking and recognition of human movement is a big challenge and application prospect. The research of human movement has a wide range of applications, and the specific application areas are as follows:

1 Intelligent security monitoring

Intelligent security monitoring is mainly used in the security requirements of the occasion, such as banks, airports, large stadiums and other places. The system will alert the security personnel in a timely manner to prevent the occurrence of crime and save a large amount of material and financial resources, and to judge whether a visitor has access to the right of the person or the gait.

2 Motion analysis

Motion analysis has a positive effect on the establishment of the human body geometry model and the explanation of the mechanism of the movement. Commonly used in sports training, dance training, and other fields. Traditional gait analysis is mainly applied to the research of joint dynamics and EMG, and it is helpful to develop medical feedback system. The system can provide effective treatment by analyzing the patient's gait. In addition, gait analysis is applied to the three-dimensional reconstruction of traffic accident and the scene of the crime scene simulation.

3 Virtual reality

Virtual reality is to provide a virtual interactive world. To reproduce the movements of a person in the virtual world and need to first obtain the person's attitude in physical space, and then mapped to the virtual space. In order to provide the user with a wider space, it should increase the user's gestures, body movements, head movements and facial expressions, etc. In addition, the virtual-reality in the animation production, video conferencing and other fields also have a wide range of applications.

4 Human computer interaction

It is the purpose of human computer interaction that people want to communicate with the computer to be as easy as the exchange between people. The exchange of people and people mainly rely on the language, and the combination of certain gestures, facial expressions and body posture, which requires the computer needs to have a certain ability to perceive the environment, rather than relying on the traditional keyboard input mode. Further computer analysis of gestures, body movements, facial expressions and their understanding, so as to achieve human-computer interaction.

5 Content-based image retrieval

With the rapid development of the Internet, the information explosion, how to search the information from a large number of images or video to their needs has become an

urgent problem to be solved. Content based image retrieval is mainly based on feature matching, such as target texture, color, shape, etc(Morphett, Adrian Lindsay, Colin M. Crawford, and Don Lee., 2003).

Recognition and analysis of human movement has been a complex research topic. So far, human motion analysis has been gradually moving towards practical application, such as tracking in the clothing of the logo has been widely used, but the signs attached to the clothes will be deformed due to movement, and prone to dislocation. Research on human motion recognition based on non-attachment markers. There are still many difficulties in the video analysis of human movement. So the paper makes several hypotheses: the target is moving in the research space, the camera is fixed or has a constant speed. The target should be directly aligned with the camera in the process of human computer interaction. (Ni L M, Zhang D, Souryal M R., 2011)

1. The assumption of the movement environment

For indoor environment, there should be a constant light source; the system also needs to obtain the absolute motion parameters of the camera parameters and hardware parameters.

2. When the subject of the motion is related to the assumption that human motion analysis is initialized, it is required to know the starting position of the human body; some systems require that the movement of the motion be in a particular color of clothing or clothing. According to the purpose of the analysis of human motion can be divided into different purposes:

①The whole body is a study object;

②The research object is the joint of the human body. In the field of video surveillance, the research object is often a complex natural scene. It is not necessary to know the information of human face, gestures and limbs, so it is necessary to determine the position and direction of the human body.

2.2.Athletes Image Feature Calculation

Contour features provide a limitation to the human projection outer contour, which requires that all of the projected surface points are located within the contour, due to the background of the synthetic simulation data is a single color. We sample the threshold segmentation directly to get the foreground contour(Papagiannakis G, Singh G, Magnenat - Thalmann N., 2008).

Boundary features can be constrained by the position of the limbs in the case of contour failure, such as the case of the arm in the projection profile. So we use boundary features as a complement to the contour features. The disadvantage of boundary features is that it is easy to be affected by noise, and it can be partially missing, especially when the garment is wrinkled or textured. In this paper, the boundary features are only used as a supplementary feature.

For contour features, First calculate the distance of the human body contour map I_t^{dist} . The gray value of each pixel in I_t^{dist} gives the distance from the pixel to the nearest contour. Let x_t^{img} be the projection point of a point on the surface. The definition of residual value is $r_i = I_{dist} x_t^{img}$. On this basis, we define the target function based on contour

$F_s(\phi_t) = \sum r_i^2$. The projection of all surface points in the ideal case is located in the inner region of the contour $F_s(\phi_t) = 0$. The objective function based on the contour features makes the optimization results meet the model projection in the outline. In optimizing $F_s(\phi_t)$, Equivalent to the I_t, I_{t-1} were replaced by I_t^{dist} and 0. The first order differential of I_t^{dist} is needed in solving the problem. The objective function based on contour features is similar to the optimization formula based on gray level features. Specific results are shown in Figure 1:

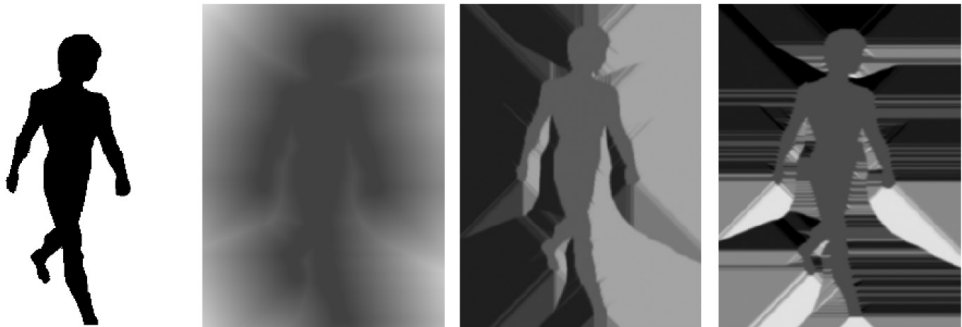


Figure 1 – Function Structure Based on Contour Feature. From Left to Right, Respectively, Contour Map, Range Chart, Distance Graph X Direction First Order Differential and First Order Differential of Y Direction

2.3. Constrained Computing Method

The idea of model based tracking algorithm can be modeled as the shape feature of the moving target, and then the model is tracked in the sequence image. In the modeling of moving objects, the researchers usually use three kinds of models to characterize objects: the linear model, such as *Ju*, which is used to realize the human body tracking. The model of human body motion is proposed. The model is based on the model. The 3-dimensional model, such as *Wathter* and *Nagel*, is used to describe the human motion. The feature of the model based tracking algorithm is that the accuracy of the tracking is determined by the accuracy of the target object's contour model. For rigid moving target, it can get good tracking effect, for example, the tracking of the vehicles in the road, and the deformation process of non-rigid moving target is almost no rule, so it is a very big problem to build a geometrical model. For tracking a specific human motion, the prior knowledge of motion using a priori knowledge can guide the tracking procedure (Rahmim A, Rousset O, Zaidi H., 2007). There are two problems in tracking the actual video using the motion probability model (1). The 3D pose of the model is very different from that of the world. (2) If the motion dynamic model is used to predict the initial value or search range, it can provide accurate position.

Compared to the weight lifting, for example, and the general human motion, weightlifting is a kind of specific human motion, action of athletes is similar, we can use of prior knowledge about weightlifting movements to compensate for the occlusion caused by lack of information.

Set the current time to extract the contour points for the T_i , the corresponding library of the preservation of the contour points is S_i . In addition, the projection position of

the joint is also preserved in the library J_k , and the projection position of the joint point of the present moment J'_k is needed. In this need to introduce two dimensional deformation function:

$$F(X)=[f_x(x,y),f_y(x,y)] \quad (1)$$

In the same function, $J'_k = F(J_k)$ is obtained from the joint points of the contour. In the TPS(Thin Plate Splines), the corresponding relationship between the TPS motion coefficient and the contour points is estimated. TPS is a kind of interpolation function based on radial basis function. Defined as a scalar height field function on the X-Y plane:

$$Z = f(x,y) \quad (2)$$

$$f = \arg \min_f \left(\sum_{i=1}^k ||z_i - f(s_i)||^2 + \lambda E(f) \right) \quad (3)$$

Where $f(x,y)$ in the (s_i, z_i) as far as possible through the control point, Satisfy the distortion energy:

$$E = \iint_{\Omega} \left[\left(\frac{\partial^2 Z}{\partial x^2} \right)^2 + 2 \left(\frac{\partial^2 Z}{\partial x \partial y} \right)^2 + \left(\frac{\partial^2 Z}{\partial y^2} \right)^2 \right] dx dy \quad (4)$$

Well, the standard expression for TPS is:

$$f(x,y) = a_0 + a_1 x + a_2 y + \sum_{i=1}^K d_i \cdot \phi(||(1,x,y) - s_i ||) \quad (5)$$

Where $s_i(1,x,y)$ is the TPS interpolation control point, $\phi = r^2 \log r$ is a radial basis function.

Because of the differences in the action of different players, the standard projection profile in the database is not aligned with the standard projection, so the time alignment method is needed. In order to reduce the error of contour extraction and the effect of shooting angle, the contour sequence is aligned to the library, and the Hausdorff distance is adopted. Alignment of the extracted contour sequences to a library of contour sequences.

2.4. Technical Process

First, we construct the virtual training scene. According to the requirements of the sports events to the training scene, the model is established. Secondly, obtain the motion data. This point is to use the sensor tracking device, to directly record the motion data of the moving entity, the recorded motion data, using the computer to make a picture, establish the actual motion model. From this way can capture the real sports data, so that the formation of the image will be abnormal, so that the scientific and

effective protection. The last is to make a repeat of the action and show. For the action of the repetition and show, in fact, is built on the basis of computer collaboration, for the traditional imaging method is concerned, it is very difficult to achieve the reproduction of these actions and repeat it. Take weight lifting as an example, the coaches pass the weight lifting athletes(Keall P J, Joshi S, Vedam S S, et al., 2005).

The establishment of the model, based on this, the arrangement of the action, to make it repeat the technical movements, in order to reproduce the action of the weight lifting athletes, and finally to make an analysis of the training effect, it can achieve the movement of the athletes and innovation and so on, and ultimately promote the improvement of the skills of athletes. The whole technical flow chart is shown in Figure 2:

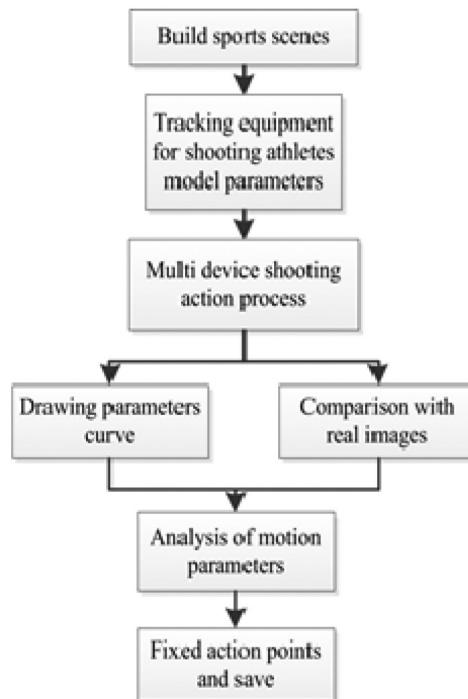


Figure 2 – Technical Flow Chart

3. Case Analysis

In the experiment, shooting a snatch from the front, side and tilted 45 degrees in three directions, and extracted from the 50 frame data. After 100 frame data, the duration is 2 seconds. Figure 2 is an image of the actual shooting scene. The scene was shot at the training ground of the weight lifting training venue,. Experiments were carried out to test the tracking of the two conditions of the use of the movement of the library and the constraint of the movement. Because of the background data is too chaotic, the boundary data can't be used, and the contour and gray features are only used in the tracking process. The actual operation speed is about 2 seconds(Beekman F, Hutton B F., 2007).

When not in use, the prior knowledge, in tracking the initial stage, as barbell occlusion, profile to trunk orientation. The error is so from began on the accumulation and in about 15 frames, trace generation deviate significantly. If you start tracking directly from fiftieth frames you can keep track of the weight lifting end, but the larger tracking error is found from the comparison view.

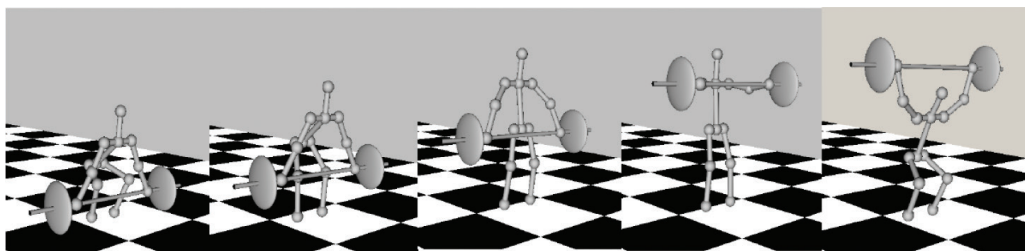


Figure 3 - 45° to Capture the Image of Athletes



Figure 4 – Shot the Player Action Image

By increasing the prior knowledge of this section, the obtained weights of the athletes are more accurate, and the reconstructed results are in good agreement with the actual results. In order to facilitate the movement analysis, the system also provides the joint angle with the time variation curve and the three-dimensional position of each joint with the time variation curve. Fig. (5) and Fig. (6) show some time height (angle) curves calculated according to the tracking results, which can be used for the analysis and comparison of weight lifting motion.

From the figure can be seen the tracking curve is smooth, hip joint height curve maxima and barbell height maxima correspond almost completely. The bending degree of the curve is in accordance with the whole movement process of the weight lifting athletes. On the one hand, the whole picture can observe the changes of the athletes' joints in time. On the other hand, it also reflects the accuracy of the athletes.

4. Conclusion

The study focuses on the effective application of computer aided technology in sports skills upgrading among active applications, and analyzes the role of the technology in sports training and the key techniques and functional requirements of the technology in the promotion of sports skills. Which we can know that the combination of computer

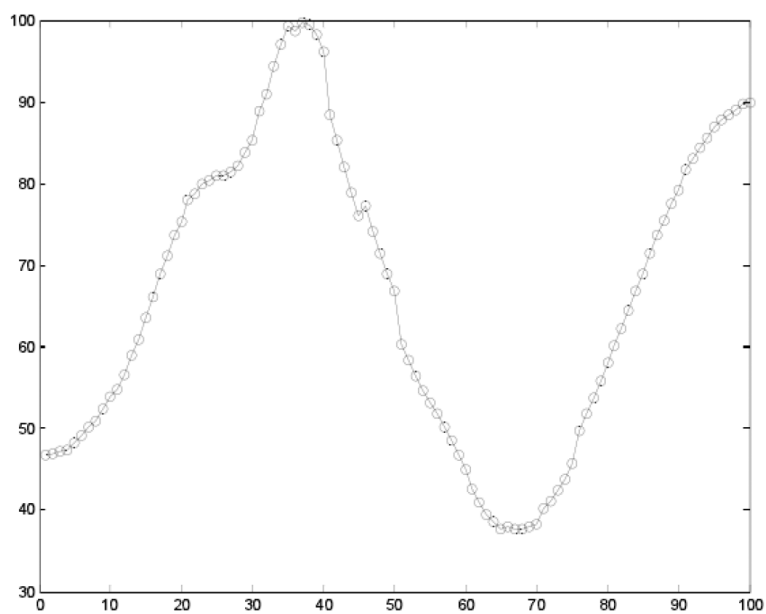


Figure 5 – Hip Joint Height

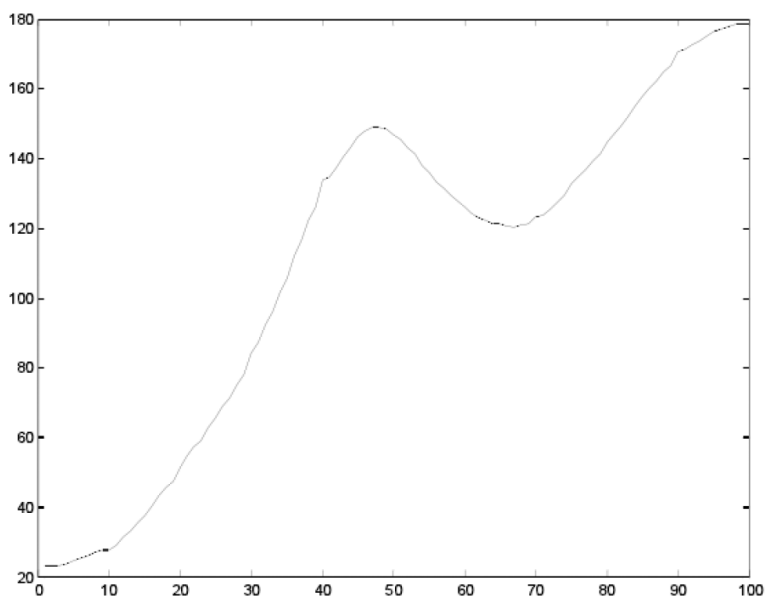


Figure 6 – Barbell Height Change Curve

technology and physical training, not only can effectively improve the athletes' knowledge, but also to promote the athletes more profound understanding of teaching content, teaching firmer grasp of technical movements.. In view of some sports characteristics and the coach's needs for sports tracking and analysis system for customization, to achieve the standard of athletes' movement, and ultimately to improve the athletes' sports skills, is a worthy of promotion technology.

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Application of Artificial Intelligence Technology in the Information Management of Sports Venues

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Abstract: Objective: with the development of the stadium, combined with modern artificial intelligence technology to establish a more scientific and efficient information management system is very practical significance. Method: Based on the decision tree algorithm in artificial intelligence technology, the power system and information management system and the hardware system of the stadium were upgraded. Process: through the use of artificial intelligence based decision tree algorithm to solve the problem of information management system for the lack of security and stability, while the use of artificial intelligence algorithms to achieve statistical analysis and data processing capabilities. Results and analysis: from the operation of the system, it can focus on processing information, complete the complex tasks, in a very short time to avoid wasting time and resources, the decision tree algorithm has a low complexity and fast advantages in dealing with a large number of data has obvious advantages. Conclusion: the information control and processing system based on artificial intelligence decision tree algorithm is effective in improving the information management level of sports venues.

Keywords: Sports venues; Information management; Artificial intelligence; Decision tree algorithm

1. Introduction

The rapid development of science and technology, such as communication, computer and control, has brought about the development of the information management of stadiums. As the “central nervous system”, the information management system will be the optimization the relationship between the four basic elements which include the structure, system, service and management. And the use of artificial intelligence technology will make the function of the gymnasium become more reasonable, become more and more safe, efficient, comfortable and convenient. It embodies the information society’s time characteristic, will greatly promote the sports industry’s transformation promotion and the people living standard (Xie Z, Ni Z, Shi B., 2007).

2. Artificial Intelligence Technology

Artificial intelligence is a new technology, Artificial intelligence is a new technology, which is a theory, method, technology or application system to study, simulate and



Figure 1 – Large Modern Stadium in a Plan

develop the human intelligent. The concrete application of artificial intelligence can be summarized as expert system, artificial neural network, fuzzy set theory and heuristic search. Artificial intelligence has experienced a long and tortuous development process, but has made a series of fruitful results (Shupeng C, van Genderen J., 2008). Achievements of the sub fields such as pattern recognition, knowledge engineering, machine learning, automatic engineering etc. has been widely used in production and life, to a large extent promoted the society of automation and intelligent.

AI Expert system is one of the most successful branches in the field of artificial intelligence. It is an intelligent computer program system, which contains a large number of experts' knowledge and experience, could deal with the problem by knowledge and methods of human experts. Artificial intelligence has experienced a long and tortuous development process, but has made a series of fruitful results. Achievements of the sub fields such as pattern recognition, knowledge engineering, machine learning, automatic engineering etc. has been widely used in production and life, to a large extent promoted the society of automation and intelligent (Yaxiong Y, Dunshan W., 2006).

Artificial neural network is good at solving nonlinear mathematical model, and has the function of self adaptation, organization and learning. Fuzzy control technology can achieve real-time traffic information and signal timing scheme, and it will be improved as a distributed intelligent real-time urban traffic control system based on fuzzy logic.

2.1. Decision Tree

In the process of information processing, there are a lot of artificial intelligence algorithms: decision tree, Bias classification, rule reasoning, genetic algorithm and neural network, etc. (Wei N, Yong W, Yan S, et al., 2009), the decision tree method is the most widely used. Mainly for the following reasons: The complexity of decision tree algorithm is small and the speed is fast. It has a strong anti-noise ability. Decision tree algorithm can be used for small data sets, but also can be used for large data sets

(Abreu, A., Rocha, Á., Cota, M. P., & Carvalho, J. V., 2015). Based on the above reasons, the decision tree algorithm has become one of the most active fields in data mining research. So this paper chooses the decision tree algorithm to strengthen the stadium information management.

Figure 2 shows the general form of a decision tree. The basic components of a decision tree: decision nodes, branches and leaves. The top node in the decision tree is called the root node, which is the beginning of the whole decision tree. Each branch is a new decision node, or a leaf node. Each decision node represents a problem and decision, usually corresponding to the attribute of the object that was waiting to be classified (Chiu Y R, Liaw C H, Chen L C., 2009). Each leaf node represents a possible classification result. In the process of traversing the decision tree from the top down, a test is encountered at each node, each node on the problem of different test output leads to different branches, and finally to reach a leaf node. This process is to use decision tree classification, the use of a number of variables to determine the category of the genus (Hashim H, Hudzori A, Yusop Z, et al., 2013).

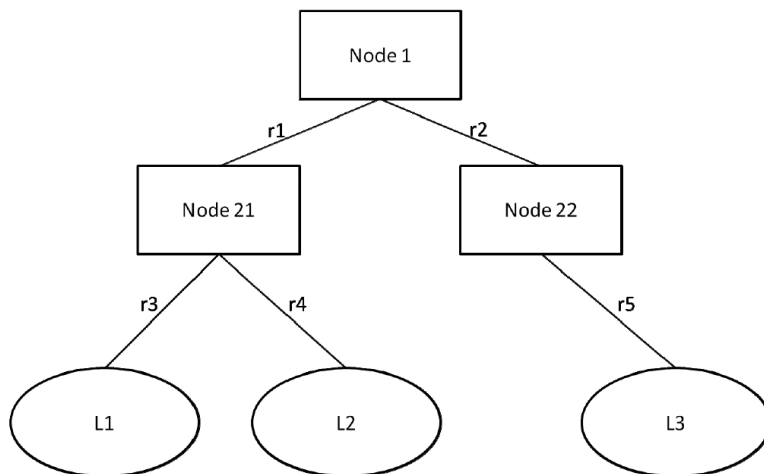


Figure 2 – Decision Tree General Representation Form

2.2. Overview of Decision Tree Algorithm

In statistics, we usually use the binomial distribution to replace the normal distribution, but it is not optimistic for correcting the estimation error rate. In fact, continuous correction is effective only for the introduction of complex factors, however, this factor should not be seen as the error rate, otherwise may lead to incomplete or excessive pruning. If the resulting decision tree is completely accurate to classify all the training examples, then:

$$e'(T_i) + SE[e'(T_i)] = \frac{1}{2} \left[L(T_i) + \sqrt{L(T_i)} \right] \quad (1)$$

Starting from a relatively independent data set from the leaf nodes of the tree, to search for a single tree to minimize the expected probability of classification error, it does not require an additional pruning data set. Either the original version or the later improved version, in the pruning of decision tree process, using the information from the training samples, the expected probability for:

$$P_i(t) = \frac{N_i(t) + P_{ki} \cdot m}{N(t) + m} \quad (2)$$

If the current node T is identified as the leaf node of the class I, the expected probability of the classification error is:

$$\begin{aligned} EER(t) &= \min \{1 - P_i(t)\} \\ &= \min \left\{ \frac{N(t) - N_i(t) + m \cdot (1 - P_{ki})}{N(t) + m} \right\} \end{aligned} \quad (3)$$

A decision tree to make the correct classification of a sample set, the required information entropy is:

$$I(P, N) = -\frac{P}{P+N} \log \frac{P}{P+N} - \frac{P}{P+N} \log \frac{P}{P+N} \quad (4)$$

If you choose to attribute a as a root of the decision tree, a V different values, using attribute a can be divided into v sub set, to attribute a as a root the expected entropy for:

$$E(A) = \sum_{i=1}^v \frac{P_i + N_i}{P + N} I(P_i, N_i) \quad (5)$$

To A as the root of the information gain is:

$$Gain(A) = I(P, N) - E(A) \quad (6)$$

3. Developmengt and Bottleneck of Information Management of Sports Venues

3.1. Development of Information Management of Sports Venues

In recent years there are a lot of changes in the number and size of the stadiums, more and more comprehensive gymnasiums have already been seen in the present time. However, with the development of the times, the requirements of the stadium is also increasing, need for a large number of functions, and now sports projects are gradually diversified development, it makes the requirements of more types of sports venues and sports facilities. In view of this situation, the former gymnasium management system has a lot of defects both in function and practicability. But in the continuous development

of information technology and artificial intelligence, the stadium management system is also beginning to realize the intelligent, information, and to focus on the information scattered throughout the processing.

3.2. Current Problems

It is well known that if the stadium can be built to complete relatively perfect intelligent information management system, not only can achieve the purpose of improving the work efficiency, but also can make the stadium's resources to optimize the configuration. So now, there are already many sports that are starting to look for the right software companies to develop their management systems, as well as some of the new management systems developed by the gym to buy software. However, there are some common problems in the current management system:

The main function of the information management system is still relatively little, it is difficult to meet the current complex management status. In recent years, the establishment of the stadium has a large number of functions, all kinds of sports stadiums are not poor, which requires the management of the stadium to complete more work, but now such a management system is clearly not able to bear this responsibility (Imteaz M A, Adeboye O B, Rayburg S, et al., 2012).

The system is lack of security and stability. In the continuous development of the integrated Stadium today, the stadium management system will need to be more data for scientific management, network management for the management system is not only in the performance of the stability on the stability of the given more assurance.

Work efficiency is generally not high, the decision support ability is not strong. Most of the stadiums are only able to provide basic data query capabilities, it is not able to meet the statistical analysis of the data, as well as processing, and so on, for the decision makers can't provide more accurate help.

3.3. Improvement Direction

Now, in the study of large-scale stadium intelligent information management system is still in a relatively early stage, more valuable research results are not many (Mun J S, Han M Y., 2012). Different from other intelligent public places, the stadium is characterized by the need to have the function, especially for the competition for the stadium with its special requirements. In the design of the system, it is attached importance to computer network, site layout, site lighting design, site sound design, scoring system design, as well as live system, etc., but other comprehensive sites mainly focus on the design of the monitoring system, the design of the satellite cable TV system.

And, for the stadium also has its own characteristics, such as the area is relatively large, but the floor is generally not high, sports equipment is not focused, so in the design of the stadium and other venues in the design, the design will increase the difficulty (Roy A, Das S K, Basu K., 2007). Although there are many differences in the design of the same subsystem, but there are a lot of differences, there is a great difference in the way of thinking and design, as a result of this, the design of the workers on the characteristics of the stadium facilities have a clear understanding. System design of gymnasium in the process, the design of many subsystems, if according to the function of classification

is as follows: The sub system of the daily operation of the gymnasium includes: floor control system, computer network system and wiring system. On the safety of the stadium security system: CCTV monitoring system, anti-theft alarm system, security electronic patrol system, etc. (Austin J, Currie B., 2003). Stadium large event service subsystem: lighting system, sound system, public broadcasting system, etc.. Large game information subsystem: time scoring system, news communication system, LED display system, and so on.

4. Application of Artificial Intelligence Technology to Strengthen the Construction of Sports Venues Information Management

4.1. Information Network System

Information network system is the basis of the operation of sports venues information management system. In the overall design of the process, need to consider from these aspects: technical measures, system structure, system application, equipment selection, technology service and Implementation (Funk D C, Ridinger L L, Moorman A M., 2004). With high efficiency, safety and stability of network products, it combined with high performance routing, switching infrastructure to construct a safe, reliable, easy to access, easy to expand, easy to manage the network information system of the gymnasium, then to meet the needs of the information system of the intelligent stadium and the convenient access to the internet.

Taking a university gymnasium information network system as an example, the system uses Gigabit Ethernet switching technology, construct a star network structure, to achieve Gigabit to the desktop, the establishment of a unified, efficient, stable and easy to expand the network platform. Among them, in the -4.500 standard high-rise fire control room set 1 Ruijie Gigabit multilayer Ethernet switch RG-S5750-24SFP/12GT as the venue of the core switches, the RG-S5750-24SFP/12GT Ethernet switch, which is connected to the southwest corner of the No.1, achieve core data platform, network high-speed switching network (Wolfe R A, Weick K E, Usher J M, et al., 2005).

Other secondary node access switch according to the regional data points of different number by Ruijie RG-S2924G or RG-S2328G the corresponding switch stack, through the Gigabit multimode fiber access module on the core layer of the Ethernet switch configuration corresponding, usually meet the venue information office needs.

Because the monitoring system uses the network monitoring method, so alone for monitoring system provide a 24 port 100m access switch Ruijie SZ126G, can provide access to 10m / 100M network video monitoring, data monitoring system to ensure smooth and stable operation.

A high-speed and reliable wireless WLAN access system is designed as a temporary access to the user; According to the construction plan of the gymnasium and the corresponding room function distribution, a total of 18 wireless AP access system to provide the entire venue of the WLAN access (Rosen P., 1993).

Due to the large number of AP in wireless system, the effectiveness, convenience, security and maintainability of the system are from many aspects, to take the WLAN deployment

model of wireless switch + thin AP, the real-time monitoring of wireless network can be realized by wireless network management system.

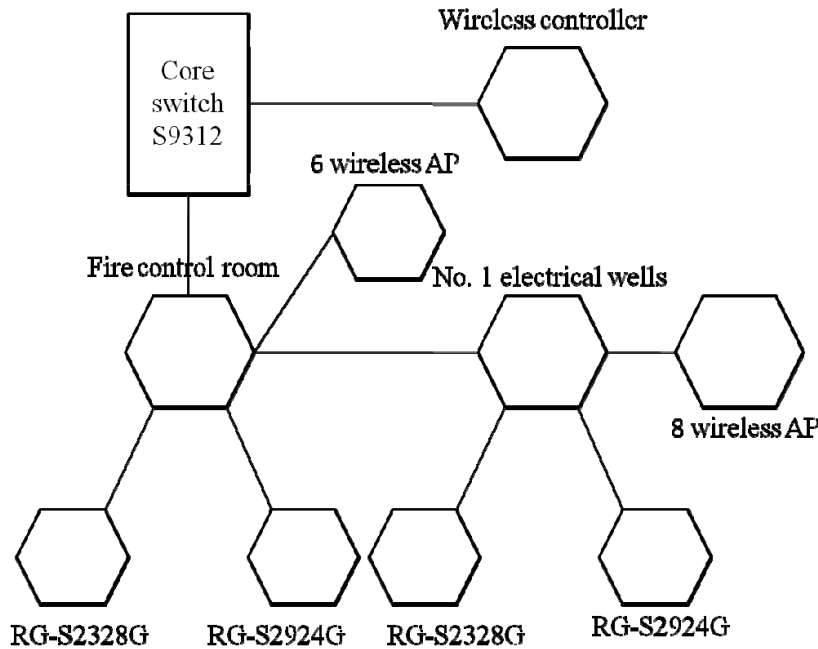


Figure 3 – Deployment Structure Diagram

4.2. Information Display and Control System

Information display and control system is an important system of intelligent gymnasium. Information display and control system is indispensable in sports activities. The display equipment of the stadium should be able to timely, accurate and clear display of the sports information, and be able to carry out the live broadcast, to achieve the effect of manufacturing tension, the atmosphere of excitement. In control, it is simple and clear, accurate and timely, strong operability, can support a number of sports activities to show demand, in accordance with a number of sports rules, but also to facilitate maintenance and upgrade (Skibniewski M J, Chao L C., 1992).

The information display and control system of the gymnasium is composed of a plurality of computer systems, namely the “console”, “the referee” and the two “playing table”, all the system uses the network to carry on the digital transmission, and the control center is produced by the program and the task distribution to each display terminal, can realize the remote control and the terminal management through the network.

The core of the whole system is the “control panel”, “control” is set up in the control room of the northeast corner of the 7.400 elevation layer, and all the control and display control operations are performed by the control and display. From the control room to the LED display line using metal wire groove along the grid. The system includes two

LED display, two players, and the player is operated by the staff to operate the console, and control the playback of the two blocks (Jian-chen L I., 2007).

In addition, the system can be introduced in the competition of the corresponding “referee”, “the referee” is set in the competition area adjacent to the court to retain control of the access port, through the embedded line and control room, which can be perfect to achieve the functions of the operator and the referee, the referee can be independent of the system for all the score, time and other operations, all the points will be immediately displayed on the big screen. At the same time, the stadium management staff can control the display of the display, such as a screen to show the score, another screen display animation, etc..



Figure 4 – Information Display System in Gymnasium

Full color LED electronic display screen, mainly used to play the game exciting scenes at the scene of the game, or slow motion replay wonderful close-up, or 3D animation games and a sports. The two electronic displays can be used as time and score display, they can be connected with the time scoring system, through the display of text or animation graphics to show the audience the relevant information. Stadium as a multifunctional gymnasium, accurate and convenient use of display, considering the display luminescence materials, control chip and control technology of high standard, high technology, high quality, culminating in the adoption of the PH10 indoor full color table affixed to the screen and indoor Phi 5.0 dual color LED display screen.

Gymnasium as a functional diversification of the stadium, not only can carry out teaching, training, but also can hold a variety of sports activities, a variety of literary and artistic activities, etc., so it is necessary to display the content, rich and diverse.

Display content can be real-time television programs, but also the information gathered by the stadium inside the camera to live, but also to play computer images of text information or other information from the information network. Display format compatible with DVD, VCD, LD and other video formats, but also supports NTSC, PAL and other formats. Display mode including the rotation, translation, scrolling and other animation display mode, can also according to the needs of the image, the text of the

proportion of display or add text in the image, etc.. In the display language, support the language of other country, all kinds of text and fonts.

In the relevant games, taking into account the need of a number of sports activities, it could release a variety of format information of volleyball, basketball and so on. In the results, it could display name, name, number and other record player. When the game is played, it can display a variety of real-time information, such as name, score, substitutions, foul to support a number of rules of sports games and display effect.

In addition, the display can be accurate, real-time display of the clock, including the Beijing time, the game clock, count down. According to different events and the rules of the game to set a different game clock, and can easily control the time to pause, reset, fast, slow, etc..

Generally speaking, the entire information display and control system compatibility is strong, reached the integration of computer, field, referee, referee, news center, gymnasium, etc., to efficiently serve the entire stadium, a variety of activities and competitions.

4.3. Information Reservation System

Information reservation system is through the network technology to achieve the combination of campus network and the information of the sports venues resources, people can completed on the stadium venues query, venue booking, venues and meal, information query on the Internet. The management staff of the venue can be realized through the background operation of the stadium hall news release, user management, booking audit management, venue information management and other functions.

Thus, on the one hand, people can't be removed from the queue, the payment of the inconvenience, but also to the venue of the information status at any time to query; on the other hand, it can save the human and material resources, improve the management efficiency of the venues. Sports venues network booking system module function is shown in Figure 5:

Survey on the use of network booking system for sports venues, 38.3% and 40.4% of the people who are very much in favor and approval, 14.6% of people think there is no such system is the same, people who are not in favor of and are not in favor of the students are 2.1% and 1.7% respectively. According to a survey of the type of booking, there are about 86% of people chose the online booking, about 11.7% chose the traditional queuing booking,. It is considered that the advantages of online booking and reservation compared to traditional booking, which is in the "save time, convenient and fast" (52.5%), "the day and night can be set to vote" (22.5%), "to the venue with a glance," and "the Internet will be able to access the Internet" (11.3%). Can be seen, the majority are hoping to use the stadium hall network booking system.

5. Conclusion

At present, China's sports stadiums also use the traditional management process, , the process is complex, the efficiency is low, the time is long, will produce a large number of

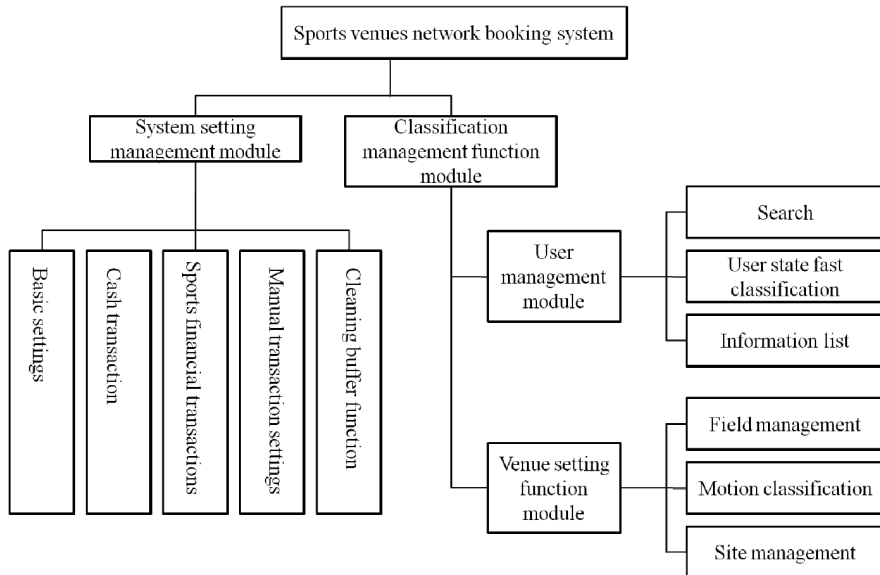


Figure 5 – Sports Venues Network Booking System

documents, is not conducive to the inquiry, renewal, maintenance and so on. In order to save management costs and improve work efficiency, use information management system based on artificial intelligence, can reduce the burden on the management of sports venues and greatly improve the work efficiency. Relying on information technology to carry out the management of the stadium, so as to improve the utilization rate of the stadium, it is necessary to maximize the function of the stadium. Intelligent information system has become an important part of the modern stadium, it will be the entire stadium construction content and expansion, the level of information technology to determine the level of the stadium.

This paper is based on the artificial intelligence technology, especially the decision tree algorithm, construct a new information management system, including three subsystems: information network system, information display and control system and information system, to help staff to work more scientific and effective management, centralized information management, greatly improve work efficiency.

This paper analyzes the design of sports venues information management system, the study of the field in the country to do a certain role, to lay the foundation for future research in this field. Because of the limited level of the author, there are still many problems and shortcomings, which need to be further studied. In the future research work, we need to study the intelligent system of the gymnasium for different levels, different events and different projects, so as to improve the research work of this thesis.

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Research on the Curriculum Design of the International Economics and Trade Major under the New Situation

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Abstract: To research on the curriculum design of the International Economics and Trade Major under the new situation. Method: Theoretical research and structure design. Process: Firstly, this paper introduces the current situation of international economic and trade professional course teaching design. Secondly, the new situation of international economic and trade talents was introduced. Finally, The design scheme of the course system of the international economic and trade major in the new situation is studied based on principles of curriculum system design. Result& Analysis: the structure of the course of international economic and trade professional and the proportion of the course were designed. Result: Building a scientific and reasonable curriculum system is a dynamic process of development, which needs to good course system reform and curriculum adjustment, and build the students' practical ability and innovative spirit through practice teaching system.

Keywords: Curriculum design, International economics and trade, New situation

1. Introduction

In the continuous development of economic globalization today, the demand of foreign enterprises, multi-national corporation and all kinds of enterprises in our country is growing up for foreign economic personnel continues. At the same time, the requirements of foreign trade talents have been improved. The cultivation of the professional knowledge and the comprehensive practical ability of the compound talents has become the University's personnel training objectives. In the process of achieving this goal, the curriculum system is particularly prominent. The new economic situation requires colleges and universities in the construction of the course system of the specialty of international economy and trade, we must adhere to the knowledge, ability and quality of the coordinated development, improve the comprehensive principle, and pay attention to overall optimization of the structure of knowledge and ability training. In this way, the university can cultivate composite talents of foreign trade according with the times and social requirements.

2. The Current Situation of International Economic and Trade Professional Course Teaching Design

2.1. No Clear Guiding Ideology

Now a lot of college students learn international economics and trade only to find a job after graduation (Novy D., 2013). In fact, this kind of professional courses do not understand. There are a lot of students who think that learning the profession is easier to find work. They can do anything about the work of the economic management and international trade, which eventually leads to all the knowledge they cannot understand (Levchenko A A, Lewis L T, Tesar L L., 2010). There are a lot of teachers in Colleges and universities have a misunderstanding of this course, and they think it is a very wide range of professional, so there is no emphasis on setting the course (Lindo-Salado-Echeverría, C., Sanz-Angulo, P., De-Benito-Martín, J. J., & Galindo-Melero, J., 2015), so that students can accomplish nothing after graduation.

2.2. Curriculum is Relatively Complex

Because of international economic and trade professional training of international talent, so many teachers in teaching will always teach combined with multi course, and emphasizes that the students should understand the economic analysis, but also understand the legal use and learn to use a foreign language to carry on the conversation. Even some teachers also let students understand the local customs and practices, historical stories (Keller W., 2010). Is in this kind of thought the curriculum, the teacher sets up the curriculum related to the economy, the politics, and the culture. The course teachers set has not focus, because all are the focus, leading to students in college life after finishing do not know what they have learned, do not know what they have learned. There are a lot of students because I don't know what I can do after graduation.

2.3. There is a Strong Repeatability in Setting up the Course Content

In the course of international economics and trade major, there are a lot of contents and other professional teaching content which is repeated, such as document production, international settlement and currency bank notes knowledge (Chor D, Manova K., 2012). Particularly the monetary banking, because this course is a major financial professional courses. Now many college teachers are a person to take a few courses, especially economic class teacher. Because these courses have continuity, so the teacher in the setting of curriculum content also repeated, resulting in students lose interest in learning.

2.4. Theoretical Courses are More Than Practical Courses

In the course of setting up the theory of light practice in many colleges and universities, a lot of theoretical courses were taken out a special teaching, such as intellectual property, dumping and anti-dumping (Lenzen M, Moran D, Kanemoto K, et al., 2012). But for those practical courses, such as documentary production, foreign trade accounting, these courses are usually mixed with other courses, so that the theoretical knowledge is too much beyond the actual ability of students, and reduce students' interest in learning.

2.5. Student's Practice Link is Little and Begin Ability is Poor

In the teaching of international economic and trade professional courses, it is mainly through the guidance of the teacher to complete the teaching of theoretical knowledge (Monar J., 2001). In the teaching of theoretical knowledge and students together with the simulation work, this kind of teaching mode students can develop a strong dependence, can not do their own to complete the task, and not develop their own tasks. In the long term, the students will have to think about the other way to help others instead how to solve them. This will not only help to cultivate students' practical ability, but also affect the development of college students.

2.6. English Course is Set Less

There are also many colleges and universities think that the international economy and trade major is no different from other majors (Engel C, Wang J., 2011). In addition, college students must learn the advanced English, no longer set up other English courses, but also open the international economic and trade related professional English courses, some colleges and universities have set up a little bit of literature, there are no emphasis on the use of professional English. English curriculum is not important, so many students will not be engaged in the use of English and international economic and trade.

3. The Ability of the New Situation to Demand International Economic and Trade Talents

Economic globalization has made the economic and trade exchanges between China and other countries frequently (Levchenko A A, Lewis L T, Tesar L L., 2010). It also puts forward new requirements for the cultivation of international economic and trade professionals in Colleges and universities. The teaching of international economics and trade in our country is not fully adapted to the needs of economic and social development. The graduates' employment is difficult, and the employment of graduates often needs a long period of transition to fully meet the requirements of the work. Combined with the new requirements of international trade and economic cooperation under the new situation, we should strengthen the cultivation of the following aspects.

3.1. Theoretical Analysis Ability

Although the international economic and trade professional belongs to the category of applied economics, the complex and changeable international and domestic situation must have a higher cognition and analysis ability, so as to carry out accurate and effective economic decision-making (Novy D., 2013). To cultivate students pay attention to the theory and study theory, the paper analyzes and discusses the current international situation based on the basic theory, and helps the students to complete a complete cognitive process from theory to practice.

3.2. International Communicative Ability

The significant difference between international economic and trade majors and other majors is that they should have excellent international communication skills (Balistreri

E J, Hillberry R H, Rutherford T F., 2011). In addition to the cultivation of higher language expression ability, but also to the non language of cultural practices, legal concepts, etc., English is the world's common language, English speaking students in the future, may also include other countries and peoples, so this is a simple language teaching in the classroom teaching of International communication is a challenge more difficultly.

3.3. Practical Business Ability

International Economic and trade professional students need to have the actual business capacity which mainly refers to the actual business operation ability and is a practical skill (Keller W., 2010). Not only the students are very familiar with the whole business process, but also the students of every part should have the business operation skills. At this stage, the training mode of students in this aspect is more mature and effective, and there are some professional software for systematic simulation training. In the course of training, the students a machine, the role of the whole, and the whole process of simulation exercises, the effect is very good, and the students are also reflected in the post employment.

3.4. Management Ability

Management ability is a comprehensive reflection of a composite ability, including students' decision-making ability, coordination ability, teamwork ability, compliance Shouji ability etc.. In addition to the ability to explain the theory in the classroom, the process of practice allows students to experience and develop. So the more effective way is to combine school enterprise, through the establishment of a training base outside the way to cultivate, the deadline can be 1-3months.

4. The Design Principle of the Course System of International Economy and Trade

The main idea of curriculum system construction is to cultivate the compound talents with general education as the goal, to cultivate the diversified and dynamic application, and to emphasize the organic connection between the curriculum modules, teaching and learning (Low B S, Heinen J T., 1993). In this curriculum system, all knowledge is not isolated, all courses can be found with the combination of its related courses, through the combination of each course module to expand the study and research on each subject. Therefore, in the construction of the international economic and trade professional curriculum system, it should follow the following principles. First, to train professional composite talents is taken as the goal of principle; second, we should adhere to the principle of combination of theory and practice; third, we should adhere to the "employment oriented", and take into account the principle of individual development. International trade professionals should take employment as the guide, strengthen professional ability and professional quality training, strengthen the training of personnel for the purpose and applicability, and promote the full employment of graduates.

5. The Design Scheme of the Course System of International Economic and Trade Major in the New Situation

Based on the modern education and teaching idea of students as the basis, the new system is set up for the students, which is suitable for the professional training objectives (Debaere P, Mostashari S., 2010). In order to improve the quality of personnel training, the new system should integrate the cultivation of professional theory knowledge, operation ability, comprehensive practice ability and innovation ability.

First of all, we construct three platforms: general education curriculum platform, professional education platform and practical teaching platform. These three platforms should highlight the deep foundation, emphasize the curriculum system's foundation, compatibility, cross, the different disciplines of mutual cross, penetration, the purpose is to enhance the social adaptability, training to adapt to the ability of high quality, wide caliber talents (Waugh M., 2010). On the basis of three courses, six teaching modules are set up, which is based on the basic required course, general elective course, subject basic required course, professional course, professional elective course, and tical teaching link (Figure 1).

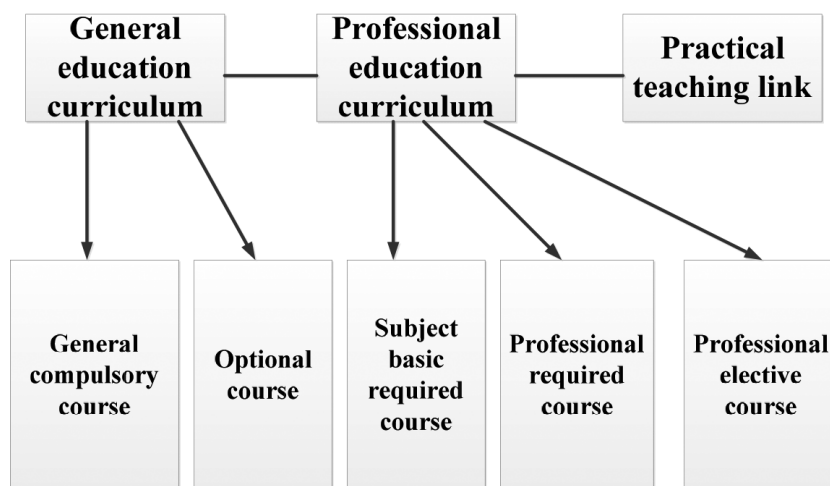


Figure 1 – Course Structure of International Economic and Trade

5.1. Set Types of Courses

1 Public basic course

Public basic course mainly trains the students' basic quality, including political quality, moral quality and physical and mental quality, computer application ability, language expression, application writing ability and foreign language application ability. On the basis of the main courses are: politics, computer application foundation, mathematics, foreign language, College Chinese, etc.

2 Subject basic course

Subject basic course is a compulsory course for students of economy class. It mainly includes four aspects: first, the basic course of economics is the basic knowledge and theory of economics (Castellani D, Serti F, Tomasi C., 2010). The specific courses include micro economics, macroeconomics, economic law, economic and trade application, accounting, statistics, management, agricultural economics and industrial economics. Two is the economy class public course, including finance, international trade theory, risk management, finance, etc.. Three is the economy class basic specialized course that lets the students master the principles and practices of marketing, master the basic theory of market economy and macro management and the knowledge of international finance theory. Its course mainly includes marketing, market economy and macro management, international finance and econometrics. Four is the economic class basic skills. The purpose is to allow students to master the financial, business, finance, e-commerce and other foreign trade business in the relevant theoretical knowledge. Courses include financial management, international business management, human resource development and management, public relations, modern enterprise system, e-commerce, CI planning and corporate culture, securities investment and futures, corporate strategic management and consumer economics.

3 Specialized course

The professional course should broaden the professional caliber, so that students in the study of professional class can be free to choose. While paying attention to the theoretical knowledge and the specific skills of the students, they pay attention to the cultivation of students' interest and social adaptability. Professional course which integrates with the international community, should pay attention to practicality. Through professional learning. Students have strong analytical skills and problem solving skills. Specifically, the professional courses can be set to four major categories: professional basic courses, professional practice, professional knowledge and related professional courses.

5.2. Practical Teaching Link

Practical teaching mainly consists of two major categories. One is the practical link in the teaching plan. Two is the practice of teaching plan.

The "hidden curriculum" is a new concept in the modern education theory. It refers to the non-planned learning activity. It is the education which the students have in the teaching program. Recessive course covers a wide range, covering almost all aspects of the school and all kinds of behavior, such as the construction of school spirit and campus culture, interaction between teachers and students and so on (Wheeler D, Mody A., 1992). It plays an important role in the environment, which transforms the factors of truth, goodness and beauty in the real environment gradually into the students' quality.

The practice in the teaching plan includes military skill training, cognition practice, graduation practice, academic year thesis and graduation thesis.

5.2.1. Cognition practice and graduation practice.

As the students in the experimental practice, the enterprise units can not be completely transparent to the operation of their own economic material, and the effect of the experimental practice is quite limited. Therefore, it is necessary to establish the laboratory of international trade specialty curriculum design.

5.2.2. Academic year thesis and graduation thesis.

Graduation thesis is the highest stage of school practice teaching activities, and is an important practical teaching link to achieve the goal of undergraduate training. Schools should establish a scientific management system and operating mechanism. One is to build the three management system of school, hospital, Department, reducing the management center of gravity; two is the subject of the subject, combined with the practical problems of professional and social development and the practical problems of teachers, enhancing the application value; three is the establishment of information feedback system from the social, school, college, and teaching, through various channels of information feedback, evaluation, identification.

5.3. The Structure of Curriculum Design

According to the above design principles, the structure of the curriculum design is shown in Table 1, Figure 2 and Figure 3.

Types	Class hours	Proportion	Academic score	Proportion
Public course	956	37.5%	50	29.4%
Discipline foundation course	320	12.5%	18	11.8%
General elective course	192	7.5%	12	7.0%
Professional required course	652	25.6%	35	20.6%
Professional elective course	430	16.9%	25	14.6%
Practical teaching	40		30	17.6%
Total	2550	100%	170	100%

Table 1-The structure Proportion of Curriculum Design

From the above tables and graphs, we can see that the score of each course in the new situation should be matched with the hours. The number of hours and the academic score of the public class should be the highest, it should be the students' key to master the knowledge. The number of hours and the academic score of the discipline basic subject should be accounted for 50% of the required course. And the practice teaching should have a certain proportion, so as to cultivate the talents who can adapt to the society.

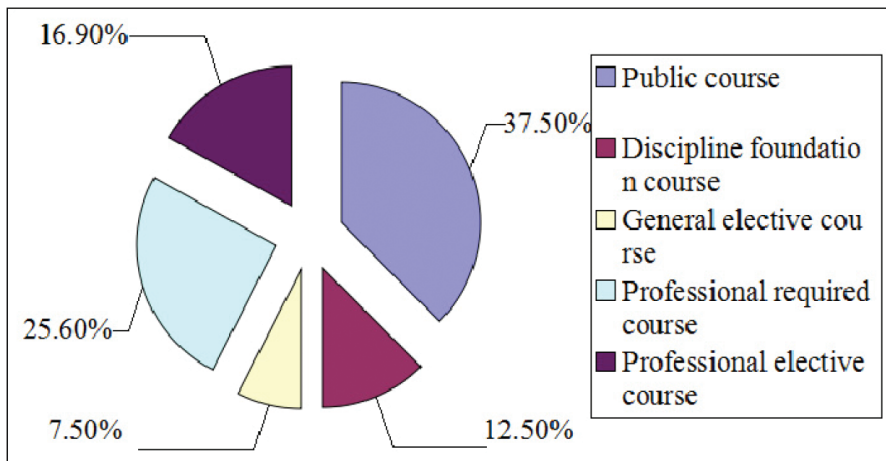


Figure 2 – The Proportion of the Course Hours

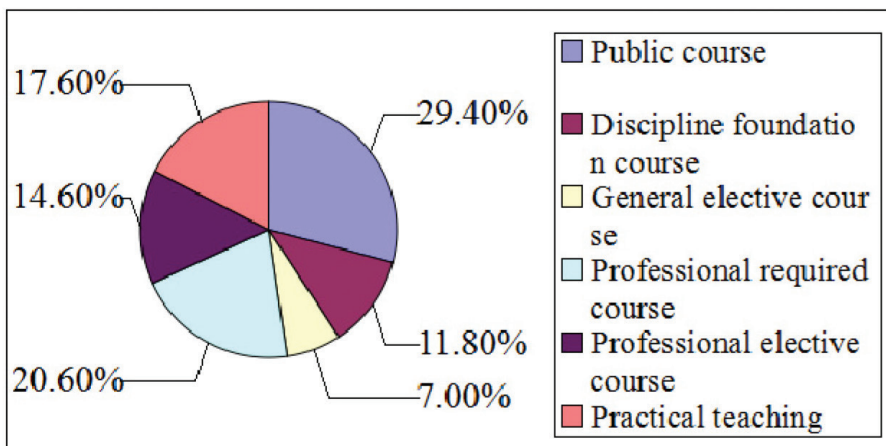


Figure 3 – The Proportion of the Academic Score

6. Reform Suggestions for the Course of International Economic and Trade Major under the New Situation

Universities want to develop a universal foreign trade personnel for the development of society, it is necessary to carry out the reform of the international economic and trade professional courses, and the reform of the course of the university can be considered from many aspects.

6.1. Reform in the Curriculum System and Curriculum Content

Curriculum construction is the basis of subject construction and specialty construction. It is also an important part of teaching reform. The quality of curriculum teaching and the course of college students are very important in the process of cultivating talents.

6.2. Sets of Professional Courses

International Economic and Trade can be combined with the actual situation of local economic development, so that people can develop better for the local economic construction and social development to make contribution, combined with the actual situation that can be expressed as a combination of local enterprises, with the needs of enterprises, and pay attention to the cultivation of students' knowledge structure and ability from the actual needs of the country to optimize the structure of talent. At the same time, the university should set up the dynamic monitoring mechanism of the talent demand, and timely release the target of talent training on the net and the talent of the society in the near future.

Demand situation, colleges and universities should increase the actual contact with the enterprise, according to the needs of the enterprise to cultivate all-round economic and trade talents, but also in accordance with the requirements of the state to increase the construction of new professional courses.

6.3. Strengthening the Cooperation between Enterprises and the Construction of Practical Teaching Base

International Economic and Trade training out of the students are not necessarily only into the foreign enterprise which have a way out, but also closely rely on local government and enterprises, timely understanding of the needs of the community, according to the requirements of enterprises to establish a school training base, which provide students with real operating platform. You can also set up school training base, so that students can not only improve the practical ability of students in the process of training to improve students' ability to adapt to the job.

6.4. Paying Attention to Practice Teaching, and Cultivating Students' Practical Ability and Innovation Ability

Schools should pay attention to practical teaching, because the improvement of innovation ability is achieved through a steady stream of practice. The practice of students can better understand the theoretical knowledge, improve students' ability to analyze problems and solve problems. The curriculum of international economic and trade should take multi-level trainings, and gradually establish a practical teaching system to reduce the proportion of teachers.

7. Conclusion

Majoring in international economy and trade in the face of economic globalization brings new challenges should be closely around the talent training curriculum of this

line of thought. Colleges and universities should attach great importance to personnel training work. In this way, can we establish a scientific curriculum system in the international economic and trade courses teaching design, establish a bridge between teaching and learning, better play a role in curriculum reform, improve the students' ability of practice and innovation, better cultivate a suitable for social and enterprise development, practical, compound talents.

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Study on the E-commerce Platform Based on Artificial Intelligence

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Abstract: With the rapid development of Internet and information technology, E-commerce has been gradually accepted by people and enters our daily life. Its rapid development has promoted the integration and development of the global economy with larger opportunities and challenges. E-commerce is a new business transaction way conducted through modern information technology and computer network. Mobile Agent technology in artificial intelligence is featured with mobility, autonomy, responsibility and intellectuality, which laid a good basis for the realization of intelligent E-commerce. On account of the issues in the E-commerce negotiation process, Multi-Agent technology classified E-commerce according to the property of the business, proposed the negotiation model based on GA (Genetic Algorithm) and accomplished the overall design of the E-commerce system of Mobile Agent. Through the establishment of reasonable utility function and learning of the opposite's preferences, this design model can relatively maximize the benefits of both merchants and customers, and realize the intellectualization of the E-commerce transaction process. According to the experimental analysis, the application of E-commerce platform based on artificial intelligence in the development of E-commerce system can effectively solve the problems existed in the current E-commerce systems.

Keywords: E-commerce platform; Agent; artificial intelligence; Genetic Algorithm

1. Introduction

In many cases, E-commerce is noted as electronic trade, electronic transaction, paperless trade or network trade, etc. Although the word "E-commerce" is widely used, E-commerce is still not mature. The form, content and characteristics of E-commerce are still evolving. Hence, it is not easy to give a strict definition of E-commerce. Many people define E-commerce according to their own understandings. For example, Tingpeng Liang (He M, Jennings N R, Leung H F., 2003) proposed the intermediate system model based on Agent E-commerce; Jeffrey (Tsvetovaty M, Gini M, Mobasher B., 1997) et al. applied Agent technology in the web-based negotiation support system and developed the E-commerce system model MagNET based on Aglet platform; Chartree (Glushko R J, Tenenbaum J M, Meltzer B., 1999) et al. first discussed the workflow issues in E-commerce system based on Mobile Agent; Chan (Wang W, Benbasat I., 2007) et al. raised the SIAS system. U.S. expert Dr. Emmelhainz (Schubert P, Ginsburg

M., 2000) pointed out that E-commerce is to realize the coordination of supplies or personnel through internet so that to facilitate commercial exchange activities. Chinese expert and researcher Wangke defined E-commerce as an overall process of realizing commercial exchange and industrial work through electronic tools based on computer and communication perspectives. Ouyangwu, an expert of Institute of Quantitative & Technical Economics, Chinese Academy of Social Sciences, defined E-commerce as data (information) exchange activities of the buyer and the seller carried out via modern information technology. In *The E-commerce of the 21st Century* compiled by Wangjun in *Chinese Journal of Computers*, E-commerce refers to a whole set of dynamic technology, application software and business process that links enterprises, customers and the society. Prof. Wangjian from the University of International Business and Economics stated in his E-commerce lecture that E-commerce refers to an electronic process of realizing a whole transaction process by electronic information technology, network interconnection technology and modern communication technology, where the transaction parties only need to contact with each other through internet instead of transmitting paper documents or files (Chen D N, Jeng B, Lee W P., 2008). By taking advantage of Agent technology in artificial intelligence, this paper made a classification based on the business properties of different business activity parties, established search engine BP neural network model on related E-commerce platform, and improved the commercial negotiation function of the platform.

2. Related Theory and Technology

2.1. Definition of Agent

In multi-Agent system, Agent is an independent entity, which continuously interacts with the environment. In the MAS environment, however, there are other processes with other Agents. In another word, Agent is an entity with a state consisted of mental components as belief, ability, selection and intention, etc. Agent can be homogeneous or heterogeneous in the system. The research of multi-Agent is to manage the intelligent behaviors of a group of independent intelligent Agents, coordinating their knowledge, ability, selection, intentions and plans to take joint measures or solve problems together. There are both cooperation and competition between the Agents. A common feature of distributed artificial intelligence and multi-Agent system is the distributed entity behavior. The multi-Agent system is designed from the bottom up. Because in principle, distributed and independent Agents are first defined, then study how to accomplish the task solving of a single or several entities. Multi-Agent system can deal with both single target and different targets. Multi-Agent system mainly studies how the logically or physically separated Agents cooperate and calculate simultaneously to solve problems (Carvalho, A. A., Araújo, I., & Fonseca, A., 2015). The main purpose is to analyze and design large and complex cooperative intelligent system, such as large information system and intelligent robot, etc. Recently multi-Agent system is studied a lot. Multi-Agent system attempts to use Agent to simulate human's rational behaviors, which is mainly applied in the fields of simulation on reality and society, robots and intelligent machinery, etc. Agent itself should be possessed with properties as independence, interactivity with environment, collaboration, communication, longevity, self-adaptability and instantaneity, etc. (Sandholm T., 2002)

2.2. Classification of E-commerce

Based on the business properties of different business activity parties, E-commerce can be divided into following categories:

1. B2B (Business-to-Business) E-commerce:

B2B E-commerce refers to the E-commerce activities between enterprises. For example, industrial and commercial enterprises use computer network to purchase from their suppliers or make payments. This kind of E-commerce, especially business activities conducted by Electronic Data Interexchange (EDI) through private or Value-added-network (VAN), has been existed for years.

The EDI technology that supports B2B refers to the exchange of unified structure and standard information conducted by entities through computer network. As the technology supports a direct exchange of information between computer systems, it can reduce or even eliminate artificial intervention and information input to the maximum. At present, EDI is successfully applied in the field.

Although the implementation of EDI is facing many difficulties, B2B E-commerce is still the main trend of E-commerce as seen from the perspective of future development.

2. B2C (Business-to-Consumer) E-commerce:

B2C E-commerce refers to the E-commerce activities between enterprises and consumers. This kind of E-commerce mainly uses the online selling activities through international internet. In recent years, B2C E-commerce has sprung up with the development of international internet. For example, there are a lot of supermarkets on the internet, where everything is available, including commodities, drinks, computers, and even automobiles, etc.

The reason for the rapid development of B2C E-commerce is because the development of international internet has created a new transaction platform for enterprises and consumers.

From the technical perspective, there is no need for a unique standard of data transmitting for enterprises and consumers. Online retail or payments only involves credit card or other electronic currencies. In addition, the browsing function and multi-media provided on the international internet make it easier for consumers to find what they need and know more about the commodities. Hence, B2C E-commerce has the minimum obstruction and large potential. Obviously, this kind of E-commerce will keep on developing and is one of the motives in promoting other types of E-commerce activities.

3. C2C (Consumer -to-Consumer) E-commerce:

C2C E-commerce is the E-commerce activities between consumers, which mainly takes advantage of the online selling activities through international internet.

4. B2A (Business-to-Administrations) E-commerce:

B2A E-commerce refers to the E-commerce activities between enterprises and authorities.

5. C2A (Consumer-to-Administrations) E-commerce:

C2A E-commerce refers to the E-commerce activities between authorities and individuals. This kind of E-commerce has not been really formed (Kartiwi M, MacGregor R C., 2007).

2.3. Genetic Algorithm (GA)

Genetic Algorithm (GA) is proposed by Prof. Holland from the University of Michigan in 1975. It is originated from Darwin's theory of evolution, Weizmann's theory of natural selection and Mendel's population genetic theory. GA is a self-organizing and adaptive artificial intelligent technology that simulates the nature evolution procedures and mechanism to solve extreme problems. The basic idea of GA is to form an algorithm of process searching optimal solution based on the simulation of natural genetic extreme value and biological evolutionism, which has a firm biological foundation. GA is a collateral global search algorithm which adopts probabilistic random seeking strategy which can automatically obtain related information in the searching period and adaptively adjust searching directions with strong robustness. Nowadays GA has been widely used in the fields of optimal control, signal processing, combinatorial optimization and artificial life, etc. (Nguyen G, Dang T T, Hluchy L., 2007)

In the simulation of natural genetic recombination and evolution, GA will first encode the problems to be solved. Every unit in the code is called the "Gene"; a group of genes can form a "Chromosome", known as an individual; several chromosomes will be processed repeatedly by operators as selection, crossover and mutation, until an optimal or sub-optimal solution is obtained. The basic operation process of using GA to solve problems is shown as Figure 1.

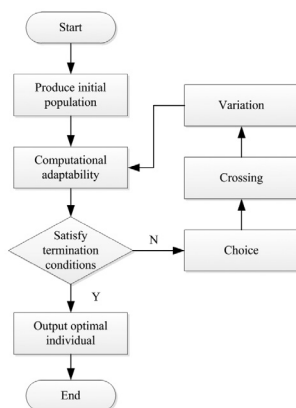


Figure 1 – Genetic Algorithm Flowchart

1. Code: code is the primary issue to be solved in GA, which can turn the practical solution into genetic structure data;
2. Generate initial species: Randomly generate initial species consisted of K genes;
3. Individual evaluation: Evaluation the advantages and disadvantages of each chromosome with adaptive functions;

4. Selection computation: The purpose of selection is to directly pass down good individuals to the next generation based on the adaptive evaluation of individuals.
5. Crossover computation: Part of two parent individual structures are replaced and recombined to generate a new individual. Crossover is actually the operation of information exchange between parent individuals;
6. Variation computation: Change the genes of some individual chromosomes in the specie to increase the variety of the specie and improve the local search ability of the algorithm;
7. Determination of termination conditions: The algorithm terminates when the adaptivity of the optimal individual reaches the given threshold value or the adaptivity of the optimal individual and the specie stops rising (Li L, Horrocks I., 2004).

2.4. Negotiation Model based on GA

Whether the negotiation of E-commerce reaches an agreement or not would decide the success or failure of the whole business activity. A good negotiation model should satisfy the following requirements:

1. Can describe the negotiation problem effectively and comprehensively;
2. Can describe the human factors in the negotiation;
3. The required computing resource is limited during the negotiation process.

Based on the above requirements, this paper designed a bilateral multi-topic negotiation model based on GA.

As the negotiation model can sense the specific environment and represents the user to accomplish a series of goals, this paper made the following basic hypotheses in the negotiation model:

1. Agent is selfish. It pursues the maximum benefit of their side;
2. Agent is not complete. It has no idea of the preferences of the opposite.
3. Agent has a limited rationality. The strategies it adopted are usually the most optimal strategies that are beneficial to them;
4. There is no cheating behaviors in the negotiation. Both of the negotiation parties are willing to reach an agreement;
5. Time is precious for the negotiation parties, which means they are making a limited negotiation;
6. Failure of negotiation is the worst result for the two parties.

The negotiation model in the paper can be defined by the following multi-component system, as shown in Formula (1).

$$Model = \langle Ag, Q, X, W, V, U, T, A \rangle \quad (1)$$

Ag represents the Agent sets in the negotiation, $Ag_i \in Ag$. Here we assume $i \in (b, s)$, where Ag_b stands for customer negotiation Agent, Ag_s represents the enterprise negotiation Agent.

Q stands for negotiation project sets, $Q = \{Q_1, \dots, Q_j, \dots, Q_J\}$, Q_j refers to the j th negotiation project (the j th gene), project number $J \geq 2$. The negotiation project sets in this paper include commodity price, delivery time and warranty.

X is the value of the negotiation project,

$$X = (x_1, \dots, x_j, \dots, x_J) \quad (2)$$

Where x_j stands for the proposition value of property Q_j in the negotiation Agent. All the proposition value should be included in the given range of $x_j \in [x_j^{\min}, x_j^{\max}]$, which is also the expected range of each negotiation Agent.

W stands for the project weight set,

$$W = \{W_1, \dots, W_j, \dots, W_J\} \quad (3)$$

W_j^i is the weight of Ag_i to Q_j , the value of which is designated by the users of the two sides. For example $W_1^i > W_2^i$, means Ag_i prefers Q_1 for the project Q_1 and Q_2 .

In this paper, assume the weight sum of the user to all the negotiation projects is 1,

$$\sum_{j=1}^J W_j = 1 \quad (4)$$

V : evaluation function, representing the evaluation of Agent on some value in the negotiation project set. The evaluation function can be linear or non-linear. For simplicity sake, this paper takes monotone linear function as the evaluation function. The monotone non-decreasing function is shown as Formula (5).

$$V(x_j) = \frac{x_j^{\max} - x_j}{x_j^{\max} - x_j^{\min}} \quad (5)$$

Monotone increasing function is shown as Formula (6)

$$V(x_j) = \frac{x_j - x_j^{\min}}{x_j^{\max} - x_j^{\min}} \quad (6)$$

During the negotiation, the merchant and consumer Agent will select proper evaluation function for each project according to their different interest orientations of the project. For the same project, their evaluation function is at the opposite.

U stands for utility function, which is the evaluation of user negotiation Agent on the value of some negotiation project set. The calculation method is shown as Formula (7).

$$U(x_j) = \sum_{j=1}^J W_j V(x_j) \quad (7)$$

T: Time limit of negotiation

A: Motion set of negotiation

$$A = \{call, request, propose, agree, reject\} \quad (8)$$

Where, *call* means to send the negotiation request; *request* means to respond the negotiation request; *propose* means to send proposal; *agree* means to agree the proposal; *reject* means to refuse the proposal (Sierra C., 2004).

2.5. Establishment of BP Neural Network Model in Search Engine

BP (Back Propagation) neural network is a learning algorithm of neural network. The full name is the artificial neural network based on error back propagation algorithm. The single-hidden layer feed forward neural network of topological structure is generally known as three-layer feed forward network or three-network perceptron, including the input layer, middle layer (or hidden layer) and output layer. The characteristics of the network is that the neurons of each layer only fully connect with the neurons of the neighboring layer, and there is no feedback connection between the neurons of each layer, which form the feed forward neural network system with hierarchical structure. The single-hidden layer feed forward neural network can only solve linear and separable problems. Only multi-hidden layer neural network can solve the non-linear problems.

1. Manually input given keywords in the search engine “Hui Sou”, download training sample articles through internet, and extract Chinese words. In the previous experiments, 10000 articles of each webpage of employment, company information and renting information were downloaded respectively. Among all the information, employment information and company information has the highest similarity, which can be tested to decide the training ability of network.
2. Use the interface provided by the open-source program of “Huge word segmentation” to conduct word segmentation of the downloaded Chinese information and extract the keywords with high occurrence rates.
3. Establish neural network: According to the original data characteristic and anticipated classifying effect, neural network tends to adopt input layer, single hidden layer, output layer and 3-layer topological structure. Obtaining of input neuron: Input neuron refers to the weights of the preliminary extracted keywords in the sample article (binarization processed with keyword “1”, otherwise “0”). Selection of activation function: sigmoid activation function (hidden layer and output neuron):

$$sigmoid(x) = \frac{1}{1 + e^{-x}} \quad (9)$$

3. Agent Technology in E-commerce

3.1. Weak Definition of Agent

At present, there is no confirmed and unified definition of Agent in academia. Researchers gave different definitions on “Agent” according to their different research contents and targets. Wooldridg and Jenning summarized the definitions of “Agent” and provided the definition that is basically accepted by the academia. They gave “Agent” two definitions as weak definition and strong definition according to the usage of “Agent”.

The weak definition of “Agent” refers to the computer software or hardware system with properties shown in Figure 2.

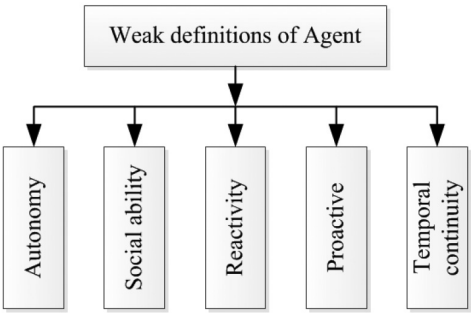


Figure 2 – Properties of Agent Weak Definition

Autonomy: it is the basic property of Agent, which can control its autologous behaviors and internal state. Without human’s direct interference, Agent can also activate a continuous motion. Its behavior is active and spontaneous; Agent has its own goal and intention; According to the requirement of target and environment, Agent should make plans for its short-term behaviors.

Social ability: Agent Communication Language (ACL) can be used to interact with other Agents. As a basic property of Agent, social ability is also known as communication, which means the information exchange between the Agents. Furthermore, Agent can proceed with “conversation”. Tasks undertaking, multi-Agent cooperation and negotiation all take the social ability or communication as the basis.

Reactivity: it means the awareness and influence to the environment. “Agent” has the ability of exploring the environment condition and responding the environment. No matter Agent lives in the real world (such as robot, service Agent on Internet) or virtual world (such the Agent in virtual mall), all the Agents should be able to perceive the environment and change the environment through their behaviors. The object that is unable to influence the environment cannot be regarded as an Agent.

Proactivity: “Agent” can take proactive measures to prove its goal-oriented property.

Temporal continuity: also known as longevity. Traditional programs are activated when needed and terminated when not needed or computation completed. Different from the programs, Agent can continuously work in a “pretty long” period. Although proactivity is not a must property, it is considered as an important property of Agent (Klose M, Lechner U., 1999).

3.2.Strong Definition of Agent

Except for the properties of weak definition, strong Agent also has following one or several properties:

Mobility: Agent has the ability of moving on computer network.

Rationality: the action of Agent should help to reach its goal rather than prevent from its goal. At least in the allowable range of belief, conflict targets are not accepted.

Adaptability: Agent should have the ability of self-adjustment and be able to adapt with the working methods or ways of other users.

Collaboration: Agent doesn't live alone but with other Agents. The effective and efficient cooperation of Agents can greatly improve the performance of the whole system. Besides, Agent cannot accept and execute any order. It should note that people would make mistakes and ignore some important information or provide uncertain information. Agent can detect the case and solve the problem through the user model established by the system or even refuse to execute the task (Terpsidis I, Moukas A, Pergoudakis B., 1997).

3.3.Problems for Agent

Common Agents have to solve the problems as cooperative mode, workflow management, media space share, heterogeneous resource integration, collaborative system security, collaborative application development environment, and virtual cooperation environment, etc. E-commerce Agents have their own technical difficulties as shown below except for the above problems:

Information discovery problem. There are a lot of distributed networks on Internet. It has been a hard-to-solve problem to discover the most appropriate information from these networks. At present, the professional information of a commodity is usually distributed everywhere on the Internet. Some company or specialize organization created the website and provides customers with the information. With the increase of online information, it becomes even harder to search and integrate the important information. Both of the buyer and seller have the same problem. Now “keywords searching” is the main solution to information discovery. However, the range of this method is limited. In addition, as the method cannot realize the related search of synonyms, “keywords searching” technology is not appropriate to search all the data on the Internet in a specified domain range. Hence search engines as “YAHOO” (www.yahoo.com) are needed for Agent to obtain all the related information of certain information. XML(Extensible Markup Language) also provided a solution to the problem of information discovery.

Communications problem: in order to obtain the professional and detained information of a certain commodity, the buyer Agent needs to contact with the seller Agent, which may lead the following three problems:

1. As shown in Figure 3, the buyer and seller should adopt the same transport protocol to transport demands and results. Protocols as TCP/IP can solve these problems by unified and convenient transportation of demands and results.

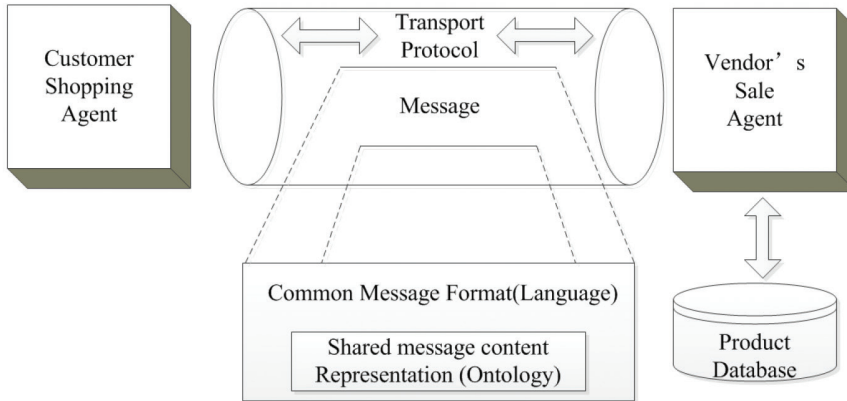


Figure 3 – Communication Problems

2. The next problem is to design a public transport language. Each party in the E-commerce should understand the language. At present, HTML is a popular language on Internet. HTML format text allows the browser to explain the webpage on WWW. However, as the main purpose of HTML design is to accurately display information rather than extract information, the information that Agent needed are usually embedded in a specific HTML text. It has always been the goal of KQML (Knowledge Query and Manipulation Language) to understand how to obtain useful information from HTML and transport them. KQML is a transport language of Agent. Similar Agent communication languages include FICA ACL (Agent Communication Language) and MIL (Market Interaction Language) which are still at the developing stage. MIL is a language specially designed for the communication of E-commerce Agents.
3. There is only one communication problem left after solving the transport protocol and transport language problems. The buyer and seller need to negotiate on the transport content, which requires the formulation of the content expression methods in the public transport language (Lin F, Huang S, Lin S., 2002).

3.4.Design and Realization of E-commerce System based on Mobile Agent

3.4.1. Systematic Structure of E-commerce Agent

This part summarized three systematic structures of E-commerce Agent:

Purchase Agent with simple ability can intellectually guide the users to buy certain commodities. All the operations of this type of Agent should observe the following two principles:

1. **Search-supporting principle.** The target of Agent with simple purchasing ability is to provide certain commodities for users. To realize this, service Agent should be equipped with the interface provided by the merchants. As soon as the users define the searching conditions, Agent with simple purchasing ability will query the backstage commodities base of each merchant through the interfaces, summary the obtained results and transport back to users in a standard expression form. The Agent with simple purchasing ability can only search the particular commodities of a certain domain. Users can only query the commodities provided by the merchants specified in the domain.
2. **Price comparison principle.** According to users' requirements, multiple merchants may return the commodities that satisfy the purchasing conditions of the users. When displaying to users, the prices, quality, service providers and additional charges (such as postal charge) will be briefly given for users' selections, which can save their time and facilitate their selections. Based on these two principles, Agent can accomplish the selection tasks of commodities (not real purchasing tasks) for users. Then, users can contact with the specified merchants and accomplish the real transactions. Based on the above operation process, this paper presented the systematic structure of the Agent with simple purchasing ability as following.

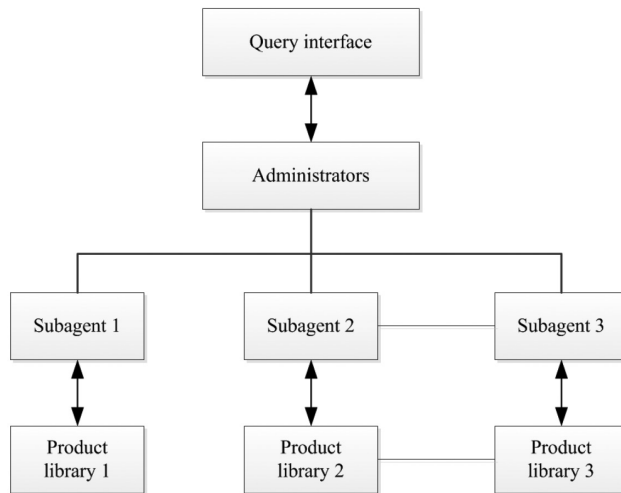


Figure 4 – Systematic Structure of Agent with Simple Purchasing Ability

This systematic structure contains four main hierarchies:

1. **Query interface:** In the query interface, the search conditions of the required commodities will be defined and the returned query results will be described.
2. **Sub-Agent:** Sub-Agent is used to execute the query task and report the results to the administrator. The sub-Agent will contact with a certain merchant, search the backstage data base of the merchant and seek the commodities that

satisfy the requirements of users. After obtaining the results, sub-Agent would forward the commodity information to the administrator. All the operations are conducted simultaneously. One sub-Agent contacts with one merchant, which greatly reduced the time of searching.

3. Administrator: The administrator is responsible for coordinating the actions of each sub-Agent and the organization, combination and ranking of the result information of each sub-Agent. He has all the information of the registered merchants and the sub-Agent at the corresponding interfaces. When receiving a specific request of the user, the administrator should transfer the request in time. When receiving specific commodity description from the merchant, the administrator should classify the results according to certain intelligence and transfer to the query interference for user's browsing.
4. Merchant: Merchant provides the commodity data base for the purchasing Agent with simple ability. The sub-Agent query will do the search on the data base. The purchasing Agent with simple ability has no direct effect on the merchant (Lee K Y, Yun J S, Jo G S., 2003).

3.4.2. General Design of System

The system is designed on the basis of MVC, which mainly include four hierarchies: expression hierarchy, Agent hierarchy, application server and data base server, as shown Figure 5.

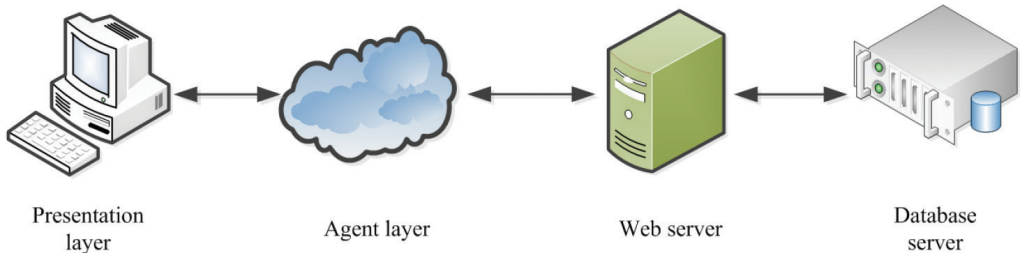


Figure 5 – General Design of Mobile Agent E-commerce System

1. Expression hierarchy

The user interface adopts the browser method to facilitate the user. As different users have different permission, this system has three different user interferences based on the transaction process of E-commerce, including merchant interface, administrator interface and buyer interface. Hence, different service interfaces will be presented to users with different permissions.

2. Agent hierarchy

Agent hierarchy is an indispensable part of realizing the mobile Agent E-commerce system. It mainly includes buyer Agent sub-system, merchant Agent sub-system, logistics Agent sub-system, payment Agent and intermediate Agent, etc. When transaction occurs, each Agent system would cooperate and accomplish the transaction rapidly and conveniently.

3. Web server

Web server is also known as the intermediate hierarchy. It mainly conducts the logic processing and maps to related data base hierarchy. The main function module of the system includes user administration, transaction administration and after-sales processing, etc.

4. Data base server

As an important part of the system, data base mainly stores various information needed in the transaction process. The system data base mainly consists of buyer data base, merchant data base, logistics data base and intermediate data base, etc. (Puliafito A, Tomarchio O, Vita L., 2000)

4. Experimental Data and Analysis

The target of the experiment is to download the E-commerce information on the internet through the search engine model “Hui Sou” designed in this paper, use neural network algorithm to automatically classify the above information, compare the number of iterations and classification accuracy of the classification algorithms by adjusting parameters as the number of neurons and training samples, so that to testify the feasibility of neural network algorithm in the intellectual search engine.

The number of input neurons f BP neuron network is 45, mainly includes the keywords with higher appearance selected by mapping keywords from three types of information (each type 15 neurons). The result of the selection is shown as below:

When the sample number is 1000, the test times is 200. When the training sample number is 100, the experimental data is shown as Table 1:

Experiment number	Training sample number	The number of iterations	Errors	Number of errors	Accuracy rate
1	100	873	0.099963	0	1
2	100	309	0.099733	24	0.88
3	100	3137	0.099825	0	1
4	100	1973	0.099919	50	0.75
5	100	1690	0.099931	0	1
6	200	1275	0.099662	9	0.955
7	200	4899	0.099344	40	0.8
8	200	3348	0.09361	3	0.985
9	200	1531	0.099594	0	1
10	200	15459	0.09999	5	0.975
11	150	259	0.099736	19	0.905
12	150	1524	0.099789	0	1
13	150	219	0.0999	5	0.975
14	150	537	0.09978	0	1
15	150	1682	0.099815	0	1

Table 1 – Statistics of Experimental Data

According to the experimental result, when the number of BP neural network input neurons is 45, all the iteration number of the classification algorithm is less than 10000, and the accuracy is higher than 0.9, as shown in Figure 6 and Figure 7. The established neural network model has good generalization ability, which can achieve the expected classification effect and apply to intellectual searching engine model. Besides, according to the comparison, the number of neural network input neurons has limited effect on the whole classification result, and the iteration number and accuracy are basically in the same level range (45 input nodes and the iteration number is relatively low). In this case, the selection difficulty of BP neural network input neurons can be avoided.

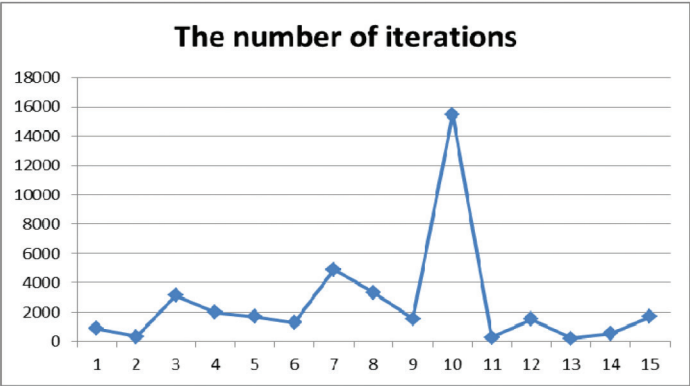


Figure 6 – Statistics of Iteration Number

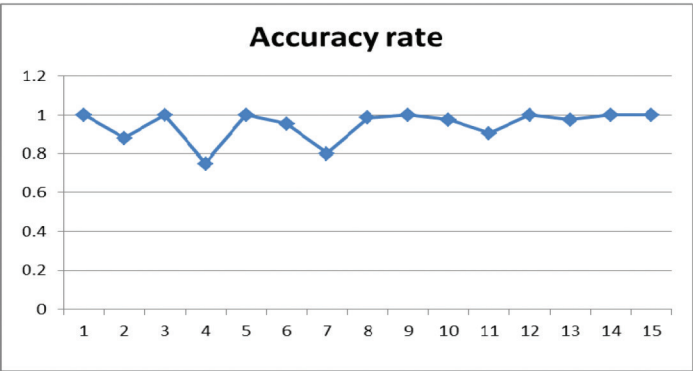


Figure 7 – Statistics of Input Nodes Accuracy Rate

Due to the network property of “Work after learning” of BP neural network and high work efficiency, although there are much iterations during the network training, the training process can be offline operated, which will not affect the visit speed of internet. The experiment also proved that the classification algorithm can satisfy the speed requirement of search engine (Su C J., 2008).

5. Conclusion

With the new trend of times, E-commerce has been more and more popular, and gradually leads the economic development of modern society. Due to the rapid information transfer, low transaction cost, high-efficient circulation, and large market scale of E-commerce, various enterprises set foot in E-commerce, which promoted the continuous development of our economy. This paper gave a definition on Agent technology, including weak definition and strong definition, classified E-commerce according to different business properties, introduced GA, proposed the negotiation model based on GA and established the general design based on mobile Agent E-commerce system on the basis of the above theory. The mobile Agent E-commerce system mainly consists of four hierarchies as expression hierarchy, Agent hierarchy, application server and data base server. In addition, the paper also applied BP neural network model into search engine and testified through experimental analysis that the classification algorithm has high work efficiency and can satisfy the speed requirement of search engine. In conclusion, this paper proposed a comparatively perfect E-commerce platform based on artificial intelligence, which can effectively realize intellectualized E-commerce and solve the problems that may appear in the using and development of E-commerce system.

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Analysis of Full-Electronic-Computer based Railway Station Interlocking System Based on Double 2 out of 2

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Abstract: Operating and scheduling railway with safety is the foundation of railway transportation. Analyzing interlocking relationships among turnout junction, signal controller, and track circuit, workers use this method to ensure the safety of train operation. This paper elaborates the structure and principle of computer based railway station Interlocking System based on double 2 out of 2, specifically focusing on computing the security and reliability of this system through factors such as fault coverage. Emphasizing on analysis of railway station computer Interlocking System, this paper elaborates on three parts for it: application logic layer, safety logic layer, and I/O layer. Then, Utilizing designed system, we do the simulation of analysis of security and reliability. The simulation shows that using different redundant structure, different interlocking systems results in incongruity in reliability and security. While in the aspect of security, interlocking system based on double 2 out of 2 has evident preponderance.

Keywords: Computer based Interlocking System based on double 2 out of 2; Fault Coverage; redundant structure; Security.

1. Introduction

Inland railway station's interlocking system between signals and turnouts experienced three phases: first mechanical interlocking control, then electrical control, and computer control plus relay executive finally. As the development of exclusive industrial control computer, a new computer redundant technology—interlocking system based on double 2 out of 2— wins the opportunity to spread and apply in computer based interlocking system. This system infuses brand-new designing ideas and methods in various aspects such as hardware structure, breakdown security, and network communication(Akita K, Watanabe T, Nakamura H, et al., 1985; Bernardeschi C, Fantechi A, Gnesi S, et al., 1998; Bondavalli A, Nelli M, Simoncini L, et al., 2001). Moreover, the scalability of this system enables different scales of railway station yard and transportation capability in China. Computer based railway interlocking system mainly aims for giving locomotive drivers real-time, accurate, and safe signals through complicated computation of interlocking relationships among turnouts, signal controller, and track circuit(Borälv A., 1998), and should be capable of reflecting all real-time monitoring states accurately. As a result,

Ministry of Railways asks for superior standards for factors such as instantaneity, reliability, and security(Chandra V, Verma M R., 1991). Because interlocking system directly affects the operating safety of train and above factors are fundamental in the selection of system(Chen G, Fan D, Wei Z, et al., 2010), it is of great importance to analyze and compare the security and reliability of interlocking systems with different redundant structures. Indeed, the study of computer based interlocking system has been continuing for years at home and abroad, and our country started to adopt computer based interlocking system in trunk railway in 1993. After 1997, the main form of interlocking structure was hot-standby, such as TYJL-II computer based interlocking system designed by China Academy of Railway Sciences, DS6-11 interlocking system designed by General Design institute, JD-IA interlocking system designed by Beijing Jiaotong University-Weilian Company, and VPI interlocking system designed by Kasco Company(Chen X, He Y, Huang H., 2011; Cimatti A, Giunchiglia F, Mongardi G, et al., 1998). Some other systems were designed on the basis of Programmable Logic Controller (PLC). A few of developed countries such as United States, Japan, Germany, and France started to study full-electronic computer based interlocking system in 1990s, then various countries began to develop toward full-electronization in succession, thus bring the system open structures, and making it smaller and smarter. Systems such as EBILOCK50 by ABB, SSI from UK, and SIMIS designed by Semen's, Germany have already replaced relay driving signals and point machines by solid state devices. These devices mostly install next to the railway(Hansen K M, Ravn A P, Stavridou V., 1998), which decreases trunk signal cables, thus decreasing the cost. As a good example, railway circuit controller by Ansaldo Company, Italy was completed by full-electronic devices.

2. Analysis of Railway Station Interlocking System Based on Double 2 Out of 2

2.1. Railway Station Interlocking System Based on Double 2 out of 2

Railway Station Interlocking System based on double 2 out of 2 possesses relatively high reliability and security (Mira-Giménez, M. J., 2015), and its overall performance is better than interlocking systems based on hot-standby structure and 3-Module redundancy structure(Haxthausen A E, Peleska J.,2000).

Similar to principle of 2 out of 3 system mentioned before, while 2 out of 2 interlocking system has better reliability and security(Ning B, Tang T, Gao Z, et al.,2006). As presented in Figure.1, the general structure of 2 out of 2 computer based interlocking system can be divided into 3 layers: monitoring layer, interlocking logical operation layer, and device interface layer.

The design of interlocking system emphasizes on interlocking logical operation layer. Not only doing interlocking logical computation, more importantly, this layer needs to ensure the system's security. On the basis of security, the system should consider reliability and maintainability to serve for availability. At present(Pataricza A, Majzik I, Huszerl G, et al., 2003), the system can be divided into centralized structure and distributed structure. And a 2 out of 2 interlocking system contains two subsystems: main interlocking system and standby interlocking system.

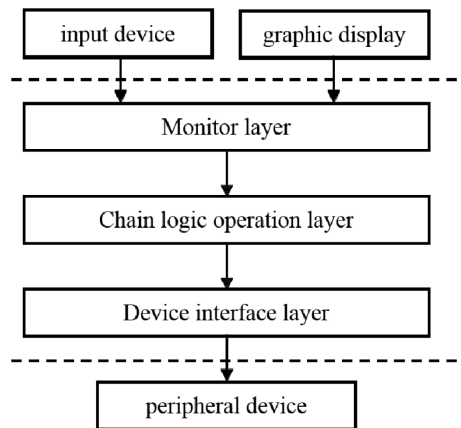


Figure 1 – Hierarchy of Two out of Two System

2.2. Operating Principle

Operator sends operating commands to monitoring layer, and shows the information of station yard through visualization. There are two sets of interlocking systems(main and standby), and each system contains 2 CPU unit. The functions of interlocking machine are listed below:

1. Two CPU units can do interlocking operation independently.
2. The results from two CPU units are transferred to 2 out of 2 voter through information channel, and the valid drive starts only when results are the same. This structure is beneficial for realizing the security of system information.
3. Exchange information between two systems(main and standby). When main voter shows that the results are different, switch to standby interlocking system.
4. When standby voter shows that the results are different, the system shuts down.

At present, most foreign double 2 out of 2 systems and 2 out of 3 systems adopt same hardware structure, even same operation system, for it makes synchronization and comparison of system easy. While if different hardware, even operation systems are adopted, the diversity between two CPUs would greatly enlarge. Moreover, if program which aims for same is developed by two sets of completely different programmers(Roanes-Lozano E, Hernando A, Alonso J A, et al., 2001), the probability of occurring security issue caused by common mode would reduce greatly. In conclusion, finding ways to realize two different algorithms in double 2 out of 2 operation platform is the key point to the further increase of security of double 2 out of 2 system.

2.3. Reliability and Safety Analysis of Double 2-Vote-2 System

In a two take two subsystem,only one module breaks down, this subsystem becomes invalid, switches to standby system and continues to work when there is no output. So we could simplify the above states and integrate related states, as Figure 2. we explain every state as table 1.

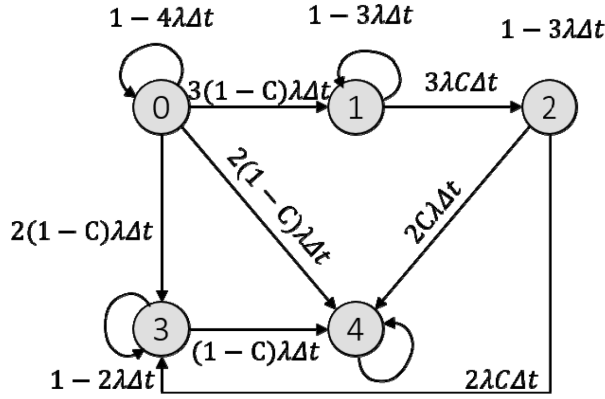


Figure 2 – Simplified State Table of Two out of Two Interlocking

o	T System State
1	The system is in good condition, and the system works well.
2	There is a module failure in the main system, but the system is not detected, the system works in the pseudo two to two state
3	In the main system, a module fault is detected and removed, and the main system is in a single module, and the main system is in a single module.
4	There is a module failure in the standby system which is in the working state, but the system is not detected, and the system is working in the pseudo two two state.

Table 1 – T System State

In above-mentioned states, system switches from state 3 to state 4, which is the key part of influencing the safety of Double-2-Vote-2 interlocking system. It indicates when modules in spare system have unpredictable malfunctions, it will make the system stay in non-malfunction safety state. According to system state transition diagram of 2*2-out-of-2 redundant structure in Figure, we could know:

1. System reliability

$$R(t) = 4C^2 e^{-\lambda t} + (10C^2 - 14C + 2)e^{-2\lambda t} + (9C^3 - 18C^2 + 7C)e^{-3\lambda t} + (-9C^3 + 4C^2 + 7C - 2)e^{-4\lambda t} \quad (1)$$

2. System safety is

$$S(t) = C^4 + (C^4 - 3C^3 + C^2 - 2C)e^{-\lambda t} + (-2C^4 - 9C^3 + 7C^2 + 2C + 2)e^{-2\lambda t} - (-7C^4 + 19C^3 - 14C^2 + 2C)e^{-3\lambda t} + (4C^4 - 7C^3 + 6C^2 - 2C - 1)e^{-4\lambda t} \quad (2)$$

Due to the reliability and safety of the above models and calculation, we could analyze further. The expressions of reliability and safety of all structure systems are:

3. $t \rightarrow 0$ When :

$$\begin{aligned} R_1(0) &= R_2(0) = R_3(0) = R_4(0) = 1 \\ S_1(0) &= S_2(0) = S_3(0) = S_4(0) = 1 \end{aligned} \quad (3)$$

The system is reliable and safe.

4. When $t \rightarrow \infty$, the safety is

$$\begin{aligned} R_1(\infty) &= R_2(\infty) = R_3(\infty) = R_4(\infty) = 0 \\ S_1(t) &= C, S_2(t) = C^2, S_3(t) = C^3, S_4(t) = C^4 \end{aligned} \quad (4)$$

It shows that: when the system is completely unreliable, its safety is still decided by fault detection coverage. It is seen that although safety $S(t)$ and reliability $R(t)$ are related, if the value of fault detection coverage C is high enough, even the system is unreliable, high safety is still guaranteed.

Fault detection coverage indicates the fault diagnosis ability of system. According to the above analysis and calculation, the selection of its value will directly influence the design plan of system. As for system maintainability, fault detection coverage is higher and closer to 1, the system could diagnose malfunction in time and handle properly, and system could effectively utilize redundant parts, finish reorganization and reconstruction of system and improve system reliability. But higher fault detection coverage necessarily increases a lot of hardware detection modules, it virtually increases the complexity of system, which not only increases the development costs of system, but also brings new problems due to complex systems; besides, current fault detection technology has higher fault detection coverage to single fault, but lower fault detection coverage to double or multiple faults. Due to low multiple fault occurrence probability, the main fault which influences the system safety is double fault.

3. Research Based on Railway Station Computer Interlocking Control System

3.1. Design Principle Of Double 2-Vote-2 Computer Interlocking System

The reliability of railway station computer interlocking control system is the measurement of finishing specified function within specified time under specified conditions ability, and the safety of railway station computer interlocking control system is the measurement of the ability of the system to produce dangerous side output without the occurrence of failure, they are closely related. The higher the reliability of the system, the smaller the probability of failure and probability of occurrence of the risk of failure occurs, which means higher safety. In general, the reliability of system is described through these two

indicators, reliability $R(t)$ and mean time between failure MTBF; the safety of system can be described as safety $S(t)$. And, reliability means the probability of performing its functions normally within specified time under the specified conditions; mean time between failure means the average time between two successive failures within specified time under the specified conditions; safety means the probability of occurrence of a hazardous side output will not occur when a failure occurs within specified time under the specified conditions. If we use α to indicate the failure of system may result in the probability of failure of the dangerous side output, then the relations of system reliability and safety could be defined as:

$$S(t) = 1 - \alpha [1 - R(t)] \quad (5)$$

The reliability of system will directly influence system safety, we need to combine them organically. Analyze its safety based on the reliability analysis of railway station computer interlocking control system.

3.2. Design and Implementation of Double 2-Vote-2 Computer Interlocking System

As Figure 3, three computing devices consist of a 2-Vote-2 system. And A and B conduct the same logical operation independently, this logical operation is application logic related to safety, detailed logics will be confirmed by clients. C is in charge of the I/O work of the whole system, and judge the calculation results (or output results) between A and B according to certain rules and application logic request periodicity, and decide if there is output control signals according to it. For external system, the whole system indicates as single C. The communication of internal system, A, B and C is transmitted by independent digital channels.

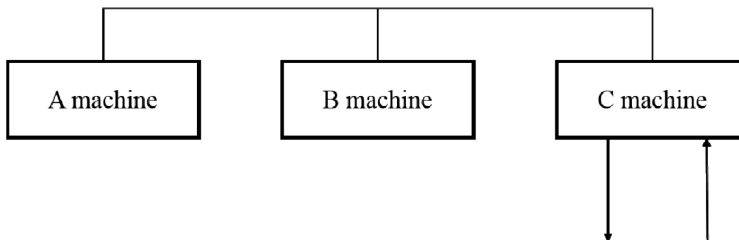


Figure 3 – System Component

According to analysis of requirement design and system workflow, we propose that based on general-purpose computer, 2-Vote-2 interlocking system is mainly composed of three parts: application logic layer, safety logic larger and device I/O layer.

Application logic layer. It consists of the application logic based on which users handle business data, and depends on the specific application. In order to ensure the reliability in handling business data, application logic layer needs to obtain the corresponding services provided by safety logic layer. The system doesn't make any assumption about

application logic but only discusses the services and corresponding interfaces safety logic layer should provide for application logic layer. Application logic layer is divided into client side application logic (A, B) and server side application logic (C). Client side application logic's program is wrote and implemented by users, hereby we just provide the interfaces deploying safety logic layer. Users obtain related services by deploying corresponding interface functions. Server side's application logic interface is similar to client side's application interface, the system operates automatically, server repeatedly asks for and receives client side's request, performs corresponding operations according to the type of request and returns operation results to client side.

Safety logic layer. It, as the core of the project, provides services for logic layer upwards and communicates with the outside through I/O device downwards. Safety logic layer with safety strategy-interlocking data comparison strategy set inside is used to determine whether the operation of current system is safe based on which control signals are outputted to achieve guidance safety.

Application logic operates simultaneously on A and B, two totally same parts. Because safety logic layer should provide services for application logic layer, service points must be placed on A and B. Safety logic layer mainly works on the handling of the communication between client side and server side after application logic layer deploys interfaces and the handling after server receives client side's corresponding request. The composition of safety logic layer is shown in Fig 4:

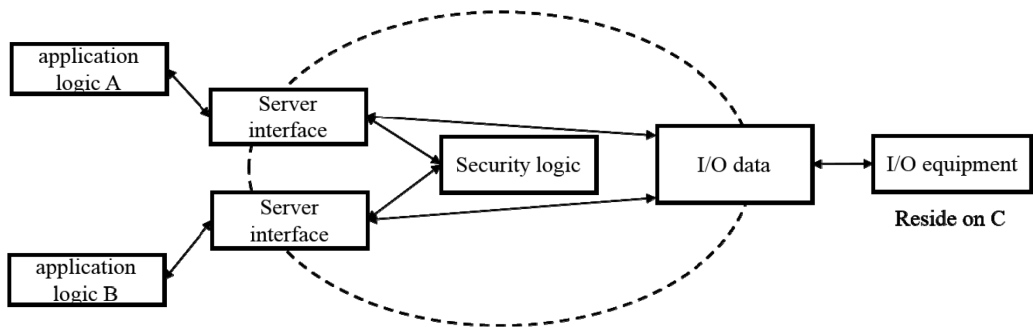


Figure 4 – Structure of Satety Logic Level

1. Data transmission

Safety logic layer is linked to client sides A, B and server side C, so data transmission is needed among its different parts and the reliability of data transmission should be guaranteed. Data transmission services are vertical in network, and the setting of network protocol is horizontal at the same level of network. Seeing from the hierarchy and structure of network protocol, the system involves application layer and transmission layer and can be divided into the upper layer-the data transmission of application layer and the lower layer-the data transmission of transmission layer. The lower layer provides services for the upper layer.

2. System time

One of the features of computer-based interlocking system is the instantaneity of system which hopes that client sides A and B do the same work in the same clock cycle and is driven by the clock. The clock signals in the past computer-based interlocking system was emitted by a single relay, and limited by process level and other factors, the clock frequency of interlocking system can only meet the system design requirements by computer-based interlocking, railway station control center and other system with low loads and computation burden and can't meet the requirements by high-speed railway, which is one of the reasons that we need to develop the two out of two system simultaneous with tasks.

Device I/O layer. It reads data from the actual I/O device. We pass the data from client sides A and B on to I/O device or distribute the data from I/O device to A and B. It mainly reads the local interfaces, seals the obtained data and puts them in the input line, and asks I/O device to conduct specific reading operation or send the read data to A or B when application logic makes reading requests; output data is outputted to the outside device after safety and logic handling.

4. Simulation Computation Examples

Railway station computer-based interlocking control system is directly related to the infrastructure involving the safe operation of trains, so the one-of-a-kind system chose for the systems with different redundant structures must have good reliability and safety and its indexes and parameters should all meet the corresponding provisions in the interim conditions about computer-based interlocking control system issued by Ministry of Railways. The parameters chose for the simulation computation conducted in the reliability and safety analysis of railway station computer-based interlocking control system adopting different redundant structures and according to the standards are shown in Table 2.

$\lambda(h^{-1})$	$R(\%)$	$\alpha(\%)$	$\delta(\%)$
0.18×10^{-7}	99.76348	0.01	99

Table 2 – Parameters for the Selection of Founder

Redundant Structure	Fiduciary Level/%	Mean Time Between Failures (H)	Probability Of Occurrence Of Failure Is Dangerous	Degree Of Safety /%
Click System	99.76348	5556000	0.01	99.999976348
hot-standby	99.99944	83333000	0.01	99.999999944
two redundant	99.99944	46296000	0.00000006	99.99999999998992
two out of two interlocking	99.99777	41667000	0.00000004	99.99999999999108

Table 3 – Reliability and Safety Analysis of Computer Interlocking Control System of Railway Station With Different Redundancy Structures

The simulation computation conducted according to the above analysis is shown in Table 3. As you see, the results of simulation computation are in line with the results of the above analysis and comparison.

5. Conclusion

In conclusion, railway station computer-based interlocking control systems adopting different redundant structures have different reliability and safety. In terms of reliability, the railway station computer-based interlocking control system adopting double-machine hot-standby redundant structure is the best on reliability index and average failure interval time among the several redundant structures. In terms of safety, the railway station computer-based interlocking control systems adopting two out of three redundant structure and two out of two by two structure have dominant advantages. As you see, the railway station computer-based interlocking control systems with different redundant structures focus on different aspects. The conclusion from the comparative analysis of railway station computer-based interlocking control systems adopting different redundant structures in reliability and safety provides technical support for system choice, but in the specific model choice process, the specific requirements for reliability and safety by the system should be considered comprehensively, and the specific situations should be calculated, analyzed and compared according to different emphases to make the most reasonable choice.

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Simulation Research of Educational Resources by Mathematical Model based on Computer Incentive Mechanism

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Abstract: Educational information resources play an important role in the teaching of information, and the sharing and application of educational information resources is the key to educational information. At present, the utilization rate of educational information resources is not high, and many high-quality education information resources cannot play a role of “color” for education and teaching, instead, it caused the waste of resources. In view of the low utilization ratio of educational information resources, lack of user education information resources of extrinsic motivation, from the characteristics of education information resources and progress of the information resource, with reference to the advantages of information education vouchers, “the use of coupons, accumulative integral, periodic settlement awards” incentive mechanism was put forward. The cumulative integration of the user simulation, the school accumulated points change simulation, school incentive funds change the simulation were carried out respectively to verify the feasibility of the model. The mathematical model of the computer incentive mechanism not only can be used as an important measure to stimulate the users to use information resources, but also can provide the basis for scientific allocation of educational information resources construction funds.

Keywords: Education information voucher; Incentive mechanism; Mathematical model

1. Introduction

Incentives of computer education information resources are mainly concentrated on the co-construction and sharing development application model of regional education information resources; in terms of concrete implementation, the “government-led, enterprise-developed, schools-used” mechanism is adopted (Jiang Xingling, before ping, wen-zheng Yang, etc., 2014). The regional education authorities are responsible for planning the construction of a regional education information resource library and classifying construction funds for education information resources into two parts-resource construction and resource use: one is for construction and development of resources; the other is incentive funding for constructing school information environments and encouraging users to actively use information resources (Zhi-ting zhu, Sun Yan yan., 2015). Enterprises as developers of education information resources cater

to demands for education information resources, make use of its technology advantages, develop education information resources and provide high-quality information resources to regional repository in a competitive way; schools will use incentive funding obtained to the construct information network environment on the one hand so that users can conveniently use education information resources, and to encourage users to actively use education information resources on the other hand, thus stimulating and maintaining users' extrinsic motivation for using education information resources (Chen Lin, etc. 2015). From the perspective of incentives to users, this paper explores strategies to improve the overall utilization of regional education information resources. Setting forth from the features of education information resources and use process analysis of education information resources, taking consumer psychology as a starting point, this paper puts forward that users use regional education information resources by virtue of "educational information vouchers"; accumulate points for users' information resource usage, settle accounts according to regular credits exchange rates (a full academic year or a semester) and allocate corresponding funds to schools; study and give play to the bridging advantage of mathematical modeling that introduces theoretical understanding towards operational practice, and initially build a mathematical model concerning schools' using education information resources and obtaining incentive funds. At the same time, use computer random simulations and validate the application feasibility and operability of this model in order to provide a reference value for improving the utilization performance of education information resources.

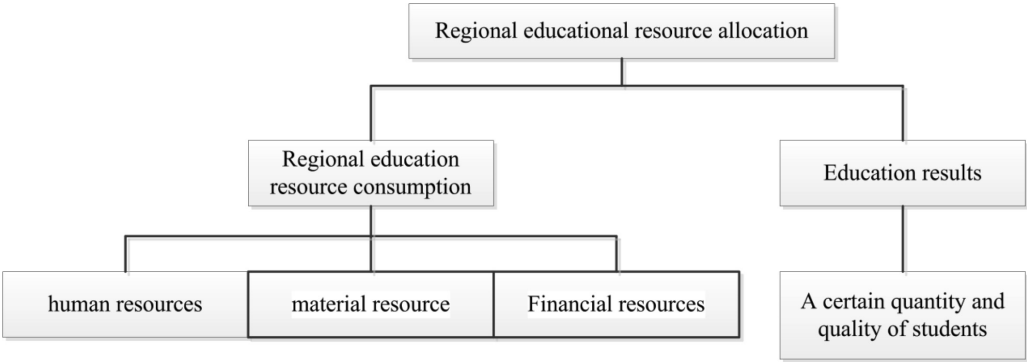


Figure 1 – Regional Educational Resource Allocation

2. Analysis of Incentive Mechanism of Education Information Resources

2.1. Characteristics of Education Information Resources

Education information resources are a set of resources that have gone through digital processing, run in the information environment and served education teaching. Comparing education information resources and traditional teaching resources, it has some unique characteristics: (1) the sharing of use; (2) timeliness of spread; (3) diversity

of performance; (4) convenience of acquisition, and (5) interactivity of transmission. (Wang Zhuli, 2014)

2.2. Using Process of Education Information Resources

The process of using education information resources coincides with the general consumption process (Fu Qian & Song Yan. 2014). In the teaching or learning process, users have needs to improve their teaching or learning performance through utilizing education information resources; the strong demand for utilizing education information resources stimulates users to create motivation of using education information resources; prompted by the motivation, users will collect various resource materials by means of school libraries (Gasca-Hurtado, G. P., Peña, A., Gómez-Álvarez, M. C., Plascencia-Osuna, Ó. A., & Calvo-Manzano, J. A., 2015), special education resource sites and scholarly journals and then compare and screen resources that meet their needs; users' satisfaction with information resources will determine whether they will continue to use these resources. The using process of education information resources will be affected by plenty of factors (Dinkelman T, Martínez A C., 2014). Intrinsic motivation derives from users' intrinsic needs such as needs to achieve self-worth; stimulation and maintenance of extrinsic motivation belong to external factors; a good information network environment, school policy support, model demonstration, school incentives among others will affect users to use resources. Based on users' complex psychology of using resources, users should also be given related incentives during using resources so as to stimulate their internal demand for using information resources, stimulate and maintain their motivation to use education information resources, encourage users to use more education information resources, tap their potential abilities and meet their needs of achieving self-worth(Vamstad J. 2014).

2.3. Motivational Process Analysis of the Use of Education Information Resources

From a psychological perspective, motivation is the process that energizes people's behavior and performance, namely by arousing and enhancing the internal driving force of human behavior through various objective factors to make people always in a state of excitement. (Ford M. 2014) Motivation plays a very important role in tapping human potential. In the meantime, motivation can also meet people's needs to achieve self-worth (Fu Qian, Song Yan., 2014). Conforming to Maslow's hierarchy of needs, appropriate incentives can not only meet lower-level needs, but also meet higher-level needs, such as need for the respect of others and needs to achieve self-worth. According to Herzberg's two-factor theory, in order to encourage users to enthusiastically use education information resources, schools should not only build a smoothly flowing information environment as a prerequisite and basis for the use of information resources, to eliminate users' dissatisfaction with the using process of educational information resource, but also give users material and spiritual motivation and improve their satisfaction with using education information resources (Quirk M, Emerson J, Husaini B, et al., 2014). Only by combining both can we better motivate users to enthusiastically use education information resources, meet the needs of users, and stimulate motivation for users to use education information resources (Ellis A L. 2015).

3. Educational Information Vouchers

In the process of using education information resources, educational information vouchers are introduced as a currency for users to use education information resources, with the purpose of intuitively stimulating users' "consumption" feeling through the "currency". Set a cumulative credit mechanism for users; on the one hand it can lay a basis for schools to apply for grant funding; on the other hand users earn credits by using education information resources, which can increase their sense of accomplishment in using resources. "Educational vouchers" were first proposed by Milton Friedman in 1955 (Wang T, Foliente G, Song X, et al., 2014). Since its implementation, some process has been made; its greatest value is that: innovate the education financial investment system, break the traditional model of education resource allocation, speed up the flow of education funding, reflect a harmonious unification of resource allocation fairness and efficiency; introduce the market competition mechanism, so that schools improve teaching quality and service in competitions with each other, while giving parents and students freedom and equal rights to select schools (Hagger M S, Keatley D A, et al. 2014).

Educational information vouchers are taken as the currency for users to use education information resources, and the main roles are: First, reflecting that each user has the opportunity to share high-quality education information resources; second, representing that users should pay to use education information resources by showing the vouchers; third, educational information vouchers are a "currency" with which users can not only use local resources but also enjoy resources within other regions, thus achieving the sharing of education information resources; fourth, educational information vouchers are pre-paid by governments and governments can learn users' potential (the ratio of used educational information vouchers and pre-paid educational information vouchers) to use education information resources in the billing cycle. The performance of consuming educational information resources by schools or users will be an important basis for governments to pre-pay educational information vouchers for the next school year, on the basis of which flexible incentives can be developed (Hillman N W & Tandberg D A & Gross J P K. 2014).

4. Construction of a Motivation Mechanism Mathematical Model of the Use of Education Information Resources

4.1. Construction Idea of a Motivation Mechanism Mathematical Model

The construction idea of a motivation mechanism mathematical model for educational resources users is: use by vouchers, cumulative credits, periodic settlement and reward acquisition. Use by vouchers means that in accordance with certain criteria, the regional education authorities distribute e-educational information vouchers to users within their jurisdiction as a basis for access to regional educational resource libraries; with free "currency" on hand users can buy and use resources they need. Cumulative credits mean that when individual users use information resources, accumulated points are generated in their resources account following the pre-set integral form as a basis to exchange credits and obtain incentives. There are mainly two forms of cumulative credits: the

number of uses (including the number of visits) and duration of use: When users are interested in a particular resource, or think this part should be learnt multiple times, they can choose to download it. Download use is considered to be users' saturation use of a resource; downloading once will get the maximum credit for this part of resources. Visits are a browsing mode for users to understand the quality of a resource or know whether it is important; or due to misuse and other reasons, the duration of use does not exceed the set timeline (such as one minute), it is recorded as one visit by default (such as an credit) to accumulate credits; the duration of use is tailored to users' on-line learning; when users select to learn online, generally credits will be accumulated based on the ratio between the actual use time and the time to complete a part of resources at one time. Periodic settlement is to set a certain billing period according to actual teaching or learning (quarterly, half-yearly or yearly). Resources within the information resource library are designed and developed in accordance with uniform standards; all resources have different functions and purposes; users within the region are also different in grades, subjects and resource needs and preferences; within a certain period of time, users get different cumulative credits. Reward acquisition means the cumulative credits of all users' resource using within the statistical billing cycle, and then the government authorities allocate total incentive funds for schools based on the ratio with total credits of users, so we can have credit exchange rates for incentive funds as well as incentive funds allocated to each school (Zhang X, Zhou Z, et al. 2014).

4.2. Construction of a Motivation Mechanism Mathematical Model

The use of education information resources is a dynamic and complex process. In order to highlight the simplified and precise role of the mathematical model, and fully explain the motivation mechanism for regional educational information resource users, the following hypotheses are proposed in the mathematical model (Zhao Y, Zhu Q., 2014):

Hypothesis 1: There are different numbers of users (teachers and students) in each school within the region; few changes take place in the total number of users in a region in the billing period; set it as constant.

Hypothesis 2: In the co-construction and sharing design and development process of resources, new educational resources will be used in different patches; there are few changes to the quality and total number of resources invested in a semester; assume that within the billing cycle, there are few changes to the quality and total number of resources invested in a semester, it does not affect the using frequency of education information resources as a whole.

Hypothesis 3: the proportion of the government's annual allocation of funds to education information resources remains unchanged, the annual investment budget is unchanged.

Hypothesis 4: When users use education information resources, they will be affected by a variety of internal and external factors. In a given period, the use of education information resources is a dynamic stochastic process, and the results are users get constantly changing cumulative credits, so set it as a random variable. Basic symbols used in model construction is shown in Table 1.

Symbol	Snapshots
P	Government input to the use of educational information resources incentive fees
N	A summary of educational information resources in the library
I	School users use educational information resources to obtain the total score
M	Download or online saturation using a cumulative maximum integral value
C	In a single user within a year to get a total score
T	Get the lowest learning time of M value
F	Funds for the use of educational information resources in a single school in the region
E	Area user integral exchange rate
U	Total number of users in the region using educational information resources
Q	The number of users in the area of a single school using educational information resources

Table 1 – Basic Symbols and Instructions of the Mathematical Model of the User's Incentive Mechanism

Incentive funds allocated to every school in the region is determined by the number of users, the credits and the credit exchange rate:

$$F = f(Q, E, C) \quad (1)$$

where E is the credit exchange rate, which is a ratio between the total cost of government investment in education information resources P and the sum of all users' cumulative credits I_u :

$$E = P / I_u = P / \sum_{k=1}^U C_k \quad (2)$$

where C is the cumulative credits of a single user in a billing cycle (a full academic year). All library resources are cut by the same technical standards; regardless of the resources, as long as users are saturated, they can get maximum credit value M of this resource. The cumulative credits of a single user consist of three parts: credits for downloading resources C_D , credits for online use C_T and credits acquired for visiting C_V , denoted as:

$$C = C_D + C_T + C_V \quad (3)$$

Substitute Formulas (2) and (3) into Formula (1), we can obtain incentive funds of each school through using education information resources:

$$F = I \circ E = \sum_{j=1}^Q C_j \left(P / \sum_{k=1}^U C_k \right) \quad (4)$$

Formula (4) shows that in a certain credit exchange rate, schools' incentive funds are closely related to schools' total credits, while the total credits are jointly determined by the number of users and frequency of using education information resources and the use time.

4.3. Mathematical Model Analysis of Motivation Mechanisms

Under fixed total funds in education information resources, the more users "consume" educational vouchers, the higher cumulative credits, the more incentive funds obtained, which mirrors the concept that "those who used more would get more benefits; those who used less would get less or no benefits". As shown in Figure 1, the funds allocation of education information resources features two-way feedback and centered on users; the market competition mechanism is introduced, which reflect more equitable allocations of funds. It is significantly different from the traditional way of allocating education funds in that: first, innovation of funds disbursement; second, user-centric advantage.

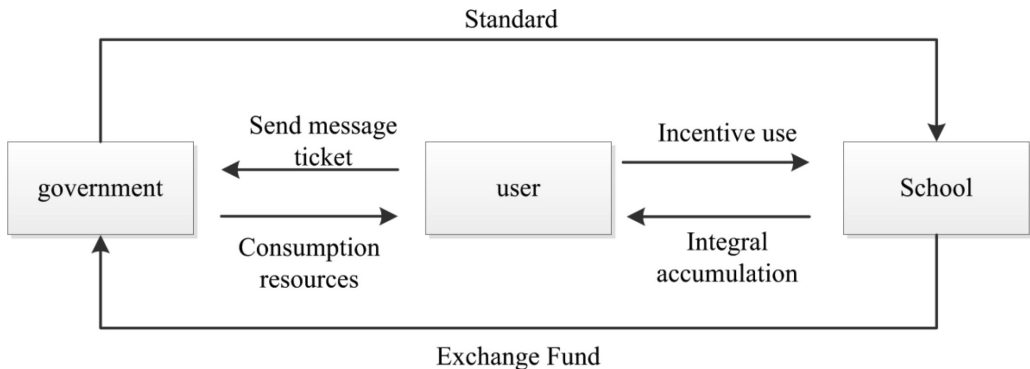


Figure 2 – Education Information Resources Use Incentive Process

5. Simulation of Motivation Mathematical Model of Educational Resources

5.1. Simulation of Users' Cumulative Credit Changes

The simulation data are from X County. Pursuant to the actual survey, the county has a total of 265 primary and secondary schools (five high schools, 30 junior high schools and 230 primary schools); the number of each school population ranges from 1000 to 2000. The credit rule is that: users can get 10 cumulative credits when using a resource in saturation, 1-10 credits for online use, 1 credit for a single visit, and 10 credits for downloading an information resource. There are 1000 resources to be selected for each grade for X county education information resource library; randomly simulate the cumulative credits of 20000 users for multiple simulations. Dynamic credit simulation of the actually used educational information resource library in the region is visible. Figure 3 presents the cumulative credit changes of randomly selected 20 users in a full academic year.

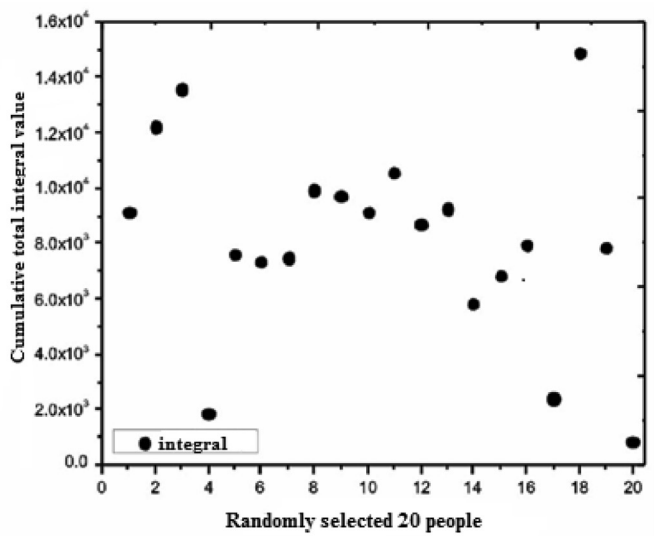


Figure 3 – Stochastic Simulation of Single User Accumulative Integral

As can be seen from Figure 3, the cumulative credits obtained by using education information resources vary to some extent. Some users get 15742 credits while some get 1746. This may be because of differences in the use purpose, habits and behavior. Focusing on users with low cumulative credits, schools need to take encouraging measures timely to strengthen their motivation.

5.2. Simulation of Schools' Cumulative Credit Changes

According to the above motivation mechanism, assume that the government gives each user educational vouchers of 400 yuan and provides that when users “consume” one yuan of educational information voucher, they can obtain one cumulative credit. The number of education information vouchers owned by schools in advance does not represent its “consumption” capability level; only the total cumulative credits obtained by users using education information resources can reflect the effect of schools in organizing users to use resources.

The credit exchange rate refers to funds in unit credit; the credit exchange rate changes with the government funds in education information resources each year and the total credits of all schools in the county. In the condition that the regional resource funds maintain stable, the greater the total credit, the smaller the credit exchange rate, the higher utilization of resources in the region. In the simulation, set X County allocates 10 million funds for information resources to schools; the government pre-pays educational information vouchers worth 32 million. It is expected that there are 32 million cumulative credits in the total region with the credit exchange rate of 0.31 yuan/

School Serial Number	Number of Users	Education Information Voucher	Accumulated Integral	Rate of Exchange	Get Money
S1	1643	657200	3351720	0.07	234620
S2	1235	494000	2519400	0.07	176358
S3	1302	520800	2656080	0.07	185925
...	...	...	...	...	...
S263	1533	613200	3127320	0.07	218912.4
S264	1023	409200	2086920	0.07	146084.4
S265	1212	484800	2472480	0.07	173073.6

Table 2 – The simulation of the accumulated points of the school and the change of the incentive funds

credit. Table 2 shows the credit exchange rate is 0.07 yuan/credit, far less than 0.31 yuan/credit in an academic year, which indicates that users' consumption of educational information vouchers are far beyond the government pre-payment, reflecting that the county has a high utilization rate of education information resources.

5.3. Simulation of School Motivation Funding Change

As indicated by the motivation mechanism mathematical model, the real incentive funds acquired by schools are the product of the total credits of school education information resources and the credit exchange rate. Regional average credits reflect the average credits obtained by each user using education information resources in the billing period, which is the ratio of total credit and the total number of population within the region. While other conditions remain unchanged, school incentive funds are theoretically closely related to the number of school population; the more the number of school population, in theory the more funds obtained.

Combining data in Table 2, S3 (1302) and S4 (1293) have almost the same number of people; theoretically they can get almost the same incentives, but in fact S3 received funds of 140,000 yuan and S4 received 104,000 yuan; S4 obtained 36,000 yuan less than S3. This shows that although the number of two schools are almost the same, the cumulative credits are different in actual using, and there is a large difference between funds obtained, reflecting a quite different consumption level of educational information resources. While other conditions remain unchanged, the more credits accumulated by the school in a period of time, the higher frequency school students and teachers use education information resources, which also to some extent shows a high level of school information education. In the billing period, S3 got more cumulative credits than S4, reflecting S3 has higher enthusiasm to use educational information resources and has a high level of information education. S4 needs to take appropriate incentives to encourage users to actively use the education information resources, improve their abilities to "consume" information resources, in order to obtain more incentive funds.

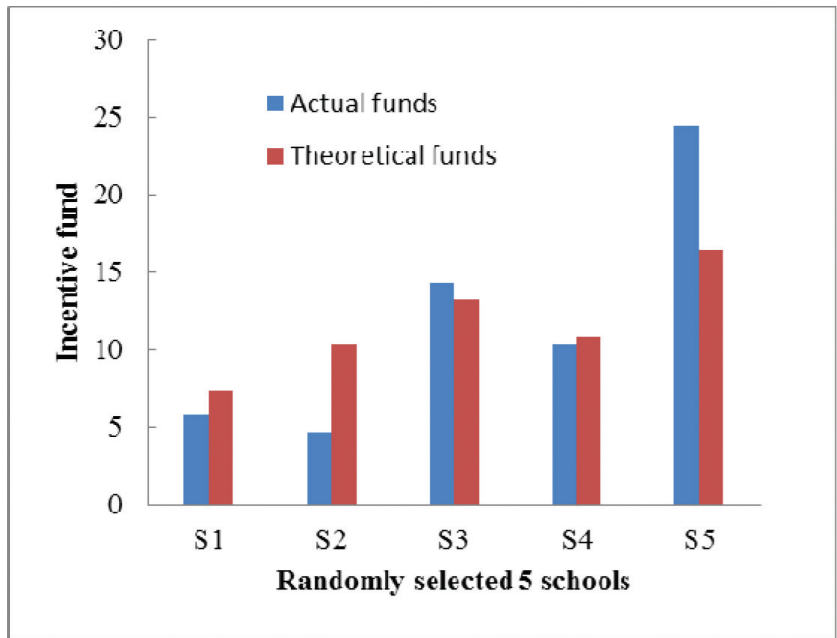


Figure 4 – Comparison Between the Actual Incentive Funds and the Theoretical Funds of the School

6. Conclusion

Co-construction and sharing of high-quality education information resources has become a consensus; the utilization of education information resources is an important problem to be solved at present. Teachers and students are the main body of using education information resources; it is a key to improve the enthusiasm of teachers and students to use education information resources. From the perspective of stimulating using, drawing on the advantage of “educational information vouchers”, this paper presents the mechanism--use by vouchers, cumulative credits, periodic settlement and reward acquisition, in order to promote schools to actively improve the information network environment and arouse teachers’ and students’ motivation to use education information resources, which can indeed improve the utilization of education information resources. A motivational mechanism mathematical model is employed in this paper tailoring to educational resources. It has been effectively verified in simulation and proved its feasibility and operability in practical applications, thus providing a strategy for improving the efficiency of using educational information resources and an appropriate reference for changing the traditional ways of allocating education funds.

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A Study of Computer-based Multimedia Teaching in Physical Education Class

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Abstract: Physical education is a bilateral study activity of great practicality and high engagement. However, the current resources are not systematic and complete. Therefore, it is necessary to design and develop a network-based education system and platform for physical education. In accordance to the characteristics of physical education, this paper adopts the web-based teaching system and the distance education system based on real-time interaction and on-demand content. The paper also interprets the demands of the development of network-based distance education platform for physical education, and analyzes the relevant key technologies, such as web technology, streaming media, database, and electronic white board. The standard design criteria of the network-based distance education platform for physical education is discussed, and the overall structure model and function model are proposed. At last, combined with the research design and the results, this paper evaluates the advantages and disadvantages of the platform during practical use.

Keywords: Physical education; Distance education; Education model; Computer technology; Multimedia

1. Introduction

The rapid development of modern science and technology requires large number of innovative talents. And the traditional education mode cannot satisfy the demands of higher education. Such situation requires great-leap-forward development for education, and provides unprecedented opportunity for the modernization of education methods. Currently, the education in China has the following features. The scale of the education is increasingly larger, and the structure of education is optimized. The idea of education is constantly upgraded and there are more education models. The development of distance education, especially network-based distance education is not only the effective solution to the question mentioned above, but also only the important motivation for the reform of traditional education model. Stemming from the west, distance education is best developed and spread in America, who proposed the plan of network-based education in 1996. More than 100 countries across the world have carried out modern distance education by 2000. The distance education started much later in China compared to the foreign countries, with the lagging research on this field. The Department of Education formally launched experimental units of distance education in four universities, including

Tsinghua University, Beijing University of Post & Telecommunication, Zhejiang University and Hunan University in 1998. Wu Zhongfu and others designed the web-based distance education platform in 1998 (Wu Zhongfu, Fu Yunqing.,1998). Zhao Shijie and others conducted the research of the application of network-based technology in physical education of universities and colleges in 2005 (Fan J, Zhao D, Guo T., 2012). Zhou Ping and others developed the information system of physical education management in universities and colleges in 2006 (Davies B S, Rafique J, Vincent T R, et al., 2012). Liu Xiaogang and others developed the cloud computing-based distance education system in 2010 (Liu Xiaogang., 2010). Gu Dexi and others designed the Ajax-based distance education system in 2014 (Lowe D, Murray S, Lindsay E, et al., 2009). There are a lot of distance education platforms so far in various universities and colleges, and a lot of schools have reached certain scale and accumulated much experience in network-based education. However, there are few platforms for physical education with comprehensive functions and stable system. This paper focuses on the design and development of network-based distance education platform for physical education, and gives overall and detailed design according to the condition and demands of physical education. What's more, this paper discusses the structure, basic principles, and features of the network-based education platform for physical education, and gives specific analysis and interpretation on the learning model, video streaming transfer, website page design, and the resource information organization technology of the network-based education platform. In the part of the overall design of the platform, the basic structure, function models, and the configuration of the software and hardware are introduced. In the part of the detailed design of the platform, the procedure of the platform and the security of the system are described. Moreover, this paper also illustrates the testing objects of the network-based distance education platform as well as the specific implementation scheme, and predicts and discusses the advantages and disadvantages of the platform.

2. Analysis of the Relevant Key Technologies and the Evaluation Methods

2.1. Web Server – Tomcat

This research chose the software, Tomcat web as the server of the network-based distance education system of physical education. Tomcat server is a web server with free open source (Martins, J., Gonçalves, R., Santos, V., Cota, M. P., Oliveira, T., & Branco, F., 2015). It is a small light-weighted application server, and is suitable for medium and small system with small volume of concurrent visiting. It is the first choice for the development and debugging of JSP procedure (Zhao Ming, 2015).

2.2.Streaming Media – Windows Media Format SDK

This research focuses on the streaming media server technology, which has been applied a lot. There are several steps in the video teaching based on streaming media technology: data collection, streaming of data, transmission of data, and data reading (Quan Xin Chen, Tian, 2014). The streaming of data relies on windows media technology, whose media format is ASF. The following figure is the detailed systematic structure of windows media format SDK (Liu Fenshan, Wang Lie, Yu Fei, et al.,2013).

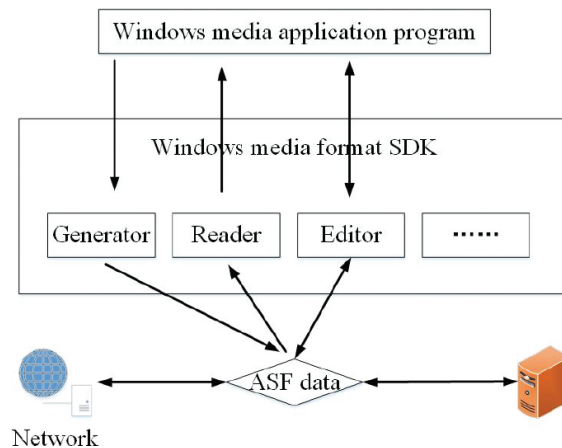


Figure 1 – Detailed System Structure Diagram of Windows Media Format SDK.

2.3. Selection of Database – SQL Database

The database technology is the core of the Internet technology. Nearly all information systems are supported by a database management system, and network-based distance education of physical education is of no exception. In this research, the selection of database has great influences on the scale, practicality of the platform, and the stability of the system (Chen Chao, 2012). Microsoft SQL Server 2003 is of great flexibility, as it is suitable for not only the individual user database for desktop system, but also the online database of enterprises, and even the global website database.

2.4. Electronic White Board – B/S

In the network-based distance education platform of physical education, electronic white board is achieved by CSCW theory and Java technology (Liu Zhaoxin, Li Yuze, Xu Jie., 2013). What's more, the electronic white board is based on B/S systematic structure and the modularized structure organization, and conducts the network communication through TCP/IP agreement and UDP agreement. It consists of OS, TCP/IP, Socket, and Student/Teacher Interface (Wang Shenghua., 2013). The following figure 2-5 demonstrates the specific model.

2.5. Real-time Multimedia Data Transmission Agreement RTP/RTCP

The real-time data transmission and synchronous control based on RTP/RTCP agreement is a transmission agreement for multimedia data stream on Internet (Li X, Cai W, An J, et al. 2009). It can provide time information and achieve synchronization during one-to-one or one-to-many transmission. The coordination of RTP and RTCP can improve the transmission speed with the most effective feedback and the least cost. It can optimize the transmission efficiency, and therefore is suitable for the real-time data transmission on the Internet.

2.6. Selection of Hardware Platform and Software Environment

The network-based distance education platform of physical education needs four types of servers: database server, application server, courseware server, and streaming media server (Chen Meiying, Zhong Daxiang., 2013). SQL server 2003 can be chosen as the database server due to the small data volume at the beginning. Quad Core CPU of 2.0GHz with 4GB internal storage are used as the application server, each of which could support 500 users every second. SCSI hot-swappable disk driver of 360G is used as the storage device. And the selection of the hardware of the courseware server shall take the demands of the 5000 concurrent users into consideration. Dual Core CPU of 2.0GHz with 4GB internal storage is sufficient for the requirements of the system performance at the beginning of design (Song Baojie., 2015). At the same time, as there are few courses at the beginning, disk driver of 80G can be used as the storage device. According to the demands of the development of network-based distance education system of physical education, the following configuration scheme is proposed: take Windows 2000/2003/XP or vista as the client operating system, with the version of IE above 6.0; take Microsoft SQL Server 2003 as the database software; and use local area network to test the platform, and use the server of campus network computing center to test the visiting of large number of users (Wang Ping, Zhao Zhilong, 2014).

2.7. Performance Test

Use SPECweb99 to test a fixed WebService, increase the number of simultaneous connection gradually, and observe the number of actual maximum simultaneous connection within the range of rate requirement during the test. The result is given in the following Figure 2:

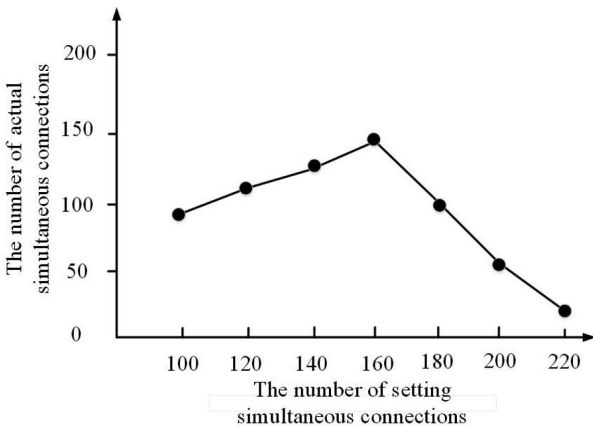


Figure 2 – Change of The Actual Performance With Negative Numbers

Therefore, the response of WebService towards the request depends on the system load. What's more, the response of the server software towards the dynamic requests also has great influence on the performance. Shield the dynamic part with centralized test firstly, and conduct pure static test to WebService. Then introduce the dynamic test, and

increase the proportion of the dynamic contents gradually, and observe the number of actual maximum simultaneous connection in the test (Zhang Wei., 2014). The result is given in the following Figure 3.

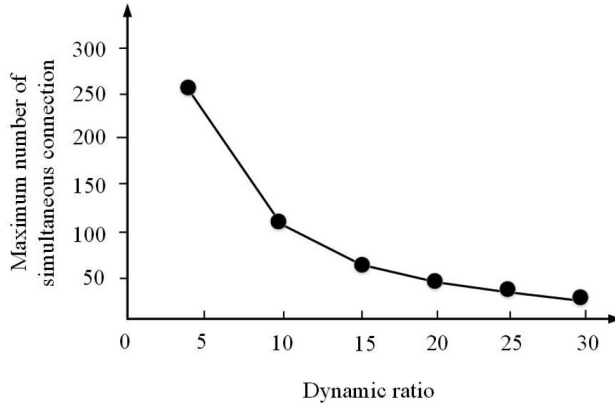


Figure 3 – Relationship Between Actual Performance and Dynamic Content Ratio

Therefore, the larger the proportion of dynamic test, the smaller the number of maxim simultaneous connection the Server could support.

2.8.Stress Testing and Concurrency Testing

Stress testing is to evaluate the maximum service level of the system by determining the bottleneck or the limiting point of the system. When the resources of the web server is saturated or overload (e.g. the CPU or internal storage is saturated), the stress testing can be used for the evaluation of the system's capability of dealing with the HTTP requests or user conversation or whether there will be mistakes in the system (Panlili. 2014). It can be regarded as a stability test under extreme stress, which can evaluate the stress of the server when large numbers of users log in the server simultaneously. The procedure of the test is a simple multithreading network procedure, and there is no need to involve thread synchronization or advanced network model to achieve the goal. The ω in the equation represents frequency

$$E(O,t) = A\sqrt{\frac{\pi}{\sigma}} \exp\left[-\frac{\pi^2 t^2}{\sigma}\right] \exp(-i\omega_0 t) \quad (1)$$

The concurrency testing is a process of load testing and stress testing. Increase the load gradually until the system reaches its bottleneck or cannot receive more loads. Then determine the concurrency performance through the comprehensive analysis of the responding data and the resource supervision index (Wang Haibin., 2015).

Calculate the average number of concurrent user:

$$C = nL / T \quad (2)$$

Maximum number of concurrent user:

$$c' \approx C + 3\sqrt{3} \tag{3}$$

In equation (2), C refers to average number of concurrent user, and n refers to the number of login session. L represents the average length of login session, and T refers to the length of time in observation. Login session refers to the time from login to logout of users.

3. Design of Network-based Distance Education Platform of Physical Education

3.1. System Arrangement Idea and Overall Logic Structure

The purpose of the design of network-based distance education platform of physical education is to provide an Internet-based learning environment for users. The functions of the platform are realized through the interaction between the servers and the browsers. After analyzing the demands of the platform and evaluating the advantages and disadvantages of the network-based education system of other courses, the network-based distance education platform is designed to consist of the following five parts, namely, My SQL database server, Tomcat Web server, campus Internet and affiliated facilities, education platform management system, client teaching and learning system (Yang Xiao, Gao Bo., 2014). These five parts are connected through hardware and software platforms to achieve the interaction between users and the platform. This is actually a process of realizing the interaction between the end of client and the end of server (Yin Lihong, 2014). Take the student user at the end of client as the example, the general functions of the platform are presented in the following figure 4.

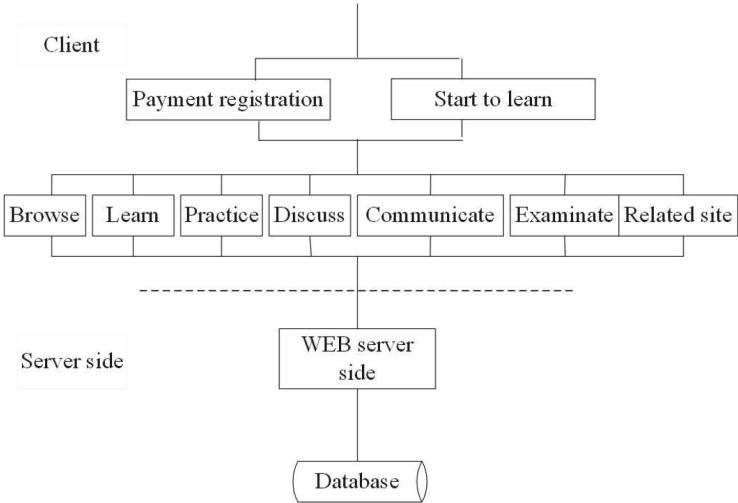


Figure 4 – Overall Function Diagram of the System of Physical Distance Network Education Platform

3.2. The General Application Framework of Distance Education Platform

The network-based distance education platform of physical education could set different accesses for different users, realizing the relevant functions of data maintenance for administrators, course learning for students, and teaching management for teachers. The structure of the system is as following:

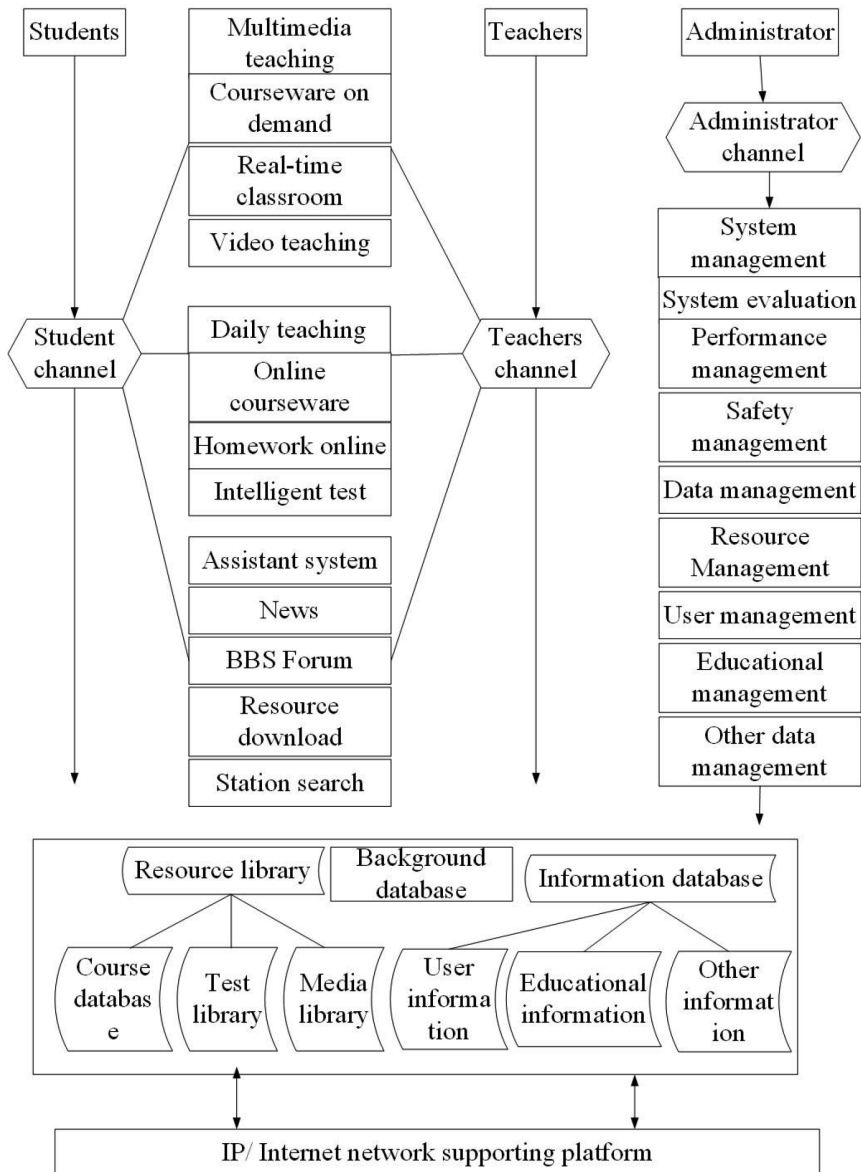


Figure 5 – Physical Network Education Platform System Structure

Based on the hierarchical framework, the establishment of the network-based distance education platform of physical education can achieve the mutual connection between independent heterogeneous application systems, and thus build the basic universal software platform, providing a uniformed operation environment of the business platform for all departments and participators.

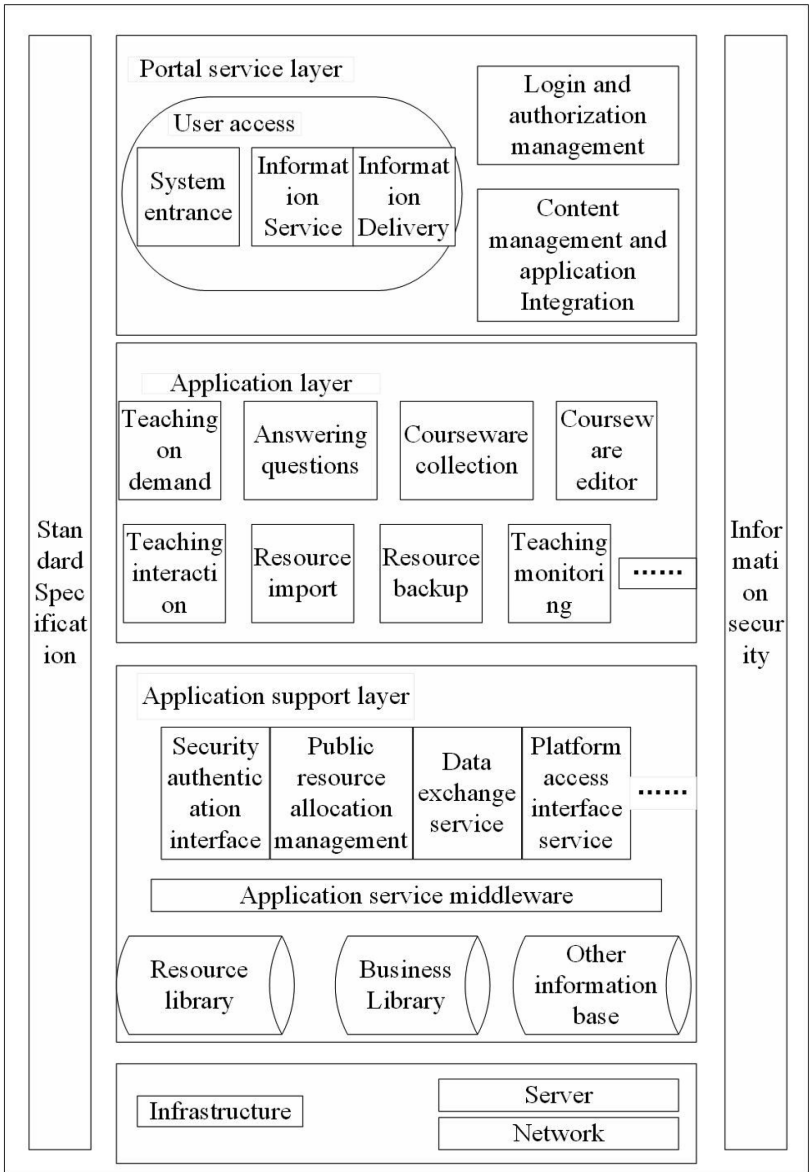


Figure 6 – Overall Application Architecture Of The System

3.3.Function Model Design of the Network-based Distance Education Platform of Physical Education

There are seven function models in this platform: course content presentation, teaching management, media resource management, interaction and communication, learning tools, and learning evaluation. These function models cooperate with each other closely while working independently.

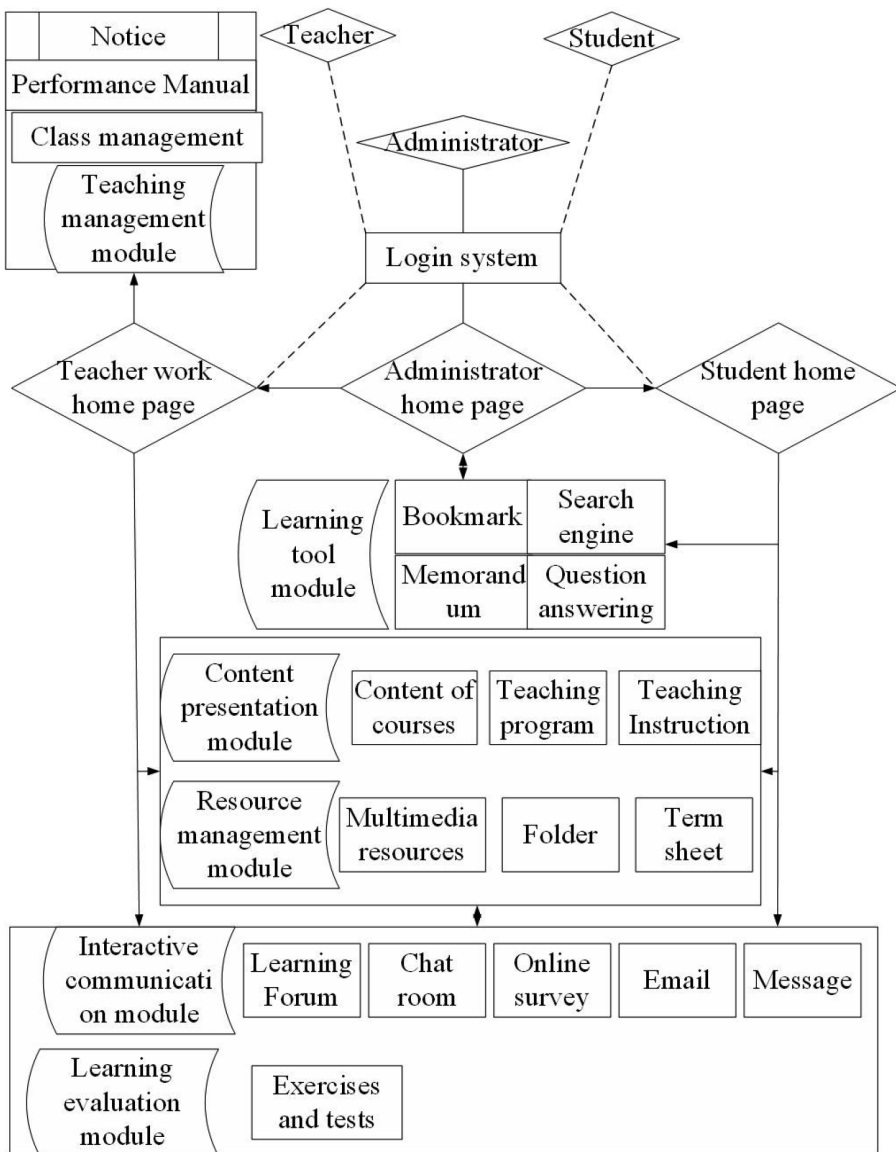


Figure 7 – Basic Structure and Working Flow Chart of the Distance Education System

4. Experiment Analysis

4.1. Experiment Study

This paper compares the traditional education model and the intelligent distance education with multimedia of physical education through experiment. The research objects are the undergraduate students of the department of physical education, Sichuan Normal University, who entered the school in 2014. Two natural classes guided by the same teacher are chosen, and the students are ranked and paired according to their basic learning level to make sure that the two students in each pair are at the similar level. Then the first 39 pairs are chosen to form an experimental class of 39 students and a control class of 39 students. The experimental class adopts the intelligent distance education model with multimedia, while the control class adopts the traditional education model. The comparison in terms of the teaching effects and students grades is presented in the following table:

	Experimental class		Control class	
	Number of people	Ratio of total number(%)	Number of people	Ratio of total numberr(%)
90-99 Score	11	28.21	10	25.64
80-89 Score	23	58.97	13	33.33
70-79 Score	5	12.82	15	38.64
60-69 Score	0	0	1	2.57
In total	39	100	39	100

Table 1 – Track and Field Performance Statistics

What’s more, this paper also studies the expected and actual employment of multimedia as well as the increase of the learning interests.

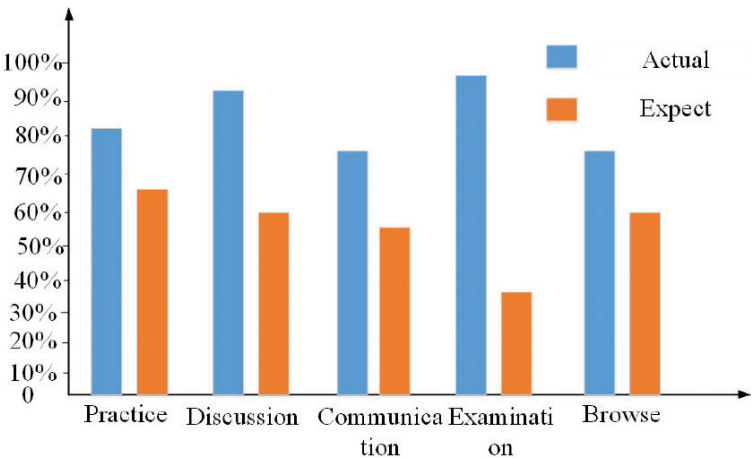


Figure 8 – Expected Use of the System and the Actual Use of the Situation

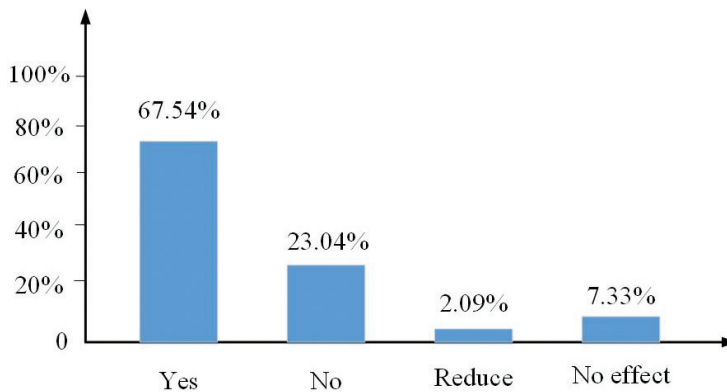


Figure 9 – Whether Reinforcement Learning Interest

The experiment results show that the learning effects of experimental class is better than that of the control class in terms of the students grades. The education model of the experimental class not only emphasizes the guiding role of the teachers, but also reflects the students' role as the cognitive subjects. In this kind of education model, the elements in the teaching activities of physical education are constantly in positive interaction, which enhances the enthusiasm of students and improves the cognitive ability of them.

4.2. Advantages of Network-based Distance Education of Physical Education

The network-based distance education of physical education demonstrates the guiding role of teachers and the students' role as the subject of learning. It gives full play to the interaction inside and outside the classes, and strengthens the development of the learner autonomy and innovation of students. At the same time, it saves the education resources of physical education, and put them into effective use, which greatly benefits the resource-learning model of the teaching and learning in physical education. The platform adopts the user-based programming technology, and focuses on users in both overall design and detailed design. It is platform of great openness and scalability, and will have excellent development in the future. What's more, it has great practicality and provides a reference for other relevant systems

4.3. Main Problems and Disadvantages of the Platform in Practice

Compared with the education system of other courses, the model functions and the style of this platform are not diverse enough. What's more, as the infrastructure of campus Internet teaching is not developed, and the information literacy awareness of students and teachers needs to be further improved, there is certain degree of deviation between the course design and the practice, and the co-construction and share of the teaching resources need to be strengthened, too. Therefore, the distance education of physical education needs to be updated in universities and colleges, and the information jam during the application of multimedia and network technologies in physical education needs to be noted. What's more, the platform is not suitable for some special subjects, as it cannot demonstrate the characteristics of the courses and the teachers.

The function system designed for the characteristics of various classes of physical education is not developed sufficiently yet. Therefore, this study shall combine with the teaching characteristics of physical education, and conduct more research on the system function of the platform to coordinate the teaching design and function system and support the network-based teaching and learning.

5. Conclusion

The modern distance education of physical education is a complicated project, and we must change the ideas and develop the physical education in universities and colleges with the advancement of the education theories and scientific technologies. There are two models of network course of physical education currently, the model of research group of teachers, and the model of business companies. Therefore, it is necessary to develop the distance education for physical education. Under the background of distance education development, this paper analyzes the relevant Web technology, streaming media technology, database, and electronic white board technology. It also explores the design principles of the network-based education platform for physical education, and proposes the overall structure model and function model. At last, this paper evaluates the platform according to the research design and results, and gives an analysis on the advantages and disadvantages of the platform during practice. It is showed in the study that the network-based distance education of physical education provides students with abundant learning resources, promotes the reform of the learning methods of physical education, and greatly enhances the network course construction of the universities and colleges.

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Research on Enterprise Internal Control Financial Assessment System Based on Artificial Intelligence

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Abstract: For enterprises, internal control is the needs of modernization management and operation management improvement. And internal control shall be perfected and improved by continuous internal control assessment. For enterprises, internal control assessment is the development trend. With the development of artificial intelligence networks, the enterprise internal control will be popular in management. Firstly, this paper briefly introduces enterprise internal control theory, and then analyzes indicators of performance evaluation, and analyzes the selection of index value in details. According to internal control financial assessment system, I propose a fuzzy comprehensive assessment algorithm to consist of enterprise internal financial control evaluation index system. In order to objectively, accurately and completely evaluate the overall levels of enterprise internal financial control, the establishment of indicator system is mainly considered from the following aspects, which are related to enterprise internal financial control, including control subject, control content, control environment and control target, and finally we use cases to analyze and testify: enterprise internal financial control is vague, using fuzzy comprehensive evaluation methods to assess enterprise internal financial control is operable.

Keywords: Internal control; Artificial intelligence network; Financial assessment system; Indicator system.

1. Introduction

Financial control (Nikolova B, 2014) is an important part of enterprise internal control, which is considered as core of financial management system. Actually a sound corporate financial control system is the perfect embodiment of the corporate governance structure, and vice versa, the innovation and deepening of financial control will also promote the establishment of modern corporate system and the perfection of corporate governance structure. According to the situation of China and actual situation of the enterprise, it is necessary to establish proper and suitable enterprise internal financial control system in the aspects of organization and financial management. Control theory is a new subject formed in 1940s, it is also an interdisciplinary subjects with strong applicability. It is a science of researching system regulation and control of all kinds of coupling elements with general rules. The idea, methodology and technology of

control theory have already penetrated into almost all natural science and social science fields. Economic control theory is a subject applying general principles and methods in economic system. Research fields of economic control theory (Gramling A A, et al, 2013) involve the whole national economic system and its subsystems, including all kinds of relations of internal and external system as well as all process and mechanism of operation in all systems. At the same time, many experts conduct a considerable amount of research on internal control. Yan Dawu and Yang Youhong(Kim A C, et al,2012) (2001) think that ensuring authenticity of accounting information is the main line of internal control development, the core of accounting control is internal control, internal control goals present a diversified development trend with the perfection of enterprise governance mechanism; Zhu Rongen(Cheng M, et al,2013) (2001) proposes using business cycle to design internal control; Li Minghui(Marinovic I,2013) (2002) thinks a sound internal control system should contain: checks and balances of corporate ownership, decision-making power, right of management and regulatory power, checks and balances of company decision-making power and right of management, internal audit organization mode and terms of reference, financial control of enterprise, internal control system and post operation norms of enterprise. He also points out that three checks and balances system chaos of internal control system exist in China's Listed Enterprises, as well as "insider" control phenomenon and etc; Professor Yan Dawu and Zhang Ruijun (Costello A M.2011) (2003) explain accounting real time control from the perspective of information technology, primarily establish accounting real time control framework.

2. Internal Control Assessment System Framework

2.1. Internal Control Assessment Framework Establishment

Internal control(Kim J B, et al,2011) is a process from design to performance, design and implementation are closely linked and indispensable. If internal control design is excellent, but perform poorly, and then internal control is an empty framework, which can't work (Mira-Giménez, M. J., 2015); on the contrary, if internal control design is wrong, then good performance is a waste of resource. So the evaluation of internal control is an evaluation process from design to performance, both of them must be taken into account. Meanwhile, the most important part of internal control assessment is not result, but to find out the problem source according to assessment process and then take measures to improve internal control to gradually perfect internal control with the help of internal control assessment. If internal control assessment could only give a score, it is meaningless. Besides, internal control is a control process. According to economic control theory, internal control should be a supervised and feedback loop process, and use this process to gradually improve the main body, strengthen internal control. Based on the above ideas, establish internal control framework, as Figure 1 shows:

In research of this paper, as shows in Figure 1, internal control assessment is composed of two first-class indicators——design and performance(Asare S K, Wright A.2012), which are given the same weights, and them compose of two second-class indicators. The assessment process is to come to internal control design score according to internal control design assessment indicators developed by five factors of internal control and

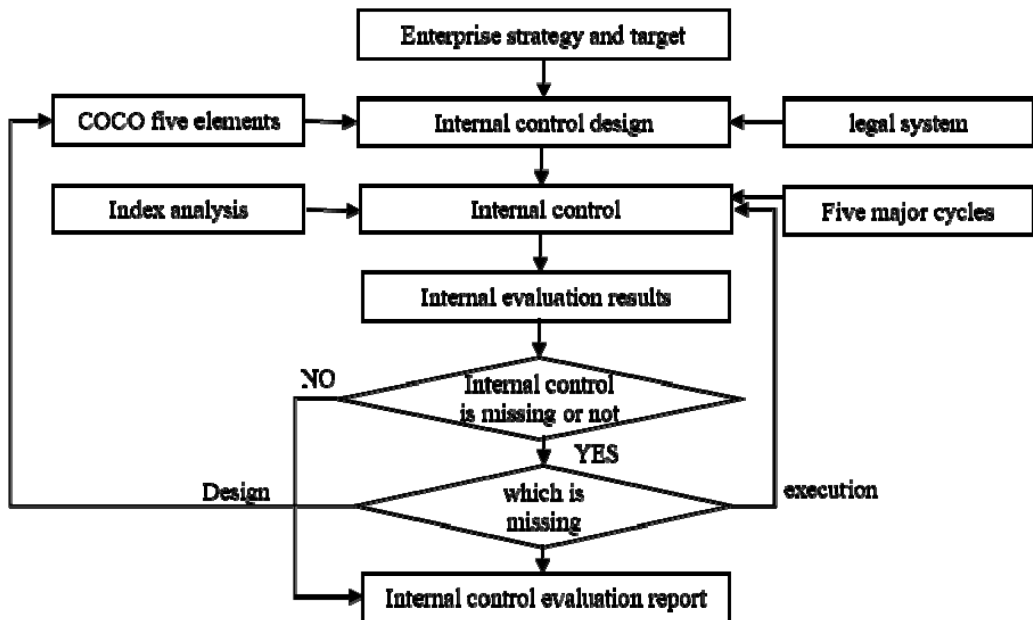


Figure 1 – Framework of Internal Control Assessment

the following of rules and regulations; and then come to performance score of internal control according to Japan's five forces analysis, risk identification control and four circular control points; come to a comprehensive score at last. During the assessment process of internal control, record problems of internal control in detail and analyze them to figure out assessment results and reasons of problems, and correct them in order to improve internal control.

2.2. Establishment of Internal Control Design Assessment Indicator System

Binns(Tseng C P. et al, 2012) thinks that internal control should be divided into internal control inside organization and internal control outside organization, which is also internal Sierpinski triangle theory(Blome C, Schoenherr T.2011), as Figure 2 shows: obviously, the internal control outside organization mainly involves customer, supplier, creditor and government. Maude Rich's evaluation standards are established by an American—Baude Rich Malcolm, which won American National Quality Award, it is an assessment based on 7 factors of organization. As Figure 1 shows, we could find out Baude Rich's evaluation standards are mainly embodied in how to perfect quality management system process, it overlaps internal control, because quality control is included in internal control itself; but it can't involve all the aspects of internal control, like financial control, controls of different activities in enterprise (like marketing activity and so on) and etc.

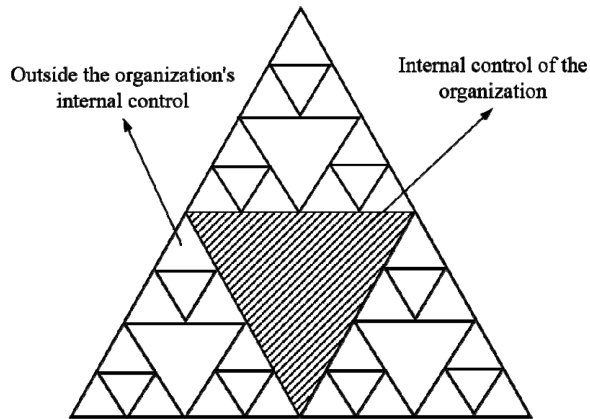


Figure 2 – Internal Triangle of Xiebinsi

1. Leader	110
2. Strategic Planning	80
3. Attention to Customers and Markets	80
4. Information and Analysis	80
5. Development and Management of Human Resources	100
6. Process Management	100
7. Operating Results	450
Total Points	1000

Table 1 – Malcolm BaIdrise National Award

2.3. Construction of Execution Evaluation Index System of Internal Control

The execution evaluation index system of internal control consists of financial index analysis and four major cycles. The four cycles include sales and payment cycle, purchase and payment cycle, production cycle as well as financing and investment cycle. Financial index analysis (Jia H. et al, 2014) mainly refers to earning power analysis, growth force analysis, productivity analysis, activity analysis, stability analysis and cash flow index analysis. In this article, the financial index analysis only involves in quantitative analysis, which is to carry out vertical and horizontal analysis of the indicators computed by balance sheet, profit distribution statement as well as cash flow statement, and propose relevant control management suggestions according to the problem revealed by analysis results (such as the problems of cash flow, inventory turnover, and fixed asset management). The above is the main function that this article is going to realize based on the financial appraisal system of case-based reasoning technology. Control management suggestions mainly involve the following aspects: sales management, cost management, expense management, asset management, fixed asset management, inventory turnover, accounts receivable turnover ratio, current assets / current liabilities management,

financial structure management, investment management, financing management, cash flow management, etc.

3. Construction of Enterprise Internal Financial Control Evaluation System

3.1. Comprehensive Judgment

Fuzzy comprehensive judgment (Ahuja M. et al,2012) is a kind of mathematical method that carries out comprehensive evaluation on the uncertain affairs in realistic world by using the thought as well as idea of fuzzy mathematics. Born in 1965, fuzzy mathematics was created by Professor L.A.Zadeh, American automatic control expert. (Soh D S B, Martinov-Bennie N. 2011) Over the 30 years, the theory of fuzzy mathematics develops rapidly with wide application. Fuzzy comprehensive judgment is just a method that applies the fuzzy set theory of fuzzy mathematics to evaluate the system comprehensively.

Specifically, the application steps of the fuzzy comprehensive judgment are as follows:

1. Determine Judgment Factor Set

According to the first-class indicator's nature characteristic of evaluation index system, the factor set in judgment relation is:

$$U = (u_1, u_2, u_3, \dots, u_n) \quad (1)$$

2. Determine Judgment Evaluation Set

Let Evaluation Set as:

$$V = (v_1, v_2, v_3, \dots, v_n) \quad (2)$$

3. Establish the single factor judgment R from U to V:

Establish the single factor judgment R from U to V: $R = (r_{ij})_{nm}$

$$R = (r_{ij})_{nm} = \begin{pmatrix} r_{11} & r_{12} & r_{13} & \dots & r_{1m} \\ r_{i21} & r_{22} & r_{23} & \dots & r_{2m} \\ \dots & \dots & \dots & \dots & \dots \\ r_{n1} & r_{n2} & r_{n3} & \dots & r_{nm} \end{pmatrix} \quad (3)$$

4. Determine Index Weight

Index weight is the proportion of each evaluation indicator in index system based on importance degree (Schwartz M.2013). The influence of each factor in factor set on judging

affairs is different, endow each factor u_i one weight a_i , then, factor's weight allocation set A can be regarded as a fuzzy set in factor set U , record it as $A = (a_1, a_2, a_3, \dots, a_n)$; it shall satisfy normalizing condition: $\sum_{i=1}^n a_i = 1$ and $0 < a_i < 1$

5. Make Judgment Result

Judgment result can be acquired through multiplying the index weight vector by the single factor evaluation matrix R : $B = A \cdot R = (\dots)$

6. Obtain Judgment Conclusion

Carry out normalization process on B set, which is to use the sum of each weight in B set to divide each weight in B set. The membership of v_i of i th evaluation grade to R_i is v_i 's share in comprehensive judgment result. According to maximum membership principle, take the judgment grade corresponding to the one with maximum membership in B as the grade of judgment object. This is the conclusion of comprehensive judgment.

3.2. Index System of Enterprise Internal Financial Control

In order to carry out enterprise internal financial control evaluation by suing fuzzy comprehensive judgment, the first is to establish the index system of fuzzy comprehensive judgment. In view of that enterprise internal financial control is a complex program, it is necessary to establish a evaluation index system that can reflect enterprise internal financial control comprehensively with multiple angles for the sake of evaluating the entire level of enterprise internal financial control objectively, accurately and completely. The design of index system of enterprise internal financial control evaluation shall be mainly considered from all the aspects enterprise internal financial control involved, such as control subject, control content, control environment and control objective.

1. Control Subject

The main body of enterprise internal financial control is the implementer of enterprise internal financial control, who principally evaluates from the aspects of business quality, moral quality and learning potential, etc.

2. Control Content

The content of enterprise internal financial control refers to its object, including financial activity control, investment activity control, asset management control and earnings management control.

3. Control Environment

The environment of enterprise internal financial control indicates the factors affecting enterprise internal financial control, which include internal and external factors. Specifically, it mainly contains the following aspects: legal environment, market mechanism, corporate governance structure, organizational structure, human resource environment, and information system.

4. Control Objective

The objective of enterprise internal financial control is the purpose that enterprise internal financial control want to obtain; mainly includes risk assessment, financial supervision, and lower transaction costs. The index system of enterprise internal financial control established based on it is shown in Table 2.

Target Layer	First Level Indicator	Second Stage Index
Enterprise internal financial control	Control body	Service quality
		Moral quality
		learning ability
	Control content	Financing activity control
		Investment activity control
		Asset management activity control
		Earnings management activity control
	control environment	market mechanism
		Human resource environment
		information system
	control objective	risk assessment
		financial supervision
		correction of deviation

Table 2 – Enterprise Internal Financial Control Evaluation Index

3.3. Application of Artificial Intelligence to Financial Management

The expert system of intelligent financial management (Rice S C, Weber D P. 2012) is intellectualized expert system; the expert system of intelligent financial management, according to financial management content, can be divided into financing management expert system (including funds management), investment management expert system, operation management expert system (including risk management, crisis management) and distribution management expert system. Each system mentioned above is embeddable into financial planning and forecasting subsystem, financial decision subsystem, financial budget subsystem, financial control subsystem as well as financial analysis subsystem. The system integration enables financial management expert system to play its function incisively and vividly, which made financial prediction become more accurate, financial decision-making more scientific, financial budget is more close to the actual, financial control in place, financial analysis more thorough, and financial management more comprehensive to realize an easy grasp of timely and comprehensively management.

1. The variable X_i exists in each node i
2. A connection weight index W_{ij} is existing from node j to node i .
3. A threshold value H_i exists in each node i

4. Define a transformation function $f_i(X_i, W_{ij}, H_i)$ to each node i , $j \neq i$; generally, this function takes the format of $f_i(\Sigma, W_{ij}, X_i, H_i)$, as shown in Fig. 3

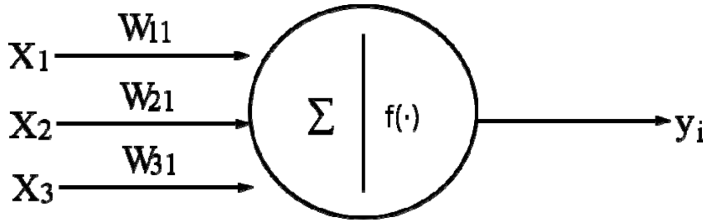


Figure 3 – Artificial Intelligence Network Model

Artificial neural network has the types of BP network, ART network, RBF network and HoP network, etc. BP network is mainly used in classification, function approximation, optimization and prediction. Nowadays, its successful application fields include: strategic financial management, listed company's financial risk early warning, investment project appraisal, stock price index prediction, fixed investment forecasting, billing data mining, financial derivative securities pricing, tax assessment, economic development mode selection, evaluation of urban land intensive utilization, marketing strategy combination, freight volume forecasting, logistics demand forecasting, and metallogenic prediction. The application fields of ART network contain: financial diagnosis, crisis warning, financial information quality control, and data mining, etc. RBF neural network has been applied to customer relationship management and housing cost estimation. Meanwhile, HoP network has been widely used in engineering technology.

4. Case analysis of Enterprise Internal Financial Control Assessment

Take an enterprise as example, utilize fuzzy comprehensive evaluation methods to comprehensively evaluate the enterprise internal financial control.

1. It is a complex multi-objective decision making problem to ensure enterprise internal financial control evaluation factors and enterprise internal financial control evaluation. This paper selects four factors in Figure 2 as factor set U of enterprise internal financial control evaluation: $U=(u_1, u_2, u_3, u_4)=$ (control subject, control content, control environment, control target).
2. Confirm comment set of enterprise internal financial control assessment
Factor evaluations of enterprise internal financial control are relatively vague, so the comment set V of all factor evaluation are set as five ranks:
 $V=(v_1, v_2, v_3, v_4, v_5) =$ (excellent, good, medium, pass, fail).
3. Establish single factor evaluation matrix R from U to V
Enterprises select a group of experts (10 people in total) with broad representation to consist of expert evaluation group of enterprise internal financial control,

enterprise internal financial control will be conducted by them. After expert group member gain more understandings of enterprise internal financial control, experts independently give evaluation ranks to the evaluation factors of enterprise internal financial control.

According to vague evaluations of all indexes of four above-mentioned factors, we come to the following conclusions: for enterprise internal financial control subject, 2 experts think it is excellent, 3 experts think it is good, 4 experts think it is medium, 1 expert thinks it passes, none of expert thinks it fails. Degree membership of influence factors of “control subject” of enterprise internal financial control are: 0.2, 0.3, 0.4, 0.1, 0, which can also be described as fuzzy vectors $R_1=(0.2, 0.3, 0.4, 0.1, 0)$.

In the same way, assessment results of other three factors can be set as: $R_2=(0.1, 0.2, 0.4, 0.2, 0.1)$; $R_3=(0, 0.2, 0.4, 0.3, 0.1)$; $R_4=(0.1, 0.4, 0.4, 0.1, 0)$ Above assessment results meet the normalization conditions, the sum of each component of vector is 1.

According to four above single factor evaluation results, single factor matrix is:

$$R=(r_{ij})_{nm}=\begin{pmatrix} 0.2 & 0.3 & 0.4 & 0 & 0 \\ 0.1 & 0.2 & 0.4 & 0.1 & 0.1 \\ 0 & 0.2 & 0.4 & 0.1 & 0.1 \\ 0.1 & 0.4 & 0.4 & 0 & 0 \end{pmatrix} \quad (4)$$

4. Confirm index weight

According to the influence degree of factors in assessment factor set of enterprise internal financial control to enterprise internal financial control, the weights of all factors are: control subject is 0.2, control content is 0.3, control environment is 0.3, control target is 0.2.

5. Make evaluation results

Experts' comprehensive assessment results to enterprise internal financial control of this enterprise are:

$$B=A \cdot R=(0.09, 0.26, 0.4, 0.19, 0.06) \begin{pmatrix} 0.2 & 0.3 & 0.4 & 0 & 0 \\ 0.1 & 0.2 & 0.4 & 0.1 & 0.1 \\ 0 & 0.2 & 0.4 & 0.1 & 0.1 \\ 0.1 & 0.4 & 0.4 & 0 & 0 \end{pmatrix} \quad (5)$$

The result shows that 9% of experts think that the enterprise internal financial control of this enterprise is excellent, 26% of experts think that the enterprise internal financial control is good, 40% of experts think that the enterprise internal financial control is medium, 19% of experts think that the enterprise internal financial control passes, 6% of experts think that the enterprise internal financial control fails.

5. Conclusion

Enterprise internal financial control assessment could make staffs in the enterprise know internal financial control ranks currently, which promotes staffs to work and make efforts together to promote the construction and improvement of internal financial control. Enterprise internal financial control is a vague thing, using fuzzy comprehensive evaluation methods to assess enterprise internal financial control has operability, which is considered as an effective method. However, internal control assessment in our country, both inside and outside the enterprises, most of them conduct subjective qualitative evaluation, and scattered evaluations can't form a system, which is disadvantageous for improving enterprise management level and strengthening competitiveness of enterprises in our country. With the needs of modernization management and intensifying competition of international and domestic competitions, it is a trend to use moderation management methods and information technology to establish internal control assessment system for internal control development.

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The Application Research of Computer in the Calculation of the Shooting Percentage in Football Match

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Abstract: With the vigorous development of modern football, the attack and defense become increasingly fierce, and the scoring becomes more and more difficult. So, in order to improve the success rate of the football match, the robot soccer game is taken as an example, a shooting algorithm based on objective function is proposed. In this paper, the shortcomings of basic shooting algorithm are analyzed on the basis of referring to a large number of documents, and through the method which used the distance as a judge condition for algorithm switching, the dithering phenomenon by reason of different control algorithms is deeply analyzed, the use of the S-curve weighted algorithm is avoided, so as to the smooth—switch between different control algorithms on the switch borderline is realized. Through an optimal search in the area that the robot can reach, this algorithm can fit to various speed statuses, improve the success rate of shot, and react to the sudden changing of the ball's motion status.

Keywords: Robot Soccer; Shooting Control; Optimal Search; Shooting Algorithm

1. Introduction

With the development of modern football, football game in the world range gradually shows new trends. In the offensive and defensive combat in football match, offensive soccer is the theme. Goal shooting is the focus. Therefore, it's the key to determining the outcome of the match to master the law of shooting and improve the shooting rate. Robot soccer match is a complex and interesting artificial intelligence research field, it combines many fields such as real time vision system, robot control, wireless communication, multi robot control and so on. It has become a standard experimental platform for the research of multi-agent systems. Reference (Jaisue, S., 2015; Anderson, K., Freeman, C., Rowett, D., Burrows, J., Scott, I., & Rigby, D. 2015; KUDO, S., 2015) presents a shooting algorithm based on using a fuzzy controller to avoid the collision between the robot and other robot. The algorithm achieves a good result of obstacle avoidance, but the success rate is not satisfactory due to the lack of consideration of the influence of the other goalkeeper. Reference (Kim, N. V. , 2015) achieves the goal by calculating the movement range and playing angle of other players, successfully breaks through the intercept of the opposing defenders and goalkeeper (Orhon, D., Sözen, S.,

Teksoy Basaran, S., & Alli, B., 2015; Miyamori, T., Nakasone, Y., Hitomi, K., Christie, J. M., Getzoffb, E. D., & Terazima, M.,2015). However, the algorithm doesn't have a reasonable choice of the shot point, and the robot can't kick the ball into the opponent's goal(Mubarok, M. Z.,2016).

2. Current Situation of Shooting Algorithm

The ability of the robot's shooting is the key to win the competition in robot soccer match. But it is very difficult to realize the precise control of the robot's shooting action, especially in the real robot system, it is harder to achieve precise control under the influence of mechanical characteristics, motion characteristics and visual error of robot car. At present, the frequently used shooting control algorithms include: the straight line shooting algorithm, the dynamic benchmark round gate algorithm(Matsumoto, H., Iwasac, T., & Yoshizawad, T.,2015), the shooting algorithm based on circular arc, shooting algorithm based on vector field(Navarro-Avino, J. P., Cioranu, C., Luis, S., Lapena, L., & Garcia-Agustin, P. 2015), shooting algorithm based on genetic algorithm and so on. These algorithms and the improved algorithm based on these algorithms can achieve accurate shot(Sun, H., Tanaka, Y., Tomita, K., Wu, Y., Rong, M., Uesugi, Y., & Ishijima, T.,2015), but the application effect of which is not very ideal in the actual dynamic competition environment. Nowadays, the speed is faster and faster, the fight is stronger and stronger, and the control request of the robot shooting movement is also higher and higher in robot soccer match. This paper proposes a shooting algorithm based on objective function after research and repeated practice(Wen, Y., Du, H., Tu, Y., Luo, W., Li, Q., Zhu, C., ... & Liang, B.,2015), the robot constantly carries on the real-time optimal search of the motion path according to current motion state of the ball through choosing objective function skillfully, so as to adjust quickly and touch the ball accurately(Wang, G. H., Nie, Q. X., Zang, C., Zhang, B. X., & Zhu, Q.,2015). The reasonable path and the quick adjustment time can make the success rate of robot increased significantly.

3. Motion-Controlling Model of Algorithm

Soccer robot is not an ideal moving particle in soccer robot system, the movement speed and rotation angle of which are limited by their physical characteristics, therefore, the motion model is required to be within the range of the robot's motion(Adamo, R. F., Fishbein, I., Zhang, K., Wen, J., Levy, R. J., Alferiev, I. S., & Chorny, M., 2016), otherwise, the planning path may not be realized in the specified time. At the same time, the motion state of the ball is not regular, which will change dramatically under the influence of the impact of robots or field frame on the field, and it is not accurate to predict the motion state of the ball after a certain period of time(Sharma, S., & Gangenahalli, G., 2015). So in most cases, there is no global optimal shooting path. Even if the ball is able to have a relative long time of free movement, it may also lead to the robot can't be completed within a given period of time under the influence of the unpredictability and the response ability of the robot motion. As a real time system with strong resistance, which requires the complexity of control algorithm not be too high, the iterative operations not be too much, and it also need to able to respond quickly to the changes of ball velocity on the field (Gasca-Hurtado, G. P., Peña, A., Gómez-Álvarez, M. C., Plascencia-Osuna, Ó. A., &

Calvo-Manzano, J. A., 2015). Therefore, the key of the algorithm is to find a non-iterative algorithm that adapts to the real-time optimal path of all kinds of match state and speed in the range of the robot's movement ability, and the algorithm also needs to maintain a certain robustness to the field and control the robot to complete the shooting well.

3.1. Thought of the Algorithm

The main idea of this paper is to control the robot to move in real time with the current optimal path. Figure 1 is a typical scene of a robot's movement shooting, where, B is the current position of the ball, and P is the prediction position of the ball, G is the target point, R is the current position of the robot, and S is the range of motion of the robot. N is the position of the robot that needs to be found in S. For the robot, its overall control goal is to make the robot to kick the ball to the target point G, according to the collision law, the position of the target point G and the motion state of the robot and the ball, we can calculate the angle of the robot and the ball when the robot touches the ball, the line and the goal line intersect at point C, the connection between the robot and the ball is required to reach the $\overline{PC}$ direction when the robot finally touches the ball. So there are two characteristics of the robot's movement in the whole movement process: Continuously approaches the predictive position P of the ball; the connection direction of the robot position and the ball continuously approaches $\overline{PC}$. Therefore, the process of controlling the robot's motion shooting is actually the process of controlling the distance d between the robot and the forecast ball as well as the absolute value α of the angle between $\overline{NP}$ and $\overline{PC}$ is reduced to 0. This is a double objective control, which needs to find the optimal value of the displacement and rotation angle of the ball in the current state. Due to the motion law and the motion range of the robot can be determined in a single shot. Therefore, we can find the optimal motion path in the current state as long as the search is performed in the motion range of the robot. The key question is how to establish the optimization objective function of two control objectives, in view of the types of the two control variables are different, the product term is more reasonable, and the proportion of d and α can be adjusted by appropriate mathematical means, so as to get the appropriate objective function.

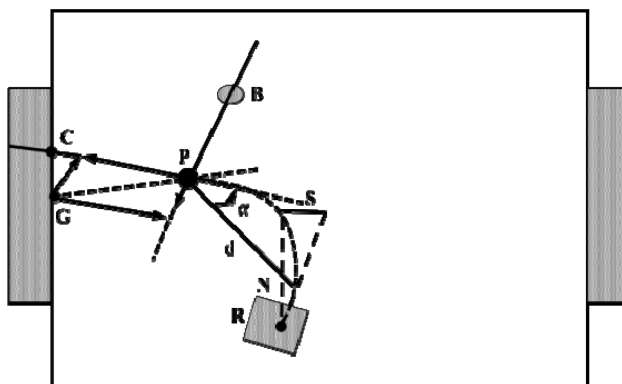


Figure 1 – Scene of Motion Control Algorithm

In every movement of the robot, through the objective function got the optimal value, that is, the predictive motion position N of the robot. The control of the robot is realized by setting the velocity of left wheel and right wheel according to the characteristics of robot control, the speed of the wheel can be calculated according to the motion law of the robot with the current position after searching the coordinates of the point N. The algorithm has good adaptability for different speed state of the ball because of it is the optimal path based on the current state. P and B are always in contact when the ball is static, in fact the robot constantly approaches B and adjusts the angle of B to make $\angle \overline{NB}$ close to $\angle \overline{BC}$, and then the algorithm also applies. When the ball is in a free motion state or in a forced motion state, the algorithm also can find the optimal path in the current speed state in real time, and make the adjustment and finish the goal quickly due to the algorithm has no dependence on the historical movement state of the ball.

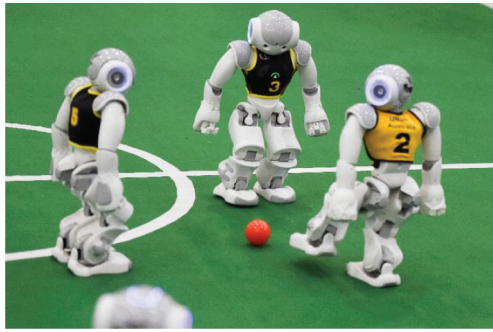


Figure 2 – Pass the Ball

3.2. Objective Function

According to the previous analysis and description, we establish the objective function. Setting the coordinates of point N is (x_n, y_n) , point P is (x_p, y_p) , the distance between the two points is d, the absolute value of the angle between $\overline{NP}$ and $\overline{PC}$ direction is α . In order to adjust the weights of the two control variables in the objective function, while take it into account that the angle value of the robot is small and the regulating requirements is high, we increase the power coefficient k for d, regard α as the power of exponential function e^α , and the objective function is ϕ , thus the minimum value is the optimal value in the search range of the function.

$$\phi = d^k \cdot e^\alpha = \sqrt{(x_n - x_p)^2 + (y_n - y_p)^2}^{2k} \cdot \exp(|\angle \overline{NP} - \angle \overline{PC}|) \quad (1)$$

The coordinates of points N are infinitely many in theory in the algorithm, although we can directly rule out many coordinates through the position information of the robots and the ball, but the amount of calculation is still relatively large, so we need to take a certain method to reduce the amount of computation. Because the angle and

the displacement of the robot can be measured and are relatively small in one shot, so we can regard its motion range as an arc of the center of point R, and make network processing to S through a certain threshold, then calculate the cross point coordinates of the grid to replace all points in the grid so as to reduce the computation.

3.3. Algorithm Flow

Step 1: Predicting the position of the ball in the next shot (x_p, y_p) according to the current position and velocity of the ball;

Step 2: Using the collision rules to calculate the ideal pool angle $\angle \overline{PC}$ of the robot that corresponds to the target G;

Step 3: Searching for all the locations in the area that the robot reaches in one shot, and calculating the values of d, α and the objective function ϕ that correspond to each position;

Step 4: Finding the predicted position (x_n, y_n) of the robot that makes the objective function ϕ minimum in the next shot;

Step 5: Calculating the wheel velocity that corresponds to the predicted position (x_n, y_n) according to the formula of the robot motion law;

Step 6: Outputting and setting the wheel speed of the robot, and returning to Step 1;

4. Problem of Chattering

The robot may have a very long time to close to the ball from the shooting to the final touching in the process of the robot's shooting. In this process, the optimal search algorithm is not suitable to the whole period, so we should choose the most simple and effective control method in the beginning stage to make the robot quickly close to the ball due to the motion state of the ball may change at any time, then choose the optimal search algorithm when the distance between the ball and the robot reaches a certain range. In practical application, when the distance is used to switch the control algorithm, the robot will "shake" in the switching boundary, that is, when the ball suddenly decelerates or stops near the edge of the boundary, the relative position of the ball is back and forth, which not only unable to complete the scheduled movements, but difficult to get out of this state.

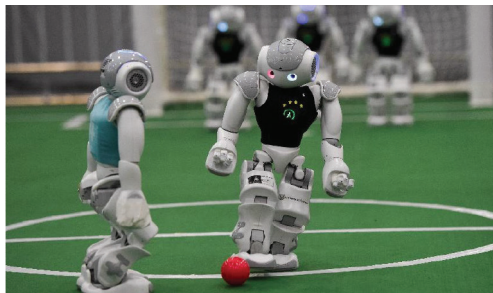


Figure 3 – Stopping the Ball

4.1. Produce of Chattering

It is not difficult to find that the main reason of the “chattering” is that the robot switches the control algorithm constantly through a careful analysis of the mechanism of “chattering”. If the algorithm is switched just on the basis of the distance, the control output of the two algorithms is different due to the different control requirements, so as to make the speed of the switch bouncing. Setting the distance of the boundary is C , the distance between the robot and the ball is D , When $D \geq C$, the control algorithm F_1 is adopted, and the output of speed is v_1 ; when $D < C$, the control algorithm F_2 is adopted, and the output of speed is v_2 . So it may appear such situation: The robot is controlled by F_1 in the case of $D \geq C$, which crosses the switching boundary by, is established at this time. When the robot car is controlled by v_1 , $D < C$ the speed need to be changed to v_2 . The speed of the car is rapidly reduced due to the big difference between v_2 and v_1 , so that the situation of is $D \geq C$ set up again, and the speed of output is v_1 , then the situation of $D < C$ is set up again, and the speed is reduced to v_2 . This cycle makes the repeated oscillation of the ball's relative position formed, then it is difficult to automatically disengage.

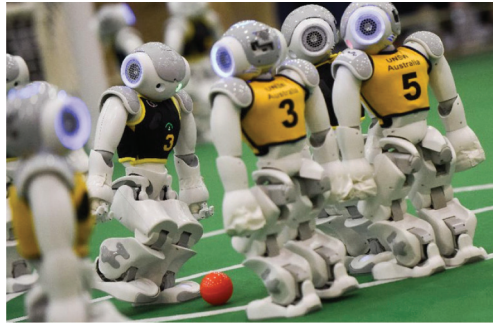


Figure 4 – Short Distance Passing

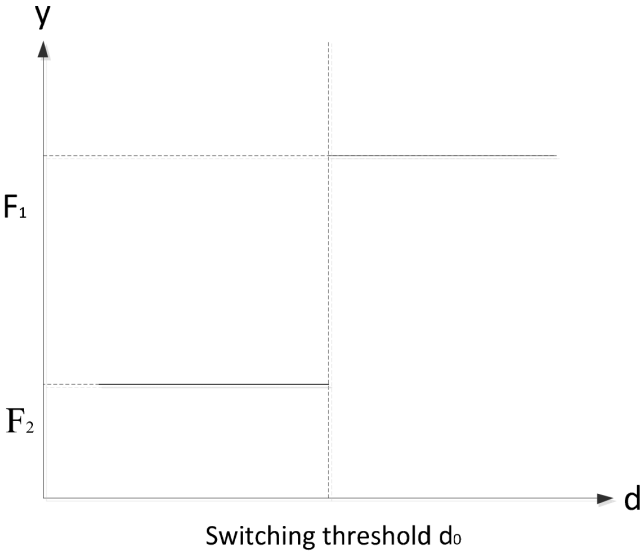
4.2. Avoidance Algorithm of Chattering

At present, the avoidance method of “chattering” is mainly to establish buffer zone, it refers to use the algorithm F_2 to estimate the output before reaching a certain distance of the switching boundary of the control algorithm. If there is a big difference between the speed and the current speed, the “chattering” may appear. The output of the algorithm F_1 is attenuated through a certain velocity attenuation factors in the range of the buffer zone, thus makes the robot relieves the jumping between the two kinds of output when the robot reaches the switching boundary, so as to avoid the “chattering”. However, this method doesn't eliminate the “chattering” in the fundamental, which just relieves the phenomenon of “chattering” through the buffer zone. At the same time, it is difficult to determine the problems that how to set the distance of the buffer zone and how to set the attenuation factor and the comparison of the threshold, and it even may increase the “chattering” because of the range of the buffer zone.

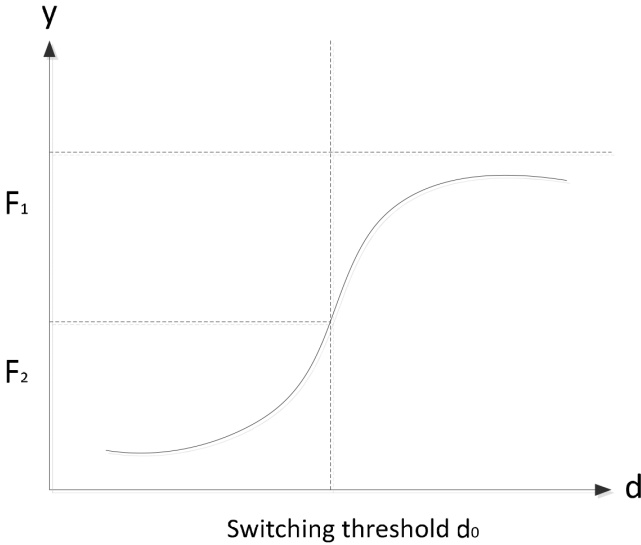
(a) Jumping Switch of Critical Distance Algorithm

(b) “S- curve”

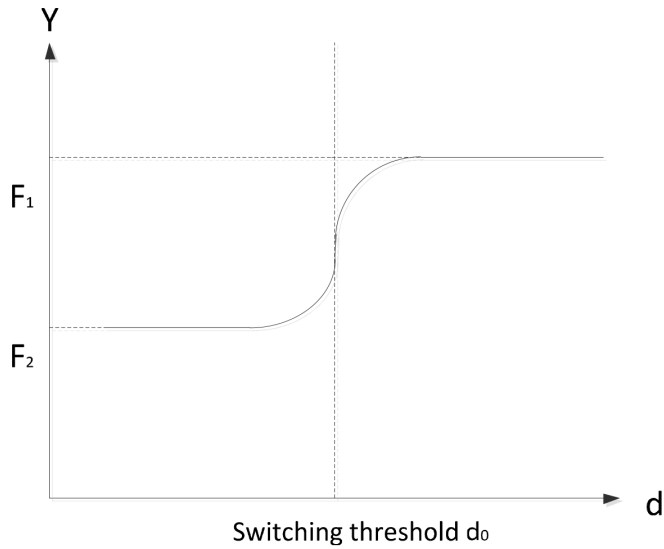
(c) Weighted Control Output



(a) Jumping Switch of Critical Distance Algorithm



(b) "S- curve"



(c) Weighted Control Output

Figure 5 – Phenomenon and Avoidance Principle of Chattering

The key of the problem is that the jump changes of the speed output of the two kinds of control algorithms in the critical position, as shown in Figure 5(a). Therefore, we need to smooth the output of the two control algorithms to achieve the smooth transition between the two algorithms. The usually smoothing method is to use the curve function to weight the two kinds of control output, and makes them be able to participate in the robot's control motion. After the research, we choose to use the output value of "S-curve" function as the weighted coefficients of proportion of the two control algorithms, as shown in Figure 5(b). The selection function is:

$$Y = \arctan[k(d - d_0)] / \pi + 0.5 \quad (2)$$

Among them, d is the distance between the robot and the ball, d_0 is the switching threshold value of the algorithm, and k is the slope adjustment factor of the curve rising. Y is regarded as the weighting coefficient α of the algorithm F_2 , then the weighting coefficient of F_1 is $1 - \alpha$, the sum of the output of the two algorithms is:

$$F = F_1 \times (1 - \alpha) + F_2 \times \alpha \quad (3)$$

When d is less than the critical value of d_0 , the value of the function is always closed to 0, and the algorithm F_1 plays a major role in the process. When d is close to d_0 , the function

value is rapidly increased to 1, which makes the control algorithm smoothly switched from F_1 to F_2 . The function image after the “s- curve” weighting shown in Figure 5 (c). The two control algorithms achieve a smooth transition in the critical position by weighted smoothing, the speed output of the robot is unable to be jumping changes, and thus avoids the “chattering”. Due to the curve of weighting function is an S shape, it is called “S- curve” function.

The algorithms that described by this paper are tested on the SimuroSot 1lvsl1 FIRA, SimuroSot5v5s and MiroSot system, and compared with the commonly used straight shooting, the dynamic referencing circle shooting and the circular arc shooting in the static and dynamic environment of the ball in 1lvsl1 SimuroSot system. We use the same match strategy and the bottom control in the experiment, the contrast experiment time is 3 minutes.

5. Comparison Results of Experiment

Shooting algorithm	Shooting times		Hit times		Shooting success rate	
	Static	Dynamic	Static	Dynamic	Static	Dynamic
Straight shooting	171	105	119	11	69.5	10.5
Arc shooting	213	185	196	99	92.1	53.5
Dynamic referencing circle shooting	252	242	241	151	95.6	62.4
Optimal search shooting	275	306	273	269	98.5	87.9

Table 1 – Comparison Results of Shooting Experiment

The comparison results of shooting experiment show that the robot soccer shooting algorithm based on the optimal search is able to improve the shot hit rate significantly in the static and dynamic conditions of the ball, especially the dynamic shooting efficiency of which is better than other common shooting algorithm. In addition, the adjusting speed of this shooting algorithm is better than other algorithms according to the shooting times of the robot in the same time.

6. Conclusion

As the era of advance and the progress of science and technology, the application of computer gradually affects all areas of development. In recent years, the application of computer information technology in the field of sports fields has also been a lot of attempts. Football is popular in the world, its impact is very wide, which is known as the world’s first movement. Football has become more and more concerned by people, the participation of the people have continued to increase. It can not only exercise the body and improve physical quality, but also relieve the pressure and increase the team cohesion. However, with the vigorous development of modern football, the attack and defense become increasingly fierce, and the scoring becomes more and more difficult. So, in order to improve the success rate of the football match, the robot soccer game as an example, this paper proposes a shooting algorithm based on objective function.

This thesis analyzes the shortcomings of basic shooting algorithm on the basis of referring to a large number of documents. According to the method which used the distance as a judge condition for algorithm switching, this paper deeply analyzes the dithering phenomenon by reason of different control algorithms, avoids using the S-curve weighted algorithm, and realizes the smooth—switch between different control algorithms on the switch borderline. Through an optimal search in the area that the robot can reach, this algorithm can fit to various speed statuses, improve the success rate of shot, and react to the sudden changing of the ball's motion status. The comparison results of shooting experiment show that the robot soccer shooting algorithm based on the optimal search is able to improve the shot hit rate significantly in the static and dynamic conditions of the ball, especially the dynamic shooting efficiency of which is better than other common shooting algorithm.

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Development Study on College Education Computer Platform Combined With CAI, CAT, CMI Computer Assisted Technology

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Abstract: The higher education in the traditional classroom teaching has been gradually unable to meet the students for diversified knowledge, learning and interaction, with the increasing popularity of the Internet and multimedia technology, computer aided teaching has begun to concern for more and more people. This form of education for college students is the biggest advantage lies in the college students' basic quality is higher, can very good application software for online learning can be free to arrange the learning time, and not subject to geographical constraints and allows students and teachers to interact. Successful computer aided education depends on good CAI courseware, the integrity of teaching, a variety of means of communication and excellent auxiliary tool for learning. In this paper, the CAI and cat, CMI computer aided teaching technology of college teaching software development platform of comprehensive and systematic study. Change the traditional passive teaching mode, not only save hours and also reflects the multimedia in teaching the intuitive and fun, the effect is obvious, to ensure the success of the network teaching.

Keywords: CAI, CAT, CMI; Multimedia; Computer Platform

1. Introduction

The rapid development of modern information technology and modern education technology to our concept of education, education methods and education mode brought far-reaching influence. Multimedia teaching can not only change the outdated teaching concept, teaching methods and teaching mode, and can make the traditional passive teaching mode to "man-machine interactive" of the modern teaching mode. With graphical, images, animation, video, text, music and other media with rich colors, vivid picture, kind realistic animation, refining the text language expression teachers find it difficult to express the content, to provide students with the tireless teacher. The teaching of colleges and universities the abstract image and the invisible becomes visible, can greatly help students to memorize and help students to imagine, is conducive to the improvement of the students' learning enthusiasm and initiative, so as to improve the teaching effect (Deng, M. J., Gan, P., Chen, Z., Shen, X. Q., Li, D. L., Yu, M. Y., ... & Huang, H., 2015). Trencher has come to the conclusion that learning is obtained through the following several ways, including visual, auditory and tactile, shown in Figure 1.

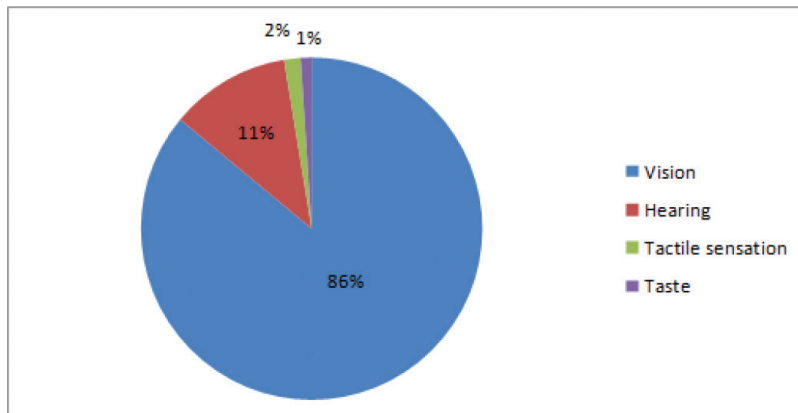


Figure 1 – Approaches to Learning

With visual, hearing, touch is accounted for 95.5%, so using multimedia teaching and computer aided education effect is very good. Multimedia teaching is the teacher from the heavy repetitive work (Abreu, A., Rocha, Á., Cota, M. P., & Carvalho, J. V., 2015), make the blackboard writing time is short, especially to reduce the amount of time the teacher drawing on the blackboard, which is used for the main energy and enriching the content of classroom teaching to improve teaching quality.

Computer aided Education (Computer -based Education CBE for short) is a kind of modern Education technology system, it mainly includes the Computer Assisted Instruction (Computer - Assisted Instruction CAI for short), Computer management of Instruction (Computer Managed Instruction referred to as “CMI”) and Computer aided test (Computer Assisted Testing (“ CAT) three parts, the Computer aided Education (CBE) is a Computer technology and multimedia technology application in the field of Education.



Figure 2 – College Education Software Platform

2. Method Principles

2.1. The University Education Software Platform Is Introduced

Along with the development of the college teaching process and in-depth, makes higher education rapidly going digital, multimedia and network, and the teaching idea, teaching content, teaching method, teaching mode, teaching evaluation, teaching environment and teaching management and so on a series of major change and influence all aspects. For higher education to cultivate talents for the high quality, innovative, high quality and internationalization development also played a role in promoting, which in the modern teaching system of teaching information resources. In the form of the teaching resources by the carrier on the network resources, CD single courseware, teaching AIDS, printing materials, disks, tapes, slides, tapes, etc.; According to the forms can be divided into animation, video, images, audio, text, etc. This article mainly refers to through the digital processing, can run in the network environment can be utilized by the teaching activities of all the digital information resources, is often said that the network teaching resources. As the network teaching resources construction in colleges and universities includes two parts: resource platform construction and high quality digital teaching resources construction. And the content of the digital teaching resources generally include the following main aspects: the teaching system of public service information; Material of teaching resources library (all kinds of multimedia material database, such as: the text material, graphics, image, video, audio, animation, materials, such as item bank, putted forward, courseware and network courseware, literature, education resources index, etc.); Digital library; Network courses; The teaching video on demand sites; Other network application materials and resources(Yu, R., Cai, Z., Du, X., He, M., Wang, Z., Yang, B., & Chang, P.,2015).

2.2. CAI, CAT, CMI

CAI, namely, computer aided teaching is the main aspect in the field of computer application in education, is based on computers to help or replace part of the teaching tasks, teachers teaching message, to teach students the knowledge and training skills, improve teaching efficiency and enhance the teaching effect, for the purpose of modern teaching technology(Zhong, S. H., Liu, Y., & Chen, Q. C.,2015). Is the computer as a teaching medium, students learning by interacting with the computer of a form of teaching. Computer assisted instruction (CAI) system is composed of teachers - computer - students, system block diagram as shown in figure 2:

Students at the center of specific learning activity, the teacher is in the commanding heights of teaching activities, learning conditions and resources according to the students' learning needs to organize, teacher to student's learning process and the elements in the process of control. Activities reflected in students and between students and teachers teach less towel communication (teacher will carefully organize resources provided to the students, help students learning process, students homework, quiz, mail, assessment to teachers' feedback) control resources, participate in students and teachers and students to discuss other factors such as communication (Kanwar, N., Gupta, N., Niazi, K. R., Swarnkar, A., & Bansal, R. C.,2015).

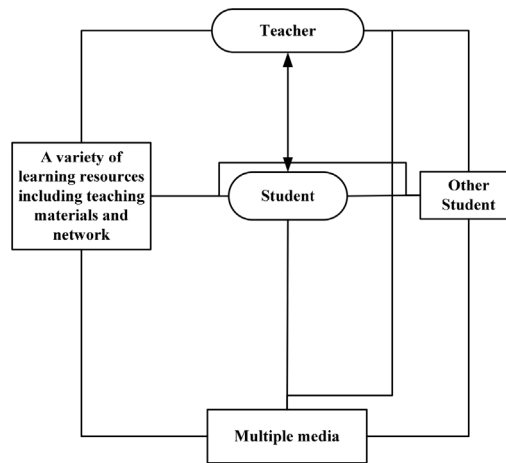


Figure 3 – Relational Graph

Computer management science (CMI) is to use the computer to collect, store and manage all kinds of information related to the teaching, to provide various services for the teaching of management techniques. Its main auxiliary object is a teacher. The role of the computer management of instruction (CMI) and scope of application: collect and analyze students' learning situation; Management and supervision of teaching activities; the education administrative management; Teaching materials of cataloging and retrieval, etc.

The computer aided test (CAT) is a system the teachers to use the computer to carry on the teaching test and evaluation, it is the implementation of an important guarantee for the computer aided teaching. The CAT can be produced according to the teaching requirements of different difficulty of quizzes, stored in the database, the teacher according to the scope and requirements of the test, through the computer from the database to select a certain proportion of different difficulty problem, compiled into individualized tests and procedures. After the test can also be automatic marking of papers, grading and login, and the test results were analyzed, and put forward the analysis report.

2.3. The CAI, CAT, CMI and the Combination of College Education Software Platform

The software which has the function of teaching courseware (CA time) configured to the computer on, then the computer can like teachers, and students constitute a human-computer teaching system. Its principle is based on the idea of teaching program, teaching and development on the basis of principle of programmed instruction. It make full use of the computer has the function of information storage, information processing and information transmission, the teaching content and teaching strategies in the form of courseware is stored in the computer, and then according to the advance in the study of the machine by computer program the order of the rules and procedures for the teaching activities. The basic process of computer assisted instruction as shown in figure 3:

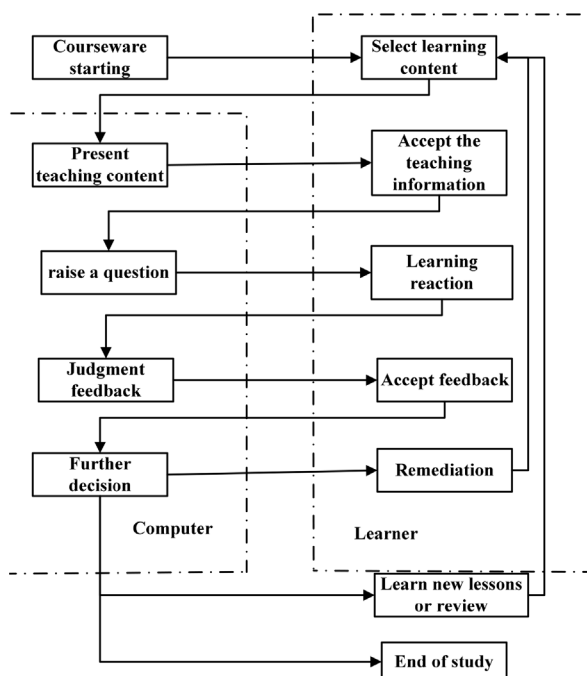


Figure 4 – Basic Process of Auxiliary Teaching

The basic model of CAI also calls the teaching strategy, reflects the interaction of the use of computers for teaching activities, usually has the following several kinds of mode.

Interactive mode	Introduces
Practice	Acquire knowledge and skills through repeated practice and manipulation by the user
Dialogue	Through the computer to realize the teacher's guiding teaching behavior, to the students to implement individualized teaching
Simulation	A CAI model of teaching activity using computer to imitate nature, social law and phenomenon
Game	You can use the student's personal hobbies, by playing games that they are familiar with the computer, learning to master the relevant content
Test	Using computer to carry out teaching test and evaluation. The system can make students receive timely feedback, to understand their own learning, for the timely adjustment of learning strategies, achieve better learning effect
Trouble shooting	To cultivate the learner's ability to analyze and solve problems and to develop the ability to explore knowledge.
Discovery learning	Students will be placed in to construct a good environment and give them provide exploration, analysis and control of new concepts and principles, cultivating students' ability to study and research

Table 1 – Interactive Mode Comparison

3. Processes

Multimedia works system is used for unified management of multimedia information editing tool, according to the application characteristics can be divided into three categories: suitable for film, TV system, on-site monitoring tool of professional work; Suitable for teaching and training, electronic books, electronic publishing and printing, the production of entertainment system work tools; Suitable for merchandise presentation, consulting management, family's book learning tool. Clearly, here we need the second type of multimedia works system as a tool for courseware development. The current development of multimedia CAI courseware in environment mainly has two kinds (Jiang, X. W., & Sun, Y. H., 2015; Khalfallah, J., & Slama, J. B. H., 2015): Is a visual programming environment based on high level language, such as visual basic, Visual C material, etc.; Another kind is the 1990 s, a few companies in the United States as a representative of software developers have launched a series of courseware authoring tools. In addition, there are dedicated to making demo or playing multimedia software, such as PowerPoint. These development tools can avoid programming, very easy to use. Here, on the development of multimedia CAI courseware platform to introduce a simple. For the first type of programming language, they have the multimedia integration, processing capability and highly efficient and flexible characteristics, unique style of courseware can be developed, is a certain programming experience will be an ideal choice. Using visibility programming language as a development platform for multimedia products created this way, is characterized by compact structure, high efficiency, good fault tolerance, however, developers need to grasp the profound programming language and programming environment, development cycle is long, is not convenient to maintenance of ordinary users, higher requirements for production personnel (Lubis, M. A., Ikwan, I., Sjahrony, A., Lubis, I. F., & Din, R., 2015). For the second kind of multimedia tools, Most of them in visual form to the user provide a powerful multimedia data integration platform, can avoid the program, very easy to use, high development efficiency, easy to be the majority of the non computer professionals to learn and master. Here we introduce the common development of several multimedia tools (Artola, V., Sanz, C. V., Moralejo, L., Pesado, P. M., & Baldassarri, S., 2015).

Tool	Advantage
Tool Book	It is easy to operate
Action!	Under moderate complexities of multimedia software
Macromedia	Professional multimedia presentation production system
PowerPoint	Easy to learn, easy to use
Author ware	Making courseware development tools as needed

Table 2 – Common Development Tools

3.1. Tool Book

This is a Windows editor tool, is a kind of object-oriented development environments, it provides Open Source language for beginners to master, thus making multimedia software is more convenient. Make a bit complicated, but expressive, interactivity is good, suitable for creating feature-rich “e-book” type of multimedia courseware and multimedia reading (Galan, D., Heradio, R., de la Torre, L., Dormido, S., & Esquembre, F., 2015).

3.2.Action!

This is the development of the United States Macromedia company which is used in the development of IBM's PC products, multimedia software written in it, by one of the "scene" (Scenes). Each scenario contains more than one "Object" (Object). "Object" has a lot of class, object such as text, images, voice, video image object, animated objects, etc. Object can be input by the system also can be used to generate Action! The Action! Mainly used in the creation of multimedia software under moderate complexities (Palacios Neffke, J., Wiens, S., Liersch, J., & Seliger, G.,2015).

3.3.Director

Macromedia Director of the company is a professional multimedia presentation system, it has two main characteristic is different from other typical presentation software: one is the high precision; the second is powerful. By the precision of the digital representation to make more accurate multimedia synchronization of each part, based on the time series of the same kind than other editing tools is much more precise. It is an important feature of can in a single frame level accuracy for synthesis of film, therefore, can be shown in the image, sound effects and music are determined A. Because of the Director's price is higher, its user positioning is an expert in multimedia production (Junqueira, E.2015).

3.4.PowerPoint

PowerPoint is a member of the Microsoft Office unit, a prominent feature of PowerPoint is easy to learn, easy to use, so, if want to demo lesson plans and interactive function requirement is not high (Neto, M. B. D. S., de Mendonça, J. M., & de Sena, A. P.,2015), PowerPoint is a best choice. Made with PowerPoint slides is most suited to play the multimedia classroom. But it also has shortcomings, the main is that the capacity of slides per page is too small, is not conducive to the students before and after running through the understanding of problems. Now playing slides page frequently, Let the students feel content coherence is poorer.

3.5.Author Ware

Macromedia company Author ware to provide customers with strong interactive ability to monitor and animation, it USES the Icon design flow chart, development of utility provides a convenient for non-programmers. Because Author ware is based on the process line of multimedia development tools using object-oriented design method, to develop high quality, fast development, and because Author ware software has good compatibility with other multimedia development tools, can support ActiveX and network technology, using the Shockwave, courseware can be transplanted to the Internet environment. It is the basic respect of application in teaching(Gosha, K., White, B., Livingston, S., Jensen, K., & Claiborne, C., 2015), it is mainly used for interactive multimedia application software production education training. This is needed for making courseware development tools (He, J. ,2015).

4. Actual Data Validation

The difference between the information-based teaching mode and the traditional teaching mode shown in the table below:

The greatest advantages of computer aided education is teaching in the course of computer with the student session, type computer using the objective respect of tone with the student to study (Eriksen, K. Å., Sundfør, B., Karlsson, B., Råholm, M. B., Fitz, N. S., Nadler, R. & Chong, E. W. J., 2015), create a harmonious environment. Students in such an environment, not only the emotional state to accept knowledge, and willingness to take risks, bold courage is much larger than in class under the eyes. The computer can also tell the students learning situation in time, can strengthen the learned knowledge, enhance the enthusiasm of study. Computer aided education can also embodies individualized learning can learn according to the students' ability and level to control the learning process and learning content, to realize individualized teaching. Computer aided education, ` allows students to learn at their own pace, study mainly on our own, embodies the teaching thought of personification. Therefore, the computer aided education for students at various levels and of learning conditions, meet the need of individualized learning. Computer aided education in the teaching of text, images graphics, animation, video, sound, etc., to enhance the teaching of interest, can simulate the real situation, image is clear. Main service object of the system is students, but at the

	The traditional teaching mode	The information teaching mode
The teaching goal	The course starts from local, emphasizing the basic skills	Prospect of course as a whole to part, emphasize the big concept
The teaching content	Strictly faithful to the fixed materials	Track the problems and interest of students
Teaching resources	Materials mainly come from books and manuals	The original information and materials can be manipulated
Teaching information	Ready, the packaging is excellent for students	By the learners themselves to discover, analysis and processing
The teaching process	Learning is a process of repetition	Learning is an interactive, build on the existing cognitive structure
The teaching method	Teachers convey information to students, students are the recipients of knowledge	Teachers and students dialogue, exchanges and help students construct knowledge
Teacher's role	Designator, experts, and authority	The questioner, guide, helper, facilitator, negotiation, negotiators
The student role	The student basically is learning independence	Students learn with team members
The teacher evaluation	Through the test to evaluate students	Both passed the test and through the student's work, the test report to evaluate students
State of knowledge	Knowledge is static	Knowledge is a dynamic, and subject to change with our experience

Table 3 – The Traditional Teaching Mode and the Information Teaching Mode Difference

same time also to the teachers' work efficiency are of great help, for example, students need to at the end of the semester evaluation test, the teacher wants to choreography of examination papers, if the work on the system implementation will be very easy. Most current exam system of group of random question selection algorithm mainly method and using heuristics, there are also some system sets algorithm using fuzzy expert system and neural network algorithm in rolls, etc. Figure 4 is a class of students' information-based teaching mode and traditional teaching mode achievements. Figure 5 is the traditional teaching mode turns to the discount and line diagram of the discount line of information teaching mode.

Full name	Chinese traditional teaching	Chinese information teaching	Mathematics traditional teaching	Mathematics information teaching
Zhang-Tong	86	90	88	90
Wang-Fei	72	78	76	81
Li-Mei	89	92	56	67
Ma-Yu	77	80	76	80
Xiao-Ran	64	71	91	95

Table 4 – The Class of Students' Information-Based Teaching Mode and Traditional Teaching Mode Achievements

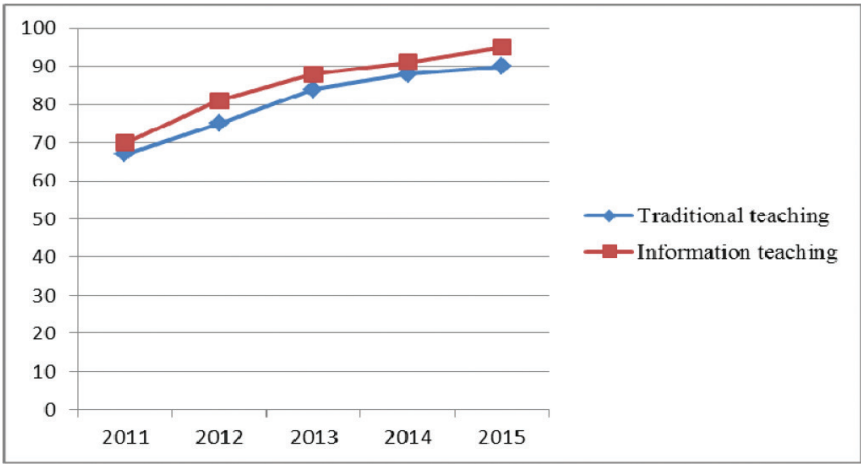


Figure 5 – Traditional Teaching Mode Turns to the Discount and Line Diagram of the Discount Line of Information Teaching Mode

Random test paper generation algorithm:

Set a total score for the S, a total of K different questions, The kinds of questions I models total score is A [I],The first kind of topic type topic for B [I],The kinds of questions

the first j I problem score for C [I, J], the above parameters must be satisfied, G:The remaining total score:

$$S = \sum_{i=1}^k A[i] \quad (1)$$

$$A[i] = \sum_{j=1}^{B[i]} C[i, j] \quad (2)$$

$$G = S \quad (3)$$

For $1 < I < k$ the kinds of questions I the rest of the total score $D[I]=A[I]$ (4)

Create random number between [1, k]

Is limited to score less than D [I] were randomly selected from the question bank the kinds of questions of the exam, I assume that R score for this topic;

$$G = G - R \quad (5)$$

$$D[I] = D[I] - R \quad (6)$$

Random question sets algorithm has simple structure, easy to program. The method of group volume index requirements under the condition of less quickly organized to meet user's test paper.

But the computer aided education to invest big, high cost, and CAI technology demand is high, therefore limits the subject of many experienced teachers personally compiled courseware. We need to develop design education in colleges and universities as long as teachers can basic software platform have the ability to use a computer, a little training can freely use them to media courseware, according to my will closely cooperate with own teaching process, realize the computer aided teaching. And computer aided education is not everything, it suit for some courses, and it is effective, and for some contents of teaching are not appropriate, in use, should pay attention to the nature of the subject and the CAI mode selection second lack of emotional communication can provide multimedia computer assisted instruction information, have the effect of teachers, but it cannot completely replace the teacher, the students learning, and lack of emotional communication between the computer and teacher's hand is cast sufficient, elegant style, personality charm has subtle influence to the student, helps the development of teaching activities. Is this the computer can't do it.

Many scholars abroad after years of research found that the effect of the CAI depends not only on good teaching software, also involves from teachers, students and the influence

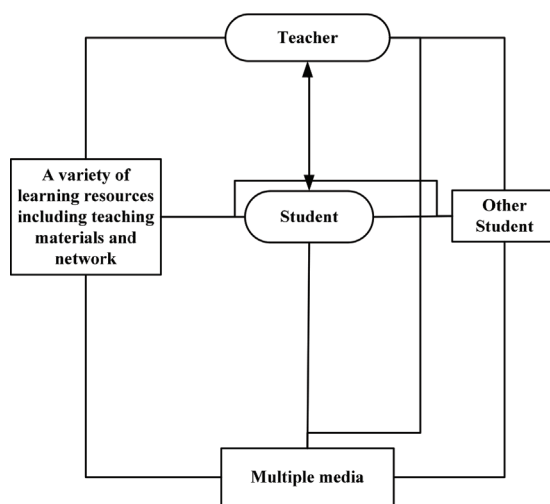


Figure 6 – Factors Influencing the Effect of CAI

of factors such as the computer teaching environment, as shown in figure 4. All of these factors that influence the effect of the CAI or variable research will help to use CAI in teaching effect.

5. Conclusions

Computer aided education as a new form of education, education for schools, teachers and students had a big effect, relative to the traditional teaching system has many characteristics and advantages. Its appearance to a great extent promote the development of education, especially in the form of implementation of quality education now under the computer aided education more conducive to the development of quality education. The most important reason is that it has the characteristics of individualized, namely the CAI system can be based on students' learning ability and level to control the learning process is a content, to realize individualized teaching. CAI can let learners at their own pace, choose learning time and learning content, control learning process for learning, the study mainly on their own, so as to play to their initiative, embodies the personal teaching and the education of students according to their aptitude thought, the improvement of students' learning enthusiasm also has a good role in promoting, this is the traditional teaching system. In CAI system, the computer can only present teaching information, but also can accept learners answer to specify the question, and answer a judgment and evaluation, thus providing targeted feedback information, such as the conversational ask an answer, an exchange of information feature called interactivity. Interactive CAI is the difference between other teaching form, one of the important features is the basis to realize individual teaching. Teachers in the teaching process is not in a single traditional teaching, but the modern multimedia technology applied in the teaching, the teaching are more diversified and modernization, for example, simulation teaching, experiment teaching and test for the students to create a positive thinking, trying to explore learning environment, therefore, it's good for students to develop

intelligence, improving logical thinking ability. Computer aided education produced for us is also a good opportunity of development, using the computer aided education, we can better carry out more vocational education and network education, to form a new learning environment, conducive to the learning, promote the smooth completion of the battle of relying on science and education. But the major defects existed in the CAI teaching system, the CAI teaching system to invest big, high cost, the comprehensive popularization and difficulties in school education; Lack of quality teaching software. Because of the CAI courseware writing system and multimedia software development system is not perfect enough, is not convenient in operation, therefore, limits the subject of many experienced teachers personally compiled courseware. CAI courseware production has not been able to achieve the traditional teaching system of preparing such convenient, free. CAI can also make students is difficult to determine their own learning objectives and learning strategies, resulting in the students to understand the load increase, also prone to study on the trek. But we cannot completely in the presence of these adverse negative, but to find it and make continuous improvement to better serve the education.

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Construction of English Learning Assistant Platform Based on Artificial Intelligence

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Abstract: Thanks to the development of information technology, learning via network platform becomes convenient and effective. This paper studies the feasibility of the assistant platform by analyzing the characteristics of computer and the problems in English learning. Combining artificial intelligence and computer technology, this paper establishes an English learning assistant platform which provides services like English word inquiries, exam practice and composition revision. The platform can help students learn English-related knowledge after class and can revise their compositions, thereby improving their English capability. Experiments verify that the platform can improve students' English proficiency. The platform increases students' time spent on practicing English, improve their understanding on English learning and help students upgrade their learning methods.

Keywords: Network platform; English learning; Computer technology; Composition revision

1. Introduction

Among the five basic English skills, listening, speaking, reading, writing and translating, writing can facilitate the mastery of language knowledge most effectively. As a written form of language output, writing can objectively reflect students' ability to organize their language and thinking. It is thus regarded as an important manifestation and indicator of students' integrated English language competence. Over a long run, most English teaching is in the basic form of lecture combined with a small amount of practice. (Statham S., 2015) However, since educational theory and scientific technology keep developing, an increasing amount of new technology has been applied into English learning. For example, computer-aided learning represented by multi-media computer has gained popularity between students. Recent years have seen successive emergence of a series of English learning assistant systems which pose positive impact on students' English learning. (Monteiro L N S., 2015) However, computer-aided learning is not as widely applied in linguistic disciplines as in other realms. On the one hand, that's because most of them only focus on students' competence in vocabulary and grammar, without an overall understanding of students' condition. Therefore, they can merely offer limited assistance in students' learning. (Lee E., 2015; Bevington-Attardi D, Rice M., 2015) On the other hand, given that language course is different from others in that

its contents are hard to be substantiated or visualized by learning assistant software and platform, the existing assistant platform cannot fully motivate student to learn actively.

In 1998, learning assistant platforms based on artificial intelligence became popular in America and were applied by American students in University, high school or primary school in their individual study. In the early 1995, Tom from educational technology department of Santiago established network-based inquiry learning on special subjects, (Karamyshev R D., 2015) namely a research-oriented learning and practice platform. Later, many learning model and platform were built up, such as Envision Schools: www.envisionschools.org, BigPicture: www.bigpicture.org, EdVision Schools: www.edvisions.coop, Small School Project: www.smallschoolproject.org, etc. Recently, a vocabulary learning system based on network emerged (Runa, A. I. D. N. F., & Miranda, G. L., 2015). For example, on the website of iciba, <http://www.iciba.com/>, visitors can search for words, translate articles, and get experts' real-time instruction online. The system improves the retention of learning journals and upgrades the process in which the intelligent interaction between man and machine is not achievable. At present, all sorts of artificial intelligent learning assistant platform have been highly regarded by students. Based on its development, the computer-aided learning can be divided into two categories: one lays much emphasis on aiding students in learning and is comprised of a variety of CAI PPT and professional teaching assistant applications; the other attaches more importance to assess students' learning and consists of different test systems. These two categories are synthesized in this system. By combining teaching assessment and independent learning and enhancing the connection and interaction between students and teachers, the system can better assist teaching. (Vargas A, Boza A, Cuenca L., 2015)

2. Theoretical Background and Main Technology

2.1. Artificial Intelligence Technology

Artificial intelligence is a new technical science aimed at studying and developing theories, methods, techniques and application systems to stimulate, extend and expand human intelligence. As a branch of computer science, it attempts to understand the essence of intelligence, and produce a new intelligent machine which can react in a manner similar to human intelligence. Researches in artificial intelligence include robotics, speech recognition, image recognition, natural language processing and expert systems. The main areas of research and application of artificial intelligence consist of pattern recognition, natural language understanding, automated theorem proving, process automation, intelligent database systems, robotics, intelligent tutoring systems, expert systems, artificial neural networks, etc. (Hurford J R., 2015; Ramos J E., 2015).

Expert system (ES), one of the most active areas of artificial intelligence application research, has gained increasingly wide applications. In consequence, people shift their attention from exploring the rules of thinking to intelligent action research, thereby making several major transformations, from theoretical research to practical application, from study of general thinking method to solution of specialized problems. Based on the knowledge and experience provided by the experts in a field, the expert system simulates the decision-making process of the experts to make deduction and judgment. It can be

regarded as a computer intelligent program system with knowledge and experience of a specific field. Its capacity comes from the knowledge of experts. Generally, it uses the knowledge representation and knowledge deduction technology of artificial intelligence to simulate the process of solving complicated problems which can only be coped with by experts. It has similar problem-solving capacity to the experts. This system design method based on knowledge is applied with the knowledge base and inference engine in the center (Guzzetti B J, Foley L M, Lesley M., 2015). The structure of expert system constitutes the construction methods and organization forms of the various components of expert system. Different expert systems have different application areas and goals, functions and structures. However, in an abstract sense, expert systems all include 6 basic components, including human-machine interface, knowledge acquisition facility, inference engine, explanation facility, knowledge base and database (Lai C S, Yang W H, Ke C Y., 2015), just as Figure 1 shows:

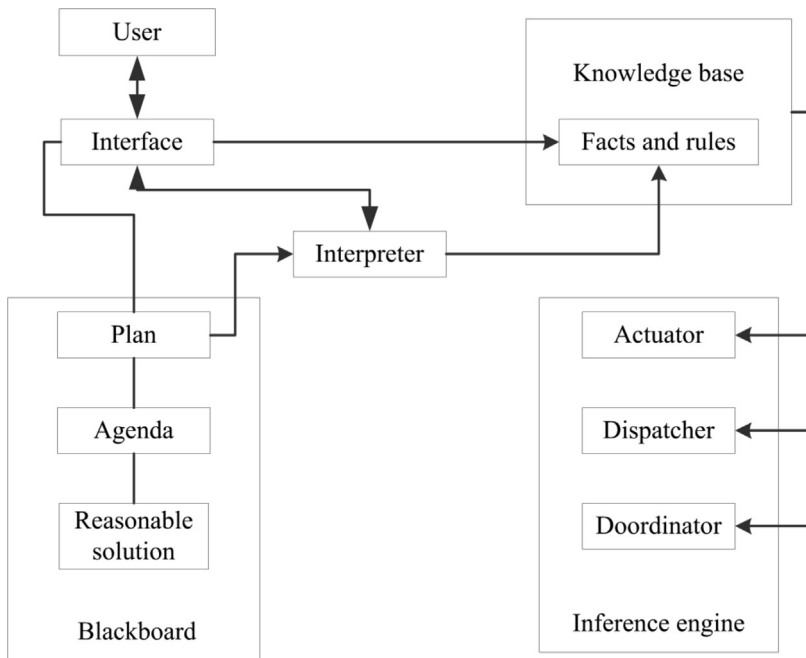


Figure 1 – Structure of Expert System

Knowledge acquisition facility: interface of between expert system and experts and knowledge engineers. Through this interface, the system can interact with experts and knowledge engineers, entering knowledge into the knowledge base and establishing a knowledge base with good performance, and continuously modifying or enriching the knowledge base. Inference engine: the facility which controls the overall performance of the expert system (Terblanché E., 2015). Based on the data input by current user, the system uses the knowledge of the knowledge base, makes deduction according to the strategy of inference engine, selects the matching rules from the knowledge base, and deduces the solution of problems through

constant inference. Performance of the inference engine is related to the structure knowledge representation and organization, but has nothing to do with the knowledge itself. In so doing, inference engine and knowledge base can operate independently. Explanation facility: Explain the inference process. It can explain to the user the behavior and results of the expert system. Its performance reflects the degree of transparency and credibility of the system. It aims to make it easier for users to accept the inference process and the conclusions (Kumar S M, Karthikayini T., 2015). Knowledge Base: Store knowledge in the field. It contains the facts and rules of the field of problems to be solved. In the system, it exists separately from the other parts. The way in which the knowledge is stored is decided by the strategy of knowledge representation, which can be demonstrated by one or several knowledge representation methods (Bezglasnaya E A, Gorbatov S B., 2015). Database: global database, also known as Blackboard, is used to store data related to the system, including the data entered by the user in the midst of system operation, results of intermediate reference and problem-solving operation. The contents of the database are constantly changing. At the beginning of the problem-solving process, the database stores the initial facts provided by the users; in the middle of the process, it stores the inference results of every step.

2.2. Platform Construction Technology

Visual Studio is a complete series of development toolkit used to generate ASP.net Web application program, XML Web Services, desktop application program, and mobile application program. Visual Basic, and Visual C++, and Visual c #, and Visual j # all apply the same integrated development environment (IDE) that can be used to share tools and help create mixed-language solutions (Aggarwal D., 2014). In addition, these languages use the functions of NET Framework, which can be used to simplify ASP Web application program and the key technologies developed by XML Web Services. Visual Studio provides the tools needed in the design, development, debugging and deployment of Web application programs, XML Web services and traditional client application programs. XML, namely Extensible Markup Language, belongs to the SGML (Standard Generalized Markup Language). XML is a cross-platform technology which depends

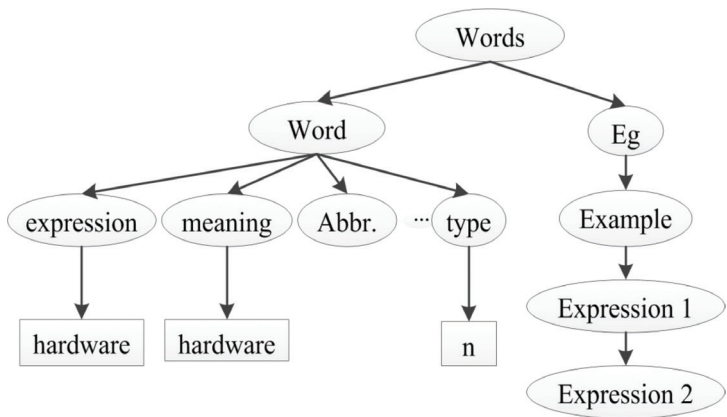


Figure 2 – XML Storage Format Chart

on contents in Internet environment. It is a powerful tool for processing structured document information at present. The platform's XML data format is shown in Figure 2:

3. Platform Function

In traditional teaching environments, people have not found an ideal method of realizing individualized learning, for which computer network technology provides good technical support. Individualized learners study automatically but not in entire isolation. They can get personalized guidance and assistance in the entire learning process, from learning contents, learning objectives, evaluation of learning structures, diagnosis of learning so that learning can be effectively conducted. In traditional teaching modes, the learning environment is generally limited to classrooms, study rooms and other places. The online classroom of English learning assistant platform enables learners to study anywhere and anytime. The greatest charm of the Internet of learning resources is that it is inexhaustible. English learning assistant platform can effectively gather vast amounts of educational resources, then storing and sharing through the network service. It allows educators to maximize the integration of education resources. The same time as the platform provides abundant learning resources for the learners, it offers indicators in more dimensions for assessment. Hence the learners' learning results can be evaluated more accurately and effectively.

The figure 3 shows platform's English dictionary function:



Figure 3 – English Dictionary Function

Take English writing as an example. Figure 4 is the title of a student's composition

After the correcting and revising the composition, the English learning assistant platform gives the following revision suggestions:

Students can use the evaluation and suggestion as above to revise their composition timely. Meanwhile, they can quickly find their weak points on vocabulary and grammar, and then take prompt measures to make up for them. Later, they can have experts guide them and answer their questions. Student's knowledge and ability to organize materials

There is a heated discussion about a kind of social phenomenon. That is academic fraud , which is widespread and be a thought-provoking social problem.

Someone copying papers and be able to get promotion. Someone offered by the governmental research fund because of academic misconducts. Absolutely, these fund is extrmely disgraceful to eventually.

If take its course, academic research became jokes, the development of science and technology were delayed, state-owned property is disappear and the consequences is very serious.

As far as I am conserved, to put an end of this phenomenon, The United States can be used for referanc It established a national science foundation, consists of an inspector general office; Put health and public service sector, alsoestablish a regulatory place, it is scientific research integrity office. Every year, constantly announced a copycat and misconduct penalties.

Figure 4 – Student Composition

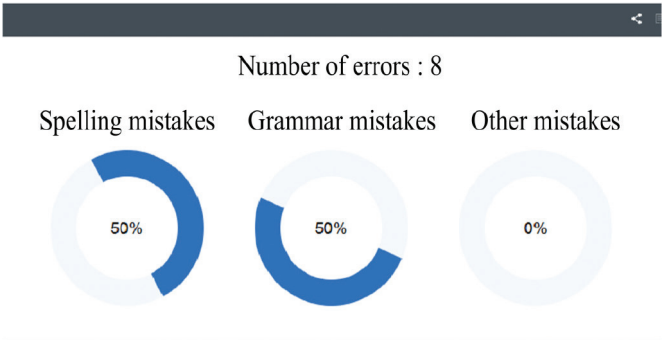


Figure 5 – Error Statistics and Its Distribution

are limited. Therefore both self-editing and peer-editing may inevitably miss students ‘ errors. The platform can present students ‘ vocabulary and grammatical errors in detail to students, but it cannot tell whether the main idea of student’s composition meets the requirements, whether the composition is well organized or structured. Experts’ tutorship to a certain extent can help students find and correct the missed problems. When tutoring students, the experts must read students’ writing, the correction and comments, measure the accuracy of the comments and find the missed errors and structural and textual problems. According to the theory of constructivism, students learn far more from the learning process than the ultimate evaluation. The platform’s repeated modification services help us and students track their progress.

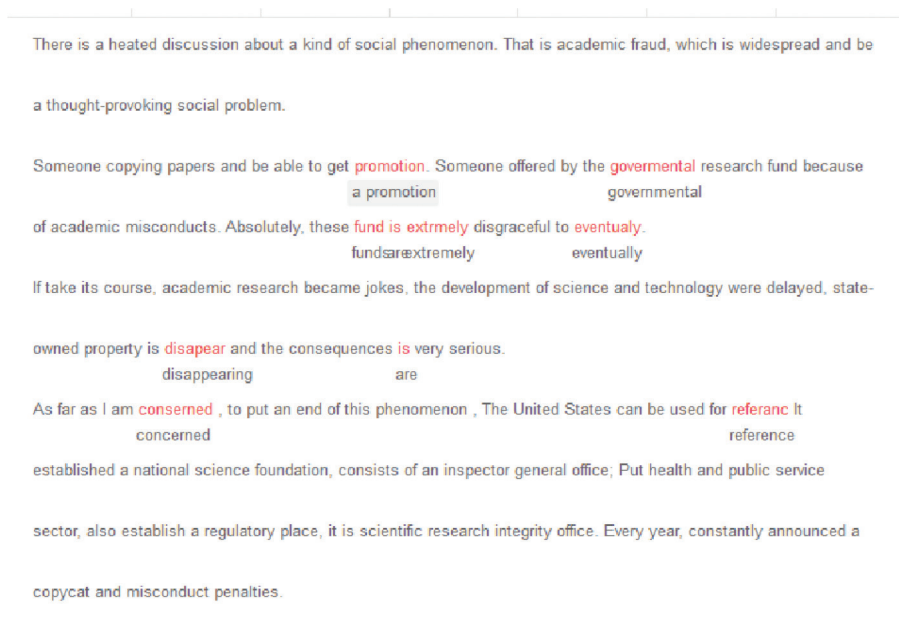


Figure 6 – Correct Post

The platform's function to repeatedly revise the composition can record all modifications, thereby effectively improving learning competence.

4. Analysis of Learning Results

Two groups of experiments are cited to demonstrate the results of learning via English learning assistant platform. Table 1 is scores of the two groups of students before test gathered through a primary survey.

	Category	Sample size	Minimum	Maximum	Average
Score	Experience group	50	62	80	70.86
Score	Control group	50	61	79	69.46

Table 1 – Experimental Group and Control Group English Test Statistics before Test

According to the above table, before the experiment, the experimental group's average English writing score is 70.86, which shows that their writing competence is at middle level; while that number of control group is 69.46, which can also be regarded at middle level. The comparison between the two groups of data reflects insignificant difference between the scores of the two groups of students before the experiment.

After the students all used the platform for a while, their scores are as follows:

	Category	Sample size	Minimum	Maximum	Average
Score	Experience group	50	68	87	78.65
Score	Control group	50	65	80	72.18

Table 2 – Experimental Group and Control Group English Test Statistics

The data in figure 5-3 shows that the scores of the experimental group improve significantly. The score of the latter test is 78.65, increasing by 7.79. In addition, the lowest score of the latter test is 68, higher than that of the former test (62); while the highest score is 87, higher than that of the former test (80). As for the control group, the average score also increases from 69.46 to 72.18. The lowest score of the latter test is 65, 4 points higher than the former one; while the highest score is 80, higher than that of the former test (79). It is logical to conclude that students’ writing competence has seen general improvement.

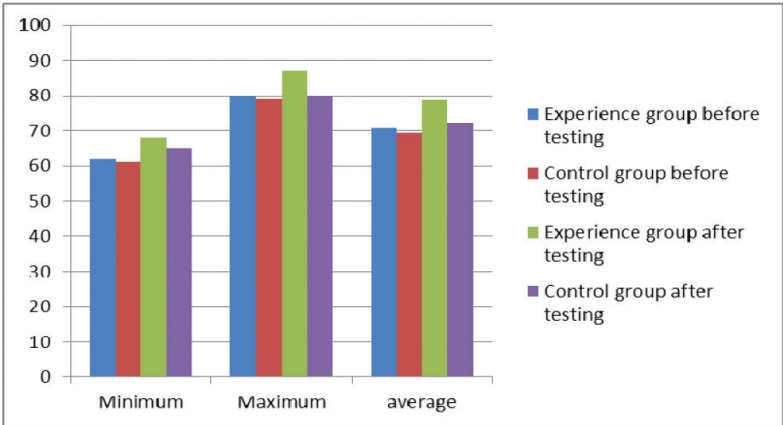


Figure 7 – Comparison of the Two Experimental Groups’ Score

Graphs can show clearly the comparison and change of the two groups of student, including the lowest, highest or average scores. The height difference between the bars which represent the students’ scores before and after the experiment is greater than the control group, which means that the score of the experimental groups improves more significantly. Therefore, the students in experimental group have made greater progress than the control group.

5. Conclusion

Using the mighty functions of computer-aided language learning platform to construct new model of English learning is a new bold exploration in the integration of educational technology and English teaching. After analyzing the factors affecting the improvement of students’ English learning ability, this research attempts to combine computer and

English learning to improve the present English writing teaching, creating a better environment for the improvement students' English learning ability. Combining artificial intelligence expert systems and using advanced computer technology, this paper establishes English learning assistant platform. The platform can provide services like English word inquiries, exam practice and composition revision. Experiments verify that the platform can improve students' English proficiency. Meanwhile, the platform effectively makes integration in 5 dimensions: classroom learning and extracurricular learning, classroom teaching and individualized learning, teachers' leading role and students' autonomy, traditional media and new media, and English language knowledge and English writing skills. It creates a reasonable and comprehensive English writing learning environment for students and uses formative assessment to promote teachers' effective teaching and students' individualized learning. It takes a long period of training and consolidation to improve the English learning ability of students. It is true that the experimental class achieved relatively better results after a semester. But to promote the learning model to be a pervasive pattern of learning and to build up a comprehensive framework of assistant learning model, more efforts should be made: the period of experimental research must be extended; empirical research must be conducted in a wider range.

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Research into Developing Business Administrative Office Automation System based on B/S 3-Tier Architecture

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Abstract: With the development of information technology, it is imperative to develop business administrative office automation system in the network environment in order to improve the work quality and efficiency of business administrative departments. Before this, this paper analyzes the current access control technology and develops a set of efficient, convenient, fast and safe office automation system based on the B/S 3-tier architecture during the specific design process while combining the ASP.NET platform technology, database technology and relevant programming languages and tools to complete the design of office automation system. Finally, this paper tests the WEB server and SQL server. The test results show that this system meets the requirement of design and can operate smoothly under overload conditions.

Keywords: B/S 3-tier architecture; office system; ASP.NET; WS server; database

1. Introduction

With the increasingly fast development and reform of modern computer and network communication technology, a new office automation system will become an inevitable product of the information society. Office automation system, a comprehensive online office application platform based on the workflow management system and reporting system, applied the computer technology, communication technology, system science and behavioral science to traditional data process technology. It is also a comprehensive technology that is difficult to be handled with huge amount of business process that has no clear structure (Kreil S., 2015). Office Automation (OA in short) is a new office mode combining modern office concept with computer, network and communication technologies, and also a very active technical application field with strong vitality in the current trend of new technology revolution. Meanwhile, it is an inevitable product of the information society (Hui L, Yifei L., 2015). Through the network, internal staffs of an organization can work at the same time at different places without interfering with each other. Office automation system integrates contents of traditional materials on the Internet and realizes the interactive transfer of internal materials of office so as to make the transfer of information more rapid, greatly expanding the office area and quickly improving the overall efficiency of the office (Hui L, Yifei L., 2015).

The first generation of office automation system regards the Management Information System (MIS) as the traditional guide with the C/S framework model as the information processing center. Its most prominent feature is taking structured data as the purpose of storage and emphasizing data's aggregating and computing capacity. The greatest feature of the second generation of office automation system is office automation centered at the workflow (Huang S, Zhou A, Yang H., 2015). This system mainly uses database and file management, mail, category service, group synergy and various other technologies to realize personnel document management, document storage management and automatic management of office meetings, etc. The third generation of office automation system is mainly based on an intranet or extranet to help enterprises to achieve the dynamic content management and knowledge resource management. The third generation of office takes knowledge management as the core (Wang X Y, Tong H X., 2015). Compared with the second generation, it further simulates and implements the entire process for each staff to apply their knowledge in the workflow while simulating and realizing the workflow. In the new round of climax promoted by information, office automation mainly has the following prominent features: first, its application background mainly simulates the real office environment, and it transfers towards the electronic collaborative work environment with higher requirements while its environment must provide users with an interactive environment for online office breaking down departmental boundaries (Martins, J., Gonçalves, R., Santos, V., Cota, M. P., Oliveira, T., & Branco, F., 2015). Second, there is a new definition and description of the application concept of office automation, which has gradually from the previous concept applied to enterprises' administration and information service to various business management and finally becomes an important part in the information operation of enterprises. Third, its extended parts have been developing rapidly, especially the concept of knowledge management (Oh S G, Park P., 2015; Li C B, Liu Y Q, Li S K., 2015).

2. Technical Theories

2.1. B/S3-Tier Architecture Theory

B/S structure, the abbreviation of Browser/Server, i.e. the browser/server architecture, is a way to realize the 3-tier C/S structure (Mahamid I, Al-ghonamy A, Aichouni M., 2015). The B/S structure is realized by using the rapidly developing WWW browsing technology and the popular IE browser and can realize all the functions of previously complex software using normal browser. B/S structure contains three parts: browser, Web server and database server, as shown in Figure 1:

The first tier is the client, which is the interface between users and the entire system. Users only need to operate the browser software like the IE browser software of Microsoft on the client, the browser will transfer the HTML code into Web pages with interactive features, and then the users put in information and propose request for processing at the backstage (Web server). The second tier is the Web server, which will start corresponding process to respond to users' request and dynamically generate a string of HTML codes and return them to users. If users' request includes data access, Web server still needs to cooperate with the database server to complete this work.

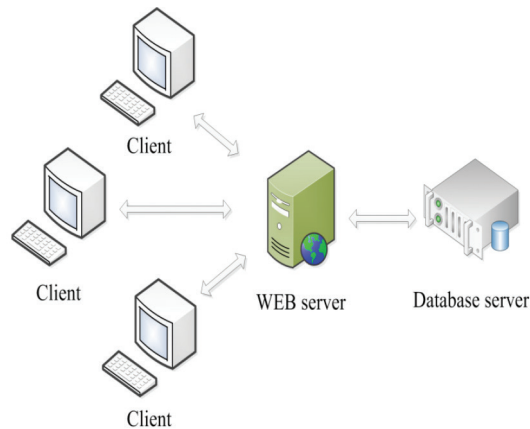


Figure 1 – B/S Structure Diagram

The third tier is database server, the task of which is similar with the C/S mode, mainly taking charge of coordinating requests of different Web servers and managing database (Anjum M J., 2015; Song L, Ravesteijn W., 2015).

2.2.ASP .NET Technology

There are a variety of technologies that can transfer documents and these technologies are relatively mature with a lot of platforms to develop the office system, such as PHP, JSP, ASP, J2EE, JAVA and ASP.NET, all of which can develop the document transfer system, but they have different characteristics and their own advantages. ASP.NET is an excellent program framework established on the common language and can be operated on the Web Server of various platforms, so it is the upgraded version of Active Server Page (ASP). Ultimately, the ASP.NET+SQL is used (Mokrozub V G, Nemtinov V A., 2015). Of course, the most convenient way is to use advanced language for programming, and it can be used in different machines. This system uses the language VB.NET+SQL. This system is established mainly with VB.NET as the language with NET operation environment and SQL server as the support of backstage system. NET technology not only represents an environment, a collection and a basic programming system, but it also establishes the Internet into the basis of the next generation of operation system while unlimitedly extending the design concept of the Internet's operation system (Gupta S K, Kar K, Mishra S., 2015). The NET technology is to establish new basic agreement between different websites, promote websites to establish a new coordinative and cooperative agreements and realize automatic exchange of information so as to help users to obtain resources and information to the maximum degree and summarize and management their data in a simple and effective way. ASP+ will provide better support for the web farms (large sites). In fact, Microsoft has made great efforts in this regard. ASP+ can make you fully consider the cluster occasions of multiple servers, and when a more powerful system performance is needed, users only need to add another server. The brand new NET framework has fully provided this method. ASP+ provides not only external session state, but also support to internal web farm (Moreto M, Rolim J G., 2015).

2.3. Database

Database stores and manages data following certain ways. With the development of computer and the network technology, especially after the 1990s, there have been booming amount of computer data, and people need kind of special software to manage data.

SQL server is DBMS software developed by Microsoft. As early as in 1988, the first version of it had been launched and has since then become one of the database management systems the most widely used with the best effect. With the development of computer and constant progress of the network technology, SQL server has been greatly improved and become easier, shrinkable and reliable. Now, it has already become one of the most advanced DBMSs (Chanak P, Banerjee I, Sherratt R S., 2015). SQL server has the following features: the SQL server uses the client/server architecture, and the powerful large server is used to store and process data resources, which has reduced requirements for clients and reduced costs. All the clients can acquire data by visiting the server, which guarantees the sharing of data to the maximum extent. The business logic and security rules are directly defined on the server, which is beneficial to the logic and integrated planning and management of security and business, and all the users can use it directly. Fig 2 shows the SQL server transfer structure diagram. After clients issue an order, it is transferred to be implemented on the SQL-Server through corresponding channels, and finally the server returns the results to users (Kumar S, Kumar V, Prasad Sl., 2015).

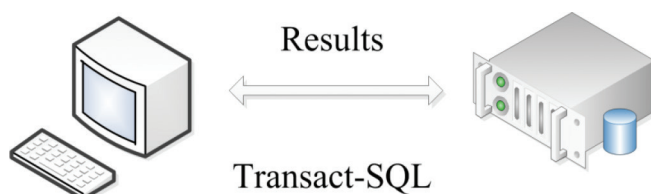


Figure 2 – SQL Server Transfer Structure Diagram

3. System Design

3.1. Design of System Function

Notices, announcements, approvals, resolutions, letters, reports, conferences and other important decisions of the government at all levels and enterprises should be sent to designated staffs following certain process. The system will provide a comprehensive set of functions to manage and query documents and archives. The overall system design includes four functional modules: document processing module (initiate, release, send, assign and handle documents), module review, process monitoring and sectoral management, etc. Main functions of the system realize the simple transfer of documents, sending emails and managing internal and external Internet links. Through the detailed explanation of this system, we can get to know the establishment of each module in the system and where we need to pay attention to in developing the document transfer system. The most important thing in dividing the system module and each

interface module is the interfaces between them, so it is the most crucial activity in the design of the entire system because it is the most important means to control the entire system. At present, this project is conducted mainly in two parts: first, divide functional modules into a hierarchical tree structure; the second is to define interface of modules. Each interface module only provides communication interface to be accessed by other interfaces so as to formulate the system procedures in the entire system: initialize, assign and handle documents and complete all the functional modules of all the categories, successfully assigning functions to each interface module and completing the overall requirement of the system to modules, excluding instable factors between modules. Meanwhile, the overall and flexible allocation of modules can be realized. Both the functional modules and process monitoring are important parts of the system. The main relationship diagram is as shown in Figure 3:

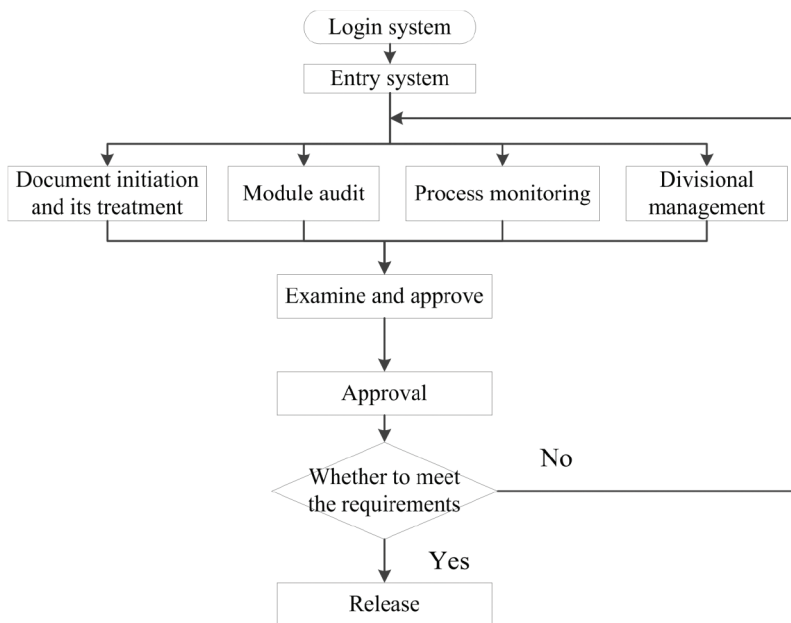


Figure 3 – System Design of Each Module

Each module in the system parallels to each other in the sub-module operation and their internal relationship is controlled through database and programming. Managers can define the document transfer path at random according to the company's actual situation, and then internal employees will choose the already defined document transfer path while submitting the documents and this will be comprehensively demonstrated when staffs handle business license to check duplicate name of enterprises. After the enterprise's name and materials have been reviewed, each service agency personnel in charge of this link will approve the documents, and finally, they will check the documents that have already been sent and approved.

3.2.Database Design

Database design refers to that in a specific application environment, through the logic and storage mode of comparing the optimal data models and appropriate physical design, users establish a database that can objectively reflect information and meet specific demands through certain DBMS.

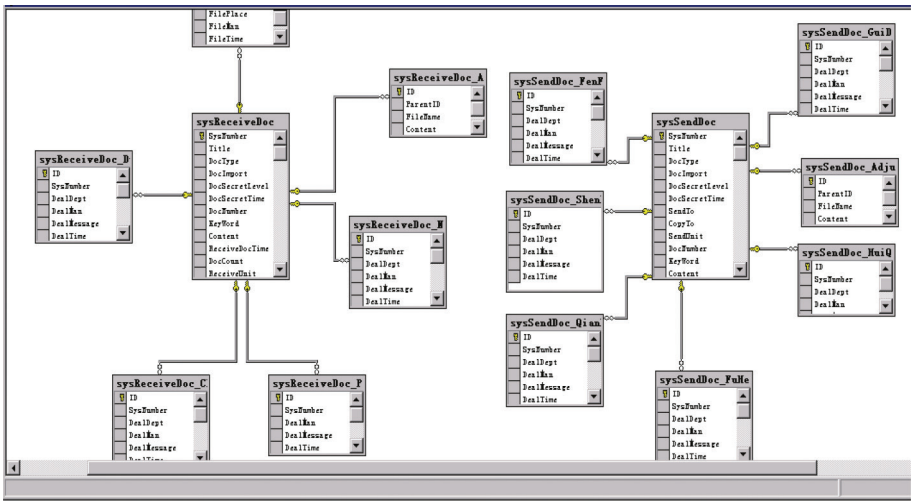


Figure 4 – Database Stored Procedure

The storage process is controlled by SQL permission flow and uses this link to input SQL statements sentence by sentence. After sentences have been refined, the entire compiling process is stored in the data server and can be extracted at random when necessary. The database relationship is shown in Figure 5.

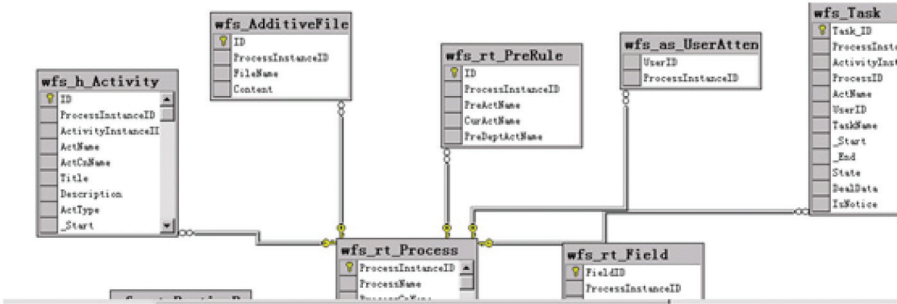


Figure 5 – Database Diagram

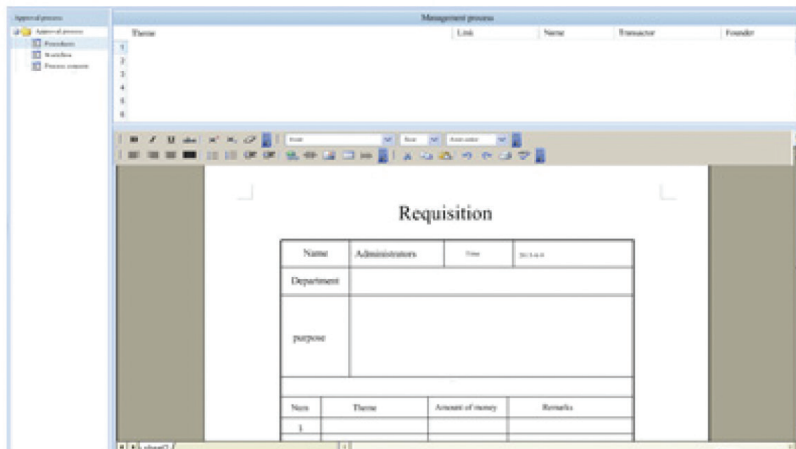
To establish a data dictionary is to make it convenient to import and export data, and more importantly, to make it easy to store users' materials and record traces of usage. In fact, all the operation information of users will be reflected in the database.

4. System Realization Part

4.1. System Function Realization

During the process of developing office automation software, after analysis and design of the system have been completed, the next step is to realize the system.

Take example of the approval process. The system's interface requires the approval process, and contents of the next stage should include processes that have been done and will be done as well as other concerning process. Take example of the approval process of application forms, contents in the table need to include documents' name and purpose. Send documents on the entire interface of the application table and the business process will follow fixed modes. This process is mainly to judge what browser we should log onto. Herein, the IE6.0 browser is mainly used for the design and log in as well as the css process combining the above process, regulating the font size and some functional applications within the module.



Name	Administrators	Time	30-1-1-1
Department			
Purpose			
Item	Theme	Amount of money	Remarks
1			

Figure 6 – Approval Process to Achieve the Interface

Through the category custom module, we can customize the document category and relevant management rights like process and employees' responsibility and authority:

This system has the following features:

1. As this system is developed according to the requirements of business administration, so the development process is strong targeted and practical. During the development process, test goes along with development to ensure the software is practical.
2. Specificity. This system targets at particular objects and is especially used for business administrative software, so compared with some general office software, it is more in line with the features and demands of office.
3. Use two development modes: development mode based on database operation and development mode based on the B/S architecture.

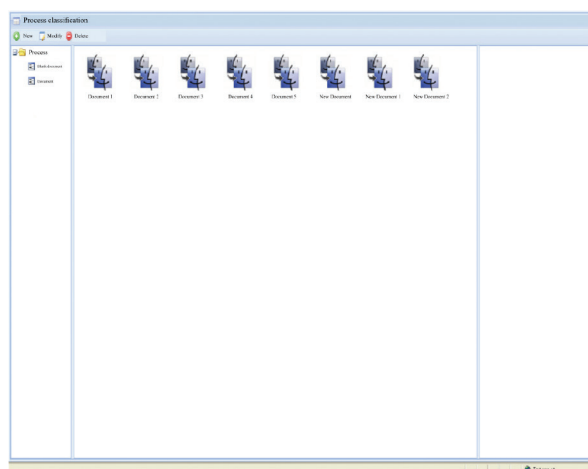


Figure 7 – Classification Implementation Interface

4. During the development process, full consideration is given to the code reuse mechanism, such as the selection of personnel and time, the uploaded documents are made into independent modules that can be reused.

4.2. System Test

Due to the limitation of conditions, the test environment is set up. WEB server uses the Apache, database adopt the SQL and the client system platform uses the WinXP operation system. During the test, the normal PC is used as the client and the server is a high-end PC (Pentium 3.0Ghz, 2G memory, and 120G hard drive).

Microsoft Web Application Stress Tool is used for pressure test of this system, and during the test, 50 simulated people are conducting online operation at the same time to reflect the capacity features of the system through monitoring the WEB page, database, memory and CPU. The specific results are as shown in Figure 8:

The operation of server database with 50 people online at the same time is shown in Figure 9:

It can be seen from results of pressure test of the system that the system can make quick response to less than 1,000 tasks and give the first piece of result. However, when there are too many tasks, such as more than 10,000, there will be the feign death.

The test aims at different systems with different items. The server hardware bottleneck -> network bottleneck (excluded for LAN)-> server operating system bottleneck (parameter configuration) -> middleware bottleneck (parameter configuration, database, web server, etc.) -> application bottleneck (SQL, database design, business logic, algorithm, etc.) According to different sources of information, it can be divided into two parts: errors in the design of scene and index data in the test. For example, this test contains the following errors:

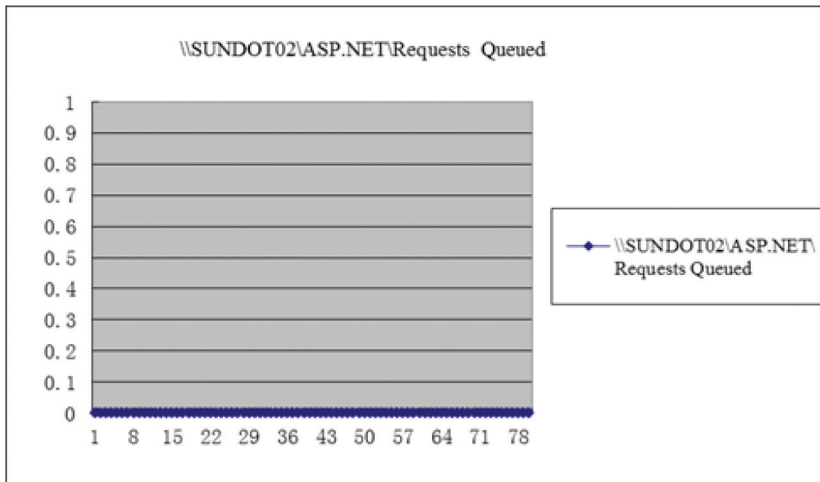


Figure 8 – Web Running Performance Chart

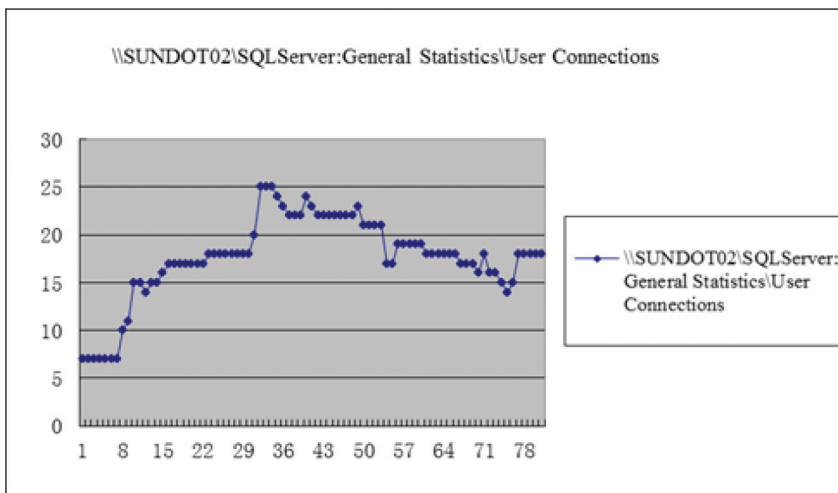


Figure 9 – Test Result of Server Database

Error: Failed to connect to server “payment.baihe.com”: Connection

Error: timed out Error: Server “user.baihe.com” has shut down the connection prematurely

In general, this situation is produced due to the influence of data transmission and server parameter. In this system modification, accuracy of process data is improved through optimizing the data transmission code in the program, especially, it is necessary to confirm and modify the white box test data.

5. Conclusion

Network office system is an office application software mainly for administrative units and enterprises to improve the office efficiency, quality and management level. The business administration office automation system researched in this paper has great importance to business administration because it can help the unit to quickly check relevant information of enterprises and individual businesses within its jurisdiction and whether any two enterprises have the same name so as to improve the timeliness and accuracy of applying for a certificate. This paper introduces the detailed design of the entire system under the B/S architecture and briefly describes computer technologies that have been involved. The business administration office automation system timely processes information and matters through the Internet, and the development of this system can greatly improve the office efficiency of each relevant department and shorten the cycle to process information so that the administration department can timely get to know the work of overall department and within departments, master the first-hand information and timely made decisions and report feedbacks.

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Development of Virtual Instruments Power Quality Monitoring System Based on LabVIEW Platform

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Abstract: With the development of China's economy, the standard of power quality is getting higher and higher in various industries. However, the current domestic power quality monitoring technology is still relatively backward. Their measurement accuracy and real-time performance cannot satisfy the increasing demands. The VI (Virtual Instruments) power quality monitoring system based on LabVIEW can make up for the shortcomings of traditional electrical parameters detection systems, which take hardware as their core with simple function and high cost. On the basis of power quality indicator and analysis method, this paper presented a VI power quality monitoring system based on LabVIEW graphical programming language. Based on LabVIEW VI platform, the system measures the voltage through an HEC-F magnetic balance voltage sensor, transforms the converted analog signal into digital signal through DAQ panel, and forms the data that can be processed by computer. Then it designs intuitive graphical instrument interface with LabVIEW, displays the real-time monitoring results, and finally conducts the test experiment and result analysis in the aspects of frequency, voltage effective value and flickering, etc. The system can monitor five steady-state power quality indicators specified in the national standard, which has a remarkable feasibility in the application of real power quality monitoring and provides a reference for the practical use of VI power quality monitoring system.

Keywords: Power quality monitoring; LabVIEW; VI (Virtual Instruments); Voltage sensor; DAQ

1. Introduction

Power quality monitoring is a precondition for the management and improvement of power quality of power supply system. The connotation of power quality not only contains traditional steady-state power quality such as frequency deviation, voltage deviation, power harmonics, three-phase imbalance as well as voltage fluctuation and flicker, but also puts forward new requirements on transient power quality, including voltage sag, voltage surge, short supply interruption, low frequency oscillation and transient pulse, etc. In recent years, due to a large use of sensitive equipment as variable frequency speed regulation equipment, microcomputer control equipment, programmable logic

controller, automated production line and computer server, the transient power quality problems as voltage sag, voltage surge, short supply interruption and oscillating pulse caused by system failure, large load starting, transformer no-load switch, motor re-acceleration after failure and automatic reclosing lock have triggered more and more accidents, which are being specially concerned by the international community. The VI technology is a new generation of measurement and control technology born in the 1990s. It was soon promoted and applied in various industries including power industry for its advantages including powerful user-defined functions, short development period, low cost, wide practical range and convenient in maintenance and upgrading, etc. Researches show that VI technology is featured with rapid development, low cost, simple to use, powerful functions, and free to extend, which can be used to develop on-line monitoring device of power quality, and preferably satisfy actual on-site demands technically and economically. Dugan R C et al. stated about power quality in 1996 (Ikni D, Camara M B, Dakyo B., 2015); Caldara S et al. designed a frequency monitoring system based on VI technology in 1998 (Durán I C, Zuñiga L S R, Pavas A., 2015); Zhenmei L et al. designed a power quality monitoring and analyzing system based on LabVIEW in 2003 (Si J, Yan Z R, Luo X M., 2015); MA Y et al. designed a new VI power quality monitoring system based on DAQ and voltage sensor in 2009 (Gu L, Ruan Z, Jia G., 2015); and in 2011, Laskar S H et al. designed more sophisticated power quality monitoring system by combining with the latest data acquisition system, and put it into practice (Liu X, Wu J, Jenkins N., 2016). On the basis of the research on the power quality of power system and VI measuring methods, this paper developed a power quality monitoring system by taking advantage of LabVIEW2011 by NI Company. The system conducts the calculation of related indicators of power quality according to the collected voltage data, gets them displayed in a direct way with graphics and data, and stores the collected voltage in the database for further analysis in the future. The system has made up for the shortcomings of simple function of domestic power quality monitoring systems.

2. Power Quality Indicators and Measuring Analyzing Methods

Normally speaking, power quality means a high quality power supply. The essence of improving the power supply quality is to reduce the deviation of each power quality indicator from its rated value. However, power energy is a whole from generation to consumption (Gasca-Hurtado, G. P., Peña, A., Gómez-Álvarez, M. C., Plascencia-Osuna, Ó. A., & Calvo-Manzano, J. A., 2015). The generation, transmission, distribution, transformation and consumption of power system are always in a dynamic balance. Any of the part would influence the power quality. Hence, the loss caused by power quality not only depends on the indicator deviation and the time of duration, but also depends on the grid structure, geographical condition, operation and maintenance management level as well as the property of the power load. Actual measurement and statistics method should be used to access the damage of this aspect.

2.1. Determination of Power Quality Indicators

Power quality indicator is a specific description on each aspect of power quality. Different indicator has different definition. According to the standard of IEC (International Electrotechnical Commission), the basic phenomena that caused interference are

classified from the perspectives of electromagnetic phenomenon and related interactions and influences, which include:

1. Transmission-type low-frequency phenomenon harmonics, inter-harmonics, signal voltage, voltage fluctuation, voltage sag and short-term power voltage imbalance, grid frequency change, low-frequency induction voltage, current in AC network;
2. Radiant low-frequency phenomenon magnetic field and electric field;
3. Transmission-type high-frequency phenomenon induction continuous wave voltage and current, one-way transient, oscillation transient;
4. Radiant high-frequency phenomenon magnetic field, electric field, electromagnetic field continuous wave, transient state;
5. Electrostatic discharge phenomenon;
6. Nuclear electromagnetic pulse.

The power quality that we are studying is basically focusing on the first phenomenon saying the transmission-type low-frequency phenomenon. Hence, the indicator of the power quality should be established according to this phenomenon. The main five newly established indicators for power quality are allowable deviation of power supply voltage, harmonics in public grid, allowable deviation of power system frequency, allowable imbalance of three-phase voltage, and voltage fluctuation and flickering. Next, the paper will briefly state the definition and measurement and analysis method of the national standard of the five indicators, and then introduce some new propositions about power quality in recent years (Porro S, Jasmin A, Conti D., 2016).

2.2. Allowable Deviation of Power Supply Voltage

Allowable voltage deviation means the deviation between actual voltage and the system nominal voltage when the voltage of the power system changes slowly. It normally refers to the situation when the voltage change is less than the deviation between actual voltage and the system nominal voltage each second.

$$U_d = \frac{U_r}{U_R} \times 100\% \quad (1)$$

Where, U_d refers to the voltage deviation, U_r represents the actual rated voltage, and U_R stands for the rated voltage.

Voltage deviation is usually caused by the voltage loss of the line. Exceeding of voltage deviation will have a severe impact on the electric equipment, grid stability and economic operation.

As the voltage at each point of the grid is different, the whole power system should set up a sufficient number and representative power stations, power substations, distribution network as well as voltage monitoring points of each voltage class user.

2.3. Harmonics in Public Supply Network

Harmonic is internationally defined as a component sine wave of an electrical quantity period. It is an integral multiple of the fundamental frequency. This definition clearly

specified that the harmonic times should be a positive integer, which is different from the definitions of inter-harmonics, sub-harmonics and fractional harmonics of EMS (Electromagnetic Compatibility Standards). Besides, it is also necessary to differentiate harmonic from transient phenomenon. Harmonic means the voltage and current wave keeps unchanged, while the voltage and current wave of transient phenomenon changes every period. Harmonic is mainly caused by large capacity power equipment, power rectifier equipment and other non-linear load in the power system. It has a bad impact on the power system (Lee Y T, Lin J S., 2016).

Normally, the PCC (Point of Common Coupling) that users connect to public grid is chosen as the monitoring point of harmonics. However, in order to get the harmonic level of the whole grid, monitoring points should be also set inside the grid, including the power station and main substation, etc., where the harmonic voltage level of the grid and the harmonic current of related lines can be detected. As the power system harmonic has a strong randomness, the actual measurement results are usually taken as the basis of solving problems. According to the implementation method, harmonic measurement can be divided into frequency-domain measurement method and time-domain measurement method.

2.4. Allowable Deviation in Power System

The frequency in power system means the periodic movement times of the electric signal per unit time, and frequency deviation refers to the difference between the real value and the nominal value of the power system frequency.

Under normal working conditions, the power system operates at a nominal frequency. However, as the power system load changes frequently and there are certain inertias of power output and its regulating system changing with the load, the system frequency will deviate from the nominal value, which means a frequency deviation is produced. Hence, an allowable deviation scope of frequency needs to be determined to assure the reliability and economy of the system operation.

The general method of measuring the system frequency is to measure the circles of the single-phase voltage signal of sine steady-state AC at a predetermined time interval (normally less than 1 second), or can be realized by a high-speed stopwatch or a counter. However, the accuracy of this method is usually limited by the deviation when the measuring voltage is over zero or limited by the speed or accuracy of the referential timer. In the voltage wave of the system, there may be harmonics, noises, or transient high-frequency noise pollution due to large disturbance of the system. So the frequency measurement of the power system should eliminate the harmonics, noises and transient high-frequency noise pollution, which is also a difficulty of frequency measurement.

2.5. Allowable Imbalance of Three-phase Voltage

In an ideal three-phase AC power system, the phasor sizes and frequencies are the same, and the deviation is $2\pi/3$ angle, which is known as a three-phase balanced system. Otherwise, it is a three-phase unbalanced system. In this system, the three-phase phasors include the positive-sequence component and the negative-sequence component. The ratio between the negative-sequence component and the positive-

sequence component is known as the imbalance degree. The reason for the imbalance of the three-phase system is that it is hard for the three-phase loads of the power system and the component parameters to be completely symmetric. Besides, any short-circuit fault in any phase of the three-phase system will also lead to the imbalance of the system (Aswin V, Dogra A, Gupta A., 2016).

The imbalance of three-phase system has a bad impact on the generation, transmission, distribution, transformation and consumption devices of the power system. Hence, it is significant to restrict and improve the imbalance.

Symmetrical component method is widely used in studying unbalanced three-phase power system. In this method, any group of asymmetric three-phase phasors (voltage or current) is disassembled into three-phase symmetric three-phase phasors with different phase sequences. For three-phase four-wire circuit when the three-phase voltage is asymmetric, there are not only harmonic components but also positive-sequence vectors, negative-sequence vectors and zero-sequence vectors. For three-phase three-wire circuit, there are only positive-sequence vectors and negative-sequence vectors. The imbalance degree of three-phase voltage is usually presented by the percentage of RMS (Root Mean Square) of negative-sequence vector and positive-sequence vector.

$$\varepsilon_u = \frac{u_1}{u_2} \times 100\% \quad (2)$$

Where, u_1 represents the RMS value of the positive-sequence vector, u_2 represents the RMS value of the negative-sequence vector.

2.6. Voltage Fluctuation and Flickering

Voltage fluctuation means a series of voltage fluctuations or continuous changes. It is usually caused by fluctuating loads (e.g. electric-arc furnace, car steel machine, electric welding machine, etc.). The voltage fluctuation value is the difference ΔU between the two extrema $U_{\max}$ and $U_{\min}$ of the voltage RMS. The relative percentage is usually presented by the percentage of the nominal voltage U_N .

$$d = \frac{U_{\max} - U_{\min}}{U_N} \times 100\% \quad (3)$$

Voltage fluctuation may influence the normal operation of many electrical devices. General speaking, as the computer and the control equipment have small capacity and can be installed with anti-interference facilities at a low cost, there is no need for special concern. Although the broader flickering includes the voltage fluctuation, the main definition of it comes from the subjective visual angle of human, which means that flickering is a subjective visual feeling of human on fluctuation (Zu F X, Gao G Y, Fu H H., 2015).

The common measurement methods of flicker gauge voltage fluctuation include square detecting method, rectifier test method and effective value test method. All the methods are realized through the demodulation of voltage fluctuation amplitude-modulated wave.

This paper adopts the recommended square detecting method.

$$u^2 = \frac{A^2}{2} \left(1 + \frac{m^2}{2}\right) + mA^2 \cos \Omega t + \frac{m^2 A^2}{4} \cos 2\Omega t + \frac{A^2}{2} \left(1 + \frac{m^2}{2}\right) \cos 2\omega t + \frac{m^2 A^2}{8} \cos 2(\omega + \Omega)t + \frac{m^2 A^2}{8} \cos 2(\omega - \Omega)t + \frac{mA^2}{2} \cos(2\omega + \Omega)t + \frac{mA^2}{2} \cos(2\omega - \Omega)t \quad (4)$$

By filtering the DC components and the frequency components of power frequency and above through 0.05Hz-35Hz band-pass filter, the amplitude-modulated wave of the response voltage fluctuation component can be detected and exported as:

$$A^2 v(t) \approx mA^2 \cos \Omega t \quad (5)$$

3. Design of Power Quality Monitoring System Based on LabVIEW

3.1. Requirements for System Design

With the advantages of strong anti-interference ability, low cost for hardware, high performance price ratio, and easy operation, VI (Virtual Instruments) technology is gradually applied in the field of measurement and analysis. Given this, based on VI, this paper will design a detection and analysis system for the key parameters of power quality, which offers the functions of power grid signal collecting and analysis and real-time parameters detection.

3.2. System Topology

This system is consisted by two parts: data collecting by hardware and data processing by software. Voltage, current transformer, PXI data acquisition (DAQ) card of signal conditioning circuit forms the hardware to sense the measured object from the outside and acquire signal data. As for the software, power quality monitoring system complied by Lab VIEW displays the interface of program.

The system topology is shown as below:

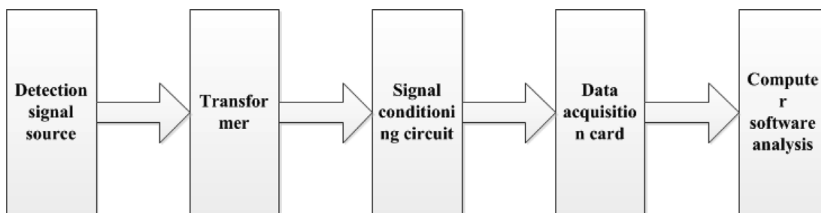


Figure 1 – System Topology

3.3. Realization of Hardware Part

As described in the basic features of VI, the essential task of the hardware in this system is to isolate and transform, as well as to convert the virtual signals transformed to digital ones, and finally form the data that can be processed by the computer. According to the hardware measurement task, we build a hardware platform as shown in Figure 2.

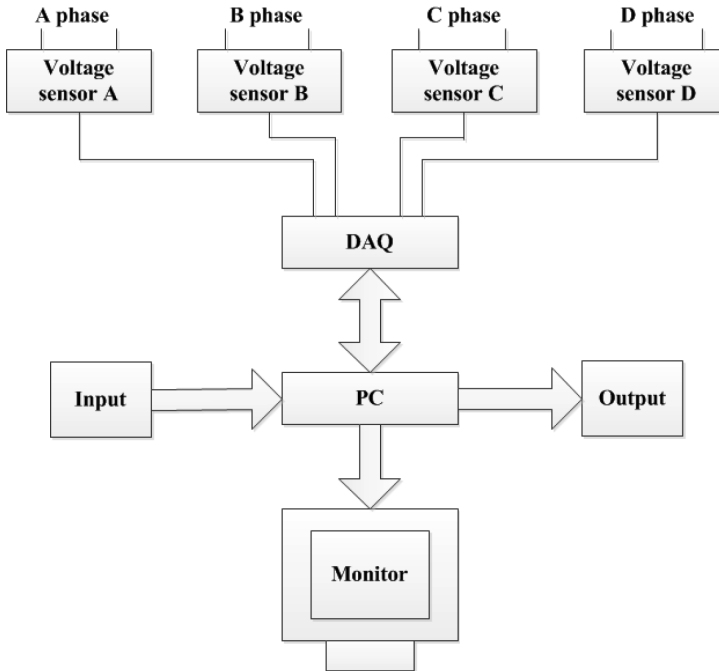


Figure 2 – The Sketch Map of Hardware

The sensor used in the sketch map is the HEC-F electromagnetic balanced voltage sensor (McClay J L, Shabalin A A, Dozmorov M G., 2015) produced by Hall Electronic Co. limited in Baoding province, Beijing. And the DAQ card is the 6040E (MIO-16E-4) DAQ card produced by National Instruments (NI) Company in the U.S. Under Microsoft Windows, the device driver of this DAQ card can be easily found and installed from the build-in driver library of LabVIEW, and added to Measurement & Automation, being available for users' configuration and usage.

PC provides a run-time environment for VI software. Display plays a similar role as indicator panel of traditional instruments while input equipment (e.g. mouse, keyboard, etc.) equals to various function buttons of the traditional instruments. There are different types of output equipment such as printers, disk units, and optical storage devices that have been growing popular in recent years, nevertheless all of which are absent in traditional instruments. Meanwhile, PC is equipped with rich functions which can also be applied to VI system.

3.4. Realization of Software Part

This project adopts the visual platform LabVIEW 2011 developed by NI Company in the U.S. as the development environment. In the light of programming theory in terms of different levels and objects, we divided the whole system into several modules: main interface module, data collecting module, data processing module, data memory module, data analysis and management module, and report generation module. Through the cooperation between these modules, the function of power quality monitoring and analysis can be realized.

Equipped with all features of language, LabVIEW is not only a functionally complete software development environment, but also a general purpose programming language with an extended function library fitting all kinds of programming tasks. The biggest difference between LabVIEW and traditional high-level programming language is the way of programming. In general, high-level language adopts text programming, while LabVIEW the graphical programming. The program complied by LabVIEW is called VI (Virtual Instruments) because the interface and functions of them are extremely similar to those of real instruments. A VI is made up of interactive user interface, dataflow diagram and icon connecting interface, and the functions of each part are as follows:

(1) The interactive interface of VI is also called the front panel because it is similar to the panel of real instruments. Front panel includes rotary knob, dial, switch, diagram and other interface tools, allowing the administrators or users to acquire data through mouse and keyboard and displaying the results. (2) VI receives instructions from dataflow diagram. As a graphical method to solve programming problems, diagram actually is the program code of VI. When we program VI, only if we select the corresponding icons in function modules and connect them by wires to achieve reciprocal data transmission, can we build a complete flow diagram. (3) Modularity is the feature of VI. A VI itself can be an upper independent program as well as the subprogram of other program. When a VI is regarded as a subprogram, it is called subVI. The function of VI's icon and connecting interface is like a graphical parameter list, transferring data between VI and SubVI. What LabVIEW adopts is the dataflow programming mode which is different to linear structure of other programming languages based on text. The execution sequence in LabVIEW depends on the dataflow among function modules, so LabVIEW is a multi-task system that could operate multi-VIs at the same time. (Alam M S, Kumar S, Khaira H., 2015)

1. Interface design of power quality monitoring and analysis system

The structure of this system is shown in Fig. 3. The main interface module is used to input set point and output the result. Data collecting module takes charge of collecting data and after data processing module deals with the data through mathematical operation, data memory module will save the result to database SQL Server. Then data analysis and management module will analyze the data from the database and finally output the result in report generation module.

In the case of specific programming, the theory of multi-threading is applied to plan and manage various function modules. More specifically, there are three major threads including main interface display thread, data collecting-processing-memory thread and data analysis-management and report generation thread. These three threads operate

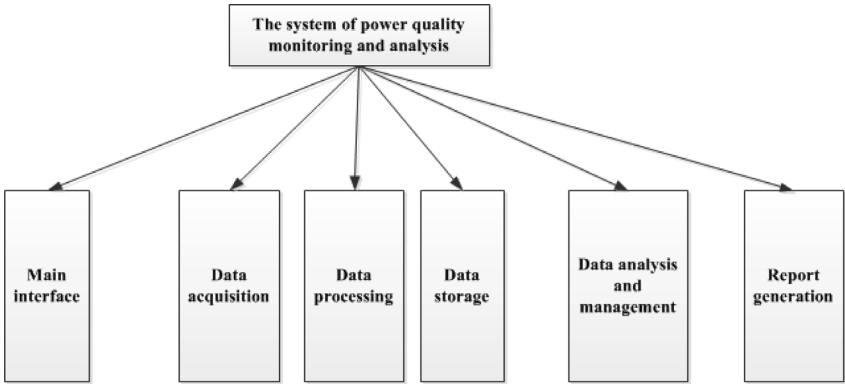


Figure 3 – Structure Diagram of the System

simultaneously when major program interface is initiated. However, they have different priority. Taking the task and importance of each thread into consideration, data collecting-processing-memory thread should be given a highest priority, that is to say, once CPU operates tremendous calculation in this thread, the work of other threads need to be paused to guarantee the smooth operation of the main thread. Main interface of power quality monitoring and analysis system is shown in Fig. 4. The main interface module is used to input set point, for example, the parameters of sample rate and buffer size, and display the real time data measured. By the switch of label button and option button, various data and diagram can be displayed in detail, which makes the result much clearer and easier for operating crew to acquire the power quality condition of power grid.

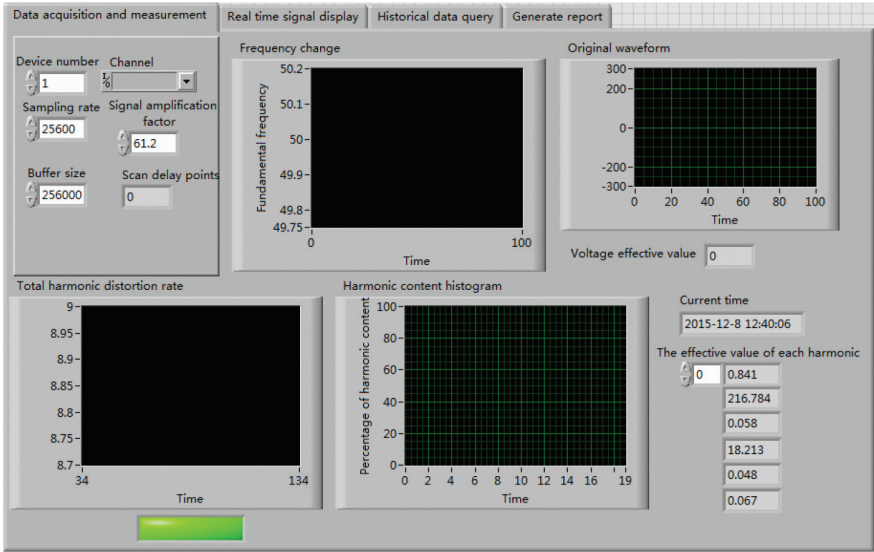


Figure 4 – Main Interface

2. Design of data collecting module

The parameter of data collecting module is defined by a Cluster. The Number 1 DAQ card is selected as the device number. This number is set by software Measurement & Automation provided by the development platform LabVIEW. After correct installation of DAQ card by the user, we can add and set the number, the input and output mode, and the attachment setting of the card in the interface of Measurement & Automation. This system adopts the products of NI Company, therefore after the installation of the driver, Measurement & Automation set the default card number as 1. Besides, we set virtual single-ended input mode as the input mode; CB-68BL wiring board as attachment. Thus the device number in the program is 1.

Those two buttons “start collecting” and “quit” on the panel is the ones controlling the data collecting and system operating. After the collecting parameters configured, we can press “start collecting” button to start collecting data. “Quit” button controls the operating condition of the whole system. It is also its essential task to effectively quit every thread due to the application of multi-threading theory to run various function modules in this program. (Lu X, Wang W, Deng Z., 2016) In this process, we set a global variable quit through which we send control message to every thread. Once pressed, Quit is endowed with “true” value, and the program exits; otherwise Quit as “false” value and the program keeps going on (Min H G, Li X C, Zhao X M., 2015).

Abundant information is displayed on the main interface of data collecting. Collecting status indicator light indicates the current status of collecting. And the caution light tells whether various index of measured system exceeds the limit and also shows whether the data collecting system is recording data or not. Waveform display is the major function of data collecting interface. It shows the real-time waveform and effective value of voltage. Information of different channels can be displayed as well through channel switch. Moreover, there is information of frequency, amplitude, effective value, harmonic content and time on the main interface of data collecting.

3. Program Design of Data Processing Module

The main function of data processing module is to conduct corresponding mathematical operations for the data collected via data collecting board. This module is composed of five sub-modules, which are frequency calculation sub-module, voltage calculation sub-module, harmonic calculation sub-module, voltage fluctuation and flickering calculation sub-module, and three-phase imbalance calculation sub-module (Jing X, Shao X, Cao C., 2015). These five sub-modules will measure and calculate the five power quality indexes respectively. The measurements will be transferred to and stored in the data storage module. If the measurements are higher than the limit, the sound-light alarm will ring to warn the operator.

4. Program Design of Data Storage Module

The selection of a proper database is of great significance since the power quality supervision and analysis system requires excellent storage and management for massive data. The most commonly used large databases are MS SQL, ORACLE, INTERBASE, SYBASE and so on. In this study, SQL Server 2000 is chosen as the background database.

SQL Server is suitable for medium and large-scale system, and it can work with thousands of client applications jointly. Compared with the multiprocessing single-

threaded database as ORACLE, SOL Server consumes less hardware resources since it is a uniprocessing multi-threaded database. Unlike the multiprocessing database requiring coordinating body for the open processing of each client, SQL Server uses the executive kernel to allocate multiple clients' access to the database, thus reducing the communication and coordination time required by multiple processing for database access. In this way, the execution efficiency can be enhanced significantly. Moreover, SQL Server can be easily linked to the VI software LabVIEW. More specifically, the database can be accessed directly in the application through standard SQL language. SQL Server is a relational database established on client/server. In power quality supervision and analysis system, it enables users to gain access to the database safely and conveniently via Web-based approach (Szalay G, Judák L, Szadai Z., 2015).

The processed results will be written in the SQL Server 2000 database by the data storage module with standard SQL language, providing data source for the following data analysis management.

5. Program Design of Data Analysis Management and Report Generation Module

The data analysis management module is designed for the statistical analysis of the data in the database as needed, such as to query various values (e.g. the maximum, minimum and average value of voltage, 95% probability big value and voltage qualified rate) in a certain time slot. Hence, operators can obtain a better understanding of the power quality from the perspective of statistics. The main interface of the analysis management module is shown in Figure 5.

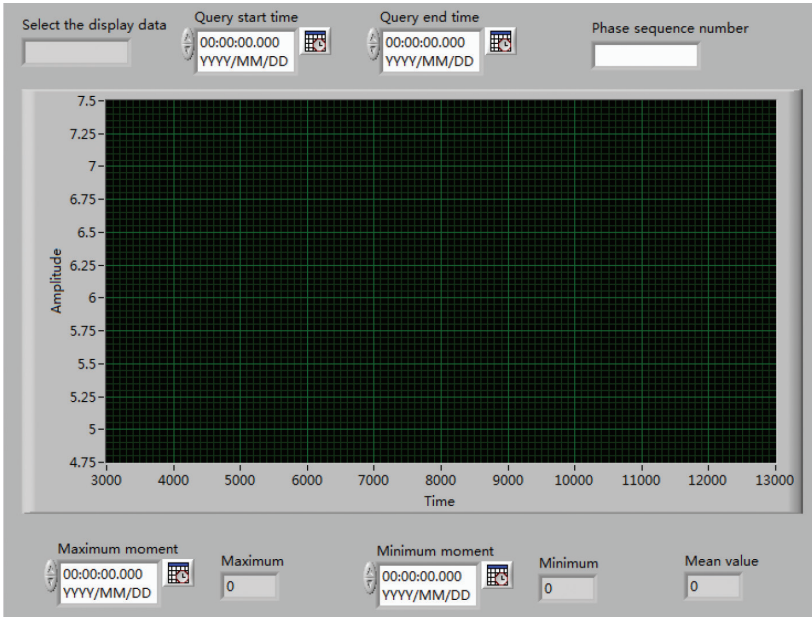


Figure 5 – Analysis Management Main Interface

The function of report generation module is to produce a standard report in form of data, forms and figures to show the power quality, and a Web page for printing and remote access. Users can choose to display or not display some of the values in the report according to their personal demands.

In this study, a power quality supervision and analysis system is designed to measure the five power quality indexes under the VI platform of LabVIEW. This system is equipped with user-friendly interface, excellent data inquiry performance and powerful statistic function. All the power quality indexes are presented in this one system, enabling users to better obtain comprehensive information of the power quality.

4. Performance Test and Result Analysis of the System

4.1. Design of Experimental System and Experimental Results

In order to verify the accuracy of the power quality monitoring and analysis system, this paper developed a signal generator based on LabVIEW. The signal generator takes the DAQ with an analog output function as its analog output port. The DAQ analog output parameters are: maximum output rate: 1 MS/s; accuracy: 12 bits; output range: $\pm 10\text{V}$; the parameters can satisfy the requirements of the experiment completely.

1. Frequency measurement experiment

Purpose: to verify the accuracy of frequency measurement.

Process: Using a signal generator to generate signals of different fundamental frequencies. The interference signals are 3 times of 10% harmonics and 5 times of 5% harmonics.

The results of the experiment show that the absolute error is less than 0.01HZ, which meets the requirements of power quality frequency measurement completely.

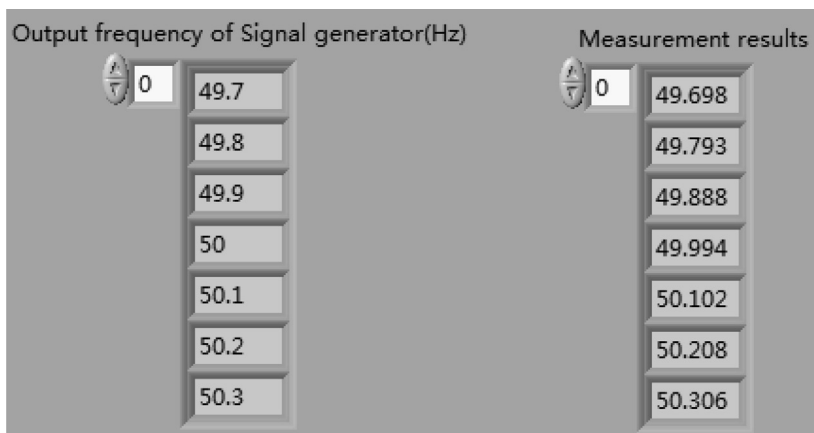


Figure 6 – Frequency Measurement Results

Output frequency of signal generator(Hz)	Measurement results of fluke43(Hz)	Measurement results of this system(Hz)
49.7	49.7	49.698
49.8	49.8	49.793
49.9	49.9	49.888
50.0	50.0	49.994
50.1	50.1	50.102
50.2	50.2	50.208
50.3	50.3	50.306

Table 1 – The Data of Frequency Test

2. Measurement Experiment of Voltage Effective Value

Purpose: to verify the accuracy of voltage effective value measurement.

Process: Using the signal generator to export different amplitude of voltage signals.

The experimental results are shown in Figure 7 and Table 2. According to the results of the experiment, the accuracy of the voltage effective value measurement is high enough to satisfy the requirements of the measurement.

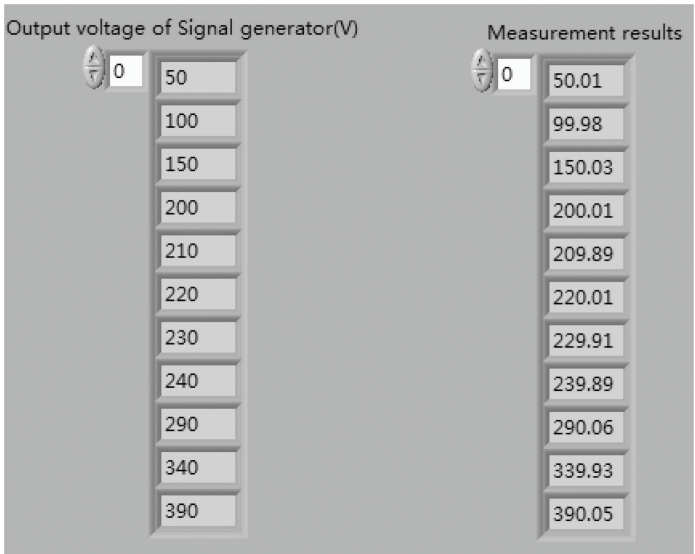


Figure 7 – Voltage Measurement Results

Output voltage of signal generator(V)	Measurement results of fluke43(V)	Measurement results of this system(V)
50	49.94	50.01
100	99.88	99.98
150	149.88	150.03
200	199.76	200.01
210	209.85	209.89
220	219.89	220.01
230	229.81	229.91
240	239.84	239.89
290	289.84	290.06
340	340.89	339.93
390	390.46	390.05

Table 2 – The Data of RMS Value Test

3. Flicker Measurement Experiment

Purpose: to verify the accuracy of flicker measurement

Process: Using a signal generator to produce a standard flicker signal with an instantaneous flicker value of one. The interfere signal is a 3 times of harmonics with the total harmonic distortion rate of 5%.

The experimental results are shown as Table 3

Amplitude modulation frequency f (Hz)	Voltage fluctuation d (%)	S(t)	
		Measured value	Theoretical value
1.0	1.432	1.0003	1.00
3.0	0.654	1.0000	1.00
5.0	0.398	1.0000	1.00
8.0	0.256	1.0000	1.00
10.0	0.262	1.0000	1.00
12.0	0.312	1.0000	1.00
16.0	0.480	1.0000	1.00
20.0	0.700	1.0000	1.00
25.0	1.042	1.0000	1.00

Table 3 – The Data of Flicker Test

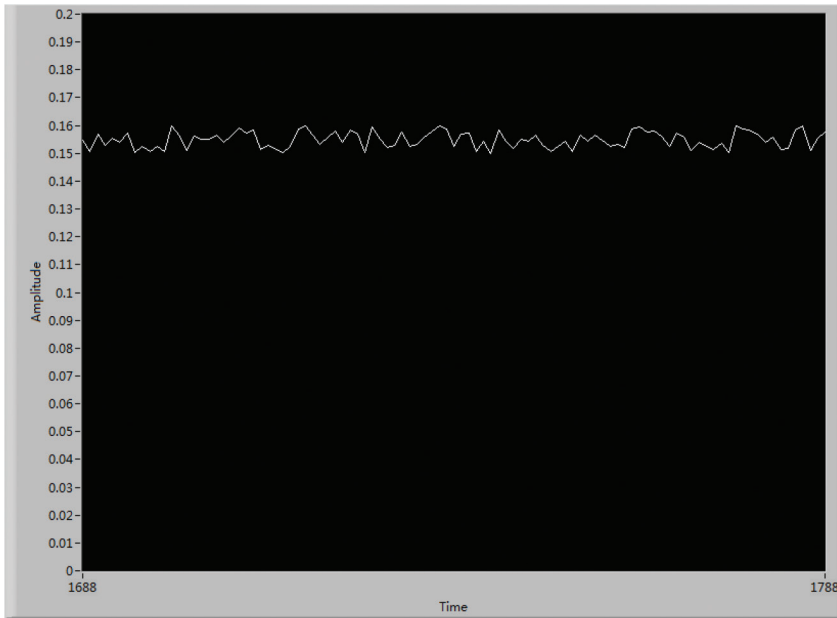


Figure 8 – The Curve of Three-phase Unbalance

4. Three-phase imbalance measurement experiment

Figure 8 shows the trend of the three-phase imbalance degree.

4.2.Measures of Improving Accuracy

The accuracy of electrical quantity measurement is an important indicator of evaluating the properties of the measurement devices. It is also an essential condition of deciding whether the control effect is good or bad. As a matter of fact, in the previous designing process of the system, not only the choice and research of each measurement algorithm of power quality but also the design of software and hardware all considered the matter of how to reduce deviation and improve the accuracy. Here we summarize as follows: (1) The resistance value has a direct impact on the transformation ratio of voltage sensor. So high-accuracy resistor should be adopted and the resistance value should be basically constant when the temperature changes so that to improve the accuracy of the measurement; (2) The relative quantitative deviation of A/D converter should be minimum. This system adopts a 12 bits /D converter, the relative quantitative deviation of which is less than $1/8192$. It means that the deviation caused by A/D converter is around $1/10000$, which can meet the measurement requirements completely; (3) Quasi synchronous processing and filtering processing are used to reduce the influences on the measurement accuracy of aliasing and leak. Meanwhile, the selection of measurement algorithm and 32 bits of CPU also assured the accuracy of measurement; (4) As for random errors, the traditional statistical approach can be used to provide more accurate measurements in way of probability big value, thus eliminating the bad effects of random errors.

Experiments and actual measurements have improved that this system is capable of providing reliable power quality supervision and analysis with high accuracy.

5. Conclusion

Power quality is very important to both the industry and our life. The VI technology has strong anti-interference capacity and relatively small hardware consumption; its advantages as high cost-effectiveness and convenience for operation have already presented in power quality measurement and analysis area. Focusing on the power quality indexes and the analysis methods, a VI (Virtual Instruments) power quality supervision system is designed in this study based on LabVIEW platform-based thorough the VI technology. The system is mainly composed of two parts, which are hardware and software. For hardware, HEC-F magnetic balance voltage sensor is adopted to ensure accurate capture of the voltage, and the collected analog signal will be transformed to digital signal via DAQ board. For software, LabVIEW graphical programming language is used to design the main interface and the data collecting, processing and storage module. In this system, the traditional hardware instruments are replaced by VI; the detection system for the key parameters of power quality has good performance, high accuracy and suit the convenience of the users. Furthermore, this system provides accurate measurements and real-time supervision of frequency, voltage effective value, flickering, three-phase imbalance and power harmonic. It can well remedy the disadvantages of the traditional supervision system as simple function and complicated structure in the actual power monitoring environment.

Acknowledgment

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Study on Modern Electrical Control Technology Teaching Reform and Its Practice in Local Agricultural and Forestry Colleges of China

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Abstract: Modern electrical control technology is a specialized course of high theorization and practicality, lay emphasis on training the practical ability. Under the guidance of “311” Talent-training Pattern and professional practice ability training roadmap of Agricultural University of Hebei, the teaching reform was conducted. On the basis of determining the course ability level, developing the corresponding syllabus and integrating the curriculum system, using modern educational technology and simulation software, combined with engineering cases, the project-driven and task-driven teaching method was introduced and formed a new teaching mode of student-centered learning. Practice has proved that through the teaching reform and practice, students’ self-learning ability, practical ability and the ability to adapt the work has all improved. It plays an important role to cultivate students’ innovation spirit and to improve the quality of talent training.

Keywords: Higher education, teaching reform, practical ability, project-driven teaching method, innovation spirit.

1. Introduction

Colleges and universities take the task of training students with great abilities. The basic education goal of engineering college students is to train up them for practical entry-level engineer. In western developed countries, people attach great importance to practical teaching activities.

Modern electrical control technology is a professional expertise required course of electrical engineering and automation, mechatronic engineering, electronic information engineering, measurement technology and instrument and other majors in universities. The course covers a wide range of knowledge, updating development rapidly, the course should not only has theoretical knowledge, but also emphasis on practical application, has a strong practicality, linked with the engineering practice closely, it will require students to have a higher professionalism and creative ability (Tajeddini M A, Safarinejadian B, Rakhshan M., 2015; Tajeddini MA, Safarinejadian B, Rakhshan M., 2015; Lepet E., 2014). As local agricultural and forestry colleges, Agricultural university of Hebei based on deepening educational reform, the creation a distinctive characteristics “311” Talent-training

Pattern, shown in Figure 1, through the integration of curriculum system, reform practice teaching, to cultivate students' innovation spirit, and then to improve the education quality and school running level (Kumar U, Kumar R., 2015; Sampson L., 2015; Yanchen L., 2015).

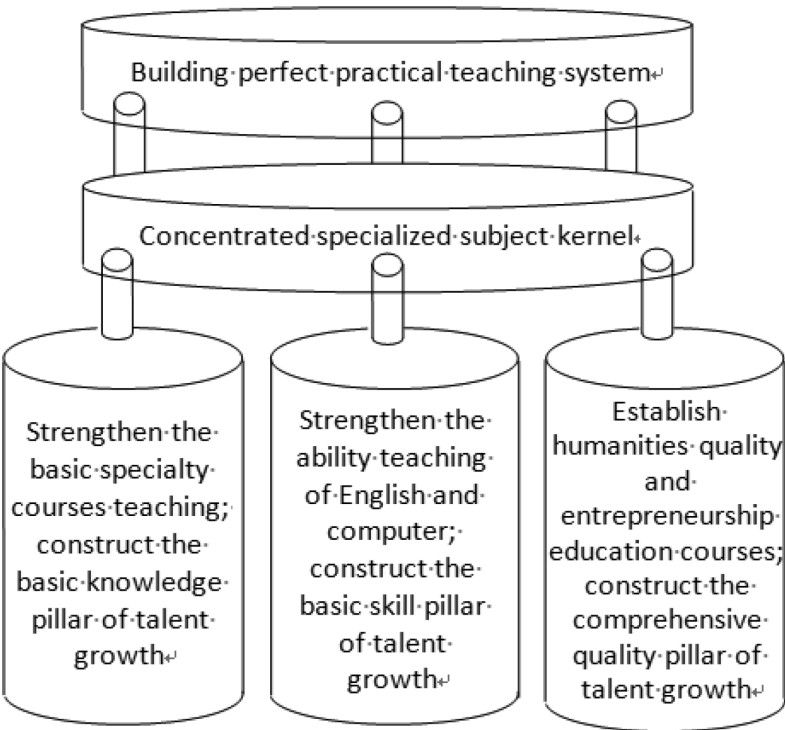


Figure 1 – Schematic Diagram of “311” Talent-training Pattern

According with the talent training pattern requirements, strengthen basic courses, compress specialized courses, and combined with the requirements of times development, based on the “electrical control technology” and “ principle and application of Programmable Logic Controller (PLC) “ courses, supplement content of CNC machine tools, frequency conversion technology, change as “modern electrical control technology”, with emphasis on technical ability training, improvement practical education quality, and adapt talent training requirements. In the traditional teaching, the theory and the practice are disjointed, too much emphasis on the theory teaching, knowledge teaching is uninteresting and not intuitive, it cannot combined theory with practice, cannot be achieved to apply their knowledge. Engineering graduates, only to solve practical engineering problems, could be accepted by the society. Aiming at the problems of the course in daily teaching, develop the educational reform and practice, employment as guide, cultivate comprehensive ability as content, achieved the changes that the “knowledge-oriented “ to “application ability-standard “.

2. Curriculum Reform

Course curriculum reform should posit course orientation clearly, make course teaching syllabus, develop teaching objectives from the knowledge, ability and quality perspectives. Therefore, in order to master modern production machinery control technology application capabilities for the purpose, melt theory into practice, outstanding application ability of engineering technology and comprehensive quality training (Oliveira, J. A., Ferreira, J., Figueiredo, M., Dias, L., & Pereira, G., 2014). Modern electrical control technology has a lot of teaching materials, but most textbooks have more or less outdated contents and have other issues, the theory and practice are disjointed. For the case of more course content but less class hours, our university, Shanxi University, Hunan Institute of Engineering and other colleges and universities jointly prepared for the materials of “modern electrical control technology”, it has published by the China Machine Press in 2012, and make the supporting courseware. As technology courses, theory can be just work enough, should focus on applications, and strengthen practice (Vanitha P, Balamurugan N B, Priya G L., 2015; Vanitha P, Balamurugan N B, Priya G L., 2015; Vert A, Satyavolu P R, Fujita A., 2016). Based on this, streamlining curriculum, integration theory content (Wei L, Li G Q, Zhang W F., 2015), reducing section of the relay and contactor, highlighting the classic circuit and design method, stressed on PLC working principle and ladder diagram analysis, design and application capabilities, strengthen practical ability training, to build a course content teaching system, as shown in Figure 2.

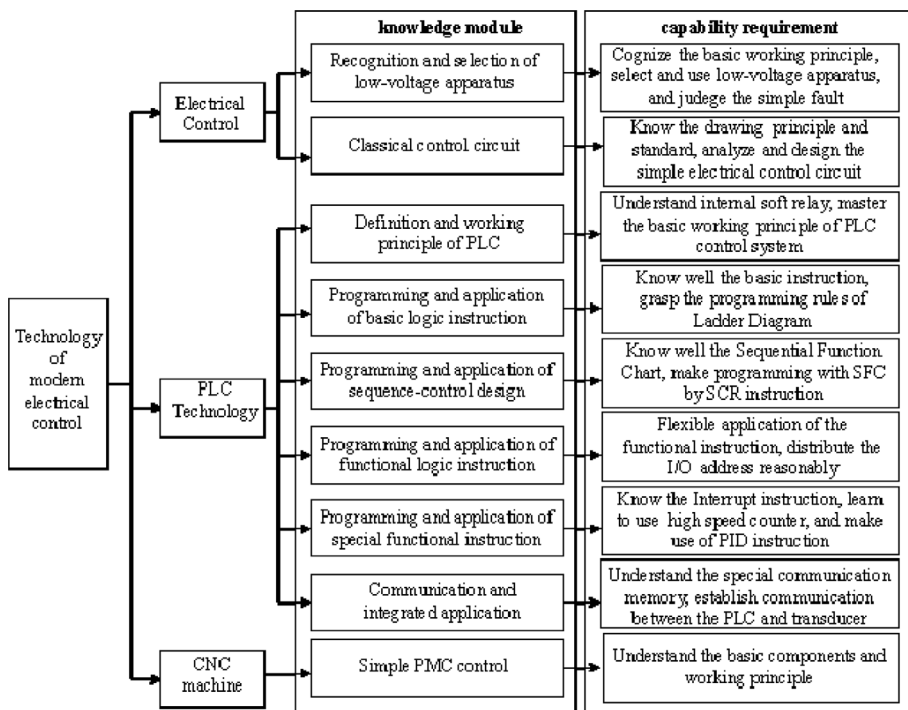


Figure 2 – A schematic of the Curriculum Modularization

By teaching modularization, decomposition of curriculum knowledge target and the ability target, posit each teaching module target clearly, and has a strong intuition and flexibility, the modules combines each other. Course content system focused on the systematicness of the teaching content, achieved by the link control to the system control, from the traditional control to PLC control.

3. Practice Teaching Reform

In China, practice teaching is the weakest link in university personnel training. Lectures enable students to master the basic concepts, methods and principles, focus on training students' analysis and problem-solving skills. Practice teaching can improve students' ability to utilize the knowledge and practice ability. Lectures and practice teaching, the two complement each other. To some extent, practice teaching is a strong guarantee to improve students' practical ability (Cingoski V, Golubovski R, Gelev S., 2015). In my university, "311" Talent-training Pattern focused on strengthening the practical aspects, established a sound practice teaching system, through practice teaching training the practical ability and innovation ability of students. Then, as an engineering curriculum of the local agricultural and forestry colleges, how to cultivate students' practical ability and to stimulate creative thinking, which is that the teaching team need to solve, specific measures are as follows.

3.1. High Standard Laboratory Construction

Laboratory is the teaching and research base, and is an important indicator to measure the level of running colleges. Through experiments, students can be from the classroom to the lab, from theory to practice.

College assembling electrical control laboratory and Siemens PLC laboratory, can set up a three-phase AC induction motor run forward or reverse control, Y- Δ low-voltage startup, dynamic braking and other electrical control experiments, and production PLC experiments of lines analog control, manipulator analog control, elevator analog control and traffic signal control, and so on.

Experimental teaching should be student centered, teacher supplement. A high level laboratory should give full play to the students' enthusiasm and initiative that will help students to acquire knowledge, improve innovation capability and overall quality, laid the material foundation of training applied engineering talents.

3.2. Adding Comprehensive Experimental Contents

Experiments are divided into validation experiments and designing experiments. To the validation experiment, the result is known. Through validation experiment, students learn the relevant knowledge, master the operational approach of various instruments, and study the experimental data measurement and processing methods. So to speak, the validation experiment could train the experimental handle ability and the serious working attitude. During the comprehensive designing experiments, students utilize the learned knowledge and skills, develop the engineering design capacity. Thus, they could combine the basic theory with the experimental applications.

In addition, curriculum design and graduation design are also belonging to the comprehensive experiments. Curriculum design and graduation design should be based on the actual, while ensuring advancement, more practicality and practical important and in accordance with equipment conditions, pay attention to cultivate comprehensive design capabilities. Both the curriculum design and graduation design are comprehensive.

Curriculum design is an important teaching link of the engineering specialty. With the help of the teachers, set aside two weeks time for the curriculum design, students complete the design task independently, to achieve the goal of comprehensive design training. Students could select the most suitable design task from the optional titles, such as automatic control system design of stereo garage based on PLC, electrical control system design of feedstuff processing workshop.

Graduation design is the important part of innovative system for talents cultivation. Engineering research methods should be introduced to the graduation design. The design title should with strong innovative, and come from the production and scientific research practice, such as the design of fancy fountain based on PLC control system, the design of vending machine based on PLC. During the guidance of graduation, teachers should lay emphasis on strengthening training students' innovative ability. Combining with the problems appeared in the graduation design; teachers could conduct heuristic discussion with the students, and give the total solutions of the encountered questions.

3.3. Actively Participate in Engineering Practice

Combined scientific research activities, technology development and other engineering practices, the teaching contents were supplemented (Kartashev I I, Tul'skii V N, Nasyrov R R., 2015).

Actively participate in scientific research activities, strong academic research environment to effectively develop students' practical ability and innovation spirit. On the one hand, students participate in specific projects to achieve the organic combination of theory and practice; on the other hand, the teachers through engineering case teaching, building students' engineering awareness, reform traditional "indoctrination" teaching, to achieve their knowledge true applies.

The interested students could join the curriculum team, and participate in engineering and academic research. For the past few years, our workgroup had completed many research projects about electrical control technology, such as the design of constant pressure water supply system, the design of variable rate fertilizer based on PLC control system, the variable scale cutting control system based on PLC, the design and experiment of a novel laser leveling system for corn harvester based on PLC. Only participating in engineering practice, teachers could be better exercised, and improves their theoretical knowledge and practical ability. And the other way round, it can enrich the content of courses, and accelerate the improvement of teaching level.

3.4. Open Laboratory and set up Second Class

Colleges should attach importance to the construction of open laboratory. Opening laboratory, not only equipments can play an efficient role of using, but also students

take more exercise to give full play to the capacity of independent thinking, the ability of analyzing and solving problems. It should pay attention to highlight the dominant position of students, make the students become the experimental principal part. Students arrange the experiments according to their own time; choose the appropriate experimental items according to their own development direction, hobbies and interests. Thus, students can take the initiative of their learning and stimulate the enthusiasm of study, to the benefit of the improvement of their comprehensive quality and innovation consciousness. So, every laboratory should be actively carried out the opening work, take many forms that open laboratories to the students.

4. Reform of Teaching Means and Methods

In teaching methods, to adopt a student-centered, teacher-led approach, change “cramming method of teaching” to “heuristics education”. Based on course content system, task-driven, combined with simulation software, change the traditional discipline system knowledge content into several educational programs, educational activities organized around the project (Ren S, Dong J, Chen W., 2015; Ben F., 2015; Turchetti M, Homulle H, Sebastiano F., 2015). A total understanding of low-voltage electrical design and selection, basic electrical control circuits, cargo vehicle shuttle control, crossroads traffic light control, automatic door sensors control system, digital display, automatic production line PLC control and other eight projects.(Rochford C, Medlin D L, Erickson K J., 2015; Gupta K, Sharma K K, Kaur I.; 2015)

Using project-based approach, with the main line of the project, for teaching the theory of knowledge and skills integrated in each project. Each project step by step, students can improve the skills and play a subjective initiative to cultivate creative thinking, improve the ability to analyze and solve problems. Table 1 is the comparison of traditional model of teaching and project-based learning method.

	Traditional model of teaching	Project-based learning method
Teaching method	cramming method of teaching	heuristics education
Learning method	memorize mechanically, not attention to summarize and improve	reasonable utilization of knowledge point to improve the ability to analyze and solve problems
Learning interest and initiative	aimless learning objectives, passive learning, poor initiative, low learning interest	Clear study aims, great initiative in finding ways, student-centered and teacher-led
Learning ability	poor self-learning ability, low summarizing ability, poor studying spirit	High operating skills, learning together, enough subjective initiative
Combination level of theory and practice	No perceptual knowledge, not applying theory to practice	Master professional theory, theory guiding practice

Table 1 – Comparison of Traditional Model of Teaching and Project-based Learning Method

5. Teaching Evaluation

Establish a scientific and reasonable teaching evaluation system. All along, curriculum assessment based on written test results, supplemented by practical assessment. In order to effectively avoid the spot questions, assault impending the exam, course grade assessment test scores is no longer the dominant theory exam, the proportion of 50% or even lower of the written test, increase practical assessment efforts. Among them, the practice test result is formed by the usual experimental results, integrated project design achievements, practical assessment and so on. We can say that the reform of assessment methods to promote the academic atmosphere change has a certain role to improve student learning enthusiasm and comprehensive ability.

6. The Effect of Curriculum Reform

In the past several years, we conducted the teaching reform of modern electrical control technology. For the effect of reform, conducting questionnaire survey, listed several questions to answer, as follows:

Question I: Teaching materials satisfaction?

Question II: Curriculum system satisfaction?

Question III: Teaching method satisfaction?

Question IV: Whether it would be beneficial to improving students' learning interest?

Question V: Whether it would be beneficial to enhancing practical ability?

Question VI: Whether it would be beneficial to cultivating students' innovation spirit?

Figure 3 is the result based on a survey of 1200 students from 2011 to 2015.

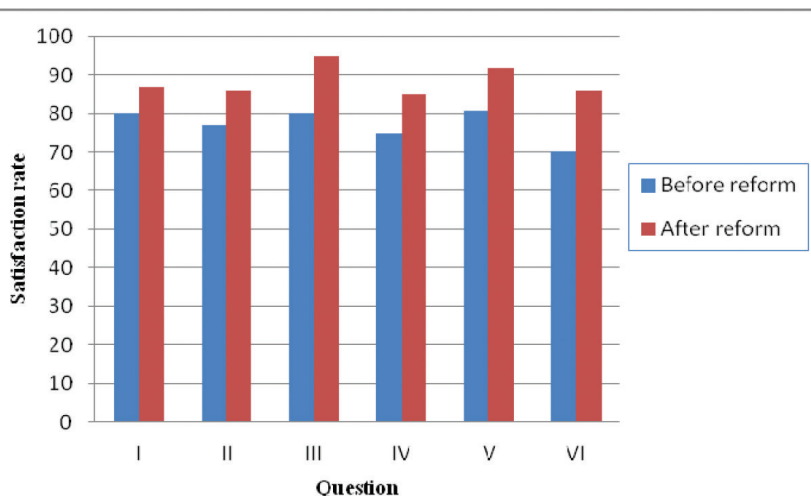


Figure 3 – Comparison of the Teaching Reform Implementation Effect

7. Conclusions

Modern electrical control technology is an important specialized course of electrical engineering and other majors. As a local agricultural and forestry college, our university explored the “311” Talent-training Pattern. Combined with the professional practice ability training roadmap, it conducted the curriculum teaching reform and practice, and achieved some effects. Aimed at the characteristics of courses extensive knowledge and high practicality, with the help of modern educational technology and simulation software, it conducted teaching activities using project-driven and task-driven method combined with engineering cases. Full respect for the students’ dominant position and personality development, thus it could mobilize the enthusiasm of students, employment-oriented, focus on the technology capabilities training. We will continue to explore ways to improve teaching in the future, in order to train engineering graduates to meet the specialty education objective and social needs.

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Research On The Paperless Oral Training Based On Computer Technology

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Abstract: Objective: In order to improve the students' paperless oral training effect. Methods: Using the paperless training way based on the computer network technology. Process: The article describes the general situation of the development of computer network technology, analyzes the theory of computer assisted instruction, establishes the computer assisted language learning system, and designs the paperless spoken language training system model. Results & Analysis: This paper studies the spoken language training theory, analysis based on the computer network platform of spoken language teaching training mode, through the analysis of the experimental data that the teaching and training platform has a good teaching effect. Results: The establishment based on computer technology of paperless spoken language training platform can greatly improve the level of students' spoken language training.

Keywords: Oral training; computer network technology; voice tone evaluation; spoken language

1. Introduction

With the rapid development of computer network technology, computer application is becoming more and more popular, the computer in the economic and social development in the increasingly prominent position. The social information level is improved, and the social demands for the computer skills of the students in the contemporary college are becoming higher and higher. Non paper spoken language teaching has become a mainstream research direction. The use of computer networks as a medium of communication activities in foreign language or second language teaching began in the late 1980s, and the study of the network communication on foreign language or second language learning began in the early 90's. Since then, scholars have carried out the relevant empirical studies from different angles, the research on the real time communication and the development of the language ability in the network has a certain proportion, some of these results have considerable influence, such as Beauvois (1992) studied the computer mediated communication in foreign language classrooms; Chun (1994) studied the effect of Internet technology on the development of interactive capabilities; Kern (1995) compared the effect of Internet writing real time communication and face-to-face communication on French learning. Warschauer (1996) also made a comparison with Kern. The results of these studies show that the real-time communication can

improve the students' participation, increase students' language output (Tanenhaus M K, Spivey-Knowlton M J, Eberhard K M., 1995). In addition, the scholars have found the other advantages of real-time communication in the Internet, such as students have the initiative to communicate, reduce the degree of anxiety, etc.. Since entering twenty-first Century, foreign studies have sprung up like mushrooms, the author makes a preliminary study of the results of these studies, including "CALL", "RECALL", "CALICO", "Learning and Technology Language", "SYSTEM" and "Teaching Language" and other 6 kinds of foreign outstanding academic journals with the characteristics of foreign language teaching and learning. The author first according to the title of the paper to find the key words, the key words involved are "SCMC, CMC, communication computer-mediated, communication online and chat online, etc. Figure 1 (a) - (b) shows the language teaching training based on computer network.



(a) Computer Assisted Oral Instruction



(b) Oral Test on Computer

Figure 1 – Oral English Teaching and Training Based on Computer Network

Levy and Stockwell think, computer network technology to the auxiliary function of the spoken language can be achieved through three ways: Audio or video communication tools; network written communication tools; man-machine conversation function (Mora, A. D., & Fonseca, J. M., 2014). The author chooses second ways as the breakthrough point of the research, because the first way and the face to face oral communication is not a big difference, and because of the large scale of College English class, voice chat easily interfere with each other, and the third way is not the corresponding teaching and research conditions, and it will also cause the “noise” in teaching (Marslen-Wilson W, Tyler L K., 1980). In the author’s view, the written real-time communication is a kind of silent oral activity, even though it’s a quiet text on the screen, but thinking is like a conversation. Some studies show, the written communication of the network has a certain similarity with the oral communication in the face to face, such as Kern (turn-taking), immediacy (short) and Sotillo (informality), etc. (Smith 1995; 2003b 2000). At the same time, the written form of the network is presented in writing, the language of the language will undoubtedly have some characteristics of the written language, such as the use of punctuation, tone of the missing, the language the strict supervision and control of the language and the high degree of word order. In addition, the written real-time communication network also has its own language features, such as spelling and feelings using thumbnail icon. Warschauer (1997) pointed out, written real-time communication is a new form of communication, it sets the language of interaction and reflection in one. If we speak and write and write as a continuous body, from the perspective of language features, written real-time communication may be a little closer to the end of the written (Gillon G T., 2000).

2. Materials and Methods

2.1. Computer Assisted Instruction Theory

Computer aided learning is a new type of learning model, which is used to aid learning. According to the form of learning, there are three ways of computer aided learning: One is the computer supported classroom learning, the two is the individual learning of computer support, three is the computer supported cooperative learning. Compared with the traditional learning mode, the computer aided learning has rich image information presentation, quickly and timely information feedback and unique and effective human-computer interaction, etc. It can be used in a variety of media, such as the combination of sound and light, rich and colorful teaching content and interface design, broaden the channels for students to enter information (Allopenna P D, Magnuson J S, Tanenhaus M K., 1998). The use of multimedia can make students not only limited to the input of information in writing, and can achieve the purpose of learning through other forms, so as to help stimulate students’ enthusiasm for learning, active inquiry questions of interest, reduce the difficulty of the students to solve or understand the problem, it also facilitates the design of friendly interface to achieve the effect of maintaining the students’ attention. The intervention of a variety of media has opened up a broad training space for the development of some of the more neglected (Cutler A, Dahan D, Van Donselaar W., 1997).

2.2. Computer Aided Language Learning System

Speech is an important part of language learning, the accuracy of pronunciation and oral training is an important part of Chinese learning. At present, speech processing technology has become an effective method to help pronunciation and oral English learning, the problem of accuracy of pronunciation and oral English training in language learning can be solved effectively by using automatic objective assessment technique. Therefore, the computer aided language learning system of Chinese pronunciation evaluation is an effective tool and an important tool for the Chinese spoken language learning. Evaluation of tone evaluation of speech prosodic, the evaluation system block diagram is shown in Figure 2. The system consists of three parts: basic frequency processing, speech recognition and speech evaluation. The pitch extraction and processing of the pitch part of the speech is completed, including forced segmentation, feature extraction, synthesizer and baseband processor; Speech recognition is a recognition model of training good recognition; Evaluation system is based on the recognition of the tone of the evaluation results (Carter R, MNCARTHY M., 1995).

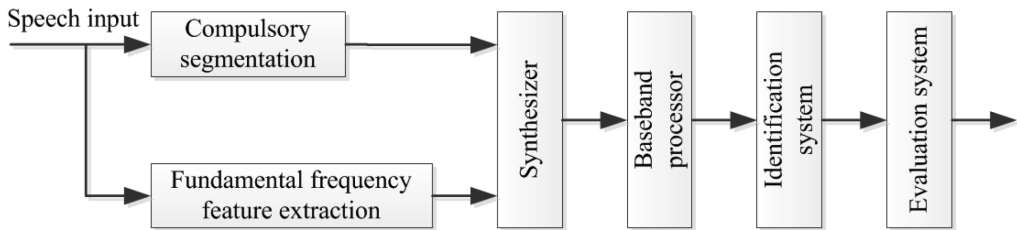


Figure 2 – Tone Evaluation System Block Diagram

The final section of frequency characteristics of Mandarin tones are mainly concentrated in the Chinese phonetic alphabet, therefore, to the voice of the input sound, vowel in tone processing before segmentation. The main function of the forced segmentation is the single word in the initial and final segmentation, this is the basis for the extraction of fundamental frequency information, it is very good to prevent the interference of the fundamental information of the consonants. The extraction of fundamental frequency features of Chinese tones is mainly related to the input speech signal processing. The characteristic of speech signal is changed with time, which can be regarded as a short-term stationary process, therefore, the speech signal can be divided into different sub frames to process. The fundamental frequency features are extracted from each 10ms as a frame (Seneff S., 1992), and the speech signal is obtained by $x(n)$, then the short-term auto correlation processing of $x(n)$ is carried out by using the Formula (1):

$$R_n(k) = \sum_{m=-\infty}^{\infty} x(m) \cdot x(m+k) \cdot h_k(n-m) \quad (1)$$

Where there is:

$$h_n(n-m) = w(n) \cdot w(n-k) \quad (2)$$

$R_n(k)$ is the result of the self correlation calculation of a signal with short time window in the vicinity of the signal n . In the process of using frequency, frequency of some of the voiced part is zero, and the fundamental frequency is not continuous, therefore, it is necessary to deal with the missing data to ensure the continuity of the fundamental data. In this paper, the (Lagrange) interpolation method is used to smooth the data of forced segmentation and fundamental frequency feature extraction, and then the processing results of the two kinds of signals are synthesized as the primary frequency of tones (Davis M H, Johnsrude I S., 2003). The fundamental frequency processor is the normalized processing and re-sampling of the original pitch of the tone. After interpolation, the fundamental frequency effect has been improved to some extent, but because the speaker's pronunciation characteristics and accent, different people to the same word pronunciation fundamental frequency curve difference, but the fundamental frequency range of the fundamental frequency of each person's speech is basically the same. Therefore, to make the model more practical, need to deal with the fundamental frequency of the interpolation after normalization processing, the Formula (3) is used to represent all the fundamental frequency data in the same order of magnitude:

$$\bar{f} = \frac{(f - f_{\min})}{(f_{\max} - f_{\min})} \quad (3)$$

In order to establish the tone model, after normalized processing, the fundamental frequency data must be processed by heavy sampling, so as to ensure that the same number of characters per word. Re-sampling is actually an interpolation operation in the corresponding sampling interval. Interpolation operations have two kinds of linear interpolation and nonlinear interpolation, in this system, the linear interpolation system is used to sample the fundamental frequency data. In order to establish the tone model, after normalized processing, the fundamental frequency data must be processed by heavy sampling, so as to ensure that the same number of characters per word. Re-sampling is actually an interpolation operation in the corresponding sampling interval (Foster P, Tonkyn A, Wigglesworth G., 2000). Interpolation operations have two kinds of linear interpolation and nonlinear interpolation, in this system, the linear interpolation system is used to sample the fundamental frequency data. The tone recognition system is the core of the whole system, for the whole tone recognition system, the core of the system is to build up a model with good performance. The overall distribution of Chinese tones is not satisfied with the distribution of a single Gauss, but it can be used to approximate the distribution of multiple Gauss functions, therefore, the mixed Gauss model (GMM) can well solve this problem. Each tone can be approximated by a set of Gauss's functions, so as to obtain the function form of this kind of voice. Tone recognition, the pitch recognition of the basic frequency vector and the probability of the Gauss function to judge, the probability that the fundamental frequency vector of this group is close to that of the Gauss function, it belongs to this kind of tone pattern, and the probability is small, the fundamental frequency vector does not belong to this kind of tone pattern, so as to achieve the purpose of tone recognition (Buchanan T W, Lutz K, Mirzazade S., 2000). Gauss mixture model (GMM) is a combination of the probability density function of multiple Gauss distribution to describe the distribution of feature vectors in probability space, the weighted sum of the probability density function of the

probability density function of the Gauss distribution is represented by the model, the probability density function of the number is called the Gauss model. A d-dimensional GMM with M number of mixed number can be expressed as a Formula (4):

$$P(x|\lambda) = \sum_{i=1}^M \omega_i p_i(x: \mu_i, \sum i) \quad (4)$$

Where x is the observation vector of d dimension; $\omega_i, i=1,2,\dots,M$ is mixed weight, and satisfied:

$$\sum_{i=1}^M \omega_i = 1 \quad (5)$$

$p_i(x: \mu_i, \sum i)$ for the d-dimensional Gauss functions, the GMM model of the i model of the Gauss component, for the mean vector of the Gauss component, for the covariance matrix, there is:

$$P(x: \mu_i, \sum_i) = \frac{1}{(2\pi)^{d/2} |\sum_i|^{1/2}} \exp \left\{ -\frac{1}{2} (x - \mu_i)^T \sum_i^{-1} (x - \mu_i) \right\} \quad (6)$$

The mean vector, the covariance matrix, and the mixture weights of the mixed components of the M are described by the Gauss mixed model. Represented by the model:

$$\lambda = \left\{ \omega_i, \mu_i, \sum_i \right\} (i=1,2,\dots,M) \quad (7)$$

After the establishment of Gauss mixture model, the parameters of GMM model are calculated by using effective model parameters (Fenn K M, Nusbaum H C, Margoliash D., 2003).

2.3. Training System Structure Design

How the object in the system at different time points during the execution and how the results of the communication, is the dynamic behavior of the system. That is to say, the object is in the life of the system by means of communication. The dynamic behavior of the system is changed by the way of changing the state. In order to better reflect the object of the training system designed in this paper, in this paper, we use the dynamic modeling mechanism in UML, that is, the sequence diagram (sequence diagram). Dynamic interactive relationship between objects in the sequence diagram; The time sequence of message passing among the objects is emphasized, and the sequence diagram has two axes: The representation of the time, the horizontal coordinates of the object (Hammes D M, Novak M A, Rotz L A., 2002). The dynamic description of the logical structure of training system user training in this paper, of course, there are many types of graphs that can be used to describe the logical architecture in UML, This paper only uses one of them, as shown in Figure 3.

In the training module of the Mandarin training module, each training unit should be set up to clear the training target, and that is the ultimate hope that learning can reach the

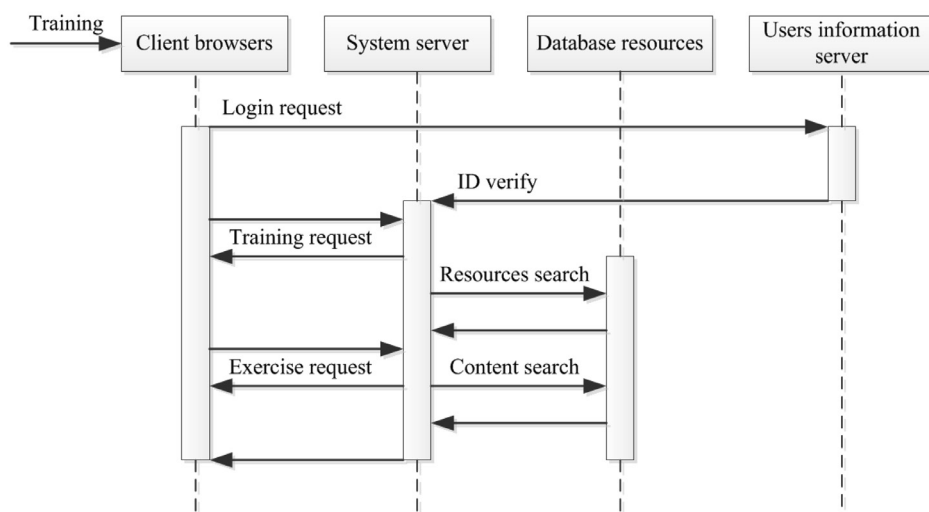


Figure 3 – System Data Flow Chart

level of ability. At the same time with the training objectives tied for: basic knowledge, training content and other projects. The basic knowledge is different from the training unit, to explain the characteristics of each unit training program, specific terms or concepts; Training content items to include a certain training method, and according to the characteristics of different units, giving the corresponding examples, comparison exercises, etc. (Wegner D M., 1995).

2.3. Training System Technology To Achieve Planning

The first thing to note is that the training system is a part of the whole learning system, in the technical realization plan is in accordance with the overall consideration of the auxiliary learning system, in the writing of the paper is a system in the form of a separate written. B/S mode is an open, cross platform, good network architecture of the three layer, in contrast to the C/S model. Based on the campus network, the “teacher” assisted learning system is the use of B/S model, in fact, the three layer client / server structure, mainly including the presentation layer, function layer and data layer. Presentation layer is the interface between application and user, and it is the window of interaction between user and system; The function layer is the user request processing, to input or output from the database by ODBC or JDBC, etc. Get the information, and then send this information to the user in the form of Jsp pages. Function layer is the key to realize Web service. This system is realized by Jsp and Servlet technology; Data layer is integrated with a variety of databases, which includes the multimedia material library, test questions, test papers, all kinds of user information, etc., they are the basis for the realization of the online teaching environment, as shown in Figure 4.

Need to explain is that the above system model structure, it can also be explained by using the three layer structure of the general public architecture represented by UML.

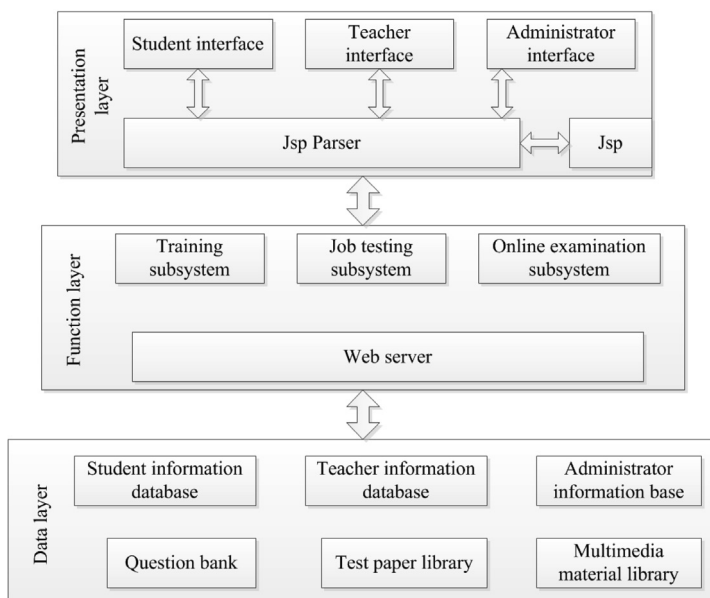


Figure 4 – Assistant Learning System Layer Architecture Diagram

The three layer structure of UML includes interface layer, business layer and database layer (Kanungo S., 1998).

3. Results and Analyse

An empirical study of the development of oral English teaching based on computer network, researchers make teaching class for students to carry out the four different types of network writing real-time communication task, which to discuss the theme, is subject to debate, role play and story solitaire. In the fourth chapter, the author discusses the effectiveness of these tasks, mainly analyzes and compares the differences above four different types of network writing real-time communication task exists in the aspects of learning interest and language output frequency, rounds of frequency and language related episodes (Mishra B K, Saini D K., 2007). The four task is to focus on the communicative purpose, “meaning” (getting meaning across), let the students use English to carry out the communicative activities, the main task of the students is to express their meanings, to achieve each other’s communication, rather than complete grammar training, so I think the theme of debate, discussion and theme of the story Solitaire, COSPLAY is focused on the significance of the language learning task. The four task is to carry out communication activities with the help of the network, the purpose is to serve as a supplementary means of oral English Teaching in college, online

written real-time exchange activity in the form of novel, and each student has an equal opportunity to participate, students can reduce the degree of anxiety and reduce the pressure on the oral English activities in the classroom, in addition, students in extra-curricular activities can continue the network English, the author thinks that based on computer network is subject to debate, the story Solitaire, topic discussion and role play to stimulate the learning enthusiasm of students, oral English teaching is a traditional injected new vitality. Therefore, it has a positive effect on College English teaching. Authenticity refers to the consistency between the learning task and real life in real life, Bachman (1996) points out that the degree of truth is relative, there is no absolute truth or not real, can only say that the comparison is true or not true. These tasks need to carry out enough network computer, QQ communication software, technical management personnel, teaching time, and be familiar with QQ chat tools of teachers and students, from the point of view of the action research. Hardware, software and human resources and other facilities, adequate resources, computer networks running normal, therefore, the development of the four tasks are feasible. The evaluation of real-time communication tasks in computer networks is shown in Table 1.

Characteristic	Subject debate	Story Solitaire	Subject discussion	Role play
Language learning opportunities	Good	Good	Good	Good
Learner adaptation degree	Relatively good	Relatively good	General	Relatively good
Focus on meaning	Yes	Yes	Yes	Yes
Truth degree	Medium	Low	High	High
Positive effect	Good	Good	Good	Good
Feasibility	Good	Good	Good	Good

Table 1 – The Subjective Assessment of the Written Real-Time Communication Task in The Network

It can be seen from the table, the computer network English teaching system has a good evaluation results, can improve the students' oral training effect.

4. Conclusions

With the improvement of social information degree, the teaching and training of paperless spoken language based on the computer network technology has become a high-tech content of modern teaching direction. This paper introduces the theory of computer-assisted instruction, constructs the corresponding auxiliary teaching and training system. As a part of the whole assisted learning system, the training system is considered in accordance with the overall of the assisted learning system in the

implementation of the plan, while it's written in the form of separate system in the paper writing. Through empirical research on College Oral English teaching based on computer network development, it's found that this paperless teaching oral training system has good training effect.

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Interactive Volume Deformation Based on Model-Fitting Lattices

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Abstract: Over the last decade, interactive deformation solutions for manipulating volumetric space, especially that those can be implemented based on hardware based acceleration strategies, have attracted a great deal of attention in medical imaging, virtual manufacturing, phenomenon simulating, etc. Since 2010, the novel scientific achievements accomplished on PC computers, specialist hardware, and gaming consoles have been popularizing the great advantages of parallel processing architectures (e.g. Computer Unified Device Architecture, CUDA) in complicated applications, such as construction simulation, virtual surgery, game design, and so on. Deriving substantial benefits from these architectures, the real-time manipulation of the interiors and exteriors insides volumetric objects (technically referred as volume deformation) has become a research hotspot because its capability of performing the changes of internal structures and external features according to parameterized material characteristics. Towards the research of this interactive strategy, this paper contributes an interactive volume deformation (IVD) solution based on a new designed self-extracting mechanism for accomplishing the so-called “model-fitting” lattice from volume data. By working with a novel data structure mentioned in this paper, this lattice can precisely enclose the interesting segment of volume data based on users’ instructions and efficiently synchronize manipulation characters through the associated volumetric space. Based on these achievements, the volume deformation strategy proposed in this paper can carry out a hardware-accelerated volume deformation solution with interactive manipulation capabilities.

Keywords: Volume data; Volume deformation; Model-fitting lattice; Look-up-table; Deformation behaviour

1. Introduction

Generally speaking, volume deformation methods can be classified into two groups: physics-based and non-physics-based; while the prior can be considered as a volumetric extension of the surface-based deformation strategy. The latter approach preserves the underlying volumetric assemblies while enabling the description of deformable constrains without the physical accuracy of deformation interaction, such as force feedback (C.D. Correa, D. Silver, M. Chen., 2010).

In recent years, the Deformation of Geometric Models Editor (DOGME) method and its developments in physics-based simulations, which uses various lattices as the “agents” for passing the displacements to the underlying model or elements, have shown to be applicable for performing various deformation behaviours (e.g., (M. Nakao, K., 2010; H.M. Baydaa, X. Ling, T. Liang et al., 2011)). However, as the necessary preparation for this deformation strategy, there must be an assumption that the lattice is the finest choice for the simulation (V. Estellers, J.P. Thiran, M. Gabrani., 2014).

This following context will start from section 2 which provides the state-of-art in physics-based volume deformation. After finishing the lattice construction in section 3 and 4 respectively cover the principle of I-DOGME method and the refinement design for the lattice extraction for ensuring the interactive rate of real-time operation. The strategy of distributions of displacements inside the volumetric object are introduced in section 5, and the common evaluation criteria are utilized to access this deformation approach in terms of intermediate results and real-time performances. Based on the current outputs, the achievements will be concluded in section 6.

2. State of the Art

The educational system in Finland implies that all persons aged 16 years have at least nine years of compulsory schooling. After this primary level of education, there is an option for upper secondary education in terms of either vocational schooling or education leading to the matriculation examination (which is a prerequisite for entrance to universities). The secondary level of education generally takes three years to pass. All schooling above that level is here called tertiary level of education. Theoretically, it lasts for three to five years, but quite few university examinations are passed before 25 years of age. A cohort therefore reaches the ultimate level of education at ages after those when migration rates are the highest (see Fig. 1 in the next section). At present, approximately 15 per cent of the population in Finland remains at the primary level of education, whereas one third attains the tertiary level of education.

In physically accurate applications, by using this lattice in the manner of 2D planar or 3D cubic form, or even parametrically defined, the physics-based deformation methods can follow the strategy of DOGME to represent the material properties of the sample voxels (X. Cui, J.S. Charles, T. Potok., 2013; W. Wang, Z. Zhao, W. Zhao., 2014). However, because of the complex processes often involved in the lattice’s construction (e.g. tessellation of the lattice), the overall quality of the deformation varies had been proven in the previous works (Garavel H, Lang F, Mateescu R, et al., 2013).

In the investigated volume deformation pilots, a tiny difference in the lattice definition strategy can lead to substantially varied deformation results (G. Chen, H. Wang, Z. Lin, et al., 2015). Westermann and Ertl had developed a method for texture-based rendering of volume data based on a uniform regular grid as well as over a tetrahedral grid, which partially resolves the problem (L. Bodenhausen, A.R. Fugl, A. Joridt et al., 2014).

An alternative approach is based on a famous polygonal-mesh-extraction algorithm, Marching Cubes (MC) (M. Gauthier, S. Alvo, J. Dejeu, et al., 2013), to construct an intermediate iso-surface (polygon mesh) from the volume data that can replace the

associated voxels in further manipulation and processing, such as collision detection, shadow casting, and animation (Gouldstone, N. Caner, T.B. Swedish et al., 2011)

As an interdisciplinary field, physics-based deformation techniques can involve Newtonian dynamics; continuum mechanics (Zapata, B. C., Niñirola, A. H., Fernández-Alemán, J. L., & Toval, A., 2014); numerical computation; differential geometry; vector calculus; approximation theory, and computer graphics (K.C.L. Wong, L. Wang, H. Zhang, et al., 2011). Because of their capability of presenting physical characters, such as gradient changes and realistic deformed features, these deformation methods were usually adapted for implementing Computational Fluid Dynamics (CFD) simulation (e.g. fluid structure interactions) (P. Punpongsanon, D. Iwai, K. Sato, SoftAR., 2015).

The review of physics-based deformation techniques was classified based on prevalent mathematical models, such as Chain-Mail algorithm, Finite Element Method (FEM), and Mass-spring system (Nir G, Sahebjavaher R S, Kozlowski P, et al., 2013)

As a powerful and comprehensive deformation tool, mass-spring system has been extensively used for dynamic simulations because its plenty of connections which can form flexible frameworks and support multiform node partitions. As a result, it can perform more flexible results than FEM and Chain-mail –based applications. The devised volume deformation approach explained in the flowing sections was constructed based on choosing the mass-spring system as the deformable solid, and comprised a series of solutions of improving the system performance of this design.

This devised volume deformation method can manipulate volume objects to present deformed behaviours in a flexible and parameterized manner; meanwhile perform the gradient changes on associated surfaces. As another outcome of this approach, the associated clipping planes can visually prove the existence of deformed interior contents and the stated coherences between exterior and interior changes. Besides, the fact that the gains from carrying out isolated data segments and GPU-based implementations can facilitate the time-consuming computations and low interactive rate of real-time operations will be proven in the following contents.

3. Methodology

3.1. Lattice Deformation

Based on the resulting iso-surfaces extracted in the lattice construction process (as shown in Figure 2 (A)), the interesting segment in volume data can be completely enclosed. Therefore, DOGME process, which uses an enclosed lattice to represent the deformation and then passes the deformation characters to the underlying models, can be directly used as the manipulation strategy in this deformation design. The sampling mechanism and the extraction mode in MC-based lattice construction process successfully made the extracted iso-surface serve as a “model-fitting” lattice which instinctively matches the surface features of the volumetric object. As a result, the I-DOMGE was devised to be integrated with the designed lattice construction for enveloping the only interesting data segment in the continuous volume data, and consequently prevented the extra computation time from being cost on the useless parts.

In order to obtain the appearances of physics-based deformation, the lattice in I-DOGME was converted into deformable solids using specific mathematical models. In this volume deformation method, the constructed lattices were all triangle-based meshes and the extracted polygons were all coplanar. Therefore, the mathematical model which requires tetrahedral frameworks, and the Chain-Mail approach requires intersected components. In addition, applying those models will lead to the separation of volume models into a number of partitions, which often consumes substantial computational time to establish regional relationships between groups of voxels, and essential matrix calculations in the displacement mapping stage. The deformation model in this programme adopted the mass-spring model for manipulating the deformable lattices.

Embedding the mass-spring mechanism was a process that transformed the control lattice from a “place-holder” to a non-rigid deformable one. In order to represent elastic behaviours in the manner of mesh dynamics, the mass-spring model connected the vertices by defining a set of link-based relationships which can be classified as three types: structural springs, shear springs and flexion springs. The lattice deformation process in the deformation system described in this paper was only based on the structural spring, and supported the various deformation results through configuring the properties of embedded mass-spring system, e.g. stiffness coefficient. The appearances of deformed lattice are shown in Figure 1 (B-F)

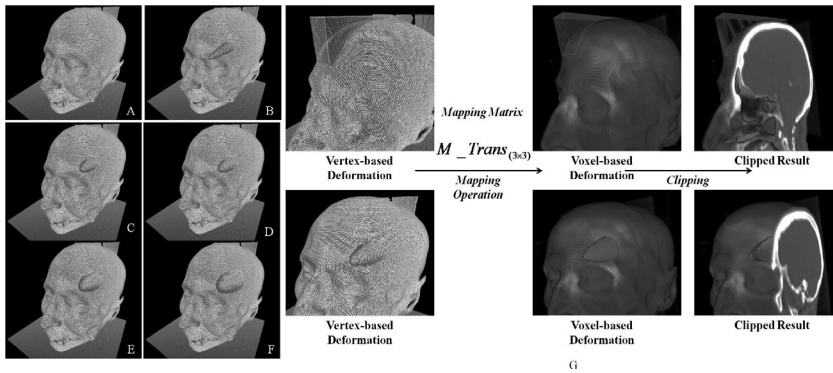


Figure 1 – Diagram Of IDOGME. Image A Represents The Result of Lattice Construction Process. Image B to F Respectively Show the Different Lattice Deformations With Stiffness Coefficients (0.7, 0.5, 0.3, and 0.1).

3.2. Displacement Mapping

In traditional DOGME methods, after finishing the lattice deformation, the displacement constraints, registered in the form of control lattices, will be “super-imposed” onto the given area by following a set of manually defined connections between control vertices and voxels. In I-DOGME, this constrained relationship was replaced by an inherent relationship which was automatically derived from the MC-based lattice construction process and named as Indexable Internal Relationship (IIR) design. Because each extracted vertex can be located on a voxel’s edge, all vertices on the control lattice were all available for being indexed by the exterior voxels in this IIR design. In addition, this

usage made a further demonstration that maintaining and encapsulating the inherent relationship should be a criterion of analysing the pros and cons of lattice refinement solutions in section 4. With the IIR design, I-DOGME method can perform the deformation appearances on the exterior layer of the volume model shown in Figure 1 (G).

4. Lattice Refinement

4.1. Interesting Segment Extraction

For improving the performance of the lattice construction process, this refinement process focused on developing a novel mechanism prepared for the volume model manipulation stage. Most of traditional methods, which involve manually defining the lattices and spending extra computation time on “off-line” delineations of meaningless data, were replaced by a volumetric extension of Active Contour-based boundary extraction algorithm. Based on the resulting extraction information, the constructed lattices can be much “closer” to the interesting segment(s) than those in manual solutions.

For processing the volume data, the volumetric boundary extraction design was implemented based on the region-based strategy of active contour method. By applying the similar energy calculation terms in the volumetric space, the variable searching domain was changed into a deformable surface, so called Active Surface.

The extraction information are represented in the form of meshes as shown in Figure 2 (C1-C4).

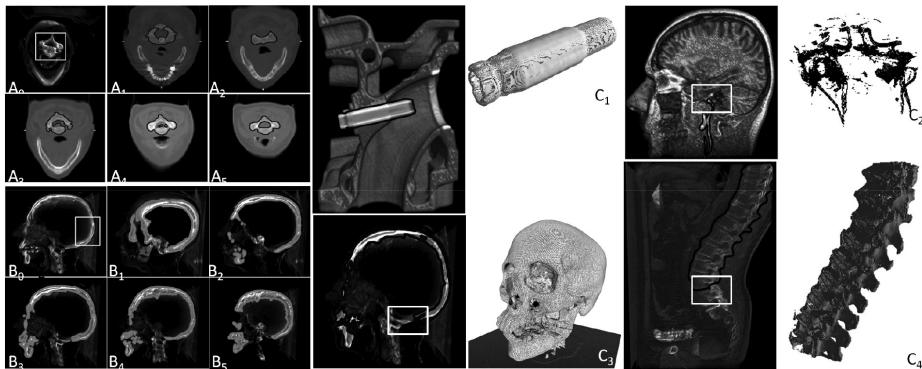


Figure 2 – Results of Interesting Segment Extraction and Mesh-Based Representations

4.2. Lattice Simplification

For this project, the biggest advantage of the MC algorithm was that it could sample voxels for the purpose of lattice construction. However, its voxel-based sampling frequency led to a significant number of extracted vertices, e.g. the extracted surface shown in Figure 3 (A) consists of 830K vertices. Because, in order to keep a complete vertex-representation of the volume data, the sampling rates for the implementation of the MC algorithm was maintained at a high frequency so that at least one vertex can be extracted from the associated voxels.

However, because these vertices serve as the control points during the deformation process, the huge amount of control points would increase the computation workload and reduce the interactive rate of real-time manipulations. Therefore, polygonal simplification methods were applied for simplifying the constructed lattices.

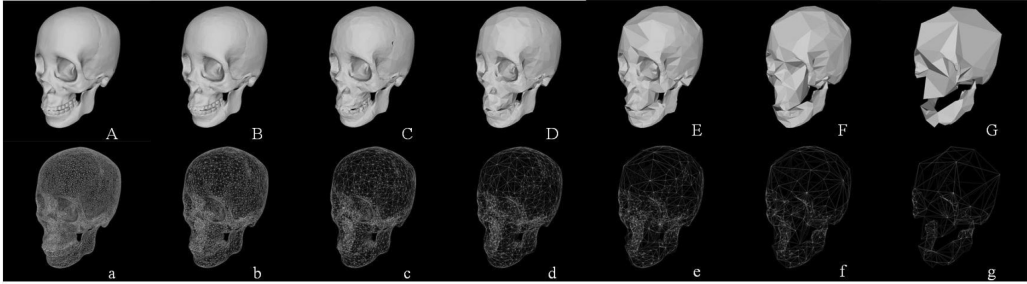


Figure 3 – Results of Lattice Refinement Process

As shown in Figure 3 (A-F), the comparisons between the results of simplification using the reverse subdivision scheme and vertex decimation method illustrated that the decimation method is more adept at capturing the exact geometry of the surface model, especially in the preservation of sharp features, than the adaptive scheme (as shown in the highlighted rectangles). As a result, simplified lattices generated by the vertex decimation method can provide more available and recognizable features. In addition, these simplified results also demonstrate the capability of these two methods for simplifying the same mesh model.

Figure 3 (G-N) compared the flexibilities of these two simplification solutions by testing them to process the same complicated mesh model and listing the numbers of vertices according to different simplification levels. Due to the constraint that the given geometry and topology method can. This disadvantage can restrict the flexibility of the lattices refinement process.

As a result of these two comparisons, the subdivision-based method was chosen to simplify the extracted iso-surfaces. The simplified lattices are shown in Figure 4 (A-G) with their wire-frame-based structures (a-g), and anticipate in the flowing deformation process.

5. Volume Deformation

5.1. Accomplishing Volume Deformation

After finishing the octree-based lookup mechanism, Grid_coord can provide the coordinates of the voxel based on its texture coordinates (e_L, f_L, g_L) and depth parameter $\text{Alpha_}(D_L)$ in Texture_inter . The internal relationship was implemented via obtaining the interior voxels' coordinates by the octree-based lookup function. As a result, after obtaining the exterior voxels' displacements in the I-DOGME process, the interiors were assigned to calculated displacements.

Based on the I-DOGME and octree-based LUT designs, the volume deformation successfully assigned computational deformations to the both exterior and interior

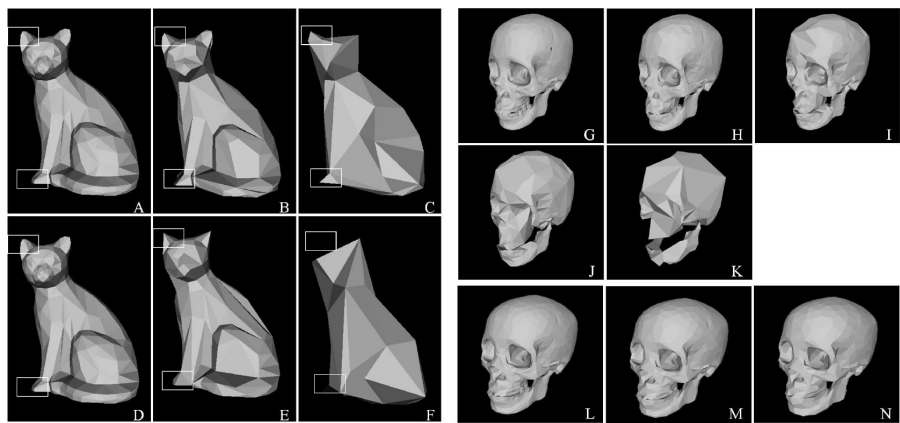


Figure 4 – Results of Mesh Simplification Strategies. Image G-K Respectively Represents the Simplified Results of Reverse Loop Subdivision Scheme at 700-600, 600-500, 500-300, 300-150, and 150-100 Vertices Levels. Image L-N (At 700-600, 600-500 and 500-300 Vertices Levels) Reveal the Limited Simplified Effects Because of the Limitation Caused by the Given Mask in the Decimation Method.

voxels, and used a series of parameter settings to result different deformation extents (as shown in Figure 5).

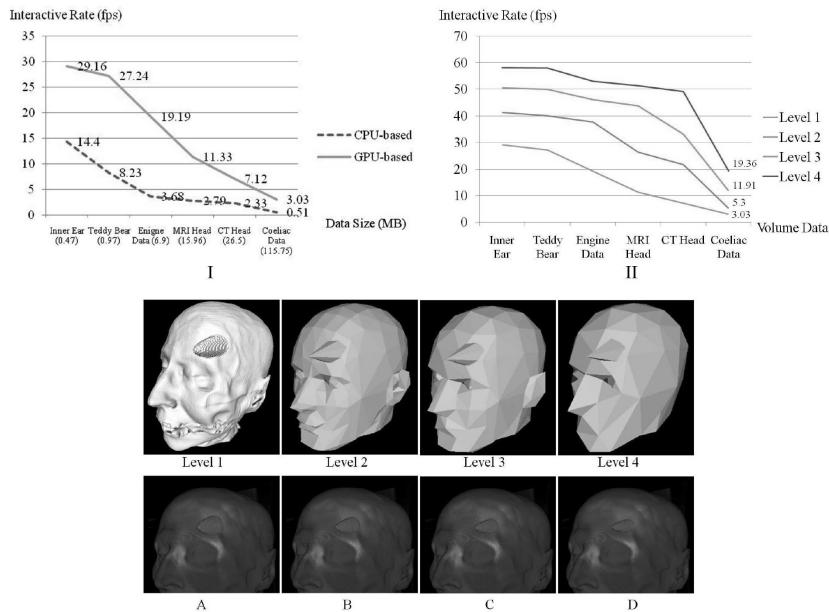


Figure 5 – Illustrations of Performance Evaluations

5.2. Results

The run-time evaluation work was based on performances obtained on a consumer grade desktop which was mainly equipped with an Intel Core 2 Quad Q9400 CPU, 4G RAM and a NVIDIA GeForce GTX 260 graphics card. This section divides the evaluation work into three parts.

5.2.1. GPU-Acceleration Design

Figure 5 (I) delineates a speed distribution plot which records the contrast in real-time deformation between different implementation modes and volume data. It can demonstrate the feasibility of using GPU-based solutions to maintain the real-time frame rate of most deformation processes at a “responsive” level (frame rates of 14 to 24 fps), expect coeliac data.

5.2.2. Adaptive Lattice Simplification

The lattice simplification served as an optimization of the lattice construction process, which reduces the number of extracted vertices in order to generate different levels of resolution, as illustrated in Figure 6. Since the voxels’ displacements derive from these vertices’ properties, the simplified lattices can enable the result to represent different deformation extents (as shown in image A-D).

Furthermore, the simplified lattices can accelerate the deformation process. Figure 6 (II) shows the interactive rates of testing different levels of resolution. Although the simplified lattice leads to the loss of several vertex displacements, the lattice simplification surely improved the frame rate of real-time deformation and accelerated the manipulation process of large volume data, e.g. the interactive rate of deforming the coeliac data can be maintained at 19.36 fps on lattice simplification level 4 (as shown in Figure 6 (II)).

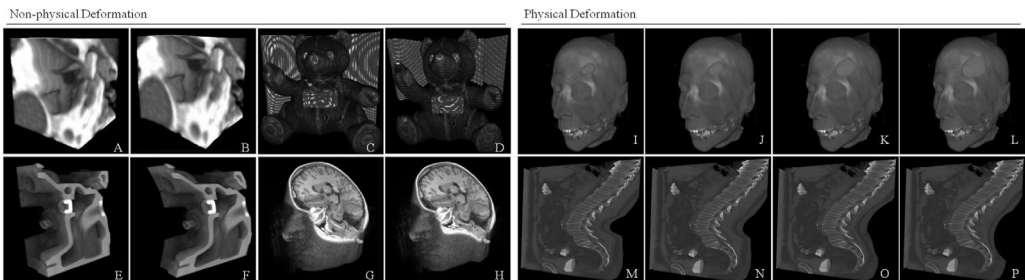


Figure 6 – Various Customized Volume Deformation Results Generated by the IDV Method

5.2.3. Freeform Deformation Behaviours

Figure 6 illustrates series deformation results of the IVD method. In images (A to H), the results of non-physics-based deformation were generated by implementing a series of linear transformation on the extracted lattices. In addition, by configuring the simplification level of the lattices, the variables of the mass-spring mechanism and the properties of the volumetric displacement diagram, the deformation mechanism can be modified to output various customized deformation results (shown in image I to P).

6. Conclusion

This paper utilized MC algorithm to achieve an accurate lattice construction work which builds a model-fitting control lattice enclosing the interesting segment precisely. Besides, GPU-based acceleration accomplished in this research can enable the oversampling mechanism inside the beginning of MC-based lattice construction work. As a result, this design can overcome the problem that traditional DOGME solutions always suffer from the inaccurate control lattice caused by manually constrained lattice construction. This lattice can directly synchronize the resulting manipulation on associated volume data without matrix calculation for displacement mapping between vertex and voxels, vertices and voxels, voxel and voxel, voxel and voxels, voxels and voxels, voxel and vertex, voxel and vertices, etc. Besides, the resulting lattices had been implemented on GPU-based platform to perform a series of reasonable and interactive relationships among different segments, e.g. simulating the reaction force between cuticular layers and interior tissues within MRI-based scanning data of human body.

The associated clustering-based segmentation strategies designed in this research will be published in the future. This research takes advantage of volume visualization and GPU to accomplish a real-time virtual medical operating prototype. It provides a novel medical imaging strategy for virtual operation training, and proves the potential of optimizing traditional computing based on hardware-based acceleration design. In the future, this research will carry on exploring interactive visualization insides different applications, such as blood pressure determination and deformation blood vessels, and irregular texture mapping.

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Study on Modern Enterprise Economic Management System under the Background of Increasingly Complex Market

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Abstract: In the current new environment and situation, our country's enterprise economic management system also has a lot of problems, at present, enterprises are facing a complex business environment and severe market challenges, therefore, many enterprises have realized the importance of economic management reform and innovation. In this paper, we are trying to discuss the current economic environment from two aspects: the importance and necessity of enterprise economic management innovation, and then analyzes the economic management and innovation of enterprises under the new situation. Finally, this paper puts forward some enterprise economic management strategies, such as the Concept innovation, strategic innovation, organizational innovation, human innovation, institutional innovation and so on, so as to achieve the long-term improvement of economic benefits at last.

Keywords: Management system; Market challenges; Reform and innovation

1. Introduction

With the continuous development and improvement of China's social and economic system, enterprise economic management has gradually become one of the representatives of the comprehensive competitiveness of enterprises., a good market operation, to a large extent, depends on the economic management system is scientific, complete and smooth operation.(Chen C, Duan S, Cai T, et al., 2011; Mangra M G, Cotoc E A, Traistaru A., 2013) In the past, the long-term development process, many domestic economic entity especially small and medium enterprises have not yet attached importance to economic management system is perfect, there is no awareness to the cost and the profit is not a simple shift in the relationship. Even, some units in the blind pursuit of the immediate interests of the maximum, and rarely consider the macro management, which greatly hindered the development of enterprises. Enterprise economic management system, in short, is to the enterprise economic activities of the unified plan, organization, monitoring, and coordination.(Roche R, Idoumghar L, Suryanarayanan S, et al., 2013; Palma-Behnke R, Benavides C, Lanas F, et al., 2013) And mobilize human and material resources to ensure the smooth completion of the enterprise economic behavior of a series of activities as a whole (see figure 1).

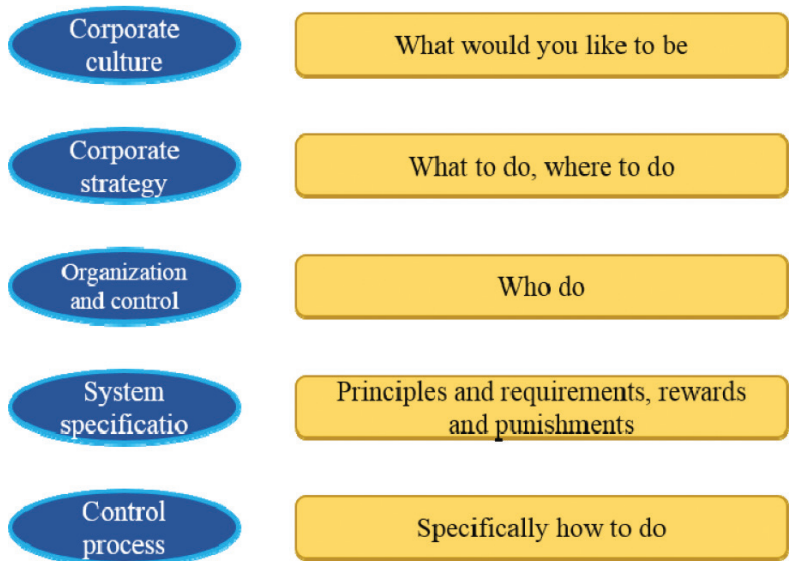


Figure 1 – Main Content of Enterprise Economic System

The functions of the top management of the enterprise. The top management of the industry should publicize the importance of the economic laws, regulations and the economic rules and regulations of the enterprise employees (Chang H H., 2011). And then set the economic management policy and economic objectives, economic management review, to ensure that the economic management of the required resources, and the economic management system planning. In the economic management system to change the planning and implementation, to maintain the integrity of the economic management system (Velásquez, E., Cardona, A., & Peña, A., 2014). Top management should ensure that the economic management policy and the purpose of the enterprise to adapt to meet the requirements and continuous improvement of the effectiveness of the economic management system commitment. Communication and understanding within the enterprise, and in the continuous adaptation assessment. Top management shall ensure that the relevant functions and levels of the enterprise to establish economic objectives, including economic management requirements to meet the requirements of the content, economic objectives should be measurable and consistent with the economic policy (Isaeva T N, Safiullin L N, Bagautdinova N G, et al., 2013). The top management of the enterprise shall be satisfied with the purpose of enhancing the customer and the related party's satisfaction, and to ensure the requirements of the customers and related parties are determined and satisfied. To the top management of the enterprise, they should ensure the responsibilities and authorities of the economic management within the enterprise shall be stipulated and communicated.

2. The Present Situation and Problems of Modern Enterprise Economic Management System

At this stage, the continuous reform of the market economy has resulted in the rapid changes of the enterprise interior. Although many enterprises in China have already

made great achievements (Di Giorgio A, Pimpinella L., 2012) and improvement in the construction of their own economic management system. But there are still some problems in the actual operation process, such as ignoring the important position of economic management, comparing the traditional closed, the risk control is not strong and so on. These problems have brought some negative effects to our country enterprises, these measures and theories cannot completely meet the development and innovation of China's market economy, the main problems are as follows:

2.1. Lack of Awareness of Economic Management

At present, most of the management of enterprises in our country is lack of consciousness, in the production process of enterprise, they pay too much attention to the production and marketing links and the important role of economic management is ignored. This leads to the development of enterprise work out of the guidance of economic management, is not conducive to the realization of the economic benefits of enterprises. Due to the enterprise leaders on the economic management is not enough attention, enterprise economic management mechanism and personnel set unreasonable (Zare M, Niknam T., 2013), the corresponding functions are not effective, resulting in the economic burden of enterprises.

2.2. Economic Management System is not Perfect

Because of the enterprise management of the economic management is not enough attention, in the enterprise will be the main energy in the short term benefit of the project, the economic management system and other related system is not perfect. Although some enterprises have set up different management levels and related management departments, it has also developed a certain management system. But in the specific implementation (Dominguez P, Bourbouze A, Demay S, et al., 2012) of the process of the problem, the division of functions and responsibilities of various departments is not clear, there is a phenomenon to cope with the problem. Performance assessment is a mere formality, leading to the staff of the economic management of the work more seriously, the effect of the work is also difficult to achieve.

2.3. Economic Management Organization is Lagging Behind

At present, if the enterprise wants to have a bigger share in the market, it must keep pace with the times and innovate the enterprise's economic management organization. Our country enterprise's economic management organization is relatively backward, and the management organization mode is unitary, in addition, most enterprises still use the linear function management organization system (Chen Y H, Lu S Y, Chang Y R, et al., 2013), and the market development is not suitable, which is not conducive to the realization of enterprise economic benefit. Also some enterprise's economic management organization is too complex, as a result, it led to the division of functions is not clear, the enterprise internal information is not smooth, cannot provide scientific decision-making basis for the enterprise's leadership and management. And business management too loose, resulting in serious slacking internal staff, to the normal work of the enterprise development caused the great influence.

2.4. The Absence of Human Resource Management

Human resource management is a very important part of enterprise management. Good human resource management, can help companies attract talent, retain talent, give full play to the positive role of the talent, for the development of enterprises to contribute. But at present, the human resources management in the enterprise is not thorough, the mobility of the personnel in the enterprise is relatively large. Enterprise to the staff's incentive is not enough, the enterprise should not only meet the material needs of the staff, but also to meet the spiritual needs of employees, give employees a good development space and opportunity, so that employees realize their value. At the same time, the enterprise to the staff's education and training work is not in place, the education training funds is small, the opportunity is also less, the enterprise staff's overall (Zhao P, Suryanarayanan S, Simões M G., 2013) quality is not high, is not conducive to the stability of the enterprise, sustainable development.

2.5. Lack of Attention to Safety Production.

Due to the lack of attention to the safety of production, the implementation of safety responsibility is not clear, In terms of coal enterprises in China, every year there will be a large and small production safety accidents., each year there will be a large and small production safety accidents. In the actual coal production activities, many companies have not implement the following principles: safety first, prevention first, people-oriented. But the pursuit of production, in order to improve the economic efficiency of enterprises. However, in the coal production enterprises, any one of the security incidents will have a serious impact on the economic benefits of enterprises and the formation of corporate image, and even dangerous to the long-term development of enterprises, and even make the enterprise into financial difficulties.

3. Enterprise Economic Management in Response to the Current Complex Economic Situation in the Main Measures

3.1. To Establish a New Concept of Economic Management

Because of the lack of enterprise leadership and management consciousness, the development of economic management is seriously affected. In order to better promote the smooth development of enterprise internal economic management, enterprise leadership and management personnel must establish a new economic management concept (see figure 2) (Xiaochuan Z, Li Z., 2014) to strengthen the learning of enterprise economic management knowledge, and improve the ability and level of economic management. At the same time, we should also learn from the relevant professional knowledge, to improve their knowledge and business skills. In addition, enterprise management should keep pace with the development of the times, and constantly update the idea of economic management, so as to better promote the effect of enterprise economic management, to achieve the greatest economic benefits.

3.2. Improve the Organization of Economic Management System

The development of enterprise economic management work cannot be separated from the perfect management system, so the enterprise should establish a sound economic

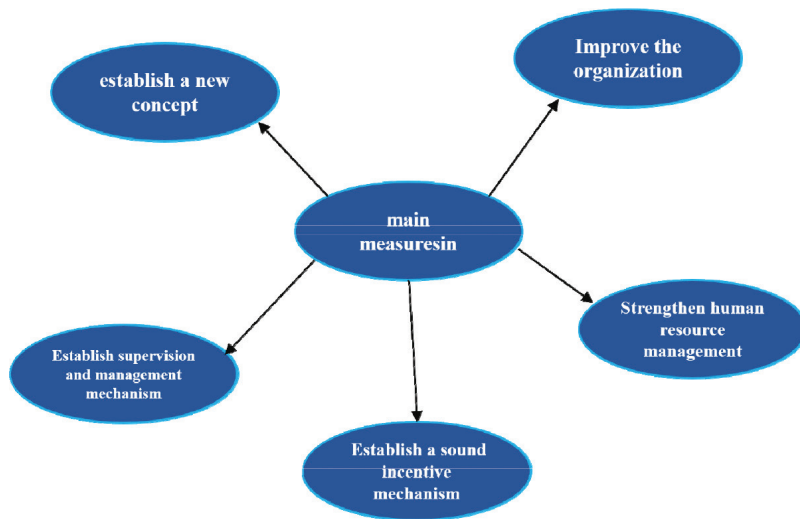


Figure 2 – Main Content of Enterprise Economic System

management system, to ensure the enterprise's economic management work to work well, so that the economic management work toward the right track development and progress. To develop a sound management system, to lay a solid foundation for economic management. Management system should be based on the enterprise development goals and the actual situation of enterprise development, scientific and reasonable formulation, and insist on keeping pace with the times, timely update and adjust the way of economic management, enterprise management system and the way of analysis and research, to understand the problems, so that the newly established economic management system can better meet the actual needs of enterprise development. At the same time, we should improve the enterprise's economic management organization, clear the various departments, each job responsibilities and authority, not only to give the enterprise staff a certain authority, but also to the staff of the work behavior of strict constraints, to ensure the smooth development of enterprise work.

3.3.Strengthen Human Resource Management

In the development of enterprises, talent is the core factor. Enterprises should adhere to the people-oriented, respect for employees, care staff, equal treatment of employees, enhance the sense of belonging to employees, reduce the loss of staff, to ensure the stability of enterprise development. Strengthen the education and training of enterprise employees, to create high quality personnel for the economic management of the enterprise, through knowledge lectures, competitions and other ways to educate and train the economic management of enterprise employees, and lay a solid foundation for the economic management of enterprises. At the same time, strengthen the enterprise staff's professional ethics and ideological and moral education (Pires C E S, Santiago R M L, Salgado A C, et al., 2012), to ensure the smooth development of economic management of enterprise, avoid employees appear opportunistic, the occurrence of corruption. Enterprises also need to establish a high-quality, professional economic

management team, through the joint efforts of economic management personnel, to achieve the effect of economic management, and promote enterprises to achieve good economic benefits.

3.4. Establish Supervision and Management Mechanism

Enterprise's economic management is a complicated work, which can strengthen the supervision and management of the work of economic management and help to improve the level of economic management. If we do not improve the supervision and management of the production of security, enterprise economic management will lose control, the staff is easy to work blindly, the effect of economic management cannot be achieved, and thus the economic benefits of the entire enterprise. So we should establish a sound supervision and management mechanism, to ensure the smooth development of enterprise economic management, to achieve a higher level of economic management, and promote the scientific and standardized management of the economy. We should strengthen the supervision and early warning of enterprise economic management, and equipped with professional supervision and management personnel, so as to ensure the efficient operation of economic management, and to promote the enterprise to achieve greater economic benefits.

3.5. Establish a Sound Incentive Mechanism

The development of enterprise economic management is very important in the development of the staff. The enthusiasm and creativity of employees are very important to the development of enterprises. Enterprises should change the past simply to work performance assessment of the incentive mechanism, to stimulate the enthusiasm of the staff, to bring more economic benefits. Industry should provide good office environment, improve the basic hardware facilities, change the attitude of the staff, respect for the staff. In addition, it should be according to the property relations to establish incentive mechanism, benefit sharing, risk sharing, promote employees to improve work enthusiasm, improve employee sense of ownership, and create more economic benefits for enterprises.

4. Innovation and Reform of Enterprise Economic Management under the New Situation

4.1. The Importance of Innovation and Reform of Enterprise Economic Management

As the main means to integrate and optimize enterprise resource allocation, management can be said to be a form of productive forces, in today's highly developed market economy. Nowadays, science and technology are very fast, the role of the Internet economy and knowledge economy has been highlighted, and the economic management reform of enterprises is more urgent. Different enterprise management environment is different, management system is also different. Enterprise economic management innovation not only refers to the innovation of enterprise economic management ideas, but also includes the theoretical innovation and organization innovation of enterprise economy. Thus, management innovation is the full range of

innovation, is the enterprise to strengthen its own development, the pursuit of profit maximization, the optimal cost control and the largest revenue.

4.2.The Necessity of Enterprise Economic Management Innovation and Change

With the continuous improvement and development of the social market economy, the economic management of the enterprise is facing a great change, the nature of the enterprise has changed a lot. Many enterprises have been unable to meet the requirements of market competition. On the one hand, many enterprises lack advanced management ideas. The organization and coordination of the economic management is still lack of strength, and the strategic and urgent of economic management still lack enough attention and recognition. Put forward new requirements of economic management is not scientific, the process is more casual has even become common to many enterprises of our country, which to the enterprise management system and management methods, economic management of enterprise cannot keep up the pace of development of the enterprise is bound to cause an enterprise to the deformity development, for the subsequent development of planted the seeds. On the other hand, the problems of enterprise's economic management innovation are also reflected in the lack of effective internal control of enterprises. Most enterprises still exist in the internal control target positioning is relatively low, a lot of targets are too simplistic and formal, cannot form a highly efficient internal control system, but also on the lack of a unified command and coordination mechanism. On the current market situation, the financial management is far from enough to meet the enterprise's comprehensive economic management, so do a lot of limitations, often cause the loss of material and property, and even the economic management of the enterprise.

4.3.Enterprise's Economic Management Innovation and Reform Strategy

1. To the concept of innovation as the starting point, the implementation of advanced economic management ideas

We should grasp the innovation of enterprise economic management concept, which is to take the concept of innovation, the transformation of the economic management innovation leader, the concept of economic management within the enterprise. In the enterprise to implement the concept of the concept of innovation for the enterprise is the most basic economic management and innovation, the latter of the other innovations are based on this. Concept innovation makes the old, cannot adapt to the modern social development of the established view and thinking mode are all get timely correction, with a brand new perspective, management methods and thinking mode to guide the enterprise's economic management reform and innovation, and establish the idea of innovation management, so that enterprises in the intensive business on the road to go farther.

2. Take strategic innovation as the breakthrough point, grasp the direction of economic management

The strategic innovation of enterprise economic management is that our enterprises should be based on the core competitiveness of the enterprises in

the process of formulating and implementing the strategy. And, with a view to the globalization of competition, the opportunity to capture the external environment in a timely manner. Enterprise's forward-looking and global strategic innovation, can make the enterprise better reflect the development trend of advanced productive forces, in order to face the challenge more strong, in the fierce competition to get more market share.

3. To organize innovation as the breakthrough point, continuous adjustment and innovation organization structure

The traditional organization of Chinese enterprises has been difficult to cope with the current complex competitive environment, we carry out organizational innovation can start from the following aspects: Firstly, the establishment of a flat organizational structure, through the traditional vertical multi-layer structure of the break, the pressure to establish a flat, compact structure of the horizontal organization, so that the information is communicated and feedback more quickly. Secondly, the establishment of flexible organization structure, the traditional organizational structure of the enterprise economic management of a great restraint, making the organization structure of the enterprise more flexible and diverse, but also to adapt to the external environment. At last, the establishment of the virtual organization structure. Will be related to the knowledge, information, human resources, etc. in the organization to reflect the dynamic, the establishment of an invisible learning organization, to better achieve corporate goals.

4. Take the human this innovation as the breakthrough point, the implementation of people-oriented economic management concept

The innovation of modern enterprise's economic management should see the human resource has become the key factor for the enterprise to win. First of all, the innovation is reflected in the flexible management. The management is too rigid, and cannot adapt to the development of the modern enterprise. Therefore, the artificial center of flexible economic management is the correct choice of modern enterprises. Pay attention to the development and utilization of human resources, pay attention to the cultivation of management personnel, technical personnel, etc., with the material and spiritual motivation as the main method. Knowledge and technological innovation of enterprise economic management should depend on the people, only through better management, improve the work of the personnel to provide security for the enterprise's economic management.

5. To the system innovation as the breakthrough point, to build a sound economic management system which is the main constraint of enterprise economic management, the enterprise should pay attention to the innovation of the system. Institutional innovation on the one hand to be able to through some of the constraints of the terms, so that enterprises become efficient operation of economic groups, making the product development of enterprises more dynamic; On the other hand, through the system innovation in the enterprise internal set up the incentive system, not because of too many constraints and restrict the development of enterprises, but also because the enterprise is too open and there are many risks. At the same time, the enterprise's system innovation must take

the production management activities as the main direction of planning, control and coordination, and ultimately for the enterprise's economic management innovation to provide a better auxiliary effect, and promote the formation of enterprise full range of system management.

5. Conclusion

In summary, the perfection of the economic management system is related to the long-term development of the enterprises and other economic entities, so we should avoid focusing too much attention on short-term benefits, therefore, the owners of the enterprises and the decision-making level should fully recognize the importance of the system, they should generate scientific economic management strategy on the basis of the economic behavior, and then form a set of effective economic management system. What's more, they should clarify the task and the person in charge of each management link, and periodically to verify and adjust the system. We believe that as long as there is a scientific economic management system and strict implementation of the process, enterprises and other economic entities will continue to reduce economic costs, improve economic benefits, and ultimately achieve economic benefits in the long run.

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Computer Fault Diagnosis System Based on Artificial Intelligence

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Abstract: With the development of computer network technology and its applications, its security also receives much concern, and the discovery, diagnosis and treatment of computer failures is also increasingly important. A SOM neural network is an artificial intelligence technology and is currently more widely applied to diagnose computer faults. A SOM neural network imitates animal neurobehavioral characteristics, automatically forms decision area required through its own learning mechanism and can generate different associated information for different faults, thus resulting in different symptom information. By constantly training, determine the type of computer failures result from the training information, thereby establishing the diagnosis type. A case study demonstrates that different fault indications will correspond to various faults detected, thus proving the SOM neural network accurately diagnose computer system failures, and the final emulation of BP neural network model in artificial intelligence proves that BP neural networks with set sampling weights has good simulation accuracy.

Keywords: Artificial intelligence; computer fault diagnosis; neural networks; analog emulation

1. Introduction

Artificial intelligence (Condit J, LV M C U., 2015) has become a broad interdisciplinary and frontier science since the 1970s. An expert system as an field of artificial intelligence applications has been the most active and fruitful area of research in current artificial intelligence, and it is a programming system with a large amount of expertise and specialized experience in particular areas. In recent years, research of expert systems or knowledge engineering has shown a trend of successfully and effectively applying artificial intelligence techniques. Because of a wealth of knowledge, human experts have excellent problem-solving skills. Hence, if a computer program can reflect and apply the knowledge, it may be able to solve the problem for human experts, and can help human experts discover errors that occur during inference, and this has been confirmed now. Maintenance of computer failures is an ordinary subject that has research value in the computer industry (Mora, A. D., & Fonseca, J. M., 2014). Now computers in the world have more or less different faults, while some failures will seriously impact applications. Moreover, with increasing computer viruses, computer diagnostic experts face growing examination workload, and more and

more users need to have their computers repaired; therefore, how to effectively improve the efficiency and quality of computer diagnostic experts and facilitate user maintenance is of great significance. The term artificial intelligence (AI) was proposed in 1956 by J. Mc Carthy *et al.* (Monteiro C A S, Leal G R, Saraiva H, et al., 2016) in a scientific conference regarding machine emulation intelligence. AI is a high-tech subject that studies machine intelligence and intelligent machines and a technical foundation to emulate, extend and expand human intelligence, and realize some mental automation. In 1943, psychologist W. McCulloch (Bonora G L., 2015) and mathematical logician W. Pitts (Özdemir Ö., 2015) first put forward a simple neural network model (referred to as MP model). Since then, there have been dozens of major network structures and a wide variety of network learning algorithms. Some most representative models contain the MP model (McCulloch and Pitts, 1943), Hebb's rule (Rodríguez - Hidalgo A, Saladié P, Ollé A, et al., 2015) (Hebb, 1949), the Perceptron (Rosenblatt, 1957), Hopfield nets (Hopfield *et al.*, 1984), BP networks (Rumelhart *et al.*, 1985), Boltzmann machines (Hinton *et al.*, 1984), dynamic BP networks (Werbos, 1990), and fuzzy neural networks. Wangzheng Wu and Zhangrui Ping (El-Sawalhi N I, Matar A N., 2015) made a profound investigation into the feasibility, basic principles, diagnostic process analysis, and parameter optimization process of artificial intelligence troubleshooting, and produced some ideal diagnostic results. Ping Jingang and Li Hang (Hammack R, Ivey T A, Utley J, et al., 2015) proposed a method of artificial intelligence suitable for remote diagnostics and a remote network fault diagnosis model based on this method to make diagnosis intelligent. Zhu Xianglin, Cai Jinyan and He Qiang (Williams L., 2015) brought about the implementation process of fault diagnosis platform interface module based on self-organization AI, while Qi Chung presented a network diagnostic system based on BP artificial intelligence. Research and design of BP artificial intelligence fault diagnosis systems are performed as well as emulation experiments through some cases.

2. The Neural Network Theory and Computer Network Failures

2.1. Neural Network Model

The term neural networks (Zalzburg O., 2015) actually comes from the neuron doctrine in biology, while neural networks we usually refer to are Artificial Neural Networks (ANN) (Kim Y, Sohn S., 2015), which are mathematical model neural networks. It features imitation of behavior features of animal neural networks and carries out distributed and parallel information processing algorithms, and is composed of a large number of processing units, which are an interconnected group of neurons. Neurons are the basic processing unit of a neural network, and the general performance is multi-input, single-output nonlinear devices. The common structural model is shown in Figure 1.

where μ_i is the internal state of a neuron, θ_i is the threshold, x_j is the input signal, w is the weight connected to neuron x_j , s_i is a control signal for external input.

First-order differential equations are commonly used to describe neuron models, as it can emulate the postsynaptic potential change law with a biological neural network over time.

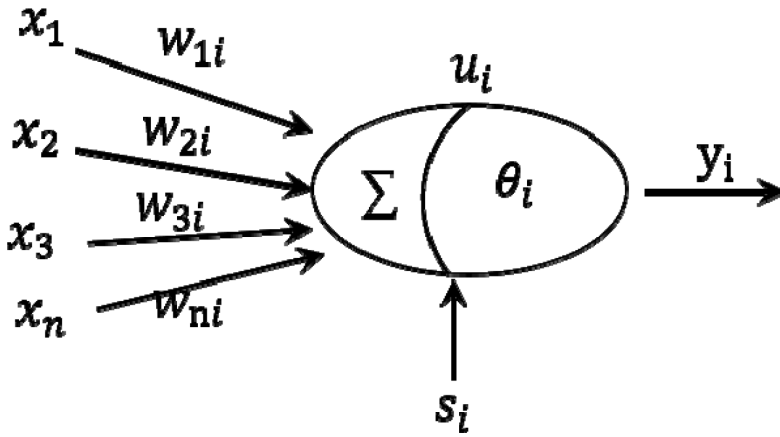


Figure 1 – Neural Cell Structure Model

$$\begin{cases} \tau \frac{du_i}{dt} = -u(t) + \sum w_{ij} x_j(t) - \theta_i \\ y_i(t) = f[u_i(t)] \end{cases} \quad (1)$$

Typically neurons use the following function expressions to present non-linear characteristics of the network.

(1) Threshold function, as the step function

$$f(u_i) = \begin{cases} 1 & u_i \geq 0 \\ 0 & u_i < 0 \end{cases} \quad (2)$$

(2) Piecewise linear function

$$f(u_i) = \begin{cases} 1 & u_i \geq u_2 \\ \alpha u_i + b & u_i \leq 0 < u_2 \\ 0 & u_i < u_1 \end{cases} \quad (3)$$

(3) S-type function

$$f(u_i) = \frac{1}{1 + \exp(-u_i / c)} \quad (4)$$

where c is a constant.

2.2. Applications of Neural Networks in Fault Diagnosis

A neural network as a self-adaptive pattern recognition technology does not require giving experiential knowledge and discrimination function for related patterns in advance. It automatically forms necessary decision areas through its own learning mechanism. The network characteristics are determined by the topological structure, neuronal characteristics, learning and training rules. It can take advantage of state information,

train information of different states one by one and get some kind of mapping relations. Further, the network can continuously learn; if the environment changes, this mapping can also be adaptively adjusted.

For fault diagnosis based on neural networks, network input nodes correspond to indications of faults, while output nodes correspond to causes of faults. First, use a set of fault samples to train the network to determine the network structure (the transfer function and the number of neurons in the intermediate layer) and parameters (connection weights and thresholds between neurons). After network training is completed, the fault pattern classification is based on a given set of signs to achieve a nonlinear mapping process from the set of symptoms to failures. It has the following characteristics.

1. can be used to recognize unknown or complex system models, as well as fault patterns for non-linear system (Sánchez-carmona A, Robles S, Borrego C., 2015).
2. have both pattern transformation and feature extraction capabilities of fault signals.
3. is not so sensitive to systems with uncertainties, noise and incomplete input mode.
4. can be used for complex multi-mode fault diagnosis.
5. can be used for off-line diagnosis and adapt to real-time monitoring requirements.

Results of a typical fault diagnosis system based on neural networks are shown in Figure 2.

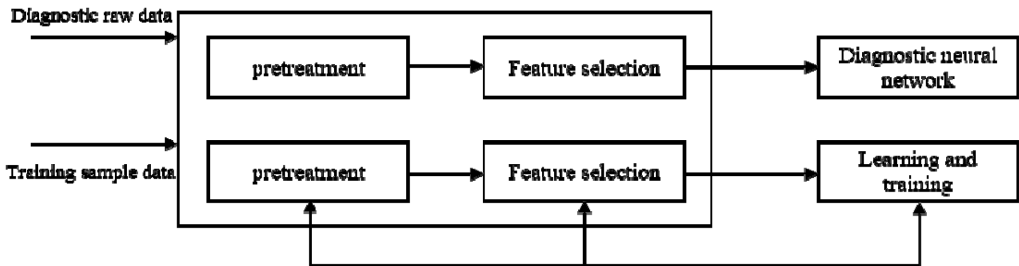


Figure 2 – Fault diagnosis based on Neural Network

2.3.Computer Failures

Modern computer network technologies are developing with each passing day. In the era of rapid development, the computer network covers all corners of the world and is used by millions of households in all walks of life. It can bring a lot of convenience to our human life and also a lot of trouble. Common network failures are categorized into two types: physical and logical faults.

Physical faults (Ballance C J, Schäfer V M, Home J P, et al., 2015) generally refer to physical or hardware problems in lines or equipment.

1. Transmission line faults

In regular network maintenance, the chances of occurrence of faults in transmission line are very high with about 70%. Line faults usually include line damage and severe electromagnetic interference.

2. Port faults

Port faults usually include physical faults such as loose plugs and ports itself.

3. Hub or router faults

Hub or router faults refers to physical damage and disability to work, which cause the network barrier.

4. Host physical faults

Network Interface Card (NIC) failure, also referred to as the host physical failure, because the network card is installed in the host and completes configuration and communication by the host, which can be seen as a network terminal. Such failures typically include network card looseness, network card physical failure, host network card slot defect and the host failure.

The most common logical fault is configuration errors, which are network anomaly or malfunction caused by wrong configuration of network equipment.

1. Router logic failure

Router logic failure usually includes incorrect router port parameter setting, wrong router routing configuration, excessively high utilization rates of the router CPU and too small router memory margin and so on.

2. Some important processes or port shutdown

Some data about the network connection data parameters are close unexpectedly since the important processes or ports are affecting by systems or viruses.

3. Host logical failure

Host logical failures cause a high network failure rate, typically including improperly installed network card drivers, network card device conflicts, incorrect setting of host network address parameters, improper host network protocol or service installation and host security failure, etc.

3. AI Research in Computer Network Fault Diagnosis

3.1. SOM Artificial Neural Networks Clustering Output

SOFM model can achieve self-organizing function, namely SOM clustering (Xu X, Huang Y, Zhang P, et al., 2016). The purpose of self-organization is to adjust the weight coefficient between input and output, so that the neural network converges to a representation form. Each time a study is performed, SOM neural networks will perform a self-organization and adaptation to external input mode. As a result, it strengthens the existing form of mapping and weakens the previous form of mapping.

Assume P_g is the column vector of the R th element, representing the input signal of the q -th training samples with Q training samples: $(P_q, t_q), q = 1, 2, \dots, Q$,

$$\left\{ \begin{array}{l} p_1 = (a_{11}, a_{12} \cdots a_{1R})^T \\ p_2 = (a_{21}, a_{22} \cdots a_{2R})^T \\ \cdots \\ p_Q = (a_{Q1}, a_{Q2} \cdots a_{QR})^T \end{array} \right. \quad (5)$$

t_q is the row vector of the S^M element, representing the teacher signal of the q-th training samples. SOM neural networks will automatically implement clustering feature of the training samples.

Set the neural network output after the SOM neural network clustering as r_q , $q = 1, 2, \cdots, Q$. Because in fault diagnosis each sample signal actually corresponds to a fault type, after realizing clustering of Q training samples, clustering output of SOM neural networks can actually represent certain classification nature of training samples.

3.2. Weights and Iteration and Update

Set BP neural networks according to the updated training samples and set different weights for several times of training. It has been found that the smaller a' weight is, which is when there are greater weights that SOM neural network clustering output r_q matches, the fewer the training number and time of BP neural networks are. However, as SOM clustering has some errors, if the clustering result r_q is matched with a too large weight, it may not fully reflect the nature of the original sample, and errors will increase. After many experiments on weight a_n , the following update methods are given:

1. Take initial weight $a' = a_0 = 1$, give minimal training number N and minimal training time T.
2. Establish a BP neural network and carry out training; for the previously given error $\varepsilon > 0$ of the neural network; for example, the actual training times N' and the actual training time T' are less than the pre-given minimal training number N and minimal training time T, the weight $a_0 = 1$ is obtained. exit; otherwise, turn to (3).
3. Let $a_n = a_{n-1} / 2$, ($n = 1, 2, \cdots$).
4. Establish a BP neural network and carry out training; for the previously given error $\varepsilon > 0$ of the neural network; for example, the actual training times N' and the actual training time T' are less than the pre-given minimal training number N and minimal training time T, exit; otherwise, turn to (3) for iteration until the requirements are satisfied.

3.3. Establishment of the BP Neural Network Model

While having training sample data with proper weights, the establishment and training of a BP neural network is also realizing. For Q pairs of training samples (P_q'', t_q) , $q = 1, 2, \cdots, Q$, establish an appropriate BP neural network, select the network layer to be M. Let a_q be the column vector for S^M elements, which represent the network output signal corresponding to the q-th training samples. As the network input node is R+1, assume the node number at the m-th layer as S^M , the node number at the output layer is S^M . For convenience, record R+1 as S_0 , so the network structure is $S^1 \rightarrow S^2 \rightarrow S^3 \rightarrow \cdots S^M$.

Since the BP neural network algorithm is very sensitive to the network structure, different network structures have different abilities to solve problems. The more complex the neural network structure, the stronger its ability to deal with complex nonlinear problems, but the longer the training time. If the neural network structure is too simple, network training will be difficult to converge or convergence time will be too long.

Topology of neural networks (Welch J L., 2015) is composed of the number of network layers, the number of neurons at each layer and connections between neurons, etc. In the BP network structure, the numbers of input neurons and output neurons are determined by the solving problem itself. Therefore, designing BP network structure should pay attention to determining the number of hidden layers and the number of neurons in the hidden layer.

The selection of hidden layers (Park J, Hirai Y, Kaneko K., 2015) depends on the complexity of the problem. According to research, an increase in the number of hidden layers can strengthen the network to solve complex and nonlinear problems, but too many hidden layers will extend the learning time of the network. For BP networks, conforming to Kolmogorov's theorem, a three-layer BP network can achieve mapping from arbitrary N dimensions to M dimensions. Hence, using a hidden layer can meet the requirements. Emulation by Li Ran, Xu Jia Cai *et al.* shows that the neural network at the hidden layer can meet the accuracy requirements as long as there is a reasonable number of neurons in the hidden layer. If there are two instead of one hidden layer, it has little effect on accuracy, but will make the network structure more complex and greatly prolong the training time.

4. Study of Artificial Intelligence Methods in Computer Network Fault Diagnosis

4.1. Case Study

After making an analysis of computer network interface failures, interfaces usually have four kinds of failures, which are B1 interface problem, B2 network failure, B3 equipment congestion and B4 communication protocol incompatibility as SOM neural network output node, 5 status indications of MIB-2 slave 2 interface, A1 interface problem, A2 input characteristic value, A3 output characteristic value, A4 network utilization rate and AS unknown protocol rate as the network input node. The samples are shown in Table 1.

A_1	A_2	A_3	A_4	A_5
0.1	0.013	0.132	0.812	0.369
0.8	0.667	0.129	0.897	0.011
0.7	0.543	0.342	0.547	0.081
0.3	0.776	0.012	0.798	0.231
0.2	0.124	0.233	0.913	0.712
0.5	0.231	0.801	0.903	0.303

Table 1 – Input Sample

This study gives the corresponding fault table so that the network training results can be compared, as shown in Table 2.

B_1	B_2	B_3	B_4	B_5
0	0	0	0	1
1	0	0	0	0
1	0	0	0	0
0	1	0	0	0
0	0	0	0	1
0	1	0	0	0

Table 2 – Corresponding Fault(1 Present V2S.0 Present No)

Since SOM neural network is unsupervised learning, the network will automatically cluster it. There are 5 network input vector elements in the range [0,1]. In order to improve network mapping and achieve the best clustering effect, after several times of training the neural network, the competitive layer of the network is designed into a 4*3 structure, as the size of training steps affects network clustering performance. Here set the training times to be 100. Use training function in the MATLAB neural network toolbox to train SOM neural networks. With an increase in the number of training steps, the distribution of neurons is gradually reasonable. After network training ends, weights are also fixed. Later when entering a value each time, the network will automatically cluster it. The results are shown in Table 3.

sample	1	2	3	4	5	6	7	8	9	10	11	12
Result	10	8	8	12	10	1	10	5	5	12	2	4
sample	13	14	15	16	17	18	19	20				
Result	8	7	7	1	11	1	9	3				

Table 3 – Output of Clusters

4.2.Emulation of Artificial Neural Networks

For the above-mentioned training samples that have weights set, use the well-trained BP neural network for emulation. For data samples that generally require emulation, update each training sample twice during neural network training; replace the column vector with R elements originally into the column vector with R+1 elements, thus adding one-dimensional elements, so that the neural network input nodes become R+1. When carrying out emulation by using the trained neural network, add one dimensions to each sample that requires emulation. Because we do not know the clustering condition of samples to be emulated in advance, we unify to set one-dimensional data to the same value of 1, to reflect the same clustering feature. When making weight setting of the sample, also use the pre-set weights in training to improve the sample data. The samples to be emulated are displayed in Table 4 below.

A_1	A_2	A_3	A_4	A_5
0.2	0.597	0.191	0.697	0.232
0.3	0.218	0.650	0.479	0.238
0.3	0.174	0.710	0.954	0.196
0.7	0.498	0.301	0.973	0.131

Table 4 – Sample of Emulation

Table 5 shows the emulation results of BP neural networks whose sample weights haven't been set.

B_1	B_2	B_3	B_4
0.0080	0.4288	0.0014	0.9599
0.7484	0.0000	0.0000	0.0000
0.0000	0.8237	0.0006	0.0051
0.0008	0.0000	0.9245	0.0321

Table 5 – Sample of Emulation without Weight

Table 6 shows the emulation results of BP neural networks whose sample weights have been set.

B_1	B_2	B_3	B_4
0.0148	0.0001	0.0006	0.9823
0.9771	0.0003	0.0252	0.0800
0.0005	0.9343	0.0095	0.0004
0.0071	0.0005	0.9585	0.0009

Table 6 – Result of Emulation

As can be seen, BP neural networks whose sample weights have been set have good emulation accuracy.

5. Conclusion

A study of computer network fault diagnosis is done by using SOM algorithm and BP neural networks to emulate and model faults in computer networks, and artificial intelligence neural networks have achieved a very good effect in fault diagnosis. BP-SOM, a combination of neural networks, can accelerate the convergence rate of BP, which has great advantages to diagnose computer faults. The future research directions should be to further apply better, more professional and optimized artificial intelligence neural networks to diagnose computer faults, to build specific scientific languages that

can be identified by artificial intelligence, such as MATLAB, C++ compiler MEX, and to establish more efficient and faster neural networks. With the further development of artificial intelligence and computer neural network models, neural network models will be more professional; intelligent algorithms will be further employed in computer diagnostics, thus promoting professional and intelligent diagnosis of computers.

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