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Review On Application Of Phase Change Thermal Storage In Solar Thermal Utilization System

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***Abstract*—This paper analyzes the research progress of phase change thermal storage in solar thermal utilization system from four aspects, i.e. phase change materials, heat storage period, structure design, and classification of heat carrying fluid. The results show that the composite phase change material can integrate the advantages of both organic phase change materials and inorganic phase change materials, which is the trend of the future research. Cross seasonal heat storage is a very potential method for large-scale utilization of solar energy, but there is little research on the technology of phase change energy storage. The good structure design of the heat storage device should be conducive to intensify heat transfer, and the heat carrying fluid should be selected in the view of the economic efficiency, freeze-proofing and heat transfer process.**

***Index terms*—solar energy, thermal utilization, phase change thermal storage**

Ⅰ. INTRODUCTION

Solar energy is a great treasure trove of energy with properties of clean, pollution-free, and convenient access, especially in some alpine regions, such as Gansu, Qinghai and Tibet in China, which is rich in solar energy but short of other sources of energy, so the use of solar energy is more common. But the solar radiation energy density that reaches the surface of the earth is very low and is influenced by geography, diurnal and seasonal variation, weather and the constraint of other random factors. Therefore, its radiation intensity is ever-changing with significant characteristics of thin, discontinuous and instability. A heat storage device is needed to store the solar energy and release it when the solar energy is insufficient in order to ensure the heat balance between supply and demand.

Common solar thermal storage modes are heat storage tanks, soil thermal storage, water table thermal storage, gravel heat storage etc.. All above-mentioned modes belong to the sensible heat storage by means of increasing the temperature of the heat storage medium. The thermal storage device has the advantage of simple structure, but the thermal storage device has large volume caused by the low heat storage density. Additionally, the temperature changes greatly during the thermal storage process that decrease the stability of the system. The latent heat storage (i.e. phase change thermal storage) technology is brought into being because of the deficiency of sensible heat storage in the solar energy storage system.

Phase change thermal storage technology stores and releases energy by energy absorption and release during the phase change process. Phase change thermal storage technology with characteristics of high storage density, phase change temperature stability, simple device, small size and flexible design etc. has been widely used in many fields. It drives on the research of phase change materials is becoming a world-wide hot research topic. This paper introduces application of phase change thermal storage in solar thermal utilization system. The structure of this paper is as follows: Section 2 introduces classification of PCM. Section 3 focuses on the analysis of heat storage period. Section 4 discusses the various structure design. Section 5 presents the classification of heat carrying fluid.

Ⅱ.PHASE CHANGE MATERIALS

The phase change thermal storage can be divided into solid-liquid phase change, liquid-gas phase change and solid-gas phase change, the latent heat of liquid-gas phase change and solid-gas phase change is very large, but the volume change in the phase change process is also very large, which leads to the complexity of the system in the application process and even difficult to realize[1]. Therefore, the solid-liquid phase change is of great practical application value. At present, most of the researches focus on the phase transition of solid-liquid phase.

Phase change material (PCM) is divided into high temperature PCM, intermediate temperature PCM and low temperature PCM according to the temperature difference. The PCM used for heating and domestic hot water system in the solar energy utilization are low temperature PCM, and the low temperature PCM are divided into inorganic, organic and composite PCM.

Inorganic PCM mainly include inorganic hydrated salt, molten salt, metal and alloy. Inorganic hydrated salt is an important energy storage material in the middle and low temperature PCM, it is big in heat conductivity coefficient, dissolution heat, density and heat storage density of per unit volume, but there are problems of supercooling and phase separation. At present, there are mainly two ways to solve supercooling, one is to add a substance that is similar to a crystalline substance as a nucleating agent to reduce the supercooling degree nearly to zero. However, it can only through experiments and observations to determine the nucleation agent applied to PCM because the study on the crystalline nature is not sufficient[2]. After thousands of times tests Dr.Telkes[3] has found that adding boric acid in $Na_2SO_4 \cdot 10H_2O$ can obviously reduce supercooling degree. The other method is to retain part of solid phase change materials, that is, to keep part of the cold zone, so that the part of no melting crystal can work as a nucleating agent. This method is known as the cold

finger method of which the operation is simple but effective. In order to solve the problem of supercooling and phase separation, some other methods are also studied, for example, the container is made into a shallow plate, and the plate container is helpful to reduce phase separation[4]. Ultrasonic method, the ultrasonic wave through the electrode embedded in the PCM induces PCM nucleation in close to the melting point, so as to reduce the supercooling degree of PCM. Elastic potential energy method, using the elastic wave generated by the elastic metal sheet which is buried in the liquid cooling fluids to induce crystallization. Stirring method can be used to promote crystallization to solve the problem of supercooling and phase separation. Micro encapsulation method, the polymer film of the outer layer has always been maintained as a solid state during phase change process, thus reducing the supercooling and phase separation phenomenon of the PCM[2].

Organic phase change materials mainly include paraffin wax, fatty acids and other types. Paraffin wax is one of the important types of energy storage materials in the middle and low temperature phase change materials. Paraffin wax has widely sources, but the price of pure paraffin is higher, so cheap industrial-grade paraffin is often used as PCM. Paraffin as phase change material has advantages of higher latent heat , almost no supercooling phenomenon, less prone to chemical reaction and better chemical stability, self nucleation, no phase separation and corrosion etc.. But there are also many disadvantages, such as lower thermal conductivity, lower density, flammable etc.. The thermal conductivity of the material is improved by adding metal filler or fin tube. And the plastic container is used to overcome the shortcomings of large volume change during melting and solidification process[5]. L.F.Cabeza et al.[6] have studied the effect of the high thermal conductivity powder and carbon fiber on the phase change materials to enhance the thermal conductivity, this method can also effectively reduce the volume change of the paraffin during phase change process.

The composite materials can be assembled together with advantages of various materials, and the preparation of composite phase change materials is an inevitable development trend of latent heat storage materials. Zhang Zhengguo et al.[7] have prepared paraffin content of 50% (mass fraction, the same below), 60%, 70% and 80% of paraffin/expanded graphite composite PCM. The structure and thermal properties of the composite PCM are characterized by scanning electron microscopy (SEM) and differential scanning calorimetry (DSC). Results show that exfoliated graphite still maintain the original loose and porous morphology of the wormlike after adsorbing paraffin, paraffin is adsorpted by expanded graphite microporous, composite PCM has the similar phase change temperature with paraffin. Storage(release) thermal performance test results show that the heat storage time of composite phase change thermal storage material with 80% paraffin wax is reduced by 69.7% compared with pure paraffin, and the heat release time is reduced by 80.2%.

The ideal PCM needs to have the appropriate phase change temperature, high thermal conductivity and low volume change rate, besides the price should be low, the corrosion should be weak, and it should have good circulation stability[1]. The corrosion of the phase change thermal storage material to the metal container and the heat exchanger is one of the bottlenecks which restrict the industrial application of PCM.

III. Heat Storage Period

Solar energy storage according to the cycle of energy storage and energy use can be divided into short-term and long-term heat storage. Short term heat storage refers to a relatively short period of heat storage like a day or a weak of which the heat storage device is relatively small, installation and operation is more flexible. Operation mode is generally storaging heat during the day, and releasing heat during rainy day or night. Zongwei Han et al.[8] have established an experimental system which is composed of a solar collector, a phase change thermal storage device, a heat pump unit, U-shaped tube ground heat exchangers, terminal devices and pipelines. It elaborates the major operation mode of the system, and has an experimental research on the system in cold areas, it is concluded that solar ground source heat pump phase change thermal storage heating system is a kind of environmental protection and energy saving heating mode, the system with solar radiation and soil heat as a composite heat source which improves reliability and flexibility of the system. And long term storage refers to seasonal thermal storage, it has large development potential in the large-scale use of solar energy. Because of the abundant sunshine and high temperature in summer, the solar collector not only has a long working time, but also has high heat collection efficiency. The situation in winter is just the opposite, and the demand for heat is very large in winter. Therefore, it is a good way to improve the energy efficiency by storing the solar energy in the summer and using it in the winter through phase change thermal storage technology. Wenyong Zhang et al.[9] have done an experimental study on seasonal thermal storage of solar soil source heat pump in cold areas. It concludes that it is feasible to add a solar seasonal soil heat storage in solar energy soil source heat pump system in the cold area. The soil temperature around the ground heat exchanger is greatly improved by thermal storage, hence the heating performance coefficient of the next heating period and the heat balance between supply and demand are both improved. Shicong Zhang and Yiqiang Jiang[10] have analyzed the operation principle of the solar seasonal underground pool heating system. The effect of the thickness of the upper layer and the thickness of the insulation layer on the heat loss of the underground heat storage pool is analyzed. It is concluded that the effective matching of the volume of the heat storage pool and the area of the collector can increase the economic efficiency of the system. Liping Liu and Hua Zhang[11] have set up the mathematical model of the seasonal thermal storage solar floor heating system, the performance of this system is studied by taking a villa in Shanghai as an example. This system uses a underground water tank to storage heat, it concludes that with the heat storage tank's volume gets bigger, the average water temperature of the heat storage tank gets lower and the temperature fluctuation gets smaller. It is also concluded that the matching of the volume of the heat storage tank and the area of the collector has an effect on the economy of the system. At present, the technology of seasonal thermal storage has been more common at home and abroad. However, compared with the sensible heat storage, studies on

seasonal latent heat storage in the open literature is still relatively few. Benlin[12] has designed a ground source heat pump system using PCM (CaCl2·6H2O) for energy storage to achieve heating to the 30m2 of the agricultural greenhouse for a period of time or throughout the day without interruption during winter heating period. At the same time, the nature of the thermal storage system is studied by experiments. It indicates that the COP of the ground source heat pump system with a phase change energy storage and the COP of the total system can reach 2.3-3.8and 2-3.5 respectively. In addition, the application of PCM is put forward to improve the stability of the whole system. Furbo et al.[13-17] put forward a kind of seasonal energy storage system of solar energy, and focus on the qualitative analysis of the heat storage unit in the thermal storage system. The storage medium is $CH_3COONa·3H2O$, and three kinds of heat storage models are put forward in the experiment. Results show that: (1) When the crystal is completely dissolved in the container, the model 1 and 2 can achieve the stability of supercooling, but the mechanical properties of the model 2 is not ideal, and the deformation will occur. (2) Part of the low temperature cooling of CO_2 is an effective way to trigger crystallization. Mark Dannemand etc.[18] have proposed that the use of stability supercooling phenomenon of $CH_3COONa·3H_2O$ can realize seasonal latent heat storage. It is suggested that the addition of sodium carboxymethyl cellulose and sodium carboxymethyl cellulose in $CH_3COONa·3H_2O$ can reduce the supercooling and phase separation of the inorganic hydrated salt, and the addition of graphite powder and other high thermal conductivity materials can increase the thermal conductivity of $CH_3COONa·3H_2O$, on this basis, it will be heated upon the melting temperature of $20\,^{\circ}C$ for a period of time to achieve stable supercooling. Thus $CH_3COONa·3H2O$ can work as a seasonal PCM, it can release heat by means of ultrasonic, mechanical method or down to a very low temperature. Yiqiang Jiang et al.[19] have done a simulation study on the application of solar seasonal phase change thermal storage heat pump system in Harbin by using CaCl2·6H2O as PCM, and the principle, components and operation mode of the system are introduced in this paper. Taking a villa in Harbin as an example, it does simulation and analysis of heat transfer fluid's inlet and outlet temperature, average temperature of PCM and heat loss of the heat storage device with different solar collector area and different heat storage volume. The results show that when the solar collector area is well matched with the heat storage volume, the use of a smaller area of solar collectors can meet the thermal load demand of buildings. Runqiang Ling et al.[20] have used $KAL(SO_4)_2·12H_2O$ as PCM, and it is sealed in a box type plastic tube array. Plastic pipe has the advantages of high pressure, high temperature resistance, corrosion resistance, long life etc., so this design have successfully solved the low efficiency of heat storage and heat release, leakage and corrosion, which provides a theoretical reference for the practical application. The seasonal phase change thermal storage has the advantages of high heat storage density, providing heat energy at constant temperature and small volume of heat storage, but it also has the disadvantages of high initial cost, complex structure and large heat loss. Seasonal storage device has heat loss throughout the year, so the insulation of heat storage device is very important for the economy of the system. To sum up, further researches should be done on technology and economy of the seasonal thermal storage .

Ⅳ. Structure Design

The structure design of the phase change thermal storage device mainly includes the package of the PCM and the internal structure of the phase change thermal storage device. The main function of PCM encapsulation is to provide a larger heat transfer area, reduce the reaction of phase change material and the external environment and control the volume change of phase change. The structure of the heat exchanger will play an important role in the heat storage characteristics of the reservoir.

PCM has a lot of packaging methods. One is the whole package or integrated energy storage heat exchanger. This method is usually used when heat transfer fluid is liquid and PCM works at high temperature, it is also suitable to take this method in industrial and commercial which generally require large capacity and better effective cost. The other is a dispersed package, which includes encapsulation using metal, plastic and thin film as the shell and micro encapsulation, dispersed package is the most common form of PCM encapsulation and its application scope is really wide[2]. However, the research on the numerical model of phase change microcapsules is still not perfect. Most studies are based on the assumption that the PCM is filled with the inner space of the microcapsules, the influence of internal porosity on the PCM phase transition process is not considered. The numerical model is based on the single phase change microcapsules, the effect of the external flow field on the micro particles is not considered, and there is less stress analysis on packaging materials. Jun Hu and Hua Dong[21] have made a phase change thermal storage unit with the structure of inner-pass fluid helical coil by taking paraffin wax as PCM. The internal fluid of spiral coil heat exchanger has disturbance strengthening effect which can effectively shorten the heat storage time. Through the analysis of the phase change process of PCM, the optimization scheme is proposed for heat exchanger design: In order to make the PCM melt in the inner and outer side of the coil as much as possible at the same time, the spiral diameter of the coil can be enlarged properly; The phase change interface's propulsion speed of the axial direction is much smaller than that of the radial direction, which is related to the spacing of the coil, and it can be accelerated by reducing the coil pitch. Haiting Cui et al.[22] have designed and built a cylindrical heat storage device experiment platform with solar energy as the heat source, and the regenerative ball with PCM is arranged in the heat storage device. It also analyzes the influence of the inlet temperature and flow rate of the heat carrier fluid on the performance of the regenerator, which provides a reference for the optimal design of the regenerator. Yi Jiang et al.[23] have established a test bench about the performance of plate form phase change thermal storage device, and the corresponding experiments are done. The results show that experiment and simulation are consistent, the flat type phase change thermal storage device is simple in

structure, the heat transfer pipe can be arranged in the phase change container to realize cold release, and it can be well used in fresh air unit with phase change cool storage. In addition to the plate type phase change heat exchanger, Xinguo Li et al.[24] have done experimental study on the phase change thermal storage of the paraffin embedded in the circular tube, and obtained the law of the thermal storage of the concentric tube phase change accumulator. Haiting Cui et al.[25] have researched on multitube array casing type phase change thermal storage device, which is improved on the basis of concentric tube type phase change thermal storage device. Through numerical simulation of the two kinds of heat storage process and calculating by the solidification / melting model of Fluent, it concludes that the multitube array model is better than that of the concentric casing model, and the number of the inner tube of the casing tube can be reasonably increased, which can effectively increase the convection intensity and the heat transfer efficiency of the PCM.

V. Classification Of Heat Carrying Fluid

The latent thermal storage device is simply a heat exchanger, in which the heat carrying fluid is the one to release heat. The heat carrying fluid mainly comprises air, water, antifreeze, and refrigerant. Water as a heat carrying fluid in the heat exchanger for heat transfer is relatively common, because it has a low cost and it is rich in source. But in the lower outdoor temperature, the heat collector may be frozen, and the water as a heat transfer fluid in the process of heat transfer not only has sensible heat but also has latent heat, and the heat transfer process is more complex. Air as a heat carrier can solve the frozen problem of the solar collector. Jia Li et al.[26] have studied on the solar air collector heating system and the application of thermal storage system in the building, it takes air as a heat carrier, the utility model solves the problem of solar collector freezing, and it can also be directly used for heating or store the excess heat in the PCM for heating in the night. Wei Xiao et al.[27] also have taken air as the heat carrier, and presented a new type of thermal energy storage floor heating system combined with solar air collector. During the day, the hot air is heated by the solar air collector, and the hot air is conveyed to the phase change floor interlayer through the heat preservation pipe, and the PCM storage heat. During the night, the cold air in the room is entered into the phase change floor layer, it is heated by the PCM and then sent into the room, and the PCM release heat. This heating system is safe and reliable, it can significantly improve the indoor temperature and has a better thermal comfort. Ciril Arkar et al.[28] have researched on performance optimization of solar air heating system with latent heat storage, it uses air as heat carrying fluid, vacuum tube solar collector and a concentric sleeve type accumulator, and it finally obtains the conclusion that the solar air heating system can take count of 54-67% heat acquired during the day for night heating. In addition, in order to solve the freezing problem of the solar collector, the antifreeze can be used as a heat carrier in the heat storage device, but the heat collection efficiency of the antifreeze in the solar collector and the heat transfer in the heat storage device is needed to be further studied. And the refrigerant as the heat carrying fluid directly releases heat in the heat storage device is the said of direct expansion solar assisted heat pump system with latent heat storage. Studies of this method is mainly concentrated in Denmark and Northern Europe, domestic research on this aspect is relatively seldom, and there is little research about this aspect in the open literature. In order to solve the problem that the direct expansion solar assisted heat pump system is affected by the solar radiation fluctuation, a direct expansion solar heat pump water heating system with phase change thermal storage device has been proposed by Yan He[29]. The system takes refrigerant as the heat carrying fluid, the heat carrying fluid absorbs heat in the evaporator and then flows through the phase change thermal storage device, it plays as the low heat source in the heat pump cycle, eliminates the intermediate heat exchange link and improves the thermal efficiency. Based on the weather conditions in Qingdao area, the temperature change of the refrigerant in the solar collector is theoretically analyzed, and the feasibility of the system is verified. Through the economic analysis of the system, it is found that the system has properties of low operation cost, energy saving and environmental protection. Wei Wu et al.[30] have put forward a new type of integrated solar heat pump water heater with heat collection, energy storage and evaporation, the system integrates a solar collector, a heat storage container and an evaporator of a heat pump system. The multistage intermediate heat exchange link of the phase change thermal storage type solar heat pump system is reduced, at the same time, it simplifies the system and improves the operation reliability and it has a very broad application prospect. In practical applications, the selection of heat carrying fluid needs to consider the application of the system, the economy of the system and other factors.

VI. Conclusion And Prospect

This paper introduces the application of phase change thermal storage in solar thermal utilization system. First, it analysis the selection of PCM. And then it analysis heat storage period and structure design of the heat storage. Finally, the classification of heat carrying fluid is introduced. The main conclusions are as follows:

(1) The composite materials can be assembled together with the advantages of various materials, and the preparation of composite phase change materials is an inevitable development trend of latent heat storage materials.

(2) Despite short term phase change thermal storage technology is becoming more mature, seasonal phase change thermal storage is still the research difficulty point.

(3) The structure design of the latent heat storage device should be analyzed from aspects of simple structure, low cost, safety and high heat transfer capability.

(4) In the phase change thermal storage system of the solar heat pump, the refrigerant is used as the heat carrying fluid. It saves the material, reduces the intermediate heat exchange link and improves the thermal efficiency.

In this paper, the research status of phase change thermal storage in solar thermal utilization system is analyzed, and the following suggestions are put forward for further research:

(1) To study the composite phase change materials actively, and to improve the thermal storage performance of PCM.

(2) Seasonal heat storage is the most potential for large-scale use of solar energy, but most of it is sensible heat storage, more in-depth studies on the seasonal phase change thermal storage should be made.

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Automatically Generating A Curriculum Tailored For A Particular Employment Position

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***Abstract*—A position-centric approach is provided for creating a curriculum. Under this approach, a curriculum is created for a particular employment position, and the courses that are included in the curriculum are selected based upon the skills that are desired or required for the particular employment position. With such a curriculum, the student is taught the specific skills that are needed to perform well in the employment position. By educating a student using such a curriculum, the student is better prepared for the particular employment position than if the student were educated using a curriculum that is developed based upon a field of study.**

***Index Terms*— Automatically Generating, Curriculum Tailored, Particular Employment Position**

I. Introduction

Many educational institutions (e.g. universities, colleges, etc.) offer degree plans in a variety of fields of study. For example, a university may offer a degree plan in electrical engineering, history, business administration, accounting, physics, etc. Under each degree plan, there are a variety of courses, with each course pertaining to one or more topics or subjects within the field of study of the degree plan. Together, all of the courses form the curriculum for the degree plan[1].

Typically, the curriculum for a degree plan is developed based upon the field of study of the degree plan. That is, the courses that make up the curriculum for a degree plan are selected because they teach a topic or subject that is within the field of study of the degree plan. Thus, a curriculum is typically developed in a field-of-study-centric manner (referred to hereinafter as the field-centric approach for developing a curriculum) [2,3].

II. Overview

In accordance with one embodiment of the present projec, a position-centric approach is provided for creating a curriculum. Under this approach, a curriculum is created for a particular employment position, and the courses that are included in the curriculum are selected based upon the skills that are desired or required for that particular employment position. With such a curriculum, the student is taught the specific skills that are needed to perform well in the employment position. By educating a student using such a curriculum, the student is better prepared for the particular employment position than if the student were educated using a curriculum developed using the field-centric approach[4,5,6].

Under the position-centric approach, courses may be designed and developed by educators differently. Rather than developing courses to teach certain topics or subjects under particular fields of study, educators may design and develop courses to teach one or more specific skills. These skills may correspond closely with the skills that are desired or required by certain employment positions. Developing courses to teach specific skills (i.e. developing courses using a skills-centric approach) enables the courses to be easily selected and incorporated into curricula that are generated for particular employment positions based upon the skills that are desired or required for those particular employment positions. A skill may be desired or required by more than one employment position; thus, a course that teaches a certain skill may be included in the curriculum of multiple employment positions[7].

For maximum efficacy, an employment position should not be too encompassing. For example, it may not be desirable to have an employment position that is as broad as “engineer” but rather it may be desirable to have a more defined employment position such as “circuit design engineer”. The more defined an employment position is, the more likely it is that a tailored curriculum can be created to teach the skills that are desired or required for that employment position[8,9,10].

III. Methodology Description

In one embodiment, a curriculum tailored for a particular employment position may be automatically generated as shown in the flow diagram of Fig. 1. Initially, a set of key skills associated with a particular employment position is obtained from a skills repository[11,12]. Then, based at least in part upon the set of key skills, a curriculum that is tailored for the particular employment position is automatically generated. Specifically, for each key skill in the set of key skills, one or more courses are selected from a course repository that teach that key skill. The selected course(s) is included in the curriculum for the particular employment position. Since this is done for each key skill, by the time all of the key skills in the set of key skills are processed, the curriculum will include at least one course for teaching each of the key skills associated with the particular employment position. Thus, this curriculum will teach a student all of the key skills that the student will need in order to perform well at the particular employment position[13,14].

This same methodology may be used to automatically generate curricula for other employment positions as well. Specifically, for another employment position, another set of key skills associated with that employment position is obtained from the skills repository. Then, based at least in part upon that set of key skills, courses are selected from the course repository that teach those keys skills, and the selected courses are included in a curriculum for the other employment position. The newly generated curriculum will teach a student all of the key skills that the student will need in order to perform well at the other employment position. The particular

employment position and the other employment position may have one or more skills in common; hence, the curriculum for the particular employment position and the curriculum for the other employment position may have one or more courses in common.

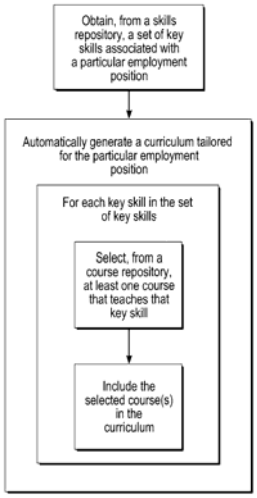

Figure 1.A high level flow diagram of a methodology that can be used to automatically generate a curriculum that is tailored

As shown in Fig. 2, the system may determine a set of desired skills for a particular employment position. The system may then store the set of desired skills into the skills repository in such a manner that indicates that the set of desired skills is associated with the particular employment position. For purposes of the present projec, the set of desired skills that are stored into the skills repository may be the same as the set of key skills that are used to generate a curriculum for the particular employment position, or it may be a superset of the set of key skills. If the set of desired skills is a superset of the set of key skills, then some filtering may be performed when obtaining the set of key skills from the skills repository. For example, if the skills in the set of desired skills are indexed or ranked, then the set of keys skills may be derived by selecting only those desired skills that have index or rank values that are above a certain threshold.

The process shown in Fig. 2 may be used to determine and store sets of desired skills for a plurality of employment positions. Thus, the skills repository may contain a plurality of sets of desired skills, with each set of desired skills being associated with a different employment position.

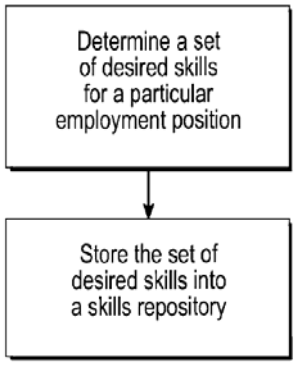

Figure 2. A high level flow diagram illustrating a methodology that can be used to determine a set of desired skills for a particular employment position

In Fig. 3, there is shown a flow diagram that illustrates, in greater detail, how the determining operation shown in block of FIG. 2 may be carried out, in accordance with one embodiment of the present projec. As shown in FIG. 3, a set of desired skills for a particular employment position may be determined by initially determininga first set of skills associated with the particular employment position. In one embodiment, the first set of skills is determined based upon objective information that is gathered and processed. A second set of skills associated with the particular employment position may also be determined. In one embodiment, the second set of skills is determined based upon subjective information from employers. Then, based at least in part upon the first set of skills and the second set of skills, an overall set of desired skills may be derived for the particular employment position. In one embodiment, it is this set of desired skills that is stored into the skills repository. In the embodiment shown in FIG. 3, the set of desired skills is derived using both the first and second sets of skills. This is not required. If so desired, the set of desired skills may be derived based on just one of the first and second sets of skills.

The above discussion of Fig. 3 is relatively high level. To provide additional context for facilitating a complete understanding of the present projec, some specific examples will now be provided. It should be noted, though, that these examples are provided for illustrative purposes only. The present projec should not be limited to these examples. In fact, many other variations and implementations are possible, and all of the possible variations and implementations are within the scope of the present projec.

Ⅳ. Specific Examples

In one embodiment, the operation shown Fig. 3 of determining a first set of skills for a particular employment position may be performed by accessing a plurality of websites, and processing job or employment posting information found on those websites.

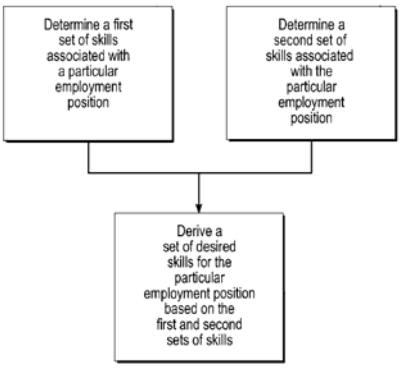

Figure 3. A flow diagram that shows in greater detail how a set of desired skills may be determined for a particular employment position

Each website may have a plurality of job or employment postings. Each job posting pertains to a specific opening for a specific type of job. On each website, there may be multiple openings for multiple types of jobs. For example, there may be ten openings (and hence ten job postings) for a financial analyst, five openings for a patent secretary, two openings for a history teacher, etc. Typically, a job posting includes at least two sections: (1) a job type or job title section; and (2) a job description section. The job type section

specifies the type of position for which a candidate is being sought (e.g. financial analyst, patent secretary, etc.), which is akin to an employment position as that term is used herein. The job description section describes the job and often specifies the desired qualities for a candidate (e.g. education level, experience level, desired skills, etc.). In one embodiment, these sections of each job posting are processed to determine a first set of skills for an employment position.

For example, on a first website, a first job posting may be accessed and processed. Initially, the job type section of the first job posting is processed to determine the employment position to which it pertains. As part of this processing, natural language processing may be used to parse the job type or job title into a plurality of words, filter out extraneous words (e.g. articles, conjunctions, etc.), and form a final employment position. For the sake of example, it will be assumed that the employment position for the first job posting is "financial analyst". The description section of the first job posting is then processed to extract key terms therefrom. Again, natural language processing may be used to try to "understand" the description. In one embodiment, nouns and verbs are identified as potential key terms. For verbs, different forms and tenses are recognized as being based on the same verb base. For nouns, adjectives and perhaps other nouns within close proximity of the noun may be grouped with the noun to form a descriptive phrase (e.g. financial statement analysis, computer model, etc.). Key terms in the description may be identified in this and other ways. For the sake of example, it will be assumed that the following three key terms are identified in the first job posting: "financial statement analysis", "computer model", and "statistics".

Ⅴ. SAMPLE SYSTEM

With reference to Fig. 4, there is shown a block diagram of a system in which one embodiment of the present projec may be implemented. As shown, the system may be coupled to a learner device, a wide area network or WAN (e.g. the Internet, etc.), and a client device. For the sake of simplicity, only one learner device and one client device are shown, but it should be noted that, for purposes of the present projec, any desired number of learner and client devices may interact with the system. The learner device and client device may take on any of various forms, including but not limited to desktop computers, laptop computers, tablet computers, smartphones, mobile devices, etc. In one embodiment, the learner device is used by a learner (e.g. a student) to interact with the system to enable the learner to take advantage of educational resources provided by the system, and the client device is used by a client (e.g. a professor, faculty member, educator, administrator, or other user of the system) to interact with the system for various purposes, as will be elaborated upon below. The learner and client devices, may execute a web browser or one or more dedicated applications in order to interact with the system. The learner device and client device may communicate with the system via any type of connection or network (e.g. local area network, wide area network, etc.).

As shown, system comprises a skills determiner. In one embodiment, it is the skills determiner that performs the operations described previously in connection with FIGS. 2 and 3 to determine a set of desired skills for each of a plurality of employment positions, and to store the desired skills into a skills repository. As described previously, in determining a set of desired skills, a first set of skills and a second set of skills may be determined. The first set of skills may be determined by processing a plurality of job postings on a plurality of websites, and the set second set of skills may be determined by soliciting and receiving information from a plurality of employers.

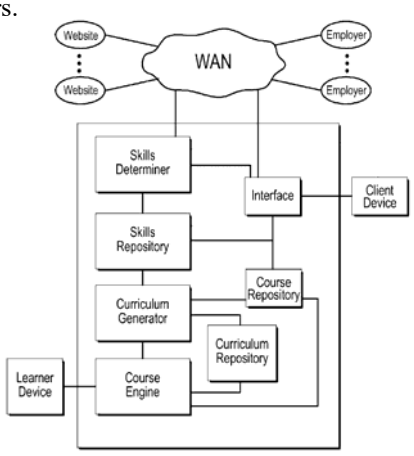

Figure 4. A functional block diagram

To determine the first set of skills for each of a plurality of employment positions, the skills determiner may access a plurality of websites, via WAN, and process a plurality of job postings available on those websites in the manner described previously. In processing the job postings, the skills determiner may implement natural language processing to parse and "understand" the language used in the job postings; thus, the skills determiner may comprise a natural language processing engine. For purposes of the present projec, any commercially available or custom natural language processing engine may be used. Alternatively, the skills determiner may use some other type of language processor to parse and process the words in the job postings. For purposes of the present projec, any type of language processor may be used by the skills determiner.

To determine the second set of skills for each of a plurality of employment positions, the skills determiner may send one or more questionnaires to a plurality of employers, via WAN, receive a plurality of responses from the employers, and process the responses to determine the second set of skills. Also, the skills determiner may send an email to the employers, via WAN, with a link to a questionnaire that is hosted on a website. The employers can click on the link to access the questionnaire and provide the employment information that is being solicited. In such a case, the skills determiner may be the component that sends the email and hosts the website of the questionnaire to collect the information from the employers. After receiving the information from the employers, the skills determiner may process the information in the manner described previously to determine a second set of skills for each of a plurality of employment positions.

Ⅵ. HARDWARE OVERVIEW

With reference to Fig. 5, there is shown a block diagram of a computer system that may be used to implement at least a portion of the present projec.

Computer system includes a bus or other communication mechanism for communicating information, and one or more hardware processors coupled with bus for processing information. Hardware processor may be, for example, a general purpose microprocessor.

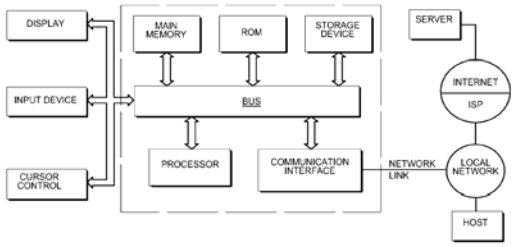

Figure 5. A block diagram of a computer system

Computer system also includes a main memory, such as a random access memory (RAM) or other dynamic storage device, coupled to bus for storing information and instructions to be executed by processor. Main memory also may be used for storing temporary variables or other intermediate information during execution of instructions to be executed by processor. Such instructions, when stored in non-transitory storage media accessible to processor, render computer system into a special-purpose machine that is customized to perform the operations specified in the instructions.

Computer system further includes a read only memory (ROM) or other static storage device coupled to bus for storing static information and instructions for processor. A storage device, such as a magnetic disk, optical disk, or solid-state drive is provided and coupled to bus for storing information and instructions.

Computer system may be coupled via bus to a display, such as a cathode ray tube (CRT), for displaying information to a computer user. An input device, including alphanumeric and other keys, is coupled to bus for communicating information and command selections to processor. Another type of user input device is cursor control, such as a mouse, a trackball, or cursor direction keys for communicating direction information and command selections to processor and for controlling cursor movement on display. This input device typically has two degrees of freedom in two axes, a first axis (e.g., x) and a second axis (e.g., y), that allows the device to specify positions in a plane.

Computer system can send messages and receive data, including program code, through the network(s), network link and communication interface. In the Internet example, a server might transmit a requested code for an application program through Internet, ISP, local network and communication interface. The received code may be executed by processor as it is received, and/or stored in storage device, or other non-volatile storage for later execution.

Ⅶ. CONCLUSIONS AND IMPLICATIONS

At this point, it should be noted that although the projec has been described with reference to specific embodiments, it should not be construed to be so limited. Various modifications may be made by those of ordinary skill in the art with the benefit of this disclosure without departing from the spirit of the projec. Thus, the projec should not be limited by the specific embodiments used to illustrate it but only by the scope of the issued claims.

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The Measuring Instrument Of Pulse Spoke

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***Abstract*— As the high-speed and parallel processing features on FPGA, so it is widely used in high-speed information processing system. In this paper, the front-end data of X - ray energy spectrum is taken as processing object, high-speed data acquisition and processing methods based on the FPGA are proposed, which embodies the advantages of FPGA in the application of high speed information processing. The compensation measures in the electronic measurement system are also discussed in this paper.**

***Index-terms*—FPGA; High-speed Information Processing; X-ray energy spectrum; Electronic measurement system; Compensation measures**

I. INTRODUCTION

The front-end data of X-ray energy spectrum is millivolt voltage pulse sequence, the pulse width of the sequence is microsecond level. But the amplitude and number of the pulse sequence contains the quantitative information of the tested samples [1]. The purpose of the data acquisition and processing system is to extract the pulse amplitude and quantity information from the pulse sequence. The pulse with the same magnitude is classified and summed, then the pulse amplitude information and its corresponding pulse quantity information is transmitted to the host computer for the further processing by serial port. In order to accurately measure the amplitude of the pulse in such a short period，the pulse width is only microsecond level，so the sampled points is not less than 10 during the duration of the pulse. If pulse width is 0.5us, sampling rate should not be less than 20MSPS, such high data streams are not processed by ordinary microprocessors, so the proposed system is FPGA as the control core. The data acquisition and processing system is composed of program control amplifier(PCA), A/D converter, FPGA unit, MCU unit and FIFO interface unit. The system block diagram is shown in figure 1.

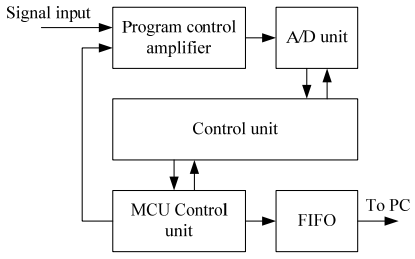

Figure 1 The system block diagram

II. SIGNAL ACQUISITION

The voltage pulse sequence signal is amplified linearly to 0-2V for A/D sampling. For small amplitude and wide bandwidth, the requirement of the amplifier is relatively high, the low noise and broadband is considered.

(1) The design of programmable amplifier

Programmable amplifier is the key to detect, its stability directly affect the accuracy of detection. The wide bandwidth, high gain and wide dynamic range are the features of the signal amplification part. So two stage amplifiers are adopted, the first stage is 10 times of the fixed amplifier, and the second stage is 1-50 times of the programmed amplification. The first stage is 10 times fixed amplification, and the second stage is 1-50 times programmed amplification, which can realize 10-500 times programmed amplification.The amplifier AD8045 with low noise and high speed operation is selected, whose -3dB bandwidth is 1GHz. The analog switch DG508 is selected, which is controlled by MCU to realize programmed amplification with 8 levels. The principle block diagram of the amplifier is shown in figure 2.

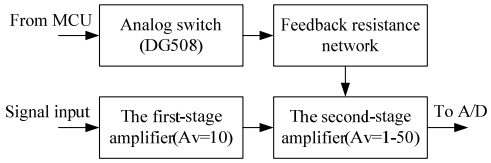

Figure 2 The principle block diagram of the Programmable amplifier

(2) The design of A/D acquisition circuit

According to the design requirements for the sampling rate 20MSPS and the resolution 10Bit, analog digital converter AD9224 is selected, whose sampling rate is 40 MSPS and resolution is 12bit, it possess on-chip high performance sample and hold amplifier and reference voltage. Under single + 5V power supply, power consumption is only 376mW. Signal to noise ratio and distortion is + 0.7dB, it have a signal overflow indicator and can directly output data by the binary[2].So AD9224 can fully meet the design requirements. In AD9224, analog input range is very flexible, which can be single or differential input by the DC or AC coupling.AD9224 uses four stage pipeline structure and efficient economic CMOS process is achieves by a broadband input sample and hold amplifier. Signal whose range is 0-2V is input to the AD9224 by a single form, so in AD9224, the reference selection (SENSE) and the reference input (VREF) and the inverted input (VINB) should be connected to the ground. In order to make the sampled data stable, the required precision for the digital power supply and analog power is high, and the filter processing is also very strict, which are obviously

different from the low speed A/D design. The specific circuit is shown in figure 3. The clock of Ad9224 is obtained by FPGA dividing, 12 bit parallel data are read into the FPGA on each clock falling edge [3].

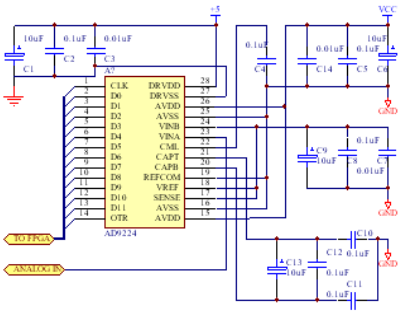

Figure 3 circuit scheme of AD9224

III. The Design On The FPGA Control Unit

Data acquisition and processing are realized by FPGA and the data configuration is achieved by MCU which co-operate FPGA to realize partial low speed data processing.

This design can avoid as far as possible that the FPGA capacity is too large to increase the cost of hardware. According to the design requirements, EPF10K10LC84_4 by Altera company is selected, which is commonly SRAM FPGA including 1000 gates. Because configuration data of the EPF10K10LC84_4 is less than 16KByte, the Flash in MCU can be used to store the configuration data of the FPGA to achieve the configuration of the FPGA [4].

FPGA design is described by MAX+PlusII integrated compiler environment, VHDL hardware description language and schematic input method. The design on FPGA is divided into six units: A/D interface unit, MCU interface unit, sequential control unit, pulse amplitude detection unit, pulse counting unit and data processing unit. The structure relation is shown in Figure 4

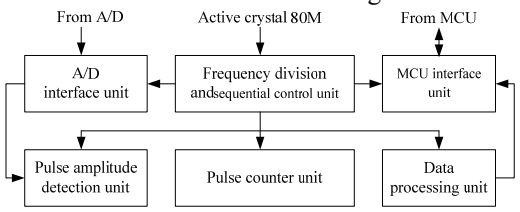

Figure 4 FPGA design principle block diagram

The clock for FPGA is provided by 80MHz active crystal, which is divided 4 frequency as the working clock of A/D converter. When FPGA detects the pulse peak, then begin to read the A/D data, high-speed data flow into the pulse amplitude detection unit for comparison operations and extract the maximum value and the maximum value of two points before and after the data. The data are processed by data processing unit cooperative MCU, and finally the data are uploaded to the host computer. The data exchange of FPGA and MCU is done by MCU interface unit. The interrupt mode is used as data parallel transmission by MCU [5]. The current popular C8051Fx series MCU is adopted in this paper, the specific model is C8051F340, which is 48 pin TQFP package, 64KByte Flash and (4K+256) Byte SRAM memory, the instruction rate up to 48MIPS, integrated with a USB2.0 controller and 1KByte FIFO memory and is very suitable for the design requirements. C8051Fx uses the CIP-51 (8051) core, the instruction system is completely compatible with the 8051, the application scope is very extensive. The uVision2 Keil is used as development environment and the C51is used as the programming language.

IV. Compensation Measures

Because the dynamic range of the input signal is relatively large, it is necessary to make a nonlinear compensation for the amplifier for ensuring the accuracy of the whole system. The nonlinearity of the amplifier is mainly caused by the change of frequency, amplitude, temperature and so on. The nonlinear error can be compensated by piecewise linear compensation or Lagrange (Lagrange) interpolation. The quantization error is determined by the discrete nature of A/D sampling, which is mainly found in the amplitude of the pulse peak detection. Due to the short pulse duration, the peak amplitude is sharp, and the sampling point can not be guaranteed to overlap with the peak value, which can cause error. Lagrange interpolation measure can be adopted to compensate this error.

(1) Nonlinear compensation

Nonlinear compensation is common, and the nonlinear compensation measures are discussed in the case of amplitude compensation. The nonlinear error caused by the variation of the input signal amplitude is shown in figure 5 after amplification factor Av is certain.

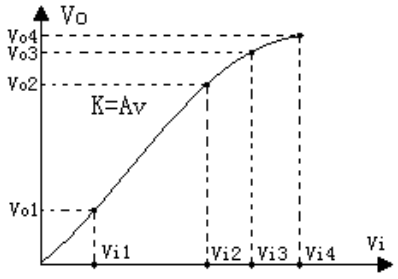

Figure 5 Schematic diagram of amplifier amplitude

Set v_i for the input amplitude, v_o for the output amplitude, $K = Av$ for the voltage amplification factor. With the v_i increase, Av will decrease, the error can be compensated by piecewise linear compensation or subsection Lagrange interpolation based on the practical application. The following is a piecewise linear compensation method, according to figure 5, the input signal can be divided into four sections, including $(0, v_{i1})$, (v_{i1}, v_{i2}), (v_{i2}, v_{i3}) (v_{i3}, v_{i4}) respectively. v_i and v_o can be regarded as linear relation in each segment, and the equation can be written as

$$v_o = Kv_i + B \quad (1)$$

where K and B can be calculated according to the boundary value. The compensation equation is obtained by taking the (v_{i3}, v_{i4}) section as an example.

$$v_o = \frac{v_{o2} - v_{o1}}{v_{i2} - v_{i1}} v_i + \frac{v_{i2}v_{o1} - v_{i1}v_{o2}}{v_{i2} - v_{i1}} \quad (2)$$

This compensation method is simple and the calculation is small, and it is suitable for the occasion where the nonlinear error is small.

(2) Quantitative compensation

The quantization error is caused by the discontinuity of sampling, as shown in figure 6.This error can be compensated by the Lagrange interpolation method.

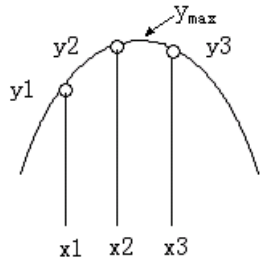

Figure6 The diagram of sampling quantization error

Setting x_1, x_2, x_3 continuous sampling point, the corresponding three sampling points are y_1, y_2, y_3, $y_{\max}$ represents maximum peak value of the pulse, so The two time interpolation expression is

$$y = y_1 \frac{(x-x_2)(x-x_3)}{(x_1-x_2)(x_1-x_3)} + y_2 \frac{(x-x_1)(x-x_3)}{(x_2-x_1)(x_2-x_3)} + y_3 \frac{(x-x_1)(x-x_2)}{(x_3-x_1)(x_3-x_2)} \quad (3)$$

When $x_1 = -1$, $x_2 = 0$, $x_3 = 1$

$$y = (0.5y_1 - y_2 + 0.5y_3)x^2 + (-0.5y_1 + 0.5y_3)x + y_2 \quad (4)$$

$$y_{\max} = \frac{4ac - b^2}{4a} = y_2 + \frac{(y_1 - y_3)^2}{8(2y_2 - y_1 - y_3)} \quad (5)$$

Lagrange interpolation is applied widely in engineering, and it has a high fitting precision. But the computation is large, and it is suitable for the occasion of high nonlinear error and high precision.

V. CONCLUSION

In this system, FPGA is used as the main controller for high-speed data acquisition and processing, and the FPGA data configuration and auxiliary calculation of partial data is carried by the MCU. Low noise high-speed operational amplifier AD8045 can achieve the 10-500 programmable amplifier and the gain bandwidth can reach 0.5G. High-speed A/D converter AD9224 can achieve the pulse signal sampling and the sampling rate reached 20MSPS. The system uses a variety of anti-jamming measures to achieve the stability of the system, using a variety of compensation measures to ensure the accuracy of the measurement. By testing, the system has achieved the design requirements.

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Research On Strengthening The Teaching Of Mobile Technology In The Course Of Volleyball Teaching

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***Abstract*—Moving method is one of the most basic techniques of volleyball, and it is also the link of the technology ". The rapid and reasonable use of various moving steps is the necessary prerequisite and guarantee for the completion of the technical movement of the ball. In this paper, the problem of the use of mobile gait in volleyball technology is analyzed and studied.**

***Index-terms*—Moving; volleyball; teaching**

I. Introduction

Volleyball technology mainly by the steps and methods of two parts and footwork reflected in mobile technology, mobile technology is series of the volleyball skill "the link". But at present, in the ordinary colleges and universities volleyball teaching, more emphasis on the study and practice of volleyball technology, while ignoring the movement of teaching and practice.

The so-called mobile, is refers to the fast and flexible steps to move to the most advantageous position to hit the ball to hit the ball process. The whole process of movement includes three parts, starting, moving and braking. The purpose is to get the ball in time, to keep the relationship between the good and the ball in order to make a more reasonable shot, but also to quickly occupy a reasonable position on the field. Its form is mainly divided into four kinds: step and slide, step, cross step and running. Depending on the position of the ball, different moving technology is adopted. No matter what kind of move, should conform to the principles of human anatomy, sports biology, in line with personal characteristics, in line with the rules and requirements of volleyball. In the completion of the mobile step should be coordinated, easy, effort, to give full play to physical fitness and skills.

II. Research Objects And Methods

(1) Object of study

In our school 13 girls volleyball class two classes for the experimental group, the other two classes for the control group. Before the experiment, the students were tested by the national physical health standard, and the results showed that there was no significant difference between the physical quality and the physical foundation. In which the experimental class 44 people, 36 people in the class, a total of 80 people, are girls.

(2)Research method

Teaching experimental method: the experimental group of students to strengthen the teaching and practice of teaching, the control group according to the normal progress of teaching. Experimental group and the control group, the total teaching hours are 28 hours.

Data statistics method: using statistical methods on students' test scores and the national student physical health standard "in the standing long jump. The results were analyzed.

III. Movement Gait In Volleyball

Volleyball movement, the use of the most is two to three steps, that is, 2 to 3 meters or so, the movement of the most critical step is to start. At the same time in order to make the body center of gravity moved quickly, need to add the horizontal component of the tread of the thigh, reach acceleration (in a forward starting, for example: on the right of the ready position based on quickly raised foreleg, abdomen in the upper body leaned forward, also hind legs quickly push hard, the body rapidly forward starting). After starting, the need to brake to ensure that the action of the ball or the next action of the convergence of the action (brake one step brake and two step brake. A multi step brake for mobile force not to move a short distance after. When braking, mobile finally stepped out of the a big step, also lower the center of gravity, the soles of the feet touched the ground, resist the body center of gravity to the inertia force of moving, within and with the waist abdomen strength control the upper part of the body, make the body center of gravity vertical landed on his feet a support surface; in larger mobile momentum by two step brake, brake, brake for the first time in the penultimate step, followed by cross out the last step to make the second brake, and leaning back, knees bent, center of gravity down, your feet firmly touched the ground, make the body is to do a technical action).

IV. In the teaching, experimental group exercises reasonable mobile take a is volleyball is very important in personal technology.

It not only needs strong analysis and judgment of the situation ability, and the need to have good posture, because the ready position is correct or not directly
Then affects the movement to take place. The following teaching methods have been adopted in the teaching process.

(1)Under the guidance of teachers to do the preparation of the posture and movement of the exercise.
(2)Since the catch method of educational research, educational research of sports training theory
The player with the ball to your front and side of the body thrown high arc ball, and then use the cross step, running or step to mobile take a, after catching the ball and then make the ready position.
(3)Two groups, the relative standing, one of them to other people before and after, left and right left ball in a high arc. Another person through mobile catches the ball and make ready posture exercises.
(4)Volleyball game,The students will be divided into equal number of teams, first stood in the limit line, and the second men standing on the bottom line. When hearing the signal, second from the pad (or transfer) as a after the ball to pioneer, and ran toward the vanguard at, Pai Tau shall pad the ball (or transfer) for the bottom line at the next person, by a person then pad (or pass the ball, the team in order to pass the ball, to pioneer outgoing ball was caught.
(5)To carry on the 3 meter * 6 turn back to run the practice.
(6)Receive and serve practice
Through the above exercises, strengthen the awareness of mobile technology, so that the players to actively carry out mobile; at the same time, can also cultivate the students' ability to feel and determine the space. Control group according to the traditional practice mode to practice.

V. ANALYSIS AND CONCLUSION

(1)Data analysis
From table 1, it can be seen that the gap between experimental group and control group average scores the second semester than the first semester, indicating that strengthen mobile teaching can be improved students' grades. Therefore, in the course of the exercise should be strengthened in different forms of exercise, improve students' enthusiasm at the same time to achieve the purpose of physical exercise, get good results.

Table 1: the experimental group and the control group, the average scor

	The average grade of the first semester	the first semester average score of second
Experimental group (44 people)	83.5	90
Control group (36 people)	82.5	81.5
Difference	2	7.5

From table 2 it is seen that before and after the experiment, the indexes of physical quality of students has increased, but the growth rate is different, the experimental class growth rate than that of the control class of (standing long jump before and after the experiment result is shown in the table). This shows that strengthening the teaching of mobile technology, not only can improve the technical level of students, but also can exercise the physical quality, to achieve the purpose of physical exercise.

Table 2: experimental group and control group project quality scores of the standing long jump table (unit: cm)

	Growth	Before	Experiment
Experimental group (44 people)	175	182	4%
Control group (36 people)	176	179	1.7%

(2)Conclusions and recommendations
Volleyball technology needs in the short distance 2 ~ 3 meters of mobile, so in the teaching and training should pay close attention to the second, three short steps away from the rapid reaction, rapid starting mobile training, so as to ensure exercises and examinations in high speed and high quality completion of the ball technology.
No matter what kind of footwork, its purpose is to get close to the ball, the better completion of batting technique, so in the usual teaching and training should be to strengthen the teaching and training of mobile technology, ensure better master the technical movements.
In class, we should increase the number of students to increase the interest of the game
Of the exercise of the project, in the fun of learning, in the laughter to get exercise. To achieve the purpose of enhancing physical fitness recreation.
Through this research, it shows the importance of mobile technology in volleyball. In teaching, we should strengthen the teaching of volleyball mobile technology, so that students can master the technology faster and better.

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Design of The Process Signal Correction Instrument

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***Abstract*—In order to facilitate the calibration of the secondary instrument in the field, a high precision and portable calibrator is designed, which can input and output voltage, resistance and current signal. The process signal correction instrument is used to generate the standard signal source, which is used to calibrate the instrument. Its purpose determines that the performance index must be higher than the calibrated meter level, and should have multiple signal types, multi function and high stability.**

***Index-terms*—calibration; process signal correction instrument; standard signal source**

I. INTRODUCTION

In the thermal instrument industry, some signals, such as temperature, current, voltage, resistance, thermocouple and so on, are often needed to be measured, output and corrected. At present, there are many single function instruments including measuring voltage, current and resistance. Some instruments including temperature signal correction meters, thermocouple calibrators, thermal resistance calibrators, can complete the measurement and display output and correction for a single signal. Because of their single function, they have a lot of inconvenience[1]. So a process signal correction instrument is designed in this paper, which can measure and correct temperature, voltage, current, resistance, thermocouple and have thermal manual function. In addition, the calibration instrument can display the internal clock function, and the built-in lithium ion battery can complete the function of self charging[2].

II. SYSTEM SCHEME

(1) Measurement section

In order to measure the voltage and current signals, two independent input channels should be designed, that is voltage input channel and the current input channel, each channel are composed of a differential amplifier, digital potentiometer and some peripheral circuit, where the differential amplifier is mainly used to amplify the input differential signal to one polarity.

(2) Output section

In order to achieve the output voltage, current, and heat signal, a voltage output channel can be designed, because the general D/A converter output is voltage output. For output the current signal, it is necessary to pass through a V/I conversion circuit, the voltage value is converted to the current value.

(3) Real time clock display

Real time clock can be implemented by DS1307, which exchanges data with MCU by I2C bus, MCU obtains the clock signal by reading clock data and display the clock on LCD[3].

(4) Host compute communication

RS232 can be used to realize the communication between the correction instrument and the host computer.

III. SYSTEM HARDWARE DESIGN

The functional block diagram of the process signal correction instrument is shown in figure 1.

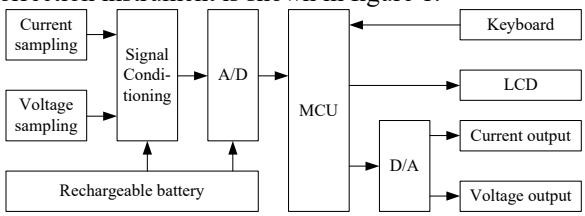

Figure1 The functional block diagram of the process signal correction instrument

(1) DC-DC converter

The so-called DC-DC converter, refers to the low (high) DC voltage directly into a high (low) DC voltage. In this paper, MC34063 is used as DC-DC converter, it has the following characteristics:

① 8 pin dual plastic;

② Its internal including reference regulated power supply, comparator, oscillator, trigger, exciter, current switch tube, less peripheral parts, convenient to realize DC voltage from low to high or high to low and transform polarity;

③ DC operating voltage range is 3-40V;

④ Static current is very small, when Vcc=5-40V, CT=luF, static current is only 4 mA

⑤ With current limiting function

⑥ Output switching current up to 1.5~8A, through the external expansion tube, the power can be more;

⑦ Continuous adjustable output voltage;

⑧ Operating frequency range 100kHz-100kHz;

⑨ Voltage source accuracy to 2%;

⑩ The efficiency of the booster circuit is close to 90%, the efficiency of the buck circuit is better than 80%, and the efficiency is about 95%.

Pin diagram of the MC34063DC/DC converter is shown in figure 2

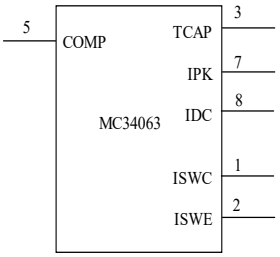

Figure 2 MC34063DC/DC converter

(2) CPU and data storage

This part mainly includes the coordination management and control for digital potentiometer, A/D converter, keyboard data input, LCD display, DA converter, clock chip DS1307, ISP and some communication interface.

(3) Design of communication interface circuit of host computer

MAX232 is used as voltage conversion chip[4]. The specific circuit is shown in figure 3

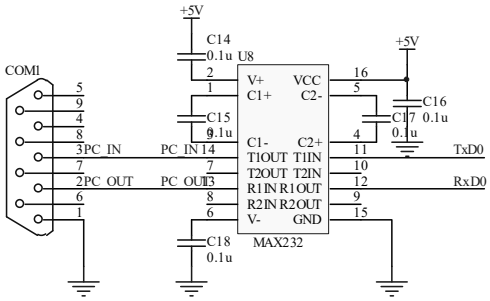

Figure 3 PC communication interface circuit

IV. System Software Design

The software design flow chart of MCU is shown in figure 4, which include initialization subroutine, keyboard scanning subroutine, key processing subroutine. According to the different keys, the key processing subroutine can be divided into the display update subroutine, I/O switching subroutine, the index number selection subroutine, delete subroutine.

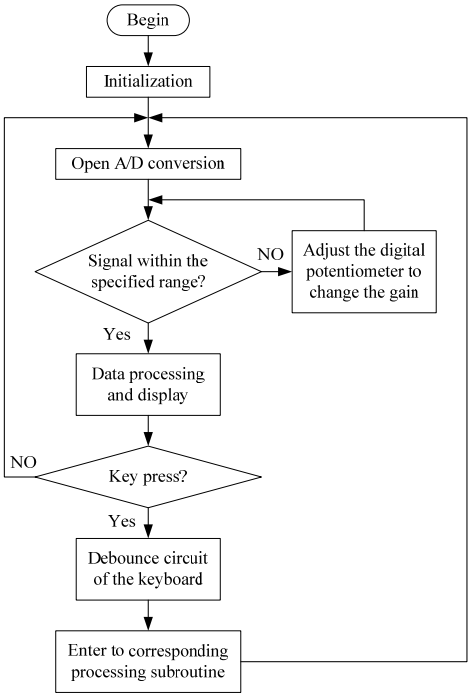

Figure 4 Software flow chart design

V. Conclusion

In this paper, a process signal correction instrument is designed. In hardware design section, for maintaining the characteristics of low power consumption and small volume, all kinds of protection circuit are designed, which can make the instrument portable. In software designe section, in order to facilitate the maintenance and expansion, keeping the code streamlined, using advanced language, assembly language form, advanced language and assembly language are combined.

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High-Efficiency Power Conversion Architecture For Driving A Thermoelectric Cooler In Energy Conscious Applications

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***Abstract*—Systems and methods are disclosed herein relating to an Alternating Current-Direct Current (AC-DC) power conversion system for supplying power to one or more Thermoelectric Coolers (TECs). A system comprises one or more TECs and an AC-DC power conversion system configured to supply power to the one or more TECs for a high efficiency mode of operation and a high heat pumping mode of operation. The AC-DC power conversion system comprises a first AC-DC power converter configured to convert an AC input to a DC output at a first output power level for the high efficiency mode of operation of the one or more TECs. The AC-DC power conversion system further comprises a second AC-DC power converter configured to convert the AC input to a DC output at a second output power level for the high heat pumping mode of operation of the one or more TECs.**

***Index Terms*—power conversion, architecture, driving a, thermoelectric, cooler in energy**

Ⅰ. Introduction

Thermoelectric Coolers (TECs) are solid state semiconductor devices that utilize the Peltier effect to transfer heat from one side of the device to the other, thereby creating a cooling effect on the cold side of the device. One example of a thermoelectric cooling device 10 is illustrated in Fig. 1. Notably, as used herein, a thermoelectric cooling device consists of a single N-type leg and a single P-type leg (i.e., is a two-leg device), whereas a thermoelectric cooling module includes many thermoelectric cooling devices connected in series. As such, the general term “thermoelectric cooler” or TEC is used herein as referring to either thermoelectric cooling devices or thermoelectric cooling modules[1,2].

As illustrated in FIG. 1, the thermoelectric cooling device 10 includes an N-type leg 1 a P-type leg 14, a top conductive metal layer 16, and a bottom conductive metal layer 18. The N-type leg 1and the P-type leg 14 are formed of a thermoelectric material (i.e., a semiconductor material having good thermoelectric properties)[3]. In order to effect thermoelectric cooling, an electrical current is applied to the thermoelectric cooling device 10 as shown. The direction of current transference in the N-type leg 1and the P-type leg 14 is parallel to the direction of heat transference in the thermoelectric cooling device 10. As a result, cooling occurs at the top conductive metal layer 16 by absorbing heat at the top surface of the thermoelectric cooling device 10 and releasing heat at the bottom surface of the thermoelectric cooling device 10. One example of a thermoelectric module is illustrated in FIG1. As illustrated, the thermoelectric module includes multiple thermoelectric cooling devices 10 connected in series. These multiple thermoelectric cooling devices 10 are packaged within a single thermoelectric module[4,5,6] .

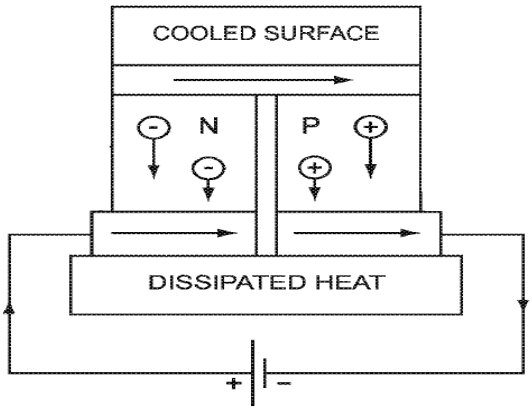

Figure 1.Thermoelectric cooling device

Ⅱ. High-Efficiency Power Conversion Architecture For Driving A Thermoelectric Cooler

Systems and methods are disclosed herein relating to an Alternating Current-Direct Current (AC-DC) power conversion system for supplying power to one or more Thermoelectric Coolers (TECs) in such a manner as to minimize or reduce total AC power draw. In some embodiments, a system comprises one or more TECs and an AC-DC power conversion system configured to supply power to the one or more TECs for a high efficiency mode of operation and a high heat pumping mode of operation. The AC-DC power conversion system comprises a first AC-DC power converter configured to convert an AC input to a DC output at a first output power level for the high efficiency mode of operation of the one or more TECs. The first output power level corresponds to a high[7].

Coefficient of Performance (COP) operation point of the one or more TECs. The first AC-DC power converter has, at the first output power level, an efficiency that is approximately equal to a maximum efficiency of the first AC-DC power converter. The AC-DC power conversion system further comprises a second AC-DC power converter configured to convert the AC input to a DC output at a second output power level for the high heat pumping mode of operation of the one or more TECs. The second output power level corresponds to a high heat pumping operation point of the one or more TECs. The second AC-DC power converter has, at the second output power level, an efficiency that is approximately equal to a maximum efficiency of the second AC-DC power converter. In this manner, a total AC draw of the system is reduced as compared to one that uses a conventional AC-DC power converter, particularly when operating the one or more TECs in the high efficiency mode of operation.

The AC-DC power conversion system further comprises a switching fabric comprising a first input coupled to an output of the first AC-DC power converter, a second input coupled to an output of the second AC-DC power converter, and an output coupled to the one or more TECs.

The AC-DC power conversion system further comprises a DC-DC converter having an input coupled to an output of the second AC-DC power converter and an output coupled to the second input of the switching fabric. In some embodiments, the system further comprises a controller configured to adaptively control the DC-DC converter when operating the one or more TECs in the high heat pumping mode of operation to adaptively adjust a power level provided to the one or more TECs within a predetermined high power level range. In some embodiments, the predetermined high power level range is a range of power levels that corresponds to a range of heat pumping energies within or including % to 100% of the maximum heat pumping (Qmax) of the one or more TECs[8,9].

The AC-DC power conversion system further comprises a DC-DC converter having an input coupled to an output of the first AC-DC power converter and an output coupled to the first input of the switching fabric. In some embodiments, the system further comprises a controller configured to adaptively control the DC-DC converter when operating the one or more TECs in the high efficiency mode of operation to adaptively adjust a power level provided to the one or more TECs within a predetermined low power level range. In some embodiments, the predetermined low power level range is a range of power levels that corresponds to a range of COP values within or including 80% to 100% of the maximum COP (COPmax) for the one or more TECs.

The system further comprises a controller configured to selectively control the switching fabric such that the one or more TECs are coupled to the output of first AC-DC power converter for the high efficiency mode of operation and coupled to the output of the second AC-DC power converter for the high heat pumping mode of operation. In some embodiments, the controller is further configured to enable the first AC-DC converter and disable the second AC-DC converter for the high efficiency mode of operation of the one or more TECs. In some embodiments, the controller is further configured to disable the first AC-DC converter and enable the second AC-DC converter for the high heat pumping mode of operation of the one or more TECs.

The one or more TECs comprises a first set of TECs and a second set of TECs, each of the first set and second set of TECs comprising one or more TECs. Further, the AC-DC power conversion system further comprises a switching fabric comprising a first input coupled to an output of the first AC-DC power converter, a second input coupled to an output of the second AC-DC power converter, a first output coupled to the first set of TECs, and a second output coupled to the second set of TECs. The switching fabric is configured to independently couple the first and second sets of TECs to the first and second AC-DC power converters such that the first and second sets of TECs are independently operated in either the high efficiency mode of operation or the high heat pumping mode of operation.

The high COP operation point is a maximum COP operation point and the high heat pumping operation point is a maximum heat pumping operation point.

A method of controlling an AC-DC power conversion system to provide power to one or more TECs for a high efficiency mode of operation and a high heat pumping mode of operation is provided. The AC-DC power conversion system comprises a first AC-DC power converter configured to convert an AC input to a DC output at a first output power level for the high efficiency mode of operation of the one or more TECs and a second AC-DC power converter configured to convert the AC input to a DC output at a second output power level for the high heat pumping mode of operation of the one or more TECs, and the method comprises determining whether to operate the one or more TECs in the high efficiency mode of operation or the high heat pumping mode of operation. The method further comprises, upon determining to operate the one or more TECs in the high efficiency mode of operation, configuring the AC-DC power conversion system to couple an output of the first AC-DC power converter to the one or more TECs, the first output power level of the DC output of the first AC-DC power converter corresponding to a high COP operation point of the one or more TECs and the first AC-DC power converter having, at the first output power level, an efficiency that is approximately equal to a maximum efficiency of the first AC-DC power converter. The method further comprises, upon determining to operate the one or more TECs in the high heat pumping mode of operation, configuring the AC-DC power conversion system to couple an output of the second AC-DC power converter to the one or more TECs, the second output power level of the DC output of the second AC-DC power converter corresponding to a high heat pumping operation point of the one or more TECs and the second AC-DC power converter having, at the second output power level, an efficiency that is approximately equal to a maximum efficiency of the second AC-DC power converter.

III. Coefficient of Performance (COP) curve for a Thermoelectric Cooler (TEC) and an efficiency curve

Systems and methods are disclosed herein relating to an Alternating Current-Direct Current (AC-DC) power conversion system for supplying power to one or more Thermoelectric Coolers (TECs) in such a manner as to minimize or reduce total AC power draw. However, before describing these systems and methods, a discussion of a Coefficient of Performance (COP) of a TEC and an efficiency of a conventional AC-DC power converter is beneficial. The COP of a TEC is a measure of the efficiency of the TEC and is defined as: $COP=Q/Pin$.

where Q is heat pumped by the TEC and Pin is the input power of the TEC. The COP of a TEC is generally low when the heat pumped, and thus input power, is high and is generally high when the heat pumped, and thus input power, is low.

In contrast, the efficiency of conventional AC-DC power converters is generally high when the output power of the AC-DC power converter is high and low when then output power of the AC-DC power converter is low. As such, when a conventional AC-DC power converter is used to provide power to a TEC operating at low COP (high heat pumping energy), the AC-DC power converter performs with high efficiency. Conversely, when the AC-DC power converter is used to provide power to a TEC operating at high COP (low heat pumping energy), the AC-DC power converter performs with low efficiency. This presents a fundamental challenge in applications where total AC power draw is desired to be low since, in order to achieve satisfactory performance, operation of the TEC is desired to be controlled such that the TEC operates at both a high COP and a low COP (i.e., high heat pumping energy) under

different conditions. For example, a TEC based refrigeration system may desire to operate the TEC at high COP most of the time (e.g., under steady state conditions) and infrequently operate the TEC at low COP (i.e., high heat pumping energy) (e.g., under pull-down or recovery conditions). As illustrated in Fig. 2. when the TEC is operated at high COP, the AC-DC power converter performs with low efficiency and, as such, the overall AC power draw is less than ideal. As also illustrated in Fig. 2. when the TEC is operated at low COP (i.e., high heat pumping energy), the AC-DC power converter performs with high efficiency, but the overall AC power draw is again less than ideal due to the low COP of the TEC.

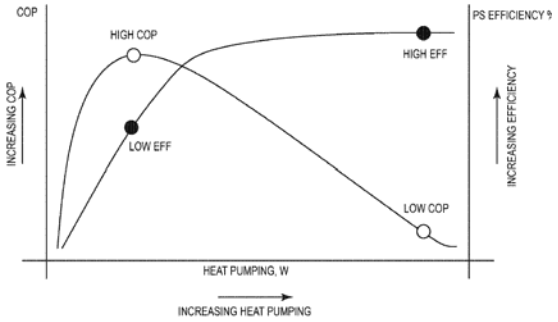

Figure 2.Coefficient of Performance (COP) curve for a Thermoelectric Cooler (TEC)

TEC(s) at low COP (i.e., high heat pumping energy). In particular, the AC-DC power conversion system includes two AC-DC power conversion subsystems, one with high power capability and one with low power capability. A switch network, or switching fabric, connects the two separate AC-DC power conversion subsystems to the TEC(s). In some embodiments, a microcontroller intelligently controls the AC-DC power conversion subsystems and the switch network. The low power AC-DC power conversion subsystem is designed such that its power conversion efficiency is maximized when the TEC(s) operates at its high COP point (with lower heat pumping magnitude). The high power AC-DC power conversion subsystem is designed such that its power conversion efficiency is maximized when the TEC(s) operates at its low COP point (with high heat pumping magnitude).

Ⅳ. AC-DC POWER CONVERSION SYSTEM

Fig. 3 illustrates a system including an AC-DC power conversion system supplying power to one or more TECs according to some embodiments of the present disclosure. The AC-DC power conversion system includes a high power AC-DC power converter and an optional DC-DC converter forming a first power conversion subsystem and a low power AC-DC power converter forming a second power conversion subsystem. An AC switching network has an input coupled to an AC source (not shown), e.g., an AC outlet via a cable , a first output coupled to an input of the high power AC-DC power converter , and a second output coupled to an input of the low power AC-DC power converter . A switching fabric , or switch network, has a first input coupled to an output of the high power AC-DC power converter (optionally via the DC-DC converter), a second input coupled to an output of the low power AC-DC power converter , and an output coupled to an input of the TEC(s) .

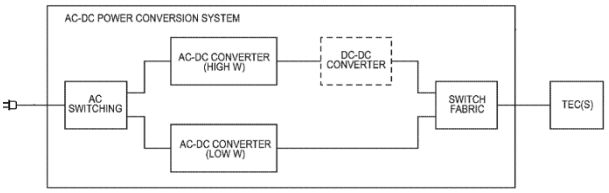

Figure 3.System including an AC-DC power conversion system

Ⅴ. THE OPERATION OF THE CONTROL SYSTEM ACCORDING

As illustrated, the control system 4determines a mode of operation in which the TEC(s) is to be operated (step 100). The determination may be made based on one or more inputs such as, e.g., temperature input(s) from a temperature sensor(s). If the determined mode of operation for the TEC(s) is the high heat pumping mode of operation (step 10 NO), the control system 4configures the AC-DC power conversion system for the high heat pumping mode of operation (step 104). In particular, the control system 4enables the high power AC-DC power converter via a high W converter enable signal and disables the low power AC-DC power converter via a low W converter enable signal. In addition, the control system 4controls the switching fabric to couple the output of the high power AC-DC power converter to the input of the TEC(s) via a DC switch control signal and controls the AC switching network to couple the AC source to the input of the high power AC-DC power converter . Optionally, the control system 4adaptively controls the DC-DC converter to adaptively adjust the output power provided to the TEC(s) during the high heat pumping mode of operation (step 106). The DC-DC converter may be used to adjust the output power level within a predetermined high power level range. In some embodiments, the high power level range is a range of power levels that corresponds to a range of heat pumping energies within or including % to 100% of the maximum heat pumping energy (Qmax) of the TEC(s) (e.g., % to 100% of Qmax, 50% to 100% of Qmax, 75% to 100% of Qmax, 40% to 90% of Qmax, or the like). In other embodiments, the high power level range is a range of power levels in which, e.g., the high power AC-DC power converter performs at approximately the maximum efficiency of the high power AC-DC power converter . Fig. 4 is a flow chart that illustrates the operation of the control system .

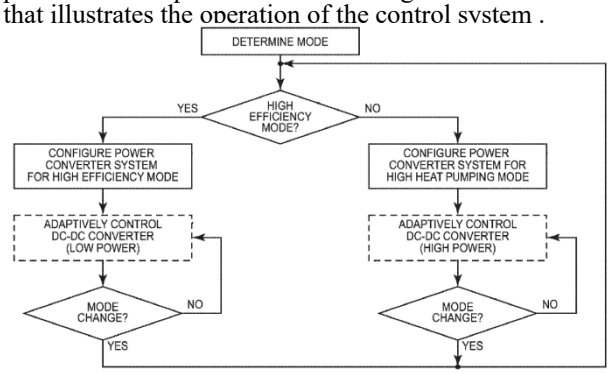

Figure 4. Is a flow chart that illustrates the operation of the control system

Notably, when operating in the high heat pumping mode of operation, in some embodiments, it may be desirable for some of the TECs to be operated at one power level and for others of the TECs to be operated at

another power level. In this case, the AC-DC power conversion system is operated such that the higher of these two power levels is input to the switching fabric . The switching fabric is intelligently controlled to provide this higher power level to the appropriate TEC(s) . For the other TEC(s) for which a lower power level is desired, the switching fabric is intelligently controlled to use Pulse Width Modulation (PWM) or periodic on/off switching to covert the higher power level to the lower power level, which is then provided to the appropriate TEC(s) . In this manner, the switching fabric is intelligently controlled through the use of PWM or periodic on/off switching to resolve the situation where one or more TECs require different power levels independently but are coupled to only the high power AC-DC power converter .

When operating in the high heat pumping mode of operation, the control system 4monitors for a mode change (i.e., monitors for one or more conditions that would trigger a switch to the high efficiency mode of operation according to, e.g., a predetermined mode control procedure) (step 108). If no mode change is detected, the control system 4returns to step 106 and continues. If there is a mode change, the control system 4returns to step 10and continues.

Returning to step 10 if the determined mode of operation is the high efficiency mode of operation (step 10 YES), the control system 4configures the AC-DC power conversion system for the high efficiency mode of operation (step 110). In particular, in some embodiments, the control system 4enables the low power AC-DC power converter via the low W converter enable signal and disables the high power AC-DC power converter via the high W converter enable signal. Notably, in other embodiments, the low power AC-DC power converter is always enabled, and only the high power AC-DC power converter is enabled/disabled depending on the mode of operation. In addition, for the high efficiency mode of operation, the control system 4controls the switching fabric to couple the output of the low power AC-DC power converter to the input of the TEC(s) via the DC switch control signal and controls the AC switching network to couple the AC source to the input of the low power AC-DC power converter . Optionally, the control system 4adaptively controls the DC-DC converter 40 to adaptively adjust the output power provided to the TEC(s) during the high efficiency mode of operation (step 11. The DC-DC converter 40 may be used to adjust the output power level within a predetermined low power level range. In some embodiments, the low power level range is a range of output power levels in which, e.g., the TEC(s) operates at approximately the maximum COP of the TEC(s) (e.g., a range of output power levels corresponding to a range of COP values within or including 80% to 100% of COPmax such as, for example, 80% to 100% of COPmax, 90% to 100% of COPmax, 8 to 98% of COPmax, or the like).

Notably, when operating in the high efficiency mode of operation, in some embodiments, it may be desirable for some of the TECs to be operated at one power level and for others of the TECs to be operated at another power level. In this case, the AC-DC power conversion system is operated such that the higher of these two power levels is input to the switching fabric .

The switching fabric is intelligently controlled to provide this higher power level to the appropriate TEC(s) . For the other TEC(s) for which a lower power level is desired, the switching fabric is intelligently controlled to use PWM or periodic on/off switching to covert the higher power level to the lower power level, which is then provided to the appropriate TEC(s) . In this manner, the switching fabric is intelligently controlled through the use of PWM or periodic on/off switching to resolve the situation where one or more TECs require different power levels independently but are coupled to only the low power AC-DC power converter .

When operating in the high efficiency mode of operation, the control system 4monitors for a mode change (i.e., monitors for one or more conditions that would trigger a switch to the high heat pumping mode of operation according to, e.g., a predetermined mode control procedure). If no mode change is detected, the control system 4returns to step 11and continues. If there is a mode change, the control system 4returns to step 10and continues.

Ⅵ.Conclusions and implications

In some embodiments, a computer program including instructions which, when executed by at least one processor, causes the at least one processor to carry out the functionality of the control system 4according to any one of the embodiments described herein is provided. In some embodiments, a carrier containing the aforementioned computer program product is provided. The carrier is one of an electronic signal, an optical signal, a radio signal, or a computer readable storage medium.

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System Design On Dot Matrix Led Large Screen

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***Abstract*—In this paper, the design method of LED graphic display system is discussed. The design includes display circuit, display driver circuit and dynamic display circuit. The design of the host computer software system is also discussed.**

***Index-terms*—LED; Serial Communication; MCU; CPLD**

I. Introduction

LED is an important display of public information, in which, the large screen dot matrix LED is applied in many occasions. In this paper, a large, small screen are suitable for display control circuit by high-speed CPLD, dual port RAM and other technologies. In particular, combined with single chip microcomputer, CPLD and dual port RAM, the complex tasks is assigned to different hardware processing to meet the requirements of real-time.

II. The Principle And Characteristics Of Dot Matrix Led

Graphic and text information first is processed to corresponding digital video signal, which is transmitted to the LED display cache by digital communication system. Then, a display unit control circuit reads the corresponding display information to display[1]. The characteristics of dot matrix LED are as follows:

(1) In the overall design, more advanced distributed control (DCS) theory is used;
(2) In the local design, modular design is adopted;
(3) Advanced distributed scanning technology;
(4) High performance communication interface;
(5) Novel software design;
(6) Good visibility;
(7) Simple installation

III. Hardware System Design

(1) Display driver circuit design

The main part of the LED is the display dot matrix, row and column driving circuit. Modular design is used for screen body, the unit module of 128 x 32 size is designed, and the entire display screen is composed of these small modules combined with the expansion. In the control circuit, the dynamic array scanning drive mode is adopted to drive LED device, one controller per two lines controls to complete row and column drive of the entire display circuit[2]. The display driver circuit composed of 74HC595 (with 1/16 scan as an example) is shown in figure 1.

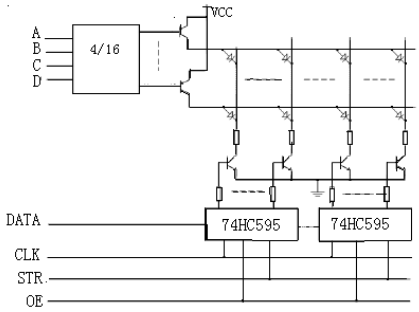

Figure1 LED driver circuit

74HC595 has the shift function of series in/ parallel output and parallel latch, which can can effectively solve the problem of data serial transmission and data display in time.

(2) Scan circuit design

The function of the scanning unit is mainly to copy the lattice information data of the display memory to the whole screen. In order to make the control unit and the scanning unit work in parallel, a dual port random access memory(RAM) CY7C132 is used as the display memory. In dual port RAM, one port is used as read output of the scanning unit, and the other port is used as update the input of control unit to the display information. The entire display screen is transverse cut into 12 scanning units, each scanning unit corresponding to the 3Kb display memory and are independent of the work.

Scanning unit outputs address signals (addr) from reading memory and read (RD) signal, but also outputs row address signal (add2-0) required by controlling display unit, data signal (data) point clock signal(CLK_1)and rows of data latch signal. The structure principle diagram as shown in figure 2

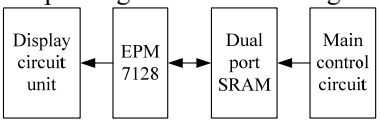

Figure 2. Scanning unit structure

(3) Communication circuit design

In this system, AT89C58 from ATEML company's microcontroller is used as slave computer, which serves as data processing, storage and communication. The PC sends dot matrix data representing the word or graphic to the microcontroller by the serial port, the microcontroller stores them in EEROM 28c64,then according to the

display requirements, microcontroller process these data and storage them at some specific address for scanning display by the scanning module[3].

Because of using the dual port RAM ,MCU storages the data collected to the dual port RAM, the DSP device take out the data from the dual port RAM to real-time operation, the data is stored in the dual port RAM after processing. MCU takes out the data from the dual port RAM to control the object or to communicate with the host computer.

In the communication interface design, the MAX485 interface chip from Maxim is adopted, which uses a single power supply +5V, rated current 300 uA and using half duplex communication mode. It can achieve TTL level conversion for RS-485 level. The level conversion diagram is shown in figure3.

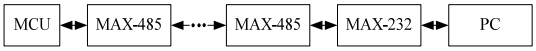

Figure 3 The level conversion diagram

IV. Software System Design

System software consists of two parts: the host computer software by VB6.0 and the slave computer by assembly language. Display control software is achieved by the MCU language, which consists of the main program and interrupt service program . The main program completes the necessary initialization work, and is responsible for display, read out data according to the requirements of the display, generate the control signal. Serial port interrupt service program solves the problem of communication with the host computer.

MCU software process as shown in figure 4.MCU first confirm that it is cold or hot start after power on, if it is cold start, a variety of signs and memory will be cleared in the initialization process, and set a variety of programmable control registers. If it is the hot start, it means that the main CPU is in interference and non normal working state, which is reset by the watchdog circuit and restart, in this case, the memory cannot be cleared, and should as far as possible to restore the previous state.

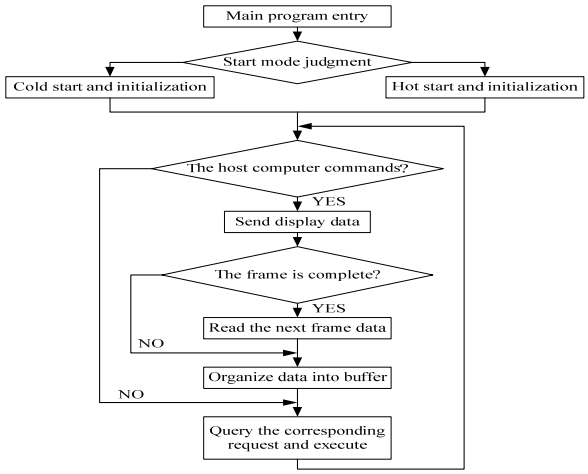

Figure 4 MCU software flow chart

MCU procedures after the system normal operation first query whether there is a storage display. If there is, the display data will be pulled to the dual port RAM memory for display. Because the amount of the display data is relative large, they should be displayed on page, so it is first determined whether the previous page of data is sent, if not , the data should continue to be put into buffer, if finished ,the next page of data should be read., In this cycle, the data sent by the PC is read into the display data buffer.

The communication program between PC and MCU is written in VB language, the communication protocol, data transmission format, transmission rate and working methods need be made in communication. The asynchronous receiver transmitter UART is used in PC serial communication. Its sending and receiving registers are 8 bits ,so the sending and receiving operations are only in bytes. In this system, the communication format is: baud rate 2400bps, eight bits of data, a stop bit, no parity, with ten bits of data consisting of a frame, it is determined whether the received data is correct by accumulation and verification[4].

V. Conclusion

In this paper, according to the actual application requirements, a LED display control system is completely designed. The drive, display, scan, control and communication circuit of the system are analyzed and designed in detail, which is basically in line with the expectation, and it is applied in practice. In this paper, the embedded structure is proposed, the system realized LED display module, by a dual port static RAM and double CPU sharing data, the realization of the rapid exchange of large amounts of data is one of the main features of this paper.

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Multi-user Detection Based on Adaptive Partial Systematic Resampling Particle Filter in Impulsive Noise

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***Abstract*—Sample degeneracy is a major problem of particle filter which is based on the sequential importance sampling. In order to solve this problem, the resampling algorithm is introduced in particle filter. Regular resampling algorithm can solve the sample degradation, but it easily lead to sample depletion and increase the computing complexity. This paper proposed adaptive partial systematic resampling particle filter for adaptive multi-user detection (MUD) in synchronous code division multiple access (CDMA) system. The adaptive partial systematic resampling algorithm adjusted the resampling time adaptively, before the resampling, classified the particles according to the weight, resampled in the minority particles, so it not only reduced the resampling time and increased the diversity of particle. The simulation result indicates that compared with standard particle filter it increases the particle filter performance and has a strong adaptability in non-Gaussian noise environment.**

***Index Terms*—particle filter, multi-user detection, adaptive partial systematic resampling, Non-Gaussian noise**

I. INTRODUCTION

Many advantages of CDMA technology has been reflected in the CDMA system. However, the system has many deficiencies. One of the drawbacks is that the spreading codes are not strictly orthogonal. Then it will cause mutual interference between different users. This interference is called multiple access interference (MAI). MAI has two main effects on the system. It will restrict system capacity and will produce the far-near effect. In order to eliminate MAI, in 1986, Verdu put forward optimum multiuser detection (MUD) algorithm [1]. Its performance can approach single-user receiver, but its complexity grows exponentially with the increase of the users' number. So this method can not be achieved in the project. Then many scholars put forward many different sub-optimal multi-user detection techniques, such as decorrelation detector and minimum mean square error (MMSE) detector [2]. Decorrelation detector can eliminate the multiple access interference completely, but it enlarges the noise power. MMSE detection algorithm is the improved algorithm for decorrelating detection, but MMSE detection algorithm can not completely eliminate MAI. In these algorithms, the background noise is assumed to be Gaussian white noise. In actual life, a lot of noises are non-Gaussian noise [3]. So the performances of these algorithms will reduce seriously in non-Gaussian noise environment. Multi-user detection technology still needs continuous improvement.

In 1993, N.J.Gordon put forward particle filter (PF) algorithm in the reference [4]. This technique can be applied to non-linear non-Gaussian system. In other words, the algorithm has a strong adaptability. In this paper, an improved algorithm, APSRPF, is applied to multi-user detection field. APSRPF overcomes the disadvantages of the standard particle filter. The new algorithm does not have particle degradation. This algorithm can significantly improve the performance of the system. This will be discussed in the following.

This paper is organized as follow: Section 2 includes the model of the CDMA system and the presentation of two kinds of non-Gaussian noises; the application of standard particle filter algorithm for multi-user detection is presented in Section 3; the application of adaptive partial systematic resampling particle filter algorithm for multi-user detection is presented in Section 4; Simulation results and conclusions are described in Section 5.

II. SYSTEM MODEL

A. CDMA SYSTEM MODEL

Consider a synchronous CDMA system with K users and symbol interval is T. The received signal is given by [4]:

$$\mathrm{r}(t)=\sum_{k=1}^{K}A_k(t)g_k(t)b_k(t)+n(t) \qquad (1)$$

Where A_k means the amplitude of the k-th user'ssignal; g_k means spread spectrum waveform of the k-th signal, and the value is ± 1; b_k means the k-th user's data, $\mathrm{b}_k=\{-1,+1\}$; n(t) is background noise.

The matched filter output y_k of the k-th user can be expressed as:

$$\begin{aligned} y_k &= \int_0^T r(t)g_k(t)dt \\ &= \int_0^T \left(\sum_{k=1}^{K}A_k(t)g_k(t)b_k(t)+n(t)\right)g_k(t)dt \end{aligned}$$

$$= A_k b_k + \sum_{\substack{i=1 \\ i \neq k}}^{K} \rho_{i,k} A_i b_i + \frac{1}{T}\int_0^{T_b} n(t) g_k(t) dt$$

$$= A_k b_k + MAI_k + z_k \quad (2)$$

$A_k b_k$ is the signal of the k-th user; MAI_k is multiple access interference (MAI); z_k is noise. In this formula, $\rho_{i,k}$ is the cross-correlation between the signature waveforms of the i-th user and the k-th user. It is defined as:

$$\rho_{i,k} = \frac{1}{T_b}\int_0^{T_b} g_k(t) g_i(t) dt \quad (3)$$

In order to simplify analysis, the received vector can be expressed as a vector-matrix form according to

$$y = RAb + z \quad (4)$$

$y = [y_1, y_2, \cdots, y_k]^T$ is the set of the output signals of matched filters. $b = [b_1, b_2, \cdots, b_k]^T$ is the users' date, R is a symmetric correlation matrix with $K \times K$ dimension ($\rho_{i,\ k} = \rho_{k,i}$). $A = diag(A_1, A_2, \cdots, A_k)$, it means the amplitude of the received signal which is a diagonal matrix. $z = [z_1, z_2, \cdots, z_k]^T$, it is a complex-valued vector with independent real and imaginary components and covariance matrix equal to $\sigma^2 R$.

R is a symmetric matrix, and Colicky factorization can be employed. There is a unique lower triangular matrix F such that $R = F^T F$ .We apply F^{-T} to formula (4), we can obtain [5] [6]

$$\bar{y} = F^{-T} y = F^{-T} FAb + F^{-T} z = FAb + \bar{z} \quad (5)$$

The covariance matrix of $\bar{z}$ is $\sigma^2 I$, where I is the identity matrix. Because the noise becomes independent and identically distributed , white noise. $\bar{y}$ is called the whitened matched filter output. Scalar expression of the received signal can be expressed as:

$$\overline{y_k} = \sum_{l=1}^{K} F_{k,l} a_l b_l + \overline{z_k} \quad (6)$$

The purpose of multi-user detection is to detect users' signals $b = \{b_1, b_2, \cdots, b_k\}$ from the output signals of the matched filter $y = [y_1, y_2, \cdots, y_k]^T$.

B. NON-GAUSSIAN NOISE SIMULATION

In order to simplify mathematical analysis, background noise is often assumed as Gaussian noise. when we analyze the system. Usually, this assumption is reasonable. However, in some natural and artificial resulting from the impact of impulsive ambient noise case, such as thunder and lightning, ice avalanches, all kinds of machine motors, neon signs, etc, does not have Gaussian nature[4]. This kind of noise shows significant peak amplitude, or "outliers" in the time domain. In order to prevent the detection performance decline under the "noise spikes". It is very necessary to establish a more accurate model than Gaussian model. The following briefly discusses two models of the non-Gaussian noise.

Firstly, introduce the Laplace noise which is one kind of non-Gaussian noise. Laplace probability density function (PDF) is expressed as [8]:

$$p(x) = \frac{1}{\sqrt{2\sigma^2}} \exp\left(-\sqrt{\frac{2}{\sigma^2}}|x|\right), \quad -\infty < x < +\infty$$

In the above formula, σ^2 parameter is variance or power of noise. Another form of expression:

$$f(x|\mu, b) = \frac{1}{2b}\exp\left(-\frac{|x-\mu|}{b}\right)$$

$$= \frac{1}{2b} * \begin{cases} \exp\left(\frac{x-\mu}{b}\right), \cdots\cdots if\,(x < \mu) \\ \exp\left(-\frac{x-\mu}{b}\right), \cdots\cdots if\,(x \geq \mu) \end{cases} \quad (8)$$

μ is the location parameter, b is the scale parameter. Laplace PDF has an obvious smearing. This is main difference between the Laplace PDF and the Gaussian PDF.

Secondly, discuss another kind of non-Gaussian noise, alpha stable noise. If the random variable X is subject to the Alpha stable distribution, then its characteristic function can be express as the following forms [9] [10]:

$$\phi(u) = \exp\left\{jau - \gamma|u|^{\alpha}\left[1 + j\beta\,\mathrm{sgn}(u)\omega(u,\alpha)\right]\right\}, \quad -1 < \beta < 1 \quad (9)$$

$$\omega(u,\alpha) = \begin{cases} \tan(\pi\alpha/2), \cdots, \alpha \neq 1 \\ (2/\pi)\log|u|, \cdots, \alpha = 1 \end{cases} \quad (10)$$

$$\mathrm{sgn}(u) = \begin{cases} 1, \cdots\cdots u > 0 \\ 0, \cdots\cdots u = 0 \\ -1, \cdots u < 0 \end{cases} \quad (11)$$

In the above formulas, $\alpha \in (0,2]$ is characteristic index, which determines the degree of the distribution pulse characteristics. α is smaller, the trailing is more thick, and then the pulse characteristics is more obvious. When $\alpha = 2$, this distribution is as same as the Gaussian distribution which its mean is a and variance is $2\sigma^2$. When $0 < \alpha < 2$, this distribution is named fractional lower order Alpha stable distribution. β is called symmetry parameter which can control the

gradient of the distribution. If $\beta = 0$, is it called symmetric α -stable distribution , denoted as $S\alpha S$. When $\alpha = 1$ and $\beta = 0$, this distribution becomes Cauchy distribution. a is location parameter. For the $S\alpha S$ distribution, when $1 < \alpha \le 2$, a is mean. When $0 < \alpha \le 1$, a is mid-value. γ is called scattering coefficients. It is dispersion measure about the samples relative to the mean, similar to the variance of the Gaussian distribution. The noise power can be expressed approximately as 2γ , but 2γ is not equal completely to the true noise power. Signal to Noise Ratio (SNR) can be expresses as: $SNR = S / 2\gamma$ (S is the signal power). When $a = 0$ and $\gamma = 1$, this distribution is called standard α -stable distribution.

III. MULTI-USER DETECTION BASED ON STANDARD PARTICLE FILTER ALGORITHM

Particle filter is a Monte Carlo method which is based on Bayesian theory. Its core idea is that using some of samples and the corresponding weights to express the posterior probability density function, and then the estimated value of the state can be obtained by the posterior probability density function. If the samples are sampled from the posterior probability distribution $p(b_{1:k} \mid \bar{y}_{1:k})$, each sample has the same weight. However, in practice, $p(b_{1:k} \mid \bar{y}_{1:k})$ does not have a typical solution. So the sampling process is very difficult to achieve. The particles are often obtained from an importance density function $q(b_{1:k} \mid \bar{y}_{1:k})$. The weights of particles are defined to be [11] [12] [13]:

$$\omega_k^i \propto \frac{p(x_{1:k}^i \mid \bar{y}_{1:k})}{q(x_{1:k}^i \mid \bar{y}_{1:k})} \quad i = 1, \cdots, N_S \tag{12}$$

The importance density function can be decomposed into:

$$q(x_{1:k} \mid \bar{y}_{1:k}) = q(x_k \mid x_{1:k-1}, \bar{y}_{1:k}) q(x_{1:k-1} \mid \bar{y}_{1:k-1}) \tag{13}$$

The posteriori probability density function is expressed as:

$$p\ (x_{1:k} \mid \bar{y}_{1:k}) = \frac{p(\bar{y}_k \mid x_{1:k}, \bar{y}_{1:k-1}) p(x_{1:k} \mid \bar{y}_{1:k-1})}{p(\bar{y}_k \mid \bar{y}_{1:k-1})}$$

$$= \frac{p(\bar{y}_k \mid x_{1:k}, \bar{y}_{1:k-1}) p(x_k \mid x_{1:k-1}, \bar{y}_{1:k-1})}{p(\bar{y}_k \mid \bar{y}_{1:k-1})} p(x_{1:k-1} \mid \bar{y}_{1:k-1})$$

$$= \frac{p(\bar{y}_k \mid x_k) p(x_k \mid x_{k-1})}{p(\bar{y}_k \mid \bar{y}_{1:k-1})} p(x_{1:k-1} \mid \bar{y}_{1:k-1})$$

$$\propto p(\bar{y}_k \mid x_k) p(x_k \mid x_{k-1}) p(x_{1:k-1} \mid \bar{y}_{1:k-1}) \tag{14}$$

By substituting (14) with (12) and (13), we can obtain the importance weights updated formula:

$$\omega_k^i \propto \frac{p(\bar{y}_k \mid x_k^i) p(x_k^i \mid x_{k-1}^i) p(x_{1:k-1}^i \mid \bar{y}_{1:k-1})}{q(x_k^i \mid x_{k-1}^i, \bar{y}_{1:k}) q(x_{1:k-1}^i \mid \bar{y}_{1:k-1})}$$

$$= \omega_{k-1}^i \frac{p(\bar{y}_k \mid x_k^i) p(x_k^i \mid x_{k-1}^i)}{q(x_k^i \mid x_{1:k-1}^i, \bar{y}_{1:k})} \tag{15}$$

The standard particle filter algorithm chooses a priori probability density function which is the most easy to achieve as the important density function.

$$q(x_k^i \mid x_{1:k-1}^i, \bar{y}_{1:k}) = p(x_k^i \mid x_{k-1}^i) \tag{16}$$

By substituting (15) with (16), the formula is simplified as:

$$\omega_k^i \propto \omega_{k-1}^i p(\bar{y}_k \mid x_k^i) \tag{17}$$

Normalize the weights:

$$\omega_k^i = \omega_k^i / \sum_{i=1}^{N_s} \omega_k^i \tag{18}$$

The posterior probability density function of states can be obtained from the generated particles and the corresponding weights. For example, the marginalized posterior probability density function $p(x_k \mid \bar{y}_{1:k})$ can be expressed as [12]:

$$p(x_k \mid \bar{y}_{1:K}) \approx \sum_{i=1}^{N_s} \omega_K^i \delta(x_k - x_k^i) \tag{19}$$

Two vectors are defined, $x_k = \left[x_k^1, x_k^2, \cdots, x_k^{N_s}\right]^T$, $\omega_k = \left[\omega_k^1, \omega_k^2, \cdots, \omega_k^{N_s}\right]^T$. According to the Maximum A Posterior (MAP) rule, we have:

$$b_k = sign(x_k^T \omega_k) \tag{20}$$

A major problem of the particle filter is that the variance of weights will be random increase with the increase of iteration times. In other words, all the particles except for a very few are assigned negligible weights. The result is that a lot of calculation is wasted in the particles whose contribution to the approximation to $p(x_k|\bar{y}_{1:k})$ is almost zero. Eventually, it will lead to the particles set can not express the actual posterior distribution. This problem is called particle degradation. In order to solve degeneration problem, resampling technique was introduced in this chapter [13].

The basic idea of resampling is that sample N_s times from the posterior probability density function $p(x_k|\bar{y}_{1:K}) \approx \sum_{i=1}^{N_s} \omega_K^i \delta(x_k - x_k^i)$ to produce a new particles set $\{x_k^{i^*}\}_{i^*=1}^{N_s}$. Since resampling is independent with the same distribution, the weight of each particle is set to be $\omega_k^j = 1/N_s$.

We have no need to resample at every moment. A suitable measure of degeneracy of the algorithm is the effective sample size N_{eff} defined as:

$$N_{eff} = round(1/\sum_{i=1}^{N_s}(\omega_k^i)^2) \tag{21}$$

Then we set a threshold $N_{threshold}$. If $N_{eff} < N_{threshold}$, resample. As a result, the complexity of the algorithm can be reduced to a certain extent.

In summary, the steps of multiuser detection based on standard particle filter are as followings [13]:

Step 1: Sample for the k-th user, making $x_k^i \sim q(x_k|x_{1:k-1}^i, \bar{y}_{1:k})$.

Step 2: Calculate the weights of the particles according to (15).

Step 3: Normalize the weights according to (18).

Step 4: Resample for the particles.

Step 5: According to (20) to estimate the signals of the k-th user.

Step 6: Turn to step1, and estimate the signals of the next user.

4. MULTI-USER DETECTION BASED ON ADAPTIVE PARTIAL SYSTEMATIC RESAMPLING PARTICLE FILTER

The main idea of partial resampling is: particles are divided into two sections, which include moderate weight particles and weights larger or smaller particles, according to the size of the weights. Moderate weight particles which are usually considered to be relatively stable don't need resampling, so resampling just take place in weights larger and smaller particles.

Set two weight thresholds: ω_1, ω_2 ($0 < \omega_1 < \omega_2$). According to them, particles are divided two sections:

Part A: $\{x_k^j, \omega_k^j\}^{N_{12}}, \omega_k^j > \omega_2 or \omega_k^j < \omega_1$

Part B: $\{x_k^j, \omega_k^j\}^{N-N_{12}}, \omega_1 < \omega_k^j < \omega_2$

N_{12} represents the number of particles in Part A that need to resampling, because of unstable particle weight. Particles in Part B are so stable that they don't need resampling. After resampling in Part A, Part A and Part B are constituted a new set of particles.

Weight threshold size selection for resampling algorithm computing time, particle diversity and particle filter's performance is critical. If the threshold is too large, not only the number of particles elected resampling becomes large but also increasing the calculation time. If the threshold is too small, it will reduce the number of resampled particles and decrease particle filter's performance. List the weight threshold values:

$$\omega_2 = [\frac{2}{N}, \frac{5}{N}, \frac{10}{N}] \quad \omega_1 = [\frac{1}{2N}, \frac{1}{5N}, \frac{1}{10N}]$$

Because only a small number of particles participate in the resampling, partial resampling accelerate the time of resampling, reduce the complexity of calculation. It also can increase the diversity of particles through controling the weight thresholds, ease the degradation of the particles.

The effective number of particles can be used to measure the degree of degradation of the particle weight, before resampling to calculate N_{eff}, according to N_{eff} to determine whether resampling, Part A that need for resampling use the system resampling.

In summary, the steps of multi-user detection based on adaptive partial systematic resampling particle filter are as follows:

Step 1: Sample for the k state, making $x_k^i \sim q(x_k|x_{1:k-1}^i, \bar{y}_{1:k})$.

Step 2: According to formula (15) to calculate the weights of the particles.

Step 3: Normalize the weights according to formula (18).

Step 4:If $N_{eff} < N_\varepsilon$, particles are divided into Part A and Part B according to ω_1, ω_2 ($0 < \omega_1 < \omega_2$). After systematic resampling in Part A, Part A and Part B are constituted a new set of particles.

Step 5: According to (20) to estimate the signals of the k-th user.

Step 6: Turn to step1, and estimate the signals of the next state.

5. SIMULATION RESULTS AND CONCLUSIONS

Analyze the performance of the multiuser detection based on adaptive partial systematic resampling particle filter algorithm by simulation. Consider a synchronous CDMA system with 5 users, 40000 information bits, 31-bit gold spread-spectrum code and the user power partial value is 10. Channel noises include Gaussian noise, Laplace noise and Alpha stable noise. Three kinds of noise variance are all 2, and Alpha stable noise parameters: $\alpha = 1.8$, $\beta = 0$, $\gamma = 1$, $a = 0$. The range of signal to noise ratio (SNR) for all users is -4~10 dB. Set N=200,tf=200.

Figure1: Under the same conditions, the signals are interfered by Gaussian noise. We can find that the performance of the APSRPF algorithm is better than the PF algorithm. APSRPF algorithm can obviously improve the performance of the system.

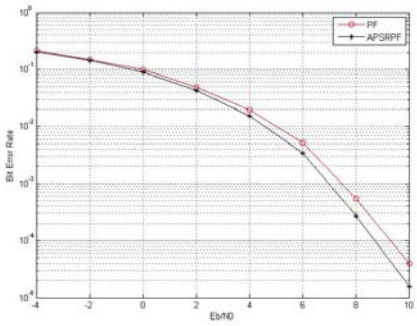

Figure 1. The BER of PF detection and APSRPF detection

Figure2: This figure analyzes the bit error rate performance of GPF detection aiming to Gaussian noise, Laplace noise and Alpha stable noise. It can be seen that the bit error rate performance of the Gaussian noises and the Laplace noise are almost the same. The bit error rate performance of the Alpha stable noises slightly weakened, as the true power of the Alpha stable noise is not 2γ . But, in the simulation, we assume its power is 2γ . This new algorithm has a strong adaptability in non-Gaussian noise environment.

All in all, the research results have important reference value for the research of MUD system.

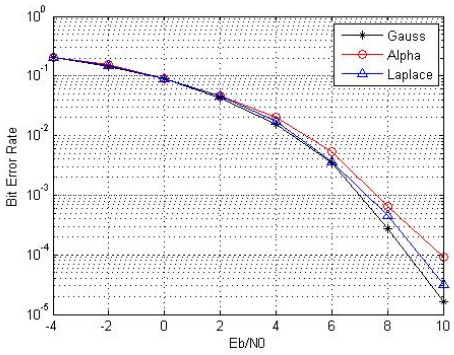

Figure 2. BER of APSR detection under three kinds of noise

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Thoughts on the Comparative Studies of National Defense Education in Chinese and American Colleges

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***Abstract*—Compare the major characteristics of national defense education in Chinese and American colleges and learn from American national defense education to shed new lights on improving the effectiveness of national defense education in Chinese colleges.**

***Index Terms*—Comparison between China and America, college, national defense education**

As peace and development are becoming the theme of the times and economic progress a high priority of Chinese modernization, the presence of wars is being forgotten and the significance of national defense education is being ignored. It's today's colleges that take their due responsibilities to improve all-round development of students as major fronts of educating outstanding young peoples; however, with the pressure of employment faced by Chinese college students intensifying in recent years, many colleges are focusing more on improving students' vocational qualities—education of professional knowledge. As a result, they are losing the proper understanding about the essence and nature of national defense education in colleges.

Meanwhile, national defense education has been highly valued worldwide, especially in developed countries. Therefore, it is of great significance to carry out the comparative studies on national defense education in Chinese and American colleges and draw experiences from it.

I. Major features of national defense education in American colleges

Implementing national defense education through legislation A complete legal system and organization form are required to capitalize the institutionalization and normalization of national defense education and legislation is a must to promote national defense education. As early as 8th B.C., Spartan, a polis in Ancient Greece, enacted the world's first law related to national defense education. Back to 1916, with the National Defense Act passed in US, cultivating military personnel through college education was nailed down by legislation. In 1950s, Soviet Union launched the first-ever artificial satellite, which catalyzed a national sense of unease in US. In order to gain upper hand in the Cold War, US made vigorous efforts to promote education, science and technology and talents cultivation to surpass Soviet Union. It was until then that national defense education was included into American legal system and the role of national defense education in colleges was given full play under the influence of laws. The American National Defense Act enacted in 1958 clearly determined the target, purpose, task, contents, forms, institutions and expenditure of national defense education. Many basic and technological subjects were closely linked with national defense education and proficient financial support was secured, ensuring that the law to enhance students' awareness of national defense and to improve their overall qualities was enforced strictly. Therefore, When the National Defense Education Act was signed into law, the then American president Eisenhower pointed out clearly ," This act... will in that time do much to strengthen or American system of education so that it can meet the broad and increasing demands imposed upon it by considerations of basic national security."

The National Defense Education Act is highly practical and operational. It provided US national defense with technological support and specific defense personnel, drawing on strength of both national defense and education. It contains 10 titles and 52 subsections. Title I of the NDEA serves as an introduction to the content and purposes of the Act. Title II authorizes the provision of grant loans for students. Title III provides financial assistance for the purposes of strengthening natural science, math, modern foreign languages and other key subjects. Title IV provides funding for graduate fellowships. Title V not only gives instruction and consultation but also tests, encourages, and identifies gifted students. Title VI serves for language progress. It provides fellowship for urgently needed postgraduates major in foreign languages. Title VII is to ensure the more effective use of television, radio, film and other educational media for studies and researches. Title VIII is a regional plan for vocational education. It pours 60 million dollars of grant funds for each state to implement the drafted plan of vocational education for young people who never attended colleges to meet the demand of national defense for professional personnel in domains critical to scientific and technological advance .Title IX contains the detailed regulations of the Act.

III. Fortifying national defense by integrating national defense education with other kinds of education

The contents of American national defense education are systematic, aimed at improving the literacy, military training and sports ability as well as ethical and spiritual quality of students. The American government believes that economic progress and technological advance are barely enough for protecting the national interests and it's essential to strengthen the spirit of American people. Every citizen should be aware of their duty to serve the country and spiritually motivated amid the material prosperity so that no unhealthy social atmosphere will harness the national interests. In addition, with government's efforts, colleges value natural science, teaching and foreign languages as key subjects and

include sport items related to military practice into national defense education. The advantages of subjects linked with national defense education to some degree such as history, geography, pure natural science are also fully leveraged. Consequently, desirable results are achieved once the realistic and potential influence of those subjects on national defense has been recognized.

The American government also highlights the cultivation of national defense personnel, emphasizes the national defense education to teenagers, and regards the organization of teenager's military training as the main method to enforce the national defense education. The military training of American students is mainly charged by The Reserve Officers Training Corps (shorten form as ROTC). The American army has set up all sorts of ROTC all together 531, among which, the number of ground force, air force, and navy accounts is 315,153,63 respectively. It aims to let teenagers accept the necessary military training to meet the qualification of a second lieutenant when they finish the preliminary studies. The training hour of the ROTC is usually 3 to 4 hours every week with another 6-week assembling training. There are a four-year and a two-year term in the school system of the ROTC. The students participating in the ROTC can get the tuition and fees offered by the army; besides, it provides the scholarship and subsidy for the third and fourth grade students. Those who gain good military grades and accept to take the active service at least for 4 years or the reserves at least for 6 years are awarded with the scholarship. The American government attaches great importance to the military training of college students, contributing greatly to educating young, knowledgeable and modern personnel for the American army. With the reputation of 'the military officer college in universities', the ROTC is highly valued especially in improving the national defense education and cultivating the national defense personnel. Meanwhile, the American government also sets the course named the Common Sense of the Nuclear War and invites many nuclear experts, physics professors and experts of national defense issues to preside over the lecture of 'The nuclear war'. Moreover, in the state-held summer camps, the government organizes students to experience the military life and learn the knowledge of navigation, aviation and aerospace so that the teenagers can get the whole picture of the modern military science and technology. "Challenger", the American aerospace plane which exploded during launching in Jan.28th, 1986, besides the routine task of satellite launching experiment, also carried a female professor to give the lecture in the aerospace. This action, initiated by the President Reagan aimed to bring teenagers into the modern science education related to the national defense as early as possible, to invoke their interest and to cultivate a strong, young and highly specialized generation of national defense personnel.

The Americans believe in nurturing nationals in a sound cultural atmosphere to enhance the national solidarity and cohesion. The American government and the private organizations has put large sum of money and energy to spread the American spirit and the American culture. For example, apart from the proper infiltration form professional educational organizations such as public and private schools as well as the educational department, they also use all sorts of cultural tools to make the culture deeply rooted in people's hearts including opera, music, literature works etc. According to the statistics, the official American media broadcast more than 350 TV programs related to the national defense and publish 200 plus magazines of the same kind annually. The world-class film factory Hollywood produces a great deal of blockbusters to advocate The American Spirit, such as the Dependence Day, the pearl Port, the Patriot etc. Some scholars claim that reflecting 70-year history of the Oscar award is just like reviewing the history of the American spirit. In order to fully tap into the cultural resources, many cities, streets, forests, graves, companies, airports, and schools are named after celebrities by the US government. For instance, in Washington there are The Washington Monument, Lincoln Memorial, Jefferson Memorial, Roosevelt Memorial and Kennedy Cultural Center. Each of 50 American states has the cities or counties named after the president, which influence, encourage and inspire the American people permanently.

The American grasp opportunities well and they methodically arrange contents of the national defense into important festivals and memorial days. According to the incomplete statistics, there are 63 famous festivals and memorial days in the whole nation and the American government takes these advantageous opportunities to endow the national defense education to all people in the country. For instance, they take the day when Japanese attacked on the pearl harbor 'America Remembers', on which memorial activities are held to remind people of the danger in stability. Besides, they determine the third Saturday in May of each year as The Day of The Armed Forces Corps and the week from the second Saturday to the third in May as The Week of The Armed Forces Corps' during which the government hold displays of the modern weapons and facilities, military parades, receptions and flight shows to enhance common people's understanding and respects to the calling of national defense and the Armed Forces Corps. The American government not only merges the national defense education in all kinds of festivals and ceremonies but also skillfully combine he national defense education with soldier conscription and recruitment. They demonstrates modern weapons and the favorable material benefits to young people in the general review of recruitment and other introductory documents as well as the advantages of being a soldier such as traveling around the world , opening up their horizon and increasing their knowledge and the like to enroll young people. They give some instant national defense education on some specific events as well. For example, on the first anniversary of 911, tens of thousands of the American held the memorial activities to mourn the innocent dead before the ruins of World Trade Center in New York.

III. Main Features of the National Defense Education in Chinese Colleges and Universities

After the foundation of China, with the settlement and improvement of the national defense education system of our country, our government has created the system including Constitution, National Defense Law, Conscription Law, Law on protecting the military facilities, Law of officers on reserve service, The Civil Air Defense Law, National Defense Education Act. Even in the Educational Law of the PRC, the government make the clear preliminary about giving the national defense education to learners. "The central committee of the communist party of China, the state council on deepening education reform, fully implementing quality education decision" requires the colleges to 'give the standard national defense education, to enhance students'

national safety consciousness, and continue to the military training thus making it institutionalization.'

The settlement of our country's national defense education and law system is relatively late. It is until the ninth session of the standing committee of the National People's Congress in April, 2001, the National Defense Education Law of the PRC was approved, and the national defense education of schools could be implemented and deepened. But the virtual parts of the contents of the national defense education are more than the real one foe lack of supervision, consequently, it just becomes the supplement of the moral education. Some colleges don't value much on the national defense education, and they often don't open or open the military courses according to the requisites taking use of the excuse such as ' There is no enough time for the compulsory courses'

At present, contents of national defense education in most colleges and universities are basically military training and teaching of military theory, while the military training remains at the level of formation training and housekeeping, further training such as guns usage and shooting exercise of firearms is extremely rare.

Studies find that more than eighty percent undergraduates haven't touched guns or performed target shooting in their military classes. Most colleges and universities have the course of military theory, which is under the regulated class requirement of syllabus of military theory course, while there are some occasions that a few schools can not meet the class requirement, or play formalism even don't run this course.

Some common national defense education regular activities, such as visiting patriotism education bases, one day in camp, shooting and so on are only carried out to a certain extent in some schools, and many schools basically have no such activities. Research indicates that more that seventy-five percent undergraduates haven't participated in military defense education practical activities in school. Leaders of some schools don't pay much attention to it, and subjectively think learning professional knowledge is more important for undergraduates in peacetime, therefore the military defense education is insufficient. Shortage of teaching expenditure is the key obstacle of the sound atmosphere of military defense education.

At the same time, the organizational form of military defense education in Chinese colleges and university is simple and rough. This education is organized and implemented by the hands of local universities by military training for freshmen, attending military theory course and other forms of education campaign. Military defense education in many colleges lack the necessary organizational guarantee and general universities basically have no relevant organizations, except some key universities with military teaching and research sectors.

However there isn't united teaching material under the current outline, so the textbooks they use are different. This course is mainly packed in the first year and don't have united regulation for class periods. Students attend this class together in large amount and can only learn some basic knowledge of military, while the learning of military knowledge and military training is just an auxiliary training mode, which shows the big gap compared with America. Besides, there is a significant difference between local colleges and the Reserve Officers Training Corps in America in the way of military education because in America, the study of military knowledge and training is conducted in relevant military academies, after students join the army.

IV. Reflections of Comparative Research about Military Education in Regular Colleges in China and the United States

With long ─ run strategic sight, the United States endeavors to make laws effective in ensuring the important place of military defense education in colleges and the impact of its effective implementation. However, in our country, although National Defense Education Act has some relevant regulations for military defense education, there is no detailed regulation in how to carry out national defense education, how to design military defense education courses and how to bring military training activities into force and so on.

Meanwhile, because weakness of legal concept and lack of financial support, the military defense education in regular colleges gradually move towards regulation in recent years, but not yet to the standard of ensuring the laws are observed. As a result, we can mirror the United States and use strong legislation and feasible law enforcement to guarantee the effective implementation of military defense course in colleges. If necessary, we should stipulate the class period, credit hour, teaching content and implementing measures in the form of law and regulation so as to ensure the quality and effect of this course in colleges and universities.

Military defense education in the United States lies in various kinds of educations, not only in the ways of propaganda and implant of military knowledge, but the most important part is to combine the teaching of military defense and natural and social sciences. We should study the advantages of curriculum provision of military defense education in the American style, construct diversified teaching pattern in curriculum construction. We must put effort in the content and form of military defense education, actively explore teaching methods of military defense education under the new form, ensure the blend of military defense education in every step of school education teaching work, master modern teaching ways, function multimedia and network, create vivid military defense education atmosphere, make it an organic component of regular colleges education and infiltrate it into every part of school education.

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Computational Hydrodynamic Modeling of the Vertical Axis Current Turbine

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***Abstract*—The device is designed to extract tidal energy when working in the shallow water. The turbine has a rotor with a diameter of 30 meters; three vertical blades of 3 meters span with a 1 m chord airfoil. The rotor frequency is 0.05 Hz with a wide range current speed. The analysis model based on Double Multiple Steam tube, have been developed to predict the steady and dynamic performances with fixed or self-acting variable pitch straight-blades. With the aid of Mathcad computational program, the hydrodynamic analysis of the VACT is given by using the Blade element theory and Momentum theory. In the program, a Double-Multiple Stream tube Model is developed for analysis each stream tube. A theoretical analysis and a numerical prediction of the turbine performances as well as comparison with the experimental test results on the model turbine will be presented and discussed.**

***Index Terms*—Hydrodynamic Modeling, Double-multiple stream tube, Vertical Axis Current Turbine, Computational modeling**

I. Introduction

Based on the methods and theories the hydrodynamic analysis of the VACT is given by using the Blade element theory and Momentum theory with the aid of Mathcad computational program. The crucial task in this part is programming the iterative procedure of calculating the induced factors and other blade variables. The numerical predictions for the performance of the device are presented. Some preliminary performance results are presented and discussed base the aim of enhancing the power coefficient.

II. Outline of the Program

Figure 1 shows that the whole VACT analysis is divided into four main stages in the Mathcad program.

The first is stream tubes Geometry. After input the turbine's parameters and give assumed induction factors, which are crucial to work out the Stream tubes geometry.

The second stage is Iterative procedure. Due to the equation is not enough to get the result, a guessed initial value must be given for the unknown factors, and then define a loop to get the new value to put it in the loop again. The equations in the iterative procedure are based on the basic concepts stated in the last chapter and the relationship between Momentum theory and Blade element theory.

The next stage is sorting the results which are acquired from the Stage Two. The final result from the iterative procedure is a large matrix, but the solution is well arranged in different rows and columns, which means any variable and its values can be got according to call the specific rows and columns.

Finally, the torque, thrust and power can be easily calculated with the results which can be got from the iterative matrix.

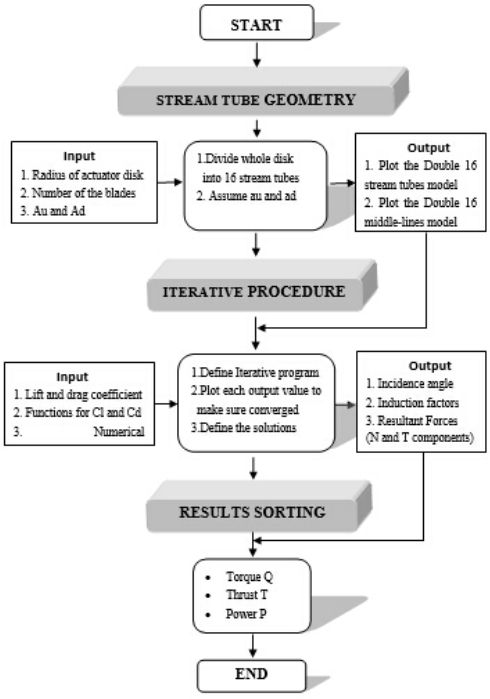

FIGURE 1. Outline of the Computational Program.
The details of each step are described in the following headings.

III. Input Working Conditions and VACT Parameters

The VACTs normally are suitable for works in the mild and shallow water. The parameters which are the values as used in the program are given in the Table 1.

TABLE I.
Parameters of the VACT

Parameters		Values	Unit
Fluid density	ρ	1.25	kg/m^3
Flow Speed	U	1-25	m/s
Radius	R	15	m
Rotor frequency	f	0.8	Hz
Chord length	C	0.1	m
Number of blades	Nb	3	-

Because the VACT works in the different speed current, it is necessary to know its working characteristics under each speed range. Therefore an array is used to define the variable current velocity. Particularly, the minimum flow speed is 1m/s, and maximum is 25m/s. The velocity space is 2m/s. Therefore a speed array with the definition equation is,

$$U_{\infty iu} := U_{\min} + (iu - 1) \cdot \Delta U \tag{1}$$

There are 13 velocity values and are ranked from low to high.

IV. Stream Tube Geometry and Modelling

A. Division of the stream tubes

The model type is determined in the previous chapter--double-multiple stream tube model. Based on the particular characteristic, stream tube geometry is worked out. It is the first and most crucial stage.

The idea to divide the stream tube is according to the equal length in the atmospheric level. That means divide the La into several parts, which determine the position of each stream tube in the atmospheric level.

In this program, La is divided into 16 components. Each component La' is La/16.

B. Assume au and ad

The induction factors au and ad are unknown but the whole modelling stage and calculation stage are all need these two value. Therefore, a guess value is defined in the bottom of the program. These two values are defined with Global definition sign which will be taken in the whole program, and changed when get the new values.

$$\mathrm{a}_u \equiv 0.14 \qquad a_d \equiv 0.1 \tag{2}$$

C. Plot Double-multiple stream tube model

Now the stream tubes position and au and ad are determined, it's possible to determine the coordinate of each stream tube.

Firstly define the number of the coordinate (jx) and number of stream tubes (js).

$$Nx := 1000 \qquad jx := 1..Nx \tag{3}$$

$$Ns1 := \frac{Ns}{2} \qquad js := 1..Ns1 \tag{4}$$

Ns is the whole stream tubes number, equal 16 in this program. Get the maximum β angle according to the sum of the incidence angle.

$$\gamma_{js} := \sum_{V=1}^{js} \Delta\gamma_{js} \tag{5}$$

$$\max\beta_u := \frac{\pi}{2} - (\gamma \frac{Ns}{2}) \tag{6}$$

Then, define an actuator disk which radius is 15m with the circle function.

Up-circle disk function:

$$c1_{js,jx} := \sqrt{(R)^2 - (x_{jx})^2} \tag{7}$$

Down-circle disk function:

$$c2_{js,jx} := \sqrt{(R)^2 - (x_{jx})^2} \tag{8}$$

Separately define the stream tubes lines in the up-circle and down-circle,

$$y1_{js,jx} := \tan(\gamma_{js})((x_{jx} - x1_{js})) + \sqrt{(\frac{js}{Ns1} \cdot R)^2 - (x1_{js})^2} \tag{9}$$

$$y2_{js,jx} := \tan(-\gamma_{js})((x_{jx} - x1_{js})) - \sqrt{(\frac{js}{Ns1} \cdot R)^2 - (x1_{js})^2} \tag{10}$$

Assume that at a point somewhere in the disk between the disks the static pressure rises through the atmospheric level and this is a straight line goes through each stream tube. The function of the lines in the atmospheric are defined as:

$$k1_{jx1} := \tan(\max\beta_u) \cdot x_{jx1} \tag{11}$$

$$k2_{jx1} := \tan(-\max\beta_u) \cdot x_{jx1} \tag{12}$$

Lastly add a middle line between the up-circle disk and down-circle disk.

$$k_{jx} := 0 \tag{13}$$

As shown in Figure 2, select the proper X, Y range in the box, and set the stream tubes lines type is "Draw", plot of stream tubes in the X-Y coordinate system is given.

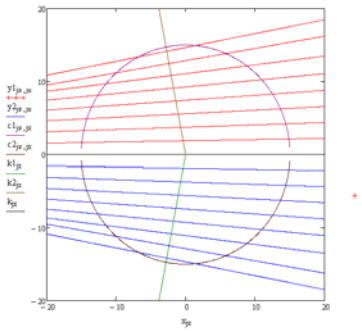

FIGURE2. Plot of stream tubes

Then define the middle line of each stream tube in the up-circle and down-circle. Both of the incline angles of the two stream tube linesss which are besides the middle line are γ1, and others can be described as $\gamma_{js1} + \gamma_{js} - 1$.sss

The functions of middle lines in up-circle are:

$$y3_{1,jx} := \tan(\gamma_1)(x_{jx} - \frac{x1_1}{2}) + \frac{\sqrt{(\frac{1}{NS1} \cdot R)^2 - (x1_1)^2}}{2} \tag{14}$$

$$y3_{js1,jx} := \tan(\gamma_{js1} + \gamma_{js1-1})(x_{jx} - \frac{x1_{js1} + x1_{js1-1}}{2}) + \frac{\sqrt{(\frac{js1}{NS1} \cdot R)^2 - (x1_{js1})^2} + \sqrt{(\frac{js1-1}{NS1} \cdot R)^2 - (x1_{js1} - 1)^2}}{2} \tag{15}$$

The functions of middle lines in down-circle are:

$$y4_{1,jx} := \tan[-(\gamma_1)](x_{jx} - \frac{x1_1}{2}) + \frac{\sqrt{(\frac{1}{NS1} \cdot R)^2 - (x1_1)^2}}{2} \tag{16}$$

$$y4_{js1,jx} := \tan[-(\gamma_{js1}+\gamma_{js1-1})](x_{jx}-\frac{x1_{js1}+x1_{js1-1}}{2})- \frac{\sqrt{(\frac{js1}{NS1}\cdot R)^2-(x1_{js1})^2}+\sqrt{(\frac{js1-1}{NS1}\cdot R)^2-(x1_{js1}-1)^2}}{2} \quad (17)$$

Now, the middle lines of the stream tubes can be plotted in the X-Y coordinate system. As shown in the Figure 3, select the proper X and Y range in the box, and set the stream tubes lines type is “Draw”.

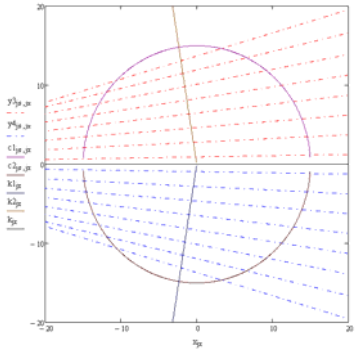

FIGURE3. Plot of middle lines

V. FORCES ON THE BLADES

A. Lift and drag forces

First of all, input the blade lift and drag coefficients in the Mathcad program. Get the specific blade lift and drag coefficients data is obtained from specific tests. There are 23 values of lift and drag coefficients varies with the alpha angles.

$A_{ia}:=$	$CD_{ia}:=$	$CL_{ia}:=$
−180 · deg	0.1	0.0
−170 · deg	0.1	0.8
−135 · deg	1.2	0.3
−105 · deg	1.9	−0.1
−95 · deg	2	−0.2
−85 · deg	1.9	−0.3
−70 · deg	1.6	−0.5
−40 · deg	0.6	−0.8
−30 · deg	0.3	−0.8
−22 · deg	0.1	−0.8
−18 · deg	0.03	−1.0
−5 · deg	0.02	0
8 · deg	0.03	1.3
12 · deg	0.1	1.1
20 · deg	0.3	1.0
30 · deg	0.6	0.8
60 · deg	1.6	0.5
75 · deg	1.9	0.3
85 · deg	2	0.2
95 · deg	1.9	0.1
135 · deg	1.2	−0.2
170 · deg	0.1	−0.8
180 · deg	0.1	0

The plot of the lift and drag coefficients are shown in the Figure 4 and Figure 5.

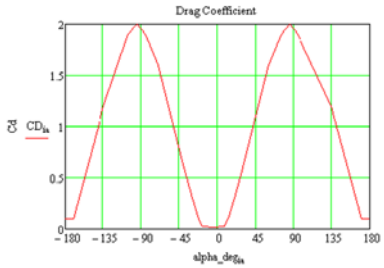

FIGURE4. Plot of drag coefficients

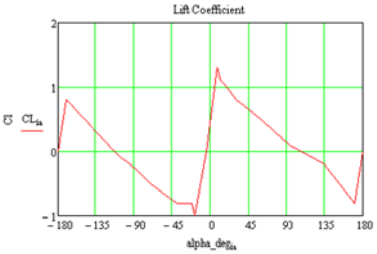

FIGURE5. Plot of lift coefficients

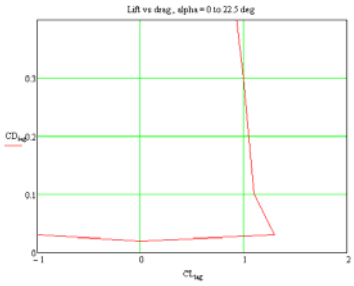

FIGURE6. Plot of the “lift vs. drag” coefficients

In Figure 6, a sudden increase in drag can be seen after the peek lift occurs.

Then, define functions for Cl & Cd.

The function to return an angle between -180 and 180 degrees is:

$$OPT(\alpha) := [2\cdot\pi\cdot(\frac{\alpha+\pi}{2\cdot\pi}-floor(\frac{\alpha+\pi}{2\cdot\pi}))]-\pi \quad (18)$$

The functions for Cl and Cd is defined with “linterp” function:

$$C_l(\alpha) := l\,\mathrm{int}\,erp(A,CL,OPT(\alpha)) \quad (19)$$

$$C_d(\alpha) := l\,\mathrm{int}\,erp(A,CL,OPT(\alpha)) \quad (20)$$

Finally, lift and drag force can be obtained from the equations:

$$L_{ia} := CL_{ia}\cdot\frac{1}{2}\cdot\rho_f\cdot U_\infty{}^2\cdot L_{chord} \quad (21)$$

$$D_{ia} := CD_{ia}\cdot\frac{1}{2}\cdot\rho_f\cdot U_\infty{}^2\cdot L_{chord} \quad (22)$$

B. Normal and chord wise components

According to the Blade element theory, the forces resolved into the local stream wise sense,

$$F = (L\cos\alpha + D\sin\alpha)\cos\theta - (L\sin\alpha - D\cos\alpha) \quad (23)$$

Therefore give Normal components and Chord wise components,

$$N_{ia} = L_{ia}\cdot\cos(\alpha) + D_{ia}\cdot\sin(\alpha) \quad (24)$$

$$T_{ia} = L_{ia}\cdot\sin(\alpha) + D_{ia}\cdot\cos(\alpha) \quad (25)$$

The normal forces coefficient in the upstream and downstream are calculated as:

$$C_{Nu_{in}} := C_1(\alpha_{u_{in}})\cdot\cos(\alpha_{u_{in}}) + C_d(\alpha_{u_{in}})\cdot\sin(\alpha_{u_{in}}) \quad (26)$$

$$C_{Nd_{in}} := C_1(\alpha_{d_{in}})\cdot\cos(\alpha_{d_{in}}) + C_d(\alpha_{d_{in}})\cdot\sin(\alpha_{d_{in}}) \quad (27)$$

To get the acceptable results, iterative steps number is important. It is necessary to make sure the iterative procedure has converged, and also need to limit the number of calculation steps for save time. Therefore, the method is plotting few values of each variable which changes with steps number "it". The converged information of incidence angle can be known in the Figure 7.

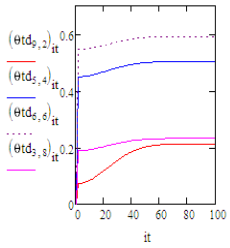

FIGURE7. Iterative result of position angle

VI. CONCLUSION

The converged information of each variable in upstream and downstream are known in Figure 8-11. Most of the values remain around 0--0.04. The results are reasonable and converged.

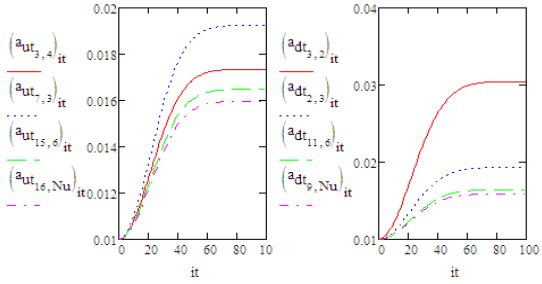

FIGURE8. Iterative result of position factors

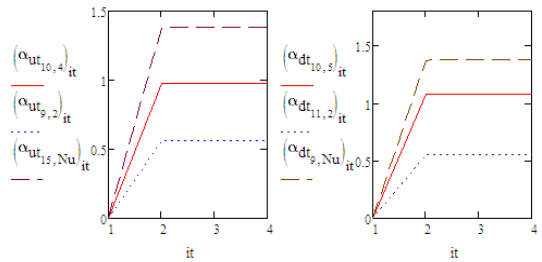

FIGURE9. Iterative result of position angles

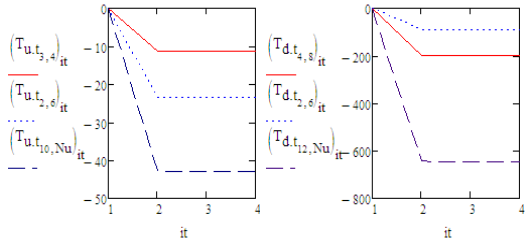

FIGURE10. Iterative result of Tangent component of blade forces

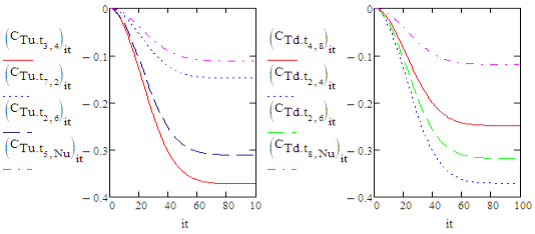

FIGURE11. Iterative result of Chord wise component of blade forces

As show in the Figures, the position angle converges in 60 steps and the induced factors take 90 steps, whereas all the forces converge just in two steps. Thus, all variables converge before it=100. Therefore, set time steps number to Nt=100.

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Simulation Research of Fracture Reorientation Under Water-Rock Coupling With XFEM

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***Abstract*—Crack initiation and extension forms are one of the key factors affecting the fracturing effect. According to fluid-structure coupling effect and on the basis of extended finite element theory, the hydraulic fracturing expansion finite element equilibrium equation is constructed, which is based on rock mechanics, elastic-plastic mechanics, seepage mechanics theory. Introduced crack initiation criterion and extension direction, hydraulic fracture reorientation analytical method is formed by using ABAQUS software, set the initial geostress field, permeability, porosity and other parameters by using the user subroutine. The example is analyzed according to the experiment scheme, the perforation phase angle and horizontal principal stress difference is the main factor that influenced the crack turning, when the perforation phase angle is from 0° to 90°, the crack swerve distance is gradually increasing, and crack initiation pressure is gradually increasing, when the perforation phase angle is 0° or 180°, it's the optimum phase angle. When the horizontal principal stress difference is greater, the crack swerve distance is less, it's easy to turn to the optimum crack direction. The research finding supplies theory basis for designing hydraulic fracturing parameters, especially the shale reservoir fracture network.**

***Index Terms*—hydraulic fracturing, fracture reorientation, solid-fluid coupling, XFEM**

I. INTRODUCTION

The production increasing effect of conventional hydraulic fracturing on low permeability reservoirs, especially for the shale reservoir, is limited. But the direction change of crack can effectively improve the fracturing effect [1-3].With the development of fracturing optimization design technology and computer simulation technology, the numerical simulation model of crack is gradually improved. Lian Zhilong [4] has simulated the process of fracture propagation by taking advantage of the critical stress criterion, but only for two-dimensional fracture. People, like Wang Han [5], Biao Fangjun [6] and Zhang Rusheng [7] et al, studied the crack initiation and extension by using cohesive unit, but, for bonding unite, it is essential to predict the path of crack propagation. Therefore, this doesn't conform to the actual cracking. Ren [8] and Lecampion [9] simulated crack propagation by the extended finite element method, but they all assumed that the net pressure in the crack remains constant, this is also not consistent with the actual situation. Wang Suling [10], took ABAQUS as the platform, analyzed the expansion mechanism of the crack in the sand / shale interface by the extended finite element method. They all didn't consider that the factors, such as fluid flow in fractured, differential pressure and permeability, influence on crack extension. This paper, basing on extended finite element method, set up the mathematical model of hydraulic fracturing crack propagation. And this paper, took ABAQUS as the platform, used subroutine to simulate the stress and permeability of stratum. Finally, we have analyzed, in the condition of water rock coupling, the hydraulic crack initiation and propagation and its influencing factors.

Ⅱ.BASIC PRINCIPLES OF XFEM

XFEM is based on the partition of unity, and using the shape functions which are extensional and discontinuous to represent the discontinuity in the cell as its core ideas. Therefore, in the process of calculation, it is completely independent between the description of the discontinuity field and meshes. So the re-meshing is unnecessary when we simulate the crack propagation.

A. Finite Element Model of Hydraulic Fracturing Extension

In order to achieve fracture analysis, the asymptotic functions near the crack tip and discontinuous functions are applied to conventional displacement pattern of finite element. Therefore, from the above, we can come up with the description of the discontinuous displacement field,

$$u = \sum_{I=1}^{N} N_I(x)[u_I + H(x)a_I + \sum_{\alpha=1}^{4} F_\alpha(x)b_I^\alpha] \quad (1)$$

In the equation, $N_I(x)$ is the displacement shape function of conventional node, u_I is the continuous part which uses the finite element displacement solution, $H(x)$ is the discontinuous jump function of the crack surface, a_I and b_I^α are the free vector of extended node, $F_\alpha(x)$ is the stress asymptotic function of the crack tip.

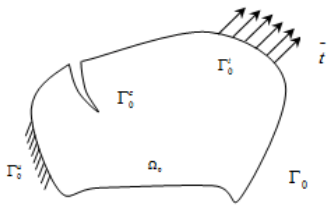

Fig.1 Two-dimensional model of rock mass containing cracks

Fig.1 is a rock matrix Ω_0 with hydraulic fracture, and its boundary is denoted by Γ_0, the hydraulic fracture is Γ_0^c, the displacement boundary is Γ_0^u, the load boundary is Γ_0^t, the normal vector of the hydraulic fracture surface

are n^+ and n^- respectively, the hydraulic pressure acting on the surface are p^+ and p^- respectively.

Its boundary conditions and initial conditions are,

Displacement boundary condition, $u = \bar{u}$, on the Γ_0^u.

Load boundary condition, $\sigma \cdot n = \bar{t}$, on the Γ_0^t.

For the cracks in the matrix, the condition that accords with the stress is zero on the crack surface are,

$\sigma \cdot n = \bar{p}$, on the Γ_0^c.

In the equation, σ is the tensor of the Cauchy stress, n is the unit normal vector, $\bar{u}$ is the displacement on the Γ_0^u, $\bar{t}$ is the surface force on the Γ_0^t, N.

The hydraulic fractured rock mass balance equation is,

$$\nabla \cdot \sigma + b = \rho \ddot{u} \qquad (2)$$

In the equation, b is the body force of per unit volume; N. ρ is the liquid density, Kg/m^3. The $\ddot{u}$ is the acceleration, m/s^2.

The constitutive equation of isotropic material is,

$$\sigma = C : \varepsilon \qquad (3)$$

In the equation, ε is the strain tensor, m. C is elasticity tensor, Pa/m. And the : is double dot product of tensor.

The strong form of the problem is multiplied by a possible displacement, so that we can get the weak style of balance equation,

$$\int_{\Omega_0} \sigma \cdot \varepsilon d\Omega_0 = \int_{\Omega_0} b \cdot u d\Omega_0 + \int_{\Omega_0} \rho \ddot{u} \cdot u d\Omega_0 + \int_{\Gamma_0} \bar{t} \cdot u d\Gamma_0 \qquad (4)$$

In the equation, u is the virtual displacement, m.

The equation above is the hydraulic fractured virtual work equation. To gain the equilibrium equation of the hydraulic fracturing finite element, we can bring the equation (1), the displacement field of extend finite element, into the equation above.

The fracture length of hydraulic fracturing is far greater than its width, therefore, we can neglect the fluid flow in the direction of crack width, only considering that the fracturing fluid flow along the crack growth direction. According to Reynolds theory and mass conservation theorem, we can get fluid flow control equation,

$$\frac{\partial p}{\partial s} = -\frac{12q}{w^3}, \frac{\partial p}{\partial s} + \frac{\partial w}{\partial t} = 0 \qquad (5)$$

In the equation, q is the section flow, m^3/s; w is the crack width, m; s is the displacement along crack propagation path; μ is the fluid viscosity, Pa·s.

Fluid mass conservation equation,

$$Q_0 \Delta t = \int_0^L \Delta w ds \qquad (6)$$

B. The fracture initiation criteria of crack and its extended direction

In this paper, the propagation criterion of crack is the maximum principal stress criterion, when the maximum principal stress, on the element integral point, reached the critical stress (within a certain error range), that will introduce new cracks or the expansion of the original crack after the next incremental step.

When the fracture criterion is satisfied, the new crack is always perpendicular to the direction of maximum principal stress.

C. The Flowing Fluid in the Cracks

The flowing fluid in the crack includes the tangential flow along the crack wall and the normal flow that perpendicular to the crack wall.

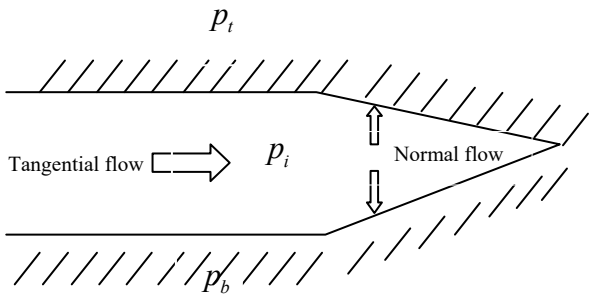

Fig.2 Fluid flow in the fracture

The volume, flow and density vector equation of tangential flow Newton fluid,

$$qw = -k_t \nabla p \qquad (7)$$

$$k_t = \frac{d^3}{12\mu} \qquad (8)$$

In the equation, k_t is the flowed friction, ∇p is the pressure gradient of crack surface.

The normal flow of fluid is the permeation of fluid in matrix; the normal fluid can be defined as,

$$q_t = c_t(p_i - p_t) \qquad (9)$$

$$q_b = c_b(p_i - p_b) \qquad (10)$$

In the equation, q_t and q_b are the fluid flow rate on the upper and lower surfaces of crack, p_i is the fluid pressure in fracture, p_t and p_b are the pore pressure on the upper and lower surfaces.

III. The Fracture Direction Change And Extension Mechanism

A. Finite Element Model

The established mechanical model, on hydraulic fracturing and two-dimensional fluid-structure interaction, is shown in Figure 3, Adopting $40m \times 40m$ model, 0.1m shaft diameter, and 0.01m perforation diameter. To discrete the mechanical model into finite element model, we can use CPE4P element. As shown in Figure 4.

Some assumptions,

(1) Formation rock is isotropic material

(2) Fluid, in rock mass, is complete saturation and not compressible.

(3) Ignoring the effect of temperature on crack propagation.

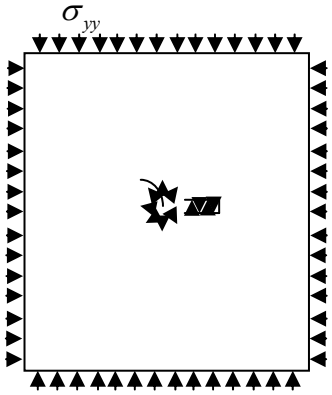

Fig.3 Hydraulic fracturing two-dimensional mechanical model

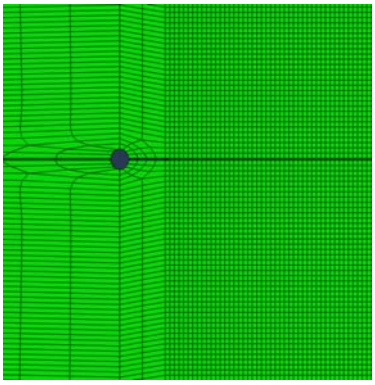

Fig.4 Hydraulic fracturing finite element mesh model

Ⅳ. Analysis Of Influencing Factors On Crack Propagation

In 2009, The experimental study on the hydraulic fracture extension was carried out by Jiang Hu[11] et al. The study found that the crack gradually shifted to the optimum fracture surface. And the perforating azimuth and horizontal principal stress difference both have effect on crack pressure and steering distance.

According to the experimental data in the reference, the elastic modulus of materials, in the module, is 8.4GPa, Poisson's ratio is 0.23, tensile strength is 2.59MPa, and the fracturing fluid viscosity is $1\times10^{-3}\,Pa\cdot s$.

A. The Influence of Perforation Azimuth

From fracture mechanics, crack, in two dimensional models, always spreads along the maximum principal stress. When the perforation azimuth angle is not 0° or 180°, the crack initiation is at the perforation tip, and gradually shift to the direction of maximum principal stress, and the steering distance is R. As shown in Figure 5.

From Figure 6, when the perforation phase angle is 90°, the initiation of hydraulic crack along the direction of perforation, and the hydraulic crack turns after it extending a distance. And the crack, finally, will extend along the direction of maximum principal stress.

When the perforation phase angle is 90°, the curve of the internal crack pressure is shown in Figure 7. As can be seen from the figure, with the internal pressure of perforation increasing, and the pressure gradually increase to the initiation pressure of rock—13.7MPa.Later, the pressure gradually decreases to about 4.5MPa, and remain stable finally.

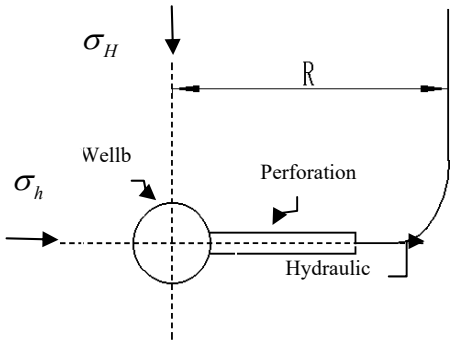

Fig.5 Fracture reorientation diagram

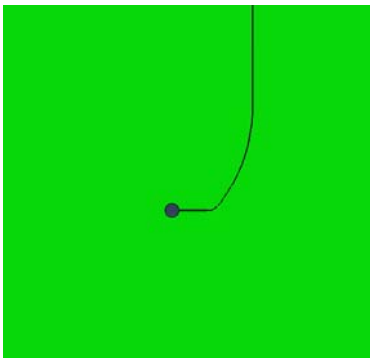

Fig.6 Simulated result of fracture reorientation（Perforation azimuth 90°）

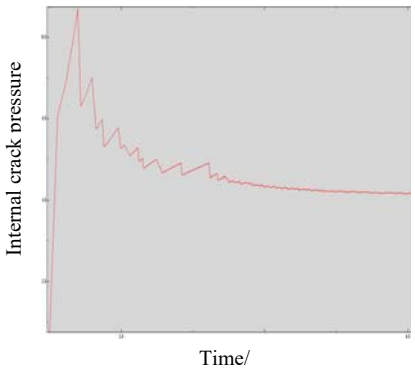

Fig.7 Pressure curve of Perforation azimuth 90°

Table1 Initiation pressure and turning radius of different Perforation azimuth

Perforation phase angle/°	Initiation pressure/MPa	Steering distance/m
0	8.7	0
30	9.5	0.36
45	10.4	0.53
60	11.6	0.74
90	13.7	1.1

As can be seen from the table 1, when the perforation phase angle increases to 90° from 0 °, fracture turning distance and initiation pressure are gradually increasing. As the perforation phase angle is 0°, it is best to crack

initiation, and the crack will crack and extend along the perforating direction, and it will not turn. While the perforation phase angle is 90°, it is most detrimental to crack initiation, the crack first extend along the perforating direction and gradually shift to the direction of maximum principal stress. This also verifies that the rock failure accord with the principle of minimum energy, the crack always crack and extend along least resistance plane, the minimum fractured resistance along vertical and minimum principal stress direction, the energy required to break is minimum, the breakdown pressure will be lower. Therefore, 0° and 180° are the best perforation phase angle.

B. Influence of Horizontal Stress Contrast

The horizontal stress contrast is the important factor that influences the crack growth pattern. , Under different stress difference conditions, when the perforation phase angle is 90°, crack initiation pressure and fracture turning distance is shown in Table 2.

Table 2 Turning radius of differential horizontal stress

Horizontal minimum principal stress/MPa	Horizontal maximum principal stress/MPa	Vertical stress /MPa	Steering distance /m
1.5	2.5	6	1.8
5	3.5	6	1.1
1.5	5.5	6	0.59

As seen in Table 2, with the maximum principal stress difference increasing, the turning distance of the crack decreases gradually, and steering radius is also decreasing. According to plane-strain model of two-dimensional crack,

$$L_R = \frac{1}{2\pi}\left[\frac{3K_1}{\sigma_h(k-1)}\right]^2 \qquad (11)$$

In the equation, L_R is the radius of curvature of crack turning, K_1 is stress intensity factor, k is the ratio of between maximum principal stress and minimum principal stress, σ_h is horizontal minimum principal stress.

As can be seen from the model, if the ratio of maximum principal stress and the minimum principal stress increase, and the horizontal principal stress difference will increase, the radius of curvature, on the contrary, will decrease. And the crack will turn to the most optimum fracture direction more easily.

V. CONCLUSIONS

1.Considering the effect of fluid structure interaction, the extended finite element model of hydraulic fracturing and flow form and flow equation of fluid in fracture are established.

2. A numerical simulation method for hydraulic fracture steering expansion is presented, with the two-dimensional, hydraulic fracture propagation, fluid and solid coupled mechanics model, established with the finite element software.

3. Perforation phase angle and horizontal principal stress difference are the main factors that influence crack turn. When the perforation phase angle shift from 0° to 90°, the distance of the crack turning gradually increase, and so does the initiation pressure. The most optimum perforation phase angle is 0° or 180°. The greater the horizontal principal stress difference is, the smaller the fracture turning distance become. And the crack will turn to the most optimum fracture direction more easily.

ACKNOLEDGMENT

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Subjective Quality Based Optimization for JPEG XR Encoding Algorithm

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***Abstract*—In this paper, an encoding algorithm with improved compression efficiency is proposed based on the standard of JPEG XR image. This algorithm designed a rate allocation scheme according to the features of Human Visual System. The macro blocks of the image are divided into 6 types by their local texture and local brightness. Each type is assigned different quantization parameters of DC, LP and HP coefficients, which distributes the bit rate of the entire image reasonably according to the complexity and brightness. Therefore, higher compression efficiency is achieved with the same subjective quality. Through the experiment, the proposed algorithm obtains a 10.5% higher compression efficiency compared with original algorithm of fixed quantization parameters.**

***Index Terms*—JPEG XR; Subjective quality; Image compression; JND; Rate-Distortion Performance; HVS**

I. Introduction

The JPEG XR is one latest image compression standard proposed by the Joint Photographic Expert Group (JPEG), which is used to represent the continuous-tone still image such as photographs and achieve better image quality [1]. JPEG XR came from the Microsoft HD PHOTO technology, which provides lossless and lossy compression in two ways. JPEG XR could achieve high dynamic range image compression and is only with integer arithmetic complexity. Compared with the traditional JPEG standard, JPEG XR could double the coding efficiency with the equal picture quality [2].

Although JPEG XR could achieve an impressive coding efficiency, it still slightly less than the JPEG 2000 standard. Thus, one of the most important research topic is to further improve its rate-distortion performance for practical applications. Schonberg et. al [3] proposed an improved JPEG XR algorithm under a variety of evaluation criteria, such as PSNR and MSSIM. Then, the selection strategy of the quantization coefficients is further discussed for JPEG XR based on the subjective quality [4]. Gao et. al achieve 0.5db PSNR increasing by optimizing the entropy coding section under some specific bit rate [5]. These studies all achieve in terms of rate-distortion performance improvement for JPEG XR. However, human vision system (HVS) based perceptual encoding optimization for JPEG XR are rarely appeared in the literatures.

In this paper, an HVS based optimization algorithm is proposed for JPEG XR, which could significantly improve the coding efficiency while maintaining the quality of the picture.

II. JPEG XR Encoding Flow

Similar to other still image compression standards, JPEG XR is also a block-based hybrid encoding method, the flow chart is shown in Fig. 1.

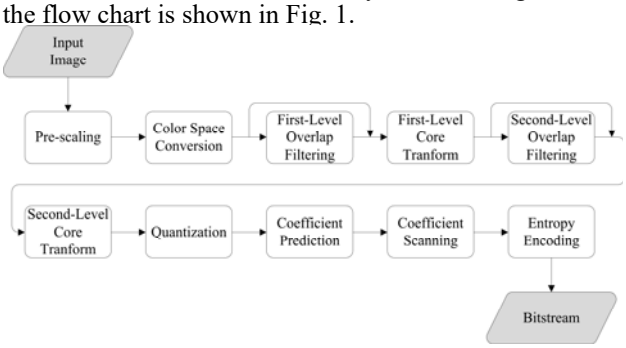

Figure 8. JPEG XR encoding flow chart

A. Tranform Process

The most distinctive aspect of JPEG XR is the coefficient transform，which includes a two stage core transforms. The first-level core transform converts the pixel values of a 16x16 macroblock from spatial to frequency domain, where each 4x4 block coefficients form the HP (high pass) coefficient of the macroblock. The second-level core transform forms a DC coefficient and an LP (low pass) coefficient of the macroblock by converting the 16 DC coefficients of each 4x4 block. Each core transform contains the core transform and pre-overlap filtering operation. The pre-overlap filtering is optional, which is used to eliminate the blocking effect and ringing effect. And the core transform is similar to DCT transform. The pre-overlap filtering in combination with core transform together constitute a double lapped transformation, which has been proved to effectively eliminate the blocking effect and to improve the visual quality [6].

B. Quantization Process

Different from the H.264 standard which the residual data is transformed and quantized after the prediction, JPEG XR directly quantizes the transforms the original pixel values. Thereby, the quantization error of one macroblock would not impact the other macroblocks that use the current macroblock as the prediction source. The quantization process of the JPEG XR standard is very flexible. Different image region and color channel have their own quantization parameter sets independently, each macroblock chooses the quantization parameter based on its image region and color channel. The quantization parameter of the DC, LP and HP coefficients of a macroblock may be different, which is just one quantization parameter for DC coefficients and 16 for the LP and HP coefficients. The range of the quantization parameters is 1 to 255, where 1 corresponds the lossless

compression. The mapping from quantization parameter to quantization factor is shown as follows.

$$\begin{cases} \text{factor}=\text{QP} & \text{QP} < 16 \\ \text{factor}=(\text{QP}\%16+16)\times 2^{\text{QP}/16-1} & \text{otherwise} \end{cases} \quad (1)$$

Lager quantization parameters are generally used only for high dynamic range (HDR) pictures, such as the ones with a bit depth of more than 8 bits. Based on the subjective and objective experiments, the quantization parameter range is generally 1 to 80 for common 24bpp RGB images. Too large quantization parameters would produce unacceptable visual distortion.

III. JND Evaluation of JPEG XR Compressed Picture

JND (Just Noticeable Distortion) refers to the maximum distortion threshold which could be detected by human eyes [7]. It plays an important role in images and video processing. Currently, many JND models have been developed, which could be divided into pixel-based and subband-based models. Their essential principles are all based on some HVS characteristics, and could be converted to each other through the spatial frequency transformation. The pixel-based JND models are much used for image quality assessment and motion estimation. Due to the restriction of spatial domain, these models did not consider the different sensitivity of HVS to different frequency components. So, it could not accurately describe the characteristics of HVS [8]. The subband-based models contain the main factor of the HVS perception, such as CSF (Contract Sensitivity Function), adaptive brightness and contract masking. This kind of models are mostly used to improve the compression efficiency for image and video coding. DCTune [9] is one of the most popular subband-based JND models. It is proposed by the NASA Ames Research Center. The latest DCTune 2.0 added the function of full reference image quality assessment, which provides a fast and convenient method for image quality evaluation.

The subband-based JND model is relevant to the transform algorithm used. Since the main image and video coding algorithm use the DCT transform, there is no accurate JND model for LBT (Lapped Biorthogonal Transform) of JPEG XR. Although the LBT and DCT transforms are essentially similar, the range of the transform domain has a big difference. So, it could not directly use the DCT-based JND model to optimize the JPEG XR encoding algorithm. The main task of this paper is to optimize the quantization process of the JPEG XR encoding algorithm based on the important characteristics of the HVS.

IV. The Proposed Optimization for JPEG XR

There are two ways to realize the optimization of image compression. One is to improve the quality of the decoded pictures while maintaining the coding rate unchanged. The other is to reduce the coding rate while maintaining the quality of the decoded pictures unchanged. The two ways are essentially the same, which are trying to increase the rate distortion performance of the image compression. In this paper, we put forward a optimization method, which is based on the second approach.

A. HVS Characteristics Based Macroblock Classification

For the monochrome image, there are two main factors that affect the visual perception threshold of each pixel. One is the average background brightness of the pixels in the region, and the other one is the non-uniformity of the background brightness [9]. The perception threshold of the human eyes is approximate parabola under different brightness. The perception threshold is lowest in the medium brightness, so that the difference is most likely to be perceived. On the contrary, the threshold is relatively high in the very dark or bright conditions, so the difference is not easy to be perceived. The threshold change could be represented as a luminance adaptive factor α_{Lum} which is shown as below.

$$\alpha_{Lum}=\begin{cases} (60-I_{avg})/150+1 & I_{avg}\le 60 \\ 1 & 60 < I_{avg} \le 170 \\ (I_{avg}-170)/425+1 & I_{avg} > 170 \end{cases} \quad (2)$$

Similarly, the non-uniformity of the background brightness, which is also called contrast masking effect, could also be expressed as an adaptive factor. But its description is more complex. In general, the difference in the smooth region and near the edge of the image could be easily perceived, and the threshold value is higher for the complex texture regions.

Based on the HVS characteristics mentioned above, in order to improve the compression efficiency, the bit rate should be made a reasonable distribution. For the luminance adaptive factor, the medium luminance areas should be allocated more bit rate, and the dark and bright areas should be allocation less bit rate. For the contrast masking effect, the smooth and the edge areas should be allocated of more bit rate, and less bit rate for the texture regions. So, the regional characteristics of the image should be accurately determined first, such as the average luminance value and the variance value of the image regions. However, these kinds of characteristic value is not available in the JPEG XR encoding process, it will occupy some certain computing resources. A better way is to use some existing value in the encoding process to determine the regional feature of the image.

Although LBT is not equivalent to DCT, the meaning of the coefficients is similar in the frequency domain. The DC coefficient of the luminance is still on behalf of the average brightness value of the macroblock, it could determine the brightness type of the macroblock according to the DC coefficient. Meanwhile, the AC coefficients could reflect the texture feature of the macroblock, the complex texture regions always with higher AC coefficients. But in fact, the high energy AC coefficients may be the complex texture region or the edge region [11]. Based on the analysis of the frequency coefficients, it could be concluded that

1) High LP coefficients corresponds the edge regions or coarse texture regions, and 2) the high HP coefficients corresponds the coarse and fine texture regions.

It can be seen that the key to distinguish the edge region is to exclude the coarse texture region from the larger LP coefficients regions. That means to eliminate the regions that have large HP coefficients. There is another situation that edge presents in the texture areas. The edge would be removed because of large HP coefficients. One compensation way is to calculate the energy difference between the HP coefficients of each macroblock and its adjacent macroblock. The one with the difference larger than a certain threshold will be

considered as edge region. The detailed edge detection steps are shown as follows.

1) Calculate the number of LP coefficients which is larger than the LP coefficient threshold of the current macroblock:

$$LP\_num = count(LP > LP\_VALUE\_TH) \tag{3}$$

2) Calculate the number of HP coefficients which is larger than the HP coefficient threshold of the current macroblock:

$$HP\_num = count(HP > HP\_VALUE\_TH) \tag{4}$$

3) Calculate the number of HP coefficients of the adjacent macroblock *HP_num_adj*,

4) The regions which is satisfied with either condition will be detected as edges:

$$\begin{aligned} &condition1:\ LP\_num > LP\_NUM\_TH \\ &condition2:\ HP\_num < HP\_NUM\_TH \\ &\quad or\ (HP\_num - HP\_num\_adj) > HP\_DIFF\_TH) \end{aligned} \tag{5}$$

Fig. 2 shows the edge detection result based on the transformed coefficients. It can be seen that most of the clear edges have been accurately detected.

FIGURE 1. Transform coefficient based edge detection result

After the edges have been detected, the macroblock will be classified into 6 types which is shown as below.

1) Medium brightness smooth or edge macroblock (MSEMB) which satisfies

DC_VALUE_TH1 < *DC* < *DC_VALUE_TH2* and (*HP_num* = 0 or *IS_EDGE*)

2) Medium brightness texture macroblock (MTMB) which satisfies

DC_VALUE_TH1 < *DC* < *DC_VALUE_TH2* and (*HP_num* ≠ 0)

3) Low brightness smooth or edge macroblock (LSEMB) which satisfies

DC < *DC_VALUE_TH1* and (*HP_num* = 0 or *IS_EDGE*)

4) Low brightness texture macroblock (LTMB) which satisfies

DC < *DC_VALUE_TH1* and (*HP_num* ≠ 0)

5) High brightness smooth or edge macroblock (HSEMB) which satisfies

DC > *DC_VALUE_TH2* and (*HP_num* = 0 or *IS_EDGE*)

6) High brightness texture macroblock (HTMB) which satisfies

DC > *DC_VALUE_TH2* and (*HP_num* ≠ 0)

Fig. 3 shows the classification result of Lena picure.

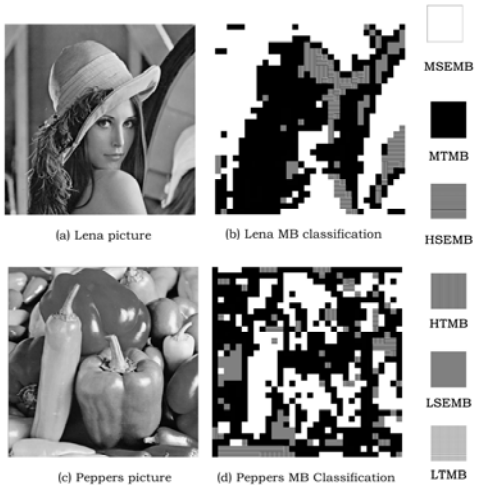

FIGURE 2. Macroblock classification result

B. Quantization Parameter Selection

Currently, there is rare research on the rate control of JPEG XR encoding. The quantization parameter is completely decided by the input parameter of the user. The simplest way is to use only a fixed QP value as the quantization parameter for all color channel and macroblock of the whole picture. The rate consumption and quality contribution of DC, LP, and HP coefficients is different. In the unified quantization parameter model, the rate of different frequency coefficients in the compressed stream of Lena picture is analyzed in literature [12], and the rate ratio is obtained as

$$DC : LP : HP \approx 2 : 13 : 26 \tag{6}$$

It can be seen that the HP coefficients are more sensitive to bit rate. In order to improve the rate distortion performance of the JPEG XR, it should extend the quantization parameter sets of the HP and LP coefficients.

According to the above observation, the proposed quantization parameter selection strategy is as follow.

Assume that the input fixed QP value is default_qp, and the actually used QP sets are one QP value for DC coefficients, two QP values for LP coefficients, and three QP values for HP coefficients.

1) Calculate the quantization factor default_factor which corresponds to default_qp value according to (1), then the actual quantization factors of each kind of coefficients are

$$\begin{aligned} \text{dc\_factor} &= \lfloor \text{default\_factor} \times \beta_{dc} \rfloor \\ \text{lp\_factor\_1} &= \lfloor \text{default\_factor} \times \beta_{lp1} \rfloor \\ \text{lp\_factor\_2} &= \lfloor \text{default\_factor} \times \beta_{lp2} \rfloor \\ \text{hp\_factor\_1} &= \lfloor \text{default\_factor} \times \beta_{hp1} \rfloor \\ \text{hp\_factor\_2} &= \lfloor \text{default\_factor} \times \beta_{hp2} \rfloor \\ \text{hp\_factor\_3} &= \lfloor \text{default\_factor} \times \beta_{hp3} \rfloor \end{aligned} \tag{7}$$

Based on some experimental results, the β values in (7) are

$$\begin{aligned} &\beta_{dc} = 0.69, \beta_{lp1} = 0.73, \beta_{lp2} = 0.91 \\ &\beta_{hp1} = 1.19, \beta_{hp2} = 1.28, \beta_{hp3} = 1.82 \end{aligned} \tag{8}$$

2) The actual quantization parameter of each kind of coefficients is obtained by the following algorithm.

Algorithm 1

if factor < 32

```
    qp = factor;
else
{
    qp = 1;
    while (factor >= 32)
    {
        Factor >>= 1;
        qp++;
    }
    qp = qp * 16 + factor -16;
}
```

3) The quantization parameter sets are formed with QP values as

$$\text{DC QP Set}:\{DC\_QP\}$$

$$\text{LP QP Set}:\{LP\_QP\_1,\ LP\_QP\_2\}$$

$$\text{HP QP Set}:\{HP\_QP\_1,\ HP\_QP\_2,\ HP\_QP\_3\}$$

4) Based on the macroblock classification mentioned in section A, the QP value for each kind of macroblock is obtained as

$$\begin{cases} \text{MSEMB}: \text{DC\_QP, LP\_QP\_1, HP\_QP\_1} \\ \text{MTMB}: \text{DC\_QP, LP\_QP\_2, HP\_QP\_1} \\ \text{LSEMB}: \text{DC\_QP, LP\_QP\_1, HP\_QP\_2} \\ \text{LTMB}: \text{DC\_QP, LP\_QP\_2, HP\_QP\_2} \\ \text{HSEMB}: \text{DC\_QP, LP\_QP\_1, HP\_QP\_3} \\ \text{HTMB}: \text{DC\_QP, LP\_QP\_2, HP\_QP\_3} \end{cases}$$

IV. Experimental Results

In this section, the performance of the proposed optimization method for JPEG XR is verified. The Lena and Peppers pictures were used. Under the condition of the same DCTune subjective quality evaluation results, the bit rate of the unified fixed quantization parameter method and the proposed method is compared. The results were shown in Table 1 and Table 2.

TABLE II. Bit rate comparison of Lena picture

DCTune subjective quality error	Bit rate (KB)		Bit rate saving
	Fixed QP method	Proposed method	
1.2	317154	300672	5.2%
2.2	215742	204184	5.4%
3.2	154249	144535	6.2%
4.8	89717	80598	10.2%
6.5	50041	45396	9.3%
8.9	26122	23957	8.3%
12.3	13949	12481	10.5%
16.6	8462	7855	7.1%

TABLE III. Bit rate comparison of Peppers picture

DCTune subjective quality error	Bit rate (KB)		Bit rate saving
	Fixed QP method	Proposed method	
1.2	244209	219491	10.10%
2.2	166121	149054	10.30%
3.2	118772	105511	11.20%
4.8	69082	58837	14.80%
6.5	38532	33139	14.00%
8.9	20114	17489	13.10%
12.3	10741	9111	15.20%
16.6	6516	5734	12.00%

Under the conditions of various same subjective quality error, it can be seen that the proposed method could improve the JPEG XR coding efficiency as compared to the fixed quantization parameter method. For Lena picture, the proposed method could achieve 5% to 10% bit rate saving, up to a maximum of 10.5%. And for the Peppers picture, the proposed method could achieve 10% to 15% bit rate saving, up to a maximum of 15.2%. Obviously, it can be concluded that the proposed optimization method could improve the compression efficiency of JPEG XR coding algorithm while keeping the subjective quality unchanged.

V. Conclusion

The HVS characteristics perception based subjective quality evaluation is integrated into JPEG XR compression standard, and a quantization parameter optimization method is proposed. The proposed method is simple and easy to use, which could improve the coding efficiency with 5%-15% bit rate saving while keeping the subjective quality unchanged. It could be used in many kinds of practical applications, such camera, medical imaging instrument, and video monitoring system.

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An Integrated Value Chain About Food Waste In China

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***Abstract*—reducing food waste and increasing resource use efficiency in the food chain has received growing attention at the international, regional and national levels. This paper has illustrated a brief summarize on the state of food waste in the context of Chinese food consumption, and then clarifies in detail the value chain in terms of food waste along the different stages. The first value chain displays with a classification model of food wastage therefore the next specifies namely agricultural loss, postharvest loss and consumer waste that occur more significant in the wastage process. Apart from this, by implementing transaction cost and governance theory, we dig out more underlying issues for instance to identify search and information costs among sectors in value chain and to exert and enhance governance in food loss in catering sectors. Nonetheless, our knowledge of transaction costs is still restricted and more research has to be done to fully understand their characteristics and effect on the chain. In future, it would be more interesting to deepen our knowledge of actual transaction costs happening in food waste and loss to under- stand its significance and urgency. On top of that, food waste is no longer a problem for China but is a more crucial challenge that needs to be tackled worldwide in forthcoming.**

***Keywords*—Integrated Value Chain, Food Waste, Food Production**

I. Introduction

Food waste in global food supply chain has been driven with a great attention for feeding nine billion population together with a projected growth of food demand of 50%-70% by 2050 (Julian Parfitt et.al, 2010). Against this ascending demand, there are still 900 million impoverished people who are chronically under-nourished which in brief equating one-eighth in worldwide. How- ever, it is estimated that only two third of all produced food is retained from human's stomach and unfortunately the rest goes into waste (Ibid). Hence, the decreasing food waste appears to be enormously significant at the international, regional, and national levels. In global mind, this issue has been taken into an agenda that each country has to make contribution to abating the interlinked issue of food waste and deliberate waste (Ibid). In China, food waste has reached up to a surprisingly amount with approximately 50 billion kilograms which accounts for nearly 9% of the total yield. More specifically, it witnesses that the waste of fruit is 21.95 million ton, for example vegetable waste (253.63 million ton), meat (12.12 million ton), and aquatic product (8.24 million ton) which have the correspondent percentage from total output with 28.6%, 47.5%, and 17.4% respectively (Wang, 2013). This report will provide an overview on the state of food waste in the context of Chinese food consumption, and explores in detail the value chain in terms of food waste along the different stages. Food waste will be further analyzed through Transaction Cost theory as well as the comprehension of governance, to understand the phenomenon and results of an integrated value chain.

II. Current Food Production Status In China

"Hunger Breeds discontentment", which has been defined as a classical proverb in China for hundreds of years. China has been using only 7% of arable land by feeding 22% of the entire population worldwide (Yinban, 2009). Following with the promoting effect of national policies and technological progress, the food production in China has achieved a consecutive increase in last decade (Ibid). At present, the total amount of the food production is about 0.46 billion ton and per capita level has risen by 370 kilograms. This total amount of production has mainly solved the subsistence problem. Nevertheless, the food production prospect is not optimistic and adversely, it confronted with a serious of issues such as the shrinking of arable land, the transforming of arable land, and threat from natural disaster (Yinjun, 2013). According to the statistic from Chinese Ministry of Land and Resources (MLR), the arable land has reduced by 8.39 million hectares from 1996 to 2011 (Zhang, 2013). With the increase of protecting arable land and agricultural structure adjustment, a number of arable lands will be turned into fallows in order to maintain the soil fertility to conduct sustainable farming. On top of this, the transforming of arable land becomes gradually severe that more farmers have subcontracted or leased their right of management to cooperatives and enterprises therefore many arable lands have turned into "non-cultivation orientated" (Sun, 2013). Locally said, the transforming of arable land benefits the enterprise and it also enriches the farmer's income. However, the transformation will be a threat to food reservation in China if it would be chronically existed. In addition, it is widely acknowledged that natural hazard is able to destroy the food production on condition that the capacity of disaster-resistance is limited and immature. According to Yinjun (Ibid), crops have greatly suffered from flood and drought damage that takes about 26% from total tillage land. At the same time, the asymmetrical distribution for region land makes those hazards occurred in each year, which accordingly leads to a food reduction (Ibid).

III. The Food Waste In China

As the economic and environmental costs of crop yield increase are getting higher and other efforts from the supply side are becoming much more difficult, the issue of food wastes becomes further complicated by the fact that a massive amount of food is lost or wasted along the entire life cycle (Gang Liu, Xiaojie Liu & Shengkui Cheng, 2013). The development of Chinese agricultural industry upgrades prosperity that the total amount of food production has mainly solved people's subsistence. However, the agricultural production structure has founded on small-range production, involved with approximately 240 million small or individual farmers

(Zhao, Q. and J. Huang, 2011). The decentralized production system contributes to a low efficiency during the planting season and a poor handling in post-harvest and accordingly lots of post-harvest losses occur in Chinese agriculture due to inadequate of infrastructure, knowledge, and technology (Ibid).

It is noteworthy that the catering sector has experienced an incredible growth that benefit from China's reform in the last century. Even though when global financial crisis prevailed, the revenue of catering service has maintained steady with a positive annual growth of 14% (Deloitte, 2012). As successively prosperous and a great number of busy consumers are inclined to eat away from home, food waste generated in restaurants and catering sector has enormously raised with public concern in recent years. In fact, the food waste, which is reflected in catering sector, can be categorized into three categories (Zhiwen Liu, Pinlin Wen, 2011). In the first place, China has the "Mianzi" with the high context of culture, and waste can be traced back to the Chinese history that we advocate the custom with "food surplus" and "food diversity". These reflect our enthusiasm, hospitality, and rich (Ibid). Therefore, in Chinese traditional culture, the host should prepare as many as dishes to treat guests and saving food would be regarded as stingy. The host rather believes more dishes could increase his "Mianzi" and he does not care about how much food waste in the end. Besides, using public fund causes food waste as well. To eat by using public fund increases the cost of public administration which leads to extravagant habit because more administrative staffs suppose that public funds can be easily applied for reimbursement and they would not care about how much they spend (Ibid). Apart from these, there are still parts of catering sectors that constantly pursue for economic benefits in a shortsighted way (Ibid).

IV. The Food Waste Value Chain In China

The agricultural food industry is an economic foundation to China, being responsible for 1.4 billion people live and consumption. As can be observed from the figure below, food losses and waste come out at different chain stages, and can be defined in different types and units. The major steps are interpreted with auricular production, postharvest handling and storage, processing, distribution and eventually terminate with consumer consumption. Meanwhile, it visually reflects that the food loss encompasses agricultural losses and postharvest losses where the postharvest losses generated from the process of harvest handling and storage, processing, and distribution, which are highlighted with the red rectangle. On top of that, consumer waste is elaborated as the most noticeable waste, which occurred from the consumption. All the losses and waste enter into both non-food uses and end-of-life management at last either to exert their surplus value or manipulating other utilities.

Agriculture loss or pre-harvest loss, which was mentioned before, mainly occurs at the initial stage of farming. The grain and crop loss are greatly affected by uncertain disease, pests, rodents, and typically severe weather (Gang Liu, Xiaojie Liu & Shengkui Cheng, 2013). Furthermore, the loss of livestock occurs due to death and sickness before first-stage processing; these types of loss are unpredictable in some backward areas and accordingly bring about output reduction (Ibid). Postharvest losses indicate that food degradation and damage will occur during the postharvest handling and processing level. The postharvest losses appear in various forms for instance, the grain is threshed, dried or when livestock is pushed in the slaughter room, as well as losses along the chain during transportation, storage, and distribution (Ibid). We can find that as the staple food in China can be distinctively categorized into rice and wheaten food. And for processing rice and wheat, it is inevitably occurred with grain losses. In storage, we can easily under- stand that insects, fungi, and rodents are main factors which deteriorate grain invisibly. What is more, the insufficient awareness, knowledge, and infrastructure make the storage having a low prevention and reservation level. Last, according to Xi (2010), losses in transportation and distribution turn up because mechanized bulk handling is not yet prevalent in China. For example, approximately 80% of grain is still loaded and unloaded in bags during transportation and manually transported jute sacks are still widespread in nowadays.

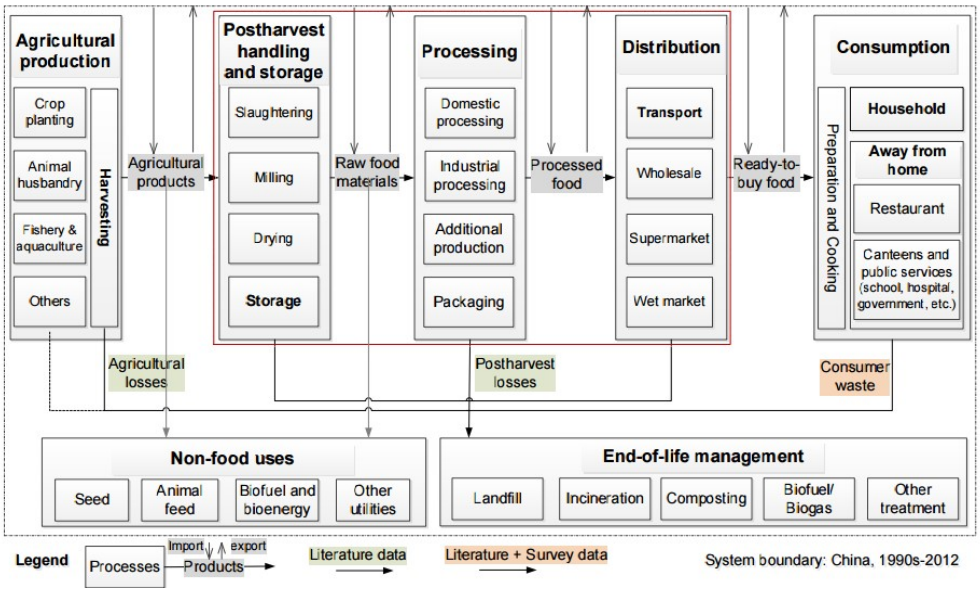

FIGURE 1. Food losses and waste along the different stages of the food value chain (Gang Liu, Xiaojie Liu & Shengkui Cheng, 2013).

Food waste that mainly generated by consumers occurs both in household and during meals away from home. It was estimated that about 30 billion kilograms of food products which wasted in catering sector (restaurant), canteens, and household tables (Fang, 2002). Most of the consumer food waste is detected in mid-to high-end restaurants and public canteens. As from Voice of China reported, leaving full table of cups and leftovers become commonly seen in Chinese formal banquet (Lei, 2013). Taking buffet as an example, although most of the restaurants have put the remind that "taking less, avoiding waste", guests still do not pay attention and in general they often overestimate their appetite. By observing the food waste value chain in Figure 3, food waste disposure has not been normalized; furthermore, how to handle leftover has not driven upon the common agreement. In China, it is commonplace that after dining the leftover will be directly dumped along the sewer. The leftover cannot be classified systematically and make good use of its functionalities. For instance, animal feeding and creating bioenergy can be regarded effectively to dispose the leftovers. Even if consumers have created enormous amount of food waste, we are able to reasonably develop and utilize the recycling system in order to compensate a little proportion of the waste.

V. Transaction Cost Analysis

As for food waste, it is capable for agricultural sectors, postharvest departments, and consumer groups to minimize the transaction costs in the wastage value chain. From market transaction cost, it includes search and information costs which agricultural sectors, postharvest departments, and consumer they all have to undertake these costs when they attempt to conduct growing, harvesting, and consuming. For instance, farmers intend to make contrast as soon as they purchase seeds, fertilizers from other manufactures. And for those famers who expect to make product differentiation, they have to spend energy on searching high- quality suppliers. The same reason is for processing, distribution, and final consumption. Bargaining and decision costs usually emerge when preparing contract. For example, the processing companies and cooperatives need to sign contract with farmers to negotiate about purchasing price, volume, and reservation time. Fresh meat and poultry have their specific storage time length and once the time expired, these meats will become un-edible and will be disposed or burned. In addition, processing companies have to sign contracts with the Chinese authority of quality Supervision, inspection and quarantine (AQSIQ, 2015) for purpose of ensuring food quality and safety. The transaction cost occurs when food processing companies and AQSIQ draft the agreement or negotiation with the safety criterion etc. This process not only takes time and effort in each party but it may also require for expensive legal tools. The decision cost would probably involve costs of gathering information, paying consultancy fees, and the cost of building consensus. In the meantime, retailing stores and restaurants, which can directly offer the food to consumers, also have to bear the cost with food safety from consumer perspective.

VI. Government Feature Analysis

The theoretical overview of governance presents the feature of governance and the given three distinctive features relate with the processes of interaction and decision-making to deal with collective problems. The first feature aims to build up with administrative arrangements with the characteristics of market. In food loss and waste, the country needs to strengthen and regulate policies, norms, and standards. In general, for planting and postharvest sectors, standards are necessary to establish focusing on unified governing and cultivating to prevent private plant activities and excessive use of fertilizer. Meanwhile, it has to take measures to regulate the storage volume in order to avoid degradation; governance could be manipulated to control the source of food loss. On the other hand, catering businesses have to undertake more corporate responsibility and initiate self-governance. Promoting "green and healthy" food consumption cannot be developed without the support from catering businesses. There are many causes of food waste in a restaurant, some of the waste actions are intentional but still some are unintentional. Thus, a catering business has to encourage consumers to consume in an appropriate action. Furthermore, to integrate the second feature of multi-jurisdictional and transnational governance, examples include varied efforts to verify food standards and safety. Chinese food safety standards are set in Beijing by AQSIQ; however, if other countries imports food from China, the presumption is that Chinese officials at the national and local level should enforce these standards. The practice of regulating food safety ought to operate simultaneously at international, national, and local levels. On top of this, the third feature of governance is to increase range and plurality of stakeholders. We can see from the food wastage value chain that different components lack the communicational scope and depth for coordination. Consequently, the inconsistent of information interaction and transformation generate the asymmetry of information. Because of the asymmetry, farmers are subject to the actions of the processors; for food consumers, they turn into indifference of their behavior and subject to conventional concept and also submit to the mislead of catering business.

VII. Conclusions

To sum up, reducing food waste and increasing resource use efficiency in the food chain has received growing attention at the international, regional and national levels. This paper has illustrated a brief summarize on the state of food waste in the context of Chinese food consumption, and then clarifies in detail the value chain in terms of food waste along the different stages. The first value chain displays with a classification model of food wastage therefore the next specifies namely agricultural loss, postharvest loss and consumer waste that occur more significant in the wastage process. Apart from this, by implementing transaction cost and governance theory, we dig out more underlying issues for instance to identify search and information costs among sectors in value chain and to exert and enhance governance in food loss in catering sectors. Nonetheless, our knowledge of transaction costs is still restricted and more research has to be done to fully understand their characteristics and effect on the chain. In future, it would be more interesting to deepen our knowledge of actual transaction costs happening in food waste and loss to under- stand its significance and urgency. On top of that, food waste is no longer a problem for China but is a more crucial challenge that needs to be tackled worldwide in forthcoming.

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Exploration And Discussion Of Thalassemia Gene Diagnosis And Prenatal Diagnosis

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***Abstract*—Purpose: To analyze the distribution of local thalassemia genes and the prenatal diagnosis situations, and to summarize the disease treatment experiences. Method: From February 2011 to May 2015, the hospital collected couples with homotype thalassemia genes, and conducted prenatal diagnosis to obtain 1,725 pairs of couples in total. Results: There were 1,846 cases of α-thalassemia genotype, accounting for 53.51%; 1,302 cases of β-thalassemia genotype, accounting for 37.74%; 295 cases of αβ-thalassemia, accounting for 8.55% of the total; 7 cases undetected but with abnormal hemoglobin. The prenatal diagnosis showed that α-thalassemia genotype accounted for 49.91%, of which the carriers accounted for 17.77%, the standard-type accounted for 14.75%, the compound-type accounted for 0.81% and the edema fetuses accounted for 16.49%; there were 213 cases of serious and medium β-thalassemia genotype and 20 cases of the compound-type thalassemia. Conclusions: It is of vital significance to conduct genetic diagnosis and prenatal diagnosis of thalassemia. The thalassemia occurrence rate of fetuses both of whose parents are thalassemia gene carriers is extremely high. The effect of different prenatal diagnosis techniques differs from each other.**

***Index Terms*—thalassemia; genetic diagnosis; genetic diagnosis; prenatal diagnosis**

Thalassemia is a common single-gene hereditary hemoglobinopathy with incomplete dominance and with hemolytic anemia, methemoglobinemia or histanoxia or compensatory polycythemia as the major pathological features. According to the globin types of the affected globins, thalassemia can be divided into α-thalassemia, β-thalassemia and γ-thalassemia. The carrying rate of thalassemia genes worldwide has reached about 1.67%. China is a country with a high carrying rate of thalassemia genes, and the rate is as high as 12% especially in Guangdong and Guangxi areas [1]. Thalassemia is a terrible disease, which can cause adverse pregnancy outcomes and birth defects. Every year, about one fifth of 1 million defected new-borns in China are diagnosed with the serious thalassemia. Many α-thalassemia babies are even terminated in pregnancy, die on the vine or the moment coming to this world. Though most of β-thalassemia new-borns can survive at birth, they die before the age of ten. Thus, thalassemia can cause a great burden to families and society. Prenatal diagnosis is an important item of antenatal care. Both sides of a couple should undergo thalassemia diagnosis. If both are thalassemia carriers, the fetuses should undergo prenatal diagnosis and the couple can decide whether to continue the pregnancy. Gene diagnosis is a golden standard for the test of thalassemia. However, it should be noted that the pathological test of thalassemia genes shows a high heterogeneity [2], so thalassemia genotypes and frequency in different regions and of different nationalities differ greatly from each other. To investigate into the mutation frequency of local thalassemia genes can provide references for prevention and treatment of thalassemia. This research attempts to analyze the distribution of the local thalassemia genes and the prenatal diagnosis situations, and to summarize the disease treatment experiences.

I. Research Materials and Methods

1.1 General research materials

Collected couples with homotype thalassemia genes from February 2011 to May 2015. The hospital's prenatal diagnosis center conducted prenatal diagnosis of their thalassemia genes, and found out that there were 1,725 couples both carrying thalassemia genes.

1.2 Research methods

The clinical data were complete and the report was found, including genotype, nationality, gestational week, prenatal diagnosis results, etc. Antenatal care is to conduct a preliminary screening to collect pregnant women's peripheral venous blood, hemoglobin (Hb) tested by the hemocyte automatic analyzer, the mean hemoglobin (MCH), the red blood cell, the mean corpuscular volume (MCV), the red blood cell volume distribution width (RDW), the mean hemoglobin concentration (MCHC) and other indexes. According to the index level, it is decided whether gene screening is necessary. The antenatal care in the 12th gestational week showed that Hb＜110g/L; Hb＜10.5/L from the 12th to 20th gestational week; any pregnancy test showed that MCH＜25pg, MCV＜80fl, RBC/MCV＞6, RBC/Hb ＞ 27.7 and RDW ＞ 15.0%. All these can undergo protein electrophoresis, Hb A2 test and HbF test. HbA and HbF were tested by the high-performance liquid chromatography (HPLC) Hb automatic analyser. If the results are positive, it means thalassemia gene analysis is necessary. DNA extraction kit was adopted to extract DNA in accordance with the operation instruction. The electrophoresis gap-PCR tested three commonly-seen thalassemia deletion types, including α-thalassemia genes. Non-deletion-type α-thalassemia and β-thalassemia were diagnosed by the reverse dot blot hybridization technique. The thalassemia gene analysis adopted the second-generation Cap-PCR technique to analyze the three commonly-seen α-thalassemia genes (--SEA/, -α3.7/ and -α4.2/). The reverse dot blot hybridization technique was employed to test three non-deletion-type thalassemia genes, namely αcsα/, αWSα/ and αQSα/, and the β-thalassemia genes commonly seen among Chinese nationalities, namely CD41-42, CD71-72,

CD17 and -28, CD26, IVS-II-654, IVS-I -I, IVS-I-5, CD43, CD31, CD27/28, -32 and -29, CD30, CD14-15, CAP and Int. Through genetic counselling, pregnant women with serious and medium thalassemia can make a prenatal judgement.

1.3 Judgment standards

Thalassemia patients were divided according to standards in Pediatrics, genotypes and clinical symptoms into α-thalassemia carriers, standard-type and medium-type, β-thalassemia light-type, medium-type and serious-type.

II. RESULTS

2.1 Test results of bad pregnancy and birth data and couple's thalassemia genes

195 pairs of couples once gave birth to Hart's edema fetuses; 51 cases gave birth to α-thalassemia medium-type infants; 357 cases gave birth to β-thalassemia serious-type, 41 cases suffered from spontaneous abortion and 10 cases suffered missed abortion.

Among 3,450 thalassemia carriers, 1,846 cases suffered from α-thalassemia, accounting for 53.51%; 1,302 cases suffered from β-thalassemia, accounting for 37.74%; 295 cases suffered from αβ-thalassemia, accounting for 8.55% of the total; 7 were undetected but had abnormal Hb.

2.2 Prenatal diagnosis

Among 1,725 cases of pregnant women, 689 cases were high-risk population and underwent prenatal diagnosis in the early pregnancy. Among them, 512 underwent TC-CVS, and 177 cases underwent TA-CVS. 813 cases underwent amnion cavity paracentesis in the medium pregnancy period, and 102 cases underwent PUBS in the medium and late period. All of them featured single-fetus pregnancy. 142 cases had Hart's edema fetuses and 127 cases had HbH. Besides, there were 213 cases of β-thalassemia serious-type and medium-type, and 20 cases of the compound-type. The distribution of α-thalassemia genes found out by the prenatal diagnosis is shown in Table 1 (See below):

TABLE I. DIFFERENT DIAGNOSIS METHODS FOR DIFFERENT A-THALASSEMIA TYPES

Type	TA-CVS(n=177)		TC-CVS (n=512)		Amniocentessis (n=813)		PUBS (n=102)		Total	
	n	%	n	%	n	%	n	%	n	%
Carrier	13	16.67	41	15.65	87	19.91	12	14.29	153	17.77
Standard-type	40	51.28	136	51.91	224	51.26	32	38.10	432	50.17
Medium-type	8	10.26	34	12.98	62	14.19	23	27.38	127	14.75
Compound-type	2	2.56	2	0.76	3	0.69	0	0.00	7	0.81
Edema fetus	15	19.23	49	18.70	61	13.96	17	20.24	142	16.49
Total	78	100.00	262	100.00	437	100.00	84	100.00	861	100.00

III. DISCUSSION

Thalassemia genes are related to factors, such as races and regions. In this research, 1,846 couples had α-thalassemia, accounting for 53.51% of the total; 1,302 couples had β-thalassemia, accounting for 37.74% of the total; 265 couples had αβ-thalassemia , accounting for 7.68% of the total; 37 couples were undetected but had abnormal Hb. These findings differed from those of other scholars to some extent [3], and reflected regional distribution differences of thalassemia genes. However, it should be noted that there were 7 cases whose thalassemia genotypes were undetected but their Hb was abnormal. Their thalassemia genotypes might be rare ones. The risk of fetuses of both sides of a couple carrying thalassemia genes to develop thalassemia was high. In this research, α-thalassemia fetuses found out by the prenatal diagnosis accounted for 49.91%, which was a little lower than the carrying rate of both sides of a couple with α-thalassemia genes, but still stayed at a high level. Among them, the standard-type accounted for 50.17%, the medium-type accounted for 14.75%; the edema fetuses accounted for 16.49%. All of these types showed pathological changes. In particular, edema fetuses called for special attention and should stop pregnancy. The percentage of the serious-type and medium-type β-thalassemia accounted for 12.35%. Though most β-thalassemia fetuses can survive, the prognosis results are poor. Research suggested that the percentage of the standard-type detected by PUBS was lower than the value detected by the other three methods. The difference showed statistical significance ($P<0.05$) and reflected differences of different test techniques. This might be related to the evolution of intrauterine changes of fetuses' thalassemia. Many pregnant women fail to take PUBS in their early pregnancy, which is the best time for prenatal diagnosis. In terms of edema fetuses, HbH patients and serious-type thalassemia patients, follow-up visits are necessary, and more often pregnancy termination is adopted. In terms of the seven cases in which the genotype of one side or both sides of a couple is uncertain, this research found that the fetus test results were favorable, but pregnancy termination was still adopted after genetic counselling. Rare genotypes are the research focus in the future.

To sum up, it is of vital significance to conduct thalassemia genotype diagnosis and prenatal diagnosis. The thalassemia occurrence rate of fetuses, both of whose parents are thalassemia carriers, is high. Under the condition, screening is important, and the gene test should be adopted as the golden standard. If both sides are thalassemia carriers or the protein of both sides is abnormal, PUBS should be conducted as early as possible. If the gestational weeks have been quite long, amniotic fluid and cord blood test should be taken.

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An Empirical Study of Banking Fragility in China Based on VAR Model

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***Abstract*—On account of its fragility, the banking system is more vulnerable to crisis, which if accumulated to a certain extent will become a financial or even economic crisis. Beginning with the empirical research concerning fragility, this paper analyzes to which extent the fragility of our banking system has reached as well as what and how this fragility has been led to. In addition, a VAR model is used to demonstrate the relationship between the fragility and its contributing factors, and finally deduce the seasonal tendency of the fragility of our banking system.**

***Keywords*—banking system; fragility; VAR model**

I. Introduction

The healthy development of the financial system plays an important role in the national economy. As the most important part in the financial system, the banking system's steady and healthy development has the vital role in the steady growth of national economy. The strength of banking fragility is related to China's financial stability and financial development. Through analyzing the fragility of banking system, we will find out some factors which can improve banking fragility, increase the ability for banks to resist the risk, and contribute to the development of macro economy.

There are a lot of calculation and demonstration for the fragility of banking system at home and abroad. Most of early paper were based on qualitative research, and in recent 20 years papers place much more emphasis on quantitative analysis. The important quantitative analysis include Frankel and SachsTomell and Velasco(1996)'s STV model, Kaminsky(1997)'s Signal Analysis Method, and Jutasompakorn,Brooks and Brown(2014) made an empirical study of influencing factors about banking fragility based on Logit model. Among the domestic scholars, in order to evaluate banking fragility of 1999-2006, Chen Jianxin(2011)selected 11 items which reflected the banking fragility, using extension method to construct the comprehensive evaluation model of fragility;Qian Xuesong(2012)used Logit model to examine the impact of financial structure on banking fragility; Based on data from 1990 to 2011, Xu Lu and Qian Xuesong (2013) structured a multiple regression equation to examine the effect of the credit boom factors on banking fragility .

Overall, these analysis deepen our understanding of banking fragility, including the reason and the relationship. But these studies also have the following deficiencies: Firstly, since China's economic environment has undergone significant changes in recent years, and banking situation changed a lot, the "0-1" form in Logistic model which is widely used in previous studies does not reflect the fragility of banking system in china. Secondly, there is a dynamic stability hypothesis in traditional econometric methods, while in fact the economy time alignment is generally non-stable. So it easily leads to "spurious regression", while Granger causality test can cover the shortage. Thirdly, different factors which affect banking fragility will also influence each other, and may have a lag effect, but the former did not take this into consideration.

In this paper, the author uses VAR model to analyze the fragility of China's banking system based on relevant data from 2007 to 2014. Banking fragility is rooted in high debt management, a maturity mismatch between assets and liabilities, the information asymmetry between supply and demand, and the periodic behavior caused by the principal-agent problems.

II. Questions and Hypotheses

Consequently, on the basis of previous studies, the author selects beta coefficients which is used to reflect banking fragility, then establishes a VAR model to analyze the relationship between banking fragility and the contributing factors. After that, impulse response function is used to analyze the degree of each variable's influence on banking fragility. Finally, in order to know the characteristics and trend of banking fragility from 2007 to 2014, the author uses Granger causality test and variance decomposition to get the contribution degree of the variables on banking fragility.

In this way, this paper not only avoids "pseudo regression problems" and the irrational simple weighted average, but also considers the lag effect, so VAR model for dealing with dynamic system is more effective .

After considering the data availability, previous research and the existing analysis, the author chooses macro and micro variables to measure and analyze it.

On the one hand, deterioration of macro economic variables will increase banking fragility, and fragility will further increase economic risk. For example, when CPI is maintained at a high level, high inflation rate will make the principal shrink. Then people will be more inclined to the investment which has high rate of return instead of savings. More seriously, it will cause a bank run and increase the fragility of banking system.

On the other hand, micro variables will also increase the fragility of banking system. For example, if the credit quality has problems, high non-performing loan ratios will increase banking fragility; Similarly, in the cases of economic stagnation or asset bubbles, higher asset-liability ratio can not turn into profits, but accumulate the risk .

III. Index Selection

On the basis of this analysis, we choose the following index and establish a model. As banking fragility (CR) is very difficult to define, this paper wants to construct a virtual beta coefficient to measure banking fragility in order to avoid the subjectivity of virtual variable method.

The coefficient is based on the CAPM theory, which is made of 180 financial index and shanghai composite index. According to the CAPM, $E(R_i) = R_F + [E(R_M) - R_F]\beta_i$, $\beta_i = Cov(R_i, R_M) / \sigma_M^2$,

it is used to measure the relative market risk of different assets. Changes of beta value and risks are in the same direction. In this paper, Ri said the 180 financial index returns, σ_M^2 said the variance of returns of Shanghai Composite Index. There are two reasons for building this index: on the one hand, 180 financial Index contains almost all stocks of the listed banks in China, which has very high representative on banks; on the other hand, beta coefficient measures the degree that returns of some risk assets depend on the market. Moreover, the volatility of return also can describe risk. Accumulation of risk may lead to fragility, so banking fragility can be explained by beta. The specific rules are as follows:

When beta>1, the returns of banking system change faster than market returns, so the banking fragility is higher .

When beta<1, it changes slower than market returns, so the banking fragility is relatively lower.

When beta=1, the returns of banking system and market change synchronously. So banking fragility also changes synchronously.

It is worth pointing out that, the market return depends on the operation of the national economy. That is to say, banking fragility is a relative concept, which says the speed of risk accumulation relative to the development of the national economy. When the economy fluctuates severely, the smaller beta coefficient is helpful to resist market risk. But when the economy is good, the smaller beta coefficient will hinder income increase and reflect the increased risk.

Therefore, according to the asset portfolio theory, the author takes returns of 180 financial index as a portfolio's return, returns of Shanghai composite index as the market portfolio returns. In this way, we can construct a beta coefficient related to banking fragility

Table 1 The meanings of variables

	Variables	The meanings of variables
Macro Variables	CPI	CPI essentially reflects a potential currency risk. For the bank, if the difference between deposits and loans is relatively large, high inflation rate will make the principal shrink. In addition, many people will choose the investment which has high rate of return instead of saving. Seriously, it can cause bank run.
	FER	Foreign exchange reserves is directly related to import and export trade, and the bank plays an important role in the import and export trade settlement.
	ER	For banks, exchange rate is directly related to exchange rate risk; in addition, if exchange rate changes excessively, it will make all kinds of financial products' price fluctuate unreasonably. Ultimately, it will be reflected in the banking fragility.
	M2	Growth rate of M2 reflect the trend of monetary policy and the situation of market liquidity, That M2 and GDP are not equal may reflect the underlying inflation.
	QR	Business climate index reflects the trend of real economic development, but there is a problem about safety margin.
Micro Variables	ALR	In the cases of economic stagnation, credit quality problems or asset bubbles, high asset-liability ratio can not turn into profits, but accumulate the risk .
	BLR	The bad loan ratio reflects the credit risk of the bank. When BLR is high, it will increase pressure of credit funds supply, and affect the operating efficiency.
	LDR	Loan to deposit ratio shows the ability that banks raise deposits to meet loan. If this value is too high, banks could face shocks of liquidity demand .

According to the IMF research, "Basel III" as well as the availability of data, all variables can be divided into two categories of macro and micro indicators. Among them, macro variables are CPI, M2 growth rate, change rate of enterprise boom index (QR), the growth rate of foreign exchange reserves (FER) and the RMB exchange rate against the dollar (ER). The micro variables which is the evaluation index of banking industry mainly include: bad loan ratio (BLR), loan to deposit ratio (LDR) and asset-liability ratio(ALR). The meaning of each variable is shown in table 1.

In this part, all data come from the National Bureau of Statistics website, the people's Bank of China website, and Chinese Banking Regulatory Commission Web site.

IV. Modeling and Analysis of Results

A Impulse response function of banking fragility

The relationship between the banking fragility and its contributing factors is a dynamic system. The effects of various economic variables on banking fragility are persistent. According to this characteristic, this paper chooses VAR model to describe the relationship between banking fragility and its contributing factors. VAR model is relatively easy to be used to analyze and predict multiple related economic indicators. To explain the effects of various economic shocks on economic variables, this model is usually used to predict correlated time series and analyze dynamical impact of random perturbations on variables.

The mathematical expression of VAR model is:

$$y_t = \Phi_1 y_{t-1} + \cdots + \Phi_p y_{t-p} + Hx_t + \varepsilon_t, t = 1,2,\cdots,T \quad (1)$$

In this formula: y_t is the column vector of k dimension endogenous variable ; x_t is the column vector of d dimension exogenous variable, p is the lag order, t is the number of sample. Φ_t and H are the coefficient matrix to be estimated, ε_t is the column vector of k dimension disturbance .

We use the AIC information criterion to select the lag order of VAR model. According to the results of table 2, we should establish the VAR (1) model.

Table 2 Lag order selection

Lag	LogL	LR	FPE	AIC	SC	HQ

0	546.68	NA	1.69e-28	-38.4056	-37.97743	-38.27473
1	824.8	367.5778*	1.75e-3*	-52.48*	-48.2032*	-51.176*

After the operation, specific expansion model of VAR (1) is:

$y_t = (CR_t, CPI_t, FER_t, ER_t, M_{2t}, QR_t, ALR_t, BLR_t, LDR_t)'$,it will comply with the economic situation.

p=1， T=29. The CR equation’ s goodness of fit R2=0.89.

Table 3 AR Roots Table

Root	Modulus
0.898039	0.898039
0.810987-0.197725i	0.834742
0.810987+0.197725i	0.834742
0.629587-0.383977i	0.737440
0.629587+0.383977i	0.737440
-0.065048-0.438418i	0.443218
-0.065048+0.438418i	0.443218
0.101456-0.186676i	0.212465
0.101456+0.186676i	0.212465

The results of AR test show that all the modulus of eigenvalues’ reciprocal are less than 1, which is located in the unit circle. So the model is stable, and the impulse response function and residual decomposition will be effective. Therefore, next we will establish the impulse response function. The function is to analyze dynamic effect when an error term changes, or the model is affected. In this paper we use this method to analyze characteristics that various economic variables affect banking fragility. Based on the VAR (1) model, impulse response function of banking fragility is shown in Figure 1. To analyze the impact of factors on banking fragility, all the diagrams are accumulative responses. Solid line in the figure represents the practical impulse response function, and dashed line represents the fluctuation of plus or minus 2 standard deviation .

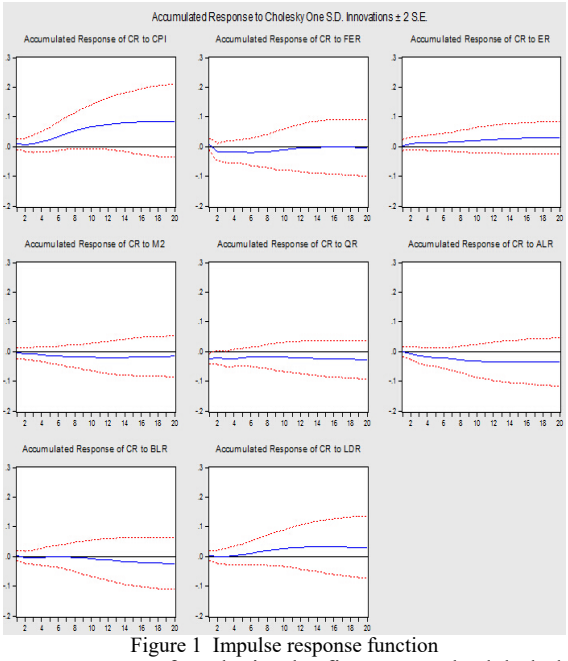

Figure 1 Impulse response function

For purposes of analysis, the figures can be labeled as 1.1-1.8 in turn from left to right, top to bottom .

Figure 1.1 shows the reaction about CPI on banking fragility. When CPI is given a positive impact, beta coefficient gradually increases before the 12 stage, then stabilizes at a positive value. It shows that when CPI increases, it is good for banks to avoid risk under the circumstances of better economic situation. That is to

Figure 1.2 shows the reaction about FER on banking fragility. When FER is given a positive impact, the beta coefficient is basically stable at a low and negative level before 12 stage. In the long term, the effect will vanish. The impact of foreign exchange on banking fragility is short-term and will comply with the economic situation .

Figure 1.3 shows the reaction about ER to banking fragility. When ER is given a positive impact, beta coefficient will be at a positive value. This trend shows that the impact of exchange rate on banking fragility will comply with economy.

Figure 1.4 shows the reaction about M2 on banking fragility. Positive impact of M2 will make beta coefficient in a backward state. This shows that in the bad economic situation, the increase of M2 will improve banking fragility.

Figure 1.5 shows the reaction about QR on banking fragility. As can be seen from the graph, the impact of enterprise level on beta coefficient has been in a negative state. This shows that when the economic situation is good, the increase of enterprise boom index will increase the banking fragility. It reflects that the relationship between enterprises and banks is becoming more and more closely.

Figure 1.6 shows the reaction about ALR on banking fragility. When ALR is given a positive impact, the beta coefficient has been in a state of decline. Until the 12 period, it becomes stable at a lower level. This shows that when the asset-liability ratio increases, the banking system has strong resistance in the precarious economy. And if national economic situation is good, the risk of banking system will accumulate quickly. This is because in the economic fluctuations, the residents are more willing to put money in the bank, then bank’s liabilities increase, so the bank has sufficient funds to deal with market risk. When the economic situation is good, the bank increases the debt actively, then increases the credit beyond the "safety boundary", so risk increases.

Figure 1.7 shows the reaction about BLR on banking fragility. The beta coefficient is almost zero before 10 stage, then become negative. This shows that the increase of BLR has no impact on banking fragility in the short term. But in the long term, it will go against the economy.

Figure 1.8 shows the reaction about LDR on banking fragility. A positive impact will cause the beta coefficient in the reverse fluctuating state before 4 period, then turn into a positive and stable effect after 12 stage. This shows that the short term impact of LDR on banking fragility will go against the economy, but in the long term it will comply with the economic situation.

B Granger causality test and Variance decomposition analysis

Granger causality test is to show the explanatory power about variables on the beta coefficient and describe banking fragility reasonably. Based on the VAR (1) model, the results of Granger causality test are shown in table 4.

Table 4 Granger Causality test

Excluded	Chi-sq	df	Prob.
CPI	5.884977	1	0.0153

FER	5.272290	1	0.0217
ER	0.094897	1	0.7580
M2	0.588924	1	0.4428
QR	0.371985	1	0.5419
ALR	0.822949	1	0.3643
BLR	0.934482	1	0.3337
LDR	0.308789	1	0.5784
All	20.39445	8	0.0089

Judging from the results, the probability that beta coefficient can not be caused by all variables is 0.89%. This is a small probability, and we should reject the hypothesis. So we can use these variables to explain beta coefficient.

In this paper, variance decomposition measures the contribution degree of each variable on the variance of beta, namely the contribution degree of each variable on beta coefficient. Therefore we can use it as the weight of each variable. From Figure 2, we can see that after 12 period the contribution degree of each variable tends to be stable, so the stable variance contributing ratio can be the weight of each variable.

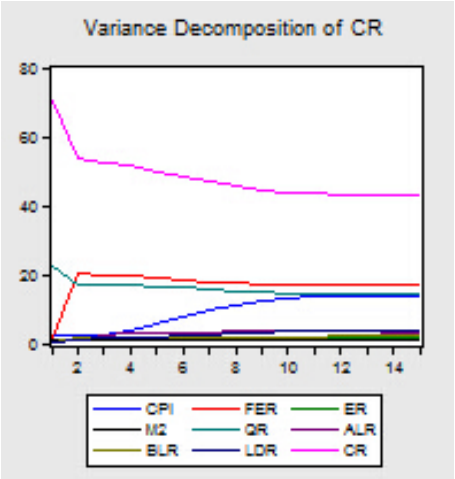

Figure 2 Residual decomposition analysis

V. CONCLUSIONS

A.According to different conditions, we should take different measures to improve banking fragility.

According to the definition of beta coefficient, lower one can help the bank improve banking fragility in the economic downturn, and higher one can improve its fragility in the economic upturn. Therefore, when banks and regulators draw up management principles on banking fragility, they should follow the economic situation. According to the results of variance decomposition analysis, when the economy is in the upturn, CPI, FER and QR can be adjusted to increase the beta coefficient. In addition, the adjustment of ER, ALR,BLR and LDR also have certain influence on the beta coefficient. To achieve the desired effect, each variable should be adjusted. When the economy is down, the beta coefficient should be reduced to improve banking fragility. Certainly, the methods should be in contrast in the economic upturn.

B. The influence of economic variables on banking fragility has a different time effect.

From the impulse response function, we can see that the response of each variable on banking fragility in the short-term and long-term are not the same. ALR, ER, CPI, LDR and QR not only cause banking fragility fluctuate in the short term, but also make banking fragility stable at a level in the long term. FER and M2 have some influence on banking fragility in the short run; when the impact of banking fragility vanishes, it will return to the original level. Namely these variables on banking fragility have no long-term effect. In addition, the effect of BLR on banking fragility is little in the short time. Therefore, the variables on banking fragility have the short-term effect and long-term effect. To improve banking fragility, we should choose different tools. When economic trend has been taken comprehensive consideration, the bank and its regulators think economic situation is only temporary, FER and M2 can be adjusted to improve the banking fragility; If the economy is in the stable state, we can choose to adjust ALR, LDR, CPI, ER and QR which have long-term effects on banking fragility.

C.Banking fragility is affected by internal factors and macroeconomic situation.

Most of the time banking fragility in China is relatively independent and its contributing factors are mainly from the banking system. But when the external economic environment fluctuates, the impact cannot be ignored. Therefore, in order to avoid shock from internal and external factors on bank fragility, the bank should establish a perfect risk management system to resist risks. In addition, banks should actively innovate different financial products to form a comprehensive, diversified product system.

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Talking about Art Exhibition of stars

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***Abstract*—Art Exhibition of stars occurred in 1979,a period of extreme political environment while coincides with a thought is relatively loose, which makes a series of works of art arises at the historic moment, At the same time diversity was trend to be emerged ,Thus Chinese art also entered a new stage along with it.**

***Index Terms*—Art Exhibition of stars revolution a new wave**

I. INTRODUCTION

After the Third Plenary Session of the Eleventh Central Committee people began to re evaluation of the past,and the Cultural Revolution which means change and the reshuffle of concept of the past, Mr Qu has in later interviews mentioned "in 1976, Chinese society happened too much things which include, the end of the cultural revolution, the Tangshan earthquake and Chairman Mao's death symbolizing an end of an era ,During the time people had a feeling of change but how to change? what does it look like? No one knows." at the same time, people began to question the pain and tears of the past they found that they can completely subverse and retrial, the "noncommittal" truth of past at the same time people condemned ,cursed and critized the emotion of discontent The people of a time will pursue the goal of that era, now it seems no longer is new and become old, in those subversive works which is created many years ago, many works have obvious traces of imitation because of the unexcellent technology owing to the only easel painting and sculpture without videos photography and conceptual art However, for the discussion of the stars we need a perspective in the historical and take the art into the context and find faith from it.

In the era of "red light, Gao Daquan" the one from the group of penniless passion of youth threw his own "thermal" into the "stars ’ ; every single "stars" are lighting independently to prove their existence. The creativity of art starts from the independence of thinking, in the conservative and political environment, it constitutes a kind of rebellious attitude, people just want to express and hit the banner of "freedom of art". Fortunately history accepted them and made them in a modern language which has aroused widespread concern and made them become the audience and the art circle, especially the topic of young people which has a warm response whether it was in favor of or oppose.[1]

From start to ban of exhibition, and finally re Exhibition ,the slogan of Art Exhibition of stars changed from "freedom of speech" to "artistic freedom" The expression of art has become the appeal of the right, the stars can be described as to open the unique character of Chinese modern art. Although they still have many immature places in the art, the social significance of this exhibition is much higher than its artistic value.

1.A strong critical sense of society and culture

The stars clearly pointed out that the artist needs to intervene in the community, people need mind the lessons that only in the combination of art and people's social destiny, can art have the vibrant vitality in the life of multiple disorders with Shadows and light interleaving, past and future overlap. In such a social environment, they are eager to express their repressed inner feelings, and talk about their ideals and aspirations.with the world.

The foreword of Art Exhibition of stars is saying “We, more than twenty art explorers take slightly harvest of work here..The world provides unlimited possibilities for explorers,We use our own eyes to know the world and use our own brush and knife to shape the world.[2]we express our own ideals..by our own drawings,..The years have come to us, and there is nothing magical to guide our actions which is the challenge of life,The combination of the shadow of the past and the future of the light constitute the life of our today because we can't cut the time from here,Our responsibility is that remember every lessons and live firmly. We love the land that nurtured us under the foot.we are unable to use language express our gratitude on the land, on the occasion of the founding of the people's Republic of China on the occasion of the 30th anniversary,we return harvest to the land and the people which makes us closer and confidenter ” The world provide countless probablity for explorers so use your own eyes to know the world and look at the world in different perspectives and use the sense of yours to create the world.The valuable point of Art Exhibition of stars is not the work itself, nor in their "artists" the identity but the ordinary people they represent.Due to this do the cry of the ordinary people have realistic and social significance.

II.TRYING TO PERFORM THE FORM

In the case of no more exposed to western art patterns, the modernity of the language model take the western modern language as the feelings of the heart which shows a kind of creativity and beauty of form in misreading and variable guide the and the return to the realism which constitutes the main thread of Chinese modern art. On the whole, the value of the thought of the stars is huge which is far exceeding the value of the exhibition works itself..The stars is proposed to take Kollwitz and Picasso as their banner, during this period, Wuguanzhong also has proposed the formal beauty of the theory, making

more and more artists began to try to use the western modern art language to show and paving the way for the development of Chinese art and arousing the rise of the art market in the 1980s and prosperity.

If Wu Guanzhong's theory of form beauty from the theory to rebell the mode of Cultural Revolution Art while Art Exhibition of stars use modern language to reflect which embodies the desire and pursuit of the new art form after the cultural revolution But noncommittal, in this series processes of exploration from the many wads chaos states, Art Exhibition of stars is failed to get rid of previous conventional political pertinence and artistic language is still the traditional It is simply to imitate the behavior of Western art and not throw personal experience into the art In the process of reference and fetch And so China is failed to appear to the soil and nutrients that breeds of modern art, the atmosphere is difficult to form which is destined to the Chinese modern art can only be rugged.

Mr. Yin Jinan once pointed out that "China modern art must have a process of from false to truth and appear artists can take off from the spirit of the free folk, classical and modern paradigm And who can reflect a kind of character which is different with past artists and calm to deal with the targeted culture and purify the art language.from them.[3]

Since the 1980s, the development of Chinese modern art in the foundation of reflect on the Cultural Revolution art went forword diffcultly in the vicissitudes of the political arena.It can be described as a fantasy to walk the tour of west for up to 100 years of Modern Art although this intensive art form with the necessity of historical development does not accord with the law of art development. In new generation of art, some boring and even slightly vulgar spoof rely on the star characters and great image is common, This kind of art which tends to subvert the traditional and attract eyeball pretentious is really no fun, but also need to arouse people's vigilance

In the history of the smoke and dust the shadow of time, skipping the canvas, write beautiful chapters Since 1985, China's modern art is in the ascendant, however the bright of stars in the history receded slowly and began to dim down, but the bright road stars opened up will not be forgotten The dark sky when the stars crowded together, the bright galaxy is so dazzling. However when it is their respective discrete time, the light will start gradually dispersed, but it can issue a dazzling spark. in the moment of the worn out of the atmosphere, Even it will be quiet after the spark people will remember the most shining moment Chinese painting master Mr. Li Keran had shout ", what one needs it is a common soul" The most valuable features of the art lies in the courage to forge ahead with innovation and the essence of the work place is have the soul and unite the spirit of the creators of the feelings. Stars is also a beacon in the dark whether we are living in what kinds of contradiction and struggle, we should take catastrophe as a moment and rack our brains to find new way of Chinese art.[4]

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Simulation And Analysis Of Access Channel In Cdma Communication System

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***Abstract*—CDMA is the major technology used in the wireless communication , especially in the mobile communication. Following the IS-95 standard set up in China ,CDMA is the mostly choice whether in China Uninet net ,in the third system (3G) that all kinds of mobile businessmen are to build or in the wider system than the third one(named 4G)that the large equipments researching businessmen have been researching.The concept of CDMA may be interpreted as the simulation that base on frequency spreading and the multiply address access project.Its reverse channel is composed of access channel and traffic channel.The access channel is used for brief information exchanging 、providing the source about the calling、the call responding 、the instruction and the enrollment.**

This design choose the part of connect channel to simulate and analyse. First,we can familiar with the process of connect channel ,understand the principleof every step of the procedure about thre channel,after studying the relating knowledge .At the same time ,we an also have some acquaintance with the software about MATLAB and the part of SIMULINK and how to set the parameter of every klock in the soft.Then we can use the MATLAB software to design the part of the connect channel, to analyse , to simulate and to validate the design of every block gradually. This purpose is to be familiar with the basic structure and basic principle of the morden wireless communication system, to mastery the technology about the Convolutional Encoder,Interleaver ,Coder spread and so forth, then use those technology to design system in practice,so that to improve our knowledge about the CDMA communication system.

***Index terms*—CRC;Convolutional Enconder;Block Repeat;Interleaver;Long code;Walsh; PN sequence**

I. INTRODUCTION

As is known to all, the mobile communication industry in the world has been developing rapidly since the emergence of cellular network in 1970s, and the technology of cellular network has been greatly developed. In the case of multiple access, in 1980s, the time division multiple access (TDMA) digital cellular network, GSM as the representative of the digital cellular mobile communication system has been widely used in China and abroad. In 1990s, the mobile communication system of code division multiple access (CDMA) cellular network is appeared. Because of its large communication capacity and good quality, it has aroused wide attention, and its advantages have been recognized by people, and its development prospects are very good. Many experts predict that twenty-first Century will be the era of CDMA communications widely used[1-17].

CDMA cellular networks (FDMA) are developed on the basis of frequency division multiple access () simulation of cellular networks and time division multiple access (TDMA) digital cellular networks. It has many unique places. From the technical point of view, the technology of.CDMA cellular network is the most advanced, and is the most complex. It can be said that in a certain range, it reflects the technical level of modern communication.

This topic selection is the reverse link access channel part of the software simulation, the use of the software is MATLAB. The construction of the access channel is built using the module of MATALAB, and the principle of the channel is analyzed and verified. This paper is in accordance with the order of the steps from theory to simulation analysis and verification, and finally a comprehensive summary.

II. INTRODUCTION OF WEAVING TECHNOLOGY

Direct spread spectrum CDMA supports the same amount of time in a large number of user groups, not just a single user digital communication service. This will reflect on how to improve the performance by using additional dimension and redundancy. Two processing techniques are used to improve the redundancy of the interleaving technique and the encoding technology used for forward error correction[2-10].

Interleaving is the process of permutation symbol sequence. This process is called a time diversity, which can be considered as a mixture of two methods: block interleaving and convolution interleaving.

It is a form of time diversity to prevent burst errors, which can be used to prevent the burst error. If the symbol is changed into the sequence or the sequence is changed, the error will be distributed in time. If the error is designed, the error will be randomly distributed. The error will be corrected by encoding[3-17].

The most common types of two kinds of interleaving techniques are block interleaving. This method is often used in the case of data sharing. On the other hand, it is easy to implement the convolution interleaving. It is easy to implement, and the initial cost of.IS-95 is not important.

There are several parameters describing the interleaver performance. One of the most important parameter is the

minimum interval S, refers to the minimum distance continuous burst error distribution. In general this parameter depends on the burst length, the burst length increased S decreased. In extreme cases, mutation length and sequence length, the smallest interval is, because no matter how to order the error between, always mutually together. Read a part of symbol interleaving, also need to store some other symbols, so it brings delay. In general, this delay also appears in the de interleaving. Time delay D said additional reading / interleaving and deinterleaving is brought about. And write operations just mentioned, process some storage unit, with M. In order to achieve better performance of interleaver, the minimum interval better, delay time and storage capacity as small as possible. So the performance is usually available minimum interval and delay than S/D and the minimum interval and storage capacity than S/M to describe.

A (I, J) block can be viewed as a storage matrix of a J row I column, which is read by a column, as shown in figure (2.1). The symbol is written in the upper left corner of the matrix, starting from the lower right corner, the continuous data processing requires two matrices; one for data writing, and the other for data read / de interleaving process also requires a two matrix, which is used to reverse the interleaving process[4-9].

III. Analysis And Verification Of Each Module

In this part of the source, we use the Bayesian binary generator to generate the required binary code, the resulting code sequence is subject to the probability distribution of the beta. In order to meet the needs of the design, we also set the output value of the shell to [80 * 1] and the output mode based on the frame format, i.e., the 80 row and 1 row matrix based on the frame format. CRC generates 8 bit cyclic redundancy check (CRC) code, and the role of CRC code in the end of the data has two points: first, it can be used to determine whether the frame (packet) is the error, second, can assist in determining the data rate of the received frame, the final data rate is the convolution decoder. In addition, using zero pad (zero filling module) module. At the end of the data frame joined a 8 bit 0, its role is, at the end of each frame of a convolutional coding, convolutional coding the shift accumulation device reset. Because of the automatic reset function of MATLAB, the zero fill module is not necessary. But in this, we still set this module to be inserted into the 8 tail bit zero, can make the data rate to reach our final requirements[5-16].

Bernoulli module parameter setting:

(1) of a zero Probability: 0.5 is represented by a probability 0.5 value of 0.5, with a probability of 1 -1;

(2) time:20/1000 Sample is said to be 20 ms, set to 20ms, the rate of 4800bit/s is 20ms; 80 is the rate per frame, the rate for 4800bit/s, the number of bits per frame is 96, the reason for this is 80, because the Zero generator and Pad CRC are 8 redundant cyclic codes and 8 end 0. Thus, the sampling time for each bit here is 20/1000/80s.

(3) the output data is set to a frame structure based on the method of selecting the outputs Frame-based option, the reason is that the input of the CRC code generating module must be based on the frame data structure.

(4) the data for each frame is 80 bits, so the number of samples per frame is set to 80, i.e., the per frame Samples is set to 80.

Parameter setting:

(1) in the subsystem, we use a [32 * 18] matrix, so the setting block diagram of the row and column are set to 32, 18.

(2) the to IntegerConverter Bit module and the to BitConverter Integer module of the subsystem are converted to an integer and an integer to 18 bits, thus setting the of bits per integer Number to 18.

(3) Elments is refers to the subsystems within the general block interleaving output sequence of symbols, namely: the [1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 of 31 32]', the number of which all refer to line numbers.

The internal structure of the subsystem is:

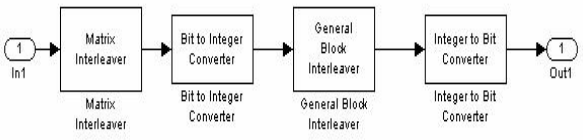

Fig.1 The subsystem of the block

Description, analysis and verification of the various modules of the subsystem:

(1) for the matrix, the function is to write the input signal into a matrix in a certain order, to complete the filling of the matrix, and to read the data from the matrix in another order. Its data operation sequence is: first, the input signal is written into the matrix, and then according to the column from the matrix read out.

(2) for the to Integer Converter Integer module and the to Bit Converter Bit module, its role is self-evident, respectively, each row of the data into a decimal integer, a decimal integer into a line of bit sequence.

(3) for the Block Interleaver General module, the function is: the input signal in accordance with their own set of the order of the replacement, the process of generating the mixed signal. Common block interleaving ensures that each input data can be in the output signal, and each output signal can only occur once, that is, the common block of the data sequence can be used to remove the duplicate bits of the data sequence.

The simulation output data theory and simulation are verified by the simulation of each module. The way of reading data is to use the workspace To module to read and display data.

IV. Conclusions

This topic is to use the software to access the channel simulation, the method in the software, there are three, I chose to use the module in the library to build, analysis and simulation. The simulation of the software, especially the use of the module to build, we should first be familiar with the module, this can be very good for the module to be used, but we have just come into

contact with the knowledge of people, this is a lack of. Therefore, we need to take full advantage of the help of the software itself to solve the problem. At the same time, we in when they encounter problems, we should cut from the entrance of the problem, the source of "fiddling" form make the problem more clearly, making it easier to solve the problem. For example: in this simulation, start, we don't know how to use the buffer module, do not know from the point of the problem, resulting in long codes and Walsh codes XOR, width data does not match the problem, use a lot of module can not solve. Finally, in the occasional opportunity to use this module to solve the problem. In the back, the I and Q data output of the first polarity conversion is also a problem, however, we use the previous experience, it will soon solve the problem.

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The Development of Chinese Sports Tourism Group Interests and Strategy

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***Abstract*—Sports tourism is a tourism, not only combines the elements of tourism, also has the function of sports activities, in today's society is to improve people's quality of life, the best choice of the mould perfect spiritual life. This article mainly from the development of Chinese sports tourism and sports tourism for tourists to choose two big aspects, further study of the present situation of sports tourism, sports tourism group, the basic situation of the tourists choose sports travel time and main purpose and its preferences, combined with the numerical analysis, statistical analysis and the method of goal programming, and about the practice of China's sports tourism related conclusion: 18-40 years old group, including students, professional and technical personnel, such as working class is the main force of sports tourism, in the choice of sports tourism types, littoral, rural and pastoral resort, lake is the most preferred category. This part of the tourist group attaches great importance to sports tourism, mostly choose sports tourism in legal holidays, the main purpose is for the sake of entertainment, enhanced physique, relax.**

***Index terms*—sports tourism; goal programming; tourism group**

I. Introduction

With economic development, and meanwhile people's living conditions are gradually improving , people selection when traveling are getting more, requirements are also becoming more and more strict. As an important tourism type, sports tourism not only can pastime, but also can enhance physique , is by far most popular one kind of tourism type.

In China sports tourism development and research, Diao Zhi-Ying through the article "China sports tourism development countermeasures and mode research", introduced on the condition of current stage China's national conditions and economic status, sports tourism development countermeasures and relative development modes. The article considered China present practical life conditions, investigated from economic conditions, government conditions, masses conditions and others multiple aspects, researched sports tourism types that adapted to different living levels, and then got most suitable China sports tourism development mode. The article pointed out: Developing China sports tourism should combine with China's national conditions, start from practice, and define most suitable sports tourism schemes for China masses[1-3].

The paper on the basis of formers, by time investigating, analyzes China sports tourism status and sports tourism group practical conditions, and then puts forward China tourists' preference types when doing sports tourism selection, and advertises sports tourism development in China masses life.

A. China current situation of sports tourism

Sports tourism is an important part of China tourism industry, from which sports tourism mainly includes three main types that are respectively events of sports tourism, nostalgia sports tourism and movement of sports tourism.

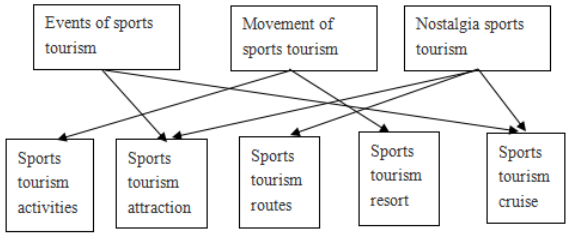

Figure 1: The three major categories of sports tourism and its content

Above Figure 1 three main types sports tourism and their contents relationship correlation shows sports tourism is the same as other types of tourisms, it has sports tourism activities, sports tourism attraction, sports tourism routes and so on. In the following, it makes comprehensive analysis of sports tourism from sports tourism status, sports tourism group structure and tourists sports tourism types selection preference these aspects.

B. Beneficial factors for sports tourism development

Sports tourism is an important factor to propel to a city development. And for sports tourism, its development also suffers many factors influences. Urban environment, cultural atmosphere, infrastructure and urban economic level and else, all are sports tourism development correlation factors.

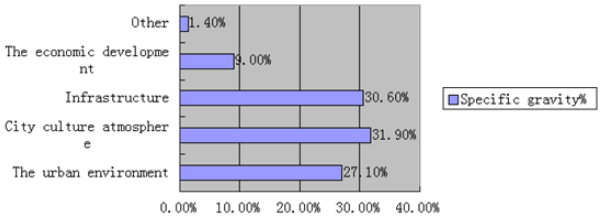

Figure 2: The related factors affecting the development of sports tourism

Above statistical Figure 2 shows: in sports tourism influential numerous city factors, city cultural atmosphere and infrastructure have largest influence on sports tourism, their proportions are respectively 31.9%, 30.6%. City cultural atmosphere reflects a city historical detail, and infrastructure construction is foundation of tourists' tourism, therefore, cultural atmosphere and infrastructure are very important for sports tourism development.

C. Sports tourism position

Sports tourism is a kind of entertainment, body building comprehensive activity; it not only combines with sports elements, but also combines with

entertainment elements. Below table is visitors' leisure time's time distribution table, by comparing visitors' time distribution, observe sports activities importance degrees in their mind.

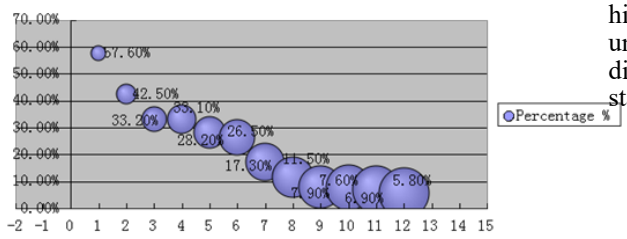

Figure 3: Visitors leisure time allocation table

By above bubble Figure 3, it can get conclusions: in activities that all visitors can participate in, participate in sports activities rank the fourth, is second to travel. It is clear about sports activities importance in people's life. There are many masses have recognized sports activities importance.

D. Sports tourism group structure

Age problem is an important problem should be considered that affects masses participating in sports tourism, and also key problem. Age limitation has very large influences on sports tourism. Below Figure 4 is sports tourism participation group age structure, different ages sports tourism participation proportions are different.

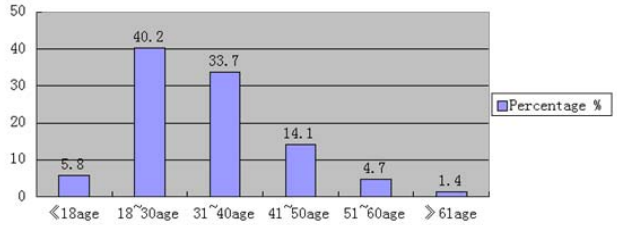

Figure 4: The age structure of sports tourism group

By above bar Figure 4, it can get conclusions: group that participates in sports tourism concentrates on 18~30 years old secondly is 31~40 years old, which mainly is affected by physical quality. In all groups that participate in sports tourism, 18~40 years old group is upmost part group.

Whether can participate in sports tourism, it also significant correlates to economic level. Good family income is foundation of implementing sports tourism, with sufficient fund then can smoothly take sports tourism. Below Figure 5 is group family per capita income that takes sports tourism, analyze its family income, and then analyzes impacts on sports tourism.

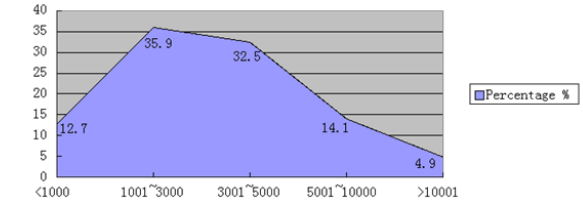

Figure 5: The family per capita income of sports tourism group

From above area Figure 5, it can get conclusions: group that takes physical exercises, its family per capita income concentrates on around 1001~5000 Yuan. Sufficient family income is guarantee of physical exercises, is the key to support its sports tourism smooth implementation. Therefore, family per capita income is very important for sports tourism.

Cultural deposits are one kind of another important factor in taking sports tourism. Different cultural education background groups' sports conscious understanding levels are different. Cultural standards get higher, then sports consciousness will be strong, and understanding on sports tourism knowledge is also different. Below Figure 6 is group's occupation level statistics that takes physical exercises.

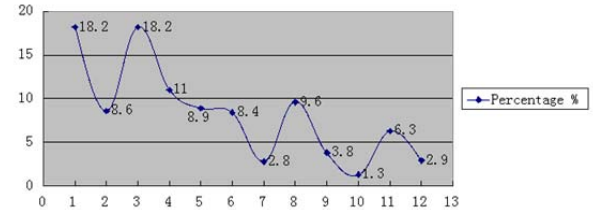

Figure 6: Sports tourism group into the professional level

From above broken line Figure 6, it gets conclusions: students and professionals are main groups that take sports tourism; their proportions are the highest both are 18.2%. And affected by working time, administrative staffs, peasants, executives and other working class participation proportions in sports tourism are not very high.

E. Tourists select sports tourism status

When taking sports tourism, different tourists' selective sports tourism time is different, statutory holidays, the two-day weekend, paid leave, and other holidays, all are selective time frames that tourists taking sports tourism. Below Figure 7 are tourists selecting sports tourism's time statistics.

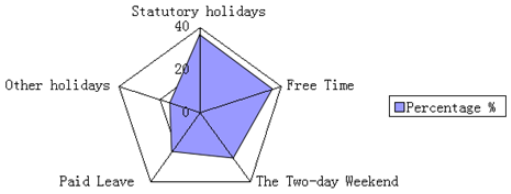

Figure 7: Tourists choose sports travel time

By above radar Figure 7, it can get conclusions: statutory holidays are tourists selecting sports tourism's best time, it is because for working class, statutory holidays are most free time, and then also peak season of tourists' tourism, tourism attractions opening.

Lots of tourists, when they take sports tourism, their main purposes are different, most tourists select sports tourism main purposes are all for entertainment and relaxing mood. Below Figure 8 is statistics on China tourists main purposes in taking sports tourism, by statistical analysis of them, it gets conclusions.

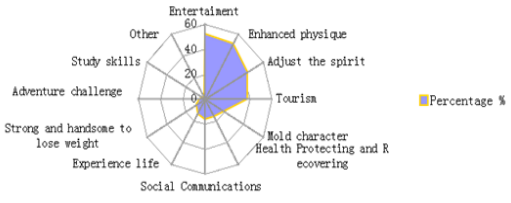

Figure 8: The main purpose of the sports tourism

By above analysis Figure 8 ,it can get : entertainment , enhanced physique and adjust the spirit, relax mood are main purposes that tourists take sports tourism, in addition, there are 38.3% tourists are for tourism. It is clear, sports tourism not only owns tourism entertainment, adjusts spirit, relaxes mood functions, but also possesses sports events enhancing physique function, is best choice of tourists to spend holidays.

III. GOAL PROGRAMMING-BASED TOURISTS PREFERENTIAL SPORTS TOURISM TYPES RESEARCH

Sport tourism is one of important selection that China tourists pass time in leisure time. With development of sports, sports tourism is also more and more favored by public, correlation data is as Table 1.

Table 1: Goal programming data investigation table

	Coast	Hot spring	Village, countryside	Lake	Hilly area	Urban holiday village	Skiing	Golf	Other
Percentage	49.7%	39.6%	31.6%	28.0%	23.1%	23.0%	17.3%	8.7%	1.1%
Satisfaction index	25.1%	23.9%	19.7%	15.6%	7.8%	5.4%	4.9%	3.6%	2.5%

A. Goal programming guiding thought

As the name suggests, goal programming is programming all given systematical problems by mathematical methods and further getting a group of optimal schemes of practice expected goal. Goal programming overcomes linear programming constraints that only solve a group of linear constraint conditions. In addition, to certain goals, they should have primary and secondary ones, and also mutual complementation and mutual antagonism. Meanwhile, there is also maximum value, minimum value as well as a difference of quantitative and qualitative, LP cannot solve these problems, while goal programming just overcomes the drawback.

Generally, goal programming has three kinds of methods, weighted coefficient method, priority method and effective solution method. Among them, weighted coefficient method is defining a weight on every solved goal, and further converting complicated multiple goals problems into single goal problems, but its weight rationality is hard to set; priority method is to classify each goal into different grades, its classification evidence is each goal importance. Effective solution can take all goals into account and further get most satisfied solution.

B. Goal programming data processing

According to above goal programming guiding thought, carry on data processing with tourists preferential sports tourism types data, here adopts sequential algorithm here. Sequential algorithm is according to priority order, transforming complicated multiple goals programming problems into multiple simple goal programming problems, its main process is as following: Among them, optimal value is z_k^*.

At first, most important is tourists' satisfaction index, therefore its priority lists the first grade P_1; secondly, tourists sports tourism implementation suffered economic conditions influences, is the second grade P_2;finally ,tourists sports tourism selection also relates to their spare time, is the third grade P_3. It is required tourists satisfaction index should be larger than 15%.

Calculate above objective function by MATLAB software, and further get goal programming optimal solution is: $z^* = (1,2,3)$, and tourists satisfaction index is 19.8%.

From above objective function optimal solution, it can get conclusions: coast, countryside and la plantation resort, lakes are best choice for China tourists to take sports tourism, and tourists' satisfaction indexes on these three tourism places are universal higher. Analyze from the perspective of environment, the three kinds of tourism places environment is good, quiet and fresh that fit for masses activities.

IV. CONCLUSION

The paper firstly researches sports tourism status and sports tourism group basic information , from sports tourism development influential factors, sports tourism position, as well as sport tourism group age structure, family per capita income, occupational level to concrete analyze above two aspects, by statistical analysis, it finally gets conclusions: cultural atmosphere and infrastructure construction are key factors that affect sports tourism individual development, by far China masses put more emphasis on sports tourism, especially for 18~40 years old group, include students, professionals, working class and so on, and all of them have certain fund base. Secondly, the paper makes concrete analysis of tourists' sports tourism implementation time frame and main purposes, and then further analyzes their preferential sports tourism types. The article by numerical analysis and goal programming, draws radar map and solve optimal solution, finally gets correlation conclusions: when tourists taking sports tourism , most of them select statutory holidays, coast、countryside and la plantation resort、lakes are their preferential sports tourism types, and basic purposes are for entertainment, enhancing physique and relaxing mood.

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Analysis And Design Of Drought Monitoring And Assessment System In Northwestern Liaoning China

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***Abstract*—Drought phenomenon frequently occured in northwestern areas of Liaoning, China. With the increasing of country's drought occurrence, an increased number of exhibits, intensifies, spread expanded platform was needed. Drought inhibits occur frequently disrupt the normal life of people and undermine the sustainable development of the ecological environment. Therefore, the construction of drought monitoring and warning assessment system was significance. This paper fully consider the characteristics of drought in northwestern areas of Liaoning, RS, GIS, databases, networks, and computer technology was launched for drought monitoring and warning evaluation system, and achieve its regular operation, which provide scientific and drought relief strategy for the future development.**

***Index terms*—drought monitoring; geographic information system; decision trees, classification rules**

I.INTRODUCTION

China is a vast country and have a relatively poor use of water resources, because of the climate differences, soil properties. The utilization of water resources is extremely uneven and the phenomenon is more prominent in the Liaoning province, China, so establish of drought monitoring system is extremely necessary. Analysis of soil moisture conditions in various regions, distribution and causes of drought, forecast the development trend, farmers timely and appropriate irrigation. The government departments timely development drought reliefIt which has great practical significance (Wan Z. et al, 2004).

Drought monitoring and assessment system is an important part of the state flood control and drought relief work (Man Cheol Kim. et al, 2010; Morid S, Smakhtin V. et al, 2006). The national and provincial flood control center attached great importance of the water sector in the drought monitoring and assessment system construction, in order to achieve the regimen, real-time monitoring and effective management of rainfall, soil moisture information (Mozny M. et al, 2012). Construction contents of the system focused on the following: soil moisture monitoring; drought information management; data sources drought information management system. The system is mainly used in the statistical data of three soil moisture stations, weather stations monitoring data and related departments to get the topic the main means of figure geographic information, data released manifestations mainly consist with various thematic maps and statistical tables (Du L. et al, 2013; Chia-HungLien. et al, 2008).

Drought in northwestern Liaoning lasted long, heavy damage, spread a wide range of other new features, the traditional method of meteorological and hydrological exposing their fast implementation on a large regional scale drought monitoring and evaluation deficiencies. However, the advent of remote sensing (RS), geographic information systems (GIS) and other advanced technology carried out drought relief work. New ideas, theories and methods to solve the existing drought monitoring and warning methods in time and space poor sensitivity on the scale, while the accuracy and reaction is low, application of scale narrow range of issues. This design of drought monitoring system achieve the following functions: achieve the pre-disaster risk map warning function; achieve a drought disaster monitoring from many angles; achieve a comprehensive post-disaster drought assessment capabilities; multi-scale early warning function achieve a drought forecast; implement drought management network and automation capabilities.

II. RELATED CONTENTS OF OBJECT AREA

A. Overview of research area

In northwestern areas, Liaoning province in the northwest located between the geographical coordinates of longitude 118 ° 52 ' to 124 ° 26', latitude 39 ° 59 'to 43 ° 28'. South of the yellow sea, the southwest border with Hebei Province, adjacent to the northwest and Inner mongolia autonomous region, Jilin Province, adjacent to the northeast and east near the central city of Liaoning group.

The total land area of research area is 59,600 square kilometers, accounting for 14.8 percent of the province's total land area. Total land area in the northwest mountain is 7,900 square kilometers, accounting for 13.31%; hills of 19,800 square kilometers, accounting for 33.16%; plain is 31,900 square kilometers, accounting for 53.53%. Mountainous terrain and hilly areas dominated terrain from the northwest to the southeast reduced stepwise to form the narrow coastal Bohai Sea coastal plains, mountains and sea, which was known as the "western corridor." Nevada is the Inner Mongolia Plateau to the transition constituted Liaohe Plain, at an elevation of 300-1000 meters (Majid Khodier. et al, 2010).

B. Water resource distributed

Northwestern Liaoning province is the most impoverished areas of water resources. Annual average amount of 6.95 billion cubic meters of water resources in northwestern areas, accounting for 20% of the province's total water resources; annual average surface water resources 5.197 billion cubic meters, accounting for 17% of the province's surface water resources; groundwater resources 3.867 billion cubic meters, accounting for 31% of the province's groundwater resources (Table 1). Therefore, northwest Liaoning province is mainly arid region.Table 1. Water resources distributed in northwestern areas

Area	The average amount water	The average surface water	The average groundwater
Liaoning Northwes	69.50	51.97	38.67
Province	341.79	302.49	124.68
Percentage	20%	17%	31%

Precipitation anomaly percentage refers to the difference between precipitation and normal over a period of climate average compared with the percentage of units (%). In the ordinary course of business used for meteorological drought events evaluate monthly, quarterly. Specific formula is as follow (Aleksandar Radonjie. et al, 2010; Seungh wan Kim. et al, 2010):

$$D_p = \frac{P - \overline{P}}{\overline{P}} * 100\% \quad (1)$$

In the formula, D_p - precipitation anomaly percentage, %;

P - Calculate the hours of precipitation, mm;

$\overline{P}$ - For many years the same period the average annual precipitation, mm; should adopt the average for nearly 30 years.

Hydrological drought refers to abnormal water shortages by the precipitation and surface water or groundwater imbalance caused by surface runoff, which can be used in combination with other factors to multi-factor analysis of hydrological drought indicators (Son N T. et al, 2012; Hao Z. et al, 2014).

Reservoir storage capacity anomaly percentage:

$$I_k = (S - S_0) / S_0 \times 100\% \quad (2)$$

In the formula, S - the current reservoir storage capacity (ten thousand cubic meters);

S_0 - Over the same period the average years of storage capacity (ten thousand cubic meters)

River inflow anomaly percentage:

$$I_r = (R_w - R_0) / R_0 \times 100\% \quad (3)$$

In the formula, R_w - current river flow (cubic meters per second);

R_0 - The same period with average flow rate (cubic meters per second)

II. Monitoring And Evaluation Information System

A. Architecture of monitoring and evaluation information system

Microsoft Visual studio 2008 was used as development platform, using C/S and B/ S two architectures, develop convenient and practical drought monitoring and evaluation systems, and business-oriented operation drought monitoring and and assessment. Where C/S-based systems for all types of data for various indicators related to the process of generating and drought, B/S mechanism for C/S processing result of the query and display (Pozzi W. et al, 2013; Katiraie-Boroujerdy P S. et al, 2015).

The system has four categories of functionality that is predicted drought early warning, monitoring, evaluation and drought management. Where drought monitoring meteorological, hydrological and remote sensing three ways to achieve, drought assessment capabilities through agriculture, population affected; short-term and long-term drought forecast by achieving. Drought management briefing by drought plan regulations into drought experience It can be achieved after the system running drought monitoring, assessment and forecasting capabilities, a complete change of the consequences of the development of drought and the resulting track. Functional structure of the system construction is shown in Figure 1.

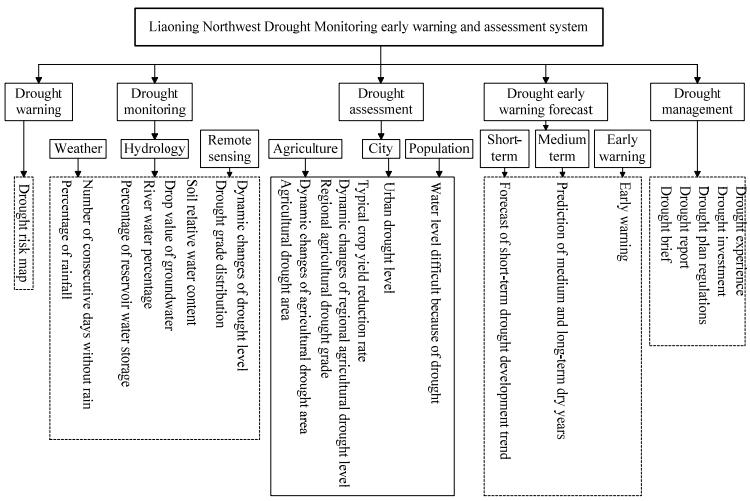

Figure 1. Functional structure of the system construction

B. Database construction

Hydrological data is basis for hydrological drought monitoring. Stations in the study area for daily news are mainly have five types of hydrological stations: water stations, rainfall stations, reservoirs station, moisture and evaporation station. In fact, the vast majority of moisture station and hydrologic station overlap coincide with few rainfall stations or reservoir station. Currently, the provincial hydrological bureau has this part of data collated and construction of the Liaoning provincial flood control and drought hydrological database, therefore, the construction of this system understand the basis of an existing database, according to the actual need of customize the database content and structure (Senay G B. et al, 2015).

According to hydrological drought monitoring needs, the northwestern areas can provide rainfall, soil moisture, reservoir, river monitoring station data. The situation and need run the group of stations, select the desired station, which was shown in Table 2:

Table 2. The distribution of selected stations

City	Number of Stations	Counties (cities, districts)	Number
Shenyang	16	Kangping	7
		Faku	9
Jingzhou	13	Yi	5
		Linghai	3
		Heishan	3
		Beizheng	2
Fuxin	18	Zhangwu	8
		Fumeng	10
Tieling	8	Changtu	8
Chaoyang	26	Lingyuan	2
		Gezuo	3
		Jianping	5
		Chaoyang	7
		Beipiao	9
Huludao	18	Xingcheng	5
		Suizhong	4
		Jianchang	9
Total	99	17	99

Hydrological drought monitoring rainfall anomaly percentage for consecutive rainless days, reservoir storage capacity anomaly percentage, river inflow anomaly percent, groundwater depth and soil moisture content decreased value calculation requires six indicators. Meanwhile, in order to facilitate the operation, the site corresponding to each index is stored separately in a table 3.

Table 3. The basic situation of each indicator selected sites

Number	Index	Number of situation
1	Rainfall anomaly percentage	58
2	Consecutive rainless days	58
3	Reservoir storage capacity anomaly percentage	35
4	River inflow anomaly percentage	23
5	Groundwater table drop value	6
6	Relatively moisture of soil	41

Note: Rainfall anomaly percentage and consecutive rainless days is the same as the selected station.

IV. EXPERIMENTAL RESULTS

A. Moderate-resolution imaging spectroradiometer data

Source remote sensing data released by nasa modis data products. Full name of modis id moderate-resolution imaging spectroradiometer. Modis onboard the 1998 model is mounted to morning orbit and afternoon orbit series of satellites, formally transmit data to the ground from December 1999. Planet Earth is nasa modis mission plans with a total of 15.

Modis is the current generation of the world's optical remote sensing instruments, with high spectral resolution, temporal resolution and multi-spatial resolution. 36 spectral channels, distributed within the range of the electromagnetic spectrum 0.4-1.4um. Multi-band data may reflect the land while providing cloud boundary, cloud properties, ocean color, phytoplankton, biological geography, chemistry, atmospheric moisture, surface temperature, cloud top temperature, air temperature, ozone and cloud top height feature information with the land surface, biosphere, solid earth, atmosphere and oceans for long-term global observations. Modis spatial resolution are 250m, 500m and 1000m, scanning width of 2330 km, in earth observation process, which can get 6.1 per megabit from the atmosphere, oceans and land surface information, can be a daily or every two days being a global observation data, these data for natural disaster monitoring, global environmental and climate change research. Global ecological changes and comprehensive research has important significance.

HDF data format is a hierarchical data management structure, which was shown in Figure 2, it was a self-described, more objective, scientific data for storage and distribution of data formats. For a variety of storage and distribution of scientific data requirements provide solutions. HDF data format design features are: self-description, diversity, flexibility, scalability and independence.

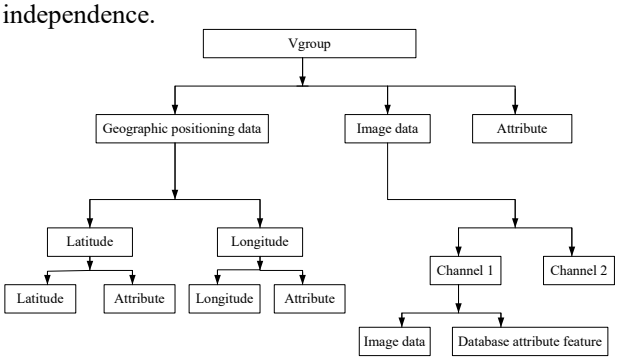

Figure 2. HDF data configuration example

B. Drought monitoring system model

Early surveillance mining library decision analysis requires a lot of well-organized and comprehensive data. In particular, data mining depend on the drought after a certain pre-plot data, which comes from a variety of external data, need to go through a complex cleansing and integration, integration to drought data mining library, the work done by the data acquisition layer. So, early data acquisition layer plays a very important role in the whole system. In this article, we have obtained pretreatment and correlation analysis layer for data in the drought data.

Data mining layer of drought situation monitoring system model is early in the highest level, also they tend to be most concerned about the user level. Data mining

library drought significant integration of data be used for the user, based on data mining data warehouse used in this layer through a variety of mining techniques and tools. Establish drought monitoring side data mining models in this layer, also known as the mining model drought data mining algorithms, algorithms decide how to analyze examples of early surveillance data mining library. In this article, we use decision tree algorithm to achieve early data mining work. Drought monitoring system database management platform was shown in Figure 3.

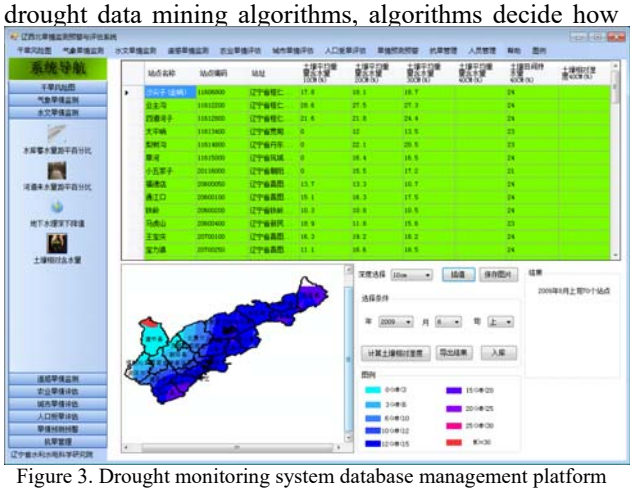

Figure 3. Drought monitoring system database management platform

IV. CONCLUSION

Meteorological drought refers to a certain period of time due to the evaporation and precipitation imbalance. Water indicated shortages caused by income greater than water itself, the system selects the rainfall anomaly percentage and consecutive rainless days two indicators to achieve a meteorological drought monitoring. Hydrological drought refers to abnormal water shortages by the precipitation and surface water or groundwater imbalance caused by surface runoff which can be used in combination with other factors to multi-factor indicators to analyze hydrological drought, reservoir storage system selected anomaly percentage, river inflow anomaly percent, groundwater depth and soil relative humidity values fall four indicators to achieve a hydrological drought monitoring. Remote sensing drought monitoring can be implemented by the regional drought monitoring grades relative humidity of soil inversion, the system selects drought grade distribution and dynamic changes level drought indicators realized remote sensing drought monitoring.

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The System of Wages Management Information System Based on the Internet of Things

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***Abstract*—The human society has been in 21century, which is a combined knowledge economy, information technology and digital period. Crop is a hall where is training the talent for the future society, so Crop can't remain the condition as now. The modern Crop management, the voluntary official business and the scientific decision are a inevitable trend in the modern official manage mental development. The wages information management has a great deal of changes of elements as an important part in the Crop management. The complicated management, long interval and big regular basal wages make a huge data, as a result, the human management becomes very difficult, so the software of the wages management is developed in the twelfth Crop of Qing he area in Tie Ling.**

***Index terms*—knowledge economy, information technology, the Crop management, the information wages, software**

I. INTRODUCTION

The traditional methods of the wages management are all used in the way of artificial statistics and calculation management, but the methods of the management not only waste time and physicals, but also easily make errors and omissions on calculation. The universal access to the technology of computers breaks the traditional management methods of financial management, improves the efficiency of management at the same time [1-14], and overcomes the problems in the traditional methods of management, and enables the controller to orderly and overally manage every worker, what's more ,it also makes them calculate and develop the wage of the staff strictly according to the terms of wages and distributed system[15-21].

The system of the wages management of enterprise can complete daily salary management, such as query, modification, additionally, deletion, storage and so on, and promptly and accurately complete all kinds of the statistics of the salary date and the summary of the work, additionally, quickly print out salary reports and greatly improve the efficiency of the enterprise management[16-19].

```
sjb.SetSJkk(sjkk);
        sjb.sql_update(m_id);
        CDialog::OnOK();
```

II. THE DESIGN OF USERS'MANAGEMENT MODULE

Achieve the functions of the new, deleting users, and the users'management dialog designed as shown in figure 1[17-21].

Figure 1The Steps of the Design

(1) Add a new Dialog resource to the project, whose ID is IDD_XINJYH. Click the right mouse' button in the IDD_XINJYH resource in the dialog ,perform the menu command of the pop-up context menu "Properties" , open the Dialog the Properties Dialog box, select the General TAB, change the" Caption "content of the text box for the "user management "in the Properties Dialog[9-18].

(2) Add four Statics, Combos, three Edits and a Button control to the Dialog resource, change the attributes of the resources, and set up the corresponding variable for the resource, as shown in table 1.

Table 1 corresponding variable for the resource

ID	Properties	Member Variables	
		Type	Member
IDC_EDIT1	Default	CString	m_name
IDC_EDIT2	Password is true	CString	m_pwd
IDC_EDIT3	Password is true	CString	m_pwd1
IDC_COMBO1	Default	CComboBox	m_jb
IDOK	Add Caption		
IDC_BUTTON1	Delete Caption		
IDCANCEL	Quit Caption		

The Code Analysis

(1)Add the OnInitDialog function, initialization Combo controls. The collective code is as follows:

```
BOOL CXinjyhdlg::OnInitDialog()
{
        CDialog::OnInitDialog();

        // TODO: Add extra initialization here
        SetIcon(m_hIcon, TRUE);
        m_jb.AddString("SYSTEM'S COMTROLLER");
        m_jb.AddString("NORMAL CONTROLLER);
        return TRUE;  // return TRUE unless you set the focus to a control
                // EXCEPTION: OCX Property Pages should return FALSE
```

Add a message responsible function to the button 'button'. The code is as follows:

```
void CXinjyhdlg::OnOK()
{
        // TODO: Add extra validation here
        UpdateData(true);
        if(m_name=="")
        {
                MessageBox("Please Input the User's name");
        return;
        }
        CString jb;
        m_jb.GetWindowText(jb);
        if(jb=="")
        {
                MessageBox("The Level Can't be Empty");
                return;
        }
    if(m_pwd=="")
        {
                MessageBox("Please Enter the Password");
                return;
        }
        if(m_pwd1=="")
        {
                MessageBox("Please Confirm the Password ");
                return;
        }
```

```
        if(m_pwd!=m_pwd1)
        {
                MessageBox("Two Password are Diffrent");
                return;
        }
        CCzyxxb xxb;
        if(xxb.Havename(m_name)==1)
        {
                MessageBox("Users to exist. Please Input
Again");
                return;
        }

        xxb.SetCzyName(m_name);
        xxb.SetPwd(m_pwd);
        m_jb.GetLBText(m_jb.GetCurSel(),strjb);
        if(strjb=="System Controller")
                strjb="1";
        else
                strjb="0";
        xxb.SetCzyjb(strjb);
        xxb.sql_insert();
        CDialog::OnOK();
}
```

Add a message responsibal function to the button "delete". The code is as follows:

```
void CXinjyhdlg::OnButton1()
{
        // TODO: Add your control notification handler code
here
        UpdateData(true);
        if(MessageBox("Whether to Delete the Current
Record
","Please Input Again ",MB_YESNO)==IDYES)
        {
                CCzyxxb xxb;
                xxb.sql_delete(m_name);
        }
}
```

When the user clicks the menu item "user management" on the main interface menu, it will perform Menuyhgl function. Specific code is as follows.

```
void CGZGLXTDlg::OnMenuyhgl()
{
        // TODO: Add your command handler code here
        if(ffxxb.GetCzyjb()=="1")
        {
                CXinjyhdlg dlg;
                dlg.DoModal();
        }
        else
        {
                MessageBox("Permission Denied ");
                return;
        }
}
```

III. ACKNOWLEDGEMENTS

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Control Method of Image Quality in Digital Printing

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***Abstract*—With the development of social economic and continuously progress of science, color image and its replication is becoming the main techniques and market demands of information visualization and its content expression. Because of its maturity, high quality and low cost, color offset printing has been the most commonly used method of color image hard copy reproduction. Research and study to resolve color image features high definition reproduction in digital printing and making sure the final printing quality's stable has been the goal of printing industry. Establishment of the controlling method based on digital printing is the key issues nowadays printing industry facing and has great significance to the whole industry technological progress and development. The influence factors on the quality of the image in digital printing were analyzed in this paper. Then the appropriate quality control system was built. Based on this control system, actual production test had been done and we optimize the main steps of the printing process and meet the anticipate requirement of printing quality.**

***Index terms*—Digital printing ; Image quality ; Control method; Color system**

I. INTRODUCTION

The first laser printer was developed by Xerox Corporation, USA in 1973. Then HP introduced the LaserJet laser printer in 1984 and formed a series of the LaserJet by which laser printer entered a new stage. In 1993, Israel Indigo Corporation launched at IPEX the world's first color digital press —— E-Print 1000. Indigo raised the revolution in digital printing technology with Xeikon on Drupa1995. Since then, there were further development and innovation on the quality, print format and printing speed of digital printing. On Drupa2000, a total of 46 digital press exhibitors have showed their promising digital technologies. In addition to the Indigo, Xcitex, Xerox and other established manufacturers, some well-known traditional offset press also began to enter the digital printing market, such as Heidelberg, MAN Roland, KBA etc. Digital press became a highlight of Drupa 2004, every company exhibited their latest digital printing press, provided the latest technology at their disposal and their achievements in the field of image quality control[1-20].

In recent years, high-speed inkjet printing plays a major role in the digital printing. An increasing number of equipment suppliers have launched into high-speed inkjet research. Apart from Kodak, HP, screen, InfoPrint, Oce, Founder and other equipment suppliers, Xerox Corporation, which is always obsessed with the static digital printing technology, has also joined the ranks. Even some traditional printing enterprises such as RR Donnelley began to develop high-speed inkjet printing equipment. The speed of high-speed inkjet printing equipment accelerates (up to 220 m/min), its format extends a lot (the maximum width is up to 762 mm) and its quality gets more reliable (the resolution is up to 1200 dpi). The flexibility , printing cost and paper printability of this equipment have also been significantly improved. As a consequence, high-speed inkjet printing equipment can be full applied to bills, demand publishing, commercial printing, personalized packaging and labeling, personalized newspapers and other related areas[1-21].

II. EVALUATION STANDARD OF COLOR DIGITAL PRINT QUALITY

An array of data standards of printing quality control have been formulated so as to control the complicated color quality during the production process and to achieve data and standardization of printing quality. The standard range of monochrome and trapping solid density is listed in Table-1. Table -2 lists a standard range of relative contrast (the value of K). Table 2-3 shows color difference standard range. Generally speaking, in terms of refined products' dots at 50%, their dot gain range is 10% to 20%, while to ordinary products is 10% to 25%[2-18].

Table 1 Solid density standard

Ground blocks	***C***	***M***	***Y***	***K***	***Trapping color***
Refined products	1.30~1.55	1.25~1.50	0.85~1.10	1.40~1.70	>1.50
Ordinary products	1.25~1.50	1.15~1.40	0.85~1.05	1.20~1.50	>1.30

Table 2 Relative contrast (the value of K) standard

Color	***Refined products***	***Ordinary products***
Y	0.25~0.35	0.20~0.30
M、C、K	0.35~0.45	0.30~0.40

Table 3 Color difference standard

Differences in visual experience	ΔE
Nearly no color difference	$0 < \Delta E < 1.0$
Little color difference	$1.0 < \Delta E < 2.0$
Moderate color difference	$2.0 < \Delta E < 3.5$
Obvious color difference	$3.5 < \Delta E < 6.0$
Strong color difference	$6.0 < \Delta E < 12.0$

III. AUTOMATIC CHROMA CONTROL PRINCIPLE

Due to the adoption of automatic chroma control, on-machine scan and measurement of control elements or even any position in picture of the printing products can be realized during the printing process. After being compared and analyzed with the stored standard data continuously, the obtained data will be fed back to a central console to be converted. A control signal will be sent to the ink control unit of the digital press to adjust and govern the amount of ink instantly, so as to change print solid density, relative contrast, dot gain and other parameters of printing products. This approach can not only ensure the stability of printing color, but provide real-time data for reference. The principle of automatic chroma control system is as figure -1 shows [13-20].

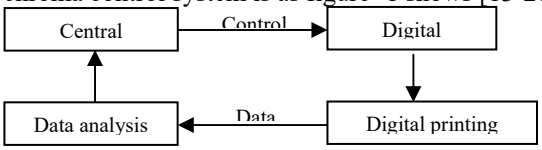

Figure 1 The principle of automatic chroma control system

IV. EMBODIMENT OF DIGITAL IMAGE QUALITY CONTROL

Although the digitized production process has significantly reduced the working hours of traditional printing and decreased the error rate, quality problems in each step of the process still exist. As a result, it's very crucial to execute control of the printing process.

Digital production process makes the actual production data flow and control flow intuitive compared with the traditional process. We can only see the input layout elements, layout information presented by display apparatus and the final output color digital proofs and CTP plates. As its job information exists in digital form, any small mistakes or errors will lead to the failure of data transmission or abnormal output results which is beyond the operator's control and makes it difficult to check the problem. Thus these variables become uncontrollable factors of the prepress operation. In order to ensure that data can flow smoothly and correctly, we need to find a practical method of data flow control.

There are two information flow of print job in the industry production, "graphic information flow" and "production control information". Graphic information flow is to solve the problem of "what to do" and production control information is to solve the problem of "how to do" and "what will be get". These two types of information are digitized during the digitization process; they can be stored, recorded, processed and transmitted by computer. Control nodes of data flow in digitization process include file preflight, print output PDF standardized digital imposition and output after RIP[6-19].

Color management system carries out color conversion of different color space profile so as to unify the output color and the original color (shows in Figure 2). Color management based on ICC has been widely used in industrial production and plays an outstanding role in it. ICC Profile is able to record color performance of different devices and connect scanners, monitors, printers and other input or output devices through gamut conversion which makes colors consistent as much as possible. The ICC working process is to convert discretional input color information into the color of CIELab color space, then convert it into the color space of output device.

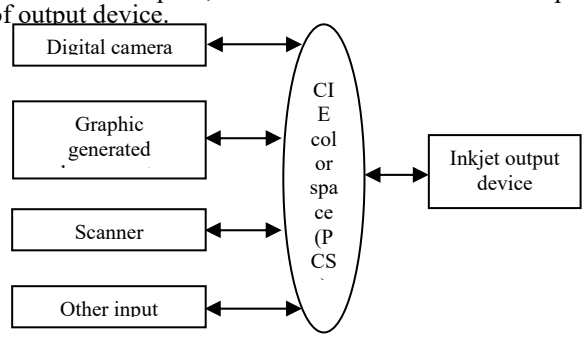

Figure 2 Color management process

Calibration of device is the primary of color management which adjust the equipment to achieve the desired operation. There are various reasons for calibration, but the most important reason for color management is to make the device behavior consistent to get accurate description by device profile. During calibration, the known color values (refer to stimulus value) will be delivered to the device and then we'll get a measured color results (refer to response value). Finally we shall regulate the device according the obtained stimulus value and response value until the response value achieves the required value.

The purpose of calibration is to adjust the working status of device to enable it to be accurate and stable and produce the same color on the same input values, i.e. produce the same response on a given stimulus. It is a prerequisite for establishing profile of devices and making the profile reflect the device behavior accurately[7-18].

The design, output and color measurement of sampling color and reasonable selection of file parameter should be accomplished for establishing the ICC profile of digital press.

(1) Optimization of output state

In terms of printing, digital proofing and printer controlled by PostScript, CMYK signals control the output of color quantity directly. As a result, the maximum amount of ink for each primary color and the tone curve can be and thus can be adjusted and controlled individually to achieve optimal output state. There is a certain standard data requirement for the solid density, halftone curve and gray balance of the maximum amount of ink for each ink channel. The optimization of this output state can be guaranteed by adjusting the printing press and printing process parameters[8-19].

Digital presses are often designed with self-correction function. The process is as follows. Firstly, outputting a calibration color patch contains every primary color gradation. Figure 3 shows the self-correcting output color patch of Konica Minolta C6000 digital press. Secondly, the dot area and solid density of color patch are measured by the color measuring instruments of device. At last, the output parameters can be adjusted automatically according to the measurement results so as to match the default output state (it's also regard as the acquiescent output state of the device). After calibration for Konica Minolta C6000 digital press, the maximum solid density of cyan, magenta, yellow and black are 1.45, 1.45, 1.10 and 1.75, each gradation output outlets has reached the target value basically[7-17].

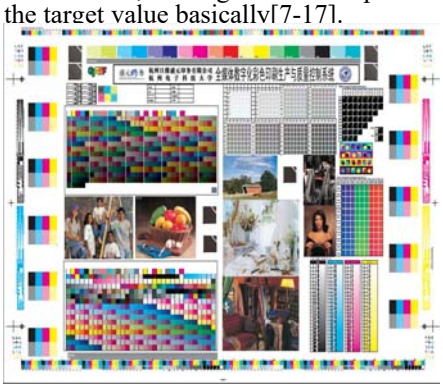

Figure 3 Self-correcting output color patch of Konica Minolta C6000 digital press

If you need to change the solid density and tone curve of one or more mass tone, you can change the maximum density value and dot gain value of the corresponding channel.

(2) Sampling

Sampling is the first step of establishing Profile that is to design some representative device color values to print or output and measure the CIE chromaticity values.

Output sampling is a process of printing or outputting color patch to color block in a hard copy way. Digital press output is directly driven by CMYK values, and then the corresponding ink level and hard copy color will be formed.

Outputting color patch is to complete the CIELAB chroma sampling, so the chroma measurement of color patch is also an important part of sampling. The easiest way to achieve the time for reaching the ultimate stable is to measure color patch continuously with an automatic measuring device until the adjacent measured results are close or identical. It's about two hours for color stability after outputting, and then you can measure color.

(3) Generating Profile

After the color measurement of color patch has been completed, a functional relationship between the device color values and CIELAB chroma values recorded in a standard relationship form (CLUT) shall be created under certain limited parameters, this generates a standard ICC profile. Before generating a profile, you need to determine the control parameters include gray match, gamut mapping and file size. When all parameters that the established profile needs are defined, a configuration file will be created and select a storage path for it.

Calling the customized ICC in output profile options and outputing the measurement of IT8 color code again to evaluate the output effect of digital presses in the case of color management. The color gamut of digital press can be better matched with offset at the case of using customized ICC.

Normally, the system can not simulate the printing results very accurately by automatically calculating, appropriate editing of the customized ICC profile, namely, secondary calibration is essential. Which involves the operator of the printing color mastery of knowledge and practical experience accumulation, the average user is more difficult to grasp.

As many types of measuring instruments are used in color management of digital printing, it's essential to choose an instrument. The color measuring instrument refers to various optical instruments which are designed to measure the reflectivity, transmittance, CIE chromaticity values of object and the color brightness of visible spectrum (380 to 730nm) or radiance.

Color exists in digital form while being transmitted, so accurate measurement of data is the key to make good color management. Judging from the current development situation of color management in digital printing, the major preoccupations for realizing the industrialization of color management are color management software, digital presses, measuring instruments, ink, paper and the staff operational level. Under the premise of specific equipment, software and materials, improving understanding of color management and operational level of staffs and doing a good job in every aspect of color management process become the most important of good digital printing color management[12-20].

With the deepening of digitization in digital workflow, the amount of data was increased geometrically. Except for a fast network, optimizing the transmission and management of data on web is also necessary. Thus two related specifications have been developed: OPI (Open Prepress Interface) specification and DCS (Desktop Color Separation) specification. OPI specification allows the low-resolution substitution image to be used in imposition which is automatically replaced with the corresponding high-resolution images in color separation output by OPI server so as to reduce the amount of file transform. DCS specification is an extension to the EPS file format, it can manage the whole color separation process of desktop publishing which shorten the production time and reduce the requirements for equipment. Data flows in the whole digital workflow, so it is extremely important to avoid the data file missing in transmission and to ensure the consistence of different platform interpretation on profile. Otherwise you will get wrong output results because of data loss of files that sent to the back-end. CIP3 standard has been developed to CIP4 to achieve unified document control in the integrated printing production and its members have also developed a new file format JDF[13-19].

Digital proofing has gained a toe-hold in the digital workflow with its own development. It is a "non-film" technology emerges with the development of network technology, CTP technology and prepress digital. It plays an important role in modern digital printing process.

The development of a new generation of RIP has effectively promoted digital proofing. The function that "RIP once, output many times" has ensured the consistence of files used in proofing and printing. Files are explained by RIP only once during this process, then they can be outputted to printers and plate setters, thereby eliminating many repetitive tasks and saving time, as well as ensuring the consistency of samples. Digital proofing is essential in digital printing workflow.

Digital proofing is different from the flat-bed cylinder printing and cylindrical extruding cylinder printing of traditional proof; it reproduces printing color by applying color printing with big color space to printing method with small color space and is based on colorimetric range of products and the related RIP data. Digital proofing is possible to meet the requirements of lithographic printing, gravure printing, relief printing, flexography printing, screen-process printing and other printing methods. It makes proofs according to the user's actual position which solve the problem that proofing and the follow-up actual printing process can not be matched[14-18].

At present, many countries have employed advanced on-line monitoring and controlling printing technology already. A printed control strip is usually applied in conventional test to only control the next printing process, and the test results can not be fed to the printing process online to control the printing process and improve the quality of printing. The advanced on-line monitoring and controlling printing technology can achieve direct feedback while testing. Not only can it test the control strip, but also test specific products directly. This development is based on the development of computer technology because the computing speed allows analysis and test of a whole picture within a very short time [11-21].

Online detection technology shoots continuously on the printing production line by CCD camera lens and transmits the taken images to computer for analysis promptly. The test contains color detection, layout detection, handwriting detection, location matching detection, tinting, etc [7-19].

V. Conclusions

Printing industry springs from traditional printing, changes of it experienced from DTP to today's CTP and digital printing. People's attention is no other than the transmission and reproduction of graphic information no matter how the printing industry changes. Accordingly, evaluating the quality of reproduction of graphic information and using effective methods for quality detection and control are extremely important. The control method of image quality in digital printing and experiments on color management based on factors affecting image quality during digital printing were discussed in this paper. Only you take every kind of factors into account can you get a satisfactory product[13-21].

Digital printing technology is mainly characterized by high speed, alterable information and layout, simple process, short cycle, etc. Thus it suitable for “personalized printing market”, “variable information printing market”, “short-run printing market” and "in demand printing market”. Digital printing technology will become the most widely used technology in printing industry which calls for solving the quality problems of digital printing effectively. With the development of digital printing technology, new controlling techniques and tools will emerge continuously. So it’s of great importance to enhance the equipment, technology and personnel quality of companies for better ensure the quality of printing products and guarantee its invincible status in the fierce market competition in the future.

VI. ACKNOWLEDGMENTS

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Design of Temperature Collection System Based On Wireless Sensor Network

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***Abstract*—The interaction mode among people has been greatly changed by the Internet, whereas, the interaction mode between people and the nature will be greatly influenced by the wireless sensor network. The wireless sensor network has attracted great attention of the world, and is an emerging researching area with multi-discipline interleaving. It integrates sensor technology, embedded computation technology, network and wireless communication technology, distributed information processing in real time, It detects, apperceives and collects the information of various environments objects with the collaboration of kinds of IC sensors. The wireless sensor network is easy to deploy and maintain with high reliability, reuse able, etc. In this paper, we designed a temperature sensor node to detect the temperature in the industrial scene, which is used to avoid the accident in the business practices.**

This paper introduces the designation of the wireless sensor nodes and the implement of wireless sensor protocol in the industrial scene temperature collection systems. Commonly in the wireless network, nodes are supported by batteries. So, how to save the limited power is the core important point in the designation of the entire wireless sensor network software and hardware system. We adopted the medium access control protocol based on TDMA. In the idle time, nodes are in the lower-Power status.

***Index terms*—Wireless sensor network; Temperature; TDMA**

I. INTRODUCTION

This topic is the study of the central control node of temperature monitoring system and design of wireless sensor nodes. For requirements and characteristics of the system, decided to adopt TDMA-based media access control protocol, using nRF905 RF transceiver module for wireless sensor networks. Research and development of the entire network, and complete test data acquisition, communication and monitoring interface[5-25].

The paper is to study the application of the system network communication protocol. A brief overview of the network communication protocol, while the completion of the data transmission network topology for single-hop star network programming, and then consider the problem of energy-saving software, and finally completed program design of the control interface protocol [4-17]

II. Network Communication Protocol

Network Topology

This design is a temperature monitoring system used in the industrial field. The entire system consists of a PC as a monitoring interface, check the hook on line 485status for all status information for a central control node, each of the central control node with up to 10 wireless sensor nodes, and each sensor node can connect up to eight thermocouples. This is the time measurement of the maximum time frame, the sampling time, a wireless transceiver, the wireless transmission of data measurement, and the amount of time measurement, and the considered of battery replacement time ,and concluded that the system's biggest hook.

Protocol design

The entire network communication protocol is a TDMA-based media access control protocol. The following describes the timing diagram, the central control node part and the part of the protocol of wireless sensor nodes.

Timing Diagram

Timing diagram is in order to describe the sequence of communication between the central control node and a wireless sensor node.

Industrial field conditions are relatively poor, cannot always replace the battery, about a year to replaced the battery, expect to from the chip select, hardware design and other aspects to consider energy conservation, and also requires each frame slot long enough to make the MCU sleep, the most appropriate length of time to come to this frame is 5s, for other time periods of set is by the accurate measurement and calculated, for each time period measurements are basically using the MSP430F147 timer measured. MSP430F147 timer respectively measured central control node sends synchronization signal (Beacon) and wireless sensor node receives synchronization (Beacon) signal of time are 6ms, a wireless sensor to collect 8 channel temperature information for 1.6s, wireless sensor sends the maximum packet to the central control node receives a packet time is 20ms, so the time of center system nodes to receive packets is set to 20ms*10. The total time 5s of frame minus time 6ms of synchronization signal, subtracting the time 200ms of it wants to receive the packet, the rest of the time left to the central control node and PC communication; the total length of the frame 5s less the time it receives a synchronization signal 6ms minus and the sampling time l.6ms, minus the wait time for other wireless sensor 6ms(this time is different according to each of the wireless sensor node ID number corresponding to different value), less the time to send data 20ms, the rest of the time is to wait for the other sensor nodes together into the next time frame [3-23].

Slot allocation

In the entire wireless network protocol design, the timeslot allocation is a key factor; it is the basis of a wireless network can communicate properly. This design uses the wireless network communication protocol is based on the way the media of TDMA (Time Division Multiple Access) access control protocol, TDMA is a non-competitive media access control protocol, each

wireless sensor node will get a communication slot, in their own communication slots for data communication, While in the other time slots can turn off the wireless communication unit to avoid communication conflicts between nodes, and to achieve energy saving.

In fact, this slot is to avoid two adjacent wireless sensor nodes in the transmission data conflict, so the calculation of the time slot size is very important, at the same time it also high accuracy requirements to be accurate to at least the order of microseconds. The size of the slot is the time of the wireless sensor nodes sends a packet to the center control node, which is measured with a microprocessor timer. These wireless sensor node ID number is programmed to calculate the time of sending data packets, according to their own ID number, calculation methods with their own ID number minus 1, multiplied by the slot, you get what you want to delay sending date packet. So that in each segment of slot, there is only one wireless sensor nodes communication with the central control node, as long as the time slot is calculated accurately, the conflict does not occur on each of the wireless sensor nodes, the central control node can accurately receive all packets [5-30].

On the one hand, it would cooperate with all wireless sensor nodes in the region, and on the other hand, it would communication with PC, and displayed the date of the temperature data according to need. According to these needs, the central control node protocol designed as follows:

(1) According to the design of requirements and measurement of part-time 5s set the time frame to 5s, in other words, this unit is necessary to synchronize with every 5s. The program starts first initialize the various parts, and then enter the circulation, timing 5s.

(2) into the sending state, send synchronization (Beacon) signal to the wireless sensor node, this signal as the start signal of the wireless sensor nodes.

(3) into a wait state, this time to wait for the wireless sensor nodes collect 8-channel temperature data. The purpose is to ensure the synchronization of the central control node and wireless sensor nodes time.

(4) enters the receiving state and waits for the reception, and receive data when the MCU to monitor the DR(Data Ready) is l.

(5) Into a wait state. This period allows a PC to send commands to the central control node MCU, and return the temperature data of PC needs to display, and then wait until the next time the beginning of the frame.

A central control node and a plurality of wireless sensor nodes form a network unit. We need a plurality of central control node to monitor due to the need to monitor the temperature of a plurality of regions, these central control node through a line 485 connected to the PC, the entire wireless sensor network system is united by all of these nodes[8-21].

The section Software design of wireless sensor nodes

Collecting temperature information is required on the one hand, on the need to coordinate with central control node. According to these needs， Parts of the agreement of Wireless sensor nodes are as follows:

(1) First, the various parts of the initialization, nRF905 in the receiving state, have been waiting for the central control node send the Sync signal (Beacon), the synchronization signal (Beacon) wireless is the start signal of sensor nodes time frame [1-19].

(2) Sampling, first turn on the MAX6675 and 74HC4051 power by the MCU control FET, and collected eight channels of temperature information, and then the two of the power is turned off at the end of the sampling. During the sampling period, the nRF905 is in shutdown mode, as we do not need to receive and transmit signals, it will be closed, this is one aspect of energy saving.

(3) Read ID number (ID number is obtained by the hardware design), calculated its own time slot, do the appropriate delay, the MCU sleep, also for energy saving. In this way, each sensor node sends data are different, they will not conflict. So this time must be calculated very accurately, which is the key to the design of the entire slot.

(4) The nRF905 into the transmit mode, sent the data, and then MCU hibernation, shut down the nRF905, reduce energy consumption as much as possible. For this node we should wake up early the MCU into the next time frame. The whole design of the entire wireless sensor nodes, the design is to achieve the maximum possible energy saving. The usefulness of this network is that the wireless sensor nodes and the central control node in the entire network are above increase or decrease in this process will not affect the existing network nodes. If a central control node with 10 wireless sensor nodes and a wireless sensor node with 8 thermocouple a central control node can collect temperature information of the 80 position it as a unit. Place a unit filled with 80 wireless sensor nodes ,while the central control node as the center, wireless sensor nodes around, covering at least l0000 m, the monitoring range is still very wide[9-21].

III. The Problem Of Energy Saving In Software Design

The energy-saving design in software programming problems is use of the microprocessor sleep function, we choice low power consumption of the MSP430F147 in the design of the microprocessor selection, it has one live mode and 5 low power mode. Anyone interrupt time can wake up the system from a variety of low-power mode, and RETI (interrupt Back) instruction can return the system to the state before the interruption. It need initialize the system in the main program, such as interrupt settings, port assignments and clock scheduling; and emperor system clock can also stop even into the power mode, the system power consumption only to uA orders of magnitude in this time. The CPU will wake up within 6us time when an enabled interrupt request, enter the active mode, execute the interrupt Service program. When the execution is completed, after the RETI instruction, the system returns to the state before the interruption, the system continue to enter the low-power mode. The operating mode of the MSP43OF147 is set by control bit. In various operating modes: The bell system generates three kinds of active is of the same. Table.1 react the various operating modes, the relationship between the activity state of the control bit and three clocks [7-18].

This design choice is the low-power mode 3. Delay, waiting for the other line sensor nodes in a wireless sensor node together into the next time frame, only requires an MCU timer operation, low-power 3 just ACLK activities.

This design is ultimately to be used for industrial field; it requires must be in accordance with the human willingness to modify some parameters of the micro-processor or to read out the data of the desired temperature. This is more to facilitate the operator to monitor the temperature of the entire system changes. This monitoring interface does not need to be done by the design, but it requires the design of the central control node between the communication protocol and the PC to ensure reliable data exchange between the PC and the central control node [17-28].

This communication protocol is divided into two parts, one part is to modify some parameters of the central control node instruction， other part is to return the desired temperature data or status information instruction.

(l) Modify the command

Modifying command is that modify the baud rate and the ID number of the central control node, the control command is % AANNCC (Cr). "%" is the command character; "AA" (range 00h to FFh) on behalf of the central control node is configured modules characters address; "NN" On behalf of the module will be configured to the new address; "CC" is configured Potter rate code, a

When MCU received this command which send by PC through 485, if the module receives the command, you need to return the “!NN(Cr)” ; if modify command invalid parameter or command format is wrong, you need to return "?AA(Cr)”; if without this module, there was no return.

(2) Return command

The return command is a command to return the corresponding temperature value or its configuration state parameters according to need. There are three kinds of control commands.

① $ AAI

"$" is Command character; "AA" (range 00h to FFh) represents the call center control node module address of the character; "l" is read configuration status command.

After MCU receives this command, if the module receives a valid command, then return“>AACC (Cr)”, instruction "AA" ibid."CC" said baud rate code now. The command is invalid and no module returns ibid modify the format of the instruction.

②$ AAZ

Where "$" is the command character; "AA" is the same meanings as above; "2" means thereon thermocouple mount state of all the sensor nodes.

After The MCU receives this command, if the module receives a valid command, it returns "> AABBFF (the CCFF ...) (Cr) instruction" AA "above;" BB "represents the address of the wireless sensor nodes," the FF "said eight channels of wireless sensor nodes mount, 0 represents the channel no thermocouple, 1 indicates the channel without thermocouple in the 8-bit byte . Channel status as shown in

“>AABBFF(CCFF...)(Cr)” command length is variable, it depends on the AA central control node connected to a number of wireless sensor nodes. If no connected wireless sensor nodes is returned ,then AA (Cr) returns ,then the longest number of bytes is (l +4 * N (0 = <N = <10) + l + l), N represents mount the number of wireless sensor nodes.

③ $ AA3

"$" is Command Prompt; meaning "AA," is the same meanings as above ;"3" refers to a node on the fixed module temperature data of all the front of the sensor and control unit.

After MCU receives this command, if the module receives a valid command, then return "> AA (data) (Cr)" instruction "from” ibid; “(data)" means Module address data from the connected sensors and front-end monitoring and control unit. The command invalid and no returned module ibid.

Above done is the analysis and interpretation of the instruction format. Because the design requirements will always be able to respond to the PC sent to command, the 485 has been in response will be the best, but during the wireless transmission of data, if the PC is sent to the command, MCU will interrupt in response to the serial port of the PC, it will cause data loss or error, so during the wireless transmission of data, you need to close the serial port interrupt response against MCU to ensure the accuracy of data transmission [19-30]

IV. CONCLUSION

The wireless sensor network research involves multiple disciplines and areas of networking, such as communications, embedded systems, signal processing, sensors, MEMS and so on, the design of the study was only in the field of communication, we use radio frequency technology to develop a temperature monitoring system. This system is simple, easy to operate, easy to install, Very energy-efficient, more importantly, timely and accurate information, safe, reliable, and low cost.

This paper first introduces the concept of wireless sensor networks, the characteristics and the challenges ahead and explains the objectives and content of the design, and then describes the specific design and testing of the entire network in detail. The design of the specific work is summarized as follows:

(l) For the central control node and wireless sensor node hardware design. Including the design of each part of the circuit, each portion corresponding to the peripheral circuit design and the design of the PCB board.

(2) Debugging software IAR for MSP430 430, using the C programming language to the normal communication between the sensor information collection, data storage, and serial port operation and control procedures of the RF transceiver module, each module of the program.

(3) Programming TDMA-based media access control protocol, and a single hop communication between multiple wireless sensor nodes and the central control node for the formation of large-scale wireless sensor networks to do the pre-exploration.

(4) Has some PC software on the entire temperature monitoring system has been tested to ensure the correctness of the system.

Through the design and research, but preliminary research on wireless sensor networks, but can be applied to the actual future follow-up of this network research and development. The design and implementation of multiple central control node and a central control node with 10 wireless sensor nodes, not the actual test, after the entire network set up, the actual test.

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Safety with Local Network Application System

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***Abstract*—Nowadays, campus network is faced with varieties of security threats during the operation. This thesis analyses securities and access control system of applications in campus network, then it puts forward a safe strategy which can be in security defense system and applications in campus network.**

***Index terms*—Campus network, network security, security planning**

I. Introduction

Convenience and shortcut are brought to education and system application by the network techniques while the safety menace of campus network is brought too. An inestimable loss and a barrier of the wider application of the information technology are caused by the illegal actions of a computer system, such as invading, stealing, distorting and damaging important information data. The network safety problem of the campus network is increasingly serious. The network safety of the campus network is urgently required. The author discusses a safety program for a campus network application system according to his experience of network teaching at the aspects of network fire wall of the campus network, the safety design of the campus network application system, etc.

II. Program And Design For The Network Fire Wall Of The Campus Network

Encryption techniques are generally contains two categories: "symmetrical type" and "asymmetric type". Symmetry encryption is to use the same encryption and decryption keys, usually called "Session Key" [1-12].It has been widely adopted, such as the U.S. government the DES encryption standard is a kind of typical "symmetrical type" encryption method, its Session Key length is 56 Bits. Asymmetric encryption is encryption and decryption, which use the different key, there are usually two keys, considered as the "public" and "private key", they must use two pairs, otherwise it can't open the encrypted files. Here the "public" means can made public, "the private key" is not, only by the holder a person know. It has the advantages, because of the symmetrical type encryption method if is on the network transmission encrypt files, it's difficult to put the key tell each other, no matter what kind of method may be don't tapping into[13-21]. Rather than symmetrical type of encryption methods have two key, and one of the "public" is public, other people know nothing about it, the recipient declassified with their own private key as long as avoid the transmission of the safety problems.

As the first line of defense of the campus network, the network fire wall can intercept most of the remote attacks. The program and design for the network fire wall of the campus network plays an important role in the safety of the campus network. The attacks to the network fire wall mainly are the attacks from DoS (Denial of Service) and DDos (Distributed Denial of Service)[6-16] .

The DoS and the DDoS attacks are one of the safety menaces of a large-scale website and a network server. The DoS is an attacking means utilizing mass data packets exceeding the handling capacity of an attacked target to consume an available system and a bandwidth resource, so as to cause the network service to be paralysed. There are three general defending modes for preventing and treating the DoS: SYN gateway, passive SYN gateway and SYN relay.

SYN Gateway

When a SYN packet of a client is received by the fire wall, the SYN packet is directly forwarded to a server. After the SYN packet is completely handled by the fire wall, the SYN packet is forwarded to the client. The server can bear more connecting states than semi-connecting states, so that the SYN gateway can efficiently relieve the attacks to the server[5-16].

Passive SYN Gateway

A SYN request overtime parameter of the fire wall is set as being much less than an overtime deadline of the server. The overtime parameter of the fire wall is much less than the overtime deadline of the server, so that the SYN Flood attacks can be efficiently prevented.

SYN Relay

The fire wall, as an agent, is used for realizing the connection of the client and the server, so that the unavailable connection can be completely filtered and forwarded to the server [11-18].

Sniffer is a frequently-used data collecting method. The sniffer also can be regarded as a tool for monitoring and collecting data information [12-20]. The sniffer is mainly used for analyzing the network flow, so as to find out the potential problems in the network. For example, when the network speed is lower but the problem cannot be found, the Sniffer can be used for accurately judging [14-19].

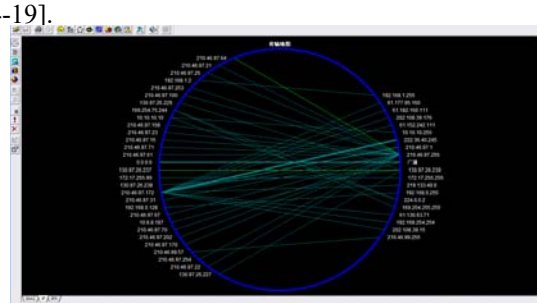

Fig.1. Use sniffer check network communication How to Find the Sniffer

Prove that the sniffer exists in your network. Presently, there are two ways:

Check if the packet loss rate of network communication is abnormally high.

Check if the network bandwidth is abnormal.

Preventing Sniffer Monitoring

A presently adopted way is to encrypt the transmitted data and use less sharing type HUB as far as possible. In this way, even if a Hacker successfully intercepted the data packet transmitted by a user, the Hacker is difficult to decrypt the data packet, so that the significance of monitoring the Sniffer by the Hacker is lost [12-17].

Another method is to use an easily accepted safety topological structure[15-18]. A system safety manager will regularly perform safety test on the managed network, so as to prevent the potential safety hazard. Meanwhile, the quantity of users owning wider limits of authority should be controlled [17-19]. At the same time, what should be kept in mind is that many attacks often come from the interior of network.

II. Safety Design Of The Campus Network Application System

The campus network application system comprises an information publishing system, an office automation system, and the like[14-19]. The obvious characteristics are that the access should be strictly controlled, only the authorized user is allowed to access, and the strict identity confirmation is required and the safety audit manner is to be supplied[20-21].

The author use the OA system as an example, the design of the system, development and acceptance. Because it involves a partner product confidentiality, here is a brief introduction on the system security audit of module structure:

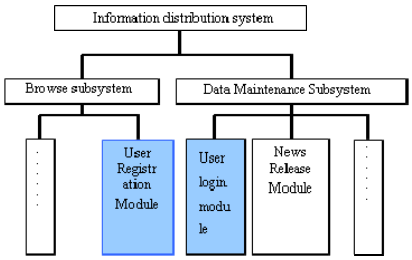

Fig. 2. Authentication structure

Identity Confirmation of the Campus Network Application System

As the first gate of protecting the network resource, the identity confirmation plays an important role.

For a user registration module, the system is forced to use strong password, namely, the length of the password must be at least 6 bits and the password must contain letters, numbers and special characters. Generally, JavaScript is utilized to identify the system before the page is submitted. For a user log-in module, generally, the module capable of being maintained by the user is controlled according to the role of the user.

A RegExp object and a String object of the JavaScript define that a regular expression is used for performing a method for powerfully matching modes, searching texts and replacing functions. After password characters are obtained from the page, the regular expression is utilized to perform length check and character validity check on the password . When a log-in button is clicked, the password verification is sent out. The page submits the data to the server only when the password passes the verification.

When the user logs in and enters into a data maintaining sub-system, a module menu capable of being maintained by the user is generated according to the ID of the logged user. The menu control is utilized to generate the menu linkage of each module in each sub-system. The user can directly access the to-be-maintained data page through the linkage.

Encryption Technique for the Campus Network Application System

When we establish a database on the website, protecting the information safety of the user is necessary. In order to solve the problem, a simple, practical but old method is provided, namely, password encryption . Herein, we utilize ASP.NET technique to encrypt the password. Simply speaking, after the password supplied by the user is encrypted, the password is compared with the data stored in the system, and if the two are same, passing the verification.

When the password is propagated on the network, the plaintext transmission should be avoided. When the user registers, the password of the user is encrypted and stored and MD5 irreversible encryption is adopted, so that even if the password is intercepted, it is very difficult to decrypt the password.

When the user logs in, we must ensure that the password is transmitted in an encrypted form, namely, the user password must be inquired according to the user name at first, and after the inputted password is encrypted, the inputted password is compared with the inquired password.

Safety Audit for the Campus Network Application System

Audit is applied to recording a process of the user to perform all activities by utilizing a computer network system and is an important tool for increasing the safety. The audit not only can identify who accessed the system but also can show the use state of the system. With regard to the confirmation of a network attack condition, the audit information is very important to confirm the problem and attack source. Meanwhile, the problem can be more quickly and systematically identified by utilizing the recording of the system events. The recording of the system events is the important accordance of the later accident handling. Besides, by continuously collecting, accumulating and analyzing the safety events, some sites or users are selectively audited and tracked, and the possible destructive actions can be early found.

The demands on the design:

Recording safety log for user operation: recording user ID, logging time and logging IP.

Recording operation log for key operations, wherein the key operations are all operations except inquiry (including inquiring list and inquiring detail information), and the key operations include: operation ID, ID of operating user, operation time, IP of operator and key information of the operation.

The safety log and the operation log can be copied at any time and can be conveniently looked up.

Aiming at the above three demands, a naming convention standard for the operations at a design moment is as Table 1:

Table 1. Naming Convention Standard

Operations	*Naming*
Establishing	CreateXXX
Modification	ModifyXXX
Deletion	DeleteXXX

In view of the above three requirements, it designs in the database aspects as Fig.3:

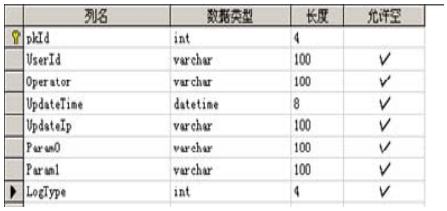

Fig.3. Log Desig

For all the operations, the log information must be filled in the database. The log information must include: Id of a present operating user, operation name, operation time, IP of machine of the operation, main operation parameters and secondary operation parameters. Besides, the logging operation is also recorded into the safety log.

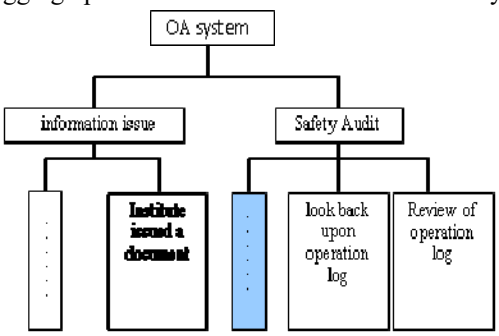

Fig.4. Safety Audit

Safety audit means to completely record, check and verify the activities related to the safety in the system; the information related to the safety is recorded into the log; and the log is the basis for tracking and analyzing an illegal event after the illegal event occurs.

III. Campus OA System Log Back Tools

According to the log type can export to log and safety operation log, it mainly to realize the OA system log data, it can also tracing the history log and meet the requirement of security audit.

Export log

This tool must be connected to the OA system database, according to the type of export log for security logs and operation log, the export log file can be compression preservation.

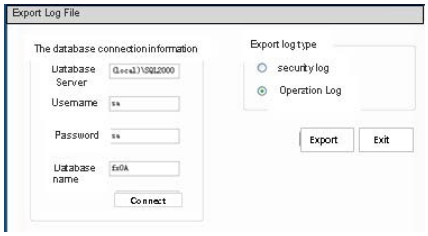

Fig.5. Export log file

Log Backtrace

Tools can be convenient retrospectively to the export log. By choosing to log compressed package files, automatic judgment log type, and then reads the log and displayed on the screen.

Safety audit means to completely record, check and verify the activities related to the safety in the system; the information related to the safety is recorded into the log; and the log is the basis for tracking and analyzing an illegal event after the illegal event occurs.

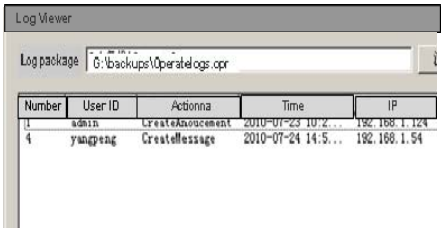

Fig.6. Log Viewer

IV. Conclusion

Theoretically, a campus network system should be as safe as possible, but a definitely safe and reliable system does not exist. In fact, a so-called safety system means that an intruder has to spend much time and money to intrude and has to bear higher risk. Hence, for making an access control system strategy for the campus network, various safety measures are specifically accepted and rejected according to the physical truth of the network (such as, the value of protected information, the attacked danger, investable capital, and the like). So to speak, the safety program is the balance between cost and efficiency under a certain condition and the target is to achieve a reasonable level of the performance of the system.

Due to the continuous improvement of the computer operation speed, all kinds of cryptographic algorithm face new password system, such as quantum cryptography, DNA code, chaos theory etc password new technology is lies in the exploration. So network security technology will be the key to the development of information network technology in the 21st Century.

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